Innovation in Processing and Manufacturing "Life Cycle" Materials from Septage, WWTP Biosolids, and Restaurant Grease Traps

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Executive Summary

Big Fish is a receiving and processing station of septage, biosolids, fats, oils & greases, portable toilets and holding tank wastes (the materials), located in Charlevoix, MI. It is the first permitted facility in the state of Michigan (November 2007). The innovative methodology utilizes proprietary equipment, devices, micro-organisms and a sustainable process. The facility is totally enclosed with 24/7 access for operator and tank trucks. (All materials received are tested, screened, aerated, blended, lime stabilized, exceptional quality biosolids manufactured, and influent reduced to residential strength). Processing air is removed from the vessels and equipment via fans into biofilters. Effluent flows to a waste water treatment plant and Exceptional Quality Class A Biosolids are used as an soil amendment.

Processing occurs only when there is material to process therefore reducing operation costs, the process can be turned off and on as needed.

The facility has attained numerous goals and objectives, including; a) Consistent operating temperatures; b) Ability to accept and process varying strengths and kinds of material; c) Low capital and operating costs per gallon; d) No detection of methane or hydrogen sulfide; and, e) Safe environment to work. Products produced are nitrogen, and Class 'A' Biosolids. The process reduces TSS 99.5%, COD 98.2%, P 99.07%, NH_3-N 52.% -NO_2 99.9%, and NO_3 99.9%. Big Fish can process 20,000 gallons per day at 2.5% solids.

The 20,000 gpd Big Fish facility has a small foot print, 60' x 72' plus the adjacent biofilter. It can process 20,000 gpd and produce a life cycle resource. The facility can serve a population of 80,000 individuals. The processing plant is modular, allowing an owner to meet the needs of the service area today and the demands of the future in less than 7 months from contract to start up.

To achieve sustainability, Big Fish produces a consistent effluent quality while continuing to meet the objective of low capital and operating costs. The next phase of our research and development program is to achieve ground water discharge quality effluent. This quality of effluent will allow independence for future facility locations and meet the 'Life Cycle' goal of Big Fish.

Big Fish eliminates the current regional practice of disposal of this material to landfills, incineration, and surface land application. Its success will stand as a model for other communities and similar endeavors throughout the U.S.

Technical Content

Untreated septage has been applied to the land for centuries. This application of material trans locates to surface water and ground water, specifically nitrates and phosphates. Vector attraction is also a factor of spreading pathogens via fowl, mammal, and insects.

The Environmental Benefits of Big Fish are:

Material Approach	Common Practice	Big Fish Environmental
Septage	2% solids	45% solids
	Pathogens	Pathogen Free
	Surface applied	Incorporated in soil
	Landfilled	No landfill
	Waste	Life Cycle product
	Vector attraction	Vector attraction free
	Virus	Viral free
	High transport costs	Low transport cost
Biosolids	Land applied 94% water	
	Incinerated	'Life Cycle'
	Land fill	'Life Cycle'
Fats-Oil-Grease	Land applied	'Life Cycle'
	Land fill	'Life Cycle'
	Bio-diesel	'Life Cycle'
	Incinerated	'Life Cycle'
Portable Toilet	Land applied	'Life Cycle'
Holding Tanks	Land applied	'Life Cycle'

Big Fish is presently recycling all Exceptional Quality 'Class A' Biosolids.

The residential strength waste water is processed in a municipal waste water treatment plant.

The objective of the Big Fish facility is to recharge the ground water aquifer, and to attain this quality of effluent with minimum cost and sustainability.

The Proposal

Work Plan

Within the existing facility there is adequate area to carry out the proposed research and development studies to improve effluent quality and meet groundwater discharge criteria. A wastewater testing laboratory is a part of the facility.

MONTH

ONE	TWO	THREE	FOUR	FIVE	SIX
Procure Equipment	Assemble Equipment				
	Testing Influent and Effluent				
	Start up Each test device	Operate and adjust each device as needed			
Establish Testing Perimeters		Month End Reports			

Testing procedures for 4.5 months (18 weeks / 135 days) for each research process

	Daily	Influent	Effluent
540 data points	DO	X	X
	pH	X	X
	M-W-F		
324 data points	$NH_3 - N$	X	X
	NO_2	X	X
	NO_3	X	X
	W-F		
216 data points	TSS	X	X
	B.O.D.	X	X
	TKN	X	X
	3^{rd} Party Testing 6 split samples. Week 2,5,8,12,15 and 18		
72 data points	$NH_3 - N$	X	X
	NO_2	X	X
	NO_3	X	X
	TSS	X	X
	B.O.D.	X	X
	TKN	X	X

Patent pending status is protecting our R&D facility and process. Our research has found no other project emulating the Big Fish approach to "Life Cycling" these materials at an efficient cost.

Relationship with Future Research and R&D

Presently the cost to process or dispose of septage biosolids, fats-oils-grease (FOG), portable toilet and holding tank waste has a range of $0.03 to $0.55 per gallon.

The average cost per gallon for operating and processing in Big Fish is as follows: Operational $0.024, Processing $0.026, Capital Costs $0.0344, Discharge $0.063. The design/build and operator training cost for a 20,000 gallon per day facility is approximately $2,500,000.00. The Big Fish approach is to keep the process simple to construct, operate and maintain; and be sustainable with 'Life Cycle' results. Phase II will solidify the results of Phase I allowing Big Fish to say, "What was once considered waste is now safely recycled for present and future use."

Facilities

The existing Big Fish facility is located in Charlevoix, Michigan. The receiving and processing structure is 48' x 72' with and attached lime mix building 32' x 52'. The building is insulated.

Receiving: Deliveries are received in a heated, enclosed structure with a partitioned, indoor drive-through lane for septage delivery vehicles. Haulers access the indoor receiving point by use of an access card. A hauler simply inserts the card into the card reader located on the exterior of the building, and is then allowed entrance into the facility. Once entered, the hauler connects the delivery truck to the Septage Receiving Station via cam-lock couplings. The Receiving Station provides ¼-inch screening and dewatering of the inorganic solids for landfill disposal. As the truck discharges, the Receiving Station automatically tallies the flow.

Material entering the facility is continuously monitored for pH. The facility is programmed to close an electrically actuated valve and stop receipt of septage if the pH of any material is outside of established limits. Further evaluation is made to determine if the material is acceptable to enter the plant.

The facility also automatically monitors available capacity within the receiving tanks. If the receiving tank does not have sufficient space, a float switch actuates a valve, preventing further discharges to the plant until space is made available (26,000 gallons capacity). A flashing strobe light signals the operator when a reserve of 1000 gallons of storage is still available.

The receiving building uses an odor control and air quality system consisting of exhaust fans and a biofilter to scrub the air. Offensive odors are vented directly from the tank and from the building atmosphere to the biofilter.(University of Minnesota Publication,2000) Material receiving takes place within the drive-through lane when both the entrance and exit doors are closed, thereby ensuring all air produced in the building goes through the biofilter.
Equalization Tank: After flow measurement, and screening, material is sent directly to a partitioned 15,000-gallon equalization tank. The first section of the tank (4,000 gallons) receives

the initial flow from the delivery vehicle and provides a basin for settlement of grit that has passed through the screening process. As more material is delivered to the facility, the first chamber material cascades into the second chamber.

The second chamber (11,000 gallons) provides an aerated mixing area for blending raw material as needed to balance waste strength. The blended material in the second chamber is then pumped into the next 15,000 gallon vessel.

As material is pumped from the 15,000 gallon vessel, lime is added to the material to attain vector attraction reduction in 1 (one) of 2 (two) 20,000 gallon tanks. Following completion of lime mixing, the material is pumped into a dewatering system.

Solids are processed into EQ Class 'A' Biosolids with a screw press (FKC Co., 2006) and stored undercover. The material is used as soil amendment.

Effluent from the dewatering system flows to a pH neutralization treatment vessel. Microbes are injected into the process at this location from the microbial hatchery.

Treatment Vessels: The treatment train of the process is conducted through one,-15,000-gallon, and eleven,-2,000-gallon treatment vessels. Each vessel is equipped with microbial aerobic process (MAP). As flow is pumped from the equalization tank, the partially treated material cascades from one treatment vessel to the next. Cascading through the vessels provides the appropriate contact time with the bacteria blend and air to treat the material to a residential waste water strength that can be sent to the municipal wastewater treatment facility for final treatment and discharge to the environment.

Post Equalization Tank: The Big Fish facility incorporates a post-equalization tank prior to discharging treated material to the municipal collection system. The post-equalization tank provides a semi-quiescent zone for settling of solids not consumed in the treatment vessels. Settled solids are pumped to the front of the plant for further treatment. Treated effluent may return to the treatment vessels during periods of no septage processing. The recycling of effluent into the system reduces BOD, TSS, and Nitrogen components.

Effluent Discharge: The facility will produce a treated effluent with waste strength characteristics equal to or less than that seen in a typical domestic household waste stream (BOD 300mg/l, TSS 350 mg/l, NH3 65 mg/l, and Phosphorus <3.0 pounds/dry). The treated effluent is discharged to the City of Charlevoix wastewater collection system for final treatment at the wastewater treatment facility.

The laboratory is 8' x 12' and tests for dissolved oxygen, pH, temperature, TSS, BOD_5, nitrate, nitrite, ammonia, and phosphorus. TKN, fecal coliform, and salmonella testing is contracted by a 3rd party. All testing devices and material is provided by HACH.

Influent material testing averages from July 2007 thru June 2008 are TSS 9800 mg/l, BOD 3180 mg/l, NH_4 125 mg/l, and P 218 mg/l.

Most recent results with the aid of a patented device show effluent averages are TSS 16mg/l, BOD 24mg/l, NH_3-N 7mg/l, & P 0.43mg/l. Further testing continues on this modual.

Commercialization

Big Fish Environmental, LLC is a privately owned company. Its primary interest is receiving, processing, and manufacturing 'Life Cycle' products from septage, biosolids, fats-oils-grease, portable toilet and holding tank waste. The research and development facility is rated at 20,000 gallons per day.

Plans are complete for facilities to receive and process 20,000, 30,000, 40,000, 50,000 gallons per day. Requirements for facilities greater than 50,000 gpd are assembled in modules (i.e. A 100,000 gpd plant will be made up of two - 50,000 gpd modules).

These facilities are for sale on a design-build turn key basis. The manufactured Exceptional Quality "Class A" Biosolids have been and are continuously being field tested in anticipation of commercial sales opportunities.

Presently there are 3 applications for a Big Fish Facility. Placement in an waste waster treatment plant to handle its biosolids and enable the plant to receive septage, fats-oils-greases, portable toilet and holding tank waste as income for the municipality. The second use is a privately owned facility. These facilities could be placed in a 15 to 25 mile radius and sized according to population requirements. This placement would reduce hauling distances and cost and presently a third application is being tested, industrial fruit processing waste. Initial testing results have been positive. Big Fish Environmental, LLC has a patent pending with the U.S. Patent Office.

Competitive Advantages

Big Fish has reversed the process of standard waste water treatment plant processing, the solids are removed first in the process.

First lime stabilization releases approximately 50% of the ammonia from the effluent and captures the majority of phosphorus during the screwpress process. The resulting effluent is reduced by the micro-organisms with a total time of 48 hours to achieve residential waste effluent strength.

Waste water has total solids of approximately 0.02% and the septage average is 2.0%. Septage is approximately 100 times stronger. If municipal waste water rates are $0.015 per gallon, then septage treatment cost would be $1.50 per gallon. To be conservative at a septage strength 20 times that of waste water the processing cost would be $0.30 per gallon. Big Fish cost per gallon is $0.95 per gallon. Presently these materials are being transported in small and large trucks from two or less to 300 plus miles round trip. Fuel cost, road maintenance, and traffic congestion bring these costs even higher. Incineration and settling ponds have issues too, cost and environmental effects. Small efficient facilities are an answer and provide 'Life Cycle' products.

The performance of Big Fish has surprised many doubters. Each day the staff addresses challenges as the facility becomes more efficient. For example, the plant recently received a 4,000 gallon load of septage. Receiving, screening, lime stabilization, and screwpress operations were normal. Odors were quite unique, but not too unremarkable. During processing, the effluent from the screwpress into process vessels caused the dissolved oxygen to plummet <0.1 mg/l from 6.0 mg/l. Big Fish staff immediately contacted the pumper and learned that he had included approximately 500 gallons of the load from a fish cleaning station. Understanding the root of the situation, the material was recycled and the plant was in full operation in 24 hours.

The market-place for this process is expanding as application of the untreated material is being challenged nation wide. At this time, Big Fish is one of very few operations, actually providing a permitted and functioning receiving and processing facility for municipal and/or private use.

Big Fish markets are two fold: Municipal and Private. A 20,000 gpd facility will serve a population of 80,000; hence, a 50,000 gpd plant will serve a population of 200,000, for residential homes on septic systems with an average pump out every five years. Waste water treatment plant biosolids processing would require a 20,000 gpd facility to serve a population of 50,000. If septic systems to municipal system are 50/50, then 4,615 plants, 20,000 gallon per day, would serve the United States (with a population of 300,000,000). Considering the potential of creating exceptional quality class 'A' biosolids while also recharging the ground water, one can see the importance and potential long term impact of this Phase I project.

Commercialization

Big Fish is a design/build facility with full operator training and support. The process is patent pending. Four pieces of equipment: screen, screwpress, microbial innoculator/generator and microbial blend are proprietary, the facility is a package. The structure may be upgraded to meet the owners needs.

The U.S. Environmental Protection Agency developed a protocol for High Strength Waste Water Treatment System for Big Fish. NSF International will provide the quality assurance statement at the end of the testing. The extensive fifteen month testing program will be completed December 2009.

Pre engineered plants are available from 10,000 to 100,000 + gpd, on a design/build turn key basis.

Note:

To enhance the wastewater treatment plant process. Solids are removed from the system at the initial phase of processing (removal of primary sludge). This procedure was tested at the Charlevoix Wastewater Treatment Plant for seven weeks (2008). Processing downstream from this point enhanced and therefore, accelerated processing time and reduced costs. Our test did not include savings on chemicals, labor and other related expenses.