PRELIMINARY ENGINEERING REPORT

for the

WASTEWATER TREATMENT SYSTEM

In

LAKE FOREST ESTATES CLEAN WATER DISTRICT

SAINTE GENEVIEVE COUNTY, MISSOURI

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1. GENERAL INFORMATION

This study was instituted in order to evaluate the existing wastewater system, determine its needs, evaluate its adequacy for growth, and provide recommendations to help the system meet its future needs.

This report is an engineering study to determine the proper course of action to develop a wastewater system that will be adequate to serve the District for the next 20 years. It has been prepared from data obtained through field surveys, information provided by the Subdivision, and studies relative to the design of a complete wastewater system.

The study indicates that improvements are needed to meet future DNR requirements. In order to finance these improvements, loans may be necessary.

2. PLANNING AREA

Lake Forest Estates is located in Sainte Genevieve County as shown in Figure 1, *Vicinity Map*. It is located in the northwest part of the county approximately 10 miles west of Sainte Genevieve and 6 miles southwest of Bloomsdale. The planning area will include the complete subdivision as can be seen on Figure 2, *Topographic Map*.

Planned but undeveloped lots should be considered in the system design; but, the expenses to construct additional collection system lines, connections, or roads will not be shown in these cost estimates. It will be assumed that these costs will be borne by the future homeowners.

The planning period for this study is for 20 years, which means that all designs will be for the anticipated conditions that will exist in the year 2040.

The property owners of Lake Forest Estates Community Association recently formed the Lake Forest Estates Clean Water District who is responsible for the planning, financing, and operating of the water and wastewater system. They have a licensed water and wastewater operator and have the authority to set and increase user rates to finance improvements to the systems.

3. ECONOMIC AND DEMOGRAPHIC DATA

Lake Forest Estates is a residential area. There are no industrial, commercial, institutional, or educational entities within the planning area. The District was formed to serve the subdivision.

3.1 Land Use

The present limits of District contains over 640 acres. There are approximately 286 residences in the Subdivision and additional room available for 60 more residences.

3.2 Population

Based upon a 1999 census taken in the subdivision, the average household has 2.7 occupants, therefore, the current population in the Subdivision is 773 people. The 2000 census for Sainte

Genevieve County also shows an average household of 2.7 people which coincides with the survey.

With additional space available for only 60 more homes, the Subdivision can see a maximum growth of 11% or 346 homes.

Therefore, a total planning area design population equivalent of 935 will be used.

Since the Subdivision is not a community, there is no census data for the local income. The subdivision is located within Ste. Genevieve Township in Ste. Genevieve County however, and there is census data for the township. From American Factfinder, the 2010 median household income for the township is $44,509.

4. ENVIRONMENTAL DATA

4.1 Topography

The topography of Lake Forest Estates is hilly, as evidenced by the contour lines on Figure 2, *Topographic Map*. Elevations range from 480 feet mean sea level (MSL) to 660 feet MSL.

Lake Forest Estates lies in the hills around three manmade lakes with the largest being approximately 81 acres. The only entrance to the Subdivision (Lakewood Drive) is located off of State Route “O”.

4.2 Soils

The predominate soil of the area is of the Union-Goss-Gasconade-Crider Complex. It is characterized by steep and very steep soils on upland side slopes. It includes small areas of pasture and cultivated land on gently to moderately sloping ridgetops, and forested, long, moderate to very steep side slopes. The soils have formed in cherty limestone residual material, although Union and Crider soils also have a thin mantle of loess present.

Union soils are characterized by having a hardpan layer; however, they are moderately well drained. They have a silt-loam topsoil grading downward into a moderately permeable subsoil overlying a massive hardpan.

Goss soils are deep, well drained, and occur on steep upland slopes of from 2% to 45%. They have a cherty, silt-loam topsoil overlying a moderately permeable, very cherty, silty-clay subsoil.

Gasconade soils are shallow, somewhat excessively drained, and occur on steep upland slopes. They have a flaggy clay-loam topsoil overlying a flaggy, clay subsoil that has moderately slow permeability. These soils occur on slopes ranging from 2% to 50%.

Crider soils are deep, well drained upland soils that also occur in some area with karst topography. They have a silt loam topsoil overlying a moderately permeable, silty-clay-loam subsoil. The slopes on which they occur range from nearly flat to 20%.

With the exception of the Crider soils, all of these have a low to very low available water capacity.

5. EXISTING SYSTEMS

5.1 Water System

Water is supplied to the residents through a State licensed non-transient community water supply system.

5.1.1 Water Supply

The water supply is composed of two deep consolidated wells. Well No. 1 is located near the entrance to the subdivision and the drilling log shows it to have a total depth of 595 feet. It utilizes 302 feet of 8-inch casing and is drilled into the Eminence aquafer. This well was drilled on April 9, 1970 and was capable of producing 225 gpm. The pump is sized to provide 125 gpm to the system. The static water level during drilling was 165 feet. This water does not need treatment; but, it is chlorinated with liquid hypochlorite for safety.

A second well was drilled later and located on the opposite side of the subdivision. There is no information on this well; however, its quality also does not require treatment. It is also chlorinated and produces 125 gpm.

Both wells are remotely controlled by the water level in the storage tank.

5.1.2 Water Distribution System

The distribution system is composed of PVC pipe in 4-inch, 3-inch, and 2-inch sizes. The lines are located adjacent to the roadways. The services lines run from the mains to the homes and have a shutoff valve near the main. The District does not have an issue with pressure and have not noticed a big issue with leaks. Without metering, the water loss is unknown.

5.1.3 Water Storage Tank

The District has a 150,000 gallon ground storage tank located near the high point of the subdivision at the end of Hill Top Lane. This steel tank was constructed in 1998 by Advance Tank and Construction. It has a diameter of 32'-8" and a height of 24'-3".

The tank was inspected in May of 2018 by Liquid Engineering Corporation. Their report does not show any major issues.

A pressure switch is located in an adjacent well house and this switch controls the on and off operation of the wells.

5.2 Wastewater System

5.2.1 Wastewater Collection System

Wastewater in and around Lake Forest Estates is transported beneath the lakes to a wastewater treatment lagoon north of the dam through 6-inch and 8-inch diameter pvc truss wall pipes and cast-in-place manholes. No manholes are located beneath the water level of the lake. They are located in the laterals surrounding the lake. The Subdivision has had problems with infiltration/inflow (I&I). They are continuously smoke testing and inspecting manholes to find sources. From this data they have repaired many leaks and raised the height of several manholes.

The collection system was installed in 1971 beneath the lake and is therefore prone to excessive infiltration when a leak develops. In 2001 when improvements to upgrade the treatment system were made, site visits did not show an excessive flow of water which would be typical with infiltration; but, flow metering was performed and daily flows measured. It was shown at that time, inflow existed during wet weather events. These flows met levels of 640,000 gpd. Since that time, the Association installed a flow meter on the treatment plant effluent to help them detect and measure excessive flows. Using that data, they have made many improvements in an effort to reduce I/I. They still have excessive I/I. In the past two years, the peak measured flow has been 556,000 gpd.

5.2.2 Wastewater Treatment System

From the collection system, the sewage currently flows by gravity into a three cell aerated lagoon. It was designed for a dry weather flow of 118,300 gallons per day; but, because of the infiltration during storm events, it was also sized to handle a wet weather flow of 376,700 gallons per day. A side overflow weir directs all peak wet weather flows to the previous facultative lagoon which is being utilized for equalization. The old lagoon system was deemed capable of handling 5 consecutive days worth of peak flows. Figure 3, Existing Lagoon Layout shows the current facility layout.

This facility discharges to Big Bottom Creek which is on MDNR's 303d list as an impaired waterway. The EPA developed a Total Maximum Daily Load (TMDL) in 2010 which was published and approved. This TMDL set Waste Load Allocations (WLA's) which produces effluent limits that are unattainable by any known treatment methods. Missouri DNR has recently revised this TMDL and has it on public notice. The existing permit; however, has limits based upon the WLA's from the 2010 TMDL. These limits were proposed in a phased manner.

A previous permit (issued on February 1, 2016), implemented effluent limits that the current treatment plant could not meet. Because the Association has been working to pay off the debt on the lagoon improvements of 2005, they were not in a financial condition to make additional improvements. They have been attempting to negotiate with DNR for some relief.

In May of 2020 a new TMDL was published by DNR and approved by EPA. Afterwards a new draft permit was placed on public notice and will be in place shortly. This permit is shown as Exhibit 1, MDNR Draft Operating Permit at the end of this report. This permit imposes the following monthly limits on their system:

Parameter	Volumetric
BOD	30 mg/L
TSS	30 mg/L
NH3 (summer)	1.9 mg/L
NH3 (winter)	3.7 mg/L

In the year 2023, this permit will change the limits to:

Parameter	Volumetric
BOD	10 mg/L
TSS	10 mg/L
NH3 (year round)	0.9 mg/L
eColi	206 #/100mL

In the year 2029, this permit will again change the limits to:

Parameter	Volumetric
BOD	5 mg/L
TSS	10 mg/L
NH3 (year round)	0.9 mg/L
eColi	206 #/100mL
Total Nitrogen	5.0 mg/L
Total Phosphorus	0.5 mg/L
Dissolved Oxygen	6.0 mg/L

5.2.3 Wastewater Flow and Effluent Quality

The records from 2017 through now show the following sample results:

Date	BOD	TSS	NH3 (S)	NH3 (W)	TN	TP	Q (avg)	Q (peak)	D.O.
17-Jan	14.3	10		8.14			0.1092	0.257	6.6
17-Feb	6.49	16		9.09			0.07	0.081	7.6
17-Mar	28.8	22		6.05	18.44	1.14	0.098	0.239	10.5
17-Apr	16.2	34	11.4				0.177	0.671	9.2
17-May	18.2	13	0.05				0.07	0.414	7.8
17-Jun	12.1	17	0.05		26.9	1.63	0.07	0.27	5.2
17-Jul	5.07	9	0.05				0.091	0.14	5
17-Aug	11.8	8	0.05				0.086	0.205	
17-Sep	14.9	7	0.053		5.41	0.79	0.065	0.111	
17-Oct	9.65	20		0.05			0.063	0.102	
17-Nov	7	19		0.05			0.074	0.102	
17-Dec	18	30		0.05	7.25	0.91	0.09	0.142	
18-Jan	13.1	8		5.75			0.08	0.139	
18-Feb	11.8	9		7.43			0.128	0.421	12.6
18-Mar	13.4	8		5.68	12.7	1.3	0.163	0.272	12.2
18-Apr	15.9	29	0.552				0.136	0.19	6.3
18-May	14.4	14.4	0.02				0.111	0.196	6.3
18-Jun	14.8	10.5	1.1		7.15	2.98	0.116	0.255	
18-Jul	21.5	13	9.08				0.087	0.149	
18-Aug	40.6	16	4.45				0.01	0.164	
18-Sep	15.2	14	0.02		14.5	4.25	0.112	0.556	4.4
18-Oct	16.8	9		1.56			0.086	0.12	6.8
18-Nov	20.3	11		0.242			0.129	0.267	12.6
18-Dec	12.8	7		6	17.3	2.07	0.147	0.432	
19-Jan	14.1	4		6.8			0.16	0.241	12.2
19-Feb	8.89	6		5.34			0.227	0.355	15.9
19-Mar	10.8/	12		3.51	10.1	1.29	0.175	0.328	11.4
19-Apr	17	9	4.43				0.172	0.258	9
19-May	5.42	6	6.76				0.17	0.379	8.2
19-Jun	5.35	7	9.29		6.31	3.4	0.11	0.217	5.8
19-Jul	14.3	8	8.45				0.099	0.275	
19-Aug	59.7	8	8.41				0.079	0.13	
19-Oct	13.3	10		6.01	7.91	1.9	0.095	0.188	

As you can see from the data, the system is doing fine at meeting the current requirements for BOD and TSS; however, it does not meet the Ammonia (NH3) limits. The system has been in violation of its permit in 15 months of the past 2 years.

In addition, once the phase II limits are implemented in 2022, the Plant will not consistently meet any of the discharge limits.

This data also shows that the average daily flow to the lagoon for the past three years has been 111,256 gpd. Using dry summer months of June through October, the average daily flow during that same time frame is 89,200 gpd. From water pumping records at the wells, the water supply has been producing only 60,360 gpm during that same time period. This is indicative of infiltration in the wastewater collection system.

6. DESIGN PARAMETERS

6.1 Wastewater Treatment

With 286 existing homes, the current population equivalent is 773 persons. The lagoon loadings will be based upon the DNR recommendation of 0.17 lb/person/day and infiltration/inflow strengths of 30 mg/L. The flows will be based upon the existing water production rates of 78 gpcd.

For the design capacity, the future population will be used. This population is based upon the subdivision capacity of 346 homes and is estimated at 935.

It is known that the I/I will not be eliminated. Improvements can be made; but, as shown by the Associations past work, the repairs only last a few years before the flows begin climbing again. With that thought in mind, the future infiltration will remain as existing and the future inflow will be reduced by 25%. The existing flows and future design capacity is being presented below:

Flows (gpd)

Condition	Population	Water Use	Infiltration	Inflow	Total
Existing					
Average Flow	773	60,400	28,900	22,000	111,300
Peak Flow	773	60,400	28,900	466,700	556,000
Future					
Average Flow	935	73,100	28,900	16,500	118,500
Peak Flow	935	73,100	28,900	350,100	452,100

Loadings

Condition	Population	Domestic	Infiltration	Inflow	Total
Existing					
Average Flow	773	132	8	6	132
Peak Flow	773	132	8	117	243
Future					
Average Flow	935	159	8	5	172
Peak Flow	935	159	8	88	255

Although the effluent limits imposed by the proposed permit are staged, the treatment plant must be capable of meeting the following effluent limits by 2029:

Parameter	Volumetric
BOD	5 mg/L
TSS	10 mg/L
NH3 (year round)	0.9 mg/L
eColi	206 #/100mL
Total Nitrogen	5.0 mg/L
Total Phosphorus	0.5 mg/L
Dissolved Oxygen	6.0 mg/L

Because the Phosphorus limit is below 1.0 mg/L, it will be necessary to ultimately install chemical feed equipment for chemical precipitation of the phosphorus. The installation of this equipment is not necessary for the immediate needs (since phosphorus will not have a limit until 2029); but, provisions should be made for its future installation.

7. EXISTING SYSTEM DEFICIENCIES

7.1 Water System

The water system is in good condition. The wells, disinfection, and storage are well maintained.

The wells are in good shape and the chlorination system appears to have relatively new pumps and equipment. Everything is in good working order and the operator does not have many issues.

The largest issue that the operator has with the distribution system is the lack of working isolation valves. Because the distribution system circles the main lake along the roadway, there were not many valves designed in it. When there is a leak, the operator has to isolate a large section of line to make the repair. Additional valves are needed; however, they can be installed individually when leaks are found.

The storage tank has some slight rusting on the exterior walls; but, the exterior coatings are in good shape and minor touchups will repair the rusting spots. The inspection report also noted some minor rusting on the interior; but, noted that these can be repaired at the next inspection.

With a population of 773 and a DNR recommended demand of 100 gpcd, the water supply should be capable of providing 77,300 gpd (althought their actual demand is less). The wells are capable of providing 180,000 gpd so there are no issues with supply. The wells are capable of providing 232% of the demand so based upon the USDA guidelines, the storage tank should be capable of providing almost 0% of the maximum day in usable volume which it does. It also according to DNR should have a total storage equal to one average days production which it also does. The storage tank is also adequate in size for their needs.

No major deficiencies are noted with the water system.

7.2 Wastewater System

7.2.1 Existing Wastewater Collection System

From the previous sections it is evident that there is extra water entering the collection system from outside the residential connections. This indicates that the collection system leaks.

From visual inspections, the majority of the sewer collection system is constructed of truss pipe. This pipe is known to become brittle and develop leaks.

From the average daily flows, it appears that there is approximately 50,900 gallons per day in excess of their water system production. This does not even account for any potential water system losses through leaking pipes. It is estimated that this flow is coming from leaks in the sewer lines below the lakes.

The peak daily flows from the past 2.5 years of data show that the peak day includes an additional 445,000 gallons of water during a wet weather event. It is estimated that this flow is coming from leaking sewer lines along the edge of the lakes and under the streams feeding the lakes.

The District does smoke test their system at times and does visual flow monitoring to locate sources of I/I. When this occurs, they find and repair broken mains. They also lower the lake levels during select winters and perform main repairs along the edges of the lakes on a regular basis.

With this occurring on regular basis, the District knows the system is faulty and has not been able to solve the problem. They can only seem to manage the I/I and keep it reduced to a medium/high level.

7.2.2 Existing Wastewater Treatment Facilities

A visual inspection of the lagoon showed no obvious defects. The District is doing an excellent job of maintaining the facilities. The existing equalization lagoons are being mowed when dry which keeps pests and vermin from breeding and causing damage to cell levees.

It is apparent from the testing results that the lagoon is not capable of meeting newer effluent limits. Regulations were changing in 2001 when the current lagoon was being designed. No one knew what the future regulations would be at that time and DNR presented effluent limits which could change. It was estimated that Ammonia limits would be enforced; however, no one knew to what extent (how low the limits would be). The lagoon was designed with a deeper water depth and smaller surface area to help reduce future upgrade costs.

The time has come for the District to begin looking at those upgrades. Some ammonia limits are already under enforcement and not being met. Lower limits of all parameters will have to be met in a few years and even lower will need to be dealt with in the future.

8. ALTERNATE SOLUTIONS

8.1 Sewer Collection System

Because the Clean Water District will be taking over the water and sewer, they will not be able to charge an annual maintenance fee like the Home Owners Association. Therefore, metering should be installed on the water service lines to provide a fair method of allocating costs. This should be done regardless of the collection or treatment system recommended.

8.1.1 Do Nothing

Doing nothing is really not an alternative. Doing nothing will allow the I/I to increase and become unmanageable. At some point it will overwhelm the treatment plant and the shallow sloping gravity mains below the dam. There it will overflow the manholes and run into the receiving stream without treatment. The high flows that go to the plant will not receive adequate treatment and can also wash sludge from the treatment plant.

8.1.2 Line the Gravity Mains with CIPP or Pipe Burst with HDPE

Lining or pipe bursting some of the mains is an option; however, only shorter mains can be repaired/replaced in these methods.

CIPP linings and pipe bursting are limited to 500 or 600 feet in length and for the installation, it is required that both ends of the pipe to be constructed are exposed for access. Most of the lines beneath the lakes are thousands of feet long. Over 25,000 feet of gravity sewer main lies beneath the water surface which can be over 40 feet deep at the dam. It is not possible to expose deeper sections of the line without draining the entire lake and the community is not agreeable to that.

There are also multiple wyes on the main under the lake and getting access for all of those is difficult as explained above.

8.1.3 Replace Portions of the Gravity Mains with a Pressure System.

It is possible to install grinder pumps at the manhole locations adjacent to the lake shoreline. These grinder stations would serve one or more residences and then pump the waste around the shoreline to the treatment plant.

These stations would be connected to forcemains ranging from 2-inch diameter up to 4-inch diameter. The forcemain would run along the edge of the roadway and discharge at the treatment plant below the dam.

Most of the stations serve multiple homes so duplex stations would be utilized to provide a backup pump if one were clogged or failed. Because the pumps house grinder blades to chop any solids into smaller particles that can pass through, a 2 HP motor is recommended. This larger motor would run cooler, clog less, and provide a longer lifespan.

Portions of the system not beneath the lake would be retained as gravity flowing to the grinder stations. These lines would be inspected via smoke testing and CCTV video and repairs made based upon these inspections.

The advantages of a pressure system are:

a. All of the collection lines will be located outside of the lakes and accessible for repair.

b. Leaks from pressure lines typically surface and are more easily found.

Disadvantages include:

a. Higher maintenance with grinder pumps.

b. Requires more operator attention to check pumps.

c. More expensive to operate due to the use of pumps.

d. Additional easements will be needed from the homeowners.

e. Instead of surface water leaking into the collection system, raw sewage would leak into the lake during a failure.

The estimated construction cost for the pressure sewer system upgrade is shown below:

Pressurized Collection System

Item	Description	Units		Unit Cost	Subtotal
1	Duplex Grinder Lift Stations	76	EA	$ 18,000.00	$ 1,368,000.00
2	Forcemain	37600	LF	$ 18.00	$ 676,800.00
3	Electrical Supply	76	EA	$ 1,000.00	$ 76,000.00
4	Gravity Connections	91	EA	$ 1,000.00	$ 91,000.00
5	Sitework	76	EA	$ 600.00	$ 45,600.00
Subtotal Metering Cost					$ 2,257,400.00

Sewer Repair

Item	Description	Units		Unit Cost	Subtotal
1	Manhole Liners	235	EA	$ 900.00	$ 211,500.00
2	CIPP Gravity Repair	3250	LF	$ 50.00	$ 162,500.00
Subtotal Collection System Cost					$ 374,000.00

Metering

Item	Description	Units		Unit Cost	Subtotal
1	5/8"x3/4" Meter, Base, Box	300	EA	$ 900.00	$ 270,000.00
2	Computer, Software & Support	1	EA	$ 20,000.00	$ 20,000.00
Subtotal Metering Cost					$ 290,000.00

Total Construction Cost	$ 2,921,400.00
Collection System Inspection	$ 79,259.10
Engineering Design	$ 228,900.00
Construction Observation	$ 171,700.00
Legal	$ 30,000.00
Easements	$ 105,000.00
Closing Costs	$ 15,000.00
Environmental	$ 7,500.00
Contingencies	$ 292,000.00
TOTAL PROJECT COST	$ 3,850,759.10

In addition there are other cost factors to look at and those are the operation and maintenance of the facilities. The District already has a full time operator for the water and wastewater so labor will not be included in the evaluation. Power and repairs will be necessary however.

Below is a chart outlining some of the added operation and maintenance items with their estimated costs:

	Annual Treatment System O&M		
System Type	Power	Repl.	Total
Pressure Sewer	$13,700	$37,100	$50,800

8.1.4 Replace Portions of the Gravity Main with New Gravity Piping.

Another option would be to replace portions of the gravity main in shallow waters with new ductile iron pipe. This option would replace the existing lines that are subject to damage from anchors and expansion/contraction due to temperature changes. The deeper lines are less prone to problems from these as they are in more temperate water conditions.

New lines under Lake Anne would be run from the manholes on the shorelines into the water and then parallel along the banks close to the shoreline. On the smaller shallower lakes, they would be replaced adjacent to the existing lines. The smaller lakes would have to essentially be drained and the Lake Anne drained to a lower level. The Association is not in agreement with draining Lake Anne dry but, draining to a lower level is acceptable.

As much of these shallower waters have developed siltation over the years, it will be necessary to remove some of this to allow the new lines to be placed below the actual lake bottom.

As above, the portions of the system not beneath the lake would be inspected and repairs made based upon the inspections.

The advantages of the gravity system are:

a. Lower maintenance costs.

b. Lower operating costs since power is not required.

c. Less operator attention is required.

Disadvantages include:

a. Leaking lines beneath the lake more difficult and time consuming to locate and repair.

b. Still possibility of leaking lines beneath the water surface.

8.1.5 Utilize Combined Methods for Gravity Sewer Repair/Replacement

By utilizing gravity sewer replacement, CIPP lining, and pipe bursting, we believe that some of the existing gravity sewer can be repaired/replaced at the most affordable cost and eliminate the potential for I/I.

Each lake in the subdivision is different and the lengths and layout of the sewer under those lakes are also different. The goal is not to relocate these mains from beneath the lake; but, to attempt to get these lines to a condition or location where leakage can be minimized.

The estimated construction cost for the gravity sewer system upgrade is shown below:

Lake Anne

Item	Description	Units		Unit Cost	Subtotal
1	Excavation & Removal	12600	CY	$ 25.00	$ 315,000.00
2	8" DIP Gravity Sewer	7050	LF	$ 100.00	$ 705,000.00
3	Manholes	21	EA	$ 5,000.00	$ 105,000.00
4	Tie-ins	19	EA	$ 3,000.00	$ 57,000.00
5	Line Plugs	4	EA	$ 5,000.00	$ 20,000.00
Subtotal Collection System Cost					$ 1,202,000.00

Lake Marian

Item	Description	Units		Unit Cost	Subtotal
1	8" DIP Gravity Sewer	3564	LF	$ 100.00	$ 356,400.00
2	Manholes	16	EA	$ 5,000.00	$ 80,000.00
3	8" CIPP Liner	640	LF	$ 50.00	$ 32,000.00
4	Tie-ins	1	EA	$ 3,000.00	$ 3,000.00
Subtotal Collection System Cost					$ 471,400.00

Lake Susan

Item	Description	Units		Unit Cost	Subtotal
1	8" Pipe Bursting	1846	LF	$ 350.00	$ 646,100.00
2	Manholes	8	EA	$ 5,000.00	$ 40,000.00
3	Pipe Fusions	6	EA	$ 3,000.00	$ 12,000.00
Subtotal Collection System Cost					$ 698,100.00

Metering

Item	Description	Units		Unit Cost	Subtotal
1	5/8"x3/4" Meter, Base, Box	300	EA	$ 900.00	$ 270,000.00
2	Computer, Software & Support	1	EA	$ 20,000.00	$ 20,000.00
Subtotal Metering Cost					$ 290,000.00

Total Construction Cost	$ 2,661,500.00
Collection System Inspection	$ 84,865.00
Engineering Design	$ 211,200.00
Construction Observation	$ 158,400.00
Legal	$ 15,000.00
Closing Costs	$ 15,000.00
Environmental	$ 7,500.00
Contingencies	$ 266,000.00
TOTAL PROJECT COST	$ 3,419,465.00

Like the pressure sewer, there are some additional cost factors to look at but with gravity sewer, they are fewer. Because power is not required, the only maintenance will be associated with the water meters.

Below is a chart outlining some of the added operation and maintenance items with their estimated costs:

	Annual Treatment System O&M		
System Type	Power	Repl.	Total
Gravity Sewer	$0	$ 6,700	$ 6,700

8.2 Wastewater Treatment Facility

Meeting ammonia limits is not the only issue with this system. The future limits being implemented are more stringent and impossible to meet. Not only does the District have to look at what upgrades are necessary, they also have to determine a course of action before the upgrades can be decided. There are several courses that the District could take. These include the following:

8.2.1 Do Nothing

Doing nothing is one alternative. The existing wastewater discharge permit includes limits which are not being met. If these limits are not met DNR will begin to enforce the state regulations through the court system. This would result in the District taking a legal pathway. The ultimate discharge requirements would then be determined by the courts.

8.2.2 Modify the Existing Treatment Plant to a No-Discharge System.

8.2.2.1 Pump to a Nearby Community

The closest community to feasible pump the waste to is the City of Bloomsdale. It is approximately 7.2 miles away. According to the existing NPDES permit for Bloomsdale, they have an oxidation ditch treatment plant with a design capacity of 70,000 gpd and also have a current average discharge of 40,000 gpd. This facility is not large enough to handle the flows from Lake Forest. Upgrades would be necessary and combined with the pump station and forcemain from Lake Forest these upgrades would cost more than other options.

8.2.2.2 Convert the Existing Plant to Land Application

A no-discharge system would eliminate the discharge permit and thereby eliminate the limits imposed by such permit. This option should carry the District through many decades without requiring upgrades for a change in limits. The largest hurdle for this type of system is the acquisition of land. There is not enough available land within the subdivision so ground would have to be purchased or rented on which to distribute the water.

The main type of no-discharge system at a facility of this size is land application. Primary treatment is needed in the form of a lagoon and the effluent is pumped to irrigation nozzles that spray the wastewater on surrounding ground.

The primary treatment lagoons must have a minimum of 90 days of wastewater storage with an allowance of 2 feet for sludge and an allowance for the precipitation that occurs during this period to allow for cold and wet weather conditions that will not allow land application. The typical annual precipitation is 42 inches; with a 1 in 10 year rainfall minus evaporation total of 12 inches over 90 days. With a high water depth of 10.5 feet, the area of the lagoon should be approximately 4.11 acres. This will require additional earthwork at the existing lagoon site.

The land application rate would be designed for 36 inches per acre per year, 3 inches per acre per week, or 1 inch per acre per day. With an annual flow of 43,200,000 gallons and a storm volume of approximately 4,000,000 gallons, there are 47,200,000 gallons to land apply. With a maximum annual application of 36 inches, the land application area will encompass 48 acres. If a 12 hour/day application period is used with an application rate of 1/2 inch/acre per day, the effluent pump will be sized for 1,471 gpm. This will require 48 days of application per year.

A land application pumping station, control panel, discharge piping, control valves, application area (land), and irrigation nozzles (big guns) will be needed in addition to the lagoon improvements.

Operation of a land application system will require the operator to visit the site on a daily basis and pump wastewater to the application area as weather permits.

Several years ago, the Association previously contacted nearby land owners to find out if land could be purchased, leased, or used for this purpose and they met with resistance. Since they are now a District, they may have more legal options available for land acquisition or there may be new land owners that are agreeable.

The advantages of a land application system are:

a. It is a non-discharge system that doesn't require stringent testing.

b. Doesn't harm aquatic life if operated properly.

c. It is relatively easy to operate.

Disadvantages include:

a. Higher maintenance as system ages.

b. Requires closer attention as I/I levels increase.

c. Requires extremely large area of land for application of wastes if available.

The estimated construction cost for the land application system is shown below:

Item	Description	Units		Unit Cost	Subtotal
1	Lagoon Earthwork	41000	CY	$ 25.00	$ 1,025,000.00
2	Structures	2	EA	$ 15,000.00	$ 30,000.00
3	Lift Station	2	EA	$ 125,000.00	$ 250,000.00
4	Forcemain	450	LF	$ 50.00	$ 22,500.00
5	Controls	1	LS	$ 50,000.00	$ 50,000.00
6	Electrical	1	LS	$ 120,000.00	$ 120,000.00
7	Sitework	2	AC	$ 5,000.00	$ 10,000.00
8	Riprap	1200	Ton	$ 35.00	$ 42,000.00
9	Strainer	1	EA	$ 60,000.00	$ 60,000.00
10	Gravel Roadway	450	Ton	$ 35.00	$ 15,750.00
11	Irrigation Guns	17	EA	$ 6,000.00	$ 102,000.00
12	Field Piping	10200	LF	$ 35.00	$ 357,000.00
Total Construction Cost					$ 2,084,250.00
Engineering Design					$ 171,000.00
Construction Observation					$ 128,300.00
Interest					$ 165,000.00
Legal/Bonding					$ 20,000.00
Environmental					$ 7,500.00
Land Costs		120	Ac	$ 10,000.00	$ 1,200,000.00
Contingencies					$ 208,000.00
TOTAL PROJECT COST					$ 3,984,050.00

In addition there are other cost factors to look at and those are the operation and maintenance of the facilities. The District already has a full time operator for the water and wastewater so labor will not be included in the evaluation. Power, sludge disposal, and repairs will be necessary however.

Below is a chart outlining some of the added operation and maintenance items with their estimated costs:

	Annual Treatment System O&M			
System Type	Power	Repl.	Sludge	Total
Land Application	$3,000	$6,000	$5,000	$14,000

8.2.3 Move the Discharge or Treatment Plant to a Different Receiving Stream

Another course of action would include relocating the treatment plant or discharge to a different stream such as Indian Creek which isn't on the Departments 303d list and/or doesn't have a TMDL. This could make the effluent requirements less stringent.

An Anti-Degradation Review would have to be completed before the actual limits would be known; but, it could be estimated that the limits would be similar to those seen in other areas of the state. Like land application above, this option requires the availability of land on which to place the discharge piping and/or treatment plant. The land could be purchased or a lease could be purchased; but, the land would have to be obtained in some fashion.

Regardless of the treatment option, both relocating the effluent of the existing plant or relocating the plant will require gravity flow piping to the new discharge site. The benefit of relocating the discharge of the existing plant would be ease of access, less potential for raw sewage overflow, less land purchase required, and lower costs for reuse of the existing infrastructure (even if only for the equalization basins). It would be better to relocate the discharge.

There are several treatment options available to meet those type of limits and they will be outlined below.

8.2.3.1 Modification of the Existing Aerated Lagoon

Modifications are being completed in other areas of the state in a few different ways. The various options for reuse of the lagoon will be outlined below:

8.2.3.1.1 Conversion to Activated Sludge System

There has been success in utilizing activated sludge lagoon systems, especially in the agricultural industry.

This could be accomplished in a couple ways. All methods would include additional aeration to convert the basins to complete mix activated sludge; but, various options exist for clarifying the water. We feel the most cost effective and operational friendly manner would be to convert the existing lagoon into a Sequencing Batch Reactor.

This upgrade would require splitting the final settling pond into two basins. A concrete wall and liner would split the basin and prevent erosion and leakage. A flow splitter would be constructed at the head of both basins to split the flow evenly between the two. Screening facilities would be incorporated before this splitter to remove any large non-degradable objects that could foul the mechanical equipment. Floating aerator/mixers would be installed on both basins to aerate and mix the water allowing the bacteria to make contact with all of the wastes. Controls would be provided that would allow for filling, aeration, settling, and decant cycles. During the fill and aerate cycles, the aerators would be energized. They would be de-energized during the settle and decant cycles. Decanters would be provided to drain the clear surface water from the basins after the sludge has settled. This water would be discharged after being disinfected by Ultraviolet light. The controls would alternate basins so that while one basin is being aerated, the other would be settling or decanting. This would reduce the peak flows leaving the plant and being disinfected. For future nutrient removal, the floating aerator/mixers could be used without aeration to mix during an anoxic period and chemical feed equipment can be added at a later date.

During decant, some of the sludge would have to be removed from the basin. Submersible pumps could be used to pump this sludge to the current aeration basin where it could be digested and stored for later removal and land application.

The advantages of an activated sludge conversion include:

a. Reduced construction footprint by utilizing existing basins.

b. Extended sludge handling intervals.

c. High quality effluent.

d. Some Biological Nitrogen and Phosphorus removal with little or no upgrade costs.

The disadvantages include:

a. Higher operation and maintenance costs with more aeration.

b. It is more prone to upset following the introduction of a caustic waste.

c. Produces higher volumes of sludge to handle

The costs for the activated sludge conversion is shown below:

Item	Description	Units		Unit Cost	Subtotal
1	Earthwork	500	CY	$ 25.00	$ 12,500.00
2	Structures - Splitter	1	EA	$ 30,000.00	$ 30,000.00
3	BioCurtain	110	LF	$ 150.00	$ 16,500.00
4	Retaining Wall	115	CY	$ 1,000.00	$ 115,000.00
5	Controls	1	LS	$ 120,000.00	$ 120,000.00
6	Decanter	3	EA	$ 90,000.00	$ 270,000.00
7	Aerators/Mixers	6	EA	$ 45,000.00	$ 270,000.00
8	Misc Piping	1	LS	$ 80,000.00	$ 80,000.00
9	Electrical	1	LS	$ 120,000.00	$ 120,000.00
10	Gravity Sewer	350	LF	$ 50.00	$ 17,500.00
11	Sludge Pumping	2	EA	$ 40,000.00	$ 80,000.00
12	Liner	14500	SF	$ 3.00	$ 43,500.00
13	UV Disinfection	1	EA	$ 175,000.00	$ 175,000.00
14	Sitework	1	Ac	$ 5,000.00	$ 5,000.00
15	Discharge Piping	6000	LF	$ 50.00	$ 300,000.00
16	Screening	1	EA	$ 150,000.00	$ 150,000.00
Total Construction Cost					$ 1,805,000.00
Engineering Design					$ 151,000.00
Construction Observation					$ 113,300.00
Interest					$ 126,000.00
Legal/Bonding					$ 20,000.00
Environmental					$ 7,500.00
Easements		6000	LF	$ 10.00	$ 60,000.00
Contingencies					$ 181,000.00
TOTAL PROJECT COST					$ 2,463,800.00

8.2.3.1.2 Conversion to Lagoon with Fixed Film Media

Another process which has shown success in meeting ammonia limits includes the addition a fixed film media to the lagoon based treatment process. This option can be completed in numerous ways and there are several manufacturers trying to sell their version. The various

versions include the placement of media pods within the lagoon basin, construction of a submerged media bed after the lagoon, and construction of a recirculating nonsubmerged media filter after the lagoon. Most of these involve additional aeration and could require insulated covers or heaters to maintain a higher water temperature during the winter months.

While similar in the actual biological treatment, the various options do have drastically different operational and maintenance concerns and costs. We feel that the best of these options include insulated covers with a submerged media bed after the lagoon. While heaters could replace the insulated covers, there has not been enough installations to prove this technology as cost efficient yet.

The recommended process would include additional aeration to generate a complete mix zone at the beginning of the plant. All of the lagoon would be covered with insulated floating covers and a fixed film reactor would be placed at the end of the lagoon from which the wastewater would discharge. The reactor is composed of a plastic media stored in a concrete basin. The lagoon effluent flows through the media and aeration is also provided through the media. To help with the lower future mussel based ammonia levels, a recirculating pump station would be constructed after the reactor to recirculate a portion of the treated water back to the lagoon or front of the reactor.

The advantages of covered lagoon with fixed film reactor include:

a. Reduced construction footprint by utilizing existing basins.

b. Less susceptible to upset. Stable treatment.

c. Lengthened sludge handling intervals.

d. Ease of operation.

e. High quality effluent.

The disadvantages include:

a. Higher operation and maintenance costs with more aeration.

b. Medium construction costs.

c. Total Nitrogen or Phosphorus removal would require substantial upgrades later.

The costs for the covered lagoon with fixed film reactor conversion is shown below:

Item	Description	Units		Unit Cost	Subtotal
1	Floating Cover	70000	SF	$ 6.00	$ 420,000.00
2	Aeration Equipment	1	LS	$ 550,000.00	$ 550,000.00
3	Aeration Building	100	SF	$ 300.00	$ 30,000.00
4	Baffles	180	LF	$ 250.00	$ 45,000.00
5	Reactor Basin	1	LS	$ 325,000.00	$ 325,000.00
6	Reactor Media	1	LS	$ 160,000.00	$ 160,000.00
7	Disinfection	1	LS	$ 150,000.00	$ 150,000.00
8	Recirculation Pump Station	1	LS	$ 125,000.00	$ 125,000.00
9	Electrical	1	LS	$ 45,000.00	$ 45,000.00
10	Sitework	1	Ac	$ 5,000.00	$ 5,000.00
11	Misc. Piping	1	LS	$ 75,000.00	$ 75,000.00
12	UV Disinfection	1	LS	$ 175,000.00	$ 175,000.00
13	Discharge Piping	6000	LF	$ 50.00	$ 300,000.00
Total Construction Cost					$ 2,405,000.00
Engineering Design					$ 193,500.00
Construction Observation					$ 145,100.00
Interest					$ 125,000.00
Legal/Bonding					$ 250,000.00
Environmental					$ 7,500.00
Easements		6000	LF	$ 10.00	$ 60,000.00
Contingencies					$ 241,000.00
TOTAL PROJECT COST					$ 3,427,100.00

8.2.3.2 Construction of a New Treatment Plant

Along with conversion of the existing facilities, the Association can opt to construct a totally new facility at the site of the existing lagoons. A new facility would eliminate any issues that the Association has with operating or maintenance of the existing plant. Other than a new lagoon based system which isn't more cost effective than modifications to the existing lagoon, the only real option is an activated sludge process.

8.2.3.2.1 Activated Sludge Treatment Plant

Several options of biological treatment exist including an oxidation ditch, solids contact, sequencing batch reactor, moving bed bioreactor, and membrane bioreactor. All of these incorporate activated sludge requiring extensive aeration needs and can meet the ammonia limits; but, some can meet more stringent limits as well and some have more construction cost than others. The most cost effective option is a sequencing batch reactor. It is able to meet the current limits as well as remove some total nitrogen and total phosphorus. It also incorporates clarification within the aeration basins to provide construction cost savings.

Advantages of this type of plant include the following:

a. It has a smaller footprint and takes up less land.

b. It produces the best quality effluent.

Disadvantages of the mechanical plant include the following:

a. It is more prone to upset following the introduction of a caustic waste.

b. It produces large volumes of sludge.

c. It can have higher operating and maintenance costs associated with the handling of sludge.

A mechanical plant would take up less than 1 acre of land and be located at a location in one of the old lagoon cells.

The estimated capital construction costs for a new concrete structured sequencing batch reactor is shown below:

Item	Description	Units		Unit Cost	Subtotal
1	Screening	1	LS	$ 150,000.00	$ 150,000.00
2	Grit Removal	1	LS	$ 150,000.00	$ 150,000.00
3	Reaction Basins	285	CY	$ 1,000.00	$ 285,000.00
4	Aeration Equipment	2	EA	$ 220,000.00	$ 440,000.00
5	Aeration Building	300	SF	$ 300.00	$ 90,000.00
6	Decant Equipment	2	EA	$ 45,000.00	$ 90,000.00
7	Sludge Transfer Pumps	2	EA	$ 35,000.00	$ 70,000.00
8	Controls	1	LS	$ 200,000.00	$ 200,000.00
9	Electrical	1	LS	$ 120,000.00	$ 120,000.00
10	Site Piping	1	LS	$ 125,000.00	$ 125,000.00
11	EQ Basin	240	CY	$ 1,000.00	$ 240,000.00
12	Site Work	1.00	AC	$ 5,000.00	$ 5,000.00
13	UV Disinfection	1	LS	$ 175,000.00	$ 175,000.00
14	Discharge Piping	6000	LF	$ 55.00	$ 330,000.00
15	Fencing	540	LF	$ 25.00	$ 13,500.00
Total Construction Cost					*$ 2,483,500.00*
Engineering Design					$ 199,000.00
Construction Observation					$ 149,300.00
Interest					$ 160,000.00
Legal/Bonding					$ 20,000.00
Environmental					$ 7,500.00
Easements		6000	LF	$ 10.00	$ 60,000.00
Contingencies					$ 248,000.00
TOTAL PROJECT COST					$ 3,327,300.00

8.2.3.3 Relocated Discharge Treatment Plant Comparisons

Based upon the above, there are three options recommended for improvements with discharge relocation. Those include new Concrete SBR with discharge relocation, Lagoon Upgrade to SBR with discharge relocation, and Lagoon Upgrade with Fixed Film Media and discharge relocation. Additional cost factors can also be taken into account however, and those are the operation and maintenance of the facilities. The District already has a full time operator for the water and wastewater so labor will not be included in the evaluation. Power, sludge disposal, and repairs will be necessary however.

Below is a chart outlining some of the added operation and maintenance items with their estimated costs:

	Annual Treatment System O&M			
System Type	Power	Repl.	Sludge	Total
New Concrete SBR	$8,650	$21,630	$7,000	$37,280
SBR Lagoon	$8,600	$20,630	$7,000	$36,230
Covered Lagoon w/ Fixed Film Reactor	$6,900	$16,630	$7,000	$30,530

Based upon the estimated construction cost and the operation and maintenance costs, the present worth value can be calculated. This is the total value of the project if all costs were brought to present day values and financed in one lump sum with the future costs placed into an interest bearing account until needed. The present worth of these options at 2.5% (from OMB Circular No. A-94) over 20 years are shown below:

System Type	Construction Cost	Present Worth of Treatment O&M	20-year Project Cost
New Concrete SBR	$3,327,300	$580,932	$3,908,323
SBR Lagoon	$2,463,800	$564,760	$3,028,560
Covered Lagoon w/ Fixed Film Reactor	$3,427,100	$475,671	$3,902,771

Based upon the present worth values, the Lagoon conversion to an SBR is the most cost effective. This option would meet the estimated limits for the alternate receiving stream and would be capable of performing some Total Nitrogen and Phosphorus removal in the future without major upgrades.

8.2.4 Maintain the Existing Discharge Location

If no land is available for land application or discharge piping and the District decides that they do not want to relocate their existing facilities, the existing facilities would have to be upgraded to meet the 2022 effluent limits. Upgrades should be made to also meet more stringent limits; but, there is no treatment option would consistently meet the 13 year limits being set.

Per the DNR discussions, we will examine options capable of meeting the 2022 limits. These options can be considered as some of the most technologically advanced treatment methods.

8.2.4.1 Modification of the Existing Aerated Lagoon by conversion to Activated Sludge System

As outlined in the previous section, the existing lagoon could be converted to a Sequencing Batch Reactor. Combined with a tertiary disc filter, it would be capable of meeting the 2022 limits. This option is also capable of some nutrient removal without a substantial upgrade.

The costs for the activated sludge conversion is shown below:

Item	Description	Units		Unit Cost	Subtotal
1	Earthwork	500	CY	$ 25.00	$ 12,500.00
2	Structures - Splitter	1	EA	$ 30,000.00	$ 30,000.00
3	BioCurtain	110	LF	$ 150.00	$ 16,500.00
4	Retaining Wall	115	CY	$ 1,000.00	$ 115,000.00
5	Controls	1	LS	$ 120,000.00	$ 120,000.00
6	Decanter	3	EA	$ 90,000.00	$ 270,000.00
7	Aerators/Mixers	6	EA	$ 45,000.00	$ 270,000.00
8	Misc Piping	1	LS	$ 80,000.00	$ 80,000.00
9	Electrical	1	LS	$ 120,000.00	$ 120,000.00
10	Gravity Sewer	350	LF	$ 50.00	$ 17,500.00
11	WAS Sludge Pumping	2	EA	$ 40,000.00	$ 80,000.00
12	Liner	14500	SF	$ 3.00	$ 43,500.00
13	UV Disinfection	1	EA	$ 175,000.00	$ 175,000.00
14	Tertiary Disc Filter	1	LS	$ 275,000.00	$ 275,000.00
15	Sitework	1	Ac	$ 5,000.00	$ 5,000.00
16	Screening	1	EA	$ 150,000.00	$ 150,000.00
Total Construction Cost					$ 1,780,000.00
Engineering Design					$ 149,200.00
Construction Observation					$ 111,900.00
Interest					$ 120,000.00
Legal/Bonding					$ 20,000.00
Environmental					$ 7,500.00
Contingencies					$ 178,000.00
TOTAL PROJECT COST					$ 2,366,600.00

8.2.4.2 Construction of a New Treatment Plant

The best form of treatment available would be provided by Reverse Osmosis (RO). This type of plant would not only require an activated sludge treatment as discussed previously; but, also require tertiary treatment, and membrane pretreatment prior to the reverse osmosis membranes. This would basically require a wastewater treatment plant followed by a water treatment plant followed by reverse osmosis.

RO has high construction, operating, and maintenance costs as membranes require high pumping pressures, routine cleaning, and regular membrane replacement.

This form of treatment only treats 75%-90% of the water. The remaining 10%-25% is wasted as a reject stream that is high in the contaminants being removed (they have to go somewhere). Based on a flow of 118,000 gpd, the reject stream would be 12,000 gpd or more. The District would have to find a location for this waste stream. It could not be discharged to Big Bottom Creek with the proposed limits. That waste stream would have to be land applied on unused property around the development.

The costs for this type of system are as follows:

Item	Description	Quantity		Unit Cost	Subtotal
SBR					
1	Screening	1	LS	$ 150,000.00	$ 150,000.00
2	Grit Removal	1	LS	$ 150,000.00	$ 150,000.00
3	Reaction Basins	285	CY	$ 1,000.00	$ 285,000.00
4	Aeration Equipment	2	EA	$ 220,000.00	$ 440,000.00
5	Aeration Building	300	SF	$ 300.00	$ 90,000.00
6	Decant Equipment	2	EA	$ 45,000.00	$ 90,000.00
7	Sludge Transfer Pumps	2	EA	$ 35,000.00	$ 70,000.00
8	Controls	1	LS	$ 200,000.00	$ 200,000.00
9	Electrical	1	LS	$ 120,000.00	$ 120,000.00
10	Site Piping	1	LS	$ 125,000.00	$ 125,000.00
11	EQ Basin	240	CY	$ 1,000.00	$ 240,000.00
12	Site Work	1.00	AC	$ 5,000.00	$ 5,000.00
13	UV Disinfection	1	LS	$ 175,000.00	$ 175,000.00
14	Fencing	540	LF	$ 20.00	$ 10,800.00
UF FILTER					
16	Filter Building	880	SF	$ 300.00	$ 264,000.00
17	Filter Equipment	4	EA	$ 150,000.00	$ 600,000.00
18	Electrical	1	LS	$ 30,000.00	$ 30,000.00
19	Booster & Backwash Pump	4	EA	$ 35,000.00	$ 140,000.00
20	Coagulant Equipment	2	EA	$ 30,000.00	$ 60,000.00
21	Piping	1	LS	$ 20,000.00	$ 20,000.00
REVERSE OSMOSIS					
22	Membrane Building	1200	SF	$ 300.00	$ 360,000.00
23	Membrane Equipment	2	EA	$ 500,000.00	$ 1,000,000.00
24	Booster Pumping	2	EA	$ 35,000.00	$ 70,000.00
25	Wetwell	1	LS	$ 35,000.00	$ 35,000.00
26	Electrical	1	LS	$ 55,000.00	$ 55,000.00
27	Piping	1	LS	$ 35,000.00	$ 35,000.00
REJECT LAND APPLICATION					
28	Excavation/Embankment	6800	CY	$ 25.00	$ 170,000.00
29	Land App. Lift Station	1	EA	$ 150,000.00	$ 150,000.00
30	Land App. Forcemain	2500	LF	$ 50.00	$ 125,000.00
31	Irrigation Guns	10	EA	$ 6,000.00	$ 60,000.00
Total Construction Cost					*$ 5,324,800.00*
Engineering Design					$ 384,600.00
Construction Observation					$ 288,500.00
Interest					$ 160,000.00
Legal/Bonding					$ 20,000.00
Environmental					$ 7,500.00
Electrical Service		4000	LF	$ 40.00	$ 160,000.00
Contingencies					$ 532,000.00
TOTAL PROJECT COST					$ 6,877,400.00

8.2.4.3 Existing Discharge Location Comparisons

Based upon the above, there are two options recommended for improvements at the existing location. Those include Lagoon Upgrade to SBR and Reverse Osmosis. Additional cost factors can also be taken into account however, and those are the operation and maintenance of the facilities. The District already has a full time operator for the water and wastewater so labor will not be included in the evaluation. Power, sludge disposal, and repairs will be necessary however.

Below is a chart outlining some of the added operation and maintenance items with their estimated costs:

	Annual Treatment System O&M			
System Type	Power	Repl.	Sludge	Total
SBR Lagoon	$8,600	$20,630	$7,000	$36,230
Reverse Osmosis	$8,650	$30,150	$7,000	$45,800

Based upon the estimated construction cost and the operation and maintenance costs, the present worth value can be calculated. This is the total value of the project if all costs were brought to present day values and financed in one lump sum with the future costs placed into an interest bearing account until needed. The present worth of these options at 5% over 20 years are shown below:

System Type	Construction Cost	Present Worth of Treatment O&M	20-year Project Cost
SBR Lagoon	$2,366,600	$564,760	$2,931,360
Reverse Osmosis	$6,877,400	$713,440	$7,590,840

Based upon the present worth values, the Lagoon conversion to an SBR is the most cost effective. This option would meet the 2022 limits and would be capable of performing some Total Nitrogen and Phosphorus removal in the future without major upgrades.

8.3 Alternative Comparison

8.3.1 Wastewater Collection

Based upon the discussion in Section 8.4.1 above, there are two options recommended for examination as a potential solution to the I/I problems. Those include replacement of the gravity collection system beneath the lake with a pressurized system or partial replacement of the gravity collection system beneath the lake with a new gravity main along the edge of the shoreline. Comparing the present worth values yields the following:

System Type	Construction Cost	Present Worth of Treatment O&M	20-year Project Cost
Pressure System Upgrade	$3,850,759	$791,275	$4,642,034
Gravity System Upgrade	$3,419,465	$104,447	$3,523,912

Based upon the present worth values, the gravity system upgrade is the most cost effective. Not only is it more cost effective, it will be much easier to operate and maintain. If the system is

not maintained effectively, gravity flow can actually reduce the potential for sanitary sewer overflows (SSO's) in the lake and be more environmentally friendly.

8.3.2 Wastewater Treatment

Based upon the above, there are three options recommended for further examination as an ultimate solution. Those include Lagoon Upgrade to SBR with discharge relocation to Indian Creek, Lagoon Upgrade to SBR with Tertiary Filtration, and Land Application. Comparing the present worth values yields the following:

System Type	Construction Cost	Present Worth of Treatment O&M	20-year Project Cost
SBR Lagoon to Ind Cr	$2,463,800	$564,760	$3,028,560
SBR Lagoon with Tert. Flt	$2,366,600	$564,760	$2,931,360
Land Application	$3,984,050	$277,393	$4,261,443

Based upon the present worth values, the Lagoon conversion to an SBR is the most cost effective. These options would meet the proposed 6 year limits, meet estimated limits for the alternate receiving stream and would be capable of performing some Total Nitrogen and Phosphorus removal. Land Application is the highest cost (due to the purchase of property); but, it also eliminates the immediate potential for further upgrades being needed. Two of these options are only available if downstream property can be acquired and because the cost for the two SBR options are essentially equal, there is no need to change the discharge location from the existing one so the option of an SBR conversion discharging to Indian Creek will be eliminated.

The construction of the Land application option will also have a negative impact to Big Bottom Creek. While they will lower the nutrient loading to the stream they will also remove all flow from the stream during the summer months. This will essentially eliminate all aquatic life in Big Bottom Creek.

8.4 Alternative Recommendation

8.4.1 Wastewater Collection

The best solution for the wastewater collection system improvements combined several gravity improvement alternatives.

One major concern with the repair/replacement of these lines deals with the dams. Excavating across the existing dams presents a major concern and could also involve additional permitting from DNR. Once deep excavations are made, it might be hard or impossible to replace the soils at a compaction like they currently are. Being a separate trench that is compacted differently from the remainder of the levee makes for a weak spot where water could seep, erode, and cause a collapse of the dam. We will work to prevent excavations that would penetrate the dam.

Not knowing the actual depths of the existing lines and the underwater terrain, it might be difficult to construct the replacements at a specific grade. They will be laid at a down gradient; however, to prevent settlement and plugging. Specific grades will be installed where possible.

Because Lake Anne can only be partially drained, not all of the mains beneath it will be accessible for repairs. On the upstream (south) end of the lake, the lines are accessible when the water level is drawn down. These lines should be replaced with 8-inch ductile iron pipe or fusion welded HDPE pipe that is weighted down and relocated as close to the shoreline as possible. The existing lines being abandoned will be plugged as far downstream as possible. Being on the upper end of the lake, it has been noted that there is a considerable amount of sediment deposited above the lines. Much of this sediment will need to be removed for the construction. Some of the sediment can be dried in place prior to removal; however, all removals will be hauled to a community or neighboring property where drying can be completed and the material stockpiled for use as fill. Best management practices will be required at the stockpile site to prevent runoff.

Lake Marian has a V-shape which makes it difficult to prevent all lines from being located along the shoreline. Some of the lines should be replaced with 8-inch ductile iron pipe or HDPE and relocated as close to the shoreline as possible; but, the main line running from the dam across the lake to the opposite side is short enough that it could be lined with a CIPP liner to make it one continuous piece of pipe. The other mains at the deepest end would be left in place and plugs installed to prevent the abandoned lines from leaking.

Lake Susan is long and narrow. Without excavating through the dam, there is no way to open cut and replace the gravity mains. It is possible however to pipe burst these lines using HDPE pipe to replace the existing. The main line would be pipe burst in two sections and fusion welded together near the first wye. The lateral lines could be replaced with HDPE through open cut methods or pipe bursting and fusion welded onto the main. This would provide a gravity system essentially composed of 1 pipe beneath the lake. There would be no joints for leakage to occur.

The proposed layout for the improvements are shown in Figure 4, *Proposed Collection System Improvements.*

Additional funds are also be estimated for some CIPP lining on those lines outside of the lake boundaries. These leaks would be found through the collection system inspection that would take place during design.

8.4.2 Wastewater Treatment

Since members of the Association have been unsuccessful in finding available ground for a land application system in the past, we will recommend that the existing aerated lagoon be converted into a Sequencing Batch Reactor.

For a SBR modification, the existing polishing cell would be divided into two cells with a concrete wall. During construction the aerated cell effluent could be directed to the old tertiary cell for settling and discharge. No excessive sludge has been noted in the polishing cell; however, if it is found, it will be disposed of in accordance with 503 guidelines.

These two new cells would then be converted to aeration basins with the addition of floating aerators and mixers. Calculations show a basin biomass volume needed of approximately 9,000 cubic feet/basin. This would store the biomass and wet weather flows. The proposed basins can hold this volume at a 4.7 feet depth. A safety depth of 3 feet would be placed above this to prevent currents from bringing biomass into the decanter after settling. This sets the low water level at 7.7 feet. During high flows, the water depth in the cells would range from this low level of 7.7 feet to a depth of 8.7 feet. During average flows, it would only rise to 8.2 feet. The existing cell has a water depth of 10 feet with an additional 2 feet of freeboard so no additional depth will need to be added.

Floating decanters would be located at the end opposite of the influent. The influent line would be re-routed to a splitter where the flows would be split to the two basins. Ringlace could be draped across the cell to help provide equal flow distribution and to provide a fixed film surface for bacteria to attach. Control would be incorporated to provide fill, aerate, settle, and decant cycles to treat the water. The aeration cycle could be modified to include anoxic mix for total nutrient removal if needed.

During decant, the water would flow to a small equalization basin that would restrict the exiting flow so that downstream components would not have to be as large. Following this equalization basin, a tertiary cloth disk filter would be constructed to filter out additional TSS. This would reduce the TSS levels as well as the BOD levels since a portion of the TSS is organic in nature. It can also help remove additional phosphorus that is bound in the solids.

After filtration, ultraviolet disinfection will be installed prior to flow measuring and discharge. The UV system will be sized for the peak flow of 0.5 MGD. Flow measuring would be incorporated into the controls to determine cycle lengths and decant flow rates during peak wet weather events as well as to help control the disinfection system. Post aeration will be provided at the discharge of the disinfection system or on the discharge outfall to bump the DO level up prior to discharge.

Sludge wasting pumps would be installed that would cycle on/off to pump settled sludge during the decant cycle. The sludge would be pumped to the existing aeration basin which could be converted to a digester. The existing aerators would be retained to provide a layer of aerated water above the digesting sludge to reduce odors and to provide some oxygen for sludge

digestion. A decanter could return the supernatant from the digester to the head of the plant for treatment. This basin will provide enough volume for over 10 years of sludge disposal but the Association can contract to have the sludge removed (pumped or dredged) from this basin and land applied as needed to prevent odors from occurring.

For the future nutrient removal criteria, the controls would be designed so that the operation of the facility could be based upon ammonia removal or nutrient removal as desired. Mixers would be initially installed. These mixers will help with mixing during the aerobic cycle when the aerators are operational as needed for ammonia removal and they will be needed in the future for the anoxic cycle once nutrient removal is required. The facilities will also be designed so that chemical feed equipment could be purchased at a future date and installed at the site. A small storage building could be added for liquid chemicals, such as alum or ferric chloride, to be stored and peristaltic pumps could be installed to pump the chemicals to the treatment plant. The electrical supply would also be designed so that these pumps and building could be easily installed at a future date.

A backup generator will also be included to provide the power to operate the equipment on the site.

The proposed layout for the improvements are shown in Figure 5, *Proposed SBR Lagoon Layout*.

The costs for the recommended improvements are as follows:

Treatment Improvements

Item	Description	Units		Unit Cost	Subtotal
1	Earthwork	500	CY	$ 25.00	$ 12,500.00
2	Structures - Splitter	1	EA	$ 30,000.00	$ 30,000.00
3	BioCurtain	110	LF	$ 150.00	$ 16,500.00
4	Retaining Wall	115	CY	$ 1,000.00	$ 115,000.00
5	Controls	1	LS	$ 120,000.00	$ 120,000.00
6	Decanter	3	EA	$ 90,000.00	$ 270,000.00
7	Aerators/Mixers	6	EA	$ 45,000.00	$ 270,000.00
8	Misc Piping	1	LS	$ 80,000.00	$ 80,000.00
9	Electrical	1	LS	$ 120,000.00	$ 120,000.00
10	Gravity Sewer	350	LF	$ 50.00	$ 17,500.00
11	WAS Sludge Pumping	2	EA	$ 40,000.00	$ 80,000.00
12	Liner	14500	SF	$ 3.00	$ 43,500.00
13	UV Disinfection	1	EA	$ 175,000.00	$ 175,000.00
14	Tertiary Disc Filter	1	EA	$ 275,000.00	$ 275,000.00
15	Sitework	1	Ac	$ 5,000.00	$ 5,000.00
16	Screening	1	EA	$ 150,000.00	$ 150,000.00
17	Backup Generator	1	EA	$ 60,000.00	$ 60,000.00
Subtotal Treatment Construction Cost					$ 1,840,000.00

Collection System Improvements

Lake Anne

Item	Description	Units		Unit Cost	Subtotal
1	Excavation & Removal	12600	CY	$ 25.00	$ 315,000.00
2	8" DIP Gravity Sewer	7050	LF	$ 100.00	$ 705,000.00
3	Manholes	21	EA	$ 5,000.00	$ 105,000.00
4	Tie-ins	19	EA	$ 3,000.00	$ 57,000.00
5	Line Plugs	4	EA	$ 5,000.00	$ 20,000.00
Subtotal Collection System Cost					$ 1,202,000.00

Lake Marian

Item	Description	Units		Unit Cost	Subtotal
1	8" DIP Gravity Sewer	3564	LF	$ 100.00	$ 356,400.00
2	Manholes	16	EA	$ 5,000.00	$ 80,000.00
3	8" CIPP Liner	640	LF	$ 50.00	$ 32,000.00
4	Tie-ins	1	EA	$ 3,000.00	$ 3,000.00
Subtotal Collection System Cost					$ 471,400.00

Lake Susan

Item	Description	Units		Unit Cost	Subtotal
1	8" Pipe Bursting	1846	LF	$ 350.00	$ 364,700.00
2	8" HDPE Gravity Sewer	804	LF	$ 150.00	$ 120,600.00
3	Manholes	8	EA	$ 5,000.00	$ 40,000.00
4	Fusion Welds	6	EA	$ 2,000.00	$ 12,000.00
Subtotal Collection System Cost					$ 537,300.00

Sewer Repair

Item	Description	Units		Unit Cost	Subtotal
1	Manhole Liners	243	EA	$ 900.00	$ 218,700.00
2	CIPP Gravity Repair	3310	LF	$ 50.00	$ 165,500.00
Subtotal Collection System Cost					$ 384,200.00

Metering

Item	Description	Units		Unit Cost	Subtotal
1	5/8"x3/4" Meter, Base, Box	300	EA	$ 900.00	$ 270,000.00
2	Computer, Software & Support	1	EA	$ 20,000.00	$ 20,000.00
Subtotal Metering Cost					$ 290,000.00

Total Construction Cost	$ 4,724,900.00
Collection System Inspection	$ 84,865.00
Engineering Design	$ 346,800.00
Construction Observation	$ 260,100.00
Legal	$ 50,000.00
Closing Costs	$ 15,000.00
Environmental	$ 7,500.00
Contingencies	$ 472,000.00
TOTAL PROJECT COST	$ 5,961,165.00

9. OPTIONS FOR FINANCING

As the District knows, improvements to a wastewater system is a major undertaking for a small group of homeowners, and if the project is to be realized, the homeowners must be willing to bear most if not all of the financial burden of the project.

Because the Association recently formed as a Re-organized Sewer District, there are more financing options available than before.

Following are brief outlines of some of the financing programs and their value to this project.

9.1 Community Development Block Grant Program

The Community Development Block Grant Program of the Missouri Department of Economic Development offers grants to low income communities and districts. This grant program provides a maximum grant amount of $750,000; however, these grants are not typically made unless the improvements will increase the user costs to 2% of the median household income. This will require an average user charge of $74.18 per month for water based on the 2010 census data. To qualify for these grants, the recipient must have 51% of its residents below the median income level. It is unlikely that the District has a LMI greater than 51% so this grant program is not available.

9.2 State Rural Sewer Grant

This program, funded by the Missouri Department of Natural Resources, can provide up to $1,400 per connection in grant funding with a grant maximum of $500,000. This program has not been funded in the past several years and funding is not anticipated for several years with the current economy. With 500 connections, the available amount would be $500,000. These

grants are based upon priority points given for need and health concerns. When available, these are hard to obtain as many communities compete for them.

9.3 State Revolving Fund

This program, through the State Department of Natural Resources, offers low interest loans. This program has an interest rate of 30% of the AAA municipal market interest rate plus a yearly administration fee of 1% which is set the week when the loan closes. This loan is paid back over 20 years. All eligible systems are placed on the Intended Use Plan unless there is not enough funding available, where they might be placed on a contingency list. Recently, these loans have not been difficult to obtain; however, they do require a bond issue be passed by the voters in the District.

This program also has a Clean Water State Revolving Fund Affordability Grant which can provide up to $2,000,000 but is limited to 50% of the project cost if the applicant qualifies. Funding is limited so this grant is also competitive and based upon need. This grant requires the recipient to meet certain criteria to be eligible. Those criteria include a population of 3,300 or less, a user charge that will be at or above 2% of the median household income, and a median household income that is at or below 75% of the state average, unemployment rate, poverty rate, and others. Preliminary completion of the online grant eligibility form shows that the District could be eligible for DNR grants. The grant eligibility form is included as Exhibit 2, Grant Eligibility Form.

The application deadline for this program is March 1, 2020. An application, including the preliminary engineering report, would have to be submitted. After submission, the State agency reviews the applications and ranks the projects using priority points based upon need and health concerns. If the project scores high enough, it will be placed upon the state Intended Use Plan which is typically issued in October. After this notification of funding is complete, it typically takes another year before construction can begin on the project.

9.4 USDA Rural Development Loan/Grant

The United States Department of Agriculture Rural Development agency has loans and grants available to low income communities. This program is based upon need and income levels of the community. Grants are not typically made unless the improvements will increase the user costs to 2% of the median household income. As with the CDBG Grant, this will require an average user charge of $74.18 per month for sewer before the grant is made. The amount of grant is typically need driven; but, as the State receives its funding in the form of 70% loan/30% grant monies, they try to keep that ratio as the maximum where possible. The District is eligible for this program.

The loans made at the intermediate rate are currently 2.375% over a 35 year period.

9.5 Revenue or General Obligation Bonds

The project can be financed by sale of revenue or general obligation (property tax) bonds. Revenue bonds are backed by revenue generated from the water system. It takes a simple majority of the voters to pass a revenue bond issue.

General Obligation (G.O.) Bonds are backed by property tax levies; however, they can be paid back with revenues from the sewer system. It takes either a four-sevenths or a two-thirds majority to pass a G.O. bond issue depending on the election date. Because the Owner is a District, they most likely do not have taxing ability and therefore G.O. Bonds are not an option.

Money can be made available from bonds sold on the open market within a very short time frame. If such financing is selected the project could be started as soon as a bond issue is passed and the design completed. The project could be under construction in late 2019.

The interest rates for open market sales are higher than the SRF bonds. Current rates on the open market are around 4.0%. If an bond issue is needed and passed, it would not be fiscally advisable to use the open market when low interest loans such as DNR and USDA are available.

9.6 Lease Financing

Another method of obtaining financing for municipal improvements is through lease financing. In a lease financing arrangement, the District leases the real property (the project site) to a third party and the third party then simultaneously leases the project site together with the improvements back to the District for rental payments that will be sufficient to pay the debt service on the bonds. The third party, which is usually a non-profit corporation (new or existing) or a bank or trust company, obtains the bonds for the project. This form of financing does not require voter approval and may be paid back with revenue from the user rates or a proposition can be taken to the voters to levy new or increased taxes. In certain circumstances, utility rates may be raised without voter approval. This type of financing is typically around 1% higher in interest rates than open market revenue bond rates; but, it is the quickest option for financing.

10. RECOMMENDATIONS FOR FINANCING

Based upon discussions with DNR and USDA, it was determined that USDA would be the best option for financing. The interest rates are not much different and the Association has history with USDA because of the previous improvements that were made.

11. LOCAL COSTS

The local costs for the project depend upon the financial vehicle used to pay the project costs.

Besides loan payments, there are other costs associated with the wastewater system that must be included in the monthly user charge.

For long term support of the project, the District should set aside funds into a replacement account to allow for the future replacement of assets. Below is a table outlining those long term costs and an annual amount to set aside:

No of Units	Description	Life Span (yrs)	Cost per unit	Subtotal (20 yr cost)
6	Aerators	20	$10,000.00	$60,000.00
1	Screening Equipment	20	$30,000.00	$30,000.00
3	Decanters	20	$30,000.00	$90,000.00
2	Sludge Blowers	10	$20,000.00	$80,000.00
64	Sludge Diffuser Membranes	10	$200.00	$25,600.00
2	Sludge Pump	10	$6,000.00	$24,000.00
2	Mixers	20	$20,000.00	$40,000.00
4	Valves	10	$5,000.00	$40,000.00
8	Bulbs	2	$100.00	$8,000.00
3	Filter Discs & Pumps	7	$6,000.00	$51,428.57
1	UV Equip	20	$20,000.00	$20,000.00
300	Water Meters	10	$200.00	$120,000.00
1	AMR computer & Software	5	$3,500.00	$14,000.00
1	Controls	20	$15,000.00	$15,000.00
			Total	$618,028.57
			Annual Cost	**$30,901.43**

Below is a listing of annual operation and maintenance, replacement accounts, sludge disposal, billing, etc. costs associated with the system:

Replacement Account	$ 30,900
Sludge Disposal	$ 7,000
Operator Costs	$ 9,000
Additional Manpower	$ 10,400
Billing/Collections	$ 6,000
Testing	$ 6,000
Repairs	$ 10,000
Fees & Permits	$ 1,000
Electrical Costs	$ 9,000
Chemicals	$ 3,000
Operating Equipment	$ 2,000
Office Rental	$ 6,000
Miscellaneous Expenses	$ 5,000
Total O&M Costs	$105,300

These costs combined with the financing of the system improvements will determine the total user costs.

11.1 No Grant Funds Involved

If no grant funds are involved and the project is funded by 100% loan through USDA, it is estimated that a loan of $5,962,000 will be taken at an interest rate of 2.375% for a period of 35 years. Such a loan would have an annual payment of $252,800. A reserve fund must also be set aside with 10% of the payment being placed into it annually. This gives a total annual cost for the system of $383,400. When split among 280 users, the estimated monthly user charge would be $114.10. This is 3.08% of the median household income.

11.2 Grant Funds Involved

Because of the high user charge based upon 100% loan financing, it is expected that grants can be obtained.

With a grant and loan combination of $2,385,000 in grants and $3,576,000 in loans the annual payment would be approximately $151,600. Combined with the other costs, the total annual cost for the system would be $272,000. When split among 280 users, the estimated monthly user charge would be $80.95 which is 2.18% of the median household income.

12. RECOMMENDATIONS

It is recommended that this report be reviewed by the District and a decision made on the recommended improvements and guidance provided on the desired finance method.

Once approved by the District, the Engineering Report can be submitted to USDA for review and financing. An anticipated timeline for the project could be as follows:

Submit Report to USDA for funding	03/01/2020
Receive approval and Letter of Intent to fund	10/31/2020
Complete Design	06/30/2021
Obtain DNR & USDA approval of design	12/31/2021
Advertise for Bids	01/31/2022
Issue Bonds for Project	03/31/2022
Authorize Construction	03/31/2022
Complete Treatment Plant Construction	02/28/2023
Complete Collection System Construction	08/21/2023

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FIGURES

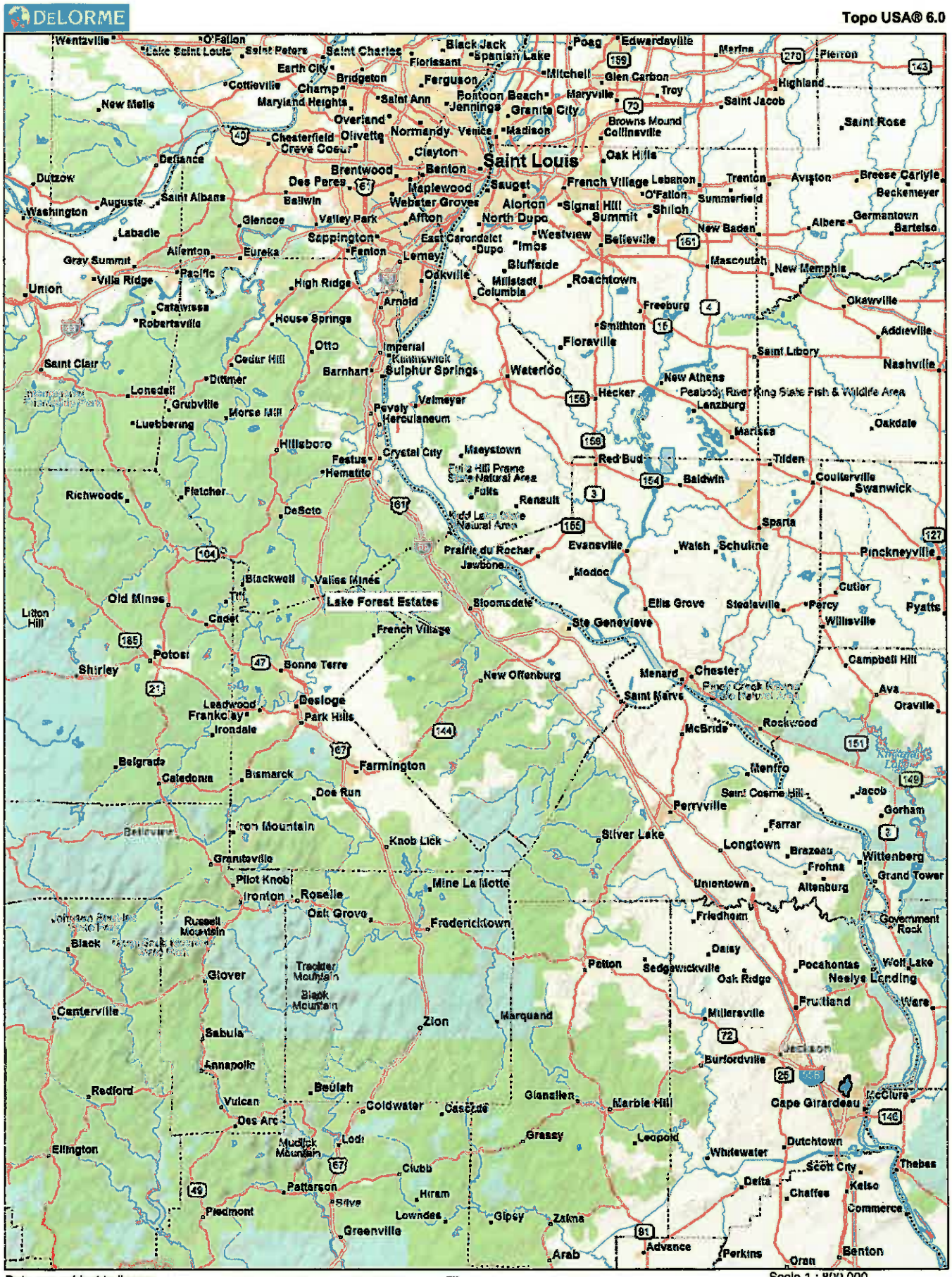


Figure 1, Vicinity Map

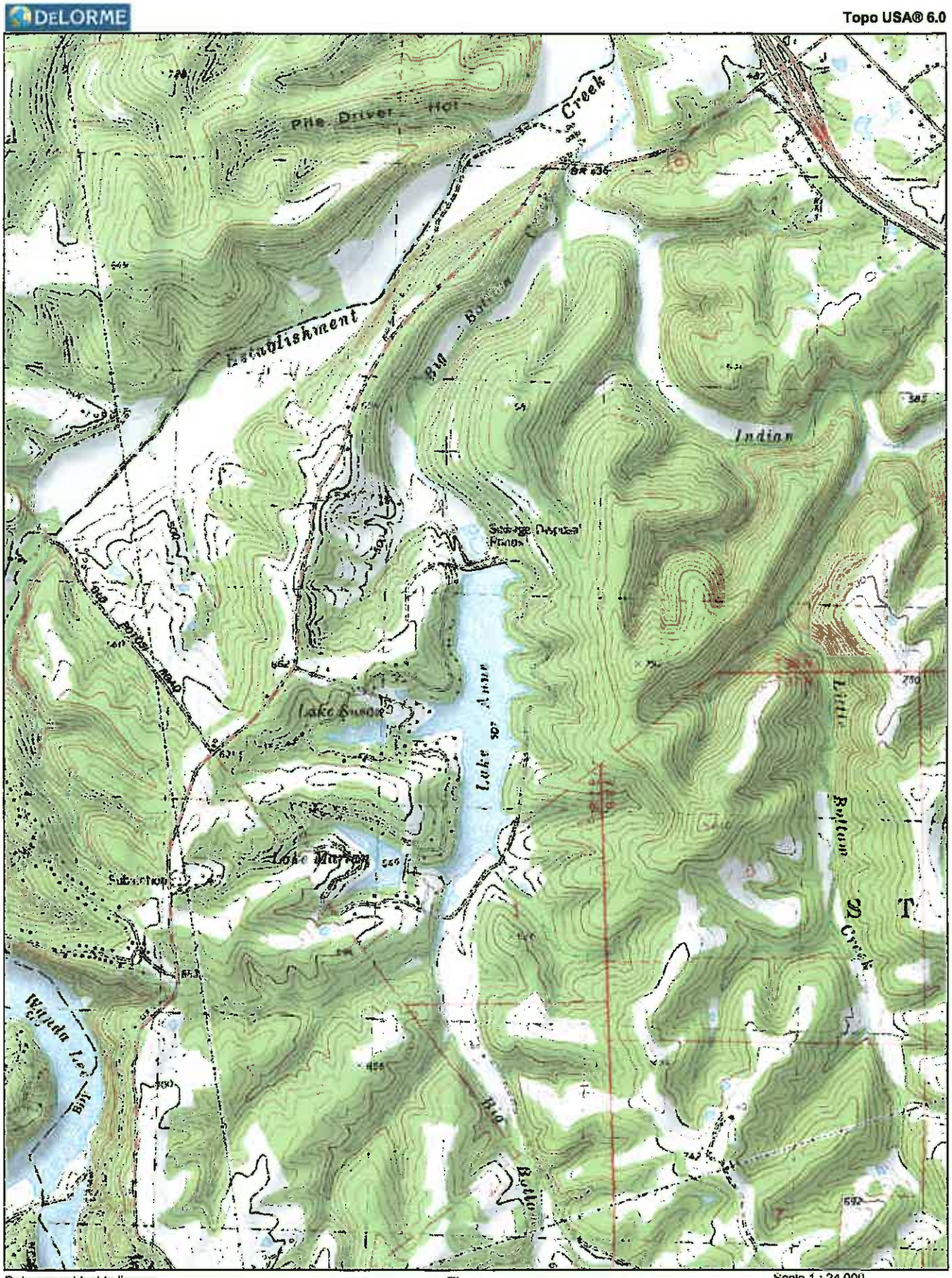
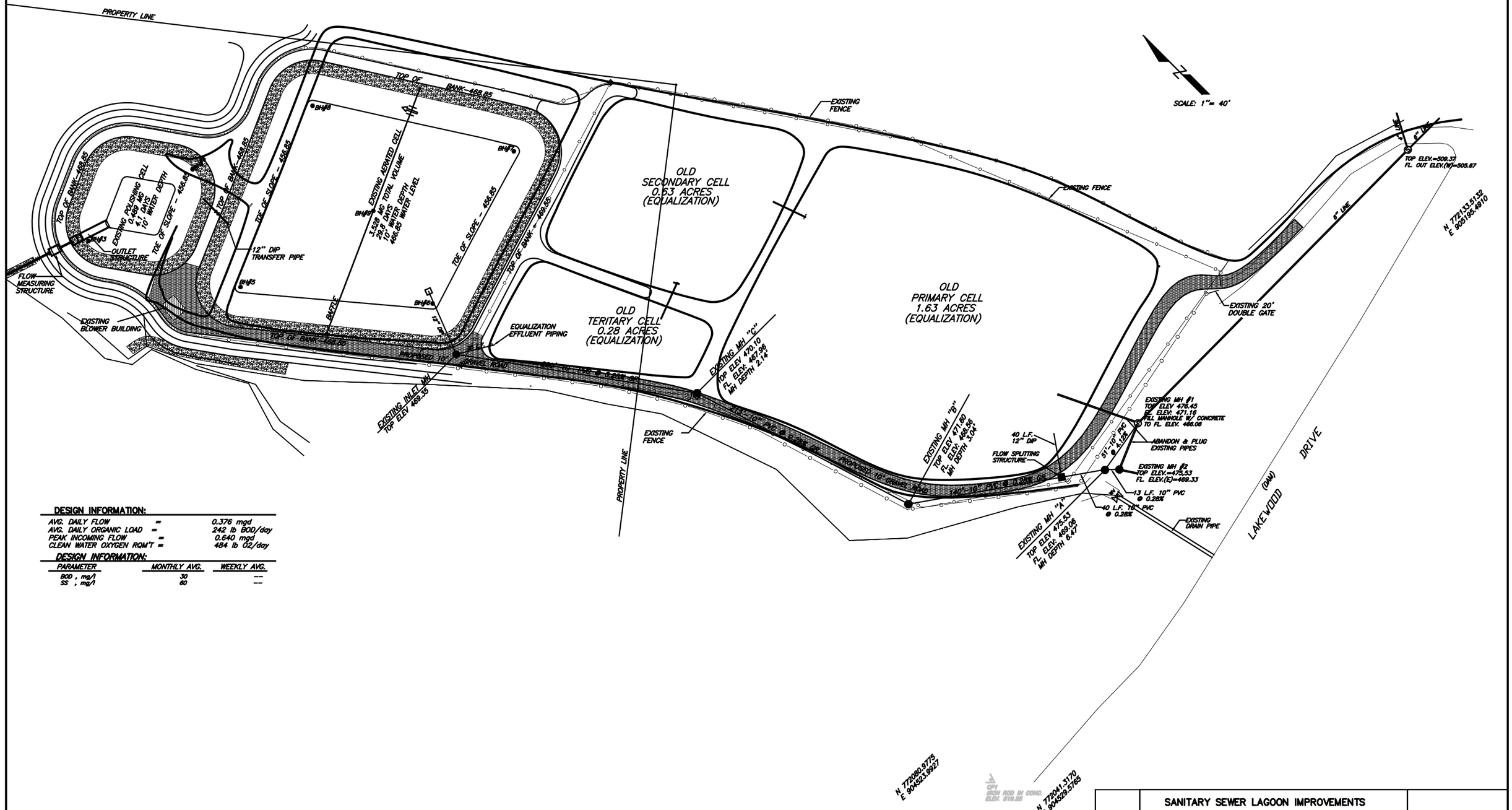


Figure 2, Topographic Map



DESIGN INFORMATION:

AVG. DAILY FLOW	=	0.376 mgd
AVG. DAILY ORGANIC LOAD	=	242 lb BOD/day
PEAK INCOMING FLOW	=	0.640 mgd
CLEAN WATER OXYGEN ROM'T	=	484 lb O2/day

DESIGN INFORMATION:

PARAMETER	MONTHLY AVG.	WEEKLY AVG.
BOD , mg/l	30	--
SS , mg/l	60	--

SANITARY SEWER LAGOON IMPROVEMENTS

LAKE FOREST SUBDIVISION

EXISTING LAGOON SITE PLAN

FIGURE 3

REVISIONS:

WATERS ENGINEERING, INC.
Civil Engineering & Surveying
P. O. Box 567
908 S. Kingshighway
Sikeston, Missouri 63801
(573) 471-5680
(573) 471-5689; Fax
E-Mail: main@waterseng.com

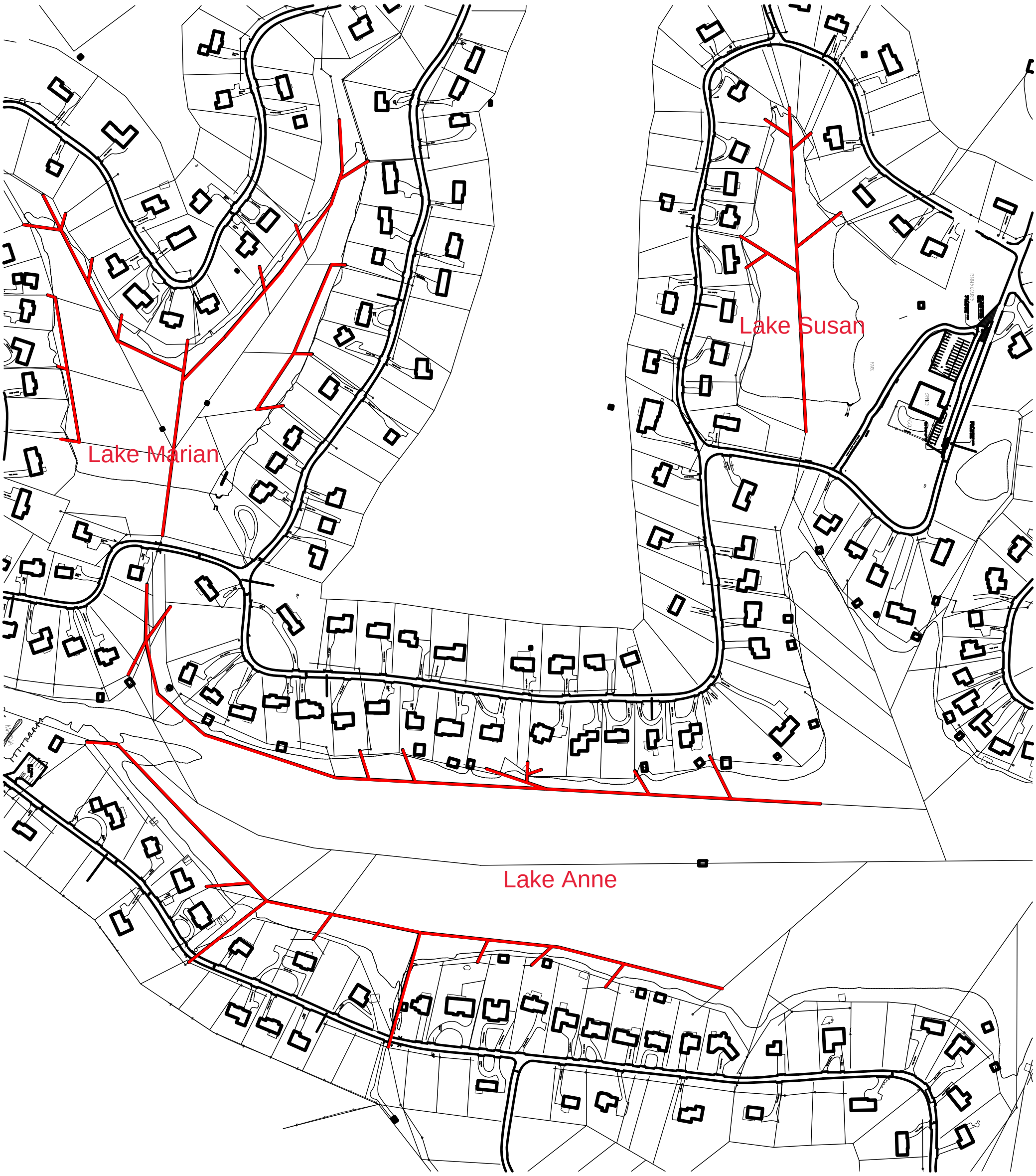


Figure 4, Proposed Collection system Improvements

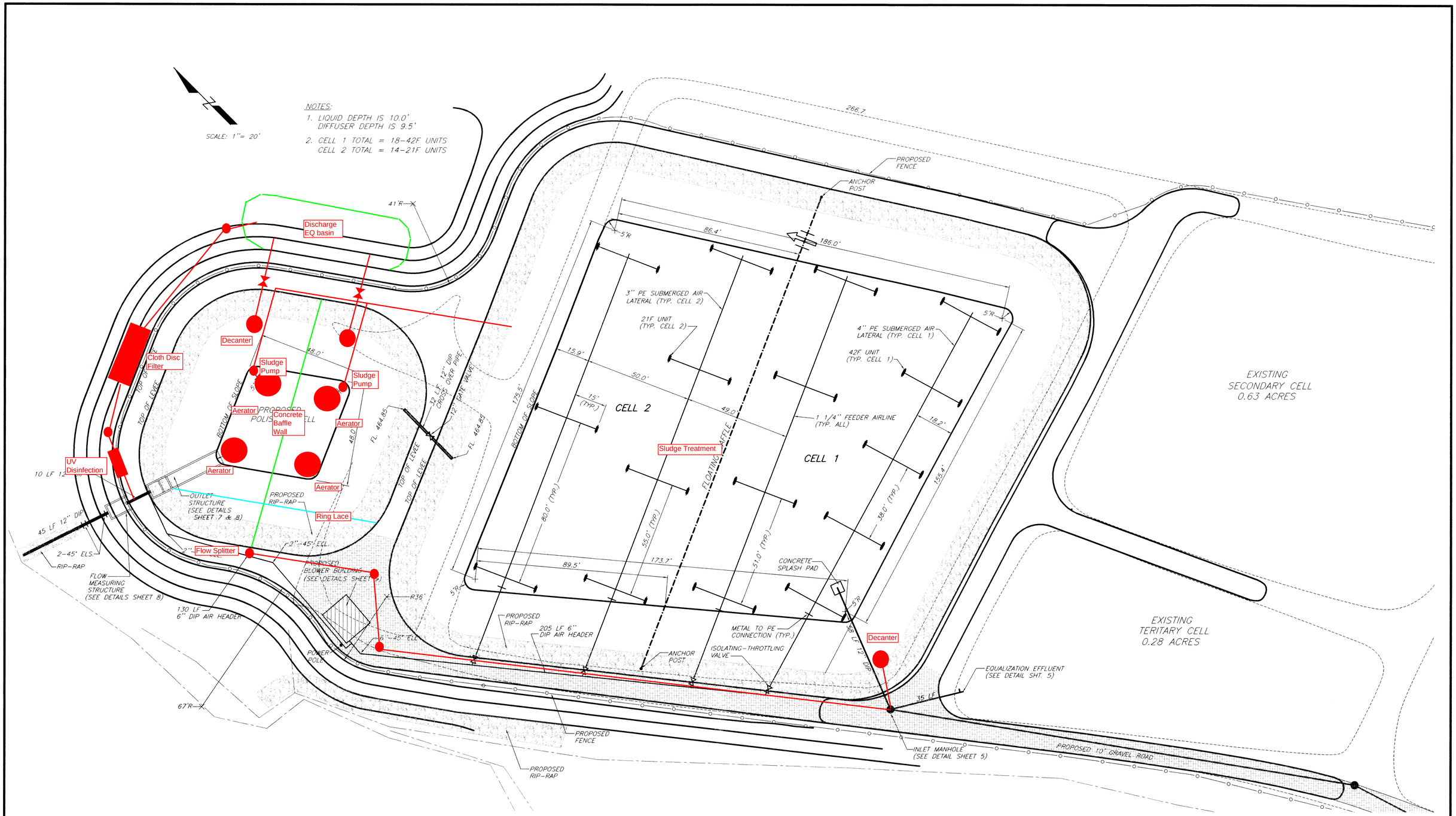


Figure 5, PROPOSED SBR LAGOON LAYOUT

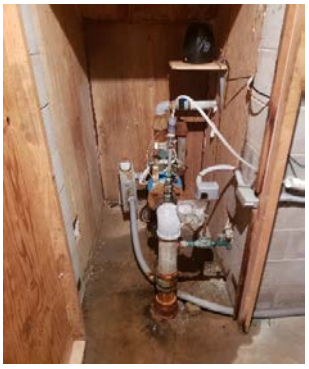
Figure 6
Lake Forest Estates Water System Photos
20-May-20

Well No. 1 Well House

Well No. 1

Well No. 2 Chemical Feed

Well No. 1 Chem Feed



Well No. 2

Water Storage Tank & Control Bldg

Water Storage Tank

EXHIBITS

STATE OF MISSOURI

DEPARTMENT OF NATURAL RESOURCES

MISSOURI CLEAN WATER COMMISSION

MISSOURI STATE OPERATING PERMIT

In compliance with the Missouri Clean Water Law, (Chapter 644 R.S. Mo. as amended, hereinafter, the Law), and the Federal Water Pollution Control Act (Public Law 92-500, 92nd Congress) as amended,

Permit No.	MO-0035742
Owner:	Lake Forest Estates Community Association
Address:	13765 Lakewood Drive, Ste. Genevieve, MO 63670
Continuing Authority:	Same as above
Address:	Same as above
Facility Name:	Lake Forest Estates Subdivision WWTF
Facility Address:	0.6 miles northeast of Hwy O and Lakewood Dr. intersection, Ste. Genevieve, MO 63670
Legal Description:	See Page 2
UTM Coordinates:	See Page 2
Receiving Stream:	See Page 2
First Classified Stream and ID:	See Page 2
USGS Basin & Sub-watershed No.:	See Page 2

is authorized to discharge from the facility described herein, in accordance with the effluent limitations and monitoring requirements as set forth herein:

FACILITY DESCRIPTION

See Page 2

This permit authorizes only wastewater discharges under the Missouri Clean Water Law and the National Pollutant Discharge Elimination System; it does not apply to other regulated areas. This permit may be appealed in accordance with Section 621.250 RSMo, Section 640.013 RSMo and Section 644.051.6 of the Law.

February 1, 2016 — Effective Date
February 17, 2017 — Modification Date

Steven Feeler, Acting Director, Division of Environmental Quality

January 31, 2021 — Expiration Date

David J Lamb, Acting Director, Water Protection Program

FACILITY DESCRIPTION (continued):

Outfall #001 – Residential Subdivision – SIC #8641
Three-cell lagoon with baffled and aerated 1st and 2nd cells / three cell flow equalization basin / sludge retained in lagoon
Design population equivalent is 1,040.
Design flow is 118,300 gallons per day.
Actual flow is 99,300 gallons per day.
Design sludge production is 15.6 dry tons/year.

Legal Description:	Landgrant 2046, Ste. Genevieve County
UTM Coordinates:	X=745263, Y=4204623
Receiving Stream:	Big Bottom Creek (C)
First Classified Stream and ID:	Big Bottom Creek (C) (1746)
USGS Basin & Sub-watershed No.:	(07140101-0907)

Permitted Feature #SM1 – Instream Monitoring
Instream monitoring location – Upstream – See Special Condition #20

Receiving Stream:	Big Bottom Creek (C)
First Classified Stream and ID:	Big Bottom Creek (C) (1746)
USGS Basin & Sub-watershed No.:	(07140101-0907)

Permitted Feature #SM2 – Instream Monitoring
Instream monitoring location – Downstream – approximately 75 meters downstream from Outfall #001 – See Special Condition #20

Legal Description:	Landgrant 2046, Ste. Genevieve County
UTM Coordinates:	X=745257, Y=4204686
Receiving Stream:	Big Bottom Creek (C)
First Classified Stream and ID:	Big Bottom Creek (C) (1746)
USGS Basin & Sub-watershed No.:	(07140101-0907)

OUTFALL #001	TABLE A-1. INTERIM EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS	PAGE NUMBER 3 of 9
		PERMIT NUMBER MO-0035742

The permittee is authorized to discharge from outfall(s) with serial number(s) as specified in the application for this permit. The interim effluent limitations shall become effective on **February 1, 2016**, and remain in effect through **January 31, 2022**. Such discharges shall be controlled, limited and monitored by the permittee as specified below:

EFFLUENT PARAMETER(S)	UNITS	INTERIM EFFLUENT LIMITATIONS			MONITORING REQUIREMENTS	
		DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Flow	MGD	*		*	twice/week	24 hr. estimate
Biochemical Oxygen Demand$_5$	mg/L		60	30	once/month	grab
Total Suspended Solids	mg/L		60	30	once/month	grab
Ammonia as N (Apr 1 – Sep 30) (Oct 1 – Mar 31)	mg/L	 3.7 7.5		 1.9 3.7	once/month	grab

MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE MARCH 28, 2016. THERE SHALL BE NO DISCHARGE OF FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

EFFLUENT PARAMETER(S)	UNITS	MONTHLY AVERAGE		QUARTERLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Total Phosphorus	mg/L	*		*	once/quarter	grab
Total Nitrogen	mg/L	*		*	once/quarter	grab

MONITORING REPORTS SHALL BE SUBMITTED QUARTERLY; THE FIRST REPORT IS DUE APRIL 28, 2016.

EFFLUENT PARAMETER(S)	UNITS	MINIMUM		MAXIMUM	MEASUREMENT FREQUENCY	SAMPLE TYPE
pH – Units **	SU	6.5			once/month	grab

MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE MARCH 28, 2016.

OUTFALL #001	TABLE A-2. INTERIM EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS	PAGE NUMBER 4 of 9
		PERMIT NUMBER MO-0035742

The permittee is authorized to discharge from outfall(s) with serial number(s) as specified in the application for this permit. The interim effluent limitations shall become effective on **February 1, 2022**, and remain in effect through **January 31, 2029**. Such discharges shall be controlled, limited and monitored by the permittee as specified below:

EFFLUENT PARAMETER(S)	UNITS	INTERIM EFFLUENT LIMITATIONS			MONITORING REQUIREMENTS	
		DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Flow	MGD	*		*	twice/week	24 hr. estimate
Biochemical Oxygen Demand$_5$	mg/L		15	10	once/month	grab
Carbonaceous Biochemical Oxygen Demand$_5$	mg/L		*	*	once/month	grab
Nitrogenous Biochemical Oxygen Demand$_5$ (Note 1, Page 5)	mg/L		*	*	once/month	calculated
Total Suspended Solids (Final)	mg/L		15	10	once/month	grab
E. coli (Note 2, Page 5)	#/100mL	1030		206	once/week	grab
Ammonia as N (Apr 1 – Sep 30) (Oct 1 – Mar 31)	mg/L	2.4 6.9		0.6 2.1	once/month	grab

MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE MARCH 28, 2022. THERE SHALL BE NO DISCHARGE OF FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

EFFLUENT PARAMETER(S)	UNITS	MONTHLY AVERAGE		QUARTERLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Total Phosphorus	mg/L	*		*	once/month	grab
Total Nitrogen	mg/L	*		*	once/month	grab

MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE MARCH 28, 2022.

EFFLUENT PARAMETER(S)	UNITS	MINIMUM		MAXIMUM	MEASUREMENT FREQUENCY	SAMPLE TYPE
pH – Units **	SU	6.5		9.0	once/month	grab

MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE MARCH 28, 2022.

EFFLUENT PARAMETER(S)	UNITS	DAILY MINIMUM		MONTHLY AVERAGE MINIMUM	MEASUREMENT FREQUENCY	SAMPLE TYPE
Dissolved Oxygen	mg/L	*		*	once/month	grab

MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE MARCH 28, 2022.

OUTFALL #001	TABLE A-3. FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS	PAGE NUMBER 5 of 9
		PERMIT NUMBER MO-0035742

The permittee is authorized to discharge from outfall(s) with serial number(s) as specified in the application for this permit. The final effluent limitations shall become effective on **February 1, 2029**, and remain in effect until expiration of the permit. Such discharges shall be controlled, limited and monitored by the permittee as specified below:

EFFLUENT PARAMETER(S)	UNITS	FINAL EFFLUENT LIMITATIONS			MONITORING REQUIREMENTS	
		DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Flow	MGD	*		*	twice/week	24 hr. estimate
Biochemical Oxygen Demand$_5$	mg/L		*	*	once/month	grab
Carbonaceous Biochemical Oxygen Demand$_5$	mg/L		7.56	5.04	once/month	grab
Nitrogenous Biochemical Oxygen Demand$_5$ (Note 1, Page 5)	mg/L		2.19	1.46	once/month	calculated
Total Suspended Solids	mg/L		15	10	once/month	grab
E. coli (Note 2, Page 5)	#/100mL	1030		206	once/week	grab
Ammonia as N	mg/L	1.0		0.3	once/month	grab

MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE MARCH 28, 2029. THERE SHALL BE NO DISCHARGE OF FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

EFFLUENT PARAMETER(S)	UNITS	MONTHLY AVERAGE		QUARTERLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Total Phosphorus	mg/L	*		0.007	once/month	grab
Total Nitrogen	mg/L	*		0.289	once/month	grab

MONITORING REPORTS SHALL BE SUBMITTED QUARTERLY; THE FIRST REPORT IS DUE APRIL 28, 2029.

EFFLUENT PARAMETER(S)	UNITS	MINIMUM		MAXIMUM	MEASUREMENT FREQUENCY	SAMPLE TYPE
pH – Units **	SU	6.5		9.0	once/month	grab

MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE MARCH 28, 2029.

EFFLUENT PARAMETER(S)	UNITS	DAILY MINIMUM		MONTHLY AVERAGE MINIMUM	MEASUREMENT FREQUENCY	SAMPLE TYPE
Dissolved Oxygen	mg/L	8.0		8.0	once/month	grab

MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE MARCH 28, 2029.

PERMITTED FEATURES #SM1 & #SM2	TABLE B-1. INSTREAM MONITORING REQUIREMENTS	PAGE NUMBER 6 of 9
		PERMIT NUMBER MO-0035742

The monitoring requirements shall become effective on **February 28, 2016**, and remain in effect until expiration of the permit.

PARAMETER(S)	UNITS	MONITORING REQUIREMENTS				
		DAILY MAXIMUM		MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Temperature	°C	*		*	once/month	measured
Ammonia as N	mg/L	*		*	once/month	grab
MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE MARCH 28, 2016.						
PARAMETER(S)	UNITS	DAILY MINIMUM		MONTHLY AVERAGE MINIMUM	MEASUREMENT FREQUENCY	SAMPLE TYPE
Dissolved Oxygen	mg/L	*		*	once/month	grab
MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE MARCH 28, 2016.						
PARAMETER(S)	UNITS	MINIMUM		MAXIMUM	MEASUREMENT FREQUENCY	SAMPLE TYPE
pH – Units	SU	*		*	once/month	grab
MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE MARCH 28, 2016.						

* Monitoring requirement only.
** pH is measured in pH units and is not to be averaged.

Note 1 - Nitrogenous Biochemical Oxygen Demand$_5$ is calculated as the difference between BOD_5 and $CBOD_5$.
$NBOD_5 = BOD_5 - CBOD_5$

Note 2 - Effluent limitations and monitoring requirements for *E. coli* are applicable only during the recreational season from April 1 through October 31. The Monthly Average Limit for *E. coli* is expressed as a geometric mean.

C. STANDARD CONDITIONS

In addition to specified conditions stated herein, this permit is subject to the attached Parts I & III standard conditions dated August 1, 2014 and March 1, 2015, and hereby incorporated as though fully set forth herein.

D. SPECIAL CONDITIONS

1. This permit may be reopened and modified, or alternatively revoked and reissued, to:
   (a) Comply with any applicable effluent standard or limitation issued or approved under Sections 301(b)(2)(C) and (D), 304(b)(2), and 307(a) (2) of the Clean Water Act, if the effluent standard or limitation so issued or approved:
      (1) contains different conditions or is otherwise more stringent than any effluent limitation in the permit; or
      (2) controls any pollutant not limited in the permit.
   (b) Incorporate new or modified effluent limitations or other conditions, if the result of a waste load allocation study, toxicity test or other information indicates changes are necessary to assure compliance with Missouri's Water Quality Standards.
   (c) Incorporate new or modified effluent limitations or other conditions if, as the result of a watershed analysis, a Total Maximum Daily Load (TMDL) limitation is developed for the receiving waters which are currently included in Missouri's list of waters of the state not fully achieving the state's water quality standards, also called the 303(d) list.
   (d) Incorporate the requirement to develop a pretreatment program pursuant to 40 CFR 403.8(a) when the Director of the Water Protection Program determines that a pretreatment program is necessary due to any new introduction of pollutants into the Publically Owned Treatment Works or any substantial change in the volume or character of pollutants being introduced.

   The permit as modified or reissued under this paragraph shall also contain any other requirements of the Clean Water Act then applicable.

2. All outfalls must be clearly marked in the field.

3. Permittee will cease discharge by connection to a facility with an area-wide management plan per 10 CSR 20-6.010(3)(B) within 90 days of notice of its availability.

D. SPECIAL CONDITIONS (continued)

5. Water Quality Standards
   (a) To the extent required by law, discharges to waters of the state shall not cause a violation of water quality standards rule under 10 CSR 20-7.031, including both specific and general criteria.
   (b) General Criteria. The following general water quality criteria shall be applicable to all waters of the state at all times including mixing zones. No water contaminant, by itself or in combination with other substances, shall prevent the waters of the state from meeting the following conditions:
      (1) Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses;
      (2) Waters shall be free from oil, scum and floating debris in sufficient amounts to be unsightly or prevent full maintenance of beneficial uses;
      (3) Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses;
      (4) Waters shall be free from substances or conditions in sufficient amounts to result in toxicity to human, animal or aquatic life;
      (5) There shall be no significant human health hazard from incidental contact with the water;
      (6) There shall be no acute toxicity to livestock or wildlife watering;
      (7) Waters shall be free from physical, chemical or hydrologic changes that would impair the natural biological community;
      (8) Waters shall be free from used tires, car bodies, appliances, demolition debris, used vehicles or equipment and solid waste as defined in Missouri's Solid Waste Law, section 260.200, RSMo, except as the use of such materials is specifically permitted pursuant to section 260.200-260.247.

7. Report as no-discharge when a discharge does not occur during the report period.

8. Reporting of Non-Detects:
   (a) An analysis conducted by the permittee or their contracted laboratory shall be conducted in such a way that the precision and accuracy of the analyzed result can be enumerated.
   (b) The permittee shall not report a sample result as "Non-Detect" without also reporting the detection limit of the test. Reporting as "Non Detect" without also including the detection limit will be considered failure to report, which is a violation of this permit.
   (c) The permittee shall provide the "Non-Detect" sample result using the less than sign and the minimum detection limit (e.g. <10).
   (d) The permittee shall use one-half of the detection limit for the non-detect result when calculating monthly averages.
   (e) See Standard Conditions Part I, Section A, #4 regarding proper detection limits used for sample analysis.

9. It is a violation of the Missouri Clean Water Law to fail to pay fees associated with this permit (644.055 RSMo).

10. Bypasses are not authorized at this facility unless they meet the criteria in 40 CFR 122.41(m). If a bypass occurs, the permittee shall report in accordance to 40 CFR 122.41(m)(3)(i), and with Standard Condition Part I, Section B, subsection 2.b. Bypasses are to be reported to the Southeast Regional Office during normal business hours or the Environmental Emergency Response hotline at 573-634-2436 outside of normal business hours. Blending, which is the practice of combining a partially-treated wastewater process stream with a fully-treated wastewater process stream prior to discharge, is not considered a form of bypass. If the permittee wishes to utilize blending, the permittee shall file an application to modify this permit to facilitate the inclusion of appropriate monitoring conditions.

11. The facility must be sufficiently secured to restrict entry by children, livestock and unauthorized persons as well as to protect the facility from vandalism.

12. At least one gate must be provided to access the wastewater treatment facility and provide for maintenance and mowing. The gate shall remain locked except when opened by the permittee to perform operational monitoring, sampling, maintenance, mowing, or for inspections by the Department.

13. At least one (1) warning sign shall be placed on each side of the facility enclosure in such positions as to be clearly visible from all directions of approach. There shall also be one (1) sign placed for every five hundred feet (500') (150 m) of the perimeter fence. A sign shall also be placed on each gate. Minimum wording shall be SEWAGE TREATMENT FACILITY—KEEP OUT. Signs shall be made of durable materials with characters at least two inches (2") high and shall be securely fastened to the fence, equipment or other suitable locations.

D. SPECIAL CONDITIONS (continued)

14. An Operation and Maintenance (O & M) manual shall be maintained by the permittee and made available to the operator. The O & M manual shall include key operating procedures and a brief summary of the operation of the facility.

15. An all-weather access road shall be provided to the treatment facility.

16. The discharge from the wastewater treatment facility shall be conveyed to the receiving stream via a closed pipe or a paved or rip-rapped open channel. Sheet or meandering drainage is not acceptable. The outfall sewer shall be protected against the effects of floodwater, ice or other hazards as to reasonably insure its structural stability and freedom from stoppage. The outfall shall be maintained so that a sample of the effluent can be obtained at a point after the final treatment process and before the discharge mixes with the receiving waters.

17. A minimum of two (2) feet freeboard must be maintained in each lagoon cell. A lagoon level gauge, which clearly marks the minimum freeboard level, shall be provided in each lagoon cell.

18. The berms of the lagoons shall be mowed and kept free of any deep-rooted vegetation, animal dens, or other potential sources of damage to the berms.

19. The facility shall ensure that adequate provisions are provided to prevent surface water intrusion into the lagoons and to divert stormwater runoff around the lagoons and protect embankments from erosion.

20. Receiving Water Monitoring Conditions
    (a) Downstream receiving water samples should be taken at the location(s) specified on Page 2 of this permit. In the event that a safe, accessible location is not present at the location listed, a suitable location can be negotiated with the Department. Samples should be taken at least four feet from the bank or from the middle of the stream (whichever is less) and 6-inches below the surface. The upstream receiving water sample should be collected at a point upstream from any influence of the effluent, where the water is visibly flowing down stream.
    (b) When conducting in-stream monitoring, the permittee shall record observations that include: the time of day, weather conditions, unusual stream characteristics (e.g., septic conditions, algae growth, etc.), the stream segment (e.g., riffle, pool or run) from where the sample was collected. These observations shall be submitted with the sample results.
    (c) Samples shall not be collected from areas with especially turbulent flow, still water or from the stream bank, unless these conditions are representative of the stream reach or no other areas are available for sample collection. Sampling should not be made when significant precipitation has occurred recently. The sampling event should be terminated and rescheduled if any of the following conditions occur:
        - If turbidity in the stream increases notably; or
        - If rainfall over the past two weeks exceeds 2.5 inches or exceeds 1 inch in the last 24 hours
    (d) Always use the correct sampling technique and handling procedure specified for the parameter of interest. Please refer to the latest edition of Standard Methods for the Examination of Water and Wastewater for further discussion of proper sampling techniques. All analyses must be conducted in accordance with an approved EPA method. Meters shall be calibrated immediately (within 1 hour) prior to the sampling event.
    (e) To obtain accurate measurements, Dissolved Oxygen and pH analyses should be performed on-site in the receiving stream where possible. However, due to high flow conditions, access, etc., it may be necessary to collect a sample in a bucket or other container. When this is necessary, care must be taken not to aerate the sample upon collection. If for any reason samples must be collected from an alternate site from the one listed in the permit, the permittee shall report the location with the sample results.
    (f) Dissolved Oxygen measurements are to be taken during the period from one hour prior to sunrise to one and one-half hour after sunrise.
    (g) Please contact the Department if you need additional instructions or assistance.

D. SPECIAL CONDITIONS (continued)

21. Electronic Discharge Monitoring Report (eDMR) Submission System.
    (a) Discharge Monitoring Reporting Requirements. The permittee must electronically submit compliance monitoring data via the eDMR system. In regards to Standard Conditions Part I, Section B, #7, the eDMR system is currently the only Department approved reporting method for this permit.
    (b) Programmatic Reporting Requirements. The following reports (if required by this permit) must be electronically submitted as an attachment to the eDMR system until such a time when the current or a new system is available to allow direct input of the data:
        (1) Schedule of Compliance Progress Reports;
        (2) Sludge/Biosolids Annual Reports;
        (3) Any additional report required by the permit excluding bypass reporting.
        After such a system has been made available by the department, required data shall be directly input into the system by the next report due date.
    (c) Other actions. The following shall be submitted electronically after such a system has been made available by the department:
        (1) Notices of Termination (NOTs);
        (2) Bypass reporting, See Special Condition #10 for 24-hr. bypass reporting requirements.
    (d) Electronic Submissions. To access the eDMR system, use the following link in your web browser: https://edmr.dnr.mo.gov/edmr/E2/Shared/Pages/Main/Login.aspx.
    (e) Waivers from Electronic Reporting. The permittee must electronically submit compliance monitoring data and reports unless a waiver is granted by the department in compliance with 40 CFR Part 127. The permittee may obtain an electronic reporting waiver by first submitting an eDMR Waiver Request Form: http://dnr.mo.gov/forms/780-2692-f.pdf. The department will either approve or deny this electronic reporting waiver request within 120 calendar days. Only permittees with an approved waiver request may submit monitoring data and reports on paper to the Department for the period that the approved electronic reporting waiver is effective.

E. SCHEDULE OF COMPLIANCE

The facility shall attain compliance with interim effluent limitations for Biochemical Oxygen Demand$_5$ and Ammonia as soon as reasonably achievable or no later than **6 years** of the effective date of this permit.

The facility shall attain compliance with final effluent limitations for Total Suspended Solids and E. coli as soon as reasonably achievable or no later than **6 years** of the effective date of this permit.

The facility shall attain compliance with final effluent limitations for Carbonaceous Biochemical Oxygen Demand$_5$, Nitrogenous Biochemical Oxygen Demand$_5$, Total Nitrogen, Total Phosphorus, Ammonia, Total Suspended Solids, and Dissolved Oxygen as soon as reasonably achievable or no later than **13 years** of the effective date of this permit.

1. Within six months of the effective date of this permit, the permittee shall report progress made in attaining compliance with the final effluent limits.

2. The permittee shall submit interim progress reports detailing progress made in attaining compliance with the final effluent limits every 12 months from effective date.

3. Within **6 years** of the effective date of this permit, the permittee shall attain compliance with the interim effluent limits for Biochemical Oxygen Demand$_5$ and Ammonia, and the final effluent limits for E. coli, and Total Suspended Solids.

4. Within **13 years** of the effective date of this permit, the permittee shall attain compliance with the final effluent limits, for Carbonaceous Biochemical Oxygen Demand$_5$, Nitrogenous Biochemical Oxygen Demand$_5$, Total Nitrogen, Total Phosphorus, Ammonia, Total Suspended Solids, and Dissolved Oxygen.

Please submit progress reports to the Missouri Department of Natural Resources, Southeast Regional Office, 2155 North Westwood Boulevard, Poplar Bluff, MO 63901.

MISSOURI DEPARTMENT OF NATURAL RESOURCES
EDMR STATEMENT OF BASIS
MO-0035742
LAKE FOREST ESTATES SUBDIVISION WASTEWATER TREATMENT FACILITY

This Statement of Basis gives pertinent information regarding an internal minor permit modification to the above listed operating permit without the need for a public comment process. A statement of basis is not an enforceable part of a Missouri State Operating Permit.

Part I – Facility Information

Facility Type: Residential Subdivision
Facility SIC Code(s): #8641
Facility Description:

Three-cell lagoon with baffled and aerated 1st and 2nd cells / three cell flow equalization basin / sludge retained in lagoon
Design population equivalent is 1,040.
Design flow is 118,300 gallons per day.
Actual flow is 99,300 gallons per day.
Design sludge production is 15.6 dry tons/year.

Part II – Modification Rationale

This operating permit was modified by adding a special condition to the permit to require the permittee to submit all discharge monitoring reports electronically (eDMR) to the department. The final rule (eReporting Rule) substitutes electronic reporting for paper-based reports and, over the long term, saves time and resources for permittees, states, tribes, territories, and EPA, while improving compliance and better protecting the Nation's waters. The final rule requires permittees and regulators to use existing, available information technology to electronically report information and data related to the NPDES permit program in lieu of filing paper-based reports. All authorized programs are required to electronically transmit the federally-required data (identified in appendix A to 40 CFR part 127) to EPA. The purpose and need for this rule was highlighted in the development of the Clean Water Act Enforcement Action Plan (Plan).

Announced by EPA in October 2009, the Plan was a collaborative effort by EPA and state environmental agencies to explore opportunities to improve water quality by emphasizing and adopting new approaches that will improve how the NPDES permitting and enforcement program is administered. The goals of the Plan include improving transparency of the information on compliance and enforcement activities in each state, connecting this information to local water quality, and providing the public with real-time, easy access to this information.

No other changes were made at this time to this permit.

Part III –Administrative Requirements

On the basis of preliminary staff review and the application of applicable standards and regulations, the Department, as administrative agent for the Missouri Clean Water Commission, proposes to issue a permit(s) subject to certain effluent limitations, schedules, and special conditions contained herein and within the operating permit.

DATE OF STATEMENT OF BASIS: FEBRUARY 7, 2017

COMPLETED BY:

SAMANTHA OSTMANN, ENVIRONMENTAL SPECIALIST
MISSOURI DEPARTMENT OF NATURAL RESOURCES
WATER PROTECTION PROGRAM
INDUSTRIAL UNIT
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MISSOURI DEPARTMENT OF NATURAL RESOURCES
FACT SHEET
FOR THE PURPOSE OF RENEWAL
OF
MO-0035742
LAKE FOREST ESTATES SUBDIVISION WWTF

The Federal Water Pollution Control Act ("Clean Water Act" Section 402 Public Law 92-500 as amended) established the National Pollution Discharge Elimination System (NPDES) permit program. This program regulates the discharge of pollutants from point sources into the waters of the United States, and the release of stormwater from certain point sources. All such discharges are unlawful without a permit (Section 301 of the "Clean Water Act"). After a permit is obtained, a discharge not in compliance with all permit terms and conditions is unlawful. Missouri State Operating Permits (MSOPs) are issued by the Director of the Missouri Department of Natural Resources (Department) under an approved program, operating in accordance with federal and state laws (Federal "Clean Water Act" and "Missouri Clean Water Law" Section 644 as amended). MSOPs are issued for a period of five (5) years unless otherwise specified.

As per [40 CFR Part 124.8(a)] and [10 CSR 20-6.020(1)2.] a Factsheet shall be prepared to give pertinent information regarding the applicable regulations, rationale for the development of effluent limitations and conditions, and the public participation process for the Missouri State Operating Permit (operating permit) listed below.

A Factsheet is not an enforceable part of an operating permit.

This Factsheet is for a Minor.

Part I – Facility Information

Facility Type: NON-POTW – Residential Subdivision – SIC #8641

Facility Description:
Three-cell lagoon with baffled and aerated 1st and 2nd cells / three cell flow equalization basin / sludge retained in lagoon

Have any changes occurred at this facility or in the receiving water body that effects effluent limit derivation?
☒ - Yes; A TMDL was completed by the EPA in 2010 which requires implementation of new effluent limits. Also, the outfall is less than 2 miles from Indian Creek, which is designated as a Whole Body Contact - B stream. Therefore, effluent limits for *E. coli* for WBC-B streams were added to the permit.

☐ - No

Application Date: 05/28/2009
Expiration Date: 11/30/2009

OUTFALL(S) TABLE:

OUTFALL	DESIGN FLOW (CFS)	TREATMENT LEVEL	EFFLUENT TYPE
#001	0.15	Equivalent to Secondary	Domestic

Facility Performance History:
The facility failed to meet Ammonia as N limits on the January, April, May, June, July, and December 2010, February, March, April, May, June, October , and December 2011, January, February, March, April, May, September, October, November, and December 2012, January, February, May, June, and September 2013, January, February, March, April, May, June, November, and December 2014 Discharge Monitoring Reports (DMR). The facility also failed to meet BOD limits on the April 2011, October 2012, October 2013, April and May 2014 DMRs. The facility failed to meet TSS limits on the February 2010 and March 2013 DMRs. The facility failed to submit the March 2010 DMR. This facility was last inspected on May 30, 2013. The inspection showed the following unsatisfactory features; the facility failed to meet effluent limitations on DMRs.

Comments:
Changes in this permit include the addition of $CBOD_5$, $NBOD_5$, Total Nitrogen, Total Phosphorus, and E. coli, and the removal of Temperature. See Part VII of the Fact Sheet for further information regarding the addition and removal of effluent parameters. Special conditions were updated to include the reporting of Non-detects, bypass reporting requirements, lagoon cell depth gauges, and the addition of instream monitoring requirements.

Part II – Operator Certification Requirements

☐ - This facility is required to have a certified operator.

☒ - This facility is not required to have a certified operator.

Part III– Operational Monitoring

☒ - As per [10 CSR 20-9.010(4))], the facility is not required to conduct operational monitoring.

☐ - As per [10 CSR 20-9.010(4))], the facility is required to conduct operational monitoring.

Part IV – Receiving Stream Information

10 CSR 20-7.031 Missouri Water Quality Standards, the Department defines the Clean Water Commission water quality objectives in terms of "water uses to be maintained and the criteria to protect those uses." The receiving stream and/or 1st classified receiving stream's beneficial water uses to be maintained, are located in the Receiving Stream Table located below in accordance with [10 CSR 20-7.031(4)].

RECEIVING STREAM(S) TABLE: OUTFALL #001

WATER-BODY NAME	CLASS	WBID	DESIGNATED USES*	12-DIGIT HUC	DISTANCE TO CLASSIFIED SEGMENT (MI)
Big Bottom Creek	C	1746	IRR, LWW, AQL, HHP, SCR	07140101-0907	0
Indian Creek	C	1747	IRR, LWW, AQL, HHP, WBC-B, SCR		1.1

* - Irrigation (IRR), Livestock & Wildlife Watering (LWW), Protection of Warm Water Aquatic Life (AQL), Human Health Protection (HHP), Cool Water Fishery (CLF), Cold Water Fishery (CDF), Whole Body Contact Recreation – Category A (WBC-A), Whole Body Contact Recreation – Category B (WBC-B), Secondary Contact Recreation (SCR), Drinking Water Supply (DWS), Industrial (IND), Groundwater (GRW).

RECEIVING STREAM(S) LOW-FLOW VALUES:

RECEIVING STREAM (C, E, P, P1)	LOW-FLOW VALUES (CFS)		
	1Q10	7Q10	30Q10
Big Bottom Creek (C)	0	0	0

MIXING CONSIDERATIONS

MIXING CONSIDERATIONS TABLE:

MIXING ZONE (CFS) [10 CSR 20-7.031(5)(A)…]			ZONE OF INITIAL DILUTION (CFS) [10 CSR 20-7.031(5)(A)…]		
1Q10	7Q10	30Q10	1Q10	7Q10	30Q10
0	0	0	0	0	N/A

RECEIVING STREAM MONITORING REQUIREMENTS:

Permitted Feature SM1. (Upstream)

Permitted Feature SM2. (Downstream)

Receiving Water Body's Water Quality
No low flow surveys have been conducted on the receiving stream. Big Bottom Creek is an impaired stream and in 2010 EPA approved a TMDL for the stream.

Part V – Rationale and Derivation of Effluent Limitations & Permit Conditions

ALTERNATIVE EVALUATIONS FOR NEW FACILITIES:
As per [10 CSR 20-7.015(4)(A)], discharges to losing streams shall be permitted only after other alternatives including land application, discharges to a gaining stream and connection to a regional wastewater treatment facility have been evaluated and determined to be unacceptable for environmental and/or economic reasons.

☐ - The facility discharges to a Losing Stream as defined by [10 CSR 20-2.010(36)] & [10 CSR 20-7.031(1)(N)].

☒ - The facility does not discharge to a Losing Stream as defined by [10 CSR 20-2.010(36)] & [10 CSR 20-7.031(1)(N)], or is an existing facility.

ANTI-BACKSLIDING:
A provision in the Federal Regulations [CWA §303(d)(4); CWA §402(o); 40 CFR Part 122.44(l)] that requires a reissued permit to be as stringent as the previous permit with some exceptions.

☒ - All limits in this operating permit are at least as protective as those previously established; therefore, backsliding does not apply.

ANTIDEGRADATION:
In accordance with Missouri's Water Quality Standard [10 CSR 20-7.031(3)], the Department is to document by means of Antidegradation Review that the use of a water body's available assimilative capacity is justified. Degradation is justified by documenting the socio-economic importance of a discharging activity after determining the necessity of the discharge.

☒ - No degradation proposed and no further review necessary. Facility did not apply for authorization to increase pollutant loading or to add additional pollutants to their discharge.

☐ - This permit contains new and/or expanded discharge; please see **APPENDIX FOR ANTIDEGRADATION ANALYSIS.**

AREA-WIDE WASTE TREATMENT MANAGEMENT & CONTINUING AUTHORITY:
As per [10 CSR 20-6.010(3)(B)], …An applicant may utilize a lower preference continuing authority by submitting, as part of the application, a statement waiving preferential status from each existing higher preference authority, providing the waiver does not conflict with any area-wide management plan approved under section 208 of the Federal Clean Water Act or any other regional sewage service and treatment plan approved for higher preference authority by the Department.

BIOSOLIDS & SEWAGE SLUDGE:
Biosolids are solid materials resulting from domestic wastewater treatment that meet federal and state criteria for beneficial uses (i.e. fertilizer). Sewage sludge is solids, semi-solids, or liquid residue generated during the treatment of domestic sewage in a treatment works; including but not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment process; and a material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screening generated during preliminary treatment of domestic sewage in a treatment works. Additional information regarding biosolids and sludge is located at the following web address: http://extension.missouri.edu/main/DisplayCategory.aspx?C=74, items WQ422 through WQ449.

☐ - Permittee land applies biosolids in accordance with Standard Conditions III and a Department approved biosolids management plan.

☒ - Permittee is not authorized to land apply biosolids. Sludge/biosolids are stored in the lagoon. The permittee must submit a sludge management plan for approval that details removal and disposal plans when sludge is to be removed from lagoons.

COMPLIANCE AND ENFORCEMENT:
Enforcement is the action taken by the Water Protection Program (WPP) to bring an entity into compliance with the Missouri Clean Water Law, its implementing regulations, and/or any terms and conditions of an operating permit. The primary purpose of the enforcement activity in the WPP is to resolve violations and return the entity to compliance.

☐ - The facility is currently under enforcement action.

☒ - The facility is not currently under Water Protection Program enforcement action.

PRETREATMENT PROGRAM:
The reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in wastewater prior to or in lieu of discharging or otherwise introducing such pollutants into a Publicly Owned Treatment Works [40 CFR Part 403.3(q)].

Pretreatment programs are required at any POTW (or combination of POTW operated by the same authority) and/or municipality with a total design flow greater than 5.0 MGD and receiving industrial wastes that interfere with or pass through the treatment works or are otherwise subject to the pretreatment standards. Pretreatment programs can also be required at POTWs/municipals with a design flow less than 5.0 MGD if needed to prevent interference with operations or pass through.

☒ - The permittee, at this time, is not required to have a Pretreatment Program or does not have an approved pretreatment program.

REASONABLE POTENTIAL ANALYSIS (RPA):
Federal regulation [40 CFR Part 122.44(d)(1)(i)] requires effluent limitations for all pollutants that are or may be discharged at a level that will cause or have the reasonable potential to cause or contribute to an in-stream excursion above narrative or numeric water quality standard.

In accordance with [40 CFR Part 122.44(d)(1)(iii)] if the permit writer determines that any given pollutant has the reasonable potential to cause, or contribute to an in-stream excursion above the WQS, the permit must contain effluent limits for that pollutant.

☐ - A RPA was conducted on Ammonia as N.

☒ - A RPA was not conducted for this facility.

REMOVAL EFFICIENCY:
Removal efficiency is a method by which the Federal Regulations define Secondary Treatment and Equivalent to Secondary Treatment, which applies to Biochemical Oxygen Demand 5-day (BOD_5) and Total Suspended Solids (TSS) for Publicly Owned Treatment Works (POTWs)/municipals.

☐ - Secondary Treatment is 85% removal [40 CFR Part 133.102(a)(3) & (b)(3)].

☐ - Equivalent to Secondary Treatment is 65% removal [40 CFR Part 133.105(a)(3) & (b)(3)].

☒ - Influent monitoring is not being required to determine percent removal.

SANITARY SEWER OVERFLOWS (SSO) AND INFLOW AND INFILTRATION (I&I):
Sanitary Sewer Overflows (SSOs) are defined as untreated sewage releases and are considered bypassing under state regulation [10 CSR 20-2.010(11)] and should not be confused with the federal definition of bypass. SSOs result from a variety of causes including blockages, line breaks, and sewer defects that can either allow wastewater to backup within the collection system during dry weather conditions or allow excess stormwater and groundwater to enter and overload the collection system during wet weather conditions. SSOs can also result from lapses in sewer system operation and maintenance, inadequate sewer design and construction, power failures, and vandalism. SSOs include overflows out of manholes, cleanouts, broken pipes, and other into waters of the state and onto city streets, sidewalks, and other terrestrial locations.

Inflow and Infiltration (I&I) is defined as unwanted intrusion of stormwater or groundwater into a collection system. This can occur from points of direct connection such as sump pumps, roof drain downspouts, foundation drains, and storm drain cross-connections or through cracks, holes, joint failures, faulty line connections, damaged manholes, and other openings in the collection system itself. I&I results from a variety of causes including line breaks, improperly sealed connections, cracks caused by soil erosion/settling, penetration of vegetative roots, and other sewer defects. In addition, excess stormwater and groundwater entering the collection system from line breaks and sewer defects have the potential to negatively impact the treatment facility.

Missouri RSMo §644.026.1.(13) mandates that the Department issue permits for discharges of water contaminants into the waters of this state, and also for the operation of sewer systems. Such permit conditions shall ensure compliance with all requirements as established by sections 644.006 to 644.141. Standard Conditions Part I, referenced in the permit, contains provisions requiring proper operation and maintenance of all facilities and systems of treatment and control. Missouri RSMo §644.026.1.(15) instructs the Department to require proper maintenance and operation of treatment facilities and sewer systems and proper disposal of residual waste from all such facilities. To ensure that public health and the environment are protected, any noncompliance which may endanger public health or the environment must be reported to the Department within 24 hours of the time the permittee becomes aware of the noncompliance. Standard Conditions Part I, referenced in the permit, contains the reporting requirements for the permittee when bypasses and upsets occur.

☒ - This facility is not required to develop or implement a program for maintenance and repair of the collection system; however, it is a violation of Missouri State Environmental Laws and Regulations to allow untreated wastewater to discharge to waters of the state.

SCHEDULE OF COMPLIANCE (SOC):

Per 644.051.4 RSMo, a permit may be issued with a Schedule of Compliance (SOC) to provide time for a facility to come into compliance with new state or federal effluent regulations, water quality standards, or other requirements. Such a schedule is not allowed if the facility is already in compliance with the new requirement, or if prohibited by other statute or regulation. A SOC includes an enforceable sequence of interim requirements (actions, operations, or milestone events) leading to compliance with the Missouri Clean Water Law, its implementing regulations, and/or the terms and conditions of an operating permit. *See also* Section 502(17) of the Clean Water Act, and 40 CFR §122.2. For new effluent limitations, the permit includes interim monitoring for the specific parameter to demonstrate the facility is not already in compliance with the new requirement. Per 40 CFR § 122.47(a)(1) and 10 CSR 20-7.031(11), compliance must occur as soon as possible. If the permit provides a schedule for meeting new water quality based effluent limits, a SOC must include an enforceable, final effluent limitation in the permit even if the SOC extends beyond the life of the permit.

A SOC is not allowed:

- For effluent limitations based on technology-based standards established in accordance with federal requirements, if the deadline for compliance established in federal regulations has passed. 40 CFR § 125.3.
- For a newly constructed facility in most cases. Newly constructed facilities must meet applicable effluent limitations when discharge begins, because the facility has installed the appropriate control technology as specified in a permit or antidegradation review. A SOC is allowed for a new water quality based effluent limit that was not included in a previously public noticed permit or antidegradation review, which may occur if a regulation changes during construction.
- To develop a TMDL, UAA, or other study associated with development of a site specific criterion. A facility is not prohibited from conducting these activities, but a SOC may not be granted for conducting these activities.

In order to provide guidance to Permit Writers in developing SOCs, and attain a greater level of consistency, on October 25, 2012 the Department issued a policy on development of SOCs. This policy provides guidance to Permit Writers on the standard time frames for schedules for common activities, and guidance on factors that may modify the length of the schedule such as an affordability analysis.

☒ - The time given for effluent limitations of this permit listed under Interim Effluent Limitation and Final Effluent Limitations were established in accordance with [10 CSR 20-7.031(11)]. The facility has been given a schedule of compliance to meet final effluent limits for Ammonia as N, $CBOD_5$, $NBOD_5$, TSS, E. coli, Total Nitrogen, Total Phosphorus, and Dissolved Oxygen. Due to the current limitations of technology, achieving compliance with the final effluent limitations will be difficult and will have a high cost, the facility is being provided a 2-phased schedule of compliance.

The first phase will allow a six (6) year schedule of compliance for the facility to meet the 2nd interim limits for BOD, TSS, E. coli, and Ammonia. The six year schedule of compliance allowed for this facility should provide adequate time to evaluate operations, obtain an engineering report, obtain funding, obtain a construction permit and implement upgrades required to meet the interim effluent limits. The facility should consider alternative solutions when evaluating how to meet the final effluent limitations. In addition to upgrading the facility, the facility should consider whether relocating the outfall location to a different receiving stream, such as Indian Creek, approximately 0.7 miles northeast of the facility, or Lake Forest, which is located approximately 0.2 miles south of the facility, would be financially feasible. Indian Creek and Lake Forest are not impaired waterways, and the facility would be required to upgrade to meet the applicable BOD_5, TSS, Ammonia and E. coli effluent limitations, but not to meet the TMDL requirements. After the upgrades are installed during the first phase and a recovery period for the stream, the Department will review the receiving stream to determine if the upgrades have allowed the stream to regain its designated uses.

After completion of the first phase of the schedule of compliance and if the streams designated uses have not been re-attained, the second phase of the schedule of compliance will allow seven (7) years for the facility to meet final limits for Ammonia as N, $CBOD_5$, $NBOD_5$, TSS, Total Nitrogen, Total Phosphorus, and Dissolved Oxygen. The seven year schedule of compliance should; provide adequate time for stream recovery after the facility has upgraded to meet the 2nd interim effluent limits, time for the Department to conduct a re-evaluation of the stream regarding use attainment, allow the Department to re-categorize the stream on the 305b report for approval by the EPA in 2026 if the stream has re-attained uses, allow the facility to evaluate operations, obtain an engineering report, obtain funding, obtain a construction permit and implement any further upgrades required to meet the final effluent limits if it is determined that the stream did not re-attain uses.

STORMWATER POLLUTION PREVENTION PLAN (SWPPP):
In accordance with 40 CFR 122.44(k) *Best Management Practices (BMPs)* to control or abate the discharge of pollutants when: (1) Authorized under section 304(e) of the Clean Water Act (CWA) for the control of toxic pollutants and hazardous substances from ancillary industrial activities: (2) Authorized under section 402(p) of the CWA for the control of stormwater discharges; (3) Numeric effluent limitations are infeasible; or (4) the practices are reasonably necessary to achieve effluent limitations and standards or to carry out the purposes and intent of the CWA.

In accordance with the EPA's *Developing Your Stormwater Pollution Prevention Plan, A Guide for Industrial Operators*, (Document number EPA 833-B-09-002) [published by the United States Environmental Protection Agency (USEPA) in February 2009], BMPs are measures or practices used to reduce the amount of pollution entering (regarding this operating permit) waters of the state. BMPs may take the form of a process, activity, or physical structure.

Additionally in accordance with the Stormwater Management, a SWPPP is a series of steps and activities to (1) identify sources of pollution or contamination, and (2) select and carry out actions which prevent or control the pollution of stormwater discharges.

☒ - At this time, the permittee is not required to develop and implement a SWPPP.

VARIANCE:
As per the Missouri Clean Water Law § 644.061.4, variances shall be granted for such period of time and under such terms and conditions as shall be specified by the commission in its order. The variance may be extended by affirmative action of the commission. In no event shall the variance be granted for a period of time greater than is reasonably necessary for complying with the Missouri Clean Water Law §§644.006 to 644.141 or any standard, rule or regulation promulgated pursuant to Missouri Clean Water Law §§644.006 to 644.141.

☐ - This operating permit is drafted under premises of a petition for variance. Please provide a brief summary of the variance as provided in the variance application. Also include if the variance was approved or denied and date of either the approval or denial. Staff can also give reason for the denial if applicable.

☒ - This operating permit is not drafted under premises of a petition for variance.

WASTELOAD ALLOCATIONS (WLA) FOR LIMITS:
As per [10 CSR 20-2.010(78)], the amount of pollutant each discharger is allowed by the Department to release into a given stream after the Department has determined total amount of pollutant that may be discharged into that stream without endangering its water quality.

☒ - Wasteload allocations were calculated where applicable using water quality criteria or water quality model results and the dilution equation below:

$$Ce = \frac{(Qe + Qs)C - (Cs \times Qs)}{(Qe)}$$ (EPA/505/2-90-001, Section 4.5.5)

Where C = downstream concentration Ce = effluent concentration
Cs = upstream concentration Qe = effluent flow
Qs = upstream flow

Chronic wasteload allocations were determined using applicable chronic water quality criteria (CCC: criteria continuous concentration) and stream volume of flow at the edge of the mixing zone (MZ). Acute wasteload allocations were determined using applicable water quality criteria (CMC: criteria maximum concentration) and stream volume of flow at the edge of the zone of initial dilution (ZID).

Water quality based maximum daily and average monthly effluent limitations were calculated using methods and procedures outlined in USEPA's "Technical Support Document For Water Quality-based Toxics Control" (EPA/505/2-90-001).

Number of Samples "n":
Additionally, in accordance with the TSD for water quality-based permitting, effluent quality is determined by the underlying distribution of daily values, which is determined by the Long Term Average (LTA) associated with a particular Wasteload Allocation (WLA) and by the Coefficient of Variation (CV) of the effluent concentrations. Increasing or decreasing the monitoring frequency does not affect this underlying distribution or treatment performance, which should be, at a minimum, be targeted to comply with the values dictated by the WLA. Therefore, it is recommended that the actual planned frequency of monitoring normally be used to determine the value of "n" for calculating the AML. However, in situations where monitoring frequency is once per month or less, a higher value for "n" must be assumed for AML derivation purposes. Thus, the statistical procedure being employed using an assumed number of samples is "n = 4" at a minimum. For Total Ammonia as Nitrogen, "n = 30" is used

WLA MODELING:
There are two general types of effluent limitations, technology-based effluent limits (TBELs) and water quality based effluent limits (WQBELs). If TBELs do not provide adequate protection for the receiving waters, then WQBEL must be used.

☐ - A WLA study including model was submitted to the Department.

☒ - WLA's were provided in the EPA approved TMDL.

WATER QUALITY STANDARDS:
Per [10 CSR 20-7.031(4)], General Criteria shall be applicable to all waters of the state at all times including mixing zones. Additionally, [40 CFR 122.44(d)(1)] directs the Department to establish in each NPDES permit to include conditions to achieve water quality established under Section 303 of the Clean Water Act, including State narrative criteria for water quality.

WHOLE EFFLUENT TOXICITY (WET) TEST:

☐ - The permittee is required to conduct WET test for this facility.

A WET test is a quantifiable method of determining if a discharge from a facility may be causing toxicity to aquatic life by itself, in combination with or through synergistic responses when mixed with receiving stream water.

Under the federal Clean Water Act (CWA) §101(a)(3), requiring WET testing is reasonably appropriate for site-specific Missouri State Operating Permits for discharges to waters of the state issued under the National Pollutant Discharge Elimination System (NPDES). WET testing is also required by 40 CFR 122.44(d)(1). WET testing ensures that the provisions in the 10 CSR 20-6.010(8)(A)7. and the Water Quality Standards 10 CSR 20-7.031(4)(D),(F),(G),(I)2.A & B are being met. Under [10 CSR 20-6.010(8)(A)4], the Department may require other terms and conditions that it deems necessary to assure compliance with the Clean Water Act and related regulations of the Missouri Clean Water Commission. In addition the following MCWL apply: §§§644.051.3 requires the Department to set permit conditions that comply with the MCWL and CWA; 644.051.4 specifically references toxicity as an item we must consider in writing permits (along with water quality-based effluent limits, pretreatment, etc…); and 644.051.5 is the basic authority to require testing conditions. WET test will be required by facilities meeting the following criteria:

- ☐ Facility is a designated Major.
- ☐ Facility continuously or routinely exceeds its design flow.
- ☐ Facility that exceeds its design population equivalent (PE) for BOD_5 whether or not its design flow is being exceeded.
- ☐ Facility (whether primarily domestic or industrial) that alters its production process throughout the year.
- ☐ Facility handles large quantities of toxic substances, or substances that are toxic in large amounts.
- ☐ Facility has Water Quality-based Effluent Limitations for toxic substances (other than NH_3)
- ☐ Facility is a municipality with a Design Flow $\geq$ 22,500 gpd.
- ☐ Other – please justify.

☒ - At this time, the permittee is not required to conduct WET test for this facility.

40 CFR 122.41(M) - BYPASSES:
The federal Clean Water Act (CWA), Section 402 prohibits wastewater dischargers from "bypassing" untreated or partially treated sewage (wastewater) beyond the headworks. A bypass is defined as an intentional diversion of waste streams from any portion of a treatment facility, [40 CFR 122.41(m)(1)(i)]. Additionally, Missouri regulation 10 CSR 20-7.015(9)(G) states a bypass means the intentional diversion of waste streams from any portion of a treatment facility, except in the case of blending, to waters of the state. Only under exceptional and specified limitations do the federal regulations allow for a facility to bypass some or all of the flow from its treatment process. Bypasses are prohibited by the CWA unless a permittee can meet all of the criteria listed in 40 CFR 122.41(m)(4)(i)(A), (B), & (C). Any bypasses from this facility are subject to the reporting required in 40 CFR 122.41(l)(6) and per Missouri's Standard Conditions I, Section B, part 2.b. Additionally, Anticipated Bypasses include bypasses from peak flow basins or similar devices designed for peak wet weather flows.

☐ - Bypasses occur or have occurred at this facility.

☒ - This facility does not anticipate bypassing.

303(d) LIST & TOTAL MAXIMUM DAILY LOAD (TMDL):

Section 303(d) of the federal Clean Water Act requires that each state identify waters that are not meeting water quality standards and for which adequate water pollution controls have not been required. Water quality standards protect such beneficial uses of water as whole body contact (such as swimming), maintaining fish and other aquatic life, and providing drinking water for people, livestock and wildlife. The 303(d) list helps state and federal agencies keep track of waters that are impaired but not addressed by normal water pollution control programs.

A TMDL is a calculation of the maximum amount of a given pollutant that a body of water can absorb before its water quality is affected. If a water body is determined to be impaired as listed on the 303(d) list, then a watershed management plan will be developed that shall include the TMDL calculation

☐ - This facility discharges to a 303(d) listed stream.

☐ - This facility does not discharge to a 303(d) listed stream.

☒ - This facility discharges to a stream with an EPA approved TMDL.

Part VI –2013 Water Quality Criteria for Ammonia

On August 22, 2013, the U.S. Environmental Protection Agency (EPA) finalized new water quality criteria for ammonia, based on toxicity studies of mussels and gill breathing snails. Missouri is home to 69 of North America's mussel species, which are spread across the state. According to the Missouri Department of Conservation nearly two-thirds of the mussel species in Missouri are considered to be "of conservation concern". Nine species are listed as federally endangered, with an additional species currently proposed as endangered and another species proposed as threatened.

The adult forms of mussels that are seen in rivers, lakes, and streams are sensitive to pollutants because they are sedentary filter feeders. They vacuum up many pollutants with the food they bring in and cannot escape to new habitats, so they can accumulate toxins in their bodies and die. But very young mussels, called glochidia, are exceptionally sensitive to ammonia in water. As a result of a citizen suit, the EPA was compelled to conduct toxicity testing and develop ammonia water quality criteria that would be protective if young mussels may be present in a waterbody. The 2nd interim Ammonia limits are based upon this new criteria for ammonia.

Part VII – Effluent Limits Determination

APPLICABLE DESIGNATIONS OF WATERS OF THE STATE:
As per Missouri's Effluent Regulations [10 CSR 20-7.015], the waters of the state are divided into the below listed seven (7) categories. Each category lists effluent limitations for specific parameters, which are presented in each outfall's Effluent Limitation Table and further discussed in the Derivation & Discussion of Limits section.

- ☐ Missouri or Mississippi River [10 CSR 20-7.015(2)]
- ☐ Lake or Reservoir [10 CSR 20-7.015(3)]
- ☐ Losing [10 CSR 20-7.015(4)]
- ☐ Subsurface Water [10 CSR 20-7.015(7)]
- ☒ All Other Waters [10 CSR 20-7.015(8)]
- ☐ Metropolitan No-Discharge [10 CSR 20-7.015(5)]

OUTFALL #001 – MAIN FACILITY OUTFALL

Effluent limitations derived and established in the below Effluent Limitations Table are based on current operations of the facility. Future permit action due to facility modification may contain new operating permit terms and conditions that supersede the terms and conditions, including effluent limitations, of this operating permit.

EFFLUENT LIMITATIONS TABLE:

PARAMETER	Unit	Basis for Limits	Daily Maximum	Weekly Average	Monthly Average	Modified	Previous Permit Limitations
Flow	MGD	1	*		*	No	*/*
BOD_5 (Interim)	mg/L	1		60	30	No	60/30
BOD_5 (Interim)	mg/L	7		15	10	Yes	60/30
BOD_5 (Final)	mg/L	8		*	*	Yes	15/10
$CBOD_5$	mg/L	8		7.56	5.04	Yes	***
$NBOD_5$	mg/L	8		2.19	1.46	Yes	***
TSS (Interim)	mg/L	1		60	30	No	60/30
TSS (Final)	mg/L	8		15	10	Yes	60/30
Ammonia as N (Apr 1 –Sep 30) (Interim)	mg/L	1, 3	3.7		1.9	No	3.7/1.9
Ammonia as N (Oct 1 – Mar 31) (Interim)	mg/L	1, 3	7.5		3.7	No	7.5/3.7
Ammonia as N (Apr 1 –Sep 30) (Interim)	mg/L	7	1.7		0.6	Yes	3.7/1.9
Ammonia as N (Oct 1 – Mar 31) (Interim)	mg/L	7	5.6		2.1	Yes	7.5/3.7
Ammonia as N (Final)	mg/L	8	1.0		0.3	Yes	2.4/0.6 6.9/2.1
Escherichia coli **	#/100mL	1, 3	1030		206	Yes	***
PARAMETER	Unit	Basis for Limits	Minimum		Maximum	Modified	Previous Permit Limitations
pH	SU	1	6.5			Yes	≥ 6.0
PARAMETER	Unit	Basis for Limits	Daily Minimum		Monthly Avg. Min	Modified	Previous Permit Limitations
Dissolved Oxygen (Interim)	mg/L	7	*		*	Yes	***
Dissolved Oxygen (Final)	mg/L	8	8		8	Yes	*/*
PARAMETER	Unit	Basis for Limits	Monthly Average		Quarterly Average	Modified	Previous Permit Limitations
Total Nitrogen (Interim)	mg/L	1	*		*	Yes	***
Total Nitrogen (Final)	mg/L	8	*		0.289	Yes	*/*
Total Phosphorus (Interim)	mg/L	1	*		*	Yes	***
Total Phosphorus (Final)	mg/L	8	*		0.007	Yes	*/*

* - Monitoring requirement only.
** - The Monthly Average for *E. coli* is a geometric mean.
*** - Parameter not previously established in previous state operating permit.

Basis for Limitations Codes:

1. State or Federal Regulation/Law
2. Water Quality Standard (includes RPA)
3. Water Quality Based Effluent Limits
4. Antidegradation Review
5. Antidegradation Policy
6. Water Quality Model
7. Best Professional Judgment
8. TMDL or Permit in lieu of TMDL
9. WET Test Policy

OUTFALL #001 – DERIVATION AND DISCUSSION OF LIMITS:

- **Flow.** In accordance with [40 CFR Part 122.44(i)(1)(ii)] the volume of effluent discharged from each outfall is needed to assure compliance with permitted effluent limitations. If the permittee is unable to obtain effluent flow, then it is the responsibility of the permittee to inform the Department, which may require the submittal of an operating permit modification.

Carbonaceous Biological Oxygen Demand$_5$, Nitrogenous Biological Oxygen Demand$_5$, Total Nitrogen, Total Phosphorus, Ammonia, and Total Suspended Solids (TSS). A Total Maximum Daily Load (TMDL) for Big Bottom Creek was approved in October 2010. This TMDL provided concentration wasteload allocations (WLAs) for $CBOD_5$, $CBOD_5$, Total Nitrogen, Total Phosphorus, Ammonia, and TSS nitrogen. Concentration-based limits have been calculated from the TMDL WLAs and compared to applicable technology (TBEL) and water quality (WQBEL) based effluent limits for these parameters (see chart below). The limits included in the permit are those that are most protective. Mass loading parameters were not included in the permit as the mass and concentration limits are both protective of the DO criteria and are duplicative. In addition, the modeling was run utilizing the design flow of the facility, 0.1183 MGD. A review of the DMRs show a majority of the actual flows reported on the Discharge Monitoring Reports were below the design flow. Since the actual flow is less, the concentration based limits will be more protective than the mass based limits.

Effluent Parameter	TMDL (mg/L)			TBEL / WQBEL (mg/L)	
	DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	WEEKLY AVERAGE	MONTHLY AVERAGE
$CBOD_5$	No Limit	7.56	5.04	NA (BOD 60)	NA (BOD 30)
$NBOD_5$	No Limit	2.19	1.46	NA	NA
NH3	1.0	No Limit	0.3	No Limit	1.3
TSS	No Limit	15.0	10.0	60	30
Effluent Parameter	DAILY MAXIMUM	MONTHLY AVERAGE	QUARTERLY AVERAGE	WEEKLY AVERAGE	MONTHLY AVERAGE
TN	No Limit	*	0.289	NA	NA
TP	No Limit	*	0.007	NA	NA

* Monitoring requirement only

- **Carbonaceous Biochemical Oxygen Demand ($CBOD_5$).**

Per the Department's 2010 Guidance for Water Quality and Antidegradation Review Assistance, for conventional pollutants, and the Department's 2009 Dissolved Oxygen Modeling and Biochemical Oxygen Demand Effluent Limit Development Administrative Guidance document, the WLA is used as the Average Monthly Limit (AML). The Average Weekly Limit is calculated by multiplying the AML by 1.5.

WLA = AML = 5.04 mg/L
AML = 5.04 mg/L

AWL = AML * 1.5 = 5.04 * 1.5 = 7.56 mg/L
AWL = 7.56 mg/L

- **Biochemical Oxygen Demand (BOD_5).** (Interim)

Per the Department's 2010 Guidance for Water Quality and Antidegradation Review Assistance, for conventional pollutants, and the Department's 2009 Dissolved Oxygen Modeling and Biochemical Oxygen Demand Effluent Limit Development Administrative Guidance document, the WLA is used as the Average Monthly Limit (AML). The Average Weekly Limit is calculated by multiplying the AML by 1.5. Per 10 CSR 20-7.015(8)(A)5., CBOD = BOD – 5 mg/L.

CBOD WLA = AML = 5.04 mg/L
CBOD AML = 5.04 mg/L
BOD AML = CBOD AML + 5 mg/L **= 10 mg/L**

BOD AWL = BOD AML * 1.5 = 10 * 1.5 = 15 mg/L
BOD AWL = 15 mg/L

- **Biochemical Oxygen Demand (BOD_5).** (Final)

☒ - Monitoring only. This will allow the facility to calculate both mass-based and concentration-based $NBOD_5$. $NBOD_5$ = BOD_5 - $CBOD_5$

- **Nitrogenous Biochemical Oxygen Demand ($NBOD_5$).**

Nitrogenous Biochemical Oxygen Demand is the difference between BOD5 and $CBOD_5$. $NBOD_5$ = BOD_5 - $CBOD_5$

Per the Department's 2010 Guidance for Water Quality and Antidegradation Review Assistance, for conventional pollutants, and the Department's 2009 Dissolved Oxygen Modeling and Biochemical Oxygen Demand Effluent Limit Development Administrative Guidance document, the WLA is used as the Average Monthly Limit (AML). The Average Weekly Limit (AWL) is calculated by multiplying the AML by 1.5.

WLA = AML = 1.46 mg/L

AML = 1.46 mg/L
AWL = AML * 1.5 = 1.46 * 1.5 = **2.19 mg/L**

- **Total Suspended Solids (TSS).**

Per the Department's 2010 Guidance for Water Quality and Antidegradation Review Assistance, for conventional pollutants, the average weekly limit is calculated by multiplying the AML by 1.5.

WLA = AML = 10 mg/L

AML = 10 mg/L
AWL = AML * 1.5 = 10 * 1.5 = **15 mg/L**

- **Total Nitrogen (Interim).** Monitoring required for facilities greater than 100,000 gpd design flow per 10 CSR 20-7.015(9)(D)7. Total Nitrogen shall be determined by testing for Total Kjeldahl Nitrogen (TKN) and Nitrate + Nitrite and reporting the sum of the results (reported as N). Nitrate + Nitrite can be analyzed together or separately.

- **Total Nitrogen (Final).** The NPDES regulations at 40 CFR 122.45(d) require that all permit limits be expressed, unless impracticable, as both average monthly limits and maximum daily limits for all dischargers other than publicly owned treatment works (POTWs), and as average weekly limits and average monthly limits for POTWs.

  In the March 3, 2004 EPA Memorandum with the subject of; Annual Permit Limits for Nitrogen and Phosphorus for Permits Designed to Protect Chesapeake Bay and its tidal tributaries from Excess Nutrient Loading under the National Pollutant Discharge Elimination System, the Office of Wastewater Management cautioned that the steady-state statistical procedures described in EPA's Technical Support Document for Water Quality-based Toxics Control (TSD) were not applicable or appropriate for developing nutrient limits for the main stem of Chesapeake Bay and its tribal tributaries. The memo stated that developing permit limits for nutrients affecting Chesapeake Bay and its tidal tributaries is different from setting limits for toxic pollutants because the exposure period of concern for nutrients is longer than one month, and can be up to a few years, and the average exposure rather than the maximum exposure is of concern. The statistical derivation procedure described in the TSD for acute and chronic aquatic life protection is not applicable to exposure periods more than 30 days (see TSD page 105). The Office of Wastewater Management concluded that due to the characteristics of nutrient loading and its effects on the water quality in Chesapeake Bay and its tidal tributaries and because the derivation of appropriate daily, weekly or monthly limits is not possible for the reasons described above, that it is therefore "impracticable" to express permit effluent limitations as daily maximum, weekly average, or monthly average effluent limitations. Therefore the Department has determined that the WLA provided in the TMDL will be applied as a Quarterly Average Limit (QAL), as an average monthly limit is not practicable due to the long term effects of nutrients on streams.

  WLA = QAL = **0.289 mg/L**
  QAL = 0.289 mg/L

  In addition to the Quarterly Average Limit, the facility will be required to monitor Total Nitrogen monthly as a monitoring only requirement.

- **Total Phosphorus (Interim).** Monitoring required for facilities greater than 100,000 gpd design flow per 10 CSR 20-7.015(9)(D)7

- **Total Phosphorus (Final).** The NPDES regulations at 40 CFR 122.45(d) require that all permit limits be expressed, unless impracticable, as both average monthly limits and maximum daily limits for all dischargers other than publicly owned treatment works (POTWs), and as average weekly limits and average monthly limits for POTWs.

In the March 3, 2004 EPA Memorandum with the subject of; Annual Permit Limits for Nitrogen and Phosphorus for Permits Designed to Protect Chesapeake Bay and its tidal tributaries from Excess Nutrient Loading under the National Pollutant Discharge Elimination System, the Office of Wastewater Management cautioned that the steady-state statistical procedures described in EPA's Technical Support Document for Water Quality-based Toxics Control (TSD) were not applicable or appropriate for developing nutrient limits for the main stem of Chesapeake Bay and its tribal tributaries. The memo stated that developing permit limits for nutrients affecting Chesapeake Bay and its tidal tributaries is different from setting limits for toxic pollutants because the exposure period of concern for nutrients is longer than one month, and can be up to a few years, and the average exposure rather than the maximum exposure is of concern. The statistical derivation procedure described in the TSD for acute and chronic aquatic life protection is not applicable to exposure periods more than 30 days (see TSD page 105). The Office of Wastewater Management concluded that due to the characteristics of nutrient loading and its effects on the water quality in Chesapeake Bay and its tidal tributaries and because the derivation of appropriate daily, weekly or monthly limits is not possible for the reasons described above, that it is therefore "impracticable" to express permit effluent limitations as daily maximum, weekly average, or monthly average effluent limitations. Therefore the Department has determined that the WLA provided in the TMDL will be applied as a Quarterly Average Limit (QAL), as an average monthly limit is not practicable due to the long term effects of nutrients on streams.

WLA = QAL = **0.007 mg/L**
QAL = 0.007 mg/L

In addition to the Average Annual Limit, the facility will be required to monitor Total Phosphorus monthly as a monitoring only requirement.

- **Total Ammonia Nitrogen (Interim).** The 2nd interim Ammonia limits are based upon the EPA's 2013 finalized new water quality criteria for ammonia, based on toxicity studies of mussels and gill breathing snails. Background total ammonia nitrogen = 0.01 mg/L. No mixing considerations allowed; therefore, WLA = appropriate criterion.

Season	Temp (°C)	pH (SU)	Total Ammonia Nitrogen CCC (mg/L)	Total Ammonia Nitrogen CMC (mg/L)
Summer	26	7.8	0.7	3.4
Winter	6	7.8	2.3	13

Summer: April 1 – September 30
Chronic WLA: $C_e = ((0.2 + 0.0)0.7 - (0.0 * 0.01))/0.2$
$C_e = 0.7$ mg/L

Acute WLA: $C_e = ((0.2 + 0.0)3.4 - (0.0 * 0.01))/0.2$
$C_e = 3.4$ mg/L

$LTA_c = 0.7$ mg/L (0.780) = 0.55 mg/L [CV = 0.6, 99th Percentile, 30 day avg.]
$LTA_a = 3.4$ mg/L (0.321) = 1.09 mg/L [CV = 0.6, 99th Percentile]

Use most protective number of LTA_c or LTA_a.

MDL = 0.55 mg/L (3.11) = 1.7 mg/L [CV = 0.6, 99th Percentile]
AML = 0.55 mg/L (1.19) = 0.6 mg/L [CV = 0.6, 95th Percentile, n =30]

Winter: October 1 – March 31
Chronic WLA: $C_e = ((0.2 + 0.0)2.3 - (0.0 * 0.01))/0.2$
$C_e = 2.3$ mg/L

Acute WLA: $C_e = ((0.2 + 0.0)13 - (0.0 * 0.01))/0.2$
$C_e = 13$ mg/L

$LTA_c = 2.3$ mg/L (0.780) = 1.79 mg/L [CV = 0.6, 99th Percentile, 30 day avg.]
$LTA_a = 13$ mg/L (0.321) = 4.14 mg/L [CV = 0.6, 99th Percentile]

Use most protective number of LTA_c or LTA_a.

MDL = 1.79 mg/L (3.11) = 5.6 mg/L [CV = 0.6, 99th Percentile]
AML = 1.79 mg/L (1.19) = 2.1 mg/L [CV = 0.6, 95th Percentile, n =30]

- **Total Ammonia Nitrogen (Final).** WLA_c = 0.3 mg/L per the 2010 EPA approved TMDL. The TMDL discusses that seasonal variation is addressed by the TMDL identifying a Loading Capacity that is protective of the Dissolved Oxygen target during the 7Q10 low flow period. Therefore the WLA_c will be used for the limit calculation. As the Ammonia limit is set to be protective of the Dissolved Oxygen target, seasonal limits are not applicable. The WLA_c for the TMDL is more protective than the WLA_a and WLA_c for protection of aquatic life, therefore the TMDL limits will apply. Effluent Limits were determined using the US EPA's Technical Support Document For Water Quality-based Toxics Control (EPA/505/2-90-001) Permit Limit Derivation from Single, Steady-State Model Output. The single WLA as provided in the TMDL was considered the chronic WLA.

  Chronic WLA: C_e = 0.3 mg/L
  LTA_c = 0.3 mg/L (0.67) = 0.2 mg/L [CV = 0.97, 99th Percentile, 30 day avg.]

  MDL = 0.2 mg/L (4.79) = **1.0 mg/L** [CV = 0.97, 99th Percentile]
  AML = 0.2 mg/L (1.32) = **0.3 mg/L** [CV = 0.97, 95th Percentile, n =30]

- ***Escherichia coli (E. coli)***. Monthly average of 206 per 100 mL as a geometric mean and Daily Maximum of 1030 per 100 mL during the recreational season (April 1 – October 31), to protect Whole Body Contact Recreation (B) designated use of the receiving stream, as per 10 CSR 20-7.031(5)(C). An effluent limit for both monthly average and daily maximum is required by 40 CFR 122.45(d). The Geometric Mean is calculated by multiplying all of the data points and then taking the nth root of this product, where n = # of samples collected. For example: Five E. coli samples were collected with results of 1, 4, 6, 10, and 5 (#/100mL). Geometric Mean = 5th root of (1)(4)(6)(10)(5) = 5th root of 1,200 = 4.1 #/100mL.

- **pH**. – ≥ 6.5 SU. Technology based effluent limitations of 6.0-9.0 SU [10 CSR 20-7.015] are not protective of the Water Quality Standard, which states that water contaminants shall not cause pH to be outside the range of 6.5-9.0 SU. 10 CSR 20-7.015 allows pH for lagoons to be maintained above 6.0 SU. With no mixing zone, the water quality standard, ≥ 6.5 SU, must be met at the outfall.

- **Dissolved Oxygen**. The 2010 EPA approved TMDL requires a minimum Dissolved Oxygen limit of 8.0 mg/L.

- **Parameters Removed**. Temperature was removed as it did not show a reasonable potential to violate Water Quality Standards.

Minimum Sampling and Reporting Frequency Requirements.

PARAMETER	SAMPLING FREQUENCY	REPORTING FREQUENCY
Flow	twice/week	once/month
BOD_5	once/month	once/month
$CBOD_5$	once/month	once/month
$NBOD_5$	once/month	once/month
TSS	once/month	once/month
Ammonia as N	once/month	once/month
pH	once/month	once/month
Total Nitrogen (Interim)	once/quarter	once/quarter
Total Phosphorus (Interim)	once/quarter	once/quarter
Total Nitrogen (Final)	once/month	once/quarter
Total Phosphorus (Final)	once/month	once/quarter
E. coli	once/month	once/month
pH	once/month	once/month
Dissolved Oxygen	once/month	once/month

Sampling Frequency Justification:

Sampling and Reporting Frequency was retained from previous permit, except for flow, which was increased to twice per week. This increase was to capture additional flow data as this facility has previously been reported as having hydraulic overloading. Weekly sampling is required for *E. coli*, per 10 CSR 20-7.015(9)(D)6.A. The interim Total Nitrogen and Total Phosphorus are to be collected quarterly per 10 CSR 20-7.015(9)(D)7.

Sampling Type Justification

As per 10 CSR 20-7.015, BOD_5, including $CBOD_5$ and $NBOD_5$ and TSS collected for lagoons may be grab samples. Grab samples must be collected for pH, Ammonia as N, *E. coli*, Dissolved Oxygen and Total Phosphorus. This is due to the holding time restriction for *E. coli*, the volatility of Ammonia, and the fact that pH and DO cannot be preserved and must be sampled in the field. As Ammonia and Total Phosphorus samples must be immediately preserved with acid, these samples are to be collected as a grab. For further information on sampling and testing methods please review 10 CSR 20-7.015(9)(D) 2.

PERMITTED FEATURE #SM1 & #SM2 – INSTREAM MONITORING (UPSTREAM AND DOWNSTREAM)

The monitoring requirements established in the below Monitoring Requirements Table are based on current operations of the facility. Future permit action due to facility modification may contain new operating permit terms and conditions that supersede the terms and conditions, including the monitoring requirements listed in this table.

MONITORING REQUIREMENTS TABLE:

PARAMETER	Unit	Basis for Limits	Daily Maximum	Weekly Average	Monthly Average	Modified	Previous Permit Limitations
Temperature	° C	8	*		*	No	*/*
Ammonia as N	mg/L	8	*		*	No	*/*
PARAMETER	Unit	Basis for Limits	Minimum		Maximum	Modified	Previous Permit Limitations
pH	SU	8	*		*	**No**	*/*
PARAMETER	Unit	Basis for Limits	Daily Minimum		Monthly Avg. Min	Modified	Previous Permit Limitations
Dissolved Oxygen (DO)	mg/L	8	*		*	No	*/*

* - Monitoring requirement only.

Basis for Limitations Codes:

1. State or Federal Regulation/Law
2. Water Quality Standard (includes RPA)
3. Water Quality Based Effluent Limits
4. Antidegradation Review
5. Antidegradation Policy
6. Water Quality Model
7. Best Professional Judgment
8. TMDL or Permit in lieu of TMDL
9. WET Test Policy

PERMITTED FEATURE #SM1 & #SM2 – DERIVATION AND DISCUSSION OF MONITORING REQUIREMENTS:

- **Temperature**. Monitoring requirement only. This parameter is required to be collected instream by the 2010 EPA approved TMDL.
- **Ammonia as N**. Monitoring requirement only. This parameter is required to be collected instream by the 2010 EPA approved TMDL.
- **pH**. Monitoring requirement only. This parameter is required to be collected instream by the 2010 EPA approved TMDL.
- **Dissolved Oxygen**. Monitoring requirement only. This parameter is required to be collected instream by the 2010 EPA approved TMDL.

Minimum Sampling and Reporting Frequency Requirements.

PARAMETER	SAMPLING FREQUENCY	REPORTING FREQUENCY
Temperature	once/month	once/month
Ammonia as N	once/month	once/month
pH	once/month	once/month
Dissolved Oxygen	once/month	once/month

Sampling Frequency Justification:
The sampling and reporting frequency for instream monitoring has been established to match the sampling frequency of the effluent parameters.

Sampling Type Justification
As Ammonia as N samples must be immediately preserved; these samples are to be collected as a grab. Temperature, pH, and Dissolved Oxygen must be collected as grab as these parameters cannot be preserved and must be sampled in the field.

Part VIII – Cost Analysis for Compliance

Pursuant to Section 644.145, RSMo., the Department is required to determine whether a permit or decision is affordable and makes a "finding of affordability" for certain permitting and enforcement decisions. This requirement applies to discharges from combined or separate sanitary sewer systems or publically-owned treatment works.

- The Department is not required to complete a cost analysis for compliance because the facility is not a combined or separate sanitary sewer system for a publically-owned treatment works.

Part IX – Administrative Requirements

On the basis of preliminary staff review and the application of applicable standards and regulations, the Department, as administrative agent for the Missouri Clean Water Commission, proposes to issue a permit(s) subject to certain effluent limitations, schedules, and special conditions contained herein and within the operating permit. The proposed determinations are tentative pending public comment.

PERMIT SYNCHRONIZATION:
The Department of Natural Resources is currently undergoing a synchronization process for operating permits. Permits are normally issued on a five-year term, but to achieve synchronization many permits will need to be issued for less than the full five years allowed by regulation. The intent is that all permits within a watershed will move through the Watershed Based Management (WBM) cycle together will all expire in the same fiscal year. This will allow further streamlining by placing multiple permits within a smaller geographic area on public notice simultaneously, thereby reducing repeated administrative efforts. This will also allow the Department to explore a watershed based permitting effort at some point in the future. Renewal applications must continue to be submitted within 180 days of expiration, however, in instances where effluent data from the previous renewal is less than 4 years old, that data may be re-submitted to meet the requirements of the renewal application. If the permit provides a schedule of compliance for meeting new water quality based effluent limits beyond the expiration date of the permit, the time remaining in the schedule of compliance will be allotted in the renewed permit. This permit will be synchronized at the next permit renewal.

PUBLIC NOTICE:
The Department shall give public notice that a draft permit has been prepared and its issuance is pending. Additionally, public notice will be issued if a public hearing is to be held because of a significant degree of interest in and water quality concerns related to a draft permit. No public notice is required when a request for a permit modification or termination is denied; however, the requester and permittee must be notified of the denial in writing. The Department must issue public notice of a pending operating permit or of a new or reissued statewide general permit. The public comment period is the length of time not less than 30 days following the date of the public notice which interested persons may submit written comments about the proposed permit. For persons wanting to submit comments regarding this proposed operating permit, then please refer to the Public Notice page located at the front of this draft operating permit. The Public Notice page gives direction on how and where to submit appropriate comments.

☒ - The Public Notice period for this operating permit was from September 25, 2015 to October 26, 2015. Responses to the Public Notice of this operating permit did not warrant the modification of effluent limits and/or the terms and conditions of this permit. Mass loading parameters were removed from the permit.

DATE OF FACT SHEET: DECEMBER 16, 2015

COMPLETED BY:

BRANT FARRIS, ENVIRONMENTAL SPECIALIST III
MISSOURI DEPARTMENT OF NATURAL RESOURCES
WATER PROTECTION PROGRAM
OPERATING PERMITS SECTION - DOMESTIC WASTEWATER UNIT
(660) 385-8061
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APPENDIX – TMDL TABLE 14:

Table 14. WLAs for Lake Forest Estates Subdivision WWTP (MO0035742) in the Big Bottom Creek Watershed

Effluent Parameter	Design Flow (MGD)	Existing Permit Limit (mg/L)		WLA at Design Flow based on QUAL2K and LDC modeling (mg/L)		Percent Reduction
		Concentration (mg/L)	Load (lbs/day)	Concentration (mg/L)	Load (lbs/day)	
$CBOD_5$	0.1183	No limit	No limit	5.04	4.99	Not applicable
$NBOD_5$	0.1183	No limit	No limit	1.46	1.45	Not applicable
TN	0.1183	No limit	No limit	0.289	0.29	Not applicable
TP	0.1183	No limit	No limit	0.007	0.01	Not applicable
NH_3	0.1183	Daily Maximum = 3.7[12] - 7.5[13] Monthly Average = 1.9[14] - 3.7[15]	3.7 - 7.4 1.9 – 3.7	0.3	0.9	50
TSS	0.1183	Weekly Average = 60 Monthly Average = 30	= 59.2 = 29.6	10.0	9.9	67

Notes: $CBOD_5$ is calculated using simulated BOD_5 divided by 1.29, based on 1998 EPA modeling guidance for NH3 toxicity and DO modeling. $NBOD_5$ is the difference between BOD_5 and $CBOD_5$. TN target loading for point sources was based on 289 µgN/L, Ecoregion 39 TN value. TP target loading for point sources was based on 7 µgP/L, Ecoregion 39 TP value. Existing permit limit loads (lbs/day) are based on existing design flow and monthly average limits.

Water Protection Program, Financial Assistance Center
Clean Water State Revolving Fund Grant Eligibility Evaluation Form

Applicant:	Lake Forest Estates Clean Water	Project No.:	
Facility:	Lake Forest Estates	Missouri State Operating Permit No.:	MO-0035742
Date Reviewed:		County:	Ste. Genevieve
Total Project Amount:	$5,736,500	Potential Grant:	

The amount of additional subsidization (ie grant) funds available to Missouri Clean Water State Revolving Fund projects each year is determined by a formula in federal statute. Pursuant to the Federal Water Pollution Control Act section 603(i), the Missouri Department of Natural Resources' developed this evaluation form to determine Clean Water State Revolving Fund grant eligibility based on affordability. As available grants are limited, this evaluation provides the Department with a means to identify eligible grant recipients and obligate grant funds to applicants with the greatest need each year through a spending plan, referred to as the Clean Water State Revolving Fund Intended Use Plan.
This evaluation indicates the project IS/IS NOT grant eligible. This evaluation provides a grant eligibility score that will assist the Department to prioritize funding among eligible applicants in **[Fiscal Year xxxx] Clean Water State Revolving Fund Intended Use Plan**. However, this evaluation represents an eligibility determination and is not a binding commitment or an actual award of financial assistance. Applicants have 2 years from the date of the Intended Use Plan to utilize the funds. In the event the loan and grant are not awarded within this timeframe, the applicant will need to re-compete for both the loan and grant funds by re-applying.

POPULATION				
Total population served by project				
Population of municipality or service area =	773	Ineligible, Pop. > 10,000		
Population 3,300 or less				50
Population of 3,301 to 7,500				
Population of 7,501 to 10,000				
UNEMPLOYMENT RATE				
Comparison of municipality or service area unemployment with State Average				
Recipient Unemployment Rate =	4.6%	State Unemployment Rate =	5.8%	
Unemployment Rate > 1% above State Average				
Unemployment Rate ± 1% State Average				
Unemployment Rate > 1% below State Average				0
INCOME				
Comparison of municipality or service area Median Household Income (MHI) with State average				
Recipient MHI =	$52,204	State MHI = $52,801	75% of State MHI = $39,600.75	
MHI < 75% of State MHI				
MHI 75% to 100% of State MHI				30
MHI > State MHI				
Proposed User Rates in municipality or service area as percentage of MHI				
Recipient User Rate =	$111.16	Recipient MHI =	$52,204	
User Rates ≥ 2% MHI				75
User Rates 1.5 to < 2%				
User Rates 1 to <1.5%		(user rate X 12 months) / Recipient MHI X 100 =	2.6%	
User Rates < 1% MHI				
OTHER RELEVANT SOCIOECONOMIC DATA				
Percentage of Households Below Poverty Level				
Households Below Poverty Level =	16.6%	State Average =	14.6%	
Households Below Poverty Level >10% above State Average				
Households Below Poverty Level ± 10% State Average				30
Households Below Poverty Level >10% below State Average				
POPULATION TREND				
Population during the last 5 years (including the last decennial census)				
Population decline or stagnant				20
Population growth				
195 Points required for SRF Grant Eligibility =			**YES**	205

MO 780-2854 (03-19)

Liquid Engineering Corporation

Steel Potable Water Reservoir Inspection Report

Job Number: 51947 | Utility: LAKE FOREST ESTATES | Tank: LAKE FOREST ESTATES TANK

Inspector: S. MOLEZZO | Dive Controller: E. BOMBERGER | Date: 5/9/2018

AMERICAN WATER WORKS ASSOCIATION
ANSI/AWWA M42 / D101-53

SSPC Legend

Grade	Description
10	No Rusting, or <0.01% of surface is rusted
9	Minor rusting, or <0.03% of surface is rusted
8	Isolated rust, <.01% of surface is rusted
7	Isolated rust, <.03% of surface is rusted
6	Extensive rusting, <1% of surface is rusted
5	Approximately 3% of the surface is rusted
4	Approximately 10% of the surface is rusted
3	Approximately 17% of the surface is rusted
2	Approximately 33% of the surface is rusted
1	Approximately 50% of the surface is rusted
0	Approximately 100% of the surface is rusted

NACE Legend

Grade	Description
A	None
B	Uniform Surface Corrosion
C	Pitting
D	Concentration Cell Corrosion
E	Galvanic Corrosion
F	Stress Corrosion Cracking
G	Erosion Corrosion
H	Intergranular Corrosion
I	Dealloying

AWS Legend

Grade	Description
L	Satisfactory
M	Spatter
N	Porosity
O	Convexity / Concavity
P	Cracks
Q	Inclusions
R	Incomplete Fusion
S	Incomplete Penetration
T	Undercut
U	Underfill
V	Overlap
W	Unable to evaluate

INTERIOR RESERVOIR ROOF

	QUADRANT 1			QUADRANT 2			QUADRANT 3			QUADRANT 4		
	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS
Vents	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Roof Panels	8	B	L	8	B	L	8	B	L	8	B	L
Roof Support	7	B	L	7	B	L	7	B	L	7	B	L
~~Roof Gussets~~	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Painting Ring	9	B	L	9	B	L	9	B	L	9	B	L

Overall Coating Rating Good | Average Blister Diameter NONE | Average Pit Depth NONE

Coating Deficiencies: Blistering ☐ Delamination ☐ Chalking ☐ Checking ☐ Cracking ☐ Growth ☐ Pinholes ☐ Staining ☑ Sags/Runs ☐

INTERIOR RESERVOIR WALLS

	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS
Wall to Roof weld	6	B	L	6	B	L	6	B	L	6	B	L
Lower Ring Panels	9	D	L	9	D	L	9	D	L	9	D	L
Middle Ring Panels	9	D	L	9	D	L	9	D	L	9	D	L
Upper Ring Panels	9	B	L	9	B	L	9	B	L	9	B	L
Interior Ladder	10	A	L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Overall Coating Rating Good | Average Blister Diameter NONE | Average Pit Depth NONE

Coating Deficiencies: Blistering ☐ Delamination ☐ Chalking ☐ Checking ☐ Cracking ☐ Growth ☐ Pinholes ☐ Staining ☑ Sags/Runs ☐

INTERIOR RESERVOIR FLOOR

	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS
Perimeter Weld	10	A	L	10	A	L	10	A	L	10	A	L
Floor Panels	9	D	L	9	D	L	9	D	L	9	D	L

Overall Coating Rating Good | Average Blister Diameter NONE | Average Pit Depth NONE

Coating Deficiencies: Blistering ☐ Delamination ☐ Chalking ☐ Checking ☐ Cracking ☐ Growth ☐ Pinholes ☐ Staining ☑ Sags/Runs ☐

Liquid Engineering Corporation

Steel Potable Water Reservoir Inspection Report

Job Number: 51947 | Utility: LAKE FOREST ESTATES | Tank: LAKE FOREST ESTATES TANK

Inspector: S. MOLEZZO | Dive Controller: E. BOMBERGER | Date: 5/9/2018

INTERIOR RESERVOIR SUPPORT COLUMNS

	QUADRANT 1			QUADRANT 2			QUADRANT 3			QUADRANT 4		
	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS
Column Structures	10	A	L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Column Bases	9	D	L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Column to Roof	8	B	L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Overall Coating Rating Good | Average Blister Diameter NONE | Average Pit Depth NONE

Coating Deficiencies: Blistering ☐ Delamination ☐ Chalking ☐ Checking ☐ Cracking ☐ Growth ☐ Pinholes ☐ Staining ☐ Sags/Runs ☐

INTERIOR RESERVOIR PLUMBING COMPONENTS

	QUADRANT 1			QUADRANT 2			QUADRANT 3			QUADRANT 4		
	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS
Inlet Plumbing	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9	D	L
Outlet Plumbing	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9	D	L
Manways	N/A	N/A	N/A	10	A	L	N/A	N/A	N/A	9	D	L
~~Floor Drains~~	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Interior Overflow	9	B	L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

EXTERIOR RESERVOIR ROOF

	QUADRANT 1			QUADRANT 2			QUADRANT 3			QUADRANT 4		
	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS
Vents	9	B	L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Roof Panels	10	A	L	10	A	L	10	A	L	10	A	L
Access Hatches	8	B/H	L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Overall Coating Rating Good | Average Blister Diameter NONE | Average Pit Depth NONE

Coating Deficiencies: Blistering ☐ Delamination ☐ Chalking ☐ Checking ☐ Cracking ☐ Growth ☑ Pinholes ☐ Staining ☑ Sags/Runs ☐

EXTERIOR RESERVOIR WALLS

	QUADRANT 1			QUADRANT 2			QUADRANT 3			QUADRANT 4		
	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS
Wall to Roof Weld	10	A	L	10	A	L	10	A	L	10	A	L
Lower Ring Panels	8	B	L	8	B	L	8	B	L	8	B	L
Mid Ring Panels	10	A	L	10	A	L	10	A	L	10	A	L
Upper Ring Panels	10	A	L	10	A	L	10	A	L	10	A	L
Exterior Overflow	10	A	L	10	A	L	10	A	L	10	A	L

Overall Coating Rating Good | Average Blister Diameter NONE | Average Pit Depth NONE

Coating Deficiencies: Blistering ☐ Delamination ☑ Chalking ☐ Checking ☐ Cracking ☐ Growth ☑ Pinholes ☐ Staining ☑ Sags/Runs ☐

FOOTINGS / FOUNDATION

Footings / Foundations:	Satisfactory ☑	Cracking ☐	Spalling ☐	Erosion/Exposed Aggregate ☐
~~Anchor Bolts:~~	Satisfactory ☐	Loose ☐	Rusted Corroded ☐	(If excessive) Diameter =

~~TOWER SUPPORT STRUCTURES~~

Tower Legs/Columns:	Satisfactory ☐	Alignment ----	Settling ----	Rust /Corrosion ----
Riser Pipe:	Satisfactory ☐	Alignment ----	Frost Casing ----	Rust /Corrosion ----
Rods & Turnbuckles:	Satisfactory ☐	Turnbuckle Tension ----	Rod Tension ----	Cotter Pins/Rod Nuts ----
Leg shoes/Brackets:	Satisfactory ☐	Coating ----	Rust/Corrosion ----	Pitting/Cracking ----

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Potable Water Reservoir Contamination, Health and Safety Report

Job Number: 51947 | Utility: LAKE FOREST ESTATES | Tank: LAKE FOREST ESTATES TANK

Inspector: S. MOLEZZO | Dive Controller: E. BOMBERGER | Date: 5/9/2018

Complies With: AWWA • OSHA • ANSI • NIOSH • NAVFAC • NFPAC

CONTAMINATION & HEALTH

Air Vents	Type: MUSHROOM		#: 1	Screen Condition(s): Good	
Hatches	Type: Square		#: 1	Secured Properly: Yes	Properly Sealed: Yes
Exterior Overflow	Flapper: Yes	Screen: Yes		Gasket: ----	Condition: Good
~~Cathodic Covers~~	In- Place: ----		#: -	Gasket: ----	Properly Sealed: ----
Roof to Wall Joint	Welded: Yes	Properly Sealed: Yes			
Roof Integrity	Holes: No	Cracking: No	Standing Water: No		
Wall Integrity	Holes: No	Cracking: No			
Manway Integrity	Leaks: No	Condition: Good			
Water Clarity	General Appearance: CLEAR			Odor: NONE	
Floating Surface Debris	Type: NONE			Source: N/A	
~~Hypalon Floating Cover~~	Condition: ----	Holes: ----	Tears: ----		
~~Telemetry Penetrations~~	Properly Sealed: ----				

FACILITY SAFETY COMPLIANCE

Exterior Ladder

Overall Ladder	Condition: Good	#: 1	Offset Landing: No	Height: 24'	
Vandal Guard	Present: No	Vandal Guard Locked: ----			
Ladder Rails & Rungs	Condition: Good	Missing/Damaged Rungs: No			
Rung Spacing & Depth	Spacing: 11 in. *(max 12")*	Toe Depth: 10 in. *(min 7")*			
Rail Spacing & Size	Width: 1 in. *(min 2")*	Thickness: 1 in. *(min 1/4")*	Rail to Rail: 13	in.*(min 16")*	
Safety Climb System	Type: Rail	Condition: Good			
Number & Locations	Wall: 1	Leg:	Roof:	Riser Pipe:	Other:
Ladder Attachments	WELDED - GOOD CONDITION				

Manways

Type and size	Type: Round	#: 2	Size: 30	inches *(24" – 18'x22" min)*
Support Structure	Type: Bolted	Condition: Good		
Number & Locations	Wall: 2	Roof:	Riser Pipe:	Other:

Hatches

Hatch Type & Size	Type: Square	#: 1	Size: 30 x 24	in. *(24" – 24"x15" min)*
Hatch & Lid Lip Height	Hatch: 8 in. *(min 4")*	Lid: 2	in. *(min 2")*	

~~Balconies & Railing~~

Deck / Walkways	Condition: ----	Width:			
Hand Rails	Condition: ----	Height:	in. *(min 42")*	No. Rails:	*(min 2)*
Toe Rail	Condition: ----	Height:	in. *(min 4")*		
Welds / Attachments	Condition: ----				

Roof

Safety Tie-Off Points	Condition: Good	#: 3	
Antennas	Type: Point to Point	#: 6	

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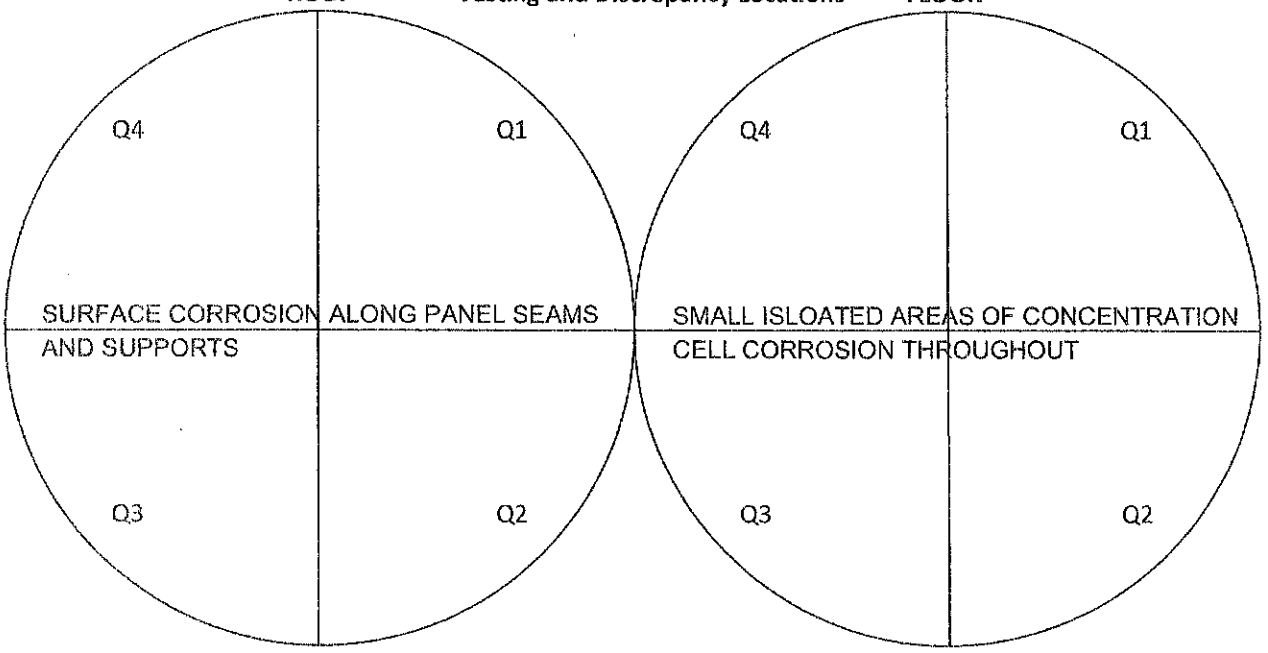
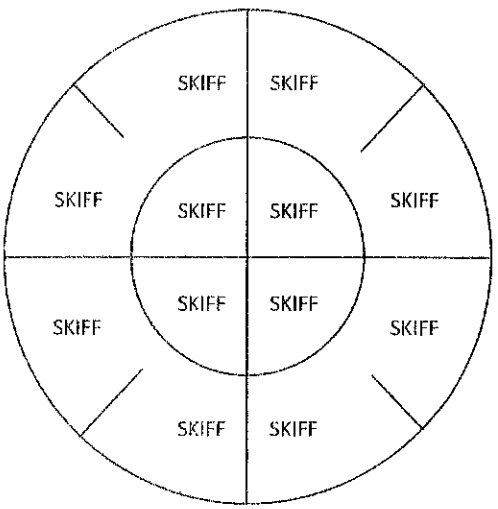
Circular Tank Diagram / Information Worksheet

Job Number 51947 Utility Name LAKE FOREST ESTATES Tank Name LAKE FOREST ESTATES TANK

Quadrant 1	Quadrant 2	Quadrant 3	Quadrant 4
STAINING AND SMALL ISOLATED AREAS OF CORROSION			

ROOF **Testing and Discrepancy Locations** **FLOOR**

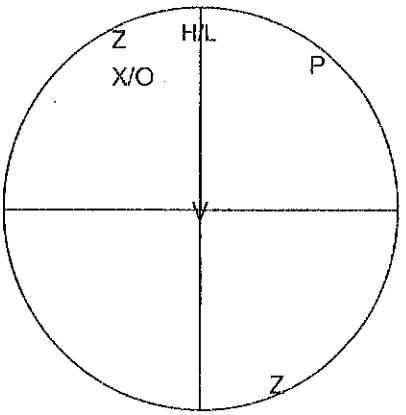




Sediment Depth Measurements

Average Sediment Depth = The sum of all measurements taken, divided by the number of measurements taken

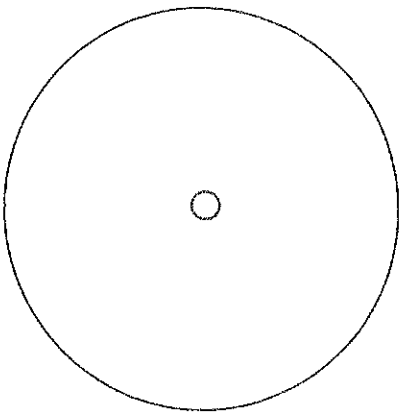
Avg. Depth SKIFF **Cubic Yardage** **Sediment Type** SAND/IRON



Plumbing & Structure location

Plumbing and structure codes

O=Outlet X=Inlet Z=Manway
V=Vent D=Drain S=Sump
L=Ladder H=Hatch P=Overflow
F=Float Level Indicator
T=Telemetry



Column Placement

Type of Column

Base Structure

Top Structure

Column Construction Steel

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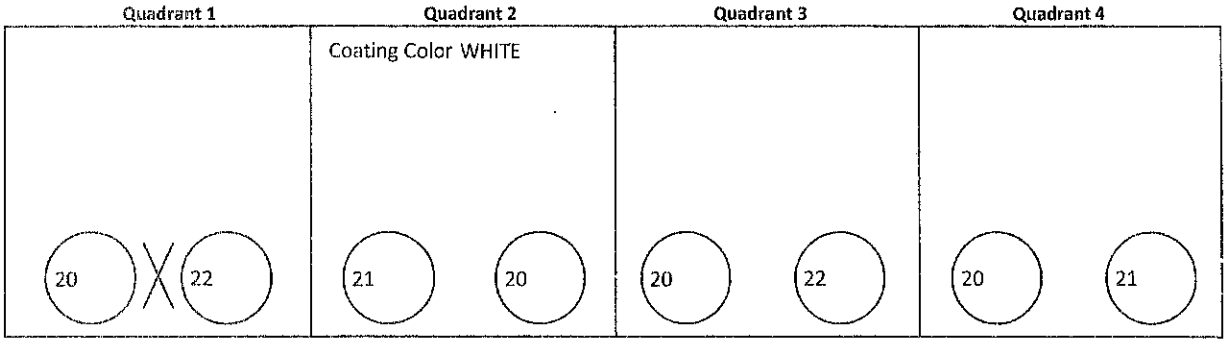
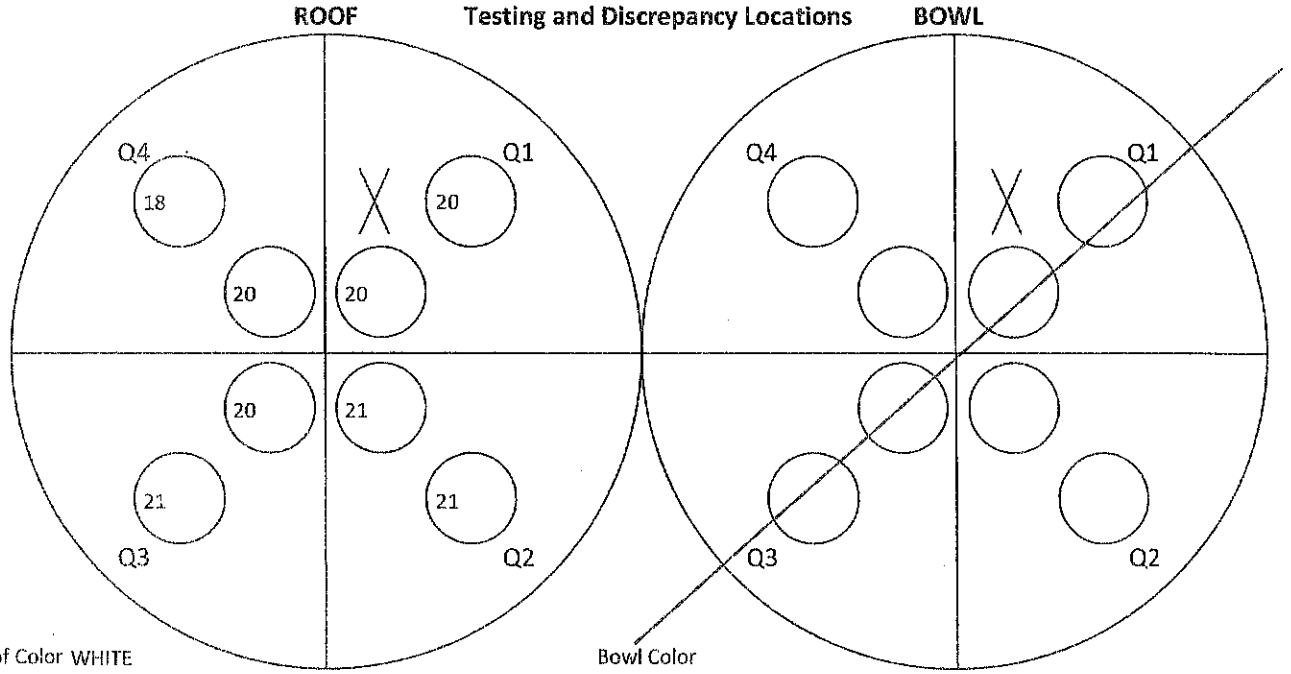
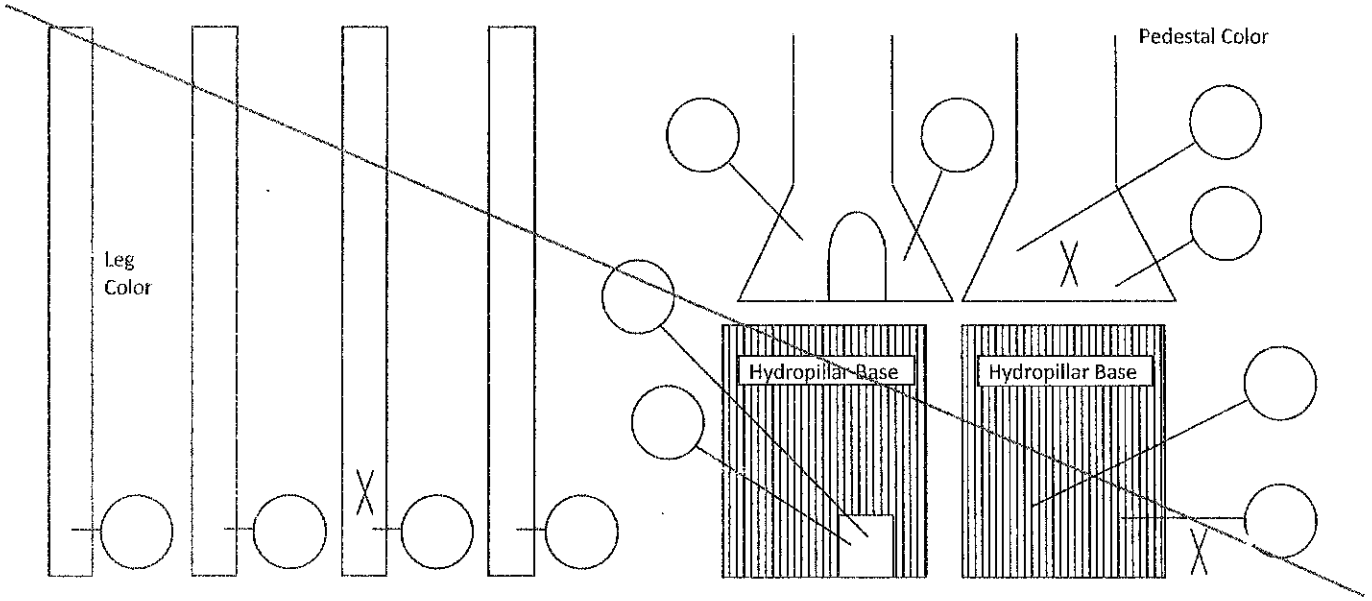
Circular Tank Diagram / NDT ☐ DFT ☑ Coating Adhesion ☐ Presence of lead ☐

Job Number 51947 Utility Name LAKE FOREST ESTATES Tank Name LAKE FOREST ESTATES TANK







DISCLAIMER

Liquid Engineering does not provide consulting engineering services. Unless otherwise noted, the findings contained in this report were neither prepared nor reviewed by a licensed Professional Engineer, but are based on experience, training and visual examination of the Dive Maintenance Technician

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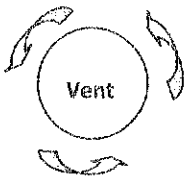
Steel Potable Water Reservoir Security / Measurement Worksheet

Job Number 51947 Utility Name LAKE FOREST ESTATES Tank Name LAKE FOREST ESTATES TANK

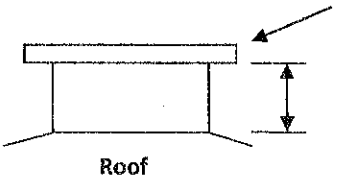
Security

Is the area surrounding the tank well lit?	No
Is the tank surrounded by a Security Fence?	No
Are the access gates locked?	N/A
Is the tank equipped with a Vandal Guard on the primary access ladder?	No
If so, is the Vandal Guard locked?	N/A
Are the vents equipped with security vent shrouds?	No
Are all of the hatches equipped with electronic monitoring devices?	No
Are the external plumbing components housed in a secure vault or out-building?	Yes
Does the surrounding geography of the tank obscure it from public view?	No
Does the exterior of the tank show signs of trespass?	No

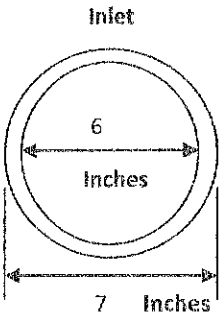
Measurements

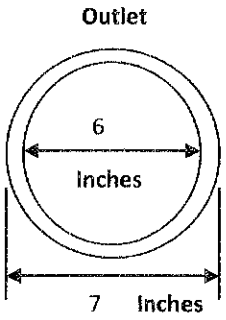


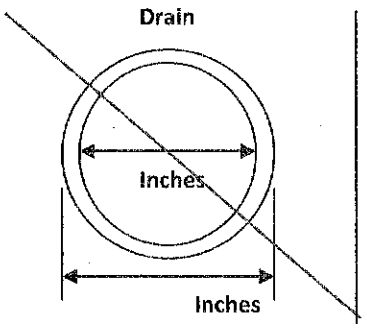
Outside Circumference
54 Inches

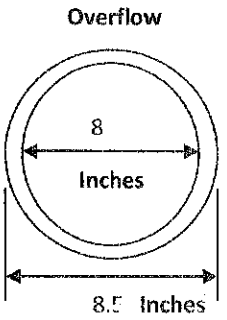


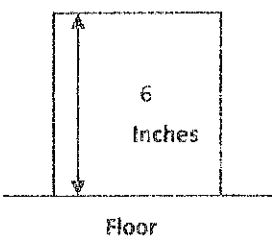
Flange Metal Thickness	1/2	Inches
Roof to Screen or Flange	6	Inches
Flange	Yes	
Number of Bolt Holes	8	Inches
Size of Bolts	3/4	Inches

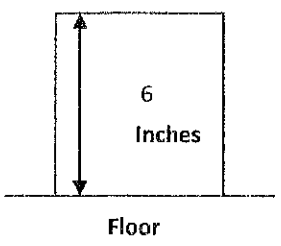


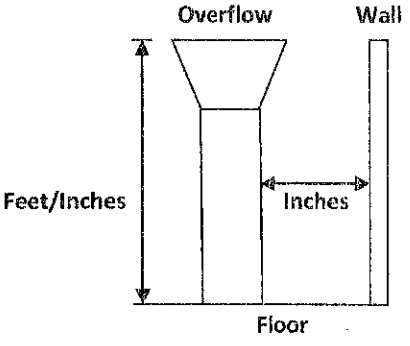












Liquid Engineering Corporation

Steel Potable Water Reservoir Immediate Needs Assessment

Job Number: 51947 | Utility: LAKE FOREST ESTATES | Tank: LAKE FOREST ESTATES TANK

Inspector: S. MOLEZZO | Dive Controller: E. BOMBERGER | Date: 5/9/2018

1. **Health and Safety Items**
   - ☐ Safety Climb System Installation: NOT RECOMENEDED
   - ☐ Vent Screen Repairs: NOT RECOMENDED

2. **Testing Items**
   - ☐ Dye Testing for Leak Evaluation: NOT RECOMENDED
   - ☐ Presence of Lead Test (Interior/Exterior): NONE DETECTED

3. **Destructive Testing Items**
   - ☐ % of Lead Test (Interior/Exterior) *(Coating samples are removed for laboratory analysis)* NOT PERFORMED
   - ☐ Coating Adhesion Test (Interior/Exterior): NOT PERFORMED

   Specific written authorization required to perform destructive testing. Destructive tests include touch-up of coating system.

4. **Repair Items**
   - ☐ Epoxy Coating Repairs: NOT RECOMENDED
   - ☐ Temporary Leak Repairs: NOT RECOMENDED
   - ☐ Float Operated Level Indicator Repairs / Maintenance: NOT RECOMENDED
   - ☐ Hypalon Repairs: N/A

5. **Security Related Items** *(Critical security upgrade information is immediately available)*
   - ☑ Tank vents are not equipped with a security vent shroud:
   - ☐ Tank hatches are not equipped with a security hatch locking device:
   - ☐ Tank perimeter not adequately secured:

The above mentioned additional work is considered immediately necessary and is recommended to be completed. Some items may be completed in conjunction with work currently being performed while the crew is on site.

Reservoir Inspection Condition Supplemental

Upon entering the reservoir, the diver noted a "skiff" of sand/iron sediment on the floor of the reservoir. As the sediment was removed, staining and small isolated areas of corrosion was observed throughout all quadrants. The corrosion is very minor, with no evidence of metal loss. There is also some light corrosion on the common inlet/outlet, which appears to be intact and free of obstruction. The support column is intact and in good condition, with light concentration cell corrosion at the base of the column. Uniform surface corrosion was observed near the column to roof joint. The walls of the reservoir appear to be in excellent condition; only staining and very minor corrosion was noted. Both of the manways appear to be in good condition, and gaskets are intact; no evidence of leaking from the exterior of the manways. There is some light corrosion starting to form on the manway in quadrant four, but is very minor. The internal ladder appears to be in excellent condition, and properly secured to the wall of the reservoir. The internal overflow has some light surface corrosion, but appears to be in good condition. The roof of the reservoir appears to have uniform surface corrosion along the panel seams, as well as along the roof supports. This corrosion is also forming along the wall to roof seam, which is causing staining of the upper walls. Due to the location of the center support column, the diver was unable to get a clear view of the internal vent. The access hatch has some light surface/intergranular corrosion starting to form, but appears to be properly sealed/secured.
It is recommended that epoxy repair be conducted during the next clean and inspect.

Liquid Engineering Corporation recommends a cleaning and inspection every 3-5 years.