San Juan Bautista, Potable Water Source Control and WWTP Improvements

Alternative Analysis
Preliminary Engineering Report

July 1, 2020

Submitted to:

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Prepared for:

The City of San Juan Bautista

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INTRODUCTION

The San Juan Bautista Wastewater Treatment Plant (WWTP) operates under Order No. R3-2009-0019 NPDES permit No. CA0047902. Amongst other effluent limitations, the average monthly discharge limits for chloride, sodium, and total dissolved solids (TDS) are 200 mg/L, 250 mg/L, and 1400 mg/L, respectively. The City has been in violation of these three effluent limits for several years and currently remains in violation.

The elevated chloride, sodium, and TDS levels observed in the City's wastewater are thought to be driven by agricultural processing (disinfection chemicals) and source water (groundwater) hardness and associated self-regenerating water softeners used for potable water treatment throughout the community. The agricultural processing facilities discharge can be mitigated by establishing a new industrial pre-treatment program, but source water reductions may still be necessary. The existing groundwater wells produce very hard water (greater than 300 mg/L as $CaCO_3$) and, as a result, many of the City's residents have installed domestic self-regenerating water softeners to provide local treatment. Water softeners exchange calcium and magnesium (the main constituents contributing to hardness) for sodium or common salt (sodium chloride, NaCl). This process results in elevated chloride, sodium, and TDS concentrations that are discharged into the City's wastewater collection system and then pass through the WWTP untreated, causing effluent discharge permit violations.

The purpose of this report is to investigate alternatives and develop a recommended program to bring the wastewater treatment plant into compliance with regulatory requirements. The alternative projects considered herein include the following:

1. Alternative 1, On-Site WWTP Upgrades and Off-Site Salinity Control: Provide source control in order to reduce the wastewater influent salinity concentrations to permittable levels. This project will allow the existing WWTP to remain operational with upgrades to the existing process facilities. All off-site salinity control options will also include the implementation of an industrial pre-treatment program for agricultural processing facilities (to limit salt discharge from those users).

    A. Option 1A, Source Control via Pellet Water Softening Plant Rehabilitation: Off-site salinity control will be accomplished by rehabilitating the City owned pellet water softening system and installing it on the potable water distribution network. After lowering source water hardness, the City will implement a buy-back program to eliminate domestic self-regenerating water softeners, in order to reduce the wastewater influent salinity concentrations to permittable levels.

    B. Option 1B, Source Control via Domestic Cartridge Water Softeners: Off-site salinity control will be accomplished by replacing all domestic self-regenerating water softeners with cartridge water softeners. Salt being discharged from household water softeners will no longer drain to the sewers (lowering influent wastewater salinity concentrations to permittable levels) and instead the salt will be collected in canisters and safely disposed of off-site.

C. Option 1C, Source Control by Importing Water from West Hills WTP: Off-site salinity control will be accomplished by replacing well water (very hard water) with treated surface water (moderately hard) and remove self-regenerating water softeners in order to reduce the wastewater influent salinity concentrations to permittable levels.

2. Alternative 2, On-Site WWTP Upgrades and On-Site Salinity Control: This project will replace the existing WWTP sequencing batch reactor (SBR) treatment system with a new membrane bioreactor (MBR), and reverse osmosis (RO) treatment or Electrodialysis Reversal (EDR) facilities that will remove salinity.

3. Alternative 3, Regionalization with Hollister WWTP and Off-Site Salinity Control: Provide source control in order to reduce the wastewater influent salinity concentrations and then pump the influent wastewater to a neighboring community (the City of Hollister WWTP). This project will replace the existing WWTP with an equalization basin and emergency storage pond to service a new pump station and pipeline to the Hollister WWTP for off-site treatment and disposal. All off-site salinity control options will also include the implementation of an industrial pre-treatment program for agricultural processing facilities (to limit salt discharge from those users).

    A. Option 1A, Source Control via Pellet Water Softening Plant Rehabilitation: Off-site salinity control will be accomplished by rehabilitating the City owned pellet water softening system and installing it on the potable water distribution network. After lowering source water hardness, the City will implement a buy-back program to eliminate domestic self-regenerating water softeners, in order to reduce the wastewater influent salinity concentrations to permittable levels.

    B. Option 1B, Source Control via Domestic Cartridge Water Softeners: Off-site salinity control will be accomplished by replacing all domestic self-regenerating water softeners with cartridge water softeners. Salt being discharged from household water softeners will no longer drain to the sewers (lowering influent wastewater salinity concentrations to permittable levels) and instead the salt will be collected in canisters and safely disposed of off-site.

    C. Option 1C, Source Control by Importing Water from West Hills WTP: Off-site salinity control will be accomplished by replacing well water (very hard water) with treated surface water (moderately hard) and remove self-regenerating water softeners in order to reduce the wastewater influent salinity concentrations to permittable levels.

Alternatives 1 and 3 both require agricultural processing facilities to have an industrial pre-treatment program (reducing the allowable salinity discharge into the sewers) and potentially potable water source control in order to reduce wastewater influent salinity concentrations to permittable levels (i.e. providing soft water to the community and eliminating self-regenerating water softeners that dump high levels of chloride, sodium, and TDS into the sewers). The source control options investigated for both alternatives include three sub-options (options A, B, and C) that will be considered for its life cycle costs and impacts on the associated alternative. In addition, Options A and B require installation of a new potable water well (Betable Road Well) to provide water security to the City's potable water portfolio, as described in detail under Section 4.1 Alternative Descriptions and Cost Estimates.

This Project Report documents the alternative analysis and provides additional information related to the Best Apparent Project with the intent of complying with the requirements of the United States Department of Agriculture – Rural Development (USDA-RD) funding program for consideration of a proposed project.

1.0 PROJECT PLANNING

The purpose of this section is to describe the project area, including the location, environmental resources, population and community. This section is divided into the following sub sections.

- Project Location
- Environmental Resources Present
- Population Trends
- Community Engagement

1.1 LOCATION

The City of San Juan Bautista (City) provides sanitary sewer collection, treatment and disposal for the community and is located in San Benito County, California. The Wastewater Treatment Plant (WWTP) is located on APN 002-220-0070 at 1120 Third Street, San Juan Bautista, CA 95045. A vicinity map showing the location of the WWTP is shown in **Figure 1**.

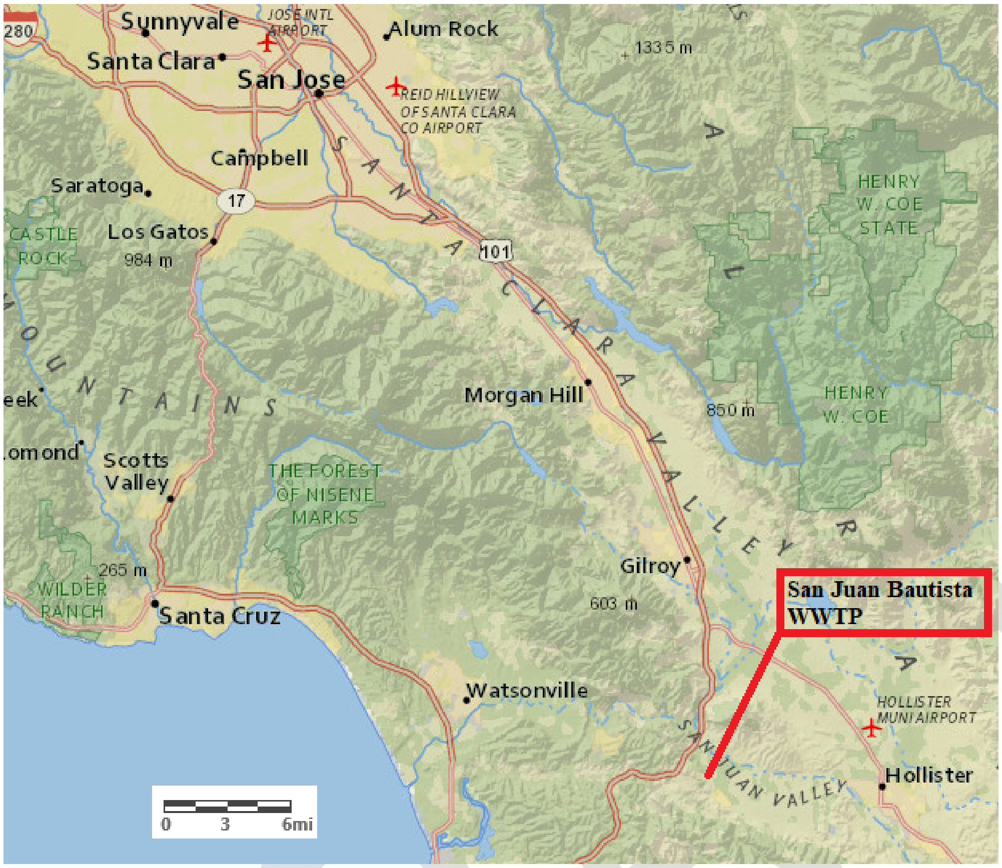


Figure 1 San Juan Bautista WWTP Vicinity Map

1.2 ENVIRONMENTAL RESOURCES PRESENT

A separate CEQA Initial Study and Mitigated Negative Declaration (IS/MND) checklist will be provided to document environmental resources present in the Project area and impacts from this Project are generally anticipated to be as follows:

- **Aesthetics**. Less than significant with mitigation incorporated. The selected project is considered to have less than significant impact.
- **Agricultural Resources**. No Impact. The selected project is not anticipated to impact any existing farmland (as the entire project falls under the rehabilitation of existing facilities and regional pipeline alignments along existing roads within the public-right-of way) and could be used to improve those resources by providing high quality effluent discharged to downstream agricultural resources.

- **Air Quality**. Less than significant with mitigation incorporated. The selected project will have a similar amount of equipment as the existing facilities, with the opportunity to provide more efficient motors and control algorithms within the rehabilitated facility.
- **Biological Resources**. No Impact. The selected project does not have any impacts to known habitat as it involves replacing existing infrastructure. However, habitat is known to exist in the project vicinity and will require careful biological surveys.
- **Cultural Resources**. No Impact. The site has been extensively modified and no archeological or historic resources were noted during the construction and operation of the facility. Further, if human remains are unearthed during construction, the project will be halted until a qualified archeologist can assess its significance and until the County Coroner has made necessary findings as to the origin.
- **Geology and Soils**. Less Than Significant Impact. The selected project is expected to have an equal or lesser risk related to expansive soils.
- **Hazardous Material**. Less than significant. The selected project does not anticipate encountering any hazardous materials and all process chemicals will be double contained.
- **Hydrology and Water Quality**. No Impact. The selected project is anticipated to have a positive impact on water quality.
- **Land Use and Planning**. No Impact. The selected project would not change or alter any existing land use planning.
- **Mineral Resources**. No Impact. The selected project is not anticipated to impact mineral resources.
- **Noise**. No Impact. The selected project is not anticipated to create more noise than the existing wastewater facility and, in fact, will have modern drives and controllers that reduce noise from potential receptors.
- **Population and Housing**. No Impact. The selected project will serve the same community plan and have a positive impact on the surrounding community by providing reliable wastewater treatment.
- **Public Services**. No Impact. The selected project will not impact public services.
- **Recreation**. No Impact. The selected project will not impact recreation opportunities in the community.
- **Transportation/Traffic**. No Impact. The selected project will not impact traffic except during construction, but there will be no long-term transportation or traffic impacts.
- **Utilities or Services**. No Impact. The selected project will not impact utilities except to repair and rehabilitate the City of San Juan Bautista WWTP and to provide a reliable potable water source.

1.2.1 Engineered Environmental Mitigation

The proposed Project is located within the existing WWTP fence line (and potentially a regional pipeline along road alignments within the public right-of-way), in previously disturbed areas and the nearest neighbors are over 200 feet away. As such, the Project does not have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community or reduce the number or restrict the range of a rare or endangered plant or animal. The amount of disturbance within the Project area (existing WWTP and roadways) indicates a low likelihood that cultural resources would be encountered during Project construction activities. Therefore, the potential array of impacts is considered less than significant and assumed to require the following Best Management Practices (to be verified in the IS/MND):

Erosion Control and Stormwater Pollution Prevention Plan: The construction contractor will prepare an erosion control plan and a stormwater pollution prevention plan prior to construction for all grading activities that exceed one acre of disturbance (as required by the Regional Board). The plans shall provide, at a minimum, measures to trap sediment, stabilize excavated soil piles, stabilize and revegetate disturbed areas, and any special stabilization measures required by the design engineer or the City. The plan shall be implemented and inspected accordingly in compliance with the permit throughout the construction process.

Noise Control: The construction contractor will be responsible for keeping construction noise levels within an acceptable range according to applicable County standards and ordinances.

Dust and Emission Control Plan: The construction contractor will prepare a dust and emission control plan prior to construction. The plans shall provide, at a minimum, measures to reduce dust and emissions (by minimizing idling time of diesel-powered equipment, apply water to disturbed areas, restrict grading and earth moving operations when wind speeds exceed 20 mph, etc.)

1.3 POPULATION TRENDS

Since the 1990's the City of San Juan Bautista has experienced a slow, but steady, rate of growth. According to census data, the City has grown from a population of 1,390 (in 1990) to a population of 1,862 (in 2010), as shown in **Table 1**. This equates to an approximate annual growth rate of 1.5%.

Per the 2014-2018 American Community Survey (ACS) 5-year estimates, the population in 2018 was 1,965. This intermediate measurement shows a slowing in the growth for the rural community.

Table 1 San Juan Bautista Population Data

Year	Population
1990	1,390
2000	1,548
2010	1,862
2018 (ACS)	1,965
2020*	2,030
2030*	2,247

*Projections based on least regression model.

1.4 COMMUNITY ENGAGEMENT

In the City's efforts to achieve the project objectives, public involvement is an important aspect of the overall plan, so that the City residents and businesses know what the City is doing with their water resources (potable water and wastewater), why, and how the City intends to 1) protect public health and enhance the environment, 2) comply with pertinent laws and regulations, 3) protect the value of properties served by the water and wastewater utilities, and 4) fund the improvements. Primary outreach efforts include:

- Community Workshops
- Community Survey
- Utility Bill Inserts
- Board Meetings

The need for wastewater treatment improvements has been known by the City for many years, as the plant has been out of compliance since the 2009 NPDES permit was adopted, and has been discussed over the years at many City Council meetings with public discussion and discourse. Most recently, there was a City Council and community workshop held on February 15, 2020, to set goals for the City (including water and wastewater treatment). Further, the City initiated a community survey to identify what is important to ratepayers. The survey was mailed to every resident in the March 2020 water utility bill. Additionally, presentations have been made by City Staff to the Council related to the project, including (most recently) on April 21, 2020. These presentations included opportunity for public involvement during the public comment period.

2.0 EXISTING WWTP FACILITIES

The existing San Juan Bautista Wastewater Treatment Plant (WWTP) is a tertiary treatment facility and is described herein.

2.1 LOCATION MAP

The existing treatment facility site layout is shown in **Figure 2**.

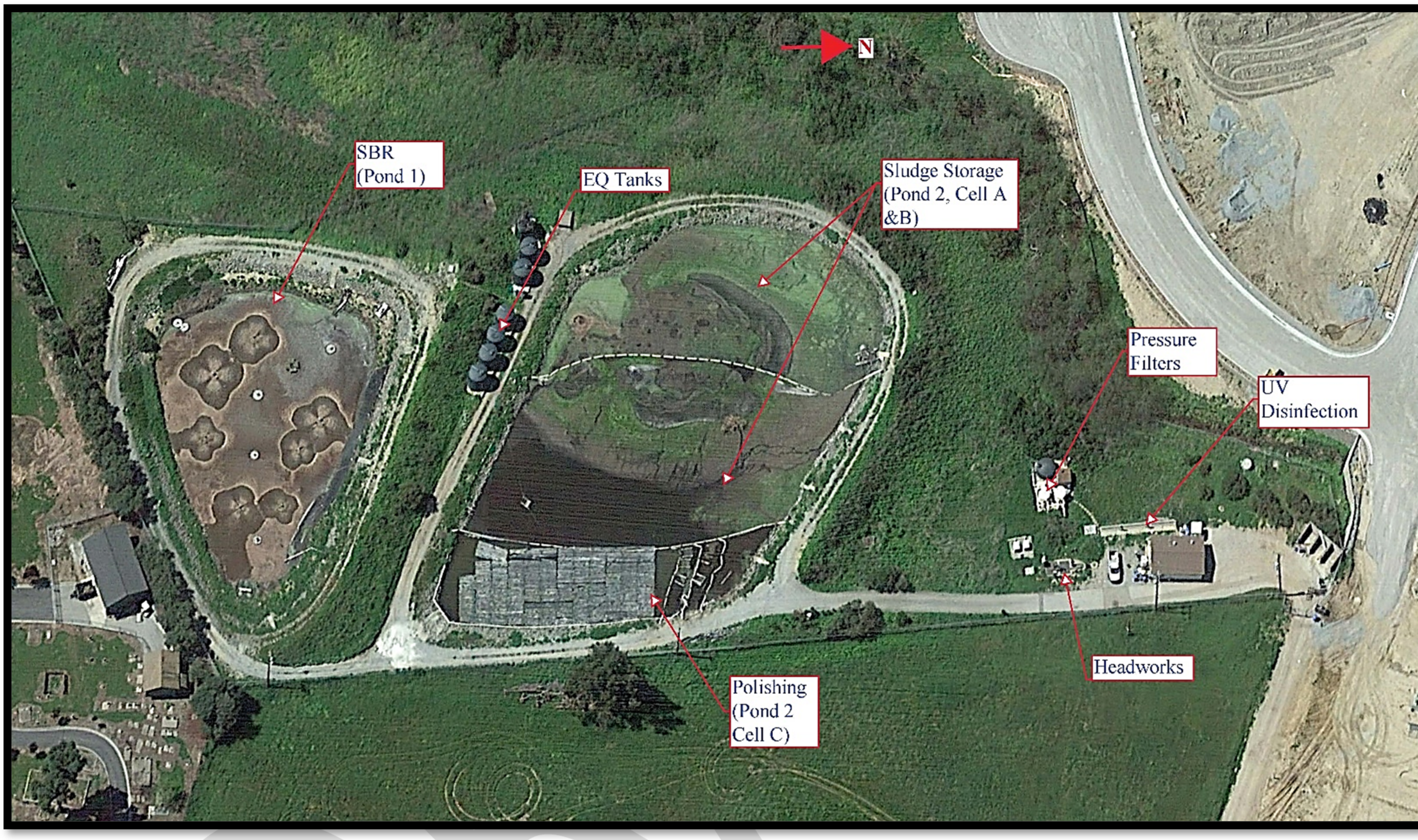


Figure 2 San Juan Bautista WWTP Site Layout

2.2 HISTORY

The original wastewater treatment plant was a facultative pond plant, constructed in the 1950s. The last major improvements project, in 2010, upgraded Pond 1 to an aerated pond that functions as sequencing batch reactors (SBR) and split Pond 2 into three cells (Cell A, B, and C). Cell C functions as a denitrifying polishing pond, while cells A and B are used as sludge storage lagoons. The 2010 upgrade project also added a mechanical basket screen (in the headworks), a new dual media pressure filtration system, and UV disinfection system. In 2018, the City removed 30-years of accumulated sludge from Pond 2, to accommodate continued operation of the treatment plant.

2.2.1 Flows and Load Characterization

Historical Flows

Influent flow data for the period from January 2016 to April 2020 were obtained and analyzed. Data shown herein is in gallons per day (gpd) or million gallons per day (Mgal/d). Daily, monthly and annual average flows are shown in **Figure 3**. The monthly flow was calculated as the rolling 30-day centered average based on the period from 14 days before to 15 days after the day in question. The annual average flow was calculated as the rolling 365-day centered average based on 182 days before to 182 days after the date in question. As shown, there are large flow spikes throughout the year and these correspond to dates when there were large storm events (January 2017 storm event resulted in 14-inches of rainfall in the month and February 2019 resulted in 7.5-inches of precipitation) and/or when Taylor Farm sends wash water to the WWTP (annual average daily flow rate of 25,000 gpd and max day of 100,000 gpd).

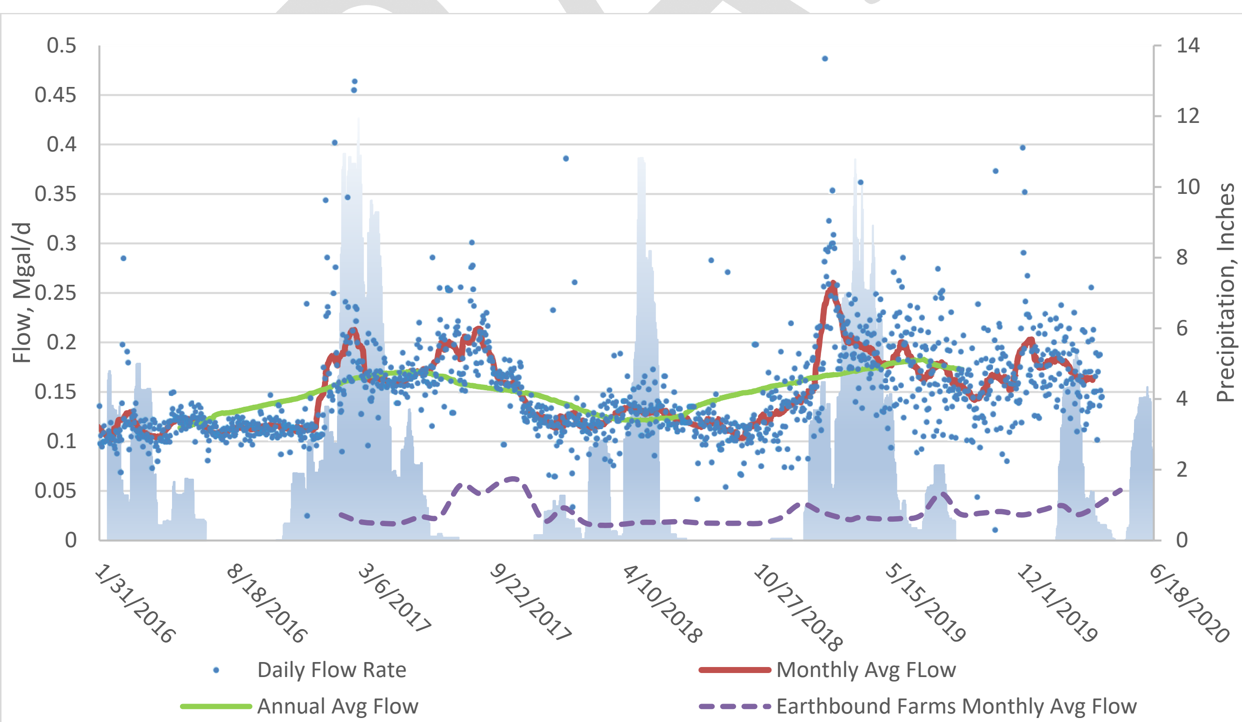


Figure 3 WWTP Historical Influent Flow Rates

The ratio of the daily flow and monthly flow to the annual average flow is plotted in **Figure 4**. The ratios of peak month flow and peak day flow to the AAF is 1.58 and 2.97, respectively as shown in **Figure 4**. The average dry weather flow (ADWF) was calculated as the average daily flow from June 1st through August 31st each year. The data shows that the AAF is nearly identical to ADWF, which indicates minimal inflow/infiltration and that Taylor Farms has a large impact on season flow, see **Table 2**.

The peak hour flow is an important parameter for wastewater treatment plant design because the headworks and the influent pumping must be designed to handle the short-term peak flows. There are no hourly logs available at the plant and so the peak hour flow ratio is assumed to be 4.0.

Based on the above data analysis, the recommended flow peaking factors are as follows:

Average Dry Weather Flow / Annual Average Flow (ADWF / AAF) = 1.0 (Table 2)

Max Month Flow / Annual Average Flow (MMF / AAF) = 1.58 (Figure 4)

Peak Day Flow / Annual Average Flow (PDF / AAF) = 2.97 (Figure 4)

Peak Hour Flow / Annual Average Flow (PHF / AAF) = 4.0 (assumed)

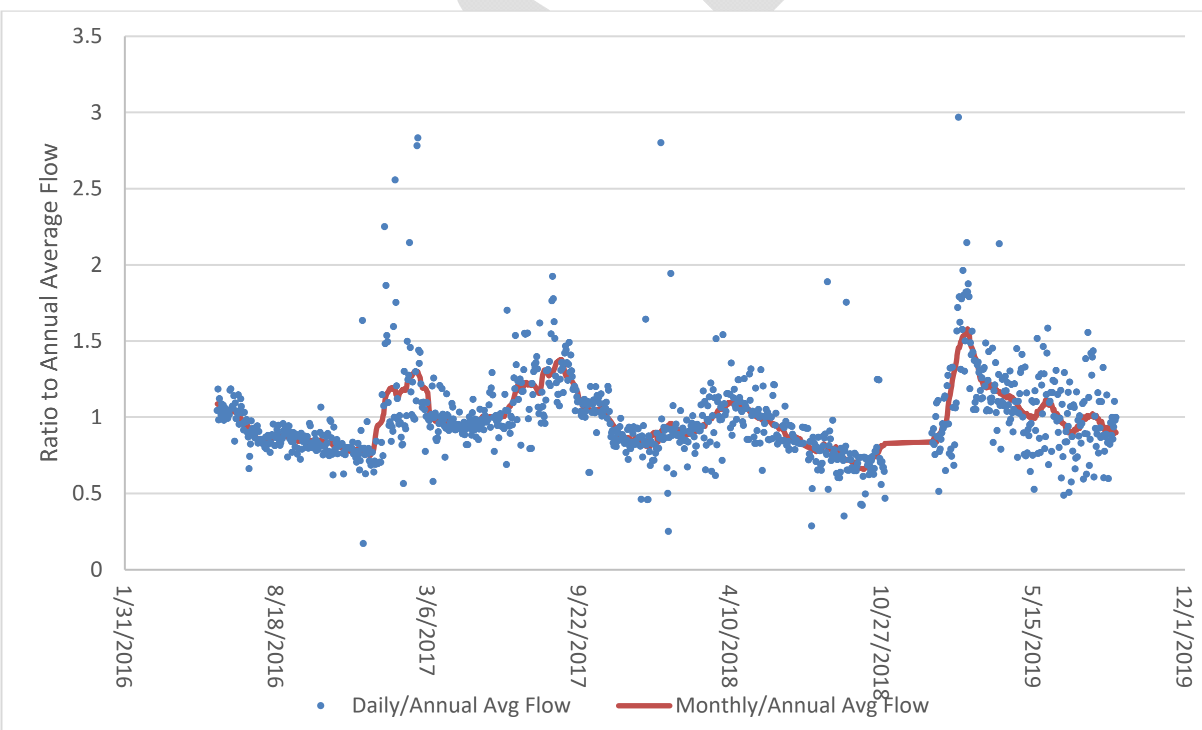


Figure 4 Flow Peaking Factors (Ratio of Daily and Monthly Flow to AAF)

Table 2 Relationship Between ADWF and AAF

Year	ADWF Mgal/d	AAF, Mgal/d[a]	ADWF/AAF Ratio
2016	0.12	0.11	1.01
2017	0.19	0.17	1.12 [b]
2018	0.12	0.12	1.00
2019	0.17	0.18	0.96

a) Calculated as the average daily flow during a specific year
b) Taylor Farms contributed to 25% of the flow during the 2017 summer months, skewing the ratio

Historical Loads

Plant influent Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS) concentrations from January 2016 to March 2020 were obtained and analyzed. Samples were flow based proportional composites (although the solenoid valve that is supposed to automatically open to take the sample has become unreliable, making the sample not fully representative of the entire day's loading). These samples were taken twice a month. BOD and TSS concentrations (mg/L) and daily influent flows were used to calculate the influent load (lb/d). As shown in **Figure 5**, the annual average BOD and TSS loads were calculated to be 334 lb/d and 351 lb/d, respectively.

Both influent BOD and TSS concentrations were highly variable beginning in 2018. Historically, samples were collected only on Thursdays. However, beginning in 2018, samples were also collected on the weekends (Friday and Saturday). Because there is a high concentration of restaurants within the City that accommodate out of town tourists, it is likely that weekend concentrations are higher than weekdays.

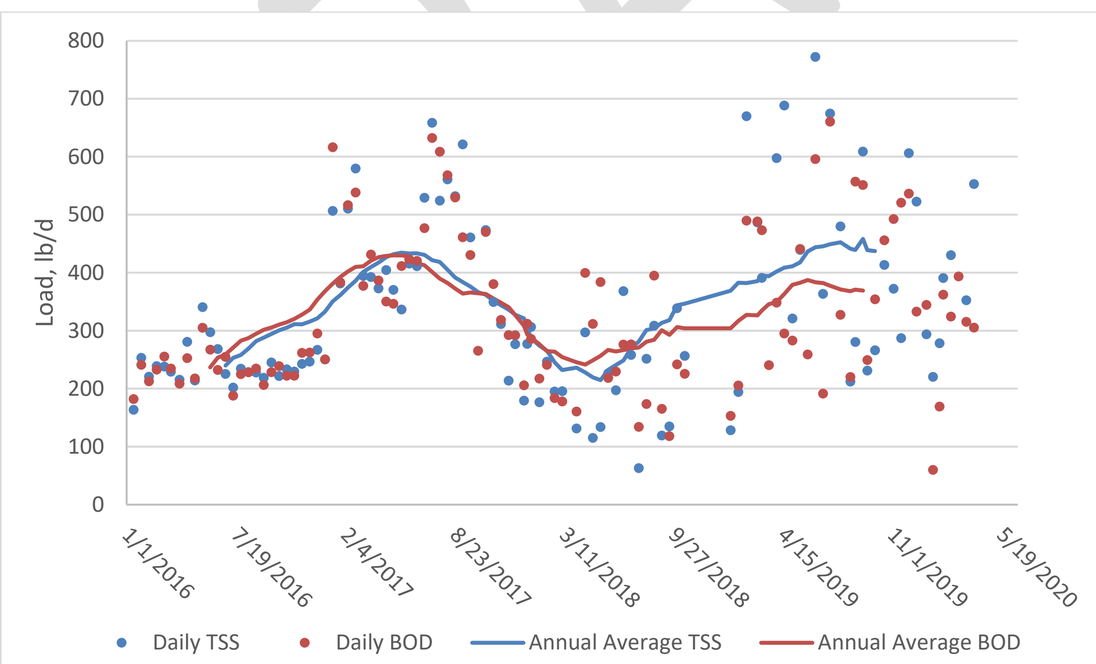


Figure 5 Influent BOD & TSS Loading

As a reality check, the average BOD expected from San Juan Bautista was calculated based on the City's population of approximately 1,900 capita and the typical BOD generation of 0.22 lb/capita/day when disposal grinders are utilized in the community or 0.18 lb/capita/day without grinders (Metcalf and Eddy, 4th edition). The resulting BOD load is between 342 and 418 lb/d, which is within the range observed from the historical sampling. As such, it is assumed that the existing annual average BOD load into the plant is 420 lb/d. It is noted that the loading increases during the summer of 2017 and 2019, likely from the industrial discharge (Taylor Farms wash water) as they are providing a higher flow rate during summer months of those two years.

However, the ratio of TSS to BOD was also variable beginning in 2018, which could be attributed to non-representative sampler withdrawal location. As shown in **Figure 6**, the ratio was around 1.0 until 2018 and then fluctuated between 0.5 and 2.1 thereafter. The typical value of TSS/BOD for municipal wastewater ranges from 1.0 to 1.1; a ratio of 1.1 was selected.

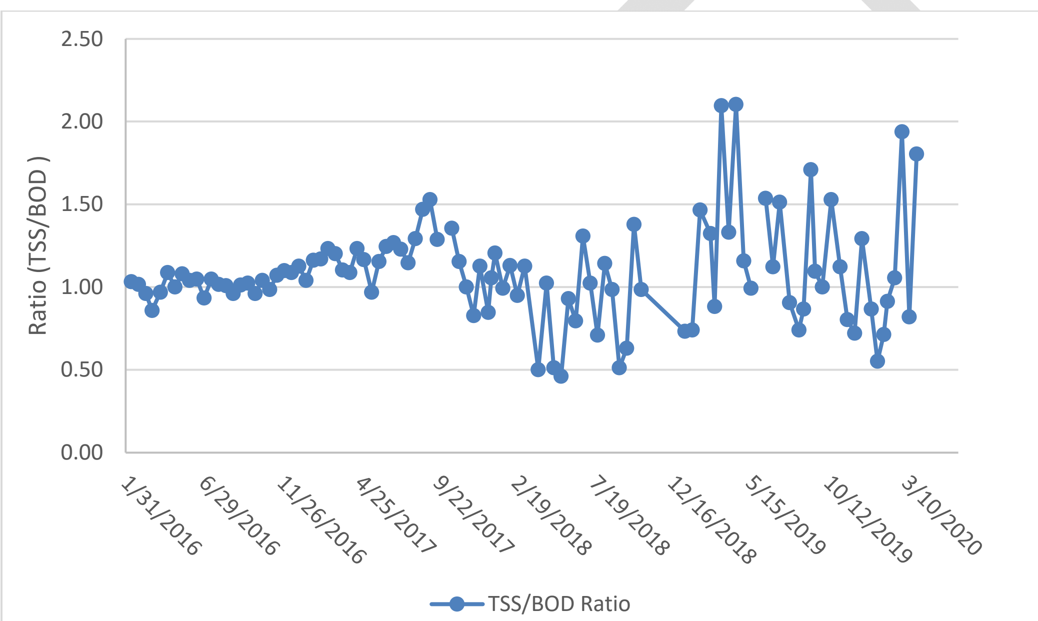


Figure 6 Influent TSS to BOD Ratio

Loading Peaking Factors

The size of the reactor basins should be large enough to accommodate a peak month load. Therefore, the ratio of the peak month load to the annual average load is an important design parameter. The ratios of the average day maximum month load (ADMML) to average annual load (AAL), for BOD and TSS, are shown in **Figure 7**. Since the historical load data is questionable, it is recommended to use a typical peak month load factor of 1.4 (adopted form Figure 3-8, Metcalf and Eddy, fourth edition), which is similar to the ratios found in the data prior to 2018.

Influent total Kjeldahl nitrogen (TKN, or ammonia plus organic nitrogen) is an important parameter that needs to be determined for plant design. The typical value of TKN/BOD for municipal wastewater ranges from 0.17 to 0.21. A conservative ratio of 0.19 is selected for design.

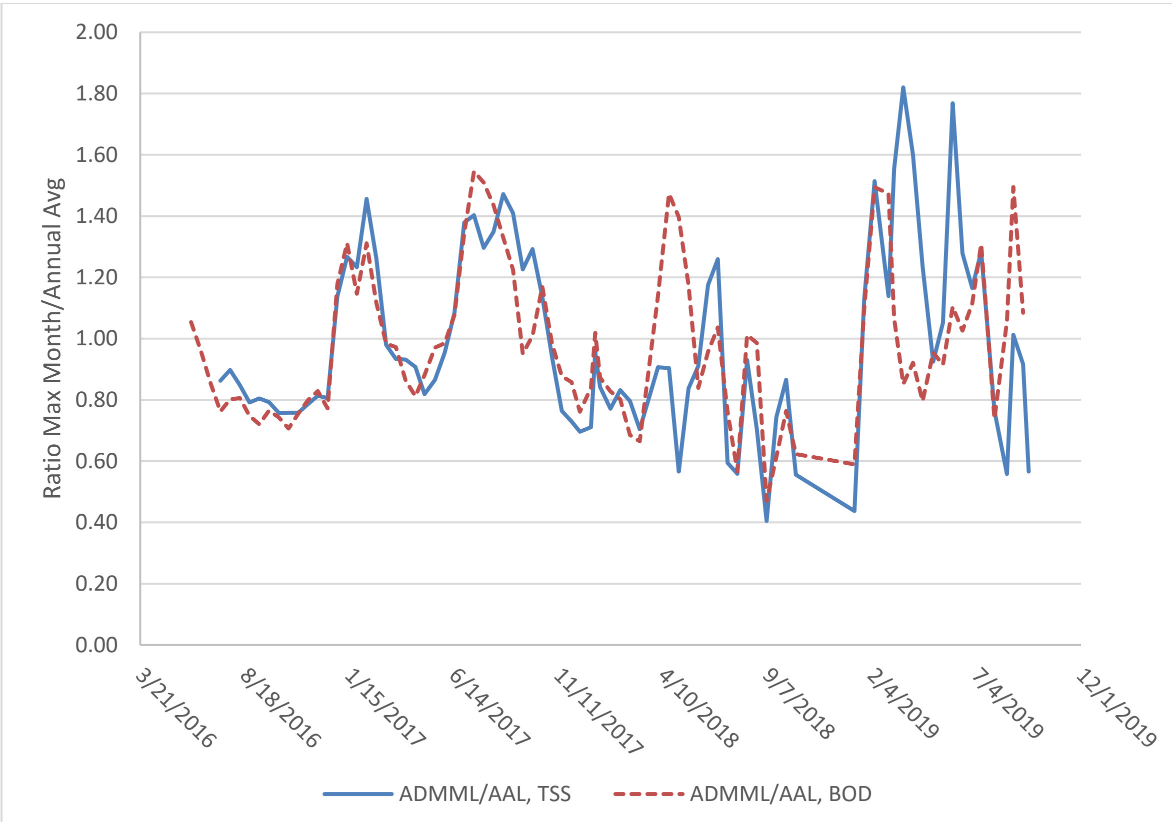


Figure 7 BOD and TSS Peaking Factors (Ratio of ADMML/AAL)

Historical Salt Concentrations

The data presented in this section provides the most up to date characterization of influent wastewater salt concentrations, so that effluent concentrations can be projected for this project. These samples were taken once a month, using a grab sample technique, which means each sample represents the wastewater concentration at a single point in time. The discharge permit issued by the Regional Board currently includes (and is expected to continue to include) limitations for TDS, chloride, and sodium. As shown in **Figures 8 to 11**, both the influent loading (lb/d) and influent concentrations have increased, likely due to the increasing population (adding associated flow) and water conservation measures, as well as continued discharge from the industrial user (Taylor Farms). When people conserve water, the mass of pollutants (salt) discharged by each person remain unchanged, but because that mass is conveyed with less water, it results in higher pollutant concentrations arriving at the wastewater treatment facility.

The annual average influent concentrations for chloride and sodium are 600 mg/L and 300 mg/L, respectively, and the annual average concentration for TDS is 1800 mg/L.

A wastewater influent salinity balance is provided in **Section 2.5,** to document the likely contributors of salt loading on the plant.

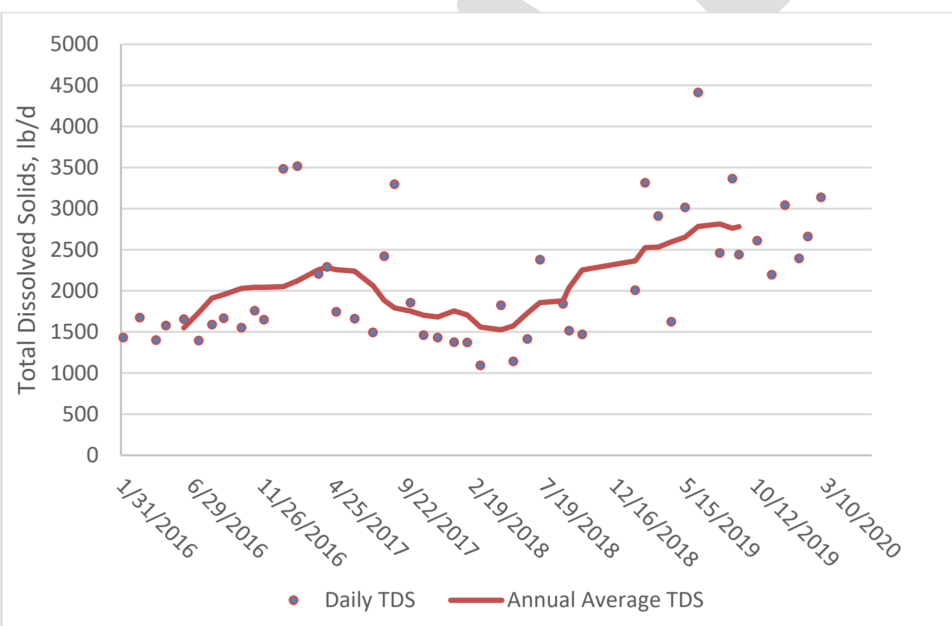


Figure 8 Influent TDS Loading

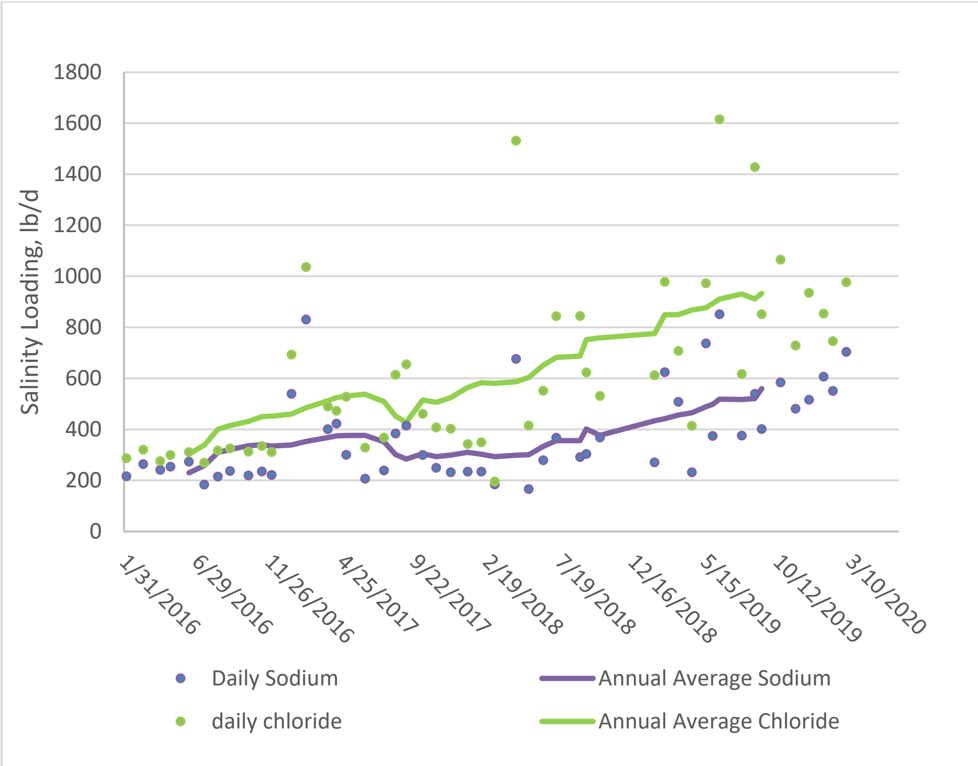


Figure 9 Influent Sodium and Chloride Loading

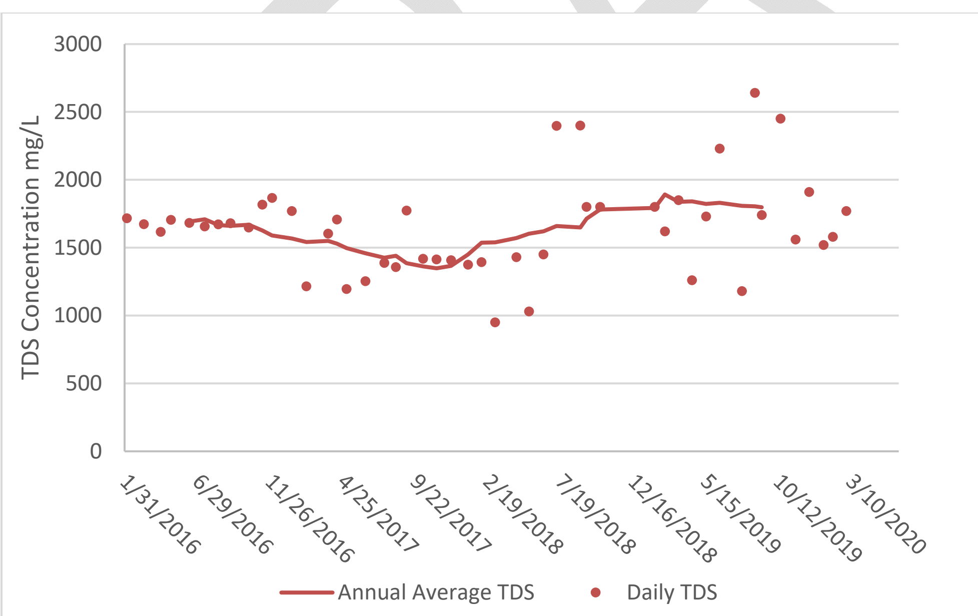


Figure 10 Influent TDS Concentration

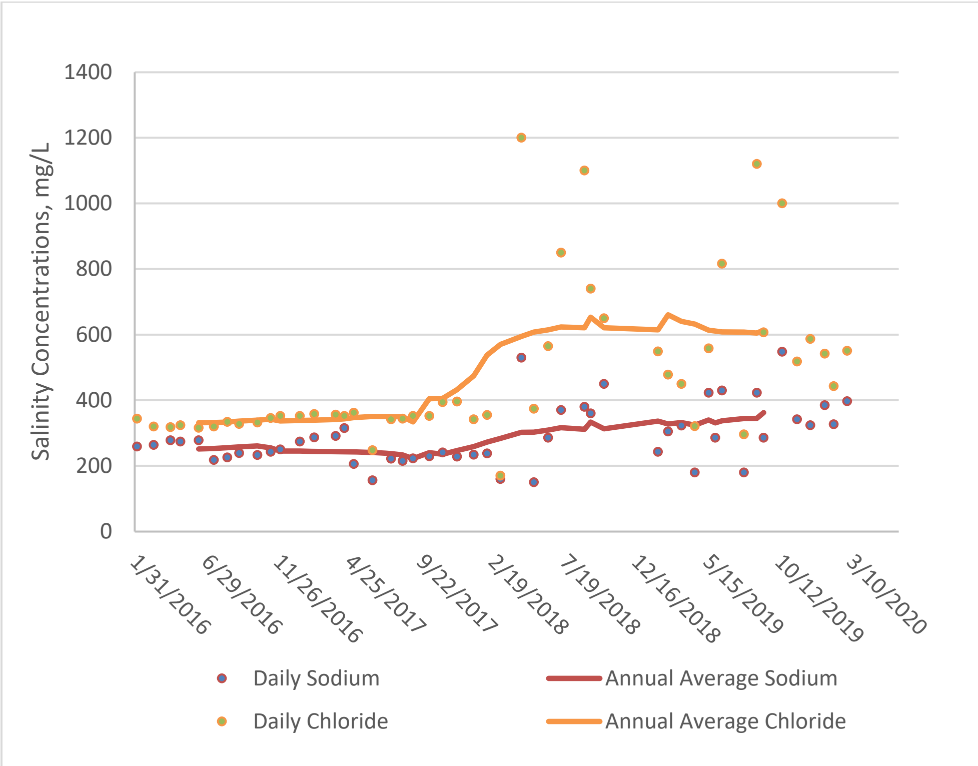


Figure 11 Influent Sodium and Chloride Concentrations

Source Water Salinity

The elevated chloride, sodium, and TDS levels observed in the City's wastewater are thought to be driven, in part, by source water (groundwater) hardness and associated self-regenerating water softeners used for potable water treatment throughout the community. The existing groundwater wells produce very hard water (greater than 300 mg/L as CaCO3) and, as a result, many of the City's residents have installed domestic self-regenerating water softeners to provide local treatment. Water softeners exchange calcium and magnesium (the main constituents contributing to hardness) for sodium or common salt (sodium chloride, NaCl). This process results in elevated chloride, sodium, and TDS that is inevitably discharged to the City's wastewater collection system and negatively impacts the WWTP. For comparison, the relative hardness scale is provided as follows:

- **Soft:** 0 to 75 mg/L as $CaCO_3$
- **Moderate:** 75 to 150 mg/L as $CaCO_3$
- **Hard:** 150 to 300 mg/L as $CaCO_3$
- **Very Hard:** Above 300 mg/L as $CaCO_3$

Water quality data for the existing potable water supply wells (Well No. 1, Well No. 5, and Well No. 6) are show in **Table 3**, below. For an analysis on the overall impact of the source water on the wastewater salinity budget, refer to **Section 2.5**, which documents the likely contributors of salt loading on the plant.

Table 3 Source Water Chemistry for Existing City Wells

Constituent	City Well 1 (Raw)	City Well 5 (Raw)	City Well 6 (Raw)
pH (std. units)	6.7 – 8.0	7.5	7.7 – 8.1
Hardness as $CaCO_3$ (mg/l) (mg/l)	353 – 485	321	334 – 371
Alkalinity as $CaCO_3$ (mg/l)	278 – 360	320	380
TDS (mg/l)	499 – 760	550	640 – 750
Chloride (mg/l)	61 – 100	81	89 – 110
Sodium (mg/l)	47 – 100	72	130 – 140

As documented in the 2020 Water Master Plan (Appendix A), the City currently uses Well No. 1 as their primary water source for much of the year. As demands increase, Well No. 1 cannot keep up with high flow rates and requires Well No. 5 to provide additional flow. Well No. 5 requires iron and manganese treatment prior to distribution, as the raw water concentrations exceed the secondary maximum contaminant levels (MCLs). Well No. 6 is the preferred primary producer, but has been taken off-line due to high nitrate contamination, which hasn't yet been isolated or controlled.

The remainder of this report, including the salinity balance in Section 2.5, is based on use of Well No. 1 as the current primary source water.

Industrial Wastewater Salinity

In addition to domestic water softeners contributing to elevated chloride, sodium, and TDS levels, industrial wastewater is also driving the elevated salinity at the WWTP influent. Taylor Farms is an agricultural processing facility that washes produce with what is believed to be a sodium hypochlorite solution (or NaCl, which is industry standard for disinfecting food, prior to packaging). As detailed in **Table 4,** this disinfection method adds substantial salinity loading to wastewater influent (from the facility's discharge). Because there is no pre-treatment program in place for the City's industrial users, there is no historical monitoring data (other than flow rate information) for Taylor Farms.

To get a better understanding of the concentrated loadings being discharged into the system, the City sampled Taylor Farms' dedicated wastewater lift station (prior to mixing with any other sources of sanitary sewers), as documented in **Table 4**. Although only one grab sample was taken (on 6/5/2020), it provides important insight into the impacts that Taylor Farms has on the City's municipal wastewater treatment plant. It is recommended that the City take additional samples to get a better understanding of how the loads change daily and seasonally.

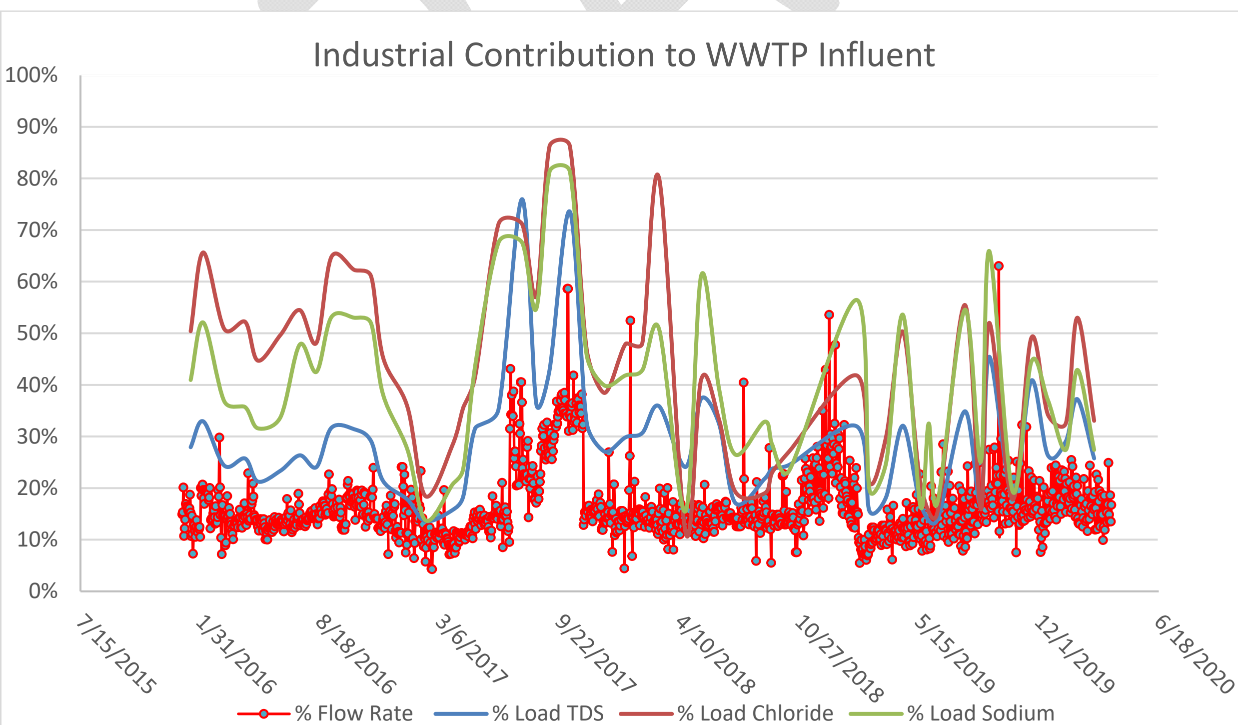
Table 4 Industrial Drain (Taylor Farms) Sampling Data

Constituent	Concentration[1], mg/L	Average Load, lb/d [2]	Peak Load, lb/d[3]
TDS	2880	663	1441
Chloride	1150	265	575
Sodium	687	158	343

1. Concentrations based on 6/5/2020 sampling event
2. Average load based on average flow rate of 28,000 gpd
3. Peak load based on max month daily flow rate of 60,000 gpd

The City of San Juan Bautista is not required to have an industrial pre-treatment program, as the WWTP flow rates are under the Regional Board's mandated threshold. However, many treatment plants require industrial dischargers (such as Taylor Farms) to comply with certain guidelines prior to sending flow to the sewers. When pre-treatment guidelines are implemented, they help limit impacts on downstream wastewater treatment and disposal facilities and help reduce the burden on residential ratepayers (who would otherwise need to offset the treatment costs associated with a few high-impact users).

As graphically depicted below, Taylor Farms is typically 15-percent of the monthly wastewater influent flow rate (peak week events reaching 40-percent and daily peaks reaching 60-percent of the influent daily flow rate, in 10/5/2017 and 9/25/2019), but calculated loading contribution are much higher (typically contributing to 30% influent salinity loading). Refer to **Section 2.5** for an analysis of the industrial wastewater discharger's impact on the WWTP influent salinity balance, which documents the likely contributors of salt loading on the plant.



Projected Design Flows and Loads

The current wastewater flows and loads presented above are used for projecting future flows and loads. Future increases in all sewage flows and loads are expected to be proportional to increases in average annual flows, which should be roughly proportional to the number of sewer connections and/or population growth. The projections further assume that all the commercial development will increase loads proportional to existing values and future industrial connections will have pre-treatment programs to ensure loading is similar to residential/commercial properties. Based on these assumptions, flow and load peaking factors will remain at current values. The Phase 1 design criteria is based on the permitted treatment capacity of 0.27 Mgal/d (ADWF). The full buildout of the service area is based on a flow rate of 0.48 Mgal/d, as described in the 2020 Wastewater Master Plan, as shown in **Appendix A**. Wastewater flows and loads for the San Juan Bautista WWTP Improvement Project are included in **Table 5**.

Table 5 WWTP Design Flows and Loads

Parameter	Unit	Current Condition ADWF = 0.18 Mgal/d	Phase 1 Condition ADWF = 0.27 Mgal/d	Buildout Condition ADWF = 0.48 Mgal/d
Flow				
Average Dry Weather Flow (ADWF)	Mgal/d	0.18	0.27	0.48
Avg. Day Annual Flow (AAF)	Mgal/d	0.18	0.27	0.48
Average Day Max Month Flow (ADMMF)	Mgal/d	0.29	0.43	0.75
Peak Day Flow (PDF)	Mgal/d	0.54	0.80	1.42
Peak Hour Flow (PHF)	Mgal/d	0.72	1.08	1.91
Biological Oxygen Demand (BOD)				
Annual Average Load (AAL)	lb/d	420	628	1,110
Avg. Day Max Month Load (ADMML)	lb/d	588	879	1,553
Average Concentration	mg/L	279	279	279
Max Month Concentration	mg/L	390	390	390
Total Suspended Solids (TSS)				
Annual Average Load (AAL)	lb/d	462	691	1,220
Avg. Day Max Month Load (ADMML)	lb/d	647	967	1,709
Average Concentration	mg/L	307	307	307
Max Month Concentration	mg/L	430	430	430
TKN Concentration				
Annual Average Load (AAL)	lb/d	80	119	211
Avg. Day Max Month Load (ADMML)	lb/d	112	167	295
Average Concentration	mg/L	53	53	53
Max Month Concentration	mg/L	74	74	75
Total Dissolved Solids	mg/L	1800	1800	1800
Chloride	mg/L	600	600	600
Sodium	mg/L	300	300	300

1. If water conservation measures materialize, then the design organic load of the plant will be reached before the hydraulic design flow.
2. Average concentrations are calculated using AAF combined w/AAL
3. Average day max month load is calculated using AAF combined w/ADMML

2.3 CONDITION OF EXISTING FACILITIES

The San Juan Bautista WWTP is a tertiary treatment facility that includes a mechanical screen and influent pump station, sequencing batch reactor pond (SBR, located in Pond 1), flow equalization tanks, a denitrification pond (located in Pond 2C with floating media), pressure sand filters, and ultraviolet (UV) disinfection. Sludge is stored in lagoons (Pond 2A and 2B).

2.3.1 Process Descriptions and Summary of Condition

Raw sewage enters the WWTP in the headworks, where a mechanical auger screen removes large debris from the incoming wastewater. Screened raw sewage is pumped to the SBR (Pond 1, Cell No. 1 or Cell No. 2). As with other conventional activated sludge SBR facilities, aeration and mixing is achieved in batch cycles (sending flow into one half of the pond while the other half is decanted). Once the biological reaction is complete, sludge settles, and supernatant is discharged to equalization storage tanks (70,000-gallon tanks). Waste activated sludge is withdrawn from the SBR and sent to the sludge storage lagoons (Pond 2A/2B).

After equalization, flow passes through the polishing pond (Pond 2C), where secondary effluent is mixed with polymer. The blended solution flows through multimedia sand filters to reduce suspended solids and turbidity. Filtered effluent is sent through a UV disinfection channel and discharged to the outfall.

Table 6 identifies the original design criteria established for the existing WWTP, as defined in the operation and maintenance manual. When comparing the existing design criteria to the current loading conditions shown in **Table 5**, the secondary treatment process is already beyond its design capacity. Further, the WWTP was never designed to remove salinity from the waste stream.

Table 6 Existing WWTP Design Criteria

Parameter	Unit	Existing WWTP Design Criteria [1]
Influent		
Secondary Capacity	Mgal/d	0.27
Tertiary Capacity	Mgal/d	0.20
BOD_5 Loading	lb/d	357
BOD_5 Concentration	mg/L	210
TSS Loading	lb/d	399
TSS Concentration	mg/L	235
Effluent		
Avg Month BOD5 Concentration	mg/L	20
Daily Max BOD5 Concentration	mg/L	60
Avg Month TSS Concentration	lb/d	20
Daily Max TSS Concentration	mg/L	60

1. Existing WWTP Design Criteria, as defined in the O&M manual.

In addition to the secondary facilities being apparently undersized (design capacity is lower than current loading rates), the plastic partition wall between the sludge storage lagoon (Ponds 2B and 2C) and the polishing pond (Pond 2A) is not sealed, allowing sludge to leach into the secondary effluent. Due to this inadvertent mixing of sludge and secondary effluent, the plant is at risk for discharge violations. For long term compliance, the sludge storage ponds need to be completely separated from the process flow stream.

Figure 12 is a picture of Pond 2, including the sludge storage lagoon and polishing pond.

Figure 12 Partition Wall Between Sludge Storage Lagoon and Polishing Pond

Further, the tertiary treatment facility is only designed to handle 0.2 Mgal/d, which is 80,000 gpd less than the existing maximum month average day flow rate (0.28 - 0.20 = 0.08 Mgal/d = 80,000 gpd). While there is some buffering capacity available in the SBR (the entire pond volume is 1.6M gallons), the available volume is not enough to equalize the excess daily flow for an entire month (totaling 2.4M gallons of excess wastewater in one month). For long term compliance, the tertiary treatment train needs to be expanded to accommodate higher flow rates (equalizing to annual average flows is not cost effective).

2.3.2 Discharge Permit Compliance Issues

The San Juan Bautista Wastewater Treatment Plant (WWTP) operates under Order No. R3-2009-0019 NPDES permit No. CA0047902. Below is a summary of the City's ability to comply with salinity, BOD, TSS, and Total Coliform effluent limitations.

<u>Salinity Compliance</u>

Amongst other effluent limitations, the average monthly discharge limits for chloride, sodium, and total dissolved solids (TDS) are 200 mg/L, 250 mg/L, and 1400 mg/L, respectively. As shown in **Figure 13**, the City was compliant except for chlorides, until 2018, and is now in violation of all three effluent limits.

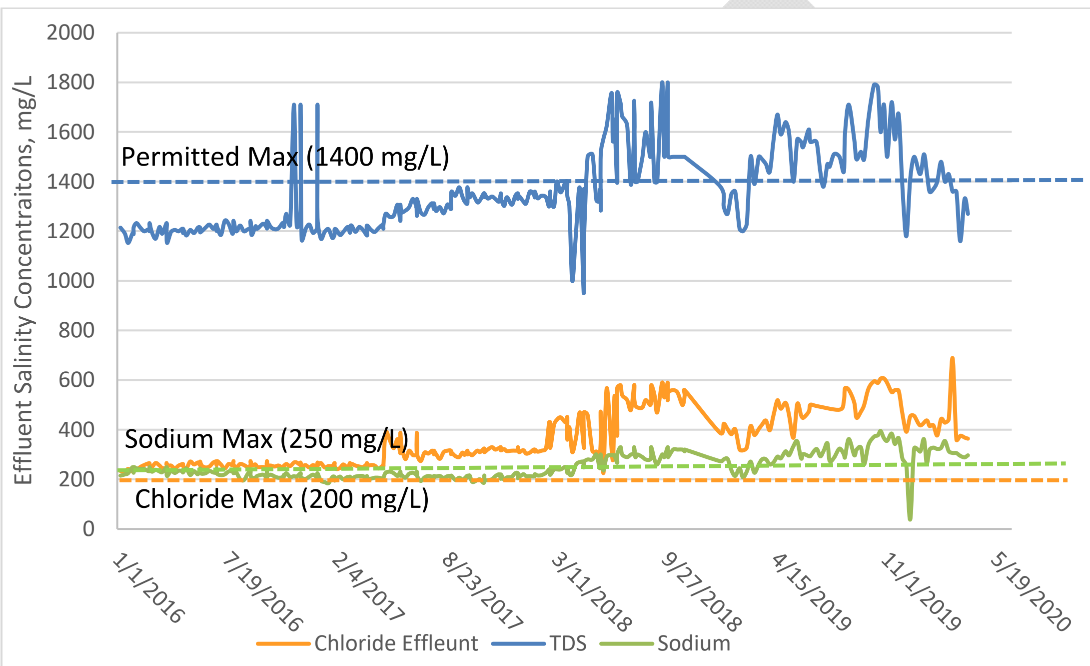


Figure 13 Effluent Monthly Salinity Concentrations

BOD and TSS Limitations

The NPDES permit limits effluent concentration for BOD and TSS to 20 mg/L (average monthly concentration) and 60 mg/L (daily maximum concentration). The plant has historically met these limits, as shown in **Figure 14**. There were three days in 2018 (August 16, August 31, and September 30) where the effluent TSS concentrations was reported to be 310 mg/L. These outlier days were removed from the graph shown below because duplicate samples taken on the same day show much lower values (around 30 mg/L) and the low values match those of surrounding days (whereas 310 mg/L would be expected in the wastewater influent, not effluent). However, there were still two events in 2019 that resulted in TSS exceeding the maximum daily limit. Further, there were several exceedances of the monthly average limits for both BOD and TSS. It is likely that the samples from August and September were affected by the sludge dredging operations, which occurred in the same time period, as further explained below.

Because the plastic partition wall between the sludge storage lagoon (Ponds 2B and 2C) and the polishing pond (Pond 2A) is not sealed, sludge leaches into the secondary effluent. Due to this inadvertent mixing of sludge and secondary effluent, the plant is at risk for discharge violations. In 2018, the City removed the accumulated sludge from Pond 2B and 2C and the operations staff was able to stabilize the biology by the following summer and have remained compliant with effluent BOD and TSS limitations since that date. However, for long term compliance, the baffle walls need to be rebuilt and the sludge storage ponds need to be completely separated from the process flow stream.

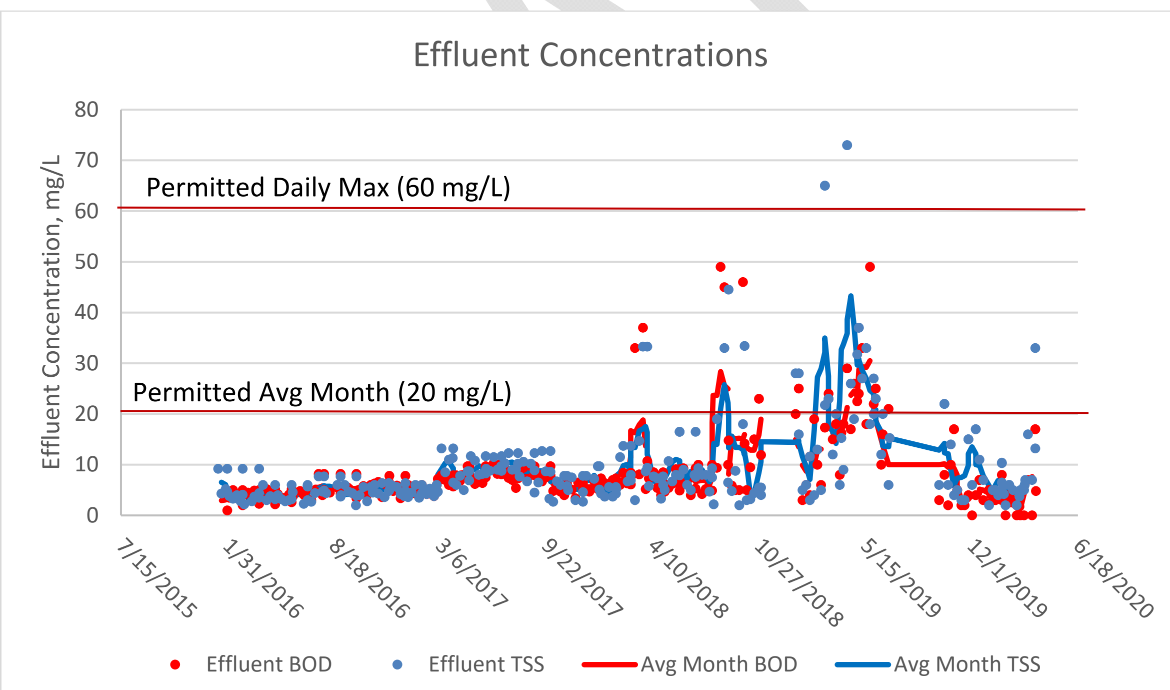


Figure 14 BOD and TSS Effluent Concentrations

Total Coliform Limitations

The permitted effluent limitation for total coliform is 23 MPN/100mL (five-day median concentration) and 2300 MPN/100mL (daily maximum concentration). The plant has historically met these limits, as shown in **Figure 15 and 16.** However, between February and April of 2019, there were several exceedances of both daily and five-day median total coliform. The discharge violations were likely due to UV bulb/sleeve aging and potentially due to undersized equalization facilities. After the city replaced cracked UV bulbs and broken sleeves (in summer of 2019), the coliform has remained compliant with discharge limitations. For long term compliance, all UV disinfection equipment must be maintained and replaced in accordance with the manufacturer's guidelines and upsized (or re-rated) to handle flow rates higher than the annual average flow.

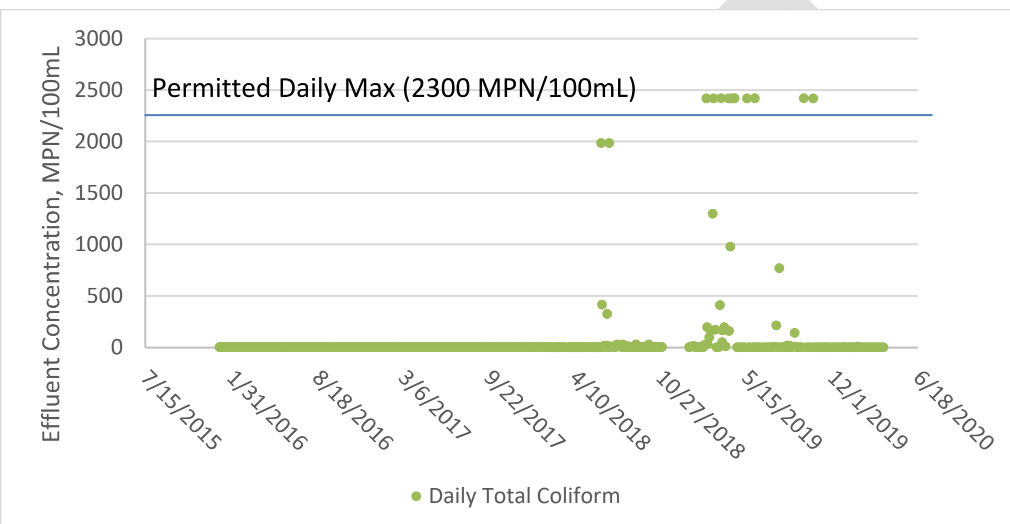


Figure 15 Daily Total Coliform Effluent Concentrations

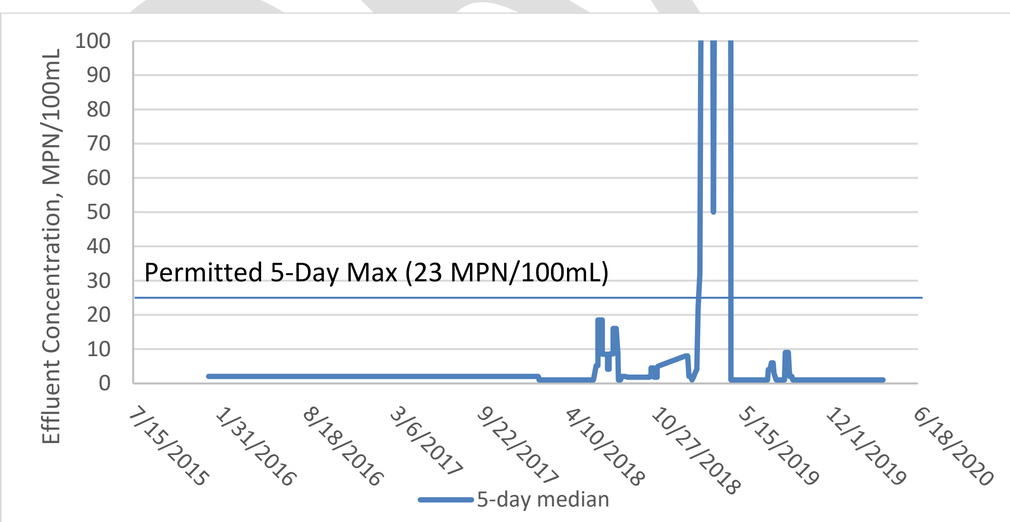


Figure 16 Five-Day Median Total Coliform Effluent Concentrations

2.4 FINANCIAL STATUS OF EXISTING FACILITES

The median household income (MHI) for the City of San Juan Bautista is $53,077, which is 74.5% of State average, and has a population of approximately 2,030. A comprehensive operating budget for the City is attached to the project application (see **Appendix B**) and includes detailed expenses and assets associated with the City's budget. The City prepared a Rate Study in 2015 and adopted new sewer rates with Ordinance 2015-20, which is summarized as:

- the base rate of $83.61/month (residential),
- $84.03 (commercial), and
- Cost per 1,000 gallons: $9.10/month (standard strength), $13.63/month (moderate strength), and $18.18/month (high strength).

There are currently 835 residential sewer accounts, and 73 commercial accounts, for a total of 908 sewer connections.

The 2020 Water and Wastewater Masterplan (in **Appendix A**) includes a capital improvement program for major upcoming projects, including the recommendations from this report. **Table 7** shows the water and sewer operating revenue and expenses from June 2019 Auditor's Report and Financial Statement.

Table 7 Financial Status, 2019 Auditor's Report

Assets	Water	Sewer
Operating Revenue	**1,312,018**	**1,182,920**
Operating Expense		
Contractual Services and Utilities	106,597	291,529
Personnel	127,639	113,110
Supplies, Materials, and Repairs	101,206	573,351
Depreciation	326,616	308,686
Total Operating Expense	**662,057**	**1,286,676**
Non-Operating Revenue / (Expense)		
Development Impact Fees	44,525	163,993
Interest Income	26,039	22,349
Interest Expense	(271,308)	(220,954)
Total Non-Operating Revenue / (Expense)	**(200,774)**	**(34,612)**

2.5 WASTEWATER AUDITS

The City is in the middle of updating their water and wastewater masterplan, as shown in **Appendix A**. The results of which have been incorporated into this report. In addition to the wastewater audits from the masterplan, the following salinity information is important to document.

2.5.1 WWTP Influent Salinity Balance

Salinity (salt) is measured by the total concentration of dissolved minerals, such as magnesium, potassium, sodium, and chlorides. Once salinity is in wastewater, it is difficult to remove. All potable water contains naturally occurring salt, but water users (industrial, agricultural, and residential) also add salt to the water before discharging into the sewers. For example, households add salt to their drains from excess salt in their diet, and use of detergents, cleaning products, soaps, and shampoos. Salt is further added to sewers when it is exchanged for hardness in the self-regenerating water softeners.

As stated previously, many of the City's residents have installed domestic self-regenerating water softeners to provide local treatment to potable water. Water softeners exchange calcium and magnesium (the main constituents contributing to hardness) for sodium or common salt (sodium chloride, NaCl). This process results in elevated chloride, sodium, and TDS that is inevitably discharged to the City's wastewater collection system.

Further, the City receives flow from an industrial user (Taylor Farms, formally Earthbound Farms). The agricultural processing facility washes produce with what is believed to be a mixture of sodium hypochlorite and a proprietary substance called SmartWash Solution (T128). While the disinfection and washing procedures of the facility are not known, it is assumed that sodium hypochlorite is used on site based on the sampling data reported herein and symposium presentations from the company at multiple agricultural conferences in the last decade. This disinfection method adds substantial salinity loading to the industrial discharge.

Based on **Table 4**, Taylor Farms discharges 2880 mg/L TDS, 1150 mg/L Chloride, and 687 mg/L sodium and historical billing information (documenting daily and monthly flow rates) the facility discharges an average flow rate of 27,600 gpd (15% of the average influent daily flow rate). Although the flow rates from Taylor Farms are 15% (on average) of the total influent flow rate, they make up 29% of the influent chloride and sodium concentrations (and 47% during the peak month event and 55% during a peak week event, as shown in **Table 8**). When the influent flow rate from Taylor Farms is higher (ratio of Taylor Farms flow rate to total influent flow rate is more than 15%), the wastewater influent salinity concentrations go up.

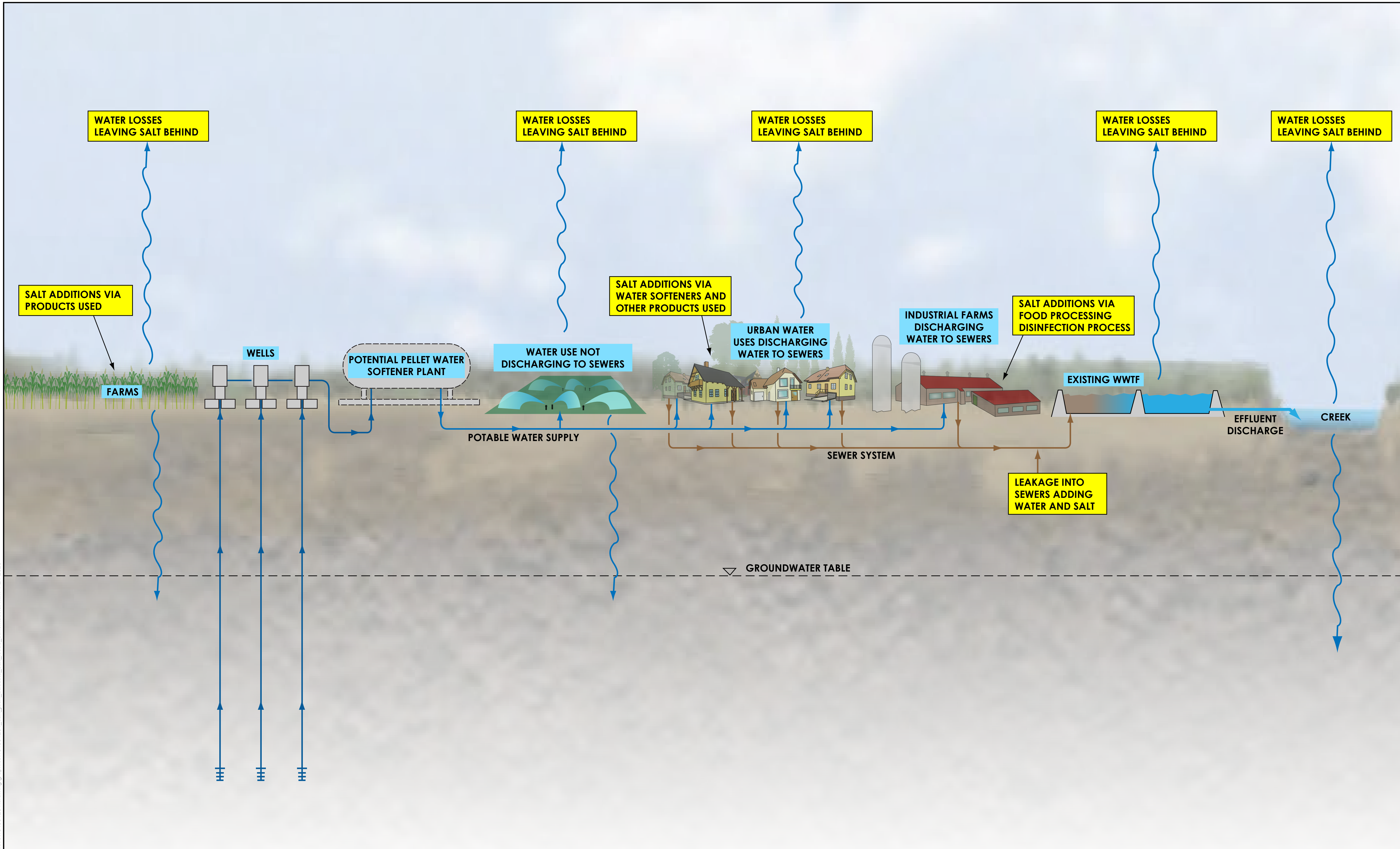
Table 8 shows an estimated salt balance for the City of San Juan Bautista wastewater influent.

As shown in **Figure 17**, salt comes from many sources and requires careful consideration as to the best option for removal.

Table 8 WWTP Influent Salinity Balance (Average Daily Loads)

Salt Contributors to Total WWTP Influent	TDS	Chloride	Sodium
SALINITY LOADING, lb/d			
Well No. 1 (Raw Water)[1]	946	116	90
Diet and Personal Care Products[2]	399	27	19
Self-Regenerating Water Softeners[3]	680	408	272
Industrial User[4]	663	265	158
Inflow and Infiltration[5]	23	88	0
TOTAL WWTP INFLUENT, lb/d	2,710	903	539
SALINITY CONCENTRATION, mg/L			
Well No. 1 (Raw Water)[1]	628	77	60
Diet and Personal Care Products[2]	265	18	12
Self-Regenerating Water Softeners[3]	452	271	181
Industrial User[4]	440	176	105
Inflow and Infiltration[5]	15	58	0
TOTAL WWTP INFLUENT, mg/L	1800	600	358
PEAK MONTH SALINITY CONCENTRATION[6], mg/L			
Industrial User	957	382	228
All Other Contributors	1,360	424	253
TOTAL Peak Month WWTP INFLUENT, mg/L	2,317	806	481
PEAK WEEK SALINITY CONCENTRATION[6], mg/L			
Industrial User	1,276	509	304
All Other Contributors	1,360	424	253
TOTAL Peak Week WWTP INFLUENT, mg/L	2,635	933	557

1. Based on average well data shown in Table 4: 0.18 Mgal/d and TDS 628 mg/L, Chloride 77 mg/L, and Sodium 60 mg/L.
2. Dietary and Personal Care Products: TDS concentration of 265 mg/L based on Central Valley Clean Water Association "Salinity Management Practices for POTWs" 2012. Chloride and sodium concentrations based on "Chloride Contributions from Water Softeners and Other Domestic Sources" University of Minnesota 2019 and "Characterizing and Managing Salinity Loading in Reclaimed Water Systems" by AWWA & Thompson 2006.
3. Water softener efficiency based on 3300 grains hardness per pound NaCl (and average hardness 425 mg/L $CaCO_3$) in accordance with historical and current California efficiency standards and half the influent flow rate is being treated by ion exchange water softeners.
4. Industrial sampling from June 2020 on Taylor Farms wash water discharge (27,600 gal/d and concentrations of 2880 mg/L TDS, 1150 mg/L chloride, and 687 mg/L sodium). To corelate these values to total influent flow concentration, the sample concentrations were multiplied by 15% (27,600gpd ÷ 180,000gpd = 15%)
5. To account for missing salinity, inflow and infiltration (I/I) based loading (salinity from agricultural runoff and natural erosion/weathering of rock minerals) was calculated by taking the difference between historical influent loads (from Table 4) and total other loads contributors identified herein.
6. Peak salinity concentrations are based on increasing flow rates from Taylor Farms (peak month flow of 60,000 gpd and peak week flow of 80,000 gpd), while all other influent concentrations remain the same.



Stantec

Figure 17
Sources for Salt Balance

While Taylor Farms provides 15-percent of the average wastewater influent flow rates, the peak month reaches 33-percent of the actual flows (60,000 gpd sent to the plant during summer months) and peak week reaches 44-percent of influent flows (80,000 gpd sent in fall). During the peak month and peak week discharges from Taylor Farms, the industrial user loading contributions increase. The anticipated average annual, peak month and peak week salinity concentrations (shown in **Table 8**) correspond to the historical concentrations identified in **Figures 10 and 11**.

As detailed in the project needs discussion (**Section 3.1.3**), the current permit limits effluent concentrations of 200 mg/L chloride, 250 mg/L sodium, and 1400 mg/L TDS. In the next permit renewal cycle, these limits are expected to be decreased to 150 mg/L chloride, 200 mg/L sodium, and 1200 mg/L TDS. The least cost solution is to reduce loading from the industrial source (Taylor Farms). Based on the salinity balance presented above, it will bring the chloride, sodium, and TDS numbers close to the discharge permit limits and may ultimately be enough to prevent additional source control. However, the extent of salt reduction will not be fully known until a pre-treatment program is implemented and additional samples are collected.

As such, the recommended first step for the City is to create an industrial pre-treatment program, that is approved by the City Council, and implement the requirements. Once the discharge limitations are enacted and Taylor Farms is complying with the pre-treatment program, the City can establish a monitoring schedule to ensure the WWTP will remain compliant with the NPDES permit. If there is additional chlorides, sodium, and TDS that needs to be removed from the influent (after the pre-treatment program is underway), the below alternatives can be considered.

3.0 NEED FOR PROJECT

3.1 HEALTH, SANITATION, AND SECURITY

Below are descriptions of the current regulatory compliance issues for the City's wastewater treatment facility.

3.1.1 Biological and Solids Management Project Needs

The San Juan Bautista WWTP currently operates under NPDES permit number CA0047902. The NPDES permit limits effluent concentration for BOD and TSS to 20 mg/L (average monthly concentration) and 60 mg/L (daily maximum concentration). In the past few years, the Regional Board has issued the City violation notices for BOD, ammonia, and suspended solids (as shown in **Figure 14** and documented in **Appendix C**). Based on the existing wastewater influent loading and the original design criteria of the WWTP, the secondary treatment facilities are undersized (design capacity is lower than current loading rates, as shown in **Tables 5 and 6**) and need to be modified to ensure continued compliance with nutrient removal.

Further, the plastic partition wall between the sludge storage lagoon (Ponds 2B and 2C) and the polishing pond (Pond 2A) is not sealed, allowing sludge to leach into the secondary effluent. Due to this inadvertent mixing of sludge and secondary effluent, the plant is at risk for continued discharge violations. For long term compliance, the sludge storage ponds need to be completely separated from the process flow stream.

3.1.2 Tertiary Treatment and Disinfection Project Needs

The permitted effluent limitation for total coliform is 23 MPN/100mL (five-day median concentration) and 2300 MPN/100mL (daily maximum concentration). Recently, there were several exceedances of both daily and five-day median total coliform and the Regional Board issued violation notices and fines (as shown in **Figure 15 and 16** and documented in **Appendix C**). Based on the existing wastewater influent flow rates and the original design criteria of the WWTP (shown in **Tables 5 and 6**), the tertiary facilities are undersized, as discussed herein.

The tertiary treatment facility is only designed to handle 0.2 Mgal/d, which is 80,000 gpd less than the existing average day maximum month flow rate (0.28 - 0.20 = 0.08 Mgal/d = 80,000 gpd). While there is some buffering capacity available in the SBR (the entire pond volume is only 1.6M gallons), the available volume is not enough to equalize the excess daily flow for an entire month (totaling 2.4M gallons of excess wastewater in one month). For long term compliance, the tertiary treatment and disinfection train needs to be expanded to accommodate higher flow rates (equalizing to annual average flows is not cost effective) or re-validate the existing facilities to higher flow rates than indicated in the design criteria (i.e. by increasing filtration rates to 5 gpm/sf and increasing UV dose rate or reducing turbidity).

3.1.3 Salinity Control Project Needs

When salinity is referenced herein (as with other engineering and scientific documents), it is often interchangeable with total dissolved solids (TDS) or electrical conductivity (EC) and includes nonionic substances (like silica) and ionic substances (like chloride, sodium, calcium, magnesium, sulfate, and nitrates). Salinity is transported with water and, as such, salt that originates in one location may be carried downstream to another. Significant problems ensue when the receiving water basin has no reliable way of disposing of salt. Increased levels of salinity can accelerate corrosion in plumbing, become toxic to aquatic life, and (most notably) negatively impact crop production.

California is one of the most productive agricultural areas on Earth. However, a downside of intensive irrigated agriculture is that it concentrates salt (both naturally occurring and added by agriculture as fertilizers and processing facilities) in residual water. The problem of salt accumulation in residual water has been recognized for decades, but potential remedies are expensive, which contributes to the ever-increasing problem of salt accumulation in the Central Coast.

In an effort to control the salt accumulation problem and ultimately stabilize it, and possibly reverse it (to some extent), the Regional Water Quality Control Board developed a salinity control plan that is incorporated into the 2016 Basin Plan and further disseminated such requirements to local municipalities within their NDPES discharge permits.

The San Juan Bautista WWTP currently operates under NPDES permit number CA0047902. Amongst other effluent limitations, the average monthly discharge limits for chloride, sodium, and total dissolved solids (TDS) are 200 mg/L, 250 mg/L, and 1400 mg/L, respectively. Based on conversations with the Regional Board and the 2016 Basin Plan, the salinity limits are expected to decrease in the next permit renewal cycle and is assumed to be similar to limits enforced in the City of Hollister's WWTP NPDES permit (150, 200, and 1200 mg/L, respectively).

As described previously, and shown in **Figure 13**, the City is currently in violation of chlorides, sodium, and TDS effluent limits and has received multiple violation notices and fines from the Regional Board for these effluent exceedance events (as documented in **Appendix C**). Further, the existing treatment facilities are not designed to remove salinity from the wastewater stream. In order to ensure long-term compliance with salinity limitations, the City will need to either implement source control measures (industrial pre-treatment programs and potentially lowering potable water hardness and associated self-regenerating water softener use) or provide additional treatment facilities to remove salinity from the wastewater.

Based on the average salinity concentrations entering the plant and the anticipated new permit limits, as shown in **Table 5** and described herein, the new salinity control measures need to be capable of removing at least 450 mg/L chloride, and 100 mg/L sodium, and 600 mg/L TDS.

3.2 AGING INFRASTRUCTURE

The original wastewater treatment plant was a facultative pond plant, constructed in the 1950s. The last major improvements project, in 2010, upgraded Pond 1 to an aerated pond that functions as sequencing batch reactors (SBR) and split Pond 2 into three cells (Cell A, B, and C). However, the 2010 project did not upgrade the liner in either Pond 1 or Pond 2. The liners have met their useful life and need to be replaced. The existing influent auto sampler does not function properly, providing unreliable composite samples, and has reached the end of life and should be replaced.

3.3 REASONABLE GROWTH

The planning period used for the project is 20 years. This allows for an appropriate timeline accommodating a limited amount of population growth (1.5%) in accordance with the City's planning horizons and roughly matches industry standards for the useful life of treatment works.

The current ADWF is approximately 0.18 Mgal/d and the treatment plant capacity is 0.27 Mgal/d. This leaves some unused treatment plant capacity that can be used to accommodate growth, some of which is already reserved. As stated previously, the WWTP should be improved in phased increments (Existing, Phase 1- near term growth, Phase 2- buildout capacity) and future users will have to fund the future capacity.

- Current: During the interim phase, the existing WWTP will continue to be used to provide treatment to the existing 908 sewer connections. This includes ongoing maintenance and repairs at the existing plant and implementation of an industrial pre-treatment program, but does not provide upgrades to the infrastructure to ensure long-term compliance with NPDES permits.
- Phase 1: The Phase 1 Project will upgrade the existing WWTP (including potential source water control) to accommodate 1.5% annual growth within current plant capacity. Upgrades to the existing facilities will ensure compliance with existing and anticipated future permits. The Phase 1 Project is described in the below detailed evaluation.
- Phase 2: The Phase 2 Project will expand the WWTP facilities to serve additional users, to accommodate "build out" conditions based on the City's Master Plan. The Phase 2 Project is not considered herein and is mentioned for long-term planning purposes only.

4.0 WWTP UPGRADE ALTERNATIVES CONSIDERED

The purpose of this report is to investigate alternatives and develop a recommended program for bringing the wastewater treatment plant into compliance with regulatory requirements. The alternative projects considered herein include the following:

1. Alternative 1, On-Site WWTP Upgrades and Off-Site Salinity Control: Provide source control (implementing a pre-treatment program and lowering potable water hardness to eliminate domestic self-regenerating water softeners) in order to reduce the wastewater influent salinity concentrations to permittable levels. This project will allow the existing WWTP to remain operational with upgrades to the existing process facilities. All off-site salinity control options will also include the implementation of a pre-treatment program for agricultural processing facilities (to limit salt discharge from those users).

    A. Option 1A, Source Control via Pellet Water Softening Plant Rehabilitation: Off-site salinity control will be accomplished by rehabilitating the City owned pellet water softening system and installing it on the potable water distribution network. After lowering source water hardness, the City will implement a buy-back program to eliminate domestic self-regenerating water softeners, in order to reduce the wastewater influent salinity concentrations to permittable levels.

    B. Option 1B, Source Control via Domestic Cartridge Water Softeners: Off-site salinity control will be accomplished by replacing all domestic self-regenerating water softeners with cartridge water softeners. Salt being discharged from household water softeners will no longer drain to the sewers (lowering influent wastewater salinity concentrations to permittable levels) and instead the salt will be collected in canisters and safely disposed of off-site.

    C. Option 1C, Source Control by Importing Water from West Hills WTP: Off-site salinity control will be accomplished by replacing well water (very hard water) with treated surface water (moderately hard) and remove self-regenerating water softeners in order to reduce the wastewater influent salinity concentrations to permittable levels.

2. Alternative 2, On-Site WWTP Upgrades and Salinity Control: This project will replace the existing WWTP sequencing batch reactor (SBR) treatment system with a new membrane bioreactor (MBR) and reverse osmosis (RO) or Electrodialysis Reversal (EDR) treatment facilities that will remove salinity.

3. Alternative 3, Regionalization with Hollister WWTP and Off-Site Salinity Control: Provide source control in order to reduce the wastewater influent salinity concentrations and then pump the influent wastewater to a neighboring community (the City of Hollister WWTP). This project will replace the existing WWTP with an equalization basin and emergency storage pond to service a new pump station and pipe alignment to the Hollister WWTP for off-site treatment and disposal. All off-site salinity control options will also include the implementation of a pre-treatment program for agricultural processing facilities (to limit salt discharge from those users).

   A. Option 1A, Source Control via Pellet Water Softening Plant Rehabilitation: Off-site salinity control will be accomplished by rehabilitating the City owned pellet water softening system and installing it on the potable water distribution network. After lowering source water hardness, the City will implement a buy-back program to eliminate domestic self-regenerating water softeners, in order to reduce the wastewater influent salinity concentrations to permittable levels.

   B. Option 1B, Source Control via Domestic Cartridge Water Softeners: Off-site salinity control will be accomplished by replacing all domestic self-regenerating water softeners with cartridge water softeners. Salt being discharged from household water softeners will no longer drain to the sewers (lowering influent wastewater salinity concentrations to permittable levels) and instead the salt will be collected in canisters and safely disposed of off-site.

   C. Option 1C, Source Control by Importing Water from West Hills WTP: Off-site salinity control will be accomplished by replacing well water (very hard water) with treated surface water (moderately hard) and remove self-regenerating water softeners in order to reduce the wastewater influent salinity concentrations to permittable levels.

Based on the average salinity concentrations entering the plant and the assumed effluent limits in the new permit, as shown in **Table 5** and described in **Section 3.1.2**, the new facilities (industrial pre-treatment program and source control options) need to be capable of removing at least 600 mg/L TDS, 450 mg/L chloride, and 100 mg/L sodium. It is assumed that, once implemented, the industrial pre-treatment program will remove at least 162 mg/L chloride, 94 mg/L sodium, and 330 mg/L TDS, (with a presumed sewer discharge limit of 89 mg/L chloride, and 69 mg/L sodium, and 722 mg/L TDS, which is considered 15% higher than the average well water concentrations). As such, the source control measures may require an additional 288 mg/L chloride, 6 mg/L sodium, and 270 mg/L TDS removal.

The extent of industrial based salt reduction will not be fully known until an industrial pre-treatment program is implemented and additional samples are collected (the preliminary numbers presented herein are based on a single grab sample from Taylor Farms). Once the pre-treatment program is adopted and frequent representative samples are analyzed, the remaining salinity removal needed to comply with the NPDES permit will be better quantified. For the purposes of this analysis, it is assumed that each source control option will provide sufficient salinity reduction, in combination with the pre-treatment program, to achieve compliance with the permit.

Note that Alternatives 1 and 3 both require the agricultural processing facility to have an industrial pre-treatment program (reducing the allowable salinity discharged into the sewers) and potentially incorporating potable water source control in order to reduce wastewater influent salinity concentrations to permittable levels (i.e. providing soft water to the community and eliminating self-regenerating water softeners that dump high levels of chloride, sodium, and TDS into the sewers).

The source control options investigated for both alternatives include three sub-options (Options A, B, and C) that will be considered for its life cycle costs and impacts on the associated alternative. In addition, Options A and B require installation of a new potable water well (Betable Road Well) to provide water security to the City's potable water portfolio, as described in detail under Section 4.1. These three options can be used in conjunction with the industrial pre-treatment program and are evaluated in case the pretreatment program (reducing Taylor Farms discharge loading) does not remove enough salinity from the influent wastewater stream to fully comply with the NPDES permit.

4.1 ALTERNATIVE DESCRIPTIONS AND COST ESTIMATES

Alternatives 1 through 3 are described herein.

4.1.1 Alternative 1, On-Site WWTP Upgrades and Off-Site Salinity Control

Because Alternative 1 requires off-site salinity control in order to reduce the wastewater influent salinity concentrations to permittable levels, the options for lowering potable water hardness and eliminating domestic self-regenerating water softeners will be evaluated first. The resulting best option will be used for the remainder of the analysis. These options can be used in conjunction with the pre-treatment program and are evaluated in case the pretreatment program (reducing Taylor Farms discharge loading) does not remove enough salinity from the influent wastewater stream to fully comply with the NPDES permit.

Option 1A: Source Control via Pellet Water Softening Plant Rehabilitation

The City purchased a pellet water softening system to reduce hardness at the source, prior to delivering potable water, in order to eliminate use of domestic water softeners. The water softening system was designed to include three main treatment processes: a pellet reactor system (crystallization on sand media), lime system (pH adjustment), and filtration system (polishing stage). Although the pellet water softening system was delivered to the site in 2011 (manufactured by Procorp Enterprises LLC), it was never installed or operated.

The main component of the water softening system is the pellet reactor column, illustrated in **Figure 18**. Raw water is pumped into the bottom of the column to create a fluidized seed/pellet bed (seed material is sand). To raise the pH of the water, reagent (lime and/or sodium hydroxide) is mixed into the bottom of the column. The driving force of the high pH water (pH of approximately 10.0) allows the calcium ions to precipitate out of solution and crystallize on the seed material, forming pellets. As the pellets grow, they fall to the bottom of the column and are periodically removed using automatic isolation valves. The removed pellets are put into a dumpster and hauled off site for disposal. Softened water flows over a weir, out of the top of the reactor, where the pH is lowered using carbon dioxide to prevent further precipitation.

The softened water, discharged from the pellet reactor column, flows through six multimedia filters to remove residual turbidity (caused by excess lime) and any remaining calcium carbonate particles. Chlorine is added to the filtered effluent and sent to the City's water distribution system. The entire water softening system is controlled by a main control panel and motor control center.

This system was designed to remove 325 mg/L hardness as $CaCO_3$, which is estimated to eliminate 338 mg/L TDS, 203 mg/L chloride and 135 mg/L sodium from water softener discharge into the sewer (75% of salt contributed from the water softener source, as the shown in the salinity balance, **Table 8**).

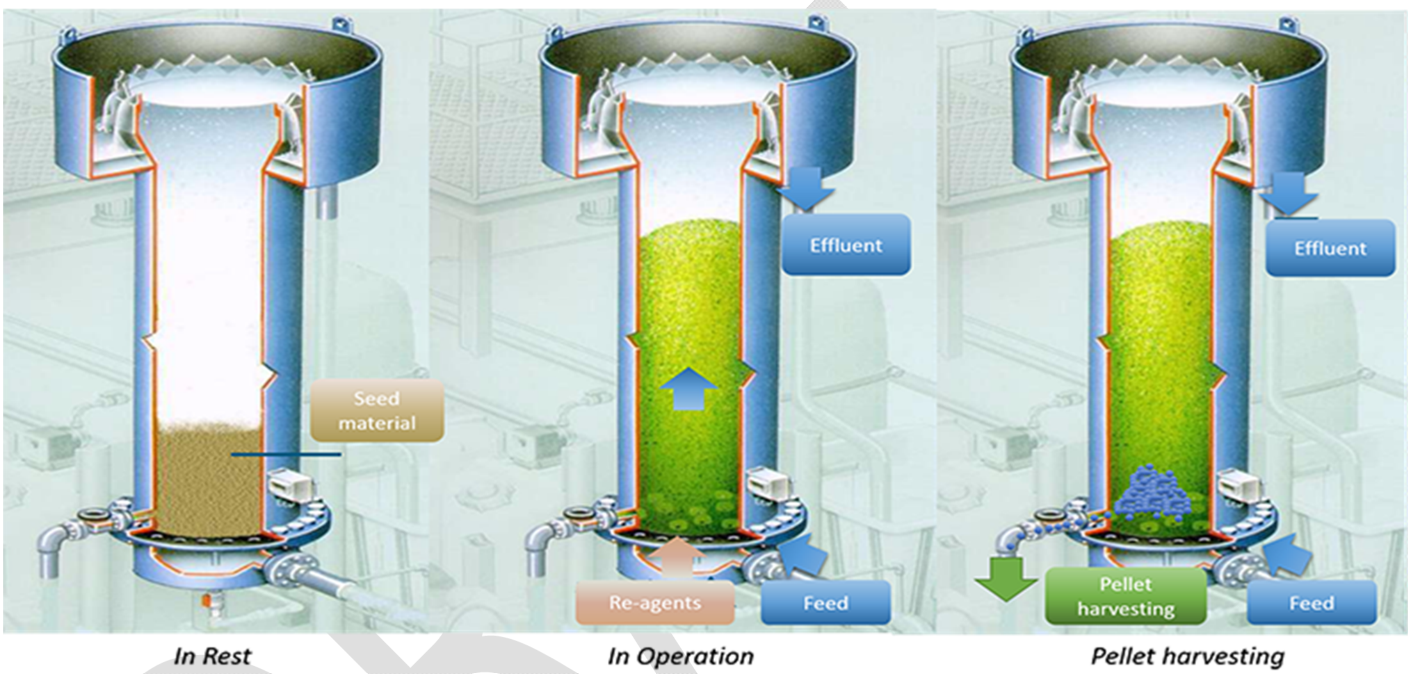


Figure 18 – Pellet Reactor Column Schematic (Procorp® Crystalactor)

As described in **Appendix D**, "Preliminary Evaluation of the Pellet Water Softening System", the softening system has operational costs that must be considered when evaluating the lifecycle costs of the system. Lime is fed at a rate of 1,100 lb/d to raise the pH of the raw water (and precipitate calcium out of solution), while 15 mg/L of carbon dioxide is added downstream of the softener to lower pH and prevent scaling. Further, sand is fed at a rate of 140 lb/d (to make up for seed/sand loss during pellet extraction) and pellets are removed at a rate of 2,400 lb/d.

The cost to rehabilitate and install the water softening system is approximately $1,800,000. The cost to operate the system (based on an average daily demand of 0.4 Mgal/d) is $9,600/month. After the Pellet Plant source control system is installed and operational, the City will need to implement a buy-back program to remove domestic water softeners from homes. Depending on the community, the rebate may cost between $300 to $800 per unit ($105,000 to $280,000- using cash payments and credits on sewer bills).

The total life cycle cost for this option is $4.15 million, as shown in **Table 9**.

Table 9 Pellet Plant Life Cycle Costs

Description	Cost
Construction Costs	$1,800,000
Engineering/CM Costs (25%)	$450,000
Annual O&M	$115,200
Present Worth O&M, 20-years @ 3%	$1,710,000
Domestic Softener Buyback	$193,000
Total Life Cycle Cost	**$4,153,000**

Option1B: Source Control via Domestic Cartridge Water Softeners

Option 1B replaces domestic self-regenerating water softeners with cartridge water softeners. Both types of domestic water softeners exchange calcium and magnesium (the main constituents contributing to hardness) for sodium or common salt (sodium chloride, NaCl). However, the cartridge softeners do not have a drain that dumps the salty brine solution into the sewers (as the self-regenerating softeners do). Rather, the cartage softeners are sized to remove hardness and store all the waste within a tank.

The cartridge water softener systems will be designed to remove 425 mg/L hardness as $CaCO_3$, which is estimated to eliminate 452 mg/L TDS, 271 mg/L chloride and 181 mg/L sodium from the sewer (as shown in the salinity balance, **Table 8**) if 350 self-regenerating water softeners are replaced with cartridge systems (removing all softeners assumed to be in the system).

On a monthly basis, the brine solution needs to be removed (hauled off-site and disposed of in a landfill) and the exchange ions (salt) need to be replaced. Culligan Water Company provided a proposal to deliver and install the systems, as well as provide a monthly service to removal brine and recharge the canisters with new salt. The costs for all the cartridge water softeners (assumed to be 350 softeners) is detailed in **Table 10**. In order to encourage users to replace their softeners, the City will need to implement a buy-back program to remove domestic water softeners from homes. Depending on the community, the rebate may cost between $300 to $800 per unit ($105,000 to $280,000- using cash payments and credits on sewer bills).

Table 10 Cartridge Water Softener Life Cycle Costs

Description	Cost[1]
Construction Costs	$455,000
Engineering/CM Costs (15%)	$68,000
Annual O&M	$154,300
Present Worth O&M, 20-years @ 3%	$2,290,000
Domestic Softener Buyback	$193,000
Total Life Cycle Cost[2]	**$3,006,000**

1. Based on replacing 350 water softeners (half the homes).

Option 1C: Source Control by Importing Water from West Hills WTP

The potable water provided by the City of Hollister's West Hills Water Treatment Plant (WTP) is only moderately hard (97 mg/L) and has less total dissolved solids (260 mg/L) than the water provided by the City of San Juan Bautista's wells. **Table 11** shows a comparison of Well No. 1 (current main potable water source) and West Hills WTP water.

Table 11 Water Chemistry for West Hills WTP

Constituent	West Hills WTP	City Well 1 (Raw)
pH (std. units)	7.8	7.0
Hardness as $CaCO_3$ (mg/L)	97	425
TDS (mg/L)	260	628
Chloride (mg/L)	79	77
Sodium (mg/L)	56	66

Similar to the pellet plant option, the West Hills WTP water source would eliminate up to 325 mg/L hardness as $CaCO_3$, which is estimated to remove 338 mg/L TDS, 203 mg/L chloride and 135 mg/L sodium from water softener discharge into the sewer (75% of salt contributed from the water softener source, as the shown in the salinity balance, **Table 8**). Further, the source water will also remove 325 mg/L of TDS from the water, making a total reduction of 663 mg/L TDS (338 + 325 =663).

In order to connect the West Hills WTP water source to the City's distribution system, a new 12-inch diameter pipe will need to be constructed in a 6.0-mile long alignment (between the City of Hollister and the City of San Juan Bautista). After the West Hills WTP water source is installed, the City will need to implement a buy-back program to remove domestic water softeners from homes. Depending on the community, the rebate may cost between $300 to $800 per unit ($105,000 to $280,000- using cash payments and credits on sewer bills). The total life cycle cost for this option is $10.2 million, as shown in **Table 12**. The lifecycle costs for this option shown in **Table 12**.

Table 12 West Hills WTP Life Cycle Costs

Description	Cost
Construction Costs	$6,000,000
Engineering/CM Costs (25%)	$1,500,000
Annual O&M[1]	$168,000
Present Worth O&M, 20-years @ 3%	$2,500,000
Domestic Softener Buyback	$193,000
Total Life Cycle Cost	**$10,193,000**

1. Based on $1500/acre-feet (West Hills wholesale fee schedule), purchasing 0.2 MGD, & saving $168,000/yr in existing water system operating costs (by not running/maintaining the wells as frequently).

Source Control Options Analysis and Recommendation

In case the industrial pre-treatment program does not entirely mitigate the excess salinity loading and additional salinity control measures need to be adopted, these source control options are being investigated. The extent of industrial based salt reduction will not be fully known until a pre-treatment program is implemented and additional samples are collected (the preliminary numbers presented herein are based on a single grab sample from Taylor Farms). Once the pre-treatment program is adopted and frequent representative samples are analyzed, the remaining salinity removal needed to comply with the NPDES permit will be better quantified. For the purposes of this analysis, it is assumed that each source control option will provide sufficient salinity reduction, in combination with the pre-treatment program, to achieve compliance with the permit.

The salinity reduction rate, after implementing potable water source control, as well as the associated costs are summarized in **Table 13**.

As discussed in the 2020 Water Master Plan, the City is at risk of having a water shortage because Well No. 6 has been decommissioned (due to increased nitrate levels that have not yet been isolated or controlled) and Well No. 5 is drawing from the same groundwater source, making it vulnerable to the same fate. With Well No. 6 offline, the City only has a firm capacity of 130 gpm using Well No. 1 as the primary source of water (when the higher production Well No. 5 is removed from service for routine maintenance or possible nitrate contamination). Without isolation or control of nitrates in the groundwater, Well No. 6 cannot return to service.

Unfortunately, Well No. 1 water production generation rate is not enough water to serve the existing connections. Because the City needs a backup water source to ensure a viable water portfolio, water security will be as important to the City as life cycle costs and reliability. As such, the cost of to develop another well (known as the Betable Road Well) is also provided in Option A and B and shown in the cost summary table, below. The Betable Road Well has similar raw water constituents as Well No. 1 and does not change the salinity removal results or wastewater influent characteristics. If the City connects to the West Hills WTP (Option C), is will provide water security to the City of San Juan Bautista and eliminate the need for the Betable Road Well.

Table 13 Source Control Options Summary

Description	Option A: Pellet Plant	Option B: Cartridge Softener	Option C: West Hills WTP
Source Control Costs			
Construction Costs	$1,800,000	$455,000 [1]	$6,000,000 [2]
Engineering/CM Costs [3]	$450,000	$68,000	$1,500,000
Annual O&M	$115,200	$154,300	$168,000 [4]
Present Worth O&M, 20-years @ 3%	$1,710,000	$2,290,000	$2,500,000
Domestic Softener Buyback	$193,000	$193,000	$193,000
Source Control, Total Life Cycle Cost	**$4,153,000**	**$3,006,000**	**$10,193,000**
Water Security Costs[5]			
Construction/Engineering/CM Costs	$5,010,000	$5,010,000	---
Annual O&M[6]	$44,800	$44,800	---
Present Worth O&M, 20-years @ 3%	$670,000	$670,000	---
Water Security, Total Life Cycle Cost	**$5,680,000**	**$5,680,000**	---
TOTAL LIFE CYCLE COST (Source control & Water Security)	**$9,840,000**	**$8,690,000**	**$10,193,000**
Salinity Reduction			
Removal Rate, mg/L (Chloride, Sodium, TDS)	203, 135, 338	271, 181, 452	203, 135, 663

1. Based on replacing 350 water softeners (half the sewer connections assumed to have softeners).
2. Based on a 12-inch diameter pipe in a 6.0-mile long alignment
3. Engineering/CM fees are estimated to be 25% of construction costs, except for Option B (assumed to be 15%).
4. Based on $1500/acre-feet (West Hills wholesale fee schedule), purchasing 200,000 gpd, and saving $168,000/yr in existing water system operating costs (by not running/maintaining the wells as frequently).
5. Water security costs are for developing the Betable Rd Well (for Options A & B) or connecting to West Hills WTP (Option C).
6. Based on $200/acre-feet, purchasing 200,000 gpd

Option B (cartridge softener installation) has the lowest life cycle costs (approximately $3.0M), but requires installing domestic cartridge softeners in every household that currently uses self-regenerating water softeners (assumed to be 350 separate locations). The coordination efforts to make that happen is difficult. The proposal from Culligan assumes that each cartridge will be installed right at the point of entry into the house. However, many homes may need the pipe to be routed to the back or around the side (to be visually pleasing), which will increase the construction costs. Further, Culligan has never removed such high levels of hardness ($CaCO_3$) and recommends installing a small number of softeners (initially operating five softeners) to ensure the system is set up correctly and results are positive.

Additionally, for Option B to be implemented, the City will need to invest $5.7M in the Betable Road Well development in order to achieve water security (making the total cost for this option $8.7M). The benefit to this option is that both the installation and maintenance of the system will be outsourced to Culligan.

Option A (Pellet Plant) has the second lowest life cycle cost (approximately $4.2M), but requires a new treatment process to be implemented in the City. This will likely require additional staff to operate and maintain the facility, which will increase the annual O&M costs, but will be in full control of the City (not relying on residents to properly maintain/protect their individual systems). It will eliminate the concern of very hard water scaling distribution pipelines and put good use of equipment the City already owns. However, in order to achieve water security, the City will need to invest $5.7M in the Betable Road Well development (making the total cost for this option $9.8M).

Option C (West Hills WTP) is the most expensive option (approximately $10.2M), but it provides a reliable water source to add to the City's portfolio, providing backup to primary wells and eliminates the need for the City to invest an additional $5.7M in the Betable Road Well. Further, this option provides limited concerns of future operational complexities, as all the source water treatment O&M will be handled by the San Benito County Water District. The West Hills WTP does receive some of its water from the State Water Project and that portion of the monthly service fees ($600 out of the $1500/AF wholesale rate) is expected to increase in the future (to an unknown extent), thereby increasing the total O&M costs.

Source Control Selection Criteria and Score

The source water options considered must be evaluated not only for their benefits to the removal of salinity, but also for their ranking against the other options. To compare the options, a list of criteria is developed by which the alternatives will be ranked. **Table 14** provides a list of criteria and a brief explanation why it is important in the evaluation process.

Table 14 Source Control Selection Criteria

Criterion	Description
Life Cycle Costs (Capital and O&M) [1]	Cost to design new processes, purchase equipment and construct facilities. Including the cost to operate new facilities – such as power costs, chemical costs, periodic replacement costs, maintenance costs, etc.
Footprint	The amount of land area needed to physically house the new process facilities
Ease of Maintenance/Operation	A measure of operator time required to operate and perform routine maintenance on equipment. It is expected that the fewer moving parts in the process, the less operator time will be needed to maintain the equipment
Reliability	A measure of how dependable and robust the system is and how well it will react to changing raw water quality and ability to remove downstream salinity
Upstream/Downstream Effect	Potential beneficial impacts that the new process will have on the upstream and downstream facilities. Such as the ability to prevent scaling on downstream pipes.
Water Security[1]	Provide backup water source for potable water users, in case City's production well is taken out of service due to nitrate issues (or otherwise)
Flexibility (Future Regulations)	Ability for new equipment to fit into existing processes

1. All costs presented in the analysis will include water security measures are taken (developing Betable Rd Well for Options A and B) to provide a fair comparison of alternatives.

The criteria themselves are given a score from one to five based their importance to the project. A score of five carries the highest level of relative importance while a score of one has a relatively lower level of importance. The value entered in the blue squares compares the criterion in the row to the criterion in the column for relative importance in the selection process. Each score entered in the blue squares will have a paired score in the white squares and the two paired scores will equal six. The relative weight of each criterion is calculated and ranked in the two columns on the right.

Table 15 provides a matrix assigning a score for each of the alternatives and its relative weight in determining the preliminary treatment process selected.

Table 15 Source Control Options Criteria Weight

	Life Cycle Costs (Capital and O&M)	Footprint	Ease of O&M	Reliability	Upstream/ Downstream Effect	Water Security	Flexibility (Future Regulations)	Relative Weight
Life Cycle Costs (Capital and O&M)		**5**	**4**	**3**	**4**	**2**	**3**	***21***
Footprint	**1**		**2**	**2**	**2**	**1**	**2**	***10***
Ease of O&M	**2**	**4**		**2**	**3**	**2**	**2**	***15***
Reliability	**3**	**4**	**4**		**4**	**3**	**3**	***21***
Upstream/ Downstream Effect	**2**	**4**	**3**	**2**		**3**	**3**	***17***
Water Security	**4**	**5**	**4**	**3**	**3**		**4**	***23***
Flexibility (Future Regulations)	**3**	**4**	**4**	**3**	**3**	**2**		***19***

Evaluation Criterion	**Entered Score**	**Paired Score**
Substantially More Important	5	1
Somewhat More Important	4	2
Equal Importance	3	3
Somewhat Less Important	2	4
Substantially Less Important	1	5

1. Blue cells are scored using evaluation criteria (score 1-5). White cells are the paired score (score 5-1). Relative weight is the total of the entire row.

Table 16 presents a comparative score (with the total of the scores equal to exactly ten) for the three options evaluated. This matrix also takes the relative weight determined in Table 15 for each of the evaluation criteria and multiplies that number by the comparative score for each of the criteria. This calculation returns a weighted score for each of the evaluation criteria and each of the alternative source control measures. The sums of these weighted scores for the seven evaluation criteria is presented as a total score on the bottom row. The higher the total score, the better the option for this application.

Table 16 Source Control Options Selection Matrix

		Comparative Score (Score Total Must Equal 10)			Criterion Score (Relative Weight Times Comparative Score)		
Criteria	***Relative Weight***	**Pellet Plant**	**Cartridge Softener**	**West Hills WTP**	**Pellet Plant**	**Cartridge Softener**	**West Hills WTP**
Life Cycle Costs (Capital and O&M)	*21*	3.3	3.5	3.2	69	74	67
Footprint	*10*	3	4	3	30	40	30
Ease of O&M	*15*	2	4	4	30	60	60
Reliability	*21*	3.5	3	3.5	74	63	74
Upstream/Downstream Effect	*17*	4	3	3	68	51	51
Water Security	*23*	3.3	3.3	3.3	77	77	77
Flexibility (Future Regulations)	*19*	4	2	4	76	38	76
				TOTAL SCORE	**423**	**402**	**434**

Source Control Recommendation

As shown in **Table 16**, connecting to the West Hills WTP scores highest compared to the other options evaluated in the analysis and is therefore the recommended source control options. The cost for this option will be carried through the remaining evaluations. However, the connection to West Hills WTP should not be fully implemented until the industrial pre-treatment program has been implemented and additional samples are collected. Once the pre-treatment program is adopted and frequent representative samples are analyzed, the remaining salinity removal needed to comply with the NPDES permit will be better quantified to determine whether the West Hills WTP connection is required (if additional salinity control is not needed, then water security needs can be met by developing the Betable Road Well option at half the cost).

WWTP Upgrades

Because the SBR pond is undersized (existing influent loading is already higher than the design criteria for the secondary treatment process) and the liner has reached is useful life expectancy, the SBR pond will be decommissioned and converted into an equalization basin (aerators will remain in place to reduce odors and provide mixing). The SBR will be replaced with a membrane bioreactor (MBR) facility, to ensure continued compliance with the permit (typically an SBR facility costs 5% more than a packaged MBR facility, but have additional benefits described herein). MBRs are considered the most robust and reliable treatment system available. MBRs provide a higher level of treatment than any other system, which is helpful in meeting both existing and anticipated future discharge requirements. Further, MBRs have the smallest footprint and are easy to expand. Additionally, an MBR facility can act as a pre-treatment process if additional on-site salinity control is needed in the future (as it produces high quality effluent that is suitable for treatment in a reverse osmosis or electrodialysis reversal).

MBR Process Description

An MBR is a suspended growth biological treatment system like conventional activated sludge. However, in the MBR, the effluent clarification stage is replaced by a membrane filtration system. Membrane filtration units are typically placed inside basins that are specifically designed and located for this use (membrane basins). Treated wastewater effluent is drawn through the membranes, leaving activated sludge solids behind. The membranes provide such a high level of solids removal that the effluent from the MBR does not need further filtration through sand filters, such as required with conventional activated sludge. This is also helpful for the City because the existing sand filters are undersized (they are designed to accommodate only 0.2 Mgal/d and there is insufficient equalization capacity to reduce existing flows that low during peak month flow condition).

In fact, MBR effluent is superior to the effluent of a conventional activated sludge system with sand filters, having a typical effluent turbidity less than 0.2 NTU, compared to 2 NTU for the conventional system. The low turbidity is highly reliable because the membranes provide an absolute barrier to solids larger than the pore size of the membranes. This will be beneficial to the City because the existing UV disinfection system is sized to accommodate 0.2 Mgal/d, assuming 2 NTU filter effluent. With better quality effluent from the MBR, it is anticipated that the disinfection system can be re-rated to accommodate higher flows.

Because an MBR system does not require solids to settle in clarifiers (or the clarification stage of the SBR process pond), mixed liquor solids concentrations can be typically about three times as high as those in a conventional activated sludge system, making the footprint much smaller than an SBR. Further, because the clarification stage of the SBR and the tertiary filters are not needed, the MBR system will have a much smaller footprint than a conventional system. The waste activated sludge will be sent to a sludge storage tank and dewatering screw press for solids handling.

MBR systems require screens with openings of 1 to 3 mm, depending on the specific manufacturer, compared to 6 mm openings on the existing influent screen. Therefore, for the MBR alternative, new screens are required. See **Figure 19** for an MBR process flow schematic.

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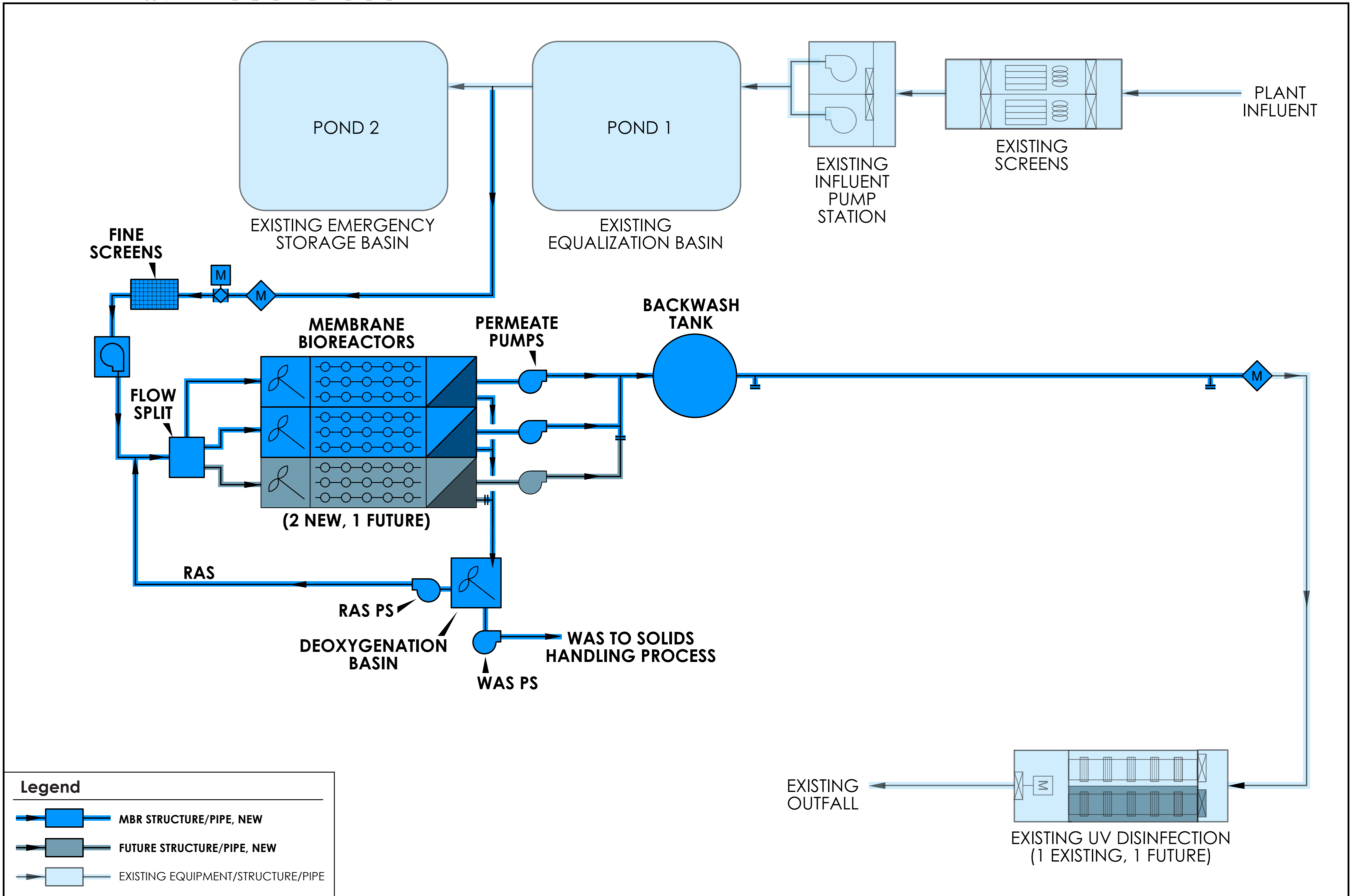

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Figure 19

MBR Process Flow Diagram

MBR Design Criteria

There are now a significant number of MBR manufacturers with many installations worldwide that could supply a system to meet the requirements at San Juan Bautista. The membrane filtration systems of these various manufacturers are substantially different from each other and require different structural and equipment layouts. Therefore, it is typical to have a separate bid process, evaluation, and selection of the MBR equipment prior to proceeding with detail design of the project. For this report, proposals were received from two of the leading manufacturers (Suez and Ovivo). The analysis and costs presented herein are believed to be generally applicable to both of these manufactures, as well as others. The design criteria for the MBR system are listed in **Table 17**.

Table 17 MBR Design Criteria

Parameter	Value
Flow Rate, Mgal/d	
Average Day	0.27
Peak Month[1]	0.43
Influent Loading	
BOD average annual load, lb/d	628
BOD Max Month Load, lb/d	879
TSS average annual load, lb/d	691
TSS Max Month Load, lb/d	967
Mixed Liquor Suspended Solids (MLSS), mg/L	
Aeration and Anoxic Basin	8,000
Membrane Basin	10,000
Minimum Monthly Average Process Temperature, ^{o}C	10

1. Flow rates higher than peak month will be equalized

Future Salinity Control with MBRs

Unlike the existing sand media filtration system, an MBR system can function as a pre-treatment process step for reverse osmosis (RO) treatment. A small RO unit can be installed on the MBR effluent to remove just the amount of salt needed to comply with whatever regulation necessitates salinity removal. Although RO treatment is not needed for this alternative, as source control measures will reduce salt loading to the permitted levels, mechanical removal at the treatment plant may become necessary if further salinity removal is required in future permit cycles (beyond the anticipated effluent limits of 150 mg/L chloride, 200 mg/L sodium, and 1200 mg/L TDS).

MBR Life Cycle Costs

The life cycle costs for the MBR plant are presented in **Table 18**.

Table 18 MBR Process Life Cycle Costs

Description	Cost
Construction Costs	$7,300,000
Engineering/CM Costs (25%)	$1,825,000
Annual O&M[1]	$73,800
Present Worth O&M, 20-years @ 3%	$1,100,000
Total Life Cycle Cost	**$10,225,000**

1. Based on mixing and aeration power, permeate pump and air scour power, membrane cleaning chemicals and membrane replacement costs.

Total Life Cycle Costs for Alternative 1

Because Alternative 1 requires off-site salinity control in order to reduce the wastewater influent salinity concentrations to permittable levels, the costs for source control must be incorporated into the MBR costs to get the total project cost. The source control can be used in conjunction with the pre-treatment program and are evaluated in case the pretreatment program (reducing Taylor Farm discharge loading) does not remove enough salinity from the influent wastewater stream to fully comply with the NPDES permit.

Table 19 Alternative 1 Life Cycle Costs

Description	Cost
MBR Construction Costs	$7,300,000
Off-Site Salinity Control Costs	$6,000,000
Engineering/CM Costs (25%)	$3,325,000
Annual Source Water O&M	$168,000
Annual MBR O&M[1]	$73,800
Present Worth O&M, 20-years @ 3%	$3,600,000
Domestic Softener Buyback	$193,000
Total Life Cycle Cost	**$20,418,000**

4.1.2 Alternative 2, On-Site WWTP Upgrades and On-Site Salinity Control

Similar to Alternative 1, the option for on-site salinity control includes an MBR facility (for biological control and as a pre-treatment train for the reverse osmosis, RO, system), but does not require the off-site West Hills WTP source control to be implemented. The costs developed for the MBR facility will be carried forward from the previous section. The purpose of this section is to analyze the RO design and cost parameters and assess the viability of a side-stream RO treatment system, as depicted in **Figure 20**.

Reverse Osmosis Process Description

Reverse osmosis is the reversal of the natural osmotic process, accomplished by applying pressure in excess of the osmotic pressure to the more concentrated solution. This pressure forces the water through the membrane against the natural osmotic gradient, thereby increasingly concentrating the water on one side (i.e., the feed) of the membrane and increasing the volume of water with a lower concentration of dissolved solids on the opposite side (i.e., the filtrate or permeate). The required operating pressure varies depending on the total dissolved solids (TDS) in the feed water (i.e., osmotic potential), as well as on membrane properties and temperature.

For San Juan Bautista, only part of the MBR effluent needs to pass through the RO process in order to reduce salinity to permittable levels. This would eliminate almost all salinity in the RO-treated portion of the flow, such that when this side-stream flow is re-combined with the remainder of the plant flow, the overall TDS, chlorides, and sodium levels would be met.

RO membranes are not designed to remove suspended solids; therefore, the main objective of the treatment facilities upstream of the RO is to minimize the amount of suspended solids loading reaching the RO system. Further, the ionic and organic constituents play a major role in determining the overall water recovery and the necessity for chemical treatment requirements (such as pH adjustment and/or scale prevention). Fouling of RO membranes usually occur due to one of the following factors:

- Suspended solids in the feedwater
- Scale formation of metals
- Precipitation of low solubility salts
- Adsorption of organic materials on the membrane surface and biofouling (organic growth)

Suspended solids will be reduced to allowable levels as it passes through the MBR treatment process (silt density index, SDI, of three will be achieved, and SDI less than five is needed to meet RO warranty requirements). Due to hardness in the City's water, anti-scalant chemicals must be added continuously to the RO influent in order to control scale formation. To prevent precipitation of salts, acid may be required (depending on the Langlier Saturation Index, LSI, at the plant. LSI must remain below 2.5). In order to reduce the organic fouling in the RO membranes, a chloramination step will take place after the MBR and prior to RO treatment.

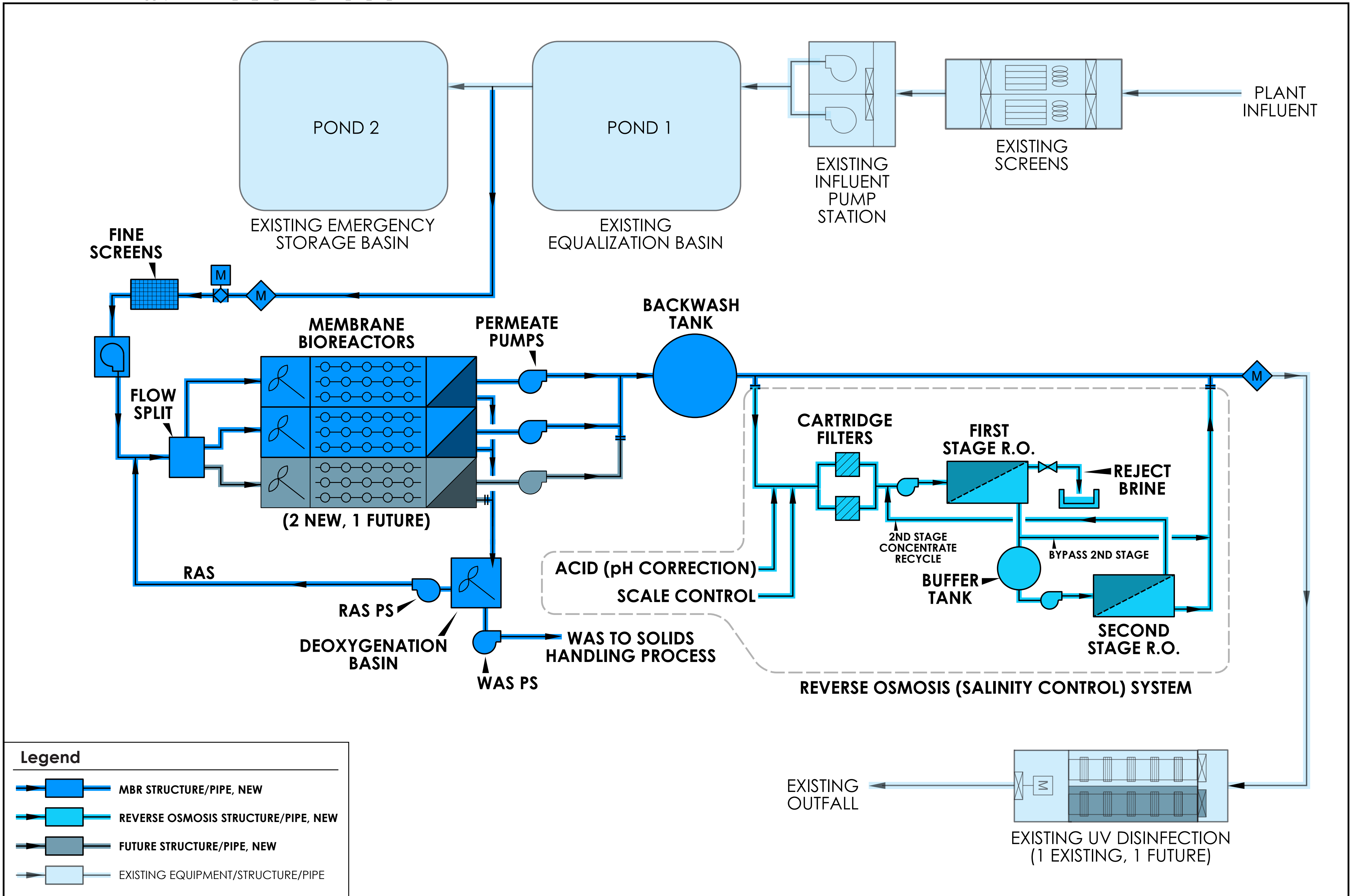

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Figure 20
MBR Plus Reverse Osmosis Process Flow Diagram

A two stage RO configuration is recommended for high water recovery (80% overall) is proposed. The reject stream from the first stream becomes the feed water from the second stage, as shown in **Figure 20**. In contrast to MBRs, there are no backwash mechanisms for RO systems, but they do require chemical cleaning.

The RO membranes are a spiral-wound module with a sandwich arrangement of flat membrane sheets (called a “leaf”) wound around a central perforated tube. One leaf consists of two membrane sheets placed back to back and separately by a fabric spacer called a permeate carrier. The layers of the leaf are glued along three edges, while the unglued edge is sealed around the perforated central tube. A layer of plastic mesh called a spacer that serves as the feed water channel separates each leaf. Feed water enters the spacer channels at the end of the spiral-wound element in a path parallel to the central tube. As the feed water flows across the membrane surface through the spacers, a portion permeates through either of the two surrounding membrane layers and into the permeate carrier, leaving behind any dissolved and particulate contaminants that are rejected by the semi-permeable membrane. The filtered water in the permeate carrier travels spirally inward around the element toward the central collector tube, while the water in the feed spacer that does not permeate through the membrane layer continues to flow across the membrane surface, becoming increasingly concentrated in rejected contaminants. This concentrate stream exits the membrane element parallel to the central tube through the opposite end from which the feed water entered. A diagram of the spiral-wound element is shown in **Figure 21**.

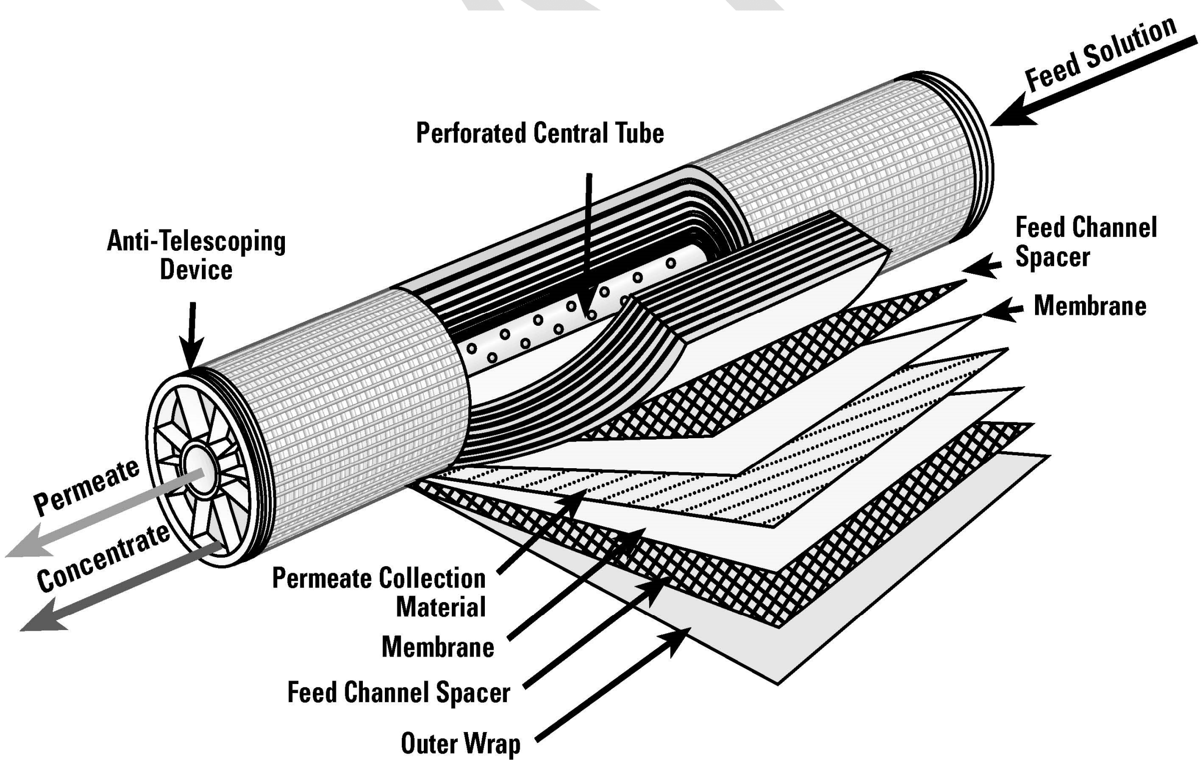


Figure 21 – Spiral-Wound RO Membrane Element Diagram

Reverse Osmosis Concentrate Management

Concentrate generated from the RO side-stream treatment process contains high amounts of TDS, chlorides, and organic compounds that are rejected by the RO membranes. Management of the reject brine solution (RO concentrate), which is typically 15% of the feed flow, poses the greatest challenge and costs for inland communities, such as San Juan Bautista.

Because ocean discharge and (presumably) deep well injection disposal options are not available, the City will need to figure out a way to manage the large volume of water rejected from the RO system. There are mechanical means to further concentrate the brine solution (such as vibratory shear enhanced processing, VSEP), which reduces the brine volume by 90%. After reducing the volume, the remaining highly concentrated brine will be stored throughout the winter season and dried in the summer before being hauled off-site for disposal (100-year water balance requires 6 acres of storage/drying and disposing in Buena Vista Landfill or John Smith Landfill). The cost of the brine management is included in the life cycle costs below.

MBR/RO Design Criteria

The MBR treatment design will be identical to the processes described in Alternative 1, with design criterial listed in Table 17. The sizing of the RO system is dependent on the targeted reduction in salinity, which may change before final design decisions are made (depending on the effectiveness of the industrial pre-treatment program). The design criteria for the side-stream RO system are listed in **Table 20**.

Table 20 Reverse Osmosis Design Criteria

Parameter	Value
Side-Stream Flow Rate,	
To RO, Mgal/d	0.43
RO Reject (flow to VSEP), gpm	60
VSEP Reject flow, gpm	6
From RO (Permeate), Mgal/d	0.34
Influent Concentrations, mg/L	
TDS	1800
Chlorides	600
Sodium	300

Table 20 Reverse Osmosis Design Criteria (Continued)

Parameter	Value
Effluent (Permeate) Concentrations, mg/L	
TDS	10.9
Chlorides	3.9
Sodium	2.3
Blended Concentrations, TDS, Chlorides, Sodium; mg/L	325,130,73

1. Flow rates higher than peak month will be equalized

Life Cycle Costs for Alternative 2

Because Alternative 2 requires MBR treatment to remove suspended solids and organic concentrations prior to entering the RO system, the MBR costs developed in Alternative 1 are included herein. The costs for RO side-stream treatment and brine concentration (VSEP) is also provided, see **Table 21** for the total life cycle costs associated with Alternative 2.

Table 21 Alternative 2 Life Cycle Costs

Description	Cost
MBR Construction Costs	$7,300,000
RO Construction Costs	$4,800,000
Engineering/CM Costs (25%)	$3,025,000
Annual MBR O&M	$73,800
Annual RO and VSEP O&M[2]	$74,400
Annual Brine Removal O&M[3]	$46,600
Present Worth O&M, 20-years @ 3%	$2,900,000
Domestic Softener Buyback	--
Total Life Cycle Cost[4]	**$18,025,000**

1. Including cost to purchase 6-acres for brine storage/drying at $85,000 per acre.
2. Based on chemical cleaning, booster pump electricity, and RO membrane replacement
3. Assumed hauling costs of $50/ton, dried to 50-percent concentration
4. The City will need to invest in the Betable Well development, to provide water reliability, adding an additional $5.7M to the total cost of this project (making the total life cycle costs $23.7M).

4.1.3 Alternative 3, Off-Site Salinity Source Control and Regionalization with Hollister WWTP

In order to send wastewater to Hollister WWTP, the off-site source control measures must be enacted, and salinity must be within Hollister's effluent limits. As such, the costs developed for the source control options, detailed in Alternative 1, will be carried though here. The source control measures can be used in conjunction with the pre-treatment program and are evaluated in case the pretreatment program (reducing Taylor Farms discharge loading) does not remove enough salinity from the influent wastewater stream to fully comply with the NPDES permit. The purpose of this section is to analyze regionalization with Hollister WWTP and the costs associated with pumping wastewater off-site for treatment and disposal, as depicted in **Figure 22**.

Regionalization Process Description

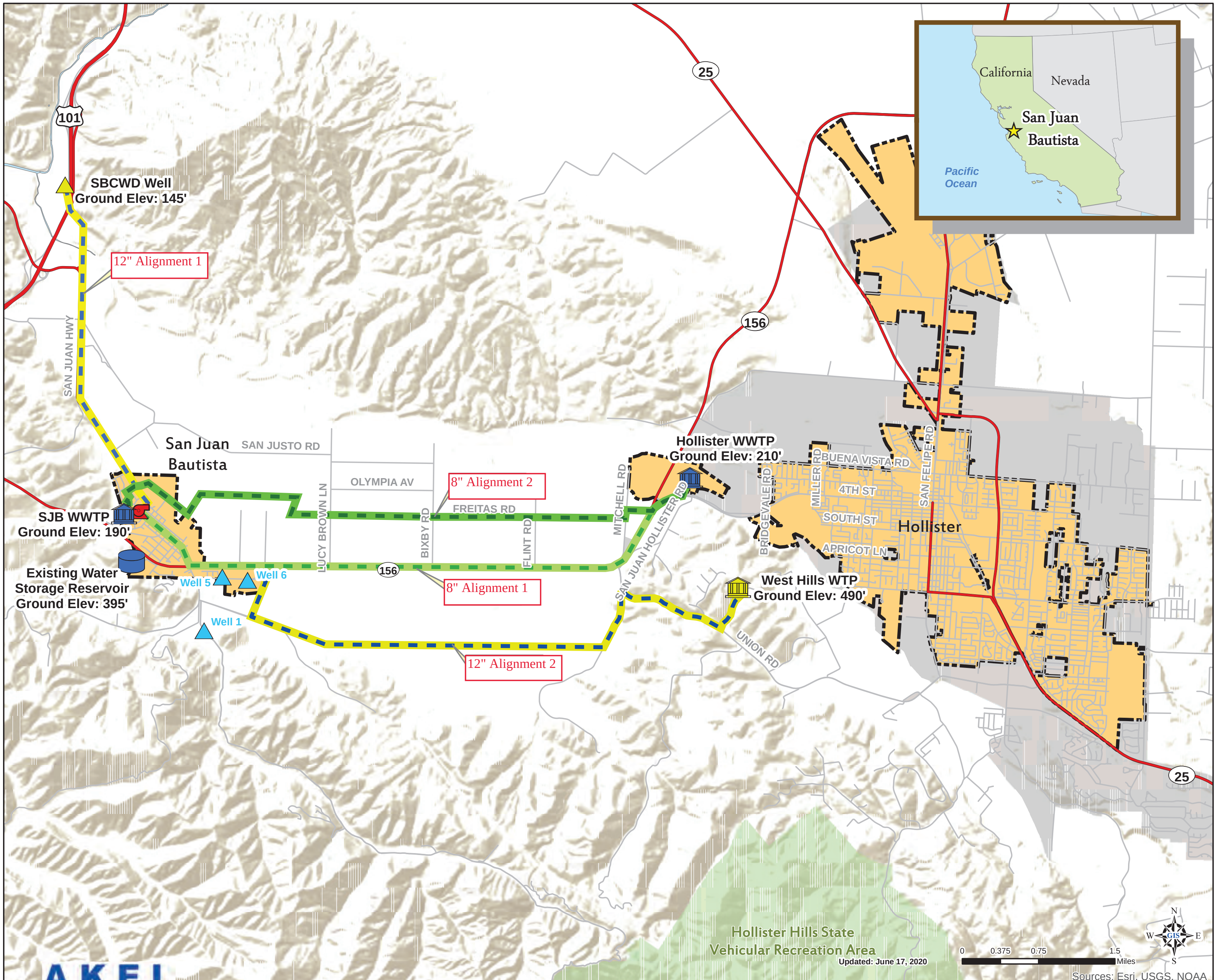
In order to send flow to the City of Hollister WWTP, the San Juan Bautista WWTP will be decommissioned and the ponds converted into equalization and emergency storage basins (aerators will remain in place to reduce odors and provide mixing). All screened raw sewage, up to the peak daily flow rates, will be pumped to Hollister in an 8-inch pipeline. The remaining flow will be diverted to a lined equalization pond (Pond 1) and overflow into an emergency storage basin (Pond 2). The pump station will be a trench style, self-cleaning, submersible pump station with centrifugal pumps. The facility will include a surge tank and pig launching station. The pipe alignment will include pig launching and receiving stations, to ensure the pipe can be properly maintained and cleaned.

Regionalization Design Criteria

The design criteria for the regional needs are listed in **Table 22**.

Table 22 Regionalization Design Criteria

Parameter	Value
Pump Station	
Capacity, gpm	550
Head, psi	105
Power Demands, HP	50
Number of Pumps	3 (1 duty, 1 standby, 1 future)
Surge Tank Size, gallons	10,000
Lined Equalization Basin Size, MG	1.6
Emergency Storage Basin Size, MG	4.3
Pipeline Dimeter (inch) & Length (miles)	8 & 6.5



Legend

- SBCWD Well
- Wells
- Potential Lift Station
- Water System Alternatives
- Sewer System Alternatives
- Major Highways
- City Limits
- Urbanized Area
- Protected Open Space
- Rivers/Streams
- Waterbodies

PRELIMINARY

Figure 22
Regional Connection Map
Infrastructure Master Plans
City of San Juan Bautista

AKEL ENGINEERING GROUP, INC.

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Life Cycle Costs for Alternative 3

Because Alternative 3 requires off-site salinity control in order to reduce the wastewater influent salinity concentrations to permittable levels, the costs for source control must be incorporated into the pump station and pipeline costs to get the total project cost, as shown in **Table 23**. The source control can be used in conjunction with the pre-treatment program and are evaluated in case the pretreatment program (reducing Taylor Farms discharge loading) does not remove enough salinity from the influent wastewater stream to fully comply with the NPDES permit.

Table 23 Alternative 3 Life Cycle Costs

Description	Cost
Regional Construction Costs	$7,100,000
Hollister Connection Fees[1]	$4,670,000
Off-Site Salinity Control Costs	$6,000,000
Engineering/CM Costs (25%)	$3,300,000
Annual Source Water O&M	$168,000
Annual Regional Pumping O&M[1]	$238,000
Present Worth O&M, 20-years @ 3%	$6,050,000
Domestic Softener Buyback	$193,000
Total Life Cycle Cost	**$27,305,000**

1. City of Hollister connection fee calculated at $26.1/gpd
2. Includes City of Hollister monthly service fee at $8.7/HCF (minus the cost savings for decommissioning the SJB WWTP, assumed to be half the existing service fees), and new regional pump station power costs.

4.2 COMMON DESIGN CRITERIA

In order to develop a fair comparison of alternatives, it is important to establish common design criteria on which to base the evaluation. Key design parameters are discussed below:

- **Design Wastewater Flow**: The design criteria of the WWTP Improvements Project indicate that the design annual average influent flow rate and peak day max month flow rates are 0.27 and 0.43 Mgal/d, respectively.
- **Design Wastewater Loads**: The design criterial of the WWTP Improvements Project indicate that the average annual influent BOD load and peak month load are 628 lb/d and 879 lb/d, respectively. Further, the average annual influent TSS load and peak month load are 307 and 430 lb/d, respectively.

- **Design Salinity Loads**: The design criterial of the WWTP Improvements Project indicate that the average annual influent TDS, Chloride, and Sodium concentrations are 1800, 600, and 300 mg/L, without industrial pretreatment or source control
- **Industrial Pre-Treatment Salinity Reduction:** It is assumed that, once implemented, the industrial pre-treatment program will remove at least 162 mg/L chloride, 94 mg/L sodium, and 330 mg/L TDS, (with a presumed sewer discharge limit of 89 mg/L chloride, and 69 mg/L sodium, and 722 mg/L TDS, which is considered 15% higher than the average well water concentrations). As such, the source control measures may require an additional 288 mg/L chloride, 6 mg/L sodium, and 270 mg/L TDS removal.
  - The extent of industrial based salt reduction will not be fully known until a pre-treatment program is implemented and additional samples are collected (the preliminary numbers presented herein are based on a single grab sample from Taylor Farms). Once the pre-treatment program is adopted and frequent representative samples are analyzed, the remaining salinity removal needed to comply with the NPDES permit will be better quantified.
  - For the purposes of this analysis, it is assumed that each source control option will provide sufficient salinity reduction, in combination with the pre-treatment program, to achieve compliance with the permit.
- **Potable Water Reliability:** The City only has a firm capacity of 130 gpm using Well No. 1 as the primary source of water (when the higher production Well No. 5 is removed from service for routine maintenance or possible nitrate contamination). As such, the City needs a backup water source to ensure a viable water portfolio, which can be achieved by a new well (the Betable Road Well) or connecting to Hollister WTP. Costs associated with water reliability measures will be incorporated into all alternatives.
- **Cost Index, Interest Rate and Useful Lives:** The cost index used for the project cost estimates is based on the ENR Construction Cost Index at start of construction (CCI) of 11,000 (June 2020). The interest rate adjusted for inflation used in the life cycle analyses is 3.0% per year and the useful life of most of the project alternatives is estimated to be approximately 20 years to match the planning horizon (although structural components will last much longer, equipment will not).
- **Planning Period:** The planning period used for the project is 20 years. This allows for an appropriate timeline accommodating community service and a limited amount of growth in accordance with City planning horizons and roughly matches industry standards for the useful life of treatment works.
- **Contingency:** For the level of project development, all costs will be escalated by 30% contingency factor, to account for unknown project details.

The design parameters relevant to the development and analysis of the various project alternatives are summarized in **Table 26**.

Table 24 WWTP Improvement Project Design Criteria

Parameter	Unit	Phase 1 Condition ADWF = 0.27 Mgal/d
Flow		
Avg. Day Annual Flow (AAF)	Mgal/d	0.27
Average Day Max Month Flow (ADMMF)	Mgal/d	0.43
Peak Day Flow (PDF)	Mgal/d	0.80
Peak Hour Flow (PHF)	Mgal/d	1.08
Biological Oxygen Demand (BOD)		
Annual Average Load (AAL)	lb/d	628
Avg. Day Max Month Load (ADMML)	lb/d	879
Average Concentration	mg/L	279
Max Month Concentration	mg/L	390
Total Suspended Solids (TSS)		
Annual Average Load (AAL)	lb/d	691
Avg. Day Max Month Load (ADMML)	lb/d	967
Average Concentration	mg/L	307
Max Month Concentration	mg/L	430
TKN Concentration		
Annual Average Load (AAL)	lb/d	119
Avg. Day Max Month Load (ADMML)	lb/d	167
Average Concentration	mg/L	53
Max Month Concentration	mg/L	74
Total Dissolved Solids[4]	mg/L	1078
Chloride[4]	mg/L	438
Sodium[4]	mg/L	206

1. If water conservation measures materialize, then the design organic load of the plant will be reached before the hydraulic design flow.
2. Average concentrations are calculated using AAF combined w/AAL
3. Average day max month load is calculated using AAF combined w/ADMML
4. After implementation of an industrial pre-treatment program (without additional source control). To be confirmed with additional samples.

4.3 POTENTIAL ENVIRONMENTAL IMPACTS OF PROJECT ALTERNATIVES

4.3.1 Alternative 1, On-Site WWTP Upgrades and Off-Site Salinity Control

The source water pipe alignment will be installed within previously disturbed areas, along the side of roadways (in the public utilities right-of-way) and the wastewater upgrades will be done at the treatment plant site (within the existing fence line). Environmental impacts are considered less than significant and, if selected, will be confirmed during the CEQA Initial Study and Mitigated Negative Declaration (IS/MND) phase.

4.3.2 Alternative 2, On-Site WWTP Upgrades and On-Site Salinity Control

The wastewater upgrades will be done at the treatment plant site (within the existing fence line). This option requires the acquisition of 6-acres of land and converting it into a brine storage and drying pond. Any new property purchased by the City will be carefully chosen to minimize environmental impacts. All other environmental impacts are considered less than significant and, if selected, will be confirmed during the CEQA Initial Study and Mitigated Negative Declaration (IS/MND) phase.

4.3.3 Alternative 3, Off-Site Salinity Source Control and Regionalization with Hollister WWTP

The source water pipe and wastewater pipe alignment will be installed within previously disturbed areas, along the side of roadways (in the public utilities right-of-way) and the wastewater decommissioning and conversion to a pump station will be done at the treatment plant site (within the existing fence line). Environmental impacts are considered less than significant and, if selected, will be confirmed during the CEQA Initial Study and Mitigated Negative Declaration (IS/MND) phase.

4.4 LAND REQUIREMENTS

The proposed Project components are all located in City owned property (within existing well sites or at the Wastewater Treatment Plant) or along existing roadways within the City's right-of-way in regional alignments and are within previously disturbed areas. Other than the Regional Alignments and the brine storage (for the RO option), the properties are currently owned by the City and does not require any additional acquisitions or lease of land. For any regional pipeline, the City will need to ensure they stay within the public utility right-of-way. If the City installs an RO (or EDR) system, they will need to purchase 6-acres of property to store and dry brine solution.

4.5 POTENTIAL CONSTRUCTION PROBLEMS

Construction of each alternative project is expected to be routine. However, potential construction problems could include keeping the existing treatment plant in operation during construction. The construction activities will also require temporary shutdowns of portions of the treatment plant though these are common for this type of project. Ingress/egress to the treatment plant must also be maintained throughout construction.

4.6 SUSTAINABILITY CONSIDERATIONS

4.6.1 Water and Energy Efficiency

The improvement project will include Title 24 compliance equipment, including premium efficiency motors. It will include upgraded instrumentation to optimize treatment performance, minimizing energy demands associated with aeration and mixing. All options will provide better water quality (effluent) that achieves water quality goals set by the Regional Board.

4.6.2 Other, California Priorities

The California state planning priorities identified in Government Code 65041.1 are intended to promote equity, strengthen the economy, protect the environment, and promote public health and safety in the State, including in urban, suburban, and rural communities. These priorities are described as follows:

- **Promoting infill development** and equity by rehabilitating, maintaining, and improving existing infrastructure that supports infill development and appropriate reuse and redevelopment of previously developed, underutilized land that is presently served by transit, streets, water, sewer, and other essential services, particularly in underserved areas, and to preserving cultural and historic resources.

- **Protecting environmental and agricultural resources** by protecting, preserving, and enhancing the state's most valuable natural resources, including working landscapes such as farm, range, and forest lands, natural lands such as wetlands, watersheds, wildlife habitats, and other wildlands, recreation lands such as parks, trails, greenbelts, and other open space, and landscapes with locally unique features and areas identified by the state as deserving special protection.

- **Encouraging efficient development** patterns by ensuring that any infrastructure associated with development, other than infill development, supports new development that does all of the following:

  - Uses land efficiently.
  - Is built adjacent to existing developed areas to the extent consistent with the priorities specified pursuant to subdivision.
  - Is located in an area appropriately planned for growth.
  - Is served by adequate transportation and other essential utilities and services.
  - Minimizes ongoing costs to taxpayers

The following bullets describe how the City will promote project alternatives that address each of the planning practices as defined in Section 65041.1 of the California Government Code and sustainable water resources management priorities.

- **Infill Development.** The City promotes infill development and equity by rehabilitating, maintaining, and improving existing infrastructure that supports infill development and appropriate reuse and redevelopment of previously developed, underutilized land that is presently served by water and sewer infrastructure, particularly in underserved areas, and to preserving cultural and historic resources. Planning activities for this and prior plant upgrades have been limited to providing capacity for anticipated infill growth within the City. Growth outside the City or in excess of capacity planned to serve anticipated infill must be planned, designed and constructed by those private parties which will benefit from those improvements.

- **Environmental Resources.** The City protects, preserves, and enhances the state's most valuable natural resources, including forest lands, natural lands such as wetlands, watersheds, wildlife habitats, and other wildlands, recreation lands such as parks, trails and other open space, and landscapes with locally unique features and areas identified by the state as deserving special protection. They accomplish this by: optimizing the footprint of their facilities, keeping those to a minimum, thereby preserving nearby forested and grassland open spaces and wetlands; water quality is protected and enhanced by the operation of their treatment and disposal facilities which produce effluent which meets (other than identified herein) and in some cases exceeds established water quality objectives. Taken together these activities enhance the overall environmental quality within the watershed.

- **Efficient Development Patterns.** The City encourages efficient development patterns by ensuring that any infrastructure associated with development that is not infill supports new development, uses land efficiently, is built adjacent to existing developed areas to the extent possible and is placed in areas appropriately planned for growth, is served by adequate infrastructure and other essential utilities and services, and minimizes ongoing costs to taxpayers. Planning activities for this and prior plant upgrades have been limited to providing capacity for anticipated infill growth within the City. Growth outside the City or in excess of capacity planned to serve anticipated infill must be planned, designed and constructed by those private parties which will benefit from those improvements.

- **Water Resources Management.** The City encourages sustainable water resources management by ensuring that sustainable water resources measures are implemented, such as conserving water, conserving energy, and applying Low Impact Development Best Management Practices to the maximum extent practicable. Taken together with the above noted activities these enhance the overall environmental quality within the watershed.

4.7 COST ESTIMATES

See Section 5.1.

5.0 SELECTION OF AN ALTERNATIVE

5.1 LIFE CYCLE COST ANALYSIS

The life cycle cost estimates for Alternatives 1, 2, and 3 are summarized in **Table 25**.

Table 25 Alternative Options Life Cycle Costs Summary

Description	Alternative 1: On-Site WWTP Upgrades & Off-Site Source Control (MBR & West Hills WTP)	Option B: On-Site WWTP Upgrades and On-Site Source Control (MBR+RO)	Option C: Regionalization with Hollister WWTP & Off-Site Source Control (Hollister WWTP & West Hills WTP)
Source Control Costs			
Construction Costs [1]	$6,000,000		$6,000,000
Engineering/CM Costs [2]	$1,500,000		$1,500,000
Present Worth O&M, 20-years @ 3% [3]	$2,500,000		$2,500,000
Domestic Softener Buyback	$193,000		$193,000
Source Control, Total Life Cycle Cost	**$10,193,000**		**$10,193,000**
Water Security Costs			
Construction/Engineering/CM Costs [4]	---	$5,010,000	---
Present Worth O&M, 20-years @ 3% [5]	---	$670,000	---
Water Security, Total Life Cycle Cost	---	**$5,680,000**	---
WWTP Upgrade Costs			
Construction Costs	$7,300,000	$12,100,000 [6]	$11,800,000 [7]
Engineering/CM Costs	$1,825,000	$3,025,000	$1,800,000
Present Worth O&M, 20-years @ 3%	$1,100,000	$2,900,000 [8]	$3,550,000 [9]
WWTP Upgrade, Total Life Cycle Cost	**$10,225,000**	**$18,025,000**	**$17,050,000**
IMPROVEMENT PROJECT TOTAL LIFE CYCLE	**$20,420,000**	**$23,705,000**	**$27,300,000**

1. Based on a 12-inch diameter pipe in a 6.0-mile long alignment
2. Engineering/CM fees are estimated to be 25% of construction cost
3. Based on $1500/acre-feet (West Hills wholesale fee schedule), purchasing 200,000 gpd, and saving $168,000/yr in existing water system operating costs (by not running/maintaining the wells as frequently).
4. Based on a 12-inch diameter pipe in a 3.5-mile long alignment and cost of iron/manganese filter
5. Based on $200/acre-feet, purchasing 200,000 gpd
6. Includes cost to purchase 6-acres for brine storage/drying (at $85,000 per acre)
7. Includes City of Hollister connection fee calculated at $26.1/gpd (totaling $4.7M)
8. Includes brine hauling costs of $50/ton, dried to 50-percent concentration
9. Includes City of Hollister monthly service fee at $8.7/HCF (minus the cost savings for decommissioning the SJB WWTP, assumed to be half the existing service fees), and new regional pump station power costs
10. Construction costs based on ENR of 13,000

5.2 NON-MONETARY FACTORS

The Improvement Project options considered must be evaluated not only for their ability to meet NPDES discharge permit compliance, but also for their ranking against the other non-monetary factors. To compare the options, a list of criteria is developed by which the alternatives will be ranked. **Table 26** provides a list of criteria and a brief explanation why it is important in the evaluation process.

Table 26 Improvements Project Selection Criteria

Criterion	Description
Life Cycle Costs (Capital and O&M)	Cost to design new processes, purchase equipment and construct facilities. Including the cost to operate new facilities – such as power costs, chemical costs, periodic replacement costs, maintenance costs, etc.
Footprint	The amount of land area needed to physically house the new process facilities
Ease of Maintenance/Operation	A measure of operator time required to operate and perform routine maintenance on equipment. It is expected that the fewer moving parts in the process, the less operator time will be needed to maintain the equipment
Reliability	A measure of how dependable and robust the system is and how well it will react to changing wastewater quantity and quality (flows and loads)
Upstream/Downstream Effect	Potential beneficial impacts that the new process will have on the upstream and downstream facilities.
Flexibility (Future Regulations)	Ability for new equipment to fit into existing processes

1. All options presented include added costs to implement water security measures (where applicable) and therefore this criterion was removed from the list.

The criteria themselves are given a score from one to five based their importance to the project. A score of five carries the highest level of relative importance while a score of one has a relatively lower level of importance. The value entered in the blue squares compares the criterion in the row to the criterion in the column for relative importance in the selection process. Each score entered in the blue squares will have a paired score in the white squares and the two paired scores will equal six. The relative weight of each criterion is calculated and ranked in the two columns on the right.

Table 27 provides a matrix assigning a score for each of the alternatives and its relative weight in determining the preliminary treatment process selected.

Table 27 Improvements Project Options Criteria Weight

	Life Cycle Costs (Capital and O&M)	Footprint	Ease of O&M	Reliability	Upstream/ Downstream Effect	Flexibility (Future Regulations)	Relative Weight
Life Cycle Costs (Capital and O&M)		**5**	**4**	**3**	**4**	**3**	***19***
Footprint	**1**		**2**	**2**	**2**	**2**	***9***
Ease of O&M	**2**	**4**		**2**	**3**	**2**	***13***
Reliability	**3**	**4**	**4**		**4**	**3**	***18***
Upstream/ Downstream Effect	**2**	**4**	**3**	**2**		**3**	***14***
Flexibility (Future Regulations)	**3**	**4**	**4**	**3**	**3**		***17***

Evaluation Criterion	**Entered Score**	**Paired Score**
Substantially More Important	5	1
Somewhat More Important	4	2
Equal Importance	3	3
Somewhat Less Important	2	4
Substantially Less Important	1	5

1. Blue cells are scored using evaluation criterion (score 1-5) as it's compared to the top row criteria. White cells are the paired score (score 5-1). Relative weight is the total of the entire row and carried through to the selection matrix.

Table 28 presents a comparative score (with the total of the scores equal to exactly ten) for the three alternatives evaluated. This matrix also takes the relative weight determined in Table 27 for each of the evaluation criteria and multiplies that number by the comparative score for each of the criteria. This calculation returns a weighted score for each of the evaluation criteria and each of the alternative source control measures. The sums of these weighted scores for the seven evaluation criteria is presented as a total score on the bottom row. The higher the total score, the better the option for this application.

Table 28 Improvements Project Options Selection Matrix

		Comparative Score (Score Total Must Equal 10)			Criterion Score (Relative Weight Times Comparative Score)		
Criteria	***Relative Weight***	**MBR & West Hills WTP**	**MBR/RO**	**Hollister WWTP & West Hills WTP**	**MBR & West Hills WTP**	**MBR/RO**	**Hollister WWTP & West Hills WTP**
Life Cycle Costs (Capital and O&M)	*19*	3.6	3.3	3.1	68	63	59
Footprint	*9*	3.5	3	3.5	32	27	32
Ease of O&M	*13*	3.5	2.5	4	46	33	52
Reliability	*18*	3.3	3.3	3.3	60	60	60
Upstream/Downstream Effect	*14*	3.3	3.3	3.3	47	47	47
Flexibility (Future Regulations)	*17*	3.5	3.5	3	60	60	51
				TOTAL SCORE	**311**	**288**	**300**

Improvements Project Recommendation

As shown in **Table 28**, upgrading to an MBR plant and connecting to the West Hills WTP (Alternative 1) scores the highest compared to the other options evaluated in the analysis and is therefore the recommended improvement project.

6.0 PROPOSED PROJECT, RECOMMENDED ALTERNATIVE

As shown in **Table 28**, upgrading to an MBR plant and connecting to the West Hills WTP (Alternative 1) scores the highest compared to the other options evaluated in the analysis and is therefore the recommended improvement project.

6.1 PRELIMINARY PROJECT DESIGN DESCRIPTION

The recommended project includes connecting the drinking water system to the West Hills WTP in a 12-inch diameter pipe constructed in a 6.0-mile long alignment (between the City of Hollister and the City of San Juan Bautista, as shown in **Figure 22**). Further, the existing SBR pond plant will be decommissioned and converted into an equalization basin (aerators will remain in place to reduce odors and provide mixing). The SBR will be replaced with a membrane bioreactor (MBR) facility with a capacity of 0.43 Mgal/d (peak month flow). The system will include a fine screen (2 mm openings), an anoxic basin that is followed by two aeration basins (with fine bubble diffusers), and two membrane basins, recycle and waste pumps, permeate/backwash pumps, and a backwash tank. Effluent from membranes (permeate) will be sent to the existing UV disinfection facility and outfall. Sludge will be directed to a new solids storage tank and dewatered in a new screw press.

6.2 PROPOSED PROJECT SCHEDULE

Implementation of the project will follow the timeline required to secure funding and to complete the environmental CEQA and permitting process, establish user rates, complete the Proposition 218 process for those rates, and complete design and construction. An estimate of the timeline, subject to change, is presented in **Table 29**.

Table 29 Preliminary Project Schedule

Task	Completion Data
Preliminary Engineering Report	July 2020
Submit Construction Funding Application	July 2020
Implement Pre-Treatment Program	October 2020
CEQA and permitting process	December 2020
Design (Plans and Specs)	March 2021
Collect Samples at Industrial Discharge	April 2021
Bidding Process	May 2021
Construction NTP	July 2021
Construction Substantially Complete	September 2021
Final Startup, Testing, and Operations	Winter 2021

6.3 PERMIT REQUIREMENTS

As stated previously, the San Juan Bautista Wastewater Treatment Plant (WWTP) operates under Order No. R3-2009-0019 NPDES permit No. CA0047902. Based on conversations with the Regional Board and the 2016 Basin Plan, the salinity limits are expected to decrease in the next permit renewal cycle and is assumed to be similar to limits enforced in the City of Hollister's WWTP NPDES permit (150, 200, and 1200 mg/L, respectively).

The design of the improvements will be in compliance with the latest building codes (2019 California Building Code, CBC), design and placement of structural concrete will conform to American Concrete Institute Code Requirements (ACI 318) and for liquid containing structures ACI 350. All drinking water improvements will be done in accordance with NSF 61 standards and comply with CCR Title 17, 22, and 40.

During construction, the General Contractor will be required to obtain an encroachment permit from the County of San Benito, an air permit from the Monterey Bay Air Resources District, and a General Permit for storm water discharges associated with construction (and SWPPP compliance) from the Regional Board.

6.4 SUSTAINABLITY CONSIDERATIONS

In agreement with the State planning priorities of Government Code 65041.1 and sustainable water resource management priorities, all new improvements completed with this project will utilize premium efficient motors where feasible. New PLC controls and SCADA alarming will help the new facilities to operate efficiently. This will be important for efficient operation and management of the new MBR process and other WWTP upgrades.

6.5 ENGINEER'S OPINION OF PROBABLE COSTS

The total capital cost for this project is estimated to be $22,384,000 and is detailed in **Table 30**.

Table 30 Total Project Cost Estimate

ITEM	Subtotal	Total
Property Purchase / Lease Agreements		--
Easement Acquisition / Right of Way / Water Rights		$15,000
Bond Counsel		--
Legal Counsel		--
Interest/Refinancing Expense		--
Other (Water Softener Buy-Back Program)		$193,000
Environmental Services		
- CEQA Environmental Report	$40,000	
- NEPA Environmental Report	$10,000	
- Environmental Mitigation Contract Services	$10,000	
Total - Environmental Services:		$60,000
Engineering Services		
Basic Services:		
- Preliminary Engineering Report (PER)	$112,000	
- Preliminary and Final Design Phase Services	$1,180,000	
- Bidding/Contract Award Phase Services	$40,000	
- Construction and Post-Construction Phase Services (w/o inspection)	$700,000	
- Resident Project Representative Services (resident inspector)	$1,330,000	
Additional Services:		
- Permitting	$80,000	
- Regulatory Compliance Reports	$5,000	
- Environmental Mitigation Services (Construction Phase)	$10,000	
- Easement Acquisition/ROW's Services (Construction Phase)	--	
- Surveying Services (Construction Phase)	$10,000	
- Operation & Maintenance Manual(s)	$100,000	
- Geotechnical Services	$25,000	
- Hydrogeologist Services	--	
- Materials Testing Services (Construction Phase)	$25,000	
- Other Services (describe)	---	
Total – Engineering Services:		$ 3,617,000
Equipment/Materials (Direct purchase using approved methods, separate from construction bid/cost)		--
Construction Cost Estimate (escalated to mid-point of construction)		$ 13,300,000
Contingency (10% of construction cost estimate)		$ 1,330,000
TOTAL PROJECT COST ESTIMATE:		**$ 18,515,000**

6.6 ANNUAL OPERATING BUDGET

6.6.1 Income

The City currently charges residential and commercial customers the rates summarized below, as detailed in **Section 2.4**:

- the base rate of $83.61/month (residential),
- $84.03 (commercial), and
- Cost per 1,000 gallons: $9.10/month (standard strength), $13.63/month (moderate strength), and $18.18/month (high strength).

Based on the 2019 Auditor's Report and Financial Statement, the City's annual operating revenue collected from water and sewer fees was $1,312,018 and $1,182,920, respectively.

6.6.2 Annual O&M Costs

With the exception of replacing the SBR and filters with an MBR plant and changing the primary production of potable water from groundwater wells to Hollister WTP, no additional operation and maintenance is anticipated as a result of the proposed Project. The MBR will have similar energy demands as the existing SBR plant because high efficient diffused aeration will be used in the MBR, mixing energy is decoupled from aeration energy, aeration will be controlled by SCADA programming and an anoxic zone is proposed. The main notable difference is that membranes will need to be replaced every ten years. **Table 31**, below, includes an estimate of the approximate annual operations and maintenance costs of the new facility.

Table 31 Projected Operations and Maintenance Costs

Annual O&M Cost Estimate	Water	Sewer
Operating Expense		
Contractual Services and Utilities	106,597	291,529
Regional Service Fees (WHWTP)	168,000	---
Membrane replacement	---	$20,000
Personnel	127,639	113,110
Supplies, Materials, and Repairs	101,206	573,351
Depreciation	326,616	308,686
Total Operating Expense	**830,058**	**1,306,676**

1. Based on 2019 O&M costs plus additional Project related O&M costs (membrane replacement and West Hills WTP service fees).

6.6.3 Debt Repayments

Based on the June 2019 Auditor's Report and Financial Statement (as detailed in **Appendix B**), the City issued an Enterprise Revenue Bond for the principal amount of $11,640,000. The bond paid for the 2008 Water and Sewer COP and Pavex Note. The cash basis debt service paid during the fiscal year ending on June 30, 2020, totals $687,064. The bonds bear interest ranging from 3 to 5-percent and are payable semi-annually, ending on October 2043.

Based on a total Project Cost of $18,515,000 (as shown in Table 30) and an estimated 45% grant from USDA, the City will need to borrow $10,175,200 to pay for the project. Based on an assumed interest rate of 1.375% (current USDA poverty interest rate) and a 40-year term loan, the annual debt service will be $332,400.

The City has limited revenues available to support another loan obligation while keeping user fees manageable for the small city of San Juan Bautista. The City is hoping they will be eligible for additional grant assistance from other sources.

6.6.4 Reserves

Based on the June 2019 Auditor's Report and Financial Statement (as detailed in **Appendix B**), the current "restricted" reserves for the water and sewer funds are $863,071 and $369,326, respectively. The City's net asset positions are summarized in **Table 32**.

Table 32 Statement of Net Asset Positions

Item	Water	Sewer
Current Assets		
Cash and Investments	$895,507	$1,189,873
Restricted Cash and Investments	$863,071	$369,326
Accounts Receivable, Net	$91,990	$98,320
Total Current Assets	$1,850,568	$1,657,519
Non-Current Assets		
Property, Plant, and Equipment	$7,413,720	$6,052,741
Total Assets		
Total Assets	$9,264,288	$7,710,260

7.0 CONCLUSION AND RECOMMENDATIONS

The apparent best project for the City of San Juan Bautista includes the following components:

- Implement an industrial pre-treatment program for salinity control
- Upgrade the existing WWTP with a new membrane bioreactor (MBR) treatment process, decommission the existing sequencing batch reactor (SBR) pond and convert to an equalization basin, and provide new screw press for sludge dewatering
- Installing a 12-inch potable water line from the West Hills WTP to the City of San Juan Bautista

APPENDIX A

2020 Water and Wastewater Masterplan

APPENDIX B

Current City Budget and Financial Audits

APPENDIX C

Violation Notices and Regional Board Comments

APPENDIX D

Pellet Plant Report