



# Florida Onsite Sewage Nitrogen Reduction Strategies Study

Task B.7

**B-HS1 Field System Monitoring Report No. 8**

**Progress Report**

February 2013

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Environmental Engineers & Scientists

In association with



**AET**  
Applied Environmental Technology

**OTIS  
ENVIRONMENTAL  
CONSULTANTS, LLC**

# **Florida Onsite Sewage Nitrogen Reduction Strategies Study**

## **TASK B.7 PROGRESS REPORT**

### **B-HS1 Field System Monitoring Report No. 8**

#### **Prepared for:**

Florida Department of Health  
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FDOH Contract CORCL

**February 2013**

#### **Prepared by:**

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### **1.0 Background**

Task B of the Florida Onsite Sewage Nitrogen Reduction Strategies Study (FOSNRS) includes performing field experiments to critically evaluate the performance of nitrogen removal technologies that were identified in FOSNRS Task A.9. To meet this objective, full scale treatment systems are being installed at various residential sites in Florida and monitored over an extended timeframe under actual onsite conditions. The Task B Quality Assurance Project Plan (Task B.5) documents the objectives, monitoring framework, sample frequency and duration, and analytical methods to be used at the home sites. This report documents the eighth, and final sample event of a passive nitrogen reduction system at a home site in Wakulla County, Florida (site B-HS1).

### **2.0 Purpose**

This monitoring report documents data collected from the eighth B-HS1 monitoring and sampling event conducted on January 24, 2013. This monitoring event consisted of collecting flow measurements from the household water use meter and the treatment system internal water meter, recording electricity use, monitoring of field parameters, collection of water samples from four points in the treatment system, and sample analyses by NELAC certified laboratories.

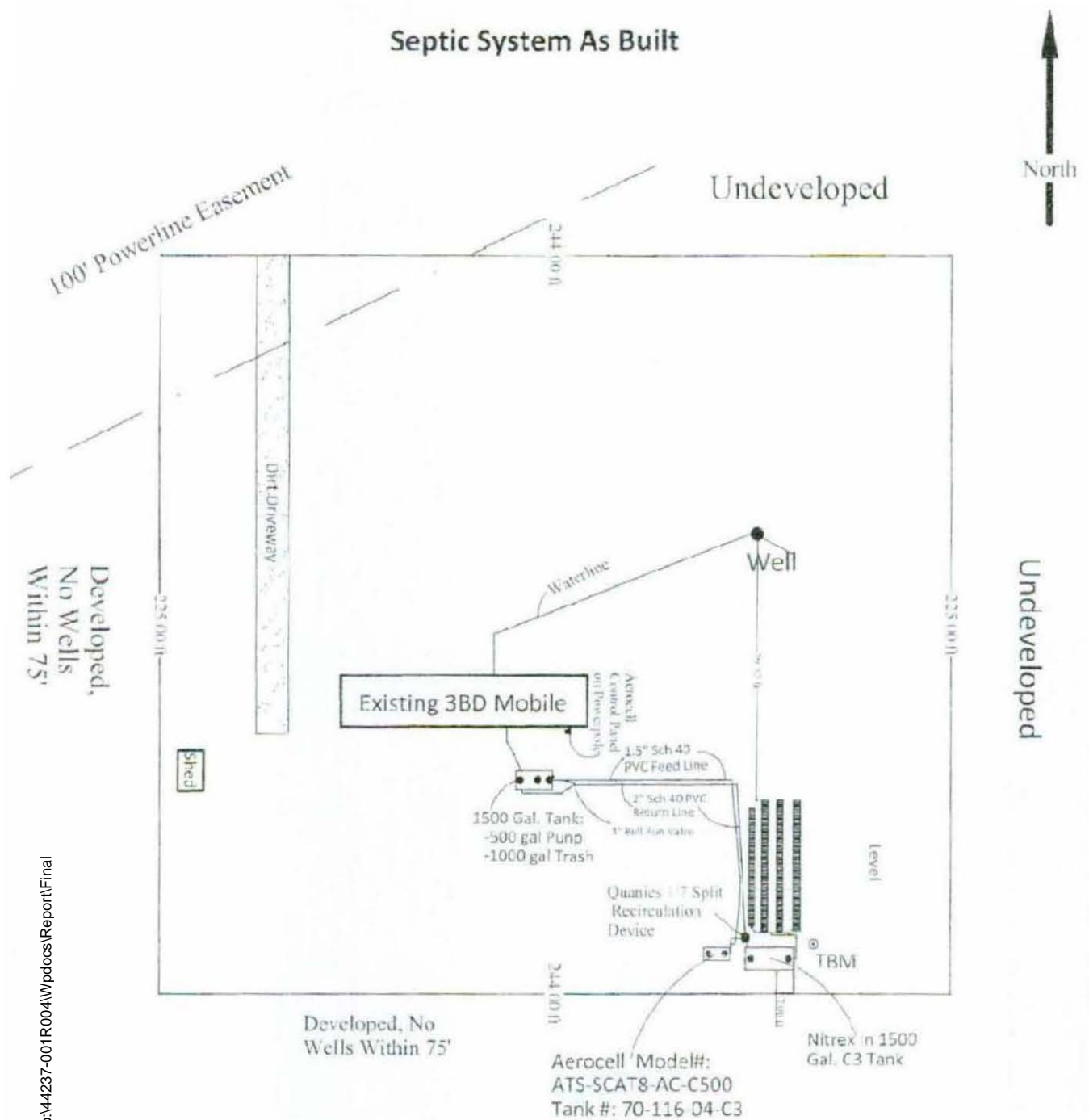
### **3.0 Materials and Methods**

#### **3.1 Project Site**

The B-HS1 field site is located in Wakulla County, FL. The nitrogen reducing onsite treatment system for the single family residence was installed in June 2011. Design and construction details were presented previously in the Task B.6 document. The B-HS1 system consists of a 1,500 gallon two chamber concrete tank with a 1,000 gallon primary treatment tank (primary chamber) and a 500 gallon pump chamber (pump chamber); an Aerocell™ unsaturated media filter; and a 1,500 gallon single chamber up flow tank containing Nitrex™ media. Treated effluent from the Nitrex™ unit is discharged to a soil dispersal system (drainfield) consisting of four Infiltrator trenches. Three of the

four Infiltrator trenches are 40 feet in length, and the fourth is 36 feet. Based on measured average wastewater flow and tank volumes, there is over a ten day transit time through the treatment system prior to dispersal. Figure 1 is a site schematic showing the system components and layout of the installation.

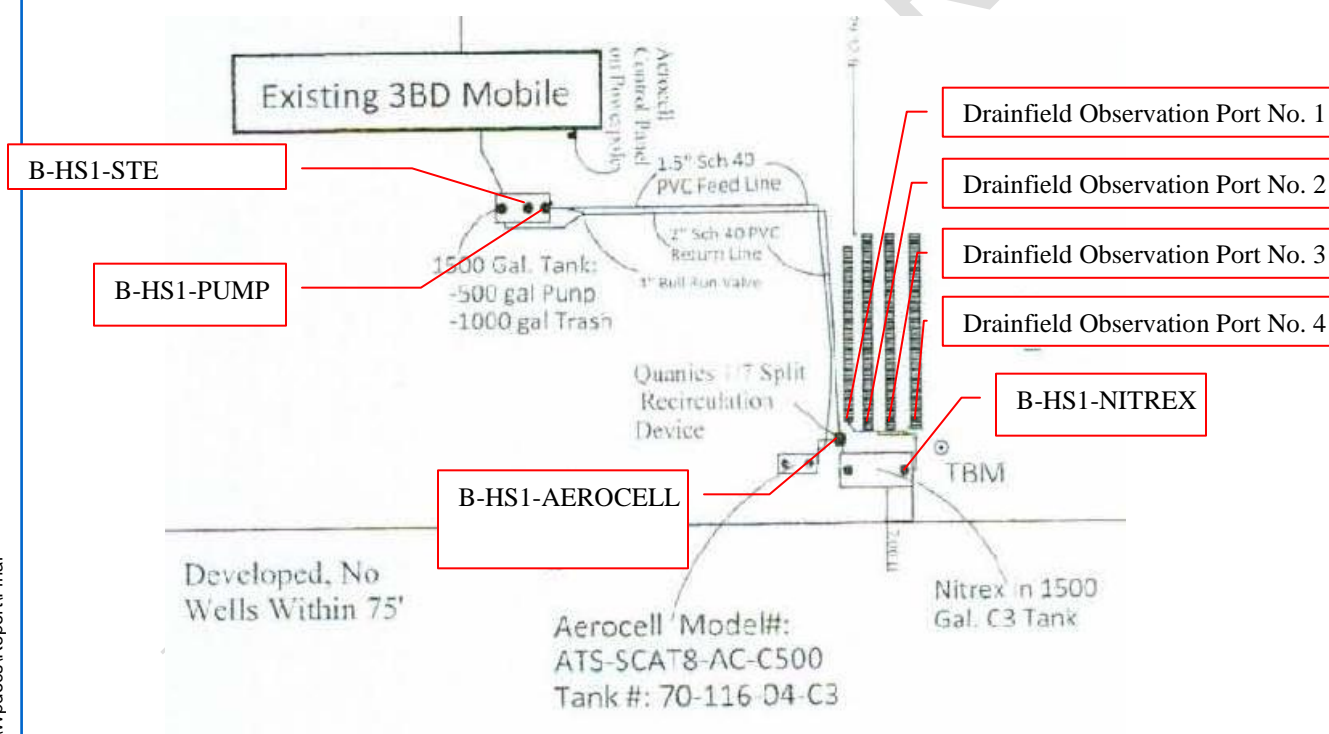




**Figure 1**  
**B-HS1 Site Schematic**

### 3.2 Monitoring and Sample Locations and Identification

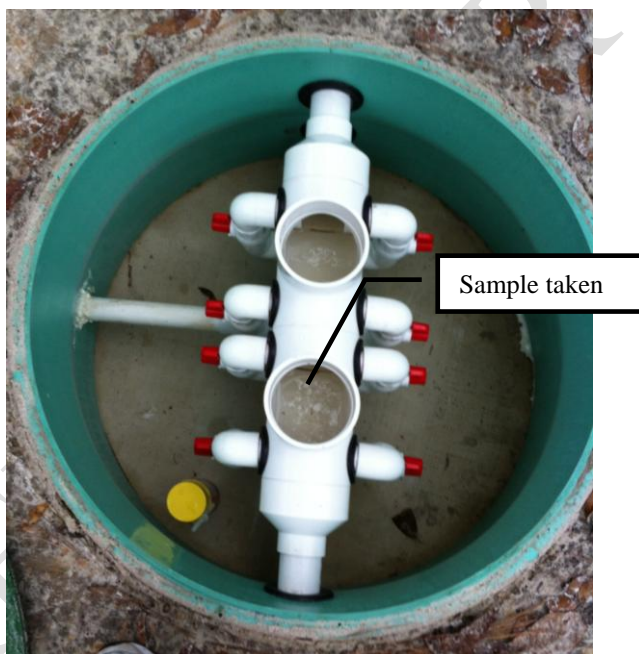
The four monitoring points for this sample event are shown in Figure 2. The first monitoring point, B-HS1-STE, is the effluent sampled approximately 1.5 feet below the surface of the first chamber of the primary tank, which is referred to as primary effluent or septic tank effluent (STE). Samples from monitoring point B-HS1-STE represent the whole household wastewater and are the influent to the remainder of the onsite nitrogen reduction system. The STE chamber is accessed from the middle tank lid of the primary treatment tank. The second sampling point (B-HS1-PUMP) was taken approximately 1.5 feet below the surface of the second chamber of the primary tank, which serves as the pump chamber and contains a mixture of primary effluent (STE) and recirculated effluent from the Aerocell™ unsaturated biofilter.



**Figure 2**  
**B-HS1 Sample and Monitoring Locations**

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The pump discharges wastewater to the top of the unsaturated Aerocell™ chamber. The Aerocell™ effluent flows into an adjustable split recirculation device which allows for a portion of the effluent to be sent back to the pump chamber. The remainder of the Aerocell™ effluent proceeds to the Nitrex™ tank. Samples from the third monitoring location are taken from the middle of the split recirculation device (B-HS1-AEROCELL) and represent Aerocell™ effluent (Figure 3).



**Figure 3**  
**Recirculation Device (B-HS1-AEROCELL sample)**

The fourth monitoring location is the Nitrex™ tank sample tube that is connected to the Nitrex™ effluent pipe (Figure 4). This sample represents the Nitrex™ effluent, which is the final effluent from the treatment system prior to being discharged to the soil infiltration system, or drainfield. Each drainfield line has an observation port installed at the end near the Nitrex system for monitoring (see Figure 2)





**Figure 4**  
**Nitrex™ Tank (B-HS1-NITREX sample)**

### 3.3 Operational Monitoring

Start-up of the system occurred on June 10, 2011 and the system has operated continually since that date. For this eighth sampling event, the water meter for the house and the Aerocell™ flow meter were read and recorded on January 24, 2013. The Aerocell™ flow meter is located on the line leading from the pump/recirculation tank to the Aerocell™ chamber and records the cumulative flow in gallons pumped from the pump chamber. The measurement of the Aerocell™ flow meter includes both the forward wastewater flow from the household and the recirculation flow. The control panel includes telemetry where reports are generated regarding alarms, pump cycles, and other information using a Vericomm panel system.

### 3.4 Energy, Chemical and/or Additives Consumption

Energy consumption was monitored using an electrical meter installed between the main power box for the house and the control panel. The electrical meter records the cumulative power usage of the system in kilowatt-hours. The power usage of the system is primarily due to the single recirculation pump in the pump chamber, although a small amount of power is used by the control panel itself. There are no chemicals added to the system. However, the Nitrex™ media is a “reactive” media which will be consumed during operation. The Nitrex™ tank was initially filled with 42 inches of media, which ostensibly will last for many years without replenishment or replacement.

### 3.5 Water Quality Sample Collection and Analyses

Influent, intermediate, and effluent water quality samples from the system were collected January 24, 2013 for water quality analysis. Samples were collected at each of the four monitoring points described in Section 3.2: B-HS1-STE, B-HS1-PUMP, B-HS1-AEROCELL, and B-HS1-NITREX. A duplicate sample was also taken at B-HS1 AEROCELL. Additionally, laboratory split samples were collected immediately subsequent to the regular samples for analysis of the nitrogen species. A peristaltic pump was used to collect samples and route them directly into analysis-specific containers after sufficient flushing of the tubing had occurred. Field parameters were then recorded. The sampling tube was placed approximately 1.5 feet below the surface in the STE and pump chamber samples and at mid-depth in the split recirculation device.

The analysis-specific containers were supplied by the analytical laboratory and contained appropriate preservatives. The analysis-specific containers were labeled, placed in coolers and transported on ice to the analytical laboratory. Each sample container was secured in packing material as appropriate to prevent damage and spills, and was recorded on chain-of-custody forms supplied by the laboratory. Chain of custody forms, provided in Appendix A, were used to document the transfer of samples from field personnel to the analytical laboratory.

Field parameters were measured using portable electronic probes and included temperature (Temp), dissolved oxygen (DO), oxidation-reduction potential (ORP), pH, and specific conductance. The field parameters were measured by placing the analytical probes in a container overflowing with sample water. The influent, intermediate, and effluent samples were analyzed by the laboratory for: total alkalinity, total Kjeldahl nitrogen (TKN-N), ammonia nitrogen ( $\text{NH}_3\text{-N}$ ), nitrate nitrogen ( $\text{NO}_3\text{-N}$ ), nitrite nitrogen ( $\text{NO}_2\text{-N}$ ), total phosphorus (TP), orthophosphate (Ortho P), total suspended solids (TSS), fecal coliform (fecal), and E.coli. All analyses were performed by independent and fully NELAC certified analytical laboratories (Southern Analytical Laboratory and Ackuritlabs, Inc.). For this sample event, both laboratories analyzed total Kjeldahl nitrogen (TKN-N), ammonia nitrogen ( $\text{NH}_3\text{-N}$ ), nitrate nitrogen ( $\text{NO}_3\text{-N}$ ), nitrite nitrogen ( $\text{NO}_2\text{-N}$ ) in order to assure analytical quality. Table 1 lists the analytical parameters, analytical methods, and detection limits for these analyses.

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**Table 1**  
**Analytical Parameters, Method of Analysis, and Detection Limits**

<b>Analytical Parameter</b>	<b>Method of Analysis</b>	<b>Method Detection Limit (mg/L)</b>
Total Alkalinity as CaCO <sub>3</sub>	SM 2320B	2 mg/L
Chemical Oxygen Demand (COD)	EPA 410.4	10 mg/L
Total Kjeldahl Nitrogen (TKN-N)	EPA 351.2	0.05 mg/L
Ammonia Nitrogen (NH <sub>3</sub> -N)	EPA 350.1	0.005 mg/L
Nitrate Nitrogen (NO <sub>3</sub> -N)	EPA 300.0	0.01 mg/L
Nitrite Nitrogen (NO <sub>2</sub> -N)	EPA 300.0	0.01 mg/L
Total Phosphorus (TP)	SM 4500P-E	0.01 mg/L
Orthophosphate as P (Ortho P)	EPA 300.0	0.01 mg/L
Carbonaceous Biological Oxygen Demand (CBOD <sub>5</sub> )	SM5210B	2 mg/L
Total Solids (TS)	EPA 160.3	.01 % by wt
Total Suspended Solids (TSS)	SM 2540D	1 mg/L
Volatile Suspended Solids (VSS)	SM 2540E	1 mg/L
Fecal Coliform (fecal)	SM9222D	2 ct/100mL
E.coli	EPA1603	2 ct/100mL
<b>Additional Analysis performed by Ackurilabs, Inc.</b>		
Total Kjeldahl Nitrogen (TKN-N)	SM 4500-NH <sub>3</sub> D	0.071 mg/L
Ammonia Nitrogen (NH <sub>3</sub> -N)	SM 4500-NH <sub>3</sub> D	0.067 mg/L
Nitrate Nitrogen (NO <sub>3</sub> -N)	SM 4500-NO <sub>3</sub> E	0.012 mg/L
Nitrite Nitrogen (NO <sub>2</sub> -N)	SM 3500-NO <sub>2</sub> B	0.012 mg/L

## 4.0 Results and Discussion

### 4.1 Operational Monitoring

The flow meter readings, recycle ratio, and average daily water use for the B-HS1 field site are summarized in Table 2. The operation and maintenance log which includes actions taken since start-up is provided in Appendix B. Summary tables of the Vericomm PLC recorded data are provided in Appendix C. These include daily and cumulative pump runtime and system alarms that are used to check general pump operation and performance.



**Table 2**  
**Summary of System Flow Rates**

Date and Time Read	House Water Meter Reading	Average Daily Household Flow, Q	Aerocell™ Flow Meter Reading	Average Daily Flow Total Q + R <sup>1</sup>	Average Recycle Ratio
	Cumulative Volume (gallons)	Gallons/day	Cumulative Volume (gallons)	Gallons/Day	Recycle: Forward Flow
6/8/2011 14:10	0.0	0.0	0.0	0.0	
6/9/2011 17:10	87.3	77.6	2.1	0.0	0.0 : 1
6/10/2011 12:25	148.2	75.9	629.2	668.9	7.8 : 1
7/6/2011 11:20	2,884.8	105.4	35,025.2	1,325.2	11.6 : 1
7/7/2011 17:10	3,088.6	164.0	38,272.2	2,612.1	14.9 : 1
7/19/2011 10:30	4,254.0	99.4	40,756.0	212.0	1.1 : 1
9/13/2011	9904.0	101.7	60,840.0	361.5	2.6 : 1
10/26/2011 8:24	13804.7	90.0	118,640.9	1333.3	13.8 : 1
11/30/2011	17673.0	111.6	125,260.0	191.0	0.7 : 1
Total average prior to SRD <sup>2</sup> replacement		101.3		722.3	6.1 : 1
12/23/2011	20,280.0	113.3	153,930.0	1,246.5	10.0 : 1
1/25/2012 9:00	23,871.3	107.6	192,410.5	1,154.4	9.7 : 1
1/30/2012 10:10	24,443.3	113.3	198,874.8	1,268.5	10.2 : 1
2/24/2012 11:08	27,458.0	120.4	231,640.5	1,308.7	9.9 : 1
3/27/2012 9:56	30,820.2	105.2	267,763.0	1,130.4	9.7 : 1
4/20/2012 11:45	33,379.8	106.3	291,392.5	981.6	8.2 : 1
5/24/2012 8:55	36,914.4	104.3	323,118.2	936.4	8.0 : 1
6/22/2012 9:13	39,954.4	104.8	351,626.7	982.6	8.4 : 1
8/6/2012 8:52	45,137.0	115.2	413,985.7	1,386.2	11.0 : 1
8/30/2012 11:16	47,678.9	105.6	444,252.0	1,257.3	10.9 : 1
9/26/2012 11:19	51,047.0	124.7	478,626.3	1,271.7	9.2 : 1
10/26/2012 12:39	54,348.4	109.8	505,821.1	904.8	7.2 : 1
11/28/2012 9:37	58,471.2	125.4	540,715.2	1,061.3	7.5 : 1
12/27/2012 10:42	61,641.0	109.1	570,706.9	1,032.7	8.5 : 1
1/24/2013 10:52	64,779.2	112.1	606,945.4	1,293.9	10.5 : 1
Total average after SRD <sup>2</sup> replacement		111.7		1,136.9	9.2 : 1
Total average start-up to 1/24/13		108.7		1,020.3	8.4 : 1

<sup>1</sup>Household (Q) + Recirculation (R)

<sup>2</sup>Split recirculation device (SRD) was replaced December 9, 2011.

The split recirculation device (SRD) controls the fraction of Aerocell™ effluent that is recirculated and the fraction sent to the Nitrex™ tank. The SRD was initially set so that 5

parts went back to the pump chamber and 1 part went to the Nitrex™ tank (5:1 recycle ratio). While calibrating the replacement SRD, the vendor increased the recycle ratio target to 10:1 to improve performance of the nitrification unit. The recycle ratio drifted downward towards 8:1 from April through June. In August and September the recycle ratio was close to the manufacturer's set point. The calculated recycle ratio was 7.2:1 for the October monthly monitoring and for the November 28, 2012 sampling event was 7.5:1. The December monthly monitoring showed an increase in the recirculation ratio to 8.5:1 and a further increase to 10.5:1 for the January 24, 2013 sampling event. The cause for the fluctuation observed in recirculation is not clear as the flow splitter device was not adjusted and the household water usage has remained fairly consistent (Table 2).

Prior to the SRD replacement, the household flow average was 101.3 gallons per day with periods of higher and lower flows. The average flow to the Aerocell™ unit was 722.3 gallons per day with a corresponding average recycle ratio of 6.1:1. Following the SRD replacement, the household flow average was 111.7 gallons per day, and the average flow to the Aerocell™ unit was 1,136.9 gallons per day with a corresponding average recycle ratio of 9.2:1. The household flow average between start-up and January 24, 2013 was 108.7 gallons per day, and the average flow to the Aerocell™ unit was 1,020.3 gallons per day with a corresponding average recycle ratio of 8.4:1.

## **4.2 Energy, Chemical and/or Additives Consumption**

Energy consumption is monitored using an electrical meter installed between the main power box for the house and the control panel to record cumulative power usage of the pump in kilowatt-hours. The recorded electrical use for the system is summarized in Table 3.

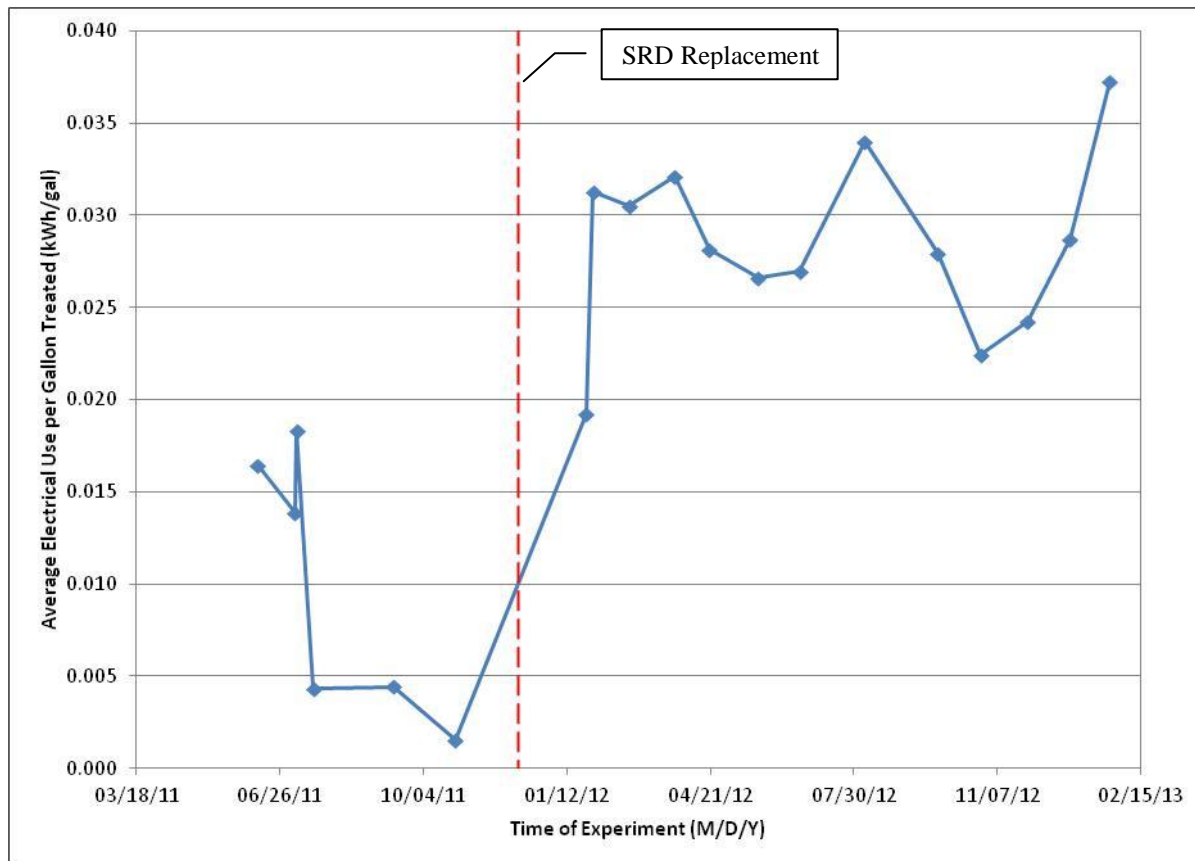
**Table 3**  
**Summary of System Electrical Use**

Date and Time Read	Electrical Meter Reading	Average Daily Electrical Use	Average Electrical Use per Gallon Treated
	Cumulative (kWh)	(kWh/day)	(kWh/gal)
6/9/2011 17:10	1		
6/10/2011 12:25	2	1.25	0.0164
7/6/2011 11:30	40	1.46	0.0139
7/7/2011 19:30	44	3.00	0.0183
7/19/2011 11:00	49	0.43	0.0043
9/13/2011	74	0.45	0.0044
10/26/2011 8:27	80	0.14	0.0015
Total average prior to SRD <sup>1</sup> replacement		0.57	0.0098
1/25/2012 8:30	268	2.07	0.0192
1/30/2012 10:26	286	3.54	0.0313
2/24/2012 11:15	378	3.67	0.0305
3/27/2012 10:06	486	3.38	0.0321
4/20/2012 11:46	558	2.99	0.0281
5/24/2012 8:58	652	2.77	0.0266
6/22/2012 9:14	734	2.83	0.0270
8/6/2012 8:50	910	3.91	0.0340
8/30/2012 11:14	994	3.49	0.0330
9/26/2012 11:21	1,088	3.48	0.0279
10/26/2012 12:40	1,162	2.46	0.0224
11/28/2012 9:40	1,262	3.04	0.0243
12/27/2012 10:43	1,353	3.13	0.0287
1/24/2013 10:52	1,470	4.18	0.0373
Total average after SRD <sup>1</sup> replacement		3.29	0.0295
Total average start-up to 1/24/13		2.47	0.0227

<sup>1</sup>Split recirculation device (SRD) was replaced December 9, 2011.

The total average electrical use through January 24, 2013 was 2.47 kWh per day. The higher readings, following the SRD replacement, are attributed to the increased pump runtime due to the increased target recycle ratio. The average electrical use following the SRD replacement was 3.29 kWh per day. The average electrical use per gallon treated following the SRD replacement is 0.0295 kWh per gallon and this parameter appears fairly stable in the period of January 30, 2012 to January 24, 2013. Figure 5 shows a plot of the average electrical use per gallon treated versus time of experiment.



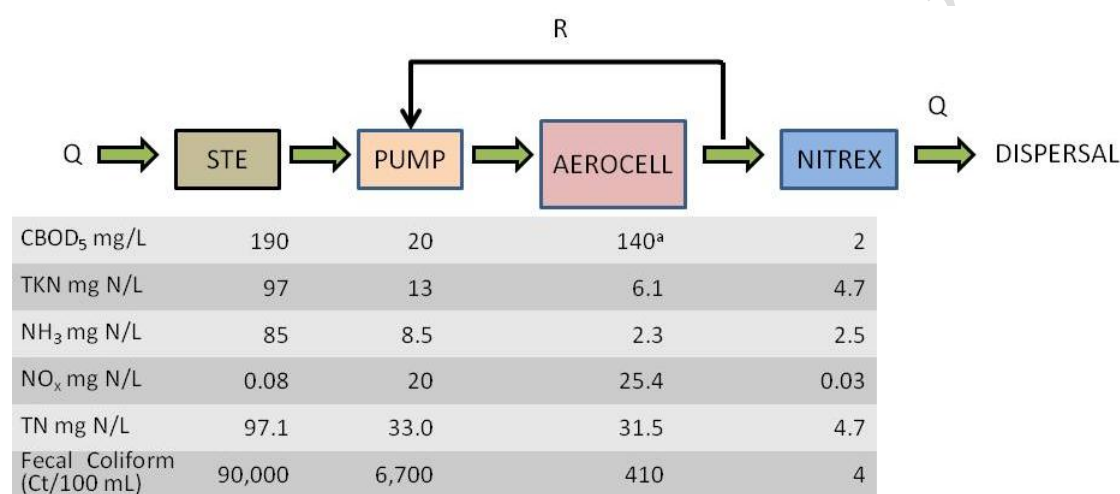


**Figure 5**  
**Plot of Average Electrical Use per Gallon Pumped**

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### 4.3 Water Quality Results, Sample Event No. 8

Water quality analytical results for Sample Event No. 8 are listed in Table 4. The laboratory reports containing the raw analytical data is included in Appendix A. The following discussion summarizes the water quality analytical results. The performance of the various system components were compared by considering the changes through treatment of nitrogen species (TKN-N,  $\text{NH}_3\text{-N}$ , and  $\text{NO}_x\text{-N}$ ), as well as supporting water quality parameters. The nitrogen and other key parameter results for this sampling event are graphically displayed in Figure 6.



<sup>a</sup>CBOD<sub>5</sub> result suspect, likely lab error, results to be checked by lab.

**Figure 6**  
**Graphical Representation of Nitrogen Results**

**Septic Tank Effluent (STE) Quality:** The water quality characteristics of STE collected in Sample Event 8 were within the typical range generally expected for domestic STE. The measured STE total nitrogen (TN) concentration was 97 mg/L, which is in the upper range of values typically reported for Florida single family residence STE. The residence has relatively low water usage for a family of four, likely resulting in the higher concentration of nitrogen in the STE.

**Pump Chamber and Aerocell™ Effluent:** The pump chamber and Aerocell™ effluent NH<sub>3</sub>-N levels were 8.5 mg/L and 2.3 mg/L, respectively with a DO level at 3.0 mg/L in the Aerocell™ effluent (Table 4). The pump chamber TSS was 8 mg/L and CBOD<sub>5</sub> was 20 mg/L. The Aerocell™ effluent TSS was 2 mg/L and CBOD<sub>5</sub> was 140 mg/L. This CBOD<sub>5</sub>

result is higher than previously measured at this site, and also significantly higher than the COD, which is very unlikely. Laboratory error is suspect, and a request to the laboratory to check calculations has been requested. The pump chamber effluent  $\text{NO}_x\text{-N}$  was 20.0 mg/L, and Aerocell<sup>TM</sup> effluent  $\text{NO}_x\text{-N}$  was 25.4 mg/L. These results indicate significant denitrification (approximately 66% reduction of STE nitrogen) was occurring as the effluent was recirculated back into the pump chamber. The Aerocell<sup>TM</sup> unit continued to show significant nitrification as seen in the previous sampling event with an  $\text{NH}_3\text{-N}$  concentration of 2.3 mg/L and TKN of 6.1 mg/L.

**Nitrex<sup>TM</sup> Effluent:** Effluent  $\text{NO}_x\text{-N}$  from the Nitrex<sup>TM</sup> unit was 0.04 mg/L. The low  $\text{NO}_x\text{-N}$  was accompanied by a measured 0.25 mg/L DO and -241 mV ORP. The DO sampling methodology was the same as the previous sampling event, using the method of taking the sample field readings in a secondary container. Extra care was taken to assure no bubbles were present in the sample tubing with a steady overflow of fresh sample during the multiple recorded readings. The Nitrex<sup>TM</sup> system was effective in producing a reducing environment and achieving the  $\text{NO}_x\text{-N}$  reduction goals. Final total nitrogen (TN) in the treatment system effluent was 4.7 mg/L, primarily TKN. The Nitrex<sup>TM</sup> unit effluent CBOD<sub>5</sub> and E. coli were effectively reduced to below the method detection limit. Fecal coliform was low at 4 colonies/100mL.

**External QC Laboratory Results:** As previously discussed, external QC laboratory samples were collected immediately subsequent to the regular samples for analysis of the nitrogen species. Table 6 shows the results of the QC sampling for this sample event, and a calculation of the percent difference between the sample value and the duplicate/split samples. The calculated TN results from the two laboratories were within 10% agreement except for the lower value Nitrex samples, which were 4.7 mg/L-N for Southern Analytical Laboratory and 2.6 mg/L-N for Ackurilabs, Inc. However, there was less agreement with the individual nitrogen species, especially with ammonia nitrogen ( $\text{NH}_3\text{-N}$ ). This is thought to be a result from the different analytical methods used by each laboratory (Table 1).

#### 4.4 Water Quality Monitoring Summary

A summary of the water quality data collected for the test system is presented in Table 5. Figure 7 presents the mean and median values of key parameter results over the 594 day monitoring period. Figure 8 provides a time series of influent and effluent TN over the study period. Figures 9 through 14 show box and whisker plots of the various monitoring points for the key parameters measured during the study period.



**Table 4**  
**Water Quality Analytical Results**

Sample ID	Analytical Laboratory	Sample Date/Time	Sample Type	Temp (°C)	pH	Total Alkalinity (mg/L)	DO (mg/L)	ORP (mV)	Specific Conductance (µS)	TSS (mg/L)	VSS (mg/L)	CBOD <sub>5</sub> (mg/L)	COD	TN (mg/L N) <sup>1</sup>	TKN (mg/L N)	Organic N (mg/L N) <sup>2</sup>	NH <sub>3</sub> -N (mg/L N)	NO <sub>3</sub> -N (mg/L N)	NO <sub>2</sub> -N (mg/L N)	NO <sub>x</sub> (mg/L N)	TIN (mg/L N) <sup>3</sup>	TP (mg/L)	Ortho P (mg/L P)	Fecal (Ct/100 mL)	E-coli (Ct/100 mL)
B-HS1-STE	Southern	1/24/2013 13:20	G			660				22	14	190	370	97.1	97	12.0	85	0.08	0.01	0.09	85.1	11	3.8		
B-HS1-STE-SP	Ackurit	1/24/2013 13:20	G	18.4	6.80		0.12	-262	1312					104.4	104	66.9	37.1	0.424	0.017	0.44	37.5			90,000	83,000
B-HS1-PUMP	Southern	1/24/2013 13:04	G			310				8	3	20	49	33.0	13	4.5	8.5	19	1.00	20.0	28.5	9.2	1.7		
B-HS1-PUMP-SP	Ackurit	1/24/2013 13:04	G	16.9	6.91		1.01	92	885					32.5	7.00	1.1	5.92	24.3	1.17	25.47	31.4			6,700	5,700
B-HS1-AEROCELL	Southern	1/24/2013 12:46	G			260				2	2	140	36	31.5	6.1	3.8	2.3	25	0.39	25.39	27.7	9.1	1.7		
B-HS1-AEROCELL-DUP	Southern	1/24/2013 12:47	G			260				2	2	130	32	31.9	5.6	3.4	2.2	26	0.34	26.34	28.5	9	1.5		
B-HS1-AEROCELL-SP	Ackurit	1/24/2013 12:46	G	16.5	7.05		3.01	77	846					31.9	1.88	0.3	1.54	29.6	0.423	30.02	31.6			410	410
B-HS1-AEROCELL-SP-DUP	Ackurit	1/24/2013 12:47	G	16.5	7.05		3.01	77	846					35.0	1.60	1.5	0.067	33.0	0.405	33.41	33.5			440	420
B-HS1-NITREX	Southern	1/24/2013 12:22	G			380				1	1	2	51	4.7	4.7	2.2	2.5	0.03	0.01	0.04	2.5	11	3.8		
B-HS1-NITREX-SP	Ackurit	1/24/2013 12:22	G	17.0	6.43		0.25	-241	809					2.6	2.60	1.1	1.49	0.012	0.012	0.02	1.5			4	2

Notes:

<sup>1</sup>Total Nitrogen (TN) is a calculated value equal to the sum of TKN and NO<sub>x</sub>.

<sup>2</sup>Organic Nitrogen (ON) is a calculated value equal to the difference of TKN and NH<sub>3</sub>.

<sup>3</sup>Total Inorganic Nitrogen (TIN) is a calculated value equal to the sum of NH<sub>3</sub> and NO<sub>x</sub>.

D.O. - Dissolved oxygen

G - Grab sample

SP - split sample; DUP - duplicate sample

Gray-shaded data points indicate values below method detection level (mdl), mdl value used for statistical analyses.

Yellow-shaded data points indicate the reported value is between the laboratory method detection limit and the laboratory practical quantitation limit, value used for statistical analysis.

Orange-shaded data points indicate results based upon colony counts exceeded the ideal range of 20-60 (fecal coliform) or 20-80 (*E. coli*) colonies per plate.

Result suspect, likely lab error, result to be checked by lab.

**Table 5**  
**Summary of Water Quality Data**

Sample ID	Statistical Parameter	Temp (°C)	pH <sup>4</sup>	Total Alkalinity (mg/L)	DO (mg/L)	ORP (mV)	Specific Conductance (µS)	TSS (mg/L)	VSS (mg/L)	TVS (mg/L)	CBOD <sub>5</sub> (mg/L)	COD	TN (mg/L N) <sup>1</sup>	TKN (mg/L N)	Organic N (mg/L N) <sup>2</sup>	NH <sub>3</sub> -N (mg/L N)	NO <sub>3</sub> -N (mg/L N)	NO <sub>2</sub> -N (mg/L N)	NOx (mg/L N)	TIN (mg/L N) <sup>3</sup>	TP (mg/L)	Ortho P (mg/L P)	Fecal <sup>4</sup> (Ct/100 mL)	E-coli <sup>4</sup> (Ct/100 mL)
B-HS1-STE	n	8	8	8	8	8	8	8	7	2	8	8	8	8	8	8	7	7	8	8	8	8	8	8
	MEAN	21.79	6.95	610.00	0.25	-168.64	1187.75	48.63	42.71	210.00	108.00	297.50	82.74	82.63	18.50	64.13	0.07	0.12	0.12	64.24	8.65	4.30	151,088	96,893
	STD. DEV.	2.71		129.17	0.39	163.53	85.33	13.04	15.88	28.28	51.97	99.68	10.96	10.98	7.89	9.72	0.09	0.17	0.11	9.72	1.49	0.94		
	MIN	18.40	6.77	530.00	0.00	-298.10	1019.00	22.00	14.00	190.00	30.00	170.00	71.13	71.00	10.00	55.00	0.01	0.01	0.01	55.01	6.60	2.60	36,000	20,000
	MAX	26.10	7.11	910.00	1.19	192.00	1312.00	63.00	64.00	230.00	190.00	420.00	97.09	97.00	29.00	85.00	0.26	0.46	0.30	85.09	11.00	5.50	800,000	740,000
B-HS1-PUMP	n	8	8	8	7	8	8	8	7	2	8	8	8	8	8	8	7	7	8	8	8	8	8	8
	MEAN	21.06	6.82	247.50	1.69	68.63	884.38	7.25	5.14	195.00	12.88	47.00	46.20	18.10	3.95	14.15	31.29	0.79	28.10	42.25	8.15	2.46	2,703.11	2,100.78
	STD. DEV.	3.37		110.42	0.95	46.13	61.65	4.62	3.93	134.35	7.14	20.25	11.87	12.85	2.28	12.77	9.53	0.65	14.18	12.89	1.34	0.91		
	MIN	16.90	6.16	110.00	0.71	-24.00	756.00	1.00	3.00	100.00	3.00	26.00	33.00	6.30	1.30	5.00	19.00	0.42	0.27	28.50	6.00	1.30	8	6
	MAX	26.30	7.03	470.00	3.31	109.00	951.00	14.00	13.00	290.00	22.00	90.00	70.20	41.00	8.90	38.00	47.00	2.20	47.53	67.20	9.50	4.10	80,000	50,000
B-HS1-AEROCELL	n	8	8	8	8	8	8	8	7	2	8	8	8	8	8	8	7	7	8	8	8	8	8	8
	MEAN	20.61	6.71	214.50	2.80	28.46	862.25	4.75	3.36	200.00	26.50	34.63	44.51	12.14	3.81	8.32	36.00	0.54	32.38	40.70	8.13	1.93	435.68	369.07
	STD. DEV.	3.61		87.19	1.02	52.70	55.88	5.73		42.43	47.01	13.74	11.55	9.71	3.04	9.12	9.80	0.35	14.81	12.28	1.33	0.79		
	MIN	16.50	5.82	86.00	1.12	-93.30	754.00	1.00	1.50	170.00	2.00	18.00	26.20	2.40	1.60	0.08	24.00	0.27	3.20	23.20	6.10	0.66	18	18
	MAX	26.10	7.07	380.00	4.42	77.00	939.00	18.00	6.00	230.00	140.00	61.00	62.30	28.00	11.10	25.00	52.00	1.30	52.27	59.30	9.60	3.30	35,000	31,000
B-HS1-NITREX	n	8	8	8	7	8	8	8	7	2	8	8	8	8	8	8	7	7	8	8	8	8	8	8
	MEAN	20.28	6.52	370.00	1.12	-170.24	792.75	3.50	4.93	101.50	27.25	75.38	7.11	7.03	2.51	4.52	0.09	0.01	0.09	4.60	7.64	2.63	5.93	4.68
	STD. DEV.	3.40		52.92	1.21	126.28	73.64	2.07	3.54	54.45	35.07	40.01	5.72	5.75	1.77	4.56	0.09	0.00	0.09	4.52	1.70	0.79		
	MIN	16.90	5.75	310.00	0.19	-284.90	669.00	1.00	1.00	63.00	2.00	47.00	2.97	2.70	0.80	0.94	0.02	0.01	0.01	1.21	5.90	1.60	2	2
	MAX	25.40	7.33	470.00	3.46	126.00	882.00	7.00	9.50	140.00	110.00	170.00	20.03	20.00	5.60	15.00	0.26	0.01	0.27	15.03	11.00	3.80	600	600

Notes:

<sup>1</sup>Total Nitrogen (TN) is a calculated value equal to the sum of TKN and NO<sub>x</sub>.

<sup>2</sup>Organic Nitrogen (ON) is a calculated value equal to the difference of TKN and NH<sub>3</sub>.

<sup>3</sup>Total Inorganic Nitrogen (TIN) is a calculated value equal to the sum of NH<sub>3</sub> and NO<sub>x</sub>.

<sup>4</sup>Geometric mean provided rather than arithmetic mean.

D.O. - Dissolved oxygen

G - Grab sample

Gray-shaded data points indicate values below method detection level (mdl), mdl value used for statistical analyses.

Yellow-shaded data points indicate the reported value is between the laboratory method detection limit and the laboratory practical quantitation limit, value used for statistical analysis.

Orange-shaded data points indicate results based upon colony counts exceeded the ideal range of 20-60 (fecal coliform) or 20-80 (*E. coli*) colonies per plate.

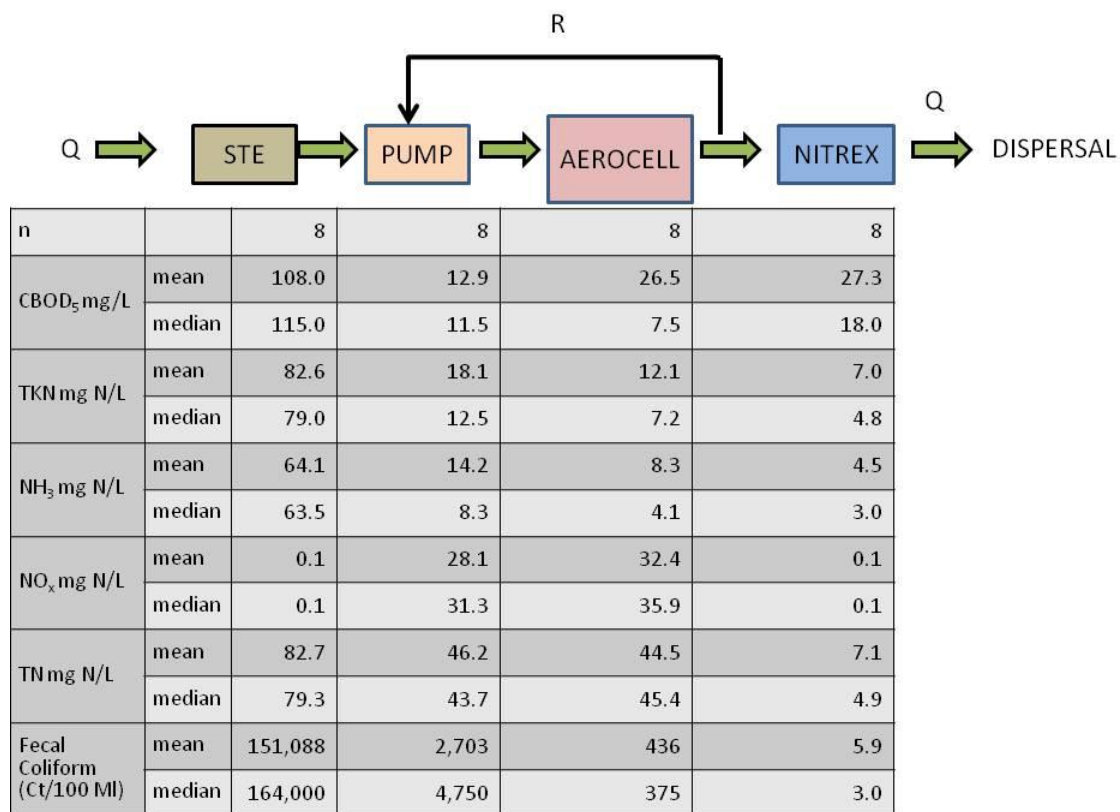
**Table 6**  
**Sample Event No. 8 External QC Sample Results**

Sample ID	Analytical Laboratory	TN (mg/L N)		TKN (mg/L N)		NH <sub>3</sub> -N (mg/L N)		NO <sub>3</sub> -N (mg/L N)		NO <sub>2</sub> -N (mg/L N)		NO <sub>x</sub> (mg/L N)	
		Value	% diff	Value	% diff	Value	% diff	Value	% diff	Value	% diff	Value	% diff
B-HS1-STE	Southern	97.1		97.0		85.0		0.1		0.01		0.09	
B-HS1-STE-SP	Ackurit	104.4	7.0%	104.0	6.7%	37.1	-129.1%	0.4	81.1%	0.02	MDL	0.44	79.6%
B-HS1-PUMP	Southern	33.0		13.0		8.5		19.0		1.00		20.00	
B-HS1-PUMP-SP	Ackurit	32.5	-1.6%	7.0	-85.7%	5.9	-43.6%	24.3	21.8%	1.17	14.5%	25.47	21.5%
B-HS1-AEROCELL	Southern	31.5		6.1		2.3		25.0		0.39		25.39	
B-HS1-AEROCELL-DUP	Southern	31.9	1.4%	5.6	-8.9%	2.2	-4.5%	26.0	3.8%	0.34	-14.7%	26.34	3.6%
B-HS1-AEROCELL-SP	Ackurit	31.9	1.3%	1.9	-224.5%	1.5	-49.4%	29.6	15.5%	0.42	7.8%	30.02	15.4%
B-HS1-AEROCELL-SP-DUP	Ackurit	35.0	8.9%	1.6	-17.5%	0.1	MDL	33.0	10.3%	0.41	-4.4%	33.41	10.1%
B-HS1-NITREX	Southern	4.7		4.7		2.5		0.03		0.01		0.04	
B-HS1-NITREX-SP	Ackurit	2.6	-80.6%	2.6	-80.8%	1.5	-67.8%	0.01	MDL	0.01	MDL	0.02	-66.7%

Gray-shaded data points indicate values below method detection level (mdl), mdl value used for statistical analyses.

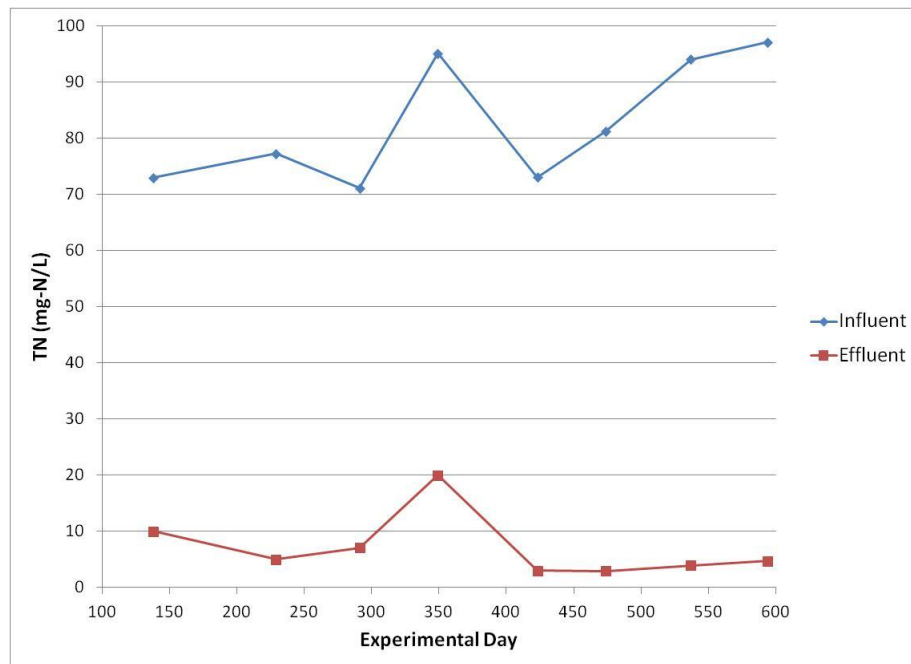
Yellow-shaded data points indicate the reported value is between the laboratory method detection limit and the laboratory practical quantitation limit, value used for statistical analysis.

Result suspect, likely lab error, result to be checked by lab.

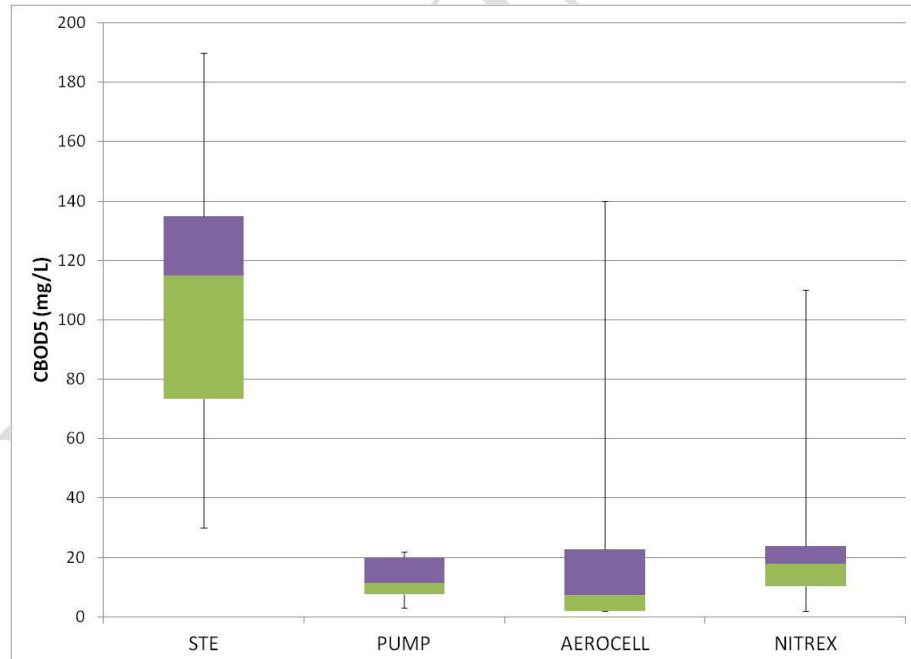


<sup>1</sup>594 day monitoring period

**Figure 7**  
**Graphical Representation of Mean and Median Values of Key Parameter Results**

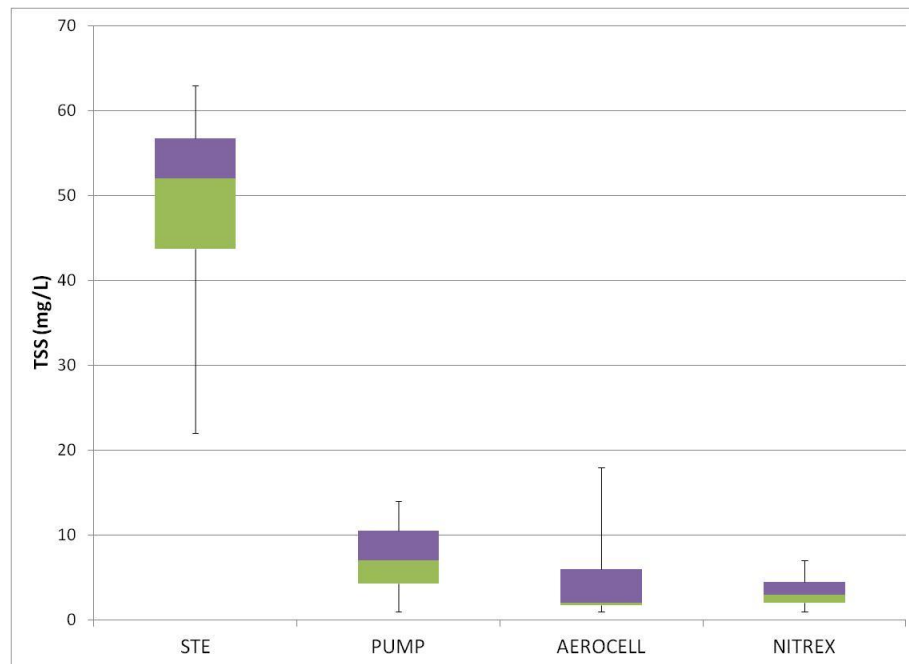


**Figure 8**  
**Influent and Effluent TN Time Series Plot**

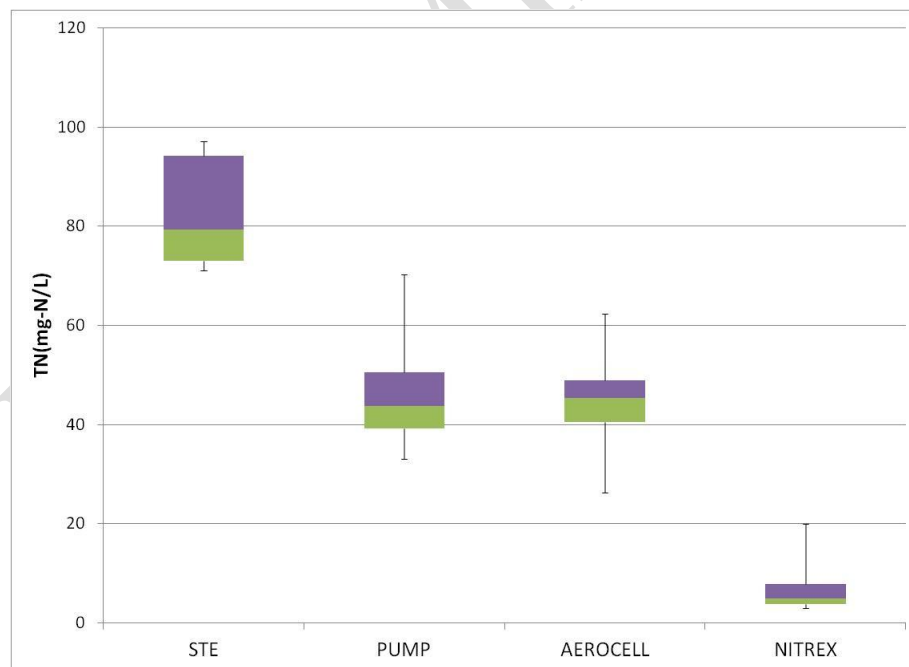


**Figure 9**  
**CBOD<sub>5</sub> Box and Whisker Plot**

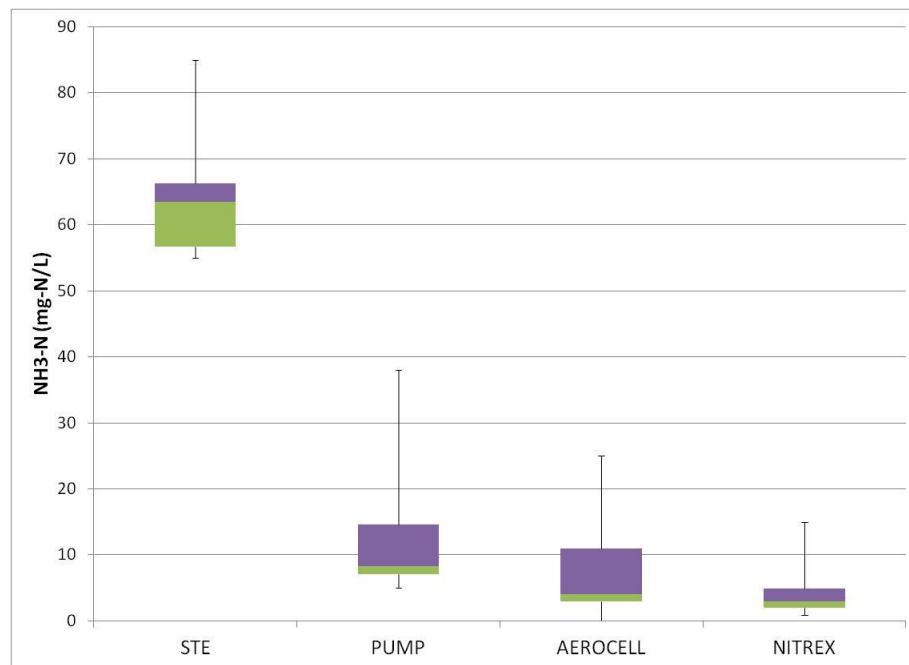




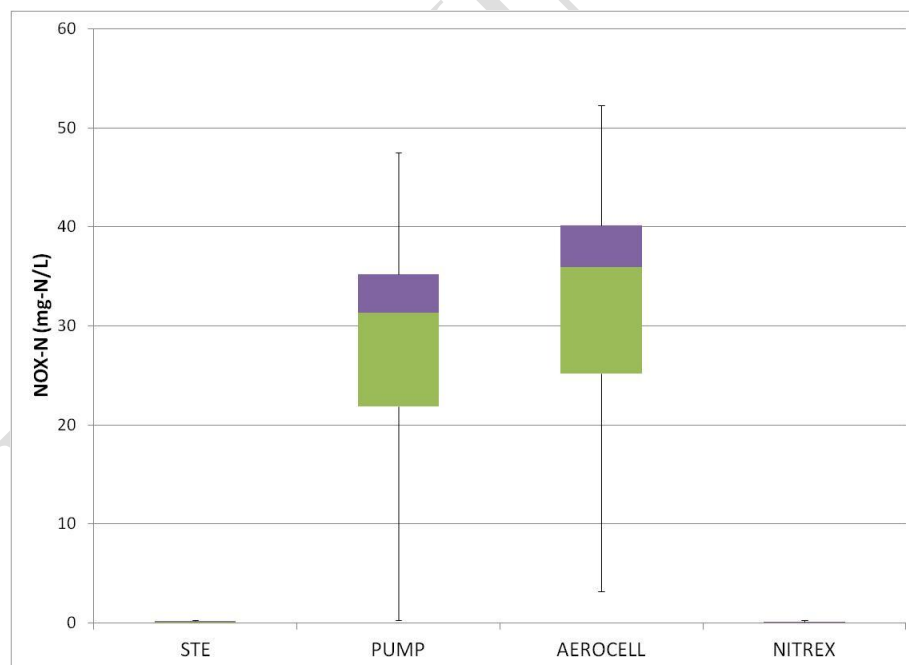
**Figure 10**  
**TSS Box and Whisker Plot**



**Figure 11**  
**TN Box and Whisker Plot**

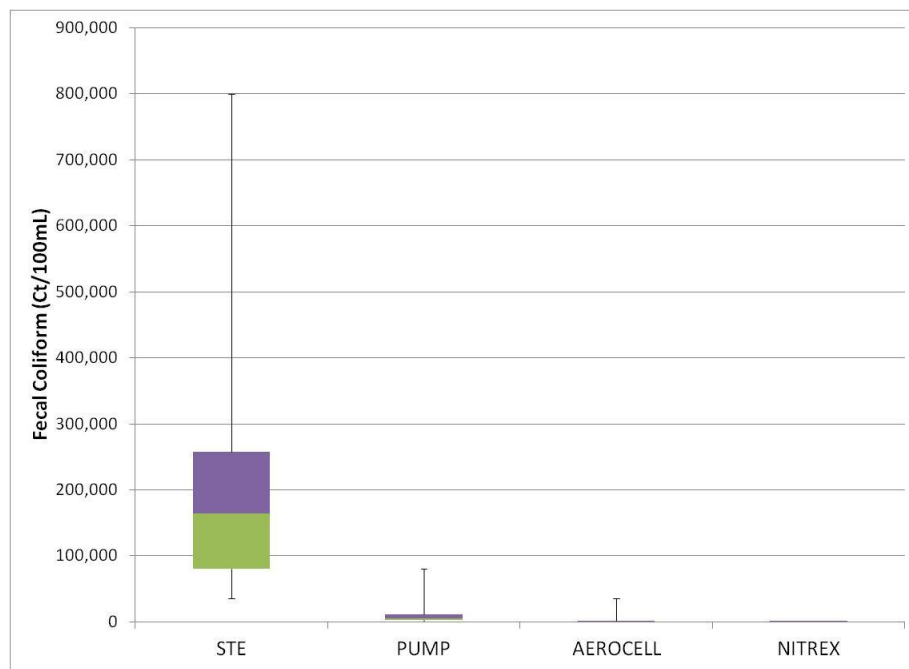


**Figure 12**  
**Ammonia N Box and Whisker Plot**



**Figure 13**  
**NOx-N Box and Whisker Plot**

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**Figure 14**  
**Fecal Coliform Box and Whisker Plot**

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## 5.0 B-HS1 Sample Event No. 8: Summary and Conclusions

### 5.1 Summary

The eighth and final sampling event results indicate that:

- Septic tank effluent (STE) quality is characteristic of typical household STE quality. The total nitrogen concentration of 97 mg/L is in the upper range of values typically reported for Florida single family residence STE.
- The Aerocell™ biofilter was effective in converting ammonia N to oxidized nitrogen; effluent contained 6.1 mg/L TKN, of which 2.3 mg/L was ammonia N.
- The Nitrex™ system was effective in producing a reducing environment and achieving the NO<sub>x</sub>-N reduction goals. The Nitrex™ unit effluent fecal coliform was reduced to 4 colonies/100ml and E. coli were effectively reduced to below method detection levels.
- The total nitrogen concentration in the final effluent from the total treatment system was 4.7 mg/L, an approximately 95% reduction from STE.

### 5.2 Conclusions

Sample Event 8 was the last funded sample event for the B-HS1 treatment system. Section 4.4 summarized the water quality data collected over the 1.6 year monitoring period for this system. These results indicate that:

- The septic tank effluent average total nitrogen concentration of 82.7 mg/L is in the upper range of values typically reported for Florida single family residence STE.
- The pump chamber effluent average NO<sub>x</sub>-N was 28.1 mg/L, and Aerocell™ effluent average NO<sub>x</sub>-N was 32.4 mg/L. These results indicate significant denitrification was occurring as the effluent was recirculated back into the pump chamber.
- The Aerocell™ unit provided significant nitrification with an average NH<sub>3</sub>-N concentration of 8.3 mg/L and average TKN of 12.1 mg/L.

- The Nitrex™ system was effective in producing a reducing environment and achieving the NO<sub>x</sub>-N reduction goals (average NO<sub>x</sub>-N concentration of 0.1 mg/L). The average final total nitrogen (TN) in the treatment system effluent was 7.1 mg/L, primarily TKN (average TKN concentration of 7.0 mg/L). The Nitrex™ unit effluent average TSS and fecal coliform concentrations were effectively reduced to below 10.

Further analysis of the results obtained at this site will occur as Task B results are compiled and summarized. The results of the data collected to date have provided insights into the performance of a full-scale passive nitrogen reduction system monitored over an extended timeframe (594 experimental days) under actual onsite conditions.





## **Appendix A: Laboratory Report**

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PRELIMINARY

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**Hazen and Sawyer**  
**10002 Princess Palm Ave, Suite 200**  
**Tampa, FL 33619**

**February 1, 2013**  
**Work Order: 1300948**

## Laboratory Report

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<b>Project Name</b>	<b>Wakulla County B-HS1 SE#8</b>
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Sample Description	<b>B-HS1-STE</b>
Matrix	<b>Wastewater</b>
SAL Sample Number	<b>1300948-01</b>
Date/Time Collected	<b>01/24/13 13:20</b>
Collected by	<b>Client</b>
Date/Time Received	<b>01/25/13 09:15</b>

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Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
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**Client Provided Field Data**

pH		6.80						
Temperature		18.4 °C						
Conductivity		1312 umhos/cm						

**Inorganics**

Ammonia as N	mg/L	85	EPA 350.1	4.0	0.95		01/28/13 14:36	100
Ammonium as NH <sub>4</sub>	mg/L	110	EPA 350.1	0.05	0.01		01/28/13 15:01	1
Carbonaceous BOD	mg/L	190	SM 5210B	2	2	01/25/13 14:47	01/30/13 11:10	1
Chemical Oxygen Demand	mg/L	370	EPA 410.4	120	50	01/28/13 10:10	01/28/13 12:43	5
Nitrate (as N)	mg/L	0.08	EPA 300.0	0.04	0.01		01/26/13 11:23	1
Nitrate+Nitrite (N)	mg/L	0.08	EPA 300.0	0.08	0.02		01/26/13 11:23	1
Nitrite (as N)	mg/L	0.01 u	EPA 300.0	0.04	0.01		01/26/13 11:23	1
Orthophosphate as P	mg/L	3.8	EPA 300.0	0.040	0.010		01/26/13 11:23	1
Phosphorous - Total as P	mg/L	11	SM 4500P-E	0.40	0.10	01/26/13 08:21	01/29/13 15:52	10
Total Alkalinity	mg/L	660	SM 2320B	8.0	2.0		01/29/13 14:57	1
Total Kjeldahl Nitrogen	mg/L	97	EPA 351.2	0.20	0.05	01/29/13 07:24	01/30/13 16:17	100
Total Suspended Solids	mg/L	22	SM 2540D	1	1	01/26/13 07:31	01/31/13 13:24	1
Volatile Suspended Solids	mg/L	14	EPA 160.4**	1	1	01/26/13 07:31	01/31/13 13:24	1

**Hazen and Sawyer**  
**10002 Princess Palm Ave, Suite 200**  
**Tampa, FL 33619**

**February 1, 2013**  
**Work Order: 1300948**

## Laboratory Report

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<b>Project Name</b>	<b>Wakulla County B-HS1 SE#8</b>
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Sample Description	<b>B-HS1-PUMP</b>
Matrix	<b>Wastewater</b>
SAL Sample Number	<b>1300948-02</b>
Date/Time Collected	<b>01/24/13 13:04</b>
Collected by	<b>Client</b>
Date/Time Received	<b>01/25/13 09:15</b>

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Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
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**Client Provided Field Data**

pH		6.91						
Temperature		16.9 °C						
Conductivity		885 umhos/cm						

**Inorganics**

Ammonia as N	mg/L	8.5	EPA 350.1	1.0	0.24		01/28/13 14:37	25
Ammonium as NH4	mg/L	11	EPA 350.1	0.05	0.01		01/28/13 15:01	1
Carbonaceous BOD	mg/L	20	SM 5210B	2	2	01/25/13 14:47	01/30/13 11:10	1
Chemical Oxygen Demand	mg/L	49	EPA 410.4	25	10	01/28/13 10:10	01/28/13 12:43	1
Nitrate (as N)	mg/L	19	EPA 300.0	0.04	0.01		01/26/13 11:23	1
Nitrate+Nitrite (N)	mg/L	20	EPA 300.0	0.08	0.02		01/26/13 11:23	1
Nitrite (as N)	mg/L	1.0	EPA 300.0	0.04	0.01		01/26/13 11:23	1
Orthophosphate as P	mg/L	1.7	EPA 300.0	0.040	0.010		01/26/13 11:23	1
Phosphorous - Total as P	mg/L	9.2	SM 4500P-E	0.20	0.050	01/26/13 08:21	01/29/13 15:29	5
Total Alkalinity	mg/L	310	SM 2320B	8.0	2.0		01/29/13 14:57	1
Total Kjeldahl Nitrogen	mg/L	13	EPA 351.2	0.20	0.05	01/29/13 07:24	01/30/13 13:43	5
Total Suspended Solids	mg/L	8	SM 2540D	1	1	01/26/13 07:31	01/31/13 13:24	1
Volatile Suspended Solids	mg/L	3	EPA 160.4**	1	1	01/26/13 07:31	01/31/13 13:24	1

**Hazen and Sawyer**  
**10002 Princess Palm Ave, Suite 200**  
**Tampa, FL 33619**

**February 1, 2013**  
**Work Order: 1300948**

## Laboratory Report

<b>Project Name</b>	<b>Wakulla County B-HS1 SE#8</b>
Sample Description	<b>B-HS1-AEROCELL</b>
Matrix	<b>Wastewater</b>
SAL Sample Number	<b>1300948-03</b>
Date/Time Collected	<b>01/24/13 12:46</b>
Collected by	<b>Client</b>
Date/Time Received	<b>01/25/13 09:15</b>

Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
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### Client Provided Field Data

pH		7.05						
Temperature		16.5 °C						
Conductivity		846 umhos/cm						

### Inorganics

Ammonia as N	mg/L	2.3	EPA 350.1	1.0	0.24		01/28/13 14:39	25
Ammonium as NH4	mg/L	3.0	EPA 350.1	0.05	0.01		01/28/13 15:01	1
Carbonaceous BOD	mg/L	140	SM 5210B	2	2	01/25/13 14:47	01/30/13 11:10	1
Chemical Oxygen Demand	mg/L	36	EPA 410.4	25	10	01/28/13 10:10	01/28/13 12:43	1
Nitrate (as N)	mg/L	25	EPA 300.0	0.04	0.01		01/26/13 11:23	1
Nitrate+Nitrite (N)	mg/L	25	EPA 300.0	0.08	0.02		01/26/13 11:23	1
Nitrite (as N)	mg/L	0.39	EPA 300.0	0.04	0.01		01/26/13 11:23	1
Orthophosphate as P	mg/L	1.7	EPA 300.0	0.040	0.010		01/26/13 11:23	1
Phosphorous - Total as P	mg/L	9.1	SM 4500P-E	0.20	0.050	01/26/13 08:21	01/29/13 15:30	5
Total Alkalinity	mg/L	260	SM 2320B	8.0	2.0		01/29/13 14:57	1
Total Kjeldahl Nitrogen	mg/L	6.1	EPA 351.2	0.20	0.05	01/29/13 07:24	01/30/13 13:44	1.98
Total Suspended Solids	mg/L	2	SM 2540D	1	1	01/26/13 07:31	01/31/13 13:24	1
Volatile Suspended Solids	mg/L	2	EPA 160.4**	1	1	01/26/13 07:31	01/31/13 13:24	1

**Hazen and Sawyer**  
**10002 Princess Palm Ave, Suite 200**  
**Tampa, FL 33619**

**February 1, 2013**  
**Work Order: 1300948**

## Laboratory Report

<b>Project Name</b>	<b>Wakulla County B-HS1 SE#8</b>
Sample Description	<b>B-HS1-AEROCELL-DUP</b>
Matrix	<b>Wastewater</b>
SAL Sample Number	<b>1300948-04</b>
Date/Time Collected	<b>01/24/13 12:47</b>
Collected by	<b>Client</b>
Date/Time Received	<b>01/25/13 09:15</b>

Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
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**Client Provided Field Data**

pH		7.05						
Temperature		16.5 °C						
Conductivity		846 umhos/cm						

**Inorganics**

Ammonia as N	mg/L	2.2	EPA 350.1	1.0	0.24		01/28/13 14:40	25
Ammonium as NH4	mg/L	2.9	EPA 350.1	0.05	0.01		01/28/13 15:01	1
Carbonaceous BOD	mg/L	130	SM 5210B	2	2	01/25/13 14:47	01/30/13 11:10	1
Chemical Oxygen Demand	mg/L	32	EPA 410.4	25	10	01/28/13 10:10	01/28/13 12:43	1
Nitrate (as N)	mg/L	26	EPA 300.0	0.04	0.01		01/26/13 11:23	1
Nitrate+Nitrite (N)	mg/L	26	EPA 300.0	0.08	0.02		01/26/13 11:23	1
Nitrite (as N)	mg/L	0.34	EPA 300.0	0.04	0.01		01/26/13 11:23	1
Orthophosphate as P	mg/L	1.5	EPA 300.0	0.040	0.010		01/26/13 11:23	1
Phosphorous - Total as P	mg/L	9.0	SM 4500P-E	0.20	0.050	01/26/13 08:21	01/29/13 15:31	5
Total Alkalinity	mg/L	260	SM 2320B	8.0	2.0		01/29/13 14:57	1
Total Kjeldahl Nitrogen	mg/L	5.6	EPA 351.2	0.20	0.05	01/29/13 07:24	01/30/13 13:46	1.98
Total Suspended Solids	mg/L	2	SM 2540D	1	1	01/26/13 07:31	01/31/13 13:24	1
Volatile Suspended Solids	mg/L	2	EPA 160.4**	1	1	01/26/13 07:31	01/31/13 13:24	1



**Hazen and Sawyer**  
**10002 Princess Palm Ave, Suite 200**  
**Tampa, FL 33619**

**February 1, 2013**  
**Work Order: 1300948**

## Laboratory Report

<b>Project Name</b>	<b>Wakulla County B-HS1 SE#8</b>
Sample Description	<b>B-HS1-NITREX</b>
Matrix	<b>Wastewater</b>
SAL Sample Number	<b>1300948-05</b>
Date/Time Collected	<b>01/24/13 12:22</b>
Collected by	<b>Client</b>
Date/Time Received	<b>01/25/13 09:15</b>

Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
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### Client Provided Field Data

pH		6.43						
Temperature		17.0 °C						
Conductivity		809 umhos/cm						

### Inorganics

Ammonia as N	mg/L	2.5	EPA 350.1	1.0	0.24		01/28/13 14:42	25
Ammonium as NH4	mg/L	3.2	EPA 350.1	0.05	0.01		01/28/13 15:01	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	01/25/13 14:47	01/30/13 11:10	1
Chemical Oxygen Demand	mg/L	51	EPA 410.4	25	10	01/28/13 10:10	01/28/13 12:43	1
Nitrate (as N)	mg/L	0.03 I	EPA 300.0	0.04	0.01		01/26/13 11:23	1
Nitrate+Nitrite (N)	mg/L	0.03 I	EPA 300.0	0.08	0.02		01/26/13 11:23	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		01/26/13 11:23	1
Orthophosphate as P	mg/L	3.8	EPA 300.0	0.040	0.010		01/26/13 11:23	1
Phosphorous - Total as P	mg/L	11	SM 4500P-E	0.40	0.10	01/26/13 08:21	01/29/13 15:53	10
Total Alkalinity	mg/L	380	SM 2320B	8.0	2.0		01/29/13 14:57	1
Total Kjeldahl Nitrogen	mg/L	4.7	EPA 351.2	0.20	0.05	01/29/13 07:24	01/30/13 13:48	1.98
Total Suspended Solids	mg/L	1	SM 2540D	1	1	01/26/13 07:31	01/31/13 13:24	1
Volatile Suspended Solids	mg/L	1 U	EPA 160.4**	1	1	01/26/13 07:31	01/31/13 13:24	1

# SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 FAX 813-855-2218



Hazen and Sawyer  
10002 Princess Palm Ave, Suite 200  
Tampa, FL 33619

February 1, 2013  
Work Order: 1300948

## Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
<b>Batch BA32508 - BOD</b>										
<b>Blank (BA32508-BLK1)</b>					Prepared: 01/25/13 Analyzed: 01/30/13					
Carbonaceous BOD	2 U	2	2	mg/L						
<b>LCS (BA32508-BS1)</b>					Prepared: 01/25/13 Analyzed: 01/30/13					
Carbonaceous BOD	171	2	2	mg/L	200		85	85-115		
<b>LCS Dup (BA32508-BSD1)</b>					Prepared: 01/25/13 Analyzed: 01/30/13					
Carbonaceous BOD	191	2	2	mg/L	200		96	85-115	11	200
<b>Duplicate (BA32508-DUP1)</b>					Source: 1300948-05 Prepared: 01/25/13 Analyzed: 01/30/13					
Carbonaceous BOD	6	2	2	mg/L		ND				25
<b>Batch BA32511 - Ion Chromatography 300.0 Prep</b>										
<b>Blank (BA32511-BLK1)</b>					Prepared & Analyzed: 01/26/13					
Nitrite (as N)	0.01 U	0.04	0.01	mg/L						
Orthophosphate as P	0.010 U	0.040	0.010	mg/L						
Nitrate (as N)	0.01 U	0.04	0.01	mg/L						
<b>LCS (BA32511-BS1)</b>					Prepared & Analyzed: 01/26/13					
Orthophosphate as P	0.897	0.040	0.010	mg/L	0.90		100	85-115		
Nitrite (as N)	1.29	0.04	0.01	mg/L	1.4		92	85-115		
Nitrate (as N)	1.69	0.04	0.01	mg/L	1.7		99	85-115		
<b>LCS Dup (BA32511-BSD1)</b>					Prepared & Analyzed: 01/26/13					
Orthophosphate as P	0.868	0.040	0.010	mg/L	0.90		96	85-115	3	200
Nitrate (as N)	1.71	0.04	0.01	mg/L	1.7		101	85-115	1	200
Nitrite (as N)	1.35	0.04	0.01	mg/L	1.4		96	85-115	5	200

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February 1, 2013  
Work Order: 1300948

## Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
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### Batch BA32511 - Ion Chromatography 300.0 Prep

<b>Matrix Spike (BA32511-MS1)</b>		<b>Source: 1300948-02</b>			Prepared & Analyzed: 01/26/13					
Nitrate (as N)	20.2 +O	0.04	0.01	mg/L	1.7	19.2	59	85-115		
Orthophosphate as P	2.69	0.040	0.010	mg/L	0.90	1.73	107	85-115		
Nitrite (as N)	2.29	0.04	0.01	mg/L	1.4	0.995	92	85-115		
<b>Matrix Spike (BA32511-MS2)</b>		<b>Source: 1300816-01</b>			Prepared & Analyzed: 01/26/13					
Nitrite (as N)	27.2	0.04	0.01	mg/L	28	ND	97	85-115		
Nitrate (as N)	34.0	0.04	0.01	mg/L	34	0.659	98	85-115		
Orthophosphate as P	18.6	0.040	0.010	mg/L	18	ND	103	85-115		

### Batch BA32601 - TSS prep

<b>Blank (BA32601-BLK1)</b>		Prepared: 01/26/13 Analyzed: 01/31/13								
Total Suspended Solids	1 U	1	1	mg/L						
Volatile Suspended Solids	1 U	1		mg/L						
<b>LCS (BA32601-BS1)</b>		Prepared: 01/26/13 Analyzed: 01/31/13								
Total Suspended Solids	44.8	1	1	mg/L	50		90	85-115		
<b>Duplicate (BA32601-DUP1)</b>		<b>Source: 1300948-01</b>			Prepared: 01/26/13 Analyzed: 01/31/13					
Total Suspended Solids	26.5	1	1	mg/L		22.5			16	30
Volatile Suspended Solids	17.0	1		mg/L		14.0			19	20

### Batch BA32604 - Digestion for TP by EPA 365.2/SM4500PE

<b>Blank (BA32604-BLK1)</b>		Prepared: 01/26/13 Analyzed: 01/29/13								
Phosphorous - Total as P	0.010 U	0.040	0.010	mg/L						

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February 1, 2013  
Work Order: 1300948

## Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
<b>Batch BA32604 - Digestion for TP by EPA 365.2/SM4500PE</b>										
<b>LCS (BA32604-BS1)</b>					Prepared: 01/26/13 Analyzed: 01/29/13					
Phosphorous - Total as P	0.806	0.040	0.010	mg/L	0.80		101	90-110		
<b>Matrix Spike (BA32604-MS1)</b>					<b>Source: 1300972-01</b> Prepared: 01/26/13 Analyzed: 01/29/13					
Phosphorous - Total as P	1.12	0.040	0.010	mg/L	1.0	0.0649	106	90-110		
<b>Matrix Spike (BA32604-MS2)</b>					<b>Source: 1300997-07</b> Prepared: 01/26/13 Analyzed: 01/29/13					
Phosphorous - Total as P	1.12	0.040	0.010	mg/L	1.0	0.0433	108	90-110		
<b>Matrix Spike Dup (BA32604-MSD1)</b>					<b>Source: 1300972-01</b> Prepared: 01/26/13 Analyzed: 01/29/13					
Phosphorous - Total as P	1.12	0.040	0.010	mg/L	1.0	0.0649	106	90-110	0.2	25
<b>Matrix Spike Dup (BA32604-MSD2)</b>					<b>Source: 1300997-07</b> Prepared: 01/26/13 Analyzed: 01/30/13					
Phosphorous - Total as P	1.08	0.040	0.010	mg/L	1.0	0.0433	104	90-110	3	25
<b>Batch BA32809 - COD prep</b>										
<b>Blank (BA32809-BLK1)</b>					Prepared & Analyzed: 01/28/13					
Chemical Oxygen Demand	10 U	25	10	mg/L						
<b>LCS (BA32809-BS1)</b>					Prepared & Analyzed: 01/28/13					
Chemical Oxygen Demand	55	25	10	mg/L	50		110	90-110		
<b>Matrix Spike (BA32809-MS1)</b>					<b>Source: 1300861-03</b> Prepared & Analyzed: 01/28/13					
Chemical Oxygen Demand	57	25	10	mg/L	50	ND	114	85-115		
<b>Matrix Spike Dup (BA32809-MSD1)</b>					<b>Source: 1300861-03</b> Prepared & Analyzed: 01/28/13					
Chemical Oxygen Demand	57	25	10	mg/L	50	ND	114	85-115	0	32

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Tampa, FL 33619

February 1, 2013  
Work Order: 1300948

## Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
<b>Batch BA32819 - Ammonia by SEAL</b>										
<b>Blank (BA32819-BLK1)</b>					Prepared & Analyzed: 01/28/13					
Ammonia as N	0.009 U	0.040	0.009	mg/L						
<b>LCS (BA32819-BS1)</b>					Prepared & Analyzed: 01/28/13					
Ammonia as N	0.53	0.040	0.009	mg/L	0.50		106	90-110		
<b>Matrix Spike (BA32819-MS1)</b>					Source: 1300918-07 Prepared & Analyzed: 01/28/13					
Ammonia as N	0.54	0.040	0.009	mg/L	0.50	0.022	103	90-110		
<b>Matrix Spike (BA32819-MS2)</b>					Source: 1300977-02 Prepared & Analyzed: 01/28/13					
Ammonia as N	0.54	0.040	0.009	mg/L	0.50	ND	108	90-110		
<b>Matrix Spike Dup (BA32819-MSD1)</b>					Source: 1300918-07 Prepared & Analyzed: 01/28/13					
Ammonia as N	0.53	0.040	0.009	mg/L	0.50	0.022	102	90-110	0.7	10
<b>Matrix Spike Dup (BA32819-MSD2)</b>					Source: 1300977-02 Prepared & Analyzed: 01/28/13					
Ammonia as N	0.52	0.040	0.009	mg/L	0.50	ND	104	90-110	3	10
<b>Batch BA32901 - Digestion for TKN by EPA 351.2</b>										
<b>Blank (BA32901-BLK1)</b>					Prepared: 01/29/13 Analyzed: 01/30/13					
Total Kjeldahl Nitrogen	0.05 U	0.20	0.05	mg/L						
<b>LCS (BA32901-BS1)</b>					Prepared: 01/29/13 Analyzed: 01/30/13					
Total Kjeldahl Nitrogen	2.56	0.20	0.05	mg/L	2.5		101	90-110		
<b>Matrix Spike (BA32901-MS1)</b>					Source: 1301020-02 Prepared: 01/29/13 Analyzed: 01/30/13					
Total Kjeldahl Nitrogen	3.64	0.20	0.05	mg/L	2.5	0.899	108	90-110		



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## Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
<b>Batch BA32901 - Digestion for TKN by EPA 351.2</b>										
<b>Matrix Spike (BA32901-MS2)</b>		<b>Source: 1301024-07</b>			Prepared: 01/29/13 Analyzed: 01/30/13					
Total Kjeldahl Nitrogen	3.27	0.20	0.05	mg/L	2.5	0.558	107	90-110		
<b>Matrix Spike Dup (BA32901-MSD1)</b>		<b>Source: 1301020-02</b>			Prepared: 01/29/13 Analyzed: 01/30/13					
Total Kjeldahl Nitrogen	3.50	0.20	0.05	mg/L	2.5	0.899	103	90-110	4	20
<b>Matrix Spike Dup (BA32901-MSD2)</b>		<b>Source: 1301024-07</b>			Prepared: 01/29/13 Analyzed: 01/30/13					
Total Kjeldahl Nitrogen	2.98	0.20	0.05	mg/L	2.5	0.558	96	90-110	9	20
<b>Batch BA32904 - Ion Chromatography 300.0 Prep</b>										
<b>Blank (BA32904-BLK1)</b>		Prepared & Analyzed: 01/29/13								
Nitrate (as N)	0.01 U	0.04	0.01	mg/L						
<b>LCS (BA32904-BS1)</b>		Prepared & Analyzed: 01/29/13								
Nitrate (as N)	1.72	0.04	0.01	mg/L	1.7		101	85-115		
<b>LCS Dup (BA32904-BSD1)</b>		Prepared & Analyzed: 01/29/13								
Nitrate (as N)	1.72	0.04	0.01	mg/L	1.7		101	85-115	0	200
<b>Matrix Spike (BA32904-MS1)</b>		<b>Source: 1301012-08</b>			Prepared & Analyzed: 01/29/13					
Nitrate (as N)	2.51	0.04	0.01	mg/L	1.7	0.722	105	85-115		
<b>Matrix Spike (BA32904-MS2)</b>		<b>Source: 1301040-01</b>			Prepared & Analyzed: 01/29/13					
Nitrate (as N)	1.74	0.04	0.01	mg/L	1.7	0.0517	99	85-115		
<b>Batch BA32921 - alkalinity</b>										
<b>Blank (BA32921-BLK1)</b>		Prepared & Analyzed: 01/29/13								
Total Alkalinity	2.0 U	8.0	2.0	mg/L						

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February 1, 2013  
Work Order: 1300948

## Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
<b>Batch BA32921 - alkalinity</b>										
<b>LCS (BA32921-BS1)</b>					Prepared & Analyzed: 01/29/13					
Total Alkalinity	130	8.0	2.0	mg/L	120		101	90-110		
<b>Matrix Spike (BA32921-MS1)</b>					Source: 1300923-01 Prepared & Analyzed: 01/29/13					
Total Alkalinity	260	8.0	2.0	mg/L	120	140	101	80-120		
<b>Matrix Spike Dup (BA32921-MSD1)</b>					Source: 1300923-01 Prepared & Analyzed: 01/29/13					
Total Alkalinity	260	8.0	2.0	mg/L	120	140	101	80-120	0	26

**Hazen and Sawyer**  
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**February 1, 2013**  
**Work Order: 1300948**

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**\* Qualifiers, Notes and Definitions**

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Results followed by a "U" indicate that the sample was analyzed but the compound was not detected. Results followed by "I" indicate that the reported value is between the laboratory method detection limits and the laboratory practical quantitation limit.

A statement of estimated uncertainty of test results is available upon request.

For methods marked with \*\*, all QC criteria have been met for this method which is equivalent to a SAL certified method.

Test results in this report meet all the requirements of the NELAC standards. Any applicable qualifiers are shown below.

+O Matrix spike source sample was over the recommended range for the method.

Questions regarding this report should be directed to :

Kathryn Nordmark

Telephone (813) 855-1844 FAX (813) 855-2218

Kathryn@southernanalyticallabs.com

or to Client Services (clientservices@southernanalyticallabs.com).



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SAL Project No. 1300948

[illegible]

**REPORT OF ANALYSIS****THIS REPORT MEETS NELAC STANDARDS**

Hazen and Sawyer, P.C.  
Attn: Josefin Edeback-Hirst, PE  
10002 Princess Palm Avenue  
Suite 200  
Tampa, FL 33619

Report #: 22358  
Report Date: February 5, 2013  
NELAC#: E81350  
FDEPQA#: 920087G  
Project#: 211296  
Sampled By: Mark Busby  
Sample Site: [REDACTED] Dr. Septic System  
Sample Date: 01-24-13

Table 1. Samples received 01-24-13.

Sample Location: Nitrex Tank  
Lab ID#: #114168-1, 2, 3  
Sample Time: 12:22

Parameter Monitored	Units	Analysis Result	Data Qualifiers	Detection Limit	Analysis Date/Time	Analyst
Total Nitrogen, Calculated	mg/L	2.60		-	-	-
Nitrate-N, SM 4500-NO3 E	mg/L	0.012	U	0.012	01-25-13 10:00	SH
Nitrite-N, SM 3500-NO <sub>2</sub> B	mg/L	0.012	U	0.012	01-25-13 10:00	SH
TKN, SM 4500-NH3 D	mg/L	2.60		0.071	02-01-13 07:30	TA
Ammonia, SM 4500-NH3 D	mg/L	1.49		0.067	02-01-13 07:30	TA
Fecal Coliform, SM 9222 D	# colonies /100mL	4		2.0	01-24-13 16:15	AL
<i>E. coli</i> , EPA 1603	# colonies /100mL	2.0	U	2.0	01-24-13 16:15	AL

Data Qualifiers that may apply:

U = The analyte was not detected and the indicated value is the detection limit.

I = Reported value is between the laboratory MDL and the PQL. (PQL = 4 x MDL).

B = Colony count exceeded the ideal of 20-60 (fecal coliform) or 20-80 (*E. coli*).

## REPORT OF ANALYSIS

### THIS REPORT MEETS NELAC STANDARDS

Hazen and Sawyer, P.C.  
Attn: Josefin Edeback-Hirst, PE  
10002 Princess Palm Avenue  
Suite 200  
Tampa, FL 33619

Report #: 22358  
Report Date: February 5, 2013  
NELAC#: E81350  
FDEPQA#: 920087G  
Project#: 211296  
Sampled By: Mark Busby  
Sample Site: [REDACTED] Dr. Septic System  
Sample Date: 01-24-13

Table 1. Samples received 01-24-13.

Sample Location: Aerocell Tank  
Lab ID#: #114169-1, 2, 3  
Sample Time: 12:46

Parameter Monitored	Units	Analysis Result	Data Qualifiers	Detection Limit	Analysis Date/Time	Analyst
Total Nitrogen, Calculated	mg/L	31.5		-	-	-
Nitrate-N, SM 4500-NO <sub>3</sub> E	mg/L	29.6		0.012	01-25-13 10:00	SH
Nitrite-N, SM 3500-NO <sub>2</sub> B	mg/L	0.423		0.012	01-25-13 10:00	SH
TKN, SM 4500-NH <sub>3</sub> D	mg/L	1.88		0.071	02-01-13 07:30	TA
Ammonia, SM 4500-NH <sub>3</sub> D	mg/L	1.54		0.067	02-01-13 07:30	TA
Fecal Coliform, SM 9222 D	# colonies /100mL	410		2.0	01-24-13 16:15	AL
<i>E. coli</i> , EPA 1603	# colonies /100mL	410		2.0	01-24-13 16:15	AL

Data Qualifiers that may apply:

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I = Reported value is between the laboratory MDL and the PQL. (PQL = 4 x MDL).

B = Colony count exceeded the ideal of 20-60 (fecal coliform) or 20-80 (*E. coli*).



**REPORT OF ANALYSIS****THIS REPORT MEETS NELAC STANDARDS**

Hazen and Sawyer, P.C.  
Attn: Josefin Edeback-Hirst, PE  
10002 Princess Palm Avenue  
Suite 200  
Tampa, FL 33619

Report #: 22358  
Report Date: February 5, 2013  
NELAC#: E81350  
FDEPQA#: 920087G  
Project#: 211296  
Sampled By: Mark Busby  
Sample Site: [REDACTED] Dr. Septic System  
Sample Date: 01-24-13

Table 1. Samples received 01-24-13.

Sample Location: Pump Tank  
Lab ID#: #114170-1, 2, 3  
Sample Time: 13:04

Parameter Monitored	Units	Analysis Result	Data Qualifiers	Detection Limit	Analysis Date/Time	Analyst
Total Nitrogen, Calculated	mg/L	31.3		-	-	-
Nitrate-N, SM 4500-NO3 E	mg/L	24.3		0.012	01-25-13 10:00	SH
Nitrite-N, SM 3500-NO <sub>2</sub> B	mg/L	1.17		0.012	01-25-13 10:00	SH
TKN, SM 4500-NH3 D	mg/L	7.00		0.071	02-01-13 07:30	TA
Ammonia, SM 4500-NH3 D	mg/L	5.92		0.067	02-01-13 07:30	TA
Fecal Coliform, SM 9222 D	# colonies /100mL	6,700	B	2.0	01-24-13 16:15	AL
<i>E. coli</i> , EPA 1603	# colonies /100mL	5,700		2.0	01-24-13 16:15	AL

## Data Qualifiers that may apply:

U = The analyte was not detected and the indicated value is the detection limit.

I = Reported value is between the laboratory MDL and the PQL. (PQL = 4 x MDL).

B = Colony count exceeded the ideal of 20-60 (fecal coliform) or 20-80 (*E. coli*).

## REPORT OF ANALYSIS

### THIS REPORT MEETS NELAC STANDARDS

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Attn: Josefin Edeback-Hirst, PE  
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Suite 200  
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Report #: 22358  
Report Date: February 5, 2013  
NELAC#: E81350  
FDEPQA#: 920087G  
Project#: 211296  
Sampled By: Mark Busby  
Sample Site: [REDACTED] Dr. Septic System  
Sample Date: 01-24-13

Table 1. Samples received 01-24-13.

Sample Location: STE Tank  
Lab ID#: #114171-1, 2, 3  
Sample Time: 13:20

Parameter Monitored	Units	Analysis Result	Data Qualifiers	Detection Limit	Analysis Date/Time	Analyst
Total Nitrogen, Calculated	mg/L	104		-	-	-
Nitrate-N, SM 4500-NO <sub>3</sub> E	mg/L	0.424		0.012	01-25-13 10:00	SH
Nitrite-N, SM 3500-NO <sub>2</sub> B	mg/L	0.017	I	0.012	01-25-13 10:00	SH
TKN, SM 4500-NH <sub>3</sub> D	mg/L	104		0.071	02-01-13 07:30	TA
Ammonia, SM 4500-NH <sub>3</sub> D	mg/L	37.1		0.067	02-01-13 07:30	TA
Fecal Coliform, SM 9222 D	# colonies /100mL	90,000		2.0	01-24-13 16:15	AL
<i>E. coli</i> , EPA 1603	# colonies /100mL	83,000	B	2.0	01-24-13 16:15	AL

Data Qualifiers that may apply:

U = The analyte was not detected and the indicated value is the detection limit.

I = Reported value is between the laboratory MDL and the PQL. (PQL = 4 x MDL).

B = Colony count exceeded the ideal of 20-60 (fecal coliform) or 20-80 (*E. coli*).

**REPORT OF ANALYSIS****THIS REPORT MEETS NELAC STANDARDS**

Hazen and Sawyer, P.C.  
 Attn: Josefin Edeback-Hirst, PE  
 10002 Princess Palm Avenue  
 Suite 200  
 Tampa, FL 33619

Report #: 22358  
 Report Date: February 5, 2013  
 NELAC#: E81350  
 FDEPQA#: 920087G  
 Project#: 211296  
 Sampled By: Mark Busby  
 Sample Site: [REDACTED] Dr. Septic System  
 Sample Date: 01-24-13

Table 1. Samples received 01-24-13.

Sample Location: Aerocell Tank Dup  
 Lab ID#: #114172-1, 2, 3  
 Sample Time: 12:47

Parameter Monitored	Units	Analysis Result	Data Qualifiers	Detection Limit	Analysis Date/Time	Analyst
Total Nitrogen, Calculated	mg/L	34.6		-	-	-
Nitrate-N, SM 4500-NO3 E	mg/L	33.0		0.012	01-25-13 10:00	SH
Nitrite-N, SM 3500-NO <sub>2</sub> B	mg/L	0.405		0.012	01-25-13 10:00	SH
TKN, SM 4500-NH3 D	mg/L	1.60		0.071	02-01-13 07:30	TA
Ammonia, SM 4500-NH3 D	mg/L	0.067	U	0.067	02-01-13 07:30	TA
Fecal Coliform, SM 9222 D	# colonies /100mL	440		2.0	01-24-13 16:15	AL
<i>E. coli</i> , EPA 1603	# colonies /100mL	420		2.0	01-24-13 16:15	AL

Data Qualifiers that may apply:

U = The analyte was not detected and the indicated value is the detection limit.

I = Reported value is between the laboratory MDL and the PQL. (PQL = 4 x MDL).

B = Colony count exceeded the ideal of 20-60 (fecal coliform) or 20-80 (*E. coli*).

Ackuritlabs, Inc.

3345 North Monroe Street, Tallahassee, FL 32303 • Telephone (850) 562-7751

Environmental Services Section

**FIELD DATA**

Hazen and Sawyer, P.C.  
Attn: Josefin Edeback-Hirst, PE  
10002 Princess Palm Avenue  
Suite 200  
Tampa, FL 33619

Report #: 22358  
Report Date: February 5, 2013  
NELAC#: E81350  
FDEPQA#: 920087G  
Project#: 211296  
Sampled By: Mark Busby  
Sample Site: [REDACTED] Drive  
Sample Date: 01-24-13

Table 2. Samples received 01-24-13.

	pH	Temperature	Conductivity	DO	ORP
Nitrex Tank, 10:52 #114168	6.43	17.0	809	0.25	-241
Aerocell Tank, 11:22 #114169	7.05	16.5	846	3.01	77
Pump Tank, 11:54 #114170	6.91	16.9	885	1.01	92
STE Tank, 12:08 #114171	6.80	18.4	1312	0.12	-262

Data Qualifiers that may apply:

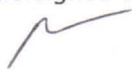
U = The analyte was not detected and the indicated value is the detection limit.

I = Reported value is between the laboratory MDL and the PQL. (PQL = 4 x MDL).

B = Colony count exceeded the ideal of 20-60 (fecal coliform) or 20-80 ( *E. coli* ) colonies per plate.

**Data Release Authorization:**

Sample integrity and reliability certified by lab personnel prior to analysis. All quality assurance samples met quality control limits unless otherwise specified. The reported analytical results relate only to the sample submitted. This report shall not be reproduced, except in full, without the written approval of Ackuritlabs. Please contact the undersigned at the above phone number with any questions regarding this report.

  
2-5-13  
Todd J. Acker, Laboratory Director



## Page 1 of 1

Page 7 of 7

## Appendix B: Operation & Maintenance Log

**Table B.1**  
**Operation and Maintenance Log**

Date	Description
6/10/11	Start-up of system
7/6/11	Homeowner reported that over the weekend the alarm kept sounding.
7/7/11	Contractor made site visit. The flow splitter device was adjusted. Some of the recirculation tubes seemed to be too low. Recirculation rate higher than intended. The wiring was not done correctly at install. Contractor rewired panel. Noted that the Nitrex sampling port has water which indicates that the Nitrex tank is now full.
7/19/11	Override float still triggering alarm. Contractor raised override float up, because of the float error. Contractor read water meter and adjusted flow splitter again. Contractor also checked the pump rate which is reading low. Pump flow rate measured at 12.5 gallons per minute.
8/18/11	Vericomm system panel installed to replace existing control panel. Drainfield observation ports installed.
9/13/11	FDOH collected samples. Contractor checked system and detected that a malfunction of the dosing floats for the pump causes a lack of dosing to the Aerocell unit.
9/20/11	Contractor checked system.
10/17/11	New sampling port for Nitrex sample installed by contractor. A tee was placed in the outlet pipe, so that a sample is taken directly from the effluent pipe. The pump vault was causing the floats to get stuck. Contractor removed pump vault within the second chamber of the primary tank.
10/26/11	Monitoring sample event No.1. Leaks apparent on Aerocell split recirculation device. Water level within the split recirc device approximately 1-inch below return tubes. Sand was noted in the return pipe leading into the pump chamber.
11/30/11	Contractor checked system.
12/9/11	Replacement of splitter recirculation device by vendor.
12/23/11	Vendor checked system.
1/25/12	Monitoring sample event No.2. Drainfield observation port #3 had ponded water ~0.25 inch in height. All other ports were dry.

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Date	Description
1/30/12	Recorded flows to verify recycle ratio. Drainfield observation port #3 had ponded water ~0.25 inch in height. All other ports were dry.
2/24/12	Site visit. Drainfield observation port #3 had ponded water ~0.25 inch in height. All other ports were dry.
3/27/12	Monitoring sample event No.3. Drainfield observation port #3 had ponded water ~0.125 inch in height. All other ports were dry.
4/20/12	Site visit. Drainfield observation port #3 had ponded water ~0.5 inch in height. All other ports were dry.
5/24/12	Monitoring sample event No.4. Drainfield observation port #3 had ponded water ~0.125 inch in height. All other ports were dry.
6/22/12	Site visit. Drainfield observation port #3 had ponding of ~ 0.25 inch to 0.5 inch in height (uneven bottom) water across entire field of vision. All other ports dry.
7/26/12	Site visit. Discussed with homeowner his concerns about the system. Sampling called off due to rain from Tropical Depression Debby.
7/30/12	Site visit. Heavy, intermittent rain, cancelled sampling again.
8/06/12	Monitoring sample event No.5. Drainfield observation port #3 had ponded water ~0.125 inch in height. All other ports dry. Ground saturated from recent heavy rains.
8/30/12	Site visit. Drainfield observation port #2 had ponded water ~3/8" inch water across entire field of vision. Port #3 had ponded water ~1/8" in a puddle ~1/2 field of view. Ports #1 and #4 were dry.
9/26/12	Monitoring sample event No.6. All drainfield observation ports were dry
10/26/12	Site visit. All drainfield observation ports were dry
11/28/12	Monitoring sample event No.7 Drainfield observation port #2 had ponded water ~1/4" inch water across entire field of vision. Port #3 had ponded water less than 1/8". Ports #1 and #4 were dry. Nitrex sample tube was blocked prior to sampling. The blockage was cleared using a stiff wire. Wood chips appeared a darker brown.
12/27/12	Site visit. All drainfield observation ports were dry.
1/24/13	Monitoring sample event No.8. All drainfield observation ports were dry.





## Appendix C: Vericomm PLC Data

System Status			5-Feb-13	24-Jan-13	5-Jan-13	5-Dec-12
Point	Description	Status	Value	Value	Value	Value
1	Alarm Status	Automatic	OK	OK	OK	OK
2	Alert Status	Automatic	OK	OK	OK	OK
3	System Mode	Automatic	Normal	Normal	Normal	Normal
5	Timer Mode	Automatic	Normal	Normal	Normal	Normal
6	Active Off Time	Automatic	15.0 Minutes	15.0 Minutes	15.0 Minutes	15.0 Minutes
7	Active On Time	Automatic	2.0 Minutes	2.0 Minutes	2.0 Minutes	2.0 Minutes
9	Pump Mode	Automatic	OffCycl	OffCycl	OffCycl	OffCycl
10	Pump Status	Automatic	Off	Off	Off	Off
12	Pump Cycles Today	Automatic	8.0 Cycles	39.0 Cycles	8.0 Cycles	8.0 Cycles
13	Override Cycles Today	Automatic	0.0 Cycles	0.0 Cycles	0.0 Cycles	0.0 Cycles
14	Pump Run Time Today	Automatic	16.1 Minutes	78.7 Minutes	16.1 Minutes	16.1 Minutes
Settings						
Point	Description	Status	Value	Value	Value	Value
17	Off Cycle Time	Constant/Setpoint	15.0 Minutes	15.0 Minutes	15.0 Minutes	15.0 Minutes
18	On Cycle Time	Constant/Setpoint	2.0 Minutes	2.0 Minutes	2.0 Minutes	2.0 Minutes
19	Override Off Cycle Time	Constant/Setpoint	7.0 Minutes	7.0 Minutes	7.0 Minutes	7.0 Minutes
20	Override On Cycle Time	Constant/Setpoint	1.7 Minutes	1.7 Minutes	1.7 Minutes	1.7 Minutes
21	Minimum Override Cycles	Automatic	3.0 Cycles	3.0 Cycles	3.0 Cycles	3.0 Cycles
23	Override Cycle Limit per Day	Constant/Setpoint	21.0 Cycles	21.0 Cycles	21.0 Cycles	21.0 Cycles
24	Time Limit per Day	Constant/Setpoint	200.0 Minutes	200.0 Minutes	200.0 Minutes	200.0 Minutes
25	High Level Pump Test	Automatic	2.0 Minutes	2.0 Minutes	2.0 Minutes	2.0 Minutes
28	Alarm Update Interval	Timing Override	120.0 Minutes	120.0 Minutes	120.0 Minutes	120.0 Minutes
29	Page Delay	Automatic	960.0 Minutes	960.0 Minutes	960.0 Minutes	960.0 Minutes
30	Page Interval	Automatic	30.0 Minutes	30.0 Minutes	30.0 Minutes	30.0 Minutes
31	Local Alarm Delay	Constant/Setpoint	1140.0 Minutes	1140.0 Minutes	1140.0 Minutes	1140.0 Minutes
32	Local Reactivate Delay	Automatic	120.0 Minutes	120.0 Minutes	120.0 Minutes	120.0 Minutes
Troubleshooting						
Point	Description	Status	Value	Value	Value	Value
33	Top Float Status	Automatic	OK	OK	OK	OK
34	Middle Float Status	Automatic	OK	OK	OK	OK
35	Bottom Float Status	Automatic	OK	OK	OK	OK
37	Contactor Status	Automatic	OK	OK	OK	OK
38	Pump Status	Automatic	OK	OK	OK	OK
40	Filter Status	Automatic	OK	OK	OK	OK
41	Tank Status	Automatic	OK	OK	OK	OK
43	Power Status	Automatic	OK	OK	OK	OK
Flow Data						
Point	Description	Status	Value	Value	Value	Value
49	Pump Run Time Today	Automatic	16.1 Minutes	78.7 Minutes	16.1 Minutes	16.1 Minutes
50	Override Cycles Today	Automatic		0	0	0
51	Pump Cycles Today	Automatic	8.0 Cycles	39.0 Cycles	8.0 Cycles	8.0 Cycles
52	Average Run Time per Cycle Today	Automatic	2.0 Minutes	2.0 Minutes	2.0 Minutes	2.0 Minutes
54	Brownouts Today	Automatic		0	0	0

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System Status			5-Feb-13	24-Jan-13	5-Jan-13	5-Dec-12
30-Day History Data						
Point	Description	Status	Value	Value	Value	Value
65	30 Day Average Run Time per Day	Automatic	160.8 Minutes	139.0 Minutes	97.1 Minutes	113.2 Minutes
66	30 Day Average Override Cycles per Day	Automatic	0.0 Cycles	0.0 Cycles	0.0 Cycles	0.0 Cycles
67	30 Day Average Cycles per Day	Automatic	79.7 Cycles	68.9 Cycles	48.2 Cycles	56.2 Cycles
68	30 Day Average Run Time per Cycle	Automatic	2.0 Minutes	2.0 Minutes	2.0 Minutes	2.0 Minutes
71	30 Day Total Pump Run Time	Automatic	4822.6 Minutes	4169.8 Minutes	2913.4 Minutes	3395.8 Minutes
72	30 Day Total Override Cycles	Automatic	0.0 Cycles	0.0 Cycles	0.0 Cycles	0.0 Cycles
73	30 Day Total Cycles	Automatic	2391.0 Cycles	2067.0 Cycles	1445.0 Cycles	1685.0 Cycles
76	30 Day Total Brownouts	Automatic	0	1	1	0
Totalized Pump Data						
Point	Description	Status	Value	Value	Value	Value
82	Pump Total Run Time	Automatic	892.1 Hours	859.6 Hours	809.4 Hours	758.4 Hours
83	Pump Total Cycles	Automatic	27434.0 Cycles	26465.0 Cycles	24973.0 Cycles	23453.0 Cycles
Miscellaneous						
Point	Description	Status	Value	Value	Value	Value
145	Pump On Auto	Automatic	Off	Off	Off	Off
147	Pump Test Today	Automatic	Off	Off	Off	Off
148	Pump Check Enable	Automatic	Off	Off	Off	Off
149	Total Override Cycles	Automatic	0	0	0	0
150	High Level Condition	Automatic	Off	Off	Off	Off
151	Leak Check Enable	Automatic	On	On	On	On
152	Brownout State	Automatic	Off	Off	Off	Off
153	Test Mode	Automatic	Off	Off	Off	Off
Alarm Points						
Point	Description	Status	Value	Value	Value	Value
161	General Alarm	Automatic	Off	Off	Off	Off
162	New Alarm	Automatic	Off	Off	Off	Off
163	Update Central Enable	Automatic	On	On	On	On
167	Page Alarm Start	Automatic	Off	Off	Off	Off
168	Pager Signal	Override Off	Off	Off	Off	Off
169	Local Alarm Start	Automatic	Off	Off	Off	Off
170	Local Alarm Silence	Automatic	Off	Off	Off	Off
Inputs & Outputs						
Point	Description	Status	Value	Value	Value	Value
177	High Level/Override Timer Float Input	Automatic	Off	Off	Off	Off
178	Timer Float Input	Automatic	On	On	On	On
179	Redundant Off Float & Low Level Alarm Input	Automatic	On	On	On	On
181	Push To Silence Input	Automatic	Off	Off	Off	Off
182	Auxiliary Contact Input	Automatic	Off	Off	Off	Off
186	Pump Output	Automatic	Off	Off	Off	Off
188	Alarm Light Output	Automatic	Off	Off	Off	Off
189	Audible Alarm Output	Override Off	Off	Off	Off	Off