



## Innovation in Wastewater Treatment



"Our Principal Product is Our Knowledge"

### Summary Preliminary Design Information For

# **Aero-Fac<sup>®</sup> Wastewater Treatment System for the Reserve Treatment Facility**

For

**St. John the Baptist Parish, Louisiana**

Prepared For:  
Comite Resources  
September, 2006

Prepared by the Applications Engineering Department of LAS International Ltd.



LAS International Ltd., 216 North 23rd Street, Bismarck, North Dakota 58501 USA  
701/222-8331 • 800/366-1857 • FAX 701/222-2773

LAS International (Europe) Ltd., Church Lane, Dersingham, King's Lynn, Norfolk PE31 6GZ U.K.  
44 (0) 1485 544074 • FAX 44 (0) 1485 544658

All material contained in this report, or other material, data, drawings or design information supplied in conjunction with this report, is Copyright © 2006 LAS International Ltd., USA and may not be used without permission. All rights reserved.

©2006 LAS International Ltd. (USA). All rights reserved. Aero-Fac, Lake Aid Systems and the Lake Aid Systems logo are registered trademarks of LAS International Ltd. Accel-o-Fac, Nitro-Fac, accelerated facultative and the LAS logo are the trademarks of LAS International Ltd. (USA)

## Executive Summary

*This document is a highly condensed discussion of the potential use of the LAS Aero-Fac® system for a newly built St. John the Baptist Parish wastewater treatment facility in conjunction with a wetlands assimilation. This document should not be relied upon for complete information nor all aspects related to the costs, design specifications and assumptions, or the significant benefits to be attained through the use of the Aero-Fac® system. A more complete report from the LAS Applications Engineering Department would contain significantly more information on the design issues, comparative costs, benefits and appropriateness of the suggested approach.*

We understand that St. John the Baptist Parish is considering the construction of a new treatment facility, possibly a mechanical treatment plant (activated sludge or extended aeration based such as an SBR, etc.), but is also considering the use of wetlands discharge. Wetlands discharge dramatically cuts the requirements for effluent quality (and, therefore, cost), particularly if a lagoon-based system is used for the treatment phase as opposed to a mechanical plant. The state regulatory agency allows for significantly less stringent discharge quality with a lagoon-based system in front of a wetlands discharge. Therefore, if wetlands discharge is selected for St. John's Parish, there can be substantial economic advantages to selecting a modern, high technology version of lagoon-based treatment.

The initial capital, ongoing O&M costs and the complexity of a treatment works are directly tied to the required effluent quality. Employing wetlands discharge opens the door to utilizing a high tech lagoon-based system such as Aero-Fac® that can deliver the higher allowed BOD effluent numbers for far less cost and complexity and with a far longer life to the key equipment components and the overall treatment facility. Aero-Fac® is unique in that it incorporates both a separate virtually no-maintenance stainless steel diffused air system in conjunction with zero-to-low energy wind/electric powered aerators in a no-sludge system that can operate at a fraction of conventional plants. Aero-Fac® also uses the least amount of consumable equipment of any similar system and offers the least amount of routine maintenance backed by the longest warranty in the industry.



*Installation of stainless no-maintenance Aero-Fac® diffused-air aeration modules.*

It is our understanding that an existing lagoon (the Reserve oxidation pond) may be available for use with an Aero-Fac® system, thereby lowering construction costs even further as compared to a

Greenfield mechanical plant. Whenever existing assets can be rehabilitated and used, there normally are significant savings in a project of this scope.

### The Significant Cost and Liability of Sludge

The largest single issue in today's regulatory environment in the construction of a new plant designed for the next 20+ years can be the 20-year obligation for the cost, regulatory issues and complexity of sludge collection, testing and disposal. Approximately 50% of the operating cost of a typical mechanical treatment works can be directly tied to sludge separation/collection, dewatering, handling and disposal. Costs and regulations regarding sludge are rising significantly worldwide and are expected to continue to rise as governments continue to ban lower cost disposal options (the Los Angeles metro area's current method of sludge land application, for example, has been banned by voters recently).

Recent information on the harmful effects of antibiotics and other pharmaceuticals contained in sludge that can contaminate groundwater, enter the food chain, mutate existing life forms, etc. means that land application may not be viable in future years. The US Center for Disease Control has recommended banning it since 1999. Some countries have already banned land application. Exposure to workers and the public has also raised concern over future health risks and legal liability issues for cities and other facility owners.

Aero-Fac® eliminates sludge as an issue for the life of the facility. No costs. No risk. No regulations. Aero-Fac® is not only dramatically mechanically simpler than a mechanical plant (including an SBR), it eliminates all capital equipment, manpower and maintenance related to the collection, dewatering, handling, testing and disposal of sludge. In side-by-side independent comparisons done by major global engineering firms, the LAS Aero-Fac® system has been shown to save approximately 85% in the ongoing annual operating costs over a 20-year facility life as compared to typical activated sludge/extended aeration mechanical plants.

### Storm Water Peak Flow Violations

Storm water peak flow issues are critical. Mechanical plants and even some total mix lagoon systems are designed around a 12-36 hour tank size. Thus peak flows can easily disrupt processing creating a potential violation during storm events. The alternative is to employ a costly and complex storm equalization system.

Aero-Fac® has built-in peak flow equalization. Existing Aero-Fac® systems routinely handle up to 10x dry weather flow with no operator intervention and no disruption of treatment. This can be essential in a wetlands discharge system where releases of untreated sewage during peak flows could have adverse effects on the wetlands and violate permits.

The LAS Aero-Fac® system overall offers the most reliable, robust, flexible and lowest maintenance lagoon-based treatment system on the market. With over 30 years of wastewater experience and an industry-unique 20-year limited parts warranty, the Aero-Fac® system offers a superior system for long-term reliability and cost control.

Key benefits of Aero-Fac® over mechanical plants or even traditional surface aerators are:

3 of 11

"Our Principal Product is our Knowledge."

All material contained in this report is for conceptual purposes only and is not intended for final construction. All material contained in this report, or other material, data, drawings or design information supplied in conjunction with this report, is Copyright © 2006 LAS International Ltd. USA and may not be used without permission. All rights reserved.

- Eliminates sludge separation/collection, testing and handling for life of facility. Thus, it eliminates any concern over possible future regulatory changes and cost increases or worker risk, exposure and safety issues (such as liability for worker exposure to hazardous materials).
- Eliminates any significant manpower costs or issues.
- Eliminates peak flow equalization basins, costs and equipment.
- Eliminates typical shock load kill-off problems.
- Employs no-maintenance diffused air aeration, a more efficient method of aeration.
  - The Aero-Fac® diffused air system is unique in that it does not run or have an operating cost when flows and loads are low. Wind/electric aerators provide 24/7 aeration at a fraction of the cost of other methods. The unique diffused air system turns on automatically only when needed for processing, thereby saving significant energy costs over the life of the facility.
- Aero-Fac® is modular and can be increased in size easily and inexpensively to accommodate future growth.
- Mechanical equipment is so simplified and robust that no other system can match it for maintenance, durability or warranty.
  - Diffused aeration modules and header require no routine maintenance and have an industry unique 20-year limited parts warranty.
  - Unique blowers require no typical PD compressor maintenance such as oil changes, bearings, filters, etc. Blowers require virtually no maintenance unlike other aeration devices including other diffused air systems or surface aerators.
  - Blowers are shore mounted for maximum worker safety and convenience.
  - Wind-powered aerators have almost no wear factor, are 100% stainless steel and use a small, 3/4 hp backup motor for light wind conditions. Thus, 24/7 aeration, treatment and biological optimization are accomplished for the life of the facility at little-to-no operating cost.
- Aero-Fac® requires the least operator intervention, the least maintenance, provides the most robust and flexible treatment possible and can easily meet wetlands discharge quality for a fraction of the price of a mechanical plant.

When considering possible options for future wastewater treatment for the St. John the Baptist Parish, by implementing the wetlands discharge program and utilizing the existing asset of the Reserve pond, the Parish can very cost-effectively meet current and future expansion goals.

However, in order to utilize a lagoon-based system that does not exhibit the common problems and inconsistent performance associated with old-fashioned conventional oxidation ponds re-

quires the use of advanced design technology and equipment. The key factor for long-term success is a clear understanding on the part of the designer of how the facultative biological process works and how it is best optimized. Much of that understanding comes from having a depth of design and problem-solving experience with hundreds of facilities over a multi-year period. LAS International brings that experience to this project. LAS applications engineers work on hundreds of lagoon-based facilities each year from around the U.S. and around the world. 30 years of designing lagoon-based systems and 30 years of development in high performance, low energy systems has made LAS a leader in this field. No other lagoon-based system offers the flexibility of operation, energy savings, longer life and lower maintenance components, and the proven no-sludge performance. An LAS designed facility has the lowest total life cost of any known facility utilizing any type of mechanical equipment.

### Project Scope

Preliminary engineering data has been supplied to the LAS Applications Engineering Department. For purposes of this very brief, highly summarized report, we have been asked to consider a 1.25 MGD flow facility (plus peak flows) as an example of a possible Aero-Fac® facility. Other options can be discussed in a follow-up expanded report. Since the LAS Aero-Fac® system is modular, it can be designed for any size flow either initially or as add-on modules at a later time.

We have also been told that the influent BOD is significantly higher than normal at 240 mg/l and have used that figure for this summary report. A BOD of 240 mg/l does increase the cost of the treatment works significantly over more typical 100-120 mg/l domestic wastewater since it effectively doubles the oxygen demand for the treatment works. If the actual 10-day average influent BOD is found to be less than 240 mg/l, the size and cost of this project would be less.

Design Flow	Storm Peak Flow	Influent BOD/TSS	Effluent BOD/TSS
1.25 MGD	3.0 MGD	240/200 mg/l	30/90 BOD/TSS

### Sample Aero-Fac® Solution

The first module of a larger future facility can be an Aero-Fac® plant designed for 1.25 MGD and would be comprised of a 5 acre primary treatment cell followed by a 2 acre secondary polishing cell. Both cells would be 15 feet in depth and would be Optimal Mix™ aerated cells.

Both cells would include the Aero-Fac® stainless steel diffused air modules with blowers as a standby system to treat maximum loading conditions. Stainless steel floating wind-powered aerators would also be in each cell to provide zero-to-low cost aeration, mix and biological optimization. These units are also equipped with 3/4 hp backup motors for light wind periods.

### Why a 5-acre Primary Cell?

Oxygen demand equals power cost. If all 1.25 MGD of the sewage (2,502 lbs of BOD) is brought into too small of an area, a significant oxygen demand is created. Natural reaeration, a very powerful source of oxygen, cannot effectively assist if the load is concentrated in too small of a surface area.

If the load or oxygen demand is spread out over a slightly larger area, power costs go down dramatically.

### Why a 15 foot Depth?

Soluble BOD removal, the basis for the discharge permit, is a function of aerobic bacterial processing. The larger the aerobic bacterial volume in a cell, the more BOD removal available in a given area. Thus, the ability to utilize a deep cell, a strength of the unique Aero-Fac® system, allows for maximum BOD removal for the lowest energy cost in the smallest space. Most surface aerators cannot effectively aerate deep cells, thus they end up with large volumes of the cell (the lower depths) anoxic or anaerobic, thus limiting the aerobic removal of BOD. The Aero-Fac® system has been developed to take advantage of the many benefits offered by a deep cell such as extremely high rates of oxygen transfer, algae control, odor control, etc.

Greater cell depths dramatically affect algae control, thus aiding in lower TSS effluent. The deep aerobic cell also precludes any odors by providing the required time and oxygen component needed to convert all hydrogen sulfide into non-odiferous elements. Deep cells can be superior cells from both an energy and a performance perspective.

### Why an Optimal Mix™ Instead of a Total Mix or Partial Mix Cell?

Aerated lagoons (cells with an oxygen demand above the normal natural reaeration ability) can be done in 3 methods — total mix, partial mix or the LAS Optimal Mix™.

Much confusion exists about the aerated facultative process. Often conventional aggressive aeration is added to a basic lagoon creating a nearly total mix environment within the primary cell. Solids or sludge that is put into suspension by the aerators compete for oxygen with the soluble BOD, thereby requiring significantly more energy to reduce the BOD. If all solids are allowed to settle to the bottom and remain undisturbed, the sludge develops colonies of anaerobic bacteria that totally consume the sludge at no cost. The key is that the sludge cannot be disturbed and it must be allowed to settle out in the very first stage of treatment. Otherwise significantly more energy is required.

Furthermore, aggressive aerators allow solids to be carried over into the secondary cell where they cause significant problems with the polishing, ammonia removal and disinfection process. Additional energy is also required in the secondary cell if solids are present.

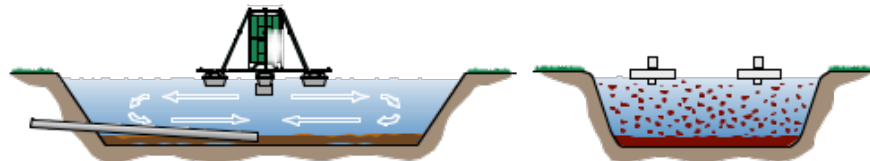
Sometimes aerated lagoons are termed as “partial mix” systems. There is a common misunderstanding of this term. The true definition of partial mix is, essentially, massive, total mix in small areas of the cell, but no aeration in other areas of the cell. The result, predictably, is no aerobic activity in many portions of the cell, and significant solids in suspension requiring oxygen for breakdown in other areas. In partial mix cells, a significant portion of the cell has no aerobic activity and, therefore, no soluble BOD removal capability. Where there is oxygen from the aggressive aerators, solids compete for that oxygen. Does it work? Yes, but at a high cost.

30 years ago, LAS developed the “Optimal Mix”™ concept whereby the entire cell is kept non-aggressively mixed for completely uniform DO, maximum aerobic volume throughout the cell from side-to-side and top-to-bottom with all solids settling for free anaerobic digestion. This total but gentle mix action of the Optimal Mix™ also distributes the total BOD load entering the plant over the entire surface of the cell, thereby lowering oxygen demand by maximizing the powerful natural reaeration mechanisms. Importantly, the critical layers of biology are not mixed nor is the sludge disturbed or put into suspension with optimal Mix™.

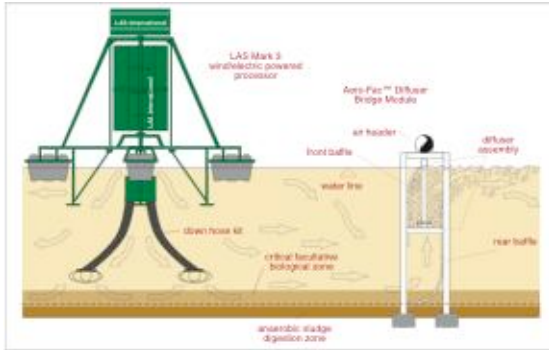
A key part of the science of a true fully biological process is that an optimized aerated facultative cell is comprised of three distinct bacterial zones as depicted below. In order to take advantage of the many benefits of the overall facultative process (lower operating costs, self-digesting sludge, etc.), all three layers of biology must be maintained and not mixed.



*Illustration 1 — Essential layering of three biological zones must not be disturbed for the facultative process to work.*



*Illustration 2 — Aggressive aeration (right) keeps sludge in suspension and destroys the facultative bacterial zone, an essential part of the overall process. Technically, some type of solids collection and removal should be used following this type of aerated cell.*



*Aero-Fac® employs zero-to-low energy wind and electric powered aerators that provide processing power 24/7 for little cost. The unique stainless steel zero-maintenance diffused air modules are set to activate only if loads coming into the plant are strong enough to require the extra oxygen. This unique system allows for handling the toughest shock loads but keeps energy and operating costs dramatically lower than other systems.*

### Cost Comparison and Performance

The economic advantages of a no-sludge, low energy, low manpower, standby blower system such as Aero-Fac® are clear even when only computing today's existing costs. When future inflated costs of sludge testing and disposal, increased labor rates and higher energy costs are estimated, the savings are even more dramatic.

While complete treatment can be achieved with a mechanical plant, it will be at a significantly higher cost initially and for each and every year of operation. The numerous parts and pieces of equipment in a mechanical plant increase the chance of failure of equipment and processing, increase the amount of replacement parts that will be required, and decrease the life of the overall facility if extensive ongoing maintenance and replacement is not performed. A mechanical plant also introduces more operator training and actual hands-on operation, including handling sludge over the next 20 years.

Implementing surface aerators such as the LAS Mark 4 Series units can also attain treatment in a lagoon-based system. The LAS Mark 4 units use far less energy than many surface aerators because LAS utilizes a true aerated facultative process as opposed to a total mix system (about 50% less energy required).

While surface aeration may appear attractive due to the lower initial cost involved, the old adage about getting what you pay for is very true when looking at aeration. All brands of surface aerators are high-speed devices that literally consume themselves. These units require frequent maintenance and inspection in order to assure that all units required for oxygen transfer and mix are functioning. The units have a relatively short lifespan as reinforced by the very short warranty typical of surface aerators. Surface aerators (excepting the LAS Mark 4 Series with deep mix capability) have difficulty reaching depths without the use of significant horsepower and energy.

Aero-Fac®, on the other hand, provides a simplistic, elegant solution to wastewater treatment. Shore mounted fan blowers require a simple shot of grease once a year. The diffused air headers and modules require no routine maintenance or service and come with a 20-year limited warranty. No operator intervention is required for most all operational situations including storm or shock flows. And there is no sludge regulation, collection, dewatering, testing or disposal for the life of the facility.

Because the flow and strength of sewage changes throughout the day, week and over the life of a wastewater plant, Aero-Fac® is designed to run the blowers only when the load exceeds the capability of the wind/electric powered aeration units. This alone can save significant operating costs and provide unmatched flexibility.

	LAS Aero-Fac®	SBR Activated Sludge Mechanical Plant	LAS or Other Surface Aerator Lagoon
<b>Capital</b>			
Equipment	\$865,000	\$ _____	\$350,000
Land	\$0	\$ _____	\$0
Pond Construction (est.)	\$100,000		\$100,000
Misc. Construction (est.)	\$200,000	\$ _____	\$200,000
<b>CAPEX Total</b>	<b>\$1,165,000</b>	<b>\$7,000,000 est. <sup>1</sup></b>	<b>\$650,000</b>
<b>OPEX</b>			
Depreciation (\$/y)	\$20,000	\$ _____	\$40,000
O&M (\$/y)	\$4,000	\$ _____	\$20,000
Energy (hp)	77 hp est. net use	_____ hp	90–170 hp <sup>2</sup>
Energy (\$/y @ \$.07 kwh)	\$39,325	\$ _____	\$46,000–86,371 <sup>3</sup>
Sludge Collection, Dewater	\$0	\$ _____	\$ _____
Sludge Hauling, Disposal Fees	\$0	\$ _____	\$ _____
<b>OPEX Total</b>	<b>\$63,325</b>	<b>\$250,000 <sup>4</sup></b>	<b>\$146,371</b>
<b>10 Year OPEX</b>	<b>\$633,250</b>	<b>\$2,500,000</b>	<b>\$1,463,710</b>
<b>20 Year OPEX</b>	<b>\$1,266,500</b>	<b>\$5,000,000</b>	<b>\$2,927,420</b>
1. Quote from 7/27/06 Times-Picayune article. 2. LAS Mark 4s = 90 hp, total mix = 170 hp. 3. Lower cost for LAS Mark 4 aerators, higher cost for total mix surface aerators. 4. Assumed 20¢/gallon OPEX			

*Note: A complete detailed breakdown of Aero-Fac® operating costs is available.*

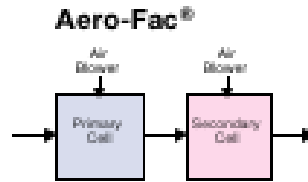


Illustration 3 — Aero-Fac® is far less complex with fewer mechanical components to fail or require service. There is also substantially less mechanical, and almost no process, interdependency to be concerned with.

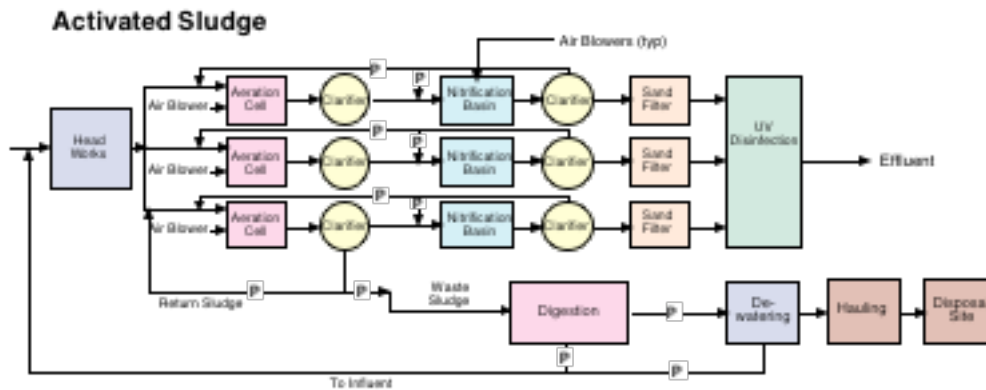
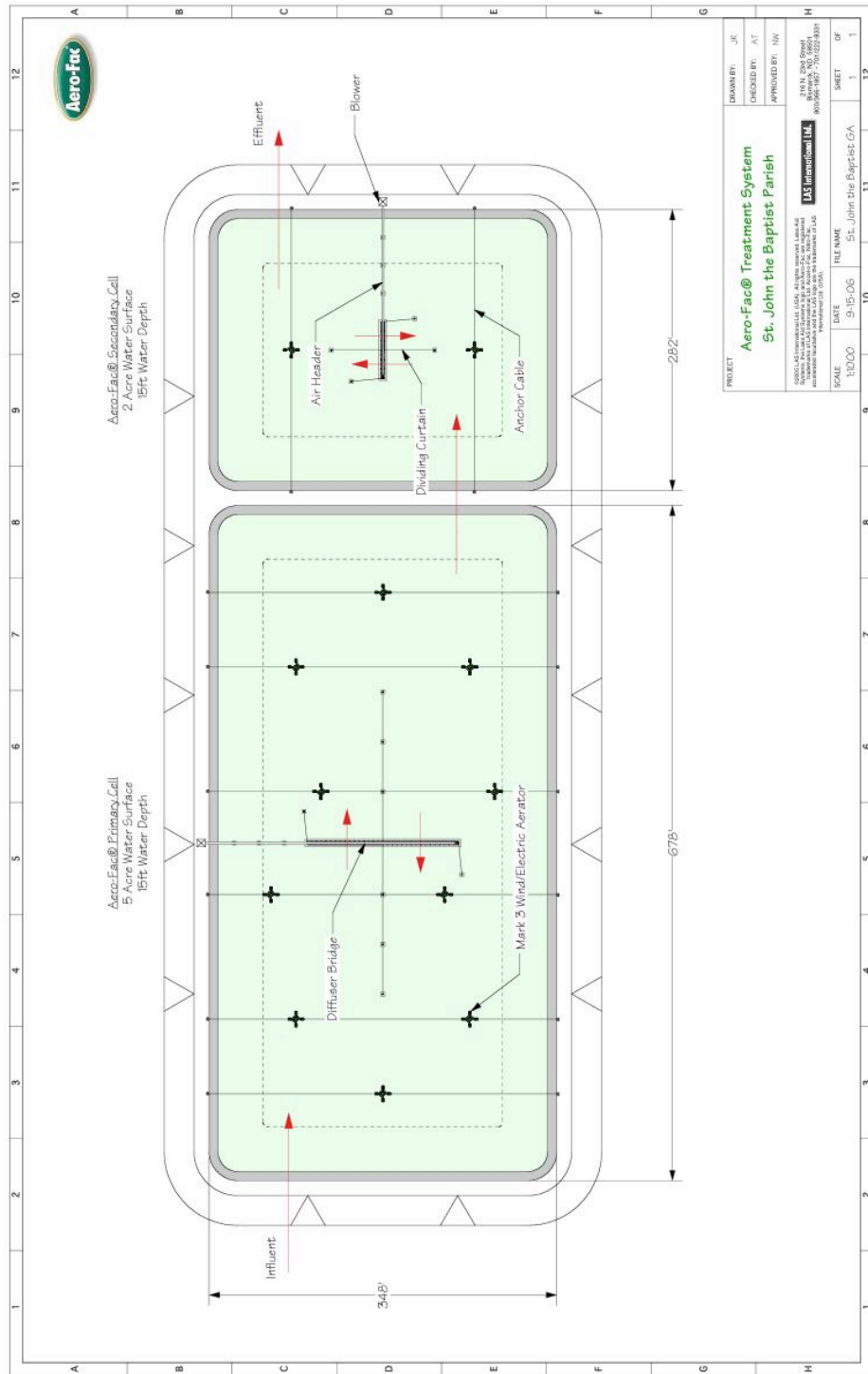


Illustration 4 — Activated sludge treatment plants require numerous stages and components, each of which must be correctly designed and manufactured. It is this complexity and interdependency that makes the system fragile, difficult to control and expensive.

Overall, the extended aeration/activated sludge option has the highest total life-cost both initially and, in particular, in ongoing operating costs for the entire life of the treatment plant (other than membrane plants). Furthermore, those operating costs are tightly tied to inflation and therefore highly unpredictable.

Why? The ever-changing costs can neither be reliably projected nor assured over an extended period with any degree of certainty. This leads to questions about the wisdom of constructing such a treatment plant when the life of the system should be for 20-30 years or more. Budgeting for the facility owner also becomes extraordinarily difficult. On the other hand, if labor costs, energy costs, chemical costs, sludge disposal regulation and costs, and replacement parts costs could all be reduced to the point where inflationary and regulatory changes had little impact, the true “total cost” of a treatment works could be better determined.



PROJECT	Aero-Fac® Treatment System	
DESIGNED BY:	JK	CHECKED BY:
APPROVED BY:	NW	AT
DATE	9/15/06	FILE NAME
SCALE	1/1000	SHEET
		OF
		12
		11
		10
		9
		8
		7
		6
		5
		4
		3
		2
		1
		12
		11
		10
		9
		8
		7
		6
		5
		4
		3
		2
		1

Typical arrangement. Other options and configurations available.

"Our Principal Product is our Knowledge."

All material contained in this report is for conceptual purposes only and is not intended for final construction. All material contained in this report, or other material, data, drawings or design information supplied in conjunction with this report, is Copyright © 2006 LAS International Ltd. USA and may not be used without permission. All rights reserved.