APPENDIX A
TECHNICAL MEMORANDUMS 1 AND 2

Memorandum

Date: July 31, 2009

To: Charles Soules

From: Jeff Keller

Re: Technical Memorandum No. 1
Wastewater Design Flow Projections
City of Lawrence Municipal Airport

Objective:

Estimate the peak design wastewater flowrate anticipated through ultimate future development scenarios at the City of Lawrence (the City) Municipal Airport based on the following three methodologies:

(1) Determine based upon Land Use and assumed density.

(2) Determine based upon Land Use and typical unit-flowrate for type of development.

(3) Determine based upon Kansas Department of Health and Environment minimum criteria.

Assumptions:

(1) Ultimate buildout of 45 or more developable acres at the Municipal Airport occurs by year 2020.

(2) Per discussions with the City, Average Day Dry Weather (AD) wastewater flowrate at the Municipal Airport is estimated to be approximately 1,000 gpd for the existing development acreage. The City's current *Airport Layout Plan Update* projects an increase in flight operations from year 2005 through 2020 of approximately 30%. Therefore, AD wastewater flow estimate for existing development acreage is increased by a factor of 1.3 for the projected increase in flight operations through year 2020.

(3) Based upon Kansas Department of Health and Environment (KDHE) minimum standards for design, a Peaking Factor (PF) of 3 * AD flow is assumed.

(4) DAR Corporation expressed interest in locating facilities at the Municipal Airport. Based on City Commission Minutes dated March 10, 2009, DAR anticipates 12 employees in 2009, 25 employees in 2010, and 65 employees in 2015. Assume 2.0 acre development to accommodate DAR Corporation facilities.

(5) Developable acreage at airport is dependent upon a currently undetermined floodplain elevation. Assuming the lowest building elevation likely at the airport of 814-ft, approximately **55.0** acres of property will potentially be developed.

(6) After dedicating 2.0 acres to DAR Corporation, assume remaining 53.0 acres of property is developed based upon the following Land Uses:

(a) 40% Commercial Office (CO) = 21.2 acres

- 7-16 gal / employee-day (AD) (*Wastewater Engineering, Metalf & Eddy, 2003*)
- 75% / Acre Max Impervious Coverage for CO (*City Land Dev. Code, Page 6-2*)
- 65% / Acre Max Lot Coverage for CO (*City Land Dev. Code, Page 6-2*)
- Assume 1 employee per 100 sq ft of building space (2006 International Building Code (I.B.C.))

- Assume 1 parking space requires 300 sq ft of impervious area (City Land Dev. Code, Page 9-5, Chapter 20 Article 9, Off-Street Parking Schedule A, Use Category: Office, Administration, and Professional)
- Assume 70% of Max Impervious Coverage is devoted to Parking/Drives

  Therefore,
  - For a single acre (43,560 sq ft) with 75% impervious coverage, assuming 70% of impervious coverage is devoted to parking/drive areas, or 0.7*0.75*43,560 sq ft = 22,869 sq ft. Remaining 30% is building space, or 0.3*0.75*43560 sq ft = 9801 sq ft.
  - Resulting number of employees per acre of CO development at 1 employee per 100 sq ft is **98 employees**.
  - Resulting number of parking spaces per acre of CO development with 300 sq ft of impervious area required per parking space is **77 spaces**.

(b) 60% Industrial/Business Park District (IBP) = 31.8 acres

15-35 gal / employee-day (AD) (*Wastewater Engineering, Metalf Eddy, 2003*)
75% / Acre Max Impervious Coverage for IBP (*City Land Dev. Code, Page 6-2*)
65% / Acre Max Lot Coverage for IBP (*City Land Development Code, Page 6-2*)

- Assume 1 employee per 100 sq ft of building space (2006 International Building Code (I.B.C.))
- Assume 1 parking space requires 300 sq ft of impervious area (City Land Dev. Code, Page 9-5, Chapter 20 Article 9, Off-Street Parking Schedule A, Use Category: Office, Administration, and Professional)
- Assume 70% of Max Impervious Coverage is devoted to Parking/Drives

  Therefore, same results as for CO development:
  - For a single acre (43,560 sq ft) with 75% impervious coverage, assuming 70% of impervious coverage is devoted to parking/drive areas, or 0.7*0.75*43,560 sq ft = 22,869 sq ft. Remaining 30% is building space, or 0.3*0.75*43560 sq ft = 9801 sq ft.
  - Resulting number of employees per acre of IBP development at 1 employee per 100 sq ft is **98 employees**.
  - Resulting number of parking spaces per acre of IBP development with 300 sq ft of impervious area required per parking space is **77 spaces**.

(7) Typical AD flowrate for commercial developments normally range from 800 gal/acre-day to 1,500 gal/acre-day (*Wastewater Engineering, Metalf Eddy, 2003*). Scaling the 1,500 gal/acre-day value for industrial developments at a factor of (35 gal / 16 gal) results in a value of 3,300 gal/acre-day.

(8) Using KDHE methodology, the typical Wet Weather flowrate is 5,000 gpd/acre for commercial development and 10,000 gpd/acre for industrial development.

Calculations:

(1) Determine maximum peak design wastewater flowrate based upon Land Use and an assumed population and building density:

(a) Existing Development:

2009 – 1,000 gpd * 3.0 PF = **3,000 gpd**
2010 – 1,000 gpd * 3.0 PF = **3,000 gpd**
2015 – Interpolate between 2010 and 2020 flows = **3,450 gpd**
2020 – 1,000 gpd * 1.3 * 3.0 PF = **3,900 gpd**

(b) DAR Corporation 2.0 Acre of development:
Assuming 16 gal / employee-day (Metcalf Eddy; Commercial Office)
2009 – 12 employees * 16 gal / employee-day * 3.0 PF = **576 gpd**
2010 – 25 employees * 16 gal / employee-day * 3.0 PF = **1,200 gpd**
2015 – 65 employees * 16 gal / employee-day * 3.0 PF = **3,120 gpd**
2020 – 65 employees * 16 gal / employee-day * 3.0 PF = **3,120 gpd**

(c) Commercial Office (CO) contribution:
Total Developable Acreage (55.0) – DAR Development (2.0) = 53.0 Ac
40% of 53.0 Developable Acres = 21.2 Acres
21.2 Acres * 98 employees per acre = 2,078 employees
(AD) Flowrate of 16 gal / employee-day (*Metcalf Eddy*; Commercial Office)

2,078 employees * 16 gpd * 3.0 PF = **99,744 gpd**

Assuming 20% of CO space in use by 2010 = **19,949 gpd**
Assuming 50% of CO space in use by 2015 = **49,872 gpd**
Assuming 100% of CO space in use by 2020 = **99,744 gpd**

(d) Industrial / Business Park District (IBP) contribution:
60% of 53.0 Developable Acres = 31.8 Acres
31.8 Acres * 98 employees per acre = 3,117 employees
(AD) Flowrate of 35 gal / employee-day (Metcalf Eddy; Commercial Office)

3,117 employees * 35 gpd * 3.0 PF = **327,285 gpd**

Assuming 20% of IBP space in use by 2010 = **65,457 gpd**
Assuming 50% of IBP space in use by 2015 = **163,643 gpd**
Assuming 100% of IBP space in use by 2020 = **327,285 gpd**

Total Design Flow = (a) + (b) + (c) + (d)

Year	Total Design Flow, gpd
2009	3,576
2010	89,606
2015	220,085
2020	434,049

(2) Determine maximum peak design wastewater flowrate based upon Land Use typical unit-flowrate for type of development (1,500 gal/ac-day Commercial; 3,300 gal/ac-day Industrial):

(a) Existing Development:

2009 – 1,000 gpd * 3.0 PF = **3,000 gpd**
2010 – 1,000 gpd * 3.0 PF = **3,000 gpd**
2015 – Interpolate between 2010 and 2020 flows = **3,450 gpd**
2020 – 1,000 gpd * 1.3 * 3.0 PF = **3,900 gpd**

(b) Commercial Office (CO) contribution:

40% of 55.0 Developable Acres = 22.0 Acres

22.0 Acres * 1,500 gal/acre-day * 3.0 PF = **99,000 gpd Commercial**

Assuming 20% of CO space in use by 2010 = **19,800 gpd**
Assuming 50% of CO space in use by 2015 = **49,500 gpd**
Assuming 100% of CO space in use by 2020 = **99,000 gpd**

(c) Industrial / Business Park District (IBP) contribution

60% of 55.0 Developable Acres = 33.0 Acres

33.0 Acres * 3,300 gal/acre-day * 3.0 PF = **326,700 gpd Industrial**

Assuming 20% of IBP space in use by 2010 = **65,340 gpd**
Assuming 50% of IBP space in use by 2015 = **163,350 gpd**
Assuming 100% of IBP space in use by 2020 = **326,700 gpd**

Total Design Flow = (a) + (b) + (c):

Year	Total Design Flow, gpd
2009	3,000
2010	88,140
2015	216,300
2020	429,600

(3) Determine maximum peak design wastewater flowrate based upon Kansas Department of Health and Environment minimum design criteria.

(a) Existing Development:
2009 – 1,000 gpd * 3.0 PF = **3,000 gpd**
2010 – 1,000 gpd * 3.0 PF = **3,000 gpd**
2015 – Interpolate between 2010 and 2020 flows = **3,450 gpd**
2020 – 1,000 gpd * 1.3 * 3.0 PF = **3,900 gpd**

(b) Assuming 55.0 Developable Acres:
40% Commercial Development at 5,000 gpd/acre = **110,000 gpd**
60% Industrial Development at 10,000 gpd/acre = **330,000 gpd**

Assuming 20% of acreage developed by 2010 = **88,000 gpd**
Assuming 50% of acreage developed by 2015 = **220,000 gpd**
Assuming 100% of acreage developed by 2020 = **440,000 gpd**

Total Design Flow = (a) + (b)

Year	Total Design Flow, gpd
2009	3,000
2010	91,000
2015	223,450
2020	443,900

Summary:

The table below presents a summary of the predicted wastewater flows for the City of Lawrence Municipal Airport future development. The values were calculated using three different methodologies; however, not significant differences in the results from the three methodologies were observed. The most conservative approach would be to adopt the values calculated based on the KDHE methodology (3). Another option would be to use the average value of the three methodologies (the average values are rounded up values).

Wastewater Design Flow Projections
(in gallons per day)

Methodology	Year 2009	Year 2010	Year 2015	Year 2020
Land Use and Assumed Density	3,576	89,606	220,085	434,049
Land Use and Typical Unit Flow Rate for Type of Development	3,000	88,140	216,300	429,600
KDHE Minimum Design Criteria	3,000	91,000	223,450	443,900
Average	**3,200**	**89,600**	**220,000**	**436,000**

Memorandum

Date: August 14th, 2009

To: Charles Soules

From: Jeff Keller

Re: Technical Memorandum No. 2
Wastewater Flow Revised Calculations and
Data from other Regional Airports
City of Lawrence Municipal Airport

Original evaluations of the potential wastewater flow resulted in relatively high values between 400,000 and 450,000 gallons per day projected for year 2020. Although these results were consistent using three different calculation methodologies, it was considered a very conservative number. Initial assumptions used in the calculations were generally taken at the "high" end of a given range of numbers, resulting in a relatively large uncertainly. Using "low" end numbers, the results could have been 50% or less of the calculated values. A phone conference held on August 6th, as well as additional data subsequently provided by the City has been used to provide recalculated values for consideration.

Updated Calculations

Calculations were performed to develop flow projections based on the revised data provided by the City. The significant changes in calculation that occurred for this technical memorandum were as follows:

1. Three different acreage scenarios were investigated
2. Two of the three scenarios used fewer acres than previous calculations
3. Peaking factors were reduced based on the use of peaking factor tables provided by the City
4. A second set of calculations were developed using a procedure used by the City to analyze flows in the area of the East Hills Business Park.

Results from these calculations can be seen in Tables 1 and 2:

Table 1 – Revised Calculations with Updated Acreage and Peaking Factors

Total Acreage	Build Out Peak Flow (gpd)
30	64,000
37	78,000
45	93,000

Table 2 – Flow Calculations Projected Using East Hills Method

Total Acreage	Build Out Peak Flow (gpd)
30	225,000
37	280,000
45	342,000

The results shown in both Tables 1 and 2 are significantly less than the projected flows reported in Technical Memorandum #1. The large difference between results in Tables 1 and 2 is likely The key parameter that now dictates the results is the occupancy rate of each building. The parameter can vary significantly and has a direct and impact on the flow rate. The raw data used to develop these numbers can be provided at your request.

Survey Results from Other Airports

In addition, multiple airports in the Kansas and Missouri were contacted to provide facility information such as number of businesses, number of employees, water and/or wastewater flow rates, acreages, etc. These values were to be compared to the Lawrence Airport's data to help provide guidance regarding a reasonable wastewater flow rate that should be used as a basis for design and analysis.

	Johnson Co. Executive	New Century	Manhattan, KS	Junction City, KS
Size, acres	300	2,200	100	192
No. of businesses	6	40	1	2
No. of employees	150	4500	50	25
% Industrial	0	NA	100	100
% Commercial	100	NA	0	0
Water, gpd	NA	550,000	NA	NA
Wastewater, gpd	10,000	NA	750	>100

Based on this data, the following parameters were calculated:

	Johnson Co. Executive	New Century	Manhattan, KS	Junction City, KS
Flow per employee (gal/d)	67	98*	15	>4
Flow per acre (gal/d)	33	200*	7.5	>0.5

Note: * Assumes wastewater flow is 80% of water

Review of these results has caused Burns & McDonnell to question the validity of the data obtained regarding the Junction City Airport wastewater flow. Ignoring data from the facility, it can be seen that the range of unit wastewater flows can vary by more than an order of magnitude. This is, in part, a reflection of the accuracy of reporting by the airports and, more significantly, large variation in the water use and disposal methods by various industrial and commercial clients. Using these metrics, projected peak wastewater flow rates can be projected as follows (using a 1.9 peaking factor):

Assuming 850 Employees (per TM #2 design data): 25,000 – 158,000 gallons per day

Assuming 503 total acres: 70,000 – 190,000 gallons per day

Discussion

As can be seen by the data provided in this memo, as well as in Technical Memo #1, the projection of wastewater flows at a facility such as the Lawrence Airport, is very challenging. The final value is highly dependant on the exact nature of the businesses operating at and around the airport, as well as on the condition of the piping network serving the area. Reasonable and industry-standard calculations can arrive at a wide-range of potential values. The actual flowrate to be observed when the area is fully built out is therefore very hard to predict.

One potential means to address is challenge is to provide a design approach that allows for easy expansion as the site fully develops. Initial sizing of the facilities at 50,000 – 100,000 gallons per day, expandable to 200,000 gallons per day, may be one approach. If the airport experiences rapid development that exceeds 200,000 gallons per day of flow, additional treatment or pumping facilities would have to be built. However, under that scenario, where activity at the airport would be many times greater than is currently being experienced, airport revenues would be similarly larger, and facility expansion could then be more easily financed compared to current conditions.

Please review this information and contact me if you have any questions. A final projected wastewater flow is needed to move forward with our scope of work. We would be happy to discuss these results with you to help in establishing a final number that the City is comfortable with.

APPENDIX B
WORRELL WATER TECHNOLOGIES INFORMATION

From: Schrock, Nicholas
To: Gonzalez, Reinaldo;
Subject: FW: Living Machine Wastewater Treatment system
Date: Wednesday, October 07, 2009 10:32:22 AM

Reinaldo - Here is the information from one of the engineered wetland designers.

Nick

From: Will Kirksey [mailto:wkirksey@worrellwater.com]
Sent: Wednesday, October 07, 2009 8:43 AM
To: Schrock, Nicholas
Subject: FW: Living Machine Wastewater Treatment system

-----Original Message-----
From: Will Kirksey
Sent: Wed 10/7/2009 2:16 AM
To: nschrock@burnsmcd.com
Subject: FW: Living Machine Wastewater Treatment system

Nick:

Confirming our conversation today and your discussions with Dave Maciolek, our Senior Engineer, we are very enthusiastic about the opportunity to be included on the Lawrence, Kansas Airport Extension. This email responds to your questions regarding a Living Machine® System for the project. Our response is intended to be an engineer's opinion of cost and is not a quote.

The following assumptions were made in preparing this response. We understand that the influent wastewater will be typical commercial and "municipal" wastewater generated by the airport, and will not contain high levels of metals or other inorganic industrial pollutants. The effluent will be discharged to a nearby stream. We have further assumed that the installation poses no unusual site challenges or requires any unusual construction techniques. Those site-specific issues could include soil conditions, topography, groundwater levels, etc. Also, we have assumed basic construction techniques will be appropriate with no unusual shapes or construction materials required for the wetland cells.

Based on this limited information and very preliminary evaluation of your situation, our response is as follows (we have deviated slightly from the order and structure of your questions):

1. Worrell Water Technologies (WWT) recommends a Tidal Wetland® Living Machine

System. Our newest technology, the Recirculating Tidal Wetland System would be a very good fit. There is no surface water in our systems and it can be planted with non-wetland plants, if desired, to avoid attracting waterfowl (aviation safety concerns).

2. Your plan calls for a total capacity of 100,000 gpd built out over time. We recommend two phases of 50,000 gpd each. This will require less capital investment up front and with the expansion designed into the overall plan, there will be some cost savings on the second phase (i.e., the cost of the second 50,000 gpd increment will be less than the first 50,000 gpd capacity).

3. The rough cost estimate for a 50,000 gpd Living Machine System is approximately $900,000. This cost is for an installed and working Living Machine System including engineering, permitting assistance, WWT specified components, software and site license, construction, commissioning and operator training. Also included is one year of operations support by WWT.

As you know, any onsite wastewater treatment system will require primary treatment, and accordingly is not included in our estimate. A primary screening system would probably be the best approach for primary treatment for a system of this size. We estimate a primary screening system would cost between $75,000 and $100,000 installed depending on the size and type.

4. WWT could provide the system in a design-build fashion working with our partner firms. Alternatively, WWT can supply the engineering and main components, then work with Burns & McDonnell and an approved contractor for installation. In the latter case the "package" cost for WWT supplied materials and services would be about $550,000. The estimated site installation costs would be about $350,000 assuming level site and "greenfield" conditions.

5. Life cycle costs for a Living Machine® system are typically significantly less than other onsite treatment systems. A major reason for this advantage is that there is no secondary sludge generated, and therefore no cost for removal or handling. Also, the system is Internet enabled and can be monitored and controlled remotely. Exact operation and maintenance costs are dependent upon operational and monitoring requirements set by the state. Contract operations services could range from $1000 to $2500 per month including monitoring analyses. Electrical operational cost are about $2000 per year at $0.10/kW-hr. The moving parts in the system are 6 heavy-duty submersible pumps and 4 electrical valves that will likely run for at least ten years. Replacement cost would be about $8000, total, when needed. Vegetation maintenance on 1-2 year intervals costs about $1000.

6. Electrical power (3 phase 200V or 230V) and Internet connection are the only utilities required.

7. System footprint: Living Machine systems are significantly smaller than other constructed wetlands. For the entire 100,000 gpd flow, the Tidal Wetland Cells would be approximately 12,000 sq. ft. including buffer and access. Also needed is an area of about

2,000 sq. ft for buried tanks and a small shed to protect the control panel. These areas can be dual use space, since there is no odor, health hazard, or potential for contact with wastewater (subsurface).

8. WWT has delivered working systems in about 6 months, when there is no need to wait on other aspects of a construction project (such as when the Living Machine is to be part of a new building). For the Lawrence Airport project, design, supply of components and construction could likely be complete within 6 months from project start, assuming no construction delays from weather, permitting, or other factors outside of our control. Start up and commissioning is an additional month. Permitting can be started early and run in parallel with the system design to avoid delays.

9. The system can be configured for Total Nitrogen less than 8 mg/L. That level would likely require a final denitrifying wetland or process and could add about $50,000. The Tidal Wetland will remove some phosphorus. Long-term phosphorous removal is something on which there is not sufficient data currently. This will be assessed further in Preliminary Engineering.

We will also send you additional materials including a detailed system description. Please let me know if I can be of further assistance. Feel free to call my cell phone (301.908.6431) or Dave Maciolek (434.249.4497) for specific questions. As I said on the phone, I may be easier to reach than Dave for the next couple of days, so you may want to start with me and I will get Dave involved on the technical questions.

Again, we appreciate your interest in Living Machine technology. We look forward to the opportunity of working with you on this project and as I said on the phone, we will be glad to arrange a trip to your offices to present the science and technology behind Living Machine wastewater treatment systems.

Sincerely,

Will

William Kirksey, P.E.
Senior Vice President
Worrell Water Technologies, LLC
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434-973-6365 ex 127 office
301-908-6431 mobile
wkirksey@worrellwater.com

ABOUT / HOW IT WORKS

We build it...Nature does the work

Worrell Water Technologies' Living Machines® are treating wastewater and generating clean water for reuse in dozens of installations around the globe. Our proprietary technology and years of R&D know-how make Living Machine® the most tested and reliable ecological wastewater treatment solution for use by:

- municipalities
- residential and office developments
- schools
- hotels and resorts
- government facilities
- business and industry
- the military
- zoos and animal shelters
- farms and food processing facilities...

Living Machines® require only a small amount of space. They work indoors or outdoors, and each is tailored to the needs of the client. We build them to conform to the demands of the location and of the local climate.

As a result, each Living Machine® installation is different. But most share a number of common features.

Indoor Living Machine, Norder Zoo, Emmen, The Netherlands

- **Settling Tank:** Before the water can enter the system, it must be gathered in a tank where the flow is equalized and solids are allowed to settle. Larger installations will use a filter for the same purpose.
- **Control System:** The flow of water through the system is managed by a central control system, which also monitors system performance. Our control system is the best in the industry, and it uses a web-based interface to track water levels and control flow rates through the system. At the same time it monitors water quality and can send alerts to remote locations if it senses a problem with the system.
- **Wetlands Installations:** At the heart of the Living Machine® are the wetland beds which contain gravel aggregate, specially engineered films of beneficial microorganisms, and plants working together in a living, highly complex, ecosystem. The newest generation of Living Machine® uses three patented wetland designs. Depending on the needs of the project, one or all of these wetlands types can be used in a Living Machine.
  - **Tidal Flow Wetland:** This proprietary design developed by Worrell Water Technologies has a smaller footprint than other conventional constructed wetlands. It also provides superior removal of nitrogen, a key step in treating wastewater. The system consists of a series of tidal cells which drain and flood many times per day. The tidal cycles bring oxygen to the beneficial microorganisms that do most of the work.
  - **Horizontal Subsurface Flow Wetland:** This simple, extremely low energy, wetland provides good initial treatment and equalizes the flow of water entering a Tidal Flow

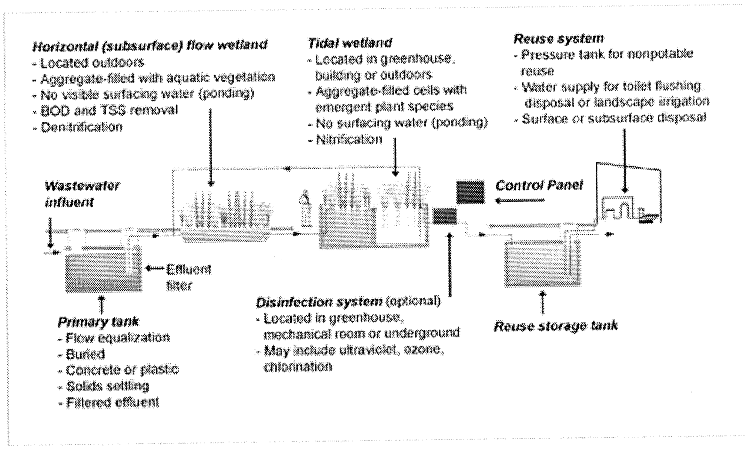
More in this Section:

- How It Works
- History
- FAQ
- Contact

Wetland. The presence of this initial treatment stage allows for greater flow rates, energy efficiency, and capacity for the entire system.

- **Vertical Flow Wetland:** This wetland design provides the ideal final, or "polishing," stage of water treatment. Water enters near the surface of the wetland, and passes through two zones containing beneficial microorganisms as it trickles down through the system. If the wastewater has been previously treated by another wetland type, the Vertical Flow Wetland is extremely efficient at final removal of nitrogen and solids.

- **Disinfection System:** This optional step can use ozone, ultraviolet, or chlorine (alone or in combination) to kill any pathogens that are left in the water. Depending on the types of wastewater being treated, disinfection systems may be required before water can be reused or discharged into the environment.
- **Reuse System:** Clean, treated water is gathered in a storage tank, and distributed for reuse. Uses for water recycled by the Living Machine® can include: toilet flushing, animal and pen cleaning, irrigation, decorative surface features such as ponds or waterfalls, or return directly to the environment.



Schematic example of a Living Machine®

To find out more about our patented wastewater treatment systems, visit the History page.

To read about the Living Machine® in action, visit our Portfolio.

For more detailed technical information, see our Resources page.

APPENDIX C
SMITH & LOVELESS INFORMATION

BUDGET PROPOSAL SUMMARY
Field Erected OXIGEST - WASTEWATER TREATMENT PLANT
Lawrence, KS. - Airport
October 8, 2009

1.0 GENERAL DESCRIPTION

The influent and desired effluent design parameters to the Smith & Loveless, Inc. field erected packaged plant Model 52RE100, are summarized in Table A and treated effluent design parameters are summarized in Table B.

Table A – Influent Design Parameters

Normal Design Flow – 100,000 gallons per day.
BOD Design Concentration – 300 mg/l.
TSS Design Concentration – 300 mg/l.
TKN (assumption) – 60 mg/l.

Table B – Design Effluent Parameters

BOD Design Concentration – 30 mg/l.
TSS Design Concentration – 30 mg/l.
NH-3 Design Concentration – 10 mg/l

2.0 PROCESS/EQUIPMENT DESCRIPTION

2.01 MODEL RE WASTEWATER TREATMENT SYSTEM

The wastewater stream would enter a flow equalization zone within the S&L field erected packaged treatment plant. The plant would have the air supply distribution pipes and coarse bubble diffusers for the flow equalization zone, aeration zone, sludge holding zone, and included would be the necessary clarifier return/waste airlift pump.

The dimensions of the Model 52RE100 plant is as follows:

- Outer Tank Diameter, 66’0”.
- Inner Tank Diameter, 18’10”.
- Sidewater depth, 15’0”.
- Tank height, 16’6”.

The compartments and volumes included in each:

- Flow equalization zone – 33,300 gallons.
- Aeration Zone – 187,000 gallons.
- Sludge Holding/Aerobic Digester Zone – 11,900 gallons.
- Clarifier – 287 square feet surface area.

All zones, but the clarifier, are found in the annular ring section of the plant. A typical Model RE Wastewater Treatment Plant is shown below (shown with a steel outer tank).

2.02 Air Blowers/Air Requirements

The treatment plant would be supplied with (2) main air blowers, each with approximately 28 HP motors. One of the main air blowers will be stand by. Required pressure is 7 psi. Blower controls included.

<u>3.0 DELIVERY, TERMS, BUDGET PRICING</u>

3.01 Delivery

Submittal drawings and other technical engineering details are expected to be complete in 6-8 weeks after receipt of a purchase order. Once Smith & Loveless receives approved drawings, manufacturing would take 18-20 weeks. Field erection and painting to take approximately 6 to 8 weeks.

3.02 Payment Terms

To be determined.

3.03 Budget Price List (FOB, Factory) – Offer Valid for 90 days.

- One Model 52RE100 with concrete outer tank…….…………….………$395,000.
    - Add for steel outer tank…………………………………...……$55,000.
    - Add for 30 HP Main Process Blowers…………………………..….$35,000.
    - Add for 4 HP Flow Equalization Blowers………………….…....$10,000.
- Bar screen…………………………………………………………Included.
- Air Blowers/controls……………….…….……………………………Included.
- Estimated Freight…………………….……………………………...Included.
- Field Erection ……………………….………………………………Included.

3.04 Field Services

Included with non-union, non-prevailing wages.

3.05 Items Not Included/Additional Notes

- Interconnecting piping and wiring outside tanks.
- Tank cover.
- Concrete slab.
- Any civil work.
- Any lighting, landscaping of the site.
- Site preparation.
- Excavation or rock work.
- Embedded supports or anchorage items.
- Design and construction of foundations.
- Field testing and inspection services.
- Procurement of right of ways or easements.
- Over-spray protection of surroundings.

From: Joe Maris
To: Schrock, Nicholas; Gonzalez, Reinaldo;
Subject: FW: Lawrence Airport Expansion
Date: Wednesday, October 21, 2009 1:23:19 AM

One quick clarification for you. I asked S&L to explain the discrepancy in the dimensions between their comments below and the budget proposal. S&L forwarded the following comments. Let me know if I can do anything else to help.

Joe

PER S&L
Sorry for the confusion. Our process group has suggested a 51.1' inside diameter dimension. Which means the outside dimension would be 55'. The concrete pad is approximately 2' longer than the plant wall and is subject to change based upon the design load and the engineers preference.

-----Original Message-----
From: Joe Maris
Sent: Friday, October 16, 2009 6:50 AM
To: 'Schrock, Nicholas'; Gonzalez, Reinaldo
Subject: Lawrence Airport Expansion

Good morning,

Attached is a budget proposal for a 100,000 gallon per day Model R and a typical layout. Smith & Loveless proposed this option because this design will allow for the most flexibility given the current flows and then future expectations. I noticed a discrepancy in the size of the tank (footprint) between the info below and the budget price. I will get the footprint clarified and send you the dimension later today.

The S&L package plant includes a small manual bar screen. I am still planning to forward info to you for an enclosed mechanical bar screen, as well as a UV disinfection system. More info to follow.

Joe

PER S&L

SYSTEM DESCRIPTION:

The influent flow will enter into a 3/4 inch manual clean bar screen, found along the annular section of the tankage and then fall by gravity into the Flow Equalization zone (FE). The FE zone is designed to receive large slug flows and will have a Mini-Ject dosing pump. The Mini-Ject is a pneumatic airlift that will be set to deliver a constant flow into aeration zone over a 24 hour period. The aeration zone will have coarse bubble diffusion, and is also found along the annular section of the Model R. The center section of the Model R is the clarifier. The base of the clarifier will have rotating sludge scrapper arms that drive the settled sludge towards the center, for automatic removal. Additionally we have a rotating surface skimmer, which removes the floating matter. The solids from the clarifier is airlifted to the Sludge Storage zone(SS). The SS is also found along the annular section of the Model R. The current design and footprint has 12 day sludge storage zone at a 2% decant.

TYPICAL INSTALLATION COST:
The contractor will need to supply a 55' diameter concrete slab, (and outer walls if that option is chosen.) Install the inlet and outlet piping. Set and Install the blowers, panel and electrical chases. Depending on material and what is existing, we have seen this figure on this size system run between $100,000 - $175,000 just for the plant itself. The area lighting, fencing, buildings (if needed) would be additional.

_O&M BUDGET
_Electrical usage at .10 /kwh 1 year $18,445.00 Operator Labor 1 visit per week 2-4 hrs per visit @ $50.00 per hour for a class C Operator $7,800 Chemical cost 141 lb/d Sodium Bicarbonate, used until the plant has stable influent alkalinity. Assume 1 year ($5,200)

UTILITY DESCRIPTION:
The blowers and controls will require 3 phase 60 hertz 460 volt.
We do not require water for the operation of the plant but would think that a 1" yard hydrant would be be nice for clean up and maintenance.

_FOOT PRINT
_The plant is 55' true outside diameter
The blowers would fit on a 10 x 10 pad.

_ITEMS NOT INCLUDED:
_- Interconnecting piping and wiring outside tanks.
- Tank cover.
- Concrete slab.
- Any civil work.

- Any lighting, landscaping of the site.
- Site preparation.
- Excavation or rock work.
- Embedded supports or anchorage items.
- Design and construction of foundations.
- Procurement of right of ways or easements.

_DELEVERY TIME:
Option 1_
Submittal drawings and other technical engineering details 6-8 weeks after receipt of a purchase order.
Manufacturing would take 14-20 weeks. (Heavily depends on the outer wall material)
Field erection and painting to take approximately 3 to 8 weeks. (Heavily depends on the outer wall material)

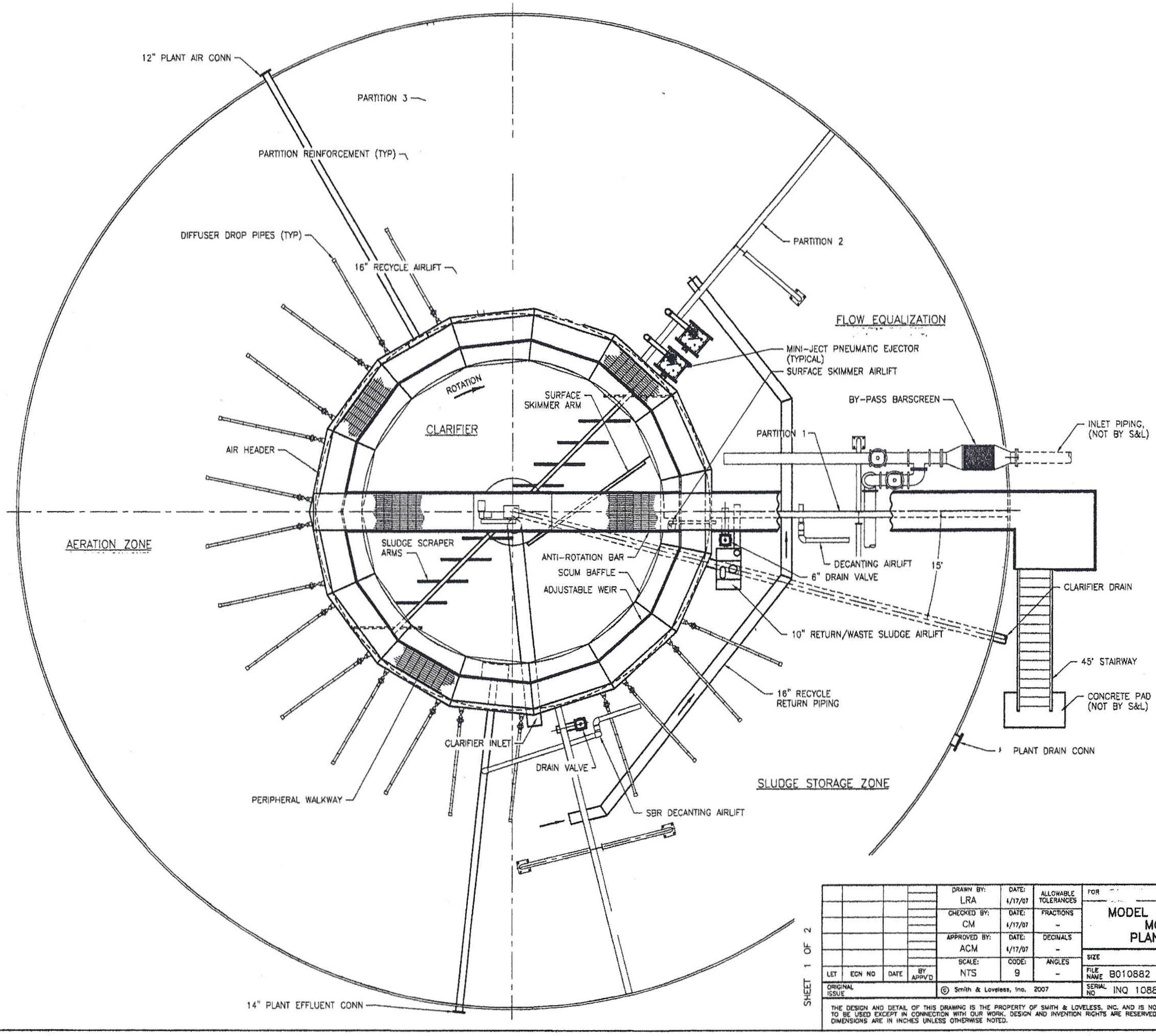
Option II
Submittals approval process waived and immediately release to manufacturing (once complete you will receive a copy) Manufacturing would take 14-20 weeks. (Heavily depends on the outer wall material)
Field erection and painting to take approximately 3 to 8 weeks. (Heavily depends on the outer wall material)

_TURNDOWN
_ The current design will allow for low flows of 20,000 gpd with no change in equipment, or temporary components.

We understand that the initial flow is a fraction of the overall final build out flow and there are several options with this style of system.

From using the sludge storage zone as the original aeration basin, to having a longer SRT time, or recycle the WAS to the head of aeration, to even using VFD controls on the blowers to turn down the blower speed, there for scfm, in turn saving money on electrical costs.

FUTURE FLOWS;
By simply adding an anoxic zone we will easily meet a TN of 8 mg/L TP can be removed by adding alum to the aeration zone and wasted with the sludge, or a separate filter can be added.



SHEET 1 OF 2

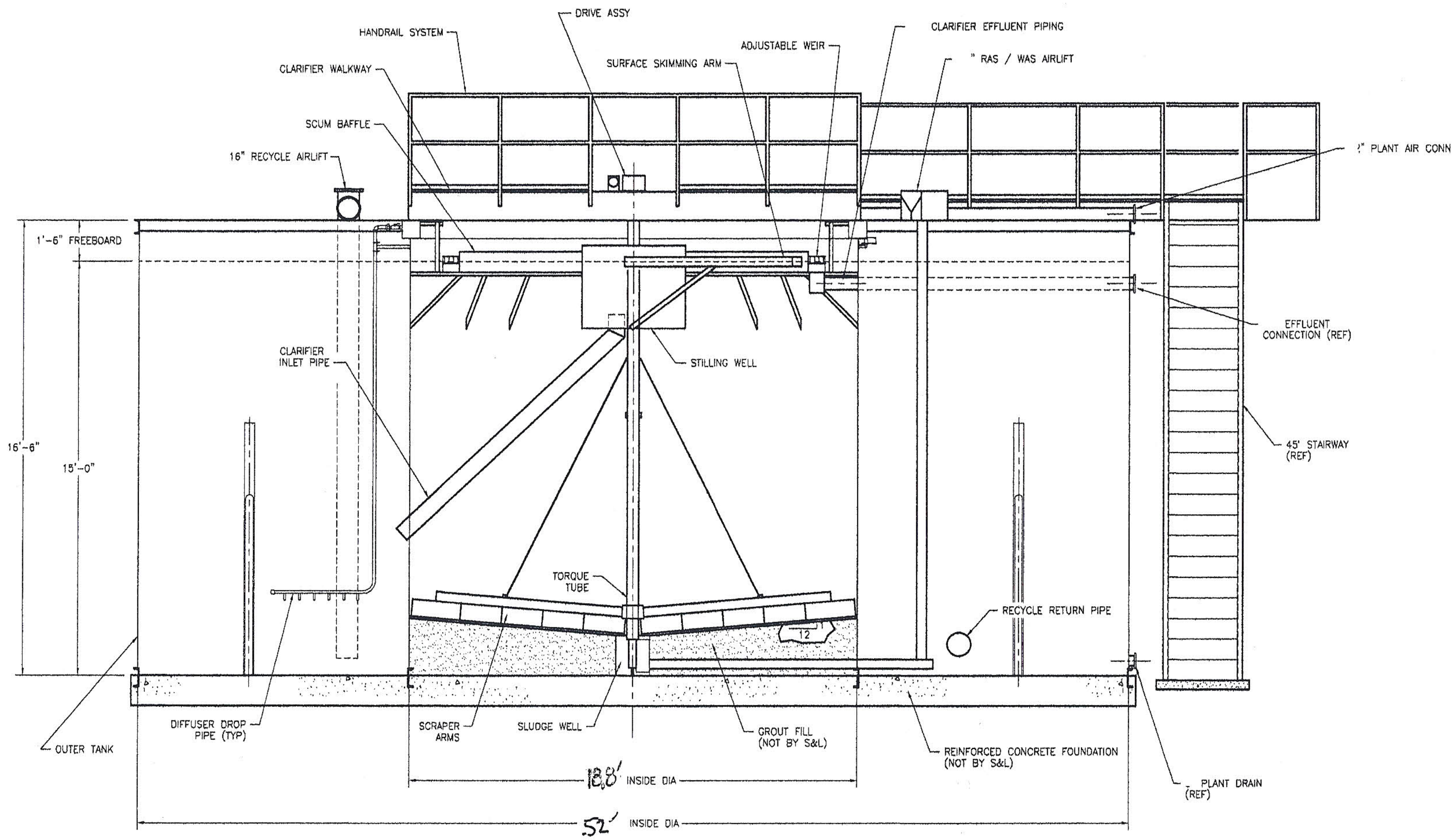
LET	ECN NO	DATE	BY APPV'D	DRAWN BY: LRA	DATE: 4/17/07	ALLOWABLE TOLERANCES
				CHECKED BY: CM	DATE: 4/17/07	FRACTIONS -
				APPROVED BY: ACM	DATE: 4/17/07	DECIMALS -
				SCALE: NTS	CODE: 9	ANGLES -
ORIGINAL ISSUE				© Smith & Loveless, Inc. 2007		

FOR

MODEL R TREATMENT PLANT
MODEL 82RE200
PLAN AND ELEVATION

SIZE	U/M EA	WT.
FILE NAME B010882		PLOT SCALE 1=64
SERIAL NO INQ 10882	DWG NO B10882-1	REV

Smith & Loveless, Inc.



SECTIONAL ELEVATION VIEW
(SEE PLAN VIEW FOR PROPER ORIENTATION)

SHEET 2 OF 2

LET	ECN NO	DATE	BY APPV'D	DRAWN BY: LRA	DATE: 4/17/07	ALLOWABLE TOLERANCES	FOR
				CHECKED BY: CM	DATE: 4/17/07	FRACTIONS -	MODEL R TREATMENT PLANT MODEL 82RE200 PLAN AND ELEVATION
				APPROVED BY: ACM	DATE: 4/17/07	DECIMALS -	SIZE / U/M EA / WT.
				SCALE: NTS	CODE: 9	ANGLES -	FILE NAME B010882 / PLOT SCALE 1=64
ORIGINAL ISSUE				© Smith & Loveless, Inc. 2007			SERIAL NO INQ 10882 / DWG NO B10882-1 / REV

DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

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APPENDIX D
COST BREAKDOWN TABLES

Septage Holding Well

Description	Quantity	Unit	Unit Cost	Total Cost
Concrete Well (10,000 gal)	80	CY	$500	$40,000
Excavation	2,854	CY	$12.0	$34,244
Site Preparation	1	LS	$10,000	$10,000
Aeration System (Blower and Coarse Bubble Diffusers)	1	LS	$15,000	$15,000
Odor Control	1	LS	$40,000	$40,000
		Equipment Subtotal		**$139,000**
Electrical and Instrumentation (15% of Equip)	0.15			$8,250
			Subtotal	**$147,000**
Field Overhead (7%)	0.07			$10,290
			Subtotal	**$157,000**
Home Office (2%)	0.02			$3,140
			Subtotal	**$160,000**
Subcontractor Overhead and Profit (7%)	0.07			$11,200
			Subtotal	**$171,000**
Prime Contractor Overhead and Profit (15%)	0.15			$25,650
			Subtotal	**$197,000**
Contingency (30%)	0.30			$59,100
			Subtotal	**$256,000**
Engineering				$75,000
Opinion of Probable Construction Cost				**$331,000**

Description	Quantity	Unit	Unit Cost	Total Cost
Electricity	65,350	kW-hr	$0.05	$3,267
Septage Hauling/Disposal	364,000	GAL	$0.10	$36,400
Activated Carbon Replacement	2,000	LBS	$4	$8,000
Labor	260	HR	$40	$10,400
			Subtotal	**$58,000**
Contingency (20%)	0.2			$11,600
Opinion of Probable Annual O&M Cost				**$70,000**

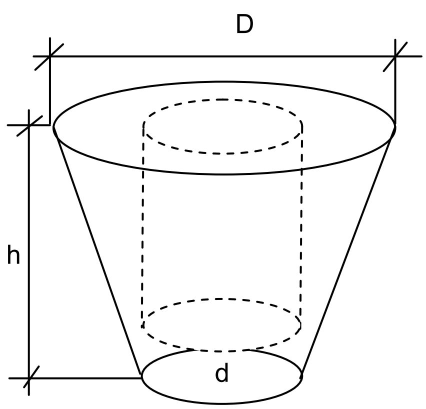
Present Value	
5-Year Period	**$800,000**

Assumptions

Number of years =	5			
Interest Rate =	8%			
Wastewater Generation =	1,000	gal/day		
Operating days per week =	7	days/week		
Number of Aeration Blowers in Operation =	1			
Aeration Blower Horsepower =	5	HP		
	3.73	kW-hr		
Exhaust Fan for the Odor Control =	5	HP		
	3.73	kW-hr		
Carbon Replacement per Year =	2,000	lbs		
Operator attention =	1	hr/day	5	days/week
Holding Well Dimensioning:				
Working Volume =	10,000	gal		
	1337	cu ft		
Depth =	30	ft		
Surface Area =	113	sq ft		
Total Volume =	3,393	cu ft		
	25,379	gal		
Assume Circular Basin:				
Diameter =	12.0	ft		
Slab Thickness =	2.5	ft		
Wall Thickness =	2	ft		
Concrete Volume =	2168	cu ft		
	80.3	cu yd		

Excavation Calculations:

Slope wall (V/H) of 1 to 1



$V = (\pi/12) * h * (D^2 + D * d + d^2)$

h =	34	ft
d =	16	ft
D =	84	ft
Volume =	77,049	cu ft
	2,854	cu yd

Lift Station and Force Main

Description	Quantity	Unit	Unit Cost	Total Cost
Pumps (2 @ 23 HP)	1	LS	$84,000	$84,000
Force Main (6-inch, PVC Pipe)	8,000	LF	$40.00	$320,000
Manholes and Air Release Valves	1	LS	$20,000	$20,000
Demolition of Aeration System	1	LS	$10,000	$10,000
Valve Vault and Meter Vault	1	LS	$130,000	$130,000
Easement Cost (10 ft wide by 8,000 ft long)	80,000	SQ FT	$0.35	$28,000
			Equipment Subtotal	**$592,000**
Electrical and Instrumentation (15% of Equip)	0.15			$32,100
			Subtotal	**$624,000**
Field Overhead (7%)	0.07			$43,680
			Subtotal	**$668,000**
Home Office (2%)	0.02			$13,360
			Subtotal	**$681,000**
Subcontractor Overhead and Profit (7%)	0.07			$47,670
			Subtotal	**$729,000**
Prime Contractor Overhead and Profit (15%)	0.15			$109,350
			Subtotal	**$838,000**
Contingency (30%)	0.30			$251,400
			Subtotal	**$1,089,000**
Engineering (12%)	0.12			$130,680
Opinion of Probable Construction Cost				**$1,220,000**

Description	Quantity	Unit	Unit Cost	Total Cost
Electricity	633,891	kW-hr	$0.05	$31,695
Activated Carbon Replacement	2,000	LBS	$4	$8,000
Labor	520	HR	$40	$20,800
			Subtotal	**$60,495**
Contingency (20%)	0.20			$12,099
Opinion of Probable Annual O&M Cost				**$73,000**

Present Value	
15-Year Period	**$2,600,000**

Assumptions

Number of years =	15			
Interest Rate =	8.0%			
No. of Pumps in Operation =	2			
Hours of Operation per Day =	24	hours		
Pump Horsepower =	23	HP		
	34.316	kW-hr		
Exhaust Fan for the Odor Control =	5	HP		
	3.73	kW-hr		
Carbon Replacement per Year =	2,000	lbs		
Operator attention =	2	hr/day	5	days/week

Constructed Wetlands

Description	Quantity	Unit	Unit Cost	Total Cost
Pumps (2 @ 23 HP)	1	LS	$84,000	$84,000
Valve Vault and Meter Vault	1	LS	$130,000	$130,000
Screen and Screen Channel	1	LS	$100,000	$100,000
Screen Insulation	1	LS	$10,000	$10,000
UV Disinfection	1	LS	$25,000	$25,000
Pipe from PS to Constructed Wetland	8,200	LF	$40.0	$328,000
Easement Cost (10 ft wide by 4,400 ft long)	44,000	SQ FT	$0.35	$15,400
Manholes and Air Release Valves	1	LS	$20,000	$20,000
		Equipment Subtotal		**$712,000**
Electrical and Instrumentation (15% of Equip)	0.15			$50,850
			Subtotal	**$763,000**
Field Overhead (7%)	0.07			$53,410
			Subtotal	**$816,000**
Home Office (2%)	0.02			$16,320
			Subtotal	**$832,000**
Subcontractor Overhead and Profit (7%)	0.07			$58,240
			Subtotal	**$890,000**
Prime Contractor Overhead and Profit (15%)	0.15			$133,500
			Subtotal	**$1,024,000**
Installed Constructed Wetland (100,000 gal)	1	LS	$1,530,000	$1,530,000
			Subtotal	**$2,554,000**
Contingency (30%)	0.30			$766,200
			Subtotal	**$3,320,000**
Engineering (12%)	0.12			$122,880
Opinion of Probable Construction Cost				**$3,440,000**

Description	Quantity	Unit	Unit Cost	Total Cost
Electricity	651,341	kW-hr	$0.05	$32,567
Wetland Electrical Operational	1	LS	$2,000	$2,000
Activated Carbon Replacement	2,000	LBS	$4	$8,000
Screenings Hauling/Disposal	23	CY	$60	$1,380
Labor	1,248	HR	$40	$49,920
Parts	1	LS	$8,000	$8,000
Vegetation Maintenance	1	LS	$1,000	$1,000
			Subtotal	**$102,867**
Contingency (20%)	0.20			$20,573
Opinion of Probable Annual O&M Cost				**$123,000**

Present Value	
15-Year Period	**$5,000,000**

Assumptions

Number of years =	15			
Interest Rate =	8.0%			
No. of Pumps in Operation =	2			
Hours of Operation per Day =	24	hours		
Pump Horsepower =	23	HP		
	34.3	kW-hr		
UV Lamps Power Consumption =	0.5	kW-hr		
UV Lamps Hours of Operation =	24	hours		
Operator attention =	4	hr/day	6	days/week
Screenings Generation =	0.063	cy/day		
Exhaust Fan for the Odor Control =	5	HP		
	3.73	kW-hr		
Odor Control Hours of Operation =	24	hours		
Carbon Replacement per Year =	2,000	lbs		
Screen Horsepower =	2	HP		
	1.49	kW-hr		
Screen Hours of Operation per day =	24	hours		

Package Wastewater Treatment Plant

Smith&Loveless

Description	Quantity	Unit	Unit Cost	Total Cost
Site Work	1	LS	$10,000	$10,000
Pumps (2 @ 23 HP)	1	EA	$84,000	$84,000
Valve Vault and Meter Vault	1	LS	$130,000	$130,000
Package Treatment WWTP (0.1 mgd capacity)	1	LS	$595,000	$595,000
Package WWTP Concrete Pad	210	CY	$500	$105,000
Screen and Screen Channel	1	LS	$100,000	$100,000
Screen Insulation	1	LS	$10,000	$10,000
UV Disinfection	1	LS	$25,000	$25,000
Pipe from PS to Package WWTP	8,200	LF	$40.0	$328,000
Easement Cost (10 ft wide by 4,400 ft long)	44,000	SQ FT	$0.35	$15,400
Manholes and Air Release Valves	1	LS	$20,000	$20,000
		Equipment Subtotal		**$1,422,000**
Electrical and Instrumentation (15% of Equip)	0.15			$140,100
			Subtotal	**$1,562,000**
Field Overhead (7%)	0.07			$109,340
			Subtotal	**$1,671,000**
Home Office (2%)	0.02			$33,420
			Subtotal	**$1,704,000**
Subcontractor Overhead and Profit (7%)	0.07			$119,280
			Subtotal	**$1,823,000**
Prime Contractor Overhead and Profit (15%)	0.15			$273,450
			Subtotal	**$2,096,000**
Contingency (30%)	0.30			$628,800
			Subtotal	**$2,725,000**
Engineering (12%)	0.12			$327,000
Opinion of Probable Construction Cost				**$3,050,000**

Description	Quantity	Unit	Unit Cost	Total Cost
Electricity	910,289	kW-hr	$0.05	$45,514
Activated Carbon Replacement	2,000	LBS	$4	$8,000
Screenings Hauling/Disposal	23	CY	$60.00	$1,380
Sludge Disposal	383,250	GAL	$0.10	$38,325
Labor	1,248	HR	$40	$49,920
			Subtotal	**$143,139**
Contingency (20%)	0.20			$28,628
Opinion of Probable Annual O&M Cost				**$172,000**

Present Value	
15-Year Period	**$4,900,000**

Assumptions

Number of years =	15			
Interest Rate =	8.0%			
No. of Feed Pumps in Operation =	2			
Feed Pumps Hours of Operation =	24	hours		
Feed Pumps Horsepower =	23	HP		
	34.316	kW-hr		
No. of RAS Pumps in Operation =	1.5			
RAS Pumps Hours of Operation =	12	hours		
RAS Pumps Horsepower =	5	HP		
	5.595	kW-hr		
UV Lamps Power Consumption =	0.5	kW-hr		
Aeration Blowers in Operation =	1			
Aeration Blowers Hours of Operation =	24	hours		
Aeration Blower Horsepower =	30	HP		
	22.38	kW-hr		
EQ Basin Blowers =	4	HP		
	2.984	kW-hr		
EQ Basin Blowers Hours of Operation =	24	hours		
Exhaust Fan for the Odor Control =	5	HP		
	3.73	kW-hr		
Carbon Replacement per Year =	2,000	lbs		
Operator Attention =	4	hr/day	6	days/week
WW Flow Rate =	0.1	mgd		
BOD Concentration =	300	mg/L		
BOD Loading =	250	lbs/day		
Biosolids Yield =	0.7			
Biosolids Generation =	175	lbs/day		
Solids Content of Biosolids =	2	%		
Volume of Biosolids =	1,050	gal/day		
Screenings Generation =	0.63	cy/mg		
	0.063	cy/day		
Screen Horsepower =	2	HP		
	1.49	kW-hr		
Screen Hours of Operation per day =	24	hours		
Concrete Pad				
Diameter =	60	ft		
Thickness =	2	ft		
Volume =	5655	cu ft		
	209	cu yd		

Present Worth Analysis for Lift Station and Force Main

Discount Rate 8.00%

Year	Disposal	Labor	Unit Cost	Labor Cost	Energy Usage	Unit Cost	Energy Cost	Carbon	Unit Cost	Carbon Cost	Const Cost	Annual Cost	Present Value		
	($)	(HR/YR)	($/HR)	($/YR)	(KWH/YR)	($/KWH)	($/YR)	(LBS/YR)	($/LBS)	($/YR)	($/YR)	($/YR)	**($)**		
2010	$ 36,400	260	$40	$10,400	65,350	$0.050	$3,267	2,000	$4.00	$8,000	$287,000	$116,067	$394,470	1	
2011	$37,492	260	$41	$10,712	65,350	$0.052	$3,366	2,060	$4.12	$8,487	$0	$118,057	$101,215	2	
2012	$38,617	260	$42	$11,033	65,350	$0.053	$3,466	2,122	$4.24	$9,004	$0	$120,121	$95,356	3	
2013	$39,775	260	$44	$11,364	65,350	$0.055	$3,570	2,185	$4.37	$9,552	$0	$122,263	$89,867	4	
2014	$40,969	260	$45	$11,705	65,350	$0.056	$3,678	2,251	$4.50	$10,134	$0	$124,486	$84,723	5	**$765,630**
2015	$0	520	$46	$24,113	-	$0.058	$0	2,319	$4.64	$10,751	$1,220,000	$95,359	$1,280,092	6	
2016	$0	520	$48	$24,836	-	$0.060	$0	2,388	$4.78	$11,406	$0	$96,737	$56,445	7	
2017	$0	520	$49	$25,581	-	$0.061	$0	2,460	$4.92	$12,101	$0	$98,177	$53,042	8	
2018	$0	520	$51	$26,349	-	$0.063	$0	2,534	$5.07	$12,838	$0	$99,681	$49,865	9	
2019	$0	520	$52	$27,139	-	$0.065	$0	2,610	$5.22	$13,619	$0	$101,253	$46,900	10	
2020	$0	520	$54	$27,953	-	$0.067	$0	2,688	$5.38	$14,449	$0	$102,897	$44,131	11	
2021	$0	520	$55	$28,792	-	$0.069	$0	2,768	$5.54	$15,329	$0	$104,615	$41,544	12	
2022	$0	520	$57	$29,656	-	$0.071	$0	2,852	$5.70	$16,262	$0	$106,413	$39,128	13	
2023	$0	520	$59	$30,546	-	$0.073	$0	2,937	$5.87	$17,253	$0	$108,293	$36,869	14	
2024	$0	520	$61	$31,462	-	$0.076	$0	3,025	$6.05	$18,303	$0	$110,260	$34,759	15	
2025	$0	520	$62	$32,406	-	$0.078	$0	3,116	$6.23	$19,418	$0	$112,318	$32,785	16	
2026	$0	520	$64	$33,378	-	$0.080	$0	3,209	$6.42	$20,601	$0	$114,473	$30,939	17	
2027	$0	520	$66	$34,379	-	$0.083	$0	3,306	$6.61	$21,855	$0	$116,729	$29,211	18	
2028	$0	520	$68	$35,411	-	$0.085	$0	3,405	$6.81	$23,186	$0	$119,091	$27,595	19	
2029	$0	520	$70	$36,473	-	$0.088	$0	3,507	$7.01	$24,598	$0	$121,566	$26,082	20	
													$2,595,016		

Present Worth Analysis for Wetlands

Discount Rate 8.00%

Year	Disposal	Labor	Unit Cost	Labor Cost	Energy Usage	Unit Cost	Energy Cost	Carbon	Unit Cost	Carbon Cost	Const Cost	Annual Cost	Present Value	
	($)	(HR/YR)	($/HR)	($/YR)	(KWH/YR)	($/KWH)	($/YR)	(LBS/YR)	($/LBS)	($/YR)	($/YR)	($/YR)	**($)**	
2010	$ 36,400	260	$40	$10,400	65,350	$0.050	$3,267	2,000	$4.00	$8,000	$287,000	$69,667	$351,507	1
2011	$37,492	260	$41	$10,712	65,350	$0.052	$3,366	2,060	$4.12	$8,487	$0	$71,657	$61,434	2
2012	$38,617	260	$42	$11,033	65,350	$0.053	$3,466	2,122	$4.24	$9,004	$0	$73,721	$58,522	3
2013	$39,775	260	$44	$11,364	65,350	$0.055	$3,570	2,185	$4.37	$9,552	$0	$75,863	$55,761	4
2014	$40,969	260	$45	$11,705	65,350	$0.056	$3,678	2,251	$4.50	$10,134	$0	$78,086	$53,144	5
2015	$1,380	1,248	$46	$57,871	651,341	$0.058	$37,754	2,319	$4.64	$10,751	$3,440,000	$139,329	$3,527,801	6
2016	$1,421	1,248	$48	$59,607	651,341	$0.060	$38,887	2,388	$4.78	$11,406	$0	$142,894	$83,377	7
2017	$1,464	1,248	$49	$61,395	651,341	$0.061	$40,053	2,460	$4.92	$12,101	$0	$146,586	$79,196	8
2018	$1,508	1,248	$51	$63,237	651,341	$0.063	$41,255	2,534	$5.07	$12,838	$0	$150,411	$75,243	9
2019	$1,553	1,248	$52	$65,134	651,341	$0.065	$42,493	2,610	$5.22	$13,619	$0	$154,373	$71,504	10
2020	$1,599	1,248	$54	$67,088	651,341	$0.067	$43,767	2,688	$5.38	$14,449	$0	$158,477	$67,968	11
2021	$1,647	1,248	$55	$69,101	651,341	$0.069	$45,080	2,768	$5.54	$15,329	$0	$162,731	$64,623	12
2022	$1,697	1,248	$57	$71,174	651,341	$0.071	$46,433	2,852	$5.70	$16,262	$0	$167,139	$61,457	13
2023	$1,748	1,248	$59	$73,309	651,341	$0.073	$47,826	2,937	$5.87	$17,253	$0	$171,709	$58,460	14
2024	$1,800	1,248	$61	$75,508	651,341	$0.076	$49,261	3,025	$6.05	$18,303	$0	$176,446	$55,623	15
2025	$1,854	1,248	$62	$77,774	651,341	$0.078	$50,738	3,116	$6.23	$19,418	$0	$181,358	$52,937	16
2026	$1,910	1,248	$64	$80,107	651,341	$0.080	$52,261	3,209	$6.42	$20,601	$0	$186,451	$50,392	17
2027	$1,967	1,248	$66	$82,510	651,341	$0.083	$53,828	3,306	$6.61	$21,855	$0	$191,734	$47,981	18
2028	$2,026	1,248	$68	$84,985	651,341	$0.085	$55,443	3,405	$6.81	$23,186	$0	$197,214	$45,697	19
2029	$2,087	1,248	$70	$87,535	651,341	$0.088	$57,107	3,507	$7.01	$24,598	$0	$202,900	$43,532	20
													$4,966,160	

Present Worth Analysis for Package Wastewater Treatment Plant

Discount Rate 8.00%

Year	Disposal	Labor	Unit Cost	Labor Cost	Energy Usage	Unit Cost	Energy Cost	Carbon	Unit Cost	Carbon Cost	Const Cost	Annual Cost	Present Value	
	($)	(HR/YR)	($/HR)	($/YR)	(KWH/YR)	($/KWH)	($/YR)	(LBS/YR)	($/LBS)	($/YR)	($/YR)	($/YR)	**($)**	
2010	$ 36,400	260	$40	$10,400	65,350	$0.050	$3,267	2,000	$4.00	$8,000	$287,000	$69,667	$351,507	1
2011	$37,492	260	$41	$10,712	65,350	$0.052	$3,366	2,060	$4.12	$8,487	$0	$71,657	$61,434	2
2012	$38,617	260	$42	$11,033	65,350	$0.053	$3,466	2,122	$4.24	$9,004	$0	$73,721	$58,522	3
2013	$39,775	260	$44	$11,364	65,350	$0.055	$3,570	2,185	$4.37	$9,552	$0	$75,863	$55,761	4
2014	$40,969	260	$45	$11,705	65,350	$0.056	$3,678	2,251	$4.50	$10,134	$0	$78,086	$53,144	5
2015	$1,380	1,248	$46	$57,871	910,289	$0.058	$52,764	2,319	$4.64	$10,751	$3,050,000	$189,719	$3,169,555	6
2016	$1,421	1,248	$48	$59,607	910,289	$0.060	$54,347	2,388	$4.78	$11,406	$0	$193,734	$113,042	7
2017	$1,464	1,248	$49	$61,395	910,289	$0.061	$55,977	2,460	$4.92	$12,101	$0	$197,890	$106,914	8
2018	$1,508	1,248	$51	$63,237	910,289	$0.063	$57,656	2,534	$5.07	$12,838	$0	$202,192	$101,146	9
2019	$1,553	1,248	$52	$65,134	910,289	$0.065	$59,386	2,610	$5.22	$13,619	$0	$206,645	$95,717	10
2020	$1,599	1,248	$54	$67,088	910,289	$0.067	$61,168	2,688	$5.38	$14,449	$0	$211,257	$90,605	11
2021	$1,647	1,248	$55	$69,101	910,289	$0.069	$63,003	2,768	$5.54	$15,329	$0	$216,033	$85,790	12
2022	$1,697	1,248	$57	$71,174	910,289	$0.071	$64,893	2,852	$5.70	$16,262	$0	$220,979	$81,253	13
2023	$1,748	1,248	$59	$73,309	910,289	$0.073	$66,839	2,937	$5.87	$17,253	$0	$226,102	$76,979	14
2024	$1,800	1,248	$61	$75,508	910,289	$0.076	$68,845	3,025	$6.05	$18,303	$0	$231,410	$72,950	15
2025	$1,854	1,248	$62	$77,774	910,289	$0.078	$70,910	3,116	$6.23	$19,418	$0	$236,909	$69,151	16
2026	$1,910	1,248	$64	$80,107	910,289	$0.080	$73,037	3,209	$6.42	$20,601	$0	$242,608	$65,569	17
2027	$1,967	1,248	$66	$82,510	910,289	$0.083	$75,228	3,306	$6.61	$21,855	$0	$248,514	$62,190	18
2028	$2,026	1,248	$68	$84,985	910,289	$0.085	$77,485	3,405	$6.81	$23,186	$0	$254,636	$59,002	19
2029	$2,087	1,248	$70	$87,535	910,289	$0.088	$79,810	3,507	$7.01	$24,598	$0	$260,983	$55,993	20
													$4,886,224	