Rehabilitating Aerated Lagoons and Increasing Energy Efficiency

Case Study: Glenwood Wastewater System

Overview

Kane County, Illinois – in early 2006, the Glenwood School for Boys and Girls began looking to upgrade their aging on site wastewater facility. Built in 1993, the lagoon based water reclamation system originally utilized coarse bubble aeration fed by blowers in a remote building. The small, two cell system handled as much as 18,000gpd, and served 180 on-site students, faculty, and staff.

Problem Identification

Because the lagoons already exhibited nominal amounts of sludge, it was imperative to the local operators that the infrastructure upgrades avoid any additional future accumulation. It was also important that changes be process non-interruptive, because the waste-water facility operated year-round and dewatering was undesirable.

Glenwood Wastewater Lagoons

The existing coarse-bubble piping was unlikely to be used with future aerators, as the header system leaked and ruptured often. The operators sought out options to avoid similar scenarios in the future. Installation cost and energy consumption were also strong considerations, as the school accepted funding only by charity. With coarse bubble aeration, the existing system was consuming 83,700 kilowatt hours of electricity, amounting to an annual expenditure of $4,463.64.

MARS Solution

John R. Sheaffer, president of civil engineering firm Sheaffer & Roland, approached the school's administration to offer a solution to their needs. In collaboration with Triplepoint Water Technologies, Sheaffer proposed the MARS Aeration System to upgrade the School's wastewater facility—to be provided 'at cost,' and designed and installed on a charitable basis. The MARS System was easily implementable in the school's two wastewater lagoons, and was projected to treat influent just as well as the existing coarse bubble system while reducing energy costs by as much as 40%. It would also feature a decentralized air pump configuration, reducing the need for piping to a remote building.

Recognizing MARS Aeration as their solution, the Glenwood operators and administrators accepted the proposal from both Sheaffer and Triplepoint. The MARS System became operational in late April, 2006.

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MARS with flexible weighted tubing

Concepts Proven

1. **Effective Treatment:**
   An independent water lab, McHenry Analytical, confirmed that the MARS treated the waste-water as effectively as the prior system. Furthermore, no significant change in BOD levels, nitrogen ammonia, dissolved solids, or pH were found. The primary treatment cell exhibited a D.O. range of 4.4-5.6 mg/L, and the secondary cell showed levels between 6.1-8.3 mg/L.

2. **Efficient aeration:**
   The MARS Aeration System consumed only 31,500 kilowatt hours, a 42% energy savings amounting to $1,900 per year. See Figure A.

3. **Decentralized pumps:**
   Reduces head loss, the need for higher pressures to pump air over long distances, and the risk of stress induced pipe failure.

4. **Sludge Maintenance:**
   Low sludge levels were maintained in the lagoons with MARS Aeration.

5. **Ease of Installation:**
   MARS Aerators were installed around existing infrastructure without the need to dewater the lagoons.

Conclusion

The MARS Aeration System proved itself to be a viable solution to the Glenwood School for Boys and Girls' wastewater needs. With its treatment effectiveness, aeration efficiency, sludge maintenance capabilities, and installation versatility, the MARS will be implementable in other, larger applications. This pilot study paves the way for a full scale deployment of the MARS, highlighting the benefits of this burgeoning technology.

Figure A:	Coarse Bubble		MARS Aeration		Savings	
Quantity	2		3			
Motor rating	5	hp	1	hp		
System Pressure	10	psi	10	psi		
Airflow	56	cfm	10	cfm		
Elect. Power	4.78	kW	1.2	kW		
Airflow, total	112	cfm	30	cfm	82	cfm
Elect. Power, total	9.56	kW	3.6	kW	7.16	kW
Annual Power, total	83,745.60	kW	31,536.00	kW	52,209.60	kW
Elect. Cost	0.082	$/kWh	0.082	$/kWh	0	
Utilization	65%		100%		-35%	
Cost/day	$12.23		$7.08		$5.15	Daily
Cost/month	$370.54		$212.54		$158.00	Monthly
Cost/year	$4,463.64		$2,550.53		$1,913.11	Yearly

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