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CIVIL ENGINEERS & LAND SURVEYORS

LOCKEFORD COMMUNITY SERVICES DISTRICT'S

Wastewater Facilities Master Plan

5/11/2023

Prepared for:
Lockeford Community Services District
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I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my knowledge and on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Neal T. Colwell 5/11/2023

My license renewal date is 12/31/2023

CONTRIBUTORS TO WASTEWATER FACILITIES MASTER PLAN

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TABLE OF ABBREVIATIONS

Abbreviation	Definition
AAF	Average Annual Flow
Ac	Acre(s)
ADWF	Average Dry Weather Flow
AO	Advanced Oxidation
AWHC	Available Water Holding Capacity
AWWA	American Water Works Association
BGC	Background Concentration
BOD	Biochemical Oxygen Demand
BOD_5	5-Day Biochemical Oxygen Demand
BPTC	Best Practicable Treatment or Control
CAL FIRE	California Department of Forestry and Fire Protection
CCI	Construction Cost Index
CCR	California Code of Regulations
CCTV	Closed Circuit Television
cfh	cubic feet per hour
cfs	cubic feet per second
CGC	California Government Code
CIMIS	California Irrigation Management Information System
CIP	Cast Iron Pipe
CPI	Consumer Price Index
CRU	Candidate Recharge/Recycled Use Area
CSTR	Continuous Stirred Tank Reactor
CY	Cubic Yard
DAF	Dissolved Air Flotation
DCB	Disinfection Contact Basin
DDW	Division of Drinking Water of the State Water Resources Control Board
DO	Dissolved Oxygen
DPB	Disinfection By-Product
DS2.2	Disinfected secondary-2.2 (recycled water)
DS23	Disinfected secondary-23 (recycled water)
DSOD	Division of Safety of Dams
DU	Dwelling Unit
EDU	Equivalent Dwelling Unit
Eff.	Effluent
ENR	Engineering News Record
US EPA	United States Environmental Protection Agency
Eto	Evapotranspiration
FAR	Floor Area Ratio
FEMA	Federal Emergency Management Agency
gpd	gallons per day
gpcd	gallons per capita per day

Abbreviation	Definition
gpm	gallons per minute
GSP	Groundwater Sustainability Plan
HDPE	High Density Poly Ethylene
Hp	Horsepower
I&I or I/I	Inflow and Infiltration
ITRC	California Polytechnic State University Irrigation Training and Research Center
LAA	Land Application Area
LAFCO	Local Agency Formation Commission, San Joaquin
LCL	Lower Confidence Level
LCSD	Lockeford Community Services District
LDR or ldru	Low Density Residential Unit
LF	Linear Foot or Linear Feet
LPHO	Low-Pressure High-Output
LRVs	Log_{10} Reduction Values
MAD	Management Allowed Depletion
MCL	Maximum Contaminant Level
MEC	Maximum Effluent Concentration
MF	Membrane Filtration
Mgal	Million Gallons
Mgal/d	Million Gallons per Day
MPN	Most Probable Number
MRP	Monitoring and Reporting Program
MSDS	Material Safety Data Sheets
MSL	Mean Sea Level
NRCS	Natural Resources Conservation Service
NTU	Nephelometric Turbidity Unit
O&M	Operation and Maintenance
PACH	Polyaluminum Chlorohydrate
PLC	Programmable Logic Controller
PMF	Peak Month Flow
P.S. or PS	Pump Station
psia	pounds per square inch absolute
PVC	Polyvinyl Chloride
PWWF	Peak Wet Weather Flow
RA	Reclamation Area
ROW	Right of Way
RWQCB	Regional Water Quality Control Board
SAE	Standard Aerator Efficiency
SOI	Sphere of Influence
SSMP	Sewer System Management Plans
SSO	Sanitary Sewer Overflow
SWRCB	State Water Resources Control Board
TDH	Total Dynamic Head
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon

Abbreviation	Definition
Total N	Total Nitrogen
TSS	Total Suspended Solids
UDS	Undisinfected secondary (recycled water)
USDA	United States Department of Agriculture
UV	Ultraviolet
UVT	UV Transmittance at 254 nm
VOC	Volatile Organic Compound
WY	Water Year
WDRs	Waste Discharge Requirements
WEF	Water Environment Federation
WSE	Water Surface Elevation
WWTP	Waste Water Treatment Plant

EXECUTIVE SUMMARY

This Wastewater Facilities Master Plan (Master Plan) has been prepared to provide an updated facilities plan for improvements to the Lockeford Community Services District's (District) sanitary sewer and wastewater treatment and disposal facilities to serve new development. This Master Plan also addresses alternative approaches to contributing to a balancing of the groundwater budget in the Eastern San Joaquin Groundwater Subbasin through such potential project approaches as recycled water use in lieu of groundwater for irrigation or groundwater recharge. The Master Plan is also intended to provide approaches for the District to meet recent revisions to the Regional Water Quality Control Board's Basin Plan for nitrate control in effluent discharges, and to a lesser extent salt. Specific objectives of this update to the Master Plan are:

1. Provide an updated and expanded master plan of wastewater facilities to serve current and future wastewater treatment and disposal needs of the District;

2. Provide for beneficial reuse of treated effluent to contribute to balancing of the groundwater basin water budget;

3. Outline a path for facilities development and construction consistent with current Basin Plan and statewide requirements and criteria related to recycled water, and nitrogen control; and

4. Establish a basis and nexus for capacity fees for new development to contribute to the funding of new wastewater facilities needed to serve that new development.

ES-1 PLANNING CRITERIA AND BACKGROUND INFORMATION

The current District wastewater service area and the surrounding Sphere of Influence (SOI) are shown in Figure ES- 1. The study area is primarily developed based on the existing District service area and Sphere of Influence (SOI) as approved by the San Joaquin Local Area Formation Commission (LAFCO), including projects specifically proposed for development or historically considered under consideration for requests for expansion of the District's wastewater service. The existing District limits consists of approximately 894 acres situated between Mokelumne River and Bear Creek in San Joaquin County, California. The District's service area includes the 105 acres that were recently annexed into the District's boundary as part of the Kautz Property proposed development. Specific projects or development types expected to occur in this study area are:

1. Infill development within the current District service area based on already subdivided parcels and residential and commercial land uses that may be readily served by the District;

2. Other larger parcels within the District boundary that may be subdivided based on San Joaquin County Land Use policies;

3. Development and construction on the Lockeford Vista and historically considered Lockeford Oaks projects; and

4. Development of the recently annexed approximately 105-acre area known as Kautz Property or Kautz Project that was recently added to the SOI and the District service area.

The areas identified in Table ES- 1, including the existing District limits and SOI totals 1,034 acres, as detailed in Table ES-1. Of the 1,034 acres within the SOI (but outside of the current service area), approximately 140 acres have not yet been annexed into the District's service area.

Table ES- 1
Study Area

Area Component	Gross Area (acres) (2)
Existing Service Area(1)	894
Area Remaining for Annexation (SOI)	140
District Service Area and Sphere of Influence	1,034

(1) Service area as defined by SJ LAFCO definition, equivalent to existing District boundary however not all of the area currently served sanitary sewer.

(2) Includes highway, road right of way, and other non-buildable areas.

This Master Plan details the calculation methods for determining existing and future flows. Appendix A also includes estimates regarding future development and population and associated wastewater flows and loads. Wastewater Treatment Plant (WWTP) facility alternatives for accommodating those future flows and loads have also been identified and reviewed. New development projects are characterized in Table ES- 2. Flows for projected future development are detailed in the Master Plan, and are projected to result in a future Average Dry Weather Flow (ADWF) of 0.50 Mgal/d.

Future growth within the District Service Area and SOI is regulated under the policies of the San Joaquin County (County) General Plan and under County adopted Zoning. With respect to future wastewater generation, development within the District is expected to occur under two means:

1. As infill development within the existing District service area; and
2. Planned development projects within the current District boundary and Sphere of Influence, including specific development as part of the Lockeford Vista, historically considered Lockeford Oaks, and Kautz Project developments.

Infill development may also occur as a result of intensified levels of development on already developed lands, e.g., development of underutilized land in the District's Service Area, or development on otherwise vacant land within the current District service area. This Master Plan does not include infill due to intensification of development such as may occur when an existing build-on property adds an accessory dwelling unit or parcel split of a moderately sized parcel already built on to result in two smaller parcels.

Recent historical District population statistics for the years of 2010 to 2020[1] indicate an overall growth rate in population of 0.9% per year. Assuming a continuation of recent annual growth rate trends, the future Lockeford population is expected to continue to grow at 0.9% per year. Using this rate of population growth, the 30-year future District population is estimated to increase by approximately 930 residents, with a 30-year future population projection reaching 3,946 residents. Considering the planned development projects listed in Table ES- 2, much of this potential population growth could occur as a result of buildout of these developments.

Table ES- 2
Estimated Flow Contribution from Planned Development Projects

Development Project	Potential Population Contribution (1)	Wastewater Flow Contribution (2) (Mgal/d)
Kautz Property	1,176	0.07
Lockeford Vista	445	0.03
Lockeford Oaks	857	0.05
Total	**2,478**	**0.15**

(1) Population estimated based on 2011 – 2020 average occupancy of 2.75 people per housing unit.
(2) Wastewater flow estimated based on 62 gpcd as evaluated in Section 4.0 of the Flows and Loads Tech Memo.

Although it is uncertain when infill development within the service area will occur, wastewater generation due to service area buildout is expected to proceed based on factors presented in Table ES- 3. The infill of the remaining service area is projected based on current zoning. Additional wastewater flows may occur if changes to current zoning occurs, or if the SOI is amended. However, zoning and potential future land uses within the SOI are predominantly industrial and therefore the sanitary sewer flows from these land uses will likely be limited depending on future characteristics of specific industrial developments that occur. For this Master Plan analysis, it is recommended that future industrial discharges (if any) be considered on a project-by-project basis. No new types of industrial discharges are known to be planned; therefore, future sanitary sewer flows from industrial land uses are assumed to be consistent with historical discharges.

[1] US Census data obtained from ESRI Vintage 2020 Time Series (2010 thru 2020) for Census Tract 4701.

Table ES- 3
Wastewater Generation Factors for Buildout within Service Area

Land Use Type	Infill Gross Area (Acres)	New Development Area (Acres)	Non-Use (1) Development (%)	Avg Density (DU/Net Acre) (2)	Population Density (Capita/DU) (3)	FAR (4)	Wastewater Generation Factors (gpd/Net Acre) (5)	District Infill WW Flow (Mgal/d)	New Development WW Flow (Mgal/d)
Agriculture Urban Reserve	60	0	1%	0.1	2.5	0.01	16	0.001	–
General Agriculture	0	0	1%	0.2	2.66	0.01	33	0.000	–
Very Low Density Residential	12	0	30%	2	3.25	N/A	400	0.003	–
Low Density Residential	20	271.63 (6)	30%	4	2.75	N/A	680	0.010	0.15
Medium Density Residential	5	0	30%	10	2	N/A	1,240	0.004	–
Office Commercial (7)	0	0	30%	18	0.33	0.25	920	0.000	–
Community Commercial	0.3	0	30%	N/A	N/A	0.25	1,056	0.000	–
General Commercial	12	0	30%	N/A	N/A	0.25	1,056	0.009	–
Public Facilities	12	8.5 (8)	30%	N/A	N/A	0.25	850	0.007	0.01
Limited Industrial	0	27 (8)	30%	N/A	N/A	0.25	1,056	0.000	0.02
General Industrial	20	102 (8)	30%	N/A	N/A	0.25	1,056	0.015	0.08
								Total: 0.05	Total: 0.26

Add'l ADWF: 0.31 Mgal/d
Current ADWF: 0.19 Mgal/d

Buildout ADWF: 0.50 Mgal/d

(1) Nonuse includes roads and other land uses that do not contribute to wastewater generation.
(2) San Joaquin County General Plan, Pgs. 69 - 120, were used for reference Dwelling Unit land use density ranges.
(3) Population density estimated based on 2 people per DU for medium density residential, 2.75 people per DU for low density residential and 3.25 people per DU for very low-density residential land use, as a means to allocate population among these differing land use types.
(4) FAR = Floor Area Ratio, the gross floor area permitted on a site divided by the total net area of the site. A site with 100 sq. ft. of land area with a FAR of 0.25 will allow a maximum of 25 sq ft of building floor area to be built.
(5) Wastewater generation factors for residential DUs are estimated for typical 62 gpcd discussed in Section 4.0 of the Flows and Loads Technical Memorandum.
(6) Low density residential area includes a total of 271.63 acres for the Kautz Property, Lockeford Vista and Lockeford Oaks planned development project areas shown in Figure 2 of the Flows and Loads Technical Memorandum in Appendix A.
(7) Office Commercial land use is assumed 80% commercial and 20% residential development
(8) New development areas include public facility and industrial areas within the SOI but outside the Service Area.

ES-2 SUMMARY OF EXISTING COLLECTION, TREATMENT AND DISPOSAL SYSTEMS

The District's current gravity sewer system drains to two main pump stations. The gravity sewers serve specific sewer shed regions, with two sewer-sheds ultimately draining to either the Locke Road Pump Station or the Bear Creek Pump Station. Figure ES- 1
shows the collection system with existing gravity sewer service areas, gravity sewer lines, force mains, and pump stations. Two additional pump stations are located within the Locke Road Pump Station sewer shed, the small Lockehaven subdivision at the north end of the community with discharge into the gravity sewer line and the Bluff Drive pump station that discharges into the nearby gravity sewer line. For the purposes of future expansion analysis, the two satellite pumps, Lockehaven Pump Station and Bluff Drive Pump Station, contribute only flows from these local areas and their future expansion is not anticipated to be needed

Table ES- 4 resents the estimated current wastewater flow contribution by land use type per primary sewershed.

Table ES- 4
Existing Land Flow Contributions to District's Main Pump Stations

Pump Station	Land Use Type	Parcel Count	Acreage	ADWF [gal/d]	PWWF [gal/min]	PWWF in Sewer Shed [gal/min]
Bear Creek PS	Low Density Residential	554	53.5	55,693	139	139
Locke Rd. PS	Agriculture Urban Reserve	54	5.6	52	0	
	Community Commercial	131	23.6	10,297	26	
	General Agriculture	8	0.4	7	0	
	General Commercial	77	13.7	5,985	15	
	General Industrial	1	0	0	0	
	Limited Industrial	45	14.0	6,103	15	
	Low Density Residential	1014	101.2	101,936	255	
	Medium Density Residential	58	21.4	4,240	11	
	Office Commercial	19	1.8	677	2	
	Public Facilities	37	6.2	2,159	5	
	Very Low Density Residential	24	4.7	2,851	7	336

Flows to the Locke Road Pump Station during PWWFs are reported to have the potential to overwhelm the pumping capacity, resulting in both of the two pumps having to operate to accommodate inflows. As such, expansion to accommodate existing system flows should be considered in the near-term. Figure ES- 1
shows the District's collection and pump station system as it currently exists. Although the Locke Road and Bear Creek Pump Stations have the above-described limitations, they are maintained in good condition and could otherwise provide service to the District into the future.

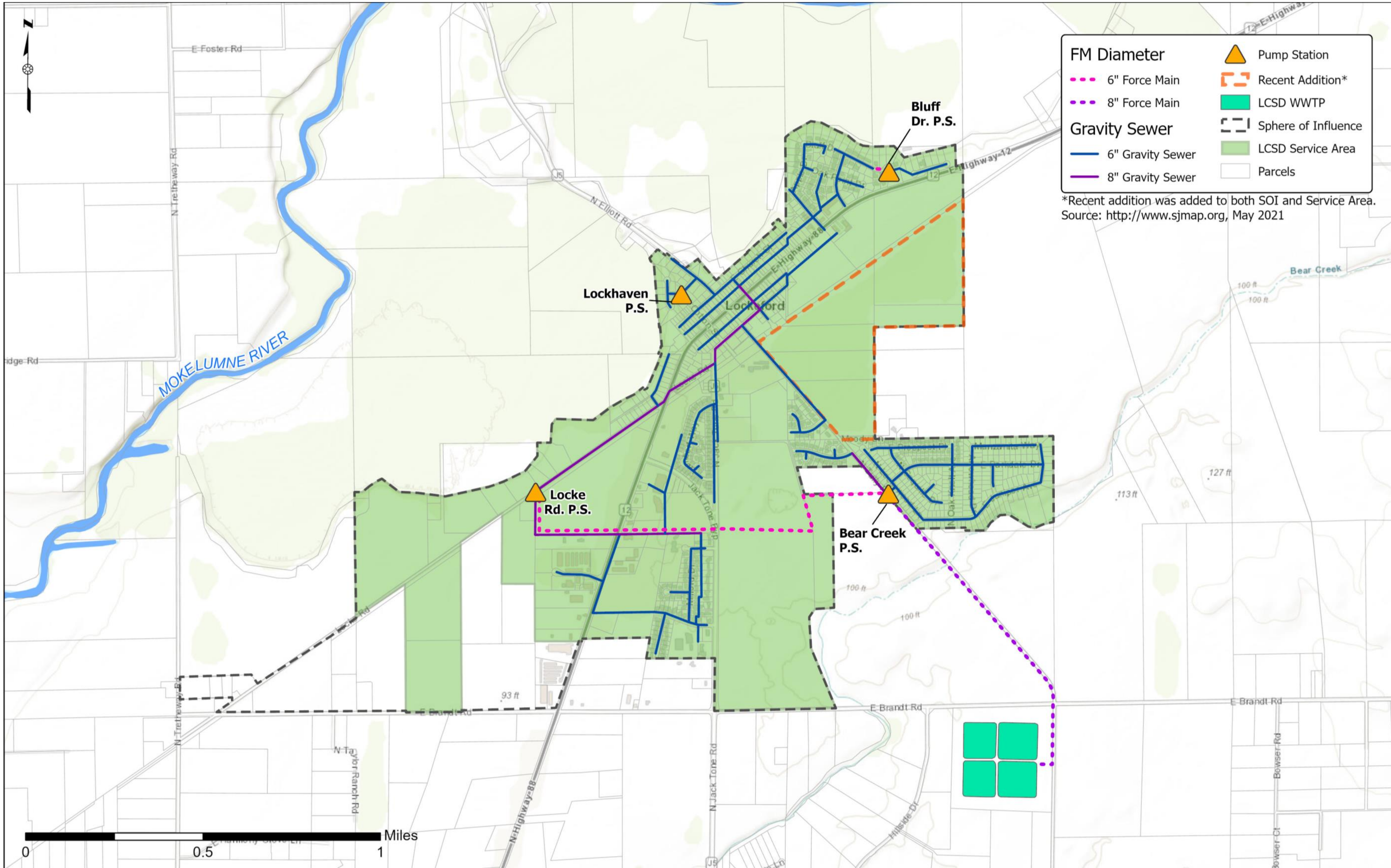

Figure ES- 1
District Existing Sewer Collection System

The existing WWTP consists of an aerated treatment pond, and three effluent storage basins as shown in Figure 2-4. The treatment pond and three storage basins, together with the District administrative office and maintenance facilities, are located on a 53-acre site south of Brandt Road and West of Tully Road. A remote storage basin is located on a 20-acre parcel owned by the District approximately 1,500 ft southwest of the treatment site. Effluent disposal is handled by irrigation of pasture grasses on an adjacent 116-acre parcel also owned by the District, called Reclamation Area No. 1. A second area near the wastewater treatment plant was purchased for expansion as Reclamation Area No. 2, however infrastructure has not been constructed to allow its use. Disposal operations are conducted under a pasture irrigation means of disposal. The existing treatment and disposal facilities referenced herein are presented in a general orientation in Figure ES- 2.

Figure ES- 2
General Existing Treatment and Disposal Facilities Layout

The single 6.5 acre treatment pond (T-1) operates at a nominal 6.3-foot depth, providing a theoretical detention volume of about 13.7 Mgal. However, only 6 of the 6.3 feet of depth can be manipulated using the outlet structure due to the lowest invert being above the pond bottom. Two 10 horsepower (hp) brush-style surface aerators are provided at the northwest and southeast areas of the ponds for supplemental aeration to meet the waste stabilization oxygen demand and consistently maintain 1.0 mg/L of dissolved oxygen in the upper one foot of the treatment pond. The effluent discharged from the treatment pond is required to meet the limitations from Waste Discharge Requirement (WDR) Order No R5-2007-0179. Additionally, the treatment ponds are required to maintain a Dissolved Oxygen (DO) concentration of at least 1.0 mg/L in the upper 1 foot of the ponds to minimize odors.

There are currently three onsite storage ponds (S-1 through S-3) at the WWTP and one remote storage pond located approximately 1,500 feet south of the WWTP. The storage ponds retain the treated effluent from the aeration treatment pond during the non-irrigation season, typically from April 1st through October 31st. Three pond overflow structures are provided to enable flow from T-1 to storage pond no. 1 (S-1), storage pond no. 3 (S-3), or the recirculation/effluent pump station. The design criteria of the storage ponds are contained in Table ES- 5, indicating a total system storage capacity of approximately 90 Mgal.

Table ES- 5
Existing Storage Pond Design Criteria

Design Parameter (1)	Units	Pond S-1	Pond S-2	Pond S-3	Remote Storage	Total
Area	Ac	5.5	5.5	6.5	12	**29.5**
Operational Volume	Mgal	16.5	16.5	19	39	**91**
Total Depth	Feet	11.3	11.3	11.3	12.4	--
Normal Operating Depth	Feet	0 – 9.3	0 – 9.3	0 – 9.3	0 – 10.9	--

(1) Values based on the 1990 DISTRICT WWTP O&M Manual

Effluent disinfection is employed when effluent is conveyed to the remote storage pond through chlorine injection and contact provided by the effluent piping's 500 ft long, 27 inch diameter reinforced concrete pipe located between storage ponds S-2 and S-3. The existing WWTP chlorination system is housed in the chlorine room of the control building, and includes provisions for chlorine gas supply from 150-lb cylinders to two manually set and adjusted wall mounted gas chlorinators.

Two effluent pumps on the WWTP site are used to convey plant effluent to the remote storage pond for irrigation or seasonal storage. The effluent pumps can also be used for recirculation of effluent to the influent splitter box. Effluent pumps consist of two submersible sewage pumps, each of which are mounted in their own individual 5-foot diameter sump located in the embankments at the central point between all four WWTP ponds. Effluent pumping to Reclamation Area No. 1 typically occurs between April 1st through October 31st when water is requested from the farmer, or when the WWTP requires disposal during wet years. Design criteria for the existing effluent pump station is presented in Table ES- 6.

Table ES- 6
Existing Effluent Pump Station Design Criteria

Design Parameter	Units	Value
Pump Type	--	Submersible Sewage
Make & Model	--	Flygt ENH-10
Motor Size (Ea.)	Hp	20
Number of Pumps	--	2
Design Point 1	As noted	750 gpm @ 25 ft TDH
Design Point 2	As noted	1,200 gpm @ 15 ft TDH
Drive Type	--	Constant Speed
Operation Type	--	Manual
Instrumentation	--	Float Switches

Values based on the 1990 District WWTP O&M Manual

The remote storage transfer pump station comprises two pumps that are both mounted in a shared 6-foot diameter sump and provide water to the irrigation disposal area from the remote storage pond. Based on the same criteria as the effluent/recirculation pumps, the remote storage transfer pumps should be able to transfer approximately 1.25 times the peak month demand to the irrigation area. The existing design capacity of the remote transfer pump station is presented in Table ES- 7.

Table ES- 7
Existing Remote Storage Pump Station Design Criteria

Design Parameter (1)	Units	Value
Pump Type	--	Submersible Sewage
Motor Size (Ea.)	Hp	5
Number of Pumps	--	2
Design Point 1	As noted	500 gpm @ 22 ft TDH
Design Point 2	As noted	700 gpm @ 15 ft TDH
Drive Type	--	Constant Speed
Operation Type	--	Hand – Off – Auto (Auto never used)
Instrumentation	--	Float Switches (2)

(1) Values based on the 1990 District WWTP O&M Manual.
(2) The transfer pump station was equipped with a control panel with space for future VFD capabilities.

Irrigation disposal is accomplished at Reclamation Area No. 1 with operations conducted under a contract between the District and a private party providing ranch management. The existing underground piped irrigation system is supplied effluent by the WWTP transfer pump stations through the common discharge pipeline. Irrigation is accomplished by manual opening of alfalfa valves that allows overland flow flooding of 50-foot wide checks. A runoff recapture system is also provided.

ES-3 SUMMARY OF EXPANSION ALTERNATIVES

Collection system improvements are planned as a modified continuation of the 1998 Master Plan improvements. Therefore, only one series of collection system improvements are planned to be considered for the alternatives analysis. However, multiple alternatives for the WWTP treatment and disposal systems are considered, including continuations of existing levels of treatment and disposal as well as recycled water production and disposal options.

Staged collection system improvements are listed in Table ES- 8 and shown in Figure ES- 3. Table ES- 8 below describes the listed improvement and when the improvement is needed. Listed improvements were formulated as interim improvements designed to accommodate increased capacity needs for development and infill of the entire SOI. New force main routes are recommended to ultimately provide the District with a reliable system for long-term operation, maintenance, and asset lifecycle replacement. It was assumed that no increase in flows to the Lockhaven Pump Station and the Bluff Drive Pump Station would occur and no improvements to these facilities would be needed.

Table ES- 8
Proposed Collection System Staged Improvements

No.	Improvement	When Needed	November 2021 Total Project Costs
1	Gravity sewer 8-inch minimum diameter 3,200-foot length in Locke Road west of existing pump station.	Upon extension of service to properties within existing service area and SOI along Locke Road west of Locke Road Pump Station.	$ 1,142,000.00
2	Improve Locke Road Pump Station by changing impellers on existing pumps and adding second wet well, to provide minimum interim peak pumping capacity of 336 gpm, based on existing flows and first phase of Lockeford Vista project.	With extension of service to properties within existing service area. Project to be implemented based on flow needs and monitoring performance of existing Locke Road Pump Station. May be triggered by Lockeford Vista project development.	$ 576,000.00
3	Parallel force main, 8-inch diameter, 3,200-foot length from Locke Road Pump Station to Jack Tone Road to increase pumping capabilities of improved pumps (phased and coordinated with Improvement No. 2).	With extension of service to properties within existing service area and SOI and to increase pumping capabilities of interim improved Locke Road Pump Station. May be triggered by second phase of Lockeford Vista project development.	$ 884,000.00
4	Construct new N. Tully Road Pump Station, with minimum peak capacity of 180 gpm to meet Kautz Property expected flows. Construct new parallel force main for N. Tully Rd. PS to wastewater treatment plant, minimum 6-inch diameter and approximately 6,200 foot length, with crossing of Bear Creek over creek coordinated with County Bridge Department. Include force main intertie for redundancy and reliability purposes.	With development of Kautz Property.	$ 2,165,000.00

No.	Improvement	When Needed	November 2021 Total Project Costs
5	Force main, 8-inch diameter, 4,800-foot length in Jack Tone Road and Brandt Road (connected to improvement No. 3), and 10-inch diameter 4,300-foot length in Brandt Road to WWTP. Discontinue discharge to existing Bear Creek Pump Station force main connection, however maintain intertie for redundancy and reliability purposes.	As flows reach capacity in force mains serving Locke Road Pump Station and N. Tully Road Pump Station, at 516 gpm (336 gpm + 180 gpm) or when combined pumping from Locke Road PS and N Tully Road PS are limited under dual pumping conditions.	$ 3,472,000.00
6	Eliminate Bear Creek Pump Station and direct flows from Bear Creek Pump Station to new N. Tully Road Pump Station through +/- 1,100-foot length minimum 8-inch gravity sewer. Upgrade N. Tully Road PS to accommodate flows diverted from Bear Creek PS.	To ultimately eliminate both Bear Creek and Locke Road PS discharging into a single force main and to consolidate pumping in this segment of the system into a single pump station. Improvement addresses lack of space at Bear Creek PS for any facilities rehabilitation.	$ 662,000.00
7	Construct new submersible duplex pump station with a minimum peak capacity of 750 gpm to replace existing Locke Road Pump Station, based on buildout within the area to be served by the Locke Road PS.	Triggered when infill development in existing service area and Lockeford Vista project develop approach capacity gained with Improvement Nos. 2 and 3.	$ 1,265,000.00
8	Gravity sewer, 8-inch minimum diameter, 2,300-foot length paralleling existing 8-inch in Locke Road from pump station easterly to Highway 12/88	Upon significant new development connecting through existing central system, including property on both sides of Highways 12/88; requires Nos. 1-7 to be completed.	$ 1,145,000.00
9	Gravity sewer, 6-inch diameter, +/- 1,000-foot length southerly from existing 6-inch to serve properties on west side of Highway 12/88.	Upon site development, may require Nos. 1-7 to be completed.	$ 380,000.00
10	East Brandt Road submersible duplex pump station discharging into +/- 4,300 feet, 10-inch force main to WWTP, to be constructed under Improvement No. 5:	Upon development of historical Lockeford Oaks area north of Brandt Road and east of Jack Tone Road. Requires 10-inch force main to Brandt Road to WWTP including in No. 5 above to be completed.	$ 1,491,000.00
a	Initial construction, assume 780 gpm capacity, based on 50% development of historical Lockeford Oaks development site and buildout within area served by Locke Road PS.		
b	Expand up to 810 gpm capacity based on additional flow from development within historical Lockeford Oaks development site.	Coordinate with modifications under Nos. 6 and 7.	
c	Subsequent expansion to 950 gpm capacity to accommodate Improvements No. 12, 13 and 14.	Coordinated with Nos. 12, 13 and 14 to accommodate West Brandt PS flows	

No.	Improvement	When Needed	November 2021 Total Project Costs
11	Construct approximately 1,700 feet of minimum 10-inch diameter gravity sewer from Jack Tone Road to new East Brandt Road PS along Brandt Road and divert force main flows from No. 5 and 13 to gravity sewer.	Upon development of historical Lockeford Oaks area north of Brandt Road and east of Jack Tone Road. Requires 10-inch force main to Brandt Road to WWTP including in No. 5 and No. 10 above to be completed. A project driver is to ultimately eliminate two pump stations discharging into the same force main. Maintain force main as intertie for reliability and redundancy purposes.	$ 781,000.00
12	Gravity sewers (6-inch or 8-inch diameter, +/- 4,700 linear feet) along Brandt Road between Highway 12/88 and Locke Road.	Upon development of sites to be served by these improvements along Brandt Road west of Highway 12/88. Requires Improvements No. 13 and 14.	$ 1,329,000.00
13	West Brant Road submersible duplex pump station with minimum peak capacity of 140 gpm.	Upon development of area long Brandt Road and Locke Road west of 12/88.	$ 411,000.00
14	West Brandt PS Force Main, 4-inch diameter, +/- 5,200-foot length) along Brandt Road from West Brandt Road Pump Station to Jack Tone Road and connection to force main (No. 5) or new gravity sewer (No. 11).	Upon development of area long Brandt Road and Locke Road west of 12/88. Project to be coordinated with Nos. 5 and 11 and completed with Nos. 12 and 13.	$ 1,337,000.00
		Total Estimated Capital Cost	**$ 17,040,000.00**

The cost estimates are represented 2021 dollars at an Engineering News Record (ENR) 20-citied Construction Cost Index (CCI) of 12,237.69. The detailed cost estimates of the alternatives are presented in Appendix D.

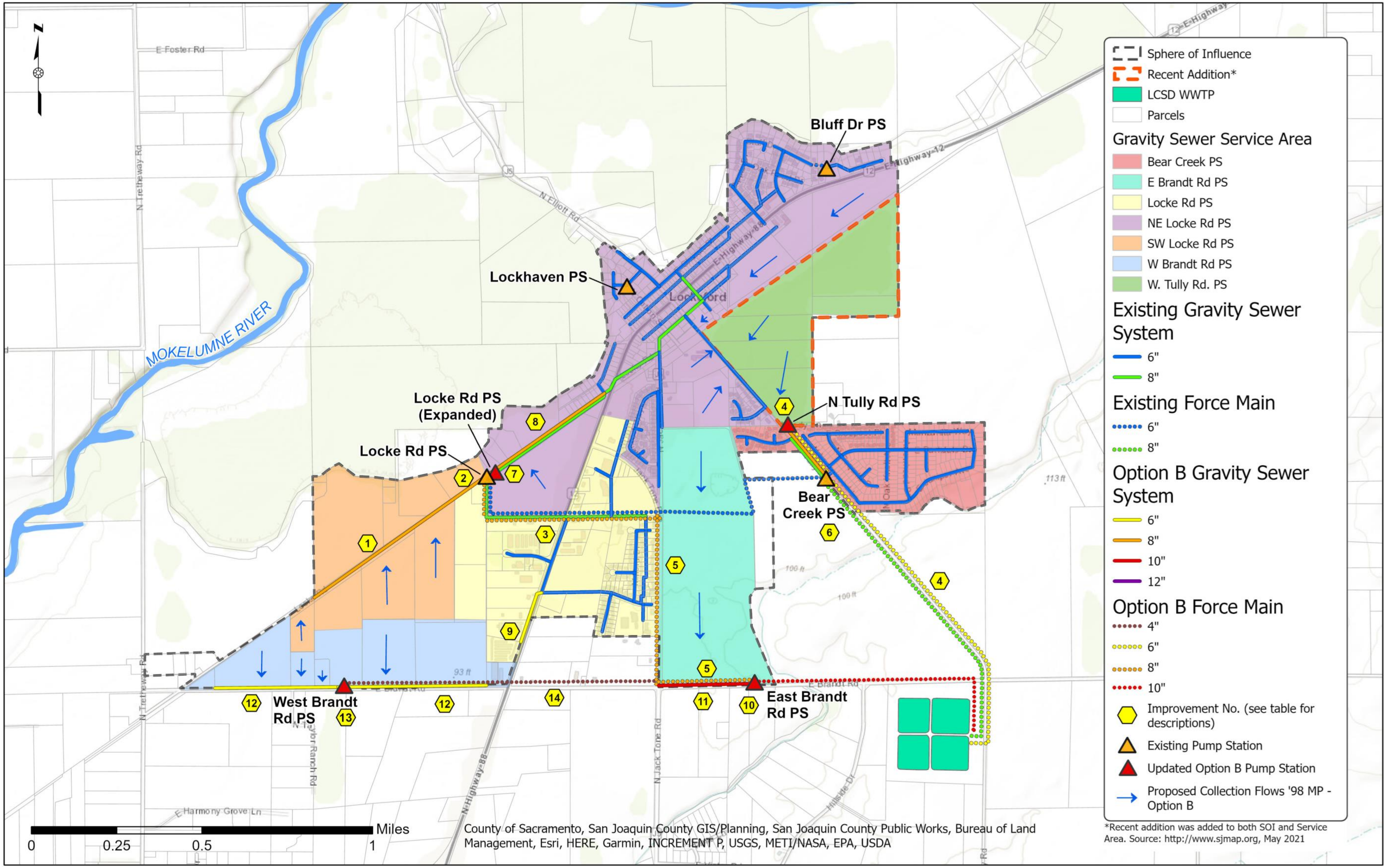

Figure ES- 3
Staged Collection System Improvements for the District

In order to develop a long-term solution for the District WWTP effluent disposal and recycled use, the feasibility of meeting District's needs has been evaluated through one or more of the following concepts:

- Continued use of secondary treatment using aerated ponds with expansion or modification of existing facilities;
- Recycled water production and groundwater recharge ponds for indirect potable reuse; and
- Recycled water production for irrigation use and in-lieu groundwater recharge, with recycled water sales or agreement for use with nearby growers.

Each treatment and disposal alternative has been identified and evaluated according to the following criteria:

1) Meets current and future District treatment, storage and disposal capacity needs;
2) Maintains, to the extent practicable, disposal operations on lands and facilities owned or controlled by District;
3) Is consistent with land disposal or recycled water use consistent with current Basin Plan and statewide policies such as Title 22 of the California Code of Regulations;
4) Benefits the District and groundwater basin for reduction in basin deficit to the extent practicable by District facilities planning and operation; and
5) Is cost efficient or offers long-term economic sustainability benefits that potentially offset a portion of cost impacts.

Key factors considered in evaluating the alternatives under the above-listed criteria include:

- Contributing to the Eastern San Joaquin Groundwater Subbasin Groundwater Sustainability Plan (GSP) goal of offsetting the 78,000 acre-foot per year pumping deficit (the groundwater cone of depression resulting from this deficit is depicted in the Master Plan.)
- Consistency with the District's Resolution No. 19-01 – Water Shortage Emergency and Establishing Water Service Moratorium, particularly to be consistent with Paragraph 3(d) to include measures to:

  "offset…impact on the District's groundwater supplies by augmenting groundwater in the Subbasin underlying the District."

Alternatives 1 and 2 continue production of disinfected secondary effluent. Alternative 1 involves conversion of S-3 into a second treatment pond, and expansion of offsite storage whereas alternative 2 focuses on maximizing onsite storage by baffling of the treatment pond.

Alternatives 3 and 4 focus on system improvements to allow for tertiary disinfected recycled water production. The potential locations for recharge ponds and crop irrigation recycled use areas within the vicinity of the District WWTP are presented in Figure ES- 4, which identify the Historic WWTP Site and Reclamation Area 2 for potential recharge ponds (Alternative 3) and nearby local active agricultural lands with crops compatible for recycled water use (Alternative 4). To meet the objective of providing in-lieu groundwater recharge, only areas shown to have existing irrigated agriculture are identified in Figure ES- 4 as candidates for recycled water use sites.

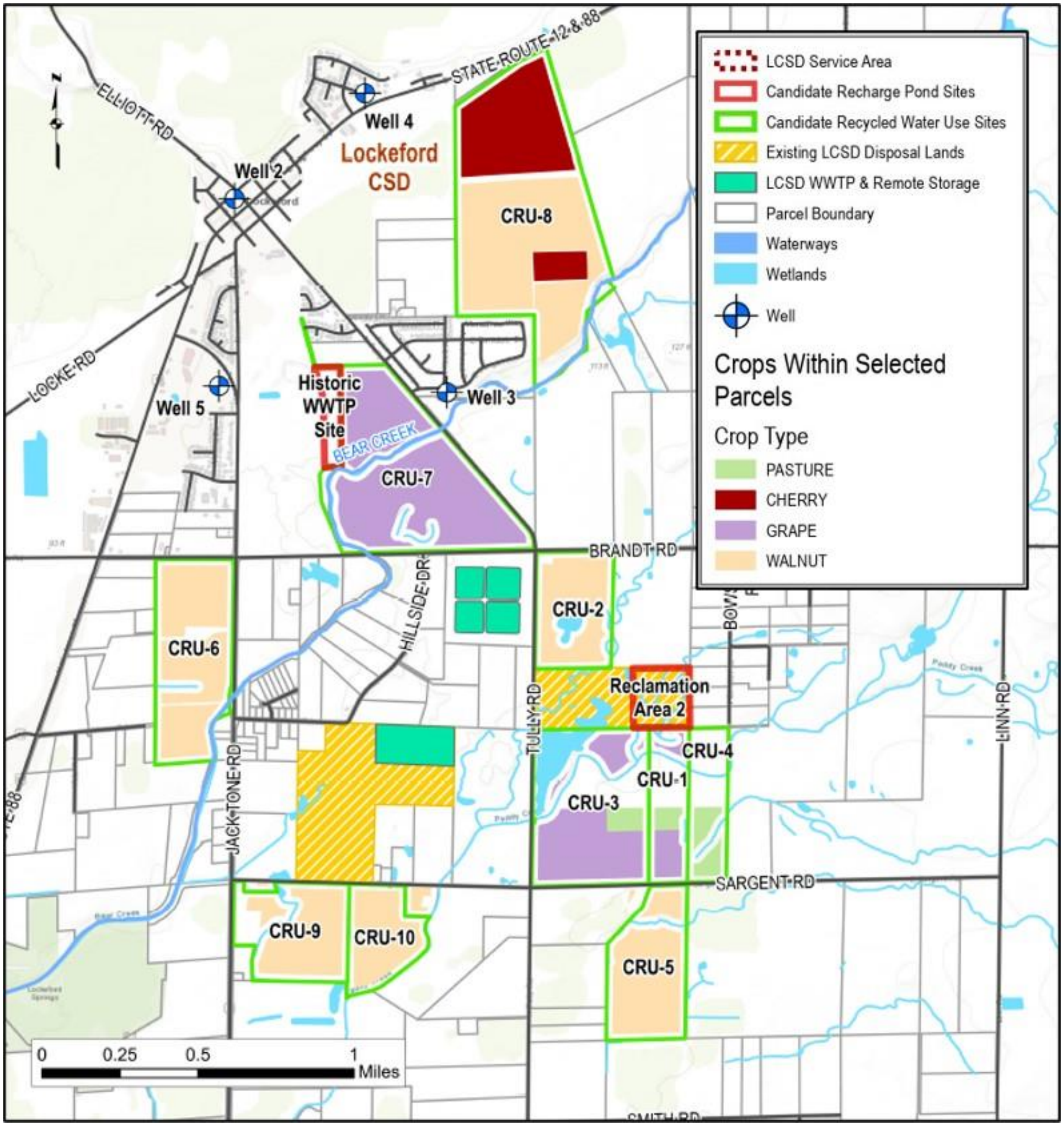

Figure ES- 4
Candidate Recharge and Recycled Use Areas Vicinity Map

Project costs have been evaluated and have indicated all project alternatives require budgets in excess of $12.75M. A review of the ability of each project alternatives' ability to meet the above criteria is provided in Table ES- 9. Ability to meet the project criteria is ultimately scored on a pass/fail basis. Results of the overall evaluation indicate both Alternative 3 and 4 are able to meet all five of the evaluation criteria. Alternatives 1 and 2 do not meet the criteria for benefitting the District by reduction of the basin deficit as a result of the majority of the effluent being lost to evapotranspiration without a balancing benefit of in-lieu groundwater recharge.

Table ES- 9
Treatment and Disposal Alternatives Comparison

Alternative	Meets Capacity Criteria	Utilizes Existing Facilities	Meets Regulatory Requirements	Benefits Groundwater Underlying District	Capital Cost Rank (1 = lowest cost, 4 = highest cost)
Alternative 1 – Land Disposal Using Expanded Off-Site Storage and Reclamation Area 1 and 2	✓	✓	✓	×	**2**
Alternative 2 – Land Disposal Maximizing WWTP Storage and Using Reclamation Area 1 and 2	✓	✓	✓	×	**1**
Alternative 3 – Groundwater Recharge of Treated Effluent for Indirect Potable Reuse	✓	✓	✓	✓	**3**
Alternative 4 – Recycled Water Use on Irrigated Agriculture for In-lieu Recharge	✓	✓	✓	✓	**4**

Alternative 4 is able to provide in-lieu recharge of up to 178 Mgal of recycled water during average year conditions with the highest capital cost of $26.90M, or at a volumetric cost of $0.15/gal benefit. Alternative 3 is able to benefit up to 115 Mgal of recycled water disposal via recharge ponds at a lower capital cost of $19.98M, or at a volumetric cost of $0.17/gal benefit. Although Alternative 4 may be more effective for its benefit to underlying groundwater, it is the most expensive alternative from both a capital and relative operational level and represents a facilities control risk to the District due to reliance on third-party agreements and grower interest in recycled water use for irrigation. Therefore, it is recommended that the District proceed with Alternative 3 for construction of recharge ponds. Based on site constraints to reclamation area 2, development of Alternative 3 using the historic WWTP site is preferred. The combined project budget for both the collection system and treatment and disposal alternative 3 is $37.02M presented in Table ES- 10.

Table ES- 10
Summary of Budgetary Costs for Recommended Alternative

Master Plan Component	November 2021 Project Costs ($)
Collection System	$17.04M
Treatment	$7.10M
Storage	$1.22M
Disposal	$11.66M
Total Budgetary Cost	**$37.02M**

ES-4 RECOMMENDED PHASING PLAN

Phasing of the collection system facilities are addressed in 0 and Table ES- 8, where a detailed process for the implementation of staged improvements is provided. Based on the benefits to the District, permitting requirements, the cost, and facilities performance and reliability, the recommended project for expansion of wastewater treatment and disposal includes a phased approach to Alternative 3, with recharge occurring at the historic WWTP site.

The initial phase 1 of Alternative 3 will include construction of the headworks facilities and conversion of S-3 into a second aeration pond (T-2). ADWFs of up to approximately 0.23 Mgal/d can be accommodated in T-1 until the peak month loading will likely begin to exceed the aeration capacity. Following phase 1, the phase 2 facility improvements will be triggered at an ADWF of 0.39 Mgal/d, which is the storage and disposal facility maximum capacity ADWF during the 1-in-100 year climatological conditions.

At phase 2, improvements will include construction of approximately one-half of the tertiary and advanced treatment and disinfection facilities (sized to 0.25 Mgal/d), along with the remote storage return pump station and pipeline, the recycled water recharge pump station and pipeline, and the historic WWTP site recharge ponds. The improvements to the disposal facilities provided in phase 2 will create additional capacity to accommodate up to approximately 0.43 Mgal/d ADWF, at which point the final phase 3 will be triggered.

In phase 3, the District has the opportunity to evaluate the efficacy of the recharge ponds and their benefit for providing groundwater recharge and sustainability. If, for example, the recharge ponds are unusually high in maintenance costs (which is atypical), then the District may choose to construct additional storage facilities and forego any additional recharge ponds. However, if the recharge ponds have been successfully implemented then the District may choose to construct additional recharge pond facilities at Reclamation Area 2, within the site environmental constraints. It should be noted that the base project construction cost of recharge ponds all at once (as presented in Table ES- 10) would amount to approximately $19.98M. The phased approach for phase 3a would add approximately $0.81M (total of $20.78M) as a result of additional mobilization, management, permitting and other contracting costs anticipated to occur from separating the projects. If option 3b were to be chosen, the total cost would decrease by approximately $1.87M (total of $18.11M) because the additional treatment facilities and recharge ponds would not be constructed and only an additional storage pond improvement would occur.

For future funding, planning and budgetary purposes, the District is recommended to proceed with the phased approach described above. At phase 3, the recharge ponds are assumed to be successfully implemented and the project will be completed with phase 3a as presented in Table ES- 12. For implementation of the proposed project, the following future investigations are recommended:

- Deeper soil explorations at Reclamation Area 2 and the Historic WWTP site, including detailed hydrogeologic characterization of the underlying aquifer and interconnectivity with groundwater supplies;
- Evaluation of travel times from the recharge sites to the nearest domestic and municipal wells; and
- Evaluation of the aquifer soil treatment for log reduction of Enteric virus, Giardia, and Cryptosporidium.

A summary of anticipated capital costs for the phased Master Plan improvements is presented in Table ES- 11. The total proposed budget through phase 3a is approximately $37.82M, which is $0.81M above the base project budget of $37.02M presented in Table ES- 10 due to additional management and contracting fees.

Table ES- 11
Summary of Proposed Budgetary Project Costs through Phase 3a

Master Plan Component	November 2021 Project Costs ($)
Collection System	$17.04M
Treatment	$7.43M
Storage	$1.22M
Disposal	$12.13M
Total Budgetary Cost	**$37.82M**

Table ES- 12
Recommended Treatment and Disposal Facility Phasing Plan

	Improvement Phase/Decision	ADWF Trigger	Facility Component	Improvement Description	2021 Project Phase Cost Estimate	2021 Total Costs
	Phase 1 Existing Treatment Expansion	0.23 Mgal/d	**2^0 Treatment Facilities**	• Headworks microscreen & washing compactor • T-1, 2 new 20 hp aerators • S-3 → T-2, 2 new 7.5 hp aerators • Plant piping modifications	$1.84M	
EVALUATE	Phase 2 Historic WWTP Recharge Ponds	0.39 Mgal/d	**3^0 Treatment Facilities**	Sizing Criteria: ~0.25 Mgal/d • Secondary effluent PS (Pump 2 of 3) • Tertiary treatment building • Rapid mixing & flocculation tanks (1 of 2) • DAF unit (1 of 2) • Self-cleaning strainers (1 of 2) • Membrane filter unit (1 of 2) • UV disinfection chamber (2 of 3) • Advanced oxidation (1 of 2) • Coagulant/chemical pumps (1 of 2) • Instrumentation/electrical	$3.30M	**Total Ph 1 & 2** **$12.21M**
			Storage Facilities	• Remote storage return PS • Remote storage return piping	$1.22M	
Recharge Ponds are a success			**Disposal Facilities**	• Recycled water recharge PS • Recycled water recharge pipeline • Historic WWTP recharge ponds • Instrumentation/electrical	$5.85M	
Recharge Ponds are not a success	Phase 3a Expand Historic WWTP Recharge Ponds	0.43 Mgal/d	**3^0 Treatment Facilities**	Sizing Criteria: 0.5 Mgal/d • Secondary effluent PS (Pump 3 of 3) • Rapid mixing & flocculation tanks (2 of 2) • DAF unit (2 of 2) • Self-cleaning strainers (2 of 2) • Membrane filter unit (2 of 2) • UV disinfection chamber (3 of 3) • Advanced oxidation (2 of 2) • Coagulant/chemical pumps (2 of 2) • Instrumentation/electrical	$2.29M	**Total Ph 1, 2 & 3a** **$20.78M**
			Disposal Facilities	• Historic WWTP recharge ponds • Reclamation area 2 recharge ponds • Monitoring wells • Instrumentation/electrical	$6.28M	
	Phase 3b Remote Storage Pond Expansion (No Additional Recharge Pond)	0.43 Mgal/d	**Storage Facilities**	• New remote storage pond at Reclamation Area 2; OR • Deepen existing remote storage pond by 4.5 ft (add'l 15 Mgal) • Continue to utilize Reclamation Area 1 for disposal	$5.92M	**Total Ph 1, 2 & 3b** **$18.11M**

ES-5 SUMMARY OF FACILITIES FINANCING PLAN

A preliminary plan for funding of the recommended improvements is discussed in Section 4.2, as summarized below. The facilities financing plan is based on updating the Master Plan facilities costs from at an ENR CCI of 12,237.69 to the current March 2023 ENR CCI basis of 13,176.3.

The charges are developed to meet applicable requirements of the California Government Code (CGC). Per CGC Section 66013 et. seq., sewer capacity charges shall not exceed the estimated reasonable cost of providing the service for which the fee or charge is imposed, unless approved by a two-thirds vote. A capacity charge is defined as a charge for public facilities in existence at the time a charge is imposed or charges for new public facilities to be acquired or constructed in the future that are of proportional benefit to the person or property being charged, including supply or capacity contracts for rights or entitlements, real property interests, and entitlements and other rights of the local agency involving capital expense relating to its use of existing or new public facilities.

The valuation methodology used to calculate the cost of providing sewer service to new users is based on:

1. Cost of all collection system facilities improvements (including financing costs), excluding correction of existing deficiencies (as identified as part of collection system Improvement #1 and Improvement #2), allocated to all future users.

2. Cost of all future treatment and disposal (recycled water) improvements applied to future users; and

3. Allocation of all future improvement facilities planned capacity to future users based on sufficiency of existing facilities to serve existing users and assignment of need to offset impacts to District's underlying groundwater applied only to new development.

The methodology used in this analysis excludes development project-specific improvements, such as in-development sewer systems and sewer line extensions, that may be needed to extend service. Such development project-specific improvements are understood to be project-specific costs and are not part of the cost of buying-in to capacity in the District's existing facilities.

ES-5.1 PRELIMINARY CAPACITY CHARGE CALCULATIONS

This Wastewater Facilities Master Plan updates previous expansion plans including the 1998 Wastewater Master Plan and facilities plans and concepts related to Reclamation Area No. 2. As such, previously calculated connection fees are no longer applicable. Instead, new capacity charges are recommended to replace the previous connection fees. Assumptions for the new sewer capacity charges are based the following:

- Continuation of pond treatment, storage and disposal on District owned land, where these existing facilities will benefit current and future users.
- Expanded District to serve a projected wastewater flow of 0.50 Mgal/d, or an estimated 0.31 Mgal/d increase in wastewater flows based on new development.
- Average wastewater flow per new EDU of approximately 170.5 gal/d.

- Costs associated with a portion of the Collection System Improvement No. 8 needed to serve the Lockeford Vista project and near-term improvements to the Locke Rd Pump Station, under Collection System Improvement No. 2 are excluded from this capacity charge at the following costs:
  - Approximately 66% of Improvement No. 2 at $0.759M at 2021 basis, or $817M at March 2023 basis.
  - Improvement No. 2 at $0.576M at 2021 basis, or $0.620M at March 2023 basis; and
- All wastewater, including commercial and industrial land uses, is in conformance with the current District sewer use ordinance, with no significant contributions of compounds that are incompatible with current treatment and disposal methods.
- Treatment, storage and disposal facility improvements are constructed consistent with this analysis.
- Direct District or property owner costs associated with making the actual physical service connection to District sewer mains are not included and would be charged based on a true connection fee basis to be established by the District.
- Charges exclude development project-specific improvements, including sewer line extensions not identified in this Wastewater Facilities Master Plan or project-specific improvements within planned subdivision or development projects needed to make connection to existing District facilities or identified Wastewater Facilities Plan improvements.
- It is assumed that Loan interest associated with project financing is included and additive to the costs per EDU when utilized in establishing the Capacity Charges since timing of collection of capacity charges will lag the need for facilities and therefore District debt financing is expected to be needed for phased project development, including the assumption that collection system improvements 3 through 7 would be debt financed.
- While costs estimates are at a July 2021 ENR CCI of 12,237.69, calculated cost per EDU is updated to a March 2023 ENR CCI of 13,176.3.

Using the above approach, and basis as described in more detail in Section 4.2.4, the average cost per EDU is presented in Table ES-13.

Table ES- 13
Preliminary Proposed Average Cost per EDU

Component		March 2023 Improvement Cost[1]
Collection System		
Gravity Mains (Net)		$5.04M
Pump Stations		$3.90M
Force Mains		$7.97M
Land and Right of Way (not included in total[3])		$0.11M
Subtotal		$16.91M
Amount Loan Financed (Improvements 3-7)		$9.10M
Loan Interest (30-years @ 1.5% interest rate)		$2.27M
Total (Subtotal + Loan Interest)		$19.18M
Future Buildout EDUs		1,659.2
Component of Cost per EDU ($/EDU)[2]	$	11,560
WWTP & Disposal System		
Treatment (Phases 1 and 2)		$5.53M
Storage (Phase 2)		$1.31M
Disposal Phase 2)		$6.30M
Subtotal		$13.14M
Amount Loan Financed (100% of Eligible Project Costs)		$13.14M
Loan Interest (30-years @ 1.5% interest rate)		$3.27M
Total (Subtotal + Loan Interest)		$16.41M
Future 30-Year EDUs		1,014.0
Component of Cost per EDU ($/EDU)[2]	$	16,183
Total Proposed Cost per EDU		
Total Cost per EDU ($/EDU)	$	27,743

1. Estimate of current value of component in March 2023 at ENR Construction Cost Index of 13,176.3.
2. Cost per Equivalent Dwelling Unit (EDU). Total projected EDUs are based on an existing EDUs of 1,114.4 found by dividing the current ADWF by the wastewater generated per EDU, plus the 159 EDUs in agreement with the Lockeford Vista developer. Using the same method, a projected 30 – year basis 2,287.4 EDUs are expected, whereas at buildout 2,932.6 EDUs are expected. Future project costs per EDU are equal to the system component subtotal divided by either the future 30-year or buildout EDUs.
3. Collection system right-of-way assumed to be dedicated by new development where improvements are not within existing right-of-way.

Cost per EDU calculations were proportioned to future users by the amount of flow contributed by each land use type, and are summarized in Table ES- 14.

ES-5.2 Indexing of Fees

Historically, the District has increased connection charges to account for inflation and rising construction costs; however, inflationary increases may not always be adequate to cover increased costs associated with changes in assumptions made in this Wastewater Facilities Master Plan. The existing District Ordinance 99-01 allows inflation adjustments of the connection fees each year and it is recommended that the future capacity charges adopted be adjusted following this same process. Annual indexing of fees based on an accepted cost indicator such as the Consumer Price Index (CPI) or the ENR CCI is recommended at minimum. However, if the assumptions made in this Wastewater Facilities Master Plan are no longer applicable, then the District may reassess the facility costs and update the capacity charges accordingly.

Table ES- 14

Costs per EDU for Future Units for Collection System and WWTP Improvements

Land Use Type	Land Use Density [1]	Population Density[2]	FAR [3]	Wastewater Generation [4]	Unit Wastewater Generation	Equivalent Dwelling Units	Proposed Cost per EDU
Residential	**Units/Net Acre**	**Capita/DU**	**–**	**gpd/Net Acre**	**gpd/Unit**	**EDUs**	**$/Unit**
Very Low Density Residential	2	3.25	N/A	400	202	1.18	$ 32,737
Low Density Residential [5]	4	2.75	N/A	680	171	1.00	$ 27,743
Medium Density Residential	10	2	N/A	1,240	124	0.73	$ 20,252
Mixed Use	**Units/Net Acre**	**Capita/DU**	**–**	**gpd/Net Acre**	**Gpd/Unit**	**EDUs**	**$/Unit**
Agriculture Urban Reserve	0.1	2.5	0.01	16	160	0.94	$ 26,078
General Agriculture	0.2	2.66	0.01	33	165	0.97	$ 26,911
Office Commercial [6]	18	0.33	0.25	920	51	0.30	$ 8,323
Non-Residential	**Units/Net Acre**	**Capita/DU**	**–**	**gpd/Net Acre**	**Gpd/KSF**	**EDUs/KSF**	**$/SF**
Community Commercial	N/A	N/A	0.25	1,056	97	0.57	$ 15.81
General Commercial	N/A	N/A	0.25	1,056	97	0.57	$ 15.81
Public Facilities	N/A	N/A	0.25	850	78	0.46	$ 12.76
Limited Industrial	N/A	N/A	0.25	1,056	97	0.57	$ 15.81
General Industrial	N/A	N/A	0.25	1,056	97	0.57	$ 15.81

(1) San Joaquin County General Plan, Pgs. 69 - 120, were used for reference Dwelling Unit land use density ranges.

(2) Population density estimated based on 2 people per DU for medium density residential, 2.75 people per DU for low density residential and 3.25 people per DU for very low-density residential land use, as a means to allocate population among these differing land use types.

(3) FAR = Floor Area Ratio, the gross floor area permitted on a site divided by the total net area of the site. A site with 100 sq. ft. of land area with a FAR of 0.25 will allow a maximum of 25 sq ft of building floor area to be built.

(4) Wastewater generation factors for residential DUs are estimated for typical 62 gpcd discussed in Section 4.0 of the Flows and Loads Technical Memorandum.

(5) Low Density Residential land use is characteristic of the typical Single Family Residential Unit and EDU within the District.

(6) Office Commercial land use is assumed 80% commercial and 20% residential development

Section 1

Introduction

This Wastewater Facilities Master Plan is organized into four sections listed below:

Section 1	Summary evaluation of historical flow and load data, and recommended planning criteria.
Section 2	Identification and evaluation of existing conditions and existing facilities within the plan area.
Section 3	Identification and evaluation of future service area characteristics, facilities alternatives and expansion recommendations.
Section 4	Detailed implementation plan descriptions for the recommended Master Plan improvement options, including facilities phasing and funding plans.

Specific objectives of this update to the Master Plan are:

1. Provide an updated and expanded master plan of wastewater facilities to serve current and future wastewater treatment and disposal needs of the District;

2. Provide for beneficial reuse of treated effluent to contribute to balancing of the groundwater basin water budget;

3. Outline a path for facilities development and construction consistent with current Basin Plan and statewide requirements and criteria related to recycled water, and nitrogen control; and

4. Establish a basis and nexus for capacity fees for new development to contribute to the funding of new wastewater facilities needed to serve that new development.

In addition to providing updated facilities alternatives and requirements, this Wastewater Facilities Master Plan (Master Plan) is also intended to address alternative approaches to contributing to a balancing of the groundwater budget in the Eastern San Joaquin Groundwater Subbasin through such potential project approaches as recycled water use in lieu of groundwater for irrigation or groundwater recharge. The Master Plan is also intended to provide approaches for the District to meet recent revisions to the Regional Water Quality Control Board's Basin Plan for nitrate control in effluent discharges, and to a lesser extent salt.

1.1 WASTEWATER SERVICE PLANNING AREA

The current District wastewater service area and the surrounding Sphere of Influence (SOI) are shown in Figure 1-1. The study area is primarily developed based on the existing District service area and Sphere of Influence (SOI) as approved by the San Joaquin Local Area Formation Commission (LAFCO), including projects specifically proposed for development or historically considered under requests for expansion of the District's wastewater service. Specific projects or development types expected to occur in this study area are:

1. Infill development within the current District service area based on already subdivided parcels and residential and commercial land uses that may be readily served by the District;

2. Other larger parcels within the District boundary that may be subdivided based on San Joaquin County Land Use policies;

3. Development and construction on the Lockeford Vista and historically considered Lockeford Oaks projects; and

4. Development of the recently annexed approximately 105-acre area known as Kautz Property or Kautz Project that was recently added to the SOI and the District service area.

Figure 1-1 presents the current District service area (which is coterminous with the District boundary) and identifies the defined Sphere of Influence of the District. The existing District limits consists of approximately 894 acres situated between Mokelumne River and Bear Creek in San Joaquin County, California. The District's service area includes the 105 acres that were recently annexed into the District's boundary as part of the Kautz Property proposed development.[2]

As part of this study, the potential for new development, including infill growth within the existing District limits and new development proposed within the District's SOI are considered. The areas identified in Figure 1-1, including the existing District limits and SOI totals 1,034 acres, as detailed in Table 1-1. Of the 1,034 acres within the SOI (but outside of the current service area), approximately 140 acres have not yet been annexed into the District's service area.

Table 1-1
Study Area

Area Component	Gross Area (acres) (2)
Existing Service Area(1)	894
Area Remaining for Annexation (SOI)	140
District Service Area and Sphere of Influence	1,034

(1) Service area as defined by SJ LAFCO definition, equivalent to existing District boundary however not all of the area currently served sanitary sewer.

(2) Includes highway, road right of way, and other non-buildable areas.

Lands that are outside of the service area are predominantly located to the southwest of the community as illustrated in Figure 1-1. The areas to the southwest have typically been occupied by industrial land uses that have occurred since the 1980s.

[2] Kautz Property annexed into SOI and District service area on December 8, 2016 by San Joaquin LAFCO, Resolution 1359

New development within the District's current boundary and SOI will typically occur through a process for land use planning and approval, land subdivision, and annexation (when applicable) within the District service area. New development proceeding under this process may take decades to occur and ultimately may develop build-out wastewater flows over long periods. According to current information, the District has three identified development projects at varying stages of approval or historically considered for development. These projects are characterized in Table 1-2. Flows for projected future development are detailed in Section 3.1.1 and are projected to result in a buildout future Average Dry Weather Flow (ADWF) of 0.50 Mgal/d.

Table 1-2
Current Community of Lockeford Development Projects

Development Project	Land Use (1)	Development Area (Acres)	Development Characteristics	Project Status
Kautz Property	Low Density Residential	105	420 ldrus	Approved, property annexed for future development of ldrus.
Lockeford Vista	Low Density Residential	41.9	159 ldrus	Approved, development planned for near-term subdivision into ldrus.
Lockeford Oaks	Low Density Residential	124.73	306 ldrus	Inactive, but previously approved Phase I for 73 ldrus,. Project potential is based on previously proposed project Phase I and Phase II.
Total	**--**	**271.63**	**885 (1)**	**--**

ldru = Low Density Residential Unit

(1) Approximate ldru potential assuming development as described in the May 2016 Lockeford Municipal Services Review, and the December 2, 2016 Kautz Property Plan of Service Memo.

1.2 POPULATION AND WASTEWATER FLOW PROJECTIONS

Based on available records, the existing land use characteristics and population characteristics for the District are summarized in the below sub-sections.

1.2.1. EXISTING CONDITIONS

Existing land use within the current Service Area consists of a combination of residential and non-residential uses. Existing residential and non-residential land uses include:

- Agriculture Urban Reserve;
- General Agriculture;
- Very Low Density Residential;
- Low Density Residential;
- Medium Density Residential;
- General Commercial;
- Community Commercial;
- Office Commercial;
- General Industrial;
- Limited Industrial; and
- Public Facilities

Further descriptions of the land use details are included in the Existing and Future Land Use and Flows and Loads Memo (Flows and Loads Memo) attached in Appendix A of this report. More specifically, Table 2 of the Flows and Loads Memo details the District's existing service area and quantitatively characterizes the potential for infill development within the current service area. Section 2 of this Master Plan details the calculation process considering existing flows used to establish an estimated daily wastewater generation rate of of 62-gallons per capita per day (gpcd) for facilities planning. The existing population of the District is estimated to be 3,016 (Census tract 4701) with historical growth rates from the years 2010 to 2020 at an average of 0.9% per year. Current land use in the District service area and SOI are shown in Figure 1-1. The breakdown of existings flows is included in Section 2.1.1.

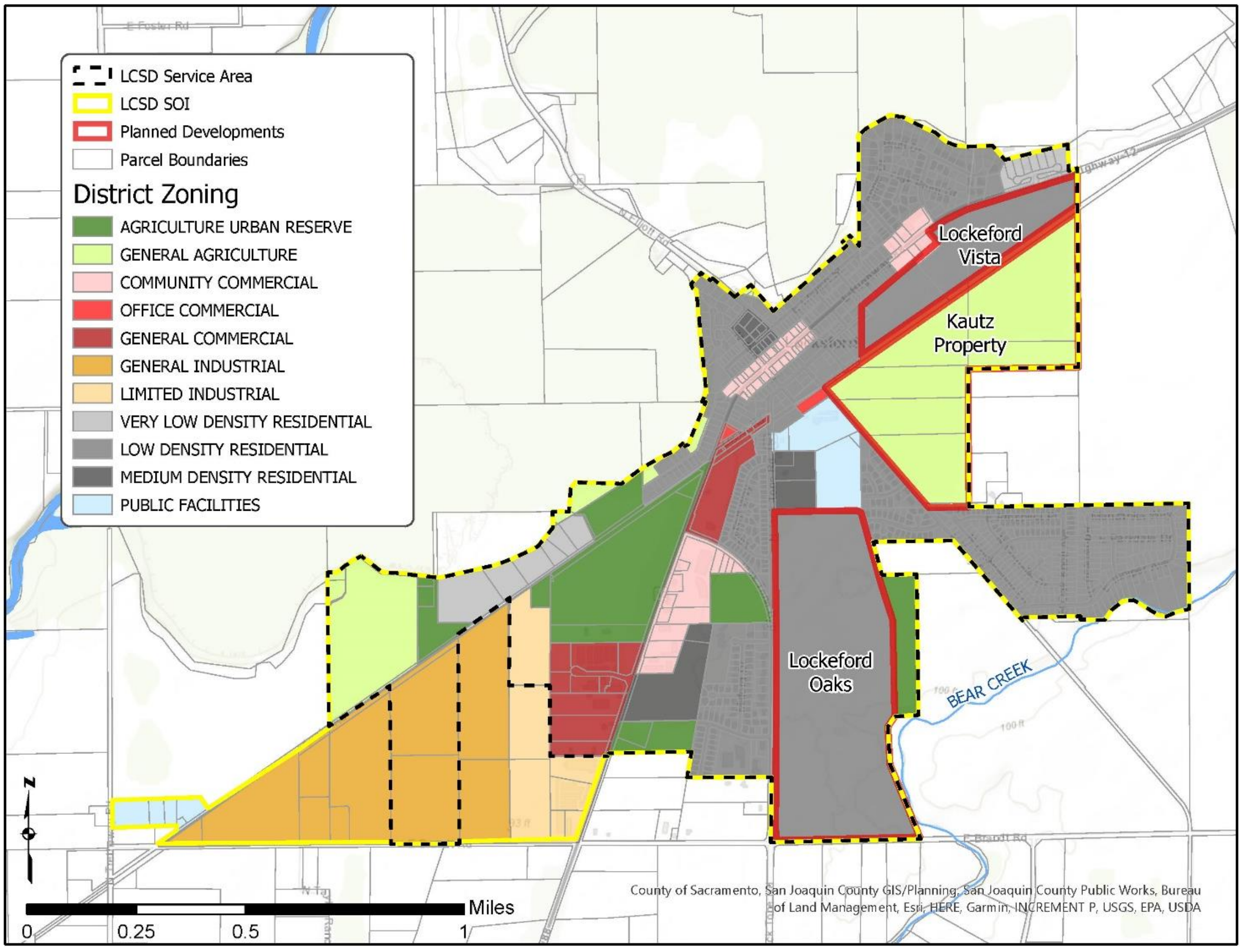

Figure 1-1
Current Land Uses in District Service Area and Sphere of Influence

1.2.2. FUTURE CONDITIONS

This Master Plan has details in both Section 2 and Section 3 the calculation methods for existing and future flows. Appendix A also includes estimates regarding future development and population and associated wastewater flows and loads. Wastewater Treatment Plant (WWTP) facility alternatives for accommodating those future flows and loads are also reviewed in Section 3.

Future growth within the District Service Area and SOI is regulated under the policies of the San Joaquin County (County) General Plan and under County adopted Zoning. With respect to future wastewater generation, development within the District is expected to occur under two means:

1. As infill development within the existing District service area; and

2. Planned development projects within the current District boundary and Sphere of Influence, including specific development as part of the Lockeford Vista, historically considered Lockeford Oaks, and Kautz Project developments.

Infill development may also occur as a result of intensified levels of development on already developed lands, e.g., development of underutilized land in the District's Service Area, or development on otherwise vacant land within the current District service area. This Master Plan did not include infill due to intensification of development, e.g., additional or expanded development on already developed parcels. Infill development was considered to occur within the current District service area based on already subdivide parcels and residential and commercial land uses that may be served by the District.

Recent historical District population statistics for the years of 2010 to 2020[3] indicate an overall growth rate in population of 0.9% per year. Assuming a continuation of recent annual growth rate trends, the future Lockeford population is expected to continue to grow at 0.9% per year. Using this rate of population growth, the 30-year future District population is estimated to increase by approximately 930 residents, with a 30-year future population projection reaching 3,946 residents. Considering the planned development projects listed in Table 1-3, much of this potential population growth could occur as a result of buildout of these developments.

Identified new development has the potential to add an estimated 885 additional single family, low density residential equivalents units. Excluding commercial development and assuming an average occupancy of 2.75 people per housing unit[4], the population of the future development could be approximately 2,434. This future potential population increase as a result of new development represents an approximately 81% increase in the Lockeford current estimated population of 3,016, to a total of 5,450. Since the capacity of the developments exceeds the estimated population growth beyond a 30-year horizon, some projects or their buildout and occupancy may not occur within a 30-year timeframe.

Table 1-3
Estimated Flow Contribution from Planned Development Projects

Development Project	Potential Population Contribution (1)	Wastewater Flow Contribution (2) (Mgal/d)
Kautz Property	1,155	0.07
Lockeford Vista	437	0.03
Lockeford Oaks	841	0.05
Total	**2,433**	**0.15**

(3) Population estimated based on 2011 – 2020 average occupancy of 2.75 people per housing unit.
(4) Wastewater flow estimated based on 62 gpcd as evaluated in Section 4.0 of the Flows and Loads Tech Memo.

Although it is uncertain when infill development within the service area will occur, wastewater generation due to service area buildout is expected to proceed based on factors presented in Table 1-4. The infill of the remaining service area is projected based on current zoning. Additional wastewater flows may occur if changes to current zoning occurs, or if the SOI is amended. However, zoning and potential future land uses within the SOI are predominantly industrial and therefore the sanitary sewer flows from these land uses will likely be limited

[3] US Census data obtained from ESRI Vintage 2020 Time Series (2010 thru 2020) for Census Tract 47.01.
[4] US Census 2011-2020 persons per household in Census Tract 47.01.

depending on future characteristics of specific industrial developments that occur. For this Master Plan analysis, it is recommended that future industrial discharges (if any) be considered on a project-by-project basis.

Table 1-4
Wastewater Generation Factors for Buildout within Service Area

Land Use Type	Infill Gross Area (Acres)	New Development Area (Acres)	Non-Use [1] Development (%)	Avg Density (DU/Net Acre) [2]	Population Density (Capita/DU) [3]	FAR [4]	Wastewater Generation Factors (gpd/Net Acre) [5]	District Infill WW Flow (Mgal/d)	New Development WW Flow (Mgal/d)
Agriculture Urban Reserve	60	0	1%	0.1	2.5	0.01	16	0.001	–
General Agriculture	0	0	1%	0.2	2.66	0.01	33	0.000	–
Very Low Density Residential	12	0	30%	2	3.25	N/A	400	0.003	–
Low Density Residential	20	271.63 [6]	30%	4	2.75	N/A	680	0.010	0.15
Medium Density Residential	5	0	30%	10	2	N/A	1,240	0.004	–
Office Commercial [7]	0	0	30%	18	0.33	0.25	920	0.000	–
Community Commercial	0.3	0	30%	N/A	N/A	0.25	1,056	0.000	–
General Commercial	12	0	30%	N/A	N/A	0.25	1,056	0.009	–
Public Facilities	12	8.5 [8]	30%	N/A	N/A	0.25	850	0.007	0.01
Limited Industrial	0	27 [8]	30%	N/A	N/A	0.25	1,056	0.000	0.02
General Industrial	20	102 [8]	30%	N/A	N/A	0.25	1,056	0.015	0.08
								Total: 0.05	Total: 0.26

(1) Nonuse includes roads and other land uses that do not contribute to wastewater generation.
(2) San Joaquin County General Plan, Pgs. 69 - 120, were used for reference Dwelling Unit land use density ranges.
(3) Population density estimated based on 2 people per DU for medium density residential, 2.75 people per DU for low density residential and 3.25 people per DU for very low-density residential land use, as a means to allocate population among these differing land use types.
(4) FAR = Floor Area Ratio, the gross floor area permitted on a site divided by the total net area of the site. A site with 100 sq. ft. of land area with a FAR of 0.25 will allow a maximum of 25 sq ft of building floor area to be built.
(5) Wastewater generation factors for residential DUs are estimated for typical 62 gpcd discussed in Section 4.0 of the Flows and Loads Technical Memorandum.
(6) Low density residential area includes a total of 271.63 acres for the Kautz Property, Lockeford Vista and Lockeford Oaks planned development project areas shown in Figure 2 of the Flows and Loads Technical Memorandum in Appendix A.
(7) Office Commercial land use is assumed 80% commercial and 20% residential development
(8) New development areas include public facility and industrial areas within the SOI but outside the Service Area.

Add'l ADWF: 0.31 Mgal/d
Current ADWF: 0.19 Mgal/d

Buildout ADWF: 0.50 Mgal/d

Future wastewater flows and loads are expected to occur as a result infill development, new development of the District's identified development projects and connection to areas outside the current Service Area but within the SOI (identified as new development in addition to the specific developments listed in Table 1-3). No new types of industrial discharges are known to be planned; therefore, future sanitary sewer flows from industrial land uses are assumed to be consistent with historical discharges. Consequently, future increases in flows and loads are expected to result only from new residential, commercial, and industrial land use-based sanitary sewer discharges development occurring within the District's service area and SOI. For identifying and evaluating facilities the basis of future flows and loads to the WWTP is recommended to be based on full build-out development of new development projects, which may drive increases in future population growth above what is expected to occur based on historical population growth rates. These future flows and loads are based on the following criteria:

1. A wastewater generation factor of 62 gallons per capita per day (gpcd), as supported by Appendix A.
2. BOD unit generation of 0.14 lbs per person per day, as supported by Appendix A; and
3. TSS unit generation of 0.17 lbs per person per day, recommended based on a typical ratio of TSS/BOD of 1.2.

Table 1-5 presents the recommended Master Plan planning criteria based on historical District monitoring data and a buildout projection of flow to 0.50 Mgal/d, which represents a buildout population of approximately 8,000 residents based on average wastewater generation of 62 gpcd. This population projection is consistent with and exceeds infill development that may occur within the existing service area limits and an orderly progression of identified future development within the District's SOI based on General Plan land use. The below recommended criteria are also based on current flows and loads continuing similar to 2018 through 2020 average flows and loads.

Table 1-5
Recommended Master Planning Criteria

Wastewater Characteristic	Units	Planning Criteria
Flows		
ADWF	Mgal/d	0.50
Peak Month Peaking Factor	Unitless	1.2
Peak Day Peaking Factor	Unitless	3.1
Peak Hour Peaking Factor (1)	Unitless	3.6
Loads		
BOD		
Average BOD Daily Load	Lbs/d	1,106
BOD Peak Month Peaking Factor	Unitless	1.6
BOD Peak Day Peaking Factor	Unitless	1.8
TSS		
Average TSS Daily Load	Lbs/day	1,307
TSS Peak Month Peaking Factor (2)	Unitless	1.6
TSS Peak Day Peaking Factor (2)	Unitless	1.8
Nitrogen		
Average TKN Daily Load (3)	Lbs/day	231
TKN Peak Month Peaking Factor (3)	Unitless	1.6
TKN Peak Day Peaking Factor (3)	Unitless	1.8

(1) Peak hour peaking factor adapted from 10 States Standards Recommended Planning Criteria: $PF_{PH} = \frac{18+\sqrt{P}}{4+\sqrt{P}}$, where PF_{PH} is the peak hour peaking factor, and P is the community population in thousands. An additional 5% factor of safety has been applied.
(2) Peaking factors for TSS based on BOD peaking factors.
(3) Because of limited nitrogen data, a unit TKN (Total Kjeldahl Nitrogen) load factor of 0.029 pounds per capita per day was assumed based on a typical ratio of TKN/BOD of 0.21.
(4) Peaking factors for TKN assumed based on BOD peaking factors.

Section 2
Overview of Existing System

The existing wastewater collection system, treatment and disposal facilities are described and evaluated in the sections below.

2.1 COLLECTION SYSTEM

Current collection of wastewater within the District service is primarily through gravity sewers that drain to two main pump stations. Gravity sewers serve specific sewer shed regions, areas of land in which flows drain into the same place, with the two sewer-sheds ultimately draining to either the Locke Road Pump Station or the Bear Creek Pump Station. Flows to these pump stations are then pumped to the treatment facilities located at the southwest corner of Brandt and Tully Road via asbestos cement 6-inch or 8-inch force mains. A portion of the force main is shared between the Locke Road and Bear Creek Pump Stations. Figure 2-1 shows the collection system with existing gravity sewer service areas, gravity sewer lines, force mains, and pump stations. Two additional pump stations are located within the Locke Road Pump Station sewer shed. One of these pumps serves the small Lockehaven subdivision at the north end of the community with discharge into the gravity sewer line and the other serves the Miravista Lane development and discharges into the nearby gravity sewer line. For the purposes of future expansion analysis in Section 3, the two satellite pumps, Lockehaven Pump Station and Bluff Drive Pump Station, contribute only flows from these local areas and their future expansion is not anticipated to be needed.

Flows originating within the Locke Road Pump Station sewer shed are primarily due to residential flows with approximately 15% of flows from industrial, agriculture, commercial, and public facilities land uses. Bear Creek Pump Station sewer shed flows are almost exclusively from residential land uses. Appendix B details the estimated existing flow contribution from these two sewer sheds.

2.1.1. SEWER SHEDS AND FLOWS TO PUMP STATION

Gravity sewer lines within the District are primarily 6-inch with 8-inch lines serving as trunk-type collectors. Limited information is available regarding the condition of the existing gravity sewer lines and a program of routine Closed Circuit Television (CCTV) inspection is recommended to track sewer condition. Per the District's 1998 Master Plan, the two main existing pump stations have the following characteristics shown in Table 2-1. Both pump stations were upsized in 1977 to allow for a longer force main pipeline to the current treatment plant site. Currently, the total system conveyance capacity is limited by the Locke and Bear Creek pumps stations. The 1998 Master Plan states that the capacities of both pump stations are exceeded during Peak Wet Weather Flow (PWWF) conditions, specifically in the heavy El Nino rains of the winter of 1996/1997; however, the plan states that such heavy rain situations are accommodated for via the significant surcharge storage capacity that exists in upstream trunk links and manholes. Pipes and pumps that do not have sufficient capacity during PWWF can produce backwater effects within the collection system that could lead to sanitary system overflows (SSO). SSOs should be avoided and a reduction in system storage that would be the result of a power failure could exacerbate an overflow hazard. As such, the 1998 Master Plan recommended additional standby power equipment to improve reliability of the system and reduce the risk of a sanitary system overflow.

The Bear Creek Pump Station, as it exists today, is also limited by the wet well dimensions, five feet in diameter, and the limited pump station site being bound by private property on three sides and N Tully Rd right-of-way on the fourth. Because of these site constraints, expansion of the Bear Creek Pump Station is not practicable. Therefore, as expansion of the existing system is considered, replacement of the Bear Creek Pump Station is proposed as described in Section 3.

Flows to the Locke Road Pump Station during PWWFs are reported to have the potential to overwhelm the pumping capacity, resulting in both of the two pumps having to operate to accommodate inflows. As such, expansion to accommodate existing system flows should be considered in the near-term. The District's 1998 Master Plan describes the location, configuration, and limitations of both the Locke Road Pump Station and Bear Creek Pump Station in detail and recommends expanding the Locke Road Pump Station should additional development lead to flows beyond the 1998 conditions. Figure 2-1 shows the District's collection and pump station system as it currently exists. Although the Locke Road and Bear Creek Pump Stations have the above-described limitations, they are maintained in good condition and could otherwise provide service to the District into the near future.

Table 2-1
District Existing Main Pump Station Characteristics

Pump Details	Pump Station	
	Bear Creek	Locke Road (Main)
Manufacturer	Smith and Loveless	Smith and Loveless
Number of Pumps	2	2
Capacity (gpm at feet TDH)		
One Pump	175 @ 51	275 @ 131
Two Pumps	185 @ 53	285 @ 137
Motor Horsepower	7 1/2	20
Pump Suction Size (inches)	6	6
Pump Discharge Size (inches)	4	4
Trunk Inlet Invert Elevation (USGS)	88.5	69.5
Wet Well Low-Level Elevation (USGS)	85	66
Wet Well Diameter (Feet)	5	4

A pipeline inventory conducted in 1998 Master Plan describes the year, material, and condition of the existing collection system. Older gravity sewers and force mains are composed of vitrified clay and asbestos cement, respectively, while more recently installed gravity sewers are composed of polyvinyl chloride (PVC). As expected, the condition of older gravity sewers is listed as fair/good compared to the good condition of new installations. As outlined in the previous 1998 Master Plan, infiltration into the collection system is expected to be low within the service area even with the presence of older pipeline infrastructure because current water table is well below the sewer system elevation. Such infiltration, therefore is expected to be limited, but is likely to exist to a measurable extent. Infiltration and Inflow (I/I) flows are primarily from inflows which enter the sewer system as a result of surface drainage into manholes, illegal connections, uncapped cleanouts, broken pipe crossing drainage courses, etc. Expansion of facilities capacity is likely a more cost effective solution for handling PWWF events than targeted I/I flow reduction measures given the expected groundwater conditions in Lockeford and low degree of infiltration. Collection system flows have been recorded as high as 0.57 Mgal/d for one day (January 2, 1997) and was recorded as 0.33 Mgal/d for an entire one-month period (January 1997). More recently, the two largest recent peak day influent flows were 0.52 Mgal/d (January 2017) and 0.45 Mgal/d (February 2017).

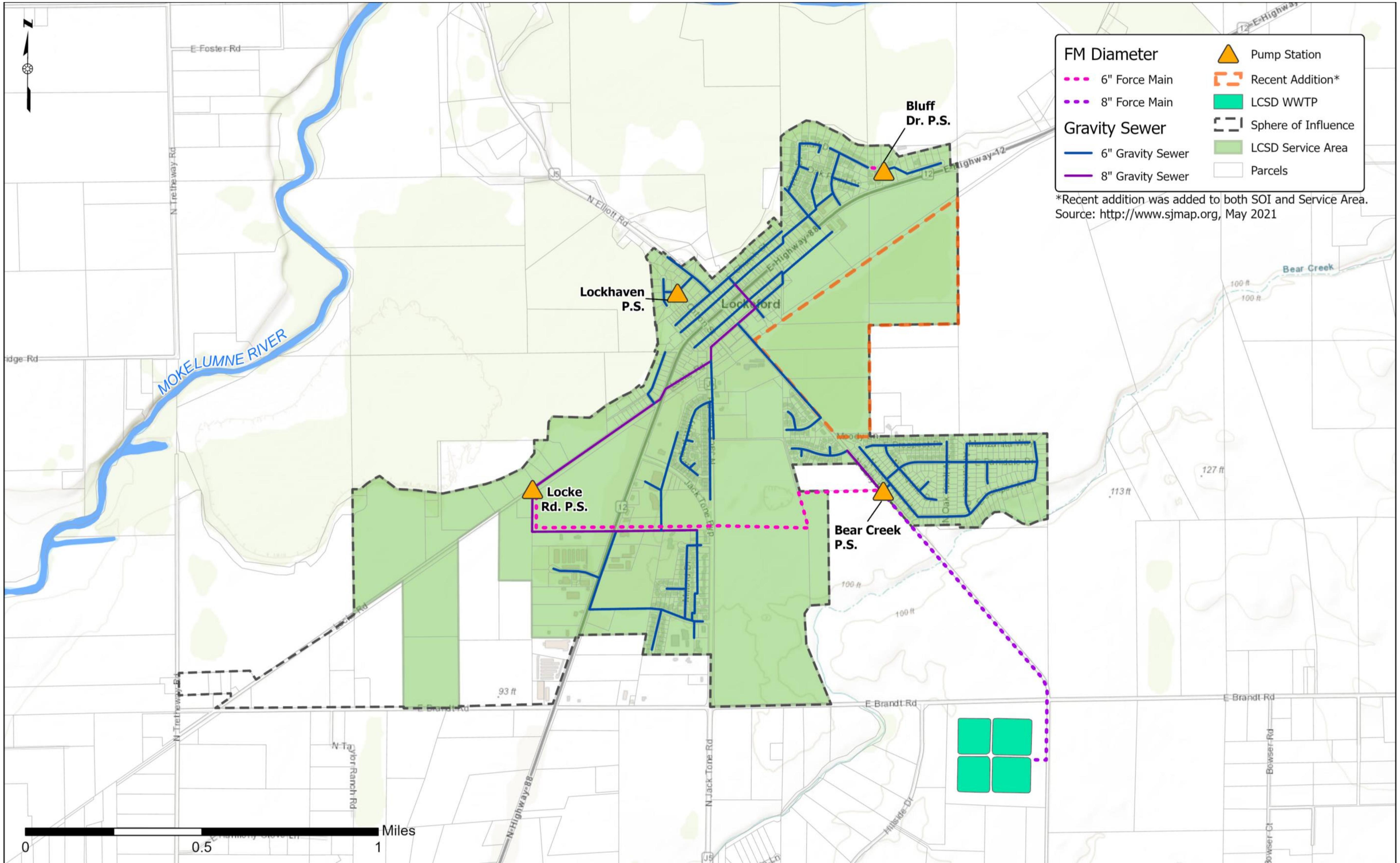

Figure 2-1
District Existing Sewer Collection System

On a relative basis, with respect to the District's recorded ADWF of 0.19 Mgal/d, this total flow was distributed based on the estimated expected relative contribution from each existing land use type as a means to assess flow contributions within the sewer system sewer sheds. Estimated influent flow values for both the Bear Creek Pump Station sewer-shed and Locke Road Pump Station sewer-shed were then calculated by summing distributed flows within their respective sewer shed. In determining the PWWF, a factor of 3.6 was multiplied by the ADWF. For further details, refer to the calculations shown in Appendix B. Based on a peak hourly peaking factor of 3.6, PWWF is estimated in Table 2-2 for the two primary pump station sewer-sheds.

Table 2-2
Existing Land Flow Contributions to District's Main Pump Stations

Pump Station	Land Use Type	Parcel Count	Acreage	ADWF [gal/d]	PWWF [gal/min]	PWWF in Sewer Shed [gal/min]
Bear Creek PS	Low Density Residential	554	53.5	55,693	139	139
Locke Rd. PS	Agriculture Urban Reserve	54	5.6	52	0	
	Community Commercial	131	23.6	10,297	26	
	General Agriculture	8	0.4	7	0	
	General Commercial	77	13.7	5,985	15	
	General Industrial	1	0	0	0	
	Limited Industrial	45	14.0	6,103	15	
	Low Density Residential	1014	101.2	101,936	255	
	Medium Density Residential	58	21.4	4,240	11	
	Office Commercial	19	1.8	677	2	
	Public Facilities	37	6.2	2,159	5	
	Very Low Density Residential	24	4.7	2,851	7	336

Approximately 30% of the 0.19 Mgal/d WWTP influent ADWF is estimated to originate from the Bear Creek Pump Station at 200,494 gallons per day, with the remaining 70% originating from the Locke Road Pump Station at 483,408 gallons per day. The estimated PWWF contributions to these pump stations are 139 gpm for the Bear Creek Pump Station and 336 gpm for the Locke Road Pump Station. In comparing the pump station reported reliable capacity as listed in Table 2-1 to the estimated PWWF in Table 2-2, this affirms reported limits of the Locke Road Pump Station to being able to accommodate current PWWF. The existing Bear Creek Pump Station appears to have reliable capacity, at 175 gpm, exceeding the estimated PWWF contribution to this pump station.

It is recommended that existing pumping deficiencies in the Locke Road Pump Station be addressed now and as expansion and development of the District continues additional capacity provided as needed. Section 3 addresses system improvements required for the collection system as development and infill take place.

2.2 TREATMENT PLANT AND DISPOSAL FACILITIES

The existing WWTP consists of an aerated treatment pond, and three effluent storage basins as shown in Figure 2-4. The treatment pond and three storage basins, together with the District administrative office and maintenance facilities, are located on a 53-acre site south of Brandt Road and West of Tully Road. A remote storage basin is located on a 20-acre parcel owned by the District approximately 1,500 ft southwest of the treatment site. Effluent disposal is handled by irrigation of pasture grasses on an adjacent 116-acre parcel also owned by the District, called Reclamation Area No. 1. A second area near the wastewater treatment plant was purchased for expansion as Reclamation Area No. 2, however infrastructure has not been constructed to allow its use. Disposal operations are conducted under a pasture irrigation means of disposal. The existing treatment and disposal facilities referenced herein are presented in a general orientation in Figure 2-2.

Figure 2-2
General Existing Treatment and Disposal Facilities Layout

2.2.1. Influent Flow Measurement

Influent flow to the WWTP is currently measured by a 6-inch closed pipe ultrasonic-type flow meter. The meter has an operating range of 90 to 2,200 gpm (~3.2 Mgal/d). Current peak hour flows estimated from the peak hour peaking factor and the current ADWF in Section 1.2.2 is approximately 0.68 Mgal/d or 475 gpm.

The raw sewage force main and plant inlet piping terminate in a 5-foot diameter flow splitter box, located at the east end of the embankment between the easterly two ponds (T-1 and S-3). The splitter box is provided with gated outlets to send raw sewage and plant recirculated flow to the treatment pond, or to bypass raw sewage to any of the other three on-site storage ponds.

An 8-inch line is provided to allow raw sewage to bypass both the influent meter box and the splitter box and flow directly into the aeration treatment pond. This capability has been provided in case of necessary repair or maintenance in the influent meter box and/or the splitter box.

2.2.2. TREATMENT POND

The single 6.5 acre treatment pond (T-1) operates at a nominal 6.3-foot depth, providing a theoretical detention volume of about 13.7 Mgal. However, only 6 of the 6.3 feet of depth can be manipulated using the outlet structure due to the lowest invert being above the pond bottom. Two 10 horsepower (hp) brush-style surface aerators are provided at the northwest and southeast areas of the ponds for supplemental aeration to meet the waste stabilization oxygen demand and consistently maintain 1.0 mg/L of dissolved oxygen in the upper one foot of the treatment pond. Design criteria for the existing treatment pond is summarized in Table 2-3.

Table 2-3
Existing Aeration Treatment Pond Design Criteria

Design Parameter	Units	Value
Area	Ac	6.5
Volume	Mgal	13.7
Number of Aerators	--	2
Aerator Power (Ea.)	Hp	10
Total Depth	Feet	8.8
Normal Operating Depth	Feet	6.3

Values based on the 1990 District WWTP O&M Manual

The effluent discharged from the treatment pond is required to meet the limitations from Waste Discharge Requirement (WDR) Order No R5-2007-0179 as presented in Table 2-4. The primary objective of secondary treatment via the aeration ponds is to reduce the effluent 5-Day Biochemical Oxygen Demand (BOD_5). Additionally, the treatment ponds are required to maintain a Dissolved Oxygen (DO) concentration of at least 1.0 mg/L in the upper 1 foot of the ponds to minimize odors.

Table 2-4
Treatment Pond Effluent Limitations

Constituent	Units	Monthly Average
BOD_5	mg/L	40
Total Nitrogen	mg/L	10
TDS	mg/L	550

BOD_5 denotes 5-day Biochemical Oxygen Demand.
Total N denotes Total Nitrogen.
TDS denotes Total Dissolved Solids.

An evaluation of the current peak month loading of T-1 has been conducted based on historical data as discussed in Section 2.2.1. The historical average monthly effluent grab sample concentrations of BOD_5 and Total Nitrogen (Total N) from July 2016 through January 2021 are presented in Figure 2-3. These grab samples are collected on a monthly basis from the outlet of the treatment pond (before entering pond S-1). Since average monthly effluent values have not exceeded the effluent limitation for either BOD_5 or Total N within the past four years, the existing treatment system performance indicates that it is adequately sized to meet the effluent limitations under current influent flow and loading conditions.

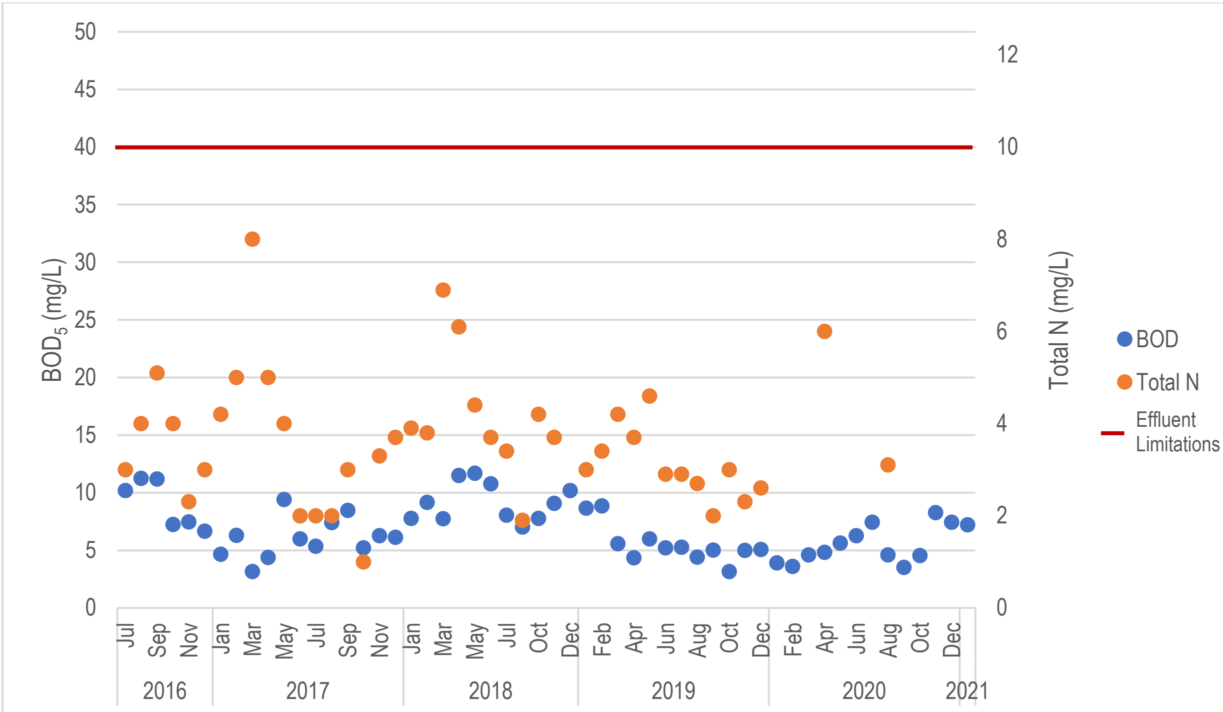

Figure 2-3
Average Monthly Effluent BOD_5 and Total N Concentrations

2.2.2.1. Treatment Pond Evaluation

The District's treatment pond was evaluated to assess its capacity to treat current and near-term influent flows under expected seasonal conditions. To evaluate the aeration system's ability to maintain compliance with the WDRs, the pond system was modeled as a Completely Mixed Batch Reactor under first order kinetics. While the pond may actually operate in a partially mixed condition, as is normal practice such systems are still conventionally modeled using the same kinetics and reactor conditions as would occur in a complete mix system. The pond evaluation was based on procedures outlined in US EPA Guidance, document 600/R-11/088, with BOD_5 reduction following first order kinetics given by Equation 1, and Equation 2 below.[5]

[5] US EPA, 2011, *Principles of Design and Operations of Wastewater Treatment Pond Systems for Plant Operators, Engineers, and Managers*, EPA National Risk Management Research Laboratory, Cincinnati, OH.

$$BOD_e = BOD_i \left[\frac{1}{1 + \left(\frac{k_T t}{n} \right)} \right]^n$$

Equation 1
(First Order BOD_5 Removal Kinetics)

Where:

BOD_e = Effluent BOD_5 concentration in cell n, mg/L
BOD_i = Influent BOD_5 concentration, mg/L
k_T = first order reaction rate constant, d^{-1}
t = total hydraulic residence time in pond system, d
n = number of cells in the series

$$k_T = k_{20}\theta^{T_w - 20}$$

Equation 2.
(Temperature Adjusted Reaction Rate Constant)

Where:

k_T = Reaction rate at temperature T, d^{-1}
k_{20} = Reaction rate at 20 ^oC, d^{-1}
θ = Arrhenius temperature coefficient, 1.036
T_W = Temperature of pond water (ambient temperature), ^oC

Equation 1 is well established as a conservative reaction model for aerated treatment pond with the rate of reaction decreasing as the BOD loading decreases.[6] Equation 2 serves as a temperature adjustment to the reaction rate at various ambient conditions.

The following assumptions were made as part of the evaluation of the aeration system:

- Reaction rate at 20 °C has been assumed to be 0.2763 /d;
- Arrhenius temperature coefficient is assumed to have a value of 1.036;[7]
- Residence time of water initially contained in the pond is the estimated volume divided by the flow rate and no recirculation dilution is occurring;
- T_w was assumed to be the average ambient temperature during the time period evaluated;
- Standard Aerator Efficiency (SAE) is assumed to be 3.0 lb O_2/Hp-hr,
- Actual Aerator efficiency is assumed to be 60%;
- O_2 to BOD_5 ratio for complete digestion is 1.4 lb O_2/lb BOD_5.
- The digestion of BOD_5 is assumed not to be limited with respect to dissolved oxygen; and
- The system is constantly, and completely mixed.

Based on historical data, it is unlikely that peak month flows and peak month loading will overlap within the same month. Instead, these two events are likely to occur approximately 4-6 months apart from each other, with peak month flows typically occurring December through April, and peak month loading happening in June through November. Peak month flows and loads for 2018 occurred in December and November, respectively, which is not typical compared to other years from 2016 through 2020. The months in which peak month flows and loads have occurred are presented in Table 2-5.

[6] Middlebrooks, E.J., et al., 1982. *Wastewater Stabilization Lagoon Design, Performance and Upgrading*, McMillan Publishing Co., New York, NY.
[7] Crites, R.W., Middlebrooks, E.J., and Reed, S.C., *Natural Wastewater Treatment Systems*, Taylor & Francis Group, Boca Raton, FL.

Table 2-5
Peak Flow and Load Typical Monthly Occurrences

Event	Month of Occurrence				
	2016	2017	2018	2019	2020
Peak Month Flows	March	January	December	February	April
Peak Month Loads	August	June	November	October	August

Considering the historical data indicating that the peak month flows and loads occur in different months, typically 4-6 months apart, two scenarios have been evaluated for the aeration system as follows:

1) Peak month loads at ADWFs; and
2) Peak month flows at average BOD_5 influent concentrations.

The results of these two scenarios are presented in Table 2-6, which indicate that peak month loading at ADWFs are the limiting scenario for the treatment system due to the higher expected BOD_5 effluent concentration.

Table 2-6
CSTR Model Results of T-1 Existing Conditions

Calculation	Units	Peak Month Loads At 0.19 Mgal/d ADWF (August Conditions)	Peak Month Flows At Avg BOD_5 (December Conditions)
INPUTS			
Total Monthly Flow	Mgal	5.890	7.068
Avg Daily Flow	Mgal/d	0.20	0.24
Temperature	Deg C	21.6	6.1
Influent BOD_5 Concentration	mg/L	424	265
Influent BOD_5 Loading	lb/day	695	521
POND T-1 RESULTS			
Pond T-1 Total Volumetric Capacity	Mgal	13.7	13.7
Hydraulic Residence Time	Days	72	58
Pond T-1 Expected Effluent BOD_5 Concentration	mg/L	19	25
Pond T-1 Expected DO Demanded	lbs	27,858	19,839
Aerator Power Required	hp	21	15

Based on the evaluation results, the District treatment system appears to be able to handle existing peak flows and loads. Under the peak loading scenario, the aeration system power of 20 hp may be marginally undersized compared to the 21 hp required in the peak month calculation. However, it is important to note the calculation assumes the pond is completely mixed. With the pond being partially mixed, and adhering to the requirement to maintain a DO concentration of 1.0 mg/L in the upper 1 foot of the pond, it is expected that existing aeration system can meet the peak month demands at its current power.

The calculations in Table 2-6 are based on the peak month loading not occurring during the same month as the peak month flows. With these conditions, it is expected that the aeration system may be able to meet current effluent limits up to an ADWF of 0.23 Mgal/d. However, as development occurs, timing of peak flows and BOD_5 loading conditions may change and a higher combined flow and load may occur within the same month. Therefore, it is recommended that sizing criteria of treatment alternatives for future expansion be based on the peak flows and loads occurring in the same month. It should be noted that the 1990 District Operation and Maintenance (O&M) Manual indicates that the design capacity for the WWTP is 0.34 Mgal/d ADWF (however under different permit conditions) and the current ADWF of 0.19 Mgal/d within the WWTP capacity.

2.2.3. STORAGE BASINS

There are currently three onsite storage ponds (S-1 through S-3) at the WWTP and one remote storage pond located approximately 1,500 feet south of the WWTP. The storage ponds retain the treated effluent from the aeration treatment pond during the non-irrigation season, typically from April 1st through October 31st. The onsite storage ponds are located as depicted in Figure 2-4.

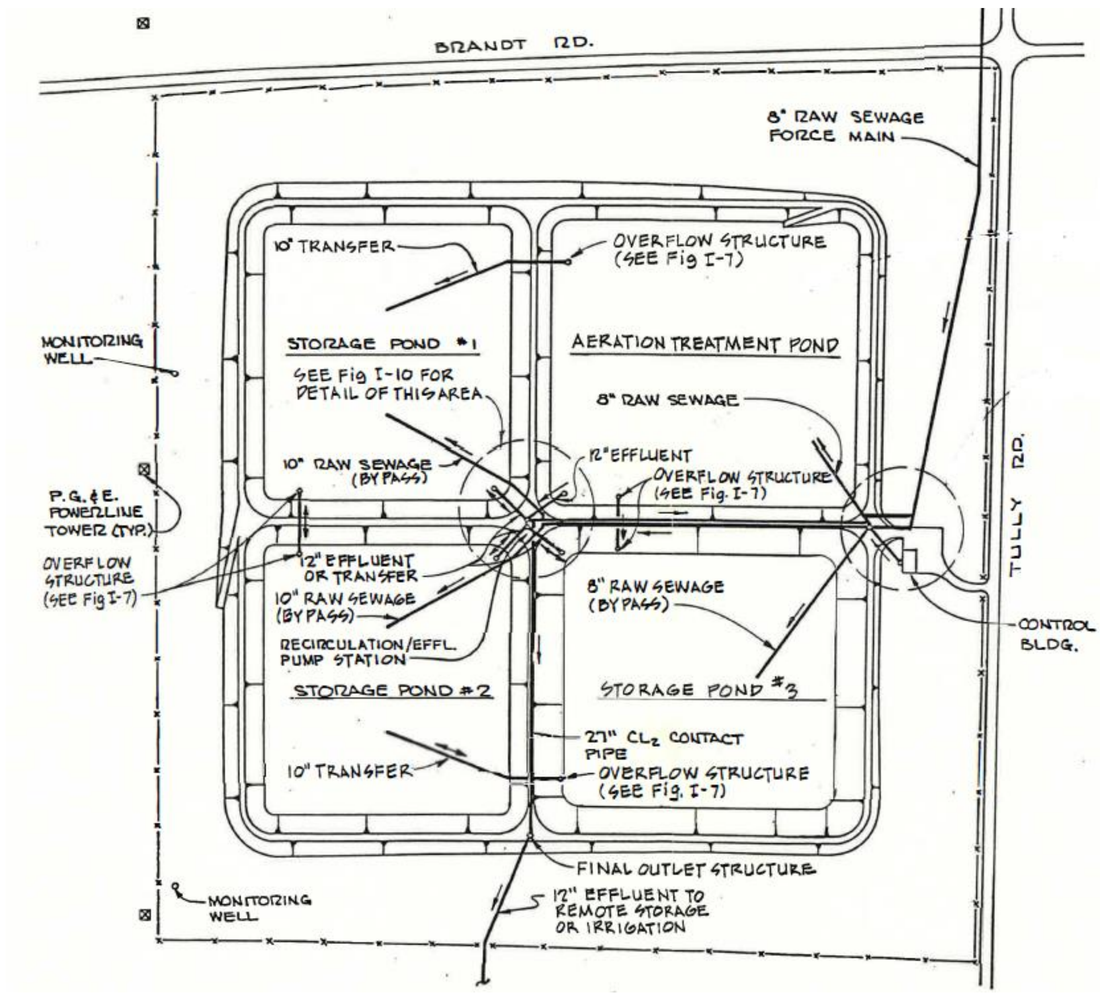

Figure 2-4
WWTP Onsite Treatment and Storage Pond Facilities

Three pond overflow structures are provided to enable flow from T-1 to storage pond no. 1 (S-1), storage pond no. 3 (S-3), or the recirculation/effluent pump station. Overflow to the recirculation/effluent pump station is provided to enable mixing of pond effluent with raw sewage to improve treatment efficiency and/or to bypass the on-site effluent storage ponds as necessary. Flow can also be directed to storage pond no. 2 (S-2) through the recirculation/effluent pump station. The overflow structures are flashboard riser type design, utilizing removable

2x6 weir boards for control of pond liquid depth. The design criteria of the storage ponds are contained in Table 2-7, indicating a total system storage capacity of approximately 90 Mgal.

Table 2-7
Existing Storage Pond Design Criteria

Design Parameter (1)	Units	Pond S-1	Pond S-2	Pond S-3	Remote Storage	Total
Area	Ac	5.5	5.5	6.5	12	**29.5**
Operational Volume	Mgal	16.5	16.5	19	39	**91**
Total Depth	Feet	11.3	11.3	11.3	12.4	--
Normal Operating Depth	Feet	0 – 9.3	0 – 9.3	0 – 9.3	0 – 10.9	--

(1) Values based on the 1990 DISTRICT WWTP O&M Manual

2.2.4. Effluent Disinfection System

Effluent disinfection is employed when effluent is conveyed to the remote storage pond through chlorine injection and contact provided by the effluent piping's 500 ft long, 27-inch diameter reinforced concrete pipe located between storage ponds S-2 and S-3. The existing WWTP chlorination system is housed in the chlorine room of the control building, and includes provisions for chlorine gas supply from 150-lb cylinders to two manually set and adjusted wall mounted gas chlorinators. Space for up to six 150-lb cylinders is available and the system's chlorination capacity is 100 lb/day. The chlorinators, along with solution injectors, offer dosing of chlorine to the two application points, which are at the influent meter box and the effluent meter box.

2.2.5. Effluent/Recirculation Pumps

There are two effluent pumps on the WWTP site that are used to convey plant effluent to the remote storage pond for irrigation or seasonal storage. The effluent pumps can also be used for recirculation of effluent to the influent splitter box. Effluent pumping consist of two submersible sewage pumps, each of which are mounted in their own individual 5-foot diameter sump located in the embankments at the central point between all four WWTP ponds. Effluent pumping to Reclamation Area No. 1 typically occurs between April 1st through October 31st when water is requested from the farmer, or when the WWTP requires disposal during wet years. Recirculation is typically utilized to improve plant treatment performance by diluting the influent raw sewage to reduce the organic loading on the aerated treatment pond. The design criteria for the existing effluent pump station is presented in Table 2-8.

Table 2-8
Existing Effluent Pump Station Design Criteria

Design Parameter	Units	Value
Pump Type	--	Submersible Sewage
Make & Model	--	Flygt ENH-10
Motor Size (Ea.)	Hp	20
Number of Pumps	--	2
Design Point 1	As noted	750 gpm @ 25 ft TDH
Design Point 2	As noted	1,200 gpm @ 15 ft TDH
Drive Type	--	Constant Speed
Operation Type	--	Manual
Instrumentation	--	Float Switches

Values based on the 1990 District WWTP O&M Manual

Each pump was originally selected to meet 1.25 times the peak irrigation month demand during the disposal season. The submersible pumps are able to be expanded to approximately 1,000 gpm at 50 ft TDH by a change of the impeller without additional changes to motors or starters, etc.

The effluent flow meter at the plant is capable of measuring flows from 160 to 3,900 gpm. This capacity is sufficient to accommodate future flows and treatment and disposal alternatives discussed in Section 3. The existing flow meter system and chart recorder are calibrated for 0 – 1,000 gpm, and would have to be recalibrated if future flows rise above 1,000 gpm.

2.2.6. Remote Storage Transfer Pumps

The remote storage transfer pump station comprises two pumps that are both mounted in a shared 6-foot diameter sump and provide water to the irrigation disposal area from the remote storage pond. Based on the same criteria as the effluent/recirculation pumps, the remote storage transfer pumps should be able to transfer approximately 1.25 times the peak month demand to the irrigation area. The existing design capacity of the remote transfer pump station is presented in Table 2-9.

Table 2-9
Existing Remote Storage Pump Station Design Criteria

Design Parameter (1)	Units	Value
Pump Type	--	Submersible Sewage
Motor Size (Ea.)	Hp	5
Number of Pumps	--	2
Design Point 1	As noted	500 gpm @ 22 ft TDH
Design Point 2	As noted	700 gpm @ 15 ft TDH
Drive Type	--	Constant Speed
Operation Type	--	Hand – Off – Auto (Auto never used)
Instrumentation	--	Float Switches (2)

(1) Values based on the 1990 District WWTP O&M Manual
(2) The transfer pump station was equipped with a control panel with space for future VFD capabilities.

2.2.7. Electrical System

The primary plant electrical service is 220V, 3-phase, 60Hz provided by the Pacific Gas and Electric Company (PG&E). The existing 400-amp electrical service is adequate for existing flows and equipment, however any increased horsepower in aeration or treatment or additional levels of treatment are likely to require an upgrade to in electrical service.

2.2.8. Irrigation Disposal Area

Irrigation disposal is accomplished at Reclamation Area No. 1 with operations conducted under a contract between the District and a private party providing ranch management. The existing underground piped irrigation system is supplied effluent by the WWTP transfer pump stations through the common discharge pipeline.

Irrigation is accomplished by manual opening of alfalfa valves that allows overland flow flooding of 50-foot wide checks. A runoff recapture system is provided.

2.2.8.1. Storage and Disposal Evaluation

Monthly waterbalance calculations were prepared for the existing WWTP to estimate the existing capability to contain and dispose of effluent consistent with average-year and 1-in-100 year evapotranspiration and climatological conditions. Disposal capacity of theses facilities has been estimated based on the historical waterbalance calculations prepared for the updated WDRs. Wastewater treatment pond and percolation pond area and volumetric capacities have been estimated as consistent with the stage-storage curves from the 1990 WWTP O&M Manual. Detailed waterbalance calculations are contained in Appendix C and assume system operation conforming to the Discharge Specifications No. 1, 11, 13, 14, and 15, and Water Recycling Specifications 8, 9, and 11 of WDR R5-2007-0179 as follows:

Discharge Specifications:

Discharge Specification No. 1: *"The monthly average flow rate may not exceed 300,000 gpd..."*

Discharge Specification No. 11: *"All treatment and storage facilities shall be designed, constructed, operated, and maintained to prevent inundation or washout due to floods with a 100-year return frequency."*

Discharge Specification No. 13: *"The facility shall have sufficient treatment, storage and disposal capacity to accommodate allowable wastewater flow, design seasonal precipitation, and ancillary inflow and infiltration. Design seasonal precipitation shall be based on total annual precipitation using a return period of 100-years, distributed monthly in accordance with historical rainfall patterns."*

Discharge Specification No. 14: *"Freeboard in any pond containing wastewater or recycled water shall never be less than two feet as measured from the water surface to the lowest point of overflow."*

Discharge Specification No. 15: *"On or about 15 October of each ."*

Water Recycling Specifications:

Water Recycling Specification No. 8: *"Application rates for recycled water shall not exceed nitrogen and water uptake rates considering the plant, soil, climate, and irrigation management system in accordance with the water balance submitted with the RWD."*

Water Recycling Specification No. 9: *"Irrigation runoff (i.e., tailwater) shall be completely contained within the designated land application area and shall not enter any surface water drainage course or stormwater drainage system."*

Water Recycling Specification No. 11: *"Irrigation of land application areas with recycled water shall not be performed within 24 hours of a forecasted storm, during or within 24 hours after any precipitation event, nor when the ground is saturated."*

Three scenarios have been evaluated under average and 1-in-100 year climatological conditions, including:

Scenario 1. The current ADWF of 0.19 Mgal/d.

Scenario 2. Wastewater flows were approximated at the maximum permitted flow of 0.30 Mgal/d.

Scenario 3. The estimated maximum capacity of the existing wastewater storage and disposal facilities (0.39 Mgal/d).

It is expected that the WWTP will have storage and disposal capacity to accommodate the influent wastewater throughout the water-year at the current ADWF of 0.19 Mgal/d (annual total wastewater volume of 71 Mgal). Under the maximum flow conditions, the max permitted flows of 0.30 Mgal/d are expected to be able to be stored and disposed of in accordance with R5-2007-0179 permit conditions. At an ADWF up to 0.39 Mgal/d, and during 1-in-100 year climatological conditions, it is expected that all wastewater can be stored and disposed using the existing storage and disposal facilities without a net annual gain. Since the actual influent flows for the facility are much less than the maximum permitted capacity, the system is expected to have sufficient storage disposal capacity to accommodate near-term disposal operations. The results of waterbalance model calculations under these scenarios are summarized in Table 2-10, with calculations contained in Appendix C.

Table 2-10
Summary of Existing Storage and Disposal Facility Waterbalance Calculations

Performance Characteristic	**Current ADWF (0.19 Mgal/d)**		**Max. Permitted Flow (0.30 Mgal/d ADWF)**		**Estimated Max. Capacity (0.39 Mgal/d ADWF)**	
Climatological Conditions	1-in-100 Year	Avg Year	1-in-100 Year	Avg Year	1-in-100 Year	Avg Year
Annual Wastewater Volume (Mgal)	71	71	112	112	149	148
Precipitation Volume (Mgal)	24	13	24	13	24	13
Evaporation Volume (Mgal)	36	38	36	38	36	38
Irrigation Volume (Mgal)	71	63	102	99	129	118
Potential Percolation Volume (Mgal)	7	7	7	7	7	7
Total Annual Inflow (Mgal)	94	83	136	125	171	160
Total *Potential* Annual Outflow (Mgal)	159	188	172	207	172	207
Unused Disposal Capacity (Mgal)	65	105	36	82	1	47
Maximum Storage Required (Mgal)	45	25	66	40	89	55
Unused Storage Capacity (Mgal)	46	66	25	51	2	47

Section 3

Evaluation of Expansion Plan and Alternatives

This Section presents the potential expansion plans to accommodate future flows and loads through both the collection system and the WWTP treatment and disposal systems. Collection system improvements are planned as a modified continuation of the 1998 Master Plan improvements. Therefore, only one series of collection system improvements are planned to be considered for the alternatives analysis. However, multiple alternatives for the WWTP treatment and disposal systems are considered, including continuations of existing levels of treatment and disposal as well as recycled water production and disposal options.

3.1 COLLECTION AND CONVEYANCE SYSTEM

This section evaluates and identifies the future staged improvements needed in the collection and conveyance system to serve new development within the District and District SOI. Figure 3-1 shows the existing collection and conveyance facilities in the existing service area and the proposed future improvements. The expansion of the collection and conveyance system can be achieved with the combination of improvements to gravity sewers, force mains and pump stations. In general, the improvements are staged to address existing system inadequacies while accommodating new flows due to planned development and future infill of existing developments. Due to the elevation of the WWTP, flows within the newly developed areas will need to be pumped after collection via gravity sewer. This situation is similar to the existing need for pumping of flows to the WWTP from the existing area served by the District's sewer system. Pump station locations, size, and piping are planned to meet typical pressure or head limitations and recommended force main velocities.

3.1.1. EVALUATION OF FUTURE FLOWS

Future flow estimates from each land use area were calculated in a similar manner to Table 9 of the Flows and Loads Memo in Appendix A. Residential wastewater generation used a 62 GPCD value based on recent historical values, and parcel counts, assumed per capita density per parcel that varied based on whether a parcel was zoned for very low density residential (3.25), low density residential (2.75), or medium density residential (2.00). Non-residential land use ADWF estimates were developed using specific land use wastewater generation factors in gallons per day per net acre with net acreage calculated using a non-use development percentage factor specific to the land use type. Projected flows and loads for the buildout of the Kautz Property, Lockeford Vista and Lockeford Oaks planned development were relied upon and are detailed in Section 6 of the Flows and Loads Memo. Total projected flows from Table 10 of the Flows and Loads Memo are reproduced in Table 3-1.

Table 3-1
Current and Estimated Future District Flows

Flow/Load Contribution	ADWF (Mgal/d)
Current	0.19
New Development within Current District Boundary	0.26
Service Area Infill, within SOI	0.05
Total Buildout Amount (rounded)	**0.50**

In a continuation of the system expansion logic of the previous 1998 Master Plan, flows related to system development were calculated on a pump station catchment basis for future development within the District and SOI. As stated above, these future flows were estimated by calculating the generated wastewater flows dependent upon the development's unique land use type make up. Staged improvements will be necessary to convey new flows and include new gravity sanitary sewers, improvement to existing pump stations, and develop new pump stations and associated force mains. Estimated flows pertaining to the staged improvements are outlined in Section 3.1.3.

3.1.2. CRITERIA FOR DEVELOPMENT

Planning criteria used to evaluate the existing system and the proposed improvements are listed in the sections below. Planning criteria cover pump stations, pipelines, and treatment and disposal facilities. These criteria are similar to what was used in the 1998 Master Plan.

3.1.2.1. Collection System Pump Stations

Table 3-2 lists the pumps station planning criteria for planning of the staged collection system improvement.

Table 3-2
Pump Station Planning Criteria

Item	Description
Type of Structure	Prefabricated dry pit with separate wet well, or submersible
Type of Pumps	Centrifugal, non-clog
Number of Pumps	Two minimum
Pump Station Capacity	Meet PWWF with largest pump out of service (Reliable Capacity)
Motors	Constant Speed, high efficiency
Pump Starts/Hour	Six (6) maximum
Screening/Communication	None Required
Flow Measurement	None Required
Standby Power	Required (Permanent or portable)

As it exists currently, the Locke Road Pump Station does not meet outlined criteria for reliable capacity, however, both existing pump stations do meet most other items listed in Table 3-2. The 1998 Master Plan discusses the need for reliable standby power equipment for the existing system but there are currently no standby backup power systems installed at the pump stations which creates risk of SSOs.

3.1.2.2. Collection System Pipelines

Table 3-3 lists the pipeline planning criteria for staged collection system improvements.

Table 3-3
Pipeline Planning Criteria

Parameter	Gravity Sewers	Force Mains
Flow Regime at PWWF	Free Flow, non-surcharged	Full Flow
Flow Velocity (Feet per Second)		
Minimum	2	2
Maximum	-	6
Pipeline Depth		
Minimum	4	4
Maximum	20	8

As mentioned in the 1998 Master Plan, exceptions to the criteria and desire limits are routinely allowed as the District develops and detailed design of specific improvements considered. An example would be low flows in a new gravity sewer or force main due to servicing of a partially developed area where the ultimate development flows are greater than existing flows. In this case, development infrastructure to temporarily meet the pipeline design criteria would be impracticable and costly.

3.1.3. STAGED COLLECTION SYSTEM IMPROVEMENTS

Staged collection system improvements are listed in Table 3-4 and shown in Figure 3-1. Table 3-4 below describes the listed improvement and when the improvement is needed. Listed improvements were formulated as interim improvements designed to accommodate increased capacity needs for the yet to be constructed developments. The approach presented establishes new gravity sewer lines to service new development and guide flows to pump stations. New force main routes, like the parallel routes from Bear Creek Pump Station to the District WWTP or the pumping and combination of Locke Road pump station flows and proposed West Brandt Pump Station flows via the proposed East Brandt Road Pump Station, are ultimately recommended to provide for a staged improvement and ultimately a reliable system for District long-term operation, maintenance, and asset lifecycle replacement. It was assumed that no increase in flows to the Lockhaven Pump Station and the Bluff Drive Pump Station would occur and no improvements to these facilities would be needed.

More details of the proposed system improvements with corresponding total capital cost estimates are shown in Table 3-4 with further explanations listed after Table 3-4. The structure of the cost analysis for the improvements were based on previous costs for similar projects that were then scaled to the current day dollar amount using the Engineering News Record (ENR) Construction Cost Index (CCI) of 12,237.69. In addition to the cost item subtotals, construction and contingency, design and engineering, environmental, permitting and legal, engineering during construction, and construction management and site inspection were incorporated into the total capital cost for each element of the staged collection system improvements. Further breakdown of the costs for each improvement are included in Appendix D.

The development of pump stations alongside land use development and infill is required to adequately convey peak flows to the WWTP and prevent sanitary system overflows during peak wet weather conditions. The staged collection system improvements presented in Table 3-4 are not necessarily presented in time series, as some development and may be somewhat independent in relation to the other Improvement needs. Table 3-4 details what the intended collection system improvement is, when it is needed, and the estimated cost to complete the improvement.

Table 3-4
Proposed Collection System Staged Improvements

No.	Improvement	When Needed	November 2021 Total Project Costs
1	Gravity sewer 8-inch minimum diameter 3,200-foot length in Locke Road west of existing pump station.	Upon extension of service to properties within existing service area and SOI along Locke Road west of Locke Road Pump Station.	$ 1,142,000.00
2	Improve Locke Road Pump Station by changing impellers on existing pumps and adding second wet well, to provide minimum interim peak pumping capacity of 336 gpm, based on existing flows and first phase of Lockeford Vista project.	With extension of service to properties within existing service area. Project to be implemented based on flow needs and monitoring performance of existing Locke Road Pump Station. May be triggered by Lockeford Vista project development.	$ 576,000.00
3	Parallel force main, 8-inch diameter, 3,200-foot length from Locke Road Pump Station to Jack Tone Road to increase pumping capabilities of improved pumps (phased and coordinated with Improvement No. 2).	With extension of service to properties within existing service area and SOI and to increase pumping capabilities of interim improved Locke Road Pump Station. May be triggered by second phase of Lockeford Vista project development.	$ 884,000.00
4	Construct new N. Tully Road Pump Station, with minimum peak capacity of 180 gpm to meet Kautz Property expected flows. Construct new parallel force main for N. Tully Rd. PS to wastewater treatment plant, minimum 6-inch diameter and approximately 6,200-foot length, with crossing of Bear Creek over creek coordinated with County Bridge Department. Include force main intertie for redundancy and reliability purposes.	With development of Kautz Property.	$ 2,165,000.00
5	Force main, 8-inch diameter, 4,800-foot length in Jack Tone Road and Brandt Road (connected to improvement No. 3), and 10-inch diameter 4,300-foot length in Brandt Road to WWTP. Discontinue discharge to existing Bear Creek Pump Station force main connection, however maintain intertie for redundancy and reliability purposes.	As flows reach capacity in force mains serving Locke Road Pump Station and N. Tully Road Pump Station, at 516 gpm (336 gpm + 180 gpm) or when combined pumping from Locke Road PS and N Tully Road PS are limited under dual pumping conditions.	$ 3,472,000.00
6	Eliminate Bear Creek Pump Station and direct flows from Bear Creek Pump Station to new N. Tully Road Pump Station through +/- 1,100-foot length minimum 8-inch gravity sewer. Upgrade N. Tully Road PS to accommodate flows diverted from Bear Creek PS.	To ultimately eliminate both Bear Creek and Locke Road PS discharging into a single force main and to consolidate pumping in this segment of the system into a single pump station. Improvement addresses lack of space at Bear Creek PS for any facilities rehabilitation.	$ 662,000.00
7	Construct new submersible duplex pump station with a minimum peak capacity of 750 gpm to replace existing Locke Road Pump Station, based on buildout within the area to be served by the Locke Road PS.	Triggered when infill development in existing service area and Lockeford Vista project develop approach capacity gained with Improvement Nos. 2 and 3.	$ 1,265,000.00

No.	Improvement	When Needed	November 2021 Total Project Costs
8	Gravity sewer, 8-inch minimum diameter, 2,300-foot length paralleling existing 8-inch in Locke Road from pump station easterly to Highway 12/88	Upon significant new development connecting through existing central system, including property on both sides of Highways 12/88; requires Nos. 1-7 to be completed.	$ 1,145,000.00
9	Gravity sewer, 6-inch diameter, +/- 1,000-foot length southerly from existing 6-inch to serve properties on west side of Highway 12/88.	Upon site development, may require Nos. 1-7 to be completed.	$ 380,000.00
10	East Brandt Road submersible duplex pump station discharging into +/- 4,300 feet, 10-inch force main to WWTP, to be constructed under Improvement No. 5:	Upon development of historical Lockeford Oaks area north of Brandt Road and east of Jack Tone Road. Requires 10-inch force main to Brandt Road to WWTP including in No. 5 above to be completed.	
a	Initial construction, assume 780 gpm capacity, based on 50% development of historical Lockeford Oaks development site and buildout within area served by Locke Road PS.		$ 1,491,000.00
b	Expand up to 810 gpm capacity based on additional flow from development within historical Lockeford Oaks development site.	Coordinate with modifications under Nos. 6 and 7.	
c	Subsequent expansion to 950 gpm capacity to accommodate Improvements No. 12, 13 and 14.	Coordinated with Nos. 12, 13 and 14 to accommodate West Brandt PS flows	
11	Construct approximately 1,700 feet of minimum 10-inch diameter gravity sewer from Jack Tone Road to new East Brandt Road PS along Brandt Road and divert force main flows from No. 5 and 13 to gravity sewer.	Upon development of historical Lockeford Oaks area north of Brandt Road and east of Jack Tone Road. Requires 10-inch force main to Brandt Road to WWTP including in No. 5 and No. 10 above to be completed. A project driver is to ultimately eliminate two pump stations discharging into the same force main. Maintain force main as intertie for reliability and redundancy purposes.	$ 781,000.00
12	Gravity sewers (6-inch or 8-inch diameter, +/- 4,700 linear feet) along Brandt Road between Highway 12/88 and Locke Road.	Upon development of sites to be served by these improvements along Brandt Road west of Highway 12/88. Requires Improvements No. 13 and 14.	$ 1,329,000.00
13	West Brant Road submersible duplex pump station with minimum peak capacity of 140 gpm.	Upon development of area long Brandt Road and Locke Road west of 12/88.	$ 411,000.00
14	West Brandt PS Force Main, 4-inch diameter, +/- 5,200-foot length) along Brandt Road from West Brandt Road Pump Station to Jack Tone Road and connection to force main (No. 5) or new gravity sewer (No. 11).	Upon development of area long Brandt Road and Locke Road west of 12/88. Project to be coordinated with Nos. 5 and 11 and completed with Nos. 12 and 13.	$ 1,337,000.00
		Total Estimated Capital Cost	**$ 17,040,000.00**

The cost estimates are represented 2021 dollars at an Engineering News Record (ENR) 20-cities Construction Cost Index (CCI) of 12,237.69. The detailed cost estimates of the alternatives are presented in Appendix D.

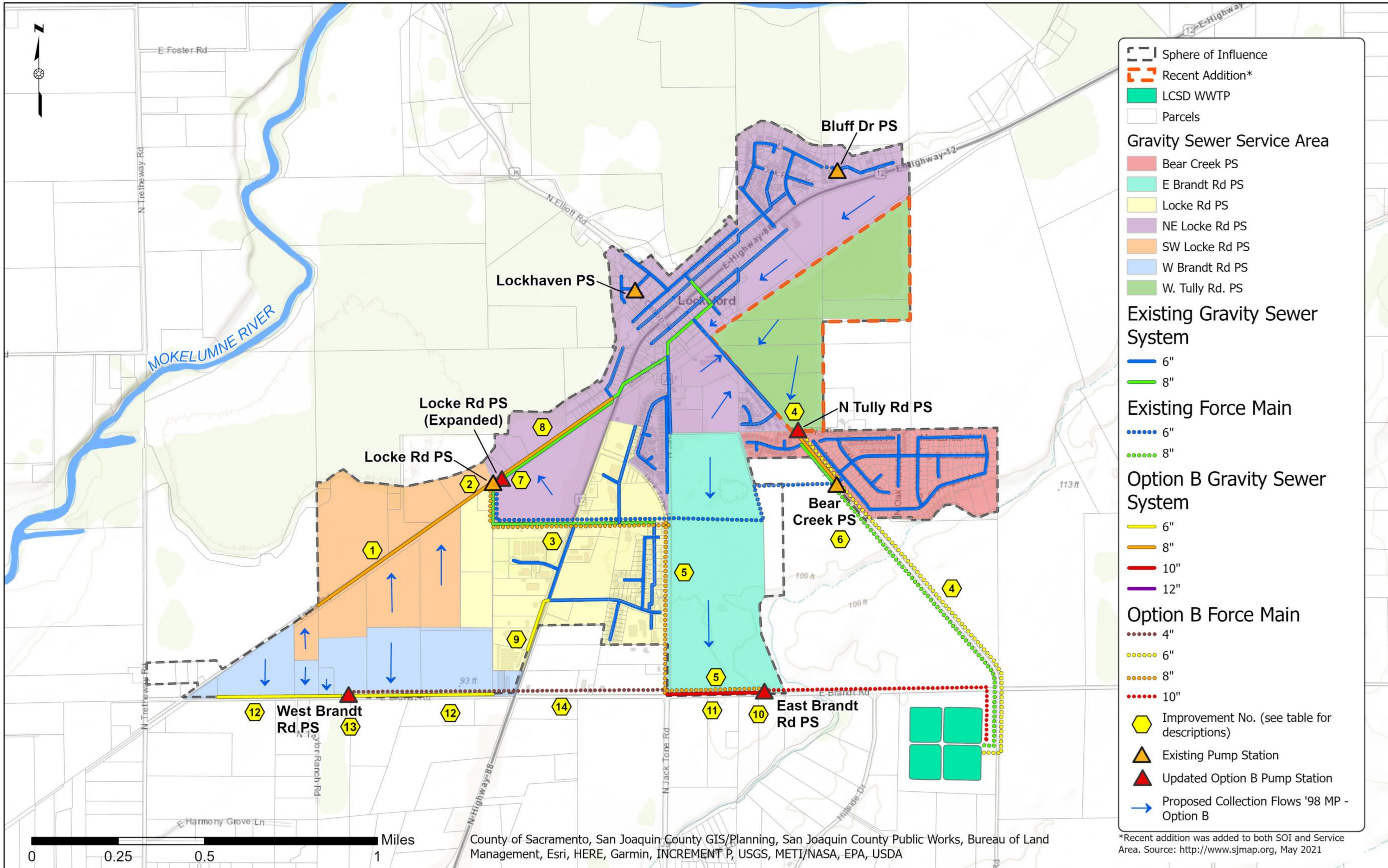

Figure 3-1
Staged Collection System Improvements for the District

3.1.3.1. Improvements 1, 2, & 3

The development of primarily industrial and agricultural land uses in the Southwest section of the Locke Road pump station sewer shed will trigger the extension of the 3,200-foot length 8-inch gravity sewer trunk line (Improvement #1). This extended service line in Improvement #1 and related buildout will lead to increased flows sent to the Locke Road Pump Station, with projected PWWF of the maximum buildout totaling 185 gpm. Flows from the complete buildout of the Southwest section of the Locke Road Pump Station sewer shed and flows from the complete buildout of Lockeford Vista would result in PWWF to the Locke Road Pump Station totaling approximately 600 gpm. However, reaching the 600 gpm is unlikely in the near-term because it captures existing flows and the complete buildout of both Lockeford Vista and properties in the Southwest section of the Locke Road Pump Station sewer shed.

The existing estimated peak flows of 336 gpm exceed the reliable capacity of the current Locke Road Pump Station. As an immediate recommended interim solution, Improvement #2 will change the impeller size on the existing pumps at the Locke Road Pump Station to better manage current influent flows and allow for nominal additional capacity to current serve near-term new development. Changes in impeller size from 11 ¼-inch to 12-inch would allow for an increase from a previously designed single pump flow of 275 gpm at 131-feet of Total Dynamic Head (TDH) to a single pump flow of 336 gpm at 144-feet of TDH. Electrical service modifications should also be implemented to achieve a minimum of 25 Hp power capacity required by this impeller change.

Improvement #3 is the development of a partial parallel 8-inch force main of approximately 3,200-feet from Locke Road Pump Station to Jack Tone Road completed in phased coordination with the changes in impeller size. The phased coordination of this improvement will allow for the pumps to experience less overall TDH as flow velocity and headloss will be increased and decreased, respectively. Interim connection and flows to the Bear Creek Pump Station will be combined in the latter half of the existing 6-inch force main with PWWFs of 336 gpm leading to approximately 3.8 feet per second velocities. Possible increases in flow may be the result of second phase development of the Lockeford Vista project. After these improvements, flow to the Locke Road Pump Station should be monitored and later improvements may be triggered when infill development in existing service area and Lockeford Vista project development approached the capacity gained with Improvement Nos. 2 and 3. See improvement #5 for the planned continuation of the force main detailed herein. Right of Way (ROW) acquisition is considered a project element of this phased improvement.

Cost estimates of the improvements are listed in Appendix D. Improvement #1, the extension of the 8-inch gravity service line, is an estimated $1,142,000 improvement, while Improvement #2, the increase of impeller size on the existing pump, is an estimated $576,000 improvement. Total project costs of Improvement #3 are estimated to be $884,000. Design and Engineering work for Improvement #2, Locke Road Pump Station impeller improvement, is estimated to be disproportionately intensive due to electrical and instrumentation improvements and space constraints and has been estimated of 25% of the subtotal improvement cost.

3.1.3.2. Improvement 4

Triggered by the development of the Kautz property with its projected total ADWF of 0.07 Mgal/d or 49 gpm, Improvement #4 details the construction of the North Tully Road Pump Station. This pump station will convey flows to the District WWTP from the Kautz development. A minimum peak reliable capacity of 180 gpm, expandable up to 320 gpm to accommodate later flows from the decommissioning of the Bear Creek Pump

Station, should be provided to meet the expected flows. Pump selection for the new pump station should have a minimum capacity of 180 gpm at 62-feet of TDH, and pump motor power and requisite electrical should have a minimum capacity to accommodate of 7.5 Hp pumps, accounting for the later upsizing to a minimum of 20 Hp.

A new pump station is required in this staged collection system improvement due to the existing limitations of the Bear Creek Pump Station, primarily limited expandability and space. Any development north of the Bear Creek Terrace subdivision, like the Kautz property, would require installation of a new pump station situated in the new development with provisions to accommodate gravity sewer flows from the Bear Creek Terrace subdivision. Improvement #4 would enable the elimination of the existing Bear Creek Pump Station (Improvement #6), although the intertie should be maintained for reliability and redundancy purposes.

In addition to the new North Tully Road Pump Station, Improvement #4 outlines the construction of a new 6,200-foot parallel force main to the District WWTP with a minimum 6-inch diameter. The force main would cross over Bear Creek and efforts should be made to coordinate with the County Bridge Department for allowing the force main to be connected to the bridge as an alternative to trenchless crossing under Bear Creek.

Cost of the North Tully Road Pump Station construction and force main are estimated to be $2,165,000.

3.1.3.3. Improvements 5 & 6

Improvement #5 would develop two force mains: A 4,800-foot length, 8-inch force main connecting improvement #3. The force main should be in Jack Tone Road, flowing South and then East and eventually connecting with the 10-inch 4,300-foot length force main in Brandt Road to the District WWTP. After the development of Improvement #3, which may be triggered by the development of the second phase of the Lockeford Vista project, Improvement #5 may be needed as flows reach capacity in force mains serving Locke Road Pump Station and N. Tully Road Pump Station, at 516 gpm (336 gpm + 180 gpm), or when combined pumping from Locke Road PS and N Tully Road PS are limited under dual pumping conditions. Flows from infill and development mainly within the Locke Road Pump Station sewer shed will dictate how quickly limitations are reached in force mains or dual pumping conditions.

Improvement #5 creates an entirely new force main route to the WWTP by connecting the Improvement #3, 8-inch force main with the proposed 8-inch force main to an expanded 10-inch force main. The junction of the later force main expansion is the site of the proposed East Brandt Road Pump Station which is detailed in Improvement #10. Flows from the Locke Road Pump Station would no longer be carried through to the Bear Creek Pump Station site and common force main and would, in conjunction with Improvement #6, eliminate need for the Bear Creek Pump Station.

Improvement #6 executes the elimination of the Bear Creek Pump Station that was limited in expandability, constructs a 1,100-foot length, 8-inch gravity sewer to accommodate diverted flows from the Bear Creek Pump Station and sends them to North Tully Road Pump Station, and expands the North Tully Road Pump Station capabilities from 180 gpm to 320 gpm to accommodate diverted flows. Upgrades to the North Tully Road Pump Station should provide conveyance capabilities of 320 gpm at 101-feet of TDH. Motor power adjustment for new flow conditions from Improvement #5 and #6 should result in an upgrade to a minimum of 20 Hp. Total capital cost for development of the force mains is estimated to be $3,472,000 with the majority of the construction costs due to the open trench installation of the 8-inch and 10-inch lines. Total estimated costs for Improvement #6 are

$662,000 with the majority of construction costs due to the expansion of the North Tully Road Pump Station and the open trench installation of the 8-inch gravity sewer.

3.1.3.4. Improvement 7

Improvement #7 would construct a new submersible duplex pump station designed to replace the existing Locke Road Pump Station with a reliable peak capacity of 750 gpm at 153 feet of TDH. Minimum motor power for the flow conditions imposed by Improvement #7 is 75 Hp. Implementation criteria for Improvement #7 is based on increased flows from infill development in the existing sewer shed area and the Lockeford Vista project approach and as the capacity gained with Improvement #2 and Improvement #3. A total capital cost for Improvement #7 is estimated to be $1,265,000 and would require design and engineering to address electrical and instrumentation and pumping system requirements.

3.1.3.5. Improvements 8 & 9

Improvement #8 will provide for service to development within the existing service area. A gravity sewer of 2,300-foot length and 8-inch minimum diameter paralleling the existing 8-inch in Locke Road would flow westerly from Highway 12/88 to the Locke Road Pump Station. Improvement #8 requires Improvement #1 to Improvement #7 to be completed and is needed when significant new development takes place and connection through the existing central system approaches existing facilities capacity. Total capital cost for the gravity sewer installation is approximately, $1,145,000.

Improvement #9 should be completed to serve properties on the west side of Highway 12/88 not already served. The improvement should service these properties via a gravity sewer that is 6-inch in diameter and approximately 1,000 feet in length, and would create an additional 30 gpm of PWWF within the Locke Road Pump Station sewer shed. This flow should be incorporated into the reliable capacity that is provided by Improvement #7 to preempt pump station modifications to accommodate an additional 30 gpm of PWWF. Estimated capital cost for the gravity sewer installation is approximately, $380,000.

3.1.3.6. Improvement 10 & 11

Improvement #10 details development of an East Brandt Road Pump Station to handle flows from both the Locke Road Pump Station, connected via Improvement #5, and the Lockeford Oaks land north of Brandt Road and east of Jack Tone Road. The proposed East Brandt Road Pump station consists of a submersible duplex pump station that will discharge into the 4,700 foot, 10-inch force main to the WWTP, to be constructed under Improvement #5. It is needed when the development of the historical Lockeford Oaks area north of Brandt Road and east of Jack Tone Road occurs, but requires the 10-inch force main from Brandt Road to the WWTP included in Improvement #5 to be completed.

To accommodate the staged development of the Lockeford Oaks property, Improvement #10 is divided into two parts, part 10(a) and part 10(b). Part 10(a) of Improvement #10 would have an initial capacity of 780 gpm at 61 feet of TDH. This is based on 50% of the historical Lockeford Oaks (30 to 35 gpm) property being developed with other infill development from within the Locke Road Pump Station service area (750 gpm). Part 10(b) incorporates the total development within Lockeford Oaks area (60 gpm) and requires an expansion of the East Brandt Road pump to accommodate the expected flows of 810 gpm at 62 feet of TDH. Motor power for Improvement #10 is a minimum of 25 Hp for both 10(a) and 10(b). These improvements should be coordinated with Improvement #6 and Improvement #7.

Part 10(c) of Improvement #10 would accommodate future flows from buildout along West Brandt Road between Highway 12/88 and Locke Road (140 gpm). As such, the East Brand Road Pump Station requires an ultimate expansion to 950 gpm at 69 feet of TDH. In order to carry flows at this rate, motor power should be at least 35 Hp. With ultimate flow at 950 gpm for Improvement #10, the estimated cost is $1,491,000.

Staged Improvement #11 recommends the construction of an approximately 1,700 foot minimum 10-inch diameter gravity sewer from Jack Tone Road to the new East Brandt Road Pump Station along Brandt Road. Flows from Improvement #5 and Improvement #13 should be diverted to the Improvement #11 gravity sewer. Improvement #11 is needed upon development of the Lockeford Oaks area and requires the 10-inch force main to Brandt Road to WWTP included in Improvement #5 and Improvement #10 above to be completed. A project driver is to ultimately eliminate two pump stations discharging into the same force main, which results in high variability in pump station output capacity, constraints asset management and maintenance ability, and increases risk with multiple pump stations discharging to a single force main (single point of failure) . Maintenance of the force main as intertie for reliability and redundancy purposes is recommended for mitigation of risk and to allow the District to maintain these systems.

Estimated cost for Improvement #10 is $1,491,000 while estimated cost for Improvement #11 is 781,000.

3.1.3.7. Improvement 12, 13 & 14

When development in the area north of Brandt Road, east of Locke Road, and west of Highway 12/88 occurs, the West Brandt Road collection and pumping system should be developed. Among these staged improvements are: Improvement #12, Improvement #13, and Improvement #14. Improvement #12 develops a 6-inch gravity sewer of approximately 4,700 linear feet along Brandt Road between Highway 12/88 and Locke Road. Improvement #13 is the installation of submersible duplex pump station with a projected minimum peak capacity of 140 gpm at 110 feet of TDH. At the estimated elevation change and required flow, the motor power should be a minimum of 20 Hp. Improvement #14 is the development of a 4-inch diameter force main of approximately 5,200 foot in length along Brandt Road from the West Brandt Road pump station to Jack Tone Road and either connection to the force main completed in Improvement #5 or connection to the new gravity sewer completed in Improvement #11.

Improvements #12, #13, and #14 should be completed during the same period and should be coordinated with Improvement #5 and Improvement #11. Cost for Improvements #12, #13, and #14 are estimated to be $1,329,000, $411,000, and $1,337,000, respectively.

3.1.4. SUMMARY OF STAGED COLLECTION SYSTEM IMPROVEMENTS

Improvements to the Locke Road Pumps Station and gravity sewers are planned to capture and pump flows from existing and new and infill development within the Master Plan study area. Existing flows from the Locke Road Pump Station are planned to eventually be diverted and carried southerly and easterly to the WWTP via a proposed force main on North Jack Tone Road and East Brandt Road, respectively. Elimination of the Bear Creek Pump Station and construction of a new North Tully Road Pump Station to accommodate flows from the Kautz property and Bear Creek Terrace subdivision will aid in the aid in the improvements' reconfiguration of flows to the WWTP. New pumped flows from development near the West Brand Road area will need to be carried to the East Brandt Road Pump Station which in turn will pump flows from both the expanded Locke Road Pump Station and the West Brandt Road Pump Station.

Table 3-5 presented the staged pump station planned pumping characteristics and Table 3-6 describes expected pump station characteristics throughout the staged improvements.

Table 3-5
Existing and Future Pump Station Flows

Pump Station Name	Existing Flow (Year 2021)				Future Flow		
	ADWF	PWWF	Reliable Capacity[1]	Capacity Deficit	ADWF	PWWF	Reliable Capacity[1]
	gpm	gpm	gpm	gpm	gpm	gpm	gpm
Locke Road	95	336	275	60	208	750	750
Bear Creek	40	140	175	0	-	-	-
North Tully Road	-	-	-	-	90	320	320
East Brandt Road	-	-	-	-	264	950	950
West Brandt Road	-	-	-	-	40	140	140

1. Reliable capacity assumes largest pump is out of service
2. gpm = gallons per minute

Table 3-6
Summary of Staged Pump Station Improvement Capacity Criteria

Pump Station Name									
Locke Road		Bear Creek		North Tully Road		East Brandt Road		West Brandt Road	
Imp. No.	Capacity Criteria	Imp. No.	Conveyance Description	Imp. No.	Conveyance Description	Imp. No.	Conveyance Description	Imp. No.	Conveyance Description
Existing	275 gpm @ 131-foot TDH – 20 Hp 285 gpm @ 137-foot TDH	Existing	175 gpm @ 131-foot TDH – 7.5 Hp 185 gpm @ 131-foot TDH	4	180 gpm @ 61-foot TDH – 7.5 Hp	10(a)	780 gpm @ 61-foot TDH – 25 Hp	13	140 gpm @ 110-foot TDH – 7.5 Hp
	Undersized for PWWF flows		Undersized for PWWF flows		Kautz property flows		50% dev from Lockeford Oaks + Improvement 7 Flows		New submersible duplex pump station
2	336 gpm @ 144-foot TDH – 25Hp (1)	5	Received flows from Locke Road PS discontinued	6	320 gpm @ 101-foot TDH – 20 Hp	10(b)	810 gpm @ 62-foot TDH – 25 Hp		
	Impeller size increase		Maintain intertie for reliability/redundancy		Kautz property flows + Diverted Bear Creek PS		100% dev from Lockeford Oaks + Improvement 7 Flows		
7	750 gpm @153-foot TDH – 75 Hp	6	Eliminate Bear Creek PS			10(c)	950 gpm @ 69-foot TDH – 35 Hp		
	New submersible duplex pump station		Divert flows to North Tully Road PS				100% dev from Lockeford Oaks + Improvement 7 Flows + West Brandt Road PS		

(1) Based on the existing pump curve.

3.2 TREATMENT AND DISPOSAL FACILITIES

This section presents the alternatives considered for the future WWTP treatment and disposal facilities. In order to develop a long-term solution for the District WWTP effluent disposal and recycled use, the feasibility of meeting District's needs through one or more of the following has been evaluated as presented in this section:

- Continued use of secondary treatment using aerated ponds with expansion or modification of existing facilities;
- Recycled water production and groundwater recharge ponds for indirect potable reuse; and
- Recycled water production for irrigation use and in-lieu groundwater recharge, with recycled water sales or agreement for use with nearby growers.

If necessary, a combination of more than one of the above approaches has been assessed.

3.2.1. Criteria for Evaluating Treatment and Disposal/Recycled Use Alternatives

Each alternative is identified and evaluated according to the following criteria:

1) Meets current and future District treatment, storage and disposal capacity needs;
2) Maintains, to the extent practicable, disposal operations on lands and facilities owned or controlled by District;
3) Is consistent with land disposal or recycled water use consistent with current Basin Plan and statewide policies such as Title 22 of the California Code of Regulations;
4) Benefits the District and groundwater basin for reduction in basin deficit to the extent practicable by District facilities planning and operation; and
5) Is cost efficient or offers long-term economic sustainability benefits that potentially offset a portion of cost impacts.

Key factors considered in evaluating the alternatives under the above-listed criteria include:

- Contributing to the Eastern San Joaquin Groundwater Subbasin Groundwater Sustainability Plan (GSP) goal of offsetting the 78,000 acre-foot per year pumping deficit (the groundwater cone of depression resulting from this deficit is depicted in Figure 3-2 **Eastern San Joaquin Groundwater Subbasin Groundwater Cone of Depression**.)
- Consistency with the District's Resolution No. 19-01 – Water Shortage Emergency and Establishing Water Service Moratorium, particularly to be consistent with Paragraph 3(d) to include measures to:

  "offset…impact on the District's groundwater supplies by augmenting groundwater in the Subbasin underlying the District."

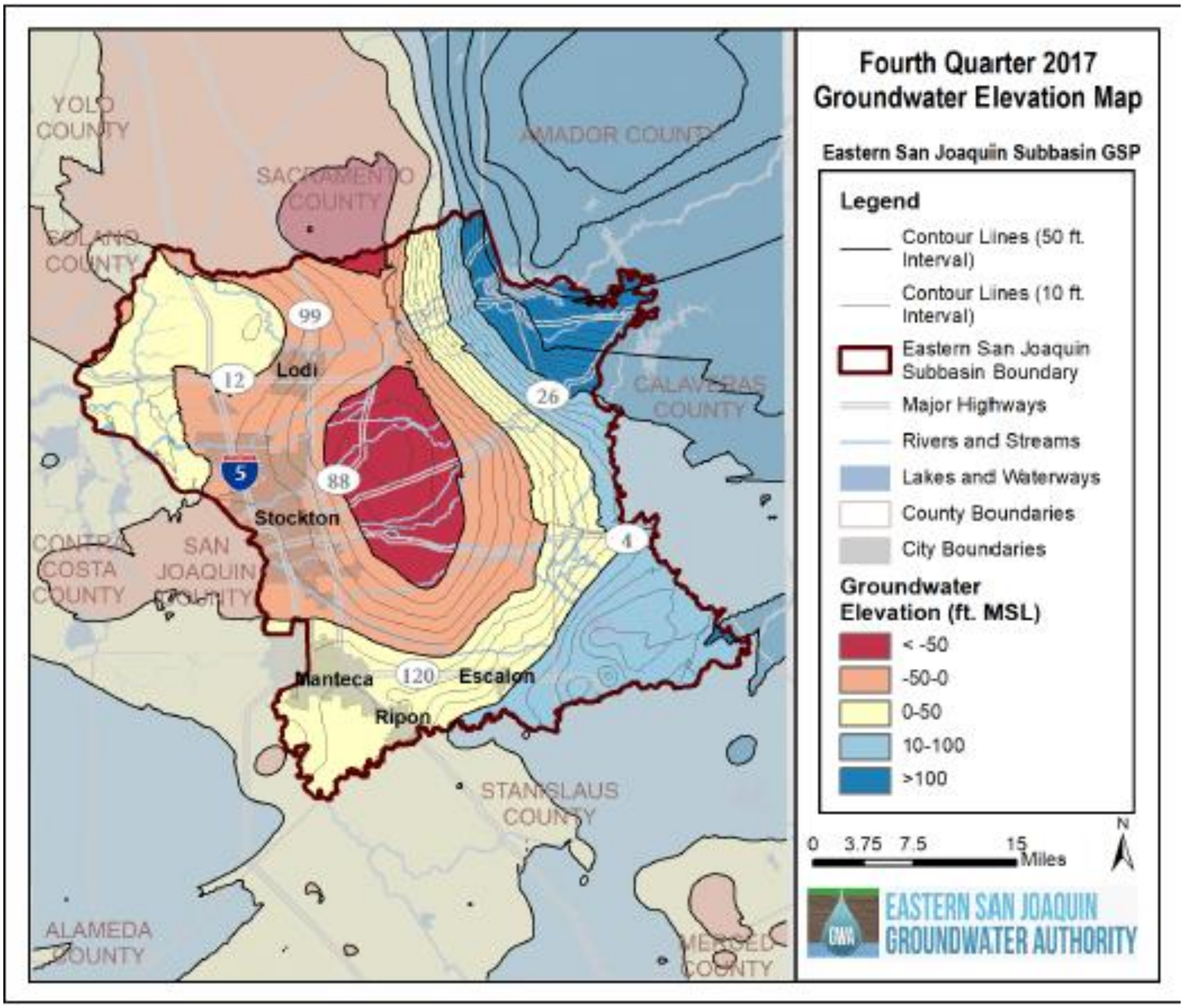

Figure 3-2
Eastern San Joaquin Groundwater Subbasin Groundwater Cone of Depression

Based on recent water supply and wastewater generation data (2018 through 2020), the District currently pumps about 130 million gallons per year of groundwater from the four active wells for potable use (equivalent to 400 acre-feet per year). Of that water produced for potable use, approximately 69 Mgal/year (or 212 acre-feet per year) arrives at the District's WWTP and is processed and disposed of through evaporation and percolation. Under the future buildout conditions contemplated in Section1.2.2, the estimated future groundwater production is projected to be 342 Mgal/year (1,050 acre-ft per year) with an estimated 182 Mgal/year (560 acre-feet per year) arriving at the WWTP in the future. A primary objective of contributing to the GSP goal of offsetting the annual pumping deficit and to meet the requirements of Paragraph 3(d) of the District's Resolution No. 19-01 is to maximize the amount of this water that is collected as wastewater to provide benefit to the Subbasin groundwater conditions.

To evaluate each alternative, waterbalance calculations have been prepared using flow conditions from the District WWTP. Flow conditions evaluated include current flows of 0.19 Mgal/d (discussed in Section 2) and projected future flows of 0.50 Mgal/d the basis of which is discussed in Section 1.2.2. Waterbalance calculations were prepared for average and 1-in-100-year climatological conditions the specifications of the WDRs identified in Section 2.2.8.

3.2.2. Headworks Facilities

For all alternatives considered, improvements to the influent control structure are recommended to accommodate the peak hour flow of approximately 1,250 gpm and multiple force main discharges. These improvements include upsizing of the influent piping from 8-inch to 12-inch and modification of the onsite gravity piping and overflow structures to be at least 12-inch diameter as well. Furthermore, it is recommended that a headworks facility be constructed, consisting of at least a primary influent channel from the collection system with a screen and screenings washer/compactor. The headworks structure would be constructed to provide a bypass channel that could be equipped with screening equipment to accommodate future peak flows. These facilities would be installed in the footprint of the existing WWTP influent flow meter and sized to the peak hour flow. Flow from the Headworks would be by gravity to the treatment pond T-1. Headworks facilities would be expanded as needed. Gravity piping (12-inch) would be installed from the headworks facility to the T-1 splitter box.

3.2.3. Expansion of Existing Treatment and Disposal Operations

The alternatives presented in this section utilize the same treatment process as what exists today, and are primarily based on an expansion of the existing secondary treatment system's capacity. Alternatives that consider other means of treatment and disposal, including recycled water, are discussed in Sections 3.2.4 and 3.2.5.

3.2.3.1. Alternative 1: Convert S-3 to T-2 for Aeration Treatment

This alternative is largely summarized by the following major components:

(1) Continuing to utilize T-1 and converting S-3 to T-2 for expanded equivalent secondary treatment.

(2) Installing 2 new 20 hp aerators in T-1 in addition to the existing 10 hp aerators.

(3) Installing 2 new 7.5 hp aerators in T-2.

(4) Continuing to use ponds S-1 & S-2 for storage by operating at a WSE range from 96.0 ft to 105.3 ft (9.3 ft depth).

(5) Construction of a new 34.5 Mgal storage pond at Reclamation Area 2.

(6) Continued use of the 116 Ac of existing alfalfa irrigation area at Reclamation Area 1

(7) Installation and activation of at least 38 Ac of alfalfa irrigation at Reclamation Area 2

Conversion of the southeast pond at the WWTP into a secondary aeration treatment pond and its efficacy of treatment capacity was assessed considering using one of the storage ponds converted to a treatment pond to achieve the target effluent BOD_5 concentration, with results presented in Table 3-7. Based on the CSTR model results, the minimum required aeration power is 55 Hp in T-1 and 12 Hp in T-2. For standard aerator sizing, it is recommended that the next highest commercial units are used, which would result in 60 Hp in T-1 (likely consisting of four 15 Hp or two 30 Hp aerators) and 15 Hp in T-2.

Table 3-7
Alternative 1 CSTR Model Results of T-1 and T-2

CALCULATION	UNITS	Peak Month Loads at 0.50 Mgal/d ADWF
INPUTS		
Total Peak Month Flow	Mgal	18.60
Avg Daily Peak Month Flow	Mgal/d	0.60
Influent BOD_5 Concentration	mg/L	424
Influent BOD_5 Loading	lb/day	2,123
POND T-1 RESULTS		
Pond T-1 Total Volumetric Capacity	Mgal	13.7
Hydraulic Residence Time	Days	23
Pond T-1 Expected Effluent BOD_5 Concentration	mg/L	88
Pond T-1 Expected DO Demanded	lbs	72,987
Minimum Aerator Power Required	Hp	55
Recommended Aerator Power	Hp	60
POND T-2 RESULTS (FORMERLY S-3)		
Pond T-2 Total Volumetric Capacity	Mgal	16.5
Hydraulic Residence Time	Days	28
Pond T-2 Expected Effluent BOD_5 Concentration	mg/L	16
Pond T-2 Expected DO Demanded	lbs	15,727
Minimum Aerator Power Required	Hp	12
Recommended Aerator Power	Hp	15

Following improvements to the WWTP aeration system, additional storage capacity would be needed in order to compensate for lost storage capacity due to the conversion of S-3 to T-2. Waterbalance calculations under the 1-in-100 climatological conditions were completed to estimate the total volume of storage required. Based on these waterbalance calculations, an additional 36.1 Mgal of storage capacity would be required in order to store treated effluent until the LAA is no longer saturated and able to receive application. To provide the additional storage capacity, another remote storage pond is recommended to be constructed either adjacent to the existing pond or at Reclamation Area 2 (if suitable space can be identified). Assuming the new remote pond would have the similar depth and embankment dimensions as the existing storage pond, it would need to be at least 9 feet deep to provide 36.1 Mgal of storage.

To meet disposal capacity required during the 1-in-100 conditions, approximately 38 acres of Reclamation Area 2 would need to be developed and activated for alfalfa production during the disposal season. A second remote pump station similar to the transfer pump station that serves Reclamation Area 1 would need to be constructed at Reclamation Area 2 and interconnecting piping installed to convey effluent to Reclamation Area No. 2. The facility planning criteria determined as a result of the waterbalance and treatment pond aeration calculations are presented in Table 3-9, with detailed calculations provided in Appendix E.

3.2.3.2. Alternative 2: Partition T-1 into Two Sequenced Aeration Basins

Alternative 2 consists of partitioning the existing pond T-1 to create two sequenced aerated ponds by constructing an earthen berm in the middle of the pond using excavated material from the site. The following list summarizes the major improvements considered under this alternative:

(1) Partitioning T-1 into 2 sequenced aerated ponds using excavated site soils (approx. 15,000 cubic yards of material) to create internal embankments.

  a. Install a total of 50 Hp of aeration in T-1 basin 1.

  b. Relocate the existing 10 Hp aerators into T-1 basin 2.

(2) Continuing to use ponds S-1, S-2 & S-3 for storage by operating at WSE range from 96.0 ft to 105.3 ft (9.3 ft depth).

(3) Deepening of the remote storage pond by approximately 4 ft to provide increase storage within the footprint of existing facilities.

(4) Continued use of the 116 Ac of existing alfalfa irrigation area at Reclamation Area 1.

(5) Installation and activation of at least 38 Ac of alfalfa irrigation at Reclamation Area 2.

The evaluation of this alternative's treatment capability supported the feasibility of using only one partition to achieve the target effluent BOD_5 concentration, with results presented in Table 3-8. Based on the CSTR model results, the minimum required aeration power is 48 Hp in T-1 Basin 1 and 15 Hp in Basin 2. For standard aerator sizing, it is recommended that the next highest commercial units are used, which would result in 50 Hp in Basin 1 and 20 Hp in Basin 2. It should also be noted that a minimum of 2 ft of pond depth were assumed to be excavated to increase the total pond T-1 volume from 13.7 Mgal to 16.2 Mgal (two 8.1 Mgal basins).

Table 3-8
Alternative 2 CSTR Model Results of T-1, Partitioned Basins 1 and 2

CALCULATION	UNITS	Peak Month Loads at 0.50 Mgal/d ADWF
INPUTS		
Total Peak Month Flow	Mgal	18.60
Avg Daily Peak Month Flow	Mgal/d	0.60
Influent BOD_5 Concentration	mg/L	424
Influent BOD_5 Loading	lb/day	2,123
POND T-1, BASIN 1 RESULTS		
Pond T-1 Total Volumetric Capacity	Mgal	8.1
Hydraulic Residence Time	Days	13.5
Pond T-1 Expected Effluent BOD_5 Concentration	mg/L	130
Pond T-1 Expected DO Demanded	lbs	63,840
Minimum Aerator Power Required	Hp	48
Recommended Aerator Power	Hp	50
POND T-1, BASIN 2 RESULTS		
Pond T-2 Total Volumetric Capacity	Mgal	8.1
Hydraulic Residence Time	Days	13.5
Pond T-2 Expected Effluent BOD_5 Concentration	mg/L	40
Pond T-2 Expected DO Demanded	lbs	19,608
Minimum Aerator Power Required	Hp	15
Recommended Aerator Power	Hp	20

Following improvements to the WWTP aeration system, additional storage capacity would be needed to accommodate future flows. Waterbalance calculations under the 1-in-100 climatological conditions were completed to estimate the total volume of storage required. Based on these waterbalance calculations, an additional 15 Mgal of storage capacity would be required in order to store treated effluent until Reclamation Area 1 and 2 are no longer saturated and able to receive application. To provide the additional storage capacity, the existing remote storage pond is recommended to be deepened by 4 ft. The pond outlet to the transfer pump station would also need to be modified to match the new bottom elevation to ensure the total volume is useable. This alternative requires less excavation than Alternative 1 because pond S-3 is able to be kept as useable storage.

To meet disposal capacity required during the 1-in-100 year conditions, approximately 38 acres of Reclamation Area 2 would need to be constructed and activated for alfalfa production during the disposal season. A second remote pump station similar to the transfer pump station that serves Reclamation Area 1 would need to be constructed at Reclamation Area 2 and interconnecting piping provided to serve Reclamation Area 2. The facility planning criteria determined as a result of the waterbalance and treatment pond aeration calculations are presented in Table 3-9, with detailed calculations provided in Appendix E.

Table 3-9
Alternative 1 and 2 Summarized Facility Planning Criteria

Alternative 1			**Alternative 2**		
Facility Planning Criteria			**Facility Planning Criteria**		
Facility Component	**Units**	**Sizing Criteria**	**Facility Component**	**Units**	**Sizing Criteria**
Secondary Treatment Facilities			**Secondary Treatment Facilities**		
Influent Screening	Mgal/d	1.80	Influent Screening	Mgal/d	1.80
	Hp	1.5		Hp	1.5
Washer Compactor	ft^3/hr	50	Washer Compactor	ft^3/hr	50
	Hp	4.5		Hp	4.5
Aeration Pond T1 (1)	Hp	60 (new 2x20+2x10Ex.)	Aeration Pond T1, Basin 1 (1)	Hp	50 (new 2x25)
Aeration Pond S3 → T2 (1)	Hp	15 (new 2x7.5)	Aeration Pond T1, Basin 2 (1)	Hp	20 (existing 2x10)
Storage Facilities			**Storage Facilities**		
NEW Remote Storage Pond (1)	CY	187,700	Remote Storage Pond (1) (Deepened 4 ft)	CY	78,000
Disposal Facilities			**Disposal Facilities**		
Reclamation Area 2 Pipeline	LF	2,650	Reclamation Area 2 Pipeline	LF	2,650
	in. Dia	8		in. Dia	8
Reclamation Area 2 PS	gpm	320	Reclamation Area 2 PS	gpm	320
	TDH	210		TDH	210
N Tully Rd Crossing	LF	100	N Tully Rd Crossing	LF	100
Pipeline ROW Acquisition	Ac	1.22	Pipeline ROW Acquisition	Ac	1.22
NEW Reclamation Area 2 Alfalfa Production Area	Ac	38	NEW Reclamation Area 2 Alfalfa Production Area	Ac	38

(1) Pond areas and volumes are consistent with the 1990 District WWTP Operations Manual.

3.2.4. Disinfected Tertiary Recycled Water Production and Use

For alternatives that involve recycled water in Section 3.2.5, a side-stream of the secondary effluent, sized to each alternatives' peak disposal capacity, would be sent through coagulation/flocculation, filtration, UV disinfection and Advanced Oxidation (if necessary) to meet the requirements of disinfected tertiary disinfected recycled water for uses onsite and allowable uses identified in Table 3-10. The planning criteria presented below are based on an initial equipment installation to provide at least 0.5 Mgal/d (350 gpm) of treatment.

- **Pre-treatment**. Per the Title 22 requirements for disinfected tertiary recycled water, automated coagulant dosing would be provided upstream of the filters. If the filter effluent exceeds 2 NTU, if the filter influent exceeds 5 NTU for more than 15 minutes, or if the filter influent exceeds 10 NTU, coagulant would be automatically dosed. In this case, it is anticipated that turbidity would be high enough that pre-treatment would be needed at all times.
- **Filtration**. The filtration system would consist of membrane filters and backwashing equipment. The water would flow through the filter with pressure from new transfer pumps.
- **Disinfection**. Effluent from the filters would be sent through either an open-channel or closed pipe UV reactor or a chlorine contactor to meet the requirements of disinfected tertiary recycled water, for allowable uses identified in Table 3-10.
- **Advanced Oxidation**. The advanced oxidation would involve injection of (non-UV inhibiting) hydrogen peroxide, ozone, hydroxyl radicals or other oxidants into the disinfection channel. For planning purposes, injection of hydrogen peroxide has been assumed.

In order to meet regulatory requirements as well as provide a level of treatment consistent with agricultural reuse, a combination of filtration and disinfection processes upgrades would be required at the WWTP to meet turbidity and total coliform bacteria reduction criteria. The requirements for the water reuse are stipulated in the CCR Title 22. There are four types of regulated non-potable recycled uses allowed. Note that end uses vary for each of these types of non-potable recycled uses. The number of allowable end uses increases with the increased level of treatment and water quality. The levels of treatment and types of recycled waters considered in Title 22 are:

1. **Undisinfected secondary (UDS) recycled water:** wastewater that has been oxidized but not disinfected (consistent with the existing level of treatment at the WWTP).
2. **Disinfected secondary-23 (DS23) recycled water:** wastewater that has been oxidized and disinfected such that secondary effluent total coliform has a median concentration of 23 (most probable number) MPN/100 mL or less.
3. **Disinfected secondary-2.2 (DS2.2) recycled water:** wastewater that has been oxidized and disinfected such that secondary effluent total coliform has a median concentration of ≤2.2 MPN/100 Ml.
4. **Disinfected tertiary recycled water:** wastewater that has been oxidized, filtered and disinfected such that secondary effluent total coliform has a median concentration of ≤2.2 MPN/100 mL, average turbidity of 2 NTU or less (or 0.2 NTU for MF), and includes either a chlorine disinfection process that provides a CT value of at least 450 milligrams-minutes per liter (mg-min/L) always with a modal contact time of no less than 90 minutes or a disinfection process that is demonstrated to inactivate and/or remove 99.999 percent of the plaque-forming units of F- specific bacteriophage MS2 or polio virus.

The water quality parameters, criteria, and approved end uses of these types of recycled waters are summarized in Table 3-10.

Table 3-10
Recycled Water Types and Approved Uses

Recycled Water Type	Parameter	Quality Criteria	Approved Uses
UDS (wastewater that has been oxidized but not disinfected)	Not applicable	• Not applicable	• Irrigation of non-food-bearing trees • Seed crops not being consumed by humans • Food and pasture for animals not producing milk for human consumption • Flushing of sanitary sewers
DS23 (wastewater that has been oxidized and disinfected)	Total Coliform	• Median concentration must not exceed 23 Most Probable Number (MPN)/100 milliliters (mL) using the last 7 days analyses that were completed • Must not exceed 240 MPN/100 mL in more than one sample in any 30-day period	All end uses of UDS recycled water plus: • Irrigation of landscaping, including freeways, golf courses, and sod farms • Industrial or commercial cooling that does not create a mist • Industrial boilers • Nonstructural firefighting • Cleaning of streets and outdoor work areas
DS2.2 (wastewater that has been oxidized and disinfected)	Total Coliform	• Median concentration must not exceed 2.2 MPN/100 mL using the last 7 days analyses were completed • Must not exceed 23 MPN/100 mL in more than one sample in any 30-day period	• All end uses of UDS and DS23 plus: • Irrigation of food crops, orchards, and vineyards not contacted by the recycled water • Fish hatcheries
Disinfected tertiary (wastewater that has been oxidized, filtered, and disinfected[a])	Turbidity for Filtration Using Natural Undisturbed Soils or a Filter Bed	• Must not exceed average turbidity of 2 nephelometric turbidity units (NTU) within a 24-hour period • Must not exceed 5 NTU more than 5 percent of the time within a 24-hour period • Must not exceed 10 NTU at any time	• All end uses of UDS, DS23, and DS2.2 plus: • Irrigation of food crops where recycled water contacts the edible portion of the crop, • Parks, and playgrounds, school yards, and residential landscaping, • Industrial or commercial cooling that does create a mist, • Flushing toilets, • Decorative fountains • Structural firefighting
	Turbidity for Filtration Using • MF • Ultrafiltration • Nanofiltration or • Reverse osmosis	• Must not exceed 0.2 NTU more than 5 percent of the time within a 24-hour period • Must not exceed 0.5 NTU at any time	
	• Total Coliform	• Median concentration must not exceed 2.2 MPN/100 mL using the last 7 days analyses were completed • Must not exceed 23 MPN/100 mL in more than one sample in any 30-day period • Must not exceed 240 MPN/100 mL at any time	

3.2.4.1. Regulatory Framework and Considerations for Groundwater Recharge

Surface application of treated municipal wastewater for groundwater replenishment and reuse is subject to regulatory requirements contained in Article 5.1., Indirect Potable Reuse: Groundwater Replenishment – Surface Application, of Chapter 3, Division 4, or Title 22 of the California Code of Regulations. According to Sections 60320.100 and 60320.102, a detailed report regarding the proposed groundwater recharge program, site characteristics, and operational and performance requirements is required to be submitted to the State Water Resources Control Board and a public hearing held before approval of the report. In general, a groundwater recharge project using treated effluent relies on multiple barriers to pathogens and contaminants of concern between the place of discharge and potential points of use.

Key requirements of Title 22 for groundwater recharge of treated municipal wastewater include, but are not limited to:

- Implementation and maintenance of a pretreatment program by the wastewater entity for control of industrial contaminants.
- Implementation and operation of a series of treatment or control measures that achieve at least the following, using a minimum of three separate treatment processes, each treatment process having limited reduction credits not exceeding 6-log or less than 1-log (discussed further in Section 3.2.4.2):
    - 12-log enteric virus reduction.
    - 10-log Giardia cyst reduction.
    - 10-log Cryptosporidium oocyst reduction.
- Validation of the log reduction achieved by each treatment process, with certain log reduction allowed for water retained underground as demonstrated by tracer study or modeling.
- Demonstrated control of nitrogen compounds.
- Monitoring and control of contaminants subject to drinking water Maximum Contaminant Levels.
- Application of dilution at a minimum of 80% of total water applied or demonstration of total organic carbon (TOC) reduction capabilities of the treatment system to result in a TOC of the effluent of less than 0.5 mg/L.
- Monitoring of TOC and indicator compounds to assess the effect of soil-aquifer treatment.

Based on the requirements contained in Article 5.1, a high degree of treatment and demonstration of soil-aquifer conditions, including the potential need to supply up to 80% dilution water, would be required for groundwater recharge of recycled water.

3.2.4.2. Log_{10} Reduction Values for Groundwater Replenishment in California

Microbial contaminants are acknowledged as the most critical constituents to regulate in recycled water applications (particularly for non-potable and indirect potable reuse) due to the potential impact and risks to public health resulting from short-term exposure. Log_{10} reduction values (LRVs) are determined by the State Water Resources Control Board (SWRCB) based on the dose-response relationship of each organism (Giardia, Cryptosporidium, and enteric viruses) to derive a point estimate-based quantitative microbial risk assessment approach for each technology.

Table 3-11 lists maximum LRVs for some of the unit processes that are currently established by the State Water Board. These LRV credit values for groundwater replenishment in California are in relation to the summary treatment unit process diagram shown in Figure 3-3 and are the same values referenced by the Expert Panel on the Feasibility of Developing Uniform Water Recycling Criteria for Direct Potable Reuse (2016)[8]. These unit processes, if constructed and functional, would award the District up to 16 LRVs for enteric viruses, 20 LRVs for Cryptosporidium, and 23 LRVs for Giardia. The minimum LRVs for each organism are 12, 10 and 10 for viruses, Cryptosporidium and Giardia, respectively. Due to their likelihood of meeting the LRV criteria, and being established as industry-recognized effective treatment technologies by the SWRCB, the treatment train presented in Figure 3-3 is recommended for preliminary planning of the District's disinfected tertiary treatment and groundwater recharge system.

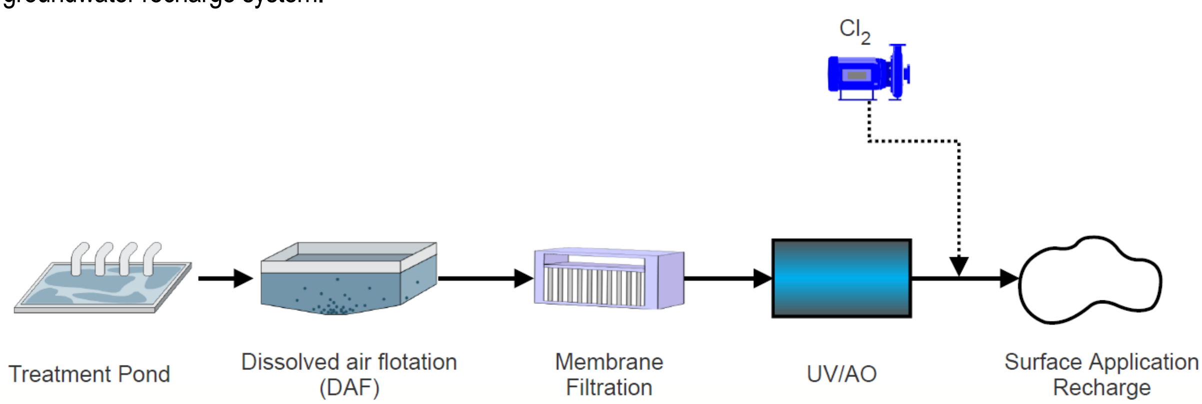

Figure 3-3
Summary Treatment Unit Process Diagram in Relation to Log_{10} Reduction Values (LRVs)

Table 3-11
Approved Log_{10} Reduction Values (LRVs) for Groundwater Replenishment in California

	Current Maximum Allowable LRVs						
	Treatment Pond	DAF	Membrane Filtration	UV/AO	Cl_2[a]	Surface Application Recharge[b]	Total Maximum LRV Achieved
V LRV	X	X	0.0	6.0	4.0	6.0	16.0
C LRV	X	X	4.0	4.0	0.0	10.0	20.0
G LRV	X	X	4.0	4.0	3.0	10.0	23.0

a. Optional chlorine injection to meet LRV
b. For 6 month retention time
Notes:
LRV = Log Reduction Value; V = Enteric Virus, Minimum required LRV of 12; C = Cryptosporidium, Minimum required LRV of 10; G = Giardia, Minimum required LRV of 10

[8] California State Water Resources Control Board, Division of Drinking Water. *Evaluation of the Feasibility of Developing Uniform Water Recycling Criteria for Direct Potable Reuse*, 2016. Expert Panel Feasibility Report.

3.2.4.3. Preliminary Jar Testing

The total suspended solids (TSS) characteristics of the District's WWTP effluent are unknown, however it is assumed that pre-treatment will likely be needed even with secondary treatment upgrades. Thus, coagulation and flocculation would be included upstream of the filtration. If turbidity and TSS are low, filtration might only be required on an intermittent basis to meet turbidity limits for high TSS events, when there is a high fraction of small solids particles not captured by the filter material, or to minimize filter backwashing and maintenance of the membrane filters if used (e.g., manual cleaning). A preliminary jar testing study has been conducted to inform coagulant selection and dosing.

Jar tests of District secondary effluent was conducted on May 27th, 2021 and included three different Polyaluminum Chlorohydrate (PACH) coagulants (JC1670, JC1676, and JC1679) provided by JenChem. Coagulants were tested at different concentrations, and with some tests including pH suppression and pre-oxidation, followed by filtration through a 0.2 micron syringe filter. Three grab samples of secondary effluent were gathered with two in the morning and one in the afternoon, with initial parameters of each grab sample presented in Table 3-12.

Table 3-12
Jar Testing Raw Secondary Effluent Water Quality

Parameter	Units	Grab Sample 1	Grab Sample 2	Grab Sample 3
Sample Time	h:mm	8:00 AM	8:00 AM	1:30 PM
pH	Std. Units	9.53	9.54	9.62
Turbidity	NTU	47.2	2.84	49.3
UV-A	%Abs	0.349	0.239	0.358
Temperature	ºC	23.7	22.8	27.7
Conductivity	µS	967.5	970.5	967.3

Pond effluent was then dosed with different coagulants at dosages ranging from 20 to 60 mg/L. After dosing, the jars were mixed at 200 rpms for 30 seconds, followed by a flocculation cycle of 20 rpm for 300 seconds. After flocculation, the supernatant was filtered through the 0.2 micron filter and analyzed for turbidity and UV-A. While turbidity is a general measurement of the suspended material in a water sample (via light absorbance), UV-A is a general parameter that correlates to the relative amount of organic material in the water sample. For coagulant testing, UV-A is used as a metric to evaluate the relative efficacy for removal of Total Organic Carbon (TOC) from the wastewater. Removal of both turbidity and UV-A are important for recycled water systems to meet disposal requirements for either system discussed in Sections 3.2.5.1 or 3.2.5.2.

Coagulant effects were compared to each other based on their performance with respect to the relative percent removal of turbidity, UV absorbance and general flocculation formation character. The results of these tests are presented in Table 3-13, and indicate that the most effective coagulant of the products tested was JC1679 at a dose of 55 to 60 mg/L based on the reduction of both turbidity and UV-A. Testing the efficacy of pH suppression and pre-oxidation coupled with the coagulants did not appear to enhance the coagulation and flocculation.

Table 3-13
Turbidity and UVA Percent Change Jar Test Results

Coagulant Dose (mg/L)	JC1670		JC1676		JC1679	
	Turbidity (%Change)	UV-A (%Change)	Turbidity (%Change)	UV-A (%Change)	Turbidity (%Change)	UV-A (%Change)
20	--	--	-84	-36.7	-8	-49.6
30	--	--	-97	-41.5	-22	-44.7
50	-99	-42.4	-87	-41.8	-90	-43.9
55	--	--	--	--	-98	-46.9
60	-99	-45.3	-99	-44.4	-99	-52.8
65	--	--	--	--	-98	-48.6

The preliminary jar testing results indicated that at a dosage of 55 mg/L of JC1679 the UV-A can be reduced by approximately 53% and turbidity may be reduced by 99%. Therefore, the supernatant for the jar containing 60 mg/L of JC1679 was selected for analysis of TOC removal. Results for laboratory analysis of filtered JC1679 supernatant indicate approximately 22% of TOC and 30% of TKN can be removed at a dose of 60 mg/L. Although the dose of 60 mg/L will be used for sizing of chemical facilities, it is recommended that additional bench-scale jar testing be performed to target TOC removal, especially for Alternative 3 described in Section 3.2.5.1. Of particular importance will be evaluating means to consistently remove as much TOC through any treatment process considered for groundwater recharge.

Table 3-14
TOC Removal Using JC1679 at a Dose of 60 mg/L

Parameter	Units	Pond Effluent	Filtered JC1679 Supernatant	Percent Change
Turbidity (NTU)	NTU	49.3	0.42	-99%
UV-A (%Abs_{254})	%Abs_{254}	0.358	0.169	-53%
TOC (mg/L)	mg/L	9.4	7.3	-22%
Nitrate N (mg/L)	mg/L	<0.2	<0.2	N/A
TKN (mg/L)	mg/L	4.6	3.2	-30%

3.2.4.4. Tertiary Treatment Unit Process Descriptions

Following the injection of coagulant, the secondary wastewater will enter a rapid mixing and flocculation system to aggregate the suspended material. The preliminary flocculation tank system consists of rectangular 304 stainless steel (SS) tanks with built in mixer mounting beams and individual rapid mix and flocculation mix cells in each tank. A summary of rapid mix and flocculation design criteria is provided in Table 3-15.

Table 3-15
Rapid Mixing and Flocculation Systems Planning Criteria

Parameter	Units	Value
Number of tanks installed	--	1 duty + 1 redundant
Number of Cells per Tank	--	2
Rapid Mixing System		
Detention time	Seconds	30
Number of Cells per Tank	--	1
Min. Tank cell dimensions (length x width x depth)	ft, in.	4'6" x 4'0" x 7'2"
Tank freeboard	ft, in.	1'8”
Number of mixers per cell	--	1
Velocity gradient G, maximum	s^{-1}	1,000
Mixer horsepower	hp	1
Motor drive type	--	VFD
Flocculation System		
Detention time per tank	Minutes	Min. 5 – 20 Max.
Number of cells required per tank	--	1
Min. Tank cell dimensions (length x width x depth)	ft, in	4’6” x 4'0” x 7'2”
Tank freeboard	ft	1'8”
Number of mixers per cell	--	1
Mixing energy x detention time (G*t)	--	11,600 – 19,100
Mixer horsepower	hp	1
Motor drive type	--	VFD

After mixing, the wastewater will be processed through a Dissolved Air Flotation (DAF) system that rapidly clarifies the wastewater. The DAF system consists of a flotation tank, contact chamber, float removal system (skimmers), recirculation system, settled solids removal system, and an effluent discharge header. Use of DAF is recommended to account for the expected need to remove algae that may be present in the aerated pond secondary effluent. The preliminary planning criteria for the DAF system is presented in Table 3-16.

Table 3-16
Dissolved Air Flotation Systems Planning Criteria

Parameter	Units	Alternative 3 (1) Flow: 0.4 Mgal/d	Alternative 4 (1) Flow: 1.34 Mgal/d
Overall System Capacities			
Dimensions (length x width x height)	ft, in.	17'11" x 6'4" x 7'2"	37'6" x 13'0" x 10'0"
Water surface elevation	ft, in.	4'7" – 4'10"	7'1" – 7'6"
Active surface area	ft^2	73	360
Nominal water volume	gal	1,550	12,400
Float hopper capacity	gal	100	780
Empty weight	lb	5,700	19,000
Operating weight	lb	19,200	135,600
Recirculation System			
Recycle pump power	hp	15	30
Recycle pump flow	gpm	60	250
Air flow rate	scfh	36 – 48	120 – 180
Air dissolving pipe volume	gal	29	73
Recycle pressure	psig	80 - 100	90 – 100
Float Removal System			
Orientation	--	Concurrent w/ Flow	Concurrent w/ Flow
Skimmer drive power	hp	0.5	1.0
Skimmer speed	ft/min	4.6 – 12.2	4.6 – 12.2
Speed control	--	VFD	VFD
Settled Solids Removal System			
Orientation	--	Countercurrent w/ Flow	Countercurrent w/ Flow
Auger drive power	hp	0.25	0.33
Augur speed	ft/min	3.6	3.6
Auger diameter	in.	6	6
Auger pitch	in.	6	6

(1) Capacities & dimensions are minimum for planning criteria, unless otherwise noted.

An example layout and process flow diagram for the DAF system is illustrated in Figure 3-4 and Figure 3-5. The DAF system was selected because it requires a very small footprint area for wastewater clarification and is less sensitive to variability in flow rate or strength of wastewater than traditional clarifiers.

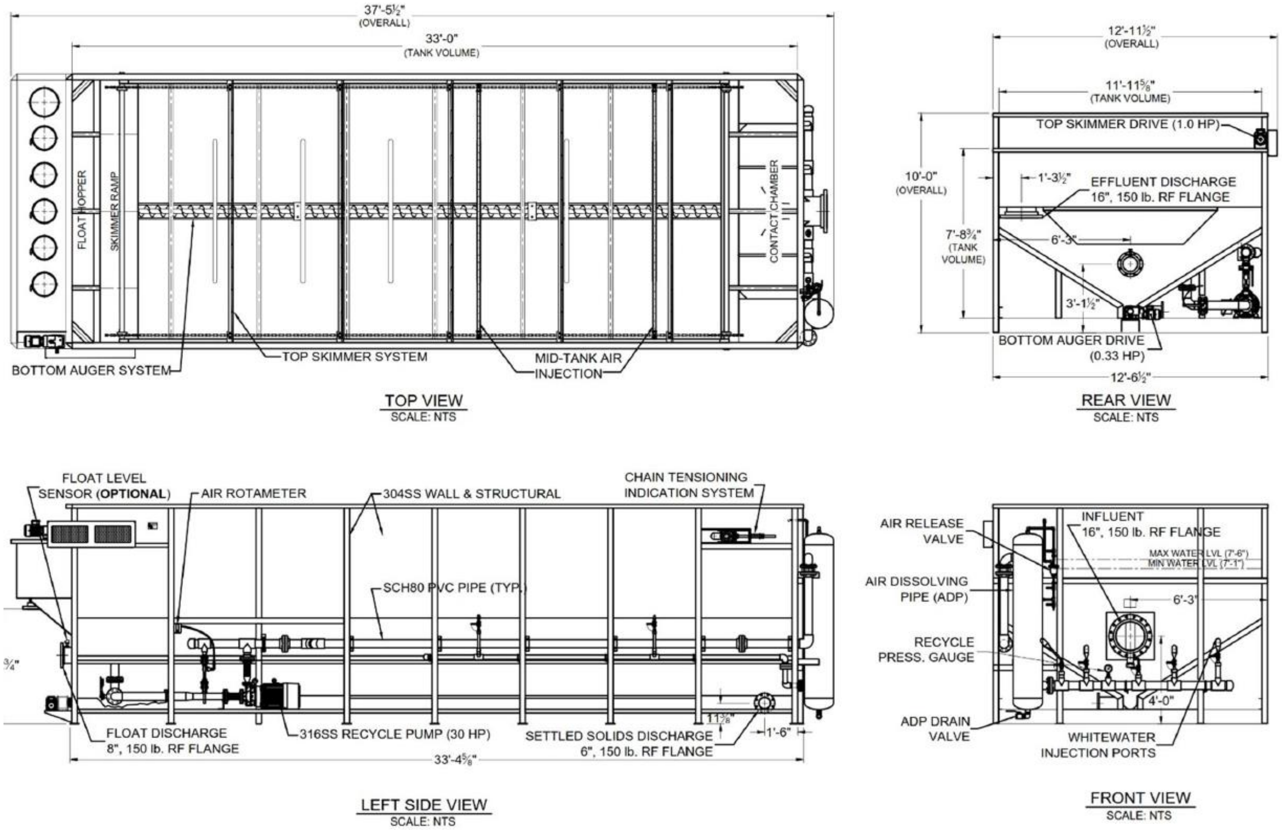

Figure 3-4
DAF System Example Layout Drawing

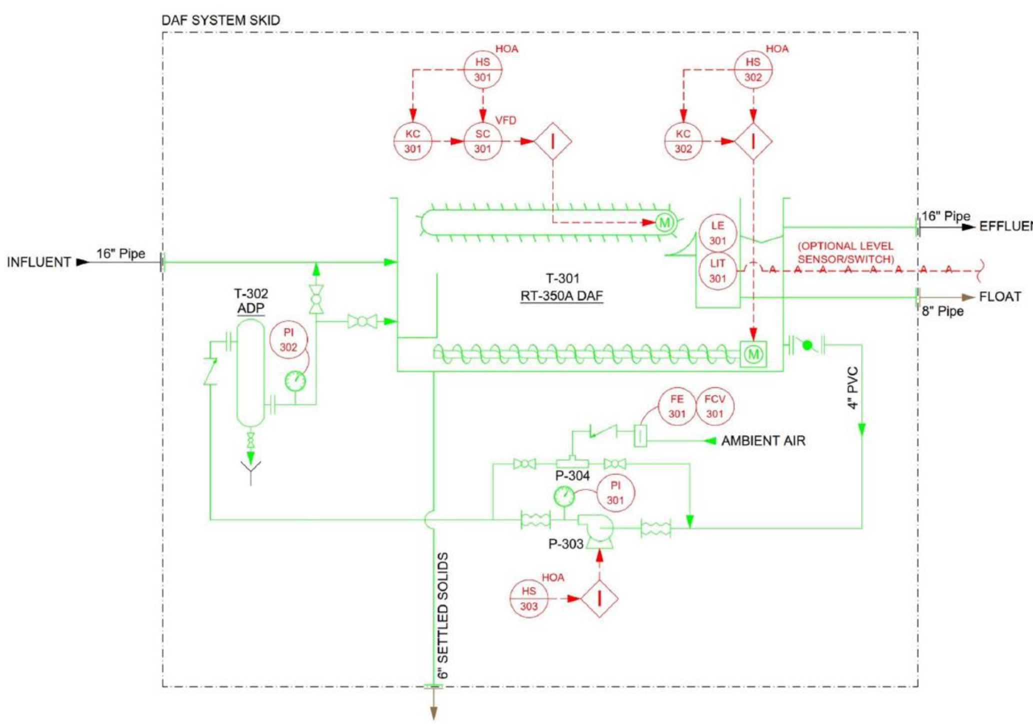

Figure 3-5
DAF System Example Process Flow Diagram

Following treatment from the DAF system, wastewater would be transferred from the DAF effluent chamber into membrane filtration units (or other means of filtration) for additional suspended solid removal. A fine screen system is recommended to be installed between the DAF effluent and the membrane filtration units to ensure membrane protection in the event of breakthrough of the DAF system. For preliminary planning, a duplex automatic self-cleaning strainer system is recommended with planning criteria presented in Table 3-17.

Table 3-17
Basket Strainer Planning Criteria

Parameter	Units	Value
Number of units	--	1 duty + 1 standby
Size	in.	8
Unit type	--	Automatic Self-Cleaning
Opening size	Mesh/micron	40/400

For the filtration system, membrane filters were selected due to their small facility footprint, simplicity, and ease of maintenance. Two module rack frames and valves and on-rack piping are planned for installation. The racks include modules, feed, filtrate, excess recirculation, and air scrub manifolds. Membrane filtration racks are provided with a Clean-in-Place (CIP) system that backwashes the membrane, and air compressors that air scrub the membranes. Each rack is able to be modified by adding or removing modules from the racks, and isolation valves are provided for each module to allow removal. The planning criteria of the membrane filtration units are presented in Table 3-18.

Table 3-18
Membrane Filtration Unit Planning Criteria

Parameter	Units	Value (1)
Number of racks	--	1 duty + 1 standby
Dimensions (length x width x height)	ft, in.	40' x 5' x 6'6"
Unit type	in.	8" Valve Rack
Max. number of modules per skid	--	60
Max feed pressure	psig	60
Membrane material	--	PVDF
Surface area per module	ft^2	538
System recovery (min.)	%	90%
Membrane flux	gpm/mod	16.8
Recirculation flow	gpm/mod	1.7
Nominal pore size	µm	0.2

(1) Values are minimum per rack or module, unless otherwise noted.

After filtration, tertiary effluent would be disinfected by in-line UV banks with internal lamps and baffles. For groundwater recharge, the advanced oxidation chemical(s) would also be injected at the head of the UV banks. The planned UV system has been based around low-pressure high-output (LPHO) lamps with automatic sleeve cleaning. A vendor provided programmable logic controller (PLC) would make adjustments using a third-party validated UV dose equation to maintain UV dose delivery at or above the required reduction equivalent dose set point without overdosing via “dose pacing.” It adjusts the system output by changing lamp power or turning UV chambers or whole trains “ON” or “OFF” to respond to changes in UVT (UV transmittance at 254 nm), lamp output (i.e., aging and fouling), or flow. A UVT meter would be installed post-filtration and a flowmeter will be included to allow UV dose-pacing. In-line UV banks would be removed in chambers/sections for maintenance, similar to fittings such as strainers or valves.

Table 3-19 presents a summary of the key planning criteria for the UV disinfection system. The equipment design criteria may be modified during detailed design if equipment is provided by another vendor or to meet specific advances oxidation treatment objectives, but the general planning criteria is anticipated to remain the same.

Table 3-19
UV Disinfection System Planning Criteria

Description	Value
UV dose, minimum[a]	100 mJ/cm^2
UV transmittance, minimum	62% at 254 nm [b]
Lamp type	Low-pressure high-output (LPHO), Low-pressure Amalgam
End of lamp life factor	0.86
Lamp fouling factor	0.88
Lamp cleaning system	Automatic mechanical
Min. Number of chambers[c]	3 (2 Duty + 1 Standby)
Chamber dimensions (in., per chamber)	80 (L) x 6 (Dia.)
Number of lamps per chamber	8
Total number of UV lamps	24
Lamp power draw (W)	1,000
Peak power draw[d]	24.2
Headloss across UV chamber at design flow, ft[e]	<2
Monitoring	• Continuous measurements for flow rate, UVT, UV intensity, operational UV dose, turbidity • On/off status for each reactor and lamp, lamp age, reactor on/off cycles, power consumption and power set point, flow rate in reactor, GFI • Daily sampling for fecal coliform
Alarms	• Lamp failure, low UV intensity, low UVT, high turbidity, low operational UV dose, high and low flow, GFI

a. Based on 99.999 percent (5-log) inactivation of F-specific bacteriophage MS2 or poliovirus.

b. Limited UVT data is available. Sixty-two percent UVT was assumed as a reasonably conservative value for system design. This assumption may be updated depending on results of pending data collection.

c. Chambers could be built, but not outfitted with UV equipment until buildout.

d. I.e., control center and other small ancillary power draws are not included.

e. Assumes headloss through each chamber is <0.5’ and intermediate header piping losses will be <0.5’.

Coagulant, and oxidant chemical addition systems are planned to be provided to supplement the reclaimed water treatment processes. Table 3-20 presents a planning level summary for the chemical addition systems. Additional discussion is given in Section 3.2.4.3 regarding coagulants and 3.2.4.4 for advanced oxidation.

Table 3-20
Chemical Addition Systems Planning Criteria

Parameter	Units	Alternative 3	Alternative 4
Coagulant System			
Number of coagulant pumps	--	2 (1 duty, 1 standby)	3 (2 duty, 1 standby)
Coagulant type and bulk concentration	%V	Polyaluminum Chloride (48% Alumina by volume)[a]	Polyaluminum Chloride (48% Alumina by volume)[a]
Coagulant dose rate, average[b]	mg/L	55	55
Coagulant pump capacity	gph	2	3
Storage Tank	gal	2 @ 1,200	3 @ 2,000
Days storage	days	31	31
Hydrogen Peroxide System			
Number of peroxide pumps	--	2 (1 duty, 1 standby)	N/A[c]
Peroxide bulk concentration	%V	30% by volume	N/A[c]
Minimum dose rate	mg/L	15	N/A[c]
Peroxide pump capacity	gph	1.0	N/A[c]
Peroxide Storage Tank	gal	2 @ 700	N/A[c]
Days storage	days	31	N/A[c]

[a] *Alumina %vol is assumed for basis of chemical feed system design; coagulant type and dose to be refined during detailed design.*
[b] *Assumed to be consistent with jar testing results discussed in Section 3.2.4.3.*
[c] *Advanced oxidation is not a required process for recycled use areas in Alternative 4.*

The coagulant and peroxide storage tank capacities were determined to provide 31-day supply assuming average dosing at buildout. It is important to note that the dose for peroxide is assumed from typical reclaimed water treatment facilities. As discussed previously, additional bench-scale jar testing and/or a pilot study is recommended to affirm the chemicals and dosages as well as treatment methods best suited for the reclaimed water system. Likewise, field testing for peroxide residual and effectiveness in storage and pipelines should be conducted to determine the required peroxide dose to achieve the desired residual.

3.2.5. Recycled Water Discharge Alternatives

The alternatives presented in this section incorporate new levels of treatment to the existing treatment process and are primarily an evaluation of projects that would allow the District to produce recycled water for the uses identified. Two different means of recycled water use are evaluated in the following subsections, including groundwater recharge ponds in Alternative 3 and recycled use through crop irrigation in Alternative 4. The potential locations for recharge ponds and crop irrigation recycled use areas within the vicinity of the District WWTP are presented in Figure 3-6, which identify the Historic WWTP Site and Reclamation Area 2 for potential recharge ponds (Alternative 3) and nearby local active agricultural lands with crops compatible for recycled water use (Alternative 4). To meet the objective of providing in-lieu groundwater recharge, only areas shown to have existing irrigated agriculture are identified in Figure 3-6 as candidates for recycled water use sites.

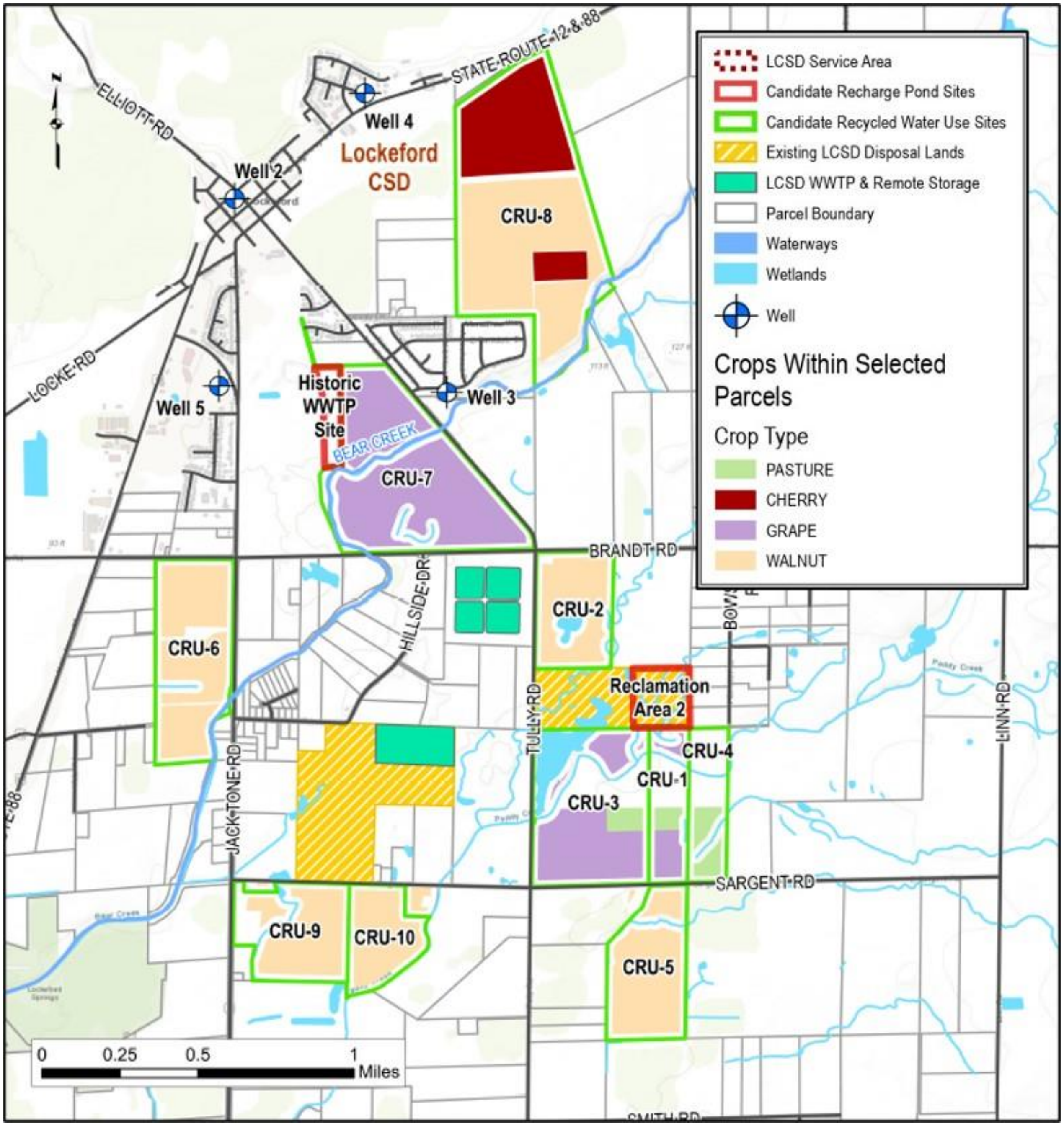

Figure 3-6
Candidate Recharge and Recycled Use Areas Vicinity Map

3.2.5.1. Alternative 3: Groundwater Recharge

This alternative includes converting the southeast pond at the WWTP (S-3) into a secondary aeration treatment pond (T-2) as described in Section 3.2.3.1. However, the effluent from the aeration ponds would be treated through tertiary coagulation, filtration, disinfection and advanced oxidation prior to being applied to recharge ponds for groundwater replenishment. The two locations proposed as candidates for the construction of recharge ponds include the Historic WWTP Site and the Reclamation Area 2 Site as indicated in Figure 3-6. Major components of this alternative include the following:

(1) Utilizing T-1 and converting S-3 to T-2 for aeration.

(2) Installing 2 new 20 hp aerators in T-1 in addition to the existing 10 hp aerators.

(3) Installing 2 new 7.5 hp aerators in T-2.

(4) Continuing to use ponds S-1 & S-2 for storage by operating at WSE range from 96.0 ft to 105.3 ft (9.3 ft depth).

(5) Construction of new tertiary treatment facilities consisting of DAF, membrane filtration, UV disinfection and Advanced Oxidation.

(6) Construction of approximately 20 to 25 Ac of recharge ponds upon the Historic WWTP Site and/or Reclamation Area 2.

(7) Continued use of the 116 Ac of existing alfalfa irrigation area at Reclamation Area 1 as needed (as a backup system during avg. years).

This alternative has the potential need to include dilution water, and it is recommended that under implementation of this project that potential sources of dilution water including surface water and collected stormwater be considered.

To ascertain the range of potential percolation rates at these locations, site-specific percolation testing was conducted at the Historic WWTP Site. Site investigation at the Historic WWTP Site involved excavation of two approximately 6 ft. deep test pits located with one at the south (TP-1) and one at the north (TP-2) of the site to assess a comprehensive range of percolation rates. Another surface test pit that was approximately 1 ft deep was also used for testing, however data from the surface pit was not reliable because test water drained through the cracks in the dried surface soil and did not permeate through the soil pores. A guelph permeameter was used at each test pit to measure the percolation rate under a constant single head. Water level measurements were recorded every 10 minutes to estimate the rate of water level change in centimeters per minute. Data collected for TP-1 and TP-2 are presented in Figure 3-7, and indicated an observed steady-state field infiltration rate of between 0.03 to 0.05 cm/min.

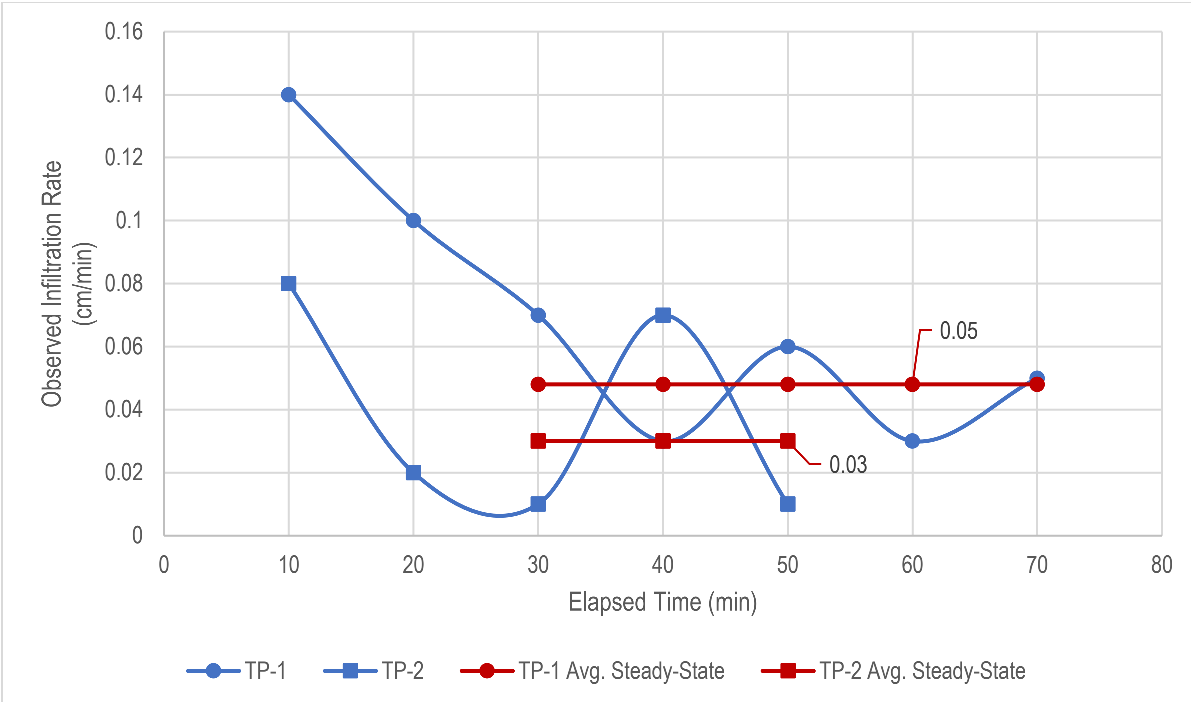

Figure 3-7
Historic WWTP Site Permeameter Percolation Test Results for TP-1 and TP-2

Although the field infiltration rate ranges from 0.03 to 0.05 cm/min, the observed data is multiplied by a safety factor to account for the cyclical nature of hydraulic loading, the normal variability of site conditions, and the limitations of the relatively small-scale field-test procedures. The factor of safety multiplier of 0.02 (2%) is used to estimate the design infiltration rate range of 0.34 to 0.54 in/day with the calculation presented in Table 3-21.[9] For waterbalance calculations, a design infiltration rate of 0.44 in/day is used for the Historic WWTP Site.

Table 3-21
Estimated Design Infiltration Rate for Historic WWTP Site Recharge Pond

Parameter	Test Pit 1	Test Pit 2
Latitude	38.154022	38.155301
Longitude	-121.145405	-121.145725
Water Column Height (cm)	15	15
Field Infiltration Rate (cm/min)	0.048	0.030
Field Infiltration Rate (in/day)	27.2	17.0
Factor of Safety for Design	2.0%	
Design Infiltration Rate (in/day)	0.54	0.34
Design Infiltration Rate (Avg. in/day)	0.44	

It should be noted that the depth of excavation of 6 ft was used to reach a more permeable layer. The silty sand at a depth of 6 ft was overlain by more silted material that is expected to have a lower infiltration rate. For design, the percolation pond at the Historic WWTP may be either excavated to a depth of 6 ft for the whole effective area, or infiltration wells filled with gravel and rip rap may also be installed. Due to the silty material in the upper 6 ft, the

[9] Reed, Sherwood C. *Natural Systems for Waste Management and Treatment*, 1995.

infiltration wells may become fouled over time by the suspended material and may become unusable. Since there is a risk that the infiltration wells may not work as a long-term solution, further planning assumes that the pond construction includes excavation to the more permeable layer at a depth of approximately 6 ft.

United States Department of Agriculture, Natural Resources Conservation Service (USDA NRCS) data for the soil at the Historic WWTP Site and Reclamation Area 2 indicates the relative soil permeability at Reclamation Area 2 is approximately 25% greater than at the Historic WWTP Site. Applying this relative increase to the planning level infiltration rate at the Historic WWTP Site results in the estimated design infiltration rate of 0.55 in/day at Reclamation Area 2. Using the planning level infiltration rates for both sites and constructing approximately 12 Ac of recharge ponds at each site, no storage improvements are expected to be required to meet future flow conditions during 1-in-100-year climatological conditions.

Across both recharge ponds, a total of 105 Mgal of recycled water can be disposed during the 1-in-100 year, with a peak month disposal flow of approximately 280 gpm (0.4 Mgal/d) between both ponds estimated to occur in July. Therefore, the sizing criteria for Alternative 3's tertiary coagulation, filtration and disinfection is 0.5 Mgal/d (25% above the disposal flows). For sizing of a recharge pond pump station, the pumping capacity is estimate 25% above the disposal demands, similar to the sizing of the existing transfer pump station yielding a design flow size for pumps at 370 gpm.

A remote storage return pump station and piping system is also recommended to be installed from the remote storage pond back to the WWTP in order to allow the treatment system to draw effluent from the existing remote storage pond without impacting onsite storage. This improvement would avoid issues that may occur if the influent flows to the WWTP exceed the tertiary treatment system's capacity while all onsite storage ponds are at capacity. The separate return system also provides reliability for maintenance by allowing one of the pump stations and pipeline to be removed from service without affecting the other.

Under this alternative there is no expected need for additional storage facility improvements beyond the existing storage ponds.

A depth of between 5-ft to 12-ft is assumed for each rectangular percolation pond, with inside slopes of 3:1, and outside slopes of 2:1. Operation and maintenance costs include annual tilling of infiltration surfaces and major repairs of embankments and removal of surface material after 10-yr. At least four monitoring wells are assumed to be required to monitor the shallow groundwater near the Historic WWTP. A summary of the design criteria for the recommended facilities under this alternative is provided in Table 3-24.

Cost estimates of the percolation pond alternative includes all appurtenant inlet and outlet systems, control valves, and inter-pond piping. An overall cost estimate of this alternative in comparison to the other alternatives is included in Table 3-25.

3.2.5.2. Alternative 4: Recycled Use Areas

Alternative 4 includes direct delivery of recycled water to growers by developing a recycled water distribution system from the WWTP. Major improvements that are recommended for this alternative include the following:

(1) Partitioning T-1 into 2 sequenced aerated ponds using excavated pond bottom (approx. 2 ft of material) to create internal embankments.

  a. Install 2 new 25 hp aerators in T-1 basin 1.

  b. Relocate the existing 10 hp aerators into T-1 basin 2.

(2) Continuing to use ponds S-1, S-2 & S-3 for storage by operating at WSE range from 96.0 ft to 105.3 ft (9.3 ft depth).

(3) Construction of new tertiary treatment facilities consisting of DAF, membrane filtration, and UV disinfection.

(4) Construction of approximately 5,000 ft of recycled water distribution piping, 350,000 gal of recycled water storage tank, and a new recycled water pump station at the WWTP.

(5) Construction of a new 28 Mgal storage pond at Reclamation Area 1 or 2.

(6) Continued use of the 116 Ac of existing alfalfa irrigation area at Reclamation Area 1 as needed (as a backup system during avg. years)

Expansion of existing onsite treatment and storage facilities are largely similar to those described in Section 3.2.3.2 for Alternative 2. The partitioning of pond T-1 and the storage improvements are recommended due to the recycled use areas being unable to accept application when saturated with water or within 24 hours of a precipitation event (see Section 2.2.8). A remote storage return pump station and piping system is also recommended to be installed from the remote storage pond back to the WWTP in order to allow the treatment system to draw effluent from the existing remote storage pond without impacting onsite storage. This improvement would avoid issues that may occur if the influent flows to the WWTP exceed the tertiary treatment system's capacity while all onsite storage ponds are at capacity. The separate return system also provides reliability for maintenance by allowing one of the storage ponds or pipelines to be removed from service without affecting the other.

Although this system includes construction of the recycled water distribution system, the cost to construct the recycled use area irrigation systems is not included because parcels with existing crop production have been selected as candidate recycled use areas.

Based on waterbalance calculations at buildout flows during the 1-in-100 year, up to 162 Ac could be provided with disinfected tertiary recycled water. An evaluation of San Joaquin County information indicated the candidate recycled use areas and their crop types as presented in Table 3-22, which are within the vicinity of the District WWTP. Clearly there are more candidate parcel potential irrigated acreages (total of 594 Ac) than can be accommodated by the volume of disinfected tertiary recycled water that the District can provide. Therefore, the initial waterbalance was estimated based on grape vineyards for CRU-7 and CRU-8, which are the parcels closest to the WWTP that have a total irrigated area of 295 Ac (greater than the 162 Ac) as a basis of alternative development for comparison. Contact with the landowners of candidate recycled use areas has not been established as part of this Master Plan, and outreach would be included in future project stages if this alternative were to be developed.

Table 3-22
Candidate Recycled Use Area Information

Identifier	APN	Parcel Address	Parcel Area (Ac)	Irrigated Area (Ac)	Irrigated Crop Type
CRU-1	053-070-07	15757 E Sargent Rd, Lodi, CA 95240-9724	40	13	Grapes
CRU-2	053-070-01	14625 E Comstock Rd, Linden, CA 95236-9606	59	34	Walnut
CRU-3	053-070-08	15757 E Sargent Rd, Lodi, CA 95240-9724	119	54	Grapes
CRU-4	053-070-06	15757 E Sargent Rd, Lodi, CA 95240-9724	40	9	N/A
CRU-5	053-110-13	16151 E Sargent Rd, Lodi, CA 95240	71	50	Walnut
CRU-6	051-250-14	6464 E Live Oak Rd, Lodi, CA 95240-9428	97	68	Walnut
CRU-7	019-060-25	2141 Hwy 224 E. Tuckerman, AR 72473	161	114	Grapes
CRU-8	019-120-04	1115 Heidelberg Way, Lodi, CA 95242-9142	226	181	Walnut, Cherry
CRU-9	053-040-39	14500 E Sargent Rd, Lodi, CA 95240-9748	69	40	Walnut
CRU-10	053-040-40	14500 E Sargent Rd, Lodi, CA 95240-9748	45	31	Walnut

Note: Candidate parcels have been selected based on proximity to existing wastewater facilities, site soil suitability, and record of current irrigated crop.

An initial length of distribution piping of approximately 5,000 ft is assumed based on an extension from the WWTP to CRU-7 and CRU-8. The initial distribution system can be expanded to reach more landowners over time. This alternative will include 0.35 Mgal of on-site recycled water storage via a steel storage tank. The storage tank capacity is based on 5 hours of demands at the recycled water pump station capacity of 1,165 gpm (during peak disposal flows).

Storage facility improvements will provide a total of approximately 119 Mgal of seasonal storage between S-1, S-2 and S-3 at the WWTP and the existing and new remote storage ponds. Recommended storage facilities to accommodate this alternative are presented in Table 3-23.

Table 3-23

Alternative 4 Storage Facilities Planning Criteria

Parameter	Units	Value
Onsite Storage Ponds		
Total Onsite Storage Volume	***Mgal***	***52.0***
Pond S-1 Area	Ac	5.75
Pond S-1 Volume	Mgal	16.5
Pond S-1 Operational Depth	ft.	9.3
Pond S-2 Area	Ac	5.75
Pond S-2 Volume	Mgal	16.5
Pond S-2 Operational Depth	ft.	9.3
Pond S-3 Area	Ac	6.75
Pond S-3 Volume	Mgal	19.0
Pond S-3 Operational Depth	ft.	9.3
Remote Storage Ponds		
Total Remote Storage Volume	***Mgal***	***67.0***
RA1 Remote Storage Pond Area	Ac	10.6
RA1 Remote Storage Pond Volume	Mgal	39.0
RA1 Remote Storage Pond Depth	ft.	11.0
RA2 Remote Storage Pond Area	Ac	10.6
RA2 Remote Storage Pond Volume	Mgal.	28.0
RA2 Remote Storage Pond Depth	ft.	7.2
Total Operational Storage Volume	**Mgal**	**119.0**
Recycled Water Storage Tank		
Tank Nominal Volume	Gal	375,000
Tank Operational Volume	Gal	350,000
Tank Diameter	ft.	44.5
Tank Height	ft.	32.5
Tank Construction	--	Bolted Steel

Recycled water storage would also include above ground steel storage tanks (one 350,000-gal storage tank) to meet peak delivery demands, while seasonal storage would require construction of a new remote storage pond at Reclamation Area 2. The new storage pond would be at least 7.5 ft deep and is similar to the new remote storage pond identified in Alternative 1 (Section 3.2.3.1). This alternative will also require construction of a Recycled Water Distribution Pump Station at the WWTP. Table 3-24 provides a summary of the facilities planning criteria for both Alternative 3 and Alternative 4.

Table 3-24
Alternative 3 and 4 Summarized Facility Planning Criteria

Alternative 3			Alternative 4		
Facility Component	**Units**	**Sizing Criteria**	**Facility Component**	**Units**	**Sizing Criteria**
Secondary Treatment Facilities			**Secondary Treatment Facilities**		
Influent Screening	Mgal/d	1.80	Influent Screening	Mgal/d	1.80
	Hp	1.5		Hp	1.5
Washer Compactor	ft^3/hr	50	Washer Compactor	ft^3/hr	50
	Hp	4.5		Hp	4.5
Aeration Pond T1 (1)	Hp	60 (new 2x20+2x10Ex.)	Aeration Pond T1, Basin 1 (1)	Hp	50 (new 2x25)
Aeration Pond S3 → T2 (1)	Hp	15 (new 2x7.5)	Aeration Pond T1, Basin 2 (1)	Hp	20 (existing 2x10)
Tertiary Treatment + Advanced Oxidation Facilities			**Tertiary Treatment Facilities**		
Secondary Eff. Pump Station	gpm	462	Secondary Eff. Pump Station	gpm	1,165
	TDH	30		TDH	30
Rapid Mixer Detention Time	seconds	227	Rapid Mixer Detention Time	seconds	131
Rapid Mixer Power	Hp	1	Rapid Mixer Power	Hp	2
Rapid Mixer Tanks	No.	2 (1 duty + 1 standby)	Rapid Mixer Tanks	No.	2 (1 duty + 1 standby)
Flocculation Detention Time	Minutes	4	Flocculation Detention Time	Minutes	2
Flocc Tanks	No.	2 (1 duty + 1 standby)	Flocc Tanks	No.	2 (1 duty + 1 standby)
Flocc Mixing Energy	G*t (unitless)	17,100	Flocc Mixing Energy	G*t (unitless)	11,600
Dissolved Air Flotation Flow	Mgal/d	0.5	Dissolved Air Flotation Flow	Mgal/d	1.34
DAF Air Injection System	cfh	122	DAF Air Injection System	cfh	326
	psig	90-100		psig	90-100
DAF Hydraulic Loading Rate	gpm/ft^2	3.5	DAF Hydraulic Loading Rate	gpm/ft^2	3.1
DAF Eff Pumps	gpm	462	DAF Eff Pumps	gpm	1,165
	TDH	86		TDH	86
Self-Cleaning Basket Strainer Size	in. Dia	6	Self-Cleaning Basket Strainer Size	in. Dia	8
Self-Cleaning Basket Strainer Units	No.	2 (1 duty + 1 standby)	Self-Cleaning Basket Strainer Units	No.	3 (2 duty + 1 standby)
Self-Cleaning Basket Openings	Mesh/Micron	40/400	Self-Cleaning Basket Openings	Mesh/Micron	40/400
Membrane Filtration Racks	No.	2 (1 duty + 1 standby)	Membrane Filtration Racks	No.	2 (1 duty + 1 standby)
Membrane Modules per Rack	No.	22	Membrane Modules per Rack	No.	65
Membrane Nominal Pore Size	µm	0.2	Membrane Nominal Pore Size	µm	0.2
UV Dose	mJ/cm^2	100	UV Dose	mJ/cm^2	100
UV Chambers	No.	1	UV Chambers	No.	3 (2 duty + 1 standby)
UV Lamps per Chamber	No.	3 (2 duty + 1 standby)	UV Lamps per Chamber	No.	8
AO (H_2O_2) Pumps	gph, ea	1.04	No AO Treatment Required		
	No.	2 (1 duty + 1 standby)			
AO (H_2O_2) Storage	Gal	775			
	No.	2 (1 duty + 1 standby)			
Coagulant Pumps	gph, ea	1.99	Coagulant Pumps	gph, ea	2.67
	No.	2 (1 duty + 1 standby)		No.	3 (2 duty + 1 standby)
Coagulant Storage	Gal	1,480	Coagulant Storage	Gal	1,983
	No.	2 (1 duty + 1 standby)		No.	3 (2 duty + 1 standby)
Storage Facilities			**Storage Facilities**		
No Storage Pond Improvements Required			RA 2 Remote Storage Pond (1)	CY	145,563
Remote Storage Return PS	gpm	460	Remote Storage Return PS	gpm	1,450
	TDH	25		TDH	25
Remote Storage Return Piping (2)	LF	2,500	Remote Storage Return Piping (2)	LF	2,500
Disposal Facilities			**Disposal Facilities**		
Recycled Water Recharge Pipeline	LF	6,350	Recycled User Distribution Pipeline	LF	5,000
	in. Dia	6		in. Dia	8
Recycled Water Recharge PS	gpm	370	Recycled Water PS	gpm	1,165
	TDH	43		TDH	174
No Storage Tank Improvements			Recycled Water Storage Tank	Gal	350,000
No N Tully Rd Crossing			N Tully Rd Crossing	LF	100
Brandt Rd Crossing	LF	100	Brandt Rd Crossing	LF	100
Bear Creek Crossing	LF	200	Bear Creek Crossing	LF	200
Pipeline ROW Acquisition	Ac	2.92	Pipeline ROW Acquisition	Ac	2.30
Monitoring Wells	No.	4	Monitoring Wells	No.	4
NEW Historic WWTP & RA 2 Recharge Ponds	Ac	25	NEW Recycled Use Areas (Grape Vineyards)	Ac	120

(1) Pond areas and volumes are consistent with the 1990 District WWTP Operations Manual.
(2) Return piping from remote storage is assumed to lie within the existing District Right of Way.

3.2.6. Treatment and Disposal Alternatives Cost Comparisons

This section presents an estimate of capital costs of headworks, secondary treatment alternatives, tertiary treatment alternatives, and disposal/recycled water alternatives. The cost estimates represent conceptual estimates of the capital costs to construct facilities. The cost estimates should be refined from this conceptual phase as the project elements are better defined and proceed into the pre-design, design, and permitting phases. The cost estimates are represented 2021 dollars at an Engineering News Record (ENR) 20-citied Construction Cost Index (CCI) of 12,237.69. The detailed cost estimates of the alternatives are presented in Appendix D.

Capital costs represent the construction and other costs necessary for project completion including constructing appurtenances to meet expected regulatory requirements. Construction costs cover the material, labor, and services necessary to build the identified project. Changes during the design of the project, in the cost of materials, labor, and equipment, and in the bidding environment will cause changes in the estimated cost. It may be possible to optimize some design details to reduce the total cost; it is recommended this be explored during the preliminary design and permitting phase.

The contingency cost item addresses the uncertainties that are associated with the preliminary sizing of projects. Factors such as unexpected construction conditions, the need for unforeseen construction items, and variations in quantities are some of the items that can increase project cost. The engineering, administrative, and legal cost item covers engineering and construction management services and items such as legal fees and administrative costs that are typically associated with a project. Environmental and permitting is included to cover the cost of acquiring the necessary permits and environmental documents for the project. Assumptions made in the development of the estimated costs for the alternatives include:

- Construction contingency at 30% based on assumption of a Class IV estimate.
- Design and engineering costs typically at 15% of construction costs, unless otherwise noted in the detailed estimates.
- Environmental, permitting and legal at 5% of construction costs.
- Engineering during construction estimated at 25% of construction costs,
- Construction management and site inspections at 15% of construction costs.

Table 3-25 summarizes the estimates of probable project costs for the treatment and disposal alternatives.

Table 3-25
Summary of Preliminary Project Costs for Treatment and Disposal Alternatives

Facility Component	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Description	Project Cost (1)	Description	Project Cost (1)	Description	Project Cost (1)	Description	Project Cost (1)
2^0 Treatment Facilities	• Headworks microscreen & washing compactor • T-1, 2 new 20 hp aerators • S-3 → T-2, 2 new 7.5 hp aerators • Plant piping modifications	$1.84M	• Headworks microscreen & washing compactor • Partition T-1 into 2 basins • T-1-1, 2 new 25 hp aerators • T-1-2, 2 existing 10 hp aerators • Plant piping modifications	$4.25M	• Headworks microscreen & washing compactor • T-1, 2 new 20 hp aerators • S-3 → T-2, 2 new 7.5 hp aerators • Plant piping modifications	$1.84M	• Headworks microscreen & washing compactor • Partition T-1 into 2 basins • T-1-1, 2 new 25 hp aerators • T-1-2, 2 existing 10 hp aerators • Plant piping modifications	$4.25M
3^0 Treatment Facilities	None	$--	None	$--	Sizing Criteria: 0.4 Mgal/d • Secondary effluent PS • Tertiary treatment building • Rapid mixing & flocculation tanks • DAF units • Self cleaning strainers • Membrane filter units • UV disinfection chambers • Advanced oxidation • Coagulant/chemical pumps • Instrumentation/electrical	$5.26M	Sizing Criteria: 1.34 Mgal/d • Secondary effluent PS • Tertiary treatment building • Rapid mixing & flocculation tanks • DAF units • Self cleaning strainers • Membrane filter units • UV disinfection chambers • Coagulant/chemical pumps • Instrumentation/electrical	$8.92M
Storage Facilities	• New Remote Storage Pond (36 Mgal)	$10.29M	• Existing Remote storage pond deepening 3.5 ft	$5.38M	• Remote storage return PS • Remote storage return piping	$1.22M	• New Remote Storage Pond (28 Mgal) • Recycled water storage tank • Remote storage return PS • Remote storage return piping	$10.33M
Disposal Facilities	• Reclamation area 2 pump station • Reclamation area 2 pipeline • Reclamation area 2 alfalfa irrigation system	$3.16M	• Reclamation area 2 pump station • Reclamation area 2 pipeline • Reclamation area 2 alfalfa irrigation system	$3.16M	• Recycled water recharge PS • Recycled water recharge pipeline • Historic WWTP recharge ponds • Reclamation area 2 recharge ponds • Monitoring wells • Instrumentation/electrical	$11.66M	• Recycled water distribution PS • Recycled water distribution pipeline • Monitoring wells • Instrumentation/electrical	$3.4M
	Total	**$15.29M**	**Total**	**$12.79M**	**Total**	**$19.98M**	**Total**	**$26.90M**

(1) Project costs include construction costs and contingencies at a mid-2021 cost basis.

3.2.7. Comparison of Treatment and Disposal Alternatives

As previously mentioned, each alternative evaluated in Section 3.2 is intended to meet the following criteria:

1) Meets current and future District treatment, storage and disposal capacity needs;
2) Maintains, to the extent practicable, disposal operations on lands and facilities owned or controlled by District;
3) Is consistent with land disposal or recycled water use consistent with current Basin Plan and statewide policies such as Title 22 of the California Code of Regulations (CCR);
4) Benefits the District and groundwater basin for reduction in basin deficit to the extent practicable by District facilities planning and operation; and
5) Is cost efficient or offers long-term economic sustainability benefits that potentially offset a portion of cost impacts.

Project costs have been evaluated in Table 3-25, and have indicated all project alternatives require budgets in excess of $12.75M. A review of the ability of each project alternatives' ability to meet the above criteria is provided in Table 3-26. Ability to meet the project criteria is ultimately scored on a pass/fail basis. A comparison of the performance of the groundwater recharge ponds and recycled use area alternatives are provided for reference in Table 3-26.

Results of the overall evaluation indicate that both Alternative 3 and 4 are able to meet all five of the evaluation criteria. Alternatives 1 and 2, although lower in relative capital cost, do not meet the criteria for benefitting the District by reduction of the basin deficit as a result of the majority of the effluent being lost to evapotranspiration without a balancing benefit of in-lieu groundwater recharge.

Table 3-26
Treatment and Disposal Alternatives Comparison

Alternative	Meets Capacity Criteria	Utilizes Existing Facilities	Meets Regulatory Requirements	Benefits Groundwater Underlying District	Capital Cost Rank (1 = lowest cost, 4 = highest cost)
Alternative 1 – Land Disposal Using Expanded Off-Site Storage and Reclamation Area 1 and 2	✓	✓	✓(1)	×	**2**
Alternative 2 – Land Disposal Maximizing WWTP Storage and Using Reclamation Area 1 and 2	✓	✓	✓(1)	×	**1**
Alternative 3 – Groundwater Recharge of Treated Effluent for Indirect Potable Reuse	✓	✓	✓(1)	✓	**3**
Alternative 4 – Recycled Water Use on Irrigated Agriculture for In-lieu Recharge	✓	✓	✓	✓	**4**

(1) Development of facilities on Reclamation Area 2 may be limited based on biological constraints, limiting the ability of the project to meet capacity criteria or regulatory requirements.

Alternative 4 is able to provide in-lieu recharge of up to 178 Mgal of recycled water during average year conditions with the highest capital cost of $26.90M, or at a volumetric cost of $0.15/gal benefit. Alternative 3 is able to benefit up to 115 Mgal of recycled water disposal via recharge ponds at a lower capital cost of $19.98M, or at a volumetric cost of $0.17/gal benefit. Although Alternative 4 may be more cost effective for its benefit to underlying groundwater, it is the most expensive alternative from both a capital and relative operational level and represents a facilities control risk to the District due to reliance on third-party agreements and grower interest in recycled water use for irrigation. If growers were to lose interest in recycled water use, then the District may have to spend additional capital on developing Reclamation Area 2 for irrigation disposal, further increasing facilities capital costs and possibly being limited by biological constraints associated with Reclamation Area 2. In contrast, Alternative 3 is able to maintain all disposal operations on properties and facilities owned or controlled by the District and does not pose the same risk as Alternative 4. Therefore, it is recommended that the District proceed with Alternative 3 for construction of recharge ponds. The combined project budget for both the collection system and treatment and disposal alternative 3 is $37.02M presented in Table 3-27.

Table 3-27
Summary of Budgetary Costs for Recommended Alternative

Master Plan Component	2021 Project Costs ($)
Collection System	$17.04M
Treatment	$7.10M
Storage	$1.22M
Disposal/Recharge	$11.66M
Total Budgetary Cost	**$37.02M**

Section 4

Recommended Expansion Plan and Project Phasing

The proposed Master Plan recommends coordinated and staged improvements to the collection system as development and infill take place within the District's SOI. These improvements address both near-term and long-term capacity needs. These sewer and conveyance system staged improvements are described in Table 3-4. The improvements were identified to provide buildout for the projected ADWF of 0.50 MGD and PWWF of 1.80 MGD.

Improvements to the treatment and disposal facilities are recommended to comprise of Alternative 3 as described in Section 3.2.4, 3.2.5 and 3.2.7. This alternative includes advanced disinfected tertiary recycled water production at the WWTP, followed by discharge into recharge ponds constructed at the Historic WWTP site and Reclamation Area 2 for the purpose of replenishing the underlying aquifer. Based on biological constraints at Reclamation Area 2, proceeding with development of recharge at the Historic WWTP site first is recommended and then future expansion considered either at the Reclamation Area 2 (if practicable) or through construction of recharge on a portion of the Reclamation Area 1 site. Since the collection system phasing has largely been discussed in Section 3.1.3, the main focus of further phasing will be the WWTP treatment and disposal facilities as discussed below.

4.1 FACILITIES PHASING PLAN

Phasing of the facilities rollout for the collection system are addressed in Section 3.1.3 where a detailed process for the implementation of staged improvements is provided.

Based on the benefits to the District and its users, permitting requirements, the cost as presented in the previous sections, and facilities performance and reliability, the recommended project for expansion of wastewater treatment and disposal includes a phased approach to Alternative 3. Although Alternatives 1 and 2 have lower capital costs, they do not provide a groundwater sustainability benefit to the District and underlying groundwater basin and development of the required land application on Reclamation Area 2 may not be achievable based on biological constraints (requiring acquisition of alternative and suitable lands). The regulatory imperative to treat the effluent and achieve recycled use to the degree practicable and sustainably drives the long-term solution to be groundwater recharge of recycled water.

The initial phase 1 of Alternative 3 will include construction of the headworks facilities and conversion of S-3 into a second aeration pond (T-2). ADWFs of up to approximately 0.23 Mgal/d can be accommodated in T-1 until the peak month loading will likely begin to exceed the aeration capacity (as discussed in Section 2.2.2.1). Following phase 1, the phase 2 facility improvements will be triggered at an ADWF of 0.39 Mgal/d, which is the storage and disposal facility maximum capacity ADWF during the 1-in-100 year climatological conditions.

At phase 2, improvements will include construction of approximately one-half of the tertiary and advanced treatment and disinfection facilities (sized to 0.25 Mgal/d), along with the remote storage return pump station and pipeline, the recycled water recharge pump station and pipeline, and the Historic WWTP Site recharge ponds. The improvements to the disposal facilities provided in phase 2 will create additional capacity to accommodate up to approximately 0.43 Mgal/d ADWF, at which point the final phase 3 will be triggered.

In phase 3, the District has the opportunity to evaluate the efficacy of the recharge ponds and their benefit for providing groundwater recharge and sustainability. If, for example, the recharge ponds are unusually high in maintenance costs (which is atypical), then the District may choose to construct additional storage facility improvements and forego any new recharge ponds at the Reclamation Area 2 site. However, if the recharge ponds have been successfully implemented and operate with few issues then the District may choose to construct the second recharge pond facility at the Reclamation Area 2 site or an alternative site that may be more suitable. The reason for expansion of the recharge ponds is to maximize the groundwater recharge benefit of the program over and above the simple disposal capacity need. It should be noted that the base project cost for construction of recharge ponds all at once (as presented in Section 3.2.5.1 and 3.2.6) would amount to approximately $19.98M. The phasing approach for phase 3a would add approximately $0.81M (total of $20.78M) as a result of additional mobilization, management, permitting and other contracting costs anticipated to occur from separating the projects. If option 3b were to be chosen, the total cost would decrease by approximately $1.87M (total of $18.11M) because the additional treatment facilities and recharge ponds to the Historic WWTP would not be constructed and only an additional storage pond improvement would occur.

For future funding, planning and budgetary purposes, it is planned that the District will proceed with the phased approach described above. At phase 3, the recharge ponds are assumed to be successfully implemented and the project will be completed with phase 3a as presented in Table 4-2. For implementation of the proposed project, the following future investigations are recommended:

- Deeper soil explorations at Reclamation Area 2 and the Historic WWTP site, including detailed hydrogeologic characterization of the underlying aquifer and interconnectivity with groundwater supplies;
- Future evaluation of alternative recharge sites in lieu of Reclamation Area 2 based on this site’s biological resource constraints;
- Evaluation of travel times from the proposed recharge sites to the nearest domestic and municipal wells; and
- Evaluation of the effectiveness of the aquifer soil treatment to support the log reduction of Enteric virus, Giardia, and Cryptosporidium.

A summary of anticipated capital costs for the recommended phased Master Plan improvements is presented in Table 4-1. At a mid-2021 basis, the total proposed budget through phase 3a is approximately $37.82M, which is $0.81M above the base project budget of $37.02M presented in Table 3-27 due to additional management and contracting fees.

Table 4-1
Summary of Proposed Budgetary Project Costs through Phase 3a

Master Plan Component	2021 Project Costs ($)
Collection System	$17.04M
Treatment	$7.43M
Storage	$1.22M
Disposal	$12.13M
Total Budgetary Cost	**$37.82M**

Table 4-2
Recommended Treatment and Disposal Facility Phasing Plan

Improvement Phase/Decision	ADWF Trigger	Facility Component	Improvement Description	Project Phase Cost Estimate(1)	2021 Total Costs
Phase 1 Existing Treatment Expansion	0.23 Mgal/d	**2^0 Treatment Facilities**	• Headworks microscreen & washing compactor • T-1, 2 new 20 hp aerators • S-3 → T-2, 2 new 7.5 hp aerators • Plant piping modifications	$1.84M	
Phase 2 Reclamation Area 2 Recharge Ponds	0.39 Mgal/d	**3^0 Treatment Facilities**	Sizing Criteria: ~0.25 Mgal/d • Secondary effluent PS (Pump 2 of 3) • Tertiary treatment building • Rapid mixing & flocculation tanks (1 of 2) • DAF unit (1 of 2) • Self-cleaning strainers (1 of 2) • Membrane filter unit (1 of 2) • UV disinfection chamber (2 of 3) • Advanced oxidation (1 of 2) • Coagulant/chemical pumps (1 of 2) • Instrumentation/electrical	$3.30M	**Total Ph 1 & 2** **$12.21M**
		Storage Facilities	• Remote storage return PS • Remote storage return piping	$1.22M	
		Disposal Facilities	• Recycled water recharge PS • Recycled water recharge pipeline • Historic WWTP recharge ponds • Instrumentation/electrical	$5.85M	
Phase 3a Construct Historic WWTP Recharge Ponds	0.43 Mgal/d	**3^0 Treatment Facilities**	Sizing Criteria: 0.5 Mgal/d • Secondary effluent PS (Pump 3 of 3) • Rapid mixing & flocculation tanks (2 of 2) • DAF unit (2 of 2) • Self-cleaning strainers (2 of 2) • Membrane filter unit (2 of 2) • UV disinfection chamber (3 of 3) • Advanced oxidation (2 of 2) • Coagulant/chemical pumps (2 of 2) • Instrumentation/electrical	$2.29M	**Total Ph 1, 2 & 3a** **$20.78M**
		Disposal Facilities	• Reclamation area 2 recharge ponds or alternative site • Monitoring wells • Instrumentation/electrical	$6.28M	
Phase 3b Remote Storage Pond Expansion (No Additional Recharge Pond)	0.43 Mgal/d	**Storage Facilities**	• New remote storage pond at Reclamation Area 2; OR • Deepen existing remote storage pond by 4.5 ft (add'l 15 Mgal) • Continue to utilize Reclamation Area 1 for disposal	$5.92M	**Total Ph 1, 2 & 3b** **$18.11M**

EVALUATE (Phase 2)
→ Recharge Ponds are a success → Phase 3a
→ Recharge Ponds are not a success → Phase 3b

4.2 FACILITIES FINANCING PLAN

The current District revenue policies for financing expansion of wastewater facilities are set forth in Ordinances 90-1, 90-2, 90-3, and 92-1 which address annexation and connection fees. This Master Plan analysis provides the basis for establishing revisions to these fees as a facilities capacity charge. Customers are billed on a monthly basis for ongoing wastewater services provided by the District and therefore future operating costs of treatment and recycled water facilities will be addressed at a later date.

A preliminary developed plan for funding of the recommended improvements is discussed in the following sections. A detailed funding plan will require further evaluation of the limitations of how the District can set various fees and how accumulated revenues are currently used. Project financing planning builds upon the previous 1998 Wastewater System Master Plan as well as the 2016 Municipal Services Review.

Annual operation and maintenance expenses are covered by monthly service charges. Monthly service charges are paid by users of the system and must cover routinely recurring expenses such as labor, power, chemicals, parts, tools, administration and deposits to capital reserve accounts for those facilities that currently provide sanitary sewer and wastewater treatment and disposal service. The capital reserve account is separate from those supported by annexation and connection fees and is intended to provide a source of funds for replacement for existing equipment, facilities and structures that wear out from time-to-time. Service charges and capital replacement are not addressed in this analysis.

The following analyses develop preliminary District revised capacity charges based on the recommended facilities phasing as presented in Section 4.1. Based on master plan report preparation, facilities costs have been developed at a 2021 basis at an ENR CCI of 12,237.69, however are updated for the purpose of presenting a basis for consideration of revised capacity charges to a March 2023 basis at an ENR CCI of 13,176.3. The recommended charges are developed and designed to meet applicable requirements of the California Government Code (CGC) for wastewater facilities capacity charges.

4.2.1. CAPACITY CHARGE REQUIREMENTS UNDER CALIFORNIA GOVERNMENT CODE

Per CGC Section 66013 et. seq., sewer capacity charges shall not exceed the estimated reasonable cost of providing the service for which the fee or charge is imposed, unless approved by a two-thirds vote. A capacity charge is defined as a charge for public facilities in existence at the time a charge is imposed or charges for new public facilities to be acquired or constructed in the future that are of proportional benefit to the person or property being charged, including supply or capacity contracts for rights or entitlements, real property interests, and entitlements and other rights of the local agency involving capital expense relating to its use of existing or new public facilities.[10]

When receiving payment of the capacity charges, the District must deposit it in a separate fund and only expend the collected payments for the purposes defined for a capacity charge. Any interest income earned from investing this separate fund will be deposited and expended in the same way.[11]

[10] CGC Section 66013 (b)(3)
[11] CGC Section 66013 (c)

The District is to also provide the following information to the public, 180 days after the last day of each fiscal year, or included in the District's annual financial report[12]:

1. A description of the charges deposited in the fund.

2. The beginning and ending balance of the fund and the interest earned from investment of moneys in the fund.

3. The amount of charges collected in that fiscal year.

4. An identification of all of the following:

    a. Each public improvement on which charges were expended and the amount of the expenditure for each improvement, including the percentage of the total cost of the public improvement that was funded with those charges if more than one source of funding was used.

    b. Each public improvement on which charges were expended that was completed during that fiscal year.

    c. Each public improvement that is anticipated to be undertaken in the following fiscal year.

5. A description of each interfund transfer or loan made from the capacity charge fund, including an identification of the public improvements on which the transferred funds are, or will be, expended, the date on which the loan will be repaid, and the rate of interest that the fund will receive on the loan.

The separate fund requirements do not apply to the following[13]:

1. Funds received to construct public facilities pursuant to a contract between the District and another party.

2. Charges used to pay existing debt service or charges that must be accounted for differently due to a contractual obligation to bondholders.

3. Charges used to reimburse the District or another party who advanced funds under a reimbursement agreement or contract for facilities in existence at the time the charges are collected.

4. Charges collected on or before December 31, 1998.

The accounting practices required by the Government Code are to be followed by the District, and capacity charges are not to be used for repairing or replacing infrastructure that will not provide benefit to the new connections.

[12] CGC Section 66013 (d)
[13] CGC Section 66013 (f)

4.2.2. Alternative Methods for Calculating Capacity Charges

The District's facilities have remaining capacity to serve anticipated development however significant improvements are identified as needed to serve future development and to achieve the groundwater recharge benefits to meet the policy requirements of Districts Resolution No. 19-01. Based on these conditions, the capacity charges associated with existing facilities should be based on the average cost of all facilities required to serve future users including the cost to increase the level of treatment, as triggered by the requirement for all new development to offset the impact to the District's underlying groundwater supplies. The valuation methodology used to calculate the cost of providing sewer service to new users is based on:

1. Cost of all collection system facilities improvements (including financing costs), excluding correction of existing deficiencies (as identified as part of Improvement #2), allocated to all future users.

2. Cost of all future wastewater treatment and disposal (recycled water) improvements (including financing costs) applied to all future users and calculated on a cost per EDU basis; and

3. Allocation of all future improvement facilities planned capacity to future users based on sufficiency of existing facilities to serve existing users and assignment of need to offset impacts to District's underlying groundwater applied only to new development.

Since the District's existing sewer facilities have significant available capacity to support service for future users, and have been maintained by existing users, the District may consider continuing to charge for new development to buy-in to these existing facilities. In such a case, alternative valuation methodologies could include:

1. Original cost, where valuation is based on the original cost of the facilities at the time of construction;

2. Net book value, where valuation is based on the original cost less accumulated depreciation;

3. Replacement cost less depreciation, where valuation is based on original cost adjusted to reflect the cost of reproducing or replacing the system in current dollars less accumulated depreciation; and

4. Replacement costs, where original costs are adjusted to reflect replacing the system in current dollars.

The above methodology excludes potential development project-specific improvements or internal development sewer system improvements or sewer line extensions that may be needed to extend service. Such development project-specific improvements are understood to be project-specific costs and are not part of the cost of capacity in the District's existing facilities.

4.2.3. Current District Annexation Fee

Based on the District's current policies, annexation fees are be paid on a lump sum by owners of land at the time their property is annexed to the District. The basis of computing the current annexation fee in accordance with District Ordinance 90-2 is to repay present users for monies they have paid up to ensure that facilities are now available to serve the new area. The District has also established, in Ordinances 99-1 and 2009-01, wastewater annexation fees of $3,200 per acre, which is subject to inflation adjustments under Ordinance 99-01. As defined, this fee is in addition to the administrative and legal expenses incurred by the District in implementing the annexation.

The basis for computation of the District annexation fee is set forth in Ordinance 90-2 however has not been reevaluated under this wastewater facilities master plan. Applying an index-based update to this historical fee, updated annexation adjusted from the previous annexation fee of $3,200 per acre based on a 1998 average ENR CCI of 5,900 to the March 2023 ENR CCI of 13,176.3 would be $7,146 per acre.

4.2.4. SEWER CAPACITY CHARGES

Sewer capacity charges (often called connection fees) are paid by individual parcel owners at the time actual service connections are made unless a special arrangement is made requiring prepayment, such as part of a specific development agreement. The District's sewer connection fees have been established as the cost per equivalent sing family dwelling unit (EDU) for expanding the collection, treatment, storage, and disposal facilities to serve new development in conformance with the Lockeford Area General Plan.

This Wastewater Facilities Master Plan updates previous expansion plans including the 1998 Wastewater Master Plan and facilities plans and concepts related to Reclamation Area No. 2. As such, previously calculated connection fees are no longer applicable. Instead, new capacity charges are recommended to replace the previous connection fees. Assumptions for the new sewer capacity charges are based the following:

- Continuation of pond treatment, storage and disposal on District owned land, where these existing facilities will benefit current and future users.
- Expanded District to serve a projected wastewater flow of 0.50 Mgal/d, or an estimated 0.31 Mgal/d increase in wastewater flows based on new development.
- Average wastewater flow per new EDU of approximately 170.5 gal/d.
- Costs associated with a portion of the Collection System Improvement No. 8 needed to serve the Lockeford Vista project and near-term improvements to the Locke Rd Pump Station, under Collection System Improvement No. 2 are excluded from this capacity charge at the following costs:
    - Approximately 66% of Improvement No. 8 at $0.759M at 2021 basis, or $0.817M at March 2023 basis.
    - Improvement No. 2 at $0.576M at 2021 basis, or $0.620M at March 2023 basis; and
- All wastewater, including commercial and industrial land uses, is in conformance with the current District sewer use ordinance, with no significant contributions of compounds that are incompatible with current treatment and disposal methods.
- Treatment, storage and disposal facility improvements are constructed consistent with this analysis.
- Direct District or property owner costs associated with making the actual physical service connection to District sewer mains are not included and would be charged based on a true connection fee basis to be established by the District.
- Charges exclude development project-specific improvements, including sewer line extensions not identified in this Wastewater Facilities Master Plan or project-specific improvements within planned subdivision or development projects needed to make connection to existing District facilities or identified Wastewater Facilities Plan improvements.

- It is assumed that Loan interest associated with project financing is included and additive to the costs per EDU when utilized in establishing the Capacity Charges since timing of collection of capacity charges will lag the need for facilities and therefore District debt financing is expected to be needed for phased project development, including the assumption that collection system improvements 3 through 7 would be debt financed.
- While costs estimates are at a July 2021 ENR CCI of 12,237.69, calculated cost per EDU is updated to a March 2023 ENR CCI of 13,176.3.

The subsequent analysis evaluates the preliminary cost per EDU for the proposed improvements. Costs per EDU are a component of the new capacity charge and do not include the total financing costs necessary for establishing new capacity charges. Estimated flow per EDU was calculated by multiplying the per capita wastewater generation factor of 62 gpcd by the low density residential DU population density of 2.75 people per DU discussed in Section 1.2.2 and 3.1.1. In this analysis it is assumed that low density residential development is representative of the typical EDU because it is expected to remain the predominant land use within the District SOI. Existing EDUs were estimated by dividing current ADWFs by the wastewater generation of 170.5 gal/d/EDU, which yields an approximate 1,114.4 EDUs (based on current influent flow average of 0.19 Mgal/d). However, the Lockeford Vista Developer has already obtained an agreement dated January 31, 2016 with the District and has reserved treatment and disposal capacity for a total of 159 connections (representing an estimated flow basis of 27,000 gallons per day). These units that will be connected are assumed to all be low-density residential, which is characteristic of the proposed Lockeford Vista development and the typical EDU.

A 30-year planning horizon is recommended for WWTP treatment and disposal improvements due to uncertainty in timing of when buildout will occur and since many of the primary improvements associated with wastewater treatment and disposal have typical useful life averaging 30 years. Using the 30-year projection basis, there are expected to be 1,173 additional EDUs (not excluding the 159 Lockeford Vista units) by 2051 resulting in an ADWF of approximately 0.39 Mgal/d. In contrast, the buildout EDU inventory is estimated by dividing the projected buildout flow of 500,000 gal/d ADWF by the 170.5 gal/d/EDU, which yields an approximate 2,932.5 buildout EDUs, of which 1,818.1 EDUs would be developed in the future including the current Lockeford Vista reserved capacity, as presented in Table 4-3.

Table 4-3
Calculation of Estimated Future EDUs

Parameter	Unit	Value
Per Person Flow	gpcd	62
LDR Unit Population Density	Persons/EDU	2.75
Wastewater Generation per EDU	gpd/EDU	170.5
Current ADWF	gpd	190,000
Estimated Existing EDUs	EDU	1,114.4
Lockeford Vista EDUs Already in Agreement	EDU	159
Total Existing EDUs	**EDU**	**1,273.4**
30-Year Development Basis		
30-Year ADWF	gpd	390,000
Estimated EDUs at 30-Year Horizon	EDU	2,287.4
Estimated Future EDUs (30-Year Less Existing)	**EDU**	**1,014.0**
Buildout Development Basis		
Future ADWF	gpd	500,000
Estimated EDUs at Buildout	EDU	2,932.6
Estimated Future EDUs (Buildout Less Existing)	**EDU**	**1,659.2**

Project costs are applied equally to future users for the full project capital costs and any future interest amounts for loans or any grant funding (if acquired). Equalizing project costs between future users are principles consistent with the basis of fee setting recommended by both the Water Environment Federation (WEF) Manual 27[14], and the American Water Works Association (AWWA) M1.[15] The Lockeford Vista users are considered existing users due to the existing January 31, 2016 Mainline Extension Agreement. Existing treatment and disposal facilities are expected to be able to accommodate the Lockeford Vista ADWF contribution with a capacity to accommodate a flow of up to 0.23 Mgal/d as presented in Table 4-2.

In order to normalize the preliminary estimated fees to a cost per Equivalent Dwelling Unit ($/EDU) basis, the cost for the collection system is estimated to serve the future 1,659.2 EDUs at buildout. The planning of the collection system includes buildout because of the necessity for developing an orderly extension of the existing sanitary sewer system to serve all areas within the current District Boundary and SOI regardless of the specific order of development. For the treatment system, the 30-year planning horizon was used to estimate service for the future 1,014 EDUs. The costs for necessary improvements to service existing users are excluded from this calculation, including Improvement # 2 presented in Table 3-4 at a cost of $576,000. Table 4-5 shows the components applied to the proposed typical cost per EDU, with their respective categorized costs for both the collection system and treatment system.

[14] Water Environment Federation, Financing and Charges for Wastewater Systems, Manual of Practice No. 27: WEF M27
[15] AWWA Manual of Water Supply Practices, Principles of Water Rates, Fees and Charges, 7th Edition: AWWA M1

Table 4-4
March 2023 Basis Master Plan Facilities Cost Summary

Component	2021 Based Improvement Cost[1]	March 2023 Basis Improvement Cost (2)
Collection System		
Gravity Mains Total	$4.68M	$5.04M
Pump Stations	$3.62M	$3.90M
Force Mains	$7.40M	$7.97M
Land and Right of Way	$0.10M	$0.11M
Subtotal	$15.80M	$17.02M
WWTP & Disposal System		
Treatment (Phases 1 and 2)	$5.14M	$5.53M
Storage (Phase 2)	$1.22M	$1.31M
Disposal Phase 2)	$5.85M	$6.30M
Subtotal	$12.21M	$13.14M
Master Plan Improvement Program Total	**$28.01M**	**$30.16M**

1. Estimate of current value of component in July 2021 at ENR Construction Cost Index of 12,237.69.
2. Cost adjusted from mid-2021 ENR CCI of 12,237.69 to March 2023 ENR CCI 13,176.3 basis.

Table 4-5
Preliminary Proposed Average Cost per EDU

Component	March 2023 Improvement Cost[1]
Collection System	
Gravity Mains (Net)	$5.04M
Pump Stations	$3.90M
Force Mains	$7.97M
Land and Right of Way (not included in total[3])	$0.11M
Subtotal	$16.91M
Amount Loan Financed (Improvements 3-7)	$9.10M
Loan Interest (30-years @ 1.5% interest rate)	$2.27M
Total (Subtotal + Loan Interest)	$19.18M
Future Buildout EDUs	1,659.2
Component of Cost per EDU ($/EDU)[2]	$ 11,560
WWTP & Disposal System	
Treatment (Phases 1 and 2)	$5.53M
Storage (Phase 2)	$1.31M
Disposal Phase 2)	$6.30M
Subtotal	$13.14M
Amount Loan Financed (100% of Eligible Project Costs)	$13.14M
Loan Interest (30-years @ 1.5% interest rate)	$3.27M
Total (Subtotal + Loan Interest)	$16.41M
Future 30-Year EDUs	1,014.0
Component of Cost per EDU ($/EDU)[2]	$ 16,183
Total Proposed Cost per EDU	
Total Cost per EDU ($/EDU)	$ 27,743

1. Estimate of current value of component in March 2023 at ENR Construction Cost Index of 13,176.3.
2. Cost per Equivalent Dwelling Unit (EDU). Total projected EDUs are based on an existing EDUs of 1,114.4 found by dividing the current ADWF by the wastewater generated per EDU, plus the 159 EDUs in agreement with the Lockeford Vista developer. Using the same method, a projected 30 – year basis 2,287.4 EDUs are expected, whereas at buildout 2,932.6 EDUs are expected. Future project costs per EDU are equal to the system component subtotal divided by either the future 30-year or buildout EDUs.
3. Collection system right-of-way assumed to be dedicated by new development where improvements are not within existing right-of-way.

Table 4-5 presented the calculated average cost per EDU at $27,743/EDU based on the total cost of improvements that benefit future users ($35.59 Million) serving a total buildout additional EDUs of 1,659.2 for the collection system and at least 1,014 future developed EDUs for treatment and recycled water, which includes facilities improvements to mitigate impacts to the District's underlying groundwater supply. Cost per EDU calculations were proportioned to future users by the amount of flow contributed by each land use type, and are summarized in Table 4-6. Based on the additional development that may occur through buildout, the costs required per EDU to recover the capital cost of the collection system and wastewater treatment facilities improvements for new users are $20,252 to $32,737 per connection of medium-density residential to very low-density residential development. Non-residential commercial development costs are between $12.76 to $15.81 per square foot. The range of capacity charges will vary depending on the amount of grant funding (if any) the District is able to secure or the cost to debt finance capital costs. The overall charges should be inclusive of the project costs per EDU, and revised by any future cost reduction through grants or accumulated loan interest.

4.2.5. INDEXING OF FEES

Historically, the District has increased connection charges to account for inflation and rising construction costs; however, inflationary increases may not always be adequate to cover increased costs associated with changes in assumptions made in this Wastewater Facilities Master Plan. The existing District Ordinance 99-01 allows inflation adjustments of the connection fees each year and it is recommended that the future capacity charges adopted be adjusted following this same process. Annual indexing of fees based on an accepted cost indicator such as the Consumer Price Index (CPI) or the ENR CCI is recommended at minimum. However, if the assumptions made in this Wastewater Facilities Master Plan are no longer applicable, then the District may reassess the facility costs and update the capacity charges accordingly.

Table 4-6
Costs per EDU for Future Units for Collection System and WWTP Improvements

Land Use Type	Land Use Density (1)	Population Density(2)	FAR (3)	Wastewater Generation (4)	Unit Wastewater Generation	Equivalent Dwelling Units	Proposed Cost per EDU
Residential	**Units/Net Acre**	**Capita/DU**	**–**	**gpd/Net Acre**	**gpd/Unit**	**EDUs**	**$/Unit**
Very Low Density Residential	2	3.25	N/A	400	202	1.18	$ 32,737
Low Density Residential (5)	4	2.75	N/A	680	171	1.00	$ 27,743
Medium Density Residential	10	2	N/A	1,240	124	0.73	$ 20,252
Mixed Use	**Units/Net Acre**	**Capita/DU**	**–**	**gpd/Net Acre**	**Gpd/Unit**	**EDUs**	**$/Unit**
Agriculture Urban Reserve	0.1	2.5	0.01	16	160	0.94	$ 26,078
General Agriculture	0.2	2.66	0.01	33	165	0.97	$ 26,911
Office Commercial (6)	18	0.33	0.25	920	51	0.30	$ 8,323
Non-Residential	**Units/Net Acre**	**Capita/DU**	**–**	**gpd/Net Acre**	**Gpd/KSF**	**EDUs/KSF**	**$/SF**
Community Commercial	N/A	N/A	0.25	1,056	97	0.57	$ 15.81
General Commercial	N/A	N/A	0.25	1,056	97	0.57	$ 15.81
Public Facilities	N/A	N/A	0.25	850	78	0.46	$ 12.76
Limited Industrial	N/A	N/A	0.25	1,056	97	0.57	$ 15.81
General Industrial	N/A	N/A	0.25	1,056	97	0.57	$ 15.81

(7) San Joaquin County General Plan, Pgs. 69 - 120, were used for reference Dwelling Unit land use density ranges.
(8) Population density estimated based on 2 people per DU for medium density residential, 2.75 people per DU for low density residential and 3.25 people per DU for very low-density residential land use, as a means to allocate population among these differing land use types.
(9) FAR = Floor Area Ratio, the gross floor area permitted on a site divided by the total net area of the site. A site with 100 sq. ft. of land area with a FAR of 0.25 will allow a maximum of 25 sq ft of building floor area to be built.
(10) Wastewater generation factors for residential DUs are estimated for typical 62 gpcd discussed in Section 4.0 of the Flows and Loads Technical Memorandum.
(11) Low Density Residential land use is characteristic of the typical Single Family Residential Unit and EDU within the District.
(12) Office Commercial land use is assumed 80% commercial and 20% residential development

APPENDICES

Appendix A

FLOWS AND LOADS TECHNICAL MEMORANDUM

KJELDSEN SINNOCK NEUDECK inc.
CIVIL ENGINEERS & LAND SURVEYORS

Stephen K. Sinnock, P.E.
Christopher H. Neudeck, P.E.
Neal T. Colwell, P.E.
Barry O'Regan, P.E.

2465-0010
03-001

TECHNICAL MEMORANDUM

April 6, 2023

To: Joseph Salzman, District Manager, Lockeford Community Services District

Subject: Existing and Future Land Use and Flows and Loads

Project: Lockeford Community Services District – Wastewater Facilities Master Plan

From: Neal T. Colwell, RCE 59437

1.0 Background and Purpose

This Technical Memorandum has been prepared to summarize current Lockeford Community Service District (LCSD) land use and population characteristics, define the Wastewater Facilities Master Plan study area, and project future land use, population, and flows and loads for the study area. This Technical Memorandum includes:

- Definition of the study area;
- Existing land uses and population characteristics of the study area;
- Existing flows and loads from the current District sanitary sewer service area;
- Future land use and population projections with the study area;
- Future flows and loads within the study area; and
- Recommended planning criteria for Wastewater Master Planning.

The recommended planning criteria will be used as the basis of subsequent Wastewater Master Plan elements including:

1. Evaluation of existing facilities;
2. Capacity requirements of alternative treatment methods;
3. Project implementation schedule; and
4. Project implementation financing and allocation of costs to users.

2.0 Project Planning Area

The study area is primarily developed based on the existing District service area and Sphere of Influence (SOI) as approved by the San Joaquin Local Area Formation Commission (LAFCO), including projects specifically proposed for development or under consideration for approval for annexation or requests for expansion of the District's SOI. Specific projects or development types expected to occur in this study area are:

1. Infill development within the current LCSD service area based on already subdivided parcels and residential and commercial land uses that may be served by LCSD;
2. Other larger parcels within the LCSD boundary that may be subdivided based on County Land Use policies;
3. Development and construction on the Lockeford Vista and Lockeford Oaks projects; and
4. Development of the recently annexed approximately 105-acre area known as Kautz Property or Kautz Project that was recently added to the SOI and the LCSD service area.

Figure 1 presents the current LCSD service area and identifies the defined Sphere of Influence of the District. The existing LCSD limits consists of approximately 894 acres situated between Mokelumne River and Bear Creek in San Joaquin County, California. The District's service area includes the 105 acres that were recently annexed into the Districts SOI boundary and service area as part of the Kautz Property proposed development.[1]

As part of this study, the potential for new development, including infill growth within the existing LCSD limits and new development proposed within the District's SOI are considered. The areas identified in Figure 1 including the existing LCSD limits and SOI totals 1,034 acres, as detailed in Table 1. Of the 1,034 acres within the SOI, approximately 140 acres have not yet been annexed into the District's service area.

Table 1
Study Area

Area Component	Gross Area (acres) [(1)]
Service Area	894
District Service Area and Sphere of Influence	1,034
Area Remaining for Annexation (SOI)	140

(1) Includes highway, road right of way, and other non-buildable areas.

Lands that are outside of the service area are predominantly located to the southwest of the community as illustrated in Figure 1. The areas to the southwest have typically been occupied by industrial land uses that has occurred since the 1980s.

[1] Kautz Property annexed into SOI and LCSD service area on December 8, 2016 by SJLAFCO, Resolution 1359

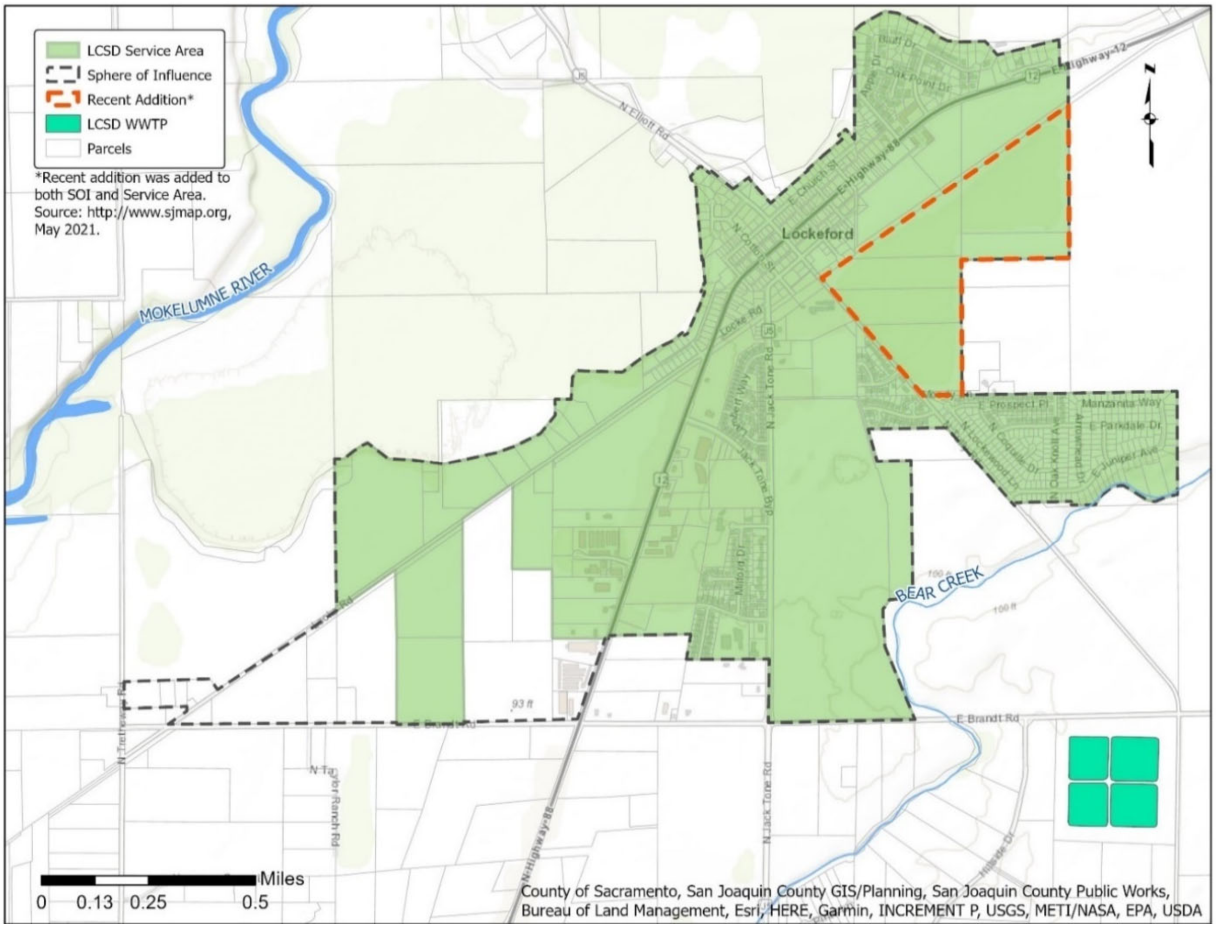

Figure 1
LCSD Service Area and Sphere of Influence

3.0 Existing Land Use and Population Characteristics

Based on available records, the existing land use characteristics and population characteristics for LCSD are summarized in the below sub-sections.

3.1 Existing Land Use

Existing land use within the current Service Area consists of a combination of residential and non-residential uses. Existing residential and non-residential land uses include:

- Agriculture Urban Reserve;
- General Agriculture;
- Very Low Density Residential;
- Low Density Residential;
- Medium Density Residential;
- General Commercial;
- Community Commercial;
- Office Commercial;
- General Industrial;
- Limited Industrial; and
- Public Facilities.

Of these land uses, all but Agriculture Urban Reserve and General Agriculture generate wastewater. Within the existing Service Area, there are three development projects that are planned to occur, which include the Lockeford Vista and the Lockeford Oaks projects, and the Kautz Property project. These projects will encompass 41.9 acres, and 124.73 acres, and 105 acres, respectively. The Lockeford Vista and Lockeford Oaks development areas are currently designated as Low Density Residential and the Kautz Property is designated as General Agriculture. For future planning purposes the Kautz Property is expected to be designated as Low Density Residential as indicated in the December 2nd, 2016 Kautz Property Plan of Service Memo by Hydros Consulting. The current land use areas within the District's service area and the approximate areas for the development projects are shown in Figure **2**.

Table 2 presents the most recent available land use inventory (2021 timeframe) within the existing Service Area with an estimate of the developed and vacant land potentially available for development. Currently undeveloped areas within the LCSD Service Area includes 413 total acres, of which approximately 141 acres of potential infill development, and 271.63 acres of development are attributed to the Kautz Property, Lockeford Vista, and Lockeford Oaks planned developments. For areas within the SOI but outside the Service Area, approximately 137.5 total acres could be connected in the future, including approximately 102 acres of general industrial, 27 acres of limited industrial, and 8.5 acres of public facilities land uses. The information in Table 2 qualitatively characterizes the potential for infill development within the current Service Area.

Table 2
LCSD Existing Service Area Land Uses

Land Use Designation (1)	Existing (2) Developed Area Within Service Area (acres)	Currently (2) Undeveloped Area Within Service Area (acres)	Unconnected Area Outside Service Area, Within SOI (acres)	Total Potential Undeveloped Area (acres)	Undeveloped Percent of Total
Agriculture Urban Reserve	39	60	0	60	11%
General Agriculture	48	0	0	0	0%
Very Low Density Residential	14	12	0	12	2%
Low Density Residential (2)	192	20 + 271.63 (2)	0	291.63	53%
Medium Density Residential	22	5	0	5	1%
General Commercial	26	12	0	12	2%
Community Commercial	29	0.3	0	0.3	0%
Office Commercial	2	0	0	0	0%
General Industrial	21	20	102	122	22%
Limited Industrial	12	0	27	27	5%
Public Facilities	9	12	8.5	20.5	4%
Totals (rounded)	**414**	**413**	**137.5**	**550.4**	**100%**

(1) Land use designation per San Joaquin County records.

(2) The Undeveloped low density residential area includes a total of 271.63 acres for the Kautz Property, Lockeford Vista and Lockeford Oaks planned development project areas shown in Figure 2.

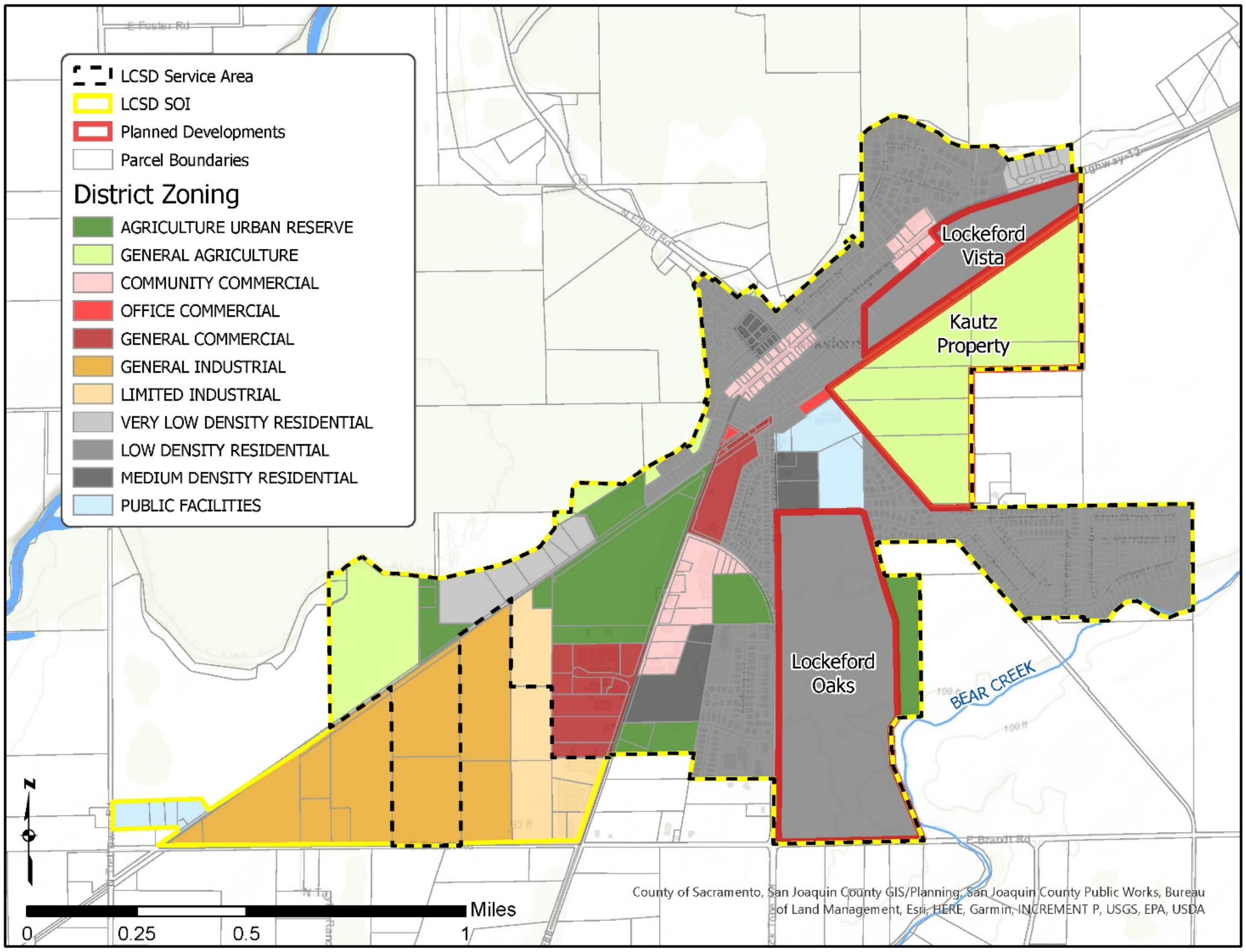

Figure 2
Current Land Uses in District Service Area and Sphere of Influence

3.2 Current and Historical Population Characteristics

Recent historical LCSD population statistics are presented in Table 3 for the years of 2010 through 2020[2]. For this time period the overall annual growth rate in population has been 0.9% per year. Assuming a continuation of recent annual growth rate trends, the future Lockeford population is expected to continue to grow at 0.9% per year.

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[2] US Census data obtained from ESRI Vintage 2020 Time Series (2010 thru 2020) for Census Tract 4701.

Table 3
Historical Lockeford Population Trends

Year	LCSD Population (Census Tract 4701)	Annual growth (%)
2010	2,762	
2011	2,781	0.8%
2012	2,812	0.9%
2013	2,841	1.0%
2014	2,876	1.0%
2015	2,894	0.9%
2016	2,926	1.0%
2017	2,958	1.0%
2018	2,991	1.0%
2019	3,008	0.9%
2020	3,016	0.9%
	Overall Average	0.9%

4.0 Existing Flows and Loads

This section characterizes wastewater flows and loads for the LCSD system including influent flows and loads to the WWTP.

4.1 WWTP Influent Flows and Characteristics

As part of its regular monitoring and reporting program the District monitors the influent wastewater to the WWTP. The monitoring program includes collection of the following information:

1. Influent flow measured daily at 7:00 AM via continuous totalizing flow meter at the WWTP headworks; and
2. Once a month for grab sampling from the headworks for laboratory measurement of 5-day Biochemical Oxygen Demand (BOD).

For this study, influent flow data collected since 2011 has been reviewed, with a focus on more recent data to assess current flows and loads. Figure **2** presents influent flows and influent BOD results for the period of January 1, 2016 through December 31, 2020. Table 4 summarizes more recent annual data for 2016 through 2020. Table 4 does not include data prior to July 2016, as BOD results were not available.

Table 4
2016 through 2020 Average Monthly Influent Flow and Monthly BOD

	2016		2017		2018		2019		2020	
Month	Avg Flow (Mgal/d)	BOD (mg/L)	Avg Flow (Mgal/d)	BOD (mg/L)	Avg Flow (Mgal/d)	BOD (mg/L)	Avg Flow (Mgal/d)	BOD (mg/L)	Avg Flow (Mgal/d)	BOD (mg/L)
January	0.197	-	0.246	334	0.173	287	0.207	267	0.184	204
February	0.179	-	0.240	235	0.167	201	0.240	312	0.184	169
March	0.198	-	0.183	186	0.179	-	0.220	120	0.189	217
April	0.175	-	0.185	159	0.178	154	0.192	174	0.190	202
May	0.175	-	0.177	197	0.169	165	0.195	156	0.186	-
June	0.168	-	0.168	356	0.181	202	0.186	210	0.184	-
July	0.170	157	0.167	228	0.187	272	0.186	195	0.180	227
August	0.178	318	0.169	-	0.186	361	0.189	178	0.186	436
September	0.175	181	0.171	182	0.183	132	0.185	272	0.185	246
October	0.176	211	0.166	177	0.193	233	0.185	374	0.181	-
November	0.180	182	0.173	123	0.200	387	0.186	218	0.187	-
December	0.179	260	0.164	298	0.200	287	0.196	200	0.186	-
Annual Average	0.179	218	0.184	225	0.183	244	0.197	223	0.185	243

Influent to the WWTP includes flows from currently and historically active domestic wastewater sources. Domestic wastewater sources are associated with those land uses described above and include residential, institutional, public facility, and commercial sources. As can be seen from Figure **2**, LCSD's influent wastewater flows respond to seasonal rainfall and associated infiltration and inflow (I/I), with dry-period flows occurring predominantly in June, July, August, and September. Recent annual average annual flows have ranged from 0.179 million gallons per day (Mgal/d) to 0.197 Mgal/d, and have remained relatively stable since 2016, however with 2019 and 2020 indicating a possible upward trend, possibly resulting from the more recent increases in economic activities.

Seasonal increases in wastewater flows expected to be a result of I/I typically occur in the months of December through March, but with occasional increases in influent flows occurring as late as May. Seasonal peak flows typically occur during very heavy rain periods, resulting in peak influent flows reaching over 0.5 million gallons in a day. The two largest recent peak day influent flows occurred on January 11, 2017 at 0.521 Mgal/d and February 21, 2017 at 0.446 Mgal/d.

Influent BOD annual averages range from 218 mg/L to 244 mg/L and are generally consistent with wastewater strength associated with a mixture of primarily residential flows with some commercial contribution. Since 2016, the overall BOD levels have been fairly consistent with the exception of occasional peaks, likely a result of the limited grab sampling of the influent wastewater. Multiple months that contained values below 10 mg/L or above 500 mg/L were excluded from analysis and treated as outliers as they were not considered to be representative of the bulk influent wastewater.

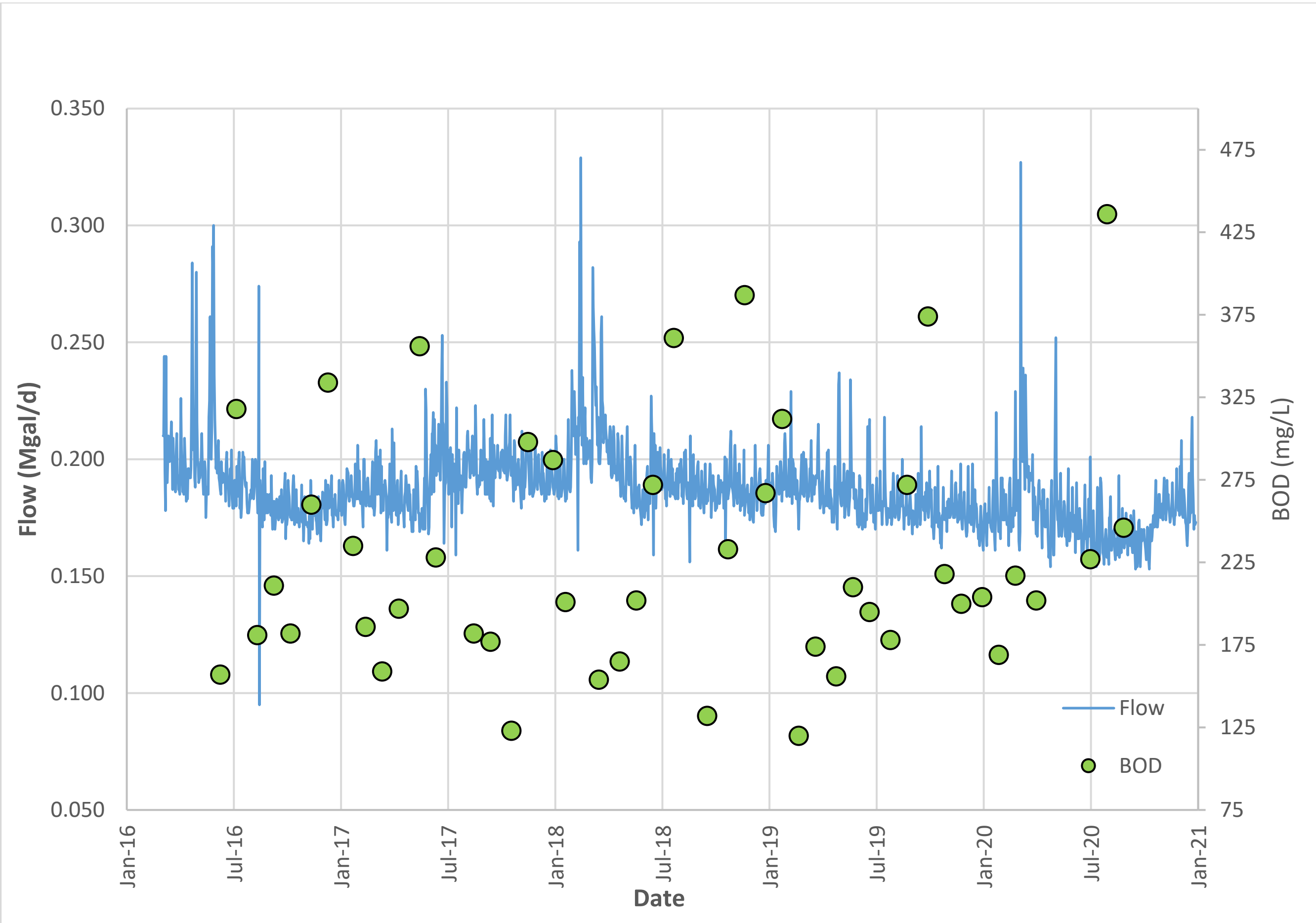

Figure 3
Lockeford Community Services District Influent Flow and BOD Characteristics

Figure 3 presents the average dry weather flow (ADWF) contributed per capita in gallons per capita per day (gpcd) from 2011 through 2020. The period from 2012 through 2017 shows a significant decreasing trend in per capita flow, however recent data from 2018 through 2020 indicates that the per capita flow has increased and stabilized at within the 61 to 62 gpcd range. The more recent period of 2018 through 2020 indicated by the shaded area in Figure 4 suggest a stabilization of per capita flows.

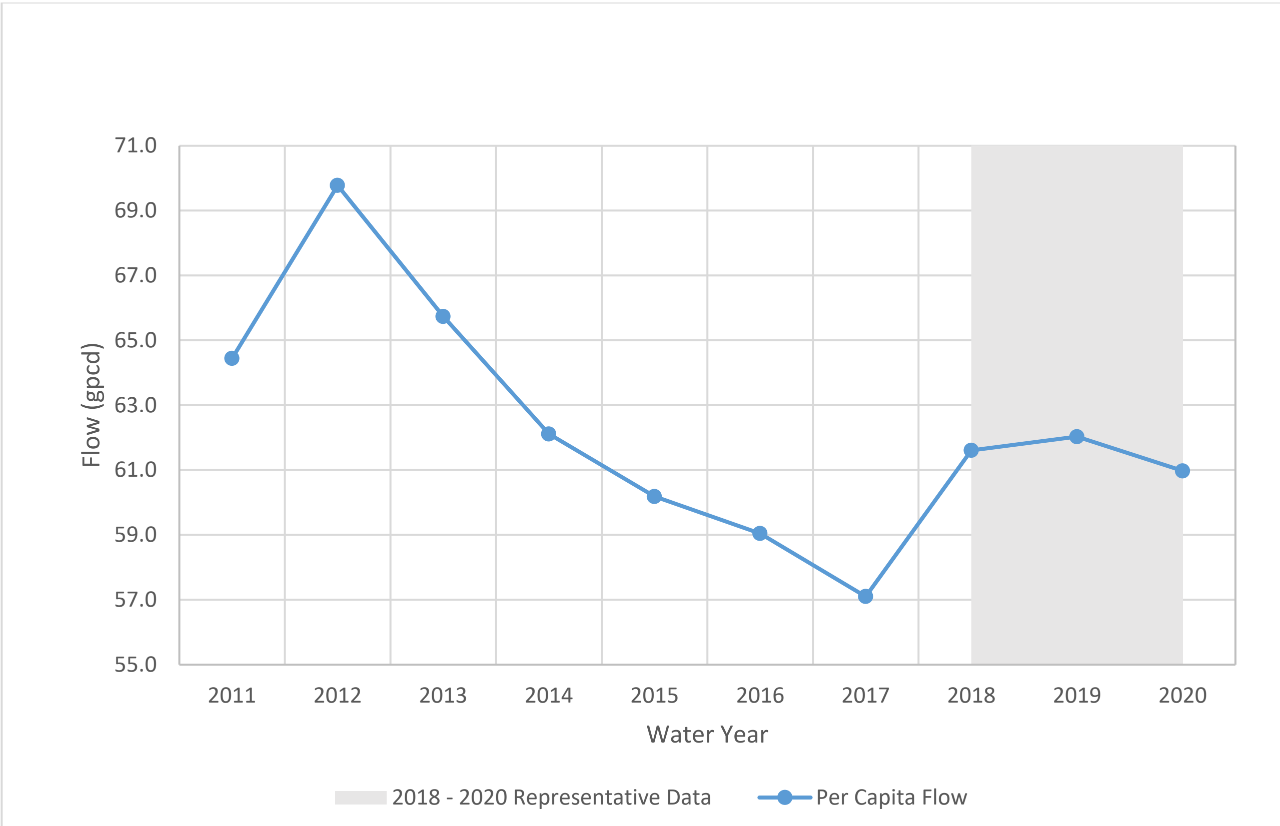

Figure 4
Lockeford Community Service District Per Capita Wastewater Flow

Table 5 presents the following characteristics:

1. Influent ADWF for water year 2018 through 2020, which includes June, July, August, and September flows;
2. Estimated average per capita wastewater flow generation rate for domestic flows on a per capita basis, assuming population as presented in Table 3;
3. Peak day flow for the water year of record and peaking factor as compared to the respective water year influent ADWF; and
4. Average influent BOD and per capita estimated BOD generation factors for domestic wastewater assuming population as presented in Table 3.

The months of June through September were considered representative of ADWFs, rather than the typical months of July through September, as June's monthly flows matched or fell below the other dry months. The District's ADWF has remained relatively constant over the last three years, ranging between 0.180 and 0.190 Mgal/d.

Table 5
Summary of WWTP Average Dry Weather Flows and Loads

Water Year	WWTP Influent ADWF (Mgal/d)	Average Domestic Flow per Capita (gal/cap-day)	Peak Day Flow (Mgal/d)	ADWF: Peak Day Peaking Factor	Average Influent BOD (mg/L)	Per-Capita BOD (lbs/cap-day)
2018	0.184	61.6	0.317[a]	1.7	278	0.14
2019	0.187	62.0	0.394[b]	2.1	214	0.11
2020	0.184	61.0	0.247[C]	1.3	303	0.15
Average (rounded)	**0.19**	**62**	**0.32**	**1.7**	**265**	**0.14**

[a] Peak day flow for 2018 occurred on April 7th.
[b] Peak day flow for 2019 occurred on March 3rd.
[c] Peak day flow for 2020 occurred on March 16th.

As previously discussed and presented in Table 5, the 2018-2020 data has been selected as the basis of estimating future flows for planning purposes. However, in reviewing the past 10 years of historical data, the highest peak day flow of record occurred on January 11, 2017 at a peak day flow of 0.521 Mgal/d, corresponding to a peak day to ADWF peaking factor of 3.1 which will be used in this assessment.

Monthly grab samples for influent BOD is not a robust means to characterize unit BOD generation factors, as shown by the apparent substantial variability month-to-month, with typical values ranging from 0.11 to 0.36 lbs per capita per day for BOD. However, as compared with the Ten States Standards recommended values of 0.17 – 0.20 lbs per capita per day for BOD and comparison with other smaller northern California communities which tend to be reflective of at least the lower end of the Ten State Standards recommended values, available data suggest a moderately low BOD per capita generation of 0.14 lbs/cap-day. Except for August 2018 and August 2020, influent BOD has been similar to what could be expected from predominantly residential and commercial wastewater sources. Per capita flow generation has also varied significantly since 2011, with values ranging from 57 gpcd to 70 gpcd, with a more recent 2018 through 2020 average of 62 gpcd. The respective per capita 0.14 lbs/cap-day BOD and 62 gpcd generation factors are proposed for facilities planning.

5.0 Future Land Use and Population Projections

The Wastewater Master Plan includes estimating future development and population and associated wastewater flows and loads and evaluating the facilities alternatives for accommodating those future flows and loads. This sub-section characterizes potential future flows and loads based on expected future land use and population projections.

Future growth within the District Service Area and SOI is regulated under the policies of the San Joaquin County (County) General Plan and under County adopted Zoning. With respect to future wastewater generation, development within the LCSD is expected to occur under two means:

1. As infill development within the existing District service area; and
2. Planned development projects within the current District boundary and Sphere of Influence as part of the Lockeford Vista, Lockeford Oaks, and Kautz Project developments.

Infill development may occur as a result of intensified levels of development on already developed lands, e.g., development of underutilized land in the LCSD's Service Area, or development on otherwise vacant land within the current District service area.

5.1 Planned Development Projects

New development within the LCSD's current boundary and SOI will typically occur through a process for land use planning, land subdivision, and annexation (when applicable) within the District service area. New development proceeding under this process may take decades to occur and ultimately develop build-out wastewater flows over long periods. According to current information, the District has three identified development projects at varying stages of approval. These projects are characterized in Table 6.

Table 6
Current Community of Lockeford Development Projects

Development Project	Land Use (1)	Development Area (Acres)	Development Characteristics	Project Status
Kautz Property	Low Density Residential	105	420 ldrus	Approved, property annexed for future development of ldrus.
Lockeford Vista	Low Density Residential	41.9	159 ldrus	Approved, development planned for near-term subdivision into ldrus.
Lockeford Oaks	Low Density Residential	124.73	306 ldrus	Approved Phase I for 73 ldrus, Phase II is currently also planned.
Total	**--**	**271.63**	**885 (1)**	**--**

ldru = Low Density Residential Unit
(1) Approximate ldru potential assuming development as described in the May 2016 Lockeford Municipal Services Review, and the December 2, 2016 Kautz Property Plan of Service Memo.

Identified new development has the potential to add an estimated 885 additional single family, low density residential equivalents units. Excluding commercial development and assuming an average occupancy of 2.75 people per housing unit[3], the population of this future development could be approximately 2,435. This future potential population increase as a result of new development represents an approximately 81% increase in the Lockeford current estimated population of 3,016. Since the capacity of the developments exceeds the population growth in Table **8**, some projects or their occupancy may occur beyond a 30-year horizon.

Table 7
Estimated Flow Contribution from Planned Development Projects

Development Project	Potential Population Contribution (1)	Wastewater Flow Contribution (2) (Mgal/d)
Kautz Property	1,155	0.07
Lockeford Vista	437	0.03
Lockeford Oaks	841	0.05
Total	**2,433**	**0.15**

(1) Population estimated based on 2011 – 2020 average occupancy of 2.75 people per housing unit.
(2) Wastewater flow estimated based on 62 gpcd as evaluated in Section 0.

[3] US Census 2011-2020 persons per household in Census Tract 47.01.

5.2 Future Population Growth

Assuming an annual average population growth rate of 0.9% (historical nine-year average), the potential future population for the community of Lockeford over a 30-year planning horizon is as outlined in Table 8. Using this rate of population growth the 30-year future LCSD population is estimated to increase by approximately 930 residents, and may reach 3,946 residents. Considering the planned development projects listed in Table 7, much of this potential population growth would occur as a result of buildout of these developments.

Table 8
Estimated Future Lockeford Population

Year	0.9% Annual Growth	Year	0.9% Annual Growth	Year	0.9% Annual Growth
2021	3,016	2032	3,328	2043	3,673
2022	3,043	2033	3,358	2044	3,706
2023	3,071	2034	3,389	2045	3,740
2024	3,098	2035	3,419	2046	3,773
2025	3,126	2036	3,450	2047	3,807
2026	3,154	2037	3,481	2048	3,841
2027	3,183	2038	3,512	2049	3,876
2028	3,211	2039	3,544	2050	3,911
2029	3,240	2040	3,576	2051	3,946
2030	3,269	2041	3,608		
2031	3,299	2042	3,640		

5.3 Potential Buildout of District Service Area

Although it is uncertain when infill development within the service area will occur, wastewater generation due to service area buildout is expected to proceed based factors presented in Table 9. The infill of the remaining service area is projected based on current zoning. Additional wastewater flows may occur if changes to current zoning occurs, or if additional parcels are annexed into the service area from the SOI. However, zoning and potential future land uses within the SOI are predominantly industrial and therefore the sanitary sewer flows will likely be limited depending on future characteristics of specific industrial developments that occur. For this Master Plan analysis, it is recommended that future industrial development be considered on a project-by-project basis. A list of parcels within the SOI but not within the service area is included in Exhibit A.

Table 9

Wastewater Generation Factors for Buildout within Service Area

Land Use Type	Infill Gross Area (Acres)	New Development Area (Acres)	Non-Use [(1)] Development (%)	Avg Density (DU/Net Acre) [(2)]	Population Density (Capita/DU) [(3)]	FAR [(4)]	Wastewater Generation Factors (gpd/Net Acre) [(5)]	LCSD Infill WW Flow (Mgal/d)	New Development WW Flow (Mgal/d)
Agriculture Urban Reserve	60	0	1%	0.1	2.5	0.01	16	0.001	–
General Agriculture	0	0	1%	0.2	2.66	0.01	33	0.000	–
Very Low Density Residential	12	0	30%	2	3.25	N/A	400	0.003	–
Low Density Residential	20	271.63 [(6)]	30%	4	2.75	N/A	680	0.010	0.15
Medium Density Residential	5	0	30%	10	2	N/A	1,240	0.004	–
Office Commercial [(7)]	0	0	30%	18	0.33	0.25	920	0.000	–
Community Commercial	0.3	0	30%	N/A	N/A	0.25	1,056	0.000	–
General Commercial	12	0	30%	N/A	N/A	0.25	1,056	0.009	–
Public Facilities	12	8.5 [(8)]	30%	N/A	N/A	0.25	850	0.007	0.01
Limited Industrial	0	27 [(8)]	30%	N/A	N/A	0.25	1,056	0.000	0.02
General Industrial	20	102 [(8)]	30%	N/A	N/A	0.25	1,056	0.015	0.08
								Total: 0.05	Total: 0.26

Add'l ADWF: 0.31 Mgal/d
Current ADWF: 0.19 Mgal/d

Buildout ADWF: 0.50 Mgal/d

(1) Nonuse includes roads and other land uses that do not contribute to wastewater generation.
(2) San Joaquin County General Plan, Pgs. 69 - 120, were used for reference Dwelling Unit land use density ranges.
(3) Population density estimated based on 2 capita per DU for medium density residential, 2.75 capita per DU for low density residential and 3.25 capita per DU for very low-density residential land use.
(4) FAR = Floor Area Ratio, the gross floor area permitted on a site divided by the total net area of the site. A site with 100 sq. ft. of land area with a FAR of 0.25 will allow a maximum of 25 sq ft of building floor area to be built.
(5) Wastewater generation factors for residential DUs are estimated for typical 62 gpcd discussed in Section 0.
(6) Low density residential area includes a total of 271.63 acres for the Kautz Property, Lockeford Vista and Lockeford Oaks planned development project areas shown in Figure 2.
(7) Office Commercial land use is assumed 80% commercial and 20% residential development
(8) New development areas include public facility and industrial areas within the SOI but outside the Service Area.

6.0 Future Flows and Loads

Future wastewater flows and loads are expected to occur as a result infill development, new development of the District's identified development projects and connection to areas outside the current Service Area but within the SOI. No new types of industrial discharges are known to be planned; therefore future industrial discharges are assumed to be consistent with historical discharges. Therefore, future increases in flows and loads are expected to result only from new residential and commercial development occurring within the District's service area and SOI. In lieu of projecting flows and loads based on the historical population growth, the basis of future flows and loads to the WWTP is recommended to be based on full build-out development of new development projects, which may drive increases in future population growth above what is expected to occur based on historical population growth rates.

Future 30-year planning horizon flows and load ranges are presented in Table **10** based on the range of population growth outlined in Table 8. These future flows and loads are based on the following criteria:

1. A wastewater generation factor of 62 gallons per person per day, as supported by Water Year 2018 through 2020 data as presented in Table 5;
2. BOD unit generation of 0.14 lbs per person per day, as supported by Water Year 2018 through 2020 data as presented in Table 5; and
3. TSS unit generation of 0.17 lbs per person per day, recommended based on a typical ratio of TSS/BOD of 1.2.

Table 10
Estimated Future Lockeford Flows and Loads

Flow/Load Contribution	ADWF (Mgal/d)	BOD Loading (1) (lb/day)	TSS Loading (2) (lb/day)	TKN Loading (3) (lb/day)
Current	0.19	420	504	88
New Development	0.26	575	670	120
Service Area Infill	0.05	111	133	23
Total Buildout Amount (rounded)	0.50	1,106	1,307	231

(1) BOD Loading based on 265 mg/L or 0.14 lb/cap/day from Table 5.
(2) TSS Loading based on 10 States Standards typical ratio of 1.2 lb TSS/lb BOD.
(3) Because of limited nitrogen data, a unit TKN (Total Kjeldahl Nitrogen) load factor of 0.029 pounds per capita per day was assumed based on a typical ratio of TKN/BOD of 0.21.

7.0 Recommended Planning Criteria

Table 11 presents the recommended Wastewater Master Plan planning criteria based on historical LCSD monitoring data and a 30-year projection of population to 3,946. This 30-year population projection is consistent with infill development that may occur within the existing service area limits and an orderly progression of identified future development within the District's SOI. Additional facilities would be needed to accommodate wastewater generated beyond the 30-year projection and to accommodate build-out development within the Sphere of Influence. The below recommended criteria are also based on current flows and loads continuing similar to 2018 through 2020 average flows and loads.

Table 11
Recommended Facilities Wastewater Master Planning Criteria

Wastewater Characteristic	Units	Planning Criteria
Flows		
ADWF	Mgal/d	0.50
Peak Month Peaking Factor	Unitless	1.2
Peak Day Peaking Factor	Unitless	3.1
Peak Hour Peaking Factor (1)	Unitless	3.6
Loads		
BOD		
Average BOD Daily Load	Lbs/d	1,106
BOD Peak Month Peaking Factor	Unitless	1.6
BOD Peak Day Peaking Factor	Unitless	1.8
TSS		
Average TSS Daily Load	Lbs/day	1,307
TSS Peak Month Peaking Factor (2)	Unitless	1.6
TSS Peak Day Peaking Factor (2)	Unitless	1.8
Nitrogen		
Average TKN Daily Load (3)	Lbs/day	231
TKN Peak Month Peaking Factor (3)	Unitless	1.6
TKN Peak Day Peaking Factor (3)	Unitless	1.8

(1) Peak hour peaking factor adapted from 10 States Standards Recommended Planning Criteria: $PF_{PH} = \frac{18+\sqrt{P}}{4+\sqrt{P}}$, where PF_{PH} is the peak hour peaking factor, and P is the community population in thousands. An additional 5% factor of safety has been applied.
(2) Peaking factors for TSS based on BOD peaking factors.
(3) Because of limited nitrogen data, a unit TKN (Total Kjeldahl Nitrogen) load factor of 0.029 pounds per capita per day was assumed based on a typical ratio of TKN/BOD of 0.21.
(4) Peaking factors for TKN assumed based on BOD peaking factors.

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Exhibit A

Inventory of Parcels in SOI not in District Service Area

Parcels Within Lockeford SOI but Outside of LCSD Service Area

APN	Acres	General Plan Designation	Zoning Designation
051-160-07	0.3	OS/O	P-F
051-160-08	1.9	OS/O	P-F
051-160-14	1.3	OS/O	P-F
051-160-15	4.8	OS/O	P-F
051-160-22	1.7	I/G	I-G
051-160-24	19.5	I/G	I-G
051-160-25	0.6	I/G	I-G
051-160-26	4.7	I/G	I-G
051-160-27	5.2	I/G	I-G
051-290-16	1.5	I/G	I-G
051-310-25	1.5	I/L	I-L
051-310-26	1.5	I/L	I-L
051-310-34	4.0	I/L	I-L
051-310-35	4.1	I/L	I-L
051-320-03	10.0	I/L	I-L
051-320-07	23.9	I/G	I-G
051-320-08	2.3	I/G	I-G
051-320-10	25.1	I/G, I/L	I-G, I-L
051-320-12	23.6	I/G	I-G

General Plan and Zoning Designations

OS/O = Open Space

I/G, I-G = General Industrial

I/L, I-L = Limited Industrial

P-F = Public Facilities

Exhibit B

Flow and BOD Summary Tables and Exhibits

Summary of Recent Average Dry Weather Flows						
Year	**ADWF (Mgal/d)**	**ADWF (gal/d)**	**Population (capita)**	**Per Capita Flow (gal/cap·d)**	**Peak Flow (Mgal/d)**	**Peaking Factor**
2011	0.179	179,213	2,781	64.4	0.300	1.7
2012	0.196	196,213	2,812	69.8	0.329	1.7
2013	0.187	186,754	2,841	65.7	0.261	1.4
2014	0.179	178,631	2,876	62.1	0.327	1.8
2015	0.174	174,172	2,894	60.2	0.252	1.4
2016	0.173	172,762	2,926	59.0	0.361	2.1
2017	0.169	168,902	2,958	57.1	0.521	3.1
2018	0.184	184,262	2,991	61.6	0.317	1.7
2019	0.187	186,582	3,008	62.0	0.394	2.1
2020	0.184	183,893	3,016	61.0	0.247	1.3
Historical Values Used for this Assessment	**0.19**	**190,000**	**N/A**	**62**	**0.521** (1)	**3.1** (1)

(1) Criteria selected based on peak day flow of record occurring on January 11, 2017.

Appendix B

STAGED IMPROVEMENT FLOW CALCULATIONS

Area Captured	Existing Service Area for Locke Road PS and Bear Creek PS	
Development Category	Developed	

Row Labels	Count of Parcels	Sum of Acreage
Bear Creek PS	556	53.51
GENERAL AGRICULTURE	2	0.01
LOW DENSITY RESIDENTIAL	554	53.50
Locke Rd. P.S.	1468	192.47
AGRICULTURE URBAN RESERVE	54	5.57
COMMUNITY COMMERCIAL	131	23.63
GENERAL AGRICULTURE	8	0.39
GENERAL COMMERCIAL	77	13.73
GENERAL INDUSTRIAL	1	0.00
LIMITED INDUSTRIAL	45	14.00
LOW DENSITY RESIDENTIAL	1014	101.17
MEDIUM DENSITY RESIDENTIAL	58	21.38
OFFICE COMMERCIAL	19	1.78
PUBLIC FACILITIES	37	6.15
VERY LOW DENSITY RESIDENTIAL	24	4.68
Grand Total	**2024**	**245.98**

Pump Station	Zoning Type	Parcel Count	Acreage	Non-Use Development [(%)]	Average Density [DU/Net Ac]	Population Density [Cap/DU]	Wastewater Generation Factors [gpd/Net Acre]	RES Parcel Count	Assumed Cap Density	ADWF Gal (RES)	ADWF Gal (Other)	ADWF ADJ (RES) [gal]	ADWF ADJ (OTHER) [gal]	PWWF ADJ (RES) [gal]	PWWF ADJ (OTHER) [gal]
Bear Creek PS	AGRICULTURE URBAN RESERVE			1%	0.1	2.5	16								
	COMMUNITY COMMERCIAL			30%	N/A	N/A	1056								
	GENERAL AGRICULTURE	2	0.01	1%	0.2	2.66	33						0		0
	GENERAL COMMERCIAL			30%	N/A	N/A	1056								
	GENERAL INDUSTRIAL			30%	N/A	N/A	1056								
	LIMITED INDUSTRIAL			30%	N/A	N/A	1056								
	LOW DENSITY RESIDENTIAL	554	53.5	30%	4	2.75	680	554	2.75	94457		55,693		200,494	
	MEDIUM DENSITY RESIDENTIAL			30%	10	2	1240								
	OFFICE COMMERCIAL			30%	18	0.33	920								
	PUBLIC FACILITIES			30%	N/A	N/A	850								
	VERY LOW DENSITY RESIDENTIAL			30%	2	3.25	400								
Locke Rd. PS	AGRICULTURE URBAN RESERVE	54	5.57	1%	0.1	2.5	16				88		52		187
	COMMUNITY COMMERCIAL	131	23.63	30%	N/A	N/A	1056				17,464		10,297		37,069
	GENERAL AGRICULTURE	8	0.39	1%	0.2	2.66	33				13		7		27
	GENERAL COMMERCIAL	77	13.73	30%	N/A	N/A	1056				10,150		5,985		21,545
	GENERAL INDUSTRIAL	1	0.00	30%	N/A	N/A	1056				0		0		0
	LIMITED INDUSTRIAL	45	14.00	30%	N/A	N/A	1056				10,350		6,103		21,969
	LOW DENSITY RESIDENTIAL	1014	101.17	30%	4	2.75	680	1014	2.75	172887		101,936		366,970	
	MEDIUM DENSITY RESIDENTIAL	58	21.38	30%	10	2	1240	58	2	7192		4,240		15,266	
	OFFICE COMMERCIAL	19	1.78	30%	18	0.33	920				1,148		677		2,436
	PUBLIC FACILITIES	37	6.15	30%	N/A	N/A	850				3,661		2,159		7,771
	VERY LOW DENSITY RESIDENTIAL	24	4.68	30%	2	3.25	400	24	3.25	4836		2,851		10,265	
									Sum (gal)	279,372	42,874	164,721	25,279		
									SUM (MGD)	0.28	0.04	0.16	0.03		
									SUM (MGD)	0.32		0.19			
									Ratio ----> sum/0.19 MGD	1.696					

ADWF to the Pump Stations

PS Name	Adjusted Flow (gpm)
Bear Creek PS	38.7
Locke Rd. PS	93.3

PF_PH
3.6

GPCD
62

PWWF to the Pump Stations

PS Name	Adjusted Flow (gpm)
Bear Creek PS	139.2
Locke Rd. PS	335.8

Pump Stations:

Locke Road Pump Station (LR PS)
Bear Creek Pump Station (BC PS)
North Tully Road Pump Station (NT PS)
East Brandt Road Pump Station (EBR PS)
West Brandt Road Pump Station (WBR PS)

Abbreviations:

- GPCD: Gallons per Capita per Day; 62 GPD assumed based on historical data
- PF_PH: Peak Hourly Peaking Factor; 3.6 assumed based on Ten States Standard
- ADWF: Average Dry Weather Flow
- PWWF: Peak Wet Weather Flow
- DU: Dwelling Unit
- Cap: Capita
- gal: Gallon
- MGD: Million Gallons per Day
- gpd: Gallons per Day
- gpm: Gallons per Minute
- fps: Feet per Second
- FM: Force Main
- WWTP: Wastewater Treatment Plant
- PS: Pump Station

Area Captured	Improvement 1 & 2 Considered for Calculation	
Development Category	Both Developed and Undeveloped	

Row Labels	Count of Parcels	Sum of Acreage
Locke Rd. P.S.	**213**	**149.59**
AGRICULTURE URBAN RESERVE	20	6.76
GENERAL AGRICULTURE	14	36.63
GENERAL INDUSTRIAL	154	83.85
LIMITED INDUSTRIAL	9	10.07
VERY LOW DENSITY RESIDENTIAL	16	12.28
West Brandt Rd PS	**15**	**1.39**
GENERAL INDUSTRIAL	15	1.39
Grand Total	**228**	**150.98**

Improvement 1 Max Buildout Projected Future Flows (gpm)

ADWF	51
PWWF	185

Existing Flows to the Locke Rd PS (gpm)

ADWF	93
PWWF	336

*** Value from the Exisitng Pumps Stations Sheet in the exisiting developed table (Adjusted ADWF/PWWF)

Flows [gpm]

To BC PS (Total) [gpm]	735
From LR PS (Max Buildout)	596
From Bear Creek Sewer Shed	139
To WWTP (Total [gpm]	735
From BC PS	735

Note: Reflects max buildout flows

Task: Extend 8" Sewer main to 3,200 feet on Locke Rd Heading west

Calc: Determine ADWF and PWWF from extension of sewer line (gpm) - This area is the SW Locke Rd PS. Determine Future Flows based on the SW Locke Rd development.

GPCD: 62 PF_PH: 3.6

Future Flows to PS

Pump Station	Zoning Type	Acreage	Non-Use Development [(%)]	Average Density [DU/Net Ac]	Population Density [Cap/DU]	Wastewater Generation Factors [gpd/Net Acre]	RES Parcel Count	Assumed Cap Density	ADWF Gal (RES)	ADWF Gal (Other)	PWWF (RES) [gal]	PWWF (OTHER) [gal]
Locke Rd. PS	AGRICULTURE URBAN RESERVE	6.76	1%	0.1	2.5	16				107		385
	COMMUNITY COMMERCIAL		30%	N/A	N/A	1056				0		
	GENERAL AGRICULTURE	36.63	1%	0.2	2.66	33				1,197		4,308
	GENERAL COMMERCIAL		30%	N/A	N/A	1056				0		
	GENERAL INDUSTRIAL	83.85	30%	N/A	N/A	1056				61,982		223,135
	LIMITED INDUSTRIAL	10.07	30%	N/A	N/A	1056				7,444		26,797
	LOW DENSITY RESIDENTIAL		30%	4	2.75	680		2.75	0			
	MEDIUM DENSITY RESIDENTIAL		30%	10	2	1240		2	0			
	OFFICE COMMERCIAL		30%	18	0.33	920				0		
	PUBLIC FACILITIES		30%	N/A	N/A	850				0		
	VERY LOW DENSITY RESIDENTIAL	12.28	30%	2	3.25	400	16	3.25	3224		11,606	
								Sum (gal)	3,224	70,729	11,606	254,626
								SUM (MGD)	0.00	0.07	0.01	0.25
								SUM (MGD)	0.07		0.27	

ADWF to the Pump Station from Imp. 1

PS Name	Adjusted Flow (gpm)
Locke Rd. PS	51.4

PF_PH
3.6

PWWF to the Pump Station from Imp. 1

PS Name	Adjusted Flow (gpm)
Locke Rd. PS	184.9

GPCD

62

Pump Station	Zoning Type	Parcel Count	Acreage	Non-Use Development [(%)]	Average Density [DU/Net Ac]	Population Density [Cap/DU]	Wastewater Generation Factors [gpd/Net Acre]	RES Parcel Count	Assumed Cap Density	ADWF Gal (RES)	ADWF Gal (Other)
Beark Creek PS	AGRICULTURE URBAN RESERVE			1%	0.1	2.5	16				
	COMMUNITY COMMERCIAL			30%	N/A	N/A	1056				
	GENERAL AGRICULTURE	2	0.01	1%	0.2	2.66	33				
	GENERAL COMMERCIAL			30%	N/A	N/A	1056				
	GENERAL INDUSTRIAL			30%	N/A	N/A	1056				
	LIMITED INDUSTRIAL			30%	N/A	N/A	1056				
	LOW DENSITY RESIDENTIAL	554	53.5	30%	4	2.75	680	554	2.75	94457	
	MEDIUM DENSITY RESIDENTIAL			30%	10	2	1240				
	OFFICE COMMERCIAL			30%	18	0.33	920				
	PUBLIC FACILITIES			30%	N/A	N/A	850				
	VERY LOW DENSITY RESIDENTIAL			30%	2	3.25	400				

Bear Creek PS Sewer Shed PWWF (EXISING) (gpm)

139

	Flow (gpm)	Velocity (fps)
PWWF resulting from Item 2 (Reliable Capacity)	335	-
Parallel FM Flows Flows	-	-
335 gpm total 8" FM[1]	191	1.22
335 gpm total 6" FM[1]	144	1.63
335 gpm total combined single 6" FM	335	3.80
PWWF resulting from total area buildout[2]	596	-
596 gpm total 8" FM[1]	341	2.18
596 gpm total 6" FM[1]	255	2.89
596 gpm total combined single 6" FM	596	6.76

1. Equalize velocity head
2. Requires Improvement #7 to achieve flows

Objective: Size new N Tully Rd PS

Calc: Flows to NT PS

Using Table 7 from F/L TM Kautz Property should contribute ADWF 0.07 Mgal/d to the new NT PS

Flow	ADWF	PWWF (PF_PH =3.6)		Force Main	
MGD	0.07	0.25		D (in)	6
gpm	49	175		A (sf)	0.196349541
	Vel (fps)---->	2.0		*** FM to WWTP	

Table 7

Estimated Flow Contribution from Planned Development Projects

Development Project	Potential Population Contribution (1)	Wastewater Flow Contribution (2) (Mgal/d)
Kautz Property	1,176	0.07
Lockeford Vista	445	0.03
Lockeford Oaks	857	0.05
Total	**2,478**	**0.15**

(1) Population estimated based on 2011 – 2020 average occupancy of 2.8 people per housing unit.

(2) Wastewater flow estimated based on 62 gpcd as evaluated in Section 4.0.

Objective:	New FM connection to WWTP. Discontinue flow to BC PS				
Calc:	Flows in FMs and different velocities. NT PS and LR PS at capacity				

	LR to WWTP	**Diameter (in)**	**Area (ft^2)**	**Length (ft)**	**Velocity (fps)**
Item 2 Changes 335 gpm --->	**LR PS to Jack Tone Rd**	8	0.349	3,200	2.1
	Jack Tone Rd to EBR PS connection	8	0.349	4,800	2.1
	EBR to WWTP	10	0.545	4,300	1.4

Item 2 Changes 335 gpm --->	**Flows PWWF [gpm]**	
	LR PS to BC PS	0
	LR PS to WWTP through EBR PS	336
	BC PS to WWTP	139
	NT PS to WWTP	175
	*** Later on include infill and LV Dev flows (Item #7)	

	LR to WWTP	**Diameter (in)**	**Area (ft^2)**	**Length (ft)**	**Velocity (fps)**
Full buildout 596 gpm --->	**LR PS to Jack Tone Rd**	8	0.349	3,200	3.8
	Jack Tone Rd to EBR PS connection	8	0.349	4,800	3.8
	EBR to WWTP	10	0.545	4,300	2.4

Full buildout 596 gpm --->	**Flows PWWF [gpm]**	
	LR PS to BC PS	0
	LR PS to WWTP through EBR PS	596
	BC PS to WWTP	139
	NT PS to WWTP	175
	*** Later on include infill and LV Dev flows (Item #7)	

Flows PWWF [gpm]		
~~LR PS to BC PS~~	~~0~~	
LR PS to WWTP through EBR PS	596	
~~BC PS to WWTP~~	~~0~~	
NT PS to WWTP	314	
BC PS to WWTP (Before #6)	139	
NT Grav Sewer		
	Flow (gpm)	314
	Diameter (in)	8
	Area (ft^2)	0.349
NT PS		
	Increase from 175 gpm to 314 gpm	

Flows from Infill and Lockeford Vista Development

	MGD	gpm
Infill and LV Dev (ADWF)	0.08	56
Infill	0.05	35
Lockeford Vista	0.03	21

***All infill to LR PS. Table 9 and Table 7 Values Used from FL TM

	MGD	gpm
Infill and LV Dev (PWWF)	0.29	200
Existing Infill	0.18	125
Lockeford Vista	0.11	75

***Includes #9 Buildout

Total LR PS Flows

	gpm
Existing Flows	336
Item #1 & #9 Dev***	215
Infill and Lockeford Vista Dev	200
Total	751

*** Item #9 flows included

8 in FM Velocity (fps)
4.79

Note: Flows included in item 7

PWWF [gpm]to LR PS due to Item #9

30.3

GENERAL COMMERCIAL	18	8.4279018
LIMITED INDUSTRIAL	16	7.9711983

Pump Station	Zoning Type	Parcel Count	Acreage	Non-Use Development [(%)]	Average Density [DU/Net Ac]	Population Density [Cap/DU]	Wastewater Generation Factors [gpd/Net Acre]	RES Parcel Count	Assumed Cap Density	ADWF Gal (RES)	ADWF Gal (Other)	PWWF ADJ (RES) [gal]	PWWF ADJ (OTHER) [gal]
Locke Rd. PS	AGRICULTURE URBAN RESERVE			1%	0.1	2.5	16				0		
	COMMUNITY COMMERCIAL			30%	N/A	N/A	1056				0		
	GENERAL AGRICULTURE			1%	0.2	2.66	33				0		
	GENERAL COMMERCIAL	18	8.4	30%	N/A	N/A	1056				6,209		22,353
	GENERAL INDUSTRIAL			30%	N/A	N/A	1056				0		
	LIMITED INDUSTRIAL	16	8.0	30%	N/A	N/A	1056				5,914		21,289
	LOW DENSITY RESIDENTIAL			30%	4	2.75	680	0	2.75	0			
	MEDIUM DENSITY RESIDENTIAL			30%	10	2	1240	0	2	0			
	OFFICE COMMERCIAL			30%	18	0.33	920				0		
	PUBLIC FACILITIES			30%	N/A	N/A	850				0		
	VERY LOW DENSITY RESIDENTIAL			30%	2	3.25	400	0	3.25	0			
									Sum (gal)	0	12,123	0	43,642
									SUM (MGD)	0.00	0.012	0.00	0.04
									SUM (MGD)	0.01		0.04	

ADWF to the Pump Stations

PS Name	Adjusted Flow (gpm)
Locke Rd. PS	8.4

PF_PH
3.6

PWWF to the Pump Stations

PS Name	Adjusted Flow (gpm)
Locke Rd. PS	30.3

EBR PS discharging into 10" FM to WWTP

a. 50% dev of historical Lockeford Oaks Dev
b. Expand based on flow from rest of development

a. 50% dev of historical Lockeford Oaks Dev

Flow to EBR PS

Flows from Lockeford Oaks Dev.------------------->

Flow	ADWF	PWWF (PF_PH =3.6)
MGD	0.025	0.09
gpm	9	31.3

Total Flows Including Item #5, 6 & 7----->

Flow	PWWF (PF_PH =3.6)
MGD	0.95
gpm	782

b. Expand based on flow from rest of development

Flow to EBR PS

Flows from Lockeford Oaks Dev.------------------->

Flow	PWWF (PF_PH =3.6)
gpm	31.3

EBR PS to WWTP Total Flows Including Item #5, 6 & 7----->

Flow	PWWF (PF_PH =3.6)
gpm	813

Flow in 10-in FM

Velocity (fps)	Area of 10-in (SF)
3.3	0.545

Flow in 12 in FM

Velocity (fps)	Area of 12-in (SF)
2.3	0.785

Estimated Flow Contribution from Planned Development Projects

Development Project	Potential Population Contribution [1]	Wastewater Flow Contribution [2] (Mgal/d)
Kautz Property	1,176	0.07
Lockeford Vista	445	0.03
Lockeford Oaks	857	0.05
Total	2,478	0.15

(1) Population estimated based on 2011 – 2020 average occupancy of 2.8 people per housing unit.

(2) Wastewater flow estimated based on 62 gpcd as evaluated in Section 4.0.

Flow to EBR PS

Flows from Lockeford Oaks Dev.----------->

Flow	PWWF (PF_PH =3.6)
gpm	31

Total Flows Including Item #5, 6 & 7----->

Flow	PWWF (PF_PH =3.6)
gpm	782

New 10-in Gravity Sewer

Divert FM flows from Improvement 5 and Improvement 13 to gravity sewer

Flows from No. 5, 7 & 10

Flow	PWWF (PF_PH =3.6)
gpm	782

*** Improvement 13 flows not included

Install Grav Sewers (6" or 8") on Brandt Rd		
Development Category	Both Developed and Undeveloped	
Pump Station Catchment Name	West Brandt Rd PS	
Row Labels	**Count of Parcels**	**Sum of Acreage**
GENERAL INDUSTRIAL	89	54.50
LIMITED INDUSTRIAL	13	13.58
PUBLIC FACILITIES	15	7.38
Grand Total	**117**	**75.46**

Pump Station	Zoning Type	Parcel Count	Acreage	Non-Use Development [(%)]	Average Density [DU/Net Ac]	Population Density [Cap/DU]	Wastewater Generation Factors [gpd/Net Acre]	RES Parcel Count	Assumed Cap Density	ADWF Gal (RES)	ADWF Gal (Other)	PWWF (RES) [gal]	PWWF (OTHER) [gal]
W Brandt Rd PS	AGRICULTURE URBAN RESERVE			1%	0.1	2.5	16				0		
	COMMUNITY COMMERCIAL			30%	N/A	N/A	1056				0		
	GENERAL AGRICULTURE			1%	0.2	2.66	33				0		
	GENERAL COMMERCIAL			30%	N/A	N/A	1056				0		
	GENERAL INDUSTRIAL	89	54.5	30%	N/A	N/A	1056				40,286		145,031
	LIMITED INDUSTRIAL	13	13.6	30%	N/A	N/A	1056				10,053		36,191
	LOW DENSITY RESIDENTIAL			30%	4	2.75	680	0	2.75	0			
	MEDIUM DENSITY RESIDENTIAL			30%	10	2	1240	0	2	0			
	OFFICE COMMERCIAL			30%	18	0.33	920				0		
	PUBLIC FACILITIES	15	7.4	30%	N/A	N/A	850				4,403		15,851
	VERY LOW DENSITY RESIDENTIAL			30%	2	3.25	400	0	3.25	0			
									Sum (gal)	0	54,743	0	197,073
									SUM (MGD)	0.00	0.05	0.00	0.20
									SUM (MGD)	0.05		0.20	

PF_PH
3.6

ADWF to the Pump Stations

PS Name	Adjusted Flow (gpm)
W Brandt Rd PS	38.0

PWWF to the Pump Stations

PS Name	Adjusted Flow (gpm)
W Brandt Rd PS	136.9

PWWF to the Pump Station	
PS Name	**Flow (gpm)**
WBR PS	137
Velocity	
4-inch FM	3.5
6-inch FM	1.6

Install 4" WBR PS FM

Connect to to FM from no. 5

	gpm
Flow from WBR FM	137
Flow from LR PS	751
Flow to EBR PS (FM)	888
Flow from Lockeford Oaks Dev	63
Total Flow to EBR PS	950
Flow from EBR PS to WWTP	813

	Velocity (fps)
10-inch FM	3.3

Connect to gravity sewer (No.11)

	gpm
Flow from WBR FM	137
Flow from LR PS	751
Flow to EBR PS (FM)	751
Flow from Lockeford Oaks Dev	63
Flow in Grav Sewer	950
Total Flow to EBR PS	950
Flow from EBR PS to WWTP	813

Appendix C

WATER BALANCE CALCULATIONS

LOCKEFORD COMMUNITY SERVICES DISTRICT — FILE: 2465-0010

FUTURE 0.39 ADWF WATER BALANCE UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS

11/1/2021

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS

STARTING AVERAGE FLOW (MGD)	0.19

IRRIGATION AREA CHARACTERISTICS

RECLAMATION AREA 1 ALFALFA PRODUCTION AREA

MINIMUM REQUIRED ALFALFA PRODUCTION AREA (AC)	95
EXISTING AREA ACTIVE ALFALFA PRODUCTION (AC)	57

RECLAMATION AREA 2 ALFALFA PRODUCTION AREA

DEVELOPED GROSS ALFALFA PRODUCTION AREA (AC)	0
NET AREA IN ALFALFA PRODUCTION (AC)	0

FUTURE ADD'L GRAPE PRODUCTION AREA

NEW GROSS GRAPE PRODUCTION AREA (AC)	0.0
NEW NET GRAPE PRODUCTION AREA (AC)	
NEW NET AREA IN GRAPE PRODUCTION (AC)	

STORAGE POND CHARACTERISTICS

TOTAL STORAGE AVAILABLE (MG)	91.0
TOTAL STORAGE AVAILABLE (AF)	279
WWTP STORAGE POND GROSS AREA (AC)	12.3
TOTAL STORAGE POND EVAP/PERC AREA (AC)	21.0
WWTP STORAGE POND EVAP/PERC AREA (AC)	10.5
OFFSITE STORAGE POND EVAP/PERC AREA (AC)	10.6
STORAGE RESERVOIR DESIGN PERC. RATE (in/day)	0.034
EXISTING STORAGE (MG)	
NW, SW & SE STORAGE PONDS AT WWTP (MG)	52.0
OFFSITE STORAGE POND (MG)	39.0
FUTURE STORAGE (MG)	
ADD'L STORAGE POND STORAGE REQ'D (MG)	0.0

TREATMENT POND CHARACTERISTICS

TREATMENT POND GROSS AREA (AC)	7.0
EVAP/PERC AREA (AC)	6.0
DESIGN PERC. RATE (in/day)	0.0
STORAGE AVAILABLE (MG)	0.0

CLIMATOLOGICAL FACTORS

CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO	1.92
OCT-APR EVAP/AVG EVAP RATIO	0.80
MAY-SEP EVAP/AVG EVAP RATIO	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.05
STORAGE CATCHMENT SOIL RUNOFF COEFF.	1.00

RECHARGE POND CHARACTERISTICS

RECHARGE POND GROSS AREA	0.0
EVAP/PERC AREA (AC)	0.0
DESIGN PERC. RATE (in/day)	0.000
STORAGE AVAILABLE (MG)	0.0

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
DAYS IN MONTH	365	31	30	31	31	28	31	30	31	30	31	31	30
AVG PRECIP, LODI (IN)	17.04	0.84	1.76	1.68	3.54	3.81	2.74	1.32	0.95	0.15	0.03	0.03	0.19
AVG EVAPORATION, LODI (IN)	51.89	3.31	1.60	0.92	0.93	1.73	3.46	5.34	6.81	7.69	7.93	6.95	5.22
DESIGN EVAPORATION (ETo) (IN)	48.43	2.65	1.28	0.74	0.74	1.38	2.77	4.27	6.81	7.69	7.93	6.95	5.22
ZONE 12 WET YEAR GRASS REFERENCE EVAPOTRANSPIRATION (ETr) (IN)	43.29	3.48	1.05	1.02	0.39	0.81	2.76	4.12	4.08	6.31	7.49	7.00	4.78
ALFALFA ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	42.42	2.07	1.16	1.20	0.45	0.95	3.23	4.88	4.86	6.41	6.73	6.24	4.24
GRAPE (NO COVER) ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	31.25	0.62	0.97	1.01	0.42	0.91	2.24	2.63	3.62	5.27	5.96	4.92	2.68
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ALFALFA CROP COEFFICIENT (Kc = ETc/ETr)		0.59	1.10	1.18	1.15	1.17	1.17	1.18	1.19	1.02	0.90	0.89	0.89
GRAPE (NO COVER) CROP COEFFICIENT (Kc = ETc/ETr)		0.18	0.92	0.99	1.08	1.12	0.81	0.64	0.89	0.84	0.80	0.70	0.56
AVERAGE DRY WEATHER FLOW (MGD)		0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
MONTHLY VOLUME OF I/I AS A PERCENT OF ADWF (2018 - 2020)		0.6%	3.3%	4.8%	1.6%	6.5%	5.8%	1.0%	0.0%	0.0%	0.0%	1.1%	0.0%
TOTAL I/I VOLUME (MGD)		0.001	0.006	0.009	0.003	0.012	0.011	0.002	0.000	0.000	0.000	0.002	0.000

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		4.9%	10.3%	9.9%	20.8%	22.4%	16.1%	7.7%	5.6%	0.9%	0.2%	0.2%	1.1%
ESTIMATED LODI/LOCKEFORD RAIN, 1-in-100 YEAR (IN)	33	1.62	3.39	3.23	6.81	7.33	5.27	2.54	1.83	0.29	0.06	0.06	0.37
EFFECTIVE RAIN FOR PLANTS (IN)	31	1.54	3.22	3.07	6.47	6.97	5.01	2.41	1.74	0.27	0.05	0.05	0.35
EVAPORATION-RELATED CALCULATIONS													
ALFALFA EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Kc)	49	1.58	1.41	0.87	0.86	1.62	3.24	5.06	8.11	7.81	7.13	6.20	4.63
GRAPE (NO COVER) EVAPOTRANSPIRATION POTENTIAL (IN) (ETc)(ETo*Kc)		0.47	1.18	0.73	0.80	1.55	2.25	2.73	6.04	6.42	6.31	4.88	2.93
STORAGE RESERVOIR EVAPORATION (IN) (ETo * Water Surface Coefficient)	48	2.65	1.28	0.74	0.74	1.38	2.77	4.27	6.81	7.69	7.93	6.95	5.22
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	69	5.9	5.7	5.9	5.9	5.3	5.9	5.7	5.9	5.7	5.9	5.9	5.7
I/I FLOW VOLUME (MG)	1	0.04	0.19	0.28	0.09	0.35	0.34	0.06	0.00	0.00	0.00	0.06	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.19	0.20	0.20	0.19	0.20	0.20	0.19	0.19	0.19	0.19	0.19	0.19
TOTAL INFLUENT FLOW VOLUME (MG)	71	6.0	5.9	6.2	6.0	5.7	6.3	5.8	5.9	5.7	5.9	6.0	5.7
TREATMENT POND CALCULATIONS													
PERCOLATION (IN)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERC. VOLUME (MG)		0.00	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL EVAP. VOLUME (MG)	8	0.43	0.21	0.12	0.12	0.22	0.45	0.69	1.11	1.25	1.29	1.13	0.85
PRECIP. VOLUME (MG)	5	0.26	0.55	0.53	1.11	1.19	0.86	0.41	0.30	0.05	0.01	0.01	0.06
TREATMENT POND RESIDUAL EFFLUENT VOLUME (MG/MONTH)	69	5.83	6.24	6.61	6.99	6.67	6.71	5.52	5.09	4.50	4.62	4.88	4.91
EXISTING ALFALFA PRODUCTION AREA CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	1.80	3.20	3.20	3.20	3.20	0.55	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		95	95	95	95	95	95	95	95	95	95	95	95
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	45	2.30	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	8.86	8.03	6.19
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	116	5.93	0.00	0.00	0.00	0.00	0.00	0.00	23.27	27.70	22.86	20.72	15.96
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		5.8	6.2	13.5	21.3	30.8	40.4	46.7	50.2	28.0	4.6	4.9	4.9
AVAILABLE EFFLUENT APPLIED (MG)	71	5.83	0.00	0.00	0.00	0.00	0.00	0.00	23.27	27.70	4.62	4.88	4.91
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.92	0.15	0.16	0.16
EFFLUENT IRRIGATION RATE (IN/MONTH)	28	2.26	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	1.79	1.89	1.90
RECLAMATION AREA 2 CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	1.80	3.20	3.20	3.20	3.20	0.55	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		0	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	37	0.04	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	7.07	6.14	4.28
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		0.00	6.24	13.47	21.28	30.81	40.38	46.73	26.97	0.33	0.00	0.00	0.00
AVAILABLE EFFLUENT APPLIED (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EFFLUENT IRRIGATION RATE (IN/MONTH)	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	0.00	0.00	0.00
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	0.00	6.86	14.29	24.15	33.67	41.21	45.15	23.53	0.00	0.00	0.00
POTENTIAL RESIDUAL STORAGE VOLUME GAIN/LOSS (MG)		0.00	6.24	6.61	6.99	6.67	6.71	5.52	-18.18	-23.20	0.00	0.00	0.00
UNADJUSTED STORAGE VOLUME (MG)		0.00	6.24	13.47	21.28	30.81	40.38	46.73	26.97	0.33	0.00	0.00	0.00
STORAGE PRECIP VOLUME (MG)	19	0.92	1.94	1.85	3.89	4.19	3.01	1.45	1.04	0.16	0.03	0.03	0.21
STORAGE EVAP VOLUME (MG)	28	1.51	0.73	0.42	0.43	0.79	1.58	2.44	3.89	4.39	4.53	3.97	2.98
STORAGE PERCOLATION (IN)	12	1.05	1.02	1.05	1.05	0.95	1.05	1.02	1.05	1.02	1.05	1.05	1.02
STORAGE PERCOLATION (MG)	7	0.60	0.58	0.60	0.60	0.54	0.60	0.58	0.60	0.58	0.60	0.60	0.58
STORAGE AT END OF MONTH (MG)		0.00	6.86	14.29	24.15	33.67	41.21	45.15	23.53	0.00	0.00	0.00	0.00

MAXIMUM STORAGE REQUIRED (MG)	45.2
TOTAL AVAILABLE STORAGE (MG)	91.0

SUMMARY

ANNUAL INFLOW (MG)		ANNUAL OUTFLOW POTENTIAL (MG)		OVERALL BALANCE	
WASTEWATER	69	EVAPORATION	36	UNUSED DISPOSAL CAPACITY (MG) (MUST NOT BE NEGATIVE)	65
INFLOW AND INFILTRATION	1	PERCOLATION	7		
PRECIPITATION	24	IRRIGATION	116	UNUSED STORAGE CAPACITY (MG) (MUST NOT BE NEGATIVE)	46
TOTAL	**94**	**TOTAL**	**159**		

LOCKEFORD COMMUNITY SERVICES DISTRICT — FILE: 2465-0010

EXISTING 0.19 ADWF WATER BALANCE UNDER AVG YEAR TYPE HYDROLOGIC CONDITIONS

11/1/2021

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS

STARTING AVERAGE FLOW (MGD)	0.19

IRRIGATION AREA CHARACTERISTICS

RECLAMATION AREA 1 ALFALFA PRODUCTION AREA	
MINIMUM REQUIRED ALFALFA PRODUCTION AREA (AC)	95
EXISTING AREA ACTIVE ALFALFA PRODUCTION (AC)	57
RECLAMATION AREA 2 ALFALFA PRODUCTION AREA	
DEVELOPED GROSS ALFALFA PRODUCTION AREA (AC)	0
NET AREA IN ALFALFA PRODUCTION (AC)	0
FUTURE ADD'L GRAPE PRODUCTION AREA	
NEW GROSS GRAPE PRODUCTION AREA (AC)	0.0
NEW NET GRAPE PRODUCTION AREA (AC)	
NEW NET AREA IN GRAPE PRODUCTION (AC)	

STORAGE POND CHARACTERISTICS

TOTAL STORAGE AVAILABLE (MG)	91.0
TOTAL STORAGE AVAILABLE (AF)	279
WWTP STORAGE POND GROSS AREA (AC)	12.3
TOTAL STORAGE POND EVAP/PERC AREA (AC)	21.0
WWTP STORAGE POND EVAP/PERC AREA (AC)	10.5
OFFSITE STORAGE POND EVAP/PERC AREA (AC)	10.6
STORAGE RESERVOIR DESIGN PERC. RATE (in/day)	0.034
EXISTING STORAGE (MG)	
NW, SW & SE STORAGE PONDS AT WWTP (MG)	52.0
OFFSITE STORAGE POND (MG)	39.0
FUTURE STORAGE (MG)	
ADD'L STORAGE POND STORAGE REQ'D (MG)	0.0

TREATMENT POND CHARACTERISTICS

TREATMENT POND GROSS AREA (AC)	7.0
EVAP/PERC AREA (AC)	6.0
DESIGN PERC. RATE (in/day)	0.0
STORAGE AVAILABLE (MG)	0.0

CLIMATOLOGICAL FACTORS

CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO	1.00
OCT-APR EVAP/AVG EVAP RATIO	1.00
MAY-SEP EVAP/AVG EVAP RATIO	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.05
STORAGE CATCHMENT SOIL RUNOFF COEFF	1.00

RECHARGE POND CHARACTERISTICS

RECHARGE POND GROSS AREA	0.0
EVAP/PERC AREA (AC)	0.0
DESIGN PERC. RATE (in/day)	0.000
STORAGE AVAILABLE (MG)	0.0

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
DAYS IN MONTH	365	31	30	31	31	28	31	30	31	30	31	31	30
AVG PRECIP, LODI (IN)	17.04	0.84	1.76	1.68	3.54	3.81	2.74	1.32	0.95	0.15	0.03	0.03	0.19
AVG EVAPORATION, LODI (IN)	51.89	3.31	1.60	0.92	0.93	1.73	3.46	5.34	6.81	7.69	7.93	6.95	5.22
DESIGN EVAPORATION (ETo) (IN)	51.89	3.31	1.60	0.92	0.93	1.73	3.46	5.34	6.81	7.69	7.93	6.95	5.22
ZONE 12 WET YEAR GRASS REFERENCE EVAPOTRANSPIRATION (ETr) (IN)	43.29	3.48	1.05	1.02	0.39	0.81	2.76	4.12	4.08	6.31	7.49	7.00	4.78
ALFALFA ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	42.42	2.07	1.16	1.20	0.45	0.95	3.23	4.88	4.86	6.41	6.73	6.24	4.24
GRAPE (NO COVER) ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	31.25	0.62	0.97	1.01	0.42	0.91	2.24	2.63	3.62	5.27	5.96	4.92	2.68
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ALFALFA CROP COEFFICIENT (Kc = ETc/ETr)		0.59	1.10	1.18	1.15	1.17	1.17	1.18	1.19	1.02	0.90	0.89	0.89
GRAPE (NO COVER) CROP COEFFICIENT (Kc = ETc/ETr)		0.18	0.92	0.99	1.08	1.12	0.81	0.64	0.89	0.84	0.80	0.70	0.56
AVERAGE DRY WEATHER FLOW (MGD)		0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
MONTHLY VOLUME OF I/I AS A PERCENT OF ADWF (2018 - 2020)		0.6%	3.3%	4.8%	1.6%	6.5%	5.8%	1.0%	0.0%	0.0%	0.0%	1.1%	0.0%
TOTAL I/I VOLUME (MGD)		0.001	0.006	0.009	0.003	0.012	0.011	0.002	0.000	0.000	0.000	0.002	0.000

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		4.9%	10.3%	9.9%	20.8%	22.4%	16.1%	7.7%	5.6%	0.9%	0.2%	0.2%	1.1%
ESTIMATED LODI/LOCKEFORD RAIN, 1-in-100 YEAR (IN)	17	0.84	1.76	1.68	3.54	3.81	2.74	1.32	0.95	0.15	0.03	0.03	0.19
EFFECTIVE RAIN FOR PLANTS (IN)	16	0.80	1.67	1.60	3.36	3.62	2.60	1.25	0.90	0.14	0.03	0.03	0.18
EVAPORATION-RELATED CALCULATIONS													
ALFALFA EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Kc)	52	1.97	1.77	1.08	1.07	2.03	4.05	6.33	8.11	7.81	7.13	6.20	4.63
GRAPE (NO COVER) EVAPOTRANSPIRATION POTENTIAL (IN) (ETc)(ETo*Kc)		0.59	1.48	0.91	1.00	1.94	2.81	3.41	6.04	6.42	6.31	4.88	2.93
STORAGE RESERVOIR EVAPORATION (IN) (ETo * Water Surface Coefficient)	52	3.31	1.60	0.92	0.93	1.73	3.46	5.34	6.81	7.69	7.93	6.95	5.22
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	69	5.9	5.7	5.9	5.9	5.3	5.9	5.7	5.9	5.7	5.9	5.9	5.7
I/I FLOW VOLUME (MG)	1	0.04	0.19	0.28	0.09	0.35	0.34	0.06	0.00	0.00	0.00	0.06	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.19	0.20	0.20	0.19	0.20	0.20	0.19	0.19	0.19	0.19	0.19	0.19
TOTAL INFLUENT FLOW VOLUME (MG)	71	6.0	5.9	6.2	6.0	5.7	6.3	5.8	5.9	5.7	5.9	6.0	5.7
TREATMENT POND CALCULATIONS													
PERCOLATION (IN)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERC. VOLUME (MG)		0.00	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL EVAP. VOLUME (MG)	8	0.54	0.26	0.15	0.15	0.28	0.56	0.87	1.11	1.25	1.29	1.13	0.85
PRECIP. VOLUME (MG)	3	0.14	0.29	0.27	0.58	0.62	0.45	0.21	0.15	0.02	0.00	0.00	0.03
TREATMENT POND RESIDUAL EFFLUENT VOLUME (MG/MONTH)	65	5.60	5.93	6.32	6.42	6.04	6.18	5.15	4.95	4.47	4.62	4.88	4.88
RECLAMATION AREA 1 CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	0.00	0.51	2.80	3.20	1.75	0.00	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		95	95	95	95	95	95	95	95	95	95	95	95
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	55	3.34	2.39	0.00	0.00	0.00	0.00	6.52	10.41	9.40	8.89	8.06	6.34
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	143	8.62	6.17	0.00	0.00	0.00	0.00	16.81	26.85	24.26	22.92	20.78	16.36
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		5.6	5.9	6.3	12.6	19.5	26.3	30.5	15.7	4.5	4.6	4.9	4.9
AVAILABLE EFFLUENT APPLIED (MG)	63	5.60	5.93	0.00	0.00	0.00	0.00	16.81	15.72	4.47	4.62	4.88	4.88
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.18	0.20	0.00	0.00	0.00	0.00	0.56	0.51	0.15	0.15	0.16	0.16
EFFLUENT IRRIGATION RATE (IN/MONTH)	24	2.17	2.30	0.00	0.00	0.00	0.00	6.52	6.10	1.73	1.79	1.89	1.89
RECLAMATION AREA 2 CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	0.00	0.51	2.80	3.20	1.75	0.00	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		0	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	40	1.17	0.10	0.00	0.00	0.00	0.00	6.52	7.21	7.67	7.10	6.17	4.45
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		0.00	0.00	6.32	12.58	19.51	26.33	13.66	0.00	0.00	0.00	0.00	0.00
AVAILABLE EFFLUENT APPLIED (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EFFLUENT IRRIGATION RATE (IN/MONTH)	7	0.00	0.00	0.00	0.00	0.00	0.00	6.52	0.00	0.00	0.00	0.00	0.00
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	0.00	0.00	6.16	13.47	20.15	25.32	10.78	0.00	0.00	0.00	0.00
POTENTIAL RESIDUAL STORAGE VOLUME GAIN/LOSS (MG)		0.00	0.00	6.32	6.42	6.04	6.18	-11.66	-10.78	0.00	0.00	0.00	0.00
UNADJUSTED STORAGE VOLUME (MG)		0.00	0.00	6.32	12.58	19.51	26.33	13.66	0.00	0.00	0.00	0.00	0.00
STORAGE PRECIP VOLUME (MG)	10	0.48	1.01	0.96	2.02	2.18	1.57	0.75	0.54	0.09	0.02	0.02	0.11
STORAGE EVAP VOLUME (MG)	30	1.89	0.91	0.53	0.53	0.99	1.98	3.05	3.89	4.39	4.53	3.97	2.98
STORAGE PERCOLATION (IN)	12	1.05	1.02	1.05	1.05	0.95	1.05	1.02	1.05	1.02	1.05	1.05	1.02
STORAGE PERCOLATION (MG)	7	0.60	0.58	0.60	0.60	0.54	0.60	0.58	0.60	0.58	0.60	0.60	0.58
STORAGE AT END OF MONTH (MG)		0.00	0.00	6.16	13.47	20.15	25.32	10.78	0.00	0.00	0.00	0.00	0.00

MAXIMUM STORAGE REQUIRED (MG) 25.3

TOTAL AVAILABLE STORAGE (MG) 91.0

SUMMARY

ANNUAL INFLOW (MG)		ANNUAL OUTFLOW POTENTIAL (MG)		OVERALL BALANCE	
WASTEWATER	69	EVAPORATION	38	UNUSED DISPOSAL CAPACITY (MG) (MUST NOT BE NEGATIVE)	105
INFLOW AND INFILTRATION	1	PERCOLATION	7		
PRECIPITATION	13	IRRIGATION	143	UNUSED STORAGE CAPACITY (MG) (MUST NOT BE NEGATIVE)	66
TOTAL	**83**	**TOTAL**	**188**		

LOCKEFORD COMMUNITY SERVICES DISTRICT FILE: 2465-0010

FUTURE 0.30 ADWF WATER BALANCE UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS 11/1/2021

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS

STARTING AVERAGE FLOW (MGD)	0.30

IRRIGATION AREA CHARACTERISTICS

RECLAMATION AREA 1 ALFALFA PRODUCTION AREA	
MINIMUM REQUIRED ALFALFA PRODUCTION AREA (AC)	**95**
EXISTING AREA ACTIVE ALFALFA PRODUCTION (AC)	**57**
RECLAMATION AREA 2 ALFALFA PRODUCTION AREA	
DEVELOPED GROSS ALFALFA PRODUCTION AREA (AC)	**0**
NET AREA IN ALFALFA PRODUCTION (AC)	**0**
FUTURE ADD'L GRAPE PRODUCTION AREA	
NEW GROSS GRAPE PRODUCTION AREA (AC)	**0.0**
NEW NET GRAPE PRODUCTION AREA (AC)	
NEW NET AREA IN GRAPE PRODUCTION (AC)	

STORAGE POND CHARACTERISTICS

TOTAL STORAGE AVAILABLE (MG)	**91.0**
TOTAL STORAGE AVAILABLE (AF)	**279**
WWTP STORAGE POND GROSS AREA (AC)	**12.3**
TOTAL STORAGE POND EVAP/PERC AREA (AC)	**21.0**
WWTP STORAGE POND EVAP/PERC AREA (AC)	**10.5**
OFFSITE STORAGE POND EVAP/PERC AREA (AC)	**10.6**
STORAGE RESERVOIR DESIGN PERC. RATE (in/day)	**0.034**
EXISTING STORAGE (MG)	
NW, SW & SE STORAGE PONDS AT WWTP (MG)	52.0
OFFSITE STORAGE POND (MG)	39.0
FUTURE STORAGE (MG)	
ADD'L STORAGE POND STORAGE REQ'D (MG)	0.0

TREATMENT POND CHARACTERISTICS

TREATMENT POND GROSS AREA (AC)	**7.0**
EVAP/PERC AREA (AC)	**6.0**
DESIGN PERC. RATE (in/day)	**0.0**
STORAGE AVAILABLE (MG)	**0.0**

CLIMATOLOGICAL FACTORS

CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO	1.92
OCT-APR EVAP/AVG EVAP RATIO	0.80
MAY-SEP EVAP/AVG EVAP RATIO	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.05
STORAGE CATCHMENT SOIL RUNOFF COEFF	1.00

RECHARGE POND CHARACTERISTICS

RECHARGE POND GROSS AREA	**0.0**
EVAP/PERC AREA (AC)	**0.0**
DESIGN PERC. RATE (in/day)	**0.000**
STORAGE AVAILABLE (MG)	**0.0**

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
DAYS IN MONTH	365	31	30	31	31	28	31	30	31	30	31	31	30
AVG PRECIP, LODI (IN)	17.04	0.84	1.76	1.68	3.54	3.81	2.74	1.32	0.95	0.15	0.03	0.03	0.19
AVG EVAPORATION, LODI (IN)	51.89	3.31	1.60	0.92	0.93	1.73	3.46	5.34	6.81	7.69	7.93	6.95	5.22
DESIGN EVAPORATION (ETo) (IN)	48.43	2.65	1.28	0.74	0.74	1.38	2.77	4.27	6.81	7.69	7.93	6.95	5.22
ZONE 12 WET YEAR GRASS REFERENCE EVAPOTRANSPIRATION (ETr) (IN)	43.29	3.48	1.05	1.02	0.39	0.81	2.76	4.12	4.08	6.31	7.49	7.00	4.78
ALFALFA ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	42.42	2.07	1.16	1.20	0.45	0.95	3.23	4.88	4.86	6.41	6.73	6.24	4.24
GRAPE (NO COVER) ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	31.25	0.62	0.97	1.01	0.42	0.91	2.24	2.63	3.62	5.27	5.96	4.92	2.68
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ALFALFA CROP COEFFICIENT (Kc = ETc/ETr)		0.59	1.10	1.18	1.15	1.17	1.17	1.18	1.19	1.02	0.90	0.89	0.89
GRAPE (NO COVER) CROP COEFFICIENT (Kc = ETc/ETr)		0.18	0.92	0.99	1.08	1.12	0.81	0.64	0.89	0.84	0.80	0.70	0.56
AVERAGE DRY WEATHER FLOW (MGD)		0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
MONTHLY VOLUME OF I/I AS A PERCENT OF ADWF (2018 - 2020)		0.6%	3.3%	4.8%	1.6%	6.5%	5.8%	1.0%	0.0%	0.0%	0.0%	1.1%	0.0%
TOTAL I/I VOLUME (MGD)		0.002	0.010	0.014	0.005	0.020	0.017	0.003	0.000	0.000	0.000	0.003	0.000

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		4.9%	10.3%	9.9%	20.8%	22.4%	16.1%	7.7%	5.6%	0.9%	0.2%	0.2%	1.1%
ESTIMATED LODI/LOCKEFORD RAIN, 1-in-100 YEAR (IN)	33	1.62	3.39	3.23	6.81	7.33	5.27	2.54	1.83	0.29	0.06	0.06	0.37
EFFECTIVE RAIN FOR PLANTS (IN)	31	1.54	3.22	3.07	6.47	6.97	5.01	2.41	1.74	0.27	0.05	0.05	0.35
EVAPORATION-RELATED CALCULATIONS													
ALFALFA EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Kc)	49	1.58	1.41	0.87	0.86	1.62	3.24	5.06	8.11	7.81	7.13	6.20	4.63
GRAPE (NO COVER) EVAPOTRANSPIRATION POTENTIAL (IN) (ETc)(ETo*Kc)		0.47	1.18	0.73	0.80	1.55	2.25	2.73	6.04	6.42	6.31	4.88	2.93
STORAGE RESERVOIR EVAPORATION (IN) (ETo * Water Surface Coefficient)	48	2.65	1.28	0.74	0.74	1.38	2.77	4.27	6.81	7.69	7.93	6.95	5.22
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	110	9.3	9.0	9.3	9.3	8.4	9.3	9.0	9.3	9.0	9.3	9.3	9.0
I/I FLOW VOLUME (MG)	2	0.06	0.30	0.45	0.15	0.55	0.54	0.09	0.00	0.00	0.00	0.10	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.30	0.31	0.31	0.30	0.32	0.32	0.30	0.30	0.30	0.30	0.30	0.30
TOTAL INFLUENT FLOW VOLUME (MG)	112	9.4	9.3	9.8	9.5	9.0	9.9	9.1	9.3	9.0	9.3	9.5	9.0
TREATMENT POND CALCULATIONS													
PERCOLATION (IN)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERC. VOLUME (MG)		0.00	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL EVAP. VOLUME (MG)	8	0.43	0.21	0.12	0.12	0.22	0.45	0.69	1.11	1.25	1.29	1.13	0.85
PRECIP. VOLUME (MG)	5	0.26	0.55	0.53	1.11	1.19	0.86	0.41	0.30	0.05	0.01	0.01	0.06
TREATMENT POND RESIDUAL EFFLUENT VOLUME (MG/MONTH)	110	9.23	9.64	10.21	10.49	9.97	10.31	8.82	8.49	7.80	8.02	8.38	8.21
RECLAMATION AREA 1 CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	1.80	3.20	3.20	3.20	3.20	0.55	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		95	95	95	95	95	95	95	95	95	95	95	95
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	50	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.34	7.47
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	129	8.36	0.00	0.00	0.00	0.00	0.00	0.00	23.27	27.70	26.49	24.09	19.26
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		9.2	9.6	20.5	31.8	44.6	57.8	67.4	74.3	55.4	30.9	8.4	8.2
AVAILABLE EFFLUENT APPLIED (MG)	102	8.36	0.00	0.00	0.00	0.00	0.00	0.00	23.27	27.70	26.49	8.38	8.21
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.92	0.85	0.27	0.27
EFFLUENT IRRIGATION RATE (IN/MONTH)	40	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	3.25	3.18
RECLAMATION AREA 2 CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	1.80	3.20	3.20	3.20	3.20	0.55	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		0	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	44	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	6.14	4.28
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		0.88	9.64	20.47	31.78	44.61	57.78	67.43	51.07	27.73	4.44	0.00	0.00
AVAILABLE EFFLUENT APPLIED (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EFFLUENT IRRIGATION RATE (IN/MONTH)	33	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	0.00	0.00
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	0.00	10.26	21.29	34.65	47.47	58.61	65.85	47.63	22.91	0.00	0.00
POTENTIAL RESIDUAL STORAGE VOLUME GAIN/LOSS (MG)		0.88	9.64	10.21	10.49	9.97	10.31	8.82	-14.78	-19.90	-18.47	0.00	0.00
UNADJUSTED STORAGE VOLUME (MG)		0.88	9.64	20.47	31.78	44.61	57.78	67.43	51.07	27.73	4.44	0.00	0.00
STORAGE PRECIP VOLUME (MG)	19	0.92	1.94	1.85	3.89	4.19	3.01	1.45	1.04	0.16	0.03	0.03	0.21
STORAGE EVAP VOLUME (MG)	28	1.51	0.73	0.42	0.43	0.79	1.58	2.44	3.89	4.39	4.53	3.97	2.98
STORAGE PERCOLATION (IN)	12	1.05	1.02	1.05	1.05	0.95	1.05	1.02	1.05	1.02	1.05	1.05	1.02
STORAGE PERCOLATION (MG)	7	0.60	0.58	0.60	0.60	0.54	0.60	0.58	0.60	0.58	0.60	0.60	0.58
STORAGE AT END OF MONTH (MG)		0.00	10.26	21.29	34.65	47.47	58.61	65.85	47.63	22.91	0.00	0.00	0.00

MAXIMUM STORAGE REQUIRED (MG)	65.9
TOTAL AVAILABLE STORAGE (MG)	91.0

SUMMARY

ANNUAL INFLOW (MG)		ANNUAL OUTFLOW POTENTIAL (MG)		OVERALL BALANCE	
WASTEWATER	110	EVAPORATION	36	UNUSED DISPOSAL CAPACITY (MG)	36
INFLOW AND INFILTRATION	2	PERCOLATION	7	(MUST NOT BE NEGATIVE)	
PRECIPITATION	24	IRRIGATION	129	UNUSED STORAGE CAPACITY (MG)	25
				(MUST NOT BE NEGATIVE)	
TOTAL	**136**	**TOTAL**	**172**		

LOCKEFORD COMMUNITY SERVICES DISTRICT — FILE: 2465-0010

FUTURE 0.30 ADWF WATER BALANCE UNDER AVG YEAR TYPE HYDROLOGIC CONDITIONS

11/1/2021

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS

STARTING AVERAGE FLOW (MGD)	0.30

IRRIGATION AREA CHARACTERISTICS

RECLAMATION AREA 1 ALFALFA PRODUCTION AREA

MINIMUM REQUIRED ALFALFA PRODUCTION AREA (AC)	95
EXISTING AREA ACTIVE ALFALFA PRODUCTION (AC)	57

RECLAMATION AREA 2 ALFALFA PRODUCTION AREA

DEVELOPED GROSS ALFALFA PRODUCTION AREA (AC)	0
NET AREA IN ALFALFA PRODUCTION (AC)	0

FUTURE ADD'L GRAPE PRODUCTION AREA

NEW GROSS GRAPE PRODUCTION AREA (AC)	0.0
NEW NET GRAPE PRODUCTION AREA (AC)	
NEW NET AREA IN GRAPE PRODUCTION (AC)	

STORAGE POND CHARACTERISTICS

TOTAL STORAGE AVAILABLE (MG)	91.0
TOTAL STORAGE AVAILABLE (AF)	279
WWTP STORAGE POND GROSS AREA (AC)	12.3
TOTAL STORAGE POND EVAP/PERC AREA (AC)	21.0
WWTP STORAGE POND EVAP/PERC AREA (AC)	10.5
OFFSITE STORAGE POND EVAP/PERC AREA (AC)	10.6
STORAGE RESERVOIR DESIGN PERC. RATE (in/day)	0.034
EXISTING STORAGE (MG)	
NW, SW & SE STORAGE PONDS AT WWTP (MG)	52.0
OFFSITE STORAGE POND (MG)	39.0
FUTURE STORAGE (MG)	
ADD'L STORAGE POND STORAGE REQ'D (MG)	0.0

TREATMENT POND CHARACTERISTICS

TREATMENT POND GROSS AREA (AC)	7.0
EVAP/PERC AREA (AC)	6.0
DESIGN PERC. RATE (in/day)	0.0
STORAGE AVAILABLE (MG)	0.0

CLIMATOLOGICAL FACTORS

CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO	1.00
OCT-APR EVAP/AVG EVAP RATIO	1.00
MAY-SEP EVAP/AVG EVAP RATIO	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.05
STORAGE CATCHMENT SOIL RUNOFF COEFF.	1.00

RECHARGE POND CHARACTERISTICS

RECHARGE POND GROSS AREA	0.0
EVAP/PERC AREA (AC)	0.0
DESIGN PERC. RATE (in/day)	0.000
STORAGE AVAILABLE (MG)	0.0

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
DAYS IN MONTH	365	31	30	31	31	28	31	30	31	30	31	31	30
AVG PRECIP, LODI (IN)	17.04	0.84	1.76	1.68	3.54	3.81	2.74	1.32	0.95	0.15	0.03	0.03	0.19
AVG EVAPORATION, LODI (IN)	51.89	3.31	1.60	0.92	0.93	1.73	3.46	5.34	6.81	7.69	7.93	6.95	5.22
DESIGN EVAPORATION (ETo) (IN)	51.89	3.31	1.60	0.92	0.93	1.73	3.46	5.34	6.81	7.69	7.93	6.95	5.22
ZONE 12 WET YEAR GRASS REFERENCE EVAPOTRANSPIRATION (ETr) (IN)	43.29	3.48	1.05	1.02	0.39	0.81	2.76	4.12	4.08	6.31	7.49	7.00	4.78
ALFALFA ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	42.42	2.07	1.16	1.20	0.45	0.95	3.23	4.88	4.86	6.41	6.73	6.24	4.24
GRAPE (NO COVER) ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	31.25	0.62	0.97	1.01	0.42	0.91	2.24	2.63	3.62	5.27	5.96	4.92	2.68
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ALFALFA CROP COEFFICIENT (Kc = ETc/ETr)		0.59	1.10	1.18	1.15	1.17	1.17	1.18	1.19	1.02	0.90	0.89	0.89
GRAPE (NO COVER) CROP COEFFICIENT (Kc = ETc/ETr)		0.18	0.92	0.99	1.08	1.12	0.81	0.64	0.89	0.84	0.80	0.70	0.56
AVERAGE DRY WEATHER FLOW (MGD)		0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
MONTHLY VOLUME OF I/I AS A PERCENT OF ADWF (2018 - 2020)		0.6%	3.3%	4.8%	1.6%	6.5%	5.8%	1.0%	0.0%	0.0%	0.0%	1.1%	0.0%
TOTAL I/I VOLUME (MGD)		0.002	0.010	0.014	0.005	0.020	0.017	0.003	0.000	0.000	0.000	0.003	0.000

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		4.9%	10.3%	9.9%	20.8%	22.4%	16.1%	7.7%	5.6%	0.9%	0.2%	0.2%	1.1%
ESTIMATED LODI/LOCKEFORD RAIN, 1-in-100 YEAR (IN)	17	0.84	1.76	1.68	3.54	3.81	2.74	1.32	0.95	0.15	0.03	0.03	0.19
EFFECTIVE RAIN FOR PLANTS (IN)	16	0.80	1.67	1.60	3.36	3.62	2.60	1.25	0.90	0.14	0.03	0.03	0.18
EVAPORATION-RELATED CALCULATIONS													
ALFALFA EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Kc)	52	1.97	1.77	1.08	1.07	2.03	4.05	6.33	8.11	7.81	7.13	6.20	4.63
GRAPE (NO COVER) EVAPOTRANSPIRATION POTENTIAL (IN) (ETc)(ETo*Kc)		0.59	1.48	0.91	1.00	1.94	2.81	3.41	6.04	6.42	6.31	4.88	2.93
STORAGE RESERVOIR EVAPORATION (IN) (ETo * Water Surface Coefficient)	52	3.31	1.60	0.92	0.93	1.73	3.46	5.34	6.81	7.69	7.93	6.95	5.22
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	110	9.3	9.0	9.3	9.3	8.4	9.3	9.0	9.3	9.0	9.3	9.3	9.0
I/I FLOW VOLUME (MG)	2	0.06	0.30	0.45	0.15	0.55	0.54	0.09	0.00	0.00	0.00	0.10	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.30	0.31	0.31	0.30	0.32	0.32	0.30	0.30	0.30	0.30	0.30	0.30
TOTAL INFLUENT FLOW VOLUME (MG)	112	9.4	9.3	9.8	9.5	9.0	9.9	9.1	9.3	9.0	9.3	9.5	9.0
TREATMENT POND CALCULATIONS													
PERCOLATION (IN)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERC. VOLUME (MG)		0.00	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL EVAP. VOLUME (MG)	8	0.54	0.26	0.15	0.15	0.28	0.56	0.87	1.11	1.25	1.29	1.13	0.85
PRECIP. VOLUME (MG)	3	0.14	0.29	0.27	0.58	0.62	0.45	0.21	0.15	0.02	0.00	0.00	0.03
TREATMENT POND RESIDUAL EFFLUENT VOLUME (MG/MONTH)	106	9.00	9.33	9.92	9.92	9.34	9.78	8.45	8.35	7.77	8.02	8.38	8.18
RECLAMATION AREA 1 CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	0.00	0.51	2.80	3.20	1.75	0.00	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		95	95	95	95	95	95	95	95	95	95	95	95
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	63	4.37	3.30	0.00	0.00	0.00	0.00	6.52	10.41	10.87	10.20	9.37	7.62
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	162	11.27	8.50	0.00	0.00	0.00	0.00	16.81	26.85	28.04	26.32	24.16	19.66
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		9.0	9.3	10.3	20.0	30.2	40.7	48.1	36.8	13.7	8.0	8.4	8.2
AVAILABLE EFFLUENT APPLIED (MG)	99	9.00	8.50	0.00	0.00	0.00	0.00	16.81	26.85	13.73	8.02	8.38	8.18
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.29	0.28	0.00	0.00	0.00	0.00	0.56	0.87	0.46	0.26	0.27	0.27
EFFLUENT IRRIGATION RATE (IN/MONTH)	39	3.49	3.30	0.00	0.00	0.00	0.00	6.52	10.41	5.32	3.11	3.25	3.17
RECLAMATION AREA 2 CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	0.00	0.51	2.80	3.20	1.75	0.00	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		0	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	47	1.17	3.30	0.00	0.00	0.00	0.00	6.52	10.41	7.67	7.10	6.17	4.45
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		0.00	0.83	10.26	20.01	30.24	40.67	31.29	9.91	0.00	0.00	0.00	0.00
AVAILABLE EFFLUENT APPLIED (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EFFLUENT IRRIGATION RATE (IN/MONTH)	20	0.00	3.30	0.00	0.00	0.00	0.00	6.52	10.41	0.00	0.00	0.00	0.00
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	0.00	0.33	10.09	20.90	30.88	39.65	28.41	5.96	0.00	0.00	0.00
POTENTIAL RESIDUAL STORAGE VOLUME GAIN/LOSS (MG)		0.00	0.83	9.92	9.92	9.34	9.78	-8.36	-18.50	-5.96	0.00	0.00	0.00
UNADJUSTED STORAGE VOLUME (MG)		0.00	0.83	10.26	20.01	30.24	40.67	31.29	9.91	0.00	0.00	0.00	0.00
STORAGE PRECIP VOLUME (MG)	10	0.48	1.01	0.96	2.02	2.18	1.57	0.75	0.54	0.09	0.02	0.02	0.11
STORAGE EVAP VOLUME (MG)	30	1.89	0.91	0.53	0.53	0.99	1.98	3.05	3.89	4.39	4.53	3.97	2.98
STORAGE PERCOLATION (IN)	12	1.05	1.02	1.05	1.05	0.95	1.05	1.02	1.05	1.02	1.05	1.05	1.02
STORAGE PERCOLATION (MG)	7	0.60	0.58	0.60	0.60	0.54	0.60	0.58	0.60	0.58	0.60	0.60	0.58
STORAGE AT END OF MONTH (MG)		0.00	0.33	10.09	20.90	30.88	39.65	28.41	5.96	0.00	0.00	0.00	0.00

MAXIMUM STORAGE REQUIRED (MG)	39.7
TOTAL AVAILABLE STORAGE (MG)	91.0

SUMMARY

ANNUAL INFLOW (MG)	
WASTEWATER	110
INFLOW AND INFILTRATION	2
PRECIPITATION	13
TOTAL	**125**

ANNUAL OUTFLOW POTENTIAL (MG)	
EVAPORATION	38
PERCOLATION	7
IRRIGATION	162
TOTAL	**207**

OVERALL BALANCE	
UNUSED DISPOSAL CAPACITY (MG) (MUST NOT BE NEGATIVE)	82
UNUSED STORAGE CAPACITY (MG) (MUST NOT BE NEGATIVE)	51

LOCKEFORD COMMUNITY SERVICES DISTRICT FILE: 2465-0010

FUTURE 0.39 ADWF WATER BALANCE UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS

11/1/2021

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS

STARTING AVERAGE FLOW (MGD)	0.39

IRRIGATION AREA CHARACTERISTICS

RECLAMATION AREA 1 ALFALFA PRODUCTION AREA	
MINIMUM REQUIRED ALFALFA PRODUCTION AREA (AC)	95
EXISTING AREA ACTIVE ALFALFA PRODUCTION (AC)	57
RECLAMATION AREA 2 ALFALFA PRODUCTION AREA	
DEVELOPED GROSS ALFALFA PRODUCTION AREA (AC)	0
NET AREA IN ALFALFA PRODUCTION (AC)	0
FUTURE ADD'L GRAPE PRODUCTION AREA	
NEW GROSS GRAPE PRODUCTION AREA (AC)	0.0
NEW NET GRAPE PRODUCTION AREA (AC)	
NEW NET AREA IN GRAPE PRODUCTION (AC)	

STORAGE POND CHARACTERISTICS

TOTAL STORAGE AVAILABLE (MG)	91.0
TOTAL STORAGE AVAILABLE (AF)	279
WWTP STORAGE POND GROSS AREA (AC)	12.3
TOTAL STORAGE POND EVAP/PERC AREA (AC)	21.0
WWTP STORAGE POND EVAP/PERC AREA (AC)	10.5
OFFSITE STORAGE POND EVAP/PERC AREA (AC)	10.6
STORAGE RESERVOIR DESIGN PERC. RATE (in/day)	0.034
EXISTING STORAGE (MG)	
SW & SE STORAGE PONDS AT WWTP (MG)	52.0
OFFSITE STORAGE POND (MG)	39.0
FUTURE STORAGE (MG)	
ADD'L STORAGE POND STORAGE REQ'D (MG)	0.0

TREATMENT POND CHARACTERISTICS

TREATMENT POND GROSS AREA (AC)	7.0
EVAP/PERC AREA (AC)	6.0
DESIGN PERC. RATE (in/day)	0.0
STORAGE AVAILABLE (MG)	0.0

CLIMATOLOGICAL FACTORS

CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO	1.92
OCT-APR EVAP/AVG EVAP RATIO	0.80
MAY-SEP EVAP/AVG EVAP RATIO	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.05
STORAGE CATCHMENT SOIL RUNOFF COEFF	1.00

RECHARGE POND CHARACTERISTICS

RECHARGE POND GROSS AREA	0.0
EVAP/PERC AREA (AC)	0.0
DESIGN PERC. RATE (in/day)	0.000
STORAGE AVAILABLE (MG)	0.0

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
DAYS IN MONTH	365	31	30	31	31	28	31	30	31	30	31	31	30
AVG PRECIP, LODI (IN)	17.04	0.84	1.76	1.68	3.54	3.81	2.74	1.32	0.95	0.15	0.03	0.03	0.19
AVG EVAPORATION, LODI (IN)	51.89	3.31	1.60	0.92	0.93	1.73	3.46	5.34	6.81	7.69	7.93	6.95	5.22
DESIGN EVAPORATION (ETo) (IN)	48.43	2.65	1.28	0.74	0.74	1.38	2.77	4.27	6.81	7.69	7.93	6.95	5.22
ZONE 12 WET YEAR GRASS REFERENCE EVAPOTRANSPIRATION (ETr) (IN)	43.29	3.48	1.05	1.02	0.39	0.81	2.76	4.12	4.08	6.31	7.49	7.00	4.78
ALFALFA ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	42.42	2.07	1.16	1.20	0.45	0.95	3.23	4.88	4.86	6.41	6.73	6.24	4.24
GRAPE (NO COVER) ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	31.25	0.62	0.97	1.01	0.42	0.91	2.24	2.63	3.62	5.27	5.96	4.92	2.68
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ALFALFA CROP COEFFICIENT (Kc = ETc/ETr)		0.59	1.10	1.18	1.15	1.17	1.17	1.18	1.19	1.02	0.90	0.89	0.89
GRAPE (NO COVER) CROP COEFFICIENT (Kc = ETc/ETr)		0.18	0.92	0.99	1.08	1.12	0.81	0.64	0.89	0.84	0.80	0.70	0.56
AVERAGE DRY WEATHER FLOW (MGD)		0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
MONTHLY VOLUME OF I/I AS A PERCENT OF ADWF (2018 - 2020)		0.6%	3.3%	4.8%	1.6%	6.5%	5.8%	1.0%	0.0%	0.0%	0.0%	1.1%	0.0%
TOTAL I/I VOLUME (MGD)		0.002	0.013	0.019	0.006	0.026	0.023	0.004	0.000	0.000	0.000	0.004	0.000

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		4.9%	10.3%	9.9%	20.8%	22.4%	16.1%	7.7%	5.6%	0.9%	0.2%	0.2%	1.1%
ESTIMATED LODI/LOCKEFORD RAIN, 1-in-100 YEAR (IN)	33	1.62	3.39	3.23	6.81	7.33	5.27	2.54	1.83	0.29	0.06	0.06	0.37
EFFECTIVE RAIN FOR PLANTS (IN)	31	1.54	3.22	3.07	6.47	6.97	5.01	2.41	1.74	0.27	0.05	0.05	0.35
EVAPORATION-RELATED CALCULATIONS													
ALFALFA EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Kc)	49	1.58	1.41	0.87	0.86	1.62	3.24	5.06	8.11	7.81	7.13	6.20	4.63
GRAPE (NO COVER) EVAPOTRANSPIRATION POTENTIAL (IN) (ETc)(ETo*Kc)		0.47	1.18	0.73	0.80	1.55	2.25	2.73	6.04	6.42	6.31	4.88	2.93
STORAGE RESERVOIR EVAPORATION (IN) (ETo * Water Surface Coefficient)	48	2.65	1.28	0.74	0.74	1.38	2.77	4.27	6.81	7.69	7.93	6.95	5.22
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	144	12.2	11.8	12.2	12.2	11.0	12.2	11.8	12.2	11.8	12.2	12.2	11.8
I/I FLOW VOLUME (MG)	3	0.07	0.39	0.59	0.20	0.72	0.71	0.12	0.00	0.00	0.00	0.13	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.40	0.41	0.41	0.40	0.42	0.42	0.40	0.39	0.39	0.39	0.40	0.39
TOTAL INFLUENT FLOW VOLUME (MG)	148	12.3	12.3	12.9	12.5	11.8	13.0	12.0	12.3	11.9	12.3	12.4	11.9
TREATMENT POND CALCULATIONS													
PERCOLATION (IN)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERC. VOLUME (MG)		0.00	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL EVAP. VOLUME (MG)	8	0.43	0.21	0.12	0.12	0.22	0.45	0.69	1.11	1.25	1.29	1.13	0.85
PRECIP. VOLUME (MG)	5	0.26	0.55	0.53	1.11	1.19	0.86	0.41	0.30	0.05	0.01	0.01	0.06
TREATMENT POND RESIDUAL EFFLUENT VOLUME (MG/MONTH)	145	12.13	12.64	13.31	13.49	12.77	13.41	11.72	11.49	10.70	11.02	11.28	11.11
RECLAMATION AREA 1 CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	1.80	3.20	3.20	3.20	3.20	0.55	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		95	95	95	95	95	95	95	95	95	95	95	95
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	50	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.34	7.48
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	129	8.36	0.00	0.00	0.00	0.00	0.00	0.00	23.27	27.70	26.49	24.09	19.30
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		12.1	15.2	29.2	43.5	59.1	75.4	87.9	97.8	81.8	60.3	40.0	22.5
AVAILABLE EFFLUENT APPLIED (MG)	129	8.36	0.00	0.00	0.00	0.00	0.00	0.00	23.27	27.70	26.49	24.09	19.30
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.92	0.85	0.78	0.64
EFFLUENT IRRIGATION RATE (IN/MONTH)	50	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.34	7.48
RECLAMATION AREA 2 CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	1.80	3.20	3.20	3.20	3.20	0.55	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		0	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	50	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.34	7.48
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		3.78	15.23	29.16	43.47	59.10	75.36	87.91	74.56	54.11	33.83	15.91	3.18
AVAILABLE EFFLUENT APPLIED (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EFFLUENT IRRIGATION RATE (IN/MONTH)	50	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.34	7.48
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	2.59	15.85	29.98	46.33	61.96	76.19	86.34	71.11	49.30	28.73	11.37
POTENTIAL RESIDUAL STORAGE VOLUME GAIN/LOSS (MG)		3.78	12.64	13.31	13.49	12.77	13.41	11.72	-11.78	-17.00	-15.47	-12.81	-8.19
UNADJUSTED STORAGE VOLUME (MG)		3.78	15.23	29.16	43.47	59.10	75.36	87.91	74.56	54.11	33.83	15.91	3.18
STORAGE PRECIP VOLUME (MG)	19	0.92	1.94	1.85	3.89	4.19	3.01	1.45	1.04	0.16	0.03	0.03	0.21
STORAGE EVAP VOLUME (MG)	28	1.51	0.73	0.42	0.43	0.79	1.58	2.44	3.89	4.39	4.53	3.97	2.98
STORAGE PERCOLATION (IN)	12	1.05	1.02	1.05	1.05	0.95	1.05	1.02	1.05	1.02	1.05	1.05	1.02
STORAGE PERCOLATION (MG)	7	0.60	0.58	0.60	0.60	0.54	0.60	0.58	0.60	0.58	0.60	0.60	0.58
STORAGE AT END OF MONTH (MG)		2.59	15.85	29.98	46.33	61.96	76.19	86.34	71.11	49.30	28.73	11.37	0.00

MAXIMUM STORAGE REQUIRED (MG)	86.3
TOTAL AVAILABLE STORAGE (MG)	91.0

SUMMARY

ANNUAL INFLOW (MG)		ANNUAL OUTFLOW POTENTIAL (MG)		OVERALL BALANCE	
WASTEWATER	144	EVAPORATION	36	UNUSED DISPOSAL CAPACITY (MG)	1
INFLOW AND INFILTRATION	3	PERCOLATION	7	(MUST NOT BE NEGATIVE)	
PRECIPITATION	24	IRRIGATION	129	UNUSED STORAGE CAPACITY (MG)	5
				(MUST NOT BE NEGATIVE)	
TOTAL	**171**	**TOTAL**	**172**		

LOCKEFORD COMMUNITY SERVICES DISTRICT FILE: 2465-0010

FUTURE 0.39 ADWF WATER BALANCE UNDER AVG TYPE HYDROLOGIC CONDITIONS

11/1/2021

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS	
STARTING AVERAGE FLOW (MGD)	0.39
IRRIGATION AREA CHARACTERISTICS	
RECLAMATION AREA 1 ALFALFA PRODUCTION AREA	
MINIMUM REQUIRED ALFALFA PRODUCTION AREA (AC)	**95**
EXISTING AREA ACTIVE ALFALFA PRODUCTION (AC)	**57**
RECLAMATION AREA 2 ALFALFA PRODUCTION AREA	
DEVELOPED GROSS ALFALFA PRODUCTION AREA (AC)	**0**
NET AREA IN ALFALFA PRODUCTION (AC)	**0**
FUTURE ADD'L GRAPE PRODUCTION AREA	
NEW GROSS GRAPE PRODUCTION AREA (AC)	**0.0**
NEW NET GRAPE PRODUCTION AREA (AC)	**0**
NEW NET AREA IN GRAPE PRODUCTION (AC)	**0**

STORAGE POND CHARACTERISTICS	
TOTAL STORAGE AVAILABLE (MG)	**91.0**
TOTAL STORAGE AVAILABLE (AF)	**279**
WWTP STORAGE POND GROSS AREA (AC)	**12.3**
TOTAL STORAGE POND EVAP/PERC AREA (AC)	**21.0**
WWTP STORAGE POND EVAP/PERC AREA (AC)	**10.5**
OFFSITE STORAGE POND EVAP/PERC AREA (AC)	**10.6**
STORAGE RESERVOIR DESIGN PERC. RATE (in/day)	**0.034**
EXISTING STORAGE (MG)	
NW, SW & SE STORAGE PONDS AT WWTP (MG)	52.0
OFFSITE STORAGE POND (MG)	39.0
FUTURE STORAGE (MG)	
ADD'L STORAGE POND STORAGE REQ'D (MG)	0.0
TREATMENT POND CHARACTERISTICS	
TREATMENT POND GROSS AREA (AC)	**7.0**
EVAP/PERC AREA (AC)	**6.0**
DESIGN PERC. RATE (in/day)	**0.0**
STORAGE AVAILABLE (MG)	**0.0**

CLIMATOLOGICAL FACTORS	
CLIMATOLOGICAL DESIGN BASIS	AVG YEAR
DESIGN PRECIP/AVG PRECIP RATIO	1.00
OCT-APR EVAP/AVG EVAP RATIO	1.00
MAY-SEP EVAP/AVG EVAP RATIO	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.05
STORAGE CATCHMENT SOIL RUNOFF COEFF.	1.00
RECHARGE POND CHARACTERISTICS	
RECHARGE POND GROSS AREA	**0.0**
EVAP/PERC AREA (AC)	**0.0**
DESIGN PERC. RATE (in/day)	**0.000**
STORAGE AVAILABLE (MG)	**0.0**

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
DAYS IN MONTH	365	31	30	31	31	28	31	30	31	30	31	31	30
AVG PRECIP, LODI (IN)	17.04	0.84	1.76	1.68	3.54	3.81	2.74	1.32	0.95	0.15	0.03	0.03	0.19
AVG EVAPORATION, LODI (IN)	51.89	3.31	1.60	0.92	0.93	1.73	3.46	5.34	6.81	7.69	7.93	6.95	5.22
DESIGN EVAPORATION (ETo) (IN)	51.89	3.31	1.60	0.92	0.93	1.73	3.46	5.34	6.81	7.69	7.93	6.95	5.22
ZONE 12 WET YEAR GRASS REFERENCE EVAPOTRANSPIRATION (ETr) (IN)	43.29	3.48	1.05	1.02	0.39	0.81	2.76	4.12	4.08	6.31	7.49	7.00	4.78
ALFALFA ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	42.42	2.07	1.16	1.20	0.45	0.95	3.23	4.88	4.86	6.41	6.73	6.24	4.24
GRAPE (NO COVER) ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	31.25	0.62	0.97	1.01	0.42	0.91	2.24	2.63	3.62	5.27	5.96	4.92	2.68
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ALFALFA CROP COEFFICIENT (Kc = ETc/ETr)		0.59	1.10	1.18	1.15	1.17	1.17	1.18	1.19	1.02	0.90	0.89	0.89
GRAPE (NO COVER) CROP COEFFICIENT (Kc = ETc/ETr)		0.18	0.92	0.99	1.08	1.12	0.81	0.64	0.89	0.84	0.80	0.70	0.56
AVERAGE DRY WEATHER FLOW (MGD)		0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
MONTHLY VOLUME OF I/I AS A PERCENT OF ADWF (2018 - 2020)		0.6%	3.3%	4.8%	1.6%	6.5%	5.8%	1.0%	0.0%	0.0%	0.0%	1.1%	0.0%
TOTAL I/I VOLUME (MGD)		0.002	0.013	0.019	0.006	0.026	0.023	0.004	0.000	0.000	0.000	0.004	0.000

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		4.9%	10.3%	9.9%	20.8%	22.4%	16.1%	7.7%	5.6%	0.9%	0.2%	0.2%	1.1%
ESTIMATED LODI/LOCKEFORD RAIN, AVG YEAR (IN)	17	0.84	1.76	1.68	3.54	3.81	2.74	1.32	0.95	0.15	0.03	0.03	0.19
EFFECTIVE RAIN FOR PLANTS (IN)	16	0.80	1.67	1.60	3.36	3.62	2.60	1.25	0.90	0.14	0.03	0.03	0.18
EVAPORATION-RELATED CALCULATIONS													
ALFALFA EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Kc)	52	1.97	1.77	1.08	1.07	2.03	4.05	6.33	8.11	7.81	7.13	6.20	4.63
GRAPE (NO COVER) EVAPOTRANSPIRATION POTENTIAL (IN) (ETc)(ETo*Kc)		0.59	1.48	0.91	1.00	1.94	2.81	3.41	6.04	6.42	6.31	4.88	2.93
STORAGE RESERVOIR EVAPORATION (IN) (ETo * Water Surface Coefficient)	52	3.31	1.60	0.92	0.93	1.73	3.46	5.34	6.81	7.69	7.93	6.95	5.22
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	144	12.2	11.8	12.2	12.2	11.0	12.2	11.8	12.2	11.8	12.2	12.2	11.8
I/I FLOW VOLUME (MG)	3	0.07	0.39	0.59	0.20	0.72	0.71	0.12	0.00	0.00	0.00	0.13	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.40	0.41	0.41	0.40	0.42	0.42	0.40	0.39	0.39	0.39	0.40	0.39
TOTAL INFLUENT FLOW VOLUME (MG)	148	12.3	12.3	12.9	12.5	11.8	13.0	12.0	12.3	11.9	12.3	12.4	11.9
TREATMENT POND CALCULATIONS													
PERCOLATION (IN)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERC. VOLUME (MG)		0.00	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL EVAP. VOLUME (MG)	8	0.54	0.26	0.15	0.15	0.28	0.56	0.87	1.11	1.25	1.29	1.13	0.85
PRECIP. VOLUME (MG)	3	0.14	0.29	0.27	0.58	0.62	0.45	0.21	0.15	0.02	0.00	0.00	0.03
TREATMENT POND RESIDUAL EFFLUENT VOLUME (MG/MONTH)	142	11.90	12.33	13.02	12.92	12.14	12.88	11.35	11.35	10.67	11.02	11.28	11.08
RECLAMATION AREA 1 CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	0.00	0.51	2.80	3.20	1.75	0.00	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		95	95	95	95	95	95	95	95	95	95	95	95
POTENTIAL AVG YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	63	4.37	3.30	0.00	0.00	0.00	0.00	6.52	10.41	10.87	10.30	9.37	7.65
POTENTIAL AVG YEAR EFFLUENT APPLICATION VOLUME (MG)	162	11.27	8.50	0.00	0.00	0.00	0.00	16.81	26.85	28.04	26.56	24.16	19.73
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		11.9	12.3	16.4	29.1	42.1	55.7	66.0	57.7	37.5	15.6	11.3	11.1
AVAILABLE EFFLUENT APPLIED (MG)	129	11.27	8.50	0.00	0.00	0.00	0.00	16.81	26.85	28.04	15.62	11.28	11.08
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.36	0.28	0.00	0.00	0.00	0.00	0.56	0.87	0.93	0.50	0.36	0.37
EFFLUENT IRRIGATION RATE (IN/MONTH)	50	4.37	3.30	0.00	0.00	0.00	0.00	6.52	10.41	10.87	6.06	4.37	4.30
RECLAMATION AREA 2 CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	0.00	0.51	2.80	3.20	1.75	0.00	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		0	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL AVG YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	53	4.37	3.30	0.00	0.00	0.00	0.00	6.52	10.41	10.87	7.10	6.17	4.45
POTENTIAL AVG YEAR EFFLUENT APPLICATION VOLUME (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		0.62	3.83	16.36	29.11	42.14	55.67	49.19	30.81	9.49	0.00	0.00	0.00
AVAILABLE EFFLUENT APPLIED (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EFFLUENT IRRIGATION RATE (IN/MONTH)	35	4.37	3.30	0.00	0.00	0.00	0.00	6.52	10.41	10.87	0.00	0.00	0.00
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	0.00	3.33	16.19	30.00	42.78	54.65	46.31	26.86	4.60	0.00	0.00
POTENTIAL RESIDUAL STORAGE VOLUME GAIN/LOSS (MG)		0.62	3.83	13.02	12.92	12.14	12.88	-5.46	-15.50	-17.36	-4.60	0.00	0.00
UNADJUSTED STORAGE VOLUME (MG)		0.62	3.83	16.36	29.11	42.14	55.67	49.19	30.81	9.49	0.00	0.00	0.00
STORAGE PRECIP VOLUME (MG)	10	0.48	1.01	0.96	2.02	2.18	1.57	0.75	0.54	0.09	0.02	0.02	0.11
STORAGE EVAP VOLUME (MG)	30	1.89	0.91	0.53	0.53	0.99	1.98	3.05	3.89	4.39	4.53	3.97	2.98
STORAGE PERCOLATION (IN)	12	1.05	1.02	1.05	1.05	0.95	1.05	1.02	1.05	1.02	1.05	1.05	1.02
STORAGE PERCOLATION (MG)	7	0.60	0.58	0.60	0.60	0.54	0.60	0.58	0.60	0.58	0.60	0.60	0.58
STORAGE AT END OF MONTH (MG)		0.00	3.33	16.19	30.00	42.78	54.65	46.31	26.86	4.60	0.00	0.00	0.00

MAXIMUM STORAGE REQUIRED (MG) 54.7

TOTAL AVAILABLE STORAGE (MG) 91.0

SUMMARY

ANNUAL INFLOW (MG)		ANNUAL OUTFLOW POTENTIAL (MG)		OVERALL BALANCE	
WASTEWATER	144	EVAPORATION	38	UNUSED DISPOSAL CAPACITY (MG)	47
INFLOW AND INFILTRATION	3	PERCOLATION	7	(MUST NOT BE NEGATIVE)	
PRECIPITATION	13	IRRIGATION	162	UNUSED STORAGE CAPACITY (MG)	36
				(MUST NOT BE NEGATIVE)	
TOTAL	**160**	**TOTAL**	**207**		

LOCKEFORD COMMUNITY SERVICES DISTRICT FILE: 2465-0010

FUTURE 0.50 ADWF WATER BALANCE UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS. ALTERNATIVE 1 - EXPAND OFFSITE STORAGE, ACTIVATE RECLAMATION AREA 2 11/1/2021

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS

STARTING AVERAGE FLOW (MGD)	0.50

IRRIGATION AREA CHARACTERISTICS

RECLAMATION AREA 1 ALFALFA PRODUCTION AREA	
RECLAMATION AREA 1 ACTIVE PRODUCTION AREA (AC)	95
EXISTING AREA ACTIVE ALFALFA PRODUCTION (AC)	57
RECLAMATION AREA 2 ALFALFA PRODUCTION AREA	
DEVELOPED GROSS ALFALFA PRODUCTION AREA (AC)	38
NET AREA IN ALFALFA PRODUCTION (AC)	38
FUTURE ADD'L GRAPE PRODUCTION AREA	
NEW GROSS GRAPE PRODUCTION AREA (AC)	0.0

STORAGE POND CHARACTERISTICS

TOTAL STORAGE AVAILABLE (MG)	108.1
TOTAL STORAGE AVAILABLE (AF)	332
WWTP STORAGE POND GROSS AREA (AC)	12.3
TOTAL STORAGE POND EVAP/PERC AREA (AC)	21.0
WWTP STORAGE POND EVAP/PERC AREA (AC)	10.5
OFFSITE STORAGE POND EVAP/PERC AREA (AC)	10.6
STORAGE RESERVOIR DESIGN PERC. RATE (in/day)	0.034
EXISTING STORAGE (MG)	
SW & SE STORAGE PONDS AT WWTP (MG)	33.0
OFFSITE STORAGE POND (MG)	39.0
FUTURE STORAGE (MG)	
ADD'L STORAGE POND STORAGE REQ'D (MG)	36.1

TREATMENT POND CHARACTERISTICS

TREATMENT POND GROSS AREA (AC)	12.5
EVAP/PERC AREA (AC)	10.7
DESIGN PERC. RATE (in/day)	0.0
STORAGE AVAILABLE (MG)	0.0

CLIMATOLOGICAL FACTORS

CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO	1.92
OCT-APR EVAP/AVG EVAP RATIO	0.80
MAY-SEP EVAP/AVG EVAP RATIO	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.05
STORAGE CATCHMENT SOIL RUNOFF COEFF.	1.00

RECHARGE POND CHARACTERISTICS

RECHARGE POND GROSS AREA	0.0
EVAP/PERC AREA (AC)	0.0
DESIGN PERC. RATE (in/day)	0.000
STORAGE AVAILABLE (MG)	0.0

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
DAYS IN MONTH	365	31	30	31	31	28	31	30	31	30	31	31	30
AVG PRECIP, LODI (IN)	17.04	0.84	1.76	1.68	3.54	3.81	2.74	1.32	0.95	0.15	0.03	0.03	0.19
AVG EVAPORATION, LODI (IN)	51.89	3.31	1.60	0.92	0.93	1.73	3.46	5.34	6.81	7.69	7.93	6.95	5.22
DESIGN EVAPORATION (ETo) (IN)	48.43	2.65	1.28	0.74	0.74	1.38	2.77	4.27	6.81	7.69	7.93	6.95	5.22
ZONE 12 WET YEAR GRASS REFERENCE EVAPOTRANSPIRATION (ETr) (IN)	43.29	3.48	1.05	1.02	0.39	0.81	2.76	4.12	4.08	6.31	7.49	7.00	4.78
ALFALFA ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	42.42	2.07	1.16	1.20	0.45	0.95	3.23	4.88	4.86	6.41	6.73	6.24	4.24
GRAPE (NO COVER) ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	31.25	0.62	0.97	1.01	0.42	0.91	2.24	2.63	3.62	5.27	5.96	4.92	2.68
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ALFALFA CROP COEFFICIENT (Kc = ETc/ETr)		0.59	1.10	1.18	1.15	1.17	1.17	1.18	1.19	1.02	0.90	0.89	0.89
GRAPE (NO COVER) CROP COEFFICIENT (Kc = ETc/ETr)		0.18	0.92	0.99	1.08	1.12	0.81	0.64	0.89	0.84	0.80	0.70	0.56
AVERAGE DRY WEATHER FLOW (MGD)		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
MONTHLY VOLUME OF I/I AS A PERCENT OF ADWF (2018 - 2020)		0.6%	3.3%	4.8%	1.6%	6.5%	5.8%	1.0%	0.0%	0.0%	0.0%	1.1%	0.0%
TOTAL I/I VOLUME (MGD)		0.003	0.017	0.024	0.008	0.033	0.029	0.005	0.000	0.000	0.000	0.006	0.000

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		4.9%	10.3%	9.9%	20.8%	22.4%	16.1%	7.7%	5.6%	0.9%	0.2%	0.2%	1.1%
ESTIMATED LODI/LOCKEFORD RAIN, 1-in-100 YEAR (IN)	33	1.62	3.39	3.23	6.81	7.33	5.27	2.54	1.83	0.29	0.06	0.06	0.37
EFFECTIVE RAIN FOR PLANTS (IN)	31	1.54	3.22	3.07	6.47	6.97	5.01	2.41	1.74	0.27	0.05	0.05	0.35
EVAPORATION-RELATED CALCULATIONS													
ALFALFA EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Kc)	49	1.58	1.41	0.87	0.86	1.62	3.24	5.06	8.11	7.81	7.13	6.20	4.63
GRAPE (NO COVER) EVAPOTRANSPIRATION POTENTIAL (IN) (ETc)(ETo*Kc)		0.47	1.18	0.73	0.80	1.55	2.25	2.73	6.04	6.42	6.31	4.88	2.93
STORAGE RESERVOIR EVAPORATION (IN) (ETo * Water Surface Coefficient)	48	2.65	1.28	0.74	0.74	1.38	2.77	4.27	6.81	7.69	7.93	6.95	5.22
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	183	15.5	15.0	15.5	15.5	14.0	15.5	15.0	15.5	15.0	15.5	15.5	15.0
I/I FLOW VOLUME (MG)	4	0.09	0.50	0.74	0.25	0.91	0.90	0.15	0.00	0.00	0.00	0.17	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.50	0.52	0.52	0.51	0.53	0.53	0.51	0.50	0.50	0.50	0.51	0.50
TOTAL INFLUENT FLOW VOLUME (MG)	187	15.6	15.5	16.3	15.8	15.0	16.4	15.2	15.5	15.0	15.5	15.7	15.0
TREATMENT POND CALCULATIONS													
PERCOLATION (IN)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERC. VOLUME (MG)		0.00	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL EVAP. VOLUME (MG)	14	0.77	0.37	0.21	0.22	0.40	0.80	1.24	1.98	2.23	2.30	2.02	1.51
PRECIP. VOLUME (MG)	10	0.47	0.98	0.94	1.98	2.13	1.53	0.74	0.53	0.08	0.02	0.02	0.11
TREATMENT POND RESIDUAL EFFLUENT VOLUME (MG/MONTH)	182	15.30	16.11	17.02	17.56	16.73	17.13	14.70	14.05	12.85	13.22	13.70	13.59
RECLAMATION AREA 1 ALFALFA PRODUCTION AREA CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	1.80	3.20	3.20	3.20	3.20	0.55	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		95	95	95	95	95	95	95	95	95	95	95	95
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	50	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.34	7.48
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	129	8.36	0.00	0.00	0.00	0.00	0.00	0.00	23.27	27.70	26.49	24.09	19.30
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		15.3	18.5	36.2	54.6	74.1	94.1	109.7	122.1	99.0	68.6	40.1	15.4
AVAILABLE EFFLUENT APPLIED (MG)	125	8.36	0.00	0.00	0.00	0.00	0.00	0.00	23.27	27.70	26.49	24.09	15.43
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.92	0.85	0.78	0.51
EFFLUENT IRRIGATION RATE (IN/MONTH)	49	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.34	5.98
RECLAMATION AREA 2 ALFALFA PRODUCTION AREA CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	1.80	3.20	3.20	3.20	3.20	0.55	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		38	38	38	38	38	38	38	38	38	38	38	38
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	47	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.34	4.28
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	48	3.34	0.00	0.00	0.00	0.00	0.00	0.00	9.31	11.08	10.60	9.64	4.42
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		6.95	18.52	36.17	54.56	74.15	94.13	109.66	98.87	71.27	42.10	16.01	0.00
AVAILABLE EFFLUENT APPLIED (MG)	44	3.34	0.00	0.00	0.00	0.00	0.00	0.00	9.31	11.08	10.60	9.64	0.00
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.37	0.34	0.31	0.00
EFFLUENT IRRIGATION RATE (IN/MONTH)	43	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.34	0.00
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	2.41	19.15	37.00	57.42	77.00	94.96	108.09	86.12	55.38	26.41	1.84
POTENTIAL RESIDUAL STORAGE VOLUME GAIN/LOSS (MG)		3.60	16.11	17.02	17.56	16.73	17.13	14.70	-18.52	-25.92	-23.87	-20.03	-1.84
UNADJUSTED STORAGE VOLUME (MG)		3.60	18.52	36.17	54.56	74.15	94.13	109.66	89.56	60.19	31.51	6.38	0.00
STORAGE PRECIP VOLUME (MG)	19	0.92	1.94	1.85	3.89	4.19	3.01	1.45	1.04	0.16	0.03	0.03	0.21
STORAGE EVAP VOLUME (MG)	28	1.51	0.73	0.42	0.43	0.79	1.58	2.44	3.89	4.39	4.53	3.97	2.98
STORAGE PERCOLATION (IN)	12	1.05	1.02	1.05	1.05	0.95	1.05	1.02	1.05	1.02	1.05	1.05	1.02
STORAGE PERCOLATION (MG)	7	0.60	0.58	0.60	0.60	0.54	0.60	0.58	0.60	0.58	0.60	0.60	0.58
STORAGE AT END OF MONTH (MG)		2.41	19.15	37.00	57.42	77.00	94.96	108.09	86.12	55.38	26.41	1.84	0.00

MAXIMUM STORAGE REQUIRED (MG) 108.1

TOTAL AVAILABLE STORAGE (MG) 108.1

SUMMARY

ANNUAL INFLOW (MG)		ANNUAL OUTFLOW POTENTIAL (MG)		OVERALL BALANCE	
WASTEWATER	183	EVAPORATION	42	UNUSED DISPOSAL CAPACITY (MG) (MUST NOT BE NEGATIVE)	12
INFLOW AND INFILTRATION	4	PERCOLATION	7		
PRECIPITATION	28	IRRIGATION	178	UNUSED STORAGE CAPACITY (MG) (MUST NOT BE NEGATIVE)	0
TOTAL	**215**	**TOTAL**	**227**		

LOCKEFORD COMMUNITY SERVICES DISTRICT FILE: 2465-0010

FUTURE 0.50 ADWF WATER BALANCE UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS. ALTERNATIVE 2 - MAXIMIZE WWTP STORAGE AND ACTIVATE RECLAMATION AREA 2 11/1/2021

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS

STARTING AVERAGE FLOW (MGD)	0.50

IRRIGATION AREA CHARACTERISTICS

RECLAMATION AREA 1 ALFALFA PRODUCTION AREA	
MINIMUM REQUIRED ALFALFA PRODUCTION AREA (AC)	95
EXISTING AREA ACTIVE ALFALFA PRODUCTION (AC)	57
RECLAMATION AREA 2 ALFALFA PRODUCTION AREA	
DEVELOPED GROSS ALFALFA PRODUCTION AREA (AC)	38
NET AREA IN ALFALFA PRODUCTION (AC)	38
FUTURE ADD'L GRAPE PRODUCTION AREA	
NEW GROSS GRAPE PRODUCTION AREA (AC)	0.0
NEW NET GRAPE PRODUCTION AREA (AC)	
NEW NET AREA IN GRAPE PRODUCTION (AC)	

STORAGE POND CHARACTERISTICS

TOTAL STORAGE AVAILABLE (MG)	106.0
TOTAL STORAGE AVAILABLE (AF)	325
WWTP STORAGE POND GROSS AREA (AC)	12.3
TOTAL STORAGE POND EVAP/PERC AREA (AC)	21.0
WWTP STORAGE POND EVAP/PERC AREA (AC)	10.5
OFFSITE STORAGE POND EVAP/PERC AREA (AC)	10.6
STORAGE RESERVOIR DESIGN PERC. RATE (in/day)	0.034
EXISTING STORAGE (MG)	
NW, SW & SE STORAGE PONDS AT WWTP (MG)	52.0
OFFSITE STORAGE POND (MG)	39.0
FUTURE STORAGE (MG)	
ADD'L STORAGE POND STORAGE REQ'D (MG)	15.0

TREATMENT POND CHARACTERISTICS

TREATMENT POND GROSS AREA (AC)	7.0
EVAP/PERC AREA (AC)	6.0
DESIGN PERC. RATE (in/day)	0.0
STORAGE AVAILABLE (MG)	0.0

CLIMATOLOGICAL FACTORS

CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO	1.92
OCT-APR EVAP/AVG EVAP RATIO	0.80
MAY-SEP EVAP/AVG EVAP RATIO	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.05
STORAGE CATCHMENT SOIL RUNOFF COEFF.	1.00

RECHARGE POND CHARACTERISTICS

RECHARGE POND GROSS AREA	0.0
EVAP/PERC AREA (AC)	0.0
DESIGN PERC. RATE (in/day)	0.000
STORAGE AVAILABLE (MG)	0.0

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
DAYS IN MONTH	365	31	30	31	31	28	31	30	31	30	31	31	30
AVG PRECIP, LODI (IN)	17.04	0.84	1.76	1.68	3.54	3.81	2.74	1.32	0.95	0.15	0.03	0.03	0.19
AVG EVAPORATION, LODI (IN)	51.89	3.31	1.60	0.92	0.93	1.73	3.46	5.34	6.81	7.69	7.93	6.95	5.22
DESIGN EVAPORATION (ETo) (IN)	48.43	2.65	1.28	0.74	0.74	1.38	2.77	4.27	6.81	7.69	7.93	6.95	5.22
ZONE 12 WET YEAR GRASS REFERENCE EVAPOTRANSPIRATION (ETr) (IN)	43.29	3.48	1.05	1.02	0.39	0.81	2.76	4.12	4.08	6.31	7.49	7.00	4.78
ALFALFA ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	42.42	2.07	1.16	1.20	0.45	0.95	3.23	4.88	4.86	6.41	6.73	6.24	4.24
GRAPE (NO COVER) ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	31.25	0.62	0.97	1.01	0.42	0.91	2.24	2.63	3.62	5.27	5.96	4.92	2.68
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ALFALFA CROP COEFFICIENT (Kc = ETc/ETr)		0.59	1.10	1.18	1.15	1.17	1.17	1.18	1.19	1.02	0.90	0.89	0.89
GRAPE (NO COVER) CROP COEFFICIENT (Kc = ETc/ETr)		0.18	0.92	0.99	1.08	1.12	0.81	0.64	0.89	0.84	0.80	0.70	0.56
AVERAGE DRY WEATHER FLOW (MGD)		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
MONTHLY VOLUME OF I/I AS A PERCENT OF ADWF (2018 - 2020)		0.6%	3.3%	4.8%	1.6%	6.5%	5.8%	1.0%	0.0%	0.0%	0.0%	1.1%	0.0%
TOTAL I/I VOLUME (MGD)		0.003	0.017	0.024	0.008	0.033	0.029	0.005	0.000	0.000	0.000	0.006	0.000

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		4.9%	10.3%	9.9%	20.8%	22.4%	16.1%	7.7%	5.6%	0.9%	0.2%	0.2%	1.1%
ESTIMATED LODI/LOCKEFORD RAIN, 1-in-100 YEAR (IN)	33	1.62	3.39	3.23	6.81	7.33	5.27	2.54	1.83	0.29	0.06	0.06	0.37
EFFECTIVE RAIN FOR PLANTS (IN)	31	1.54	3.22	3.07	6.47	6.97	5.01	2.41	1.74	0.27	0.05	0.05	0.35
EVAPORATION-RELATED CALCULATIONS													
ALFALFA EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Kc)	49	1.58	1.41	0.87	0.86	1.62	3.24	5.06	8.11	7.81	7.13	6.20	4.63
GRAPE (NO COVER) EVAPOTRANSPIRATION POTENTIAL (IN) (ETc)(ETo*Kc)		0.47	1.18	0.73	0.80	1.55	2.25	2.73	6.04	6.42	6.31	4.88	2.93
STORAGE RESERVOIR EVAPORATION (IN) (ETo * Water Surface Coefficient)	48	2.65	1.28	0.74	0.74	1.38	2.77	4.27	6.81	7.69	7.93	6.95	5.22
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	183	15.5	15.0	15.5	15.5	14.0	15.5	15.0	15.5	15.0	15.5	15.5	15.0
I/I FLOW VOLUME (MG)	4	0.09	0.50	0.74	0.25	0.91	0.90	0.15	0.00	0.00	0.00	0.17	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.50	0.52	0.52	0.51	0.53	0.53	0.51	0.50	0.50	0.50	0.51	0.50
TOTAL INFLUENT FLOW VOLUME (MG)	187	15.6	15.5	16.3	15.8	15.0	16.4	15.2	15.5	15.0	15.5	15.7	15.0
TREATMENT POND CALCULATIONS													
PERCOLATION (IN)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERC. VOLUME (MG)		0.00	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL EVAP. VOLUME (MG)	8	0.43	0.21	0.12	0.12	0.22	0.45	0.69	1.11	1.25	1.29	1.13	0.85
PRECIP. VOLUME (MG)	5	0.26	0.55	0.53	1.11	1.19	0.86	0.41	0.30	0.05	0.01	0.01	0.06
TREATMENT POND RESIDUAL EFFLUENT VOLUME (MG/MONTH)	184	15.43	15.84	16.71	16.79	15.97	16.81	14.92	14.69	13.80	14.22	14.58	14.21
RECLAMATION AREA 1 CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	1.80	3.20	3.20	3.20	3.20	0.55	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		95	95	95	95	95	95	95	95	95	95	95	95
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	50	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.34	7.48
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	129	8.36	0.00	0.00	0.00	0.00	0.00	0.00	23.27	27.70	26.49	24.09	19.30
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		15.4	18.4	35.7	53.3	72.2	91.8	107.6	120.7	98.5	69.1	41.5	17.4
AVAILABLE EFFLUENT APPLIED (MG)	127	8.36	0.00	0.00	0.00	0.00	0.00	0.00	23.27	27.70	26.49	24.09	17.42
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.92	0.85	0.78	0.58
EFFLUENT IRRIGATION RATE (IN/MONTH)	49	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.34	6.75
RECLAMATION AREA 2 CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	1.80	3.20	3.20	3.20	3.20	0.55	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		38	38	38	38	38	38	38	38	38	38	38	38
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	47	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.34	4.28
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	48	3.34	0.00	0.00	0.00	0.00	0.00	0.00	9.31	11.08	10.60	9.64	4.42
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		7.08	18.39	35.71	53.33	72.16	91.82	107.57	97.42	70.76	42.60	17.39	0.00
AVAILABLE EFFLUENT APPLIED (MG)	44	3.34	0.00	0.00	0.00	0.00	0.00	0.00	9.31	11.08	10.60	9.64	0.00
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.37	0.34	0.31	0.00
EFFLUENT IRRIGATION RATE (IN/MONTH)	43	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.34	0.00
FUTURE GRAPE PRODUCTION AREA CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	1.06	3.10	3.20	3.20	3.20	3.20	2.89	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		0	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.62	9.35	9.46	8.03	2.58
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		3.74	18.39	35.71	53.33	72.16	91.82	107.57	88.11	59.68	32.00	7.75	0.00
AVAILABLE EFFLUENT APPLIED (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EFFLUENT IRRIGATION RATE (IN/MONTH)	31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.62	9.35	9.46	8.03	0.00
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	2.54	19.01	36.54	56.19	75.01	92.65	106.00	84.66	54.87	26.90	3.21
POTENTIAL RESIDUAL STORAGE VOLUME GAIN/LOSS (MG)		3.74	15.84	16.71	16.79	15.97	16.81	14.92	-17.89	-24.98	-22.87	-19.15	-3.21
UNADJUSTED STORAGE VOLUME (MG)		3.74	18.39	35.71	53.33	72.16	91.82	107.57	88.11	59.68	32.00	7.75	0.00
STORAGE PRECIP VOLUME (MG)	19	0.92	1.94	1.85	3.89	4.19	3.01	1.45	1.04	0.16	0.03	0.03	0.21
STORAGE EVAP VOLUME (MG)	28	1.51	0.73	0.42	0.43	0.79	1.58	2.44	3.89	4.39	4.53	3.97	2.98
STORAGE PERCOLATION (IN)	12	1.05	1.02	1.05	1.05	0.95	1.05	1.02	1.05	1.02	1.05	1.05	1.02
STORAGE PERCOLATION (MG)	7	0.60	0.58	0.60	0.60	0.54	0.60	0.58	0.60	0.58	0.60	0.60	0.58
STORAGE AT END OF MONTH (MG)		2.54	19.01	36.54	56.19	75.01	92.65	106.00	84.66	54.87	26.90	3.21	0.00

MAXIMUM STORAGE REQUIRED (MG)	106.0
TOTAL AVAILABLE STORAGE (MG)	106.0

SUMMARY

ANNUAL INFLOW (MG)		ANNUAL OUTFLOW POTENTIAL (MG)		OVERALL BALANCE	
WASTEWATER	183	EVAPORATION	36	UNUSED DISPOSAL CAPACITY (MG) (MUST NOT BE NEGATIVE)	10
INFLOW AND INFILTRATION	4	PERCOLATION	7		
PRECIPITATION	24	IRRIGATION	178	UNUSED STORAGE CAPACITY (MG) (MUST NOT BE NEGATIVE)	0
TOTAL	**211**	**TOTAL**	**221**		

LOCKEFORD COMMUNITY SERVICES DISTRICT — FILE: 2465-0010

FUTURE 0.50 ADWF WATER BALANCE UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS. ALTERNATIVE 3 - PHASE 3A RECHARGE POND WITH ADDITIONAL STORAGE — 11/1/2021

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS

STARTING AVERAGE FLOW (MGD)	0.50

IRRIGATION AREA CHARACTERISTICS

CURRENT NET AREA IN ALFALFA PRODUCTION (AC)	**95**
EXISTING AREA IN ALFALFA PRODUCTION PRE-2008 (AC)	**95**
EXISTING AREA ACTIVE ALFALFA PRODUCTION (AC)	**57**
BOLEA PROPERTY ALFALFA PRODUCTION AREA	
2008 DEVELOPED GROSS ALFALFA PRODUCTION AREA (AC)	**0**
2008 DEVELOPED NET AREA IN ALFALFA PRODUCTION (AC)	**0**
FUTURE ADD'L GRAPE PRODUCTION AREA	
NEW GROSS GRAPE PRODUCTION AREA (AC)	**0.0**
NEW NET GRAPE PRODUCTION AREA (AC)	
NEW NET AREA IN GRAPE PRODUCTION (AC)	

STORAGE POND CHARACTERISTICS

TOTAL STORAGE AVAILABLE (MG)	**86.0**
TOTAL STORAGE AVAILABLE (AF)	**264**
WWTP STORAGE POND GROSS AREA (AC)	**17.9**
TOTAL STORAGE POND EVAP/PERC AREA (AC)	**25.8**
WWTP STORAGE POND EVAP/PERC AREA (AC)	**15.2**
OFFSITE STORAGE POND EVAP/PERC AREA (AC)	**10.6**
STORAGE RESERVOIR DESIGN PERC. RATE (in/day)	**0.034**
EXISTING STORAGE (MG)	
SW & SE STORAGE PONDS AT WWTP (MG)	33.0
OFFSITE STORAGE POND (MG)	39
FUTURE STORAGE (MG)	
ADD'L STORAGE POND STORAGE REQ'D (MG)	14.0

TREATMENT POND CHARACTERISTICS

TREATMENT POND GROSS AREA (AC)	**12.5**
EVAP/PERC AREA (AC)	**10.7**
DESIGN PERC. RATE (in/day)	**0.0**
STORAGE AVAILABLE (MG)	**0.0**

CLIMATOLOGICAL FACTORS

CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO	1.92
OCT-APR EVAP/AVG EVAP RATIO	0.80
MAY-SEP EVAP/AVG EVAP RATIO	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.05
STORAGE CATCHMENT SOIL RUNOFF COEFF	1.00

RECHARGE POND CHARACTERISTICS

HISTORIC WWTP RECHARGE PONDS	
RECHARGE POND GROSS AREA (AC)	**0.0**
EVAP/PERC AREA (AC)	**0.0**
DESIGN PERC. RATE (in/day)	**0.440**
STORAGE AVAILABLE (MG)	**0.0**
NEW RECLAMATION AREA 2 RECHARGE PONDS	
RECHARGE POND GROSS AREA (AC)	**12.0**
EVAP/PERC AREA (AC)	**9.8**
DESIGN PERC. RATE (in/day)	**0.550**
STORAGE AVAILABLE (MG)	**0.0**

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
DAYS IN MONTH	365	31	30	31	31	28	31	30	31	30	31	31	30
AVG PRECIP, LODI (IN)	17.04	0.84	1.76	1.68	3.54	3.81	2.74	1.32	0.95	0.15	0.03	0.03	0.19
AVG EVAPORATION, LODI (IN)	51.89	3.31	1.60	0.92	0.93	1.73	3.46	5.34	6.81	7.69	7.93	6.95	5.22
DESIGN EVAPORATION (ETo) (IN)	48.43	2.65	1.28	0.74	0.74	1.38	2.77	4.27	6.81	7.69	7.93	6.95	5.22
ZONE 12 WET YEAR GRASS REFERENCE EVAPOTRANSPIRATION (ETr) (IN)	43.29	3.48	1.05	1.02	0.39	0.81	2.76	4.12	4.08	6.31	7.49	7.00	4.78
ALFALFA ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	42.42	2.07	1.16	1.20	0.45	0.95	3.23	4.88	4.86	6.41	6.73	6.24	4.24
GRAPE (NO COVER) ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	31.25	0.62	0.97	1.01	0.42	0.91	2.24	2.63	3.62	5.27	5.96	4.92	2.68
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ALFALFA CROP COEFFICIENT (Kc = ETc/ETr)		0.59	1.10	1.18	1.15	1.17	1.17	1.18	1.19	1.02	0.90	0.89	0.89
GRAPE (NO COVER) CROP COEFFICIENT (Kc = ETc/ETr)		0.18	0.92	0.99	1.08	1.12	0.81	0.64	0.89	0.84	0.80	0.70	0.56
AVERAGE DRY WEATHER FLOW (MGD)		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
MONTHLY VOLUME OF I/I AS A PERCENT OF ADWF (2018 - 2020)		0.6%	3.3%	4.8%	1.6%	6.5%	5.8%	1.0%	0.0%	0.0%	0.0%	1.1%	0.0%
TOTAL I/I VOLUME (MGD)		0.003	0.017	0.024	0.008	0.033	0.029	0.005	0.000	0.000	0.000	0.006	0.000

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		4.9%	10.3%	9.9%	20.8%	22.4%	16.1%	7.7%	5.6%	0.9%	0.2%	0.2%	1.1%
ESTIMATED LODI/LOCKEFORD RAIN, 1-in-100 YEAR (IN)	33	1.62	3.39	3.23	6.81	7.33	5.27	2.54	1.83	0.29	0.06	0.06	0.37
EFFECTIVE RAIN FOR PLANTS (IN)	31	1.54	3.22	3.07	6.47	6.97	5.01	2.41	1.74	0.27	0.05	0.05	0.35
EVAPORATION-RELATED CALCULATIONS													
ALFALFA EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Kc)	49	1.58	1.41	0.87	0.86	1.62	3.24	5.06	8.11	7.81	7.13	6.20	4.63
GRAPE (NO COVER) EVAPOTRANSPIRATION POTENTIAL (IN) (ETc)(ETo*Kc)		0.47	1.18	0.73	0.80	1.55	2.25	2.73	6.04	6.42	6.31	4.88	2.93
STORAGE RESERVOIR EVAPORATION (IN) (ETo * Water Surface Coefficient)	48	2.65	1.28	0.74	0.74	1.38	2.77	4.27	6.81	7.69	7.93	6.95	5.22
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	183	15.5	15.0	15.5	15.5	14.0	15.5	15.0	15.5	15.0	15.5	15.5	15.0
I/I FLOW VOLUME (MG)	4	0.09	0.50	0.74	0.25	0.91	0.90	0.15	0.00	0.00	0.00	0.17	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.50	0.52	0.52	0.51	0.53	0.53	0.51	0.50	0.50	0.50	0.51	0.50
TOTAL INFLUENT FLOW VOLUME (MG)	187	15.6	15.5	16.3	15.8	15.0	16.4	15.2	15.5	15.0	15.5	15.7	15.0
TREATMENT POND CALCULATIONS													
PERCOLATION (IN)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERC. VOLUME (MG)		0.00	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL EVAP. VOLUME (MG)	14	0.77	0.37	0.21	0.22	0.40	0.80	1.24	1.98	2.23	2.30	2.02	1.51
PRECIP. VOLUME (MG)	10	0.47	0.98	0.94	1.98	2.13	1.53	0.74	0.53	0.08	0.02	0.02	0.11
TREATMENT POND RESIDUAL EFFLUENT VOLUME (MG/MONTH)	182	15.30	16.11	17.02	17.56	16.73	17.13	14.70	14.05	12.85	13.22	13.70	13.59
HISTORIC WWTP RECHARGE POND CALCULATIONS													
PERCOLATION (IN)	161	13.64	13.20	13.64	13.64	12.32	13.64	13.20	13.64	13.20	13.64	13.64	13.20
PERC VOLUME (MG)	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W.S. AREA (AC)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EVAP VOLUME (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PRECIP VOLUME (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P/E POND DISPOSAL POTENTIAL (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NEW RECLAMATION AREA 2 RECHARGE POND CALCULATIONS													
PERCOLATION (IN)	201	17.05	16.50	17.05	17.05	15.40	17.05	16.50	17.05	16.50	17.05	17.05	16.50
PERC VOLUME (MG)	53	4.5	4.4	4.5	4.5	4.1	4.5	4.4	4.5	4.4	4.5	4.5	4.4
W.S. AREA (AC)		9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79
EVAP VOLUME (MG)	13	0.70	0.34	0.20	0.20	0.37	0.74	1.14	1.81	2.04	2.11	1.85	1.39
PRECIP VOLUME (MG)	9	0.43	0.90	0.86	1.81	1.95	1.40	0.68	0.49	0.08	0.02	0.02	0.10
P/E POND DISPOSAL POTENTIAL (MG)	58	4.81	3.83	3.87	2.92	2.51	3.87	4.85	5.86	6.35	6.62	6.36	5.68
RECLAMATION AREA 1 CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	1.80	3.20	3.20	3.20	3.20	0.55	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		95	95	95	95	95	95	95	95	95	95	95	95
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	50	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.34	7.48
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	129	8.36	0.00	0.00	0.00	0.00	0.00	0.00	23.27	27.70	26.49	24.09	19.30
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		10.5	13.0	26.9	42.5	60.3	77.0	87.9	94.2	73.2	46.2	20.8	7.9
AVAILABLE EFFLUENT APPLIED (MG)	114	8.36	0.00	0.00	0.00	0.00	0.00	0.00	23.27	27.70	26.49	20.76	7.92
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.92	0.85	0.67	0.26
EFFLUENT IRRIGATION RATE (IN/MONTH)	44	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	8.05	3.07
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	0.68	13.73	27.89	46.05	63.76	78.04	85.97	66.67	39.58	13.43	0.00
POTENTIAL RESIDUAL STORAGE VOLUME GAIN/LOSS (MG)		2.14	12.29	13.16	14.64	14.21	13.26	9.85	-15.07	-21.20	-19.90	-13.43	0.00
UNADJUSTED STORAGE VOLUME (MG)		2.14	12.97	26.88	42.54	60.26	77.02	87.89	70.89	45.47	19.68	0.00	0.00
STORAGE PRECIP VOLUME (MG)	23	1.13	2.37	2.26	4.77	5.13	3.69	1.78	1.28	0.20	0.04	0.04	0.26
STORAGE EVAP VOLUME (MG)	34	1.85	0.90	0.52	0.52	0.97	1.94	2.99	4.77	5.38	5.55	4.87	3.65
STORAGE PERCOLATION (IN)	12	1.05	1.02	1.05	1.05	0.95	1.05	1.02	1.05	1.02	1.05	1.05	1.02
STORAGE PERCOLATION (MG)	9	0.74	0.71	0.74	0.74	0.67	0.74	0.71	0.74	0.71	0.74	0.74	0.71
STORAGE AT END OF MONTH (MG)		0.68	13.73	27.89	46.05	63.76	78.04	85.97	66.67	39.58	13.43	0.00	0.00

MAXIMUM STORAGE REQUIRED (MG)	86.0
TOTAL AVAILABLE STORAGE (MG)	86.0

SUMMARY

ANNUAL INFLOW (MG)	
WASTEWATER	183
INFLOW AND INFILTRATION	4
PRECIPITATION	41
TOTAL	**228**

ANNUAL OUTFLOW POTENTIAL (MG)	
EVAPORATION	61
PERCOLATION	62
IRRIGATION	129
TOTAL	**252**

OVERALL BALANCE	
UNUSED DISPOSAL CAPACITY (MG) (MUST NOT BE NEGATIVE)	24
UNUSED STORAGE CAPACITY (MG) (MUST NOT BE NEGATIVE)	0

LOCKEFORD COMMUNITY SERVICES DISTRICT FILE: 2465-0010

FUTURE 0.50 ADWF WATER BALANCE UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS. ALTERNATIVE 3 - PHASE 3B HISTORIC WWTP & RECLAMATION AREA 2 RECHARGE PONDS 11/1/2021

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS

STARTING AVERAGE FLOW (MGD)	0.50

IRRIGATION AREA CHARACTERISTICS

RECLAMATION AREA 1 ALFALFA PRODUCTION AREA	
EXISTING AREA IN ALFALFA PRODUCTION PRE-2008 (AC)	95
EXISTING AREA ACTIVE ALFALFA PRODUCTION (AC)	57
RECLAMATION AREA 2 ALFALFA PRODUCTION AREA	
DEVELOPED GROSS ALFALFA PRODUCTION AREA (AC)	0
NET AREA IN ALFALFA PRODUCTION (AC)	0
FUTURE ADD'L GRAPE PRODUCTION AREA	
NEW GROSS GRAPE PRODUCTION AREA (AC)	0.0
NEW NET GRAPE PRODUCTION AREA (AC)	
NEW NET AREA IN GRAPE PRODUCTION (AC)	

STORAGE POND CHARACTERISTICS

TOTAL STORAGE AVAILABLE (MG)	72.0
TOTAL STORAGE AVAILABLE (AF)	221
WWTP STORAGE POND GROSS AREA (AC)	17.9
TOTAL STORAGE POND EVAP/PERC AREA (AC)	25.8
WWTP STORAGE POND EVAP/PERC AREA (AC)	15.2
OFFSITE STORAGE POND EVAP/PERC AREA (AC)	10.6
STORAGE RESERVOIR DESIGN PERC. RATE (in/day)	0.034
EXISTING STORAGE (MG)	
SW & SE STORAGE PONDS AT WWTP (MG)	33.0
OFFSITE STORAGE POND (MG)	39
FUTURE STORAGE (MG)	
ADD'L STORAGE POND STORAGE REQ'D (MG)	0.0

TREATMENT POND CHARACTERISTICS

TREATMENT POND GROSS AREA (AC)	12.5
EVAP/PERC AREA (AC)	10.7
DESIGN PERC. RATE (in/day)	0.0
STORAGE AVAILABLE (MG)	0.0

CLIMATOLOGICAL FACTORS

CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO	1.92
OCT-APR EVAP/AVG EVAP RATIO	0.80
MAY-SEP EVAP/AVG EVAP RATIO	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.05
STORAGE CATCHMENT SOIL RUNOFF COEFF.	1.00

RECHARGE POND CHARACTERISTICS

HISTORIC WWTP RECHARGE PONDS	
RECHARGE POND GROSS AREA (AC)	12.1
EVAP/PERC AREA (AC)	9.9
DESIGN PERC. RATE (in/day)	0.440
STORAGE AVAILABLE (MG)	0.0
NEW RECLAMATION AREA 2 RECHARGE PONDS	
RECHARGE POND GROSS AREA (AC)	12.0
EVAP/PERC AREA (AC)	9.8
DESIGN PERC. RATE (in/day)	0.550
STORAGE AVAILABLE (MG)	0.0

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
DAYS IN MONTH	365	31	30	31	31	28	31	30	31	30	31	31	30
AVG PRECIP, LODI (IN)	17.04	0.84	1.76	1.68	3.54	3.81	2.74	1.32	0.95	0.15	0.03	0.03	0.19
AVG EVAPORATION, LODI (IN)	51.89	3.31	1.60	0.92	0.93	1.73	3.46	5.34	6.81	7.69	7.93	6.95	5.22
DESIGN EVAPORATION (ETo) (IN)	48.43	2.65	1.28	0.74	0.74	1.38	2.77	4.27	6.81	7.69	7.93	6.95	5.22
ZONE 12 WET YEAR GRASS REFERENCE EVAPOTRANSPIRATION (ETr) (IN)	43.29	3.48	1.05	1.02	0.39	0.81	2.76	4.12	4.08	6.31	7.49	7.00	4.78
ALFALFA ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	42.42	2.07	1.16	1.20	0.45	0.95	3.23	4.88	4.86	6.41	6.73	6.24	4.24
GRAPE (NO COVER) ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	31.25	0.62	0.97	1.01	0.42	0.91	2.24	2.63	3.62	5.27	5.96	4.92	2.68
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ALFALFA CROP COEFFICIENT (Kc = ETc/ETr)		0.59	1.10	1.18	1.15	1.17	1.17	1.18	1.19	1.02	0.90	0.89	0.89
GRAPE (NO COVER) CROP COEFFICIENT (Kc = ETc/ETr)		0.18	0.92	0.99	1.08	1.12	0.81	0.64	0.89	0.84	0.80	0.70	0.56
AVERAGE DRY WEATHER FLOW (MGD)		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
MONTHLY VOLUME OF I/I AS A PERCENT OF ADWF (2018 - 2020)		0.6%	3.3%	4.8%	1.6%	6.5%	5.8%	1.0%	0.0%	0.0%	0.0%	1.1%	0.0%
TOTAL I/I VOLUME (MGD)		0.003	0.017	0.024	0.008	0.033	0.029	0.005	0.000	0.000	0.000	0.006	0.000

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		4.9%	10.3%	9.9%	20.8%	22.4%	16.1%	7.7%	5.6%	0.9%	0.2%	0.2%	1.1%
ESTIMATED LODI/LOCKEFORD RAIN, 1-in-100 YEAR (IN)	33	1.62	3.39	3.23	6.81	7.33	5.27	2.54	1.83	0.29	0.06	0.06	0.37
EFFECTIVE RAIN FOR PLANTS (IN)	31	1.54	3.22	3.07	6.47	6.97	5.01	2.41	1.74	0.27	0.05	0.05	0.35
EVAPORATION-RELATED CALCULATIONS													
ALFALFA EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Kc)	49	1.58	1.41	0.87	0.86	1.62	3.24	5.06	8.11	7.81	7.13	6.20	4.63
GRAPE (NO COVER) EVAPOTRANSPIRATION POTENTIAL (IN) (ETc)(ETo*Kc)		0.47	1.18	0.73	0.80	1.55	2.25	2.73	6.04	6.42	6.31	4.88	2.93
STORAGE RESERVOIR EVAPORATION (IN) (ETo * Water Surface Coefficient)	48	2.65	1.28	0.74	0.74	1.38	2.77	4.27	6.81	7.69	7.93	6.95	5.22
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	183	15.5	15.0	15.5	15.5	14.0	15.5	15.0	15.5	15.0	15.5	15.5	15.0
I/I FLOW VOLUME (MG)	4	0.09	0.50	0.74	0.25	0.91	0.90	0.15	0.00	0.00	0.00	0.17	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.50	0.52	0.52	0.51	0.53	0.53	0.51	0.50	0.50	0.50	0.51	0.50
TOTAL INFLUENT FLOW VOLUME (MG)	187	15.6	15.5	16.3	15.8	15.0	16.4	15.2	15.5	15.0	15.5	15.7	15.0
TREATMENT POND CALCULATIONS													
PERCOLATION (IN)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERC. VOLUME (MG)		0.00	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL EVAP. VOLUME (MG)	14	0.77	0.37	0.21	0.22	0.40	0.80	1.24	1.98	2.23	2.30	2.02	1.51
PRECIP. VOLUME (MG)	10	0.47	0.98	0.94	1.98	2.13	1.53	0.74	0.53	0.08	0.02	0.02	0.11
TREATMENT POND RESIDUAL EFFLUENT VOLUME (MG/MONTH)	182	15.30	16.11	17.02	17.56	16.73	17.13	14.70	14.05	12.85	13.22	13.70	13.59
HISTORIC WWTP RECHARGE POND CALCULATIONS													
PERCOLATION (IN)	161	13.64	13.20	13.64	13.64	12.32	13.64	13.20	13.64	13.20	13.64	13.64	13.20
PERC VOLUME (MG)	43	3.7	3.5	3.7	3.7	3.3	3.7	3.5	3.7	3.5	3.7	3.7	3.5
W.S. AREA (AC)		9.88	9.88	9.88	9.88	9.88	9.88	9.88	9.88	9.88	9.88	9.88	9.88
EVAP VOLUME (MG)	13	0.71	0.34	0.20	0.20	0.37	0.74	1.15	1.83	2.06	2.13	1.86	1.40
PRECIP VOLUME (MG)	9	0.43	0.91	0.87	1.83	1.97	1.41	0.68	0.49	0.08	0.02	0.02	0.10
P/E POND DISPOSAL POTENTIAL (MG)	47	3.94	2.98	2.99	2.03	1.71	2.99	4.01	5.00	5.53	5.77	5.51	4.84
NEW RECLAMATION AREA 2 RECHARGE POND CALCULATIONS													
PERCOLATION (IN)	201	17.05	16.50	17.05	17.05	15.40	17.05	16.50	17.05	16.50	17.05	17.05	16.50
PERC VOLUME (MG)	53	4.5	4.4	4.5	4.5	4.1	4.5	4.4	4.5	4.4	4.5	4.5	4.4
W.S. AREA (AC)		9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79
EVAP VOLUME (MG)	13	0.70	0.34	0.20	0.20	0.37	0.74	1.14	1.81	2.04	2.11	1.85	1.39
PRECIP VOLUME (MG)	9	0.43	0.90	0.86	1.81	1.95	1.40	0.68	0.49	0.08	0.02	0.02	0.10
P/E POND DISPOSAL POTENTIAL (MG)	58	4.81	3.83	3.87	2.92	2.51	3.87	4.85	5.86	6.35	6.62	6.36	5.68
RECLAMATION AREA 1 CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	1.80	3.20	3.20	3.20	3.20	0.55	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		95	95	95	95	95	95	95	95	95	95	95	95
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	50	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.32	7.48
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	129	8.36	0.00	0.00	0.00	0.00	0.00	0.00	23.27	27.70	26.49	24.03	19.30
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		6.6	9.3	20.2	33.9	49.9	63.7	70.5	71.8	45.3	12.5	1.8	3.1
AVAILABLE EFFLUENT APPLIED (MG)	75	6.56	0.00	0.00	0.00	0.00	0.00	0.00	23.27	27.70	12.50	1.83	3.07
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.92	0.40	0.06	0.10
EFFLUENT IRRIGATION RATE (IN/MONTH)	29	2.54	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	4.85	0.71	1.19
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	0.00	10.07	21.25	37.37	53.38	64.67	68.59	44.30	11.68	0.00	0.00
POTENTIAL RESIDUAL STORAGE VOLUME GAIN/LOSS (MG)		0.00	9.31	10.17	12.61	12.51	10.27	5.85	-20.07	-26.72	-11.68	0.00	0.00
UNADJUSTED STORAGE VOLUME (MG)		0.00	9.31	20.24	33.86	49.88	63.65	70.51	48.52	17.57	0.00	0.00	0.00
STORAGE PRECIP VOLUME (MG)	23	1.13	2.37	2.26	4.77	5.13	3.69	1.78	1.28	0.20	0.04	0.04	0.26
STORAGE EVAP VOLUME (MG)	34	1.85	0.90	0.52	0.52	0.97	1.94	2.99	4.77	5.38	5.55	4.87	3.65
STORAGE PERCOLATION (IN)	12	1.05	1.02	1.05	1.05	0.95	1.05	1.02	1.05	1.02	1.05	1.05	1.02
STORAGE PERCOLATION (MG)	9	0.74	0.71	0.74	0.74	0.67	0.74	0.71	0.74	0.71	0.74	0.74	0.71
STORAGE AT END OF MONTH (MG)		0.00	10.07	21.25	37.37	53.38	64.67	68.59	44.30	11.68	0.00	0.00	0.00

MAXIMUM STORAGE REQUIRED (MG)	68.6
TOTAL AVAILABLE STORAGE (MG)	72.0

SUMMARY

ANNUAL INFLOW (MG)		ANNUAL OUTFLOW POTENTIAL (MG)		OVERALL BALANCE	
WASTEWATER	183	EVAPORATION	74	UNUSED DISPOSAL CAPACITY (MG) (MUST NOT BE NEGATIVE)	71
INFLOW AND INFILTRATION	4	PERCOLATION	105		
PRECIPITATION	50	IRRIGATION	129	UNUSED STORAGE CAPACITY (MG) (MUST NOT BE NEGATIVE)	3
TOTAL	**237**	**TOTAL**	**308**		

LOCKEFORD COMMUNITY SERVICES DISTRICT

FILE: 2465-0010

FUTURE 0.50 ADWF WATER BALANCE UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS. ALTERNATIVE 4 - RECYCLED USE ON GRAPE VINEYARDS FOR IN-LIEU RECHARGE

11/1/2021

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS	
STARTING AVERAGE FLOW (MGD)	0.50
IRRIGATION AREA CHARACTERISTICS	
RECLAMATION AREA 1 ALFALFA PRODUCTION AREA	
EXISTING AREA IN ALFALFA PRODUCTION PRE-2008 (AC)	0
EXISTING AREA ACTIVE ALFALFA PRODUCTION (AC)	0
RECLAMATION AREA 2 ALFALFA PRODUCTION AREA	
DEVELOPED GROSS ALFALFA PRODUCTION AREA (AC)	0
NET AREA IN ALFALFA PRODUCTION (AC)	0
FUTURE ADD'L GRAPE PRODUCTION AREA	
NEW GROSS GRAPE PRODUCTION AREA (AC)	162.4
NEW NET GRAPE PRODUCTION AREA (AC)	
NEW NET AREA IN GRAPE PRODUCTION (AC)	

STORAGE POND CHARACTERISTICS	
TOTAL STORAGE AVAILABLE (MG)	119.0
TOTAL STORAGE AVAILABLE (AF)	365
WWTP STORAGE POND GROSS AREA (AC)	17.9
TOTAL STORAGE POND EVAP/PERC AREA (AC)	25.8
WWTP STORAGE POND EVAP/PERC AREA (AC)	15.2
OFFSITE STORAGE POND EVAP/PERC AREA (AC)	10.6
STORAGE RESERVOIR DESIGN PERC. RATE (in/day)	0.034
EXISTING STORAGE (MG)	
SW & SE STORAGE PONDS AT WWTP (MG)	52.0
OFFSITE STORAGE POND (MG)	39.0
FUTURE STORAGE (MG)	
ADD'L STORAGE POND STORAGE REQ'D (MG)	28.0
TREATMENT POND CHARACTERISTICS	
TREATMENT POND GROSS AREA (AC)	7.0
EVAP/PERC AREA (AC)	6.0
DESIGN PERC. RATE (in/day)	0.0
STORAGE AVAILABLE (MG)	0.0

CLIMATOLOGICAL FACTORS	
CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO	1.92
OCT-APR EVAP/AVG EVAP RATIO	0.80
MAY-SEP EVAP/AVG EVAP RATIO	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.05
STORAGE CATCHMENT SOIL RUNOFF COEFF	1.00
RECHARGE POND CHARACTERISTICS	
RECHARGE POND GROSS AREA	0.0
EVAP/PERC AREA (AC)	0.0
DESIGN PERC. RATE (in/day)	0.000
STORAGE AVAILABLE (MG)	0.0

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
DAYS IN MONTH	365	31	30	31	31	28	31	30	31	30	31	31	30
AVG PRECIP, LODI (IN)	17.04	0.84	1.76	1.68	3.54	3.81	2.74	1.32	0.95	0.15	0.03	0.03	0.19
AVG EVAPORATION, LODI (IN)	51.89	3.31	1.60	0.92	0.93	1.73	3.46	5.34	6.81	7.69	7.93	6.95	5.22
DESIGN EVAPORATION (ETo) (IN)	48.43	2.65	1.28	0.74	0.74	1.38	2.77	4.27	6.81	7.69	7.93	6.95	5.22
ZONE 12 WET YEAR GRASS REFERENCE EVAPOTRANSPIRATION (ETr) (IN)	43.29	3.48	1.05	1.02	0.39	0.81	2.76	4.12	4.08	6.31	7.49	7.00	4.78
ALFALFA ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	42.42	2.07	1.16	1.20	0.45	0.95	3.23	4.88	4.86	6.41	6.73	6.24	4.24
GRAPE (NO COVER) ZONE 12 WET YEAR EVAPOTRANSPIRATION (ETc) (IN)	31.25	0.62	0.97	1.01	0.42	0.91	2.24	2.63	3.62	5.27	5.96	4.92	2.68
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ALFALFA CROP COEFFICIENT (Kc = ETc/ETr)		0.59	1.10	1.18	1.15	1.17	1.17	1.18	1.19	1.02	0.90	0.89	0.89
GRAPE (NO COVER) CROP COEFFICIENT (Kc = ETc/ETr)		0.18	0.92	0.99	1.08	1.12	0.81	0.64	0.89	0.84	0.80	0.70	0.56
AVERAGE DRY WEATHER FLOW (MGD)		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
MONTHLY VOLUME OF I/I AS A PERCENT OF ADWF (2018 - 2020)		0.6%	3.3%	4.8%	1.6%	6.5%	5.8%	1.0%	0.0%	0.0%	0.0%	1.1%	0.0%
TOTAL I/I VOLUME (MGD)		0.003	0.017	0.024	0.008	0.033	0.029	0.005	0.000	0.000	0.000	0.006	0.000

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		4.9%	10.3%	9.9%	20.8%	22.4%	16.1%	7.7%	5.6%	0.9%	0.2%	0.2%	1.1%
ESTIMATED LODI/LOCKEFORD RAIN, 1-in-100 YEAR (IN)	33	1.62	3.39	3.23	6.81	7.33	5.27	2.54	1.83	0.29	0.06	0.06	0.37
EFFECTIVE RAIN FOR PLANTS (IN)	31	1.54	3.22	3.07	6.47	6.97	5.01	2.41	1.74	0.27	0.05	0.05	0.35
EVAPORATION-RELATED CALCULATIONS													
ALFALFA EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Kc)	49	1.58	1.41	0.87	0.86	1.62	3.24	5.06	8.11	7.81	7.13	6.20	4.63
GRAPE (NO COVER) EVAPOTRANSPIRATION POTENTIAL (IN) (ETc)(ETo*Kc)		0.47	1.18	0.73	0.80	1.55	2.25	2.73	6.04	6.42	6.31	4.88	2.93
STORAGE RESERVOIR EVAPORATION (IN) (ETo * Water Surface Coefficient)	48	2.65	1.28	0.74	0.74	1.38	2.77	4.27	6.81	7.69	7.93	6.95	5.22
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	183	15.5	15.0	15.5	15.5	14.0	15.5	15.0	15.5	15.0	15.5	15.5	15.0
I/I FLOW VOLUME (MG)	4	0.09	0.50	0.74	0.25	0.91	0.90	0.15	0.00	0.00	0.00	0.17	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.50	0.52	0.52	0.51	0.53	0.53	0.51	0.50	0.50	0.50	0.51	0.50
TOTAL INFLUENT FLOW VOLUME (MG)	187	15.6	15.5	16.3	15.8	15.0	16.4	15.2	15.5	15.0	15.5	15.7	15.0
TREATMENT POND CALCULATIONS													
PERCOLATION (IN)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERC. VOLUME (MG)		0.00	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL EVAP. VOLUME (MG)	8	0.43	0.21	0.12	0.12	0.22	0.45	0.69	1.11	1.25	1.29	1.13	0.85
PRECIP. VOLUME (MG)	5	0.26	0.55	0.53	1.11	1.19	0.86	0.41	0.30	0.05	0.01	0.01	0.06
TREATMENT POND RESIDUAL EFFLUENT VOLUME (MG/MONTH)	184	15.43	15.84	16.71	16.79	15.97	16.81	14.92	14.69	13.80	14.22	14.58	14.21
FUTURE GRAPE PRODUCTION AREA CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	1.06	3.10	3.20	3.20	3.20	3.20	2.89	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		162	162	162	162	162	162	162	162	162	162	162	162
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.62	9.35	9.46	8.03	5.78
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	164	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.36	41.22	41.69	35.40	25.48
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		15.43	29.82	47.28	65.08	84.56	104.86	120.80	133.56	122.77	89.88	56.53	29.77
AVAILABLE EFFLUENT APPLIED (MG)	164	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.36	41.22	41.69	35.40	25.48
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.66	1.37	1.34	1.14	0.85
EFFLUENT IRRIGATION RATE (IN/MONTH)	37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.62	9.35	9.46	8.03	5.78
RECLAMATION AREA 1 CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	1.80	3.20	3.20	3.20	3.20	0.55	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		0	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	50	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.34	7.48
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		15.4	29.8	47.3	65.1	84.6	104.9	120.8	113.2	81.6	48.2	21.1	4.3
AVAILABLE EFFLUENT APPLIED (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EFFLUENT IRRIGATION RATE (IN/MONTH)	50	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.34	7.48
RECLAMATION AREA 2 CALCULATIONS													
BEGINNING WATER IN SOIL (IN)		0.00	0.00	1.80	3.20	3.20	3.20	3.20	0.55	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		0	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)	50	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.34	7.48
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAX EFFLUENT APPLICATION VOLUME AVAILABLE (MG)		15.43	29.82	47.28	65.08	84.56	104.86	120.80	133.56	122.77	89.88	56.53	29.77
AVAILABLE EFFLUENT APPLIED (MG)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EFFLUENT IRRIGATION RATE (IN/MONTH)	50	3.24	0.00	0.00	0.00	0.00	0.00	0.00	9.02	10.74	10.27	9.34	7.48
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	13.97	30.58	48.29	68.59	88.06	105.88	118.87	108.98	75.66	41.95	15.56
POTENTIAL RESIDUAL STORAGE VOLUME GAIN/LOSS (MG)		15.43	15.84	16.71	16.79	15.97	16.81	14.92	-5.67	-27.42	-27.47	-20.82	-11.27
UNADJUSTED STORAGE VOLUME (MG)		15.43	29.82	47.28	65.08	84.56	104.86	120.80	113.20	81.56	48.20	21.12	4.29
STORAGE PRECIP VOLUME (MG)	23	1.13	2.37	2.26	4.77	5.13	3.69	1.78	1.28	0.20	0.04	0.04	0.26
STORAGE EVAP VOLUME (MG)	34	1.85	0.90	0.52	0.52	0.97	1.94	2.99	4.77	5.38	5.55	4.87	3.65
STORAGE PERCOLATION (IN)	12	1.05	1.02	1.05	1.05	0.95	1.05	1.02	1.05	1.02	1.05	1.05	1.02
STORAGE PERCOLATION (MG)	9	0.74	0.71	0.74	0.74	0.67	0.74	0.71	0.74	0.71	0.74	0.74	0.71
STORAGE AT END OF MONTH (MG)		13.97	30.58	48.29	68.59	88.06	105.88	118.87	108.98	75.66	41.95	15.56	0.18

MAXIMUM STORAGE REQUIRED (MG) 118.9

TOTAL AVAILABLE STORAGE (MG) 119.0

SUMMARY

ANNUAL INFLOW (MG)	
WASTEWATER	183
INFLOW AND INFILTRATION	4
PRECIPITATION	28
TOTAL	**215**

ANNUAL OUTFLOW POTENTIAL (MG)	
EVAPORATION	42
PERCOLATION	9
IRRIGATION	164
TOTAL	**215**

OVERALL BALANCE	
UNUSED DISPOSAL CAPACITY (MG) (MUST NOT BE NEGATIVE)	0
UNUSED STORAGE CAPACITY (MG) (MUST NOT BE NEGATIVE)	0

Appendix D

DETAILED FACILITIES COST ESTIMATES

Collection System
Preliminary Cost Estimate

Print Date: 11/1/2021

C-01: Locke Road Gravity Sewer						
2465-0010						
Item	Description	Unit	Estimated Quantity	Item Price	Total	
1	Mobilization	LS	1	$30,000	$30,000	
2	Traffic Control	LS	1	$10,993	$11,000	
3	Open Trench Installation of Gravity Sewer - 8"	LF	3,200	$168	$539,000	
4	Pavement Restoration	SF	80	$25	$2,000	
5	Precast Manholes	EA	12	$7,385	$89,000	
6	Pipeline ROW Acquisition	Ac	0.0	$25,259	$0	
				SUBTOTAL	**$671,000**	
				CONSTRUCTION CONTINGENCY 30%	$201,000	
				DESIGN AND ENGINEERING 15%	$101,000	
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$34,000	
				ENGINEERING DURING CONSTRUCTION 5%	$34,000	
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$101,000	**Running Subtotal**
				TOTAL	**$1,142,000**	**$1,142,000**

C-02: Locke Road Pump Station						
2465-0010						
Item	Description	Unit	Estimated Quantity	Item Price	Total	
1	Mobilization	LS	1	$20,000	$20,000	
2	Demolition	LS	1	$10,000	$10,000	
2	Secondary Wet Well	LS	1	$130,000	$130,000	
3	Impeller & Motor Upgrade	EA	2	$30,000	$60,000	
5	Instrumentation & Electrical	LS	1	$100,000	$100,000	
				SUBTOTAL	**$320,000**	
				CONSTRUCTION CONTINGENCY 30%	$96,000	
				DESIGN AND ENGINEERING 25%	$80,000	
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$16,000	
				ENGINEERING DURING CONSTRUCTION 5%	$16,000	
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$48,000	**Running Subtotal**
				TOTAL	**$576,000**	**$1,718,000**

C-03: Locke Road Pump Station Force Main						
2465-0010						
Item	Description	Unit	Estimated Quantity	Item Price	Total	
1	Mobilization	LS	1	$20,000	$20,000	
2	Traffic Control	LS	1	$11,000	$11,000	
3	Open Trench Installation of Force Main - 6"	LF	3,200	$126	$404,000	
4	Road Undercrossing	EA	1	$24,000	$24,000	
5	ARV Assemblies	EA	2	$5,000	$10,000	
6	Valve Boxes	EA	2	$776	$2,000	
7	Force Main Interconnection	LS	1	$5,883	$6,000	
8	Pipeline ROW Acquisition	Ac	1.1	$25,259	$28,000	
				SUBTOTAL	**$505,000**	
				CONSTRUCTION CONTINGENCY 30%	$152,000	
				DESIGN AND ENGINEERING 20%	$101,000	
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$25,000	
				ENGINEERING DURING CONSTRUCTION 5%	$25,000	
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$76,000	**Running Subtotal**
				TOTAL	**$884,000**	**$2,602,000**

Collection System
Preliminary Cost Estimate

C-04: N Tully Road Pump Station					
2465-0010					
Item	Description	Unit	Estimated Quantity	Item Price	Total
1	Mobilization	LS	1	$60,000	$60,000
2	Pump Station - 180 gpm (Expandable to 320 gpm)	LS	1	$230,000	$230,000
2	Traffic Control	LS	1	$21,299	$21,000
3	Open Trench Installation of Force Main - 6"	LF	6,200	$126	$783,000
4	Road/Creek Crossing	EA	2	$23,863	$48,000
5	ARV Assemblies	EA	4	$5,000	$20,000
5	Force Main Interconnection	LS	1	$5,883	$6,000
6	Valve Boxes	EA	2	$776	$2,000
7	Instrumentation & Electrical	LS	1	$103,000	$103,000
				SUBTOTAL	**$1,273,000**
				CONSTRUCTION CONTINGENCY 30%	$382,000
				DESIGN AND ENGINEERING 15%	$191,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$64,000
				ENGINEERING DURING CONSTRUCTION 5%	$64,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$191,000
				TOTAL	**$2,165,000**

Running Subtotal
$4,767,000

C-05: 8" Jack Tone Rd to 10" East Brandt Rd Force Main to WWTP					
2465-0010					
Item	Description	Unit	Estimated Quantity	Item Price	Total
1	Mobilization	LS	1	$100,000	$100,000
2	Traffic Control	LS	1	$31,261	$31,000
3	Open Trench Installation of Force Main - 8"	LF	4,800	$168	$808,000
4	Open Trench Installation of Force Main - 10"	LF	4,300	$226	$970,000
5	Road/Creek Crossing	EA	4	$23,863	$95,000
6	ARV Assemblies	EA	6	$5,000	$30,000
7	Force Main Interconnection	LS	1	$5,883	$6,000
8	Valve Boxes	EA	4	$776	$3,000
				SUBTOTAL	**$2,043,000**
				CONSTRUCTION CONTINGENCY 30%	$613,000
				DESIGN AND ENGINEERING 15%	$306,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$102,000
				ENGINEERING DURING CONSTRUCTION 5%	$102,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$306,000
				TOTAL	**$3,472,000**

Running Subtotal
$8,239,000

C-06: Eliminate Bear Creek Pump Station, Upgrade N Tully Pump Station					
2465-0010					
Item	Description	Unit	Estimated Quantity	Item Price	Total
1	Mobilization	LS	1	$20,000	$20,000
2	Demolition	LS	1	$15,811	$16,000
3	N Tully Pump Station - 140 gpm (Expansion to 320 gpm)	LS	1	$44,808	$45,000
4	Traffic Control	LS	1	$3,779	$4,000
5	Open Trench Installation of Gravity Sewer - 8"	LF	1,100	$189	$208,000
6	Precast Manholes	EA	3	$7,385	$22,000
7	Road/Creek Crossing	EA	1	$23,863	$24,000
8	Gravity Sewer Interconnection	LS	1	$4,707	$5,000
9	Force Main Interconnection	LS	1	$5,883	$6,000
10	Valve Boxes	EA	2	$776	$2,000
				SUBTOTAL	**$352,000**
				CONSTRUCTION CONTINGENCY 30%	$106,000
				DESIGN AND ENGINEERING 30%	$106,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$18,000
				ENGINEERING DURING CONSTRUCTION 5%	$18,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$53,000
				TOTAL	**$653,000**

Running Subtotal
$8,892,000

Collection System
Preliminary Cost Estimate

C-07: New Locke Rd Pump Station (Duplex System)						
2465-0010						
Item	Description	Unit	Estimated Quantity	Item Price	Total	
1	Mobilization	LS	1	$20,000	$20,000	
2	Demolition	LS	1	$10,000	$10,000	
3	Locke Road Pump Station - 750 gpm	LS	1	$460,791	$461,000	
4	Force Main Interconnection	LS	1	$5,883	$6,000	
5	Electrical & Instrumentatiion	LS	1	$187,000	$187,000	
				SUBTOTAL	$684,000	
				CONSTRUCTION CONTINGENCY 30%	$205,000	
				DESIGN AND ENGINEERING 30%	$205,000	
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$34,000	
				ENGINEERING DURING CONSTRUCTION 5%	$34,000	
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$103,000	Running Subtotal
				TOTAL	$1,265,000	$10,157,000

C-08: Locke Road 6" Parallel Gravity Sewer						
2465-0010						
Item	Description	Unit	Estimated Quantity	Item Price	Total	
1	Mobilization	LS	1	$20,000	$20,000	
2	Traffic Control	LS	1	$7,901	$8,000	
3	Open Trench Installation of Gravity Sewer - 6"	LF	2,300	$126	$290,000	
4	Pavement Restoration	SF	3,450	$25	$87,000	
5	Precast Manholes	EA	9	$7,385	$66,000	
6	Pipeline ROW Acquisition	Ac	1.1	$25,259	$27,000	
				SUBTOTAL	$498,000	
				CONSTRUCTION CONTINGENCY 30%	$149,000	
				DESIGN AND ENGINEERING 20%	$100,000	
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$25,000	
				ENGINEERING DURING CONSTRUCTION 5%	$25,000	
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$75,000	Running Subtotal
				TOTAL	$872,000	$11,029,000

C-09: S Hwy 12/88 6" Gravity Sewer						
2465-0010						
Item	Description	Unit	Estimated Quantity	Item Price	Total	
1	Mobilization	LS	1	$10,000	$10,000	
2	Traffic Control	LS	1	$3,435	$3,000	
3	Open Trench Installation of Gravity Sewer - 6"	LF	1,000	$126	$126,000	
4	Road/Creek Crossing	EA	1	$23,863	$24,000	
5	Precast Manholes	EA	4	$7,385	$30,000	
6	Pipeline ROW Acquisition / Encroachment Permitting	Ac	0.5	$25,259	$12,000	
				SUBTOTAL	$205,000	
				CONSTRUCTION CONTINGENCY 30%	$62,000	
				DESIGN AND ENGINEERING 30%	$62,000	
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$10,000	
				ENGINEERING DURING CONSTRUCTION 5%	$10,000	
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$31,000	Running Subtotal
				TOTAL	$380,000	$11,409,000

C-10: E Brandt Rd Pump Station (Duplex System)						
2465-0010						
Item	Description	Unit	Estimated Quantity	Item Price	Total	
1	Mobilization	LS	1	$30,000	$30,000	
2	E Brandt Road Pump Station - 810 gpm	LS	1	$483,683	$484,000	
3	Force Main Interconnection	LS	2	$5,883	$12,000	
4	Electrical & Instrumentatiion	LS	1	$198,000	$198,000	
				SUBTOTAL	$724,000	
				CONSTRUCTION CONTINGENCY 30%	$217,000	
				DESIGN AND ENGINEERING 30%	$217,000	
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$36,000	
				ENGINEERING DURING CONSTRUCTION 5%	$36,000	
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$109,000	Running Subtotal
				TOTAL	$1,339,000	$12,748,000

Collection System
Preliminary Cost Estimate

C-11: East Brandt Road 10" Gravity Sewer 2465-0010					
Item	Description	Unit	Estimated Quantity	Item Price	Total
1	Mobilization	LS	1	$20,000	$20,000
2	Traffic Control	LS	1	$5,840	$6,000
3	Open Trench Installation of Gravity Sewer - 10"	LF	1,700	$210	$358,000
4	Junction Structure - 48-in with Force Main Drop Bowls	LS	1	$23,100	$23,000
5	Force Main Interconnection	LS	1	$5,883	$6,000
6	Valve Boxes	EA	2	$776	$2,000
7	Precast Manholes	EA	6	$7,385	$44,000
8	Pipeline ROW Acquisition	Ac	0.0	$25,259	$0
				SUBTOTAL	**$459,000**
				CONSTRUCTION CONTINGENCY 30%	$138,000
				DESIGN AND ENGINEERING 15%	$69,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$23,000
				ENGINEERING DURING CONSTRUCTION 5%	$23,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$69,000
				TOTAL	**$781,000**

Running Subtotal
$13,529,000

C-12: West Brandt Road 6" Gravity Sewer 2465-0010					
Item	Description	Unit	Estimated Quantity	Item Price	Total
1	Mobilization	LS	1	$40,000	$40,000
2	Traffic Control	LS	1	$16,146	$16,000
3	Open Trench Installation of Gravity Sewer - 6"	LF	4,700	$126	$594,000
5	Pump Station Interconnection	LS	1	$5,883	$6,000
8	Precast Manholes	EA	17	$7,385	$126,000
9	Pipeline ROW Acquisition	Ac	0.0	$25,259	$0
				SUBTOTAL	**$782,000**
				CONSTRUCTION CONTINGENCY 30%	$235,000
				DESIGN AND ENGINEERING 15%	$117,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$39,000
				ENGINEERING DURING CONSTRUCTION 5%	$39,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$117,000
				TOTAL	**$1,329,000**

Running Subtotal
$14,858,000

C-13: West Brandt Road Duplex Pump Station 2465-0010					
Item	Description	Unit	Estimated Quantity	Item Price	Total
1	Mobilization	LS	1	$10,000	$10,000
2	W Brandt Road Pump Station - 140 gpm	LS	1	$160,058	$160,000
3	Force Main Interconnection	LS	1	$5,883	$6,000
4	Electrical & Instrumentatiion	LS	1	$66,000	$66,000
				SUBTOTAL	**$242,000**
				CONSTRUCTION CONTINGENCY 30%	$73,000
				DESIGN AND ENGINEERING 15%	$36,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$12,000
				ENGINEERING DURING CONSTRUCTION 5%	$12,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$36,000
				TOTAL	**$411,000**

Running Subtotal
$15,269,000

C-14: 6" Force Main from West Brandt Rd PS to N Jack Tone Road Junction Structure 2465-0010					
Item	Description	Unit	Estimated Quantity	Item Price	Total
1	Mobilization	LS	1	$40,000	$40,000
2	Traffic Control	LS	1	$17,863	$18,000
3	Open Trench Installation of Force Main - 6"	LF	5,200	$126	$657,000
4	Road/Creek Crossing	EA	2	$23,863	$48,000
5	ARV Assemblies	EA	3	$5,000	$15,000
5	Junction Structure & Force Main Interconnection	LS	1	$5,883	$6,000
6	Valve Boxes	EA	4	$776	$3,000
9	Pipeline ROW Acquisition / Encroachment Permitting	Ac	1.3	$25,259	$33,000
				SUBTOTAL	**$787,000**
				CONSTRUCTION CONTINGENCY 30%	$236,000
				DESIGN AND ENGINEERING 15%	$118,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$39,000
				ENGINEERING DURING CONSTRUCTION 5%	$39,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$118,000
				TOTAL	**$1,337,000**

Total Project Cost
$16,606,000

NOTES:

1. Costs are based on an ENR CCI of 12237.05 as of July 2021

SUMMARY OF TREATMENT DISPOSAL ALTERNATIVES

Alternative 1

Description:

This alternative includes the following components:

- Utilizing T-1 and converting S-3 to T-2 for aeration.
  - Install 2 new 20 hp aerators in T-1 in addition to the 2 existing 10 hp aerators
  - Install 2 new 7.5 hp aerators in T2
- Continuing to use ponds S1 & S2 for storage by operating at WSE range from 96.0 ft to 105.3 ft (9.3 ft depth).
- Construct a new 34.5 Mgal storage pond at Reclamation Area 2.
- Continued use of the existing 95 of the 116 acres of existing disposal area.
- Installation and activation of the 38 acre Reclamation Area 2 alfalfa production area.

Facility Planning Criteria		
Facility Component	**Units**	**Sizing Criteria**
Secondary Treatment Facilities		
Aeration Pond T1 (1)	Mgal	N/A
	Ac	6.5
	Hp	60 (new 2x20+2x10Ex.)
Aeration Pond S3 → T2 (1)	Mgal	N/A
	Ac	6.5
	Hp	15 (new 2x7.5)
Tertiary Treatment Facilities		
No Tertiary Treatment for this Alternative		
Storage Facilities		
Pond S1 (1)	Mgal	16.5
Pond S2 (1)	Mgal	16.5
Remote Storage Pond (1) (Unchanged)	Mgal	39
New Remote Storage Pond	Mgal	36.1
Total Storage	Mgal	108.1
Disposal Facilities		
Existing Alfalfa Production Area	Ac	95
Reclamation Area 2 Alfalfa Production Area	Ac	38
Total Disposal Area	Ac	133

Alternative 2

Description:

This alternative includes the following components:

- Partitioning T-1 into 2 sequenced aeration basins using internal embankments.
  - Install 2 new 25 hp aerators in first T-1 basin.
  - Relocate existing 10 hp aerators into second T1 basin.
- Continuing to use ponds S-1, S-2 & S-3 for storage by operating at WSE range from 96.0 ft to 105.3 ft (9.3 ft depth).
- Deepening the remote storage pond by 4 feet is recommended to provide increased storage within the footprint of existing facilities.
- Continued use of the existing 95 of the 116 acres of existing alfalfa production area.
- Activation of the 38 acre Reclamation Area 2 property alfalfa production area.

Facility Planning Criteria		
Facility Component	**Units**	**Sizing Criteria**
Secondary Treatment Facilities		
Aeration Pond T1 Basin 1 (1)	Mgal	N/A
	Ac	3.2
	Hp	50 (new 2x25)
Aeration Pond T1 Basin 2 (1)	Mgal	N/A
	Ac	3.2
	Hp	20 (2x10Ex.)
Tertiary Treatment Facilities		
No Tertiary Treatment for this Alternative		
Storage Facilities		
Pond S1 (1)	Mgal	16.5
Pond S2 (1)	Mgal	16.5
Pond S3 (1)	Mgal	19
Remote Storage Pond (1) (Deepened)	Mgal	54
Total Storage	Mgal	106
Disposal Facilities		
Existing Alfalfa Production Area	Ac	95
Reclamation Area 2 Alfalfa Production Area	Ac	38
Total Disposal Area	Ac	133

Alternative 3

Description:

This alternative includes the following components:

- Utilizing T-1 and converting S-3 to T-2 for aeration.
  - Install 2 new 20 hp aerators in T-1 in addition to the 2 existing 10 hp aerators
  - Install 2 new 7.5 hp aerators in T-2
- Continuing to use ponds S-1, S-2 & S-3 for storage by operating at WSE range of 96.0 ft to 105.3 ft (9.3 ft).
- Construction of new tertiary treatment facilities consisting of DAF, Membrane Filtration, Cl_2 / UV and Advanced Oxidation (3)
- Construction of approx. 20 to 25 acres of recharge ponds upon sites with suitable soils (see map).
- Continue to maintain the existing 95 acres of fallow alfalfa production area for as needed disposal (as a backup system during avg. years).

Facility Planning Criteria		
Facility Component	**Units**	**Sizing Criteria**
Secondary Treatment Facilities		
Aeration Pond T1 (1)	Mgal	N/A
	Ac	6.5
	Hp	60 (new 2x20+2x10Ex.)
Aeration Pond S3 → T2 (1)	Mgal	N/A
	Ac	6.5
	Hp	15 (new 2x7.5)
Tertiary Treatment + Advanced Oxidation Facilities		
Dissolved Air Flotation Membrane Filtration Chlorine / UV & AO	Mgal/d	0.40 – 0.52
Storage Facilities		
Pond S1 (1)	Mgal	16.5
Pond S2 (1)	Mgal	16.5
Remote Storage Pond (1) (Unchanged)	Mgal	39
Total Storage	Mgal	72
Disposal Facilities		
Recharge Ponds (2)	Ac	20 – 25
Existing Alfalfa Production Area	Ac	95
Total Disposal Area	Ac	115 – 120

Alternative 4

Description:

This alternative includes the following components:

- Partitioning T1 into 2 sequenced aeration basins using internal embankments.
  - Install 2 new 25 hp aerators in first T1 basin.
  - Relocate existing 10 hp aerators into second T1 basin.
- Construction of new tertiary treatment facilities consisting of DAF, Membrane Filtration, and Cl_2 / UV (4)
- Continuing to use ponds S1, S2 & S3 for storage by operating at WSE range of 96.0 ft to 105.3 ft (9.3 ft).
- Construct a new 28 Mgal storage pond at Reclamation Area 2.
- Coordinate with up to 162 acres of recycled use areas such as local grape vineyards
- Continue to maintain the existing 95 acres of fallow alfalfa production area for disposal as a backup system.

Facility Planning Criteria		
Facility Component	**Units**	**Sizing Criteria**
Secondary Treatment Facilities		
Aeration Pond T1 Basin 1 (1)	Mgal	N/A
	Ac	3.2
	Hp	50 (new 2x25)
Aeration Pond T1 Basin 2 (1)	Mgal	N/A
	Ac	3.2
	Hp	20 (2x10Ex.)
Tertiary Treatment Facilities		
Dissolved Air Flotation Membrane Filtration Chlorine / UV	Mgal/d	1.34
Storage Facilities		
Pond S1 (1)	Mgal	16.5
Pond S2 (1)	Mgal	16.5
Pond S3 (1)	Mgal	19
Remote Storage Pond (1) (Unchanged)	Mgal	39
New Remote Storage Pond	Mgal	28
Total Storage	Mgal	119
Disposal Facilities		
Recycled Use Areas (Grape Vineyards)	Ac	162
Fallow Existing Alfalfa Production Area (5)	Ac	95
Total Disposal Area	Ac	257

(1) Pond area and volumes are consistent with the 1990 LCSD WWTP Operations Manual
(2) Potential recharge sites are presented in the attached map. Soil permeability of the Historic WWTP Site has been measured to better assess site-specific disposal capacity and is preliminarily estimated to be 0.44 in./day.
(3) Groundwater recharge for potable replenishment will require treatment that provides 12-log removal of enteric viruses, and 10-log removal of Giardia and Cryptosporidium. Treatment for TOC removal may also be required.
(4) Title 22 Criteria for tertiary disinfected recycled water production.
(5) Existing alfalfa production area would be retained as a backup disposal system.

PRELIMINARY ALTERNATIVES PLANNING CRITERIA

Alternative 1

Facility Component	Units	Sizing Criteria
Secondary Treatment Facilities		
Influent Screening	Mgal/d	1.80
	Hp	1.5
Washer Compactor	ft^3/hr	50
	Hp	4.5
Aeration Pond T1 (1)	Hp	60 (new 2x20 + 2x10 Ex.)
Aeration Pond S3 → T2 (1)	Hp	15 (new 2x7.5)
Tertiary Treatment Facilities		
No Tertiary Treatment for this Alternative		
Storage Facilities		
NEW Remote Storage Pond (1)	CY	187,673
No Remote Storage Return Piping or PS Required		
Disposal Facilities		
Reclamation Area 2 Pipeline	LF	2,650
	in. Dia	8
Reclamation Area 2 PS	gpm	320
	TDH	210
No Storage Tank Improvements		
N Tully Rd Crossing	LF	100
No Brandt Rd or Bear Creek Crossings		
Pipeline ROW Acquisition	Ac	1.22
No New Monitoring Wells		
NEW Reclamation Area 2 Alfalfa Production Area	Ac	38

Alternative 2

Facility Component	Units	Sizing Criteria
Secondary Treatment Facilities		
Influent Screening	Mgal/d	1.80
	Hp	1.5
Washer Compactor	ft^3/hr	50
	Hp	4.5
Aeration Pond T1, Basin 1 (1)	Hp	60 (new 30+30)
Aeration Pond T1, Basin 2 (1)	Hp	20 (existing 10+10)
Tertiary Treatment Facilities		
No Tertiary Treatment for this Alternative		
Storage Facilities		
Remote Storage Pond (1) (Deepened)	CY	77,980
No Remote Storage Return Piping or PS Required		
Disposal Facilities		
Reclamation Area 2 Pipeline	LF	2,650
	in. Dia	8
Reclamation Area 2 PS	gpm	320
	TDH	210
No Storage Tank Improvements		
N Tully Rd Crossing	LF	100
No Brandt Rd or Bear Creek Crossings		
Pipeline ROW Acquisition	Ac	1.22
No New Monitoring Wells		
NEW Reclamation Area 2 Alfalfa Production Area	Ac	38

Alternative 3 (Ph 1)

Facility Component	Units	Sizing Criteria
Secondary Treatment Facilities		
Influent Screening	Mgal/d	1.80
	Hp	1.5
Washer Compactor	ft^3/hr	50
	Hp	4.5
Aeration Pond T1 (1)	Hp	60 (add'l 20+20)
Aeration Pond S3 → T2 (1)	Hp	10 (new 5+5)
Tertiary Treatment + Advanced Oxidation Facilities		
Secondary Eff. Pump Station	gpm	347
	TDH	30
Rapid Mixer Detention Time	seconds	227
Rapid Mixer Power	Hp	1
Rapid Mixer Tanks	No.	2 (1 duty + 1 standby)
Flocculation Detention Time	Minutes	4
Flocc Tanks	No.	2 (1 duty + 1 standby)
Flocc Mixing Energy	G*t (unitless)	19,700
Dissolved Air Flotation Flow	Mgal/d	0.5
DAF Air Injection System	cfh	122
	psig	90-100
DAF Hydraulic Loading Rate	gpm/ft^2	3.5
DAF Eff Pump Station	gpm	347
	TDH	86
Self-Cleaning Basket Strainer Size	in. Dia	6
Self-Cleaning Basket Strainer Units	No.	2
Self-Cleaning Basket Openings	Mesh/Micron	40/400
Membrane Filtration Racks	No.	2 (1 duty + 1 standby)
Membrane Modules per Rack	No.	22
Membrane Nominal Pore Size	µm	0.2
UV Dose	mJ/cm^2	100
UV Channels	No.	1
UV Banks per Channel	No.	3 (2 duty + 1 standby)
AO (H_2O_2) Pumps	gph, ea	1.04
	No.	2 (1 duty + 1 standby)
AO (H_2O_2) Storage	Gal	775
	No.	2 (1 duty + 1 standby)
Coagulant Pumps	gph, ea	1.99
	No.	2 (1 duty + 1 standby)
Coagulant Storage	Gal	1,480
	No.	2 (1 duty + 1 standby)
Storage Facilities		
No Storage Capacity Improvements		
Remote Storage Return PS	gpm	430
	TDH	25
Remote Storage Return Piping (2)	LF	2,500
Disposal Facilities		
Recycled Water Recharge Pipeline	LF	6,350
	in. Dia	6
Recycled Water Recharge PS	gpm	347
	TDH	43
No Storage Tank Improvements		
No N Tully Rd Crossing		
Brandt Rd Crossing	LF	100
Bear Creek Crossing	LF	200
Pipeline ROW Acquisition	Ac	2.92
Monitoring Wells	No.	4
NEW Historic WWTP & RA 2 Recharge Ponds	Ac	24

Alternative 4

Facility Component	Units	Sizing Criteria
Secondary Treatment Facilities		
Influent Screening	Mgal/d	1.80
	Hp	1.5
Washer Compactor	ft^3/hr	50
	Hp	4.5
Aeration Pond T1, Basin 1 (1)	Hp	60 (new 30+30)
Aeration Pond T1, Basin 2 (1)	Hp	20 (existing 10+10)
Tertiary Treatment Facilities		
Secondary Eff. Pump Station	gpm	1,163
	TDH	30
Rapid Mixer Detention Time	seconds	131
Rapid Mixer Power	Hp	2
Rapid Mixer Tanks	No.	2 (1 duty + 1 standby)
Flocculation Detention Time	Minutes	2
Flocc Tanks	No.	2 (1 duty + 1 standby)
Flocc Mixing Energy	G*t (unitless)	11,600
Dissolved Air Flotation Flow	Mgal/d	1.34
DAF Air Injection System	cfh	326
	psig	90-100
DAF Hydraulic Loading Rate	gpm/ft^2	3.1
DAF Eff Pump Station	gpm	1163
	TDH	86
Self-Cleaning Basket Strainer Size	in. Dia	8
Self-Cleaning Basket Strainer Units	No.	2
Self-Cleaning Basket Openings	Mesh/Micron	40/400
Membrane Filtration Racks	No.	2 (1 duty + 1 standby)
Membrane Modules per Rack	No.	65
Membrane Nominal Pore Size	µm	0.2
UV Dose	mJ/cm^2	100
UV Channels	No.	2
UV Banks per Channel	No.	3 (2 duty + 1 standby)
No AO Treatment Required		
Coagulant Pumps	gph, ea	2.67
	No.	3 (2 duty + 1 standby)
Coagulant Storage	Gal	1,983
	No.	3 (2 duty + 1 standby)
Storage Facilities		
RA 2 Remote Storage Pond (1)	CY	145,563
Remote Storage Return PS	gpm	1450
	TDH	25
Remote Storage Return Piping (2)	LF	2,500
Disposal Facilities		
Recycled User Distribution Pipeline	LF	5,000
	in. Dia	8
Recycled Water PS	gpm	1163
	TDH	174
Recycled Water Storage Tank	Gal	350,000
N Tully Rd Crossing	LF	100
Brandt Rd Crossing	LF	100
Bear Creek Crossing	LF	200
Pipeline ROW Acquisition	Ac	2.30
Monitoring Wells	No.	4
NEW Recycled Use Areas (Grape Vineyards)	Ac	120

(1) Pond area and volumes are consistent with the 1990 LCSD WWTP Operations Manual

(2) Return piping from remote storage is assumed to lie within the existing LCSD Right of Way.

ALTERNATIVE 1
Preliminary Cost Estimate

Print Date: 11/1/2021

Proposed LCSD WWTP Upgrades - Secondary Treatment Facilities					
2465-0010					
Opinion of Probable Costs [1]					
Item	**Description**	**Unit**	**Estimated Quantity**	**Item Price**	**Total**
1	Mobilization	LS	1	$50,000	$50,000
2	Demolition	LS	1	$20,000	$20,000
3	Influent Screen Trenching and Excavation	LS	1	$2,292	$2,000
4	Influent Screen and Washing Compactor	LS	1	$380,199	$380,000
5	Influent Screen Channel Structure	LS	1	$60,000	$60,000
6	Pond T1 Aerators - 20 Hp	EA	2	$85,514	$171,000
7	Pond T2 Aerators - 7.5 Hp	EA	2	$38,813	$78,000
8	Influent Flow Meter Relocation	LS	1	$42,000	$42,000
9	Influent Pond Outfall and Piping Replacement (from 8" to 12")	LS	1	$57,000	$57,000
10	Gate Valves - 10"	EA	4	$4,825	$19,000
11	Electrical	LS	1	$201,300	$201,000
				SUBTOTAL	**$1,080,000**
				CONSTRUCTION CONTINGENCY 30%	$324,000
				DESIGN AND ENGINEERING 15%	$162,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$54,000
				ENGINEERING DURING CONSTRUCTION 5%	$54,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$162,000
				TOTAL	**$1,836,000**

No Tertiary Treatment Facilities for this Alternative					
Opinion of Probable Costs [1]					
Item	**Description**	**Unit**	**Estimated Quantity**	**Item Price**	**Total**
				SUBTOTAL	$0
				CONSTRUCTION CONTINGENCY 30%	$0
				DESIGN AND ENGINEERING 15%	$0
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$0
				ENGINEERING DURING CONSTRUCTION 5%	$0
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$0
				TOTAL	**$0**

ALTERNATIVE 1
Preliminary Cost Estimate

Proposed LCSD WWTP Upgrades - Storage Facilities					
Opinion of Probable Costs [1]					
Item	**Description**	**Unit**	**Estimated Quantity**	**Item Price**	**Total**
1	Mobilization	LS	1	$290,000	$290,000
2	NEW Remote Storage Pond Excavation	CY	187,673	$28	$5,165,000
3	Clay Import Material Compacted Pond Base	CY	17,069	$33	$564,000
4	Remote Pond Outlet Structure	LS	1	$25,833	$26,000
5	Instrumentation & Electrical	LS	1	$7,800	$8,000
				SUBTOTAL	$6,053,000
				CONSTRUCTION CONTINGENCY 30%	$1,816,000
				DESIGN AND ENGINEERING 15%	$908,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$303,000
				ENGINEERING DURING CONSTRUCTION 5%	$303,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$908,000
				TOTAL	**$10,291,000**

Proposed LCSD WWTP Upgrades - Disposal Facilities					
Opinion of Probable Costs [1]					
Item	**Description**	**Unit**	**Estimated Quantity**	**Item Price**	**Total**
1	Mobilization	LS	1	$90,000	$90,000
2	Reclamation Area 2 PS - 320 gpm, 210 ft TDH	LS	1	$196,646	$197,000
3	Reclamation Area 2 Pipeline - 8" PVC	LF	2,650	$189	$502,000
4	Road & Creek Crossing	EA	1	$23,863	$24,000
5	Pipeline ROW Acquisition	Ac	1.22	$25,259	$31,000
6	Reclamation Area 2 - Alfalfa Irrigation System	Ac	38.00	$25,212	$958,000
7	Instrumentation & Electrical	LS	1	$59,100	$59,000
				SUBTOTAL	$1,861,000
				CONSTRUCTION CONTINGENCY 30%	$558,000
				DESIGN AND ENGINEERING 15%	$279,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$93,000
				ENGINEERING DURING CONSTRUCTION 5%	$93,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$279,000
				TOTAL	**$3,163,000**

TOTAL ALTERNATIVE 1 PROJECT COST **$15,290,000**

NOTES:

1. Costs are based on an ENR CCI of 12237.05 as of July 2021

ALTERNATIVE 2
Preliminary Cost Estimate

Proposed LCSD WWTP Upgrades - Secondary Treatment Facilities					
2465-0010					
Opinion of Probable Costs [1]					
Item	**Description**	**Unit**	**Estimated Quantity**	**Item Price**	**Total**
1	Mobilization	LS	1	$120,000	$120,000
2	Demolition	LS	1	$60,000	$60,000
3	Influent Screen Trenching and Excavation	LS	1	$2,292	$2,000
4	Influent Screen and Washing Compactor	LS	1	$380,199	$380,000
5	Influent Screen Channel Structure	LS	1	$60,000	$60,000
6	Partition Pond T1 into Two Basins	LS	1	$1,321,000	$1,321,000
7	Pond T1, Basin 1 Aerators - 25 Hp	EA	2	$89,077	$178,000
8	Pond T1 Inlet/Outlet Modifications	LS	1	$41,311	$41,000
9	Influent Flow Meter Relocation	LS	1	$42,000	$42,000
10	Influent Pond Outfall and Piping Replacement (from 8" to 12")	LS	1	$57,000	$57,000
11	Gate Valves - 10"	EA	4	$4,825	$19,000
12	Electrical	LS	1	$218,700	$219,000
				SUBTOTAL	**$2,499,000**
				CONSTRUCTION CONTINGENCY 30%	$750,000
				DESIGN AND ENGINEERING 15%	$375,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$125,000
				ENGINEERING DURING CONSTRUCTION 5%	$125,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$375,000
				TOTAL	**$4,249,000**

No Tertiary Treatment Facilities for this Alternative					
Opinion of Probable Costs [1]					
Item	**Description**	**Unit**	**Estimated Quantity**	**Item Price**	**Total**
				SUBTOTAL	$0
				CONSTRUCTION CONTINGENCY 30%	$0
				DESIGN AND ENGINEERING 15%	$0
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$0
				ENGINEERING DURING CONSTRUCTION 5%	$0
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$0
				TOTAL	**$0**

ALTERNATIVE 2
Preliminary Cost Estimate

Proposed LCSD WWTP Upgrades - Storage Facilities					
Opinion of Probable Costs [1]					
Item	**Description**	**Unit**	**Estimated Quantity**	**Item Price**	**Total**
1	Mobilization	LS	1	$150,000	$150,000
2	Remote Storage Pond Deepening 4 ft.	CY	77,980	$31	$2,414,000
3	Clay Import Material Compacted Pond Base	CY	17,069	$33	$564,000
4	Remote Pond Outlet Modification	LS	1	$25,833	$26,000
5	Instrumentation & Electrical	LS	1	$7,800	$8,000
				SUBTOTAL	$3,162,000
				CONSTRUCTION CONTINGENCY 30%	$949,000
				DESIGN AND ENGINEERING 15%	$474,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$158,000
				ENGINEERING DURING CONSTRUCTION 5%	$158,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$474,000
				TOTAL	**$5,375,000**

Proposed LCSD WWTP Upgrades - Disposal Facilities					
Opinion of Probable Costs [1]					
Item	**Description**	**Unit**	**Estimated Quantity**	**Item Price**	**Total**
1	Mobilization	LS	1	$90,000	$90,000
2	Reclamation Area 2 PS - 320 gpm, 210 ft TDH	LS	1	$196,646	$197,000
3	Reclamation Area 2 Pipeline - 8" PVC	LF	2,650	$189	$502,000
4	Road & Creek Crossing	EA	1	$23,863	$24,000
5	Pipeline ROW Acquisition	Ac	1.22	$25,259	$31,000
6	Reclamation Area 2 - Alfalfa Irrigation System	Ac	38.00	$25,212	$958,000
7	Instrumentation & Electrical	LS	1	$59,100	$59,000
				SUBTOTAL	$1,861,000
				CONSTRUCTION CONTINGENCY 30%	$558,000
				DESIGN AND ENGINEERING 15%	$279,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$93,000
				ENGINEERING DURING CONSTRUCTION 5%	$93,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$279,000
				TOTAL	**$3,163,000**

TOTAL ALTERNATIVE 2 PROJECT COST **$12,787,000**

NOTES:

1. Costs are based on an ENR CCI of 12237.05 as of July 2021

ALTERNATIVE 3
(No Phasing)
Preliminary Cost Estimate

Proposed LCSD WWTP Upgrades - Secondary Treatment Facilities					
2465-0010					
Opinion of Probable Costs [1]					
Item	Description	Unit	Estimated Quantity	Item Price	Total
1	Mobilization	LS	1	$50,000	$50,000
2	Demolition	LS	1	$20,000	$20,000
3	Influent Screen Trenching and Excavation	LS	1	$2,292	$2,000
4	Influent Screen and Washing Compactor	LS	1	$380,199	$380,000
5	Influent Screen Channel Structure	LS	1	$60,000	$60,000
6	Pond T1 Aerators - 20 Hp	EA	2	$85,514	$171,000
7	Pond T2 Aerators - 7.5 Hp	EA	2	$38,813	$78,000
8	Influent Flow Meter Relocation	LS	1	$42,000	$42,000
9	Influent Pond Outfall and Piping Replacement (from 8" to 12")	LS	1	$57,000	$57,000
10	Gate Valves - 10"	EA	4	$4,825	$19,000
11	Electrical	LS	1	$201,300	$201,000
				SUBTOTAL	**$1,080,000**
				CONSTRUCTION CONTINGENCY 30%	$324,000
				DESIGN AND ENGINEERING 15%	$162,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$54,000
				ENGINEERING DURING CONSTRUCTION 5%	$54,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$162,000
				TOTAL	**$1,836,000**

Proposed LCSD WWTP Upgrades - Tertiary Treatment + Advanced Oxidation Facilities					
Opinion of Probable Costs [1]					
Item	Description	Unit	Estimated Quantity	Item Price	Total
1	Mobilization	LS	1	$150,000	$150,000
2	Demolition & Clearing	LS	1	$14,000	$14,000
3	Secondary Effluent Pump Station - 370 gpm	LS	1	$103,000	$103,000
4	Yard & Misc. Piping	LS	1	$168,000	$168,000
5	Rapid Mixer Station	EA	2	$15,432	$31,000
6	Rapid Mixer Basin Foundation Slab	CY	29	$729	$21,000
7	Flocculation Tanks	EA	2	$51,899	$104,000
8	Flocculation Tank Foundation Slab	CY	27	$729	$19,000
9	Dissolved Air Flotation Unit	LS	1	$326,330	$326,000
10	DAF Foundation Slab	CY	44	$729	$32,000
11	DAF Effluent Pump Station Transfer Pumps (in-building)	EA	3	$9,908	$30,000
12	Self-Cleaning Basket Strainers	EA	2	$20,794	$42,000
13	Filtration, Disinfection & Chemical Facility Building	SF	500	$398	$199,000
14	Membrane Filter Rack - 185 gpm Ultrafiltration	EA	2	$364,682	$729,000
15	Reverse Filtration Pumps - 130 gpm	EA	3	$13,942	$42,000
16	Air Compressors - 125 PSIG	EA	2	$8,056	$16,000
17	CIP System for Membrane Filters	LS	1	$36,085	$36,000
18	CIP Waste Tanks - 1,600 Gal	EA	2	$4,518	$9,000
19	CIP Waste Tank Foundation Slab	CY	13	$729	$9,000
20	UV Disinfection In-Line System	LS	1	$194,989	$195,000
21	Advanced Oxidation - H_2O_2 Pumps - 1.0 GPH	EA	2	$2,539	$5,000
22	Advanced Oxidation - H_2O_2 Storage Tanks - 710 Gal	EA	2	$2,844	$6,000
23	Coagulant Pumps - 10.0 gph	EA	2	$33,840	$68,000
24	Coagulant Storage Tanks - 3,650 Gal	EA	2	$34,167	$68,000
25	Gate Valves - 8"	EA	12	$4,825	$58,000
26	Instrumentation & Electrical	LS	1	$610,200	$610,000
				SUBTOTAL	$3,090,000
				CONSTRUCTION CONTINGENCY 30%	$927,000
				DESIGN AND ENGINEERING 15%	$464,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$155,000
				ENGINEERING DURING CONSTRUCTION 5%	$155,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$464,000
				TOTAL	**$5,255,000**

ALTERNATIVE 3
(No Phasing)
Preliminary Cost Estimate

Proposed LCSD WWTP Upgrades - Storage Facilities					
Opinion of Probable Costs [1]					
Item	Description	Unit	Estimated Quantity	Item Price	Total
1	Mobilization	LS	1	$30,000	$30,000
2	Remote Storage Return PS - 369 gpm, 25 TDH w/ Wet well	LS	1	$202,829	$203,000
3	Remote Storage Return Piping	LF	2,500	$168	$421,000
4	Instrumentation & Electrical	LS	1	$60,900	$61,000
				SUBTOTAL	$715,000
				CONSTRUCTION CONTINGENCY 30%	$215,000
				DESIGN AND ENGINEERING 15%	$107,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$36,000
				ENGINEERING DURING CONSTRUCTION 5%	$36,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$107,000
				TOTAL	**$1,216,000**

Proposed LCSD WWTP Upgrades - Disposal Facilities					
Opinion of Probable Costs [1]					
Item	Description	Unit	Estimated Quantity	Item Price	Total
1	Mobilization	LS	1	$330,000	$330,000
2	Recycled Water Recharge PS	LS	1	$207,025	$207,000
3	Recycled Water Recharge Pipeline	LF	6,350	$168	$1,069,000
4	Road & Creek Crossing	EA	4	$23,863	$95,000
5	Pipeline ROW Acquisition	Ac	2.92	$25,259	$74,000
6	Historic WWTP Site Recharge Ponds	Ac	12.00	$208,584	$2,503,000
7	Reclamation Area 2 Recharge Ponds	Ac	12.00	$205,706	$2,468,000
8	Monitoring Wells - 4"x150 ft., 0.020 Slot	EA	4.00	$12,593.35	$50,000
9	Instrumentation & Electrical	LS	1	$62,100	$62,000
				SUBTOTAL	$6,858,000
				CONSTRUCTION CONTINGENCY 30%	$2,057,000
				DESIGN AND ENGINEERING 15%	$1,029,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$343,000
				ENGINEERING DURING CONSTRUCTION 5%	$343,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$1,029,000
				TOTAL	**$11,659,000**

TOTAL ALTERNATIVE 3 PROJECT COST **$19,966,000**

NOTES:

1. Costs are based on an ENR CCI of 12237.05 as of July 2021

ALTERNATIVE 3
(Phase 3A)
Preliminary Cost Estimate

Proposed LCSD WWTP Upgrades - Secondary Treatment Facilities

2465-0010

Opinion of Probable Costs [1]

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	Mobilization	LS	1	$50,000	$50,000
2	Demolition	LS	1	$20,000	$20,000
3	Influent Screen Trenching and Excavation	LS	1	$2,292	$2,000
4	Influent Screen and Washing Compactor	LS	1	$380,199	$380,000
5	Influent Screen Channel Structure	LS	1	$60,000	$60,000
6	Pond T1 Aerators - 20 Hp	EA	2	$85,514	$171,000
7	Pond T2 Aerators - 7.5 Hp	EA	2	$39,215	$78,000
8	Influent Flow Meter Relocation	LS	1	$42,000	$42,000
9	Influent Pond Outfall and Piping Replacement (from 8" to 12")	LS	1	$57,000	$57,000
10	Gate Valves - 10"	EA	4	$4,825	$19,000
11	Electrical	LS	1	$201,300	$201,000
				SUBTOTAL	**$1,080,000**
				CONSTRUCTION CONTINGENCY 30%	$324,000
				DESIGN AND ENGINEERING 15%	$162,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$54,000
				ENGINEERING DURING CONSTRUCTION 5%	$54,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$162,000
				TOTAL	**$1,836,000**

Phase 1 RA 2 Recharge Pond WWTP Upgrades - Tertiary Treatment + Advanced Oxidation Facilities

Opinion of Probable Costs [1]

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	Mobilization	LS	1	$90,000	$90,000
2	Demolition & Clearing	LS	1	$14,000	$14,000
3	Secondary Effluent Pump Station - 185 gpm	LS	1	$103,000	$103,000
4	Yard & Misc. Piping	LS	1	$168,000	$168,000
5	Rapid Mixer Station	EA	1	$15,432	$15,000
6	Rapid Mixer Basin Foundation Slab	CY	15	$729	$11,000
7	Flocculation Tanks	EA	1	$22,122	$22,000
8	Flocculation Tank Foundation Slab	CY	13	$729	$10,000
9	Dissolved Air Flotation Unit	LS	1	$207,206	$207,000
10	DAF Foundation Slab	CY	22	$729	$16,000
11	DAF Effluent Pump Station Transfer Pumps (in-building)	EA	2	$9,908	$20,000
12	Self-Cleaning Basket Strainers	EA	1	$20,794	$21,000
13	Filtration, Disinfection & Chemical Facility Building	SF	500	$398	$199,000
14	Membrane Filter Rack - 185 gpm Ultrafiltration	EA	1	$364,682	$365,000
15	Reverse Filtration Pumps - 130 gpm	EA	2	$13,942	$28,000
16	Air Compressors - 125 PSIG	EA	1	$8,056	$8,000
17	CIP System for Membrane Filters	LS	1	$36,085	$36,000
18	CIP Waste Tanks - 1,600 Gal	EA	1	$4,518	$5,000
19	CIP Waste Tank Foundation Slab	CY	6	$729	$5,000
20	UV Disinfection In-Line System	LS	1	$117,832	$118,000
21	Advanced Oxidation - H_2O_2 Pumps - 1.0 GPH	EA	1	$2,539	$3,000
22	Advanced Oxidation - H_2O_2 Storage Tanks - 710 Gal	EA	1	$2,844	$3,000
23	Coagulant Pumps - 10.0 gph	EA	1	$33,840	$34,000
24	Coagulant Storage Tanks - 3,650 Gal	EA	1	$34,167	$34,000
25	Gate Valves - 8"	EA	6	$4,825	$29,000
26	Instrumentation & Electrical	LS	1	$376,500	$377,000
				SUBTOTAL	$1,941,000
				CONSTRUCTION CONTINGENCY 30%	$582,000
				DESIGN AND ENGINEERING 15%	$291,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$97,000
				ENGINEERING DURING CONSTRUCTION 5%	$97,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$291,000
				TOTAL	**$3,299,000**

ALTERNATIVE 3
(Phase 3A)
Preliminary Cost Estimate

Phase 2 Hist WWTP Recharge Pond WWTP Upgrades - Tertiary Treatment + Advanced Oxidation Facilities					
Opinion of Probable Costs [1]					
Item	**Description**	**Unit**	**Estimated Quantity**	**Item Price**	**Total**
1	Mobilization	LS	1	$60,000	$60,000
2	Demolition & Clearing	LS	1	$0	$0
3	Secondary Effluent Pump Station - 370 gpm	LS	1	$46,000	$46,000
4	Yard & Misc. Piping	LS	1	$0	$0
5	Rapid Mixer Station	EA	1	$15,432	$15,000
6	Rapid Mixer Basin Foundation Slab	CY	15	$729	$11,000
7	Flocculation Tanks	EA	1	$51,899	$52,000
8	Flocculation Tank Foundation Slab	CY	13	$729	$10,000
9	Dissolved Air Flotation Unit	LS	1	$173,607	$174,000
10	DAF Foundation Slab	CY	22	$729	$16,000
11	DAF Effluent Pump Station Transfer Pumps (in-building)	EA	1	$9,908	$10,000
12	Self-Cleaning Basket Strainers	EA	1	$20,794	$21,000
13	Filtration, Disinfection & Chemical Facility Building	SF	0	$398	$0
14	Membrane Filter Rack - 185 gpm Ultrafiltration	EA	1	$364,682	$365,000
15	Reverse Filtration Pumps - 130 gpm	EA	1	$13,942	$14,000
16	Air Compressors - 125 PSIG	EA	1	$8,056	$8,000
17	CIP System for Membrane Filters	LS	1	$36,085	$36,000
18	CIP Waste Tanks - 1,600 Gal	EA	1	$4,518	$5,000
19	CIP Waste Tank Foundation Slab	CY	6	$729	$5,000
20	UV Disinfection In-Line System	LS	1	$106,220	$106,000
21	Advanced Oxidation - H_2O_2 Pumps - 1.0 GPH	EA	1	$2,539	$3,000
22	Advanced Oxidation - H_2O_2 Storage Tanks - 710 Gal	EA	1	$2,844	$3,000
23	Coagulant Pumps - 10.0 gph	EA	1	$33,840	$34,000
24	Coagulant Storage Tanks - 3,650 Gal	EA	1	$34,167	$34,000
25	Gate Valves - 8"	EA	6	$4,825	$29,000
26	Instrumentation & Electrical	LS	1	$288,000	$288,000
				SUBTOTAL	$1,345,000
				CONSTRUCTION CONTINGENCY 30%	$404,000
				DESIGN AND ENGINEERING 15%	$202,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$67,000
				ENGINEERING DURING CONSTRUCTION 5%	$67,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$202,000
				TOTAL	**$2,287,000**

Proposed LCSD WWTP Upgrades - Storage Facilities					
Opinion of Probable Costs [1]					
Item	**Description**	**Unit**	**Estimated Quantity**	**Item Price**	**Total**
1	Mobilization	LS	1	$30,000	$30,000
2	Remote Storage Return PS - 369 gpm, 25 TDH w/ Wet well	LS	1	$202,829	$203,000
3	Remote Storage Return Piping	LF	2,500	$168	$421,000
4	Instrumentation & Electrical	LS	1	$60,900	$61,000
				SUBTOTAL	$715,000
				CONSTRUCTION CONTINGENCY 30%	$215,000
				DESIGN AND ENGINEERING 15%	$107,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$36,000
				ENGINEERING DURING CONSTRUCTION 5%	$36,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$107,000
				TOTAL	**$1,216,000**

ALTERNATIVE 3
(Phase 3A)
Preliminary Cost Estimate

Proposed LCSD WWTP Upgrades - Disposal Facilities					
Opinion of Probable Costs [1]					
Item	**Description**	**Unit**	**Estimated Quantity**	**Item Price**	**Total**
1	Mobilization	LS	1	$160,000	$160,000
2	Recycled Water Recharge PS	LS	1	$207,025	$207,000
3	Recycled Water Recharge Pipeline	LF	2,650	$168	$446,000
4	Road & Creek Crossing	EA	1	$23,863	$24,000
5	Pipeline ROW Acquisition	Ac	2.92	$25,259	$74,000
6	Reclamation Area 2 Recharge Ponds	Ac	12.00	$205,706	$2,468,000
7	Instrumentation & Electrical	LS	1	$62,100	$62,000
				SUBTOTAL	$3,441,000
				CONSTRUCTION CONTINGENCY 30%	$1,032,000
				DESIGN AND ENGINEERING 15%	$516,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$172,000
				ENGINEERING DURING CONSTRUCTION 5%	$172,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$516,000
				TOTAL	**$5,849,000**

Proposed LCSD WWTP Upgrades - Disposal Facilities					
Opinion of Probable Costs [1]					
Item	**Description**	**Unit**	**Estimated Quantity**	**Item Price**	**Total**
1	Mobilization	LS	1	$130,000	$130,000
2	Recycled Water Recharge Pipeline	LF	5,350	$168	$901,000
3	Road & Creek Crossing	EA	2	$23,863	$48,000
4	Pipeline ROW Acquisition	Ac	2.46	$25,259	$62,000
5	Historic WWTP Site Recharge Ponds	Ac	12.00	$208,584	$2,503,000
6	Monitoring Wells - 4"x150 ft., 0.020 Slot	EA	4.00	$12,593.35	$50,000
				SUBTOTAL	$3,694,000
				CONSTRUCTION CONTINGENCY 30%	$1,108,000
				DESIGN AND ENGINEERING 15%	$554,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$185,000
				ENGINEERING DURING CONSTRUCTION 5%	$185,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$554,000
				TOTAL	**$6,280,000**

TOTAL PHASE 3A PROJECT COST **$20,767,000**

NOTES:

1. Costs are based on an ENR CCI of 12237.69 as of July 2021

ALTERNATIVE 3
(Phase 3B)
Preliminary Cost Estimate

Proposed LCSD WWTP Upgrades - Secondary Treatment Facilities					
2465-0010					
Opinion of Probable Costs [1]					
Item	Description	Unit	Estimated Quantity	Item Price	Total
1	Mobilization	LS	1	$50,000	$50,000
2	Demolition	LS	1	$20,000	$20,000
3	Influent Screen Trenching and Excavation	LS	1	$2,292	$2,000
4	Influent Screen and Washing Compactor	LS	1	$380,199	$380,000
5	Influent Screen Channel Structure	LS	1	$60,000	$60,000
6	Pond T1 Aerators - 20 Hp	EA	2	$85,514	$171,000
7	Pond T2 Aerators - 7.5 Hp	EA	2	$39,215	$78,000
8	Influent Flow Meter Relocation	LS	1	$42,000	$42,000
9	Influent Pond Outfall and Piping Replacement (from 8" to 12")	LS	1	$57,000	$57,000
10	Gate Valves - 10"	EA	4	$4,825	$19,000
11	Electrical	LS	1	$201,300	$201,000
				SUBTOTAL	**$1,080,000**
				CONSTRUCTION CONTINGENCY 30%	$324,000
				DESIGN AND ENGINEERING 15%	$162,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$54,000
				ENGINEERING DURING CONSTRUCTION 5%	$54,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$162,000
				TOTAL	**$1,836,000**

Reclamation Area 2 Recharge Pond LCSD WWTP Upgrades - Tertiary Treatment + Advanced Oxidation Facilities					
Opinion of Probable Costs [1]					
Item	Description	Unit	Estimated Quantity	Item Price	Total
1	Mobilization	LS	1	$90,000	$90,000
2	Demolition & Clearing	LS	1	$14,000	$14,000
3	Secondary Effluent Pump Station - 185 gpm	LS	1	$103,000	$103,000
4	Yard & Misc. Piping	LS	1	$168,000	$168,000
5	Rapid Mixer Station	EA	1	$15,432	$15,000
6	Rapid Mixer Basin Foundation Slab	CY	15	$729	$11,000
7	Flocculation Tanks	EA	1	$22,122	$22,000
8	Flocculation Tank Foundation Slab	CY	13	$729	$10,000
9	Dissolved Air Flotation Unit	LS	1	$207,206	$207,000
10	DAF Foundation Slab	CY	22	$729	$16,000
11	DAF Effluent Pump Station Transfer Pumps (in-building)	EA	2	$9,908	$20,000
12	Self-Cleaning Basket Strainers	EA	1	$20,794	$21,000
13	Filtration, Disinfection & Chemical Facility Building	SF	500	$398	$199,000
14	Membrane Filter Rack - 185 gpm Ultrafiltration	EA	1	$364,682	$365,000
15	Reverse Filtration Pumps - 130 gpm	EA	2	$13,942	$28,000
16	Air Compressors - 125 PSIG	EA	1	$8,056	$8,000
17	CIP System for Membrane Filters	LS	1	$36,085	$36,000
18	CIP Waste Tanks - 1,600 Gal	EA	1	$4,518	$5,000
19	CIP Waste Tank Foundation Slab	CY	6	$729	$5,000
20	UV Disinfection In-Line System	LS	1	$117,832	$118,000
21	Advanced Oxidation - H_2O_2 Pumps - 1.0 GPH	EA	1	$2,539	$3,000
22	Advanced Oxidation - H_2O_2 Storage Tanks - 710 Gal	EA	1	$2,844	$3,000
23	Coagulant Pumps - 10.0 gph	EA	1	$33,840	$34,000
24	Coagulant Storage Tanks - 3,650 Gal	EA	1	$34,167	$34,000
25	Gate Valves - 8"	EA	6	$4,825	$29,000
26	Instrumentation & Electrical	LS	1	$376,500	$377,000
				SUBTOTAL	$1,941,000
				CONSTRUCTION CONTINGENCY 30%	$582,000
				DESIGN AND ENGINEERING 15%	$291,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$97,000
				ENGINEERING DURING CONSTRUCTION 5%	$97,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$291,000
				TOTAL	**$3,299,000**

ALTERNATIVE 3
(Phase 3B)
Preliminary Cost Estimate

Item	Description	Unit	Estimated Quantity	Item Price	Total
Proposed LCSD WWTP Upgrades - Expanded Offsite Storage Facilities					
Opinion of Probable Costs [1]					
1	Mobilization	LS	1	$200,000	$200,000
2	Remote Storage Return PS - 369 gpm, 25 TDH w/ Wet well	LS	1	$202,829	$203,000
3	Remote Storage Return Piping	LF	2,500	$168	$421,000
4	NEW Remote Storage Pond Excavation	CY	87,406	$31	$2,706,000
5	Clay Import Material Compacted Pond Base	CY	17,069	$33	$564,000
6	Remote Pond Interconnections	LS	1	$30,000	$30,000
7	Instrumentation & Electrical	LS	1	$69,900	$70,000
				SUBTOTAL	$4,194,000
				CONSTRUCTION CONTINGENCY 30%	$1,258,000
				DESIGN AND ENGINEERING 15%	$629,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$210,000
				ENGINEERING DURING CONSTRUCTION 5%	$210,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$629,000
				TOTAL	**$7,130,000**

Item	Description	Unit	Estimated Quantity	Item Price	Total
Proposed LCSD WWTP Upgrades - Disposal Facilities					
Opinion of Probable Costs [1]					
1	Mobilization	LS	1	$160,000	$160,000
2	Recycled Water Recharge PS	LS	1	$207,025	$207,000
3	Recycled Water Recharge Pipeline	LF	2,650	$168	$446,000
4	Road & Creek Crossing	EA	1	$23,863	$24,000
5	Pipeline ROW Acquisition	Ac	2.92	$25,259	$74,000
6	Reclamation Area 2 Recharge Ponds	Ac	12.00	$205,706	$2,468,000
7	Instrumentation & Electrical	LS	1	$62,100	$62,000
				SUBTOTAL	$3,441,000
				CONSTRUCTION CONTINGENCY 30%	$1,032,000
				DESIGN AND ENGINEERING 15%	$516,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$172,000
				ENGINEERING DURING CONSTRUCTION 5%	$172,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$516,000
				TOTAL	**$5,849,000**

TOTAL PHASE 3B PROJECT COST **$18,114,000**

NOTES:

1. Costs are based on an ENR CCI of 12237.69 as of July 2021

ALTERNATIVE 4
Preliminary Cost Estimate

Proposed LCSD WWTP Upgrades - Secondary Treatment Facilities					
2465-0010					
Opinion of Probable Costs [1]					
Item	**Description**	**Unit**	**Estimated Quantity**	**Item Price**	**Total**
1	Mobilization	LS	1	$120,000	$120,000
2	Demolition	LS	1	$60,000	$60,000
3	Influent Screen Trenching and Excavation	LS	1	$2,292	$2,000
4	Influent Screen and Washing Compactor	LS	1	$380,199	$380,000
5	Influent Screen Channel Structure	LS	1	$60,000	$60,000
6	Partition Pond T1 into Two Basins	LS	1	$1,321,000	$1,321,000
7	Pond T1, Basin 1 Aerators - 25 Hp	EA	2	$89,077	$178,000
8	Pond T1 Inlet/Outlet Modifications	LS	1	$41,311	$41,000
9	Influent Flow Meter Relocation	LS	1	$42,000	$42,000
10	Influent Pond Outfall and Piping Replacement (from 8" to 12")	LS	1	$57,000	$57,000
11	Gate Valves - 10"	EA	4	$4,825	$19,000
12	Electrical	LS	1	$218,700	$219,000
				SUBTOTAL	**$2,499,000**
				CONSTRUCTION CONTINGENCY 30%	$750,000
				DESIGN AND ENGINEERING 15%	$375,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$125,000
				ENGINEERING DURING CONSTRUCTION 5%	$125,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$375,000
				TOTAL	**$4,249,000**

Proposed LCSD WWTP Upgrades - Tertiary Treatment Facilities					
Opinion of Probable Costs [1]					
Item	**Description**	**Unit**	**Estimated Quantity**	**Item Price**	**Total**
1	Mobilization	LS	1	$250,000	$250,000
2	Demolition & Clearing	LS	1	$14,000	$14,000
3	Secondary Effluent Pump Station - 1,165 gpm	LS	1	$154,000	$154,000
4	Yard & Misc. Piping	LS	1	$189,000	$189,000
5	Rapid Mixer Station	EA	2	$23,148	$46,000
6	Rapid Mixer Basin Foundation Slab	CY	44	$729	$32,000
7	Flocculation Tanks	EA	2	$173,863	$348,000
8	Flocculation Tank Foundation Slab	CY	33	$729	$24,000
9	Dissolved Air Flotation Unit	LS	1	$430,138	$430,000
10	DAF Foundation Slab	CY	44	$729	$32,000
11	DAF Effluent Pump Station Transfer Pumps (in-building)	EA	3	$9,908	$30,000
12	Self-Cleaning Basket Strainers	EA	3	$27,725	$83,000
13	Filtration, Disinfection & Chemical Facility Building	SF	625	$398	$249,000
14	Membrane Filter Rack - 930 gpm Microfiltration	EA	2	$754,829	$1,510,000
15	Reverse Filtration Pumps - 130 gpm	EA	3	$13,942	$42,000
16	Air Compressors - 125 PSIG	EA	2	$12,083	$24,000
17	CIP System for Membrane Filters	LS	1	$143,777	$144,000
18	CIP Waste Tanks - 7,500 Gal	EA	2	$31,110	$62,000
19	CIP Waste Tank Foundation Slab	CY	13	$729	$9,000
20	UV Disinfection In-Line System	LS	1	$327,124	$327,000
21	Coagulant Pumps - 24 gph, skid-mounted	EA	2	$48,391	$97,000
22	Coagulant Storage Tanks - 13,800 Gal	EA	2	$42,335	$85,000
23	Gate Valves - 8"	EA	12	$0	$0
24	Instrumentation & Electrical	LS	1	$1,064,400	$1,064,000
				SUBTOTAL	$5,245,000
				CONSTRUCTION CONTINGENCY 30%	$1,574,000
				DESIGN AND ENGINEERING 15%	$787,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$262,000
				ENGINEERING DURING CONSTRUCTION 5%	$262,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$787,000
				TOTAL	**$8,917,000**

ALTERNATIVE 4
Preliminary Cost Estimate

Proposed LCSD WWTP Upgrades - Storage Facilities					
		Opinion of Probable Costs [1]			
Item	**Description**	**Unit**	**Estimated Quantity**	**Item Price**	**Total**
1	Mobilization	LS	1	$50,000	$50,000
2	Remote Storage Pond Deepening 10 ft.	CY	145,563	$28	$4,006,000
3	Clay Import Material Compacted Pond Base	CY	17,069	$33	$564,000
4	Remote Pond Outlet Modification	LS	1	$25,833	$26,000
5	Flexible Storage Tank Joint - 8"	EA	1	$9,159	$9,000
6	Recycled Water Storage Tank - 0.35 MG, 45' Dia x 24'H	Gal	350,000	$1.12	$391,000
7	Recycled Water Storage Tank - Ring Foundation	CY	35	$729.46	$25,000
8	Remote Storage Return PS - 1,450 gpm, 25 TDH w/ Wet well	LS	1	$377,447	$377,000
9	Remote Storage Return Piping	LF	2,500	$189	$474,000
10	Instrumentation & Electrical	LS	1	$153,600	$154,000
				SUBTOTAL	$6,076,000
				CONSTRUCTION CONTINGENCY 30%	$1,823,000
				DESIGN AND ENGINEERING 15%	$911,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$304,000
				ENGINEERING DURING CONSTRUCTION 5%	$304,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$911,000
				TOTAL	**$10,329,000**

Proposed LCSD WWTP Upgrades - Disposal Facilities					
		Opinion of Probable Costs [1]			
Item	**Description**	**Unit**	**Estimated Quantity**	**Item Price**	**Total**
1	Mobilization	LS	1	$100,000	$100,000
2	Recycled Water Pump Station - 1,165 gpm, 187 ft. TDH	LS	1	$385,255	$385,000
3	Recycled User Distribution Pipeline - 8" PVC	LF	6,350	$189	$1,203,000
4	Road & Creek Crossing	EA	3	$23,863	$72,000
5	Pipeline ROW Acquisition	Ac	2.92	$25,259	$74,000
6	Monitoring Wells - 4"x150 ft., 0.020 Slot	EA	4.00	$12,593.35	$50,000
7	Instrumentation & Electrical	LS	1	$115,500	$116,000
				SUBTOTAL	$2,000,000
				CONSTRUCTION CONTINGENCY 30%	$600,000
				DESIGN AND ENGINEERING 15%	$300,000
				ENVIRONMENTAL, PERMITTING AND LEGAL 5%	$100,000
				ENGINEERING DURING CONSTRUCTION 5%	$100,000
				CONSTRUCTION MANAGEMENT/SITE INSPECTION 15%	$300,000
				TOTAL	**$3,400,000**

TOTAL ALTERNATIVE 4 PROJECT COST **$26,895,000**

NOTES:

1. Costs are based on an ENR CCI of 12237.05 as of July 2021

Appendix E

OTHER CALCULATIONS AND RELEVANT INFORMATION

LOCKEFORD COMMUNITY SERVICES DISTRICT - WASTEWATER POND EVALUATION 2465-0010

CURRENT WASTEWATER POND PERFORMANCE DURING PEAK MONTH FLOWS @ AVG BOD LOADS (December), BATCH POND SYSTEM 11/1/2021

INPUT DATA, CONSTANT

SITE CONDITIONS	**UNITS**	
POND T-1 TOTAL VOLUMETRIC CAPACITY[1]	MGAL	13.7
POND T-2 TOTAL VOLUMETRIC CAPACITY (EA.)[1]	MGAL	0.0
LAA DISPOSAL AREA[1]	ACRES	95.0
TYPICAL POND TOTAL AERATOR POWER	HP	20.0
BRUSH AERATOR POWER	HP	20.0
ASPIRATOR AERATOR POWER (NOT USED)	HP	0.0

PEAK MONTH CONDITIONS	**UNITS**	
AVERAGE DRY WEATHER FLOW	MGAL/D	0.190
PEAK MONTH ADWF PEAKING FACTOR	--	1.20
PEAK MONTH FLOW	MGAL/D	0.23
AVERAGE BOD_5 CONCENTRATION	MG/L	265
PEAK MONTH BOD_5 PEAKING FACTOR	--	1.00
PEAK MONTH BOD_5 CONCENTRATION	MG/L	265

EFFLUENT LIMITATIONS

MAXIMUM EFFLUENT BOD LIMITATION	MG/L	**40**

AERATOR KINETICS DATA	**UNITS**	
KINETIC COEFFICIENT, K_{20}	N/A	0.2763
ARRHENIUS COEFFICIENT	N/A	1.037
NUMBER OF EQUIVALENT CELLS IN POND T-1	No.	1
NUMBER OF EQUIVALENT CELLS IN PONDS T-2, T-3 & T-4	No.	1
ASPIRATOR AERATOR STANDARD OXYGEN TRANSFER RATE	lb O_2 / HP / HR	1.4
BRUSH AERATOR STANDARD OXYGEN TRANSFER RATE	lb O_2 / HP / HR	3.0
STANDARD AERATOR EFFICIENCY	%	60%
ASPIRATOR AERATOR ACTUAL OXYG TRANSFER RATE	lb O_2 / HP / HR	0.83
BRUSH AERATOR ACTUAL OXYGEN TRANSFER RATE	lb O_2 / HP / HR	1.80
DAILY OPERATION RUN TIME	HRS	24
BOD OXYGEN CONVERSION RATIO	lb O2 / lb BOD	1.4

BOOSTER PUMP & DISTRIBUTION SYSTEM

ADDITIONAL FACILITIES NEEDS CALCULATIONS		
ADDITIONAL T-1 VOLUME REQUIRED TO MEET 30 MG/L EFFLUENT BOD	MGAL	**0.00**

ATMOSPHERIC CONSTANTS & ASSUMPTIONS		
OXYGEN AIR PERCENTAGE	%	21%
AIR TRANSFER EFFICIENCY	%	9%
GAS CONSTANT	FT-lb/(lb air x ºR)	53.3
INLET PRESSURE (P1)	PSI	14.7
OUTLET PRESSURE (P2)	PSI	21
SPECIFIC HEAT FACTOR	N/A	0.283
COMPRESSOR EFFICIENCY	%	70%

(1) SITE CONDITIONS BASED ON LCSD PROVIDED INFORMATION AND HISTORICAL RECORDS.

PEAK MONTH CALCULATIONS

CALCULATION	UNITS	PEAK MONTH
FLOW CALCS		
TOTAL MONTHLY FLOW	MGAL	7.068
AVG DAILY FLOW	MGAL/D	0.228
POND T-1 CALCS		
INFLUENT BOD_5 CONCENTRATION	MG/L	265
HYDRAULIC RESIDENCE TIME	DAYS	60
TOTAL INITIAL BOD ENTERING POND SYSTEM	LB	15,631
AVG AMBIENT TEMPERATURE	DEG C	6.1
POND T-1 EXPECTED FINAL BOD_5 CONCENTRATION	MG/L	24
POND T-1 EXPECTED TOTAL BOD_5 LEAVING POND	LB	1,417
POND T-1 EXPECTED DO DEMANDED	LB	19,899
BRUSH STYLE AERATOR RUN TIME REQUIRED	DAYS	23
BRUSH STYLE AERATOR POWER REQUIRED	HP	15
EQUIVALENT AERATOR POWER AVAILABLE	HP	20

LOCKEFORD COMMUNITY SERVICES DISTRICT - WASTEWATER POND EVALUATION 2465-0010

CURRENT WASTEWATER POND PERFORMANCE DURING AVG FLOWS @ PEAK MONTH LOADS (August), BATCH POND SYSTEM 11/1/2021

INPUT DATA, CONSTANT

SITE CONDITIONS	UNITS	
POND T-1 TOTAL VOLUMETRIC CAPACITY(1)	MGAL	13.7
POND T-2 TOTAL VOLUMETRIC CAPACITY (EA.)(1)	MGAL	0.0
LAA DISPOSAL AREA(1)	ACRES	95.0
TYPICAL POND TOTAL AERATOR POWER	HP	20.0
BRUSH AERATOR POWER	HP	20.0
ASPIRATOR AERATOR POWER (NOT USED)	HP	0.0

PEAK MONTH CONDITIONS	UNITS	
AVERAGE DRY WEATHER FLOW	MGAL/D	0.190
PEAK MONTH ADWF PEAKING FACTOR	--	1.00
PEAK MONTH FLOW	MGAL/D	0.19
AVERAGE BOD_5 CONCENTRATION	MG/L	265
PEAK MONTH BOD_5 PEAKING FACTOR	--	1.60
PEAK MONTH BOD_5 CONCENTRATION	MG/L	424

EFFLUENT LIMITATIONS

MAXIMUM EFFLUENT BOD LIMITATION	MG/L	**40**

AERATOR KINETICS DATA	UNITS	
KINETIC COEFFICIENT, K_{20}	N/A	0.2763
ARRHENIUS COEFFICIENT	N/A	1.037
NUMBER OF EQUIVALENT CELLS IN POND T-1	No.	1
NUMBER OF EQUIVALENT CELLS IN PONDS T-2, T-3 & T-4	No.	1
ASPIRATOR AERATOR STANDARD OXYGEN TRANSFER RATE	lb O_2 / HP / HR	1.4
BRUSH AERATOR STANDARD OXYGEN TRANSFER RATE	lb O_2 / HP / HR	3.0
STANDARD AERATOR EFFICIENCY	%	60%
ASPIRATOR AERATOR ACTUAL OXYG TRANSFER RATE	lb O_2 / HP / HR	0.83
BRUSH AERATOR ACTUAL OXYGEN TRANSFER RATE	lb O_2 / HP / HR	1.80
DAILY OPERATION RUN TIME	HRS	24
BOD OXYGEN CONVERSION RATIO	lb O2 / lb BOD	1.4

ADDITIONAL FACILITIES NEEDS CALCULATIONS		
ADDITIONAL T-1 VOLUME REQUIRED TO MEET 30 MG/L EFFLUENT BOD	MGAL	**0.00**

ATMOSPHERIC CONSTANTS & ASSUMPTIONS		
OXYGEN AIR PERCENTAGE	%	21%
AIR TRANSFER EFFICIENCY	%	9%
GAS CONSTANT	FT-lb/(lb air x ºR)	53.3
INLET PRESSURE (P1)	PSI	14.7
OUTLET PRESSURE (P2)	PSI	21
SPECIFIC HEAT FACTOR	N/A	0.283
COMPRESSOR EFFICIENCY	%	70%

(1) SITE CONDITIONS BASED ON LCSD PROVIDED INFORMATION AND HISTORICAL RECORDS.

PEAK MONTH CALCULATIONS

CALCULATION	UNITS	PEAK MONTH
FLOW CALCS		
TOTAL MONTHLY FLOW	MGAL	5.890
AVG DAILY FLOW	MGAL/D	0.190
POND T-1 CALCS		
INFLUENT BOD_5 CONCENTRATION	MG/L	424
HYDRAULIC RESIDENCE TIME	DAYS	72
TOTAL INITIAL BOD ENTERING POND SYSTEM	LB	20,841
AVG AMBIENT TEMPERATURE	DEG C	21.6
POND T-1 EXPECTED FINAL BOD_5 CONCENTRATION	MG/L	19
POND T-1 EXPECTED TOTAL BOD_5 LEAVING POND	LB	943
POND T-1 EXPECTED DO DEMANDED	LB	27,858
BRUSH STYLE AERATOR RUN TIME REQUIRED	DAYS	32
BRUSH STYLE AERATOR POWER REQUIRED	HP	21
EQUIVALENT AERATOR POWER AVAILABLE	HP	20

LOCKEFORD COMMUNITY SERVICES DISTRICT - WASTEWATER POND EVALUATION 2465-0010

CURRENT WASTEWATER POND PERFORMANCE DURING PEAK MONTH FLOWS & LOADS (Oct - Apr), POND SYSTEM IN-SERIES 11/1/2021

INPUT DATA, CONSTANT

SITE CONDITIONS	UNITS	
POND T-1 BASIN 1 TOTAL VOLUMETRIC CAPACITY[(1)]	MGAL	6.85
POND T-1 BASIN 2 TOTAL VOLUMETRIC CAPACITY (EA.)[(1)]	MGAL	6.85
LAA DISPOSAL AREA[(1)]	ACRES	95.0
TYPICAL POND TOTAL AERATOR POWER	HP	20.0
BRUSH AERATOR POWER	HP	20.0
ASPIRATOR AERATOR POWER (NOT USED)	HP	0.0

PEAK MONTH CONDITIONS	UNITS	
AVERAGE DRY WEATHER FLOW	MGAL/D	0.500
PEAK MONTH ADWF PEAKING FACTOR	--	1.20
PEAK MONTH FLOW	MGAL/D	0.60
AVERAGE BOD_5 CONCENTRATION	MG/L	265
PEAK MONTH BOD_5 PEAKING FACTOR	--	1.60
PEAK MONTH BOD_5 CONCENTRATION	MG/L	424

EFFLUENT LIMITATIONS

MAXIMUM EFFLUENT BOD LIMITATION	MG/L	**40**

ADDITIONAL FACILITIES NEEDS CALCULATIONS

ADDITIONAL VOLUME REQUIRED (Ea. BASIN) TO MEET 30 MG/L EFFLUENT BOD	MGAL	**1.26**

AERATOR KINETICS D	UNITS	
KINETIC COEFFICIENT, K_{20}	N/A	0.2763
ARRHENIUS COEFFICIENT	N/A	1.037
NUMBER OF EQUIVALENT CELLS IN POND T-1	No.	1
NUMBER OF EQUIVALENT CELLS IN PONDS T-2, T-3 & T-4	No.	1
ASPIRATOR AERATOR STANDARD OXYGEN TRANSFER RATE	lb O_2 / HP / HR	1.4
BRUSH AERATOR STANDARD OXYGEN TRANSFER RATE	lb O_2 / HP / HR	3.0
STANDARD AERATOR EFFICIENCY	%	60%
ASPIRATOR AERATOR ACTUAL OXYG TRANSFER RATE	lb O_2 / HP / HR	0.83
BRUSH AERATOR ACTUAL OXYGEN TRANSFER RATE	lb O_2 / HP / HR	1.80
DAILY OPERATION RUN TIME	HRS	24
BOD OXYGEN CONVERSION RATIO	lb O2 / lb BOD	1.4

BOOSTER PUMP & DISTRIBUTION SYSTEM

ATMOSPHERIC CONSTANTS & ASSUMPTIONS		
OXYGEN AIR PERCENTAGE	%	21%
AIR TRANSFER EFFICIENCY	%	9%
GAS CONSTANT	FT-lb/(lb air x ºR)	53.3
INLET PRESSURE (P1)	PSI	14.7
OUTLET PRESSURE (P2)	PSI	21
SPECIFIC HEAT FACTOR	N/A	0.283
COMPRESSOR EFFICIENCY	%	70%

(1) SITE CONDITIONS BASED ON LCSD PROVIDED INFORMATION AND HISTORICAL RECORDS.

PEAK MONTH CALCULATIONS

CALCULATION	UNITS	PEAK MONTH
FLOW CALCS		
TOTAL MONTHLY FLOW	MGAL	18.600
AVG DAILY FLOW	MGAL/D	0.600
POND T-1-1 CALCS		
INFLUENT BOD_5 CONCENTRATION	MG/L	424
HYDRAULIC RESIDENCE TIME	DAYS	13.52
TOTAL INITIAL BOD ENTERING POND SYSTEM	LB	65,815
AVG AMBIENT TEMPERATURE	DEG C	6.1
POND T-1-1 EXPECTED FINAL BOD_5 CONCENTRATION	MG/L	130
POND T-1-1 EXPECTED TOTAL BOD_5 LEAVING POND	LB	20,215
POND T-1-1 EXPECTED DO DEMANDED	LB	63,840
BRUSH STYLE AERATOR RUN TIME REQUIRED	DAYS	74
BRUSH STYLE AERATOR POWER REQUIRED	HP	48
EQUIVALENT AERATOR POWER AVAILABLE	HP	20
POND T-1 BASIN 2 CALCS (IF USED AS IN-SERIES TREATMENT)		
INFLUENT BOD_5 CONCENTRATION	MG/L	130
HYDRAULIC RESIDENCE TIME (EA.)	DAYS	13.5
TOTAL INITIAL BOD ENTERING POND T-1-2	LB	20,215
AVG AMBIENT TEMPERATURE	DEG C	6.1
PONDS T-1-2 EXPECTED FINAL BOD_5 CONCENTRATION OF EFFLUENT	MG/L	40
PONDS T-1-2 EXPECTED TOTAL BOD_5 LEAVING POND (TOTAL)	LB	6,209
PONDS T-1-2 EXPECTED DO DEMANDED (TOTAL)	LB	19,608
AERATOR POWER REQUIRED	HP	15

LOCKEFORD COMMUNITY SERVICES DISTRICT - WASTEWATER POND EVALUATION 2465-0010

CURRENT WASTEWATER POND PERFORMANCE DURING PEAK MONTH FLOWS & LOADS (Oct - Apr), POND SYSTEM IN-SERIES 11/1/2021

INPUT DATA, CONSTANT

SITE CONDITIONS	UNITS	
POND T-1 TOTAL VOLUMETRIC CAPACITY[(1)]	MGAL	13.7
POND T-2 TOTAL VOLUMETRIC CAPACITY (EA.)[(1)]	MGAL	16.5
LAA DISPOSAL AREA[(1)]	ACRES	95.0
TYPICAL POND TOTAL AERATOR POWER	HP	20.0
BRUSH AERATOR POWER	HP	20.0
ASPIRATOR AERATOR POWER (NOT USED)	HP	0.0

PEAK MONTH CONDITIONS	UNITS	
AVERAGE DRY WEATHER FLOW	MGAL/D	0.500
PEAK MONTH ADWF PEAKING FACTOR	--	1.20
PEAK MONTH FLOW	MGAL/D	0.60
AVERAGE BOD_5 CONCENTRATION	MG/L	265
PEAK MONTH BOD_5 PEAKING FACTOR	--	1.60
PEAK MONTH BOD_5 CONCENTRATION	MG/L	424

EFFLUENT LIMITATIONS

MAXIMUM EFFLUENT BOD LIMITATION	MG/L	**30**

AERATOR KINETICS D	UNITS	
KINETIC COEFFICIENT, K_{20}	N/A	0.2763
ARRHENIUS COEFFICIENT	N/A	1.037
NUMBER OF EQUIVALENT CELLS IN POND T-1	No.	1
NUMBER OF EQUIVALENT CELLS IN PONDS T-2, T-3 & T-4	No.	1
ASPIRATOR AERATOR STANDARD OXYGEN TRANSFER RATE	lb O_2 / HP / HR	1.4
BRUSH AERATOR STANDARD OXYGEN TRANSFER RATE	lb O_2 / HP / HR	3.0
STANDARD AERATOR EFFICIENCY	%	60%
ASPIRATOR AERATOR ACTUAL OXYG TRANSFER RATE	lb O_2 / HP / HR	0.83
BRUSH AERATOR ACTUAL OXYGEN TRANSFER RATE	lb O_2 / HP / HR	1.80
DAILY OPERATION RUN TIME	HRS	24
BOD OXYGEN CONVERSION RATIO	lb O2 / lb BOD	1.4

BOOSTER PUMP & DISTRIBUTION SYSTEM

ADDITIONAL FACILITIES NEEDS CALCULATIONS		
ADDITIONAL T-1 VOLUME REQUIRED TO MEET 30 MG/L EFFLUENT BOD	MGAL	**0.00**

ATMOSPHERIC CONSTANTS & ASSUMPTIONS		
OXYGEN AIR PERCENTAGE	%	21%
AIR TRANSFER EFFICIENCY	%	9%
GAS CONSTANT	FT-lb/(lb air x ºR)	53.3
INLET PRESSURE (P1)	PSI	14.7
OUTLET PRESSURE (P2)	PSI	21
SPECIFIC HEAT FACTOR	N/A	0.283
COMPRESSOR EFFICIENCY	%	70%

(1) SITE CONDITIONS BASED ON LCSD PROVIDED INFORMATION AND HISTORICAL RECORDS.

PEAK MONTH CALCULATIONS

CALCULATION	UNITS	PEAK MONTH
FLOW CALCS		
TOTAL MONTHLY FLOW	MGAL	18.600
AVG DAILY FLOW	MGAL/D	0.600
POND T-1 CALCS		
INFLUENT BOD_5 CONCENTRATION	MG/L	424
HYDRAULIC RESIDENCE TIME	DAYS	23
TOTAL INITIAL BOD ENTERING POND SYSTEM	LB	65,815
AVG AMBIENT TEMPERATURE	DEG C	6.1
POND T-1 EXPECTED FINAL BOD_5 CONCENTRATION	MG/L	88
POND T-1 EXPECTED TOTAL BOD_5 LEAVING POND	LB	13,682
POND T-1 EXPECTED DO DEMANDED	LB	72,987
BRUSH STYLE AERATOR RUN TIME REQUIRED	DAYS	84
BRUSH STYLE AERATOR POWER REQUIRED	HP	55
EQUIVALENT AERATOR POWER AVAILABLE	HP	20
POND T-2 CALCS (IF USED AS IN-SERIES TREATMENT)		
INFLUENT BOD_5 CONCENTRATION	MG/L	88
HYDRAULIC RESIDENCE TIME (EA.)	DAYS	27.5
TOTAL INITIAL BOD ENTERING POND T-2	LB	13,682
AVG AMBIENT TEMPERATURE	DEG C	6.1
PONDS T-2 EXPECTED FINAL BOD_5 CONCENTRATION OF EFFLUENT	MG/L	16
PONDS T-2 EXPECTED TOTAL BOD_5 LEAVING POND (TOTAL)	LB	2,448
PONDS T-2 EXPECTED DO DEMANDED (TOTAL)	LB	15,727
AERATOR POWER REQUIRED	HP	12

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

ORDER NO. R5-2007-0179

WASTE DISCHARGE REQUIREMENTS

FOR

LOCKEFORD COMMUNITY SERVICES DISTRICT
WASTEWATER TREATMENT FACILITY
SAN JOAQUIN COUNTY

The California Regional Water Quality Control Board, Central Valley Region, (hereafter Regional Water Board) finds that:

1. The Lockeford Community Services District (hereafter referred to as Discharger) submitted a Report of Waste Discharge (RWD) on 9 June 2006 for updating existing Waste Discharge Requirements (WDRs) for its wastewater treatment facility. The purpose of the update is to provide effluent disinfection, add a new land application area, and modify an existing wastewater storage pond to treat and dispose of domestic wastewater generated in existing and new residential developments. Supplemental information to the RWD was received on 8 March 2007.

2. For the purposes of this Order, the term "Wastewater Treatment Facility" (WWTF) shall mean the wastewater collection system, the wastewater treatment ponds, recycled water distribution piping, recycled water storage ponds, and the land application areas. The general location of the facility is shown on Attachment A, which is attached hereto and made part of this Order by reference.

3. Improvements at the facility are referred to as the Disposal Improvement Project, which will be implemented by the Discharger when this Order is adopted, and the Treatment Improvement Project, which has not yet been scheduled for implementation by the Discharger.

4. The WWTF is presently located in two areas and a third area will be added as part of the Disposal Improvement Project. The areas are named Treatment Area, Land Application Area No. 1, and Land Application Area No. 2. The locations of the areas are presented on Attachment A.

5. The Treatment Area is at 17725 North Tully Road, Lockeford, in Section 6, T3N, R8E, MDB&M. The Lockeford Community Services District owns and operates the WWTF, Treatment Area, Land Application Area (LAA) No. 1 and LAA No. 2. LAA No. 1 is in Section 6 T3N, R8E, MDB&M. LAA No. 2 is in Section 5 T3N, R8E, MDB&M. The Treatment Area site plan is shown on Attachment B, which is attached hereto and made part of this Order by reference.

6. WDRs Order No. 90-312 and Wastewater Reclamation Requirements (WRRs) Order No. 90-313, adopted by the Regional Water Board on 2 November 1990, prescribe requirements for the Lockeford Community Services District WWTF and LAA No. 1. Continued use of Orders 90-312 and 90-313 is not consistent with the current plans and policies of the Regional Water Board, nor with the Discharger's need to expand capacity.

7. The Assessor's Parcel Numbers (APNs) for the WWTF are presented below:

Area	APN
Treatment Area	053-030-39
LAA No. 1	053-030-58
	053-030-51
LAA No. 2	053-070-03

Existing Facility, Facility Improvements, and Discharge

8. The existing WWTF treats and disposes of wastewater from the unincorporated community of Lockeford. The WWTF is being expanded and disinfection is being added to provide better treatment for the wastewater that will be generated due to future land development. Currently, the flow rate varies from 0.24 to 0.29 Million gallons per day (Mgal/day).

9. Wastewater is delivered to the treatment system from two pump stations; one of the pump stations is equipped with an alarm that will alert the system operator of malfunctions. The other pump station is checked on a daily basis. This order requires all pumping stations to be equipped with alarm systems. Additional pump stations will be added based on need.

10. Wastewater is metered using ultrasonic flow meters at the headworks (prior to treatment), downstream of treatment/storage ponds and prior to chlorination, and downstream of the chlorination pipe.

11. Presently, five wastewater ponds exist. Ponds No. 1 through 4 are located at the Treatment Area; Pond No. 5 is located at LAA No. 1. A sixth pond, Pond No. 6, will be constructed at LAA No. 2 as part of the Treatment Improvement Project.

12. A wastewater treatment schematic is presented on Attachment C, which is attached hereto and made part of this Order by reference. The following summarizes the treatment process:

    a. Wastewater is biologically treated in a mechanically aerated treatment pond (Pond No. 1) prior to discharge to three storage ponds (Ponds No. 2, 3, and 4). The existing treatment capacity is in excess of 0.40 Mgal/day.

    b. Wastewater in Ponds No. 2, 3, and 4 has undergone biological treatment but has not been disinfected. This wastewater is currently pumped either to Pond No. 5 for storage or to LAA No. 1 for disposal. In this Order, wastewater that is disinfected is considered "recycled water."

c. Effluent disinfection processes will be added as part of the Disposal Improvement Project. The disinfectant will be chlorine gas. The chlorine contact chamber will consist of a 20-inch diameter pipe that is 500 feet long. Recycled water will be pumped to either Pond No. 5, to Pond No. 6 (when built), or directly to LAAs No. 1 or 2.

d. Until the disinfection process is operable, the Discharger is prohibited from applying undisinfected wastewater to land.

13. Pond configurations are expected to change as part of the future Treatment Improvement Project, which will provide better wastewater treatment and flexibility of operation. However, the footprint of the ponds at the Treatment Area will not change. The wastewater ponds are described below:

a. At the Treatment Area, four ponds presently exist.

i) Pond No. 1 is a treatment pond and is equipped with two 10-horsepower brush aerators and three 7.5-horsepower aspirator type aerators. The pond does not contain a synthetic liner. As part of the Treatment Improvement Project, two 10-horsepower brush type mechanical aerators will be added to the treatment pond to increase treatment capacity, improve mixing, and reduce the potential for short-circuiting in the pond. The pond is 39 ac•ft in size and holds 13-million gallons at two feet of freeboard.

ii) Ponds No. 2, 3, and 4 are used for wastewater storage but could be converted to treatment ponds if needed (to allow sludge removal from Pond No. 1 or other operation and maintenance needs). The ponds do not contain synthetic liners. The three ponds hold a total of 156 ac•ft and 51 million gallons at two feet of freeboard.

b. Each LAA will contain a recycled water storage pond. The acreage that the ponds occupy is not part of the LAA irrigation acreage used in water balance calculations.

i) Pond No. 5 is located at LAA No. 1 and is presently used to store treated (undisinfected) wastewater; however, in the future it will store recycled water. The pond does not contain a synthetic liner. Pond No. 5 will be deepened to increase the storage capacity from the current volume of 40 million gallons (123 ac•ft), to 51 million gallons (157 ac•ft) at two feet of freeboard as part of the Disposal Improvement Project.

ii) Pond No. 6 will be constructed at LAA No. 2 as part of the Treatment Improvement Project and will be used to store recycled water. As described in the RWD, the pond will not contain a synthetic liner. The pond will be constructed when sludge is removed from Pond No. 1 as part of the Treatment Improvement Project, which will remove Pond No. 1 from service temporarily. Pond No. 6 will be 52 ac•ft in size and will hold 17 million gallons at two feet of freeboard. The parcel for LAA No. 2 consists of 60 acres; however, only 38 acres are proposed for land application of recycled water because of Pond No. 6 and setbacks from natural drainages throughout the parcel.

14. The Disposal Improvement Project will consist of the activities listed below. This project will formally begin when this Order is adopted.

    a. Deepening of Pond No. 5 to increase storage capacity by at least 11 million gallons.

    b. Installation of new groundwater monitoring wells for the ponds and land application areas.

    c. Installation of disinfection equipment.

    d. Improvements on 38 acres to allow the land application of recycled water on LAA No. 2.

    e. Submittal of documentation showing that a legal covenant regarding land use has been signed with the property owner located south of LAA No. 2.

    f. Preparation and submittal of a technical report documenting completion of the foregoing.

15. The Treatment Improvement Project will consist of the following activities, and while not currently scheduled, will be performed two years prior to sludge removal from the existing treatment pond (Pond No. 1):

    a. At least 17 Mgal of new storage will be constructed as Pond No. 6. The planned site for the new Pond No. 6 is the northwest corner of LAA No. 2.

    b. A storage pond at the Treatment Area will be converted to a new 0.4 Mgal/day, two-cell aerated treatment pond system so that Pond No. 1 can be taken out of service.

    c. Once the new storage Pond No. 6 is constructed and a storage pond has been converted to a treatment pond, Pond No. 1 will be taken out of service, the sludge will be removed, and Pond No. 1 will be converted into a second 0.4 Mgal/day, two-cell aerated treatment pond system.

    d. At the end of the Treatment Improvement Project, the Discharger will have a 0.6 Mgal/day, three-cell treatment plant with a fourth cell in reserve to allow any of the three cells to be taken out of service for any reason.

    e. The Treatment Improvement Project will be initiated when any of the following occurs:

i) The flow rate is projected to exceed 0.4 Mgal/day within 2.5 years;

ii) The treatment system threatens to violate WDRs.

iii) Sludge becomes problematic in the treatment pond system for any reason.

16. The Discharger has two portable generators. They are used to operate the lift stations and some of the water supply wells. The Discharger is planning to install an electrical transfer switch at the Treatment Area to run key components such as pumps, instruments, and the office but will not be completed until 2008. All new pump stations are designed with an emergency generator and automatic transfer switch.

17. Stormwater that falls on the roadways surrounding the ponds at the Treatment Area drains into the ponds. Other stormwater falling on roofs and paved areas drains to the surrounding unpaved areas where it infiltrates. Stormwater that falls on turf areas at the treatment facility will infiltrate.

18. Influent wastewater quality has been characterized by the Discharger. Based on samples collected since January 2004 until March 2006, wastewater quality is as follows:

Constituent	Units	Average
Monthly Average Flow Rate	Mgal/day	0.254
Biochemical Oxygen Demand	mg/L	184

19. Effluent wastewater quality has also been characterized by the Dischager. The following table summarizes average effluent quality since August 2005. Samples were collected at the Pond No. 1 (treatment pond) outlet.

Constituent	Units	Effluent Quality
Biochemical Oxygen Demand	mg/L	17
Total Dissolved Solids	mg/L	479
Nitrate as Nitrogen	mg/L	Not Detectable
Total Nitrogen	mg/L	4.0
Chloride	mg/L	97.3
Sodium	mg/L	69.3

Recycled Water Application

20. Undisinfected wastewater is currently applied to 95 acres at LAA No. 1 using flood irrigation. Pasture grass is presently grown and beef cattle are allowed to graze the area.

21. Upon implementation of the Disposal Improvement Project, the Discharger will apply recycled water to the LAAs as follows:

    a. A total of 133 acres of land application areas will be available to the Discharger. The LAAs will be divided into five 26.6 acre irrigation checks.

b. Each 26.6 acre irrigation check will be sequentially rotated in alfalfa production for three years and fallow for two years. Every year 79.8 acres will be used for wastewater application.

c. The fallow 53.2 acres can be used to grow pasture grass or other crop if deemed appropriate, but the Discharger states that action would be an unusual occurrence.

22. Wastewater will be applied by flood irrigation. LAAs will be deep-ripped to allow drainage and deep rooting of the alfalfa crop. LAAs will be graded to allow effective flood irrigation and minimize ponding. Beef cattle will be allowed to graze LAA No. 1; no livestock will be allowed on LAA No. 2.

23. To further reduce the salinity of shallow groundwater underlying and downgradient of the LAAs, the LAAs will be designed and operated to capture and percolate most of the rain falling on the LAAs. Upon completion of the Disposal Improvement Project, the captured rainfall runoff will be applied to the irrigation fields to minimize pooling along runoff containment berms, and the associated risk of mosquito breeding. The Discharger estimates only five-percent of rainfall will runoff the LAA during an average rainfall year. Allowing runoff from the LAAs is acceptable because the wastewater will be disinfected and wastewater application will not occur during winter months except when climatic conditions allow.

24. Effluent will be applied at plant uptake rates for both nitrogen and water application. Irrigation tailwater will be controlled through such measures as controlling application and grading the area to prevent off-site drainage.

25. The RWD contains a water balance that demonstrates hydraulic capacity for a wastewater flow rate of 400,000 gpd when the Disposal Improvement Project has been completed. The water balance requires 101.9 million gallons of storage capacity and 80 acres of land application area. Presently, the Discharger has 90.9 million gallons of storage capacity and 95 acres of land application area at LAA No. 1. To increase the storage capacity, Pond No. 5 will be deepened to add 11 million gallons of storage capacity for a total of 101.9 million gallons. The water balance does not require any wastewater to be applied from November through March. However, this Order does not prohibit such application when conditions allow.

26. As described in Water Recycling Specification No. E.5, Title 22, Division 4, Chapter 3, Article 3 requires recycled water application setbacks based on adjacent land uses. To allow application of recycled water closer than allowed by setbacks, the Discharger has obtained an easement on the property south of LAA No. 2. The agreement limits where groundwater wells can be placed on the affected area. The easement allows application of recycled water within 20-feet of the property boundary, which is enough room for a tailwater return ditch, containment levee, and road.

Wastewater Collection System

27. Parts of the collection system are upwards of 50 years old. Approximately 40-percent of the system is believed to consist of clay pipe; the remaining is poly vinyl chloride (PVC) pipe. Based on seasonal flow rate variations, infiltration and inflow appears to be minimal. New wastewater collection system piping will consist primarily of schedule-40 PVC pipe. If excessive inflow and infiltration is identified in new or existing collection system piping, it can be replaced or repaired as needed.

28. The sanitary sewer system collects wastewater and consists of sewer pipes, manholes, and/or other conveyance system elements that direct raw sewage to the treatment facility. A "sanitary sewer overflow" is defined as a discharge to ground or surface water from the sanitary sewer system at any point upstream of the treatment facility. Temporary storage and conveyance facilities (such as wet wells, regulated impoundments, tanks, highlines, etc.) may be part of a sanitary sewer system and discharges to these facilities are not considered sanitary sewer overflows, provided that the waste is fully contained within these temporary storage/conveyance facilities. Sanitary sewer overflow is also defined in State Water Resources Control Board (State Water Board) Order No. 2006-0003-DWQ, *Statewide General Waste Discharge Requirements for Sanitary Sewer Systems*, which can be found at:
http://www.waterboards.ca.gov/resdec/wqorders/2006/wqo/wqo2006_0003.pdf.

29. For this facility, any sanitary sewer overflows would consist of varying mixtures of domestic and commercial wastewater, depending on land uses in the sewage collection system. The chief causes of sanitary sewer overflows include grease blockages, root blockages, debris blockages, sewer line flood damage, manhole structure failures, vandalism, pump station mechanical failures, power outages, storm or groundwater inflow/infiltration, lack of capacity, and/or contractor caused blockages.

30. Sanitary sewer overflows often contain high levels of suspended solids, pathogenic organisms, toxic pollutants, nutrients, oxygen demanding organic compounds, oil and grease, and other pollutants. Sanitary sewer overflows can cause temporary exceedences of applicable water quality objectives, pose a threat to public health, adversely affect aquatic life, and impair the public recreational use and aesthetic enjoyment of surface waters in the area.

31. The Discharger is expected to take all necessary steps to adequately maintain, operate, and prevent discharges from its sanitary sewer collection system. This Order requires the Discharger to prepare and implement a *Sewer System Management Plan* (SSMP) consistent with State Water Board Order No. 2006-0003-DWQ.

Site-Specific Conditions

32. Annual precipitation in the vicinity averages approximately 16.91 inches. The mean evapotranspiration rate is approximately 67.94 inches per year. All portions of the WWTF are outside the 100-year flood zone.

33. The facility lies within the Lower Mokelumne River Hydrologic Unit Area No. 531.20, as depicted on interagency hydrologic maps prepared by the Department of Water Resources in August 1986.

34. Based on the National Resource Conservation Service soil survey, the soils at the LAAs consist primarily of the Exeter sandy loam and San Joaquin Loam.

35. Published infiltration rates for the soils range from 0.06 to 2.0 in/hr.

Groundwater Considerations

36. The Lockeford community obtains its potable water from groundwater. Water quality data from 2005 and 2006 are presented below:

Analyte	Units	2005	2006
Boron	mg/L	ND (0.10)	ND (0.50)
Chloride	mg/L	21	23
Manganese	mg/L	ND (0.020)	ND
Nitrate (as N)	mg/L	1.3	0.87
Ammonia	mg/L	ND (0.50)	ND (0.50)
Sodium	mg/L	27	32
Electrical Conductivity	umhos/cm	350	387
PH	Std.	7.3	7.2
Total Dissolved Solids	mg/L	278	296
Total Hardness	mg/L	104	124

37. The following table presents a summary of the monitoring wells that have been installed to date and their status. Wells TPMW-5 and R1MW-2 were drilled deeper than the depth of well casing; the excess borings were sealed with bentonite clay. Well TPMW-1 was constructed with an unusually long sand filter pack. The well locations are presented on Attachments A and B.

Well Name	Location	Dia. (in.)	Depth (ft.)	Screen Int (ft. bgs)	Filter Pack	Status
TP MW-1	Treatment	4	120	90-120	85-120	Perched
TP MW-2	Treatment	4	132	102-132	96-132	Water Table
TP MW-3	Treatment	4	135	105-135	100-135	Water Table
TP MW-4	Treatment	4	145	130-145	128-145	Water Table
TP MW-5	Treatment	4	63	44.5-54.5	42.5-54.5	Perched
R1 MW-1	LAA No. 1	4	145	130-145	128-145	Water Table

Well Name	Location	Dia. (in.)	Depth (ft.)	Screen Int (ft. bgs)	Filter Pack	Status
R1 MW-2	LAA No. 1	4	100	68-83	66-83	Perched
R1 MW-3	LAA No. 1	4	140	125-140	123.4-140	Water Table
R1 MW-4	LAA No. 1	4	145	130-145	128-145	Water Table
BMW-1	Backgnd	4	145	130-145	124-145	Water Table
BMW-2	Backgnd	4	145	130-145	128-145	Water Table
R2 MW-1	LAA No. 2	4	145	115-145	112-145	Water Table
R2 MW-2	LAA No. 2	4	145	115-145	112-145	Water Table
R2 MW-3	LAA No. 2	4	145	115-145	112-145	Water Table
R2 MW-4	LAA No. 2	4	145	115-145	112-145	Water Table
R2 MW-5	LAA No. 2	4	145	115-145	112-145	Water Table

TP denotes Treatment Area. R1 denotes Reclamation Area (LAA Area) No. 1. BMW denotes Background Monitoring Well. R2 denotes Reclamation Area (LAA Area) No. 2.

38. The RWD presents the following information about groundwater conditions at the site:

a. Groundwater monitoring wells have been installed at the wastewater treatment system and both LAAs. The unlined wastewater treatment ponds appear to have created a groundwater mound that complicates determination of groundwater flow direction.

b. Two water bearing zones have been identified: a local perched zone and the regional water table. The perched zone has been identified at the Treatment Area and at LAA No. 1. Wells TPMW-1, TPMW-5, and R1MW-2 exhibit groundwater elevations above the regional water table elevations. Review of the groundwater elevation data from wells screened in the perched and regional water table indicates a downward vertical gradient exists between the saturated zones. However, the existence of the perched zone at the Treatment Area wells is questionable and may be the result of a groundwater mound generated by the unlined wastewater ponds percolating wastewater into the subsurface.

c. Groundwater elevations in each zone are discussed below:

   i. The groundwater flow direction of the perched zone wells could not be determined because no continuous perched zone between the wells could be identified. Typical depths to perched groundwater are 50 to 70 feet below ground surface.

   ii. The groundwater flow direction in the water table zone is to the southeast with a slight gradient (0.00073 to 0.0013 ft./ft.). Typical depths to groundwater are 120-130 feet below ground surface.

   iii. Regional groundwater maps prepared by the Department of Water Resources indicate that groundwater flow is to the south or southeast.

iv. Although Well No. TPMW-1 was constructed with a sand pack presumably deep enough to show a groundwater elevation typical of the regional water table, it possesses a groundwater elevation higher than expected. The cause of the elevation anomaly is unknown but the well may be acting as a vertical conduit allowing mounded wastewater to move to lower saturated zones more quickly. Further investigation and possible replacement of Well TPMW-1 is warranted.

39. Groundwater quality has been characterized by quarterly sampling of monitoring wells. A summary of average groundwater quality for all the wells (except total coliform organisms as described in Finding No. 39.g) is presented in the table below as well as the Water Quality Limit for each analyte.

Treatment Area monitoring wells TPMW-1, TPMW-2, and TPMW-3 have been sampled since March 2000; Background Wells BMW-1 and BMW-2; Treatment Area Wells TPMW-4 and TPMW-5; and LAA No. 1 Wells R1MW-1 through R1MW-4 have been sampled since November 2006; LAA No. 2 Wells R2MW-1 through R2MW-4 have been sampled since August 2005; and LAA No. 2 Well R2MW-5 has been sampled since October 2005.

Well	Location	Units	NO_3 as N	TKN	TDS	Hardness	Na	Cl	Alkalinity	TCO (MPN/100ml)
WQL	--	mg/L	10 [1]	NA	450 [2]	NA	69 [2]	106 [2]	NA	<2.2 [3]
BMW-1	Bkgnd	mg/L	0.7	ND (1.0)	367	124	51	82	67	<2
BMW-2	Bkgnd	mg/L	4.0	ND (1.0)	354	161	37	38	130	<2
TPMW-1	Trtmt	mg/L	4.0	ND (1.0)	636	415	62	136	313	<2
TPMW-2	Trtmt	mg/L	3.6	ND (1.0)	351	118	48	45	127	<2
TPMW-3	Trtmt	mg/L	1.9	ND (1.0)	548	347	59	77	328	<2
TPMW-4	Trtmt	mg/L	2.8	ND (1.0)	249	92	39	37	98	<2
TPMW-5	Trtmt	mg/L	0.9	ND (1.0)	653	273	177	84	346	<2
R1MW-1	LAA 1	mg/L	1.8	ND (1.0)	283	65	47	22	72	<2
R1MW-2	LAA 1	mg/L	6.3	ND (1.0)	449	189	62	72	155	<2
R1MW-3	LAA 1	mg/L	3.5	ND (1.0)	286	75	37	31	81	<2
R1MW-4	LAA 1	mg/L	6.0	ND (1.0)	246	87	26	27	67	<2
R2MW-1	LAA 2	mg/L	2.7	0.4	288	48	27	17	86	<2
R2MW-2	LAA 2	mg/L	1.1	0.3	224	57	28	19	92	<2
R2MW-3	LAA 2	mg/L	2.1	0.3	236	66	26	16	95	<2
R2MW-4	LAA 2	mg/L	3.7	0.3	252	73	34	28	90	<2
R2MW-5	LAA 2	mg/L	1.8	0.3	204	47	28	25	71	<2

Bkgnd denotes background well. Trtmt denotes Treatment Area well. LAA 1 denotes Land Application Area No. 1 well. LAA 2 denotes Land Application Area No. 2 well. NO_3-N denotes Nitrate as Nitrogen. TKN denotes Total Kjeldahl Nitrogen. TDS denotes Total Dissolved Solids. Na denotes sodium. Cl denotes chloride. TCO denotes Total Coliform Organisms. MPN/100mL denotes Most Probable Number per 100 mL. ND denotes Not Detected. NA denotes Not Applicable. WQL denotes Water Quality Limit. [1] USEPA Primary Maximum Contaminant Level (Drinking Water). [2] Agricultural Water Quality Goals. [3] Water Quality Control Plan.

40. In general, groundwater quality is good and the analyte concentrations are less than the Water Quality Limit values. However, the Treatment Area wells contain waste constituents

at higher concentrations than the background wells and the land application area wells. Similarly, LAA No. 1 wells tend to contain waste constituents at higher concentrations than the wells located at LAA No. 2 (where no wastewater has yet been applied). The water quality trends are described below:

a. None of the monitoring wells contained average nitrate concentrations that exceed the water quality limit. Average concentrations in background wells are approximately 4 mg/L or less. At the Treatment Area, the concentrations vary from 4 mg/L to less than 2 mg/L. At LAA No. 1 average concentrations range from 6.3 mg/L to 1.8 mg/L. At LAA No. 2 average concentrations range from 1.1 mg/L to 3.7 mg/L.

b. Three of the monitoring wells contain average TDS concentrations that exceed the TDS water quality limit of 450 mg/L. Average concentrations in background wells are approximately 350 mg/L or less. At the treatment facility, three wells exceed the limit; they are Well TPMW-1 (636 mg/L), TPMW-3 (548 mg/L), and TPMW-5 (653 mg/L). At LAA No. 1 average concentrations range from 449 mg/L to 246 mg/L. At LAA No. 2 average concentrations range from 288 mg/L to 204 mg/L.

   i) It is noted that Well TPMW-3 possesses an elevated TDS average concentration (548 mg/L) and is located upgradient of the wastewater ponds. This seems to indicate the well is located within a groundwater mound, but the groundwater elevation in the well is not higher than the regional water table.

c. One well contained average sodium concentrations that exceeded the water quality limit of 69 mg/L. Background concentrations range from 37 mg/L to 51 mg/L. The remaining concentrations ranged from 62 mg/L to 26 mg/L. Concentrations were lowest in wells located at LAA No. 2.

d. One well contained average chloride concentrations that exceed the water quality limit of 106 mg/L. Average concentrations in background wells varied from 82 mg/L to 38 mg/L. At the treatment facility, one well exceeded the limit; it is Well TPMW-1 (136 mg/L). At LAA No. 1 average chloride concentrations range from 72 mg/L to 22 mg/L. At LAA No. 2 average concentrations range from 28 mg/L to 16 mg/L.

e. Although there are not water quality limits for hardness or alkalinity the analytes can be used to determine if groundwater quality degradation has occurred. The average concentrations of hardness and alkalinity are highest in wells located at the Treatment Area.

f. The wells that are screened (or have sand pack that extends to shallow zones) in perched zone groundwater tend to have higher concentrations of waste constituents. Those wells are TPMW-1, TPMW-5, and R1MW-2. It is noted that Well TPMW-4 was installed adjacent to Well TPMW-5 but was constructed to only monitor the lower regional water table zone. Significant differences between the chemistry of the two wells have been observed.

g. Detectable levels of Total Coliform Organisms (TCO) were reported in 13 of 16 wells since monitoring was initiated but the concentrations have reduced to non-detectable in the most recent sampling events. Upon installation, the wells were not disinfected. Because coliform organisms are normally filtered as they migrate through soil media, the presence of TCO in the wells is likely a result of contamination during well installation or sampling. The current non-detectable TCO concentration complies with the Basin Plan.

h. Although not presented in the table above due to space limitations, total trihalomethanes (THMs) were included in the analyses for LAA No. 2. No detectable total THM was reported. Because wastewater has not been chlorinated to date there is little reason to expect THMs to be present in the wastewater or groundwater. However, once wastewater is disinfected, it will be reasonable to require monitoring for these constituents. The non-detectable THM concentration complies with the Basin Plan.

41. Based on the average total nitrogen concentration in effluent (4 mg/L), and the flow rate (0.4 Mgal/day), the total nitrogen applied to the land application areas (80 acres active each year) is expected to be approximately 61 lbs/acre•year. The Discharger plans to grow alfalfa in the LAAs. According to the *Western Fertilizer Handbook*, alfalfa is capable of taking up 480 lbs/acre•year of nitrogen. When wastewater is properly applied to land, the alfalfa should take up all the applied nitrogen. Groundwater beneath land application areas is not anticipated to be degraded by nitrogen compounds as a result of the wastewater application.

42. Based on the average TDS concentration in effluent from the treatment pond (479 mg/L), and the flow rate (0.4 Mgal/day), the total TDS applied to the land application areas (80 acres active each year) is expected to be 7,256 lbs/acre•year. Because TDS consists of biodegradable dissolved solids and Fixed Dissolved Solids (FDS), the loading rate of FDS should be slightly less than the TDS loading rate. Groundwater beneath land application areas and wastewater ponds is expected to be degraded by TDS compounds as a result of the wastewater application and storage. However, the degradation is consistent with the Antidegradation Policy as described below:

a. The RWD describes a groundwater model that predicts the concentration of wastewater percolate and the potential impact on groundwater quality. The model estimates groundwater quality degradation to be limited to a value below the water quality objective. Degradation of groundwater quality is expected to remain under the water quality limit of 450 mg/L. The model assumptions are presented below:

i) The alfalfa crop will remove approximately 1,200 pounds of FDS. That is based on 6 tons per acre of alfalfa and a 10-percent ash content. Crops will be removed from the LAAs so that the accumulated salt is removed from the system.

ii) Wastewater will be applied at night to minimize evaporation, even with that measure approximately 47 percent will be lost to the atmosphere through evapotranspiration.

iii) Approximately 50-percent of the wastewater applied will be leached through the soil to prevent salt buildup in the root zone.

iv) Precipitation will be collected and applied to land application areas to dilute the salinity of wastewater applied.

v) The overall, long-term average salinity of percolate (of rainfall and wastewater origins) is estimated to be 446 mg/L.

vi) The resulting salinity of shallow zone groundwater immediately downgradient from the LAAs is also estimated to have an overall, long-term average salinity of 446 mg/L because the percolate concentration is the dominant factor in determining shallow groundwater quality.

vii) Because the recycled water storage ponds will not be lined, groundwater quality may be degraded by THMs. Additional groundwater monitoring wells will be required to monitor the ponds where recycled water is stored.

Antidegradation Analysis

43. State Water Resources Control Board (State Board) Resolution No. 68-16 (hereafter Resolution 68-16 or the "Antidegradation Policy") requires the Regional Water Board in regulating the discharge of waste to maintain high quality waters of the state (i.e., background water quality) until it is demonstrated that any change in quality will be consistent with maximum benefit to the people of the state, will not unreasonably affect beneficial uses, and will not result in water quality less than that described in the Regional Water Board's policies (e.g., quality that exceeds water quality objectives). Resolution 68-16 requires that any discharge that could degrade the waters of the state be regulated to assure use of best practicable treatment or control of the discharge to assure that pollution or nuisance will not occur, and the highest water quality consistent with maximum benefit to the people of the State will be maintained.

44. The Discharger has not provided an antidegradation analysis except for TDS. Staff's review of the information in the Findings finds that effluent disposal has the potential to degrade or pollute the underlying groundwater with respect to salinity constituents. However, as discussed in Finding No. 41, the Discharger believes that the degradation will remain below the salinity water quality objective for the beneficial use of agriculture, 450 mg/L TDS.

45. The average concentration of TDS in the potable water supplied to the City of Lockeford is approximately 290 mg/L. The recent TDS concentration in the effluent discharged to the percolation ponds is approximately 480 mg/L. The incremental addition of dissolved salts

though water usage at this facility (about 190 mg/L) is within the normal range for domestic use and is considered reasonable.

46. The Regional Board further finds that some degradation of the groundwater beneath the WWTP is consistent with the maximum benefit to the people of the state provided that:

    a. The degradation is confined within a specified boundary;

    b. The Discharger minimizes the degradation by fully implementing, regularly maintaining, and optimally operating Best Practicable Treatment and Control (BPTC) measures;

    c. The degradation is limited to waste constituents typically encountered in municipal wastewater as specified in the groundwater limitations in this Order; and

    d. The degradation does not result in water quality less than that prescribed in the Basin Plan.

47. Some degradation of groundwater by some of the typical waste constituents released with discharge from a municipal wastewater utility after effective source control, treatment, and control is consistent with maximum benefit to the people of California. The technology, energy, and waste management advantages of municipal utility service far exceed any benefits derived from a community otherwise reliant on numerous concentrated individual wastewater systems, and the impact on water quality will be substantially less. Degradation of groundwater by constituents (e.g., toxic chemicals) other than those specified in the groundwater limitations in this Order, and by constituents that can be effectively removed by conventional treatment (e.g., total coliform bacteria) is prohibited. When allowed, the degree of degradation permitted depends upon many factors (i.e., background water quality, the waste constituent, the beneficial uses and most stringent water quality objective, source control measures, waste constituent treatability).

48. This Order acknowledges that some degradation may occur as a result of the application of treated wastewater to land, but the Regional Board finds that such degradation at this facility is consistent with the maximum benefit to the people of the state. Economic prosperity of local communities and associated industry is of benefit to the people of California, and therefore sufficient reason exists to accommodate growth and some groundwater degradation, provided that the terms of the Basin Plan are met. State Board Resolution No. 77-1, *Policy with Respect to Water Recycling in California*, encourages recycling projects that replace or supplement the use of fresh water, and *The Water Recycling Law* (CWC section 13500-13529.4) declares that utilization of recycled water is of primary interest to the people of the state in meeting future water needs. This Order is consistent with State Water Board policy.

Treatment and Control Practices

49. Resolution No. 68-16 requires the discharge to be regulated to assure use of best practicable treatment or control (BPTC). The Regional Water Board may not, in general,

specify the manner of compliance; therefore, to implement Resolution No. 68-16, the Regional Water Board sets forth effluent and receiving water limitations. To be consistent with Resolution No. 68-16, the Discharger must assure that it is complying with the requirements of this Order and complying with the receiving water limits. The Discharger will provide treatment and control of the discharge that incorporates:

a. Alarms to prevent system bypass or overflow;

b. Future disinfection of treated effluent;

c. Future application of recycled water at plant uptake (for nitrogen and water) rates;

d. Appropriate biosolids storage and disposal practices;

e. An Operation and Maintenance (O&M) manual; and

f. Certified operators to assure proper operation and maintenance.

50. In order to determine compliance with Resolution No. 68-16 it is appropriate to establish a schedule for sampling of groundwater monitoring wells and to formally determine background groundwater concentrations for selected constituents. If groundwater is degraded or there is evidence that the discharge may cause degradation, then the Discharger will be required to evaluate and implement additional BPTC measures for each conveyance, treatment, storage, and disposal component of the system. Completion of these tasks will ensure that BPTC and the highest water quality consistent with the maximum benefit to the people of the state will be achieved.

51. This Order establishes interim groundwater limitations for the WWTF that will not unreasonably threaten present and anticipated beneficial uses or result in groundwater quality that exceeds water quality objectives set forth in the Basin Plan. This Order also contains tasks for assuring that BPTC and the highest water quality consistent with the maximum benefit to the people of the state will be achieved. Accordingly, the discharge is consistent with Resolution 68-16 and the Basin Plan. Based on the results of the scheduled tasks, the Regional Water Board may reopen this Order to reconsider groundwater limitations and other requirements to comply with Resolution 68-16.

Basin Plan, Beneficial Uses, and Regulatory Considerations

52. The *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins, Fourth Edition* (hereafter Basin Plan) designates beneficial uses, establishes water quality objectives, contains implementation plans and policies for protecting waters of the basin, and incorporates by reference plans and policies adopted by the State Board. These requirements implement the Basin Plan.

53. The beneficial uses of the Mokelumne River between Camanche Reservoir and the Delta are agricultural supply; water contact recreation; non-contact water recreation; warm freshwater habitat; cold freshwater habitat; migration of aquatic organisms; spawning, reproduction, and/or early development; and wildlife habitat.

54. The Basin Plan designates the beneficial uses of underlying groundwater as municipal and domestic supply, agricultural supply, industrial service supply, and industrial process supply.

55. The Basin Plan encourages water recycling.

56. The Basin Plan establishes numerical and narrative water quality objectives for surface water and groundwater within the basin. Numerical and narrative water quality objectives are maximum (i.e., least stringent) limits directly applicable to the protection of designated beneficial uses of the water. Controllable water quality factors are not allowed to cause further degradation of water quality in instances where other factors have already resulted in water quality objectives being exceeded. Controllable factors are those actions, conditions, or circumstances resulting from human activities that may influence the quality of the waters of the State are subject to the authority of the State or Regional Board, and that may be reasonably controlled. In addition, the water quality objectives do not require improvement over naturally occurring background concentrations. As described in the attached Information Sheet, the Basin Plan requires that the Regional Water Board, on a case-by-case basis, follow specified procedures to determine maximum numerical limitations that apply the narrative objectives when it adopts waste discharge requirements.

57. The Basin Plan includes a water quality objective for Chemical Constituents that, at a minimum, requires waters designated as domestic or municipal supply to meet the maximum contaminant levels (MCLs) specified in the following provisions of Title 22, California Code of Regulations (CCR): Tables 64431-A (Inorganic Chemicals) and 64431-B (Fluoride) of Section 64431, Table 64444-A (Organic Chemicals) of Section 64444, Table 64449-A (Secondary Maximum Contaminant Levels-Consumer Acceptance Limits) of Section 64449, and 64449-B (Secondary Maximum Contaminant Levels-Ranges) of Section 64449. The Basin Plan's incorporation of these provisions by reference is prospective, and includes future changes to the incorporated provisions as the changes take effect. The Basin Plan recognizes that that the Regional Water Board may apply limits more stringent than MCLs to ensure that waters do not contain chemical constituents in concentrations that adversely affect beneficial uses.

58. State Board Order No.WQO-2003-0014 upheld the Regional Board's use of numeric groundwater limits, and states that numeric groundwater limits must be restricted to those constituents present in the waste, breakdown products of constituents present in the waste, and those that might be leached from the soil beneath the wastewater disposal area. The Groundwater Limitations of this Order complies with State Board Order No. WQO-2003-0014, as described below. Additional information regarding each of these chemicals is found in the Information Sheet.

    a. The Discharger has not yet sampled its effluent for boron. However, boron occurs naturally in waters, and is known to be present in the cleaning products used in domestic households[1]. Boron has been found in the wastewater effluent at other domestic wastewater treatment facilities at concentrations ranging from 0.7 to 2.2 mg/l, and is expected to be present in the wastewater at this facility. Boron has the potential to degrade groundwater quality due to the unlined wastewater ponds, as well as the application of wastewater to LAAs. The groundwater underlying the facility has the designated beneficial use of agricultural supply. According to Ayers and Westcot[2], boron can damage sensitive crops if present in excess of 0.7 mg/L in irrigation water, thereby impairing agricultural use of the water resource. The applicable water quality objective to protect the agricultural use from discharges of boron is the narrative Chemical Constituents objective, which is implemented following the "Policy of Application of Water Quality Objectives" in the Basin Plan. A numerical groundwater limitation of 0.7 mg/L for boron, based on Ayers and Westcot, is appropriate to apply the narrative Chemical Constituents objective to protect the agricultural use of groundwater. This limit assumes no impact on sensitive agricultural uses, consistent with the high quality of expected natural background water quality in the area of the discharge.

b. The Discharger's effluent contains an average chloride concentration of 97.3 mg/L. Chloride is known to be present in wastewater, as it is one of the major components of total dissolved solids. Chloride is a major anion in natural water and wastewater, and is added to the waste stream because chloride is present in the human diet and is excreted unchanged from the human body[1,3]. Chloride concentrations at other facilities vary depending on the salinity of the source water and the activities resulting in wastewater discharge. At other domestic wastewater facilities, chloride has been present in the wastewater at concentrations ranging from 48 to 310 mg/l. Chloride has the potential to degrade groundwater quality due to the unlined wastewater ponds, as well as the application of wastewater to LAAs. According to Ayers and Westcot[2], chloride can damage sensitive crops if present in excess of 106 mg/L in irrigation water applied by sprinklers, thereby impairing agricultural use of the water resource. The applicable water quality objective to protect the agricultural use from discharges of chloride is the narrative Chemical Constituents objective, which is implemented following the "Policy of Application of Water Quality Objectives" in the Basin Plan. A numerical groundwater limitation of 106 mg/L for chloride, based on Ayers and Westcot, is appropriate to apply the narrative Chemical Constituents objective to protect the agricultural use of groundwater. This limit assumes no impact on sensitive agricultural uses, consistent with the high quality of expected natural background water quality in the area of the discharge.

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[1] American Public Health Association et al., 1985.Standard Method for the Examination of Water and Wastewater, 16th Edition.

[2] Ayers, R.S. and D.W. Westcot, Water Quality for Agriculture, Food and Agriculture Organization of the United Nations- Irrigation and Drainage Paper No. 29, Rev. 1, Rome (1985). This paper contains the results of studies of the impacts of various chemicals on agricultural uses including crop irrigation and stock watering. Therefore, it is appropriate to use the data contained therein to apply the narrative Chemical Constituent water quality objective.

[3] Metcalf and Eddy, 2003. Wastewater Engineering Treatment and Reuse, 4th Edition.

c. The Discharger has not yet sampled its effluent for iron. Iron is naturally occurring in all waters due to its presence in soils and rocks[1], and is liberated from the soil under oxidizing conditions associated with the biodegradation of organic matter. Iron is known to be present in domestic wastewater, and at other domestic wastewater facilities has been found at concentrations ranging from 70 to 190 ug/L. It is also expected to be present in the effluent from this facility. Iron has the potential to degrade groundwater quality due to the unlined wastewater ponds, as well as the application of wastewater to LAAs. In addition, naturally occurring iron can be solubilized from soil under reducing conditions caused by the land disposal of domestic wastewater[1]. The Chemical Constituents objective prohibits concentrations of chemical constituents in excess of California MCLs in groundwater that is designated as municipal or domestic supply. The California secondary MCL for iron is 0.3 mg/L, and groundwater beneath the facility is designated as municipal or domestic supply. It is therefore appropriate to adopt a numerical groundwater limitation of 0.3 mg/L for iron to implement the Chemical Constituents objective to protect the municipal and domestic use of groundwater.

d. The Discharger has not yet sampled its effluent for manganese. Manganese occurs naturally in waters and is added to the waste stream through both domestic and industrial use[1]. Manganese has been found at other facilities at concentrations ranging from 2 to 21 ug/L, and is expected to be present at this facility. Manganese has the potential to degrade groundwater quality due to the unlined wastewater ponds, as well as the application of wastewater to LAAs. In addition, naturally occurring manganese can be solubilized from soil under reducing conditions caused by the land disposal of domestic wastewater, and is more prevalent in dissolved forms in groundwater[1]. The Chemical Constituents objective prohibits concentrations of chemical constituents in excess of California MCLs in groundwater that is designated as municipal or domestic supply. The California secondary MCL for manganese is 50 ug/L, and groundwater beneath the facility is designated as municipal or domestic supply. It is therefore appropriate to adopt a numerical groundwater limitation of 50 ug/L for manganese to implement the Chemical Constituents objective to protect the municipal and domestic use of groundwater.

e. The average sodium concentration in the effluent from this facility is 69.3 mg/L. Sodium is known to be present in wastewater, as it is one of the major components of total dissolved solids. Sodium is a major cation in natural water, due to its prevalence in the earth's crust, and in wastewater because sodium chloride is present in the human diet and is excreted unchanged by the body[1]. Sodium concentrations at other facilities vary depending on the salinity of the source water and the activities resulting in wastewater discharge. At other domestic wastewater facilities, sodium has been present in the wastewater at concentrations ranging from 89 to 300 mg/l. Sodium has the potential to degrade groundwater quality due to the unlined wastewater ponds, as well as the application of wastewater to LAAs.. According to Ayers and Westcot[2], sodium can damage sensitive crops if present in excess of 69 mg/L in irrigation water, thereby impairing agricultural use of the water resource. The applicable water quality objective to protect the agricultural use from discharges of sodium is the narrative Chemical Constituents objective, which is implemented following the "Policy of Application of Water Quality Objectives" in the Basin Plan. A numerical groundwater limitation of 69 mg/L for sodium, based on Ayers and Westcot, is appropriate to apply the narrative Chemical Constituents objective to protect the agricultural use of groundwater. This limit assumes no impact on sensitive agricultural uses, consistent with the high quality of expected natural background water quality in the area of the discharge.

f. Total dissolved solids, which were found to be present in the wastewater at average concentrations of 476 mg/L, have the potential to degrade groundwater quality due to the unlined wastewater ponds, as well as the application of wastewater to LAAs. According to Ayers and Westcot[2], dissolved solids can damage sensitive crops if present in excess of 450 mg/L in irrigation water, thereby impairing agricultural use of the water resource. The applicable water quality objective to protect the agricultural use from discharges of total dissolved solids is the narrative Chemical Constituents objective, which is implemented following the "Policy of Application of Water Quality Objectives" in the Basin Plan. A numerical groundwater limitation of 450 mg/L for total dissolved solids, based on Ayers and Westcot, is appropriate to apply the narrative Chemical Constituents objective to protect the agricultural use of groundwater. This limit assumes no impact on sensitive agricultural uses, consistent with the high quality of expected natural background water quality in the area of the discharge.

g. Nitrate, which was not found in the wastewater at the detection limit (0.05 mg/L), has the potential to degrade groundwater quality due to the unlined wastewater ponds, as well as the application of wastewater to LAAs. The Chemical Constituents objective prohibits concentrations of chemical constituents in excess of California MCLs in groundwater that is designated as municipal or domestic supply. The California primary MCL for nitrate is equivalent to 10 mg/L as nitrogen, and groundwater beneath the facility is designated as municipal or domestic supply. It is therefore appropriate to adopt a numerical groundwater limitation of 10 mg/L for nitrate as nitrogen to implement the Chemical Constituents objective to protect the municipal and domestic use of groundwater.

h. The Discharger has not yet sampled its effluent for ammonia. However, wastewater has been found in the influent to other wastewater treatment facilities at concentrations ranging from 17 to 30 mg/l, and in the effluent from 1.4 to 1.6 mg/L. Ammonia has the potential to degrade groundwater quality due to the unlined wastewater ponds, as well as the application of wastewater to LAAs. According to Amoore and Hautala[4], the odor of ammonia can be detected in water at a

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[4] Amoore, J.E. and E. Hautala, *Odor as an Aid to Chemical Safety: Odor Thresholds Compared with Threshold Limit Values and Volatilities for 214 Industrial Chemicals in Air and Water Dilution*, Journal of Applied Toxicology, Vol. 3, No. 6, (1983). These authors studied the concentration of chemicals in air that caused adverse odors and then calculated the concentration in water that would be equivalent to that amount in air.

concentration of 1.5 mg/L (as ammonia), and concentrations that exceed this value can impair the municipal or domestic use of the resource due to the adverse odor. The applicable water quality objective to protect the municipal and domestic use from discharges of ammonia is the narrative Tastes and Odors objective, which is implemented following the "Policy of Application of Water Quality Objectives" in the Basin Plan. A numerical groundwater limitation of 1.5 mg/L for ammonia (as ammonia), based on Amoore and Hautala, is appropriate to apply the narrative Tastes and Odors objective to protect the municipal and domestic use of groundwater.

i. pH, which ranged from 7.6 to 10.1 standard units in the wastewater, has the ability to degrade groundwater quality due to the unlined wastewater ponds, as well as the application of wastewater to LAAs. According to Ayers and Westcot[2], pH less than 6.5 or greater than 8.4 can damage sensitive crops if present in irrigation water, thereby impairing agricultural use of the water resource. The applicable water quality objective to protect the agricultural use from discharges of substances that affect pH is the narrative Chemical Constituents objective, which is implemented following the "Policy of Application of Water Quality Objectives" in the Basin Plan. A numerical groundwater limitation range of 6.5 to 8.4 for pH, based on Ayers and Westcot, is appropriate to apply the narrative Chemical Constituents objective to protect the agricultural use of groundwater. This limit assumes no impact on sensitive agricultural uses, consistent with the high quality of expected natural background water quality in the area of the discharge.

j. The trihalomethane chemicals bromoform, bromodichloromethane, chloroform, and dibromochloromethane are found in wastewater that has been chlorinated and have the ability to degrade groundwater quality due to the unlined wastewater ponds, as well as the application of wastewater to LAAs. These byproducts are formed from reactions with organic matter during the disinfection process. Although the Discharger has not yet begun disinfecting its wastewater, it is reasonable to assume that trihalomethanes will be present in the effluent after disinfection. These volatile organic chemicals do not naturally occur in groundwater, and are toxic priority pollutants. Local groundwater is designated as municipal and domestic supply and is used as a source of drinking water by the Discharger. According to the USEPA and the Cal/EPA Office of Environmental Health Hazard Assessment, these four chemicals pose a cancer risk at low concentrations in drinking water, and could thereby impair the municipal and domestic beneficial use by imposing toxicity. The applicable water quality objective to protect the municipal and domestic beneficial use from discharges of these trihaolmethanes is the narrative Toxicity objective, which is implemented following the "Policy of Application of Water Quality Objectives" in the Basin Plan. For bromoform, a numerical groundwater limitation of 4 ug/L, based on the USEPA IRIS[5] cancer risk level, is appropriate to apply the narrative Toxicity

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Therefore, it is appropriate to use the data contained therein to apply the narrative Tastes and Odors water quality objective.

5 U.S. Environmental Protection Agency, Integrated Risk Information System, http://www.epa.gov/iris.

objective to protect the municipal and domestic beneficial use of groundwater. For bromodichloromethane, a numerical groundwater limitation of 0.27 ug/L, based on the Cal/EPA Cancer Potency Factor[6], is appropriate to apply the narrative Toxicity objective to protect the municipal and domestic beneficial use of groundwater. For chloroform, a numerical groundwater limitation of 1.1 ug/L, based on the Cal/EPA Cancer Potency Factor, is appropriate to apply the narrative Toxicity objective to protect the municipal and domestic beneficial use of groundwater. For dibromochloromethane, a numerical groundwater limitation of 0.37 ug/L, based on the Cal/EPA Cancer Potency Factor, is appropriate to apply the narrative Toxicity objective to protect the municipal and domestic beneficial use of groundwater.

59. The Basin Plan contains narrative water quality objectives for Chemical Constituents, Tastes and Odors, and Toxicity. The Toxicity objective, in summary, requires that groundwater be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life associated with designated beneficial uses. The Chemical Constituents objective requires that groundwater “shall not contain chemical constituents in concentrations that adversely affect beneficial uses.” The Tastes and Odors objective requires that groundwater “shall not contain taste- or odor-producing substances in concentrations that cause nuisance or adversely affect beneficial uses.” Chapter IV, Implementation, of the Basin Plan contains the “Policy for Application of Water Quality Objectives.” This Policy specifies, in part, that numerical receiving water limitations will be established in Board orders which will, at a minimum, meet all applicable water quality objectives, that where compliance with narrative objectives is required (i.e., where the objectives are applicable to protect specified beneficial uses), the Regional Water Board will, on a case-by-case basis, adopt numerical limitations in orders which will implement the narrative objectives, and that compliance with narrative water quality objectives may be evaluated considering numerical criteria and guidelines developed and/or published by other agencies and organizations.

60. The “Antidegradation” section of the attached Information Sheet lists the various waste constituents identified thus far as fitting the restriction of the Findings, along with limits of each constituent necessary to protect beneficial uses known to be adversely affected by waste constituents in groundwater. The listing identifies each constituent, the beneficial uses, water quality objective, and its associated limit, as well as the technical reference for the limit. Some limits may become less restrictive when the water supply is limited to certain applications of a beneficial use. However, in the absence of specific factual information supplied by the discharger to justify restricting certain beneficial uses, groundwater limits have been selected so as to provide protection of unrestricted beneficial uses. Interim groundwater limitations for each constituent reflect the most restrictive listed limit for the waste constituent, except if natural background quality is greater, in which case background becomes the interim limitation.

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[6] California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, California Environmental Protection Agency Toxicity Criteria Database, http://www.oehha.org/risk/ChemicalDB/index.asp.

Water Recycling

61. As noted above, State Water Board Resolution No. 77-1, *Policy with Respect to Water Recycling in California*, encourages recycling projects that replace or supplement the use of fresh water, and *The Water Recycling Law* (CWC sections 13500-13529.4) declares that utilization of recycled water is of primary interest to the people of the State in meeting future water needs.

62. The California Department of Public Health (CDPH) has established statewide water recycling criteria in Title 22, CCR, Section 60301 et. seq. (hereafter Title 22). After expansion, the Discharger will treat the wastewater to secondary-23 recycled water standards and disinfect the effluent per Title 22 requirements.

63. A 1988 Memorandum of Understanding between CDPH and the State Water Board on the use of recycled water establishes basic principles relative to the two agencies and the regional water boards. The Memorandum allocates primary areas of responsibility and authority between the agencies and provides for methods and mechanisms necessary to assure ongoing, continuous future coordination of activities relative to use of recycled water.

64. Section 60323(a) of Title 22 states that no person shall produce or supply recycled water for direct reuse from a proposed water recycling plant unless an engineering report is submitted for review by CDPH. Irrigation of fodder crops is considered a beneficial reuse. The Discharger submitted a Title 22 Engineering Report to CDPH on 21 August 2007 and an Amended Title 22 Engineering Report on 10 September 2007. CDPH provided comments on the Amended Title 22 Report on 26 September 2007; those comments are addressed in these WDRs.

Other Regulatory Considerations

65. On 2 May 2006, the State Water Board adopted Statewide General Waste Discharge Requirements For Sanitary Sewer Systems General Order No. 2006-0003-DWQ (General Order). The General Order requires all public agencies that own or operate sanitary sewer systems greater than one mile in length to comply with the Order. The Discharger’s collection system exceeds one mile in length, therefore the General Order is applicable.

66. The United States Environmental Protection Agency (EPA) has promulgated biosolids reuse regulations in 40 CFR 503, *Standard for the Use or Disposal of Sewage Sludge,* which establishes management criteria for protection of ground and surface waters, sets application rates for heavy metals, and establishes stabilization and disinfection criteria.

67. The Regional Water Board is using the Standards in 40 CFR 503 as guidelines in establishing this Order, but the Regional Water Board is not the implementing agency for 40 CFR 503 regulations. The Discharger may have separate and/or additional compliance,

reporting, and permitting responsibilities to the EPA. All biosolids will be hauled to a separate permitted facility.

68. The State Water Board adopted Order No. 97-03-DWQ (General Permit No. CAS000001) specifying waste discharge requirements for discharges of stormwater associated with industrial activities, and requiring submittal of a Notice of Intent by all affected industrial dischargers. This Order requires the Discharger to obtain coverage under the General Permit.

69. A mitigated negative declaration was adopted by the Lockeford Community Services District on 27 July 2006. The mitigated negative declaration was adopted in accordance with the California Environmental Quality Act (CCR, Title 14, Section 15261 et. seq.). The proposed wastewater treatment and disposal system is consistent with the project as analyzed when mitigation measures are implemented. Potentially significant impacts were identified in the Initial Study and Mitigated Negative Declaration. The potentially significant impacts consisted of:

    a. Objectionable odors that might be generated by the wastewater system. Maintaining adequate treatment and complying with the WDRs will reduce this potential impact to less than significant.

    b. Degradation of surface water and groundwater quality by wastewater application. This Order protects surface waters by prohibiting the discharge of tailwater from the LAAs, and controlling recycled water application rates should prevent groundwater degradation. The controls should reduce the potential impact to less than significant.

    The Regional Water Board finds that this Order contains requirements that, if complied with, implement the mitigation measures related to wastewater issues and will reasonably protect the beneficial uses of waters of the state and prevent nuisance.

70. Section 13267(b) of the CWC provides that: “In conducting an investigation specified in subdivision (a), the regional board may require that any person who has discharged, discharges, or is suspected of discharging, or who proposes to discharge within its region, or any citizen or domiciliary, or political agency or entity of this state who has discharged, discharges, or is suspected of discharging, or who proposes to discharge waste outside of its region that could affect the quality of the waters of the state within its region shall furnish, under penalty of perjury, technical or monitoring program reports which the board requires. The burden, including costs of these reports, shall bear a reasonable relationship to the need for the reports and the benefits to be obtained from the reports. In requiring those reports, the regional board shall provide the person with a written explanation with regard to the need for the reports, and shall identify the evidence that supports requiring that person to provide the reports.”

The attached Monitoring and Reporting Program No. R5-2007-0179 is necessary to assure compliance with these waste discharge requirements. The Discharger owns and operates the facility that discharges the waste subject to this Order.

71. The California Department of Water Resources sets standards for the construction and destruction of groundwater wells (hereafter DWR Well Standards), as described in *California Well Standards Bulletin 74-90* (June 1991) and *Water Well Standards: State of California Bulletin 94-81* (December 1981). These standards, and any more stringent standards adopted by the state or county pursuant to CWC Section 13801, apply to all monitoring wells used to monitor the impacts of wastewater storage or disposal governed by this Order. Those wells that do not have a construction log, boring log, or County permit may not be used for monitoring associated with this Order.

72. State regulations that prescribe procedures for detecting and characterizing the impact of waste constituents from waste management units on groundwater are found in Title 27 CCR Section 20380. While the WWTF is exempt from Title 27, the data analysis methods of Title 27 may be appropriate for determining whether the discharge complies with the terms for protection of groundwater specified in this Order.

73. The discharge authorized herein and the treatment and storage facilities associated with the discharge, except for discharges of residual sludge and solid waste, are exempt from the requirements of Title 27, CCR, Section 20380 et seq.. The exemption, pursuant to Title 27 CCR Section 20090(a), is based on the following

    a. The waste consists primarily of domestic sewage and treated effluent;

    b. The waste discharge requirements are consistent with water quality objectives; and

    c. The treatment and storage facilities described herein are associated with a municipal wastewater treatment facility.

74. Pursuant to CWC Section 13263(g), discharge is a privilege, not a right, and adoption of this Order does not create a vested right to continue the discharge.

Public Notice

75. The recommendations of the State Department of Public Health regarding the public health aspects of water recycling have been considered in preparation of this Order.

76. All the above and the supplemental information and details in the attached Information Sheet, which is incorporated by reference herein, as well as the Regional Water Board's administrative record, were considered in establishing the following conditions of discharge.

77. The Discharger and interested agencies and persons have been notified of the Regional Water Board's intent to prescribe waste discharge requirements for this discharge, and they have been provided an opportunity to submit written comments and an opportunity for a public hearing.

78. All comments pertaining to the discharge were heard and considered in a public hearing.

IT IS HEREBY ORDERED that Orders No. 90-312 and 90-313 are rescinded, and that pursuant to Sections 13263 and 13267 of the California Water Code, Lockeford Community Services District, their agents, successors, and assigns, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted hereunder, shall comply with the following:

[Note: Other prohibitions, conditions, definitions, and some methods of determining compliance are contained in the attached "Standard Provisions and Reporting Requirements for Waste Discharge Requirements" dated 1 March 1991.]

A. Discharge Prohibitions

1. Discharge of wastes to surface waters or surface water drainage courses is prohibited.

2. Bypass or overflow of untreated or partially treated waste is prohibited.

3. Discharge of sewage from a sanitary sewer system at any point upstream of a wastewater treatment facility is prohibited. Discharge of treated recycled water downstream of the wastewater treatment facility, other than at the designated storage ponds or land application areas, is prohibited.

4. Discharge of waste classified as “hazardous” under Title 23 CCR Chapter 15, Section 2521, or “designated,” as defined in Section 13173 of CWC is prohibited.

5. Application of recycled water in a manner or location other than that described herein is prohibited.

6. The use of recycled water for purposes other than irrigation as defined in Title 22 CCR Section 60304(a) and this Order is prohibited.

B. Discharge Specifications

1. The monthly average flow rate may not exceed 300,000 gpd. Upon approval of the *Recycled Water Expansion Report* (RWER) by the Executive Officer, the monthly average flow rate may be increased to a maximum of 400,000 gpd.

2. The Discharger shall not take Pond No. 1 out of service without first submitting the report required by Provision No. G.1.h, and receiving written approval from the Executive Officer.

3. Only disinfected water may be applied to LAA No. 1 and Pond No. 5. Only disinfected water shall be applied to LAA No. 2.

4. Wastewater treatment and use of recycled water shall not cause pollution or a nuisance as defined by Section 13050 of the CWC.

5. Public contact with wastewater and recycled water shall be precluded or controlled through such means as fences, signs, or acceptable alternatives.

6. No waste constituent shall be released or discharged, or placed where it will be released or discharged, in a concentration or in a mass that causes violation of the Groundwater Limitations.

7. Objectionable odors originating at the facility shall not be perceivable beyond the limits of the property owned by the Discharger.

8. As a means of discerning compliance with Discharge Specification B.7, the dissolved oxygen content in the upper one foot of any wastewater treatment or storage pond shall not be less than 1.0 mg/L.

9. The Discharger shall operate all systems and equipment to maximize treatment of wastewater and optimize the quality of the discharge.

10. Effective with the approval of the RWER, the Discharger shall treat the wastewater such that it complies with Title 22 CCR, Section 60301.225 (“Disinfected Secondary-23 Recycled Water”).

11. All treatment and storage facilities shall be designed, constructed, operated, and maintained to prevent inundation or washout due to floods with a 100-year return frequency.

12. Wastewater and recycled water ponds shall be managed to prevent breeding of mosquitoes. In particular,

    a. An erosion control program shall be implemented to ensure that small coves and irregularities are not created around the perimeter of the water surface.

    b. Weeds shall be minimized through control of water depth, harvesting, or herbicides.

    c. Dead algae, vegetation, and debris shall not accumulate on the water surface.

13. The facility shall have sufficient treatment, storage, and disposal capacity to accommodate allowable wastewater flow, design seasonal precipitation, and ancillary inflow and infiltration. Design seasonal precipitation shall be based on total annual precipitation using a return period of 100 years, distributed monthly in accordance with historical rainfall patterns.

14. Freeboard in any pond containing wastewater or recycled water shall never be less than two feet as measured from the water surface to the lowest point of overflow.

15. On or about **15 October** of each year, available pond storage capacity shall at least equal the volume necessary to comply with Discharge Specifications B.13 and B.14.

16. The application of recycled water to land application areas by spray irrigation is prohibited.

17. All recycled water conveyance and distribution piping and equipment shall comply with California Department of Public Health requirements and the American Water Works Association (AWWA) *Guidelines for Distribution of Non-Potable Water* and *Guidelines for the On-site Retrofit of Facilities Using Disinfected Tertiary Recycled Water*.

18. A use supervisor shall be appointed by the Discharger. The use supervisor shall be responsible for installation, operation, and maintenance of the recycled water system, prevention of potential hazards, implementing these requirements, and coordination with the cross-connection control program of the water purveyor or the San Joaquin County Environmental Health Department.

C. Effluent Limitations

1. Effective immediately, effluent discharged from the treatment pond (Pond No. 1 or alternative treatment pond) shall not exceed the following limits:

Constituent	Units	Monthly Average
BOD_5	mg/L	40
Total Nitrogen	mg/L	10
TDS	mg/L	550

BOD_5 denotes 5-day Biochemical Oxygen Demand. Total N denotes Total Nitrogen. TDS denotes Total Dissolved Solids.

2. Effluent discharged from the Treatment Area to Pond No. 5, Pond No. 6 (future), or directly to LAA No. 1 or 2 shall not exceed the following limits for total coliform organisms:

   a. The median concentration of total coliform bacteria measured in the disinfected effluent shall not exceed a most probable number (MPN) of 23 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed

   b. The number of total coliform bacteria shall not exceed an MPN of 240 per 100 milliliters in more than one sample in any 30-day period.

3. No stored wastewater or recycled water shall have a pH less than 6.5 or greater than 10.0.

D. General Solids Disposal Specifications

1. Sludge means the solid, semisolid, and liquid residues removed during primary, secondary, or advanced wastewater treatment processes. Solid waste refers to grit and screenings generated during preliminary treatment. Residual sludge means sludge that will not be subject to further treatment at the facility. Biosolids refers to sludge that has undergone sufficient treatment and testing to qualify for reuse pursuant to federal and state regulations as a soil amendment for agriculture, silviculture, horticulture, and land recycling.

2. Sludge and solid waste shall be removed from screens, sumps, and ponds as needed to ensure optimal plant operation.

3. Treatment and storage of sludge shall be confined to the treatment facility property, and shall be conducted in a manner that precludes infiltration of waste constituents into soils in a mass or at concentrations that will violate the Groundwater Limitations of this Order.

4. Any storage of residual sludge, solid waste, and biosolids at the facility shall be temporary, and the waste shall be controlled and contained in a manner that minimizes leachate formation and precludes infiltration of waste constituents into soils in a mass or at concentrations that will violate the Groundwater Limitations of this Order.

5. Residual sludge, biosolids, and solid waste shall be disposed of in a manner approved by the Executive Officer and consistent with Title 27 CCR Division 2. Removal for further treatment, disposal, or reuse at disposal sites operated in accordance with valid waste discharge requirements issued by a regional water quality control board will satisfy this specification.

6. Use and disposal of biosolids shall comply with the self-implementing Federal regulations of 40 CFR 503, which are subject to enforcement by the U.S. EPA, not the Regional Water Board. If during the life of this Order, the state accepts primacy for implementation of 40 CFR 503, the Regional Water Board may also initiate enforcement where appropriate.

E. Water Recycling Specifications

1. Application of recycled water shall be confined to the designated application areas as defined in this Order.

2. Recycled water shall be used in compliance with Title 22, Division 4, Chapter 3, Article 3, *Uses of Recycled Water.*

3. Public contact with recycled water shall be controlled through use of fences, signs, and/or other appropriate means. All use areas where recycled water is used that are accessible to the public shall be posted with signs that are visible to the public, in a size no less than 4 inches by 8 inches and include the following wording, “Recycled Water – Do Not Drink.” The size and content of these signs shall be as described in Section 60310(g) of Title 22.

4. Recycled water controllers, valves, and similar appurtenances shall be affixed with recycled water warning signs, and shall be equipped with removable handles or locking mechanisms to prevent public access or tampering. Quick couplers, if used, shall be of a type, or secured in a manner, that permits operation only by authorized personnel. Hose bibs shall not be used.

5. Application of recycled water shall comply with the following setback requirements:

Setback Definition	Minimum Setback (feet)
Edge of land application area to domestic well	100
Wastewater/Recycled water storage pond to domestic well	100
Spray irrigation to residence or exposure similar to park, playground, or school yard.	100
Impoundment of undisinfected secondary wastewater to domestic well	150
Land Application Area to Surface Water[1]	50

1. Excluding ditches used exclusively for tailwater return from the land application area.

The setbacks may be modified by written approval of the Executive Officer if they are described in the Title 22 Engineering Report, are approved by the California Department of Public Health, legal agreements are executed and recorded at the County Recorder's Office, the documents are provided to the Regional Water Board, and the Discharger shows that water quality will still be protected with smaller setbacks.

6. Any use of recycled water shall comply with the following:

   a. Any irrigation runoff shall be confined to the recycled water use area, unless the runoff does not pose a public health threat and is authorized by the regulatory agency.

   b. Spray, mist, or runoff shall not enter dwellings, designated outdoor eating areas, or food handling facilities.

   c. Drinking water fountains shall be protected against contact with recycled water spray, mist, or runoff.

7. Any connection between the recycled water conveyance system and any potable water conveyance system, groundwater supply well, or surface water supply source for the purpose of supplementing recycled water shall be equipped with a CDPH-approved backflow prevention device.

8. Application rates for recycled water shall not exceed nitrogen and water uptake rates considering the plant, soil, climate, and irrigation management system in accordance with the water balance submitted with the RWD.

9. Irrigation runoff (i.e., tailwater) shall be completely contained within the designated land application area and shall not enter any surface water drainage course or stormwater drainage system.

10. Sprinkler heads shall be of the type approved for recycled water and shall create a minimum amount of mist. Drainage through sprinkler heads is prohibited.

11. Irrigation of land application areas with recycled water shall not be performed within 24 hours of a forecasted storm, during or within 24 hours after any precipitation event, nor when the ground is saturated.

12. Wastewater shall not be applied to LAA No. 1 (or any other land application area) until the disinfection system is operable and all applied wastewater complies with Effluent Limitation C.2.

13. Land application areas shall be managed to prevent breeding of mosquitoes. In particular:
    a. There shall be no standing water 48 hours after application of recycled water;
    b. Tailwater ditches must be maintained essentially free of emergent, marginal, or floating vegetation, and;
    c. Low-pressure and unpressurized pipelines and ditches accessible to mosquitoes shall not be used to store recycled water.

F. Groundwater Limitations

1. Release of waste constituents from any portion of the WWTF and land application areas shall not cause groundwater to:

    a. Contain any of the following constituents in concentrations greater than listed or greater than natural background quality, whichever is greater. Note that natural background conditions have not yet been established for the land application areas.

Constituent	Units	Limitation
Boron	mg/L	0.7
Chloride	mg/L	106
Iron	mg/L	0.3
Manganese	mg/L	0.05
Sodium	mg/L	69
Total Coliform Organisms	MPN/100 mL	<2.2
Total Dissolved Solids	mg/L	450 [1]

Constituent	Units	Limitation
Total Nitrogen	mg/L	10
Nitrate (as N)	mg/L	10
Ammonia (as NH_4)	mg/L	1.5
Bromoform	μg/L	4
Bromodichloromethane	μg/L	0.27
Chloroform	μg/L	1.1
Dibromochloromethane	μg/L	0.37

[1] A cumulative impact limit that accounts for several dissolved constituents in addition to those listed here separately [e.g., alkalinity (carbonate and bicarbonate), calcium, hardness, phosphate, and potassium].

2. Exhibit a pH of less than 6.5 or greater than 8.4 pH units.

3. Impart taste, odor, toxicity, or color that creates nuisance or impairs any beneficial use.

G. Provisions

1. All of the following reports shall be submitted pursuant to Section 13267 of the California Water Code and shall be prepared as described in Provision G.3.

   a. By **5 February 2008**, the Discharger shall either apply for coverage or submit a Notice of Non Applicability for Order No. 97-03-DWQ, Discharges of Stormwater Associated With Industrial Activities.

   b. Regardless of the status of any RWER submittal, by **6 March 2008**, documentation of the completed ownership transfer of LAA No. 2 to Lockeford CSD shall be submitted to the Regional Water Board.

   c. By **5 May 2008**, the Discharger shall submit a report describing installation of alarms at all wastewater pumping stations.

   d. By **6 March 2008**, the Discharger shall submit a *Groundwater Monitoring Workplan and Well Construction Evaluation* prepared in accordance with, and including the items listed in, the first section of Attachment D: *"Requirements for Monitoring Well Installation Workplans and Monitoring Well Installation Reports."* The workplan shall describe installation of groundwater monitoring wells at Ponds No. 5 and (future) Pond 6. The wells shall be designed to ensure that background water quality is adequately characterized and any potential water quality impacts from the discharges are detected. The system shall be designed to yield samples representative of the uppermost portion of the first aquifer underlying the site (anticipated to be the perched zone).

The Well Construction Evaluation portion of the report shall include an evaluation of Wells TPMW-1, 2, 3, and 4. The evaluation shall present and analyze the well construction details, groundwater elevations, chemical constituent concentrations, and determine the need for further investigation, well modification, or replacement. If it is determined that a well could be acting as a vertical conduit for waste constituents to migrate to lower intervals, those wells shall be properly destroyed and replaced as needed.

e. By **7 April 2008**, the Discharger shall submit an *Operation and Maintenance Plan* (O&M Plan) for the WWTF. A copy of the O&M Plan shall be kept at the facility for reference by operating personnel. Key personnel shall be familiar with its contents. The O&M Plan shall provide the following:

  i. Operation and Control of Wastewater Treatment - A description of the wastewater treatment equipment; operational controls; treatment requirements/effluent limitations; flow diagrams including valve/gate locations; operation of the treatment systems during start-up, normal operation, by-pass, shut-down, and draining procedures; potential operational problems including a troubleshooting guide.

  ii. Sludge Handling - A description of the biosolids handling equipment, operational controls, control tests and observations related to process control, potential operational problems including a troubleshooting guide, and disposal procedures.

  iii. Operation and Control of Recycled Water Distribution System – A description of the recycled water distribution system, operational controls, flow diagrams including valve/gate locations; potential operational problems including a troubleshooting guide and backflow and cross-connection controls.

  iv. Personnel - Recommended staffing requirements, staff qualifications, training requirements and schedule, and operator certification requirements.

  v. Maintenance – Maintenance procedures, equipment record system, scheduling and use of the maintenance record system, inventory system, special tools, warranty provisions and expiration dates, maintenance cost and budgeting system, maintenance schedule of all equipment.

  vi. Emergency Response – A description of the vulnerability analysis including emergencies such as power outage, severe weather, or flooding. An equipment and telephone list for emergency personnel and equipment vendors. Coordination procedures with fire, police, and health department personnel, and an emergency operating plan.

  vii. Safety – A general discussion of the hazards of collection systems, mechanical equipment, explosion, pathogens, oxygen deficiencies, chemical and electrical hazards, etc.

viii. Appendices – Shall include flow diagrams, valve/gate locations, copy of WDRs, miscellaneous form samples, manufacturers manuals, and a list of reference materials.

f. By **4 June 2008**, the Discharger shall submit a *Monitoring Well Installation/ Destruction Report* prepared in accordance with, and including the items listed in, the second section of Attachment D. The report shall describe the installation or destruction of any wells, describe well development, and explain any deviation from the approved workplan.

g. By **30 September 2008,** the Discharger shall submit a *Disposal Improvement Project Report of Results* demonstrating that the work described in Finding No. 14 has been completed in compliance with the specifications of this Order.

h. By **31 August 2010**, the Discharger shall submit a *Background Groundwater Quality Study Report*. For each groundwater monitoring parameter/constituent identified in the MRP, the report shall present a summary of monitoring data and calculation of the concentration in background monitoring wells. Determination of background quality shall be made using the methods described in Title 27 CCR, Section 20415(e)(10), and shall be based on data from at least eight consecutive quarterly (or more frequent) groundwater monitoring events. For each monitoring parameter/constituent, the report shall compare the calculated background concentration with the interim numeric limitations set forth in Groundwater Limitation F.1.a. Where background concentrations are statistically greater than the interim limitations specified in Groundwater Limitation F.1.a, the report shall recommend final groundwater limitations which comply with Resolution 68-16 for the waste constituents listed therein. Subsequent use of a concentration as a final groundwater limitation will be subject to the discretion of the Executive Officer.

i. **At least 60 days** before the Discharger wishes to take Pond No. 1 out of service so that sludge may be removed, the Discharger shall submit a report showing that Pond No. 6 has been constructed to provide 52 acre-feet (17 million gallons) of storage, and that at least one of Ponds No. 2, 3, or 4 has been converted to a treatment pond. The report shall also document how the Discharger proposes to remove, dry, store, and dispose of sludge in a manner consistent with this Order.

j. **At least 90 days** before the Discharger wishes to increase the wastewater flow rate, the Discharger shall submit a *Recycled Water Expansion Report* that shall contain the following:

   i. At least two groundwater well sampling events at wells installed at the new land application areas and/or recycled water storage ponds. It is the Discharger's responsibility to submit, as needed, the *Groundwater Monitoring Workplan* and the *Monitoring Well Installation Report* in accordance with a schedule that allows the sample event data to be included in the *Recycled Water Expansion Report*.

ii. A copy of the executed *Agreement of Use Restriction and Grant of Easement* and documentation of recording at the San Joaquin County Recorder's Office. If the easement could not be executed or recorded, provide an updated water balance for the reduced land area.

iii. Documentation that notification signs are installed as required by Water Recycling Specification E.3.

iv. Documentation of the property ownership transfer of LAA No. 2 to the Lockeford CSD.

v. Documentation of Pond No. 5 storage capacity increase. The increase must provide at least 11 million gallons of additional storage, resulting in at least 51 million gallons of storage provided by Pond No. 5.

vi. Documentation of improvements to the LAAs to allow wastewater application as described in the Water Recycling Specifications.

vii. Documentation that the wastewater disinfection system is operational, has been tested, and complies with Effluent Limitation C.2.

viii. Updates to the Operation and Maintenance Plan.

2. If groundwater monitoring results show that the discharge of waste is causing groundwater to contain waste constituents in concentrations statistically greater than background water quality then, within **120 days** of the request of the Executive Officer, the Discharger shall submit a *BPTC Evaluation Workplan* that sets forth the scope and schedule for a systematic and comprehensive technical evaluation of each component of the facility's waste treatment and disposal system to determine best practicable treatment and control for each waste constituent listed in the Groundwater Limitation F.1.a of this Order. The workplan shall contain a preliminary evaluation of each component of the WWTF and effluent disposal system and propose a time schedule for completing the comprehensive technical evaluation. The schedule to complete the evaluation shall be as short as practicable, and shall not exceed one year.

3. In accordance with California Business and Professions Code Sections 6735, 7835, and 7835.1, engineering and geologic evaluations and judgments shall be performed by or under the direction of registered professionals competent and proficient in the fields pertinent to the required activities. All technical reports specified herein that contain workplans for investigations and studies, that describe the conduct of investigations and studies, or that contain technical conclusions and recommendations concerning engineering and geology shall be prepared by or under the direction of appropriately qualified professional(s), even if not explicitly stated. Each technical report submitted by the Discharger shall bear the professional's signature and stamp.

4. The Discharger shall comply with Monitoring and Reporting Program No. R5-2007-0179, which is part of this Order, and any revisions thereto as ordered by the Executive Officer.

5. The Discharger shall comply with the "Standard Provisions and Reporting Requirements for Waste Discharge Requirements," dated 1 March 1991, which are attached hereto and made part of this Order by reference. This attachment and its individual paragraphs are commonly referenced as "Standard Provision(s)."

6. The Discharger shall use the best practicable cost-effective control technique(s) including proper operation and maintenance, to comply with discharge limits specified in this order.

7. The Discharger shall provide certified wastewater treatment facility operators in accordance with Title 23 CCR, Division 3, Chapter 26.

8. As described in the Standard Provisions, the Discharger shall report promptly to the Regional Water Board any material change or proposed change in the character, location, or volume of the discharge.

9. Upon the reduction, loss, or failure of the sanitary sewer system resulting in a sanitary sewer overflow, the Discharger shall take any necessary remedial action to (a) control or limit the volume of sewage discharged, (b) terminate the sewage discharge as rapidly as possible, and (c) recover as much as possible of the sewage discharged (including wash down water) for proper disposal. The Discharger shall implement all applicable remedial actions including, but not limited to, the following:

   a. Interception and rerouting of sewage flows around the sewage line failure.

   b. Vacuum truck recovery of sanitary sewer overflows and wash down water.

   c. Use of portable aerators where complete recovery of the sanitary sewer overflows are not practicable and where severe oxygen depletion is expected in surface waters.

   d. Cleanup of sewage-related debris at the overflow site.

10. The Discharger shall report to the Regional Water Board any toxic chemical release data it reports to the State Emergency Response Commission within 15 days of reporting the data to the Commission pursuant to section 313 of the "Emergency Planning and Community Right to Know Act of 1986."

11. The Discharger shall not allow pollutant-free wastewater to be discharged into the wastewater collection, treatment, and disposal system in amounts that significantly diminish the system's capability to comply with this Order. Pollutant-free wastewater means rainfall, groundwater, cooling waters, and condensates that are essentially free of pollutants.

12. The Discharger shall submit to the Regional Water Board on or before each compliance report due date, the specified document or, if appropriate, a written report detailing compliance or noncompliance with the specific schedule date and task. If noncompliance is being reported, then the Discharge shall state the reasons for such noncompliance and provide an estimate of the date when the Discharger will be in compliance. The Discharger shall notify the Regional Water Board in writing when it returns to compliance with the time schedule.

13. In the event of any change in control or ownership of the facility or wastewater disposal areas, the Discharger must notify the succeeding owner or operator of the existence of this Order by letter, a copy of which shall be immediately forwarded to this office. To assume operation as Discharger under this Order, the succeeding owner or operator must apply in writing to the Executive Officer requesting transfer of the Order. The request must contain the requesting entity's full legal name, the state of incorporation if a corporation, the name and address and telephone number of the persons responsible for contact with the Regional Water Board, and a statement. The statement shall comply with the signatory paragraph of Standard Provision B.3 and state that the new owner or operator assumes full responsibility for compliance with this Order. Failure to submit the request shall be considered a discharge without requirements, a violation of the California Water Code. Transfer shall be approved or disapproved by the Executive Officer.

14. At least **90 days** prior to termination or expiration of any lease, contract, or agreement involving disposal or recycling areas or off-site reuse of effluent, used to justify the capacity authorized herein and assure compliance with this Order, the Discharger shall notify the Regional Water Board in writing of the situation and of what measures have been taken or are being taken to assure full compliance with this Order.

15. The Discharger must comply with all conditions of this Order, including timely submittal of technical and monitoring reports as directed by the Executive Officer. Violations may result in enforcement action, including Regional Water Board or court orders requiring corrective action or imposing civil monetary liability, or in revision or recession of this Order.

16. A copy of this Order shall be kept at the discharge facility for reference by operating personnel. Key operating personnel shall be familiar with its contents.

17. The Regional Water Board will review this Order periodically and will revise requirements when necessary.

I, PAMELA C. CREEDON, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Central Valley Region, on 6 December 2007.

PAMELA C. CREEDON, Executive Officer

TRO/WSW: 12/6/07

REVISED

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

MONITORING AND REPORTING PROGRAM NO. R5-2007-0179

FOR

LOCKEFORD COMMUNITY SERVICES DISTRICT
WASTEWATER TREATMENT FACILITY
SAN JOAQUIN COUNTY

This Monitoring and Reporting Program (MRP) describes requirements for monitoring influent wastewater, treated effluent, treatment/storage/recycled water ponds, land application areas, groundwater, and water supply. This MRP is issued pursuant to Water Code Section 13267. The Discharger shall not implement any changes to this MRP unless and until a revised MRP is issued by the Executive Officer. Regional Board staff shall approve specific sample station locations prior to implementation of sampling activities.

This MRP is effective upon date of signature; however, portions of the MRP will not be relevant until the Wastewater Treatment Facility (WWTF) is expanded and is in use. In the meantime, the Discharger shall submit the monitoring data that is possible to collect, monthly construction status reports, and quarterly groundwater monitoring reports as described in the "Reporting" section of this MRP.

All samples shall be representative of the volume and nature of the discharge or matrix of material sampled. The time, date, and location of each grab sample shall be recorded on the sample chain of custody form. Field test instruments (such as those used to measure pH and dissolved oxygen) may be used provided that:

1. The operator is trained in proper use and maintenance of the instruments;
2. The instruments are calibrated prior to each monitoring event;
3. The instruments are serviced and/or calibrated by the manufacturer at the recommended frequency; and
4. Field calibration reports are submitted as described in the "Reporting" section of the MRP.

INFLUENT MONITORING

Influent flow monitoring shall be performed at the headworks. Influent monitoring shall include the following:

Constituent	Units	Type of Sample	Sampling Frequency	Reporting Frequency
Flow[1]	gpd	Continuous Meter	Daily	Monthly
Average Daily Flow[2]	gpd	Calculated	Monthly	Monthly
BOD_5[3]	mg/L	Grab	Monthly	Monthly

1 Flow represents the daily flow rate.
2 Average Daily Flow represents the daily flow rate averaged over the month.
3 BOD denotes 5-day Biochemical Oxygen Demand.

EFFLUENT MONITORING

Effluent samples shall be collected immediately downstream of the treatment pond, and prior to discharge to any storage pond or LAA. Samples shall be collected for total coliform analysis and trihalomethanes immediately downstream of the disinfection equipment. All samples shall be representative of the volume and nature of the discharge. Effluent monitoring shall include the following:

Constituent	Units	Type of Sample	Sampling Frequency	Reporting Frequency
BOD_5	mg/L	Grab/Composite[1]	Weekly	Monthly
Total Coliform Organisms [2]	MPN/100 ml [3]	Grab	Daily [4]	Monthly
Total Dissolved Solids	mg/L	Grab/Composite[1]	Monthly	Monthly
Fixed Dissolved Solids	mg/L	Grab/Composite[1]	Monthly	Monthly
Sodium	mg/L	Grab/Composite[1]	Monthly	Monthly
Chloride	mg/L	Grab/Composite[1]	Monthly	Monthly
Nitrate as Nitrogen	mg/L	Grab/Composite[1]	Monthly	Monthly
Total Kjeldahl Nitrogen	mg/L	Grab/Composite[1]	Monthly	Monthly
Total Nitrogen (as N)	mg/L	Grab/Composite[1]	Monthly	Monthly
Standard Minerals [5]	mg/L	Grab/Composite[1]	Annually	Annually
Trihalomethanes [6]	ug/L	Grab/Composite[1]	Annually	Annually

1. Grab/Composite indicates samples may be collected by composite sampler or grab method.
2. Using a minimum of 15 tubes or 3 dilutions.
3. Most probable number per 100 ml.
4. Coliform sampling is required whenever treated effluent is discharged to LAA Nos. 1 or 2, Pond No. 5, or Pond No. 6 (upon construction).
5. Standard Minerals shall include, at a minimum, the following elements/compounds: boron, calcium, magnesium, potassium, sulfate, iron, manganese, total alkalinity (including alkalinity series), and hardness.
6. Individual trihalomethane constituent concentrations shall be identified, using EPA Method 8260B or equivalent.

TREATMENT/STORAGE/RECYCLED WATER POND MONITORING

Each treatment and recycled water storage pond shall be monitored as specified below:

Constituent	Units	Type of Sample	Sampling Frequency	Reporting Frequency
Dissolved Oxygen [1]	mg/L	Grab	Weekly	Monthly
Freeboard	0.1 feet	Measurement	Weekly	Monthly
pH [1]	Standard	Grab	Weekly	Monthly
Odors	--	Observation	Weekly	Monthly
Total Dissolved Solids	mg/L	Grab	Monthly	Monthly
Fixed Dissolved Solids	mg/L	Grab	Monthly	Monthly
Berm condition	--	Observation	Monthly	Monthly

1 Samples shall be collected at a depth of one foot from each pond in use, opposite the inlet. Samples shall be collected between 0700 and 0900 hours.

LAND APPLICATION AREA MONITORING

Monitoring of each land application area shall be conducted **daily** when irrigation is occurring, and the results shall be included in the monthly monitoring report. All land application areas shall be inspected following an irrigation event to identify any equipment malfunction or other circumstance that might allow recycled water or treated wastewater to runoff the land application area and/or create ponding conditions that violate the Waste Discharge Requirements. Evidence of erosion, saturation, irrigation runoff, or the presence of nuisance conditions shall be noted in the report. A log of these inspections as well as any public complaints of runoff shall be kept at the facility and made available for review upon request.

Effluent monitoring results shall be used in calculations to ascertain loading rates at the land application area. Monitoring of the land application area shall include the following:

Constituent	Units	Type of Sample	Sampling Frequency	Reporting Frequency
Flow	Gallons	Continuous	Daily	Monthly
Rainfall	Inches	Observation	Daily	Monthly
Acreage Applied [1]	Acres	Calculated	Daily	Monthly
Water Application Rate [2]	gal/acre·day	Calculated	Daily	Monthly
Total Nitrogen Loading Rate [2]	lbs/ac•month	Calculated	Monthly	Monthly
Nitrogen from Fertilizer Application	lbs/ac•month	Calculated	Monthly	Monthly
TDS Loading Rate [2]	lbs/ac•month	Calculated	Monthly	Monthly

[1] Land application areas shall be identified and a map identifying all land application areas included.
[2] For each land application area, including other sources of nitrogen including fertilizers.

GROUNDWATER MONITORING

Prior to construction and/or sampling of any groundwater monitoring wells, the Discharger shall submit plans and specifications to the Board for review and approval. All wells identified in the groundwater monitoring well network in the Findings of this Order, as well as any wells installed after adoption of this Order, shall be sampled and analyzed according to the schedule below.

Prior to sampling, the groundwater elevations shall be measured and the wells shall be purged of at least three well volumes until temperature, pH, and electrical conductivity have stabilized. Depth to groundwater shall be measured to the nearest 0.01 feet. Samples shall be collected using standard EPA methods. Groundwater monitoring shall include, at a minimum, the following:

Constituent	Units	Type of Sample	Sampling and Reporting Frequency
Depth to Groundwater	0.01 feet	Measurement	Quarterly
Groundwater Elevation [1]	0.01 feet	Calculated	Quarterly
Gradient	feet/feet	Calculated	Quarterly
Gradient Direction	Degrees	Calculated	Quarterly
Total Dissolved Solids	mg/L	Grab	Quarterly
Fixed Dissolved Solids	mg/L	Grab	Quarterly
Nitrate as Nitrogen	mg/L	Grab	Quarterly
Total Kjeldahl Nitrogen	mg/L	Grab	Quarterly
pH	pH units	Grab	Quarterly
Trihalomethanes [2,3]	μg/l	Grab	Quarterly
Boron	mg/L	Grab	Quarterly
Chloride	mg/L	Grab	Quarterly
Iron	mg/L	Grab	Quarterly
Manganese	mg/L	Grab	Quarterly
Sodium	mg/L	Grab	Quarterly
Total Coliform Organisms	MPN/100 mL	Grab	Quarterly
Standard Minerals [4]	mg/L	Grab	Annually
Metals [5]	ug/L	Grab	Annually

1 Groundwater elevation shall be determined based on depth-to-water measurements using a surveyed measuring point elevation on the well and a surveyed reference elevation.

2 Individual trihalomethane constituent concentrations shall be identified, using EPA Method 8260B or equivalent.

3 Trihalomethanes analysis only required in samples collected from wells located in LAA areas.

4 Standard Minerals shall include, at a minimum, the following elements/compounds: calcium, magnesium, potassium, sulfate, total alkalinity (including alkalinity series), and hardness.

5 At a minimum, the following metals shall be included: arsenic, copper, lead, iron, manganese, molybdenum, nickel, and zinc. Analytical methods shall be selected to provide reporting limits below the Water Quality Limit for each constituent.

SLUDGE MONITORING

A composite sample of digested sludge shall be collected at least once per year when sludge is removed from the wastewater treatment system for disposal in accordance with EPA's POTW Sludge Sampling and Analysis Guidance Document, August 1989, and analyzed for cadmium, copper, nickel, chromium, lead, and zinc.

Sampling records shall be retained for a minimum of five years. A log shall be kept of sludge quantities generated and of handling and disposal activities. The frequency of entries is discretionary; however, the log should be complete enough to serve as a basis for part of the annual report.

WATER SUPPLY MONITORING

A sampling station shall be established where a representative sample of the municipal water supply can be obtained. Water supply monitoring shall include at least the following for each water source used during the previous year:

Constituents	Units	Sampling Frequency
Total Dissolved Solids	mg/L	Annually
pH	Std. Unit	Annually
Standard Minerals [1]	mg/L	Annually

[1] Standard Minerals shall include, at a minimum, the following elements/compounds: boron, calcium, magnesium, sodium, potassium, chloride, nitrogen, sulfate, iron, manganese, total alkalinity (including alkalinity series), and hardness.

REPORTING

In reporting monitoring data, the District shall arrange the data in tabular form so that the date, sample type (e.g., effluent, pond, etc.), and reported analytical result for each sample are readily discernible. The data shall be summarized in such a manner to clearly illustrate compliance with waste discharge requirements and spatial or temporal trends, as applicable. The results of any monitoring done more frequently than required at the locations specified in the Monitoring and Reporting Program shall be reported to the Regional Board.

As required by the California Business and Professions Code Sections 6735, 7835, and 7835.1, all Groundwater Monitoring Reports shall be prepared under the direct supervision of a Registered Engineer or Geologist and signed by the registered professional.

A. Monthly Monitoring Reports

Daily, weekly, and monthly monitoring data shall be reported in monthly monitoring reports. Monthly reports shall be submitted to the Regional Board on the **1st day of the second month following sampling** (i.e. the January Report is due by 1 March). At a minimum, the reports shall include:

1. The report shall include the following:
    a. Results of influent; effluent; treatment/storage/recycled water ponds; and land application area monitoring.
    b. A comparison of monitoring data to the discharge specifications and an explanation of any violation of those requirements. Data shall be presented in tabular format;
    c. If requested by staff, copies of laboratory analytical report(s); and

d. A calibration log verifying calibration of all hand-held monitoring instruments and devices used to comply with the prescribed monitoring program.
e. Monthly construction reports that briefly describe WWTF construction activities.

B. Quarterly Monitoring Reports

The Discharger shall establish a quarterly sampling schedule for groundwater monitoring such that samples are obtained approximately every three months. Quarterly monitoring reports shall be submitted to the Board by the **1st day of the second month after the quarter** (i.e. the January-March quarterly report is due by May 1st) and may be combined with the monthly report. The Quarterly Report shall include the following:

1. Results of groundwater monitoring;
2. A narrative description of all preparatory, monitoring, sampling, and analytical testing activities for the groundwater monitoring. The narrative shall be sufficiently detailed to verify compliance with the WDR, this MRP, and the Standard Provisions and Reporting Requirements. The narrative shall be supported by field logs for each well documenting depth to groundwater; parameters measured before, during, and after purging; method of purging; calculation of casing volume; and total volume of water purged;
3. Calculation of groundwater elevations, an assessment of groundwater flow direction and gradient on the date of measurement, comparison of previous flow direction and gradient data, and discussion of seasonal trends if any;
4. A narrative discussion of the analytical results for all groundwater locations monitored including spatial and temporal tends, with reference to summary data tables, graphs, and appended analytical reports (as applicable);
5. A comparison of monitoring data to the groundwater limitations and an explanation of any violation of those requirements;
6. Summary data tables of historical and current water table elevations and analytical results;
7. A scaled map showing relevant structures and features of the facility, the locations of monitoring wells and any other sampling stations, and groundwater elevation contours referenced to mean sea level datum; and
8. Copies of laboratory analytical report(s) for groundwater monitoring.

C. Annual Report

An Annual Report shall be prepared as the fourth quarter monitoring report. The Annual Report will include all monitoring data required in the monthly/quarterly schedule. The Annual Report shall be submitted to the Regional Board by **1 February** each year. In addition to the data normally presented, the Annual Report shall include the following:

1. The contents of the regular groundwater monitoring report for the last sampling event of the year;
2. If requested by staff, tabular and graphical summaries of all data collected during the year;
3. An evaluation of the groundwater quality beneath the wastewater treatment facility, recycled water storage ponds, and land application areas;
4. A discussion of compliance and the corrective actions taken, as well as any planned or proposed actions needed to bring the discharge into full compliance with the waste discharge requirements;
5. A discussion of any data gaps and potential deficiencies/redundancies in the monitoring system or reporting program;
6. A copy of the certification for each certified wastewater treatment plant operator working at the facility and a statement about whether the Discharger is in compliance with Title 23, CCR, Division 3, Chapter 26.
7. Summary of information on the disposal of sludge and/or solid waste;
8. The results from annual monitoring of the groundwater wells and water supply;
9. The results from any sludge monitoring required by the disposal facility;
10. Equipment maintenance and calibration records, as described in Standard Provision No. C.4;
11. A forecast of influent flows, as described in Standard Provision No. E.4;
12. A discussion of whether the treatment plant upgrade project is projected to begin within the next year. Include a specific discussion about (a) whether the wastewater flow rate is expected to exceed 300,000 gpd within 2.5 years, (b) whether the treatment system is unable to perform according to the requirements of the WDRs; and (c) an estimate of the volume of sludge in the treatment pond and its effect on the system's treatment ability.
13. A discussion of the following:
    a. Compliance with any interim effluent performance limits as specified in the Effluent Limitations of the WDRs;
    b. Salinity reduction efforts implemented in accordance with any required workplan;
    c. Other best practical treatment and control measures implemented pursuant to any approved BPTC Workplan (if required by the Executive Officer); and
    d. Based on monitoring data, an evaluation of the BPTC measures that were implemented.

A letter transmitting the self-monitoring reports shall accompany each report. Such a letter shall include a discussion of requirement violations found during the reporting period, and actions taken or planned for correcting noted violations, such as operation or facility modifications. If the Discharger has previously submitted a report describing corrective actions and/or a time schedule for implementing the corrective actions, reference to the previous correspondence will be satisfactory. The transmittal letter shall contain the penalty of perjury statement by the Discharger, or the Discharger's authorized agent, as described in the Standard Provisions General Reporting Requirements Section B.3.

The Discharger shall implement the above monitoring program on the first day of the month following adoption of this Order.

Ordered by: ______________________________
PAMELA C. CREEDON, Executive Officer

6 December 2007
(Date)

TRO: 12/6/07

INFORMATION SHEET

ORDER NO. R5-2007-0179
LOCKEFORD COMMUNITY SERVICES DISTRICT
WASTEWATER TREATMENT FACILITY
SAN JOAQUIN COUNTY

Background

The Lockeford Community Services District (CSD) is planning a Wastewater Treatment Facility (WWTF) expansion that will result in improved treatment, more flexibility in how the WWTF is operated, and lower waste constituent loading rates. The improvements will serve existing and future residential and commercial developments and will be completed in two projects: the Disposal Improvement Project and the Treatment Improvement Project, although some aspects of the Treatment Improvement Project will be performed sooner to improve present treatment.

The Wastewater Treatment Facility (WWTF) includes the wastewater treatment equipment, wastewater collection system, recycled water storage ponds, recycled water delivery system, and land application areas. The Discharger owns all the equipment and land Lockeford CSD is hereafter referred to as “Discharger.”

The facility presently treats approximately 240,000 to 290,000 gallons per day (gpd). Initially, the flow limit in this Order will allow discharge of up to 300,000 gallons per day (gpd) to the existing facility. Upon completion of improvements and submittal of technical documents describing the improvements, the flow limit can be increased through submittal of a *Recycled Water Expansion Report* (RWER), which must be approved by the Executive Officer. This Order will allow the wastewater flow rate to increase to a maximum of 400,000 gpd.

The WWTF is located in three places. The Treatment Area is the location of the headworks, the Treatment Pond (Pond No. 1), and three wastewater storage ponds (Ponds No. 2, 3, and 4). An existing off-site Land Application Area (LAA) (LAA No. 1) is equipped with a storage pond (Pond No. 5). A second off-site land application area (LAA No. 2) is also planned and a storage pond is planned for that location (Pond No. 6), but the pond will not be constructed until the treatment improvements at the Treatment Area are scheduled to begin. Pond No. 5 requires deepening to provide adequate storage for the increased flow rate. None of the ponds are, or are planned to be, equipped with synthetic liners.

Wastewater Treatment

The treatment facility provides biological treatment in an oxidation pond. Present treatment capacity is in excess of 400,000 gpd. However, this Order limits the discharge flow rate to 300,000 gpd, as the wastewater system is limited by the disposal capacity. The Disposal Improvement Project will increase the disposal capacity to 400,000 gpd. To improve operational flexibility and reliability, the Discharger has also developed the Treatment Improvement Project. Each of those projects is described below.

The Disposal Improvement Project will be performed upon adoption of this Order. . The project includes the following: deepening an existing pond to increase storage capacity, installation of groundwater monitoring wells, installation of disinfection equipment, preparing a new LAA for wastewater application, securing a legal covenant regarding land use with an adjacent property owner, and technical report preparation and submittal. The improvements will be described in a Disposal Improvement Project Report.

The Treatment Improvement Project will be performed based on treatment system performance criteria described in the WDRs. The project includes the following: construction of at least 17 million gallons (Mgal) of storage in a new pond located at LAA No. 2, conversion of an existing wastewater storage pond to a two-cell treatment pond, rehabilitation of the existing treatment pond and conversion to a two-cell treatment pond, and addition of two 10-horsepower mechanical aerators in the existing treatment pond. The addition of new aerators in the existing pond will be performed before the rest of the items in the Treatment Improvement Project.

Sludge will be allowed to accumulate in the treatment or storage ponds and will be removed on an as needed basis to maintain pond capacity and treatment effectiveness. There are two pump stations that deliver wastewater to the WWTF. One of the stations is equipped with an alarm, the other is visually inspected daily. This Order requires all new and existing lift stations to be equipped with alarms. Additional pump stations will be added as needed with new developments.

Land Application

The Discharger owns 133 acres of land application areas, but plans to apply wastewater to only 80 acres each year through a LAA rotation that will result in LAAs in use three out of five years. The fallow land will minimize the impact of salinity on groundwater quality. The water balance submitted in the RWD states the storage capacity required is 101 Million gallons (Mgal) (395 ac•ft) and 80-acres of LAA is required for the designed flow rate of 400,000 gallons per day (gpd).

Recycled water will be applied during spring, summer, and fall months, and if conditions allow, application during winter months is acceptable. Recycled water will be applied to cropped LAAs. Recycled water will be applied by flood irrigation but sprinkler irrigation is also acceptable if performed in accordance with the WDRs. Recycled water will be applied at crop uptake rates for both nitrogen and water application with a 47-percent irrigation efficiency. (Indicates 47-percent of wastewater applied is transpired by the crop). Irrigation tailwater will be controlled using perimeter berms, grading the area to prevent off-site drainage, and/or management controls. This Order requires that wastewater be disinfected to secondary standards before application to land. Therefore, stormwater runoff from the land application areas is acceptable if wastewater is not applied at least 24-hours before a precipitation event. The RWD states stormwater will be retained on-site at the land application areas to the extent possible to dilute concentrations of wastewater percolate.

Basin Plan, Beneficial Uses, and Regulatory Considerations

Surface water from the WWTF is to the Mokelumne River between Camanche Reservoir and the Delta. The beneficial uses are agricultural supply; water contact recreation; non-contact water recreation; warm freshwater habitat; cold freshwater habitat; migration of aquatic organisms; spawning, reproduction, and/or early development; and wildlife habitat
The *Water Quality Control Plan for the California Regional Water Quality Control Board Central Valley Region, Fourth Edition* (Basin Plan), designates beneficial uses, establishes water quality objectives, and contains implementation plans and policies for all waters of the Basin. Beneficial uses often determine the water quality objectives that apply to a water body. For example, waters designated as municipal and domestic supply must meet the Maximum Contaminant Levels (MCLs) for drinking waters. The Basin Plan sets forth the applicable beneficial uses (industrial, agricultural, and domestic and municipal supply in this instance) of groundwater, procedure for application of water quality objectives, and the process for and factors to consider in allocating waste assimilation capacity.

Antidegradation

The antidegradation directives of State Water Board Resolution No. 68-16, "Statement of Policy With Respect to Maintaining High Quality Waters in California," or "Antidegradation Policy" require that waters of the State that are better in quality than established water quality objectives be maintained "consistent with the maximum benefit to the people of the State." Waters can be of high quality for some constituents or beneficial uses and not others. Policies and procedures for complying with this directive are set forth in the Basin Plan.

Resolution 68-16 is applied on a case-by-case, constituent-by-constituent basis in determining whether a certain degree of degradation can be justified. It is incumbent upon the Discharger to provide technical information for the Regional Board to evaluate that fully characterizes:

- All waste constituents to be discharged;
- The background water quality of the uppermost layer of the uppermost aquifer;
- The background quality of other waters that may be affected;
- The underlying hydrogeologic conditions;
- Waste treatment and control measures;
- How treatment and control measures are justified as best practicable treatment and control;
- The extent the discharge will impact the quality of each aquifer; and
- The expected degree of degradation below water quality objectives.

In allowing a discharge, the Regional Water Board must comply with CWC Section 13263 in setting appropriate conditions. The Regional Water Board is required, relative to the groundwater that may be affected by the discharge, to implement the Basin Plan and consider the beneficial uses to be protected along with the water quality objectives essential for that purpose. The Regional Board need not authorize the full utilization of the waste assimilation capacity of the groundwater (CWC 13263(b)) and must consider other waste discharges and factors that affect that capacity.

Certain domestic wastewater constituents are not fully amenable to waste treatment and control and it is reasonable to expect some impact on groundwater. Some degradation for certain constituents is consistent with maximum benefit to the people of California because the technology, energy, water recycling, and waste management advantages of municipal utility service to the State far outweigh the environmental impact of a community that would otherwise be reliant on numerous concentrated individual wastewater systems. Economic prosperity of local communities is of maximum benefit to the people of California, and therefore sufficient reason to accommodate wastewater discharge provided terms of reasonable degradation are defined and met. The proposed Order authorizes some degradation consistent with the maximum benefit to the People of the State but does not authorize pollution (i.e., violation of any water quality objective).

Groundwater monitoring has been conducted at the site but the area monitored is large and additional investigation is needed at the off-site storage ponds and land application areas, and possibly at the Treatment Area; therefore staff is unable to establish the most appropriate groundwater limits. In addition, certain aspects of wastewater treatment and control practices may not be justified as representative of Best Practicable Treatment and Control (BPTC). Reasonable time is necessary to gather specific information about the WWTF to make informed, appropriate, long-term decisions. This Order, therefore, establishes interim groundwater limitations to assure protection of the beneficial uses of groundwater of the State pending the completion of certain tasks and provides time schedules to complete specified tasks. During this period, degradation may occur from certain constituents, but can never exceed water quality objectives (or natural background water quality should it exceed objectives) or cause nuisance.

According to the Basin Plan, water quality objectives define the least stringent limits that could apply as water quality limitations for groundwater at this location, except where natural background quality unaffected by the discharge of waste already exceeds the objective. The interim groundwater limits below apply numeric and narrative water quality objectives that must be met to maintain specific beneficial uses of groundwater. The constituents listed are those that are expected to be found in treated domestic wastewater or to be released from the soil upon the application of such waste. The *Policy for Application of Water Quality Objectives* in Chapter IV of the Basin Plan provides a mechanism to apply narrative objectives using relevant and appropriate numeric limits published by other agencies and organizations. Due to the expected high quality of natural background groundwater in the location of the discharge, numeric limits were selected so as to require that conditions of nuisance, adverse tastes and odors, toxicity, or impact to sensitive agricultural uses would not be expected to occur. For the same reason, where incorporated drinking water MCLs are expressed as ranges, limits were selected that represent no impact on the municipal or domestic supply beneficial use. Unless natural background for a constituent proves to be higher, the groundwater quality limit established in proposed Order is the most stringent of the values for the listed constituents. Once the discharger provides information on background water quality and best practicable treatment or control, the groundwater limits may need to be adjusted (see *Reopener* below).

Constituent	Units	Limit	Beneficial Use	Water Quality Objective	Criteria or Justification
Ammonia	mg/L	1.5	MUN [1]	Tastes and Odors	Odor Threshold [2]
Boron	mg/L	0.7	AGR [3]	Chemical Constituents	Protect sensitive crops [4]
	mg/L	1.0	MUN[1]	Toxicity	Calif. Drinking Water Notification Level based on toxicity[11]
Chloride	mg/L	106	AGR [3]	Chemical Constituents	Sensitivity of certain crops irrigated via sprinklers [4]
Chloride (cont.)	mg/L	142	AGR [3]	Chemical Constituents	Chloride sensitivity on certain crops [4]
	mg/L	250	MUN [1]	Chemical Constituents	Recommended Secondary MCL [5]
	mg/L	500	MUN [1]	Chemical Constituents	Upper Secondary MCL [5]
Iron	mg/L	0.3	MUN [1]	Chemical Constituents	Secondary MCL [6]
Manganese	mg/L	0.05	MUN [1]	Chemical Constituents	Secondary MCL [6]
Nitrate plus Nitrite as N	mg/L	10	MUN [1]	Chemical Constituents	Primary MCL [7]
Nitrite as N	mg/L	1	MUN [1]	Chemical Constituents	Primary MCL [7]
Sodium	mg/L	69	AGR [3]	Chemical Constituents	Sensitivity of certain crops [4]
Total Dissolved Solids	mg/L	450[8]	AGR [3]	Chemical Constituents	Crop sensitivity [4]
	mg/L	500	MUN [1]	Chemical Constituents	Recommended Secondary MCL [5]
	mg/L	1,000	MUN [1]	Chemical Constituents	Upper Secondary MCL [5]
Total Coliform Organisms	MPN/100 ml	<2.2	MUN [1]	Bacteria	Basin Plan and non-detect
Trihalomethanes	ug/L	80	MUN [1]	Chemical Constituents	MCL [8]
Bromoform	ug/L	4	MUN [1]	Toxicity	USEPA IRIS Cancer Risk Level [9]
Bromodichloromethane	ug/L	0.27	MUN [1]	Toxicity	Cal/EPA Cancer Potency Factor [12]

Constituent	Units	Limit	Beneficial Use	Water Quality Objective	Criteria or Justification
Chloroform	ug/L	1.1	MUN [1]	Toxicity	Cal/EPA Cancer Potency Factor [12]
Dibromochloromethane	ug/L	0.37	MUN [1]	Toxicity	Cal/EPA Cancer Potency Factor [12]
pH	pH Units	6.5 to 8.5	MUN [1]	Chemical Constituents	Secondary MCL [10]
		6.5 to 8.4	AGR [3]	Chemical Constituents	Protect sensitive crops [4]

1 Municipal and domestic supply
2 J.E. Amoore and E. Hautala, *Odor as an Aid to Chemical Safety: Odor Thresholds Compared with Threshold Limit Values and Volatilities for 214 Industrial Chemicals in Air and Water Dilution*, Journal of Applied Toxicology, Vol. 3, No. 6 (1983).
3 Agricultural supply
4 Ayers, R. S. and D. W. Westcot, Water Quality for Agriculture, Food and Agriculture Organization of the United Nations – Irrigation and Drainage Paper No. 29, Rev. 1, Rome (1985)
5 Title 22, California Code of Regulations (CCR), Section 64449, Table 64449-B which is incorporated by reference into the Basin Plan.
6 Title 22, CCR, Section 64449, Table 64449-A which is incorporated by reference into the Basin Plan.
7 Title 22, CCR, Section 64431, Table 64431-A which is incorporated by reference into the Basin Plan.
8 Title 22, CCR, Section 64439, which applies the narrative objective to fully protect the cited beneficial use.
9 USEPA Integrated Risk Information System, http://www.epa.gov/iris.
10 Title 40, Code of Federal Regulations, Section 143.3, which applies the narrative objective to fully protect the cited beneficial use.
11 California Department of Health Services, Division of Drinking Water and Environmental Management, Drinking Water Notification Levels, http://www.dhs.ca.gov/ps/ddwem.
12 CAL/EPA Toxicity Criteria Database (OEHHA), http://www.oehha.org/risk/ChemicalDB.

Domestic wastewater contains numerous dissolved organic and inorganic constituents that together comprise Total Dissolved Solids (TDS). Each component constituent is not individually critical to any beneficial use. Critical constituents are individually listed. The cumulative impact from the other constituents, along with the cumulative affect of the constituents that are individually listed can be effectively controlled using TDS as a generic indicator parameter. The relevant numerical water quality limit for salinity is 450 mg/L, and is used through Basin Plan procedures to apply the narrative Chemical Constituents water quality objective for the protection of agricultural supply, the beneficial use most sensitive to TDS. This limit assumes no impact on sensitive agricultural uses, consistent with the high quality of expected natural background water quality in the area of the discharge. Most individual salt components can safely be assumed to be proportionately low such that TDS can be an effective indicator parameter in their regulation.

Not all TDS constituents pass through the treatment process and soil profile in the same manner or rate. Chloride tends to pass through both rapidly to groundwater. As chloride concentrations in most groundwaters in the region are much lower than in treated municipal wastewater, chloride is a useful indicator parameter for evaluating the extent to which effluent reaches groundwater. Boron is another TDS constituent that may occur in wastewater in concentrations greater than groundwater depending on the source water and the extent residents use cleaning products containing boron. Other indicator constituents for monitoring for groundwater degradation due to recharged effluent include total coliform bacteria, ammonia and total nitrogen, and Total Trihalomethanes (TTHMs), a by-product of chlorination.

A Groundwater Limitation for chloroform is included in this Order and is based on the Basin Plan Toxicity objective and OEHHA Toxicity Criteria for the protection of human health. The Office of Environmental Health Hazard Assessment (OEHHA) has published and maintains the Toxicity Criteria Database, which contains cancer potency factors for chemicals, including chloroform, that have been used as a basis for regulatory actions by the boards, departments and offices within the California Environmental Protection Agency (Cal/EPA). The cancer potency factor for oral exposure to chloroform in this database is 0.031 milligrams per kilogram body weight per day (mg/kg-day). By applying standard toxicologic assumptions used by OEHHA, USEPA and other environmental agencies in evaluating health risks via drinking water exposure (i.e., 70 kg body weight and 2 liters per day water consumption), this cancer potency factor is equivalent to a concentration in drinking water of 1.1 ug/L (ppb) at the 1-in-a-million cancer risk level. The 1-in-a-million risk level is consistent with that used by the California Department of Public Health (CDPH) to set *de minimis* risks from involuntary exposure to carcinogens in drinking water in the development of drinking water MCLs and Action Levels and by OEHHA to set negligible cancer risks in the development of Public Health Goals for drinking water. The one-in-a-million cancer risk level is also mandated by USEPA in applying human health protective criteria contained in the National Toxics Rule and the California Toxics Rule for priority toxic pollutants in California surface waters.

Similarly, Groundwater Limitations for bromodichloromethane and dibromochloromethane are included in this Order and are based on the Basin Plan Toxicity objective and the Cal/EPA cancer potency factor. Ther Groundwater Limitation for bromoform included in this Order is based on the Basin Plan Toxicity objective and USEPA IRIS cancer risk level for the protection of human health. The U.S. Environmental Protection Agency maintains the Integrated Risk Information System (IRIS), which contains concentrations of constituents in drinking water associated with specified cancer risk levels. The Groundwater Limitations for bromoform, bromodichloromethane, and dibromochloromethane were also based on the 1-in-a-million risk level. Assumptions and rationale for selection of these limitations are identical to those discussed above for chloroform.

Treatment Technology and Control

Given the character of domestic wastewater, secondary treatment technology is generally sufficient to control degradation of groundwater from decomposable organic constituents. Adding disinfection significantly reduces populations of pathogenic organisms, and reasonable soil infiltration rates and unsaturated soils can reduce them further. Neither organics nor total coliform organisms, the indicator parameter for pathogenic organisms, should be found in groundwater in a well-designed, well-operated facility. The bacteria objective in the Basin Plan, cited as a groundwater limitation in the order, is equivalent to requiring that coliform organisms not be detected in groundwater. Because all stormwater will not be prevented from running off the land application areas disinfection of wastewater is required. Chlorine disinfection of effluent causes formation of trihalomethanes, which are toxic priority pollutants. Treatment to reduce these in wastewater generally has not been performed, and little is known at this point on the typical impact on groundwater. Because the Discharger did not disinfect wastewater previously, THMs are unlikely to exist in groundwater at the site. However, the Discharger will begin disinfecting wastewater prior to storage or application at the off-site land application areas. As a result, groundwater monitoring of land application areas includes THMs on the analyte list.

Domestic wastewater typically contains nitrogen in concentrations greater than water quality objectives, which vary according to the form of nitrogen. Groundwater degradation by nitrogen can be controlled by an appropriate secondary treatment system, soil bacteria which naturally remove some nitrogen, and growing crops that are harvested and removed from the land application area. The effectiveness varies, but generally best practicable treatment and control is able to control nitrogen degradation of groundwater at a concentration well below the water quality objectives. The proposed interim limitation reflects water quality objectives.

Dissolved solids can pass through the treatment process and soil profile; effective control of such constituents relies primarily upon source control and pretreatment measures. In the best of circumstances, long-term land discharge of recycled water will degrade groundwater with dissolved solids (as measured by TDS and EC). The proposed Order sets water quality objectives for the interim while site-specific, constituent-specific limits are developed in conjunction with a BPTC evaluation of source control and pretreatment.

Other constituents in domestic wastewater that may pass through the treatment process and the soil profile, include recalcitrant organic compounds, radionuclides, and pharmaceuticals. Hazardous compounds are not usually associated with domestic wastewater and when present are reduced in the discharge to inconsequential concentrations through dilution and treatment. It is inappropriate to allow degradation of groundwater with such constituents, so proposed limits are nondetectable concentrations.

A discharge of recycled water that overloads soils with nutrients and organics can result in anaerobic conditions in the soil profile, which in turn creates organic acids and decreases soil pH. Under conditions of low soil pH (below 5), iron and manganese compounds in the soil can solubilize and leach into groundwater. Overloading the land application areas is preventable. Though iron and manganese limits are set at the water quality objective, groundwater pH is expected to remain the same as background.

Title 27

Title 27, CCR, Section 20005 et seq. (“Title 27”), contains regulations to address certain discharges to land. Title 27 establishes a waste classification system, specifies siting and construction standards for containment of classified waste, requires extensive monitoring of groundwater and the unsaturated zone for any indication of failure of containment, and specifies closure and post-closure maintenance requirements. Generally, no degradation of groundwater quality by any waste constituent is acceptable under Title 27 regulations.

Discharges of domestic sewage and recycled water can be treated and controlled to a degree that will not result in unreasonable degradation of groundwater. For this reason, they have been conditionally exempted from Title 27. Discharges of domestic sewage and treated effluent that are regulated by WDRs and treatment and storage facilities associated with the WWTF are considered exempt from Title 27 under Section 20090(a), provided that the discharges and facilities will not result in a violation of any water quality objective. As the exemption specifically excludes the discharge to land of: 1) solid waste such as grit and screenings that result from treatment of domestic sewage, and 2) residual sludge that will not be further treated at the WWTF, such discharges must comply with provisions of Title 27. The discharge of recycled water and the operation of treatment and/or storage facilities associated with a wastewater treatment plant can be allowed without requiring compliance with Title 27 only if groundwater degradation complies with the Basin Plan, Resolution No. 68-16 (Antidegradation Policy), and does not violate any water quality objectives.

Proposed Order Terms and Conditions

Discharge Prohibitions and Specifications

The Order allows the flow rate to increase based on submittal, and approval by the Executive Officer, of a *Recycled Water Expansion Report* which will document the treatment system capacity, and the availability of land application areas.

The proposed Order's Effluent Limitations for BOD_5, TDS, and total nitrogen are based on reasonable loading limits, odor control, and groundwater quality protection. Historical effluent sampling indicates the Discharger has been able to meet the limits. Effluent TDS concentrations average approximately 505 mg/L; that is an increase over domestic water supply of approximately 218 mg/L, a reasonable increase in salinity based on domestic water use. The discharge specifications regarding dissolved oxygen and freeboard are consistent with Regional Board policy for the prevention of nuisance conditions and overtopping, and are applied to all such facilities.

In order to protect public health and safety, the proposed Order requires the Discharger to comply with the provisions of Title 22 and to implement best management practices with respect to recycled water application (application at reasonable rates considering the crop, soil, and climate).

Monitoring Requirements

Section 13267 of the CWC authorizes the Regional Board to require monitoring and technical reports as necessary to investigate the impact of a waste discharge on waters of the state. In recent years there has been increased emphasis on obtaining all necessary information, assuring the information is timely as well as representative and accurate, and thereby improving accountability of any discharger for meeting the conditions of discharge. Section 13268 of the CWC authorizes assessment of civil administrative liability where appropriate.

The proposed Order includes influent and effluent monitoring requirements, wastewater and storage pond monitoring, land application area monitoring, sludge monitoring, groundwater monitoring, and water supply monitoring. In order to adequately characterize the effluent, the Discharger is required to monitor for BOD, total coliform organisms, TDS, sodium, chloride, nitrogen, pH, and other constituents. Monitoring of additional minerals is required on an annual basis. To ensure that storage ponds do not create nuisance conditions, the Discharger is required to monitor freeboard and dissolved oxygen weekly.

The Title 27 zero leakage protection strategy relies heavily on extensive groundwater monitoring to increase a discharger's awareness of, and accountability for, compliance with the prescriptive and performance standards. With treated wastewater application to land, monitoring takes on even greater importance. The proposed Order includes monitoring of effluent quality, application rates, and groundwater quality.

Title 27 regulations pertaining to groundwater monitoring and the detection and characterization of waste constituents in groundwater have been in effect and successfully implemented for many years. No regulation currently specifies similar criteria more suitable for a situation where extensive land application of recycled water occurs. It is appropriate that the Title 27 groundwater monitoring procedures be extended and applied on a case-by-case basis under Water Code Section 13267.

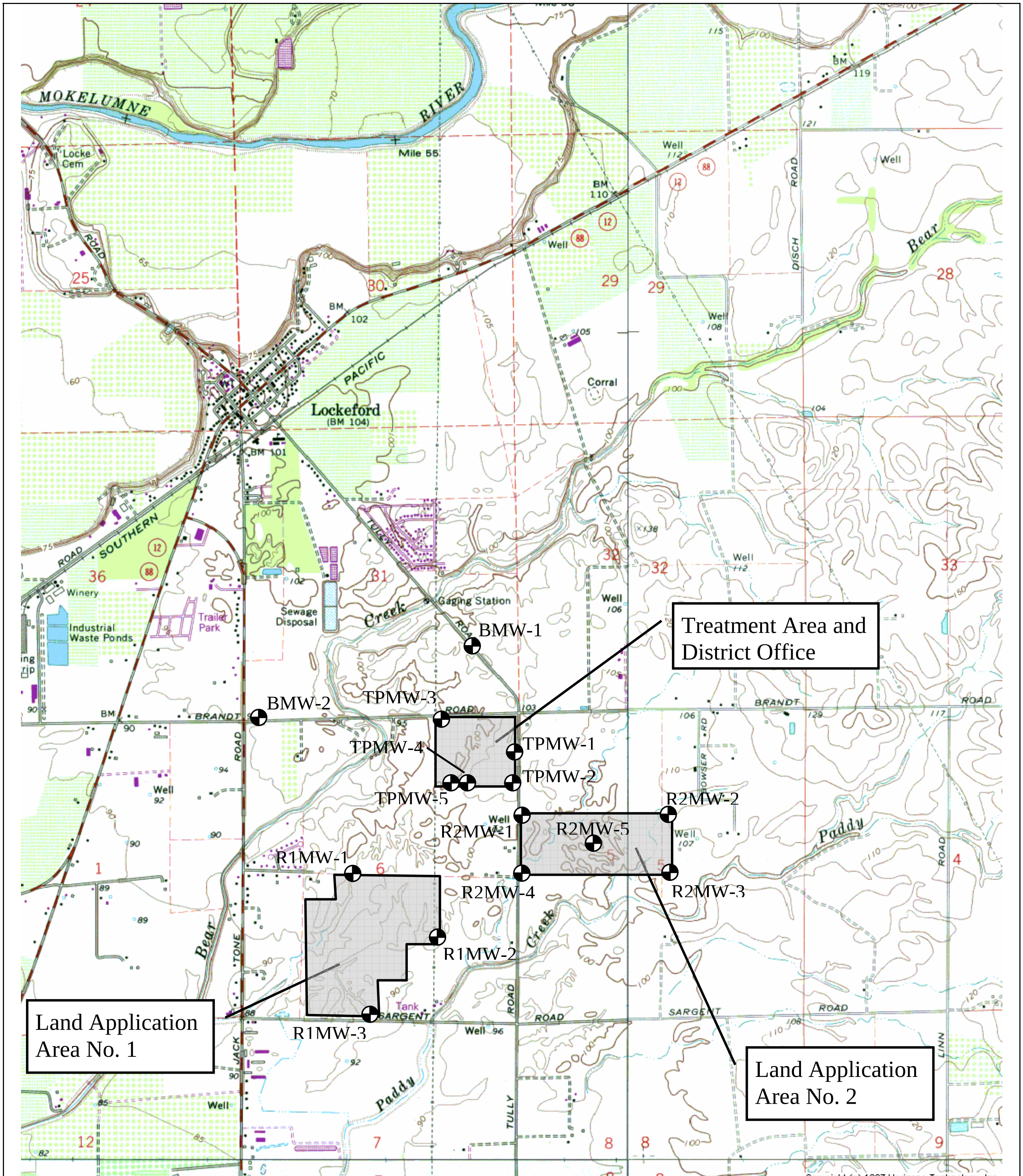
The Discharger must monitor groundwater for wastewater constituents expected to be present in the discharge, capable of reaching groundwater, and violating groundwater limitations if treatment, control, and environmental attenuation proves inadequate. This Order requires evaluation of the existing monitoring wells for suitability, and additional wells to be installed in areas most likely to detect groundwater impacts. Those areas were identified to be locations of storage ponds and land application areas.

For each constituent listed in the Groundwater Limitations section, the Discharger must, as part of each monitoring event, compare concentrations of constituents found in each monitoring well (or similar type of groundwater monitoring device) to the background concentration or to prescribed numerical limitations to determine compliance.

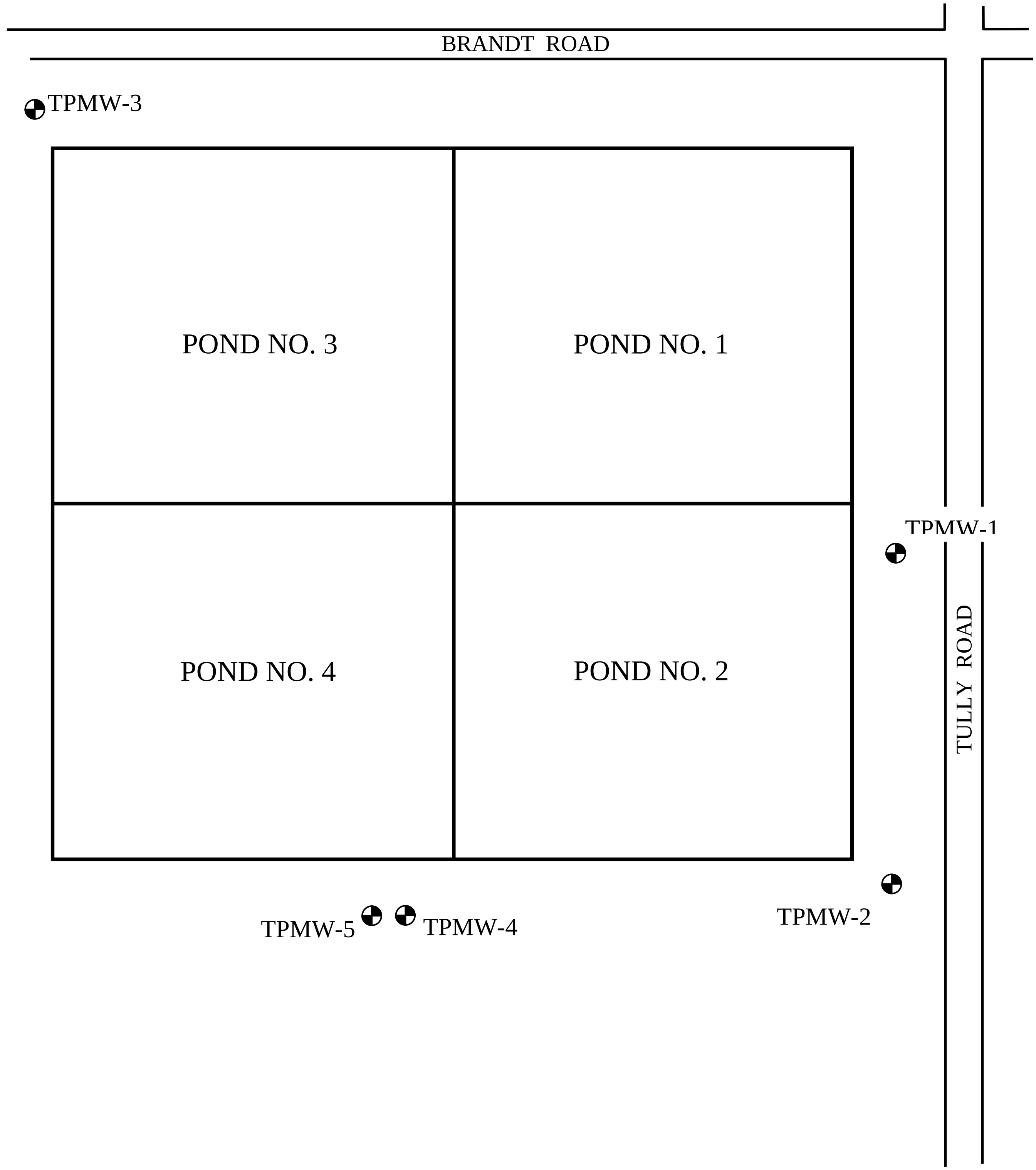
Reopener

The conditions of discharge in the proposed Order were developed based on currently available technical information and applicable water quality laws, regulations, policies, and plans, and are intended to assure conformance with them. However, information is presently insufficient to develop final recycled water and groundwater limitations, so the proposed Order contains interim limitations. Additional information must be developed and documented by the Discharger as required by schedules set forth in the proposed Order. As this additional information is obtained, decisions will be made concerning the best means of assuring the highest water quality possible and that could involve substantial cost. It may be appropriate to reopen the Order if applicable laws and regulations change, but the mere possibility that such laws and regulations may change is not sufficient basis for reopening the Order. The CWC requires that WDRs implement all applicable requirements.

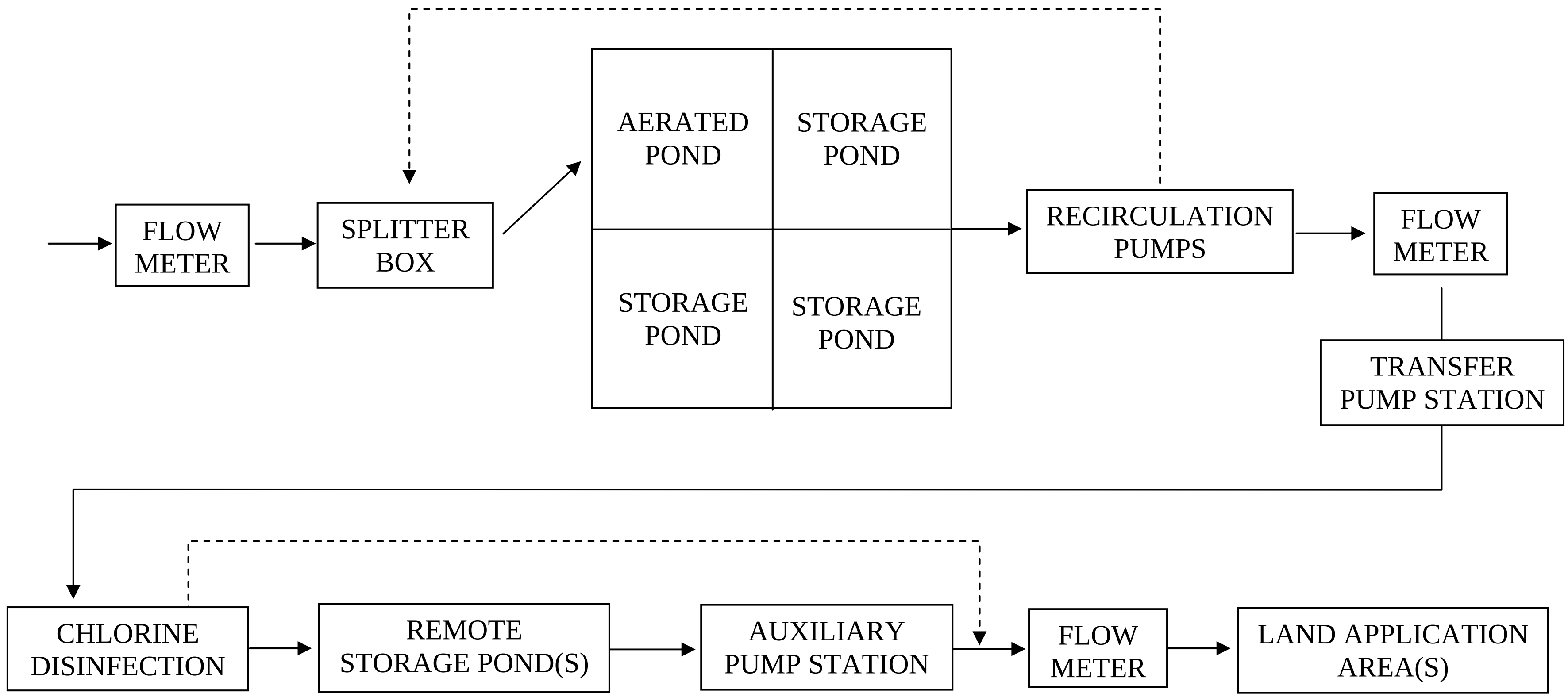
TRO/WSW: 12/6/07



Drawing Reference: U.S.G.S LOCKEFORD TOPOGRAPHIC MAP 7.5 MINUTE QUAD	**SITE LOCATION MAP** Lockeford Community Services District 17725 North Tully Road Lockeford, San Joaquin County	N S E W approx. scale 1 in. = 0.5 mile



Drawing Reference: U.S.G.S Quad Name TOPOGRAPHIC MAP 7.5 MINUTE QUAD	**TREATMENT AREA SITE PLAN** Lockeford Community Services District 17725 North Tully Road Lockeford, San Joaquin County	N W E S not to scale



Drawing Reference:
Adapted from Figure 4-1
Treatment Process Schematic
June 2006 RWD, ECO:LOGIC Engineering

Treatment Process Schematic
Lockeford Community Services District
17725 North Tully Road
Lockeford, San Joaquin County

Linda Adams
Secretary for Environmental Protection

California Regional Water Quality Control Board
Central Valley Region

Karl E. Longley, ScD, P.E., Chair

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Arnold Schwarzenegger
Governor

ORDER NO. R5-2007-0179
ATTACHMENT D
REQUIREMENTS FOR MONITORING WELL INSTALLATION WORKPLANS AND MONITORING WELL INSTALLATION REPORTS

Prior to installation of groundwater monitoring wells, the Discharger shall submit a workplan containing, at a minimum, the information listed in Section 1, below. Wells may be installed after staff approve the workplan. Upon installation of the monitoring wells, the Discharger shall submit a well installation report which includes the information contained in Section 2, below. All workplans and reports must be prepared under the direction of, and signed by, a registered geologist or civil engineer licensed by the State of California.

SECTION 1 - Monitoring Well Installation Workplan and Groundwater Sampling and Analysis Plan

The monitoring well installation workplan shall contain the following minimum information:

A. General Information:
    Purpose of the well installation project
    Brief description of local geologic and hydrogeologic conditions
    Proposed monitoring well locations and rationale for well locations
    Topographic map showing facility location, roads, and surface water bodies
    Large scaled site map showing all existing on-site wells, proposed wells, surface drainage courses, surface water bodies, buildings, waste handling facilities, utilities, and major physical and man-made features

B. Drilling Details:
    On-site supervision of drilling and well installation activities
    Description of drilling equipment and techniques
    Equipment decontamination procedures
    Soil sampling intervals (if appropriate) and logging methods

C. Monitoring Well Design (in narrative and/or graphic form):
    Diagram of proposed well construction details
- Borehole diameter
- Casing and screen material, diameter, and centralizer spacing (if needed)
- Type of well caps (bottom cap either screw on or secured with stainless steel screws)
- Anticipated depth of well, length of well casing, and length and position of perforated interval
- Thickness, position and composition of surface seal, sanitary seal, and sand pack
- Anticipated screen slot size and filter pack

D. Well Development (not to be performed until at least 48 hours after sanitary seal placement):
Method of development to be used (i.e., surge, bail, pump, etc.)
Parameters to be monitored during development and record keeping technique
Method of determining when development is complete
Disposal of development water

E. Well Survey (precision of vertical survey data shall be at least 0.01 foot):
Identify the Licensed Land Surveyor or Civil Engineer that will perform the survey
Datum for survey measurements
List well features to be surveyed (i.e. top of casing, horizontal and vertical coordinates, etc.)

F. Schedule for Completion of Work

G. Appendix: Groundwater Sampling and Analysis Plan (SAP)
The Groundwater SAP shall be included as an appendix to the workplan, and shall be utilized as a guidance document that is referred to by individuals responsible for conducting groundwater monitoring and sampling activities.

Provide a detailed written description of standard operating procedures for the following:

- Equipment to be used during sampling
- Equipment decontamination procedures
- Water level measurement procedures
- Well purging (include a discussion of procedures to follow if three casing volumes cannot be purged)
- Monitoring and record keeping during water level measurement and well purging (include copies of record keeping logs to be used)
- Purge water disposal
- Analytical methods and required reporting limits
- Sample containers and preservatives
- Sampling
    - General sampling techniques
    - Record keeping during sampling (include copies of record keeping logs to be used)
    - QA/QC samples
- Chain of Custody
- Sample handling and transport

SECTION 2 - Monitoring Well Installation Report

The monitoring well installation report must provide the information listed below. In addition, the report must also clearly identify, describe, and justify any deviations from the approved workplan.

A. General Information:
Purpose of the well installation project
Brief description of local geologic and hydrogeologic conditions encountered during installation of the wells
Number of monitoring wells installed and copies of County Well Construction Permits
Topographic map showing facility location, roads, surface water bodies

Scaled site map showing all previously existing wells, newly installed wells, surface water bodies, buildings, waste handling facilities, utilities, and other major physical and man-made features.

B. Drilling Details (in narrative and/or graphic form):

On-site supervision of drilling and well installation activities
Drilling contractor and driller's name
Description of drilling equipment and techniques
Equipment decontamination procedures
Soil sampling intervals and logging methods
Well boring log

- Well boring number and date drilled
- Borehole diameter and total depth
- Total depth of open hole (same as total depth drilled if no caving or back-grouting occurs)
- Depth to first encountered groundwater and stabilized groundwater depth
- Detailed description of soils encountered, using the Unified Soil Classification System

C. Well Construction Details (in narrative and/or graphic form):

Well construction diagram, including:

- Monitoring well number and date constructed
- Casing and screen material, diameter, and centralizer spacing (if needed)
- Length of well casing, and length and position of perforated interval
- Thickness, position and composition of surface seal, sanitary seal, and sand pack
- Type of well caps (bottom cap either screw on or secured with stainless steel screws)

E. Well Development:

Date(s) and method of development
How well development completion was determined
Volume of water purged from well and method of development water disposal
Field notes from well development should be included in report

F. Well Survey (survey the top rim of the well casing with the cap removed):

Identify the coordinate system and datum for survey measurements
Describe the measuring points (i.e. ground surface, top of casing, etc.)
Present the well survey report data in a table
Include the Registered Engineer or Licensed Surveyor's report and field notes in appendix