Lolo RSID 901 Wastewater System Preliminary Engineering Report

Lolo, MT

November 2022

MONTANA
MISSOULA COUNTY
PUBLIC WORKS DEPT.

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02/09/2023

Date

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Executive Summary

The Lolo RSID 901 Water & Sewer Department provides critical services to the community overseeing the entire wastewater collection and treatment systems. The overall objective of this report is to plan for future capital needs and ensure adequate long-term funding for continued operation of the wastewater collection and treatment systems. Specifically, individual objectives are as follows:

- Update the previous wastewater system analysis and document the findings in the current preliminary engineering report format, so that Lolo RSID 901 can apply for grant funding as needed.
- Evaluate the condition and the capacity of the wastewater system to meet existing and projected future wastewater flows, assess the general condition of aboveground facilities and belowground infrastructure, and describe potential future regulatory requirements.
- Identify and prioritize projects and project phasing for a 20-year planning horizon.
- Identify funding sources and strategies.

Population was projected for both Lolo and the Lolo RSID 901 service area. Based on available information provided by the County, it is expected that Lolo's population will increase by 1,289 by 2040 with a total population of 5,688. This increase equates to an average yearly population growth rate of 1.29%. It is also assumed that all population growth between 2020 and 2040 will be served by Lolo RSID 901's Wastewater System, rather than individual septic systems. Assuming this rate remains constant, a service population of 6,529 is estimated within Lolo by 2040 due to population growth and existing persons switching from septic systems to treatment at the Lolo WWTP. Table ES-1 summarizes the existing and projected population for Lolo RSID 901.

Table ES-1. Existing and Projected CDP and Service Population

Year	Lolo CDP Population	Lolo Service Population
2020	4,399	3,500
2025	4,690	4,090
2030	5,001	4,780
2035	5,332	5,587
2040	5,688	6,529

The Lolo service population projections were used to project future influent flows. These flows are shown in Table ES-2.

Table ES-2. Projected Influent Flows

Year	Average Day (mgd)	Max Month (mgd)	Peak Day (mgd)	Peaking Factor	Peak Hourly (gpm)
2020	0.26	0.30	0.33	3.38	604
2025	0.30	0.35	0.39	3.32	694
2030	0.35	0.41	0.46	3.26	796
2035	0.41	0.48	0.53	3.20	912
2040	0.48	0.56	0.62	3.14	1,044

The population and flow projections were used to evaluate the unit processes at the Lolo WWTP, the RSID collection system, and the RSID's three lift stations. Alternatives were developed and evaluated as needed to facilitate this process. A summary of the recommended improvement projects following this analysis are shown in Table ES-3. The phasing and need for project are also summarized in the Table. Recommended projects are split between Phase 1 and Phase 2. Phase 1 projects consist of near-term improvements that will generally be addressed immediately, and Phase 2 projects consist of longer-term improvements that will need to be addressed before the end of the planning period. All Phase 1 projects will be funded with money from ARPA Minimum Allocation and Competitive Grants. OPCCs do not include any associated engineering or design costs.

Table ES-3. Recommended Projects Summary

Project	Category	OPCC	Phase	Recommended Timeline
Lift Station No. 1 Improvements and Force Main Installation	Reasonable Growth / Aging Infrastructure	$1,140,000	Phase 1	Completed by March 2024
Collection System Improvements (Inflow & Infiltration Mitigation and 200 LF of 16-inch Gravity Main Replacement from LS No. 1 to Red Fox Rd.	Reasonable Growth / Aging Infrastructure	$525,000	Phase 1	Completed by March 2024
Biosolids Dewatering Building and Equipment	Health, Sanitation and Security	$3,290,000	Phase 1	Completed by March 2024
Biological Treatment Upgrade, Convert SC No. 1 to CAS	Reasonable Growth / Aging Infrastructure	$350,000	Phase 1	Completed by March 2024
EQ Basin Liner	Reasonable Growth / Aging Infrastructure	$84,000	Phase 1	Completed by March 2024
Security Fence	Health, Sanitation and Security	$86,000	Phase 1	Completed by March 2024

Project	Category	OPCC	Phase	Recommended Timeline
Influent Pump and RAS Pump Replacement	Reasonable Growth / Aging Infrastructure	$410,000	Phase 1	Completed by March 2024
Collection System Improvements (Remaining Gravity Sewer Replacement: 2,000 LF of 16-inch, 1,500 LF of 10-inch, and 1,200 LF of 8-inch)	Reasonable Growth / Aging Infrastructure	$2,770,000	Phase 2	Dependent on Rate of Development
Biological Treatment Capacity Upgrade (to meet 2040 capacity) or Membrane Bioreactor (MBR), depending upon nutrient regulations.	Reasonable Growth / Regulation	$5,000,000 - $10,000,000	Phase 2	Dependent on Rate of Development
UV Capacity Addition	Reasonable Growth	$230,000	Phase 2	Dependent on Rate of Development

Total OPCCs for Phase 1 and Phase 2 are summarized in Table ES-4.

Table ES-4. Total Project OPCCs by Phase

Project Phase	Total OPCC
Phase 1	$5,885,000
Phase 2	$8,000,000 - $13,000,000

1. Basis of Planning

1.1 Project Planning Overview

The purpose of this Basis of Planning is to give an overview of the project objectives and to provide general information about the Lolo RSID 901 (Lolo) Wastewater System. This report follows the 2017 Uniform Application for Montana Public Facility Projects, 12th Edition, which follows the *Uniform Preliminary Engineering Report for Montana Public Facility Projects* outline provided by the State of Montana. Additional sections have been added to this report as necessary to provide information or clarity on specific items related to the Lolo RSID 901 Wastewater System. The compiled report is organized as follows.

Section 1 – Basis of Planning

Section 2 – Existing Facilities

Section 3 – Need for Project

Section 4 – Alternatives Considered

Section 5 – Alternative Selection

Section 6 – Proposed Project (Recommended Alternative)

Section 7 – Conclusions and Recommendations

1.1.1 Project Objectives

The Lolo RSID 901 Water & Sewer Department provides critical services to the community overseeing the entire wastewater collection and treatment systems. The overall objective of this report is to plan for future capital needs and ensure adequate long-term funding for continued operation of the wastewater collection and treatment systems. Specifically, individual objectives are as follows:

- Update the previous wastewater system analysis and document the findings in the current preliminary engineering report format, so that Lolo RSID 901 can apply for grant funding as needed.
- Evaluate the condition and the capacity of the wastewater system to meet existing and projected future wastewater flows, assess the general condition of aboveground facilities and belowground infrastructure, and describe potential future regulatory requirements.
- Identify and prioritize projects and project phasing for a 20-year planning horizon.
- Identify funding sources and strategies.
- Identify design and operations & management (O&M) strategies that leverage technology and promote environmental and economic sustainability.

1.1.2 Summary of Previous Planning Documents

The following is a summary of previous Lolo RSID 901 Wastewater System planning documents that were reviewed in preparation for the development of this preliminary engineering report (PER).

1.1.2.1 Missoula County Lolo RSID 901 Wastewater Facilities Plan, 1999

The 1999 Wastewater Facilities Plan was commissioned by Missoula County and prepared by HDR Engineering, Inc. primarily to address the impacts of individual wastewater disposal systems on the area's environmental resources. Increasing population prompted a review of the wastewater capacity of RSID 901. Demand was projected out to 2045 using contemporary population data. The plan led to a recommendation to increase capacity through installation of an additional secondary clarifier and expansion of the RSID 901 sewer service area. These improvements and others were completed in the summer of 2002, addressing near-term needs of the system.

1.1.2.2 Missoula County Lolo RSID 901 Wastewater Treatment Plant Phase 2 Improvements PER, 2006

The 2006 Wastewater Treatment Plant Phase 2 Improvements PER, also prepared by HDR Engineering, Inc., continued with the proactive approach outlined in the 1999 plan to protect groundwater resources and the Bitterroot River from wastewater contamination. The plan's primary recommendations included:

- Installation of a permanent diesel generator backup power system at the wastewater treatment plant, capable of generating 250 kW of emergency power.
- Increasing capacity via implementation of open channel UV disinfection, replacing the previous chlorine gas disinfection system thus increasing capacity.
- Implementation of membrane secondary treatment system with nitrification/denitrification (N/DN) and chemical phosphorus removal.

1.1.2.3 Missoula County Growth Policy, 2016

The Lolo Wastewater Treatment System is operated by the Missoula County Public Works Department. The 2016 Missoula County Growth Policy was developed as an update to the 2005 Missoula County Growth Policy to reflect economic and demographic changes. Lolo's water and wastewater systems were evaluated as part of this policy. Findings relevant to Lolo include the definition of Lolo's sewer service area and endorsement of decommissioning individual septic tank systems in favor of connection to the public Lolo wastewater system.

1.2 Location

The community of Lolo is located on the mountainous western half of Montana in Missoula County approximately 3,199' above sea level. Lolo is at the north end of the Bitterroot River drainage basin which is roughly bordered by the Bitterroot Mountain Range on the west and the Sapphire Mountain Range on the east. Lolo is a census designated place and is part of the Missoula Metropolitan Statistical Area. The community lies at the intersection of U.S. Highway 12 and U.S. Highway 93. Lolo is approximately 10 miles south of the City of Missoula at the confluence of the Bitterroot River and Lolo Creek. The planning area is primarily in Township 12N, Range 20W, Sections 22, 25, 26, 27, 36, 35, 34, 33 and 32 with a small portion in Township 11N, Range 20W, Sections 1, 2 and 3. An aerial photo of the Lolo area is shown in Figure 1-1.

1.3 Environmental Resources Present

1.3.1 Surface Water

The planning area is located in the Clark Fork River Basin. The major surface waters include the Bitterroot River and its tributaries. The Bitterroot River runs along the east side of Lolo, flowing south to north. Lolo Creek, a small tributary of the Bitterroot River, approaches Lolo from the west, flowing into the Bitterroot southeast of Lolo. Doyles Slough is a year-round pond that sits in the bend of the Bitterroot River in the northeast area of Lolo.

1.3.2 Groundwater

Groundwater is the sole source of drinking water supply for Lolo at this time, being supplied by three main groundwater wells.

1.3.3 Floodplain

Federal Emergency Management Agency (FEMA) floodplain maps show the existence of the 100-year floodplain along the Bitterroot River within the planning area. This floodplain parallels the river channel. Portions of the existing wastewater system are located within the 100-year floodplain, along the Bitterroot River. See the FEMA National Flood Hazard map in Figure 1-2 below.

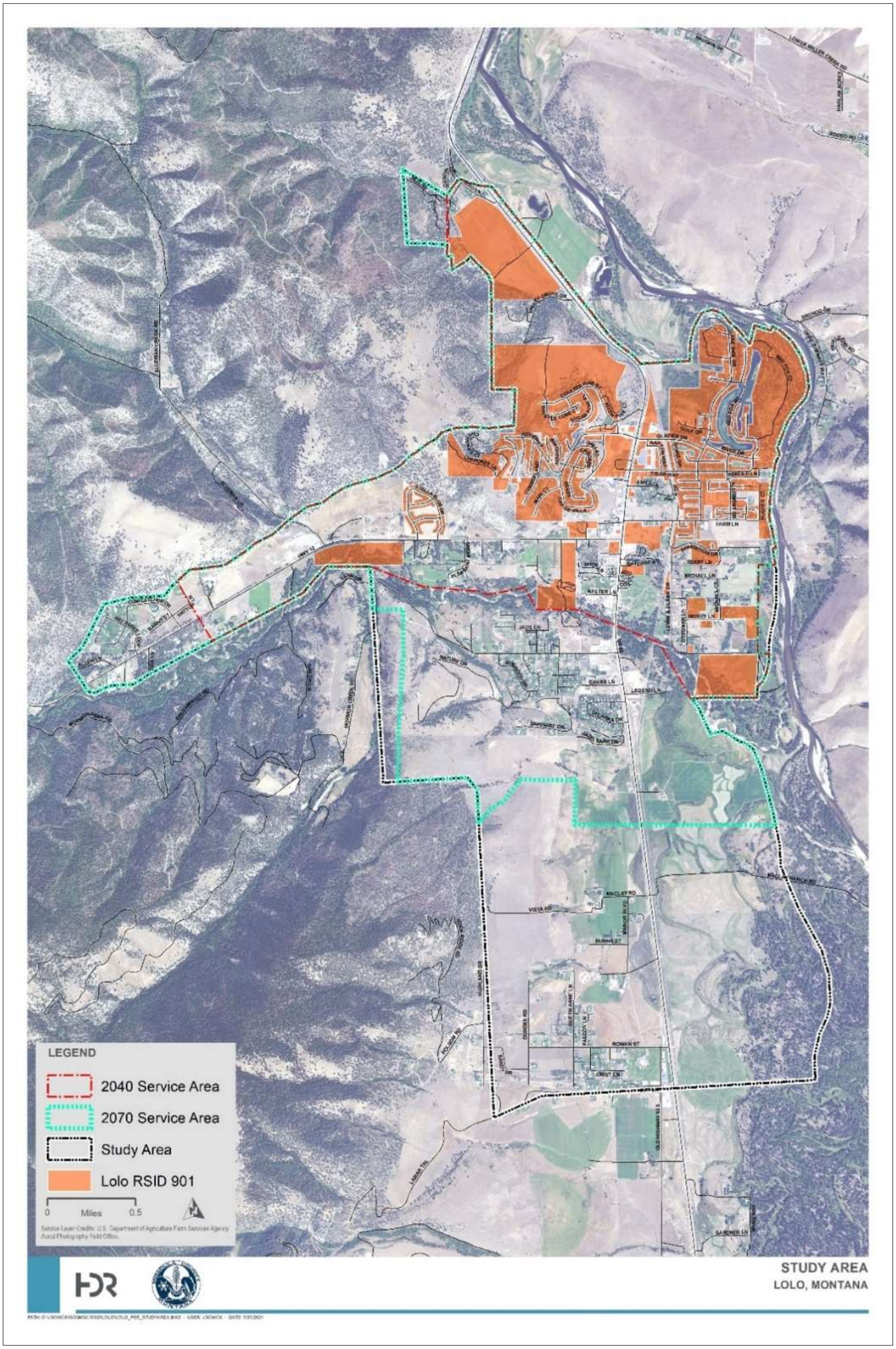

Figure 1-1. Lolo Study Area

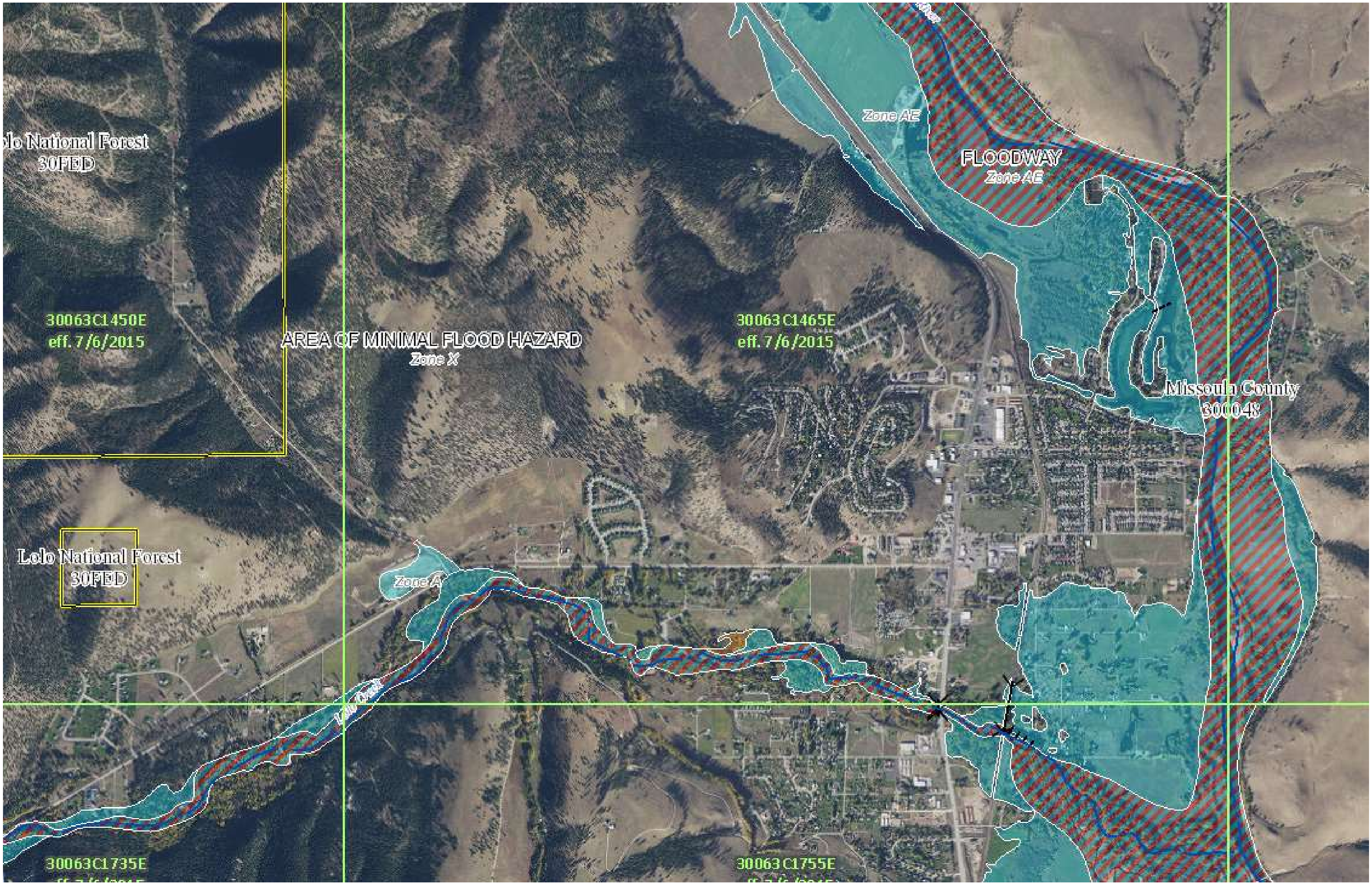

Figure 1-2. FEMA Floodplain Map

1.3.4 Geology and Soils

Lolo sits upon three main geological areas; the Bitterroot River, Lolo Creek, and the hillside. Along the Bitterroot River the soils are gravel, sand, silt and clay deposits of the river channel and floodplain. In the Lolo Creek drainage and fan there are variable deposits that range from pebble to boulder size and include sand, silt and clay. The hillside is predominantly composed of limestone and dolomitic limestone with siltite partings. A map is shown in Figure 1-3 below.

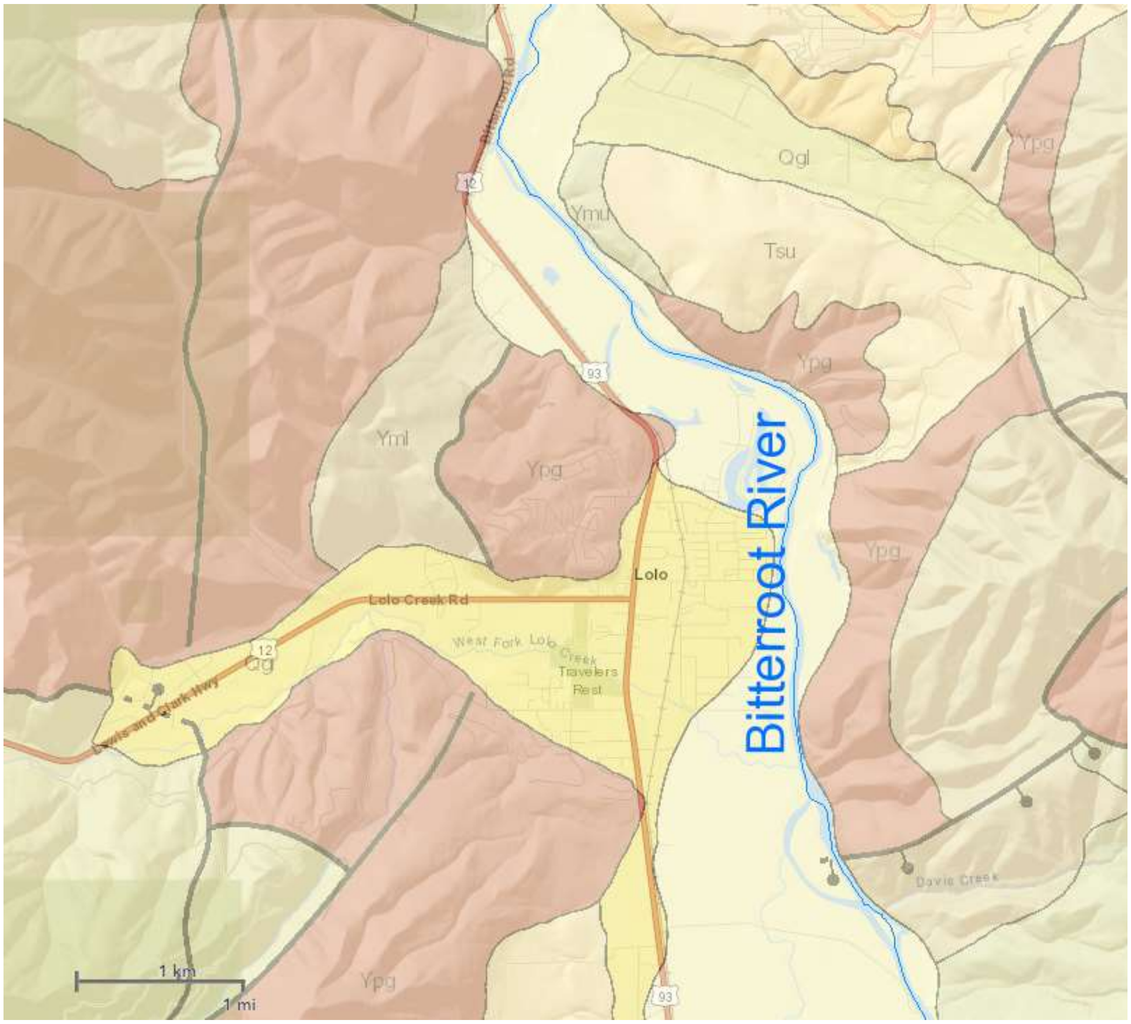

Figure 1-3. Lolo Geology

1.3.5 Wetlands

The majority of the Lolo RSID 901 Wastewater System exists outside of delineated wetland areas, however, there are some wetland areas present within the system. The first is the Lolo Creek Bed, which is a narrow and primarily forested riparian area. Additionally, along the Bitterroot River a portion of the existing and future service area is forested riparian area with a scattering of scrub-shrub and emergent riparian areas and forested and emergent wetlands. Wetland areas are shown in the Natural Heritage Map Viewer image in Figure 1-4.

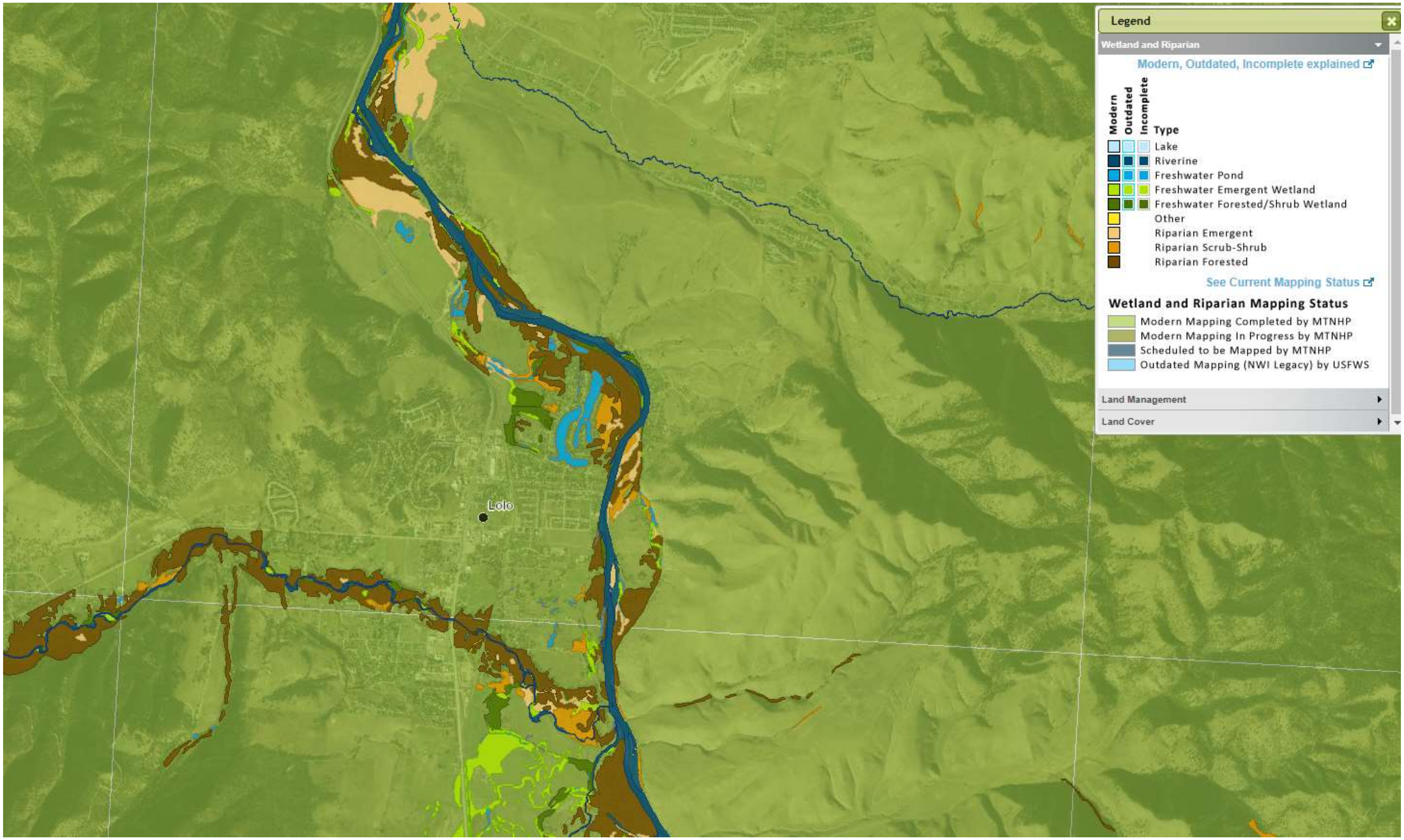

Figure 1-4. Wetlands Map

1.3.6 Wildlife

The areas in and around Lolo are home to many large mammals including grizzly bear, black bear, cougar, timber wolf, mountain goat, bighorn sheep, elk, moose, and mule deer, in addition to smaller mammals and numerous bird species. There are a number of conservation easements on the surrounding land, and a new 832-acre easement, the Maclay Ranch Easement, which is located 1.5 miles south of Lolo allows for an east-west corridor for wildlife moving between the Bitterroot and Sapphire mountains, across U.S. Highway 93. The Bitterroot River drainage is home to west slope cutthroat, rainbow, brown, brook, and bull trout.

1.4 Population Trends

1.4.1 Study Area

Areas of Lolo that are experiencing the greatest amount of growth and development include the area north of Ridgeway Dr., vacant land between Ridgeway Dr. and the Lolo school property on the west side of Highway 93, and the area along Allomont Dr. on the east side of town. Over the next 20 years, development is expected to expand along the hillside north of Coulter Pine, west from the Lolo Creek Trails addition to the Sleeman Creek neighborhood, south of Highway 12 along the Highway 93 corridor to the West Fork of Lolo Creek, and infill projects eastward to the Bitterroot River's floodplain boundary.

1.4.2 Population

The 2000, 2010, and 2020 Census population counts for Missoula County were used to calculate the average annual growth rate between the years 2000 and 2020. The average annual growth rate for all Missoula County between 2000 and 2020 was 0.94%. By using this growth rate, Missoula County is estimated to grow to a population of approximately 142,187 by 2040.

The population estimates for the census designated place (CDP) were used to acquire Lolo’s population as a percentage of Missoula County, as well as Lolo’s population growth rate and their overall population projection. Based on these estimates, Lolo’s existing population was determined to be approximately 3.7% of Missoula County’s existing population. Based on available information provided by the County, it is expected that Lolo’s population will increase by 1,289 by 2040 with a total population of 5,688. This increase equates to an average yearly population growth rate of 1.29%. It is also assumed that all population growth between 2020 and 2040 will be served by Lolo RSID 901’s Wastewater System, rather than individual septic systems. Assuming this rate remains constant, a service population of 6,529, an increase of 3,029, is estimated within Lolo by 2040. Table 1-1 summarizes the existing and projected population for Lolo RSID 901.

Table 1-1. Existing and Projected CDP and Service Population

Year	Lolo CDP Population	Lolo Service Population
2020	4,399	3,500
2025	4,690	4,090
2030	5,001	4,780
2035	5,332	5,587
2040	5,688	6,529

1.5 Community Engagement

Similar to previous planning projects, it is anticipated that this PER will be available for public review and comment and be presented to the Community Council and County Commissioners. Several progress review presentations were given to the Community Council and Commissioners throughout the process of developing this PER.

2. Existing Facilities

2.1 Location Map

The Lolo RSID 901 Wastewater Treatment Plant (WWTP) is located in the northern part of Lolo adjacent to the Bitterroot River. An aerial image of the WWTP is shown in Figure 2-1 and a site plan is shown in Figure 2-2.

Figure 2-1. Lolo RSID 901 WWTP Facility Aerial Imagery

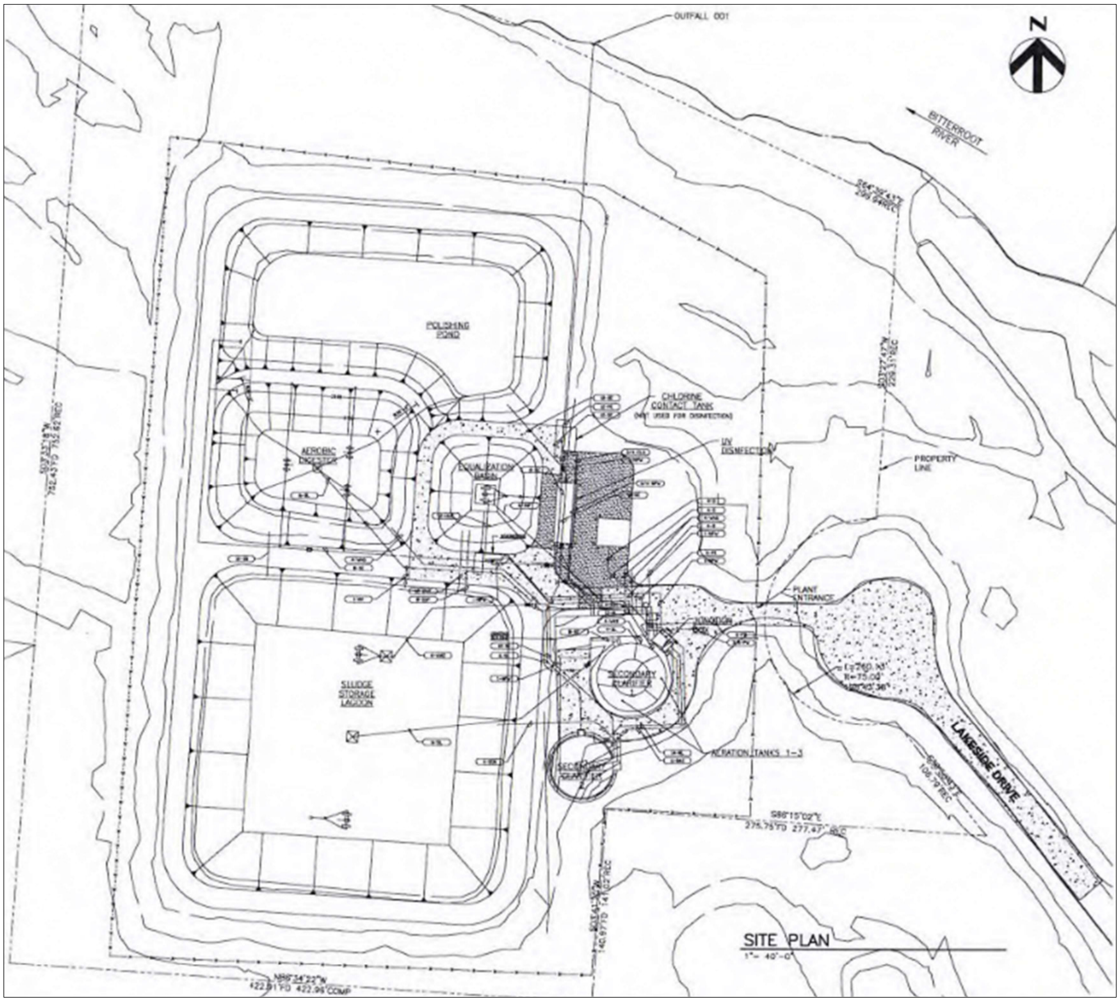

Figure 2-2. Lolo RSID 901 WWTP Facility Site Plan

2.2 History

The RSID 901 WWTP was constructed in the late 1960s. At the time, the plant undertook secondary treatment via a single-tank plug flow activated sludge system. This configuration had a design flow of 0.25 MGD utilizing aeration basins and secondary clarification. Upgrades detailed in the 1999 plan were completed by 2002, including a larger influent transfer pump, addition of a spiral screen at the headworks structure, and the addition of a new secondary clarifier and lagoon style aerobic digester. These improvements aimed to meet the near-term capacity needs of the wastewater system and they increased the capacity of the treatment plant to 0.34 MGD. Phase 2 of the plan was detailed in the 2006 PER, addressing long-term needs identified in the 1999 Plan. Improvements included on-site backup power, implementation of UV disinfection in place of the previous chlorine gas system, and a membrane secondary treatment system with nitrification/denitrification (N/DN) and chemical phosphorus removal. The on-site backup power and UV disinfection improvements were completed in 2009. The membrane secondary treatment system was not implemented. Additional information related to previous upgrades can be found in their respective planning documents outlined in Section 1.1.2, Summary of Previous Planning Documents.

2.3 Applicable Regulations

2.3.1 Montana Pollutant Discharge Elimination System (MPDES)

Lolo RSID 901 is authorized by an MPDES permit to discharge treated effluent to the Bitterroot River at one outfall. Discharge is regulated by the Montana Water Quality act via MDEQ and the Federal Water Pollution Control Act ("Clean Water Act") via the EPA. Limitations set for the current permitted discharge are outlined in Table 2-1.

Table 2-1. Lolo RSID 901 Effluent Limitations

Effluent Characteristics	Effluent Limitations			
	Units	Average Monthly Limit	Average Weekly Limit	Maximum Daily Limit
Biochemical Oxygen Demand (BOD5), mg/L	mg/L	30	45	N/A
	lbs/day	62.6	93.8	
Total Suspended Solids (TSS), mg/L	mg/L	30	45	N/A
	lbs/day	62.6	93.8	
E. coli, April 1 – October 31	cfu/100 ml	126	252	N/A
E. Coli, November 1 – March 31	cfu/100 ml	630	1,260	N/A
pH	-	Effluent pH shall remain between 6.0 and 9.0		

The current permit became effective on March 1, 2022. The fact sheet establishes how the technology-based effluent limits in the draft permit were calculated. It is stated that the mass limits for BOD_5 and TSS are the nondegradation allocation limits established in the 1993 permit, and that the design flow used to calculate the non-degradation limits established in the 1993 permit of 0.25 mgd will be used in the mass limit calculations for BOD_5 and TSS for the renewed permit.

The fact sheet also evaluates the need for water quality based effluent limits (WQBELs). A Bitterroot River 7Q10 flow of 392 cfs and a 14Q5 flow of 538 cfs were used in these calculations. Reasonable potential (RP) calculations were performed for the following parameters:

- TSS
- BOD_5
- pH
- oil and grease (O&G)
- E. coli
- Total ammonia-N
- Nitrate plus nitrite nitrogen (NO_3/NO_2)
- Total nitrogen (TN)

- Total phosphorus (TP)
- Lead

RP calculations did not find a need for additional WQBELs for the conventional pollutants of TSS, BOD_5, pH, (O&G), and E. coli. RP was not exceeded for lead either. As a result, no additional limits, beyond the TBELs already discussed, are projected for these parameters this permit cycle.

An in-depth RP analysis was performed for ammonia. Ammonia limits are developed from standards that consider both the pH and temperature of the receiving water, as well as whether salmonid fish are present and whether fish in early life stages are present. The values and assumptions used by MDEQ in their ammonia calculations are summarized in Table 2-2.

Table 2-2. Applicable Standards used in Ammonia RP Calculations

Condition	Period	Salmonids Present	Early Life Stages Present	Ambient Condition		Water Quality Standard (mg/L)
				pH	Temp (°C)	
Acute	Annual	Yes	NA	7.8	NA	8.11
Chronic	Annual	NA	Yes	7.8	13.6	3.18

MDEQ used the maximum effluent ammonia concentration from the WWTP of 29.2 mg/L in their RP analysis, and a CV of 0.6. The RP calculation found a chronic value of 0.56 mg/L and an acute value of 4.86 mg/L. Neither of these values exceed water quality standards; therefore, no ammonia limits are projected for this permit cycle.

RP calculations for NO_3/NO_2 used a maximum effluent concentration of 30.1 mg/Land a CV of 0.6. An RP value of 0.63 mg/L was calculated, which does not exceed the applicable water quality standard. As such, no effluent limits are projected for this permit cycle.

Numeric water quality standards are not currently established for the Bitterroot River. However, numeric standards are in place for the Clark Fork River, the receiving body for the Bitterroot. The current numeric standards on the Clark Fork River are 300 µg/L for TN and 39 µg/L for TP, both effective from June 21 to September 21 each year. These values and the Bitterroot 14Q5 flow were used by MDEQ to determine RP for TN and TP. The maximum effluent TN value used in the calculations was 45.6 mg/L and the maximum effluent TP value used in the calculations was 7.4 mg/L. CV values of 0.6 were used for both parameters. The calculated RP value for TN of 277 µg/L does not exceed Clark Fork standards, and so no effluent limits for TN are projected this permit cycle. The calculated RP value for TP of 31.8 µg/L does not exceed the Clark Fork standards; therefore, no effluent limits for TP are projected this permit cycle.

2.3.2 Bitterroot Watershed Total Maximum Daily Load

The Lolo RSID 901 WWTP discharges directly to the Bitterroot River. Total Maximum Daily Loads (TMDLs) for the Bitterroot River were updated by MDEQ in December 2014. The TMDL plan identified no excess nutrients in the Bitterroot proper. Concentrations of metals were listed as impairing aquatic life in the Bitterroot River. DEQ indicated that a 77% reduction in lead load to the Bitterroot River would achieve water quality goals. It is important to note that the 2014 TMDL/Water Quality Improvement Plan document estimates that “the Lolo WWTP’s load (0.0009lbs/day) represents a mere 0.004% of the river’s TMDL (21.1 lbs/day). Lolo WWTP is an insignificant source of lead to the Bitterroot River” (pp 6-11). The TMDL cites the toxic, carcinogenic, and/or bioconcentrating effects of excess metal concentrations on aquatic life and humans who consume water or fish from affected watersheds as reasoning for this TMDL.

2.3.3 Biosolids Regulations

Recommendations regarding Lolo’s solids handling process are made later in this document. Biosolids regulations are codified in Title 40 of the Code of Federal Regulations (CFR), Part 503 *Standards for the Use or Disposal of Sewage Sludge*. The sewage sludge/biosolids standards, commonly referred to as Part 503 Rule or Part 503, became effective on March 22, 1993.The Part 503 Rule is a complex, risk-based assessment of potential environmental effects of pollutants that may be present in biosolids. The EPA subsequently published *A Plain English Guide to the EPA Part 503 Biosolids Rule* in September 1994 to help end users interpret and implement the rule.

The Part 503 Rule regulates pollutant and pathogen concentrations as well as vector attraction reduction (VAR). The guideline defines biosolids as Class A or Class B, depending on the potential level of pathogens. Class A biosolids must meet strict pathogen standards and can be used with no restrictions, while Class B biosolids can meet less stringent pathogen requirements, with application restricted to crops with limited human and animal exposure. Biosolids in both classes must meet VAR requirements. A full discussion of current regulations stemming from the Part 503 Rule is included in Appendix A.

2.4 Existing Facilities

2.4.1 Lift Station No. 1 and Other Lift Stations

Lift Station No. 1 is located on Lakeside Drive and is a wet well / dry well configuration with two (2) 15 HP dry-pit submersible pumps equipped with variable frequency drives (VFDs) which operate the pumps to deliver flow utilizing the fill and draw control method. The existing lift station is located on Lakeside Drive and conveys raw sewage to the equalization basin at the Lolo WWTP. The dry-pit is constructed of carbon steel and is nearing the end of its useful life. The lift station was designed for an approximate peak flow of 424 gpm at 75’ TDH. In 2014 the lift station’s electrical equipment and instrumentation and control equipment was updated to include new Allen-Bradley VFDs, PLC, pump controller, SCADA system, 60A main breaker, concrete equipment pad, wet well level indicator and transmitter, dry well controls that included lighting, sump pump, dehumidifier, and fan. The 6-inch force main is considered to be in good condition, although it is undersized for future peak flows.

2.4.2 Lift Station No. 3

Lift Station No. 3 is located on Highway 12 and is a Gorman-Rupp J Series package duplex lift station with 2.7 HP submersible pumps equipped with level sensors, control panel, and a fiberglass reinforced plastic (FRP) enclosure. The existing lift station is located at the intersection of Peninsula Place and Red Fox Road and conveys raw sewage to River Drive through a 4-inch force main. Raw sewage from the Lift Station No. 3 force main discharge flows by gravity to Lift Station No. 1. Lift Station No. 3 was designed for an approximate peak flow of 110 gpm at 18’ TDH.

2.4.3 Other Lift Stations

Lift station 2 is depicted in figures throughout this report but was not evaluated it is operating well and not in need of improvements for projected growth.

2.4.4 Collection System

The RSID 901 collection system collects and conveys domestic and commercial wastewater from the majority of residences and businesses in Lolo. The system is comprised of three lift stations and includes approximately 350 manholes, and 15 miles of gravity mains ranging in size from 8 to 12-inch diameter that generally follows the roads within the RSID boundary. Figure 2-3 depicts the existing system characteristics.

To analyze existing collection system capacity, a steady-state InfoSewer model, a wastewater collection modeling software made by Innovyze, was built with as-recorded construction drawings, survey data, WWTP influent flow data, future development projections, and other applicable data. Due to small lift station and small diameter (2-inch) force main modeling constraints, flows from smaller diameter and/or private force mains were applied directly to the downstream gravity manhole and are represented as “Unmodeled Mains” in model figures.

The model was constructed to specifically estimate collection system capacity and lift stations flow values under peak hour conditions for existing (2020) and future (2040) conditions. Average day sewer flow values were assigned to modeled manholes by distributing WWTP influent flow data throughout the system in a weighted manner to evaluate areas with a higher number of connections and flow. A peak demand curve determined peak hour flow values per MDEQ Circular 2, Eqn. 10.1 and a prior inflow and infiltration (I&I) study conducted by HDR provided values for peak flows, base infiltration, and wet-weather infiltration into the collection system.

Table **2-3** below summarizes the modeled scenarios and associated peak flow values. Figure 2-4 and Figure 2-5 depict system conditions under existing base and peak wet-weather scenarios.

Table 2-3. InfoSewer Model Results

Scenario	Flow to Lift Station No. 1 (gpm)	Flow to Lift Station No. 3 (gpm)	Notes
2020 Average Flow and Base Infiltration without a Wet Weather Event	265	13	This scenario models existing system conditions under current average flows including base infiltration but no peak flow or increased I&I from a wet weather event.
2020 Peak Flow and Wet Weather Event with Increased Infiltration	703	54	This scenario models existing system conditions under current peak hour flows including increased I&I from a wet weather event.
2040 Average Flow and Base Infiltration without a Wet Weather Event	330	98	This scenario models existing system conditions under 2040 average flows including base infiltration but no peak flow or increased I&I from a wet weather event.
2040 Peak Flow and Wet Weather Event with Increased Infiltration	897	353	This scenario models existing system conditions under 2040 peak hour flows including increased I&I from a wet weather event.

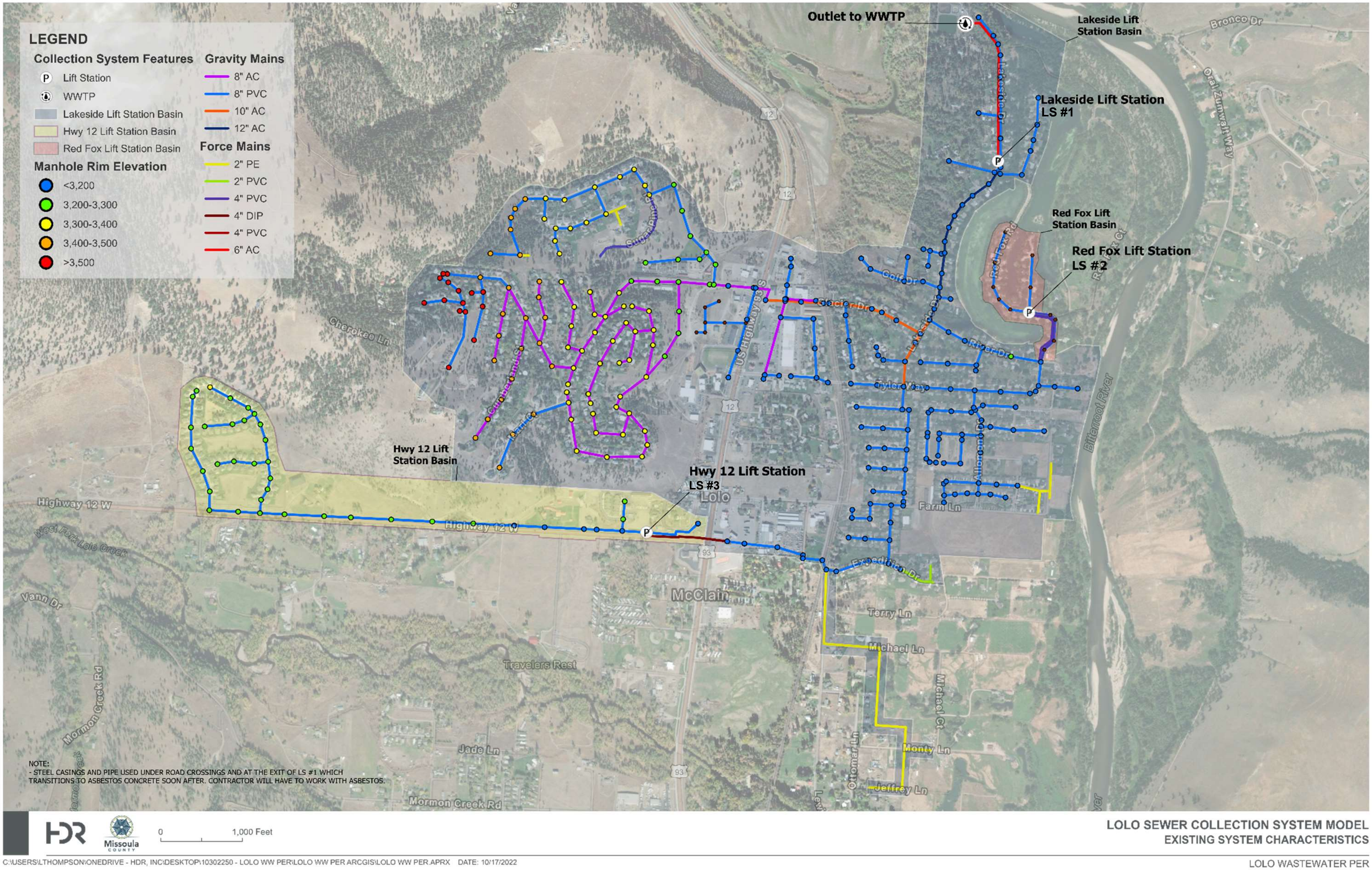

Figure 2-3. Existing Collection System Characteristics

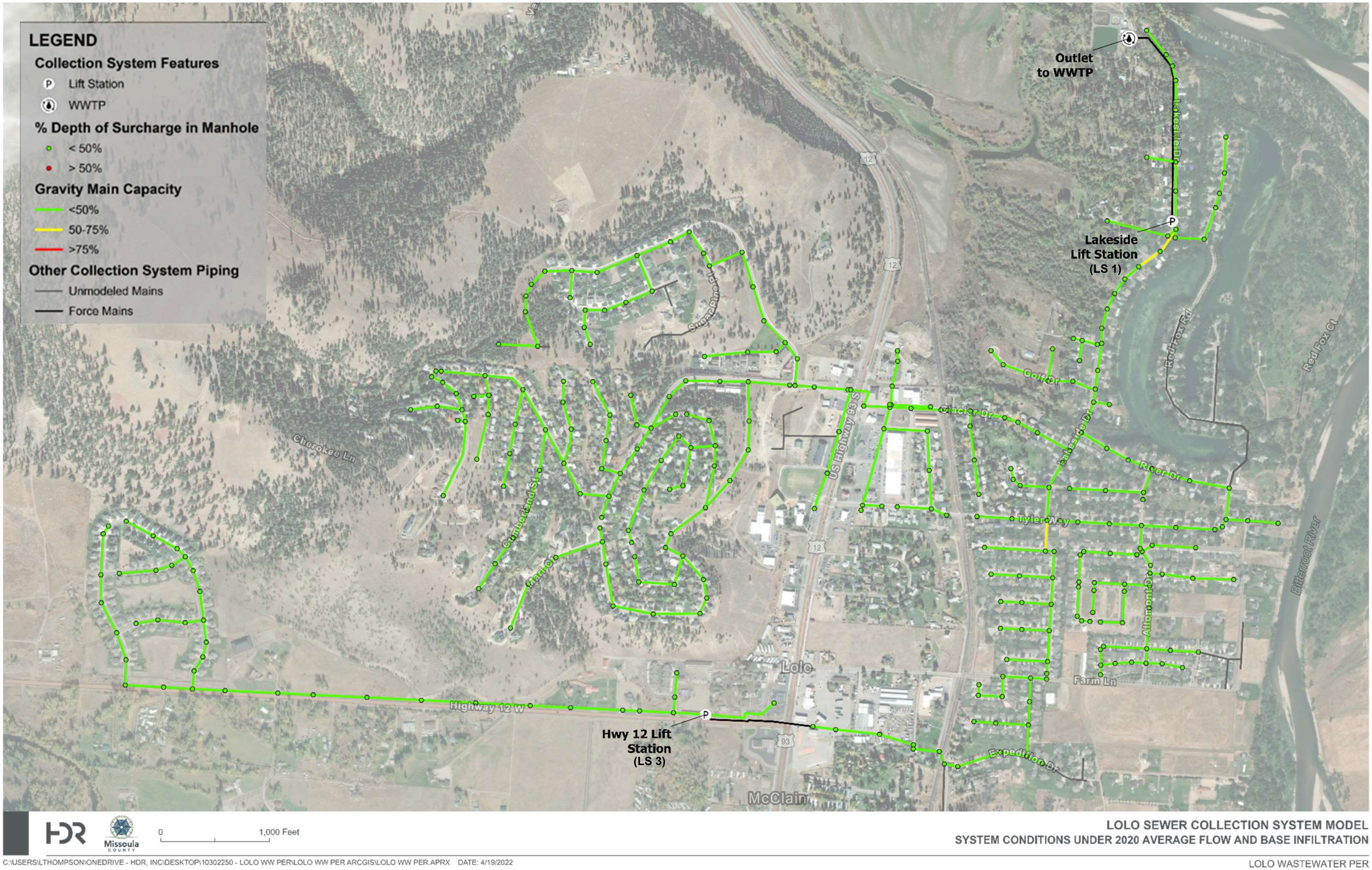

Figure 2-4. Existing Collection Conditions Under 2020 Average Flow and Base Infiltration

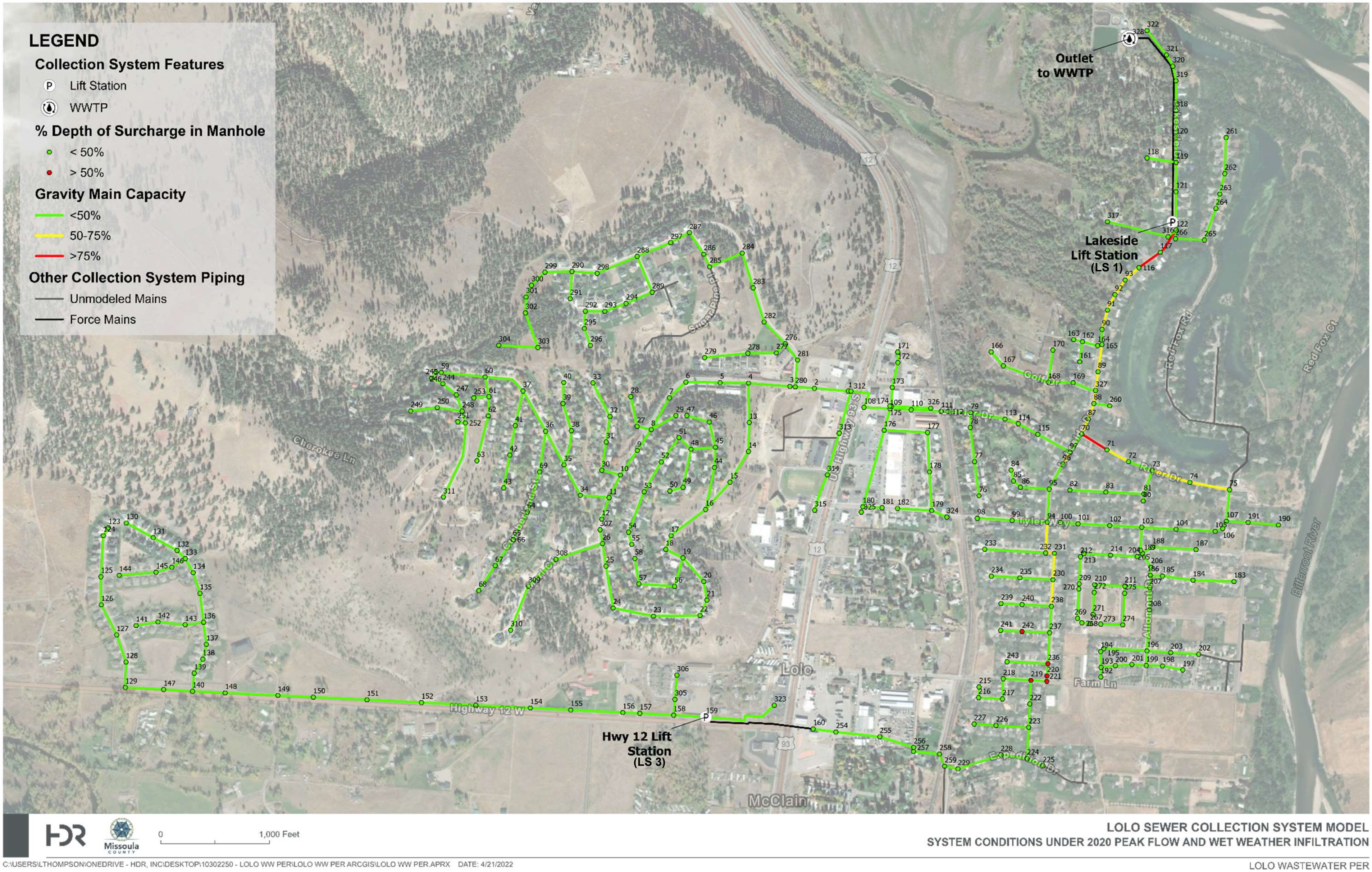

Figure 2-5. Existing Collection Conditions Under 2020 Peak Flow and Wet Weather Infiltration

As shown in Figure 2-4, the existing system does not experience significant surcharging (depth remaining in manhole of <50%) or sewer main capacity impacts (d/D >75%) under current dry conditions. Figure 2-5 depicts 2020 system conditions during a wet weather event where there is an increase in surcharging and a decrease in sewer main capacity along Lakeside Drive and River Drive. Under current conditions, there is adequate capacity in the collection system under dry conditions but wet weather events during peak hour flow cause minor capacity issues.

Modeling of existing conditions indicates that the system is suitable for average conditions but will need additional capacity for wet weather events and future development. Collection infiltration data and review of applicable closed-circuit television (CCTV) data shows that infiltration is taking place primarily at pipe joints and service lateral connection points, and that there is a need for rehabilitation and/or replacements projects to mitigate excessive I&I. The collection system meets MDEQ standards with the exception of insufficient slope requirements for a few gravity mains as depicted in Figure 3-2.

2.4.5 Lolo WWTP

The RSID 901 Lolo WWTP accomplishes secondary treatment of domestic and commercial wastewater collected within the sewer service area. Secondary treatment consists of the removal of 85 percent or more of the incoming organic and solids materials. The wastewater treatment plant consists of an aboveground, plug flow activated sludge facility in a steel tank, without primary treatment. The original plant, which was constructed in the late 1960s, included a single-tank packaged contact stabilization activated sludge facility.

For the purposes of discussion, facilities can be separated into liquid stream and solids stream processes. Liquid stream facilities are those designated for wastewater treatment, while solids stream processes are those dedicated for handling the sludge produced during wastewater treatment. In actual operation, the liquid and solids streams are closely interrelated. Influent and effluent data was provided from January 2018 to June 2021 and is summarized in Table 2-4. Generally, the influent to the WWTP is typical with the exception of elevated BOD. The source of elevated BOD values has not yet been determined but is discussed in length in the two prior wastewater preliminary engineering reports.

Table 2-4. WWTP Influent and Effluent Characteristics

Metric	Influent	Effluent
Flow	0.25 MGD Average, 0.3 MGD MMF	
BOD	441 mg/L or 920 lb/day	9.3 mg/L or 19.4 lb/day
TSS	259 mg/L or 550 lb/day	6.7 mg/L or 14 lb/day
TN	49.3 mg/L or 110 lb/day	21.1 mg/L or 43.8 lb/day
TP	6.1 mg/L or 20 lb/day	4.3 mg/L or 9 lb/day
pH	7.2	
Temperature	13.9°C Average, 4.3°C Minimum, 24.1°C Maximum	

2.4.5.1 Liquid Stream

In the liquid stream, raw wastewater is transferred from the wastewater collection system by Lift Station No. 1. The lift station is equipped with two constant-speed pumps which deliver the flow to the treatment plant utilizing a fill and draw method. All raw sewage entering the treatment plant is screened to remove rags and other debris. Rags and debris are mechanically removed to avoid interference with downstream treatment operations. Screened wastewater then travels to a flow equalization basin where influent flow fluctuations are "equalized" prior to pumping to the treatment facilities. Dedicated grit removal is not provided at the treatment plant. The equalization basin is aerated to maintain solids in suspension and prevent the influent flow from becoming septic. However, some grit settles in the equalization basin, forming a de facto grit removal step. Grit removal is accomplished by periodically pumping the accumulated material from the basin approximately every two years.

Wastewater is withdrawn from the equalization basin by the Influent Pumping Station and discharged through a series of piping and valves where it is measured by a magnetic flow meter, mixed with return activated sludge, and delivered to the aeration tanks. The aeration tanks are three semicircular basins constructed along the outer perimeter of a single large circular tank in a packaged treatment plant configuration. The tank also incorporates a single secondary clarifier positioned in the center one-third of the tank.

The aeration basins are where microorganisms in the return activated sludge consume organic matter in the influent wastewater. Oxygen is supplied to the wastewater by three positive displacement air blowers (one blower serves as a redundant unit). Overflow from the aeration basins passes to the secondary clarifier, which through gravity, separates the microorganisms and solids from the treated wastewater. The secondary clarifier overflow is then routed to the UV banks for disinfection. Disinfected effluent is then discharged to the Bitterroot River.

2.4.5.2 Solids Stream

Periodic sludge removal from the liquid stream, called wasting, is required to maintain effluent quality. This sludge must be stabilized before it can be disposed of or utilized as a biosolids product. In the solids stream, waste activated sludge (WAS) is first pumped from the Secondary Clarifier 2 underflow to the Aerobic Digester for partial stabilization. Digested sludge is overflows from the Aerobic Digester to the Sludge Storage Lagoon. Digested and stored sludge is periodically dredged and dewatered in geotextile biobags. The dewatered solids, which are known as biosolids, are sent to the landfill.

2.4.5.3 Existing Capacities

The Lolo WWTP is made up of the following main unit process elements, which will be evaluated against projected flows in Section 3 to identify any potential capacity deficiencies. The current capacities of the respective unit processes are discussed in the following sections.

- Rotary Screen
- Equalization Basin

- Influent Pumps
- Aeration Tanks
- Secondary Clarifiers
- RAS/WAS Systems
- UV Disinfection
- Aerobic Digestion
- Sludge Storage Lagoon

SCREENING

The influent screening arrangement consists of two channels arranged in parallel. One channel is fitted with a manual bar rack and the other is equipped with a mechanically operated and automated rotary screen. The screen channels were configured so that only a single channel would be in operation at one time, and the manual bar rack is not typically used unless the rotary screen is out of service. The capacity of the rotary screen is listed in Table 2-5.

Table 2-5. Headworks & Influent Pumping Capacities

Unit Process	Value
Screening	
Number	1
Type	Rotary Screen
Capacity	2.10 mgd
Channel Width	20 in

FLOW EQUALIZATION BASIN

The working capacity of the equalization basin is approximately 40,000 gallons, or 5,348 cubic feet. Grit accumulation is not currently an issue, but as wastewater flow continues to increase the quantity of deposits may increase and consideration should be given to installation of grit removal facilities ahead of the equalization basin. A photo of the equalization basin is shown in Figure 2-6.

Figure 2-6. Equalization Basin

INFLUENT/TRANSFER LIFT PUMPS

Influent pumping consists of two horizontal close coupled end suction pumps located in the Control Building basement. The pumps are driven by variable frequency drives controlled by a bubbler level control system and manual settings for flow rate determined from average daily flow to the plant. The influent pumps must accommodate not only the incoming wastewater, but also the supernatant from the sludge storage basin when it is overflowing. The capacities of the influent pumps are listed in Table 2-6. A photo of the pumps is shown in Figure 2-7.

Table 2-6. Headworks & Influent Pumping Capacities

Unit Process	Value
Influent Pumps	
Number	2
Type	Non-Clog Centrifugal
Pump 1 Design Criteria	565 gpm at 69’ TDH, 20 HP
Pump 2 Design Criteria	225 gpm at 69’ TDH, 3 HP

Figure 2-7. Influent Pump 2

AERATION BASINS

The core of the liquid stream is the secondary treatment facility, which includes the Aeration Basins. The Aeration Basins are the key process that establishes the organic capacity of the treatment plant. Organic matter in the wastewater is consumed by microorganisms in the Aeration Basins. These microorganisms and inert solids settle in the Secondary Clarifier. Most of the settled solids are recycled to the influent wastewater as return activated sludge (RAS). A portion of the settled solids is wasted to the solids stream. An objective of the Aeration Basins, or secondary treatment system, is to maintain a large inventory of organic-consuming microorganisms, which are properly conditioned to settle in the secondary clarifier.

The secondary wastewater treatment process uses the suspended growth of microorganisms to accomplish organic removal. As described above, the Lolo treatment process is a plug flow activated sludge process which allows for shorter hydraulic detention times (higher rate) in the aeration basins as compared to extended air systems. In this process, unanticipated shifts in the sludge inventory between the aeration reactor (Aeration Basins in this case) and the secondary clarifier can be more disruptive than in lower rate activated sludge systems, such as extended aeration.

The aeration basins at Lolo are located in an above ground steel sidewall tank, which is not insulated, and the basins are susceptible to impacts from ambient air temperature fluctuations. The steel tank has visible rusting but is not believed to be leaking or compromised. Organic matter in the wastewater is converted to microorganisms in the Aeration Basins, which have a cumulative volume of 169,200 gallons. Oxygen is transferred to the wastewater through submerged fine bubble air diffusers with low pressure air supplied by two duty positive displacement blowers and one standby blower. Figure 2-8 shows the existing aeration tanks and Figure 2-9 shows the existing diffuser layout.

Figure 2-8. Aeration Basins

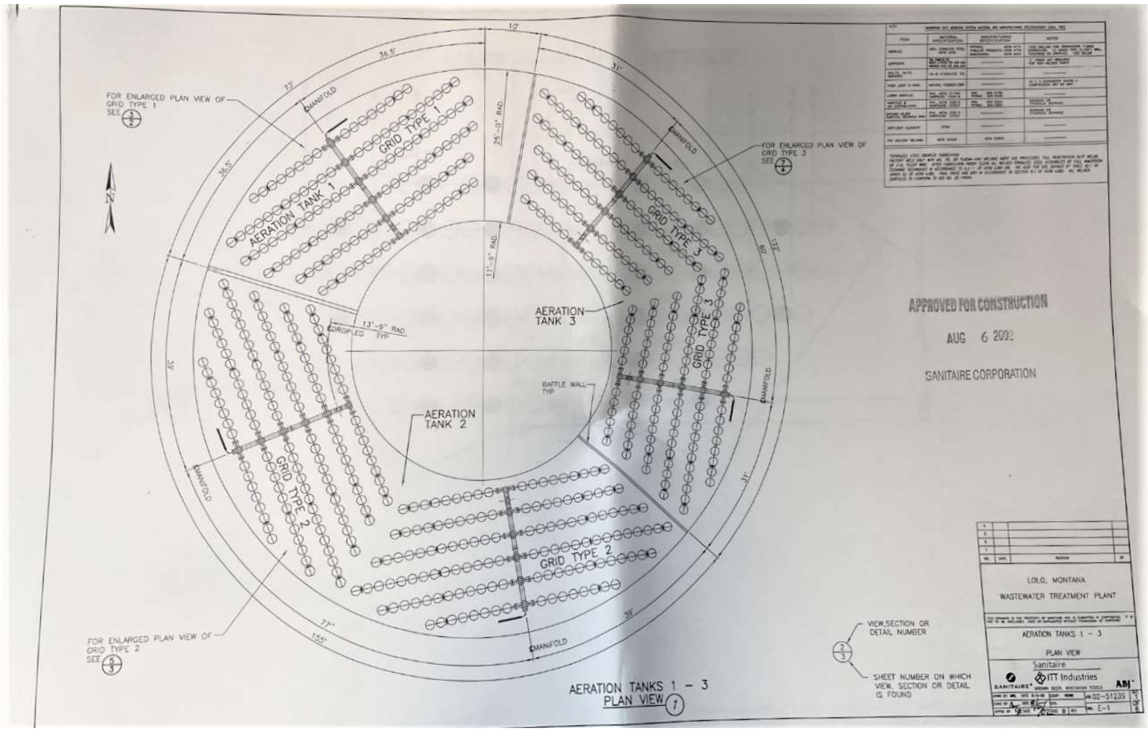

Figure 2-9. Aeration Basin Diffuser Layout

The original design loading for the Aeration Basins was 30 pounds of BOD per day per 1,000 cubic feet of aeration basin volume. The design loading is based on the assumption that a certain concentration of microorganisms can be maintained in the Aeration Basins to consume wastewater contaminants. This concentration of microorganisms is measured by mixed liquor suspended solids (MLSS) or mixed liquor volatile suspended solids (MLVSS). Mixed liquor refers to the combination of wastewater and return activated sludge in the Aeration Basins. The design assumption was that a MLSS concentration of 2,031 mg/l would be maintained. Actual operating conditions have shown that significantly higher (4,500 - 4,800 mg/L) MLSS concentrations are achieved. Although operating at higher MLSS values, the operations staff have not reported difficulties with poor settling sludge or the occurrence of filamentous organisms which are more prevalent at low food to microorganism conditions. Operations staff have indicated at lower temperatures the settleability of the sludge in the secondary clarifier becomes poor and the greater solids inventory must be reduced to prevent excess solids overflow from the clarifier.

The MLSS concentration is linked to sludge age. Sludge is wasted from the system to the Aerobic Digester on a routine basis to maintain a desired sludge age, which in turn establishes the MLSS concentration. Original design criteria for complete mix activated sludge was an age of 5 to 15 days. The Operation and Maintenance Manual states that the design intent was to maintain a sludge age of 10 days.

The long, narrow configuration of the aeration basins and their exposure to outside air temperature fluctuations suggests that the system should be operated at the higher sludge age of 15 days to ensure adequate BOD and TSS removals are achieved. This is contrary to the original design; however, operating data supports that the suggested 15-day sludge age will result in optimal performance, particularly during the winter months when aeration basin temperatures are at their lowest point.

A lower sludge age helps to prevent nuisance growths of *Norcardia* and reduces the solids loading on the secondary clarifier. When the sludge age is increased to above 15 days, a growth of *Norcardia* may form on the Aeration Basins surface. *Norcardia* is a microorganism that forms a dense mat of thick scum. This growth becomes a nuisance that may compromise plant operation. Operations Staff did not report significant problems with *Norcardia* until temperatures increase in the summer months. The operations staff reduces the volume of solids in the system when approaching the warmer summer months to address this problem. A "froth spray" system is also installed on the Aeration Basin perimeter to break up foaming and floating material to prevent it from becoming a nuisance. This system is not frequently used and cannot be used during the winter months because of freezing problems with the spray water pipelines.

AERATION CAPACITY

Oxygen is required for the biological treatment process to operate correctly. Oxygen is supplied by two air blowers (a third redundant unit is also available) through submerged air diffusers on the Aeration Basin's floor. The positive displacement blowers generate excessive noise. The blowers operate at a high rotational speed, which contributes to noise concerns. The blowers are installed with inlet silencers; however, ear protection for operations staff is required in the blower room. The high operational speed may result in a reduced equipment life. The diffused air system also maintains mixing within the Aeration Basins. Air diffuser oxygen transfer capacity can be adjusted by controlling the amount of low-pressure air delivered to the diffuser headers.

The capacity of the aeration system is 870 standard cubic feet per minute (SCFM) with 795 SCFM directed to the aeration basins. Assuming an oxygen transfer efficiency of 3 lb of O_2/hp-hr for the fine bubble diffusers, the capacity of the system is estimated at approximately 130 pounds of oxygen per hour to the aeration basins. Diffuser layout is depicted in Figure 2-9. Information pertaining to the aeration tank volumes, diffuser amounts, and blower capacities is summarized in Table 2-7.

Table 2-7. Aeration Tank Volumes

Unit Process	Value
Aeration Basins	
Number	3
Tank 1	37,900 gal
Tank 2	74,620 gal
Tank 3	56,680 gal
Total Volume	169,200 gal
Depth	15.5 ft
Diffusers	
Tank 1	92
Tank 2	200
Tank 3	152
Aeration System Blowers	
Number	3
Capacity (ea)	435 scfm
Power	25 HP

ORGANIC LOADING CAPACITY

Per MDEQ Circular 2 section 92.31, permissible aeration tank capacity for Lolo should conform to an organic loading rate of 40 lbs of BOD_5/day/1,000 ft^3 of basin volume. Using the current average BOD concentration of 441 mg/L and aeration system volume of 169,200 gallons, Table 2-8 summarizes different flow and loading scenarios for the existing basin.

Table 2-8. Organic Loading as Compared to MDEQ Circular 2

Flow Scenario	Flow (MGD)	lbs of BOD_5/day/1,000 ft^3 of Basin Volume
Maximum Flow Based on MDEQ Criteria	0.245	39.7
Existing Average Flow	0.26	42.2
Existing MMF	0.3	48.7
Projected Average Flow	0.48	77.9
Project MMF	0.56	90.8

To supplement MDEQ guidelines for estimating organic loading capacity, a wastewater treatment process model was created in BioWin, a wastewater process modeling software made by EnviroSim, to specifically evaluate existing aeration basin performance and capacity. A base model was created for initial calibration, capacity evaluation, and subsequent alternative analysis for future treatment alternatives. The following criteria were incorporated into the base model in an effort to calibrate the model to better estimate existing capacity and performance:

- Included existing plant characteristics, sizing, and layout such as basin volumes, diffuser amount, etc.
- Specified influent parameters, calibration criteria, and other model criteria using influent and effluent data from 2018 to 2021
- To mimic the least effective treatment conditions of the year, assumed an influent temperature of 10°C to model more conservatively
- Assumed a solids retention time (SRT) of 10 days to mimic estimated existing conditions and typical industry values
- Assumed a target MLSS of 3,500 mg/L to more conservatively represent estimated existing conditions
- Primary calibration criteria changed influent TKN value to approach known effluent TN values

Base model calibration was primarily focused on approaching existing effluent BOD, TN, and TP values and was conducted until the difference in existing and modeled effluent values was the lowest. Discrepancies in influent and effluent values were assumed to be negligible for the purposes of this modeling scope with the exception of the aforementioned TKN value adjustment for calibration. Table 2-9 summarizes existing conditions as compared to modeled conditions.

Table 2-9. Existing Conditions as Compared to the Calibrated Model

Metric	Existing Conditions	Calibrated Model
MMF	0.3	0.3
Influent BOD	441	441
Influent TSS	259	232
Influent TN	49.0	35.2
Influent TP	6.1	6.0
Effluent BOD	9.3	3.1
Effluent TSS	6.7	11.1[1]
Effluent TN	21.1	22.6
Effluent TP	4.3	3.3

[1] TSS values may not be indicative of actual conditions because model assumes ideal clarification.

The base model was used to estimate treatment performance and capacity for the target MLSS of 3,500 mg/L and to estimate modeled conditions for existing and projected MMF. Table 2-10 summarizes model estimates for existing conditions based on different flows. Variations in BOD, TN, and TP treatment between base model conditions were negligible between each scenario with the exception of TSS roughly doubling for projected MMF (20 mg/L in the effluent). The most affected model variable between each scenario was MLSS.

Table 2-10. Existing Conditions as Compared to the Calibrated Model

Flow Scenario	Existing Capacity Based on Average Flow 0.26 MGD	Existing Capacity Based on Target MLSS 0.28 MGD	Existing MMF 0.3 MGD	Projected MMF 0.56 MGD
BOD Loading (lb/day)	453	488	523	976
MLSS (mg/L)	3,250	3,500	3,700	6,700
Aeration Required (SCFM)	460	500	540	1,055

Values summarized in Tables 2-8 and 2-9 show that the organic loading capacity per MDEQ recommendations is exceeded for existing average and maximum month flow and a target MLSS of 3,500 mg/L is exceeded for existing MMF, respectively. Despite these exceedances, treatment data from the last three years indicates that current organic loading can be treated despite a higher operational MLSS and increased aeration effort. Based on these factors, it is assumed that the aeration basin's existing capacity is 0.34 MGD.

SECONDARY CLARIFIERS

The purpose of the secondary clarifier is to separate the activated sludge from the final effluent and to thicken the waste sludge prior to discharging to the aerobic digester or sludge lagoon. The multiple processing steps, clarification and sludge thickening, are partially conflicting. With clarification, it is desirable to remove the sludge as rapidly as it settles. For thickening, it is desirable to retain the sludge to allow it to compact and remove excess water from the sludge. At larger wastewater treatment plants, clarification and thickening are frequently performed in separate tanks focused on these specific objectives. There are two secondary clarifiers at the WWTP, but Secondary Clarifier 1 is not in use. The capacity of Secondary Clarifier 2 is 1.01 mgd. The dimensions of both clarifiers are summarized in Table 2-11.

Table 2-11. Secondary Clarifier Capacity

Unit Process	Value
Clarifier 1*	
Diameter	23.5 ft
Side Water Depth	15 ft
Clarifier 2	
Diameter	45 ft
Side Water Depth	16.5 ft
Original Design Capacity	1.01 mgd
*Clarifier 1 is not currently in use	

UV SYSTEM

Effluent from the secondary clarifier undergoes UV treatment before final discharge to the Bitterroot River. The UV disinfection system at the Lolo WWTP currently consists of two banks that are in service with space for additional banks for future flow requirements. Each respective bank has a peak flow capacity of 1.01 mgd. UV system information is summarized in Table 2-12.

Table 2-12. Tertiary Treatment Capacity

Unit Process	Value
UV Disinfection	
Number of Banks	2 (1 Duty, 1 Spare)
Capacity (per bank)	1.01 mgd peak flow
Type of Lamp	Low pressure, high intensity, variable output
Cleaning System	Automatic Wiper

SLUDGE COLLECTION AND PUMPING

Operation of the Aeration Basin system requires that sludge be returned. Typically, a sludge return rate equal to 50 to 70 percent of the influent wastewater flow is used. Two RAS pumps pump clarifier underflow (RAS) and discharge it to the aeration tank influent line. Control of the RAS flow is provided by using variable speed pump controllers and cycle timers.

Waste activated and digested sludge transfer pumping is accomplished by progressive cavity pumps located in the basement of the Control Building. The suction lines from the aerobic digester and secondary clarifier are configured such that each pump may serve as a redundant unit to the other.

Floating solids called scum accumulate at the surface of the Secondary Clarifier. All secondary scum collected is transferred via submersible chopper pump to the aerobic digester. Operations staff have indicated the pumping system collects a considerable amount of water at each pumping cycle which is a very inefficient process for scum collection. Staff have modified the pumping cycles to minimize the amount of extra water carry-over to the digester; however, this system is not operating at desirable conditions. The respective capacities of the RAS pumps, WAS pumps, and scum pump are summarized in Table 2-13.

Table 2-13. Sludge Pumping Capacities

Unit Process	Value
Waste Activated Sludge Pumps	
Number	2
Type	Progressing Cavity
Capacity (ea)	10 gpm
Power	1 HP
Return Activated Sludge Pumps	
Number	2
Type	Centrifugal
Capacity (ea)	110 gpm at 111' TDH
Scum Pump	
Number	1
Type	Submersible Chopper
Capacity (ea)	210 gpm at 17' TDH
Power	5 HP

AEROBIC DIGESTER

The treatment plant includes a single aerobic sludge digester with a volume of 600,000 gallons. The digester aeration system consists of several floating surface aerators. During digestion, volatile, putrescible solids are converted to carbon dioxide and water which reduces sludge volume. This volatile solids destruction is necessary to meet the Part 503 Sewage Sludge Regulations and also to reduce the quantity of sludge to be disposed. Regulations state that aerobic digestion between 40 days at 20°C (68°F) to 60 days at 15°C (59°F) is required to produce a Class B sludge product. Since the sludge may exceed the lower temperature range during the winter, the necessary detention period to achieve this level of solids reduction may be extensive.

SLUDGE STORAGE LAGOON

Aerobically digested biosolids overflow from the aerobic digester to the sludge storage lagoon. The storage lagoon has a volume of 3,080,000 gallons. Additional stabilization of solids likely occurs in the sludge storage lagoon, although the extent of stabilization is difficult to quantify. The lagoon is fitted with surface aspirating-type aerators sized at 10 HP each. The volumes of the sludge storage basin, as well as the capacities of the sludge transfer pump and aerators, are summarized in Table 2-14. A photo of the lagoon is shown in Figure 2-10.

Table 2-14. Sludge Digestion and Storage Capacities

Unit Process	Value
Blowers	
Number	3
Type	Aspirating Aerator
Power (ea)	10 HP
Sludge Storage Basin	
Volume	3,080,000 gal
Type	Lined Lagoon
Sludge Transfer Pump	
Number	1
Type	Non-clog Centrifugal
Capacity	400 gpm at 34’ TDH
Power	7.5 HP

Figure 2-10. Sludge Storage Lagoon

2.4.5.4 Capacity Summary

The capacities of the respective WWTP unit processes are summarized in Table 2-15.

Table 2-15. WWTP Unit Process Capacities

Process Area	Design Condition	Capacity at Design Condition
Headworks		
Rotary Screen	Peak Hour	2.10 mgd
Influent Pumps	Peak Hour, Firm Capacity	0.32 mgd
Secondary Treatment		
Aeration Tanks	Max Month	0.34 mgd
Secondary Clarifier Basin	Max Month	1.60 mgd
Tertiary Treatment		
UV Disinfection	Peak Hour, Firm Capacity	1.01 mgd
RAS/WAS System		
RAS Pumps	RAS Rate, Firm Capacity	110 gpm
WAS Pumps	WAS Rate, Firm Capacity	10 gpm
Solids Digestion and Disposal		
Aerobic Digester	WAS Rate, 60-day HRT	7 gpm
Sludge Transfer Pump	-	400 gpm

2.5 Financial Status of Wastewater Utility

2.5.1 Target Rates

The Community Development Division (CDD) of the Montana Department of Commerce has updated the U.S. Census Bureau's American Communities Survey (ACS) data set 2015-2019 for the calculation of local government target rates. The Treasure State Endowment Program (TSEP) and Community Development Block Grant (CDBG) programs use ACS information as the base data set to calculate applicant target rates for community infrastructure systems. These calculated rates, along with other demographic information, are components of the review and analysis of applications submitted to the programs for funding requests. Applications to be submitted in 2021 or later for TSEP or CDBG programs must use the 2015-2019 ACS data for the calculation of target rates for an applicant. Lolo tabulates revenues as a combined water and sewer revenue figure. The target rate for water and sewer for Lolo CDP is $112.49.

2.6 Water/Energy/Waste Audits

There are no applicable audits pertaining to this project to discuss at this time.

3. Need for Project

3.1 Health, Safety, and Sanitation

There are no relevant concerns pertaining to health, sanitation, or safety to discuss at this time.

3.2 Aging Infrastructure

3.2.1 Lift Station No. 1

Lift Station No. 1 includes the wet well / dry well structure that was originally constructed, with updated electrical equipment, instrumentation and controls, and pumps. However, the structures are reaching the end of their useful life and need to be replaced. The lift station electrical equipment is also installed in a location that provides some line-of-sight obstruction for the resident at 320 Red Fox Drive. In addition, the existing capacity of the lift station needs to be expanded to accommodate future flows.

3.2.2 Lift Station No. 3

Lift Station No. 3 was built in 2006 and appears to be in good condition. At this time, the lift station has sufficient hydraulic capacity, but as development continues to occur, the lift station's pumps will need to be upgraded to meet the projected 2040 wastewater flows.

3.2.3 Collection System

The RSID 901 collection system is comprised of 15 miles of pipe up to 12 inches in diameter. An inflow/infiltration analysis was conducted by HDR Engineering, Inc. from March to October 2020, in four geographical areas that include Lakeside, the main trunk carrying 95% of flow to the WWTP, and its three main laterals: Riverside, Glacier, and Dove. Infiltration was measured over a separate period for each area, reaching as high as 1.23 GPD/LF within the system. Infiltration analysis suggests the existing gravity sewer pipes within the River and Glacier areas are experiencing the highest amount of infiltration on a lineal feet basis as a result of their age and existing condition. A review of available CCTV data was performed for a portion of the collection system. The overall gravity main condition for the areas that were televised appears to be good; however, there were a number of service laterals with noticeable infiltration at the service lateral to gravity main connection, in addition to considerable root intrusion.

3.3 Reasonable Growth

3.3.1 Lift Stations and Collection System

As outlined in Section 1, development and growth in Lolo is expected to continue which will become a capacity issue for the existing lift stations and collection system. The projected flows will begin to cause capacity-related issues at Lift Station No. 1 in the near future, both with the wet well capacity, pump capacity, and also with available force main capacity and redundancy. The collection system will also begin to see capacity-related issues, primarily with the gravity mains along the main trunk line located in Lakeside Drive and River Drive. The 2020 collection system inflow/infiltration analysis suggests that key laterals within the Lolo system are currently between 29% and 64% of peak capacity. However, Lolo's new school is planned to move to the River lateral, which currently experiences the highest loading. Lolo School flow data, accounting for remote learning at the time of analysis, suggests that the River Lateral will be able to support approximately 89 more EDUs before meeting capacity. A number of gravity mains have been identified in this PER as needing to be upsized in order to accommodate growth. Table 3-1 provides the current design point for each lift station, 2020 flow conditions, and projected 2040 flow conditions.

Table 3-1. Projected Lift Station Influent Flows

Year / Condition	Lift Station No. 1	Lift Station No. 3
Current Design Point	424 gpm	110 gpm
2020 Dry, Average Day	265 gpm	13 gpm
2020 Peak, Wet Weather	703 gpm	54 gpm
2040 Dry, Average Day	330 gpm	98 gpm
2040 Peak, Wet Weather	897 gpm	353 gpm

3.3.1.5 Collection System Capacity Analysis

As mentioned in Section 2, the collection system capacity currently meets average flows during dry weather events but begins to experience capacity issues during peak hour, wet weather flows. Projected 2040 growth and associated wastewater flows were distributed within the sewer collection system model per location direction from Operations Staff to determine system capacity for projected 2040 flows. Figure 3-1 and Figure 3-2 depict existing system conditions under 2040 demand for average and peak conditions respectively.

Under 2040 average day dry weather conditions, existing system capacity is sufficient but 2040 peak wet weather conditions exceed capacity in multiple areas. Similar to existing peak wet weather conditions, Lakeside Drive and Riverside Drive are the primary areas with additional capacity needs. Project alternatives that provide for additional capacity are highlighted in Section 4.

3.3.2 Wastewater Treatment Plant

Population trends suggest that Lolo will continue to grow during the 20-year planning period, which will bring additional wastewater influent to the WWTP. Additionally, Missoula County plans to continue to convert existing Lolo households from individual septic systems to RSID wastewater connections. Connection of current residents along with population growth could mean growth of 4-5% per year in RSID 901 connections, which far exceeds the population growth rate discussed in Section 1. Taken together, these factors will soon bring the Lolo RSID WWTP to near its design capacity.

3.3.2.1 Projected Wastewater Flows

Lolo's service population is expected to grow at a higher rate than straight population growth suggests due to existing households connecting to the system in lieu of using septic tanks.

This will lead to higher influent flows than simply projecting from population increase. Projected influent flows are shown in Table 3-4.

Table 3-2. Projected Influent Flows

Year	Average Day (mgd)	Max Month (mgd)	Peak Day (mgd)	Peaking Factor	Peak Hourly (gpm)
2020	0.26	0.30	0.33	3.38	604
2025	0.30	0.35	0.39	3.32	694
2030	0.35	0.41	0.46	3.26	796
2035	0.41	0.48	0.53	3.20	912
2040	0.48	0.56	0.62	3.14	1,044

Average flows were projected using the projected population values in Table 1-1 and an average daily demand per capita value of 68.6 GPDC. Peak day flows were projected using the projected population values in Table 1-1 and the average per capita sewer usage on max usage days from 2018-2021.

Peak hourly demand flows were calculated by multiplying the projected average day flow by the design peak hourly flow factor developed using the formula shown in MDEQ Circular 2, whose equation is shown below. Design peak hourly flow is defined as the largest volume of flow demand during a one-hour period expressed as a volume per unit time. The variable P is population in thousands. The peak hour flow is intended to be used as a worst-case scenario planning event.

$$Design\ Peak\ Hourly\ Flow = \frac{(18 + \sqrt{P})}{(4 + \sqrt{P})} * Design\ Average\ Flow$$

The 2020 service population is estimated to be approximately 3,500, which yields a peaking factor from the DEQ-2 formula of 3.38.

3.3.2.2 Projected Sludge Flows

Projected sludge flows to the aerobic digester and the solids stream were calculated using the flows in Table 3-2 and modeling from BioWin to determine optimal RAS and WAS rates. The projected flow and solids loading from the WAS is summarized in Table 3-3.

Table 3-3. Projected WAS Flows

Year	Flow (gpm)	% TSS	lb/d TSS
2020	3.6	1.1%	472
2040	6.8	1.1%	895

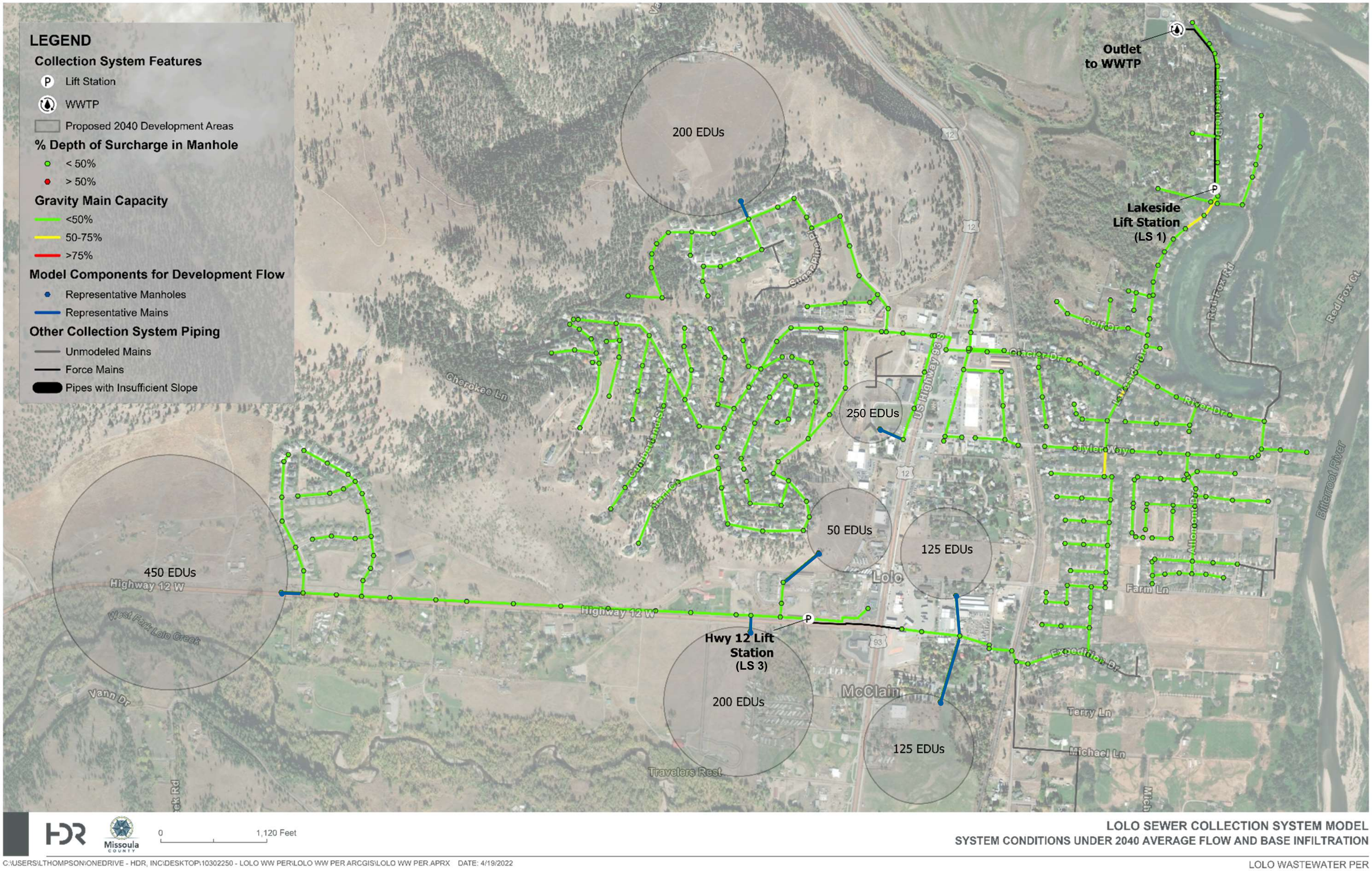

Figure 3-1. Existing Collection Conditions Under 2040 Average Flow and Base Infiltration

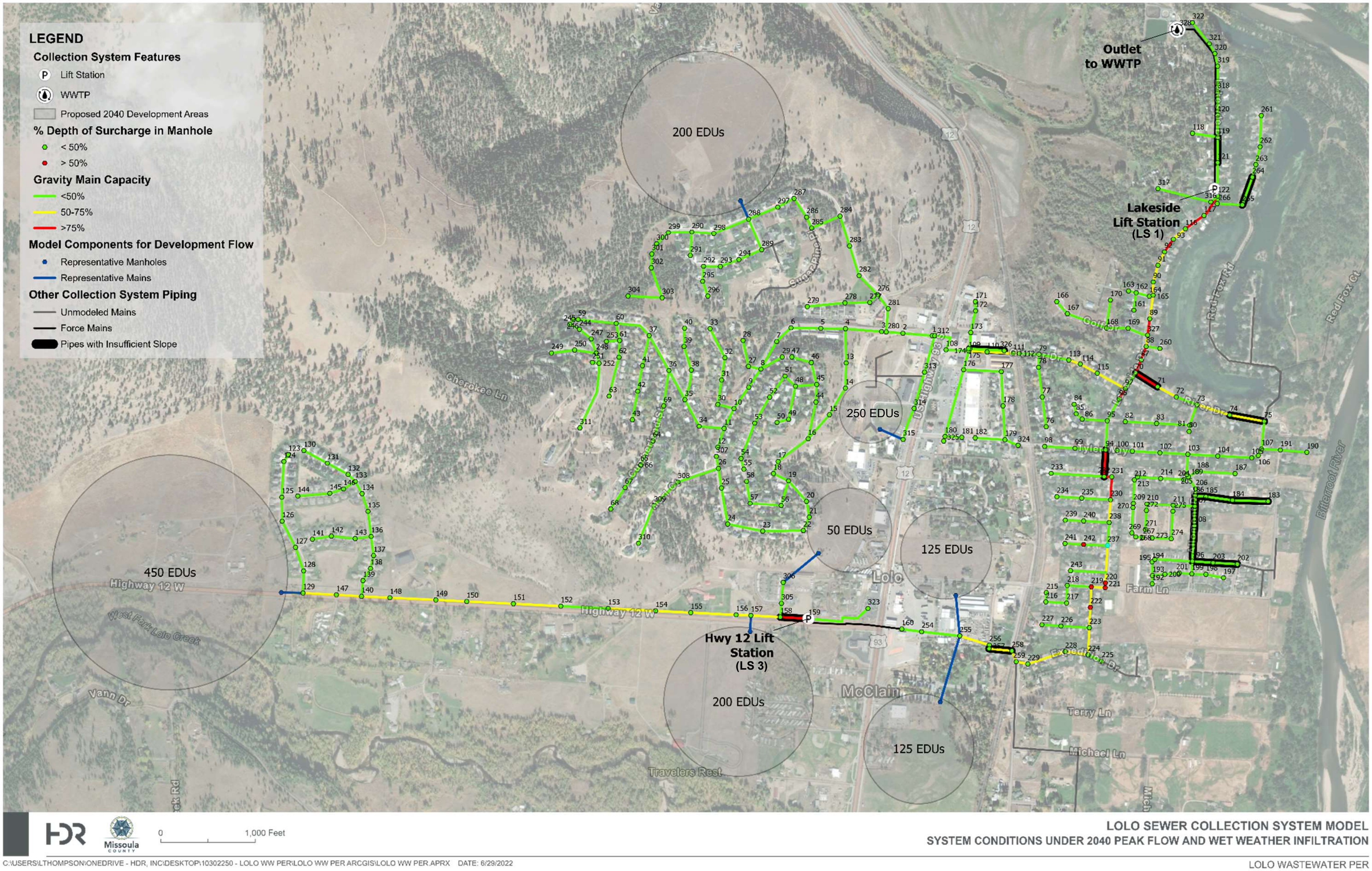

Figure 3-2. Existing Collection Conditions Under 2040 Peak Flow and Wet Weather Infiltration

3.3.2.3 WWTP Capacity Analysis

The projected growth, and accompanying increase in flows, outlined in Section 3.3 constitutes the primary need for the project. To quantify whether the WWTP can accommodate the future projected flows, a capacity analysis was performed for each unit process to determine where deficiencies are projected and whether consideration of any alternatives is required. The existing capacity of each unit process was established in Section 2, and these values are compared to the projected loadings expected during the planning period in the following subsections.

The capacity of a wastewater treatment plant is linked to its ability to transport a volumetric quantity of wastewater. However, wastewater treatment plant capacity is also defined in terms of its capacity to accommodate organic and solids loadings. Organic strength is measured by biochemical oxygen demand (BOD) and solids strength by suspended solids (TSS). Treatment unit sizing is therefore based upon hydraulic, organic, and solids criteria, depending on the unit process. For the Lolo RSID 901 WWTP, capacity criteria for unit processes are identified in Table 3-4.

Table 3-4. Wastewater Treatment Plant Limiting Capacities

Treatment Process	Limiting Criteria
Liquid Stream	
Screens	Hydraulic
Equalization Basin	Hydraulic
Influent Lift Pumps	Hydraulic
Aeration Basins	Hydraulic and Organics Loading
Secondary Clarifier	Hydraulic and Solids Loading
UV Disinfection	Hydraulic
Solids Stream	
RAS/WAS System	Hydraulic and Solids Loading
Aerobic Digester	Solids Loading
Sludge Storage Lagoon	Solids Loading

SCREENING

The rotary screen has a capacity of 2.10 mgd. This capacity is adequate to cover the range of expected future peak flows during the planning period. No further alternatives will be considered for the headworks screening.

EQUALIZATION BASIN

The working capacity of the equalization basin is 40,000 gallons, or 5,348 cubic feet. As the EQ basin is not a “true” equalization basin necessary for the proper functioning of the plant, the current volume is adequate for its intended purpose. i.e., all unit processes will be sized to meet the appropriate projected flow regardless of whether any flow equalization is provided. The existing capacity will provide some equalization of the variations in diurnal flow, which is adequate for current treatment function.

INFLUENT/TRANSFER LIFT PUMPS

Influent Pump 1 has a design point of 565 gpm at 69' TDH, or 0.81 mgd. Influent Pump 2 has a design point of 225 gpm at 69' TDH, or 0.32 mgd. These pumps are undersized to meet the projected 2040 peak hour flow of 1,044 gpm, and the pumps will need to be upgraded or additional units will need to be installed to meet the future design condition with one pump out of service (firm capacity).

AERATION BASINS

As discussed in section 2.4.4, a maximum month flow (MMF) of 0.34 MGD was determined to be the maximum flow or capacity of the existing aeration basins. It is estimated that a MMF of 0.34 MGD could occur as soon as 2025, and more aeration basin capacity will be required to meet the 2040 MMF of 0.56 MGD.

SECONDARY CLARIFIERS

The two critical factors in secondary clarifier design are the surface overflow rate and the solids loading rate. The surface overflow rate is the rate of flow leaving the clarifier divided by the clarifier surface area. The overflow rate is thus the average upward velocity of effluent leaving the clarifier. Suspended solids will be captured in the clarifier if their settling velocity is greater than the average overflow rate.

The solids loading rate is also important in determining the clarifier capacity. The solids loading rate is the total mass rate of suspended solids entering the clarifier divided by the tank cross-sectional area. The total mass rate to the clarifier is the sum of the tank effluent flow rate and the tank underflow, or RAS pumping rate, times the MLSS concentration. A safety factor is typically applied to the clarifier design that takes into consideration variations in design loading, settleability, and other variables.

Secondary Clarifier 2 at the WWTP was designed to meet a 1.01 mgd flow. This flow is slightly less than the projected 2040 peak hour value. The solids loading to the clarifier must also be considered, as the operating points for the aeration tank system are not necessarily identical to the original design point. MDEQ Circular 2 stipulates a maximum surface overflow rate of 1,200 gpd/ft^2, and a maximum solids loading rate of 50 lb/d/ft^2 for conventional treatment processes not needing to meet 20 mg/L TSS. Surface overflow rate and solids loading to Secondary Clarifier No. 3 for 2020 and 2040 peak hour flows are shown in Table 3-5. A 70% RAS rate and MLSS concentration of 3,500 mg/L was used in the calculations.

Table 3-5. Secondary Clarifiers Loading

Parameter	2020 Rate	2040 Rate	Maximum Design Value
Surface Overflow Rate (gpd/ft^2)	547	945	1,200
Solids Loading Rate (lb/d/ft^2)	27.1	46.9	50

The projected future flows do not exceed the capacity of the existing Secondary Clarifier No. 3, but there is not currently any redundancy at the WWTP. The loading analysis and DEQ benchmarks suggest that the secondary clarifier can accommodate up to approximately 1.60 mgd overall influent flow, with the solids loading being the limiting parameter. A capacity analysis was also performed for Secondary Clarifier No. 1 using the same parameters. The capacity analysis suggests that SC No. 1 can accommodate up to 0.44 mgd overall influent flow, with the solids loading being the limiting factor.

UV SYSTEM

The UV disinfection system at the Lolo WWTP consists of two banks. Each respective bank has a peak flow capacity of 1.01 mgd. Additional lamps should be installed eventually to provide peak hour redundancy at future projected peak hour flows, but this will not be necessary until the end of the planning period.

RAS/WAS PUMPS

The existing WAS pumps have respective capacities of 10 gpm. This is adequate to meet the projected 2040 WAS flow of 6.8 gpm. The existing RAS pumps have respective capacities of 110 gpm. These pumps are old and have reached the end of their expected life. They will be replaced with new pumps capable of meeting the projected max month flows.

AEROBIC DIGESTER

The aerobic digester has a capacity of 600,000 gallons. At the projected 2040 WAS rate of 6.8 gpm, this flow rate translates to a projected HRT of approximately 61 days. To conform to the requirements of 40 CFR Part 503 and produce Class B biosolids, aerobic digestion between 40 days at 68°F to 60 days at 59°F is required. The projected HRT is adequate to meet Part 503 requirements so long as an adequate temperature is maintained in the digester. No further alternatives analysis is necessary for the aerobic digester.

SLUDGE STORAGE LAGOON AND DEWATERING

Digested sludge from the aerobic digester flows by gravity to the sludge storage lagoon. The status quo operations of dredging biosolids from the lagoon and placing them into biobags to dewater is undesirable due to limited staff availability and the intensity of labor required to perform the operation. This operation will be replaced. Alternatives for final biosolids disposal are discussed in Section 4.

3.3.2.4 Summary

The existing capacities of the various unit processes are shown in Table 3-6, and the accompanying design flow at projected 2040 conditions is also provided. Process elements that are not projected to meet 2040 capacity requirements are highlighted red. Process elements that are projected to meet 2040 design conditions but will require additional redundancy to meet regulatory requirements are highlighted orange.

Unit processes that show capacity deficiencies by the end of the planning horizon include the influent pumps, aeration tanks, secondary clarifier basins, UV disinfection, and biosolids dewatering. Upgrade alternatives for these processes are evaluated in Section 4.

Table 3-6. Summary of Identified Capacity Deficiencies

Process Area	Design Condition	Capacity at Design Condition	2040 Design Flow
Headworks			
Rotary Screen	Peak Hour	2.10 mgd	1.50 mgd
Equalization Basin	Peak Hour	40,000 gal	1.50 mgd
Influent Pumps	Peak Hour, Firm Capacity	0.32 mgd	1.50 mgd
Secondary Treatment			
Aeration Tanks	Max Month	0.34 mgd	0.56 mgd
Secondary Clarifier Basin	Peak Hour Hydraulic, Peak Hour & 70% RAS Solids	1.60 mgd	1.50 mgd
Tertiary Treatment			
UV Disinfection	Peak Hour, Firm Capacity	1.01 mgd	1.50 mgd
RAS/WAS System			
RAS Pumps	RAS Rate, Firm Capacity	110 gpm	292 gpm
WAS Pumps	WAS Rate, Firm Capacity	10 gpm	6.8 gpm
Solids Digestion and Disposal			
Aerobic Digester	WAS Rate, 60-day HRT	7 gpm	6.8 gpm
Biosolids Dewatering	WAS Rate, Firm Capacity	NA	6.8 gpm

4. Alternatives Considered

4.1 Summary of Needs/Description

4.1.1 Lift Station No. 1

Existing condition and capacity-related deficiencies for Lift Station No. 1 were identified in Section 3. Lift station components that show capacity or redundancy deficiencies by the end of the planning horizon include wet well, pumping units, and the force main that conveys flow to the equalization basin at the WWTP. Alternatives pertaining to lift station design and force main alignment will be addressed in this section.

4.1.2 Collection System

Capacity deficiencies for the collection system were identified in Section 3. Proposed gravity main upsizing alternatives are outlined in this section.

4.1.3 Wastewater Treatment Plant

Capacity deficiencies for the individual unit processes at the WWTP were identified in Section 3. Unit processes that show capacity or redundancy deficiencies by the end of the planning horizon include the influent pumps, aeration tanks, UV disinfection, and biosolids dewatering. Alternatives for these respective unit processes are considered in this section.

4.2 Design Criteria

4.2.1 Lift Stations No. 1

All lift station improvements will be designed in accordance with the Montana Department of Environmental Quality Circular DEQ-2: Design Standards for Wastewater Facilities and with Missoula County Public Works Standards & Specifications.

4.2.2 Collection System

The design parameters for the wastewater collection system will include slope requirements per Montana Department of Environmental Quality Circular DEQ-2: Design Standards for Wastewater Facilities, and additional industry-standard metrics for evaluating sewer collection system capacity. Generally, manholes with an unfilled depth of less than 50% and a d/D ratio of greater than 75% are used throughout the industry as indicators of potential capacity insufficiencies. These metrics were also used to inform collection system improvements to increase capacity.

4.2.3 Wastewater Treatment Plant

4.2.3.5 Liquid Stream

The design parameters for the liquid stream portion of the WWTP are the future projected flows and aforementioned BioWin modeling characteristics. These flows are shown in Table 3-2 and BioWin model set up and description can be found in section 2.4.4.

Recommended MDEQ Circular 2, section 92.31 loading criteria is exceeded by current average loading even though aeration capacity and treatment performance are recorded as sufficient in the data. The BioWin model uses current plant characteristics and data to provide conservative treatment performance and capacity estimates that are closer to existing conditions. Because of these considerations, the model was elected to be used for design because of its ability to better estimate existing aeration basin capacity conditions as compared to MDEQ guidance.

4.2.3.6 Solids Stream

The design parameters for the solids stream portion of the WWTP are the projected WAS flows. These flows and associated solids content are shown in Table 3-3.

4.3 Alternatives Descriptions

4.3.1 Lift Station No. 1

Alternatives that were evaluated as part of the lift station improvements included the siting location of the lift station, configuration and type of wet well and wet well pumping arrangement. Alternatives that were evaluated for the force main included pipe size, number of force mains, and alignment. A “do nothing” alternative, in which no lift station improvements are made was considered along with the various alternative analyses presented below; however, this option does not address the issues associated with upcoming development and growth and therefore will not be carried forward for further evaluation.

4.3.1.1 Lift Station Siting Options

The two site alternatives evaluated were:

- Alternative 1. New lift station wet well and valve vault located farther away from Lakeside Drive on existing 320 Red Fox Rd. property (requires property acquisition).
- Alternative 2. New lift station wet well and valve vault where existing electrical equipment is currently installed.

ALTERNATIVE 1

This alternative locates the new wet well and valve vault approximately 15’ off the edge of pavement along Lakeside Drive, and subsequently outside of the public right of way and will require approximately 1,625 sq ft (0.037 ac) of property acquisition from 320 Red Fox Rd. This alternative allows for the re-use and relocation of some existing electrical equipment installed in 2014 and removes any line-of-sight obstructions for vehicular traffic pulling onto Lakeside Drive from 320 Red Fox Rd. The alternative allows the existing lift station to remain online and active throughout construction to minimize the amount of required bypass pumping.

ALTERNATIVE 2

This alternative locates the new wet well and valve vault within the public right of way, where the existing electrical equipment pad is currently installed. There is no property acquisition required for his alternative; however, a significant amount of bypass pumping is required, and the proposed lift station enclosure may still provide some line-of-sight issues for vehicular traffic leaving 320 Red Fox Rd.

4.3.1.2 Force Main Configuration, Size, and Alignment

Three potential force main arrangements were evaluated:

- Alternative 1. A single force main
- Alternative 2. Dual force mains of identical size
- Alternative 3. Dual force mains of differing size

ALTERNATIVE 1

This alternative evaluated the use of a single force main to convey projected 2040 peak flows from Lift Station No. 1 to the equalization basin at the WWTP. Based on the diameter of the existing force main, conveyance of the projected 2040 flows in the existing force main is impractical due to resulting high pipe velocities that would create excessive head loss and require increase motor size for the lift station pumps. In addition, a single force main configuration does not provide for the redundancy that is desired by Lolo Operations Staff. Since the system's entire wastewater flow is pumped from Lift Station No. 1 to the WWTP, a failure of this pipe would be catastrophic.

ALTERNATIVE 2

This alternative evaluated the use of dual force mains of identical size. Due to the existing force main being 6-inch diameter, a dual force main configuration would require both force mains be utilized under normal operating conditions to convey the range of flows; therefore, eliminating the desired redundancy.

ALTERNATIVE 3

This alternative evaluated the use of dual force mains of differing size, which utilizes the existing 6-inch force main, and a new 8-inch force main. This configuration allows for maximum operational flexibility through a valved interconnection at the lift station. The existing 6-inch force main would remain in service (i.e., not abandoned) but valved off and would be used for redundancy or emergencies, should the proposed 8-inch force main need to be taken offline.

The new force main would be installed along Lakeside Drive parallel to the existing force main, through the plant parking lot and into the influent channel. A valved interconnection with the exiting 6-inch force main would be installed just prior to the new force main connection into the influent channel to allow for either force main to be utilized.

4.3.1.3 Lift Station Pump Configuration

It is proposed that Lift Station No. 1 would discharge to a dual 6-inch/8-inch force main configuration and would be designed for a peak flow of 897 gpm (primary design point) and a minimum flow rate of 330 gpm (secondary design point). To meet the system hydraulic requirements, a tri-plex (3-pump) submersible pump arrangement is being proposed. Two differing sized pumps are being proposed to handle the wide range in flows efficiently while still providing for the required redundancy. A single large horsepower pump will be capable of meeting the 2040 peak flow when operated alone. The pump will be capable of passing a 3-inch solid. Two (2) smaller horsepower pumps will be provided to meet the 2040 peak flow when operated together. These pumps will be capable of passing a 3-inch solid. The two smaller pumps will be designed to handle normal lift station operation (lead and lag) with the larger submersible pump available for significant wet weather events and as the required redundancy. Each pump will be equipped with VFDs to allow for operational flexibility and more efficient operation as conditions and flows change. Each pump will be provided with a stainless-steel guide rail used to direct each pump in proper alignment with the stationary discharge piping. One (1) large wet well access door will be provided to allow for pump removal using a portable davit crane. Wet well level will be measured through the use of a submersible level transducer with a backup float system for low and high-high levels.

4.3.1.4 Lift Station Wet Well Configuration

To accommodate the projected 2040 flows and allow for adequate pump clearances, the proposed wet well is a 10' diameter circular structure. The wet well will be configured with a three-pump arrangement with one pump serving primarily as redundancy for the other two pumps. The approximate wet well depth will be determined by the existing influent line elevation and based on knowledge of the existing system would be approximately 25' in depth.

The wet well structure will be protected from hydrogen sulfide and corrosion with the use of an admixture of Xypex Bio-San C500, or an approved equal. Above-ground enclosures that house control panels and other electrical equipment will be constructed of FRP.

The wet well configuration will include permanent suction bypass piping to be used in conjunction with a permanent above-grade emergency pump connection on the discharge side which will remain valved off until bypassing of the lift station is required, and a removable davit crane to assist in pulling pumps, when required.

4.3.2 Collection System

The aforementioned sewer collection system model was used to evaluate areas for gravity main replacement and upsizing, and to identify locations that experienced surcharging under the projected 2040 peak flow, wet weather conditions. Figure 4-7 below depicts the proposed collection system improvements that provide for increased capacities and favorable manhole unfilled depth and d/D ratio metrics under the projected 2040 peak wet weather flows.

Collection system improvements consist of approximately 2,200 LF of 16-inch gravity main to replace the existing 12-inch gravity mains from Lift Station No. 1 south to the intersection of Lakeside Drive and River Drive; approximately 1,500 LF of 10-inch gravity main along River Drive to replace the existing 8-inch gravity main; and approximately 1,200 LF of 12-inch gravity main to replace the existing 8-inch and 10-inch gravity mains from the intersection of Lakeside Drive and River Drive south to the intersection of Lakeside Drive and Bison Lane. All of the proposed improvements will address the manhole and gravity main capacity concerns for the projected 2040 peak flow. Required lengths of new piping are summarized in Table 4-1.

Table 4-1. Required Lengths of New Sewer Piping

Pipe Diameter	Required Length to be Installed (Lineal Feet)
10”	1,467
12”	1,179
16”	2,278

4.3.3 Wastewater Treatment Plant

The developed alternatives for each respective unit process are introduced in the following subsections.

4.3.3.5 Influent Pumps

There are two alternatives pertaining to the influent pumps.

- Alternative 1. Maintain Status Quo/Do Nothing
- Alternative 2. Install New Influent Pumps

In Alternative 1, the existing influent pumps would continue to be used and no additional pumping capacity would be added. This alternative would result in projected peak hour flows surpassing the firm capacity of the existing pumps and possibly inhibiting proper WWTP operations. As a result, this alternative is dismissed and is not considered further.

In Alternative 2, the existing influent pumps will be replaced with two or more pumps of higher capacity that would be capable of meeting the projected planning period flows with one pump out of service (firm capacity). No other major infrastructure changes will be required to facilitate Alternative 2. Pumps will be placed in the basement of the Control Building.

A system curve was constructed based on the as built drawings to size the replacement influent pumps. Based on this information, the pumps will need to cover a range of design points during the 20-year planning period from 796 gpm at 32’ TDH to 1,044 gpm at 43’ TDH. The preliminary design plan is to install one large pump capable of handling the entirety of the peak hour flow, and two smaller pumps capable of handling the peak hour flow combined. This will provide for required redundancy and operational flexibility to accommodate lower influent flows, as the peak hour flow is large and will likely be observed infrequently.

4.3.3.6 RAS Pumps

There are two alternatives pertaining to the influent pumps.

- Alternative 1. Maintain Status Quo/Do Nothing
- Alternative 2. Install New RAS Pumps

In Alternative 1, the existing RAS pumps would continue to be used and no additional pumping capacity would be added. This alternative would result in projected RAS flows surpassing the firm capacity of the existing pumps and possibly inhibiting proper WWTP operations. As a result, this alternative is dismissed and is not considered further.

In Alternative 2, the existing RAS pumps will be replaced with two pumps of higher capacity that would be capable of meeting the projected planning period flows with one pump out of service (firm capacity). No other major infrastructure changes will be required to facilitate Alternative 2. Pumps will be selected to provide a firm capacity of 292 gpm at 11' TDH, with turndown capacity to 214 gpm at 9' TDH. These flows represent 75% of the 2040 and 2030 max month flows, respectively.

4.3.3.7 Aeration Basin

As discussed in Section 4.2.3.5, the aforementioned BioWin model, based on maintaining existing treatment performance and targeting an MLSS of 3,500 mg/L, was used to estimate alternative performance, sizing, and capacity for 2040 flows. Five alternatives are proposed for aeration basin or reactor improvements.

Alternatives 1 to 3 would require a redundant clarifier deviation which will need to be requested and approved by MDEQ as the existing decommissioned Secondary Clarifier No. 1 serves as the redundant clarifier. It is expected that the adjacent sludge storage lagoon has capacity and potential to serve as an emergency/redundant clarifier. Alternative 4 would be required if a redundant clarifier variance was not approved. Alternatives 3 and 5 would be required and economical only if permitted nutrient loading amounts decrease significantly. Summarized treatment processes that are mentioned for the alternatives are depicted in Figure 4-1.

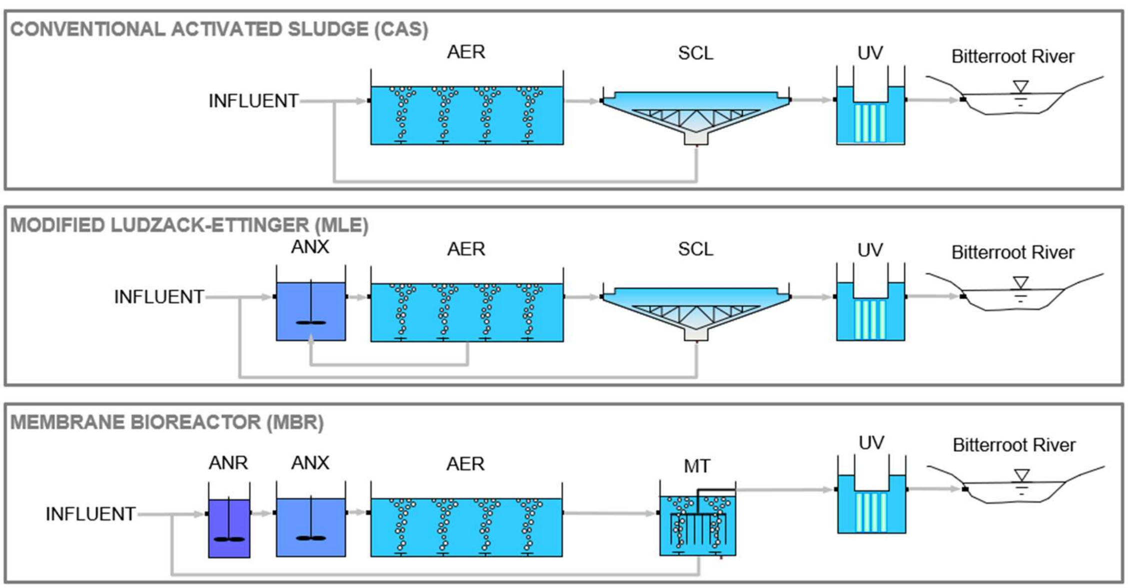

Figure 4-1. Proposed Alternative Treatment Configurations

ALTERNATIVE 1

Alternative 1 would convert the existing basin internal clarifier to an aerobic reactor to maintain the existing conventional activated sludge (CAS) treatment process and increase capacity. Converting the existing decommissioned internal clarifier to an aerobic reactor would increase MMF capacity to 0.4 MGD to accommodate an approximate 500 additional EDUs or the estimated population in 2030. Figure **4-2** depicts the Alternative 1 layout.

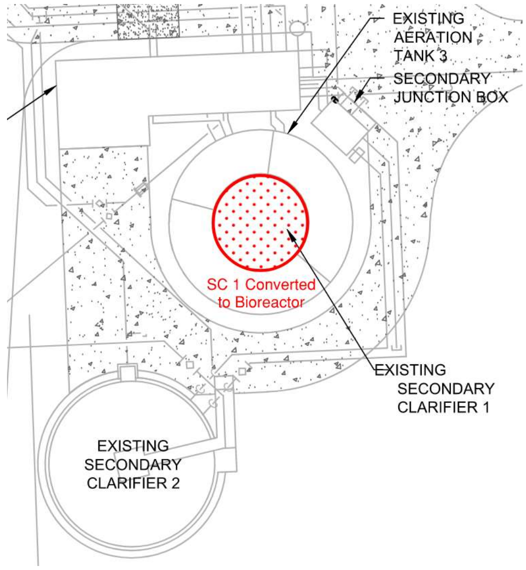

Figure 4-2. Aeration Basin Alternative 1 Layout

ALTERNATIVE 2

Alternative 2 would convert the existing decommissioned internal clarifier to an aerobic reactor to maintain the existing conventional activated sludge (CAS) treatment process and increase MMF capacity to 0.4 MGD to accommodate an approximate 500 additional EDUs or the estimated population in 2030. To accommodate projected growth and a MMF of 0.56 MGD in 2040, an additional 83,000 gallons of aerobic reactor capacity would be constructed to meet loading and treatment criteria. Figure 4-3 depicts the alternative 2 layout.

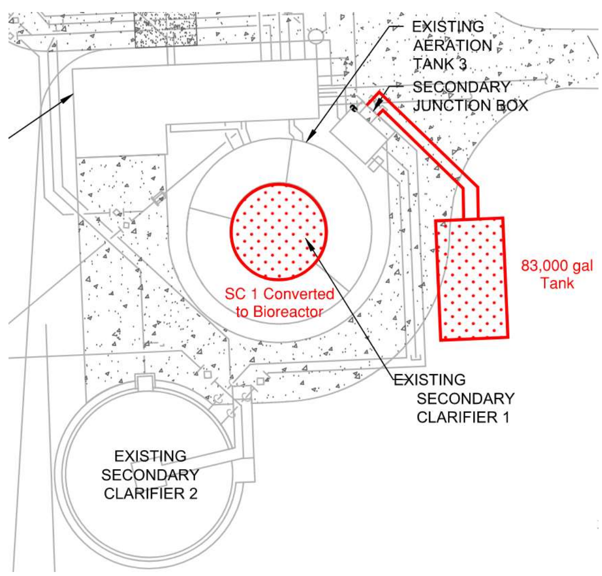

Figure 4-3. Aeration Basin Alternative 2 Layout

ALTERNATIVE 3

In the case that nutrient regulations become more stringent on the Bitterroot River, a more effective nutrient treatment process would be required. Alternative 3 would convert the existing decommissioned internal clarifier to an anoxic reactor to change the treatment process to a Modified Ludzack-Ettinger (MLE) to increase nutrient treatment. This change would also increase MMF capacity to 0.35 MGD to accommodate an approximate 250 additional EDUs or the estimated population in 2025. This alternative would improve nutrient treatment by primarily decreasing effluent TN from around 20 mg/L down to an estimated 7 mg/L. To accommodate the MMF of 0.56 MGD in 2040, an additional 173,000 gallons of reactor capacity would need to be constructed to meet loading and treatment criteria. Figure 4-4 depicts the alternative 3 layout.

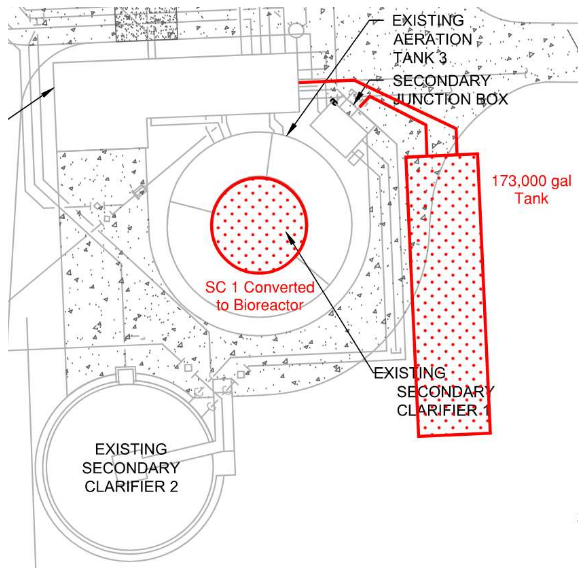

Figure 4-4. Aeration Basin Alternative 3 Layout

ALTERNATIVE 4

In the case that receiving MDEQ clarifier variance is not feasible, or it is not preferred to convert the existing tank clarifier and use the sludge storage lagoon as an emergency/redundant clarifier, then additional aeration basin volume and additional clarifier would need to be built. Alternative 4 would improve aeration tank capacity to accommodate the MMF of 0.56 MGD in 2040 by constructing an additional clarifier and 130,000 gallons of reactor capacity to meet loading and treatment criteria as depicted in Figure 4-5.

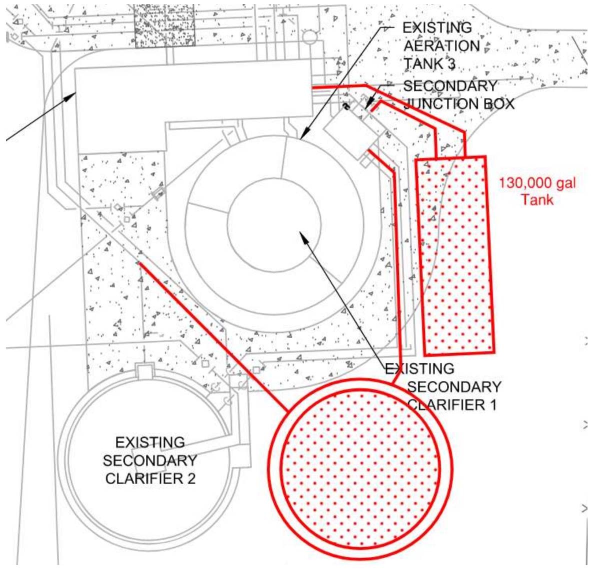

Figure 4-5. Aeration Basin Alternative 4 Layout

ALTERNATIVE 5

In the case that nutrient regulations become more stringent on the Bitterroot River, a more effective nutrient treatment process would be required. Alternative 5 includes utilization of existing aeration tank capacity (full use of existing steel tank including the internal clarifier) and conversion of the existing secondary clarifier (or new 52,000-gallon reactor) into a membrane bioreactor (MBR). The MBR would allow for higher TN and TP treatment for 2040 flows while removing the need for a secondary clarifier. With an MBR system, effluent TN is estimated to decrease from about 20 mg/L to 6 mg/L and effluent TP is estimated to decrease from about 4 mg/L to 0.6 mg/L. Figure 4-6 depicts Alternative 5.

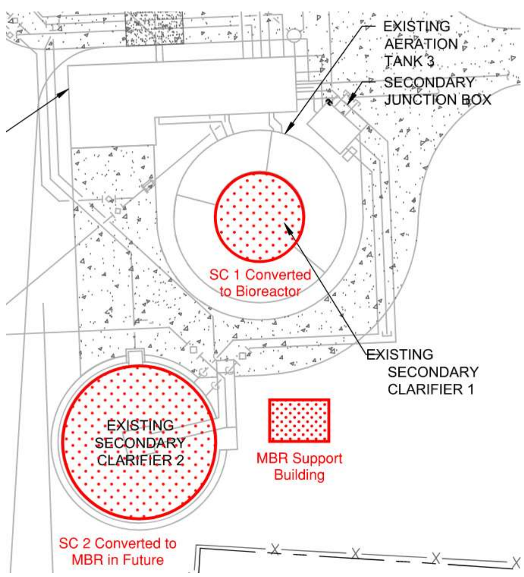

Figure 4-6. Aeration Basin Alternative 5 Layout

4.3.3.8 UV Disinfection

There are two alternatives pertaining to the UV disinfection system.

- Alternative 1. Maintain Status Quo/Do Nothing
- Alternative 2. Install UV Lamps in Second Bank

In Alternative 1, the existing UV system capacity would be maintained and no additional lamps would be added to the second UV bank. If Alternative 1 is selected, there would be no UV capacity redundancy at future projected peak flows. A lack of redundancy could jeopardize the WWTP's ability to meet permit requirements if a system failure were to occur. As a result, this alternative is dismissed and is not considered further.

In Alternative 2, additional lamps would be installed to provide redundant capacity at future projected flows. Approximately 0.50 mgd of additional treatment capacity would be installed in each UV bank, bringing the total treatment capacity for each to 1.50 mgd. No other major infrastructure changes would be required to facilitate Alternative 2. Additional capacity will not be necessary until later in the planning period, and this unit process is not a priority relative to the others showing deficiencies.

4.3.3.9 Biosolids Dewatering

There are two alternatives pertaining to the biosolids dewatering system.

- Alternative 1. Maintain Status Quo/Do Nothing
- Alternative 2. Install Mechanical Biosolids Dewatering Process

The current biosolids dewatering process consists of intermittently dredging sludge from the storage lagoon and dewatering it in geotextile biobags. This dewatering process is cumbersome and is labor intensive. As such, it is desired that a dedicated dewatering process be installed that will allow for the consistent and continual dewatering of biosolids. Alternative 1 is dismissed and is not considered further because of this.

There are several types of mechanical solids dewatering equipment available that could be used at the Lolo WWTP- for Alternative 2. These technologies include screw presses (volute and conventional), belt filter presses and centrifuges. Of these technologies, screw presses are the most applicable to the operations at Lolo given the small size of the WWTP and the drawbacks of the other technologies. Screw presses do not require constant operator observation and can be automated to function unattended for long periods of time, even 24 hours per day. Additionally, screw presses have minimal power and wash water requirements, with most models exhibiting motors of 2 – 5 HP. By contrast, belt filter presses consume relatively large amounts of electricity and wash water, and also require consistent operator engagement. Centrifuges can generally produce a higher percent solids than belt filter presses and screw presses, but they also tend to involve a higher level of operator engagement for small facilities than that of a screw press and they have much higher horsepower requirements. Given the small size of the Lolo WWTP, a centrifuge would not be an ideal fit as it would not offer the level of unattended operation desired and it would need to be run for short durations due to the limitations in machine sizes available.

For these reasons, centrifuges and belt filter press alternatives are not carried forward further in the analysis. Alternatives that will be considered in the remainder of this PER include the following:

- Alternative 2a. Volute Screw Press Dewatering (similar to PW Tech volute press)
- Alternative 2b. Conventional Screw Press Dewatering (similar to a HUBER screw press)

In Alternative 2a and 2b, screw presses would be installed to dewater biosolids. This alternative would require that piping modifications be made to connect the screw press to the digested sludge stream, and that a dedicated dewatering building be constructed to house the screw press(es). The dewatering building would be designed similarly to the maintenance garage (metal building with conventional framing and insulation) and would be constructed in the area of the existing polishing pond. Other improvements would include implementing a drivable route to the building. The difference between the two alternatives pertains to the screw press manufacturer, which will affect sizing and equipment costs. Two screw presses are proposed to be installed to provide redundancy.

Dimensions and operational criteria for the two example screw press manufacturers is shown in Table 4-2. PW Tech provided a proposal for their Volute Dewatering Press ES-302[1], and HUBER provided a proposal for their Q-Press 440.2. Both models were sized off a planned dewatering schedule of eight hours per day for five days a week. HUBER also provided a proposal for their Q-Press 620.2, which is slightly larger than the 440.2 model and is capable of dewatering approximately 28 gpm. The dewatering schedule desired by Lolo staff will largely affect the eventual model selection, which will be finalized during project design.

Table 4-2. Dewatering Equipment Information

Parameter	Alternative 2a. PW Tech	Alternative 2b. HUBER
Capacity	35 gpm @ <1% solids	24 gpm @ <0.9% solids
Power Requirements	2.9 HP	2.0 HP
Wash Water Requirements	12 gpm	44 gph @ 72.5 psi
Dimensions	149"(L) x 51"(W) x 64"(H)	163”(L) x 35”(W) x 82”(H)

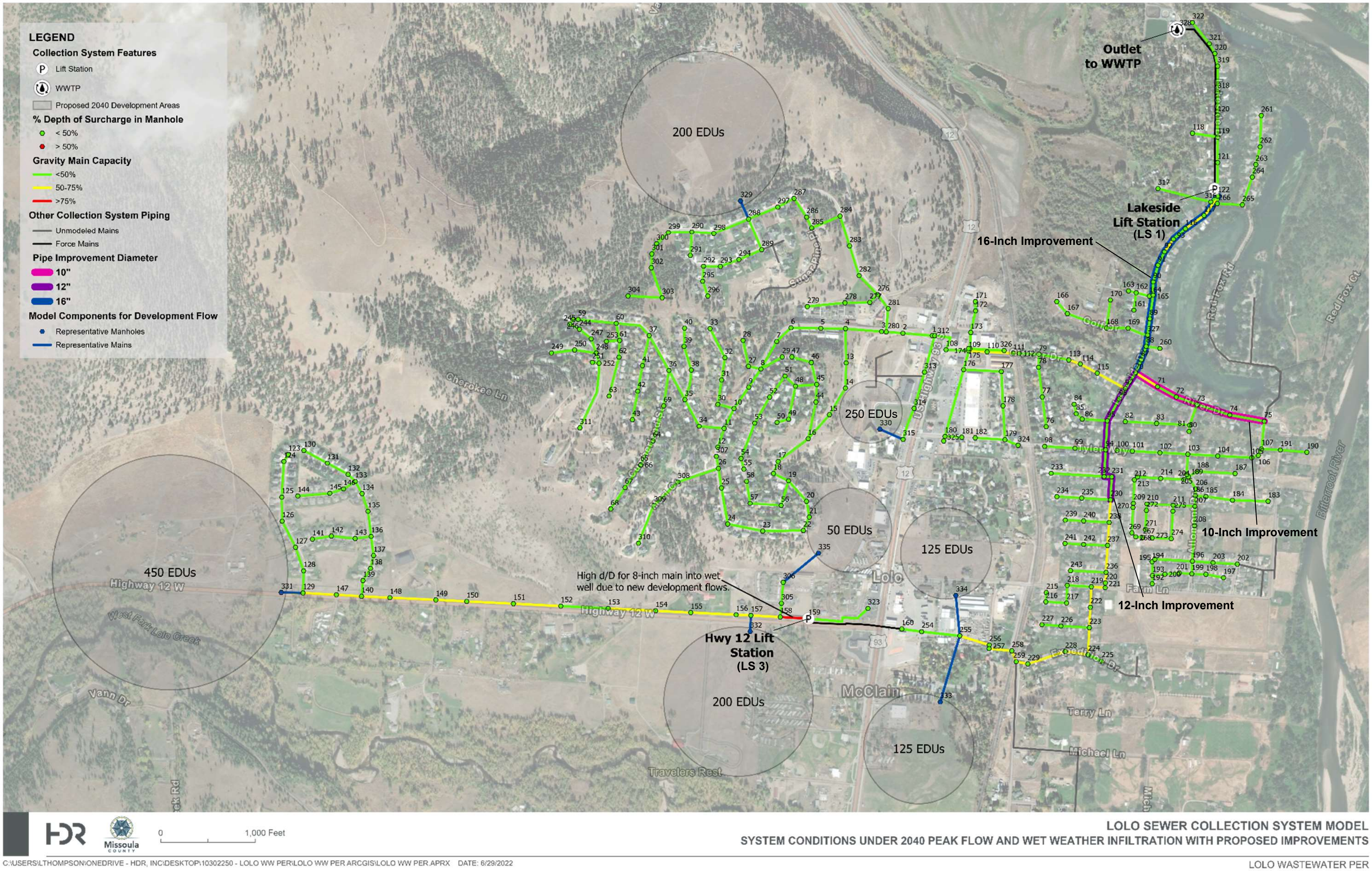

Figure 4-7. Collection System Improvements and Conditions Under 2040 Peak Flow and Wet Weather Infiltration

4.4 Map

4.4.1 Lift Station No. 1

ALTERNATIVE 1

A graphic depicting Lift Station No. 1 Alternative 1 is shown in Figure 4-8.

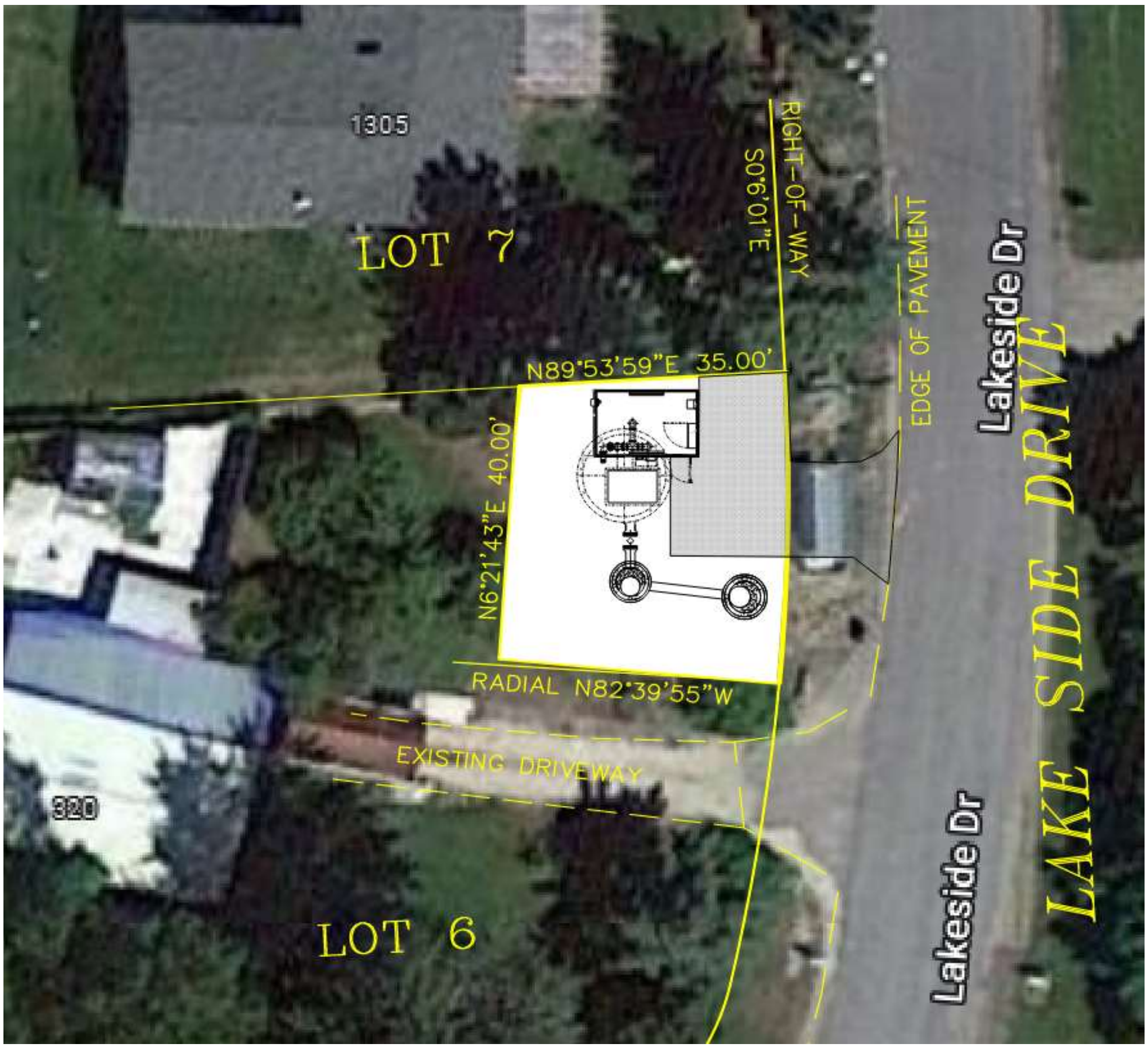

Figure 4-8. Lift Station No. 1 Alternative 1 Footprint

ALTERNATIVE 2

A graphic depicting Lift Station No. 1 Alternative 2 is shown in Figure 4-9.

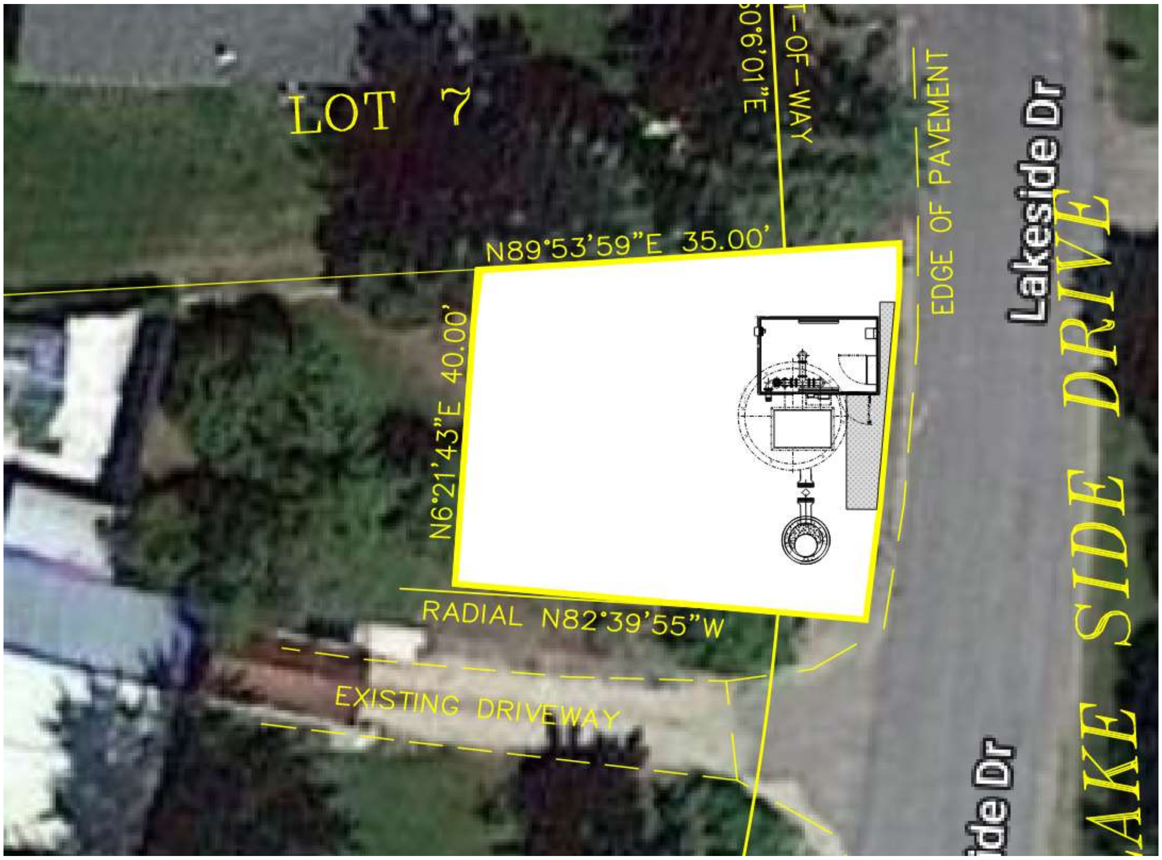

Figure 4-9. Lift Station No. 1 Alternative 2 Footprint

4.4.2 Collection System

A map of proposed improvements is shown in Figure 4-7.

4.4.3 Wastewater Treatment Plant

The dewatering building that houses the screw press would be placed in the existing polishing pond. A map showing a preliminary site plan of the new building and the access road is shown in Figure 4-10. The access road will extend from the WWTP entrance. Backfill will be required in the polishing pond before the building can be constructed.

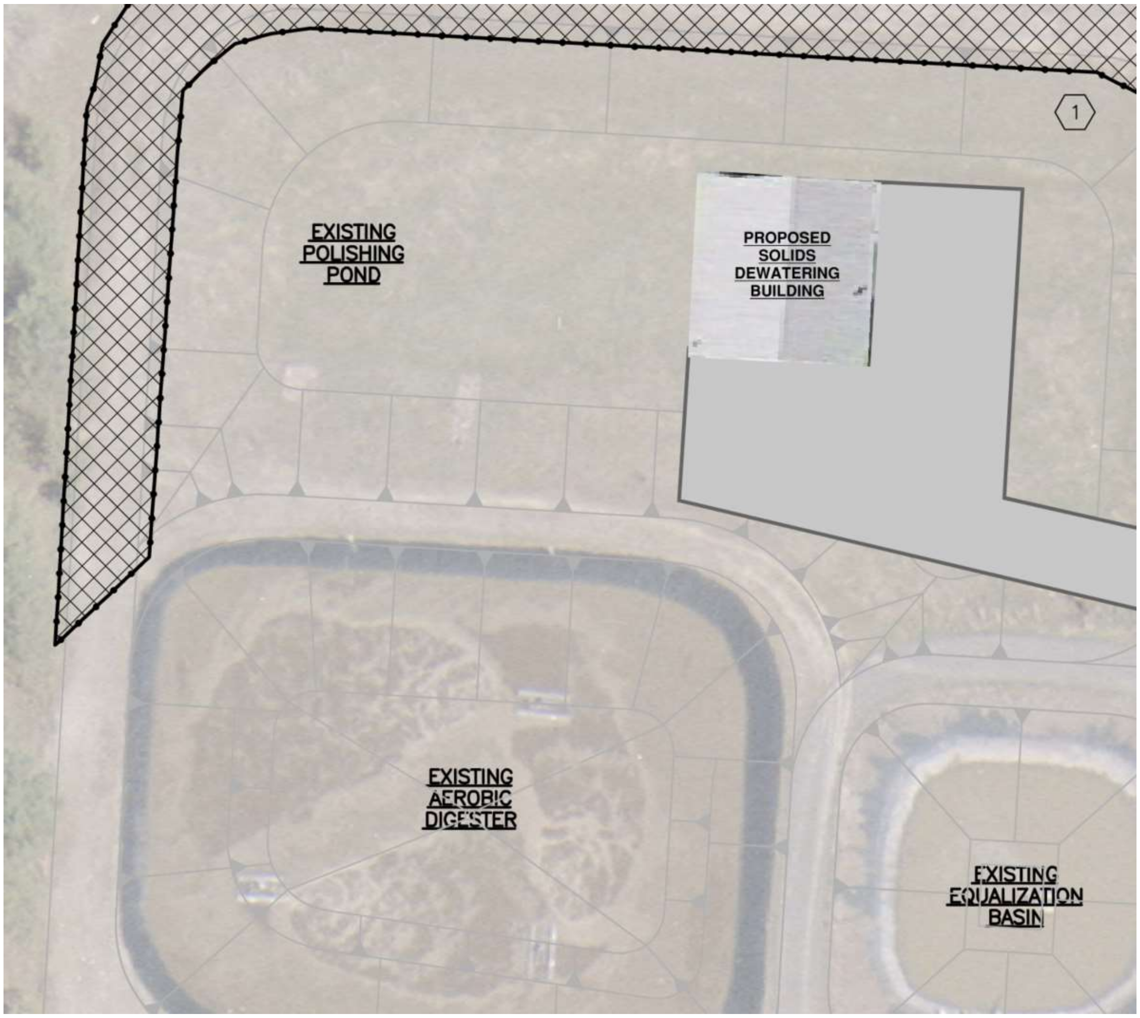

Figure 4-10. Map of Proposed Solids Dewatering Building

There are no other relevant maps pertaining to the WWTP to discuss.

4.5 Environmental Impacts

4.5.1 Lift Station No. 1

The proposed lift station alternatives have no direct impact to floodplains, wetlands, other important land resources, endangered species, historical or archaeological properties, etc.

4.5.2 Collection System

The proposed collection system alternatives have no direct impact to floodplains, wetlands, other important land resources, endangered species, historical or archaeological properties, etc.

4.5.3 Wastewater Treatment Plant

No direct impacts to the surrounding environment are posed by any of the WWTP alternatives.

4.6 Land Requirements

4.6.1 Lift Station No. 1

ALTERNATIVE 1 PROPERTY ACQUISTION

Due to the depth of the wet well, required area for construction, and subsequent operations and maintenance, it is anticipated that a small section of property, approximately 1,625 SQ FT (0.037 acres), will need to be acquired from 320 Red Fox Rd.

A graphic depicting the required property acquisition for Lift Station No. 1 is shown in Figure 4-11.

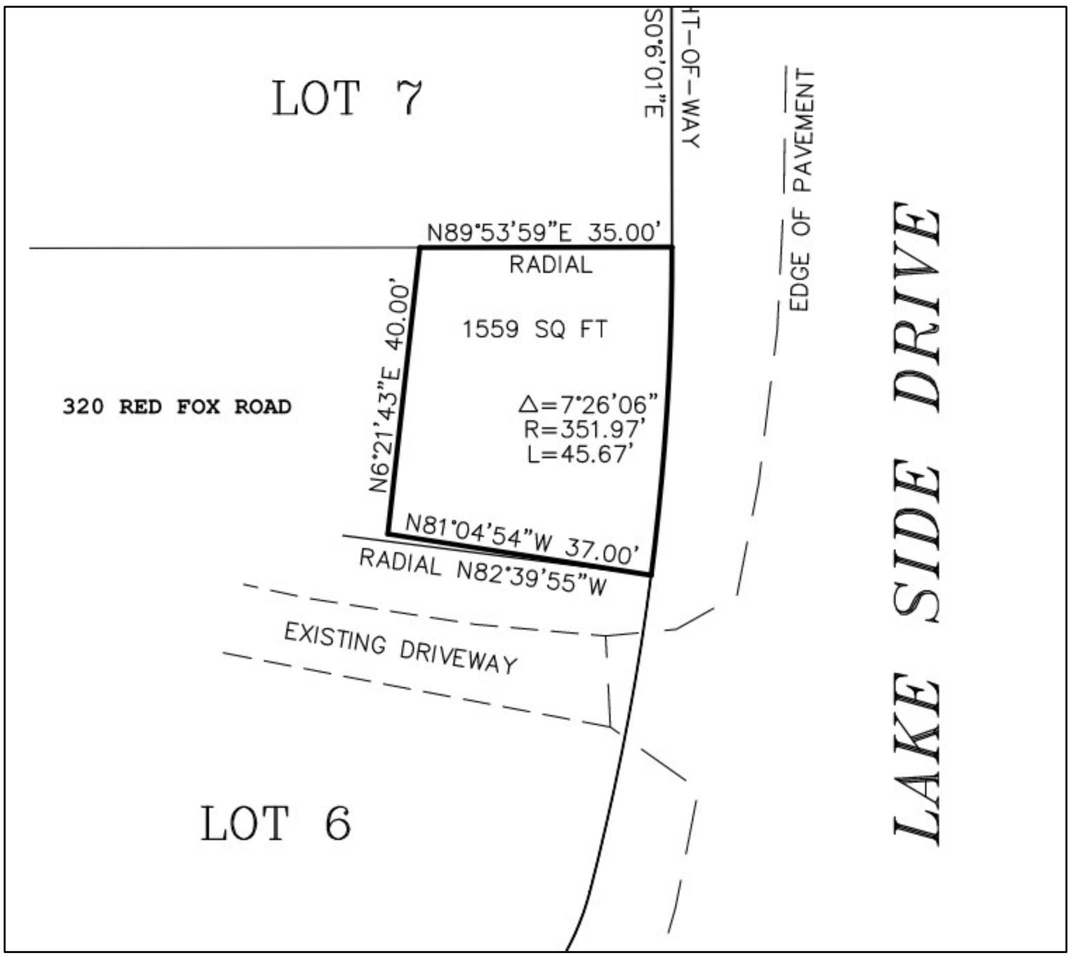

Figure 4-11. Lift Station No. 1 Property Acquisition

4.6.2 Collection System

There are no new land requirements required for the proposed collection system alternatives. All collection system alternatives exist within the current pipeline alignment with no new proposed pipeline configurations.

4.6.3 Wastewater Treatment Plant

There are no new land requirements for any of the WWTP alternatives. All alternatives would be confined to the existing WWTP footprint and constructed on land owned by the County.

4.7 Potential Construction Challenges

4.7.1 Lift Station No. 1

Potential construction challenges associate with the lift station alternatives include dewatering as a result of high groundwater that may be encountered, implementation of applicable erosion and sedimentation control measures to prevent stormwater runoff escaping the construction site, and for the Alternative No. 3 lift station site location, bypass pumping to take the existing lift station offline to allow for the construction of the new lift station.

4.7.2 Collection System

Potential construction challenges associate with the collection system alternatives includes maintenance of active sewer flow during construction and dewatering as a result of high groundwater that may be encountered.

4.7.3 Wastewater Treatment Plant

There are several potential construction challenges that could be posed by the alternatives. The operations of the WWTP will need to be maintained during any construction periods, which will require prior planning and coordination with WWTP personnel. Additionally, care will need to be taken to prevent any site runoff to the Bitterroot River during construction.

4.8 Sustainability Considerations

WATER AND ENERGY EFFICIENCY

Lift Station No. 1

Variable frequency drives provide a number of control features that include varying the speed of the pump motor up and down to hold a level setpoint which provides the ability to control the length of pump run cycles. They also provide extended acceleration/deceleration ramp times when the motor starts and stops which eliminate the in rush of current (amperage). VFDs only use as much power as they need to turn the pump, resulting in additional savings on electricity.

Wastewater Treatment Plant

Implementing nitrification and denitrification (NDN) treatment processes can decrease required oxygen requirements by as much as 43%. Oxygen pulled from nitrate (NO_3^--N) during the denitrification process decreases the total amount of oxygen needed during treatment ultimately decreasing blower demand and saving energy. Denitrification improves oxygen transfer efficiency which also helps decrease oxygen input and decreases energy demands.

Screw presses are the most water and energy efficient technology available to dewater biosolids. As discussed, screw presses utilize considerably smaller motors than other dewatering technologies like belt filter presses. Wash water consumption for screw press operation is also low, generally less than 5 gpm.

GREEN INFRASTRUCTURE

There are no applicable green infrastructure considerations to discuss at this time given the scope of the discussed alternatives.

OTHER

Screw presses will provide operational simplicity to the dewatering process. Their ability to operate for long periods with minimal operator oversight makes them ideal pieces of equipment for a relatively small WWTP such as Lolo.

4.9 Cost Estimates

Opinions of probable construction cost (OPCCs) were developed for each alternative that was not dismissed. OPCCs do not include any associated engineering or design costs. A full breakdown of each respective OPCC is included in Appendix B.

4.9.1 Lift Station No. 1

The OPCC for a new lift station, to include new wet well, valve vault, electrical and controls work, excavation, demolishing, traffic control, dewatering, asphalt removal and replacement, 2,200 LF of new 8-inch force main with all applicable valves and fittings, and a Tri-Plex package pumping system is $1,140,000.

4.9.2 Collection System

The OPCC for the replacement of approximately 1,470 LF of new 10-inch gravity main, 1,200 LF of 12-inch gravity main, and 2,300 LF of 16-inch gravity main, including twenty-five (25) new manholes, and required bypass pumping is $3,300,000. Wastewater Treatment Plant

4.9.3 WWTP

4.9.3.1 Influent and RAS Pumps

The OPCC for installing three new influent pumps as previously described (one duty pump capable of handling entirety of peak hour flow with two smaller pumps capable of handling peak hour flow together), and two new RAS pumps is $410,000.

4.9.3.2 Aeration Tank

The OPCCs for the discussed aeration tank alternatives are summarized in

Table 4-3.

Table 4-3. Aeration Tank Alternative OPCCs

Aeration Tank Alternative	Additional Constructed Volume (Gallons)	OPCC
Alternative 1. Converted Clarifier	-	$350,000
Alternative 2. CAS	82,100	$1,190,000
Alternative 3. MLE	172,100	$1,510,000

4.9.3.3 UV Disinfection

The OPCC for installing an additional 1.0 mgd of UV treatment capacity, 0.50 mgd in each UV bank, is $230,000.

4.9.3.4 Biosolids Dewatering

Budgetary cost estimates were obtained for each of the screw press models evaluated in Alternative 2 and Alternative 3. The budgetary cost estimates are summarized in Table 4-4. Budgetary costs include freight and startup services.

Table 4-4. Screw Press Budgetary Equipment Costs

Screw Press Equipment	Budgetary Cost
PW Tech Model ES-302[1] Dewatering Press (per unit)	$225,000
HUBER Q-Press 440.2 (per unit)	$250,000

An overall OPCC was also developed for each screw press model that incorporates the cost of constructing a dewatering building, access road, and installing associated electrical/SCADA infrastructure. There are no significant differences between the two overall project alternatives except for the screw press budgetary cost. These costs are shown in Table 4-5.

Table 4-5. Overall Project OPCCs

Screw Press Equipment	OPCC
Alternative 1. PW Tech	$3,150,000
Alternative 2. HUBER	$3,290,000

5. Alternative Selection

5.1 Life Cycle Cost Analysis

5.1.1 Lift Station No. 1

Replacement alternatives for the existing lift station generally include the same present and future costs; with the only difference being site location.

5.1.2 Collection System

A life cycle cost analysis is not applicable for replacement and upsizing of gravity sewer piping within the collection system.

5.1.3 Wastewater Treatment Plant

5.1.3.5 Influent Pumps

Replacing the influent pumps is the only alternative that was carried forward and this section is unapplicable as a result.

5.1.3.6 Aeration Tanks

Each aeration tank alternative is purposed for achieving different levels of treatment capacity, primarily for BOD and TSS. Final selection of an alternative will be dependent upon the new nutrient regulations adopted by the State of Montana, as discussed. Consequently, this section is unapplicable.

5.1.3.7 UV Capacity

Installing additional UV treatment capacity is the only alternative that was carried forward and this section is unapplicable as a result.

5.1.3.8 Solids Dewatering

Installing screw presses for dewatering is the only alternative that was carried forward and this section is unapplicable as a result.

5.2 Non-Monetary Factors

5.2.1 Lift Station No. 1 and Collection System

The lift station and collection system alternatives presented in this PER can be further evaluated by considering the following non-monetary factors.

5.2.1.9 Implementation

The timing of implementation of an alternative based on collection system modeling and projected growth and development. The improvements associated with these alternatives have the ability to be phased accordingly based on capacity needs and available funding.

5.2.1.10 Reliability

The ability of an alternative to consistently meet capacity needs and provide reliable collection and conveyance of wastewater.

5.2.1.11 Operational Flexibility

The ability of an alternative or facility to easily operate, without constant supervision and oversight, during dry weather and wet weather events. All alternatives were evaluated to achieve the most operational flexibility available.

5.2.2 Wastewater Treatment Plant

5.2.2.12 Influent Pumps

Redundancy and operability are two important non-monetary factors to consider when evaluating the influent pump alternatives. If the status quo is maintained, Alternative 1, then the projected increase in peak hour flows will eclipse the existing capacity of the larger pump. Furthermore, there is no redundant capacity if the larger of the two influent pumps goes down, and the resulting firm capacity would be just 225 gpm. This firm capacity is inadequate to handle the current peak hour flow rate, and consequently Alternative 1 is untenable when non-monetary factors are considered, as previously stated. Alternative 2 will be the recommended path forward.

5.2.2.13 Aeration Tanks

Treatment performance is the most important non-monetary factor pertaining to the aeration tank alternatives. Each aeration tank alternative will achieve differing levels of nutrient treatment. The nutrient regulations that are ultimately adopted by Montana will largely determine how much additional capacity is required, or whether the aeration tanks should be upgraded to an MLE process. Since there is not yet a regulatory imperative to greatly increase nutrient treatment performance, converting the existing Secondary Clarifier No. 1 to part of the CAS process (Alternative 1) is the recommended path forward. This action will also be required if Alternative 2 or Alternative 3 is implemented and doing so will address near term capacity issues while maintaining flexibility to adapt to any potential future treatment regulations.

5.2.2.14 UV Treatment

Redundancy is an important non-monetary factor to consider when evaluating the UV disinfection alternatives. Alternative 2 will be the recommended path forward, and additional UV treatment capacity should be installed as described.

5.2.2.15 Solids Dewatering

There are several important non-monetary factors to consider in regard to biosolids dewatering. As previously discussed, it is necessary that the new dewatering equipment be capable of operating for long periods of time without active operator presence. This will both reduce staff time spent monitoring the dewatering equipment and provide a steady centrate return stream that will not disturb liquid stream treatment functions in the aeration tanks. For these reasons, only screw presses were carried forward in the alternatives analysis. Installing screw presses is the recommended path forward. The actual screw press model will not be selected until project design commences because sizing is dependent on the dewatering schedule desired by WWTP staff.

6. Proposed Project (Recommended Alternative)

6.1 Proposed Project

This section provides additional details on priority projects that are scheduled to receive American Rescue Plan Act (ARPA) funding, and additional projects that will need to be phased as growth continues and funding allows. Recommended projects are split between Phase 1 and Phase 2. Phase 1 projects consist of near-term improvements that will generally be addressed immediately, and Phase 2 projects consist of long-term improvements that will need to be addressed before the end of the planning period. All Phase 1 projects will be funded with money from ARPA Minimum Allocation and Competitive Grants.

6.2 Preliminary Project Design

6.2.1 Lift Station No. 1

Due to their age and upcoming capacity limitations, it is recommended to replace Lift Station No. 1 and install a new redundant force main along Lakeside Drive. Alternative 1 for the new lift station site location and Alternative 3 for the force main configuration are the recommended paths forward.

6.2.2 Collection System

It is recommended to replace the approximate 5,000 LF of gravity sewer that will become capacity-deficit within the planning horizon in a phased approach. The existing sewer is recommended to be replaced with 10-inch, 12-inch, and 16-inch pipe, and can be phased according to growth and available funding. It is also recommended to perform a comprehensive CCTV analysis, specifically evaluating infiltration at gravity main to service lateral connections within areas of the collection system that are known to have high groundwater or be susceptible to infiltration.

6.2.3 Wastewater Treatment Plant

6.2.3.1 Influent Pumps

It is recommended that one large pump capable of conveying the peak hour flow of 1,044 gpm and two smaller pumps capable of conveying the peak hour flow together (522 gpm per pump) be installed.

6.2.3.2 Aeration Tanks

Alternative 1 is the recommended path forward since there is not yet a regulatory imperative to greatly increase nutrient treatment performance. To implement Alternative 1, the existing Secondary Clarifier No. 1 will be converted to part of the aeration tank CAS process. This action will also be required if Alternative 2 or Alternative 3 is implemented and will address near term capacity issues while maintaining flexibility to adapt to any potential future treatment regulations.

6.2.3.3 UV Treatment

It is recommended that an additional 0.50 mgd of UV treatment capacity be installed in each respective UV bank. This will provide firm capacity for the future projected peak hour flow conditions.

6.2.3.4 Biosolids Dewatering

It is recommended that screw presses be installed to provide dewatering. Two presses should be installed to provide redundancy. The actual screw press model will be determined during project design. It is also recommended that a dewatering building be constructed to house the equipment.

6.2.3.5 Other Projects

The proposed project also includes two small projects that did not warrant an alternatives analysis given their limited scope. These projects consist of replacing the EQ basin liner and installing a new security fence around the WWTP property. These projects are both required due to aging infrastructure. A graphic of the new security fence is shown in Figure 6-1. Replacing the EQ Basin liner will require approximately 6,000 ft^2 of new liner.

Figure 6-1. New Security Fence

6.3 Project Schedule

Following the review and approval of the recommended project presented in this report, final selection of the preferred screw press alternative following the pilot study, and approval of the design concept by Montana Department of Environmental Quality (MDEQ), the following steps outline the proposed implementation and construction of the recommended improvements:

1. Procurement of grant funding (completed).
2. Development of construction plans and specifications for the project.
3. During the design phase, Lolo to finalize financing arrangements and determine if there will be a rate impact for the funding of future Phase 2 projects.
4. Advertise for construction bids after MDEQ approval of plans and specifications.
5. Receive and review submitted construction bids. Following the determination of the responsive and responsible low bidder, all contract documents would be submitted to MDEQ and/or other funding agencies for their review and concurrence in the award of a construction contract.
6. Award the construction contract and authorize the responsive and responsible low bidder to begin construction.
7. During construction, Lolo and their consultant must maintain proper financial records of the project, process partial payments, process change orders, and provide necessary staffing to support the project. Other components incorporated into the construction phase include finalization of the plan of operation, and the submittal of a draft O&M manual and final O&M manual. Following completion of the construction project, arrange for final inspections, certification of the facility, and final payment(s) from grant or loan agencies.

Implementation of the proposed project will require coordination between Lolo RSID 901 operations staff, Missoula County, HDR Engineering, Inc., MDEQ, and the funding agencies. An implementation schedule for high priority projects has been prepared that outlines the tasks and dates to apply for grant or loan funding. High priority projects are associated with the greatest threat to the public's health, safety and welfare and should be implemented in the near term. The proposed implementation schedule is presented in Table 6-1.

Table 6-1. Phase 1 Projects – Funding and Construction Schedule

Task	Proposed Dates
PER Completion	August 2022
Grant Funding and Commitment	TBD
Completion of Final Plans and Specifications	December 2022
DEQ Review and Approval	January 2023
Advertise and Receive bids for Construction	February 2023
Award Construction Contract	April 2023
Begin Construction	June 2023
Construction Complete / Project Closeout	March 2024

The preliminary schedule is based on experience with similar projects and assumes a typical implementation process which presents a completion of the final design in December 2022 and construction of the Phase 1 Recommended Projects by March 2024.

6.4 Permit Requirements

Table 6-2 summarizes potential permits and agency coordination based upon the final design.

Table 6-2. Summary of Permit Requirements & Environmental Considerations

Environmental Consideration or Permit Required	Coordinating Agency	Reason for Coordination
Water System Improvements	MDEQ	MDEQ provide plan review and approval for almost all types of water system.
Water Quality	MDEQ U.S. Army Corps of Engineers Montana Department of Natural Resources and Conservation	MPDES 318 Authorization Compliance with Section 404 of the Clean Water Act Compliance with Montana Stream Projection Act (Section 124)
Wetlands	U.S. Army Corps of Engineers	Jurisdictional determination and mitigation for impacts to water of the US and wetlands
Floodplains	Missoula County Planning Department	Determine delineated floodplains in project areas and need for floodplain development permit
Cultural Resources	Montana State Historic Preservation Office	Identify cultural resource cites for a project area Section 196 of National Historic Preservation Act
Threatened/Endangered Species	U.S. Fish and Wildlife Service, Ecological Field Office	Listed species for project areas and compliance with Endangered Species Act
Species of Special Concern	Montana Natural Heritage Program US Forest Service-Beaverhead National Forest	Species potentially found in project areas
Wildlife, Fisheries, Habitat	Montana Department of Fish, Wildlife & Parks US Forest Service-Beaverhead National Forest	Species information and habitat in project areas, comments on wildlife/fisheries impacts
Hazardous Material/Substances/Sites	Montana Department of Environmental Quality (Permitting and Compliance) U.S. Environmental Protection Agency	Underground storage tanks, contamination concerns, federal and state cleanup sites

Environmental Consideration or Permit Required	Coordinating Agency	Reason for Coordination
Important Farmland	Natural Resources Conservation Service District Conservationist	Soils information, farmland classifications, and compliance with Farmland Protection Policy Act
Socio-economic Information	Montana Department of Commerce Census and Economic Information Center	Population and economic data for Montana and Missoula County
Land Use Planning and Regulations	Missoula County Planning Department U.S. Forest Service-Beaverhead National Forest U.S. Bureau of Land Management	Growth Policy information and existing land use regulations affecting project areas Forest Plans affecting project areas Resources Management Plans affection project areas

6.5 Total Project Cost Estimate

The recommended projects and associated OPCCs are summarized in Table 6-3.

Table 6-3. Overall Recommended Projects and OPCCs, Phase 1 and Phase 2

Project	OPCC	Phase
Lift Station No. 1 Improvements and Force Main Installation	$1,140,000	Phase 1
Collection System Improvements (Inflow & Infiltration Mitigation and 200 LF of 16-inch Gravity Main Replacement from LS No. 1 to Red Fox Rd.	$525,000	Phase 1
Biosolids Dewatering Building and Equipment	$2,070,000	Phase 1
Biological Treatment Upgrade, Convert SC No. 1 to CAS	$351,000	Phase 1
EQ Basin Liner	$84,000	Phase 1
Security Fence (Automatic Gate)	$43,000	Phase 1
Influent Pump and RAS Pump Replacement	$560,000	Phase 1
Collection System Improvements (Remaining Gravity Sewer Replacement: 2,000 LF of 16-inch, 1,500 LF of 10-inch, and 1,200 LF of 8-inch)	$2,770,000	Phase 2
Biological Treatment Capacity Upgrade (to meet 2040 capacity) or Membrane Bioreactor (MBR), depending upon nutrient regulations.	$5,000,000 - $10,000,000	Phase 2
UV Capacity Addition	$226,000	Phase 2

Total OPCCs for Phase 1 and Phase 2 are summarized in Table 6-4.

Table 6-4. Total Project OPCCs by Phase

Project Phase	Total OPCC
Phase 1	$4,780,000
Phase 2	$8,000,000 - $13,000,000

6.6 Annual Operating Budget

The Lolo Sewer & Water Maintenance District fund breakdown for the 2021 fiscal year is shown below in Table 6-5. Costs are passed along to system users via year end taxes.

Table 6-5. Lolo RSID 901 Enterprise Funds

Line Item	Total
Operating Revenues	$653,300
Operating Expenses	$(1,247,471)
Total Non-Operating Revenues	-
Total Capital Grants and Transfers In	$200,000
Change in Net Position	**$(394,171)**

6.6.1 Income

The District collected $653,300 in revenue for the most recent fiscal year for which there is data available. An additional $200,000 was transferred in.

6.6.2 Annual O&M Costs

The District spent $1,247,471 in expenses for the most recent fiscal year for which there is data available.

6.6.3 Debt Repayment

The District had no debt service payments for the most recent fiscal year for which there is data available.

6.6.4 Reserves

The District had no debt service reserve for the most recent fiscal year for which there is data available.

7. Conclusions and Recommendations

7.1 Introduction

The previous sections described the history and background of the Lolo RSID 901 wastewater collection and treatment systems, potential growth scenarios, outcomes of the collection system and WWTP modeling, and the result of determining the overall system needs and alternatives to meet those needs. The purpose of this section is to assist with capital improvement planning and outline a financial strategy to implement the recommended improvement projects identified in the PER.

An ARPA Water & Sewer Infrastructure Minimum Allocation and Competitive Grant were awarded to Lolo RSID 901 which will provide design and construction funding for a number of the improvement projects; however, improvements that are strictly growth-related will need to use additional funding sources from user charges, revenue bonds, or general obligation bonds.

The existing Lolo RSID wastewater system is primarily funded through taxes assessed to properties within the RSID to cover operations and maintenance of the system. Connection fees are assessed to new connections which provide revenue for operations and maintenance expenses as well as growth-related improvements. A financial evaluation is currently underway for the Lolo RSID 901 water and wastewater utilities and the results of the study are expected to inform the financial and implementation strategy for the recommended improvement projects.

7.2 Summary of Recommended Projects

The implementation of the recommended improvement projects identified herein will require input from the rate study and coordination with other RSID 901 financial commitments. A summary of recommended improvement projects is shown in Table 7-1. The phasing and need for project are also summarized in the table.

In addition to the proposed phasing for recommended improvement projects, it is recommended that the screw press equipment evaluated and discussed in this PER be piloted at the Lolo WWTP. It is anticipated that the final design will encompass the selected model following the pilot and confirmation of projected screw press performance.

Table 7-1. Recommended Projects Summary

Project	Category	OPCC	Phase	Recommended Timeline
Lift Station No. 1 Improvements and Force Main Installation	Reasonable Growth / Aging Infrastructure	$1,140,000	Phase 1	Completed by March 2024
Collection System Improvements (Inflow & Infiltration Mitigation and 200 LF of 16-inch Gravity Main Replacement from LS No. 1 to Red Fox Rd.	Reasonable Growth / Aging Infrastructure	$525,000	Phase 1	Completed by March 2024
Biosolids Dewatering Building and Equipment	Health, Sanitation and Security	$2,070,000	Phase 1	Completed by March 2024
Biological Treatment Upgrade, Convert SC No. 1 to CAS	Reasonable Growth / Aging Infrastructure	$351,000	Phase 1	Completed by March 2024
EQ Basin Liner	Reasonable Growth / Aging Infrastructure	$84,000	Phase 1	Completed by March 2024
Security Fence (Automatic Gate)	Health, Sanitation and Security	$43,000	Phase 1	Completed by March 2024
Influent Pump and RAS Pump Replacement	Reasonable Growth / Aging Infrastructure	$560,000	Phase 1	Completed by March 2024
Collection System Improvements (Remaining Gravity Sewer Replacement: 2,000 LF of 16-inch, 1,500 LF of 10-inch, and 1,200 LF of 8-inch)	Reasonable Growth / Aging Infrastructure	$2,770,000	Phase 2	Dependent on Rate of Development
Biological Treatment Capacity Upgrade (to meet 2040 capacity) or Membrane Bioreactor (MBR), depending upon nutrient regulations.	Reasonable Growth / Regulation	$5,000,000 - $10,000,000	Phase 2	Dependent on Rate of Development
UV Capacity Addition	Reasonable Growth	$226,000	Phase 2	Dependent on Rate of Development

Appendix A. Biosolids Regulations

Application of the Rule

As defined in 40 CFR 503.1(b)(1), the Part 503 Rule "applies to any person who prepares sewage sludge, applies sewage sludge to the land, or fires sewage sludge in a sewage sludge incinerator and to the owner/operator of a surface disposal site." Furthermore, a *person* is defined as an individual, association, partnership, corporation, municipality, State or Federal agency, or an agent or employee thereof. A *preparer* is a person who generates or derives a material from biosolids (i.e., change the quality of biosolids). (Plain English guide).

The Part 503 Rule applies to biosolids applied to agricultural and non-agricultural land, biosolids placed in or on surface disposal sites, and biosolids that are incinerated. Biosolids that are landfilled or used as a cover material at a landfill are subject to federal requirements in 40 CFR Part 258. The general provisions of the Part 503 Rule provide basic requirements for biosolids applied to land including pollutant limits, management practices, operational standards and monitoring, record keeping, and reporting.

POLLUTANT LIMITS

A pollutant is defined in the 40 CFR 503.9 as:

> "*…*an organic substance, an inorganic substance, a combination of organic and inorganic substances, or a pathogenic organism that, after discharge and upon exposure, ingestion, inhalation, or assimilation into an organism either directly from the environment or indirectly by ingestion through the food chain, could, on the basis of information available to the Administrator of EPA, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunction in reproduction), or physical deformations in either organisms or offspring of the organisms."

As it relates to the Part 503 Rule, pollutants are generally metals. Two approaches to meeting the Part 503 pollutant limits are allowed:

- A maximum concentration in the biosolids must be met, or
- A maximum cumulative amount of metals added to the soil from biosolids application must be met.

Biosolids meeting the Part 503 requirements by the first method are called pollutant concentration (PC) biosolids and limits are shown in Table A-1. If biosolids metals meet these concentrations, no record keeping of cumulative loading to soils is required for land application. If PC biosolids also meet Class A pathogen reduction standards, they are considered exceptional quality (EQ), and may be distributed to the general public (although some commonsense restrictions should be applied because of public perception issues.)

Table A-1. 40 CFR Part 503 Pollutant Concentrations

Pollutant	Allowable Monthly Average Concentration (mg/kg)[1]
Arsenic (As)	41
Cadmium (Cd)	39
Copper (Cu)	1,500
Lead (Pb)	300
Mercury (Hg)	17
Nickel (Ni)	420
Selenium (Se)	100
Zinc (Zn)	2,800

Source: Table 3 of 40 CFR 503.13
1. Dry weight basis

Biosolids meeting the metals limits of the Part 503 regulations by the second method are called cumulative pollutant loading rate (CPLR) biosolids. Column two of Table A-2 shows the maximum allowable metals concentrations in any biosolids applied to land. Columns three and four of Table A-2 show the maximum allowable cumulative loading rates of metals applied to land.

Table A-2. Ceiling Concentrations and Cumulative Loading

Pollutant	Ceiling Concentration (mg/kg)[1]	CPLR[3] Loading	
		kg/ha	lb/ac
Arsenic (As)	75	41	36.6
Cadmium (Cd)	85	39	34.8
Copper (Cu)	4,300	1,500	1,338
Lead (Pb)	840	300	268
Mercury (Hg)	57	17	15.2
Molybdenum (Mo)[2]	75	N/A	N/A
Nickel (Ni)	420	420	375
Selenium (Se)	100	100	89.2
Zinc (Zn)	7,500	2,800	2,499

Source: Tables 1 and 2 of 40 CFR 503.13
1. Dry weight basis
2. No cumulative limit for molybdenum
3. CPLR = Cumulative Pollutant Loading Rate

POLLUTANT LIMIT COMPLIANCE

Technologies to produce Class A and Class B biosolids generally do not decrease concentrations of metals in biosolids, unless other material is mixed with the biosolids such as amendment material for composting.

An effective industrial pretreatment program is the key to complying with Part 503 metals limits, as industrial inputs into the collection system are the primary source of metals. EPA is currently considering whether other compounds should be regulated in biosolids.

Pathogen Reduction Alternatives

Pathogenic organisms are defined in 40 CFR 503.31 as "disease-causing organisms. These include, but are not limited to, certain bacteria, protozoa, viruses, and viable helminth ova." As mentioned previously, two classes of biosolids are defined by EPA that can be land applied, Class A and Class B. Class A biosolids have stringent limits for pathogens and can be used without any additional public contact restrictions. Class B biosolids may have low levels of pathogens and restrictions are imposed on public access and crop harvesting after land application. Those restrictions are described in the following sections. Class B biosolids are discussed first as they are more commonly produced.

CLASS B BIOSOLIDS

Class B biosolids are the predominant class of biosolids produced in the US (USEPA, 1999; NEBRA, 2007). Common treatment technologies, such as aerobic and anaerobic digestion, are used at many municipal wastewater treatment plants to inactivate the vast majority of potential pathogens in biosolids. However, the biosolids are not considered "pathogen-free," and EPA requires that specific management practices be employed to protect the public. Class B biosolids must also meet the same vector attraction reduction requirements as Class A biosolids.

Class B biosolids must meet one of several pathogen destruction alternatives included in Table A-3.

Table A-3. Alternatives for Meeting Part 503 Class B Pathogen Requirements

Alternative	Description
Alternative 1	Meet monitoring requirements for fecal coliform (geometric mean fecal coliform density must be less than 2 million coliform forming units (CFU) or most probable number (MPN) per gram of biosolids)
Alternative 2	Employ a Process to Significantly Reduce Pathogens (PSRP)
Alternative 3	Employ a process equivalent to a PSRP

PSRPs include the following:

- Anaerobic digestion between 15 days at 35°C (95°F) to 60 days at 20°C (68°F).
- Aerobic digestion between 40 days at 20°C (68°F) to 60 days at 15°C (59°F).
- Air drying for at least 3 months.
- Composting
    - Temperature of the sludge must be 40°C (104°F) or higher for at least five days. For four hours of that period the temperature must be 55°C (131°F) or higher.
- Lime stabilization
    - pH of the sludge must be raised to 12 for at least two hours and must remain above 11.5 for 24 hours.

Alternative 3 for Class B biosolids requires approval of the EPA or state regulatory agency. The regulating authority makes the decision on whether or not a process should be considered as equivalent to a PSRP. Both equivalent processes and PSRPs must meet specified pathogen requirements, as well.

CLASS A BIOSOLIDS

Class A pathogen reduction requirements include fecal coliforms of less than 1,000 MPN per gram Total Solids (TS) of biosolids or *Salmonella* of less than 3 MPN per 4 grams TS. Alternatives for meeting Class A pathogen requirements are shown in Table .

Alternative 1, thermal treatment, means a specific time-temperature requirement must be met as specified by the Part 503 Rule regulations. All biosolids particles processed using this alternative must be subjected to the EPA specified time-temperature regime, which means that batch or plug flow processing must be employed. Continuous flow processes with a detention time on, or above, the time-temperature curve are not acceptable.

Table A-4. Alternatives for Meeting Part 503 Class A Pathogen Requirements

Alternative	Biosolids Treatment Description
Alternative 1	Thermally treated, i.e., biosolids must meet specific time- temperature requirements depending on solids concentration.
Alternative 2	High pH-high temperature, e.g., lime stabilization followed by air drying.
Alternative 3	Other Processes. Sampling is required.
Alternative 4	Unknown Processes. Sampling is required.
Alternative 5	Process to Further Reduce Pathogens (PFRP)
Alternative 6	Process equivalent to PFRP. Requires approval of EPA's Pathogen Equivalency Committee.

Alternative 2, the high pH-high temperature process, is defined as the biosolids having the following three conditions:

- A pH of greater than 12 for at least 72 hours,
- Retaining the temperature of the biosolids above 52°C for at least 12 hours while the pH is above 12, and
- Air drying to over 50 percent solids after the 72-hour period of elevated pH

Class A biosolids requirements for Alternatives 3 and 4 rely on enteric virus and helminth ova testing, which can be expensive and time-consuming, typically four weeks for helminth ova testing and two weeks or longer for enteric viruses. There are also a limited number of accredited laboratories capable of performing these analyses. Washington State eliminated the availability of Alternatives 3 and 4 in the 2007 update to the state biosolids rule, Chapter 173-308 WAC.

Processes to Further Reduce Pathogens (PFRPs) to produce Class A biosolids include composting, heat drying, heat treatment, thermophilic aerobic digestion (also known as autothermal thermophilic aerobic digestion or ATAD), beta ray irradiation, gamma ray irradiation, and pasteurization. New processes not specified by the EPA can be considered equivalent to a PFRP. The permitting authority, generally the Pathogen Equivalency Committee (PEC) of the EPA, is responsible for determining if a process is equivalent.

Although the State of Montana still allows the use of Alternative 3 and 4, the EPA is considering eliminating their use to achieve Class A. Many states have already eliminated the testing to achieve Class A. The PEC is notoriously slow in considering new PFRP Equivalency and budget cuts to the EPA only increases the likelihood that new processes would not be approved.

Vector Attraction Reduction

Vectors, such as rodents and insects, are attracted to putrescible organic matter and can facilitate disease transmission by transmitting pathogens to humans. Federal biosolids regulations require that certain standards be met to reduce how much vectors are attracted to biosolids. Vector attraction reduction (VAR) requirements for Class A biosolids are the same as for Class B requirements.

The EPA outlines 12 options in the Part 503 Rule for meeting the VAR requirements (Table A-5). Option 1 through 8 and Option 12 are designed to reduce the attractiveness of biosolids to vectors. Options 9 through 11 prevent direct contact between vectors and biosolids. In general, pathogen reduction must be achieved prior to, or at the same time, as vector attraction reduction for biosolids to be considered Class A. Problems with pathogen regrowth led EPA to include this provision.

Table A-5. Options for Meeting Vector Attraction Requirements

Option	Description
Option 1	Meet 38 percent reduction in volatile solids content.[1]
Option 2	Demonstrate vector attraction reduction with additional anaerobic digestion in a bench-scale unit.
Option 3	Demonstrate vector attraction reduction with additional aerobic digestion in a bench-scale unit.
Option 4	Meet a specific oxygen uptake rate (SOUR) for aerobically digested biosolids.
Option 5	Use aerobic processes at greater than 40C for 14 days or longer.
Option 6	Alkali addition under specified conditions.
Option 7	Dry biosolids with no unstabilized solids to at least 75 percent solids.
Option 8	Dry biosolids with unstabilized solids to at least 90 percent solids.
Option 9	Inject biosolids beneath the soil surface.
Option 10	Incorporate biosolids into the soil within 6 hours of application to or placement on the land.
Option 11	Cover biosolids placed on a surface disposal site with soil or other material at the end of each operating day. (Note: Only for surface disposal.)
Option 12	Alkaline treatment of domestic septage to pH 12 or above for 30 minutes without adding more alkaline material.

Source: 40 CFR 503.33

1. Meeting the 38 percent VS destruction criteria is commonly achieved during anaerobic digestion due to the high efficiency of the process.

Biosolids Management Practices

A number of management practices are required by the Part 503 regulations and apply to bulk (large quantities) land application of both Class A and Class B biosolids.

GENERAL

General management practices required for land application include providing buffer zones around wells, surface water, and property boundaries; not causing any adverse impact to threatened or endangered species; and not applying biosolids to flooded, frozen, or snow-covered land.

Biosolids management, depending on the treatment process and the quality of the final product, can generate revenue in some cases. However, Class A solids treatment technologies generally require increased capital and operations and maintenance (O&M) costs for processing. Producing Class A biosolids can reduce costs associated with acquiring new land application sites compared to the land application of Class B biosolids.

Management practices are required to limit public and animal contact after Class B biosolids are applied and to allow natural processes to further inactivate potential pathogens. The management practices for Class B biosolids are in addition to the general management requirements specified in Subpart A of the Part 503 regulations and are summarized in Table A-6.

Table A-6. Site Restrictions for Class B Biosolids Application

Land/Crop Characteristic	Regulatory Criteria (State and Federal)
Land with a high potential for public exposure	Public access restricted for 1 year after biosolids application
Land with a low potential for public exposure	Public access restricted for 30 days after biosolids application
Food crops, feed crops or fiber crops	Not harvested for 30 days after biosolids application
Food crops with harvested parts that touch the biosolids/soil mixture and are totally above the land surface (e.g., melons, cucumbers)	Not harvested for 14 months after biosolids application
Food crops with harvested parts below the land surface (e.g., root crops such as potatoes, carrots, radishes)	Not harvested for 20 months after biosolids application
Animal grazing on a site	Restricted for 30 days after biosolids application
Turf placed on land with high potential for public exposure or a lawn unless otherwise specified by the permitting authority	Restricted for 1 year after biosolids application

AGRONOMIC APPLICATION RATES

Another key general management requirement is that biosolids be applied at an agronomic rate. Nitrogen application (dry weight basis) must not exceed that needed by a crop or vegetation. As defined in 40 CFR 503:

"Agronomic rate is the whole sludge application rate (dry weight basis) designed:

- To provide the amount of nitrogen needed by the food crop, feed crop, fiber crop, cover crop, or vegetation grown on land; and
- To minimize the amount of nitrogen in the sewage sludge that passes between the root zone of the crop or vegetation grown on the land to the groundwater."

Excess nitrogen applied to land could result in nitrate contamination of groundwater. The agronomic rate must be determined by considering total and available nitrogen in the biosolids and the expected yield of the crop or vegetation.

Monitoring

Microbiological monitoring for either fecal coliforms or Salmonella is required for all biosolids. For Class A biosolids, each sample analyzed must meet the requirements, not just the average of several samples. Requirements must be met at the time of use or disposal, at the time the biosolids are prepared for sale or give away in a bag or other container for land application, or at the time the biosolids or material derived from the biosolids (e.g., compost) is prepared to meet the requirements in Part 503.

Monitoring requirements vary by the size of the wastewater utility and the method of sludge processing. Table A-7 summarizes the required frequency of monitoring for all biosolids under Part 503, which depends on the quantity produced by a utility in a given year.

Table A-7. Frequency of Monitoring Required by Part 503 Regulations

Amount of Biosolids per 365-day Period Minimum Frequency	Dry Metric Tons	Dry English Tons
Once per year	0 – 290	0 – 320
Once per quarter	290 – 1,500	320 – 1,654
Once per 60 days	1,500 – 15,000	1,654 – 16,540
Once per month	15,000 or greater	16,540 or greater

Reprint of Table 3-4 from USEPA, 2003 1 metric ton = 1.1 English tons

Regulatory Trends and Drivers for Biosolids Management

Despite the nearly unblemished safety record of biosolids land application programs, nationally and internationally, there continues to be questions regarding the long-term safety of land application programs, both to the environment and to human health. It is known that biosolids can contain numerous substances with the potential to be harmful, and there is ongoing debate on the relative risks of these compounds.

The National Academy of Sciences (NAS) completed an assessment of the science that supports the Part 503 Rule in 2002 and concluded that there is no evidence that current biosolids management practices under existing regulations are unsafe but did conclude that more research is required to update the science behind the regulations (NRC, 2002). NAS concerns included the synergistic effects of chemical pollutants and pathogens, and other pathogens and chemical pollutants not considered in the risk assessment of the Part 503 Rule.

EPA is currently reviewing the Part 503 regulations and is expected to issue an updated version in the near future. EPA is performing a sewage sludge survey to assess a variety of compounds that are not currently regulated under the Part 503 rule. It is possible that additional compounds may be regulated under the new biosolids rule.

Pathogen Re-growth and Reactivation

Recent research by the Water Environment Research Foundation (WERF) has shown that fecal coliform, the indicator organism commonly used for pathogens, sometimes reactivates and/or re-grows after mechanical dewatering of solids. This has occurred with a variety of anaerobic digestion processes, both Class B and Class A. Research is ongoing to further understand the mechanisms and causes of this phenomenon. Research to date has shown that high solids centrifuges have the greatest potential to reactivate/re-grow fecal coliform. This research could ultimately lead to changes in the regulatory requirements surrounding dewatering.

Pathogen content in compost and compost like products are of concern in a number of parts of the country. Local Enforcement Agencies (LEA) and other regulatory agencies are being forced to require additional monitoring and provide additional scrutiny at sites. This not only adds cost to the overall management of the biosolids, but also potentially opens the facility to negative public reactions and third-party lawsuits.

Microconstituents of Concern

The presence of trace organic chemicals (TOrCs) in municipal biosolids in the U.S. has received considerable attention by the public and scientific community over the last several years. Of particular concern is whether the presence of TOrCs in biosolids results in significant risks to public health and the environment upon land application. While the EPA has evaluated the risks associated with dioxins present in biosolids-amended soils, to date, no other TOrCs or those of emerging concern, have been subjected to complete risk assessments. However, there are a growing number of studies being published every year that address the occurrence, mobility, persistence, bioaccumulation, toxicity, and microbial impacts of biosolids-borne TOrCs in soils. As more scientific data becomes available on this subject it is likely that the EPA will start regulating TOrCs that poses clear ecological and human health risk.

Recent studies have found that some TOrCs can leach from fields, particularly when the applied biosolids are not dewatered. Specifically, steroid hormones have recently been shown to have the potential for runoff after heavy rainfall. However, other TOrCs (e.g., polybrominated diphenyl ethers, synthetic musks, and some steroidal chemicals) were shown to have low leaching potential.

The persistence of biosolids-borne TOrCs in soils is a result of many processes, but biodegradation is generally considered the dominant process for biodegradation. Environmental factors such as pH, moisture content, metal cations, temperature, and bacterial cell concentration all can affect biodegradation rates. Biodegradation rates of steroidal chemicals are favorably impacted by the presence of biosolids, increased temperatures, and adequate (but not excessive) water content in soils. Unfortunately, degradation data for many TOrCs are not yet available for soils and biosolids-amended soils.

Bioaccumulation of some of the TOrCs has been documented, but few studies examined bioaccumulation and bioavailability specifically in biosolids-amended soils. Some TOrCs (tetracycline antibiotics, antimicrobials, fluoroquinolones, and synthetic musks, brominated flame retardants) can accumulate in a variety of plants including grass, green onions, cabbage, corn, alfalfa, lettuce, radish, zucchini, and carrots. Studies have shown that bioaccumulation of TOrCs in animals, particularly invertebrates such as earthworms, is also possible.

Several studies have indicated that many of the TOrCs found in biosolids can be significantly reduced in concentration if the biosolids are being treated by a combined anaerobic and aerobic digestion process. It is also likely that many TOrCs will be degraded during aerobic production of Class A biosolids created from composting. A selected list of high priority trace organic chemicals present in biosolids include the following compounds:

- Brominated Flame Retardants
- Perflourochemicals (PFCs) - Surface Coatings
- Pharmaceuticals and Personal Care Products (PPCPs)
    - Antimicrobials
    - Antibiotics
    - Musks
- Plasticizers - Bisphenol A (BPA)
- Steroidal Chemicals-Natural and Synthetic hormones
- Surfactants
- Nanoparticles - antibacterial/antifungal agents

The future will likely bring both substantial challenges to, and attractive opportunities for, biosolids management. A continuation of substantial existing pressures, along with the emergence of new ones, presents serious challenges to biosolids management likely resulting in the loss, severe restriction, and/or increased cost of management options. This includes the persistence of public perception concerns substantially driven by odor, in combination with more emergent public health concerns (such as microconstituents), as well as the emergence of new regulatory actions such as the Sewage Sludge Incineration (SSI) rule and managing the phosphorus component of biosolids consistent with agronomic rates. However, substantial opportunities also exist for new and expanded biosolids management. The opportunity is largely tied to the repositioning of biosolids as a community resource too valuable to waste in the context of renewable energy needs, urban sustainability interests, population growth, soil depletion, and technology improvements. These important and substantial societal trends can equate to a compelling opportunity to reposition the biosolids management and product discussions to overcome entrenched negative positions and perceptions and recognize biosolids as a resource too valuable to waste.

Public Perception

Political divisions and conflicts have emerged over the management of biosolids around the US, particularly in California, Virginia, and Pennsylvania. Local ordinances have been passed banning either Class B or all biosolids land application. More organized opposition to current biosolids management practices is compelling utilities to apply biosolids in more remote areas or process solids more extensively in order to manage biosolids in alternative ways.

Technology Trend Considerations

Looking into the future, trends in Europe sometimes portend the future direction of programs in America. In Europe, public perception related to risks of biosolids land application has resulted in greater focus on energy recovery/combustion technologies such as incineration, cement kilns, and gasification.

Recently, however, here in the U.S., the USEPA under the Clean Air Act, designated Sewage Sludge as a "Solid Waste". This action, as well as litigation from environmental groups, forced the Sewage Sludge Incinerator (SSI) Rule to change the monitoring and emission control Maximum Achievable Control Technology (MACT) standards from Rule 112 Standards to Rule 129 Standards. Rule 129 Standards are considerably more stringent. This led to a series of meetings, letter writing campaigns and ultimately a lowering of some of the emission limits and lessening of some of the monitoring whereby facilities with SSIs can achieve compliance. The regulations will lead to modifications in most cases and it will be expensive but they will be able to continue to operate. Because some of these SSI facilities still do not consider these rule changes to be reasonable or appropriate; NACWA is initiating litigation.

The interpretation of these rule changes is also causing concern from the Wastewater Community. First, even though not intended by USEPA, the rule could apply to all combustion of sewage sludge, biosolids and biosolids products which, if enforced, could bring all use of digester gas under new rules and standards. Second, if sludges and biosolids are classified as a solid waste, public perception on whether they should be land applied may shift.

Appendix B. Preliminary OPCCs

Lolo RSID 901 WWTP PER - Lift Station No. 1 Improvements and Force Main Installation				
Description	**Quantity**	**Unit**	**Base Unit Price ($/unit)**	**Total ($)**
Divison 1 - General Conditions				
Permits	1	LS	$ 2,835	$ 2,835
LS Demolition	1	CY	$ 4,535	$ 4,535
Traffic Control	1	LS	$ 1,134	$ 1,134
			Subtotal	$ 8,504
Divison 3 - Concrete				
Pre-cast Vault	1	LS	$ 15,000	$ 15,000
Pre-cast Wetwell cover	1	LS	$ 12,500	$ 12,500
Pre-cast Wetwell	1	LS	$ 30,500	$ 30,500
			Subtotal	$ 58,000
Division 9 - Finishes				
High Performance Wet Well Coating	484	SF	$ 20	$ 9,671
			Subtotal	$ 9,671
Division 26 - Electrical				
Electrical and Controls Work	1	LS	$ 75,000	$ 75,000
			Subtotal	$ 75,000
Division 31 - Earthwork				
Excavation	2000	CY	$ 5	$ 10,000
Dewatering	1	LS	$ 45,350	$ 45,350
Backfill	500	CY	$ 10	$ 5,000
Clearing and Grubbing	1	LS	$ 14,173	$ 14,173
			Subtotal	$ 74,523
Division 32 - Exterior Improvements				
Bollards	1	LS	$ 2,850	$ 2,850
Asphalt removal and replacement	1	LS	$ 18,380	$ 18,380
			Subtotal	$ 21,230
Division 40 - Process Interconnections				
8" Force Main Pipe	2125	LF	$ 150	$ 318,750
Miscellaneous Piping	10	LF	$ 200	$ 2,000
8" Gate Valve	4	EA	$ 2,500	$ 10,000
6" Gate Valve	1	EA	$ 1,500	$ 1,500
8" Check Valve	2	EA	$ 4,000	$ 8,000
Miscellaneous Process Fittings	1	LS	$ 15,000	$ 15,000
			Subtotal	$ 355,250
Divison 46 - Water and Wastewater Equipment				
Lift Station Package Russell Industries	1	LS	$ 101,000	$ 101,000
Station Startup	1	LS	$ 2,000	$ 2,000
			Subtotal	$ 103,000
		Subtotal		**$ 705,178**
		Mobilization, Bonds & Insurance	8%	$ 56,000
		Contractor's Overhead and Profit	15%	$ 106,000
		Subtotal		**$ 867,000**
		Montana Public Work's Tax	1%	$ 9,000
		Subtotal		**$ 876,000**
		Miscellaneous Items and Contingencies	30%	$ 263,000
		Subtotal		**$ 1,139,000**
		Total Opinion of Probable Construction Cost		**$ 1,139,000**

Lolo RSID 901 WWTP PER - Collection System Improvements				
Description	**Quantity**	**Unit**	**Base Unit Price ($/unit)**	**Total ($)**
Division 8 - Openings				
Manholes	25	EA	$ 7,000	$ 175,000
			Subtotal	$ 175,000
Division 40 - Process Interconnections				
Collection System 10-inch Pipe	1467	LF	$ 350	$ 513,450
Collection System 12-inch Pipe	1179	LF	$ 375	$ 442,125
Collection System 16-inch Pipe	2278	LF	$ 400	$ 911,200
			Subtotal	$ 1,866,775
		Subtotal		**$ 2,041,775**
		Mobilization, Bonds & Insurance	8%	$ 163,000
		Contractor's Overhead and Profit	15%	$ 306,000
		Subtotal		**$ 2,511,000**
		Montana Public Work's Tax	1%	$ 25,000
		Subtotal		**$ 2,536,000**
		Miscellaneous Items and Contingencies	30%	$ 761,000
		Subtotal		**$ 3,297,000**
		Total Opinion of Probable Construction Cost		**$ 3,297,000**

Original PER Cost Estimate

Lolo RSID 901 WWTP PER - Biosolids Dewatering Building and Equipment				
Description	**Quantity**	**Unit**	**Base Unit Price ($/unit)**	**Total ($)**
Divison 3 - Concrete				
Building Foundation Slab-on-Grade	40	CY	$ 2,000	$ 79,012
Screw Press Pad	2	CY	$ 2,000	$ 4,000
			Subtotal	$ 83,012
Division 13 - Special Construction				
Building Package	1600	SF	$ 350	$ 560,000
Installation	1	LS	$ 56,000	$ 56,000
			Subtotal	$ 616,000
Division 23 - HVAC				
HVAC Equipment	1	LS	$ 50,000	$ 50,000
			Subtotal	$ 50,000
Division 26 - Electrical				
Electrical Work	1	LS	$ 202,500	$ 202,500
Building Lights, Receptacles, and Switches	1	LS	$ 10,000	$ 10,000
Instrumentation	1	LS	$ 67,500	$ 67,500
			Subtotal	$ 280,000
Division 31 - Earthwork				
Access Road Grading, Sub-grade, Asphalt	8000	SF	$ 15	$ 120,000
Polishing Pond Backfill	5093	CY	$ 12	$ 61,111
Building Excavation	375	CY	$ 12	$ 4,500
Building Backfill	79	CY	$ 20	$ 1,574
			Subtotal	$ 187,185
Division 32 - Exterior Improvements				
Landscape/Site Restoration	1	LS	$ 10,000	$ 10,000
			Subtotal	$ 10,000
Division 40 - Process Interconnections				
4" DI Pipe	100	LF	$ 150	$ 15,000
Miscellaneous Process	1	LS	$ 15,000	$ 15,000
Installation	1	LS	$ 15,000	$ 15,000
			Subtotal	$ 45,000
Divison 46 - Water and Wastewater Equipment				
Conveyor System	1	LS	$ 45,000	$ 45,000
Sludge Feed Pump	2	EA	$ 40,000	$ 80,000
Screw Press	2	EA	$ 250,000	$ 500,000
Installation	1	LS	$ 187,500	$ 187,500
			Subtotal	$ 812,500
		Subtotal		**$ 2,033,698**
		Mobilization, Bonds & Insurance	8%	$ 163,000
		Contractor's Overhead and Profit	15%	$ 305,000
		Subtotal		**$ 2,502,000**
		Montana Public Work's Tax	1%	$ 25,000
		Subtotal		**$ 2,527,000**
		Miscellaneous Items and Contingencies	30%	$ 758,000
		Subtotal		**$ 3,285,000**
		Total Opinion of Probable Construction Cost		**$ 3,285,000**

Updated Cost Estimate at 60% Design Point

Lolo RSID 901 WWTP PER - Biosolids Dewatering Building and Equipment				
Description	**Quantity**	**Unit**	**Base Unit Price ($/unit)**	**Total ($)**
Divison 3 - Concrete				
Building Foundation Slab-on-Grade	48	CY	$ 2,000	$ 95,062
Screw Press Pad	2	CY	$ 2,000	$ 4,000
			Subtotal	$ 99,062
Division 13 - Special Construction				
Building Package	1	LS	$ 100,000	$ 100,000
			Subtotal	$ 100,000
Division 23 - HVAC				
HVAC Equipment	1	LS	$ 50,000	$ 50,000
			Subtotal	$ 50,000
Division 26 - Electrical				
Electrical Work	1	LS	$ 184,335	$ 184,335
Building Lights, Receptacles, and Switches	1	LS	$ 10,000	$ 10,000
Instrumentation	1	LS	$ 61,445	$ 61,445
			Subtotal	$ 255,780
Division 31 - Earthwork				
Access Road Grading, Sub-grade, Asphalt	5000	SF	$ 15	$ 75,000
Polishing Pond Backfill	2648	CY	$ 12	$ 31,778
Building Excavation	444	CY	$ 12	$ 5,333
Building Backfill	88	CY	$ 20	$ 1,759
			Subtotal	$ 113,870
Division 32 - Exterior Improvements				
Landscape/Site Restoration	1	LS	$ 10,000	$ 10,000
			Subtotal	$ 10,000
Division 40 - Process Interconnections				
4" DI Pipe	200	LF	$ 150	$ 30,000
Miscellaneous Process	1	LS	$ 20,000	$ 20,000
Installation	1	LS	$ 25,000	$ 25,000
			Subtotal	$ 75,000
Divison 46 - Water and Wastewater Equipment				
Conveyor System	1	LS	$ 30,000	$ 30,000
Sludge Feed Wet Well	1	LS	$ 150,000	$ 150,000
Rotary Lobe Sludge Feed Pump	2	EA	$ 16,875	$ 33,750
Polymer Blending System	1	LS	$ 18,700	$ 18,700
Screw Press	1	EA	$ 332,000	$ 332,000
Installation	1	LS	$ 169,335	$ 169,335
			Subtotal	$ 733,785
		Subtotal		**$ 1,387,497**
		Mobilization, Bonds & Insurance	8%	$ 111,000
		Contractor's Overhead and Profit	15%	$ 208,000
		Subtotal		**$ 1,706,000**
		Montana Public Work's Tax	1%	$ 17,000
		Subtotal		**$ 1,723,000**
		Miscellaneous Items and Contingencies	20%	$ 345,000
		Subtotal		**$ 2,068,000**
		Total Opinion of Probable Construction Cost		**$ 2,068,000**

Lolo RSID 901 WWTP PER - Biological Treatment Upgrade, Convert SC No. 1 to CAS				
Description	**Quantity**	**Unit**	**Base Unit Price ($/unit)**	**Total ($)**
Division 13 - Special Construction				
Modify Clarifier 1 into Bioreactor	1	LS	$ 100,000	$ 100,000
			Subtotal	$ 100,000
Division 26 - Electrical				
Electrical Work	1	LS	$ 12,000	$ 12,000
Instrumentation	1	LS	$ 6,000	$ 6,000
			Subtotal	$ 18,000
Division 32 - Exterior Improvements				
Landscape/Site Restoration	1	LS	$ 5,000	$ 5,000
			Subtotal	$ 5,000
Division 40 - Process Interconnections				
6" DI Pipe	20	LF	$ 100	$ 2,000
Miscellaneous Process	1	LS	$ 10,000	$ 10,000
Installation	1	LS	$ 4,000	$ 4,000
			Subtotal	$ 16,000
Divison 46 - Water and Wastewater Equipment				
Blower	1	EA	$ 60,000	$ 60,000
Installation	1	LS	$ 18,000	$ 18,000
			Subtotal	$ 78,000
		Subtotal		**$ 217,000**
		Mobilization, Bonds & Insurance	8%	$ 17,000
		Contractor's Overhead and Profit	15%	$ 33,000
		Subtotal		**$ 267,000**
		Montana Public Work's Tax	1%	$ 3,000
		Subtotal		**$ 270,000**
		Miscellaneous Items and Contingencies	30%	$ 81,000
		Subtotal		**$ 351,000**
		Total Opinion of Probable Construction Cost		**$ 351,000**

Lolo RSID 901 WWTP PER - Equalization Basin Liner Replacement				
Description	**Quantity**	**Unit**	**Base Unit Price ($/unit)**	**Total ($)**
Division 13 - Special Construction				
Replacement Liner	6000	SF	$ 5	$ 30,000
Installation	1	LS	$ 9,000	$ 9,000
Preparation	1	LS	$ 5,000	$ 5,000
			Subtotal	$ 44,000
Division 31 - Earthwork				
Erosion Control	1	LS	$ 5,000	$ 5,000
			Subtotal	$ 5,000
Division 32 - Exterior Improvements				
Landscape/Site Restoration	1	LS	$ 2,500	$ 2,500
			Subtotal	$ 2,500
		Subtotal		**$ 51,500**
		Mobilization, Bonds & Insurance	8%	$ 4,000
		Contractor's Overhead and Profit	15%	$ 8,000
		Subtotal		**$ 64,000**
		Montana Public Work's Tax	1%	$ 600
		Subtotal		**$ 64,600**
		Miscellaneous Items and Contingencies	30%	$ 19,000
		Subtotal		**$ 83,600**
		Total Opinion of Probable Construction Cost		**$ 83,600**

Original PER Cost Estimate

Lolo RSID 901 WWTP PER - Security Fence Replacement				
Description	**Quantity**	**Unit**	**Base Unit Price ($/unit)**	**Total ($)**
Division 13 - Special Construction				
Security Fence	700	LF	$ 50	$ 35,000
Installation	1	LS	$ 10,500	$ 10,500
			Subtotal	$ 45,500
Division 31 - Earthwork				
Erosion Control	1	LS	$ 5,000	$ 5,000
			Subtotal	$ 5,000
Division 32 - Exterior Improvements				
Landscape/Site Restoration	1	LS	$ 2,500	$ 2,500
			Subtotal	$ 2,500
		Subtotal		**$ 53,000**
		Mobilization, Bonds & Insurance	8%	$ 4,000
		Contractor's Overhead and Profit	15%	$ 8,000
		Subtotal		**$ 65,000**
		Montana Public Work's Tax	1%	$ 700
		Subtotal		**$ 65,700**
		Miscellaneous Items and Contingencies	30%	$ 20,000
		Subtotal		**$ 85,700**
		Total Opinion of Probable Construction Cost		**$ 85,700**

Updated Cost Estimate at 60% Design Point

Lolo RSID 901 WWTP PER - Security Fence Replacement				
Description	**Quantity**	**Unit**	**Base Unit Price ($/unit)**	**Total ($)**
Division 13 - Special Construction				
Automatic Security Gate	1	LS	$ 20,000	$ 20,000
Installation	1	LS	$ 6,000	$ 6,000
			Subtotal	$ 26,000
Division 32 - Exterior Improvements				
Landscape/Site Restoration	1	LS	$ 1,000	$ 1,000
			Subtotal	$ 1,000
			Subtotal	**$ 27,000**
Mobilization, Bonds & Insurance			8%	$ 2,000
Contractor's Overhead and Profit			15%	$ 4,000
Subtotal				**$ 33,000**
Montana Public Work's Tax			1%	$ 300
Subtotal				**$ 33,300**
Miscellaneous Items and Contingencies			30%	$ 10,000
Subtotal				**$ 43,300**
Total Opinion of Probable Construction Cost				**$ 43,300**

Original PER Cost Estimate

Lolo RSID 901 WWTP PER - Influent and RAS Pumps Replacement				
Description	**Quantity**	**Unit**	**Base Unit Price ($/unit)**	**Total ($)**
Division 26 - Electrical				
Electrical Work	1	LS	$ 12,500	$ 12,500
Instrumentation	1	LS	$ 5,000	$ 5,000
			Subtotal	$ 17,500
Division 40 - Process Interconnections				
6" DI Pipe	13	LF	$ 150	$ 1,950
3" & 4" Pipe Demolition and Removal	13	LF	$ 100	$ 1,300
			Subtotal	$ 3,250
Divison 46 - Water and Wastewater Equipment				
Large Influent Pump	1	EA	$ 50,000	$ 50,000
Small Influent Pumps	2	EA	$ 35,000	$ 70,000
RAS Pumps	2	EA	$ 30,000	$ 60,000
Installation	1	LS	$ 54,000	$ 54,000
			Subtotal	$ 234,000
			Subtotal	**$ 254,750**
		Mobilization, Bonds & Insurance	8%	$ 20,000
		Contractor's Overhead and Profit	15%	$ 38,000
		Subtotal		**$ 313,000**
		Montana Public Work's Tax	1%	$ 3,000
		Subtotal		**$ 316,000**
		Miscellaneous Items and Contingencies	30%	$ 95,000
		Subtotal		**$ 411,000**
		Total Opinion of Probable Construction Cost		**$ 411,000**

Updated Cost Estimate at 60% Design Point

Lolo RSID 901 WWTP PER - Influent and RAS Pumps Replacement				
Description	**Quantity**	**Unit**	**Base Unit Price ($/unit)**	**Total ($)**
Division 26 - Electrical				
Electrical Work	1	LS	$ 57,450	$ 57,450
Instrumentation	1	LS	$ 28,725	$ 28,725
			Subtotal	$ 86,175
Division 40 - Process Interconnections				
6" DI Pipe	20	LF	$ 150	$ 3,000
6" Check Valves	4	EA	$ 3,000	$ 12,000
6" Plug Valves	8	EA	$ 2,000	$ 16,000
Misc Tees & Bends	1	LS	$ 5,000	$ 5,000
8" DI Pipe	5	LF	$ 200	$ 1,000
3" & 4" Pipe Demolition and Removal	30	LF	$ 100	$ 3,000
			Subtotal	$ 40,000
Divison 46 - Water and Wastewater Equipment				
Influent Pumps	2	EA	$ 49,500	$ 99,000
RAS Pumps	2	EA	$ 46,250	$ 92,500
Installation	1	LS	$ 57,450	$ 57,450
			Subtotal	$ 248,950
			Subtotal	**$ 375,125**
		Mobilization, Bonds & Insurance	8%	$ 30,000
		Contractor's Overhead and Profit	15%	$ 56,000
		Subtotal		**$ 461,000**
		Montana Public Work's Tax	1%	$ 5,000
		Subtotal		**$ 466,000**
		Miscellaneous Items and Contingencies	20%	$ 93,000
		Subtotal		**$ 559,000**
		Total Opinion of Probable Construction Cost		**$ 559,000**

Lolo RSID 901 WWTP PER - UV Treatment Expansion				
Description	**Quantity**	**Unit**	**Base Unit Price ($/unit)**	**Total ($)**
Division 26 - Electrical				
Electrical Work	1	LS	$ 10,000	$ 10,000
Instrumentation	1	LS	$ 10,000	$ 10,000
			Subtotal	$ 20,000
Divison 46 - Water and Wastewater Equipment				
UV Lamps in Second Bank	1	EA	$ 100,000	$ 100,000
Installation	1	LS	$ 20,000	$ 20,000
			Subtotal	$ 120,000
		Subtotal		**$ 140,000**
		Mobilization, Bonds & Insurance	8%	$ 11,000
		Contractor's Overhead and Profit	15%	$ 21,000
		Subtotal		**$ 172,000**
		Montana Public Work's Tax	1%	$ 2,000
		Subtotal		**$ 174,000**
		Miscellaneous Items and Contingencies	30%	$ 52,000
		Subtotal		**$ 226,000**
		Total Opinion of Probable Construction Cost		**$ 226,000**