OFFICE OF WATER PROGRAMS AT SACRAMENTO STATE AND SAN LUCAS COUNTY WATER DISTRICT

WATER SYSTEM IMPROVEMENTS DRAFT ENGINEERING REPORT

JULY 12, 2024

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Water System Improvements DRAFT Engineering Report

July 2024

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EXECUTIVE SUMMARY

This Engineering Report (ER) summarizes the engineering work and analyses performed by MKN & Associates, Inc. (MKN) to identify and recommend solutions to the non-nitrate- and nitrate-related potable water quality violations and concerns within the community of San Lucas, California.

The community of San Lucas has experienced historical water quality issues including salinity, nitrate, iron, manganese, and sulfate contaminants violating California drinking water standards, and the existing treatment system is no longer adequate to mitigate these constituents. It should be noted that while the primary intent of this ER is to present solutions to remedy the non-nitrate water quality concerns (i.e., salinity, iron, manganese, and sulfate), the project alternatives presented in the following ER are also intended to address nitrate-related water quality issues as well. For additional information to supplement the reader's knowledge of San Lucas's historical nitrate-related water quality issues, please see *San Lucas County Water District – Feasibility Study Peer Review - Nitrate Work (MKN, 2024)*. Additionally, San Lucas experiences color and odor issues within their water supply, which is likely to be a result of the constituents named above. The poor water quality has also led to distribution system-wide deficiencies over time, causing health-related issues in the community as well as damage to the distribution system and personal property of community members.

Based on level of required treatment, available local water supplies, existing Local Area Formation Commission (LAFCo) service areas and discussions with project stakeholders, four alternative solutions were developed:

- **Alternative No. 1 – Intertie with King City**

  Consists of a physical connection of the San Lucas County Water District's (SLCWD) system with the California Water Service Company (Cal Water) King City system and includes: the construction of an approximately 8.2-mile pipeline to the SLCWD system, a booster pump and chemical injection station, a master meter and backflow preventer at the connection point (Sub-Alternative B), abandonment of existing Well #3, removal of existing treatment facility, and rehabilitation of the existing distribution system.

- **Alternative No. 2 – Wellhead Treatment – Manganese Dioxide Filtration and Ion Exchange**

  Involves constructing manganese dioxide and ion exchange treatment systems, a new concrete masonry unit (CMU) building, chemical storage and injection systems, electrical and controls infrastructure, 7,000-gallon FRP waste equalization tank and associated disposal infrastructure, and rehabilitation of the existing distribution system.

- **Alternative No. 3 – Wellhead Treatment – Manganese Dioxide Filtration and Reverse Osmosis**

  Involves constructing manganese dioxide, reverse osmosis, and forced draft degasifier treatment systems, a new CMU building, chemical storage and injection systems, electrical and controls infrastructure, 10,000-gallon FRP waste equalization tank and associated disposal infrastructure, and rehabilitation of the existing distribution system.

- **Alternative No. 4 – Wellhead Treatment – New Well Drilling**

  Involves the acquisition of land and construction of a new well. Given uncertainty surrounding the water quality of the new well, if constructed, it is assumed that this alternative would be paired with the wellhead treatment methodology presented in Alternative No. 2 or 3.

In addition to the alternatives listed above, each alternative has two associated sub-alternatives (one of which will be selected along with the primary alternative selection):

- **Sub-Alternative A – SLCWD Ownership**

  Under this sub-alternative, SLCWD would continue to own and operate the water system assuming only additional operations and maintenance (O&M) costs associated with the selected alternative.

- **Sub-Alternative B – Physical and/or Managerial Consolidation with Cal Water, King City**

  Under this sub-alternative, Cal Water would own and operate the existing SLCWD system as well as any improvements constructed as a result of this project. This means that San Lucas residents would assume the Cal Water rate structure and O&M costs associated with the selected alternative.

Capital, O&M, and consumption costs associated with each alternative and sub-alternative were developed and are presented in **Table ES-1**.

Table ES-1: Estimated Costs of Alternatives

Alternative	Monthly Consumption Charges Per Service[1]	Monthly O&M Costs per Service	Total Capital Costs[2]
Alternative 1A	$100	$20	$23,548,000
Alternative 1B	$182	$42	$27,807,000
Alternative 2A	$100	$120	$7,753,000
Alternative 2B	$182	$143	$12,036,000
Alternative 3A	$100	$112	$8,654,000
Alternative 3B	$182	$135	$12,937,000
Alternative 4A	$100	$112 - $120	$12,959,000 - $13,858,000
Alternative 4B	$182	$135 - $143	$17,242,000 - $18,141,000

(1) Consumption charges are estimated water use charges based on typical water use and the water purveyor's billing rates.
(2) Total Capital Costs shown do not reflect potential reduction of capital costs due to grant funding and/or contributions from Mission Ranches and the Naraghi Family to address nitrate pollution. Grant funding for capital improvements from the State Water Board Division of Financial Assistance may be eligible for up to $80,000 per connection (currently 97 connections estimated), assuming Deputy Director approval. Unfunded costs will need to be paid for through other funding sources including a potential loan that would need to be repaid through increased water rates over time.

Following evaluation of all alternatives and sub-alternatives, Alternative Nos. 2 and 3 are recommended to mitigate the ongoing water quality issues experienced by San Lucas in conjunction with either Sub-alternative A or B. Alternative Nos. 2 and 3 are the preferred alternatives for the following reasons:

- **Improved Water Quality**. Both alternatives will successfully resolve the water quality issues experienced by San Lucas and bring the distribution system into compliance with California drinking water standards.
- **Cost**. Both alternatives are approximately 15 million dollars less than Alternative No. 1 and 10 million dollars less than Alternative No. 4.
- **Construction Impact**. Both alternatives will pose less construction-related impacts to the community and environment when compared to Alternative No. 1 or 4.
- **Timing**. Both alternatives will require less permitting, coordination, and investigation efforts than Alternative No. 1 or 4, giving San Lucas the quickest opportunity for improved drinking water.

Alternative No. 3 may be more preferable and feasible from a waste disposal standpoint. An evaluation of waste disposal alternatives was performed and found that cost of waste disposal and ease of permitting is more preferable under Alternative No. 3 rather than Alternative No. 2.

Either sub-alternative is recommended as the selected sub-alternative will not affect the ability of Alternative Nos. 2 or 3 to address the water quality issues experienced by San Lucas and is predominately a matter of stakeholder preference. As such, the selected alternative and sub-alternative will be finalized following future stakeholder and community input.

1.0 INTRODUCTION AND BACKGROUND

1.1 Background

San Lucas (Community) is a small community located within Monterey County and Salinas Valley, positioned near King City and San Ardo. The Community is currently served by a single well (Well #3), which is owned by the Naraghi Family. The water system currently serves approximately 315 residents and includes 97 service connections. As of November 2022, the water system is under the regulatory jurisdiction of the State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW).

University Enterprises, Inc. (UEI) is assisting San Lucas as a technical assistance provider to apply for Safe and Affordable Funding for Equity and Resilience (SAFER) funding through the SWRCB Division of Financial Assistance. MKN & Associates, Inc. (MKN) was retained by UEI to evaluate alternatives for providing San Lucas with clean and reliable water. This engineering report (ER) presents a water system evaluation that identifies water quality deficiencies and discusses viable alternatives to mitigate the water quality issues currently facing San Lucas. This report focuses on the evaluation of the non-nitrate related water quality issues with the San Lucas water system. Nitrate water quality issues and potential solutions are being evaluated separately. However, there may be solutions that address both nitrate and non-nitrate concerns. Therefore, nitrate issues are briefly referenced in this report.

1.1.1. Existing Water System

The San Lucas water system (System) is currently operated by the San Lucas County Water District (SLCWD). Although the System includes three wells, severe water quality issues have led SLCWD to rely only on Well #3 for potable water use. Well #3 was installed in 2014, is screened from 60 to 100 feet below the ground surface (BGS), and experiences static water levels at approximately 10 to 15 feet BGS. The System operator stated that Well #3 produces approximately 120 to 150 gallons per minute (gpm) with a pressure of approximately 100 pounds per square inch (psi). However, during a site visit performed by MKN, the well discharge flow meter only displayed a totalized flow reading and no pressure gauge was present at the well discharge. Based on demand calculations presented in **Section 1.1.4** it is likely that the estimates provided by the operator are correct. For the purposes of this ER, it is assumed that Well #3 produces 150 gpm at 100 psi. The well pump size and operation curve should be developed or confirmed prior to designing any improvements. The existing electrical service serving the well is unknown, although assumed to be adequate for all proposed alternatives within this report given the well's production.

Water from Well #3 is pumped around 1,000 feet northeast before reaching the current treatment facility. The current treatment facility consists of four manganese dioxide filtration vessels for the removal of iron and manganese with an upstream chlorine injection system for oxidation of iron and manganese and provision of a disinfection residual in the filtered effluent. The control system for the filter vessels is currently non-operational, and as a result, the filter vessels are manually backwashed once per week by the contracted water treatment operator. The chlorine injection system building is currently flooded with approximately a ½-inch of water due to a leak in the filtration system manifold. The chlorine injection system utilizes a Pulsatron Electronic Metering Pump to inject approximately 12 gallons per day (gpd) of sodium hypochlorite into the System.

Following treatment, the water travels approximately 1.2 miles through 6-inch diameter pipeline to reach the San Lucas distribution system and a water storage tank. A 300,000-gallon bolted steel storage tank is located approximately 1,000 feet to the northwest of the Community to provide storage and maintain pressures. The distribution system is primarily made up of 6-inch and 8-inch diameter pipelines. Each residence is served via a 1-inch service lateral.

The System pressure is provided by Well #3 and the potable water storage tank but the system pressure is not known throughout the distribution system. Based on the estimated 100 psi discharge from Well #3, an average elevation gain of 70 feet from the well to the Community, and anticipated pipeline and appurtenance losses, it is estimated for the purposes of this report that the average System pressure is approximately 60 psi. System pressures should be confirmed prior to design of certain improvements.

An overview of the existing system is shown in **Figure 1-1** and a detailed map of the distribution system is shown in **Figure 1-2**. An overview of the existing wastewater collection system is shown in **Figure 1-3** as the existing collection system is pertinent to the water treatment liquid waste byproduct disposal option discussed in the *San Lucas County Water District – Liquid Waste Byproduct Disposal Evaluation – Non-Nitrate Work Plan* technical memorandum (**Appendix A**).

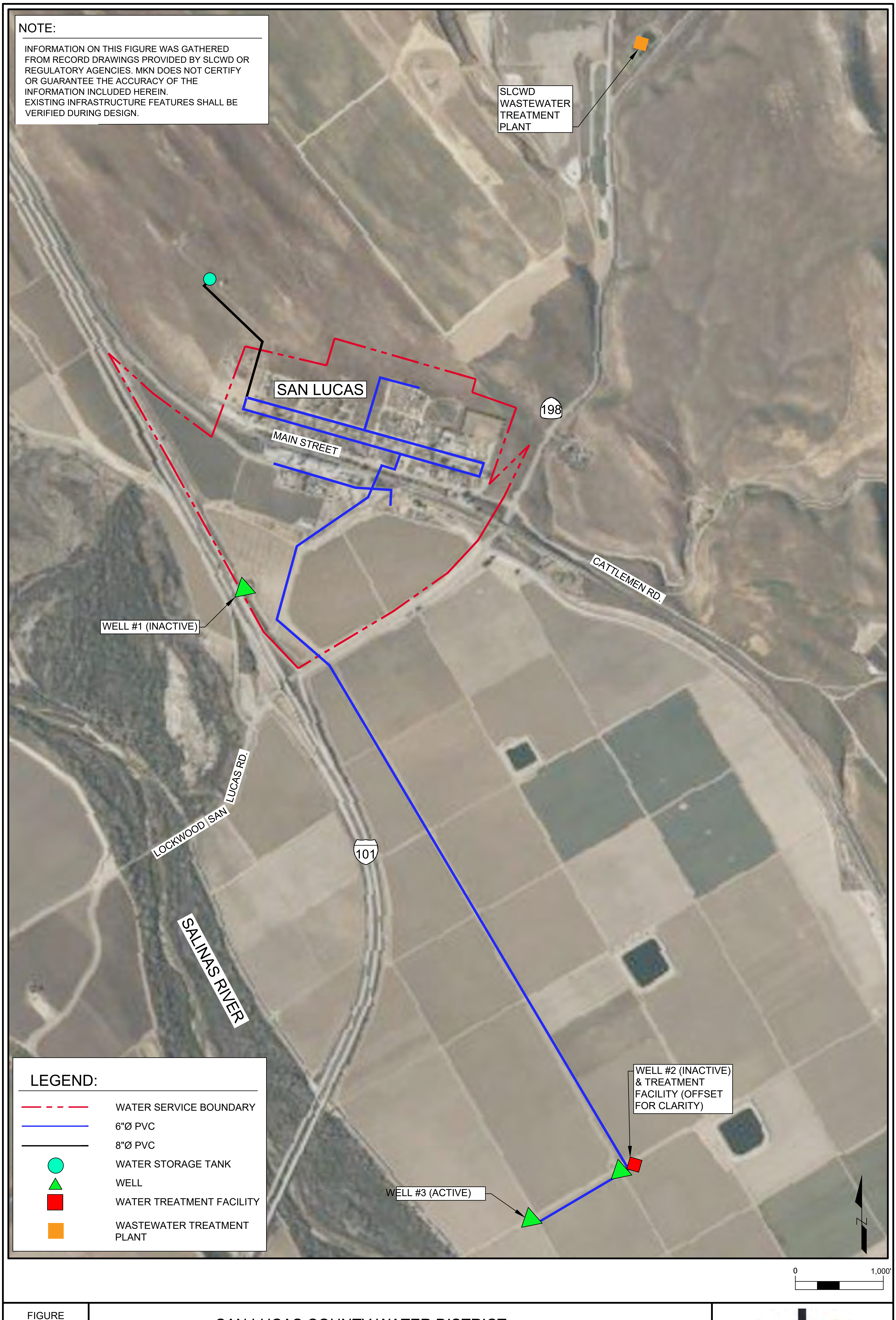

FIGURE 1-1

SAN LUCAS COUNTY WATER DISTRICT

EXISTING WATER SYSTEM

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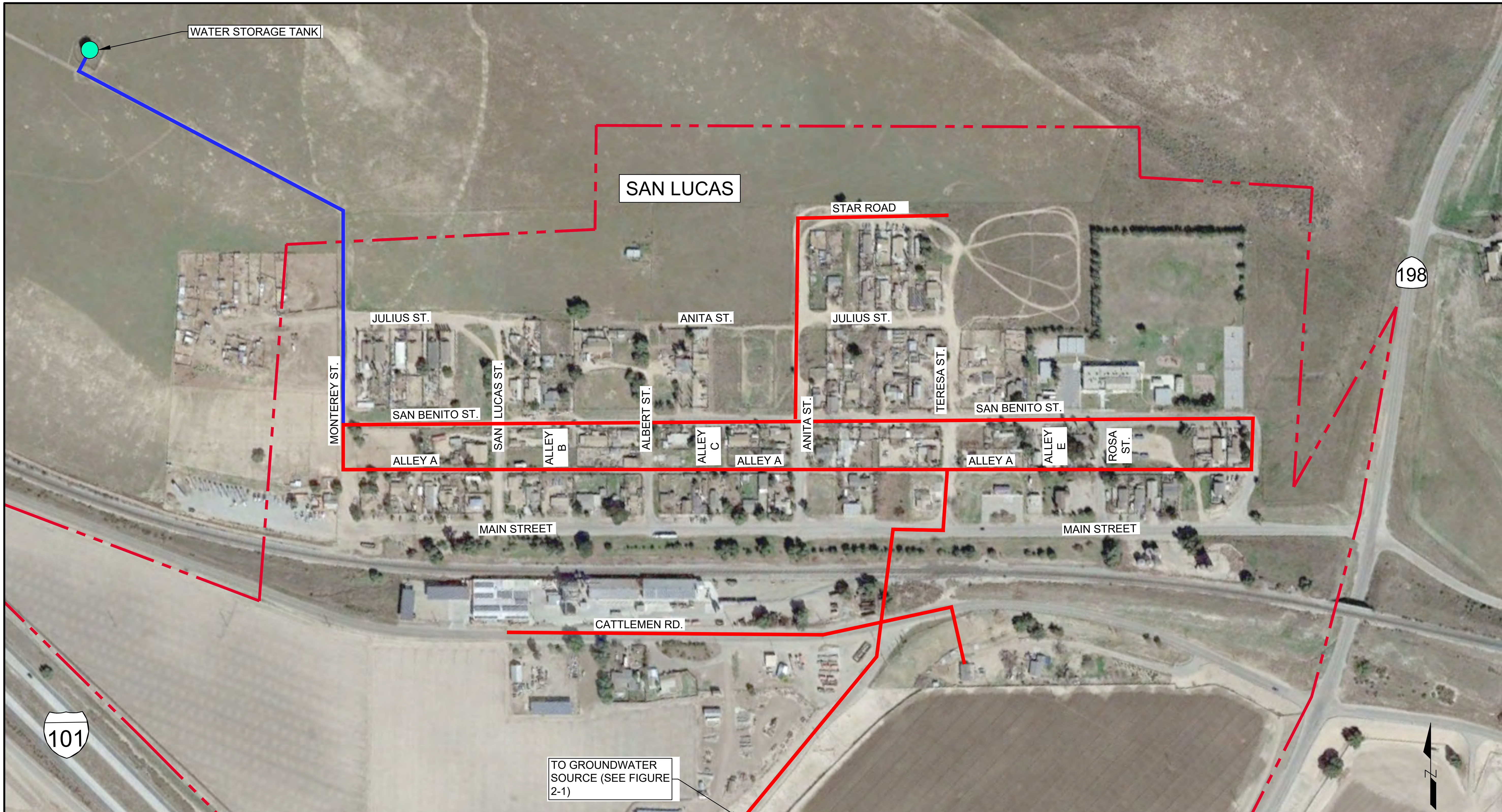

LEGEND:

(red dash-dot line)	WATER SERVICE BOUNDARY
(red line)	6"Ø PVC
(blue line)	8"Ø PVC
(green circle)	WATER STORAGE TANK

NOTES:

1. ALL SERVICE LATERALS ARE 1"Ø
2. INFORMATION ON THIS FIGURE WAS GATHERED FROM RECORD DRAWINGS PROVIDED BY SLCWD OR REGULATORY AGENCIES. MKN DOES NOT CERTIFY OR GUARANTEE THE ACCURACY OF THE INFORMATION INCLUDED HEREIN. EXISTING INFRASTRUCTURE FEATURES SHALL BE VERIFIED DURING DESIGN.

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SAN LUCAS COUNTY WATER DISTRICT

EXISTING DISTRIBUTION SYSTEM

FIGURE 1-2

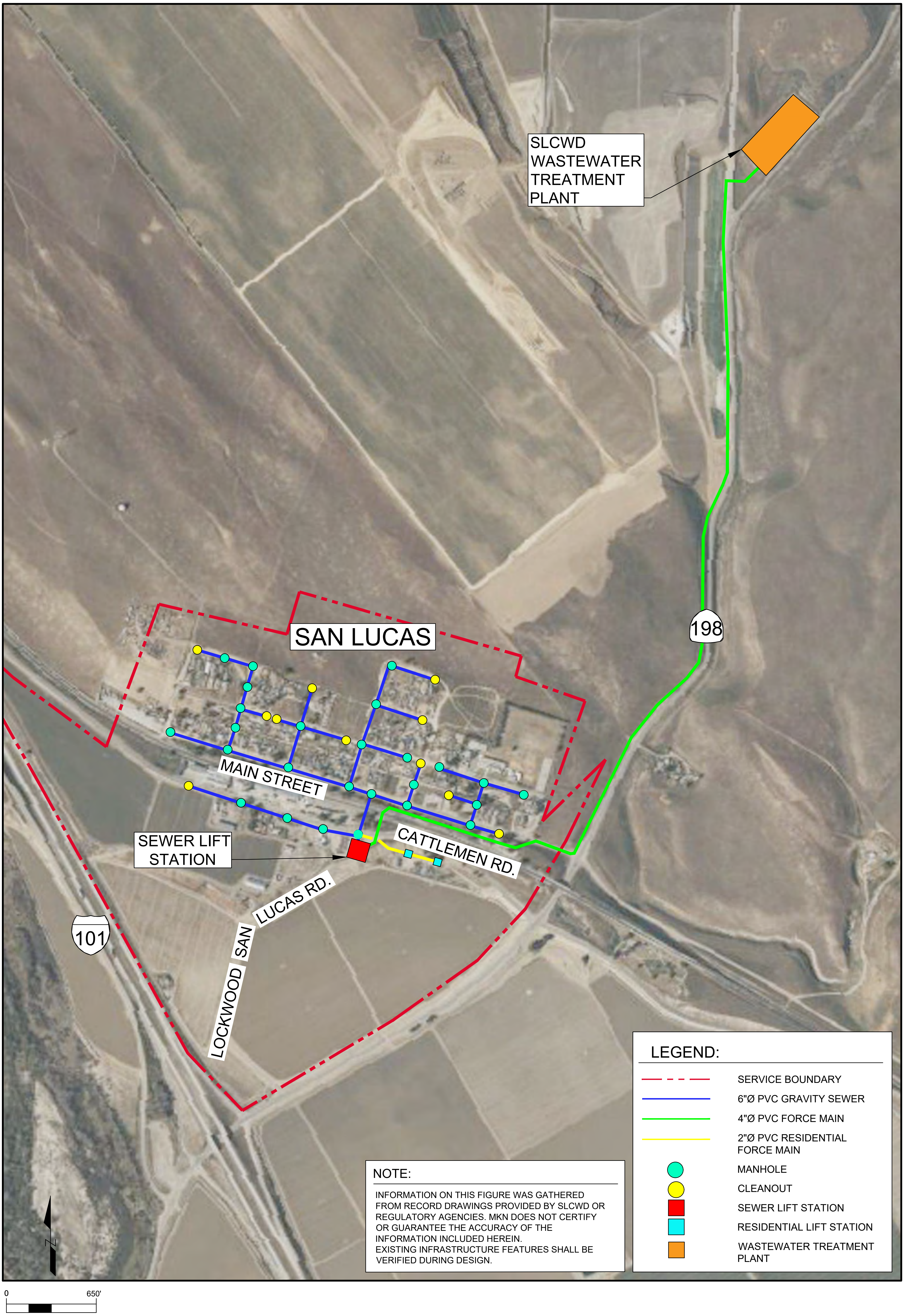

FIGURE 1-3

SAN LUCAS COUNTY WATER DISTRICT

EXISTING WASTEWATER COLLECTION SYSTEM

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1.1.2. Condition Assessment

While a full condition assessment is outside of the scope of this Project, the existing infrastructure was observed during a site visit in September 2023. Well #3 is not equipped with soft-start functionality, and therefore, the motor experiences higher-than-necessary wear and tear. At the treatment facility, there is a leak in the filtration system manifold, which is responsible for producing a ½-inch of water flooding the chlorine injection building. The control system for the filtration units is not operational and manual backwashing is necessary. The chlorine injection system is in working condition. The condition of the distribution piping was not evaluated, although the System's main pipelines were replaced with 8-inch and 6-inch CL-150 PVC as of September 2006. Distribution mainlines are operational and are expected to be undamaged. The potable water storage tank was observed to be in good condition and has recently received corrective maintenance as of August 2023. However, the tank's inlet and outlet piping were observed to have rust/corrosion on the surface and recoating of pipes and valves should be considered. Photographs of the site visit and existing condition of the District's system are provided in **Appendix B**.

1.1.3. Existing Water Quality

A summary of key water quality parameters and water quality data for Well #3 and the potable water storage tank is presented below in **Table 1-1** and **Table 1-2**, respectively. Contaminants that exceed primary drinking water Maximum Contaminant Levels (MCL) are highlighted in red, while contaminants exceeding secondary drinking water MCLs are highlighted in yellow. If a contaminant does not exceed primary or secondary drinking water MCLs, it is left unhighlighted.

Table 1-1: Historical Water Quality for Well #3 (2014 - 2023)					
Parameter	**Average**	**Minimum**	**Maximum**	**Units**	**MCL[1]**
Aggressive Index	12.02	11.7	12.3	AGGR	--
Arsenic - Dissolved (1)	3.20	1.1	7	ug/L	10
Barium - Dissolved (1)	61.78	44.1	104	ug/L	1000
Calcium - Dissolved (1)	152.80	111	180	mg/L	--
Carbon Tetrachloride	0.14	ND	0.69	ug/L	0.5
Chloride	109.02	82.1	130	mg/L	250
Conductivity @ 25C	1416.67	1129	1600	umhos/cm	900
Gross Alpha Particle Activity	15.45	4.14	63.4	pCi/L	15
Hardness as CaCO3, Dissolved	616.20	441	730	mg/L	--
Iron - Dissolved (1)	304.06	44	1040	ug/L	300
Manganese - Dissolved (1)	478.31	39	860	ug/L	50
Nitrate as N	3.71	0.1	19.9	mg/L	10
Nitrite as N	0.20	0.20	0.2	mg/L	1
pH (1)	7.19	7.1	7.3	pH Units	--
Selenium - Dissolved (1)	3.45	1.3	5.6	ug/L	50
Sodium - Dissolved (1)	76.50	63	84	mg/L	--
Sulfate	453.75	327	550	mg/L	250
Total Dissolved Solids	1321.31	260	2200	mg/L	500
Uranium, Radiological	8.21	2	39.9	pCi/L	20
Note: 1. *"—" indicates no MCL for a selected constituent.*					

Table 1-2: Historical Water Quality for Storage Tank (2015 - 2023)					
Parameter	**Average**	**Minimum**	**Maximum**	**Units**	**MCL**
Manganese - Dissolved	540	490	590	ug/L	50
Nitrate as N	1.39	0.2	2.8	mg/L	10
Total Dissolved Solids	1250	1200	1300	mg/L	500

1.1.4. Water System Demands

Monthly reports of water usage from Well #3 were provided by SLCWD dating back to January 2018. SLCWD has also been receiving 5-gallon water jug deliveries for drinking water supply. These data provide the basis for estimating the water system demands. SLCWD's water system demand was estimated using methods outlined in the California Water Code Title 22 Subsection 64554 methods for systems with monthly water usage data. System demands were calculated for the existing population as well as a future population assuming a 20 percent increase in population, which is considered to be a conservative representation of the future population based on discussion with SLCWD and Monterey

County staff. Additionally, the projected increase is incompliance with the SWRCB DFA's policy to fund projects accommodating a reasonable amount of future growth, not substantial further development. The estimated system service demand including the average day demand (ADD), maximum day demand (MDD), and peak hour demand (PHD) is summarized in **Table 1-3** below.

Table 1-3: Estimated SLCWD Service Demands

Water System	Service Population	ADD	MDD[1]	PHD[2]	PHD
		(gpd)	(gpd)	(gpd)	(gpm)
Existing	315	66,039	99,058	148,587	103
Future	378	79,246	118,870	178,305	124

Notes:
1. *MDD = ADD x 1.5.*
2. *PHD = MDD x 1.5.*

The purpose of the project is not to increase the System's water supply, but rather develop a solution to meet the System's future domestic and fire flow demands. Fire flow demands for the System per the California Fire Code are 2,000 gpm sustained over a duration of two hours. Since the existing storage tank provides adequate fire flow protection, the project alternatives were not evaluated for meeting fire flow requirements. Instead, all proposed project alternatives must be able to provide SLCWD's future PHD (i.e., 124 gpm).

1.1.5. King City System Description

MKN identified the California Water Service Company (Cal Water) and its King City water system (CWKC) as a potential consolidation partner with San Lucas. Following discussion with Cal Water, it was determined that Cal Water is willing to consolidate with San Lucas, if determined feasible. The feasibility of consolidating the San Lucas water system with CWKC is discussed in further detail in **Section 3.2**.

Formed in 1962, CWKC is owned and operated by Cal Water. As of June 2021, CWKC operates seven ground water wells, four storage tanks, four booster pumps, and more than 29 miles of pipeline to deliver approximately 1.5 million gallons of ground water per day to King City residents. Currently, CWKC has a total water supply capacity of 7,361 gpm, firm water supply capacity of 4,360 gpm, and a PHD of 3,393 gpm. This leaves CWKC with an additional supply of 967 gpm available for expansion. A summary of CWKC's supply and demands is included as **Table 1-4**.

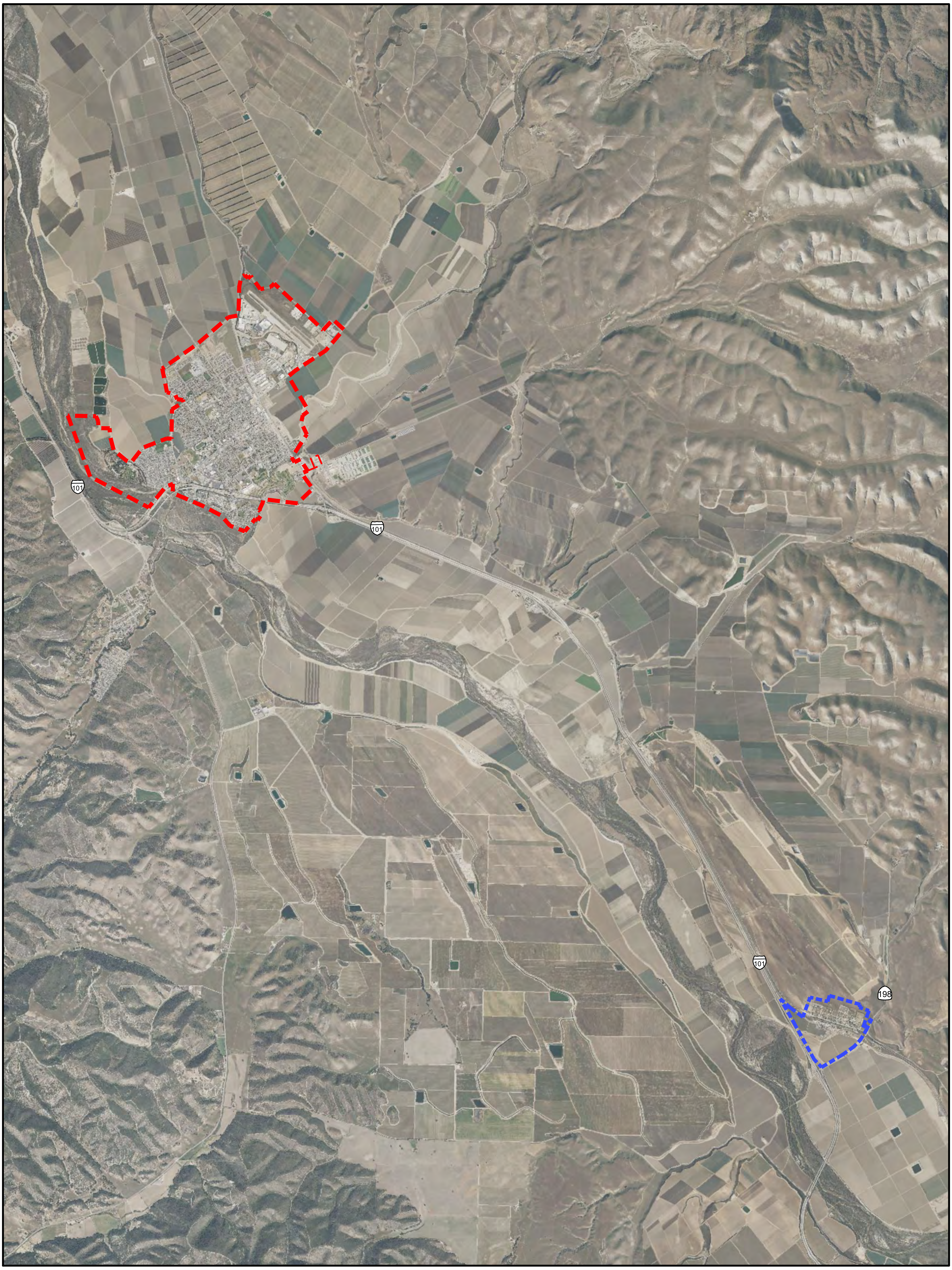
Table 1-4: CWKC Supply and Demand

Water System	Service Population	Demand[1]				Supply		Surplus
		ADD	MDD	PHD	PHD	Total	Firm	Firm Supply - PHD
		(MGD[2])	(MGD)	(MGD)	(gpm)	(gpm)	(gpm)	(gpm)
Existing	13,670	2.04	3.49	4.89	3,393	7,361	4,360	**967**
Future	16,404	2.45	3.67	5.51	3,827	7,361	4,360	**533**

Note:
1. *Demands calculated according to the CWKC Water Supply and Facilities Master Plan (CWKC Master Plan), dated September 2008.*
2. *MGD = Million gallons per day*

CWKC operates two pressure zones within King City. The southern pressure zone (closest to any connection to San Lucas) is the 430 pressure zone which operates from 37-59 psi. Based on corresponding elevations, it is estimated that a connection to San Lucas would experience approximately 42 psi on average at the connection point to CWKC.

CWKC's service area in relation to San Lucas is shown in **Figure 1-4**.



LEGEND:

CAL WATER - KING CITY SERVICE AREA

SAN LUCAS SERVICE AREA

FIGURE 1-4

CAL WATER - KING CITY DISTRICT

WATER SERVICE AREA

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2.0 PROBLEM DESCRIPTION

2.1 Water Quality Issues

General, organic, and inorganic water quality for Well #3 is summarized in **Table 1-1** (see **Section 1.1.3)**. Brief summaries of pertinent water quality concerns related to the long-term solutions that address both nitrate and non-nitrate water quality issues are discussed in **Section 3.0**.

Given that total trihalomethane sampling exceedances pertain to the distribution System sampling (rather than Well No. 3), water quality concerns will be discussed in **Section 3.0**.

Historical nitrate concentrations from 2016 to 2023 are depicted on **Figure 2-1**. It is generally observed that between the spring and late fall/early winter months of each year, nitrate concentrations typically spike, often lasting several months before decreasing to non-detect levels during winter months. Between 2016 and 2021, nitrate concentrations exhibited significant deviation, ranging from non-detect to 20 milligrams per liter (mg/L) (as Nitrogen). The upper concentrations of the aforementioned deviation range exceed the primary MCL concentration of 10 mg/L (as Nitrogen) mandated by the SWRCB DDW. Given the significant deviations previously observed in the raw water nitrate concentrations, it is anticipated that nitrate concentrations will continue to fluctuate in the future.

Historical salinity (Total Dissolved Solids [TDS]) concentrations from 2014 to 2023 are depicted on **Figure 2-2**. While the quantity of TDS sampling data from Well No. 3 is much more limited than the nitrate sampling data, it is observed that between the spring and winter months of 2016, TDS concentrations spiked, lasting several months before slightly decreasing during the start of 2017. In comparison with spikes in nitrate concentrations that occurred roughly during this time frame, it is suspected that spikes in salinity can also be loosely correlated with the cause(s) of the nitrate spikes. Between 2016 and 2017, TDS concentrations exhibit significant deviation, ranging from 890 to 2,200 mg/L. The upper and lower concentrations of the aforementioned deviation range exceed both the recommended and upper secondary MCL concentrations (500- and 1,000 mg/l, respectively) mandated by the DDW. Given the deviations previously observed in the raw water TDS concentrations, it is anticipated that TDS concentrations will also continue to fluctuate in the future.

With respect to both nitrates and TDS concentrations, it is understood that San Lucas CWD will continue to routinely monitor Well No. 3 to better understand trends in raw water quality.

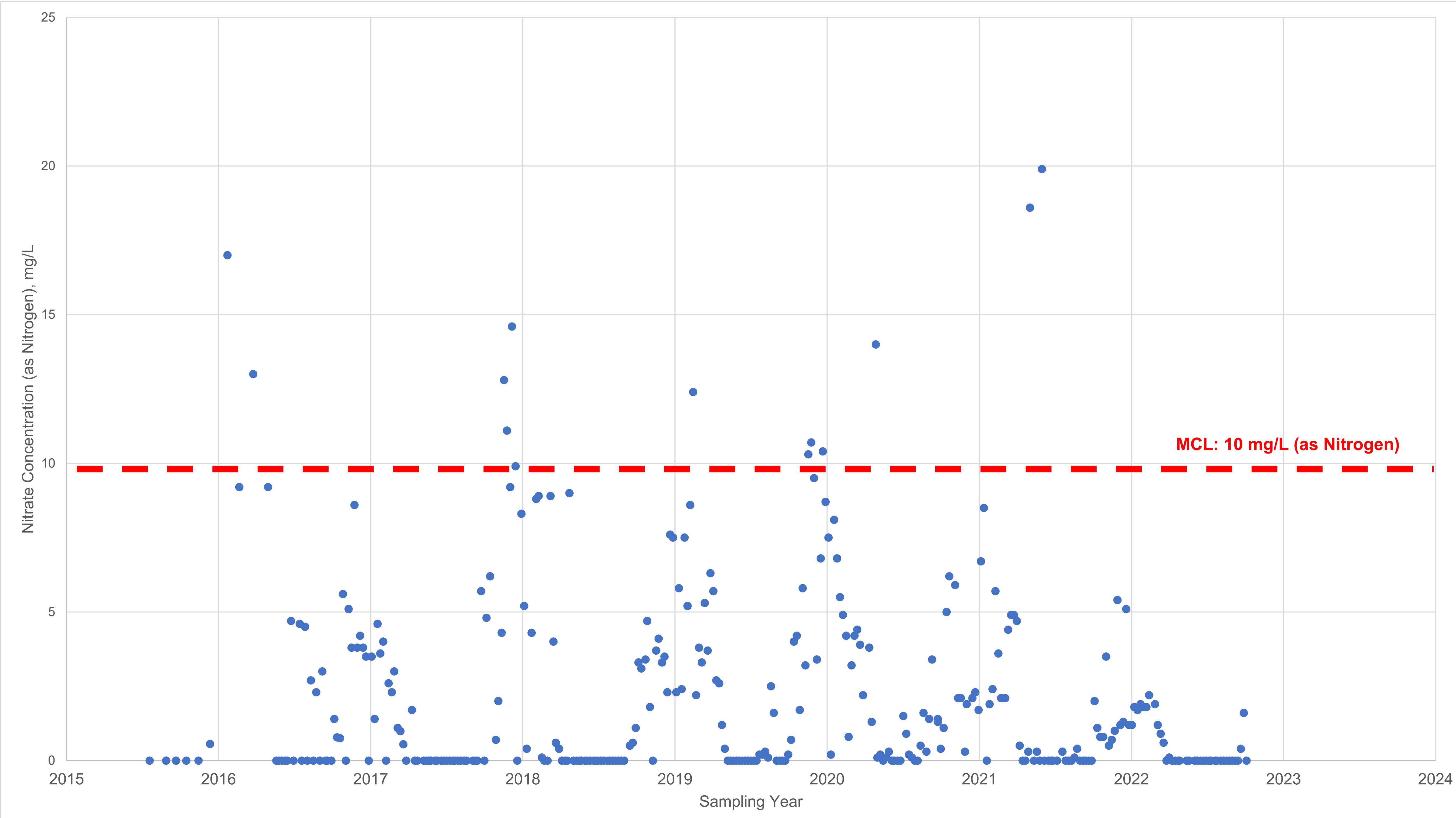


Figure 2-1: Historical Nitrate Concentrations - Well No. 3 (2016 - 2023)

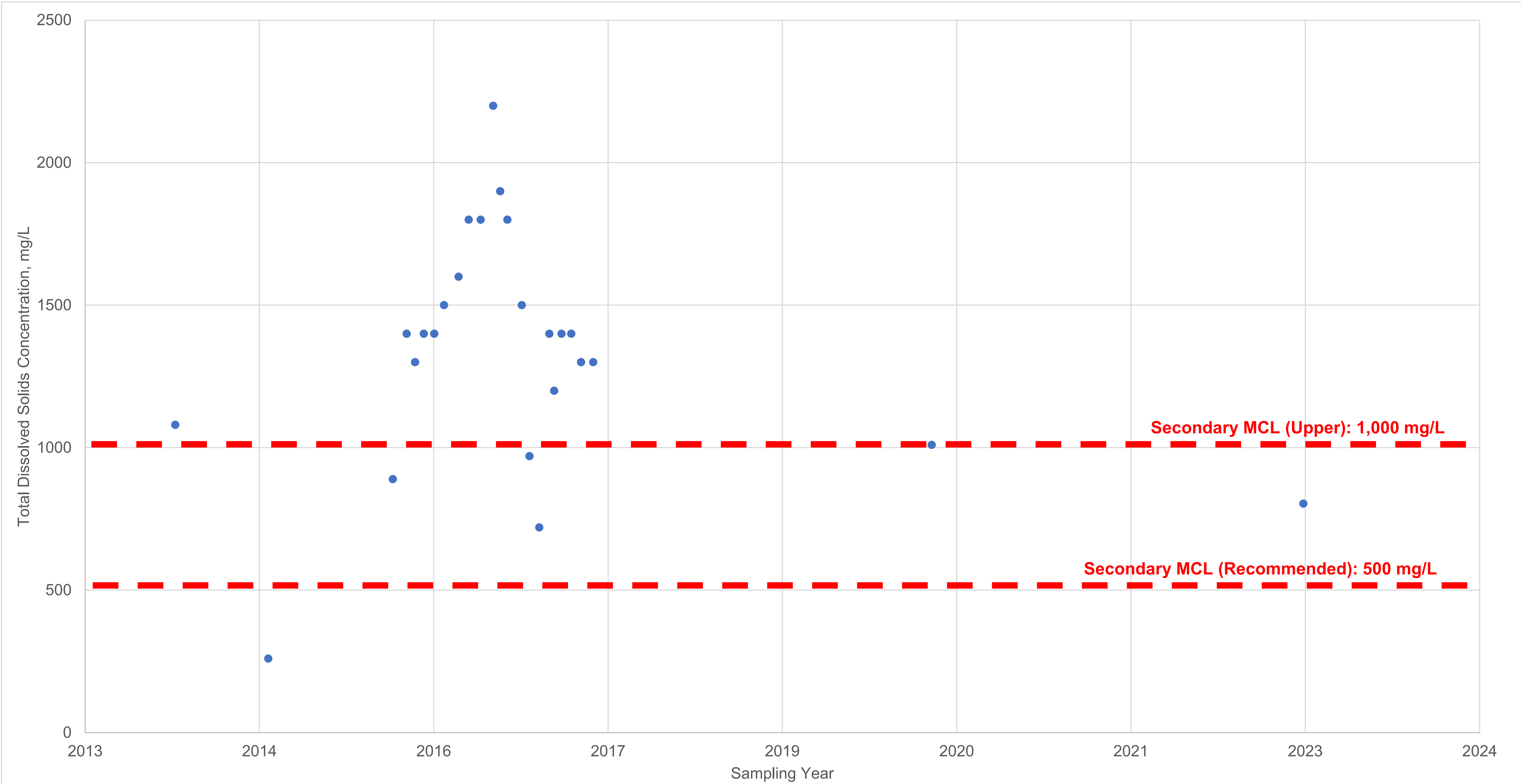


Figure 2-2. Historical TDS Concentrations - Well No. 3 (2014 - 2023)

Iron concentrations have historically ranged from 44 to 1040 micrograms per liter (µg/L), while manganese concentrations have historically ranged from 39 to 860 µg/L. The average of iron and manganese concentrations from 2014 to 2023 are quite high, calculated to be approximately 318 and 494 µg/L, respectively. The majority of the sampling values for both constituents are above the secondary MCLs of 300 µg/L (iron) and 50 µg/L (manganese).

Uranium concentrations have historically ranged from 2 to 39 picocuries per liter (pCi/L) and Gross Alpha Activity concentrations have ranged from 4.13 to 6.14 pCI/L. Only one exceedance of the MCL occurred in the second quarter of 2017. While the calculated average of uranium concentration is approximately 8 pCi/L, the uranium samples since 2017 have remained below the MCL. Given that sampling events have remained below 10 pCi/L since the first quarter of 2022, it is expected that uranium concentrations will continue to remain below the MCL in the future. It is suspected that the Gross Alpha Activity concentration exceedances can be primarily attributed to the presence of uranium in the raw water. While Gross Alpha Activity exceedances have been observed since 2017, concentrations have been steadily decreasing between 2017 to 2023. Furthermore, while the last Gross Alpha Activity exceedance occurred in October 2020, the observed concentration (15.1 pCi/L) was only 0.1 mg/L above the MCL of 15 pCi/L.

Carbon tetrachloride was observed in a single sampling event in April 2014 at 0.69 mg/L (0.19 mg/L above the current MCL of 0.5 mg/L). It has been observed to be non-detect in subsequent sampling events, suggesting that its occurrence was transient within the local groundwater supply (potentially resulting from agricultural activities).

Color concentrations have historically ranged from 4 to 5 color units. The average of color units from 2014 to 2023 is approximately 4.5 color units. While the range of historically sampled color units remains below the secondary MCL of 15 color units, the presence of color measured at or above 5 color units can often be attributed to discoloration of water obtained from household appliances. It is suspected that oxidation of higher concentrations of iron and manganese can be attributed to the slight discoloration of the raw water.

Odor measurements have historically ranged from 1 to 3 threshold odor numbers (TON). The average of odor measurements from 2014 to 2023 is approximately 2 TON. While the range of historically sampled odor measurements remains at or below the secondary MCL of 3 TON, the presence of odor measured above 1 TON can easily be smelled in water obtained from household appliances. It is suspected that the presence of odor can potentially be attributed to the reduction of sulfurous elements in the aquifer (i.e., sulfates, sulfides) into hydrogen sulfide gas (typically resulting in a “rotten egg” smell).

2.2 Existing SLCWD System Deficiencies & Distribution System Analysis

During and following a site visit in September 2023 and community meeting in October 2023, MKN reviewed the following information to evaluate the SLCWD water distribution system.

- Record drawings
- Customer complaints
- Feedback from customers obtained during Community meeting
- Conversations with System operators and staff
- Available water quality data

The following information was requested, but not available.

- Construction and repair photographs
- Inspection reports

Based on the information reviewed, the following distribution system deficiencies were identified.

- Water odor throughout the System
- Skin irritation and issues throughout the System
- Black, brown, and yellow/milky water along San Benito Street and Alley A
- Water heater failures along San Benito Street and Alley A
- Pipe breaks in two areas along Alley A
- Low or fluctuating pressure in the southeast corner of the distribution System
- Dirt in pipes and drains throughout the entirety of the System
- Old and degraded service laterals

Odors, skin irritants, and yellow/milky water are likely caused by water quality issues (namely sulfuric compounds) as discussed in **Section 2.1**. Removal of the compounds contributing to these issues will be addressed by the overall project solution to improve water quality.

Black or brown water and damage to household appliances (e.g., water heaters and washing machines) were the most common complaints among residents. Typically, this color of water is caused by iron and manganese in the water, which is supported by the water quality results at Well #3 and the water storage tank. Often the color of the water darkens when high-flow events occur (e.g. flushing or pipe breaks), suggesting that iron and manganese deposits have built up on the pipes and deposits are removed when scouring flows are reached. Additionally, iron and manganese deposits are a likely cause of the reported buildup and staining in appliances causing their failure. This hypothesis would also align with resident's complaints of old and degrading service lateral connections, which is only likely to only be apparent due to iron and manganese deposit buildup resulting from water quality issues. Service laterals are located on private property. However, there is potential for service laterals to be included as part of the chosen solutions to SLCWD's water quality issues if water quality issues are deemed the primary contributor to the service lateral degradation. For this to be considered, further evaluation would be necessary to assess the current condition of service lateral connections and potential causes of degradation and/or iron and manganese build-up. It may be recommended that solutions to water quality and distribution system issues are implemented first and color issues are monitored to determine the extent to which private laterals contribute to the issue.

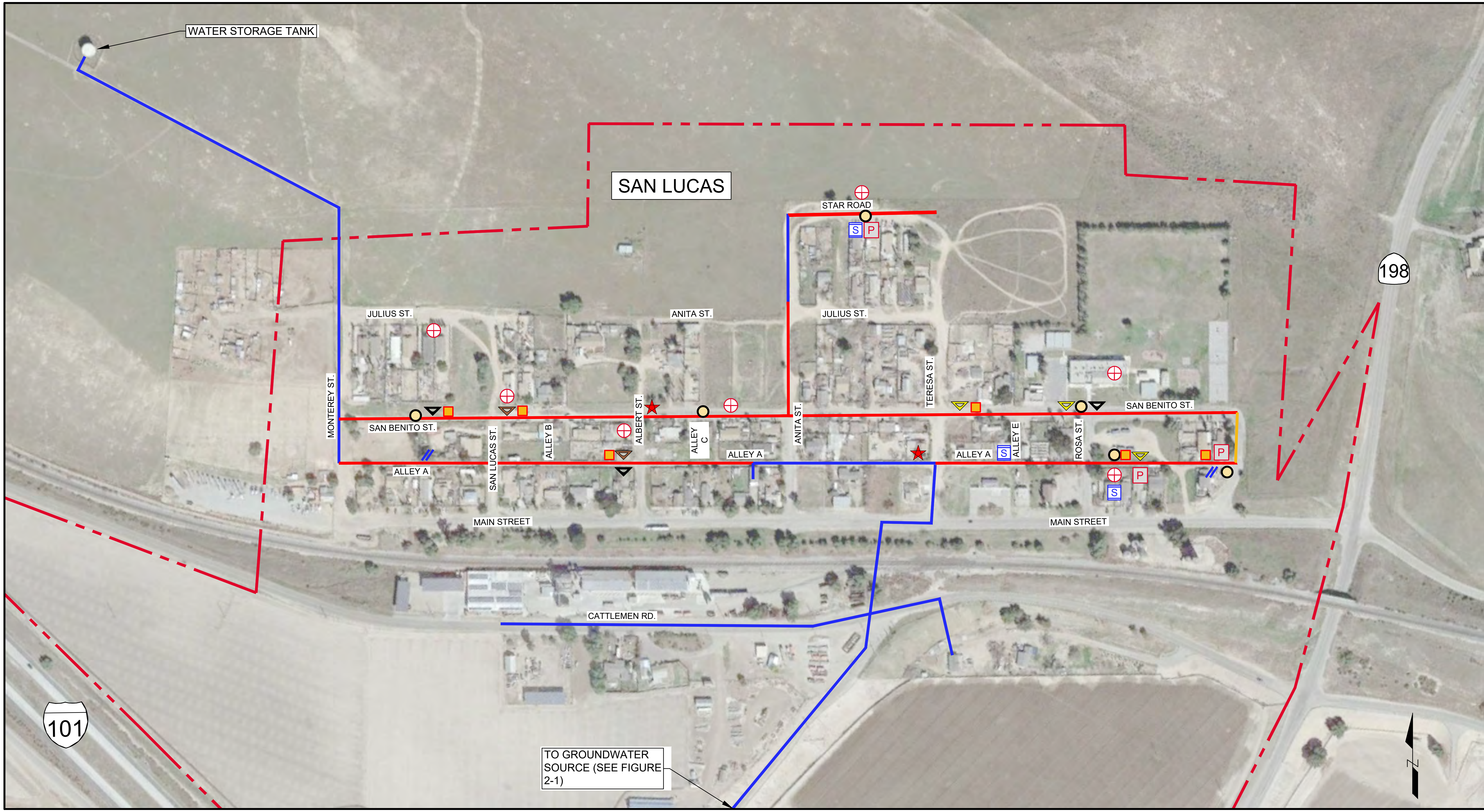
Iron and manganese removal will be addressed by the overall project solution to improve water quality, however it is anticipated that buildup on the pipes will still be present. Pipe swabbing or ice pigging may be used to "clean" the insides of the pipes so that these issues do not persist following the implementation of improved water quality solutions. If implemented, these pipe cleaning methods should be executed prior to the implementation of the preferred alternative solution.

The SLCWD distribution system mains are relatively new, installed in 2006. The mains have experienced some infrequent breaks but are not anticipated to be past their useful life. It is unknown when service laterals were installed, but no major repairs were identified during the information review. Pressure fluctuations may be attributed to leaks in the distribution System or hydraulic deficiencies. Additionally, dirt in the pipes may be from small leaks/breaks or historical breaks. The "dirt" may also be mis-identified iron and manganese accumulation. A hydraulic model and a water loss audit may be developed to identify hydraulic deficiencies or any leaks in the distribution System.

All the aforementioned issues will be taken into consideration when discussing treatment alternatives to address the water quality issues of San Lucas in **Section 3.0**. The issues reported by Community members are illustrated in **Figure 2-3**.

Efforts to remedy the distribution system issues in addition to improvements to overall water quality should include the following.

- Cleaning the pipe interiors via swabbing or ice pigging
- Hydraulic modeling of the distribution system to identify hydraulic deficiencies
- Conducting a water loss audit
- Construction of new service lateral connection, if deemed necessary in future evaluations



LEGEND:

WATER SERVICE BOUNDARY	(dash-dot line)
ISSUES REPORTED	(solid red line)
NO INFORMATION AVAILABLE	(solid blue line)
BLACK WATER	
BROWN WATER	
YELLOW/MILKY WATER	
PIPE BREAKS	
APPLIANCE FAILURE	
LOW PRESSURE	
DIRT IN PIPES/DRAINS	
FLUSHING LOCATION	
SKIN ISSUES	
ODOR	

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SAN LUCAS COUNTY WATER DISTRICT

REPORTED DISTRIBUTION SYSTEM ISSUES

FIGURE 2-3

3.0 PROJECT ALTERNATIVES

3.1 Summary of Analysis

MKN evaluated the feasibility of water treatment and consolidation options to develop the following three alternatives. Although not a comprehensive list, these alternatives have been assessed to be the most viable options to address the water quality issues experienced by SLCWD (i.e., nitrate, salinity, and additional water quality concerns discussed in **Section 2.1**). The proposed alternatives include:

- Alternative No. 1 – Intertie with King City
- Alternative No. 2 – Wellhead Treatment – Manganese Dioxide Filtration and Ion Exchange
- Alternative No. 3 – Wellhead Treatment – Manganese Dioxide Filtration and Reverse Osmosis
- Alternative No. 4 – Wellhead Treatment – New Well Drilling

In addition to the alternatives listed above, there is an opportunity for SLCWD to continue operation of the water System or to consolidate with CWKC. Two Sub-alternatives have been developed to define these ownership and operation scenarios as they relate to the proposed alternatives. The proposed Sub-alternatives include:

- Sub-alternative A – SLCWD Ownership
- Sub-alternative B – Consolidation with King City

A selected alternative will be defined both by the primary alternative and the sub-alternative. For example, "Alternative No. 1, Sub-alternative A" would define a selected alternative in which an intertie with King City would be installed, but the System would be owned and operated by SLCWD. Sub-alternative B would indicate an alternative owned and operated by CWKC.

3.2 Alternative No. 1 – Intertie with King City

3.2.1. Alternative Summary

Alternative No. 1 includes the construction of an 8-inch pipeline connecting the San Lucas and CWKC water systems. The pipeline would extend from the SLCWD System's mainline where it crosses the railroad to the intersection of S 1st Street and Lonoak Road in King City at the CWKC system. This pipeline would either act as a wholesale intertie from CWKC to the System or a supply main for full physical consolidation, depending on the Sub-alternative chosen (discussed in **Section 4.5**). Under Sub-alternative A, all water use would be metered by SLCWD on individual meters to each connection. Under Sub-alternative B, a master meter would be provided at the north end of the new pipeline for a wholesale intertie with CWKC.

The 8-inch pipeline would be approximately 43,200 linear feet (LF) (8.2 miles), constructed from a point in line with Teresa Street, between Main Street and Cattlemen Road on the south side of San Lucas. The pipeline would continue northwest along the Union Pacific Railroad (UPRR) alignment into King City. The pipeline would then connect to the CWKC system at the intersection of S 1st Street and Lonoak Road within the King City public right of way. The proposed consolidation pipeline alignment is indicated in **Figure 3-1**. If selected, this alignment should be discussed in significant detail with UPRR and Caltrans.

It is anticipated that significant coordination will be necessary to overcome challenges along this alignment. Alternatively, the pipeline could be constructed along the Hwy 101 alignment. However, it is anticipated that permitting, construction, and coordination of this alignment would be substantially more difficult and costly. Therefore, any discussion of Alternative No. 1 in this report assumes the selection of the UPRR alignment.

An 8-inch isolation valve will be included at the point of connection near the intersection of S 1st Street and Lonoak Road in King City and a booster pump station and sodium hypochlorite injection system will be included at the connection point to the SLCWD distribution system. A master meter and a backflow preventer would also be provided at the connection point to CWKC. The water system owner, as described by **Section 3.6**, would be responsible for operation and maintenance of the improvements described in this alternative.

The existing SLCWD water storage tank would continue to be used to supply adequate storage for various demand scenarios.

3.2.2. Engineering and Constructability Considerations

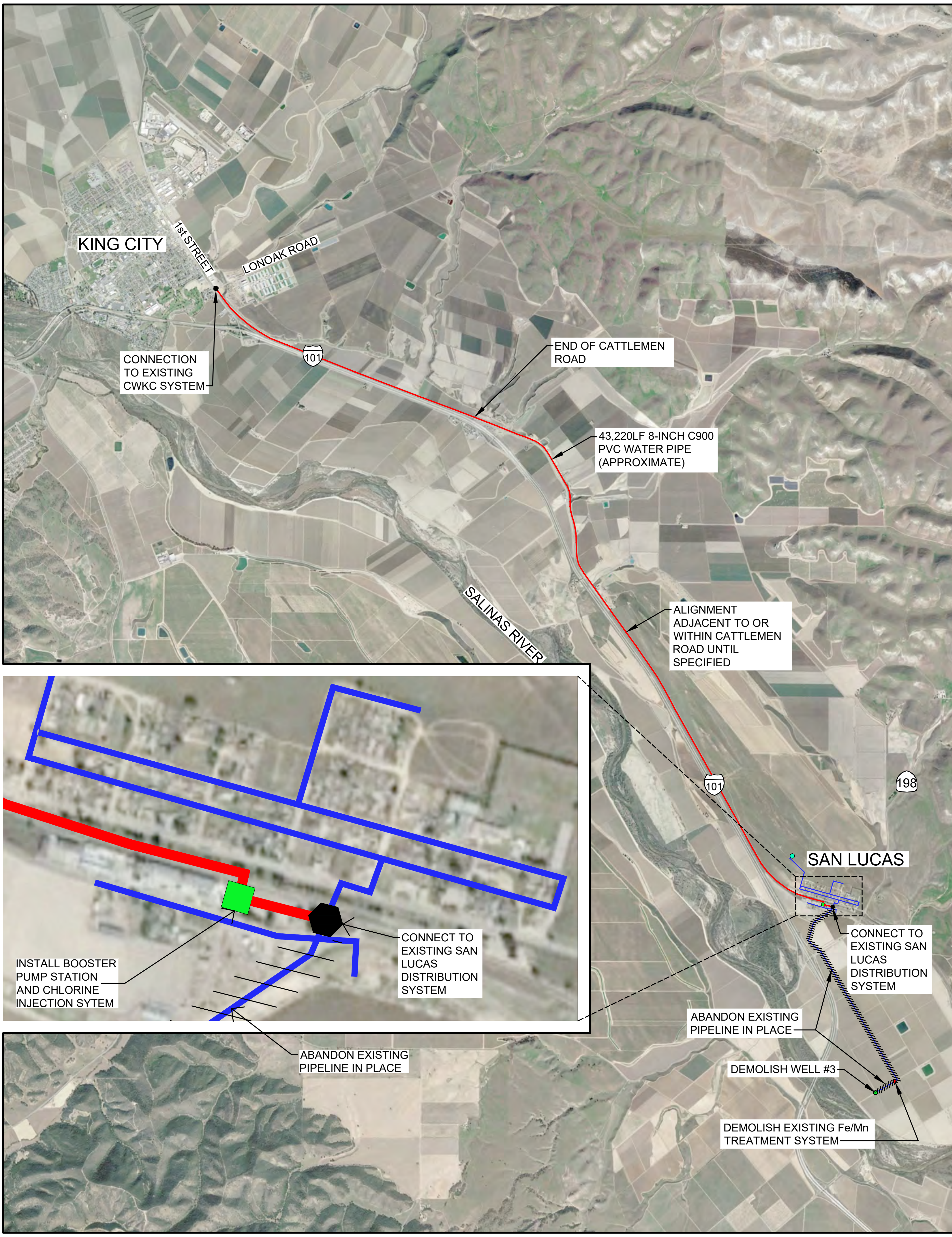
A summary of the anticipated project improvements for Alternative 1 include:

- Installation of 43,200 LF of 8-inch pipe connecting CWKC to the System
- Installation of an isolation valve at the connection point and every 1,320 feet along the pipeline per current CA Waterworks Standards
- Installation of a master meter and backflow prevention at the connection point
- Installation of a booster pump station and chlorine injection system at the connection to the San Lucas distribution system
- Abandonment-in-place of the existing pipeline from Well #3 to the San Lucas distribution system
- Removal of the iron and manganese treatment facility
- Rehabilitation of the distribution system prior to connection to new transmission system, as described in **Section 2.2**

3.2.2.1. Cal Water Pipeline Standards

Under Alternative 1, it is anticipated that any improvements should be compliant with Cal Water standards. Although Cal Water does not maintain an official standards document, several improvement standards are stated in the CWKC Master Plan. Applicable standards to the sizing of the pipeline include 8-inch minimum nominal pipe diameter, 10 foot per second maximum velocities, pressure losses not exceeding 10 feet per 1,000 feet of pipe at peak hour demand, and a minimum pressure of 40 psi.

Further, Cal Water standards for fire flow conform to the California Fire Code. As discussed in **Section 1.0**, San Lucas requires a minimum of 2,000 gpm in fire flow to serve the Community in case of a fire. However, an 18-inch pipe is required to convey fire flows from King City to San Lucas and maintain compliance with velocity requirements and overcome pressure losses. An 18-inch pipe is far larger than necessary for San Lucas' drinking water needs, and as discussed in **Section 1.0**, the purpose of the project is not to greatly increase fire protection. Additionally, an oversized pipe may cause significant water age concerns. For these reasons, Cal Water fire flow standards are neglected given that the proposed pipeline maintains the same amount of fire protection currently in place in San Lucas. In this case, an 8-inch pipe can convey San Lucas' 150 gpm (the capacity of Well #3) and meet velocity and pressure loss requirements.



LEGEND:

(red line)	(N) 8"Ø C900 PVC
(blue line)	(E) WATER DISTRIBUTION SYSTEM
(teal circle)	(E) WATER STORAGE TANK
(black hexagon)	(N) POINT OF CONNECTION
(green square)	(N) BOOSTER PUMP STATION AND CHLORINE INJECTION

N

0 4500'

FIGURE

3-1

SAN LUCAS COUNTY WATER DISTRICT

ALTERNATIVE 1: INTERTIE WITH KING CITY

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3.2.2.2. Water Age

Based on the Community evaluated in this project, it is not anticipated that substantial additional customers or additional communities between CWKC and SLCWD will be served by the project in the immediate future. Furthermore, the proposed pipeline would not serve any customers along the pipeline itself. This length of pipe with no customers creates concerns regarding water age and low chlorine residuals. Assuming that no customers besides SLCWD exist along the existing and the proposed 8-inch main, it is estimated that water age reaching SLCWD will be 1.5 days and 1.0 days under ADD and MDD conditions, respectively.

Based on CWKC's 2022 Consumer Confidence Report, free chlorine concentration in the distribution system ranges from 0.31 to 1.3 mg/L with an average of 0.67 mg/L. With respect to the average concentration and the anticipated water age once water reaches the SLCWD distribution system, chlorine residuals may be somewhat low for the entrance to the distribution system. Therefore, it is recommended that an online chlorine analyzer and chlorine injection system are added at the connection point to the SLCWD distribution system.

3.2.2.3. Water Supply and Pressure

As discussed in **Section 2.1.5**, CWKC is anticipated to have sufficient reliable water supplies to meet future San Lucas' demands. Additionally, the San Lucas System maintains adequate water storage to meet storage requirements.

As discussed in **Section 2.1.5**, CWKC is anticipated to supply approximately 41.5 psi at the connection point to the proposed pipeline. Preliminary calculations have indicated that approximately 18.8 psi of loss may be expected along the pipeline. Therefore, the remaining pressure at the entrance to the San Lucas distribution system would be approximately 22.7 psi, too low to comply with CWKC or California Waterworks standards throughout the system. A booster pump station would be necessary at the connection point to the San Lucas distribution system to boost the incoming pipeline pressure to approximately 60 psi to match system pressures. Land acquisition may be necessary for the construction of this facility.

Since the existing SLCWD distribution system will be utilized, the level of fire protection provided is anticipated to remain relatively equal to SLCWD's current fire protection.

In compliance with the SWRCB's capacity requirements for funding, the proposed 8-inch main line is the smallest pipe diameter in compliance with CWKC standards that can accommodate the future MDD, which is less than 3x the existing MDD.

3.2.2.4. Pipeline Construction

43,200 LF of 8-inch PVC pipe will be installed within the UPRR and Monterey County right of way along the railroad tracks and in portions of Cattlemen Road as indicated in **Figure 3-1.** Based on preliminary observations of the proposed alignment, the following obstacles and conflicts may be present along the pipeline alignment:

- Close proximity to the railroad tracks and Hwy 101 in several locations. The alignment must maintain a minimum 35-foot setback from the centerline of railroad tracks. This is likely going to be very challenging along the proposed alignment and may not be possible. A variance may need to be requested from UPRR, which they may be unwilling to grant.

- Several stretches of overhead electrical in close proximity.

- Portions are close enough to Hwy 101 that the alignment may be within the Caltrans right of way, which would require an encroachment permit.
- Several utility markers (un-readable) are present adjacent to the railroad tracks as well as other potential unknown below-ground utilities.
- Drainage piping from agricultural fields crosses the alignment in several locations.
- Topography (drainage swales and raised railroad tracks) is not conducive to trenching and pipeline installation.
- The alignment may need to deviate outside of the UPRR right of way and into the Monterey County right of way at Cattlemen Road due to topography obstacles. Aligning the pipeline in Cattlemen Road wherever possible may be preferable to reduce UPRR and Caltrans coordination.
- Significant vegetation is present within the alignment.
- Traffic control on Cattleman Road would likely be necessary, and UPRR will likely require an inspector and flagger for the duration of construction.
- Construction of several miles of pipeline often presents design challenges to avoid obstacles such as culverts, waterways, and other utilities. The alignment has relatively tight space constraints to avoid possible obstacles in several locations.

3.2.3. Operation and Maintenance Considerations

See **Section 3.6** for details on ownership and operation of the proposed improvements under each Sub-alternative.

O&M activities included in this alternative include the following:

- Incidental repairs due to pipe breaks or leaks
- Valve exercising
- Continued operation and administration of the SLCWD water system
- Routine maintenance of booster pumps, valves, and instrumentation
- Routine maintenance of chlorination pumps, analyzer, and instrumentation
- Regular purchase of sodium hypochlorite

3.2.4. Environmental and Permitting Considerations

All of the proposed improvements are anticipated to be located on previously-disturbed areas in the UPRR, public right of ways, and on SLCWD property. Therefore, significant environmental and permitting challenges for Alternative 1 are not anticipated. However, a detailed environmental constraints analysis should be performed upon the selection of a preferred alternative. Potential considerations include:

- Impacts to streambeds and drainage courses along the alignment.

- Biological resources impacts.
- Cultural and archeological impacts.

The following environmental documents, permits, and approvals are anticipated under Alternative 1:

- CEQA Initial Study and Negative Declaration or Mitigated Negative Declaration
- Monterey County Encroachment Permit
- UPRR Encroachment Permit
- UPRR Crossing Application
- King City Encroachment Permit
- Possible Caltrans Encroachment Permit and coordination
- Consolidation or Service Agreement between CWKC and SLCWD (dependent on the chosen Sub-alternative)
- Local Area Formation Commission (LAFCo) out-of-area service agreement or service area amendment (dependent on the chosen Sub-alternative)
- Water system permit revisions

3.2.5. Evaluation of Alternative No. 1

3.2.5.1. Advantages

The key advantages for Alternative No. 1 are as follows:

- A reliable source of water that meets State and Federal drinking water quality requirements.
- Connection with CWKC would provide increased supply source redundancy compared to SLCWD's existing system.
- No new waste streams are created, so no disposal connection or hauling of liquid waste would be required.
- No further operation or maintenance of the Well #3 site would be required.

3.2.5.2. Disadvantages

The key disadvantages for Alternative No. 1 are as follows:

- This alternative cannot be ruled out completely as infeasible at this point. However, there are significant challenges associated with this alternative including coordination with several agencies that may be unlikely to grant permits. It is highly recommended that this alternative is not pursued. If it is desired that this alternative is pursued by project stakeholders, it is recommended that substantial additional feasibility work and investigations are conducted.
- Length of the required pipeline and installation along the UPRR contributes to a relatively complex construction project with substantial coordination required.

- Water age and pressure deficiencies necessitate the installation of a booster pump station and chlorine injection system.
- High capital cost as compared to other alternatives.
- The proposed pipeline provides a single point of failure, such that if the pipe breaks, SLCWD would experience water outages.
- Under Sub-alternative A, Cal Water has stated that they would prefer to not simply be a wholesaler.
- Construction will require encroachment permits from multiple agencies and a railroad crossing permit, which may take a considerable amount of time for review and approval.
- Land acquisition may be required for the construction of a booster pump station and chlorine injection facility.

3.3 Alternative No. 2 – Wellhead Treatment – Manganese Dioxide Filtration and Ion Exchange

3.3.1. Alternative Summary

This project alternative would consist of two primary treatment steps: replacement of the existing manganese dioxide filtration followed by ion exchange.

3.3.1.1. Manganese Dioxide Filtration

Manganese dioxide filtration provides an oxidation-adsorption process to remove dissolved iron, manganese, and odorous compounds (i.e. sulfides) from raw water. If high color sampling values in the raw water can be attributed to iron and manganese, color will also be removed. In the current configuration, raw influent is pumped through manganese dioxide filtration media, which provides an ideal surface for the manganese to be oxidized and adsorbed. The oxidation reaction is facilitated by upstream addition of sodium hypochlorite. Depending on concentration and variability of manganese loading rates, the filter bed is backwashed several times per week to remove accumulated debris. However, backwashing at least once a day (following the end of a treatment cycle) is recommended to prevent "curing" of accumulated manganese sludge since excessive head loss across the filter bed could noticeably reduce the instantaneous pumping capacity and the media could be damaged by high differential pressures. Backwash waste would be disposed of to a new 7,000-gallon waste equalization tank (sized to accommodate both backwash waste and ion exchange liquid waste byproducts, see **Section 3.3.2**).

Optimum manganese removal typically occurs at a pH greater than 9.3, however, the typical influent pH values ranging from the 7 to 8 should provide sufficient removal of manganese with proper oxidant mixing and dosage. Other water quality parameters that can affect the process include total organic carbon (TOC), arsenic, silica, or ammonia. If ammonia is present, the potential variability in oxidant demand could affect the removal efficiency of manganese. It is suspected that slightly elevated silica and organics concentrations observed in a recent sampling event from October 2023 (28.9 mg/L and 1.9 mg/L, respectively) could be slightly impacting the performance of the existing manganese dioxide filtration system.

Following discussions with the existing filtration system manufacturer (ATEC Systems) and a previous condition assessment MKN conducted in September 2023, it is recommended that existing system be replaced in-kind with a newer manganese dioxide filtration system for the following reasons:

- The vessels and valves are badly damaged and require extensive repairs.
- The cost differential of repairing the existing system versus complete replacement is fairly low.
- Features of newer ATEC manganese dioxide filtration systems (i.e. improved backwash flow control assemblies, upgraded local control panel, etc.) could be more easily integrated with the new treatment system (see discussion below).

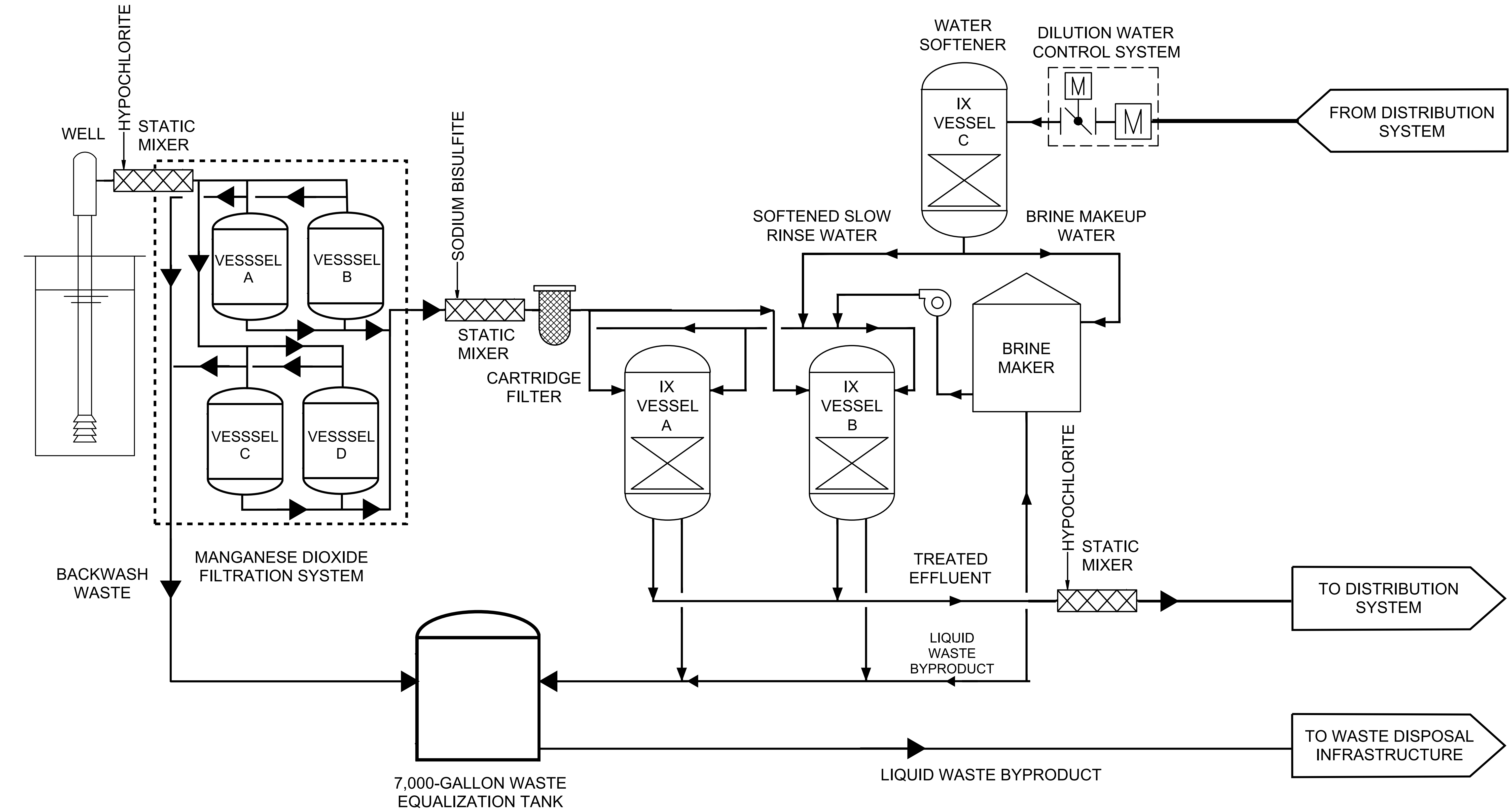
3.3.1.2. Ion Exchange Treatment

Ion exchange treatment is a physical-chemical process using a specially treated resin. The strong base anion (SBA) resin is equipped with active sites that are electrically charged and can attract negatively charged ions (anions) in water, typically consisting of uranium, nitrate, bromide, total organic carbon (the negatively charged speciation), chloride, sulfate, and bicarbonate ions. When placed into service, the resin is pre-loaded with chloride ions. As water passes by the media, the chloride ions exchange places with the anions in the water, removing uranium, nitrate, bromide, and a portion of the total organic carbon from the water. It should be noted that by removing a portion of the total organic carbon and bromide from the water, the total trihalomethane formation potential is reduced. Two vessels are estimated to be required to treat raw water to produce an effluent nitrate concentration below 80-percent of the MCL (8 mg/L as Nitrogen). One vessel would be in service treating water, while a second is offline being regenerated or waiting to return to service. Each vessel would rotate in service, so that the system is always available to treat design flows.

Once the resin becomes exhausted of chloride ions, the vessel containing the exhausted resin undergoes regeneration. During a regeneration cycle, the vessel is taken out of service and backwashed for a short period of time. A regenerative brine is prepared by diluting the concentration of the delivered brine (typically 25 to 30 percent) to approximately 6 percent to prevent “floating” of the resin during a regeneration cycle. The diluted brine solution is then pumped through the vessel in either a co-current (downward) or counterflow (upward) flow direction for several hours, exchanging nitrate and other anionic constituents bound to the resin with chloride from the brine solution. Since the resin is initially too saline to be placed into service following a regeneration cycle, slow- and fast-rinse cycles using softened and raw water are conducted to lower the salinity of the resin before it is cycled back into service. It should be noted that the calcium carbonate hardness of the dilution water (obtained from the distribution system discharge piping) will likely cause mineral scaling in the waste equalization storage tank and waste disposal infrastructure. A small commercial water softener would be required to soften the dilution- and slow-rinse water to minimize scaling during regeneration cycles.

The existing SLCWD water storage tank would continue to be used to supply adequate storage for various demand scenarios.

A block flow diagram of the conceptual treatment system and infrastructure improvements layout are presented in **Figure 3-2** and **Figure 3-3**, respectively.



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OFFICE OF WATER PROGRAMS
SAN LUCAS CWD NON-NITRATE ENGINEERING REPORT

ALTERNATIVE NO. 2 - WELLHEAD TREATMENT - MANGANESE DIOXIDE FILTRATION AND ION EXCHANGE BLOCK FLOW DIAGRAM

FIGURE
3-2

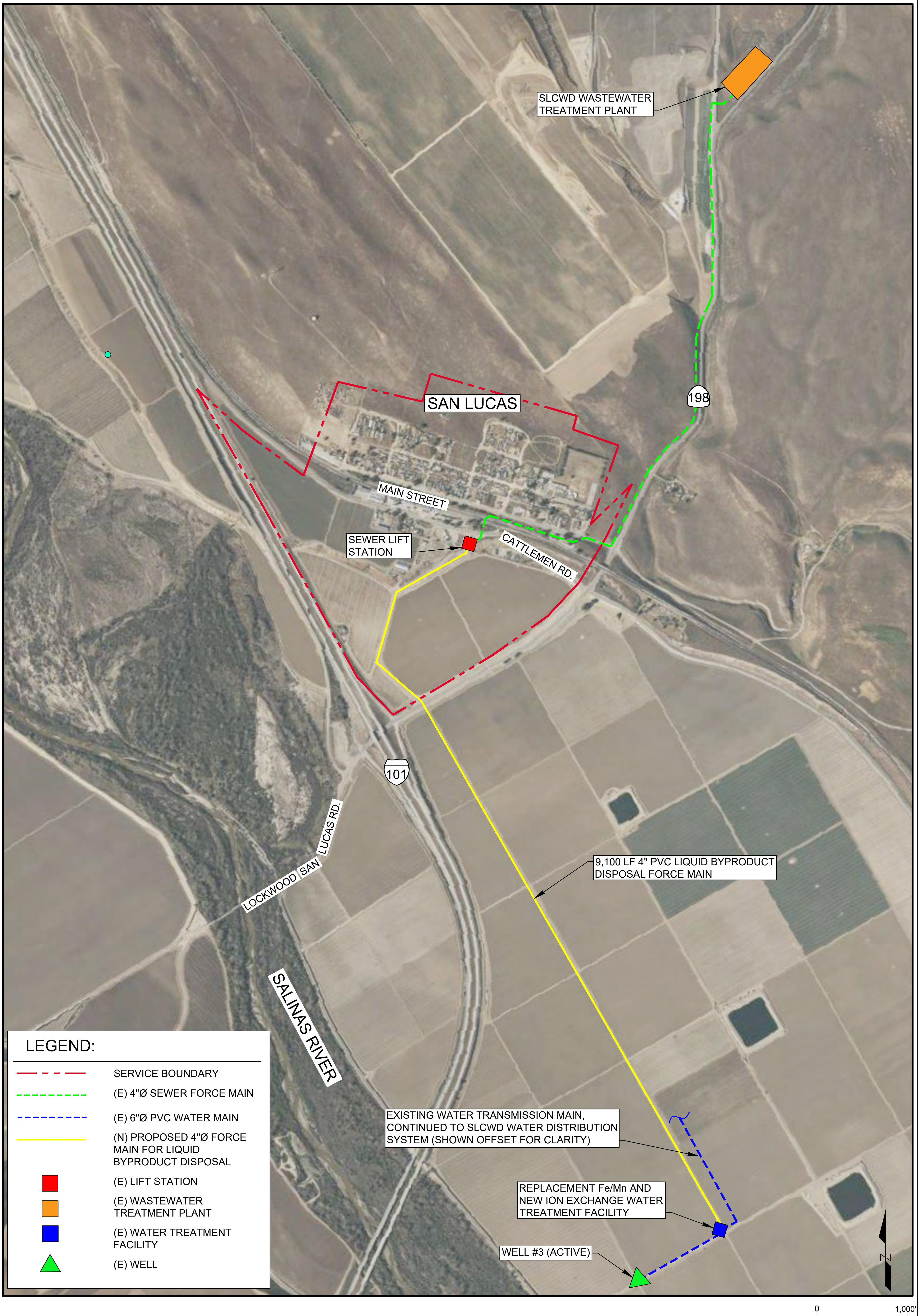

FIGURE 3-3

SAN LUCAS COUNTY WATER DISTRICT

PROPOSED ION EXCHANGE LIQUID BYPRODUCT DISPOSAL INFRASTRUCTURE

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3.3.2. <u>Engineering and Constructability</u>

A summary of the anticipated project improvements for Alternative 2 include:

- Removal of the existing iron and manganese treatment system, adjacent CMU building, and security fencing, backfilling the existing backwash disposal sump with native soil
- Performing civil site work (i.e. site grading, trenching and backfill, constructing new access roads, new security fencing, installing new yard process and service piping)
- Construction of a new concrete masonry unit (CMU) building with a single 15-foot wide and tall rollup door, multiple access doors and windows, area for treatment equipment, electrical room, equipment storage/maintenance room, and operations room.
- Installation of electrical improvements and controls infrastructure
- Installation of a backup generator
- Installation of manganese dioxide and ion exchange treatment systems
- Installation of associated chemical storage and injection systems
- Installation of a 7,000-gallon FRP waste equalization tank and associated waste disposal infrastructure
- Installation of associated process and service piping within the building
- Rehabilitation of the distribution system as described in **Section 2.2**

The existing electrical infrastructure at the SLCWD treatment facility is a <320-amp, 240-volt, 4-wire Pacific Gas and Electric service, which is anticipated to be inadequate for the proposed improvements in this alternative. Increasing the electrical service to a 400-amp, 480-volt, 3-phase, 4-wire rating is included in capital cost estimate (see **Section 4.2**) to cover electrical improvement costs.

This alternative would produce waste streams in the form of liquid backwash from the manganese dioxide filtration system and liquid waste byproduct from the ion exchange system regeneration cycles. Backwash waste produced by the manganese dioxide filtration system would be directed to the new waste equalization tank.

In recent conversations with the DDW, it is understood that SLCWD regularly exceeds the 90^{th} percentile for the copper action level. It is recommended that a post-treatment corrosion control should also be included within the scope of IX Field Piloting to determine the most optimal equipment design parameters for minimizing copper leaching within the SLCWD customer premise plumbing.

Preliminary discussions with Regional Water Quality Control Board (RWQCB) have indicated the most preferable disposal method of liquid waste byproduct would be to temporarily store it in the new waste equalization tank and subsequently dispose at the existing SLCWD WWTP. A brief discussion of each disposal alternative and results of the discussion with the RWQCB is included below. Further detail is provided in the *San Lucas County Water District – Liquid Waste Byproduct Disposal Evaluation* technical memorandum (**Appendix A**).

3.3.2.1. *Blending with Mission Ranches Irrigation Water*

Under this alternative, IX liquid waste byproduct would be collected and blended with Mission Ranches' irrigation water during irrigation periods. Cost considerations and O&M are the biggest benefits of this option. However, there is large concern regarding periods when irrigation is not occurring and the long-term reliance on an outside private entity to manage a public waste stream. Additionally, the RWQCB had concern of directly applying additional salt loading to land. For these reasons, this option was removed from primary consideration but could potentially still be used as a backup disposal method in the future or in emergency scenarios. However, if utilized for backup or emergency scenarios, additional studies, agreements, and permitting would need to occur.

3.3.2.2. *WWTP Disposal*

Under this alternative, IX liquid waste byproduct would be discharged to the sewer collection system and blended with influent to the WWTP at the north end of San Lucas. Liquid waste byproduct would be collected in a storage tank and once per day would be pumped through a force main to a second storage tank located at the closest entry point to the sewer collection system (i.e., along Cattleman Road) roughly 1.75 miles away from the treatment site. Liquid waste byproduct would then be discharged to the sewer main and blended with WWTP influent using a small blending pump at a constant, controlled rate.

Maintenance activities to maintain a liquid waste byproduct disposal force main would typically include periodic cleaning via "pigging" and inspection of above-grade pumps, piping, and valves that experience stagnation of liquid waste byproduct. Recent advances in liquid waste byproduct piping cleaning technology have also allowed the implementation of chemical cleaning with special antiscalants that are mixed with liquid waste byproduct to inhibit crystallization within disposal pumps, piping, and valves. Implementation of such antiscalants have been proven to reduce salt deposition (crystallization) with liquid waste byproduct disposal infrastructure and would likely be implemented under this alternative as a relatively cost-effective method of reducing maintenance activities.

Preliminary analyses as discussed in the *San Lucas County Water District – Liquid Waste Byproduct Disposal Evaluation* technical memorandum (**Appendix A**) indicate that this disposal method is feasible and will comply with current and historical state regulations imposed on the SLCWD WWTP.

3.3.2.3. *Mechanically-Enhanced Evaporation*

Under this alternative, liquid waste byproduct would be disposed into steel evaporation tanks with four mechanical evaporators (e.g. misting). Per the RWQCB, the enhanced evaporation system would be designed to meet Title 27 requirements. A weather station would be installed to monitor ambient humidity, temperature, and wind direction and would be programmed to shut off the evaporators when weather conditions indicate potential drift towards populated areas.

Enhanced evaporation is a proven technology for disposal of liquid waste byproduct with TDS similar to that from an ion exchange system. A new evaporation system would result in additional operations and maintenance activities for SLCWD, including monitoring evaporators for scale build-up and removing liquid waste byproduct scale deposits on a monthly basis. In addition to capital cost and maintenance concerns raised by this disposal method, liquid waste byproduct scale deposits would ultimately need to be hauled off-site to a landfill disposal site, and this is likely to be unacceptable to the RWQCB, which renders this disposal methodology undesirable.

3.3.2.4. Hauling to a Brine Disposal Facility

Under this alternative, liquid waste byproducts would be stored in a storage tank and collected daily to be hauled by trucks to the Monterey Regional Treatment Plant. This option is highly cost prohibitive and should only be considered as an emergency backup. For this reason, this option was removed from consideration.

3.3.3. <u>Operation and Maintenance</u>

Installing the additional equipment for wellhead treatment at SLCWD will trigger an amendment of their current water supply permit that will stipulate the need for a certified operator (Treatment Grade 3 anticipated) to operate and maintain the facility. SLCWD could continue operation of the treatment facility using their current operator, Cypress Water Services, or arrange for another qualified, local operations group (i.e. California Water Services) to provide operations services to meet their amended permit requirements.

Typical O&M activities for this treatment system would include daily inspections of process mechanical equipment, piping, valves, and critical analyzers/alarms (i.e. flowmeters, online water quality analyzers, pressure transducers, high- and low- water quality threshold alarms, etc.) that are required to keep the plant functioning to meet the intended design criteria. Furthermore, operations staff would be responsible for additional pre- and post-treatment sampling requirements prescribed through SLCWD’s revised water system supply permit, as well as any other laboratory water quality samples required to evaluate the performance of treatment units within the plant. Operations staff would also be responsible for ensuring that adequate chemical storage volumes are maintained daily and periodically placing orders for restocking and bulk-, tote-, or drum chemicals and brine salt required to maintain the functionality of the treatment system. As discussed in **Section 3.3.2**, the ion exchange system would produce liquid waste byproduct to be disposed of on an ongoing basis. The additional equipment installed at SLCWD would introduce additional ongoing maintenance and operation costs and would require periodic resin replacement (anticipated every 7 to 10 years), additional power needs, and additional chemicals needed in the treatment process.

Compared to Alternative No. 3 (see **Section 3.4**), ion exchange systems are inherently less difficult to operate than reverse osmosis systems due to the fact that treatment and resin regeneration events can be more easily automated than regular membrane cleaning events that are required to maintain permeability of reverse osmosis systems. Furthermore, treatment via ion exchange is considered to be a “passive” form of treatment that simply requires water to be pumped directly from the well (or other external source) to the distribution system after passing through the resin media bed. In comparison, reverse osmosis often requires additional pumping (i.e. more mechanical components) to boost the raw water supply pressure to reach a minimum osmotic pressure that allows water to pass through the membranes to achieve an allowable recovery. Since the permeate (treated water) leaving the RO system is typically very low in pressure and inherently corrosive/undisinfected, additional product water storage and pumping are often required downstream to stabilize and disinfect the final treated water blend and be pumped into the distribution system.

See **Section 3.6** for details on ownership and operation of the proposed improvements under each Sub-alternative.

3.3.4. Environmental and Permitting Considerations

All of the proposed improvements are anticipated to be located on previously-disturbed areas, therefore, significant environmental and permitting challenges for Alternative 2 are not anticipated. The following environmental documents, permits, and approvals are anticipated under Alternative 1:

- CEQA Initial Study and Negative Declaration or Mitigated Negative Declaration
- Monterey County Encroachment Permit
- WDR revisions for liquid waste byproduct disposal
- Consolidation or Service Agreement between CWKC and SLCWD (dependent on the chosen Sub-alternative)
- LAFCo service area amendment (dependent on the chosen Sub-alternative)
- Water system permit revisions
- Authority to Construct/Permit to Operate from the Monterey Bay Air Resources District

3.3.5. Evaluation of Alternative No. 2

3.3.5.1. Advantages

The key advantages for Alternative No. 2 are as follows:

- The proposed treatment infrastructure components are easily matched to the capacity and requirements of SLCWD's existing water system infrastructure.
- Ion exchange removes the majority of the nitrates and other anionic constituents from the water, slightly improving the overall water quality.
- Operation of an SBA system is inherently simplistic (similar to the existing "pump and treat" system used for iron and manganese removal at SLCWD) and would be completely automated.

3.3.5.2. Disadvantages

Under the 2014 Well License Agreement between the Naraghi family and SLCWD, SLCWD does not maintain any water rights from Well #3 following development of a permanent feasible solution to address the water quality concerns. Negotiations between the Naraghi family and SLCWD for a new easement (prior to alternative selection) will be necessary to successfully implement this alternative. If negotiations are unsuccessful, a combination of this alternative and Alternative No. 4 may need to be implemented following confirmation of the new well's water quality (see **Section 3-5**).

Additional key disadvantages for Alternative No. 3 are as follows:

- Operations staff would be responsible for the operation of the treatment systems and would be required to respond to water quality issues.
- Additional pumping and treatment activities will increase SLCWD's current operations and maintenance costs.

- Compared to broad-spectrum membrane-based treatment, the overall water quality would not be improved significantly (see **Section 3.4).**
- Liquid waste byproduct waste disposal infrastructure would need to be constructed and maintained (see **Section 3.3.2**)

3.4 Alternative No. 3 – Wellhead Treatment – Manganese Dioxide Filtration and Reverse Osmosis

3.4.1. Alternative Summary

Alternative No. 3 consists of two main treatment steps: manganese dioxide filtration followed by a reverse osmosis system.

3.4.1.1. Manganese Dioxide Filtration

The first treatment step under Alternative No. 3 would be to replace the existing manganese dioxide filtration system, as discussed in **Section 3.3.1**.

3.4.1.2. Reverse Osmosis

Following manganese removal and dechlorination of the treated effluent from the upstream filtration system, reverse osmosis (RO) would be utilized. The following treated water quality objectives were considered when performing RO treatment projections:

- Blended Maximum Nitrate Concentration: 8 mg/L Nitrate (as Nitrogen) (80 Percent of the MCL)
- Langelier Saturation Index: 0 to 0.25
- CO_2: < 2 mg/L
- Iron: < 300 ug/L
- Manganese: < 50 ug/L
- TDS: 400 mg/L (80 Percent of the Secondary MCL, Lower Limit)

To avoid treating the entire raw water flow and minimize capital and O&M costs, widely-accepted industry design standards typically dictate that the blended maximum nitrate concentration be 70 to 80 percent of the MCL and the blended TDS concentration be 80 percent of the secondary MCL.

RO removes mono- and divalent ions (the sum of which comprise the TDS concentration) from the feed water, resulting in reduction of a high TDS feed water to a low TDS permeate. RO also removes additional contaminants of concern discussed in **Section 2.1**, including uranium, nitrate, as well as the organic precursors for color, odor, and TTHMs. TDS and other contaminants rejected by the membranes across one or more stages of pressure vessels result in a reject (or “treatment system byproduct”) waste stream that is typically four to five times the feed water TDS concentration (considering a standard two-stage RO configuration).

The percentage of RO feed water converted to permeate is defined as the “recovery”. Obtaining a high recovery must be balanced against potential increases in chemical, pretreatment, membrane replacement, and/or pumping requirements and costs. Overall system recovery increases with each stage of RO treatment. Hydraulic loading rate (commonly referred to as “flux”) is another critical design parameter that contributes to the range of acceptable system recoveries. Optimum flux is determined on a case-by-case basis, typically taking feedwater quality, membrane type, capital cost, and operations and maintenance constraints into account. Operating above the optimum system flux may increase the potential for membrane fouling, leading to decreased permeate production, increased pumping costs, and potential long-term damage to the membranes.

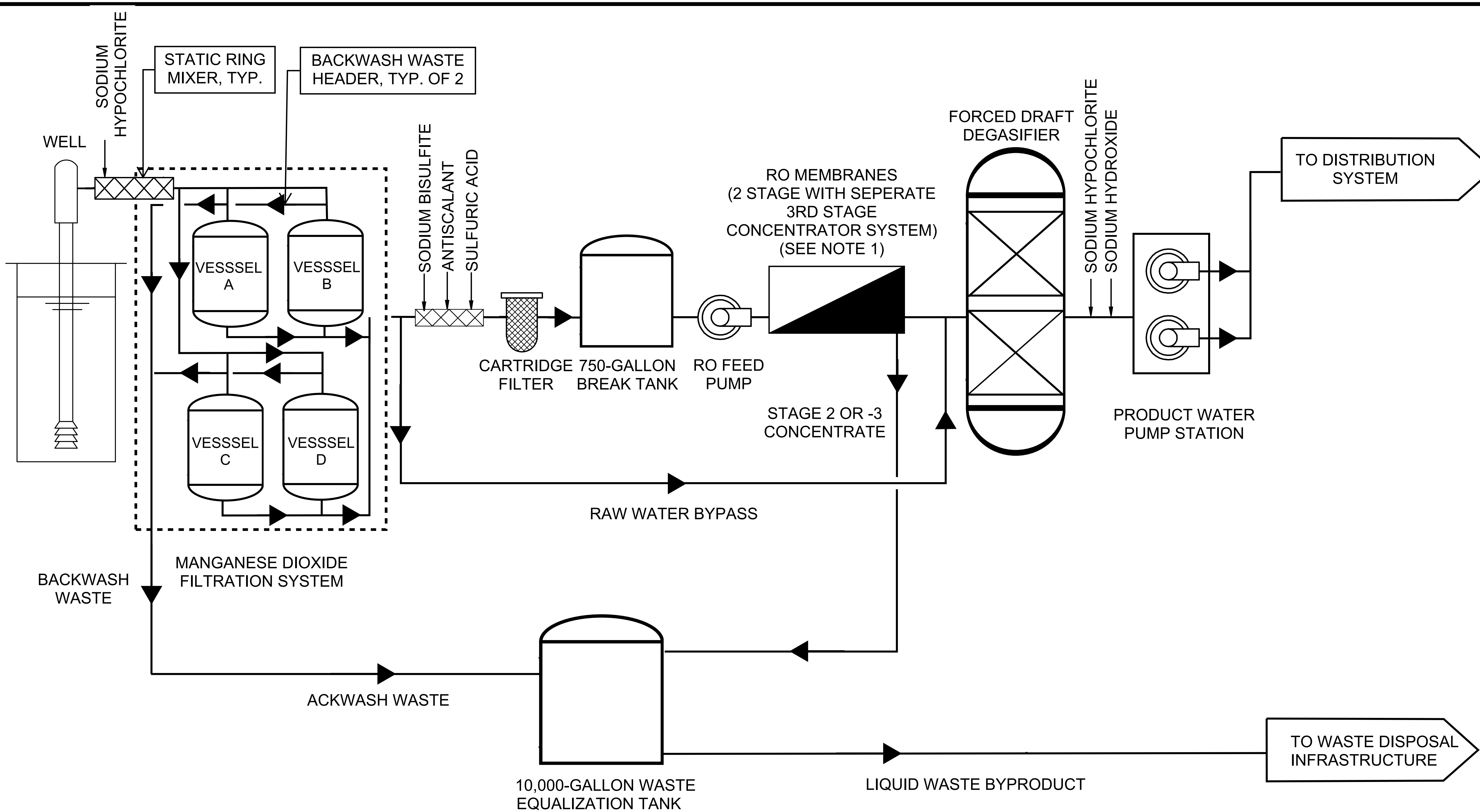
For the concept design it is estimated that approximately 60 percent of the water requires treatment through the RO system, while 40 percent of the water could be bypassed. The portion of treated effluent from the manganese dioxide filtration system that becomes influent to the RO system would be passed through a 5-micron cartridge filter. Antiscalant, sodium bisulfite, and sulfuric acid would subsequently be injected into a static mixer to minimize mineral scaling and bacteriological fouling on the membranes and to maintain adequate flux. Pre-treated water would discharge to a 750-gallon break tank, to allow sufficient chemical contact time for sodium bisulfite. The pressure of the pre-treated water would then be boosted by a small vertical turbine pump through a three-stage membrane system, generating permeate and reject streams.

It is estimated that at average system flux values ranging from 10 to 14 gallons per square foot of membrane area per day, two stages of treatment would result in system recovery of 84 percent and three stages of treatment would result in overall system recovery of 90 percent. Assuming a two-stage RO system to be conservative, this alternative will require a flow rate of 139 gpm, accounting for total system demand, percentage of bypass water, and percentage of RO recovery.

The permeate would be blended with the fraction of the raw water that bypasses the RO system to slightly stabilize the product water, while RO treatment system byproduct would be directed to a waste disposal tank with an air-gap. Combined permeate would pass through a forced draft degasifier to remove entrained carbon dioxide. Since the raw water contains moderate levels of dissolved carbon dioxide suspected to contribute to milky water to SLCWD's current customers, carbon dioxide may need to be removed from the permeate-bypass water blend. Since the treated water blend will contain moderate levels of calcium carbonate hardness, scaling across the degasifer media will need to be monitored closely. The permeate-bypass water blend would be further stabilized with sodium hydroxide to raise the pH and alkalinity to prevent corrosion in the downstream distribution system. Alternatively, only the RO permeate could be sent to the degasifer and the raw water bypass could be blended with the degasifer effluent. More sodium hydroxide would be required to remove carbon dioxide from the raw water portion of the blend. Specifics of product water stabilization will be further evaluated closer to detailed design. Product water would subsequently be conveyed to a below-grade, cast-in-place concrete clearwell for disinfection and pumped into the distribution system by a vertical turbine pump station (arranged in a 1 active + 1 standby configuration). The existing SLCWD water storage tank would continue to be used to supply adequate storage for various demand scenarios.

Both treatment systems would be installed at the existing well yard within a new treatment building constructed of concrete masonry. The existing hypochlorite injection would need to be moved to the upstream of the manganese dioxide filtration system, while a second hypochlorite injection would be required at the product water (blended RO permeate) discharge to mitigate any bacterial growth in the downstream storage tanks and provide an adequate disinfection residual in the distribution system. The system would be operated daily to refill the tanks based on the previous day's consumption.

A block flow diagram of the project alternative and infrastructure improvements layout are presented in **Figure 3-4** and **Figure 3-5**, respectively.



NOTES:

1. 3RD STAGE CAN BE OPERATED DURING SUMMER MONTHS TO REDUCE CONCENTRATE VOLUME, AS NECESSARY. 3RD STAGE MEMBRANES WILL REMAIN PRESERVED IN BISULFITE AND REGUARLY EXERCISED TO PREVENT FOULING AND PRESERVE LONGEVITY.

mkn	OFFICE OF WATER PROGRAMS SAN LUCAS CWD NON-NITRATE ENGINEERING REPORT	FIGURE
	ALTERNATIVE NO. 3 - WELLHEAD TREATMENT - MANGANESE DIOXIDE FILTRATION AND REVERSE OSMOSIS BLOCK FLOW DIAGRAM	3-4

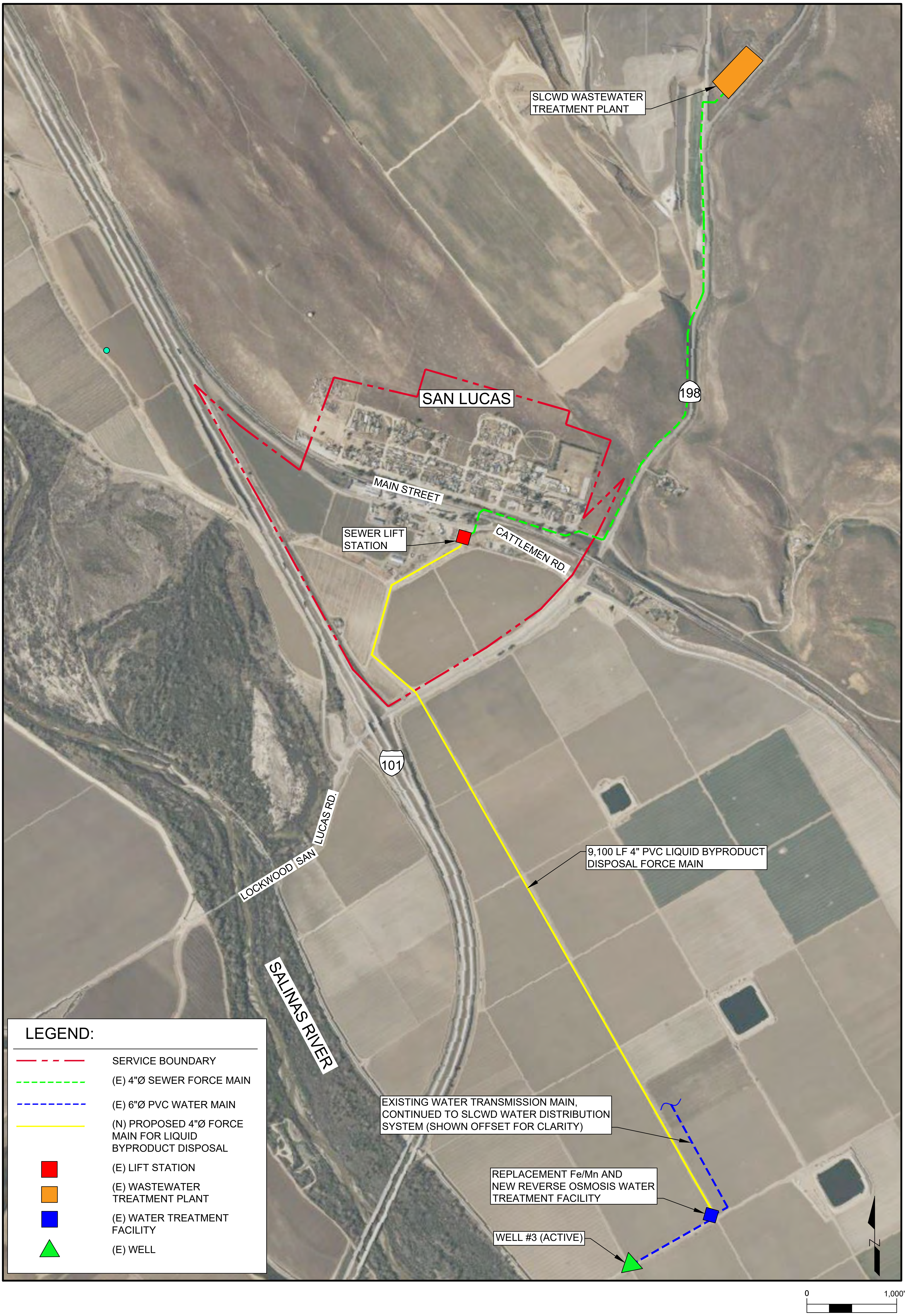


FIGURE 3-5

SAN LUCAS COUNTY WATER DISTRICT

PROPOSED REVERSE OSMOSIS LIQUID BYPRODUCT DISPOSAL INFRASTRUCTURE

mkn
8405 N. FRESNO ST, SUITE 120,
FRESNO, CA 93720 (559) 500-4750

3.4.2. *Engineering and Constructability*

A summary of the anticipated project improvements for Alternative 3 include:

- Removal of the existing iron and manganese treatment system, adjacent CMU building, and security fencing, backfilling the existing backwash disposal sump with native soil
- Performing civil site work (i.e. site grading, trenching and backfill, constructing new access roads, new security fencing, installing new yard process and service piping)
- Construction of a new CMU building with a single 15-foot wide and tall rollup door, multiple access doors and windows, area for treatment equipment, electrical room, equipment storage/maintenance room, and operations room.
- Installation of electrical improvements and controls infrastructure
- Installation of a backup generator
- Installation of manganese dioxide-, reverse osmosis-, and forced draft degasifier treatment systems
- Installation of associated chemical storage and injection systems
- Installation of a 10,000-gallon FRP waste equalization tank and associated waste disposal infrastructure
- Installation of associated process and service piping within the building
- Rehabilitation of the distribution system as described in **Section 2.2**

The existing electrical infrastructure at the SLCWD treatment facility is a <320-amp, 240-volt, 4-wire Pacific Gas and Electric service, which is anticipated to be inadequate for the proposed improvements in this alternative. Increasing the electrical service to a 400-amp, 480-volt, 3-phase, 4-wire rating is included in capital cost estimate (see **Section 4.2**) to cover electrical improvement costs.

While performing reverse osmosis scaling projections for a 2-stage system at RO unit recovery rates ranging from 84- to 88-percent, it was discovered that barium sulfate saturation in the feed water (and resulting RO treatment system byproduct streams from each stage) was quite high. While barium sulfate tends to precipitate extremely slowly over a long period of time before a decline in membrane flux/loss of permeability is observed, it is recommended that a short field pilot be conducted to quantify the impact of barium sulfate scaling over short period of time (anticipated to be 1 to 2 months, operating 6 to 8 hours per working day). Furthermore, piloting should be conducted in conjunction with detailed design to provide information that would optimize the design and operational parameters of the treatment system. In recent conversations with the DDW, it is understood that SLCWD regularly exceeds the 90th percentile for the copper action level. It is recommended that a post-treatment corrosion control should also be included within the scope of RO Field Piloting to determine the most optimal equipment design parameters for minimizing copper leaching within the SLCWD customer premise plumbing.

A RO treatment system byproduct disposal system will be required for Alternative No. 3 as described in **Section 3.3.2.** and **Appendix A.** The preferred method for disposal of waste byproducts from the RO system would be discharge to the San Lucas Wastewater Plant, which would involve the construction of an approximately 1.75-mile-long liquid waste byproduct discharge pipeline to the San Lucas sewer collection system.

3.4.3. Operation and Maintenance

Installing the additional equipment for wellhead treatment at SLCWD will trigger an amendment of their current water supply permit that will stipulate the need for a certified operator (Treatment Grade 3 anticipated) to operate and maintain the facility. SLCWD could continue operation of the treatment facility using their current operator, Cypress Water Services, or arrange for another qualified, local operations group (i.e. California Water Services) to provide ongoing contract operations services to meet their amendment permit requirements.

Typical O&M activities for this treatment system would include daily inspections of process mechanical equipment, piping, valves, and critical analyzers/alarms (i.e. flowmeters, online water quality analyzers, pressure transducers, high- and low- water quality threshold alarms, etc.) that are required to keep the plant functioning to meet the intended design criteria. Furthermore, operations staff would be responsible for additional pre- and post-treatment sampling requirements prescribed through SLCWD's revised water system supply permit, as well as any other laboratory water quality samples required to evaluate the performance of treatment units within the plant. Operations staff would also be responsible for ensuring that adequate chemical storage volumes are maintained daily and periodically placing orders for restocking and bulk-, tote-, or drum-chemicals required to maintain the functionality of the treatment system.

Compared to Alternative No. 2 (see **Section 3.3**), reverse osmosis systems are inherently more difficult to operate than ion exchange systems due to the fact that regular membrane cleaning events that are required to maintain permeability of reverse osmosis systems. Most treatment and resin regeneration events can be almost entirely automated with ion exchange systems. Reverse osmosis also requires additional pumping (i.e. more mechanical components) to boost the raw water supply pressure to reach a minimum osmotic pressure that allows water to pass through the membranes to achieve an allowable recovery. Since the permeate (treated water) leaving the RO system is typically very low in pressure and inherently corrosive/undisinfected, additional product water storage and pumping are often required downstream to stabilize and disinfect the final treated water blend and be pumped into the distribution system. In comparison, treatment via ion exchange is considered to be a "passive" form of treatment that simply requires water to be pumped directly from the well (or other external source) to the distribution system after passing through the resin media bed. However, in the context of this project, given the small size and minimized complexity of the proposed RO system to treat a fraction of the raw water from Well No. 3, it is anticipated that the complexity of O&M of an RO system would only be marginally higher than that of the previously described IX system.

As discussed in **Section 3.4.1**, the reverse osmosis system would produce a treatment system byproduct to be disposed of on an ongoing basis. The additional equipment installed at SLCWD would introduce additional ongoing maintenance and operation costs and would require periodic membrane element replacement (anticipated every 8 to 10 years), additional power needs, and additional chemicals needed in the treatment process. Additionally, annual cleaning of the treatment system byproduct disposal force main to the WWTP would need to occur.

See **Section 3.6** for details on ownership and operation of the proposed improvements under each Sub-alternative.

3.4.4. Environmental and Permitting Considerations

All of the proposed improvements are anticipated to be located on previously-disturbed areas, therefore, significant environmental and permitting challenges for Alternative 3 are not anticipated. The following environmental documents, permits, and approvals are anticipated under Alternative 3:

- CEQA Initial Study and Negative Declaration or Mitigated Negative Declaration
- Monterey County Encroachment Permit
- WDR revisions for liquid waste byproduct disposal
- Consolidation or Service Agreement between CWKC and SLCWD (dependent on the chosen Sub-alternative)
- LAFCo service area amendment (dependent on the chosen Sub-alternative)
- Water system permit revisions
- Authority to Construct/Permit to Operate from the Monterey Bay Air Resources District

3.4.5. Evaluation of Alternative No. 3

3.4.5.1. Advantages

The key advantages for Alternative No. 3 are as follows:

- The proposed treatment infrastructure components are easily matched to the capacity and requirements of SLCWD's existing water system infrastructure.
- Reverse Osmosis provides broad-spectrum membrane-based treatment, which significantly improves overall water quality provided to customers.

3.4.5.2. Disadvantages

Under the 2014 Well License Agreement between the Naraghi family and SLCWD, SLCWD does not maintain any water rights from Well #3 following development of a permanent feasible solution to address the water quality concerns. Negotiations between the Naraghi family and SLCWD for a new easement (prior to alternative selection) will be necessary to successfully implement this alternative. If negotiations are unsuccessful, a combination of this alternative and Alternative No. 4 may need to be implemented following confirmation of the new well's water quality (see **Section 3-6**).

Additional key disadvantages for Alternative No. 3 are as follows:

- Operations staff would be responsible for the operation of the treatment systems and would be required to respond to water quality issues.
- Additional pumping and treatment activities will increase SLCWD's current operations and maintenance costs.
- Liquid waste byproduct waste disposal infrastructure would need to be constructed and maintained (see **Section 3.4.2**)

3.5 Alternative No. 4 – Wellhead Treatment – New Well Drilling

3.5.1. Alternative Summary

Alternative No. 4 consists of acquiring land in an area presumed to have equivalent or better groundwater quality than that discussed in **Section 2.1** and constructing a well if easement negotiations between the Naraghi Family and SLCWD are not successful. Should this alternative be pursued following discussion with the Naraghi Family, wellhead treatment via the methodology presented in Alternative No. 2 or Alternative No. 3 is anticipated to be paired with this alternative, and costs reflected as such in **Section 4**.

3.5.2. Engineering and Constructability

A summary of the anticipated project improvements for Alternative 4 include:

- Hydrogeology and groundwater quality conceptual model
- Exploratory borehole drilling coupled with water quality analyses
- Hydrogeology services for well design and testing
- Installation of a new well, wellhead motor, pump, and appurtenances
- Selection and implementation of preferred water treatment methodology (Alternative No. 2 or 3)
- Installation of transmission pipeline to SLCWD distribution system and appurtenant features
- Connection to SLCWD distribution system
- Rehabilitation of the distribution system as described in **Section 2.2**

3.5.2.1. Additional Hydrogeological and Engineering Investigations

MKN conducted a brief desktop survey of local groundwater conditions based on readily available information.

The California Department of Water Resources' (DWR) Bulletin 118 describes the Salinas Valley Basin, Upper Valley Subbasin as having impairments in TDS, sulfate, boron, and nitrate. Additionally, the SWRCB's Aquifer Risk Map appears to have limited data in the vicinity of San Lucas but indicates "high risk" of nitrate contamination adjacent to the Community.

Well completion reports from 19 wells in and around the Community were reviewed and indicated an average depth of approximately 200 feet below ground surface, approximately 100-125 feet deeper than Well #2 and Well #3. Additionally, CWKC's wells were reviewed and those indicating low nitrate concentrations (< 5 mg/L as N) tended to be located on the west side of King City, closest to the Salinas River and averaged approximately 190 feet deeper than Well #2 and Well #3 (96-57 feet above mean sea level [AMSL]).

This preliminary research indicates that there is potential for better groundwater quality in the vicinity of San Lucas, especially at deeper depths and closer to the west side of the Community. However, due to regional impairments, the likelihood of locating groundwater that meets all water quality standards without treatment is low. To obtain preferable groundwater quality conditions within a reasonable distance of the SLCWD distribution system, multiple analyses will need to be completed and are discussed below:

- Comprehensive hydrogeology and groundwater quality conceptual model to evaluate the geospatial conditions within a one-mile radius of the SLCWD distribution system.
- Exploratory borehole drilling, consisting of drilling one to three boreholes based on information from the desktop analysis. During each borehole drilling operation, depth to ground water will be documented and water quality samples will be obtained pursuant to California SWRCB sampling procedures.
- Treatment methodology evaluation based on the water quality results of the exploratory boreholes including either (1) Alternative No. 2 or 3, or (2) reevaluation of the treatment methodology if water quality is substantially better to the existing water quality. If reevaluation is necessary due to better water quality, this will occur concurrent to detailed well design.

3.5.3. Operation and Maintenance

Since it is unknown whether superior water quality can be achieved by drilling a new well, it is assumed that this alternative will be paired with the treatment methodology presented in Alternative No. 2 (**Section 3.3**) or Alternative No. 3 (**Section 3.4**). As such, the O&M cost associated with this alternative is equivalent to that of Alternative No. 2 or 3 (see **Section 4.3**), depending on the preferred selection.

3.5.4. Environmental and Permitting Considerations

It is unknown whether the proposed improvements will be located in previously-disturbed areas. Therefore, environmental and permitting challenges will need to be investigated, including a detailed environmental constraints analysis if Alternative No. 4 is selected. Potential considerations include:

- Impacts to streambeds and drainage courses along the alignment
- Biological resources impacts
- Cultural and archeological impacts

The following environmental documents, permits, and approvals are anticipated under Alternative No. 4:

- CEQA Initial Study and Negative Declaration or Mitigated Negative Declaration
- Monterey County Encroachment Permit
- Monterey County Well Permit (potentially multiple)
- Monterey County Combination Building Permit
- Additional permits not discussed in this list will be determined by the alternative selected to be paired with Alternative No. 4 (see **Sections 3.3.4** and **3.4.4**)

3.5.5. Evaluation of Alternative No. 4

3.5.5.1. Advantages

The key advantages for Alternative No. 4 are as follows:

- No easement negotiations and/or future issues with use, access, or maintenance of the constructed facilities
- Potential for improved groundwater quality
- Potential for reduced treatment equipment
- See **Sections 3.3.5.1** and **3.4.5.1** for advantages related to Alternative No. 2 and 3

3.5.5.2. Disadvantages

The key disadvantages for Alternative No. 4 are as follows:

- Potential for equivalent or worse groundwater quality
- Requires more investigation to determine well location and feasibility
- Requires land acquisition
- Higher cost than Alternative Nos. 2 and 3 alone
- See **Sections 3.3.5.2** and **3.4.5.2** for disadvantages related to Alternative No. 2 and 3.

3.6 Ownership and Operation Sub-Alternatives

The SLCWD water system has an opportunity under each of the proposed alternatives to either continue to be owned and operated by SLCWD or consolidated with CWKC to be owned and operated by Cal Water. The sub-alternatives described in this section present the concept, advantages, and disadvantages to each party owning and operating the SLCWD water system following the construction of the selected alternative.

3.6.1. Sub-alternative A – SLCWD Ownership

This sub-alternative describes the operations concept in which SLCWD would continue to own and operate the existing SLCWD water system and any improvements constructed as a result of this project.

SLCWD would maintain its water system permit and maintain the responsibility to ensure compliance of the system with applicable rules and regulations. SLCWD would be solely responsible for delivering reliable, safe, and clean drinking water to its customers.

SLCWD would continue to read meters, bill customers, and provide administrative services to operate the water system. SLCWD would continue to maintain a contractual relationship with a certified contract operator to operate the treatment and distribution systems. SLCWD would be solely responsible for the continued operation, upkeep, maintenance, and repairs of all piping, valves, structures, and water system equipment both existing and future.

It is anticipated that SLCWD would bill customers based on the rates described in **Section 5.6**.

3.6.1.1. Advantages

The following items are key advantages related to Sub-alternative A:

- Customers would have a well-known, local point of contact with the water purveyor.
- The water purveyor would be solely focused on serving the community of San Lucas, not any other communities.
- SLCWD would own and operate both the water and wastewater facilities.
- Water rates would be lower than those under Cal Water.

3.6.1.2. Disadvantages

The following items are key disadvantages related to Sub-alternative A:

- SLCWD has historically had difficulty providing clean drinking water given their limited resources.
- SLCWD would rely on a contract operator rather than internal staff.

3.6.2. Sub-alternative B – California Water Service Acquisition

This sub-alternative describes the operations concept in which Cal Water would acquire the existing SLCWD system and own and operate any improvements constructed as a result of this project.

Under Alternative 1B, CWKC would physically consolidate with SLCWD, and thus, a new water system permit would not be necessary for ownership and operation of the SLCWD system. Under Alternatives 2B and 3B, SLCWD would forego its water system permit and Cal Water would obtain a new water system permit through the DDW for ownership and operation of the SLCWD system.

Cal Water would take on the responsibility to ensure compliance of the system with applicable rules and regulations. Cal Water would be solely responsible for delivering reliable, safe, and clean drinking water to its customers. Cal Water would take on the responsibility to read meters, bill customers, and provide administrative services to operate the water system. Cal Water would leverage its internal operations staff to provide a certified operator to operate the treatment and distribution systems. Cal Water would be solely responsible for the continued operation, upkeep, maintenance, and repairs of all piping, valves, structures, and water system equipment both existing and future.

It is anticipated that Cal Water would bill customers based on the rates described in **Section 5.6**.

3.6.2.1. Additional Improvements

Cal Water has stated that they would be hesitant to engage in acquisition and ownership of the SLCWD water system without a secondary water source. With any primary alternative under sub-alternative B, it is anticipated that a new well would be drilled near San Lucas and better-quality water would be targeted.

A hydrogeologist would be engaged for preliminary well siting and subsequent exploratory drilling (e.g. hydropunching or test well construction) would take place to target locations with water quality better than Well #3. A new well would be drilled, equipped, and connected to the SLCWD distribution system. The length of well discharge transmission pipeline and the necessity of property acquisition and treatment is highly dependent on the location and water quality of the well.

There is a high level of uncertainty that a new well with water quality within drinking water standards could be drilled. Therefore, if sub-alternative B is selected as the preferred alternative, it is recommended that this ER be revised to further detail the procedures for exploratory drilling, the results of which, and the necessary improvements. For the purposes of alternative selection, a budgetary allowance for well construction and equipping has been included in **Section 5.4**.

3.6.2.2. Advantages

The following items are key advantages related to Sub-alternative B:

- Cal Water is a large water purveyor with significant resources. Cal Water would be capable of maintaining the System and mitigating future issues that arise.
- Cal Water has highly experienced treatment operators capable of operating a proposed treatment system under any of the alternatives.
- San Lucas would be provided with source redundancy.

3.6.2.3. Disadvantages

The following items are key disadvantages related to Sub-alternative B:

- The Community may not have as much trust in a large entity as it does with SLCWD. The Community should be consulted on this consideration.
- Water service and wastewater service would be provided by two different entities, which may cause confusion within the Community.
- A substantial level of effort and schedule duration increase would be experienced in exploratory drilling and construction of a new well site.
- Water rates would be higher than those under SLCWD.

4.0 OPINION OF PROBABLE COST

4.1 Summary

This section presents a comparison of costs of the alternatives presented in **Section 3.0**. Cost opinions are presented for the capital improvement costs, operations and maintenance costs, and life cycle costs for each alternative. Life cycle costs analyses were evaluated over an assumed 20-year period.

4.2 Opinions of Probable Capital Cost

Opinions of probable capital cost for Alternatives No. 1, 2, 3, and 4 are included in **Tables 4-1, 4-2**, **4-3**, and **4-4,** respectively. As discussed in Section 3.5, the capital costs associated with drilling a new well under Alternative No. 4 are assumed to be combined with the wellhead treatment discussed in Alternative No. 2 or 3. Therefore, **Table 4-4** will contain two capital cost totals, reflective of combining with either wellhead treatment methodology.

Table 4-1: Alternative No. 1: Intertie with CWKC – Opinion of Probable Capital Cost				
Item	**Quantity**	**Units**	**Unit Price**	**Cost**
General				
Mobilization, Demobilization, and Cleanup[1]	1	LS	$657,000	$657,000
Demolish Iron and Manganese Treatment Facility[3]	1	LS	$100,000	$100,000
Miscellaneous Demolition	1	LS	$10,000	$10,000
Electrical and Instrumentation Improvements	1	LS	$200,000	$200,000
SLCWD System Rehabilitation[4]	1	LS	$77,000	$77,000
			Subtotal	**$1,044,000**
Equipment				
Booster Pump Station	1	LS	$500,000	$500,000
Chlorine Analyzer	1	EA	$35,000	$35,000
Sodium Hypochlorite Injection System	1	EA	$40,000	$40,000
			Subtotal	**$575,000**
Piping and Appurtenances				
Trenching and Backfilling	43200	LF	$150	$6,480,000
Pavement Removal and Repair[5]	4320	LF	$110	$476,000
Traffic Control	54	Days	$5,000	$270,000
8-inch PVC Pipe	43200	LF	$80	$3,456,000
8-inch Isolation Valve[6]	34	EA	$5,250	$179,000
8-inch Backflow Preventer Assembly	1	EA	$6,000	$6,000
Master Meter	1	EA	$13,600	$14,000
Connection at CWKC[7]	1	LS	$30,000	$30,000
Connection at SLCWD[7]	1	LS	$10,000	$10,000
Unanticipated Challenges	1	LS	$1,000,000	$1,000,000
Miscellaneous Fittings and Appurtenances	1	LS	$100,000	$100,000
			Subtotal	**$12,021,000**
Other				
CEQA Documentation[8]	1	LS	$80,000	$80,000
Monterey County Encroachment Permit	1	EA	$5,000	$5,000
UPRR Encroachment Permit	1	EA	$50,000	$50,000
King City Encroachment Permit	1	EA	$5,000	$5,000
Caltrans Encroachment Permit[9]	1	EA	$0	$0
Service Agreement between CWKC and SLCWD	1	EA	$5,000	$5,000
LAFCo Service Agreement or Service Area Amendment	1	EA	$5,000	$5,000
			Subtotal	**$150,000**
			Construction Total	**$13,790,000**
			Contingency (20%)	**$2,758,000**
			Total with Contingency	**$16,548,000**
Administrative, Engineering, Construction Management, and Permitting (20%)[10]				**$3,310,000**

Table 4-1: Alternative No. 1: Intertie with CWKC – Opinion of Probable Capital Cost Cont'd	
Total	**$19,858,000**
Inflation Adjustment[11]	**$3,690,000**
Total at Time of Bid	**$23,548,000**

Notes:

1. *Assumes mobilization, demobilization, and cleanup to be approximately 5% of the Construction Total.*
2. *Includes removal of piping, fencing, well structure, and disconnecting electrical.*
3. *Includes removal of concrete, treatment equipment, piping, fencing, and chemical housing structure.*
4. *Includes pipe cleaning, hydraulic modeling, and a water loss audit.*
5. *Assumes 10% of pipeline alignment will need pavement removal and repair.*
6. *Isolation valves spaced every 1320 feet per California Waterworks Standard 64577.*
7. *Includes potholing, excavation, fittings, appropriate valves and appurtenances, and pavement repair.*
8. *Includes CEQA Initial Study and Negative Declaration or Mitigated Negative Declaration.*
9. *A CalTrans permit may be needed. However, this should be further evaluated in a future detailed design project.*
10. *Consists of financing (5%), construction administration (5%), engineering and construction management during construction (5%), and legal/administrative costs (5%).*
11. *Adjustment accounting for inflation between project cost estimation and project bidding. Based on the project schedule presented in* ***Section 6.0*** *and the average Engineering News Record Construction Cost Index change for 2020 – 2024 (5.84%).*

Table 4-2: Alternative No. 2– Wellhead Treatment – Manganese Dioxide Filtration and Ion Exchange - Opinion of Probable Capital Cost				
Item	**Quantity**	**Units**	**Unit Price**	**Cost**
General				
Mobilization, Demobilization, and Cleanup[1]	1	LS	$216,150	$217,000
Earthwork and Grading[2]	1	LS	$100,000	$100,000
Demolition and Disposal[3]	1	LS	$100,000	$100,000
Electrical and Instrumentation[4]	1	LS	$267,000	$267,000
SLCWD System Rehabilitation[5]	1	LS	$77,000	$77,000
			Subtotal	**$761,000**
Equipment				
Online Analyzers[6]	1	LS	$110,000	$110,000
Manganese Dioxide Filtration System[7]	1	LS	$77,000	$77,000
Ion Exchange System[8]	1	LS	$480,000	$480,000
Chemical Feed Storage and Injection Systems[9]	1	LS	$77,000	$77,000
7,000 Gallon FRP Waste Equalization Tank[10]	1	LS	$39,000	$39,000
Backup Generators[11]	1	LS	$300,000	$300,000
			Subtotal	**$1,083,000**
Structures and Foundations				
Concrete Masonry Unit Building and Foundation[12]	1	LS	$300,000	$300,000
			Subtotal	**$300,000**
Potable Water Piping and Appurtenances				
Process and Service Piping, Fittings, and Appurtenances[13]	1	LS	$250,000	$250,000
			Subtotal	**$250,000**
Other				
Waste Disposal Infratructure[14]	1	LS	$1,796,000	$1,796,000
Legal Negotiation Fees	1	LS	$150,000	$150,000
Piloting and Corrosion Control Study	1	LS	$200,000	$200,000
			Subtotal	**$2,146,000**
			Construction Total	**$4,540,000**
			Contingency (20%)	**$908,000**
			Total with Contingency	**$5,448,000**
			Administrative, Engineering, Construction Management, and Permitting (20%)[15]	**$1,090,000**
			Total	**$6,538,000**
			Inflation Adjustment[16]	**$1,215,000**
			Total at Time of Bid	**$7,753,000**

Table 4-2: Alternative No. 2 – Wellhead Treatment – Manganese Dioxide Filtration and Ion Exchange - Opinion of Probable Capital Cost Cont'd
Notes:

Notes:

1. *Assumes mobilization, demobilization, and cleanup to be approximately 5% of the Construction Total.*
2. *Trenching/excavation, backfilling, clearing, grubbing, site leveling of building foundations.*
3. *Demolition and disposal of existing piping, filtration system, building, and associated electrical/controls infrastructure within the existing treatment site.*
4. *New power/control wiring and conduits to new process equipment, treatment site lighting (interior and exterior), associated instrumentation and new control panel(s). Assumed to be 15% of Cost Opinion Subtotal, based on recent projects.*
5. *Includes pipe cleaning, hydraulic modeling, and a water loss audit.*
6. *Consists of two (2) online Free/Chlorine/pH Analyzer and one (1) Nitrate Analyzer (Reagentless).*
7. *36-inch Diameter, four (4) Vessel Packaged Filtration Skid (with Backwash Controller) supplied by treatment equipment vendor.*
8. *Consists of a 150-gpm packaged strong-base anion exchange system, cartridge filters, local control panel, brine pump, piping and appurtenances, brine maker tank, and liquid waste byproduct tank.*
9. *Consists of duplex diaphragm metering pump skids with associated piping and instrumentation (assumes delivery of 275-IBC Tote Chemicals) for 12.5% Sodium Hypochlorite and 38% Sodium Bisulfite.*
10. *Consists of one (1) 7,000-gallon FRP liquid waste byproduct equalization storage tank with associated piping and appurtenances.*
11. *Consists of two (2) diesel backup generators capable of providing 24 - 48 hours of continuous power to Well #3 and the treatment facility.*
12. *Assumes 25' x 50' x 10' (Length x Width x Height) concrete masonry unit building (8-inch split-faced CMU walls with adequate insulation, two (2) doors, and a single coiling overhead roll-up door with associated structural foundations.*
13. *Assumes Schedule 80 PVC (above-grade interconnecting process piping), C900 PVC and ductile-iron yard pipe and fittings (buried and exposed, respectively).*
14. *Includes effluent holding tanks, pumps, piping, appurtenances, electrical, and permitting.*
15. *Consists of financing (5%), construction administration (5%), engineering and construction management during construction (5%), and legal/administrative costs (5%).*
16. *Adjustment accounting for inflation between project cost estimation and project bidding. Based on the project schedule presented in **Section 6.0** and the average Engineering News Record Construction Cost Index change for 2020 – 2024 (5.84%).*

Table 4-3: Alternative No. 3– Wellhead Treatment – Manganese Dioxide Filtration and Reverse Osmosis - Opinion of Probable Capital Cost				
Item	**Quantity**	**Units**	**Unit Price**	**Cost**
General				
Mobilization, Demobilization, and Cleanup[1]	1	LS	$241,250	$242,000
Earthwork and Grading[2]	1	LS	$100,000	$100,000
Demolition and Disposal[3]	1	LS	$100,000	$100,000
Electrical and Instrumentation[4]	1	LS	$360,000	$355,000
SLCWD System Rehabilitation[5]	1	LS	$77,000	$77,000
			Subtotal	**$87,000**
Equipment				
Online Analyzers[6]	1	LS	$110,000	$110,000
Manganese Dioxide Filtration System[7]	1	LS	$77,000	$77,000
Reverse Osmosis System[8]	1	LS	$511,000	$511,000
Forced Draft Degasifier[9]	1	LS	$114,000	$114,000
Cast-in-Place Concrete Clearwell[10]	1	LS	$50,000	$50,000
Vertical Turbine Product Water Pump Station[11]	1	LS	$65,000	$65,000
Chemical Feed Storage and Injection Systems[12]	1	LS	$154,000	$154,000
10,000-Gallon FRP Concentrate Waste Equalization Tank[13]	1	LS	$58,000	$58,000
750-Gallon FRP Break Tank[14]	1	LS	$8,000	$8,000
Backup Generators[15]	1	LS	$300,000	$300,000
			Subtotal	**$1,447,000**
Structures and Foundations				
Concrete Masonry Unit Building and Foundation[16]	1	LS	$300,000	$300,000
			Subtotal	**$300,000**
Potable Water Piping and Appurtenances				
Process and Service Piping, Fittings, and Appurtenances[17]	1	LS	$300,000	$300,000
			Subtotal	**$300,000**
Other				
Waste Disposal Infratructure[18]	1	LS	$1,796,000	$1,796,000
Legal Negotiation Fees	1	LS	$150,000	$150,000
Piloting and Corrosion Control Study	1	LS	$200,000	$200,000
			Subtotal	**$2,146,000**
			Construction Total	**$5,067,000**
			Contingency (20%)	**$1,014,000**
			Total with Contingency	**$6,081,000**
			Administrative, Engineering, Construction Management, and Permitting (20%)[19]	**$1,217,000**
			Total	**$7,298,000**
			Inflation Adjustment[20]	**$1,356,000**
			Total at Time of Bid	**$8,654,000**

Table 4-3: Alternative No. 3– Wellhead Treatment – Manganese Dioxide Filtration and Reverse Osmosis - Opinion of Probable Capital Cost Cont'd
Notes: 1. *Assumes mobilization, demobilization, and cleanup to be approximately 5% of the Construction Total.* 2. *Trenching/excavation, backfilling, clearing, grubbing, site leveling of building foundations.* 3. *Demolition and disposal of existing piping, filtration system, building, and associated electrical/controls infrastructure within the existing treatment site.* 4. *New power/control wiring and conduits to new process equipment, treatment site lighting (interior and exterior), associated instrumentation and new control panel(s). Assumed to be 15% of Cost Opinion Subtotal, based on recent projects.* 5. *Includes pipe cleaning, hydraulic modeling, and a water loss audit.* 6. *Consists of two (2) online Free/Chlorine/pH Analyzer and one (1) Nitrate Analyzer (Reagentless).* 7. *(6) 36-inch Diameter, four (4) Vessel Packaged Filtration Skid (with Backwash Controller) supplied by treatment equipment vendor.* 8. *Consists of an 87-gpm (assumes approx. 40% of the raw water bypassed), 2-stage reverse osmosis skid with 8-inch elements, cartridge filters, online turbidity, ORP, TDS, pressure, and flow analyzers, local control panel, booster pump, skid-mounted piping and appurtenances, clean-in-place pump and tank, and permeate flush pump.* 9. *Consists of media-loaded reactor vessels, control panel, and blower with associated piping and appurtenances.* 10. *Consists of baffled concrete basin with associated piping and appurtenances.* 11. *Consists of barrel pump and pressure transducer with associated piping and appurtenances.* 12. *Consists of duplex diaphragm metering pump skids with associated piping and instrumentation (assumes delivery of 275-IBC Tote Chemicals) for 12.5% Sodium Hypochlorite, 38% Sodium Bisulfite, 93% Sulfuric Acid, and 100% Antiscalant.* 13. *Consists of one (1) 10,000-gallon FRP treatment system byproduct equalization storage tank with associated piping and appurtenances.* 14. *Consists of one (1) 750-gallon FRP break tank with associated piping and appurtenances.* 15. *Consists of two (2) diesel backup generators capable of providing 24 - 48 hours of continuous power to Well #3 and the treatment facility.* 16. *Assumes 25' x 50' x 10' (Length x Width x Height) concrete masonry unit building (8-inch split-faced CMU walls with adequate insulation, two (2) doors, and a single coiling overhead roll-up door with associated structural foundations.* 17. *Assumes Schedule 80 PVC (above-grade interconnecting process piping), C900 PVC and ductile-iron yard pipe and fittings (buried and exposed, respectively).* 18. *Includes effluent holding tanks, pumps, piping, appurtenances, electrical, and permitting.* 19. *Consists of financing (5%), construction administration (5%), engineering and construction management during construction (5%), and legal/administrative costs (5%).* 20. *Adjustment accounting for inflation between project cost estimation and project bidding. Based on the project schedule presented in* ***Section 6.0*** *and the average Engineering News Record Construction Cost Index change for 2020 – 2024 (5.84%).*

Table 4-4: Alternative 4: Wellhead Treatment - New Well Drilling Coupled with Alternative No. 2 or 3 - Opinion of Probable Capital Cost				
Item	**Quantity**	**Units**	**Unit Price**	**Cost**
General				
Mobilization, Demobilization, and Cleanup[1]	1	LS	$146,000	$146,000
Site Preparation	1	LS	$15,000	$15,000
Electrical and Instrumentation Improvements	1	LS	$200,000	$200,000
			Subtotal	**$363,000**
Equipment				
Online Analyzers	1	EA	$35,000	$35,000
Sodium Hypochlorite Injection System	1	LS	$40,000	$40,000
			Subtotal	**$75,000**
Structures and Foundations				
Steel Shade Structure and Foundation	1	LS	$60,000	$60,000
Chainlink Fencing	290	LF	$35	$11,000
			Subtotal	**$71,000**
Piping and Appurtenances				
Exploratory Boreholes and Associated Testing[2]	2	EA	$200,000	$400,000
Production Well Allowance	1	LS	$300,000	$300,000
Vertical Turbine Pump and Discharge Piping	1	EA	$325,000	$325,000
Trenching and Backfilling	5280	LF	$150	$792,000
6-in PVC Pipe[3]	5280	LF	$36	$189,000
Misc. Fittings and Appurtenances	1	LS	$10,000	$10,000
Connection at SLCWD	1	LS	$10,000	$10,000
			Subtotal	**$2,026,000**
Other				
Land Acquisition Allowance[4]	1	LS	$50,000	$50,000
Test Well Planning[5]	1	LS	$150,000	$150,000
Engineering Investigations[6]	1	LS	$300,000	$300,000
Monterey County Permit(s)[7]	1	EA	$15,000	$15,000
			Subtotal	**$515,000**
			Construction Total	**$3,048,000**
			Alternative No. 2 or 3 Construction Total	**$4,540,000 - $5,067,000**
			Combined Construction Total	**$7,588,000 - $8,115,000**
			Contingency (20%)	**$1,518,000 - $1,623,000**
			Total with Contingency	**$9,106,000 - $9,738,000**
			Administrative, Engineering, Construction Management, and Permitting (20%)[8]	**$1,822,000 - $1,948,000**
			Total	**$10,928,000 - $11,686,000**
			Inflation Adjustment[9]	**$2,031,000 - $2,172,000**
			Total at Time of Bid	**$12,959,000 - $13,858,000**

Table 4-4: Alternative 4: Wellhead Treatment - New Well Drilling Coupled with Alternative No. 2 or 3 - Opinion of Probable Capital Cost Cont'd
Notes: 1. *Assumes mobilization, demobilization, and cleanup to be approximately 5% of the Construction Total.* 2. *Consists of constructing test well, development, zone testing and sampling, pump testing, and demolition.* 3. *This is a budgetary estimate as the exact location of the new production well is not yet determined.* 4. Consists of acquiring approximately one (1) acre of land in the surrounding areas of San Lucas. 5. *Consists of hydrogeology desktop study, test well design, and test well reporting and analysis.* 6. *Consists of additional hydrogeology related desktop investigations and treatment methodology analysis.* 7. *Monterey County permits will potentially consist of encroachment permit, building permit(s), and well permit(s).* 8. *Consists of financing (5%), construction administration (5%), engineering during construction (5%), and legal/administrative costs (5%).* 9. *Adjustment accounting for inflation between project cost estimation and project bidding. Based on the project schedule presented in* ***Section 6.0*** *and the average Engineering News Record Construction Cost Index change for 2020 – 2024 (5.84%).*

4.3 Opinion of Probable Annual O&M Cost

Opinions of probable annual O&M costs for Alternatives No. 1, 2, and 3 are provided in **Tables 4-5**, **4-6**, and **4-7**, respectively. If Alternative No. 4 is pursued, the alternative will have O&M costs as reflected in **Table 4-6** or **4-7**, depending on the alternative selected in combination with the new well drilling.

Table 4-5: Alternative No. 1: Intertie with CWKC – Opinion of Probable Annual O&M Cost

Item	Annual Cost	Cost per Service Connection	Cost per 1,000 Gallons	Cost per Million Gallons
O&M				
Maintenance[1]	$11,182	$115.28	$0.39	$386.58
Labor[2]	$5,200	$53.61	$0.18	$179.78
Chemicals[3]	$845	$8.72	$0.03	$29.23
Power[4]	$5,782	$59.61	$0.20	$199.90
Total	**$23,009**	**$237**	**$0.80**	**$795**

Notes:

1. *Estimated as a lump sum average for miscellaneous pipe, valve, and appurtenance repairs of $1,000 per mile per year as well as $250 per month for miscellaneous booster pump station repairs.*
2. *Assumes 104 hours of labor per year (2 hours per week) at a burdened labor cost of approximately $100 per hour.*
3. *Based on a supply concentration of 12.5% and average usage rate of 0.12 gallons per day.*
4. *Based on a production utilization rate of 0.37 on all equipment and $0.45/kWh.*

Table 4-6: Alternative No. 2 – Wellhead Treatment – Manganese Dioxide Filtration and Ion Exchange – Opinion of Probable Annual O&M Cost

Item	Annual Cost	Cost Per Service Connection	Cost per 1,000 Gallons	Cost per Million Gallon
O&M				
Chemicals[1]	$3,714	$44	$0.13	$127
Power[2]	$15,882	$187	$0.54	$544
Labor and Maintenance[3]	$83,400	$981	$2.86	$2,859
Analytical[4]	$1,800	$21	$0.06	$62
Equipment Replacement[5]	$1,832	$22	$0.06	$63
Additional Consumables[6]	$10,250	$121	$0.35	$351
WWTP Disposal Infrastructure Maintenance[7]	$23,237	$273	$0.80	$797
Total	**$140,114**	**$1,648**	**$4.80**	**$4,803**

Table 4-6: Alternative No. 2 – Wellhead Treatment – Manganese Dioxide Filtration and Ion Exchange – Opinion of Probable Annual O&M Cost Cont'd
Notes: 1. *Assumes a 37% production utilization factor for injection of 12.5% Sodium Hypochlorite and 40% Sodium Bisulfite delivered in 55-Gallon Drums.* 2. *Well Pump assumed to be operating at flow rate of 150 gallons per minute @ 25 HP, assumes 1 kW for ion exchange system treatment power/controls at a production utilization factor of approximately 37% and $0.15 per kWH.* 3. *Assumes 834 hours of labor and maintenance per year (two hours per day) at a burdened labor cost of approximately $100 per hour.* 4. *Consists of monthly sampling for post-treatment nitrate, iron, and manganese, and quarterly sampling of general water quality analytes.* 5. *Consists of replace 99 cubic feet of ion exchange resin once every ten (10) years, assumes approximately $185 per cubic foot.* 6. *Assumes delivery of $125 per metric ton of potassium chloride salt and approximately 82 metric annual tons of salt required for resin regeneration.* 7. *Includes the cost of waste disposal pipeline antiscalent, power for a 2 HP pump operating at 40 gpm for four (4) hours per day, labor and maintenance assuming 52 hours of labor per year (1 hour per week) at a burdened labor cost of approximately $100 per hour, $5,000 per year for byproduct waste disposal pipeline cleaning via ice pigging, and $1,000 per year per mile of pipe for additional maintenance costs.*

Table 4-7: Alternative No. 3 – Wellhead Treatment – Manganese Dioxide Filtration and Reverse Osmosis – Opinion of Probable Annual O&M Cost

Item	Annual Cost	Cost Per Service Connection	Cost per 1,000 Gallons	Cost per Million Gallon
O&M				
Chemicals[1]	$5,470	$64	$0.19	$188
Power[2]	$14,666	$173	$0.50	$503
Labor and Maintenance[3]	$83,400	$981	$2.86	$2,859
Analytical[4]	$1,800	$21	$0.06	$62
Equipment Replacement[5]	$1,800	$21	$0.06	$62
WWTP Disposal Infrastructure Maintenance[6]	$23,237	$273	$0.80	$797
Totals	**$130,373**	**$1,534**	**$4.47**	**$4,469**

Table 4-7: Alternative No. 3 – Wellhead Treatment – Manganese Dioxide Filtration and Reverse Osmosis – Opinion of Probable Annual O&M Cost Cont'd
Notes: 1. *Assumes a 37% production utilization factor for injection of 12.5% Sodium Hypochlorite, 100% Antiscalant, 93% Sulfuric Acid, 25% Sodium Hydroxide, and 40% Sodium Bisulfite delivered in 55-Gallon Drums.* 2. *Well Pump assumed to be operating at flow rate of 150 gpm @ 5 HP, RO Feed Pump operating at flowrate of 87 gpm @ 7.5 HP, product water pump station operating at 135 gpm @ 7.5 HP, degasifer blower operating at 600 scfm @ 2.5 HP, evaporation system at 5 HP, assumes 1 kW for RO system treatment power/controls at a production utilization factor of approximately 37% and $0.15 per kWH.* 3. *Assumes 834 hours of labor and maintenance per year at a burdened labor cost of approximately $100 per hour.* 4. *Consists of monthly sampling for post-treatment nitrate, iron, and manganese, and quarterly sampling of general water quality analytes.* 5. *Consists of replacing 18 reverse osmosis membrane elements once every ten (10) years, assumes approximately $1,000 per element for common high-recovery reverse osmosis membrane elements.* 6. *Includes the cost of waste disposal pipeline antiscalent, power for a 2 HP pump operating at 40 gpm for four (4) hours per day, labor and maintenance assuming 52 hours of labor per year (1 hour per week) at a burdened labor cost of approximately $100 per hour, $5,000 per year for byproduct waste disposal pipeline cleaning via ice pigging, and $1,000 per year per mile of pipe for additional maintenance costs.*

4.4 Opinion of Probable Sub-Alternative Additional Costs

Each alternative has two sub-alternatives, where the SLCWD System either (A) remains under SLCWD ownership or (B) is consolidated with CWKC. The two sub-alternatives and their respective requirements are discussed in detail in **Section 3.6**. This section describes the additional costs associated with each sub-alternative. Additional costs discussed in this section will be presented alongside each alternative in the subsequent sections.

4.4.1. Sub-Alternative A – SLCWD Ownership

If Sub-alternative A is pursued, there would be no change in the System management, and there would be no additional equipment required other than what is presented in **Section 4.2**. Additional costs borne by the residents of San Lucas would be the result of any additional operation and maintenance costs produced by the selected alternative as well as the legal fees associated with Alternative No. 2 or 3. Operation and maintenance costs are presented in **Section 4.3**.

4.4.2. Sub-Alternative B – Consolidation with CWKC

Cal Water has stated that they are willing to consider acquiring the SLCWD system under the condition of a secondary water source being obtained for the system. Obtaining a secondary water source would include the drilling of a new production well. Opinions of the probable capital as well as operation and maintenance costs for the new production well are captured below in **Tables 4-8** and **4-9**, respectively.

Additionally, under Alternatives 2B, 3B, and 4B, Cal Water would need to obtain a new water system permit in order to own and operate the SLCWD system and serve the San Lucas community. Costs related to this effort are summarized in **Table 4-10**.

Table 4-8: Sub-Alternative B: New Production Well – Opinion of Probable Capital Cost				
Item	**Quantity**	**Units**	**Unit Price**	**Cost**
General				
Mobilization, Demobilization, and Cleanup[1]	1	LS	$119,000	$119,000
Site Preparation	1	LS	$15,000	$15,000
Electrical and Instrumentation Improvements	1	LS	$200,000	$200,000
			Subtotal	**$334,000**
Equipment				
Online Analyzers	1	EA	$35,000	$35,000
Sodium Hypochlorite Injection System	1	LS	$40,000	$40,000
			Subtotal	**$75,000**
Structures and Foundations				
Steel Shade Structure and Foundation	1	LS	$60,000	$60,000
Chainlink Fencing	60	LF	$35	$3,000
			Subtotal	**$63,000**
Piping and Appurtenances				
Test Well and Associated Testing[2]	1	LS	$200,000	$200,000
Production Well	1	LS	$300,000	$300,000
Vertical Turbine Pump and Discharge Piping	1	EA	$325,000	$325,000
Trenching and Backfilling[3]	5280	LF	$150	$792,000
6-in PVC Pipe	$189,000	$189,000	$189,000	$189,000
Misc. Fittings and Appurtenances	$10,000	$10,000	$10,000	$10,000
			Subtotal	**$1,816,000**
Other				
Land Acquisition Allowance[4]	$50,000	$50,000	$50,000	$50,000
Test Well Planning[5]	$150,000	$150,000	$150,000	$150,000
Monterey County Well Permit	$5,000	$5,000	$5,000	$5,000
			Subtotal	**$205,000**
			Construction Total	**$2,493,000**
			Contingency (20%)	**$499,000**
			Total with Contingency	**$2,992,000**
			Administrative, Engineering, Construction Management, and Permitting (20%)[6]	**$599,000**
			Total	**$3,591,000**
			Inflation Adjustment[7]	**$668,000**
			Total at Time of Bid	**$4,259,000**

Table 4-8: Sub-Alternative B: New Production Well – Opinion of Probable Capital Cost Cont'd

Notes:

1. *Assumes mobilization, demobilization, and cleanup to be approximately 5% of the Construction Total.*
2. *Consists of constructing a test well, development, zone testing and sampling, pump testing, and demolition.*
3. *This is a budgetary estimate as the exact location of the new production well is not yet determined.*
4. Consists of acquiring approximately one (1) acre of land in the surrounding areas of San Lucas.
5. *Consists of hydrogeology desktop study, test well design, and test well reporting and analysis.*
6. *Consists of financing (5%), construction administration (5%), engineering during construction (5%), and legal/administrative costs (5%).*
7. *Adjustment accounting for inflation between project cost estimation and project bidding. Based on the project schedule presented in **Section 6.0** and the average Engineering News Record Construction Cost Index change for 2020 – 2024 (5.84%).*

Table 4-9: Sub-Alternative B: New Production Well – Opinion of Probable Annual O&M Cost

Item	Annual Cost	Cost per Service Connection	Cost per 1,000 Gallons	Cost per Million Gallons
O&M				
Maintenance[1]	$5,000	$51.55	$0.17	$172.86
Labor[2]	$5,200	$53.61	$0.18	$179.78
Additional Analytical[3]	$6,000	$61.86	$0.21	$207.43
Chemicals[4]	$845	$8.72	$0.03	$29.23
Power[5]	$9,224	$95.09	$0.32	$318.90
Total	**$26,269**	**$271**	**$1**	**$908**

Notes:

1. *Assumes a lump sum average for miscellaneous pipe, valve, and appurtenance repairs.*
2. *Assumes 52 hours of labor per year (1 hour per week) at a burdened labor cost of approximately $100 per hour.*
3. *Consists of quarterly sampling of general water quality analytes.*
4. *Based on a supply concentration of 12.5% and average usage rate of 0.12 gallons per day.*
5. *Based on a production utilization rate of 18% on all equipment and $0.45/kWh.*

Table 4-10: Alternative Nos. 2B & 3B – Opinion of Probable Additional Capital Cost				
Item	**Quantity**	**Units**	**Unit Price**	**Cost**
General				
Water System Permit[1]	1	EA	$20,000	$20,000
			Subtotal	**$20,000**
			Construction Total	**$20,000**
			Contingency (20%)	**$4,000**
			Total with Contingency	**$24,000**

Notes:

1. *Includes all professional services related to Cal Water's acquisition of SLCWD and obtaining a new water system permit for ownership and operation of SLCWD system.*

4.5 Opinion of Probable Life-Cycle Cost

The opinion of probable life-cycle cost for each alternative discussed in **Section 3.0** is provided below in **Table 4-11.**

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Table 4-11: Summary of Total Life Cycle Costs								
Expense	**Alternative 1A**	**Alternative 1B**	**Alternative 2A**	**Alternative 2B**	**Alternative 3A**	**Alternative 3B**	**Alternative 4A**	**Alternative 4B**
Net Present Value of 20-Year O&M[1]	$905,000	$1,937,000	$5,506,000	$6,538,000	$5,123,000	$6,155,000	$5,123,000 - $5,506,000	$6,155,000 - $6,538,000
Total Project Capital Cost	$23,548,000	$23,548,000	$7,753,000	$7,753,000	$8,654,000	$8,654,000	$12,959,000 - $13,858,000	$12,959,000 - $13,858,000
Additional Sub Alt Costs	$0	$4,259,000	$0	$4,283,000	$0	$4,283,000	$0	$4,283,000
Present 20-Year Life Cycle Cost Total	**$24,453,000**	**$29,744,000**	**$13,259,000**	**$18,574,000**	**$13,777,000**	**$19,092,000**	**$18,465,000 - $18,981,000**	**$23,765,000 - $24,272,000**
Cost Per Connection	**$252,000**	**$307,000**	**$137,000**	**$191,000**	**$142,000**	**$197,000**	**$190,000 - $196,000**	**$245,000 - $250,000**

Note:
Assumes 5.8% interest rate for 20-year Life Cycle costs, accounts for inflation per recent economic projections. Rounded up to nearest thousand.

4.6 Rate Structure

Each sub-alternative presented in **Section 3.6** has an associated rate structure. SLCWD currently reads individual meters at each connection and bills on a consumption basis. Under Sub-Alternative A, SLCWD's rate structure would apply, which is equivalent to the current rate structure for San Lucas residents. **Table 4-12** below summarizes the anticipated ongoing monthly service fees that could be expected under Sub-Alternative A, which represents current conditions. Under Sub-Alternative B, CWKC's rate structure would apply. Following preliminary discussions with CWKC and review of CWKC's current rate schedule, the approximate anticipated monthly service fees were summarized and are presented below in **Table 4-13**.

The rate structures presented in **Table 4-12** and **4-13** do not include system improvements, and as a result, these fees are subject to increase based on the respective O&M cost of the selected alternative. For each rate structure, current average daily demands and population are estimated as described in **Section 1.1.4.**

Table 4-12: Sub-Alternative A − Estimated SLCWD Consumption Charges[1]

Population Data		**Monthly Service Fee**	
Service Connections	97	Tier Charge, 10-15 Unit Tier[4]	$60.00
Service Population (Future)	378	Tier Charge, 15-20 Unit Tier[4]	$70.00
Estimated Demands		Tier Charge, 20-25 Unit Tier[4]	$80.00
Water Demand per Capita (GPD)	210	Tier Charge, 25-30 Unit Tier[4]	$90.00
Total Water Demand (GPD)	79,246	Tier Charge, 30-35 Unit Tier[4]	$100.00
Total Water Demand (gallons per month)	2,377,380	Tier Charge, 35-40 Unit Tier[4]	$110.00
Gallons per Unit[2]	748	Tier Charge, 40-45 Unit Tier[4]	$120.00
Total Units per Month	3178		
Units per Connection per Month[3]	33	**Estimated Monthly Service Fee Total[5]**	**$9,700**
Units being Charged at 30-35 Unit Tier[3]	3178	**Estimated Monthly Service Fee per Service**	**$100**

Notes:

1. *Costs are for San Lucas connection and service fees only and do not include system improvements, pipeline installation, etc.*
2. *One unit is equivalent to 100 cubic feet, or approximately 748 gallons.*
3. *Assuming all connections use an average of 33 units per month, each connection would be charged on the 30-35 unit tier.*
4. *Each connection is charged a flat rate based on the tier their monthly water use falls within based on SLCWD 2009 rate sheet (current rates as of January 2024).*
5. *Monthly service fee is calculated as: (tier charges, 30-35 unit tier) *(units being charged as 30-35 unit tier).*

Table 4-13: Sub-Alternative B − Estimated Cal Water Consumption Charges[1]			
Population Data		**Monthly Service Fee**	
Service Connections	97	Meter Base Charge (Monthly)[4]	$20.18
Service Population (Future)	378	Units Charge, 0-7 Unit Rate[5]	$3.18
Estimated Demands		Units Charge, 8-14 Unit Rate[5]	$3.98
Water Demand per Capita (GPD)	210	Units Charge, >14 Unit Rate[5]	$5.96
Total Water Demand (GPD)	79,246	CPUC Surcharge	$124
Total Water Demand (gallons per month)	2,377,380	**Estimated Monthly Service Fee Total[6]**	**$17,670**
Gallons per Unit[2]	748	**Estimated Monthly Service Fee per Service**	**$182**
Total Units per Month	3178	CAP Credit[7]	-$10.09
Units being Charged at 1-7 Unit Rate[(3)]	679	**Estimated Monthly Service Fee per Service (Low-Income Households)**	**$172**
Units being Charged at 8-14 Unit Rate[3]	679		
Units being Charged at >14 Unit Rate[3]	1820		

Notes:

1. *Costs are for San Lucas connection and service fees only and do not include system improvements, pipeline installation, etc.*
2. *One unit is equivalent to 100 cubic feet, or approximately 748 gallons.*
3. *The first 7 units per service connection per month will be charged at the 1-7 unit rate, the next 7 units per service connection per month will be charged at the 8-14 unit rate, any additional units per service connection per month will be charged at the >14 unit rate.*
4. *Based on 5/8"x3/4" water meter.*
5. *Per Cal Water Schedule No. SVR-1-R.*
6. *Monthly service fee is calculated as: (meter base charge)*(service connections)+(unit charges, 1-7 units)*(units being charged as 1-7 unit rate)+(unit charges, 8-14 units)*(units being charged as 8-14 unit rate)+(unit charges, >14 units)*(units being charged as >14 unit rate), rounded.*
7. *Customer Assistance Program credit for low-income customers meeting certain requirements. Per Cal Water Schedule No. CAP.*

4.7 Estimated Monthly Billing

It is anticipated that residents will incur costs of water higher than they currently pay under each alternative and sub-alternative, with Sub-Alternative B rendering higher monthly costs. Costs of water realized by residents are anticipated to include consumption-based charges, O&M costs, and potentially system improvement loan payments. At this time, it is not certain whether the selected alternative will be fully grant-funded or what capital costs will be borne by Community members. **Table 4-14** presents an estimate of the monthly cost of water for each home based on the costs discussed previously in this section, exclusive of any capital costs not funded through outside sources.

It is recognized that there is some discrepancy between existing billing information and calculated billing. SLCWD has stated that their average bill is approximately $50 per connection. However, this average bill does not reconcile with the system's reported demands and rate structure. Additionally, SLCWD has stated that the stated average billing value may not capture all connections. For the purposes of this report and for an equivalent comparison between all alternatives and current conditions, it is assumed that the average bill is actually closer to $100 per **Table 4-14**.

Table 4-14: Estimated Costs of Alternatives

Alternative	Monthly Consumption Charges Per Service[1]	Monthly O&M Costs per Service	Total Capital Costs[2]
Alternative 1A	$100	$20	$23,548,000
Alternative 1B	$182	$42	$27,807,000
Alternative 2A	$100	$120	$7,753,000
Alternative 2B	$182	$143	$12,036,000
Alternative 3A	$100	$112	$8,654,000
Alternative 3B	$182	$135	$12,937,000
Alternative 4A	$100	$105 - $115	$12,959,000 - $13,858,000
Alternative 4B	$182	$128 - $137	$17,242,000 - $18,141,000

(1) Consumption charges are estimated water use charges based on typical water use and the water purveyor's billing rates.
(2) Total Capital Costs shown do not reflect potential reduction of capital costs due to grant funding and/or contributions from Mission Ranches and the Naraghi Family to address nitrate pollution. Grant funding for capital improvements from the State Water Board Division of Financial Assistance may be eligible for up to $80,000 per connection (currently 97 connections estimated), assuming Deputy Director approval. Unfunded costs will need to be paid for through other funding sources including a potential loan that would need to be repaid through increased water rates over time.

5.0 RECOMMENDED ALTERNATIVE

5.1 Alternative Evaluation and Ranking

To better compare the alternatives, a set of criteria and corresponding weighting was prepared. These criteria were carefully selected to ensure a fair evaluation, considering water quality improvements, financial impacts (capital improvement costs, as well as O&M costs), community effects and impact, and supply redundancy. The criteria selected include:

- Improved Water Quality (35%)
- Capital Improvement Costs (25%)
- Operations and Maintenance Costs (10%)
- Operational Complexity (10%)
- Construction Impact (10%)
- Timing (10%)

Scoring of each criterion was based on the following scale:

1 - Bad (Low)

2 - Not Good

3 - Neutral

4 - Good

5 - Great (High)

Supply redundancy is not evaluated as the selection of Sub-Alternative A or Sub-Alternative B is going to be revisited following community and stakeholder input, and inclusion of the Sub-alternatives would directly affect the scores for supply redundancy under each primary alternative. Additionally, Alternative No. 4 is not evaluated as it would receive the same score as Alternative No. 2 or 3, depending on the paired alternative.

Table 5-1 below summarizes the scores assigned to each alternative for each criterion, as well as the overall weighted score assigned to each alternative.

Table 5-1: Evaluation Matrix				
Criteria	Weight (%)	Scores		
		Alternative No. 1 - Intertie with King City	Alternative No. 2 - Wellhead Treatment - Manganese Dioxide Filtration and Ion Exchange	Alternative No. 3 - Wellhead Treatment - Manganese Dioxide Filtration and Reverse Osmosis
Improved Water Quality	35%	5	4	5
Capital Improvement Cost	25%	1	5	4
O&M Cost	10%	4	2	3
Operational Complexity	10%	4	2	3
Construction Impact	10%	1	3	3
Timing	10%	1	3	3
Weighted Totals	**100%**	**3.0**	**3.7**	**4.0**

Based on Table 5-1, Alternative No. 3 scores the highest. However, the weighted totals between Alternatives 2 and 3 are within approximately 10% and the weighting and scoring is subjective. Therefore, both Alternative Nos. 2 and 3 are being recommended prior to further stakeholder and community input given their similarity in meeting water quality objectives, cost, operational complexity, construction and community impact, and timing.

5.2 Recommended Alternative

Given the significant additional cost, construction, and coordination impacts and challenges associated with Alternative No. 1, it is highly recommended that this alternative is not pursued. If it is desired that Alternative No. 1 is pursued by project stakeholders, it is recommended that substantial additional feasibility work and investigation are conducted.

Alternative Nos. 2 and 3 are recommended as the preferred alternatives, however Alternative No. 3 may be somewhat more preferable and feasible from a waste disposal standpoint. Due to limited performance-related information on the existing well, the well pump size and operation curve should be developed or confirmed prior to designing any improvements. The following items have been identified as key benefits for the selection of Alternative Nos. 2 or 3.

- **Improved Water Quality.** Both alternatives will successfully resolve SLCWD's water quality issues and bring the System into compliance with the SWRCB DDW. Alternative No. 2, however, does not provide a significant increase in overall water quality when compared to the broad-spectrum, membrane-based treatment utilized in Alternative No. 3, which is capable of removing constituents causing system deficiencies.

- **Cost.** Both alternatives have significantly lower capital costs when compared to Alternative No. 1's capital cost of $23,548,000, with Alternative Nos. 2 and 3 having a capital cost of $7,753,000 and $8,654,000, respectively.

- **Construction Impact.** Both alternatives are anticipated to have fewer construction-related impacts relative to Alternative No. 1, which requires 8.2-miles of 8-inch pipe. Whereas Alternative Nos. 2 and 3 require 1.75 miles of 4-inch pipe (in addition to typical treatment-related piping), which is approximately one quarter of the amount of pipe required for Alternative No. 1 at half the pipe diameter.

- **Timing.** Alternative No. 1 has more environmental, permitting, and administrative requirements than Alternative Nos. 2 and 3. This will result in a longer period between the selection of Alternative No. 1 and construction of the project, which is anticipated to be higher-impact and longer in duration as mentioned above.

For both recommended alternatives, either Sub-Alternative A or Sub-Alternative B appear feasible. A brief summary of the advantages and disadvantages of each is provided below.

- **Sub-Alternative A**: This sub-alternative maintains SLCWD's water rates and management of the water and wastewater facilities. This leaves San Lucas residents with a well-known, local point of contact. However, under SLCWD ownership, there is potential for mitigation issues if there are future water quality problems as SLCWD has historically had difficulty providing clean drinking water. Additionally, with SLWCD's limited resources, treatment would rely on a contracted operator rather than internal staff.

- **Sub-Alternative B**: This sub-alternative increases monthly service, capital, and O&M cost under all alternatives. However, through drilling a new production well, supply reliability would be improved. Additionally, given Cal Water's size and resources, Cal Water would be capable of internally handling all future system operations as well as mitigating any future system issues. If this sub-alternative is selected, it is recommended that this ER be revised to further detail the procedures for exploratory drilling, the results of which, and the necessary improvements.

Following input from the community and project stakeholders, the recommended alternative and sub-alternative will be further refined to a single recommendation. Recommended next steps are as follows:

- Feedback from community
- Stakeholder selection of preferred alternative
- Begin discussion with the Naraghi family to evaluate the necessity of Alternative No. 4
- Develop and implement piloting study if a wellhead treatment alternative is selected
- Conduct hydrogeologic investigations if Alternative No. 4 is necessary

5.3 Design Criteria

Upon community and stakeholder input, this section will be expanded to incorporate additional design criteria for the selected alternative.

6.0 PROJECT SCHEDULE

The proposed implementation schedule for the SLCWD water system improvements is presented in **Table 6-1.** The following is a general description of activities to be completed for implementation, and timeframes may vary depending on the alternative selected.

Table 6-1: Proposed Project Implementation Schedule	
Task Name / Deliverable	**Anticipated Date of Completion**
General Package	
General Package	January 2025
Technical Application Package	
Administrative Draft Engineering Report	Complete
Draft Engineering Report	Complete
Final Engineering Report	September 2024
Draft Comprehensive Response to Climate Change	Complete
Final Comprehensive Response to Climate Change	September 2024
Draft Water Rights Documentation	Complete
Final Water Rights Documentation	September 2024
Technical, Managerial, Financial (TMF) Assessment	April 2025
30% Plans, Specifications, & Estimate (PS&E)	June 2025
60% PS&E	December 2025
Draft 90% PS&E	May 2026
Final 90% PS&E	September 2026
Complete Technical Package	October 2026
Environmental Package	
File CEQA Documents	December 2025
Complete Environmental Package	October 2026
Implementation Period	
Complete Financial Security Package	October 2026
RWRCB Cleanup and Abatement Order Settlement	October 2027
DWSRF Executed Construction Agreement	November 2027
Construction Advertising/Bidding	January 2028
Construction Award	February 2028
Start of Construction	May 2028
Completion of Construction/System Operational	January 2030

7.0 ADDITIONAL PROJECT CONSIDERATIONS

7.1 Construction Considerations

The construction phase of this project shall be well coordinated to minimize the impact to SLCWD residents. Many of the proposed improvements will be constructed independently of the existing water system. Shutdowns to fully tie in the improvements will be coordinated to minimize the amount of time without water service. All service interruptions to connect any system improvements to the existing infrastructure shall be coordinated with SLCWD, and the impacted residents shall be notified ahead of each planned shut-down.

7.2 Comprehensive Response to Climate Change

7.2.1. Vulnerability

Temperatures in the San Lucas and King City area have historically ranged from 41 to 86 degrees Fahrenheit. No vulnerability issues are suspected based on the historic temperature ranges and future impacts as a result of climate change.

7.2.2. Adaptation

No adaptations will be necessary during the design or construction of the selected alternative as there are no identified vulnerability impacts due to climate change.

7.2.3. Mitigation

Given that the components and purpose of the selected project alternative do not pertain to slowing or stopping changes caused by greenhouse gas emissions in the atmosphere, no mitigation measures were deemed applicable.

7.3 Water Rights

For all three alternatives discussed, water is obtained solely through groundwater wells that reside in the Upper Valley Aquifer Subbasin of the Salinas Valley Basin. The basin is currently regulated by the Salinas Valley Basin Groundwater Sustainability Agency. However, the basin is not adjudicated and is not designated as critically over drafted by the Sustainable Groundwater Management Act. As a result, there are no groundwater conservation mitigation efforts in place under the Sustainable Groundwater Management Act.

Groundwater rights are specifically tied to the ownership of the overlying land. Therefore, agreements must be made between SLCWD and the Naraghi family for the continued use or purchase of Well #3 and the associated land. Alternatively, SLCWD may acquire land for the construction of a new well for which it owns the water rights.

Appendix A

San Lucas County Water District – Liquid Waste Byproduct Disposal Evaluation – Non-Nitrate Work Plan

TECHNICAL MEMORANDUM

To: Randy Marx, PE | Office of Water Programs
Sheri Braden | San Lucas County Water District

From: Mihika Ram, PE | MKN & Associates
Stefanos Word, PE, ENV SP | MKN & Associates
Brian McCauley, PE | MKN & Associates
Carson Hatmaker, EIT | MKN & Associates

Date: July 12, 2024

Re: San Lucas County Water District – Liquid Waste Byproduct Disposal Evaluation – Non-Nitrate Work Plan

Funding for this project has been provided in full or in part through an agreement with the State Water Resources Control Board. The contents of this document do not necessarily reflect the views and policies of the foregoing, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

The following Technical Memorandum (TM) presents the evaluation of waste disposal alternatives associated with the wellhead treatment alternatives described in **Sections 3.2** and **3.3** of the *San Lucas County Water District - Water System Improvements Engineering Report* (Report).

1.0 DISPOSAL ALTERNATIVES

As discussed in **Sections 3.2** and **3.3** of the Report, both the Ion Exchange and Reverse Osmosis wellhead treatment alternatives would produce liquid waste byproducts that will require disposal. Four alternatives for waste disposal were considered and are described below.

1.1 Blending with Mission Ranches Irrigation Water

Under this alternative, waste byproduct would be collected and blended with Mission Ranches' irrigation water during irrigation periods. Capital cost considerations as well as operations and maintenance (O&M) are the biggest benefits of this option. However, there is large concern regarding periods when irrigation is not occurring and the long-term reliance on an outside private entity to manage a public waste stream. Additionally, the Regional Water Quality Control Board (RWQCB) had concern of directly applying additional salt loading to land. For these reasons, this option was removed from primary consideration but could potentially still be used as a backup disposal method in the future or in emergency scenarios.

If this alternative was elected for future consideration, the RWQCB has requested that the following would needed to evaluate the viability of this option:

- Antidegradation analysis for the proposed discharge associated with impacts to the groundwater basin;
- Monitoring proposal to verify there are no long-term adverse impacts related to the disposal;
- Description of the blending process (flows, concentrations, how mixing occurs); and
- Designation of an alternative disposal option for when irrigation water is not being used.

1.2 Hauling to a Brine Disposal Facility

Under this alternative, waste byproduct would be stored in a storage tank and collected daily to be hauled by trucks to the Monterey Regional Treatment Plant. This option is highly cost prohibitive and should only be considered as an emergency backup. For this reason, this option was removed from consideration.

1.3 Mechanically Enhanced Evaporation

Under this alternative, waste byproduct would be disposed into steel evaporation tanks with four mechanical evaporators (e.g. misting). Per the RWQCB, the enhanced evaporation system would be designed to meet Title 27 requirements. A weather station would be installed to monitor ambient humidity, temperature, and wind direction and would be programmed to shut off the evaporators when weather conditions indicate potential drift towards populated areas.

While enhanced evaporation is a proven technology for disposal of liquid waste byproduct with TDS similar to that from an ion exchange system or concentrate from an RO system, implementation of an enhanced evaporation system would require acquisition of a minimum of 12,000 square feet of land to locate evaporation tanks, associated equipment and control infrastructure, and access for vehicles as well as easements to locate a new liquid waste byproduct discharge pipeline from the water treatment plant (WTP) to the proposed evaporation site. A new evaporation system would also result in additional operations and maintenance activities for SLCWD, including monitoring evaporators for scale build-up and removing waste byproduct scale deposits on a monthly basis. This waste would then need to be collected and disposed of offsite by a third-party contractor. For these reasons, this option was removed from further consideration.

1.4 Disposal at San Lucas Wastewater Treatment Plant

Under this alternative, treatment plant waste would be discharged to the sewer collection system and blended with influent to the wastewater treatment plant (WWTP) at the north end of San Lucas. Treatment waste would be collected in a storage tank and once per day would be pumped through a force main to a second storage tank located at the closest entry point to the sewer collection system (i.e., along Cattleman Road) roughly two miles away from the well site. Liquid waste byproduct would then be discharged to the sewer main and blended with WWTP influent using a small blending pump at a constant, controlled rate. Maintenance activities to maintain a liquid waste byproduct disposal force main would typically include periodic cleaning via “pigging” and inspection of above-grade pumps, piping, and valves that are exposed to stagnated waste byproduct. Recent advances in liquid waste byproduct pipe cleaning technology have also allowed the implementation of chemical cleaning with special antiscalants that are mixed with the liquid waste byproduct to inhibit crystallization within disposal pumps, piping, and valves. Implementation of such antiscalants have been proven to reduce salt deposition (crystallization) with liquid waste byproduct disposal infrastructure and would likely be implemented under this alternative as a relatively cost-effective method of reducing maintenance activities.

For these reasons, disposal to the San Lucas WWTP was considered the most preferable option by RWQCB in recent preliminary discussions. A more detailed analysis of this option is provided in Section 2 of this TM.

2.0 RECOMMENDED DISPOSAL ALTERNATIVE

2.1 Wastewater Treatment Plant

The San Lucas WWTP is owned by the San Lucas County Water District and operated by Cypress Water Services. The facility is located approximately one mile north of San Lucas and is permitted to treat up to 34,000 gallons per day. The treatment process consists of three mechanically aerated ponds, an oxidation pond, and an effluent storage pond. Treated wastewater is then discharged to a seven-acre spray disposal area that is vegetated.

While monthly monitoring reports from 2023 indicate daily influent flows ranging from approximately 5,600 to 15,000 gallons per day, a letter from the RWQCB in 2022 indicated that the facility was treating an average daily flow of 19,000 gallons. It is noted that flow data from monitoring reports appear to have been totaled over the course of the month and then averaged to obtain theoretical daily flows, therefore true daily influent flows to the WWTP are unknown. It is further noted that there is a large discrepancy between known drinking water demands (ranging between approximately 20,000 to 60,000 gallons per day in recent years) and influent flows to the wastewater treatment facility. While some of this discrepancy may be attributed to domestic irrigation or other water losses, additional sampling and flow monitoring is recommended to more accurately define the typical characteristics of influent flow to the WWTP.

If RO or Ion Exchange were to be blended into the existing wastewater collection system, approximately 9,450 or 4,100 gallons per day would be added, respectively. When combined with available data on daily influent flows to the WWTP, the treatment facility could expect to see daily influent flows of approximately 28,450 and 23,100 gallons per day for RO and Ion exchange, respectively, which is less than the current WWTP capacity. Additionally, pipe sizes, slopes, and lift station capacities were evaluated for the wastewater collection system and determined to be adequate for the proposed blending into the system. However, all pipe sizes, lift station capacities, and other components of the wastewater collection system should be confirmed during design.

2.2 Permitting

In order to implement disposal of WTP waste to the WWTP, additional permitting or permit revisions would be necessary.

The construction of a liquid waste byproduct discharge pipeline to the sewer collection system at Cattleman Rd would require the acquisition of easements along private property. It is anticipated that the discharge line could be installed parallel to the existing water transmission pipeline for the majority of the alignment and any existing easements may be widened to accommodate the waste line. The proposed alignment and discharge to the collection system, however, is far more preferable to constructing a pipe directly to the WWTP. A pipeline connecting the WTP to the WWTP directly would require significant Caltrans coordination and easements in addition to the private property easements.

Additionally, initial conversations with the RWQCB indicate that amendments to the WWTP's discharge permit may be required to allow for the disposal of additional salts and nitrate (discussed in **Section 2.4**) to the existing spray field discharge. The RWQCB would likely require a revised Report of Waste Discharge to be submitted including projections of the increased flows and loading rates. Initial conversations have indicated that there is likely a feasible path forward to achieve the required revisions to the WWTP's discharge permit.

2.3 Infrastructure

The recommended alternative for the discharge of treatment plant waste to the WWTP would involve the construction of an approximately 1.75-mile pipeline from the water treatment plant to the sewer collection system along Cattlemen Road. It is assumed that the sewer collection system and associated lift stations would be able to handle the additional flow from the water treatment plant, however this will need to be confirmed during design.

A schematic of the proposed infrastructure necessary is included in **Figure 2-1**, below.

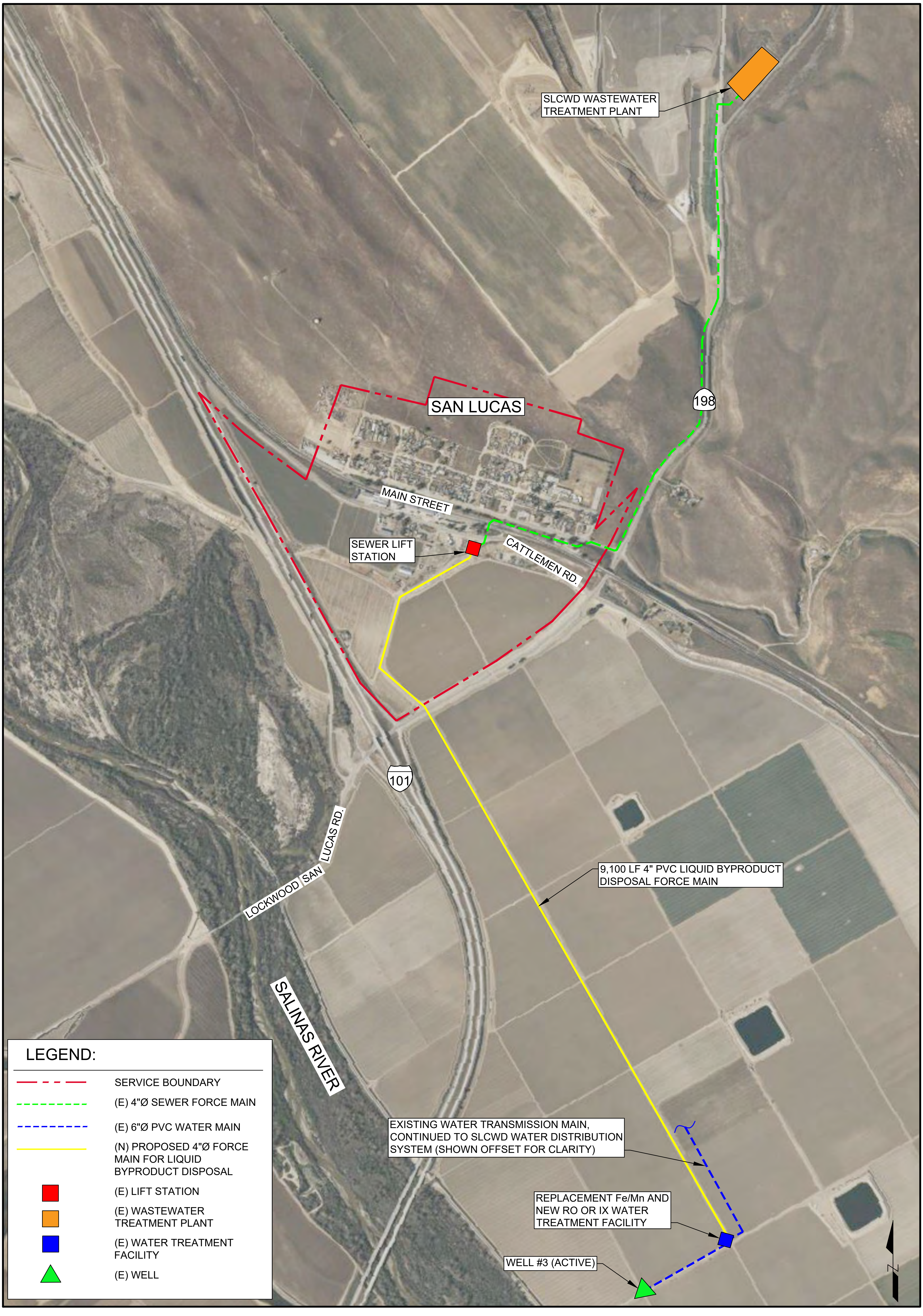


FIGURE 2-1

SAN LUCAS COUNTY WATER DISTRICT

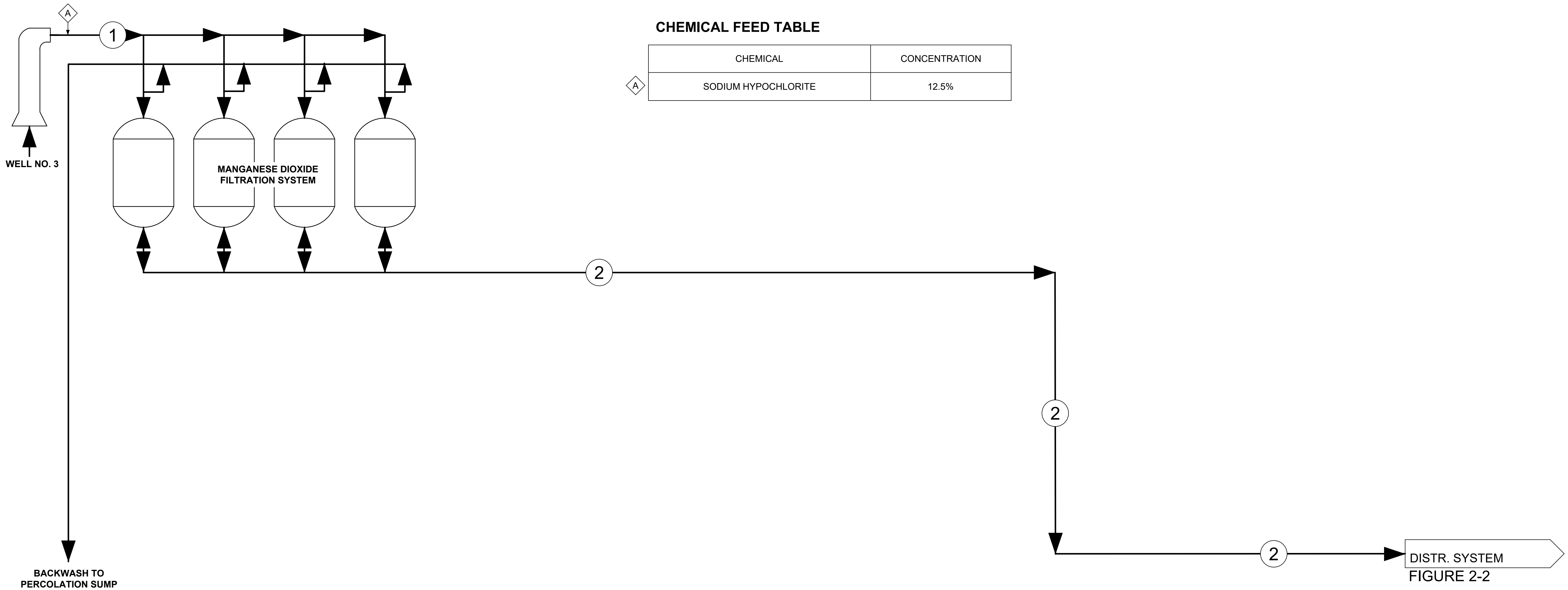
PROPOSED LIQUID BYPRODUCT DISPOSAL INFRASTRUCTURE

mkn
8405 N. FRESNO ST, SUITE 120,
FRESNO, CA 93720 (559) 500-4750

2.4 Anti Degradation Analysis

The following section provides a summary of the analysis performed to determine whether disposal of treatment plant waste to the WWTP would comply with the State of California's anti-degradation policy. This analysis considers the two main treatment alternatives described in the Report – Ion Exchange Treatment and Reverse Osmosis Treatment.

The current flows and loads from the existing drinking water facility and to the WWTP are summarized in **Figures 2-2** and **2-3** below. It is noted that bottled water deliveries to residents of San Lucas indicated in **Figure 2-2** would be discontinued upon implementation of a wellhead treatment system.



CHEMICAL FEED TABLE

	CHEMICAL	CONCENTRATION
A	SODIUM HYPOCHLORITE	12.5%

FLOW TABLE AND MASS BALANCE

FLOWSTREAM	1 WELL	2 PRODUCT WATER DISCHARGE (COMBINED)
FLOW, GPD	66,039	66,039
TDS, MG/L	1,321	1,321
NITRATE, MG/L	15	15
TDS, LBS/DAY	728	728
NITRATE, LBS/DAY	8	8

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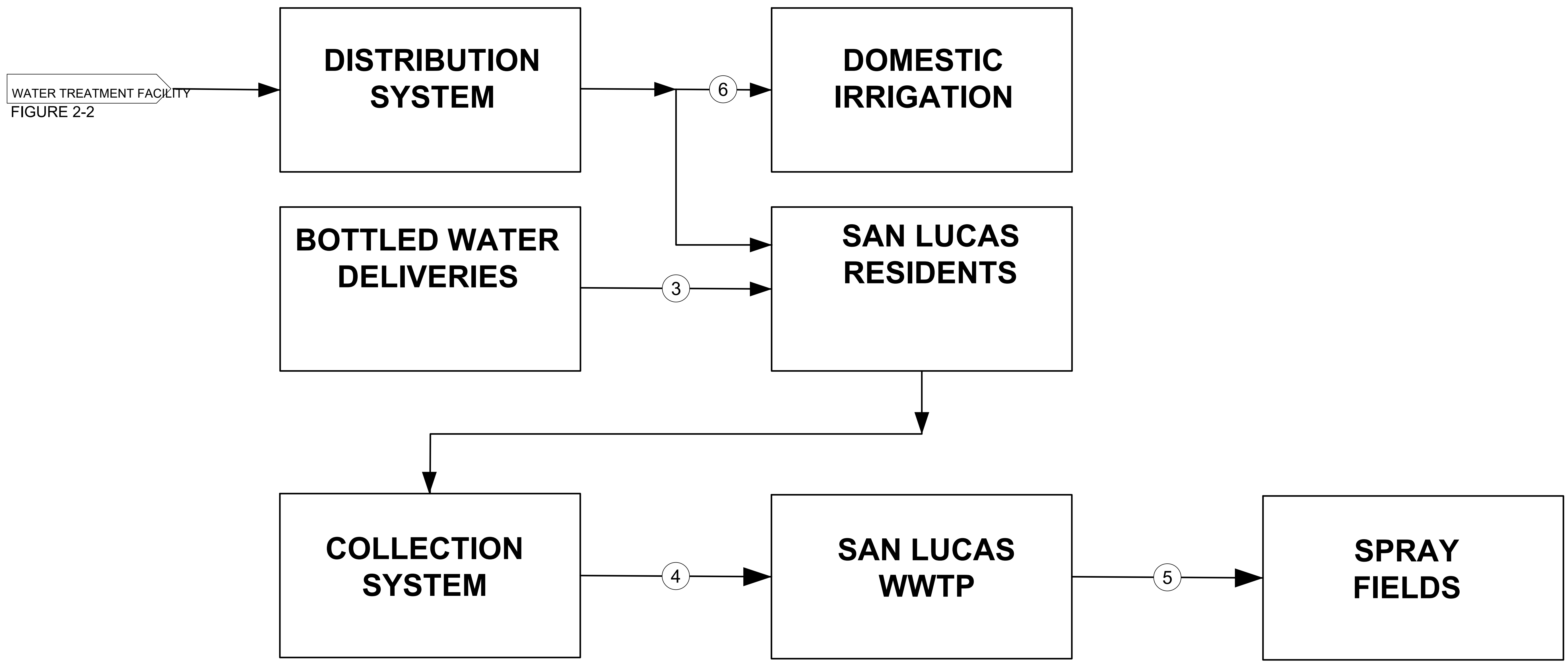
San Lucas County Water District
Liquid Waste Byproduct Disposal Evaluation – Non-Nitrate Work Plan

CURRENT WTP AND WWTP FLOWS AND LOADS

FIGURE
2-2

DWG: N:\University Enterprises, Inc\University Enterprises-2023-005 San Lucas Non Nitrate (539541A)\300 Engineering\301 CAD\Plansets\4 G-004.dwg Layout Name: FIGURE 2-2 - Plotted by: Stefanos Word Date: 5/22/2024 - 3:50 PM



FLOW TABLE AND MASS BALANCE

FLOWSTREAM	(3) BOTTLED WATER DELIVERIES	(4) WWTP INFLUENT	(5) WWTP DISCHARGE (SPRAYFIELDS)	(6) DOMESTIC IRRIGATION
FLOW, GPD	44	19,000	19,000	47,039
TDS, MG/L	400	1,525	1,525	1,321
NITRATE, MG/L	-	15	15	15
TDS, LBS/DAY	0	242	242	519
NITRATE, LBS/DAY	-	-	2	6

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CURRENT WTP AND WWTP FLOWS AND LOADS

FIGURE
2-3

DWG: N:\University Enterprises, Inc\University Enterprises-2023-005 San Lucas Non Nitrate (539541A)\300 Engineering\301 CAD\Plansets\4 G-004.dwg Layout Name: FIGURE 2-3 - Plotted by: Stefanos Word Date: 5/22/2024 - 3:50 PM

2.4.1 Wellhead Treatment with Ion Exchange

This alternative would produce waste streams in the form of liquid backwash from the manganese dioxide filtration system, waste byproduct from the ion exchange system regeneration cycles, and waste associated with daily flushing of the well. All three waste streams would be directed to the new waste equalization tank. It is anticipated that roughly 2,820 gallons of backwash waste would be generated by the manganese dioxide filtration system on a daily basis, with TDS and nitrate concentrations matching those of the source water. It is conservatively assumed that approximately 1,000 gallons of wastewater would be produced during daily flushing. Ion exchange system regeneration cycles will be initiated to manage nitrate in the treated effluent.

Waste byproduct projections were previously prepared in the *San Lucas County Water District – Feasibility Study Peer Review – Nitrate Work Plan TM (MKN, 2023)*. It is anticipated that approximately 8.3- to 8.6-percent of the total plant production will be generated as liquid waste byproduct (approximately 3,900 to 4,100 gallons) following the regeneration cycle of one vessel. It is estimated that a single vessel will need to be regenerated once every several hours, assuming daily average treatment system utilization rates ranging from approximately 20 to 25 percent (average of 22 percent). Preliminary projections of waste byproduct water quality indicate that the TDS would range between 20,000 to 40,000 mg/L using a 6 to 10 percent waste byproduct solution for regeneration. Two double-contained 7,000-gallon waste equalization tanks (one active, one standby) would be included to store the daily waste that would be produced by the ion exchange system.

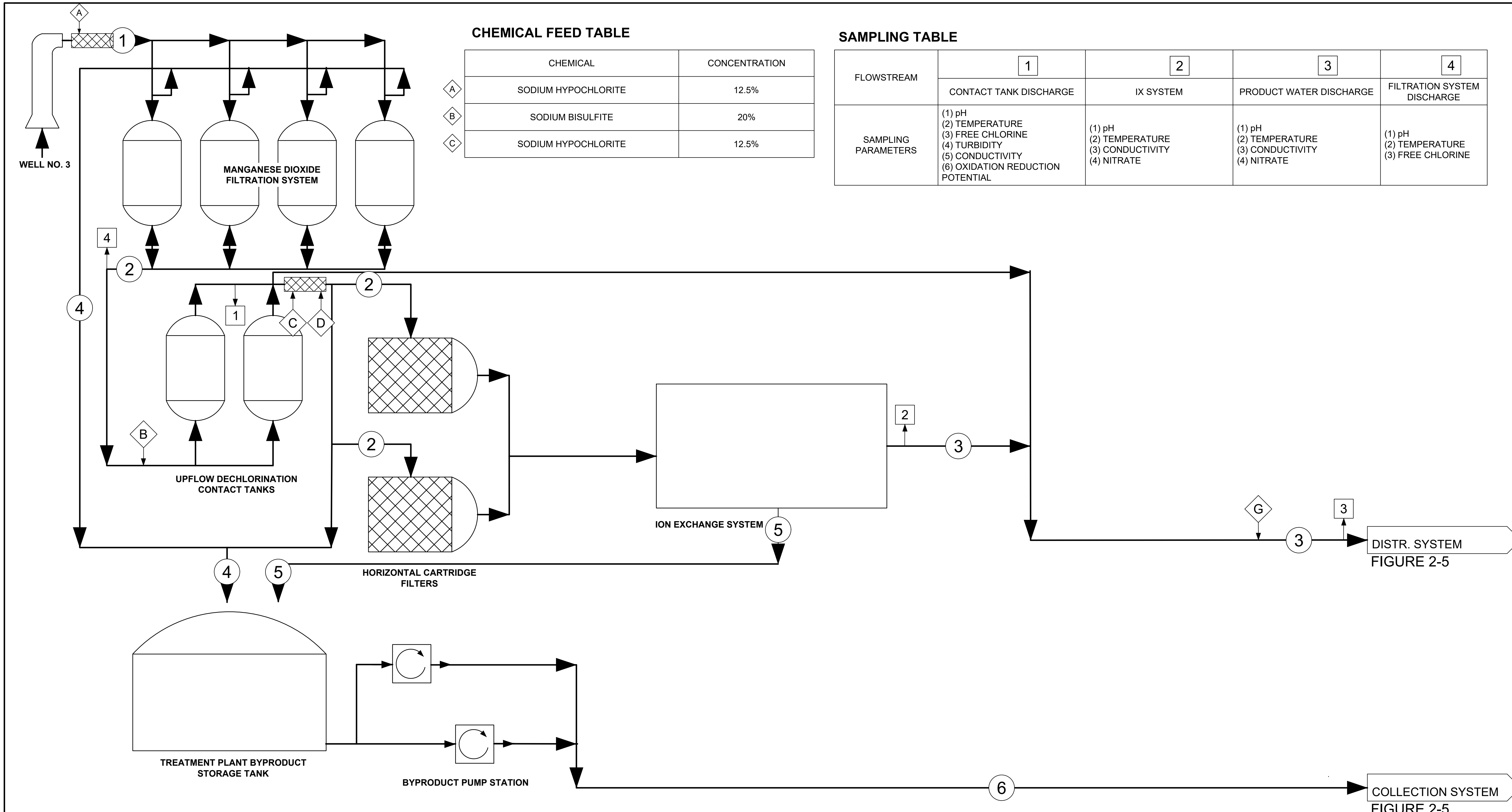
The flows and loads from the proposed ion exchange treatment system and to the WWTP under future estimated average daily demand conditions are presented in **Figures 2-4** and **2-5 below.**

CHEMICAL FEED TABLE

	CHEMICAL	CONCENTRATION
A	SODIUM HYPOCHLORITE	12.5%
B	SODIUM BISULFITE	20%
C	SODIUM HYPOCHLORITE	12.5%

SAMPLING TABLE

FLOWSTREAM	1	2	3	4
	CONTACT TANK DISCHARGE	IX SYSTEM	PRODUCT WATER DISCHARGE	FILTRATION SYSTEM DISCHARGE
SAMPLING PARAMETERS	(1) pH (2) TEMPERATURE (3) FREE CHLORINE (4) TURBIDITY (5) CONDUCTIVITY (6) OXIDATION REDUCTION POTENTIAL	(1) pH (2) TEMPERATURE (3) CONDUCTIVITY (4) NITRATE	(1) pH (2) TEMPERATURE (3) CONDUCTIVITY (4) NITRATE	(1) pH (2) TEMPERATURE (3) FREE CHLORINE



FLOW TABLE AND MASS BALANCE

FLOWSTREAM	1	2	3	4	5	6
	WELL	IX SYSTEM INFLUENT	PRODUCT WATER DISCHARGE	BACKWASH DIS	BYPRODUCT DISCHARGE	COMBINED BYPRODUCT TANK DISCHARGE
FLOW, GPD	90,949	88,129	79,316	2,820	8,831	11,651
TDS, MG/L	1,321	1,321	1,321	1,321	40,000	30,638
NITRATE, MG/L	15	8	8	15	15	11
TDS, LBS/DAY	1,003	971	874	31	2,947	2,979
NITRATE, LBS/DAY	11	6	5	0	1	1

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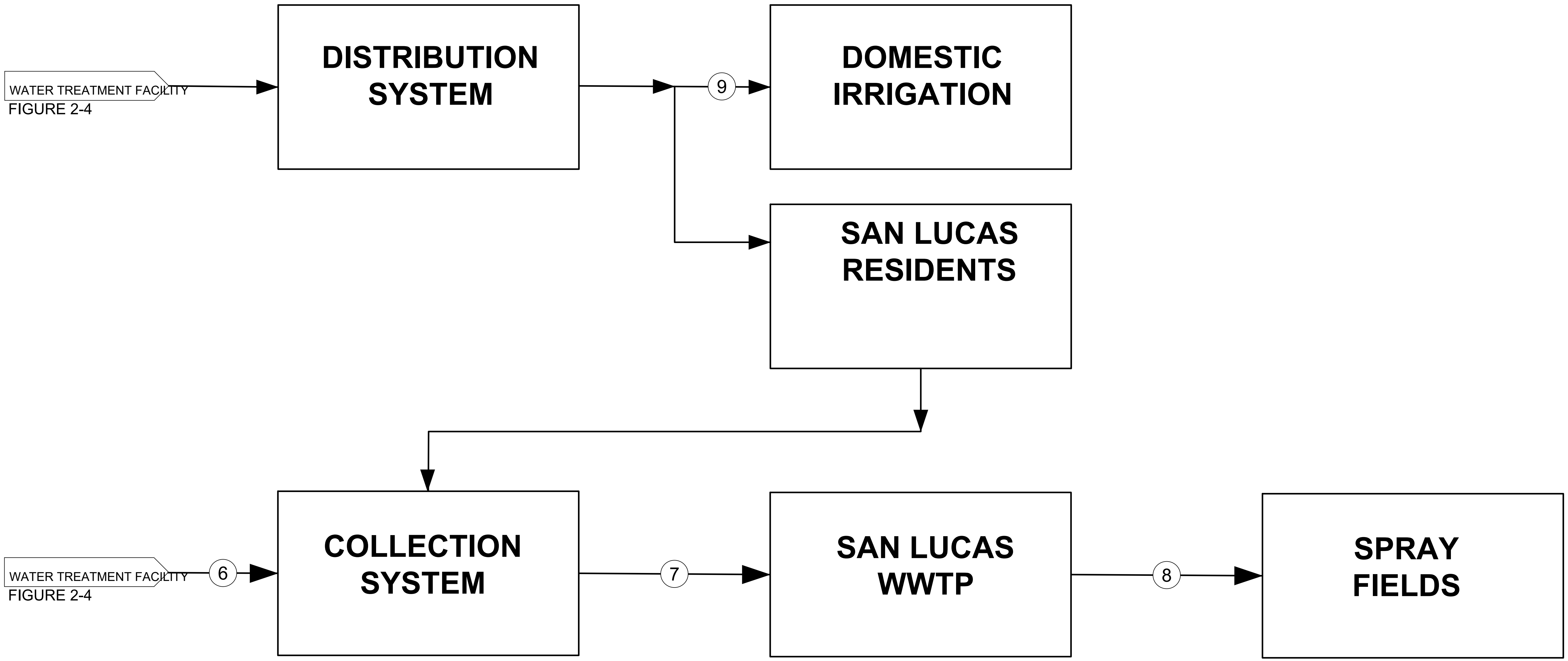
San Lucas County Water District
Liquid Waste Byproduct Disposal Evaluation – Non-Nitrate Work Plan

PROPOSED ION EXCHANGE TREATMENT PLANT AND WWTP FLOWS AND LOADS

FIGURE 2-4



FLOW TABLE AND MASS BALANCE

FLOWSTREAM	6 COMBINED BYPRODUCT TANK DISCHARGE	7 WWTP INFLUENT (COMBINED BYPRODUCT DISCHARGE AND HOUSEHOLD WASTEWATER)	8 WWTP DISCHARGE (SPRAYFIELDS)	9 DOMESTIC IRRIGATION
FLOW, GPD	11,651	34,451	34,451	44,865
TDS, MG/L	30,638	10,692	10,692	1,321
NITRATE, MG/L	11	10	10	8
TDS, LBS/DAY	2,979	3,074	3,074	495
NITRATE, LBS/DAY	1	3	3	3

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Liquid Waste Byproduct Disposal Evaluation – Non-Nitrate Work Plan

PROPOSED ION EXCHANGE TREATMENT PLANT AND WWTP FLOWS AND LOADS

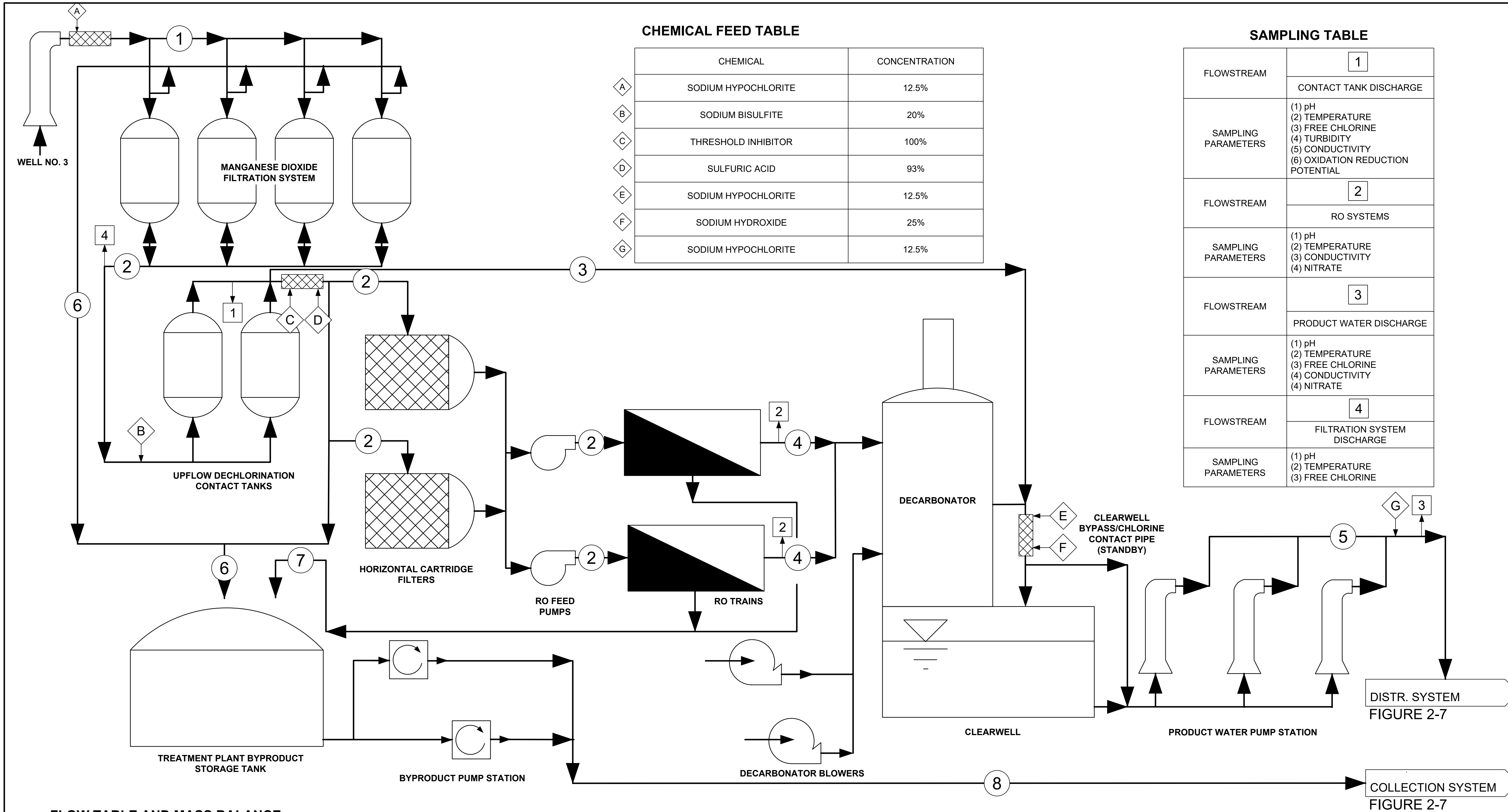
FIGURE 2-5

2.4.2 Wellhead Treatment with Reverse Osmosis

This alternative would produce waste streams in the form of liquid backwash from the manganese dioxide filtration system, RO treatment system byproduct from the RO membranes, and waste associated with daily flushing of the well. All three waste streams would be directed to the new waste equalization tank. It is anticipated that roughly 2,820 gallons of backwash waste would be generated by the manganese dioxide filtration system on a daily basis, with TDS and nitrate concentrations matching those of the source water. It is conservatively assumed that approximately 1,000 gallons of wastewater would be produced during daily flushing.

When operating the RO system in a two-stage configuration at 84 to 88 percent recovery (with approximately 30 percent of raw water being bypassed), it is anticipated that approximately 10.4 to 14 gpm of RO treatment system byproduct will be produced while the membrane system is operating. Approximately 7,100 to 9,450 gallons per day of RO treatment system byproduct would be produced assuming average daily treatment utilization rates ranging from 20 to 25 percent (average of 22 percent). When operating the RO system in a three-stage configuration, it is anticipated that approximately 9 gpm of RO treatment system byproduct will be produced (ie, overall recovery of 90 percent). This would result in approximately 5,900 gallons per day of RO treatment system byproduct at future average daily demand conditions. Preliminary projections of the RO treatment system byproduct water quality indicate that the TDS will range between 9,100 and 11,400 mg/L (depending on system operating recovery).

The flows and loads from the proposed RO treatment system and to the San Lucas WWTP under future estimated average daily demand conditions is presented in **Figures 2-6** and **2-7** below.



CHEMICAL FEED TABLE

	CHEMICAL	CONCENTRATION
A	SODIUM HYPOCHLORITE	12.5%
B	SODIUM BISULFITE	20%
C	THRESHOLD INHIBITOR	100%
D	SULFURIC ACID	93%
E	SODIUM HYPOCHLORITE	12.5%
F	SODIUM HYDROXIDE	25%
G	SODIUM HYPOCHLORITE	12.5%

SAMPLING TABLE

FLOWSTREAM	1 CONTACT TANK DISCHARGE
SAMPLING PARAMETERS	(1) pH (2) TEMPERATURE (3) FREE CHLORINE (4) TURBIDITY (5) CONDUCTIVITY (6) OXIDATION REDUCTION POTENTIAL
FLOWSTREAM	2 RO SYSTEMS
SAMPLING PARAMETERS	(1) pH (2) TEMPERATURE (3) CONDUCTIVITY (4) NITRATE
FLOWSTREAM	3 PRODUCT WATER DISCHARGE
SAMPLING PARAMETERS	(1) pH (2) TEMPERATURE (3) FREE CHLORINE (4) CONDUCTIVITY (4) NITRATE
FLOWSTREAM	4 FILTRATION SYSTEM DISCHARGE
SAMPLING PARAMETERS	(1) pH (2) TEMPERATURE (3) FREE CHLORINE

FLOW TABLE AND MASS BALANCE

FLOWSTREAM	1 WELL	2 RO SYSTEM INFLUENT	3 RO SYSTEM BYPASS	4 RO SYSTEM PERMEATE	5 PRODUCT WATER DISCHARGE (COMBINED)	6 BACKWASH DISCHARGE	7 COMBINED CONCENTRATE DISCHARGE	8 COMBINED BYPRODUCT TANK DISCHARGE
FLOW, GPD	85,680	59,065	24,858	55,521	79,316	2,820	5,907	8,727
TDS, MG/L	1,321	1,321	1,321	-	396	1,321	11,286	8,066
NITRATE, MG/L	15	15	15	2	8	15	107	72
TDS, LBS/DAY	944	651	274	-	262	31	556	587
NITRATE, LBS/DAY	11	7	3	1	5	0	5	5

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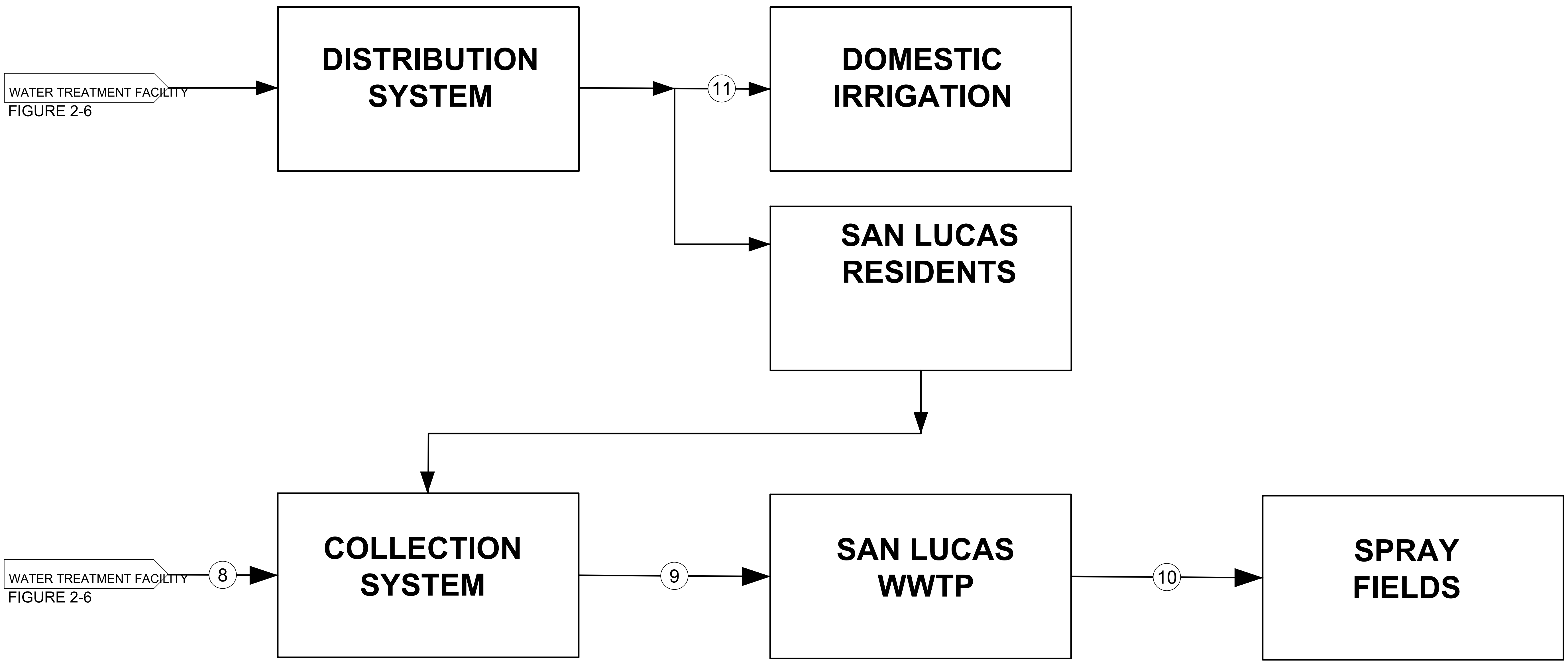
PROPOSED REVERSE OSMOSIS TREATMENT PLANT AND WWTP FLOWS AND LOADS

FIGURE
2-6



FLOW TABLE AND MASS BALANCE

FLOWSTREAM	8 COMBINED BYPRODUCT TANK DISCHARGE	9 WWTP INFLUENT (COMBINED BYPRODUCT DISCHARGE AND HOUSEHOLD WASTEWATER)	10 WWTP DISCHARGE (SPRAYFIELDS)	11 DOMESTIC IRRIGATION
FLOW, GPD	8,727	31,527	31,527	47,789
TDS, MG/L	8,066	2,594	2,594	396
NITRATE, MG/L	72	27	14	8
TDS, LBS/DAY	587	682	682	158
NITRATE, LBS/DAY	5	7	4	3

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PROPOSED REVERSE OSMOSIS TREATMENT PLANT AND WWTP FLOWS AND LOADS

FIGURE 2-7

2.4.3 Impacts to Local Groundwater Quality

Referenced from a January 2022 RWQCB letter to SLCWD detailing permit violations, the "WWTP is located on slightly sloping topography consisting of sandy silt soilds to a depth of 12 feet. Depth to groundwater is estimated to be greater than 60 feet below ground surface. There are no groundwater wells at the site. The Salinas River is located 1.5 miles southwest of the facility and flows in a northwesterly direction to the Pacific Ocean."

It is understood that groundwater is relatively shallow at the WWTP. Shallow groundwater in this area is protected by a basin plan objective of 600 mg/L of Total Dissolved Solids (TDS). However, per the Department of Water Resources Bulletin 118 for the Salinas Valley Basin, Upper Valley Subbasin, the local groundwater is relatively poor and is impaired by high TDS concentrations. For example, Well 3 has historically produced water with a TDS concentration ranging from 260 to 2,200 mg/L with an average of 1,313 mg/L, well above the basin plan objective of 600 mg/L. Therefore, an alternate method of analyzing potential impacts to groundwater is proposed by comparing existing conditions versus proposed conditions.

Table 2-1 provides a summary of the total loading of TDS and Nitrate to land within the community of San Lucas as a result of domestic water production based on average day demands (ADD) of water, as presented in **Figures 2-2** through **2-7**. That is, the loads presented below are a result of constituents found in the source water and any treatment waste byproducts, exclusive of any domestic waste additions already sent to the WWTP.

Table 2-1: Land Application of Constituents within San Lucas[1]		
Scenario	TDS Load lb/d	NO_3 Load lb/d
Current[2]	760	8.3
Reverse Osmosis	841	6.8
Ion Exchange	4949	6.3

Notes:

1. Presents mass loadings at estimated future average daily demands.
2. Presents current mass loadings to WWTP based on conservative assumptions of source water conditions.

It is additionally noted that loading of constituents in the current conditions is spread over a somewhat larger area due to the presumed use of water for domestic irrigation. **Table 2-2** presents a spatial analysis of the constituent loading presented in **Table 2-1**.

Table 2-2: Spatial Loading Rates of Constituents within San Lucas[1]				
Scenario	TDS Load lb/ac/d		NO_3 Load lb/ac/d	
	Domestic Irrigation	Sprayfields	Domestic Irrigation	Sprayfields
Current	12	35	0.1	0.3
Reverse Osmosis	4	97	0.1	0.5
Ion Exchange	11	643	0.1	0.5

Notes:

1. Presents mass loadings at estimated future average daily demands.

Based on the loading rates presented in **Table 2-1**, TDS and nitrate loading as a result of RO treatment of the source water provides a nominal increase in loading rates to land. As indicated in **Table 2-2**, the nominal increase in total loadin is redistributed to be applied on a smaller spatial area as a result of RO treatment. The total loading rate of TDS is expected to increase by approximately 10% and nitrate to decrease by approximately 18% following RO treatment. Nitrate loading is anticipated to be somewhat reduced due to treatment through the anaerobic zones of the WWTP. Additionally, a portion of TDS and nitrate will be removed by plant consumption on the cropped sprayfields which can partially mitigate the decrease in spatial loading indicated in **Table 2-2.** Therefore, it is anticipated that impacts to groundwater will be nominal as compared to current conditions following RO treatment.

Loading rates as a result of ion exchange treatment are substantially increased as compared to current conditions. Therefore, it is anticipated that there will be significant permitting challenges to this approach in its current concept and additional measures or offsite removal may need to be explored.

2.5 Costs

Table 2-3 and **2-4** below present opinions of probable capital and O&M costs associated with disposal to the San Lucas WWTP, respectively. The costs presented herein are reflected in the capital and O&M costs included in the Report and apply to both the Reverse Osmosis and Ion Exchange treatment alternatives.

Table 2-3: Wellhead Treatment - WWTP Disposal Infrastructure - Opinion of Probable Capital Cost

Item[1]	Quantity	Units	Unit Price	Cost
10,000 Gallon Treatment Byproduct Holding Tank[2]	2	EA	$22,980	$46,000
4-inch PVC Pipe	9100	LF	$11	$96,000
Fittings and Appurtenances	1	LS	$25,000	$25,000
Connection to SLCWD Wastewater Collection System	1	LS	$15,000	$15,000
Trenching and Backfilling	9100	LF	$150	$1,365,000
Asphalt Restoration	2600	LF	$10	$26,000
Traffic Control	4	Days	$2,000	$8,000
Blending Pump	1	EA	$5,000	$5,000
Electrical & Instrumentation	1	LS	$200,000	$200,000
Caltrans Encroachment Permit	1	EA	$10,000	$10,000
Construction Total				**$1,796,000**
Contingency (20%)				**$359,200**
Total with Contingency				**$2,155,200**
Administrative, Engineering, Construction Management, and Permitting (20%)[3]				**$432,000**
Total				**$2,588,000**
Inflation Adjustment[4]				**$481,000**
Total at Time of Bid				**$3,069,000**

Notes:

1. Mobilization and demobilization are neglected in this cost estimate as these costs are included in the full cost estimate for Alternatives 2 and 3.
2. Tank size is based on RO byproduct projections. Cost related to holding tanks would decrease marginally should Alternative 2 be pursued.
3. Consists of financing (5%), construction administration (5%), engineering during construction (5%), and legal/administrative costs (5%).
4. Adjustment accounting for inflation between project cost estimation and project bidding. Based on the project schedule presented in Section 7 and the average Construction Cost Index changes over the previous 2 years.

Table 2-4: Wellhead Treatment - WWTP Disposal Infrastructure - Opinion of Probable Annual O&M Cost				
Item	**Annual Cost**	**Cost per Service Connection**	**Cost per 1,000 Gallons**	**Cost per Million Gallons**
O&M				
Chemicals[1]	$10,000	$103.09	$0.35	$345.72
Power[2]	$1,314	$13.55	$0.05	$45.43
Labor and Maintenance[3]	$11,923	$122.92	$0.41	$412.22
Totals	**$23,237**	**$240**	**$0.80**	**$803**

Notes:

1. Bulk chemical pricing for byproduct waste disposal pipeline antiscalant.
2. Calculated based on a 2HP pump operating for four (4) hours per day at $0.45/kWh.
3. Assumes 52 hours of labor per year (1 hour per week) at a burdened labor cost of approximately $100 per hour, $5,000 per year for byproduct waste disposal pipeline cleaning via ice pigging, and $1,000 per year per mile of pipe for additional maintenance costs.

2.6 Summary

Based on the results of the analyses in this TM, the least impactful approach to the groundwater is the combination of RO wellhead treatment and waste byproduct disposal at the WWTP. This is due to RO producing product water of the highest quality as well as a waste byproduct with TDS concentrations far lower than that of ion exchange, as captured in **Section 2.4**.

Appendix B

Photographs of Existing San Lucas CWD Water System

Site Visit Photographs – September 11, 2023

Water Treatment Facility

Water Treatment Facility
Overview

Abandoned Well at
Treatment Facility

Manganese Dioxide
Filtration System

Process Piping and
Appurtenances

Manganese Dioxide
Filters

Chemical
Storage/Injection Building

Sodium Hypochlorite
Injection Facilities

Treatment Facility Air
Compressor

Multi-Parameter Online Analyzer Display


Wastewater from Filter Backwash

<u>Well #3</u>

Overview of Well #3

Well #3 Electric Control Panel

Piping and
Appurtenances

Badger Recordall
Flowmeter

Storage Tank

Overview of Storage Tank

Storage Tank Inlet/Outlet

Inlet Pressure Guage

Outlet Flow Control Valve

Overflow Drain and
Piping

Appendix C
References

References

MKN reviewed the following information in preparation of this feasibility study:

- SLCWD System
    - Water Quality Information
    - Water System Condition Assessment (2014)
    - Distribution System Drawings
    - Billing Information
    - Regulatory Letters
    - SLCWD Board Reports (2018-2023)
    - Miscellaneous Planning Documents
    - CCRWQCB Formal Correspondence
    - Operations and Maintenance Records
    - Well Completion Report
    - Photographs of Infrastructure
    - Site Visit Data
    - Verbal Accounts by SLCWD representatives
- CWKC System
    - 2022 Water Quality Report
    - 2008 Water Supply and Facilities Master Plan
    - 2020 Urban Water Management Plan
    - Rate Structure
- Other Data
    - Miscellaneous Equipment and Services Quotations
    - SWRCB - Drinking Water State Revolving Fund Program Basics (webpage)
    - SWRCB - Drinking Water State Revolving Fund Interest Rate History (webpage)
    - SWRCB – Aquifer Risk Tool
    - SWRCB – SGMA Data Viewer
    - SWRCB – Drinking Water Watch
    - DWR – Well Completion Report Mapping Tool
    - DWR – Bulletin 118