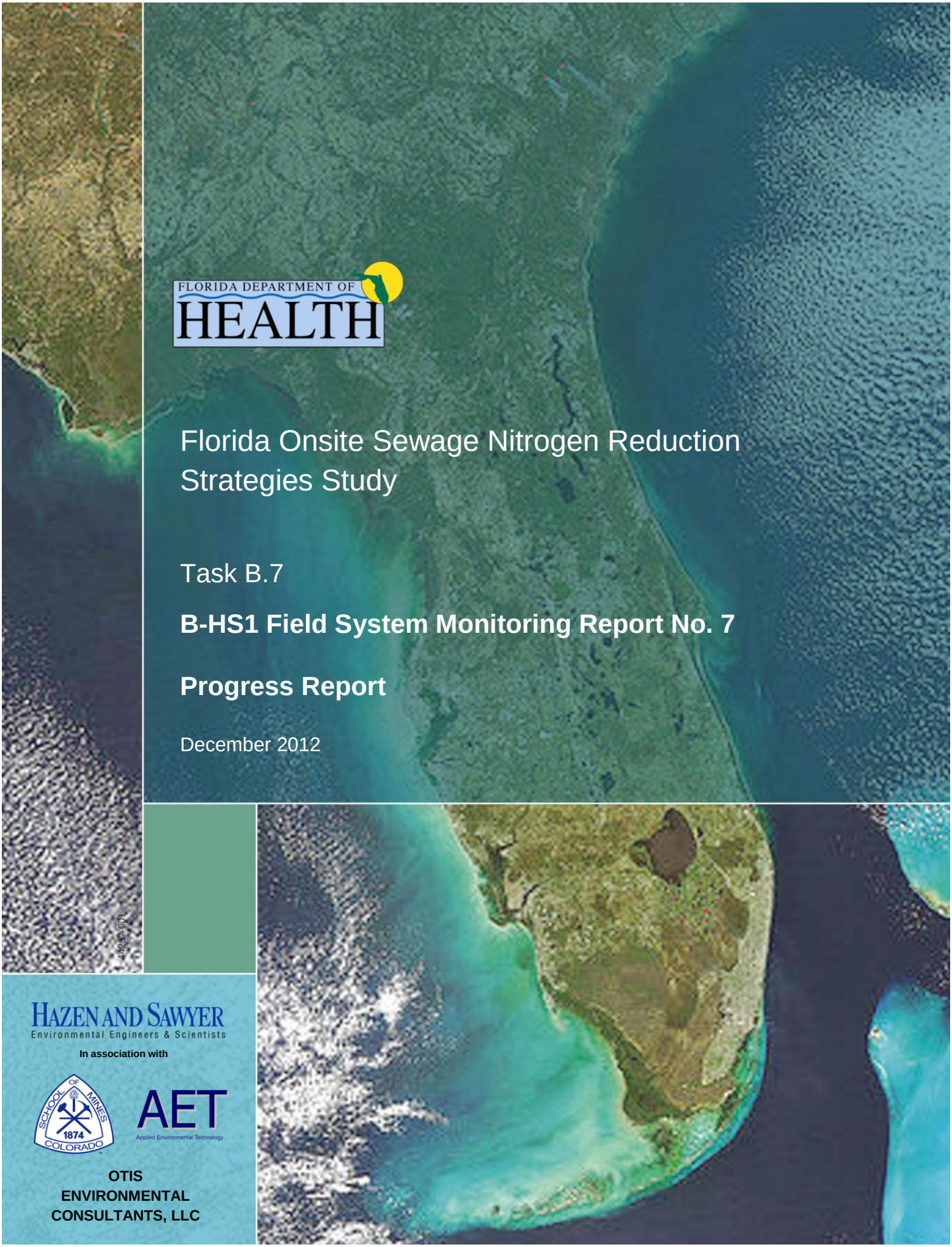

FLORIDA DEPARTMENT OF HEALTH

Florida Onsite Sewage Nitrogen Reduction Strategies Study

Task B.7

B-HS1 Field System Monitoring Report No. 7

Progress Report

December 2012

4423-001

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Environmental Engineers & Scientists

In association with

SCHOOL OF MINES 1874 COLORADO

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. 7

Prepared for:

Florida Department of Health
Division of Disease Control and Health Protection
Bureau of Environmental Health
Onsite Sewage Programs
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December 2012

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B-HS1 Field System
Monitoring Report No. 7

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 seventh 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 seventh B-HS1 monitoring and sampling event conducted on November 28, 2012. 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 a NELAC certified laboratory.

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 upflow 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.

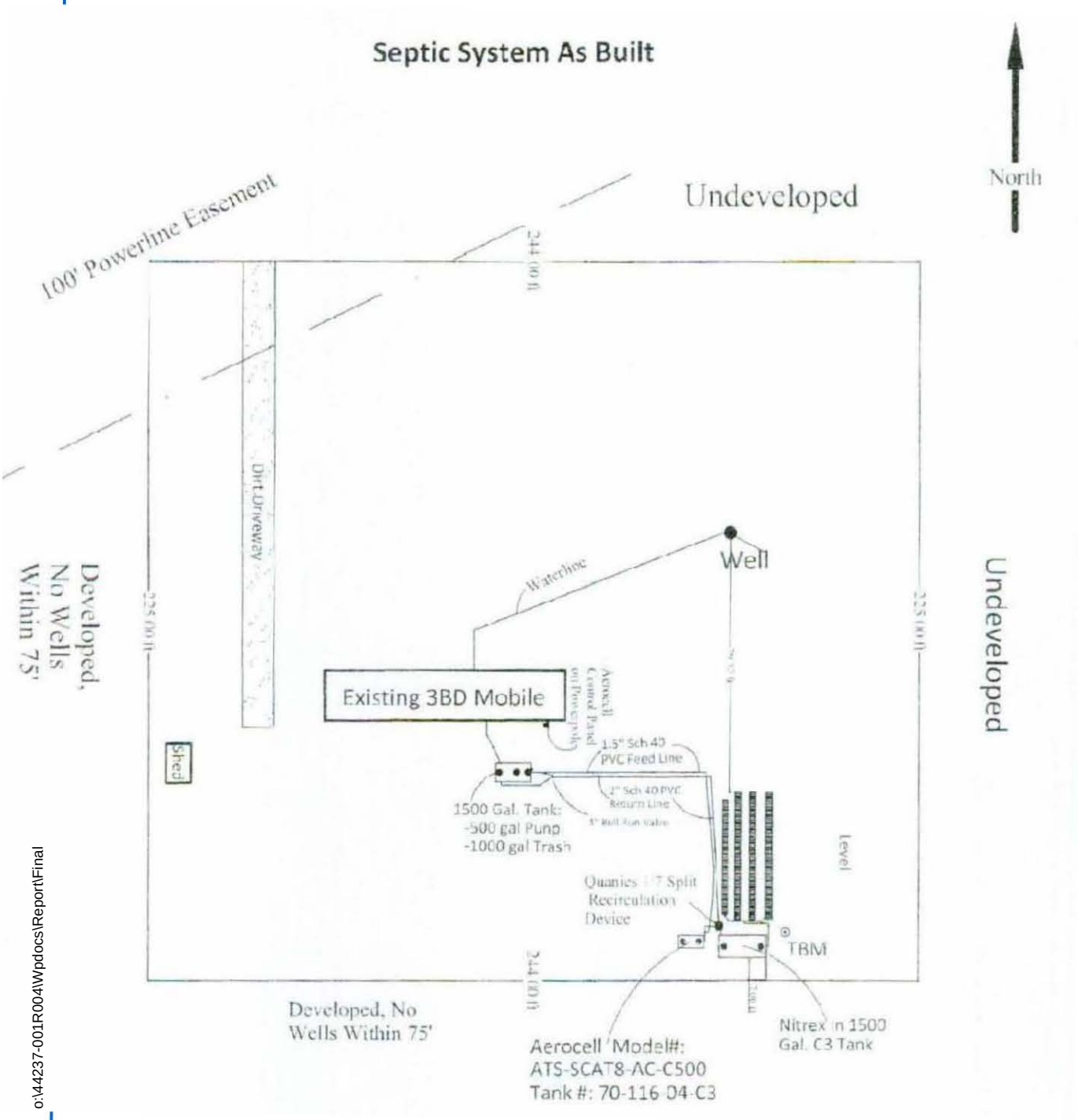


Figure 1
B-HS1 Site Schematic

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.

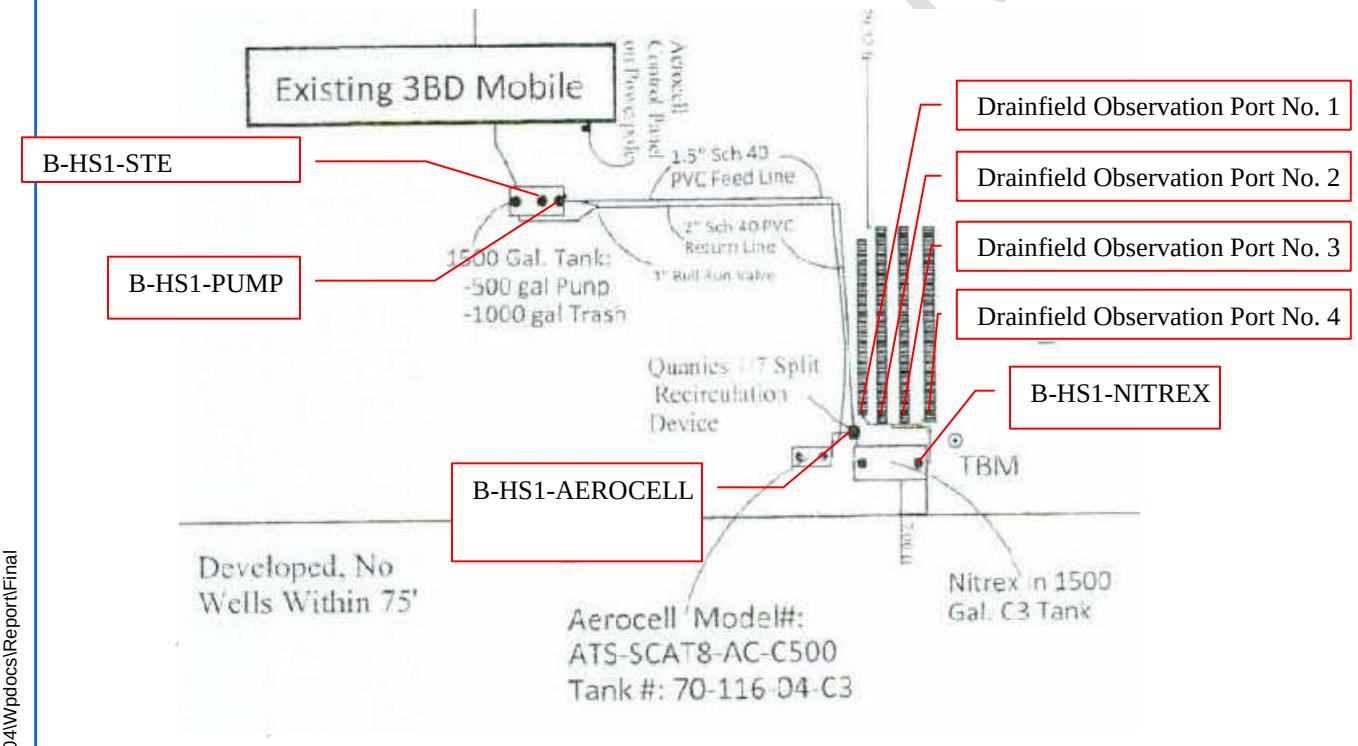


Figure 2
B-HS1 Sample and Monitoring Locations

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).

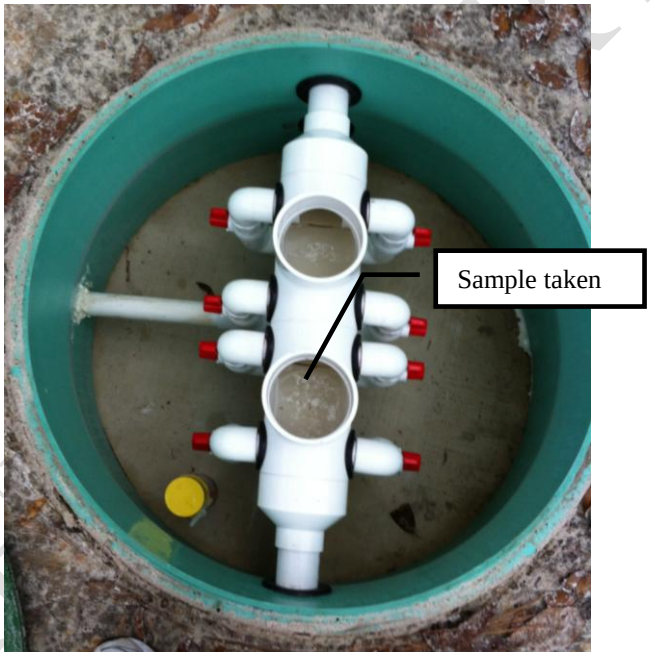


Figure 3
Recirculation Device (B-HS1-AEROCELL sample)

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 seventh sampling event, the water meter for the house and the Aerocell™ flow meter were read and recorded on November 28, 2012. 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 November 28, 2012 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 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 (NH_3-N), nitrate nitrogen (NO_3-N), nitrite nitrogen (NO_2-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.). Table 1 lists the analytical parameters, analytical methods, and detection limits for these analyses.

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

Analytical Parameter	Method of Analysis	Method Detection Limit (mg/L)
Total Alkalinity as $CaCO_3$	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_3-N)	EPA 350.1	0.005 mg/L
Nitrate Nitrogen (NO_3-N)	EPA 300.0	0.01 mg/L
Nitrite Nitrogen (NO_2-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 ($CBOD_5$)	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

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[1]	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[2] 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
Total average after SRD[2] replacement		111.9		1,132.9	9.1 : 1
Total average start-up to 11/28/12		108.5		1,005.4	8.3 : 1

[1]Household (Q) + Recirculation (R)

[2]Split recirculation device (SRD) was replaced December 9, 2011.

The split recirculation device (SRD) controls the fraction of Aerocell™ effluent that is re-circulated 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. However, the recycle ratio drifted downwards below 8:1 in October and November to 7.2:1 and 7.5:1, respectively. The cause for the decrease in recirculation is not clear.

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 111.9 gallons per day, and the average flow to the Aerocell™ unit was 1,132.9 gallons per day with a corresponding average recycle ratio of 9.1:1. The household flow average between start-up and November 28, 2012 was 108.5 gallons per day, and the average flow to the Aerocell™ unit was 1,005.4 gallons per day with a corresponding average recycle ratio of 8.3:1.

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 Pumped to Aerocell
	Cumulative (kWh)	(kWh/day)	(kWh/gal)
6/9/2011 17:10	1		
6/10/2011 12:25	2	1.25	0.0019
7/6/2011 11:30	40	1.46	0.0011
7/7/2011 19:30	44	3.00	0.0011
7/19/2011 11:00	49	0.43	0.0020
9/13/2011	74	0.45	0.0012
10/26/2011 8:27	80	0.14	0.0001
Total average prior to SRD[1] replacement		0.57	0.0012
1/25/2012 8:30	268	2.07	0.0018
1/30/2012 10:26	286	3.54	0.0028
2/24/2012 11:15	378	3.67	0.0028
3/27/2012 10:06	486	3.38	0.0030
4/20/2012 11:46	558	2.99	0.0030
5/24/2012 8:58	652	2.77	0.0030
6/22/2012 9:14	734	2.83	0.0029
8/6/2012 8:50	910	3.91	0.0028
8/30/2012 11:14	994	3.49	0.0028
9/26/2012 11:21	1,088	3.48	0.0027
10/26/2012 12	1,162	2.46	0.0027
11/28/2012 9	1,262	3.04	0.0029
Total average after SRD[1] replacement		3.23	0.0028
Total average start-up to 11/28/12		2.35	0.0023

[1]Split recirculation device (SRD) was replaced December 9, 2011.

The total average electrical use through November 28, 2012 was 2.35 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 3.23 kWh per day. The average electrical use per gallon pumped to the Aerocell™ following the SRD replacement is 0.0028 kWh per gallon, and this parameter appears fairly stable in the period of January 30, 2012 through November 28, 2012. Figure 5 shows a plot of the average electrical use per gallon pumped versus time of experiment.

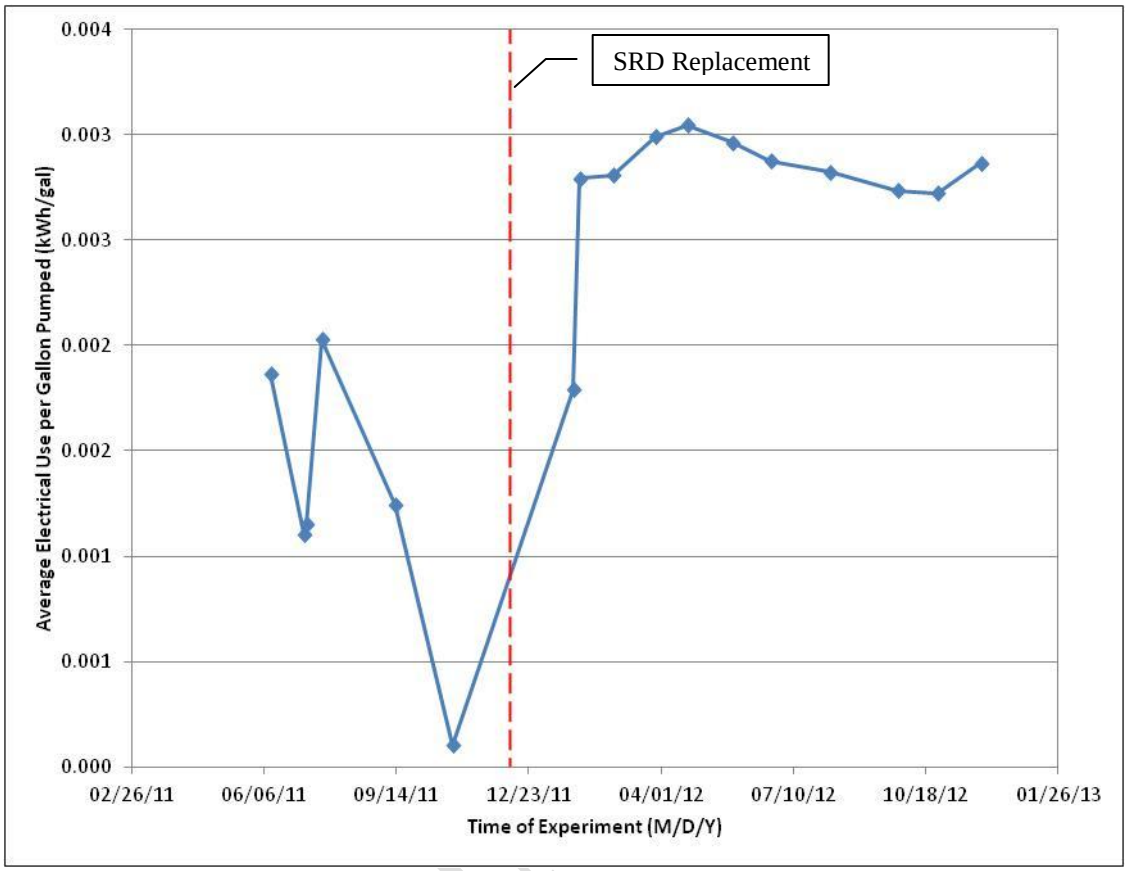
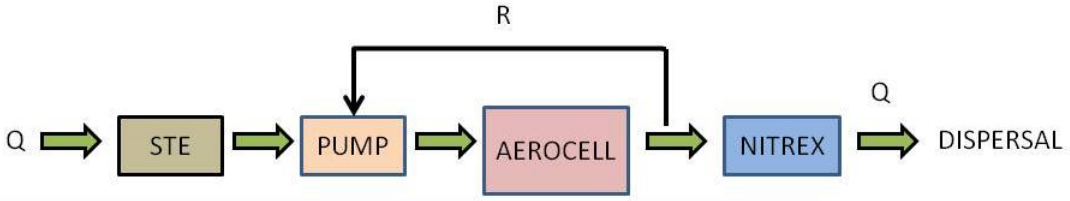


Figure 5
Plot of Average Electrical Use per Gallon Pumped

4.3 Water Quality

Water quality analytical results, for Sample Event No.7, are listed in Table 4. The laboratory report 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 was compared by considering the changes through treatment of nitrogen species (TKN-N, NH_3-N, and NO_X-N), as well as supporting water quality parameters. The nitrogen results are graphically displayed in Figure 6. A summary of the water quality data collected to date for the test system is presented in Table 5.



$CBOD_5$ mg/L	130	8	8	13
TKN mg N/L	94	8.5	8.2	3.9
NH_3 mg N/L	66	6.0	4.5	2.2
NO_x mg N/L	0.02	34.4	37.5	0.06
TN mg N/L	94.0	42.9	45.7	4.0
Fecal Coliform (Ct/100 mL)	198,000	460	590	2

Figure 6
Graphical Representation of Nitrogen Results

Septic Tank Effluent (STE) Quality: The water quality characteristics of STE collected in Sample Event 7 were within the typical range generally expected for domestic STE. However, the measured STE total nitrogen (TN) concentration was 94 mg/L, which is somewhat higher than has been typically reported for Florida single family residence STE.

Pump Chamber and Aerocell™ Effluent: The pump chamber and Aerocell™ effluent NH_3-N levels were 6.0 mg/L and 4.5 mg/L, respectively with a DO level at 3.4 mg/L in the Aerocell™ effluent (Table 4). TSS and $CBOD_5$ were below 10 mg/L. The pump chamber effluent NO_x-N was 34.4 mg/L, and Aerocell™ effluent NO_x-N was 37.5 mg/L. These results indicate significant denitrification (approximately 50% reduction of STE nitrogen) was occurring as the effluent was recirculated back into the pump chamber. Even with

an increased STE TN concentration, the Aerocell™ unit showed improved nitrification from the previous sampling event with an NH_3-N concentration of 4.5 mg/L and TKN of 8.2 reduced from 7.9 mg/L and 19 mg/L, respectively.

Nitrex™ Effluent: Effluent NO_x-N from the Nitrex™ unit was 0.06 mg/L. The low NO_x-N was accompanied by a measured 0.19 mg/L DO and -223 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™ system was effective in producing a reducing environment and achieving the NO_x-N reduction goals. Final total nitrogen (TN) in the treatment system effluent was 4 mg/L. The Nitrex™ unit effluent $CBOD_5$ of 13 mg/L was lower than the previous sample event which was below 17 mg/L. Fecal coli-form and E. coli were all effectively reduced to less than the mdl of 2 colonies/100 mL.

Table 4
Water Quality Analytical Results

Sample ID	Sample Date/Time	Sample Type	Temp (°C)	pH	Total Alkalinity (mg/L)	DO (mg/L)	ORP (mV)	Specific Conductance (µS)	TSS (mg/L)	$CBOD_5$ (mg/L)	COD	TN (mg/L N)[1]	TKN (mg/L N)	Organic N (mg/L N)[2]	NH_3-N (mg/L N)	NO_3-N (mg/L N)	NO_2-N (mg/L N)	NOx (mg/L N)	TIN (mg/L N)[3]	TP (mg/L)	Ortho P (mg/L P)	Fecal (Ct/100 mL)	E-coli (Ct/100 mL)
B-HS1-STE	11/28/2012 12:08	G	19.5	7.1	540	0.10	-228	1260	51	130	420	94.0	94	28.0	66	0.01	0.01	0.02	66.02	8.2	4.4	198,000	124,000
B-HS1-PUMP	11/28/2012 11:54	G	18.1	6.79	190	3.31	103	893	1	8	26	42.9	8.5	2.5	6	34	0.42	34.42	40.42	7.3	1.7	460	440
B-HS1-AEROCELL	11/28/2012 11:22	G	18.0	6.58	190	3.38	53	883	2	8	24	45.7	8.2	3.7	4.5	37	0.52	37.52	42.02	7.3	1.9	590	550
B-HS1-NITREX	11/28/2012 10:52	G	17.5	6.62	330	0.19	-223	778	2	13	47	4.0	3.9	1.7	2.2	0.05	0.01	0.06	2.26	6.5	2.2	2	2

Notes:

[1]Total Nitrogen (TN) is a calculated value equal to the sum of TKN and NO_X.

[2]Organic Nitrogen (ON) is a calculated value equal to the difference of TKN and NH_3.

[3]Total Inorganic Nitrogen (TIN) is a calculated value equal to the sum of NH_3 and NO_X.

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 5
Summary of Water Quality Data

Sample ID	Statistical Parameter	Temp (°C)	pH[4]	Total Alkalinity (mg/L)	DO (mg/L)	ORP (mV)	Specific Conductance (µS)	TSS (mg/L)	VSS (mg/L)	TVS (mg/L)	$CBOD_5$ (mg/L)	COD	TN (mg/L N)[1]	TKN (mg/L N)	Organic N (mg/L N)[2]	NH_3-N (mg/L N)	NO_3-N (mg/L N)	NO_2-N (mg/L N)	NOx (mg/L N)	TIN (mg/L N)[3]	TP (mg/L)	Ortho P (mg/L P)	Fecal[4] (Ct/100 mL)	E-coli[4] (Ct/100 mL)
B-HS1-STE	n	7	7	7	7	7	7	7	6	3	7	7	7	7	7	7	6	6	7	7	7	7	7	7
	MEAN	22.27	6.97	602.86	0.27	-155.30	1170.00	52.43	47.50	140.00	96.29	287.14	80.69	80.57	19.43	61.14	0.07	0.14	0.12	61.26	8.31	4.37	162,694	99,059
	STD. DEV.	2.53		137.81	0.42	171.87	74.52	7.96	10.50	122.88	43.24	102.91	10.05	10.06	8.04	5.21	0.10	0.18	0.12	5.23	1.24	0.99		
	MIN	19.50	6.77	530.00	0.00	-298.10	1019.00	40.00	32.00	0.00	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	1260.00	63.00	64.00	230.00	150.00	420.00	95.09	95.00	29.00	67.00	0.26	0.46	0.30	67.30	10.00	5.50	800,000	740,000
B-HS1-PUMP	n	7	7	7	6	7	7	7	6	6	7	7	7	7	7	7	6	6	7	7	7	7	7	7
	MEAN	21.66	6.82	238.57	1.81	65.29	884.29	7.14	5.50	65.00	11.86	46.71	48.09	18.83	3.87	14.96	33.33	0.76	29.26	44.21	8.00	2.57	2,464	1,943
	STD. DEV.	3.15		116.11	0.99	48.77	66.59	4.98	4.18	117.26	7.06	21.85	11.45	13.70	2.45	13.57	8.59	0.71	14.90	12.57	1.37	0.93		
	MIN	18.10	6.16	110.00	0.71	-24.00	756.00	1.00	3.00	0.00	3.00	26.00	35.27	6.30	1.30	5.00	22.00	0.42	0.27	31.27	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	7	7	7	7	7	7	7	6	4	7	7	7	7	7	7	6	6	7	7	7	7	7	7
	MEAN	21.20	6.67	208.00	2.77	21.53	864.57	5.14	3.58	100.00	10.29	34.43	46.37	13.00	3.82	9.18	37.83	0.57	33.37	42.56	7.99	1.97	439	364
	STD. DEV.	3.46		92.06	1.10	52.83	59.94	6.07		118.04	11.15	14.83	11.11	10.15	3.29	9.49	9.33	0.37	15.71	11.99	1.37	0.84		
	MIN	17.50	5.82	86.00	1.12	-93.30	754.00	1.00	1.50	0.00	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	57.00	939.00	18.00	6.00	230.00	31.00	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	7	7	7	7	7	7	7	6	6	7	7	7	7	7	7	6	6	7	7	7	7	7	7
	MEAN	20.74	6.54	368.57	1.09	-160.13	790.43	3.86	5.58	33.83	30.86	78.86	7.45	7.36	2.55	4.81	0.10	0.01	0.09	4.90	7.16	2.46	6	5
	STD. DEV.	3.38		56.99	1.25	132.85	79.22	1.95	3.38	57.79	36.25	41.89	6.09	6.13	1.91	4.84	0.09	0.00	0.09	4.80	1.10	0.69		
	MIN	16.90	5.75	310.00	0.00	-284.90	669.00	2.00	1.00	0.00	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	8.70	3.20	600	600

Notes:

[1]Total Nitrogen (TN) is a calculated value equal to the sum of TKN and NO_X.

[2]Organic Nitrogen (ON) is a calculated value equal to the difference of TKN and NH_3.

[3]Total Inorganic Nitrogen (TIN) is a calculated value equal to the sum of NH_3 and NO_X.

[4]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.

5.0 B-HS1 Sample Event No. 7: Summary and Recommendations

5.1 Summary

The results of the seventh sampling event indicate that the system is operating well and no adjustments are recommended at this time. For this sampling event, nitrification was improved as indicated by the Aerocell™ sample values of 37.5 mg/L NO_x-N and 8.2 mg/L TKN. The Sample Event No. 7 results indicate that:

- Septic tank effluent (STE) quality is characteristic of typical household STE quality. The total nitrogen concentration of 94 mg/L is in the upper range of values typically reported for Florida single family residence STE.

- The Aerocell™ biofilter was more effective in converting ammonium to oxidized nitrogen; effluent contained 8.2 mg/L TKN, of which 4.5 mg/L was ammonia.

- The Nitrex™ system was effective in producing a reducing environment and achieving the NO_x-N reduction goals. The Nitrex™ unit effluent fecal coliform 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 approximately 4 mg/L, an approximately 96% reduction from STE.

5.2 Recommendations

No operational adjustments are recommended at this time, and continued sampling should provide additional insight to system performance.

Appendix A: Laboratory Report

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

December 12, 2012
Work Order: 1213732

Laboratory Report

Project Name **Wakulla County B-HS1 SE#7**

Sample Description	**B-HS1-STE**
Matrix	**Wastewater**
SAL Sample Number	**1213732-01**
Date/Time Collected	**11/28/12 12:08**
Collected by	**Client**
Date/Time Received	**11/29/12 12:55**

Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Inorganics								
Ammonia as N	mg/L	66	EPA 350.1	2.0	0.47		12/03/12 12:59	50
Ammonium as NH4	mg/L	85	EPA 350.1	0.05	0.01	12/04/12 12:36	12/04/12 12:38	1
Carbonaceous BOD	mg/L	130	SM 5210B	2	2	11/29/12 08:36	12/05/12 15:45	1
Chemical Oxygen Demand	mg/L	420	EPA 410.4	25	10	12/03/12 08:05	12/03/12 11:30	1
Nitrate (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		11/30/12 09:45	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		11/30/12 09:45	1
Orthophosphate as P	mg/L	4.4	EPA 300.0	0.040	0.010		11/30/12 09:45	1
Phosphorous - Total as P	mg/L	8.2	SM 4500P-E	0.20	0.050	12/01/12 07:31	12/04/12 10:40	5
Total Alkalinity	mg/L	540	SM 2320B	8.0	2.0		12/04/12 11:46	1
Total Kjeldahl Nitrogen	mg/L	94	EPA 351.2	0.20	0.05	12/05/12 08:06	12/11/12 12:09	20
Total Suspended Solids	mg/L	51	SM 2540D	1	1	12/03/12 08:11	12/03/12 16:31	1
Volatile Suspended Solids	mg/L	64	EPA 160.4**	1	1	12/04/12 08:03	12/05/12 16:48	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

December 12, 2012
Work Order: 1213732

Laboratory Report

Project Name **Wakulla County B-HS1 SE#7**

Sample Description	**B-HS1-PUMP**
Matrix	**Wastewater**
SAL Sample Number	**1213732-02**
Date/Time Collected	**11/28/12 11:54**
Collected by	**Client**
Date/Time Received	**11/29/12 12:55**

Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Inorganics								
Ammonia as N	mg/L	6.0	EPA 350.1	0.40	0.095		12/03/12 13:44	10
Ammonium as NH4	mg/L	7.8	EPA 350.1	0.05	0.01	12/04/12 12:36	12/04/12 12:38	1
Carbonaceous BOD	mg/L	8	SM 5210B	2	2	11/29/12 08:36	12/05/12 15:45	1
Chemical Oxygen Demand	mg/L	26	EPA 410.4	25	10	12/03/12 08:05	12/03/12 11:30	1
Nitrate (as N)	mg/L	34	EPA 300.0	0.04	0.01		11/30/12 09:45	1
Nitrite (as N)	mg/L	0.42	EPA 300.0	0.04	0.01		11/30/12 09:45	1
Orthophosphate as P	mg/L	1.7	EPA 300.0	0.040	0.010		11/30/12 09:45	1
Phosphorous - Total as P	mg/L	7.3	SM 4500P-E	0.20	0.050	12/01/12 07:31	12/04/12 10:41	5
Total Alkalinity	mg/L	190	SM 2320B	8.0	2.0		12/04/12 11:46	1
Total Kjeldahl Nitrogen	mg/L	8.5	EPA 351.2	0.20	0.05	12/05/12 08:06	12/06/12 10:42	9.62
Total Suspended Solids	mg/L	1 U	SM 2540D	1	1	12/03/12 08:11	12/03/12 16:31	1
Volatile Suspended Solids	mg/L	3	EPA 160.4**	1	1	12/04/12 08:03	12/05/12 16:48	1

SOUTHERN ANALYTICAL LABORATORIES, INC.
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Hazen and Sawyer
10002 Princess Palm Ave, Suite 200
Tampa, FL 33619

December 12, 2012
Work Order: 1213732

Laboratory Report

Project Name **Wakulla County B-HS1 SE#7**

Sample Description	**B-HS1-AEROCELL**
Matrix	**Wastewater**
SAL Sample Number	**1213732-03**
Date/Time Collected	**11/28/12 11:22**
Collected by	**Client**
Date/Time Received	**11/29/12 12:55**

Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Inorganics								
Ammonia as N	mg/L	4.5	EPA 350.1	0.40	0.095		12/03/12 13:46	10
Ammonium as NH4	mg/L	5.8	EPA 350.1	0.05	0.01	12/04/12 12:36	12/04/12 12:38	1
Carbonaceous BOD	mg/L	8	SM 5210B	2	2	11/29/12 08:36	12/05/12 15:45	1
Chemical Oxygen Demand	mg/L	24 I	EPA 410.4	25	10	12/03/12 08:05	12/03/12 11:30	1
Nitrate (as N)	mg/L	37	EPA 300.0	0.04	0.01		11/30/12 09:45	1
Nitrite (as N)	mg/L	0.52	EPA 300.0	0.04	0.01		11/30/12 09:45	1
Orthophosphate as P	mg/L	1.9	EPA 300.0	0.040	0.010		11/30/12 09:45	1
Phosphorous - Total as P	mg/L	7.3	SM 4500P-E	0.20	0.050	12/01/12 07:31	12/04/12 10:42	5
Total Alkalinity	mg/L	190	SM 2320B	8.0	2.0		12/04/12 11:46	1
Total Kjeldahl Nitrogen	mg/L	8.2	EPA 351.2	0.20	0.05	12/05/12 08:06	12/06/12 10:44	9.62
Total Suspended Solids	mg/L	2	SM 2540D	1	1	12/03/12 08:11	12/03/12 16:31	1
Volatile Suspended Solids	mg/L	6	EPA 160.4**	1	1	12/04/12 08:03	12/05/12 16:48	1

SOUTHERN ANALYTICAL LABORATORIES, INC.
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Hazen and Sawyer
10002 Princess Palm Ave, Suite 200
Tampa, FL 33619

December 12, 2012
Work Order: 1213732

Laboratory Report

Project Name **Wakulla County B-HS1 SE#7**

Sample Description	**B-HS1-NITREX**
Matrix	**Wastewater**
SAL Sample Number	**1213732-04**
Date/Time Collected	**11/28/12 10:52**
Collected by	**Client**
Date/Time Received	**11/29/12 12:55**

Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Inorganics								
Ammonia as N	mg/L	2.2	EPA 350.1	0.040	0.009		12/03/12 13:05	1
Ammonium as NH4	mg/L	2.8	EPA 350.1	0.05	0.01	12/04/12 12:36	12/04/12 12:38	1
Carbonaceous BOD	mg/L	13	SM 5210B	2	2	11/29/12 08:36	12/05/12 15:45	1
Chemical Oxygen Demand	mg/L	47	EPA 410.4	25	10	12/03/12 08:05	12/03/12 11:30	1
Nitrate (as N)	mg/L	0.05	EPA 300.0	0.04	0.01		11/30/12 09:45	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		11/30/12 09:45	1
Orthophosphate as P	mg/L	2.2	EPA 300.0	0.040	0.010		11/30/12 09:45	1
Phosphorous - Total as P	mg/L	6.5	SM 4500P-E	0.20	0.050	12/01/12 07:31	12/04/12 10:43	5
Total Alkalinity	mg/L	330	SM 2320B	8.0	2.0		12/04/12 11:46	1
Total Kjeldahl Nitrogen	mg/L	3.9	EPA 351.2	0.20	0.05	12/05/12 08:06	12/06/12 10:15	1
Total Suspended Solids	mg/L	2	SM 2540D	1	1	12/03/12 08:11	12/03/12 16:31	1
Volatile Suspended Solids	mg/L	3	EPA 160.4**	1	1	12/04/12 08:03	12/05/12 16:48	1

SOUTHERN ANALYTICAL LABORATORIES, INC.
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Hazen and Sawyer
10002 Princess Palm Ave, Suite 200
Tampa, FL 33619

December 12, 2012
Work Order: 1213732

* Qualifiers, Notes and Definitions

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 limts 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.

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).

SOUTHERN ANALYTICAL LABORATORIES, INC.

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

SAL Project No. 1213732

Client Name	Contact / Phone:
Hazan and Sawyer	Josephin Edeback-Hirst 813-630-4498
Project Name / Location	jedeback@hazanandsawyer.com
Wakulla County-B-HS1 SE#7	
Samplers: (Signature)	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	1LP, Cool Total Alkalinity, NO_3, NO_2, TSS, VSS, CBOD, OP	250mL P, H_2SO_4 TKN, NH_4, COD, TP				Field Temp	Field Cond	Field pH	No. of Containers (Total per each location)
01	B-HS1-STE	11/28/12	12:08	WW		X	1	1				19.5	1260	7.10	2
02	B-HS1-PUMP	11/28/12	11:54	WW		X	1	1				18.1	893	6.79	2
03	B-HS1-AEROCELL	11/28/12	11:22	WW		X	1	1				18.0	884	6.61	2
04	B-HS1-NITREX	11/28/12	10:52	WW		X	1	1				17.5	778	6.62	2

Containers Prepared/ Relinquished:	Date/Time:	Received:	Date/Time:
gBowling	11/15/12 1500	UPS	
Relinquished: UPS	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time: 1455 11/28/12	Received: Fed Ex	Date/Time:
Relinquished: fedex	Date/Time:	Received:	Date/Time: 1255 11-29-12
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact?	(Y)	N	N/A
Samples intact upon arrival?	(Y)	N	N/A
Received on ice? Temp 0.4	(Y)	N	N/A
Proper preservatives indicated?	(Y)	N	N/A
Rec'd within holding time?	(Y)	N	N/A
Volatiles rec'd w/out headspace	Y	N	(N/A)
Proper containers used?	(Y)	N	N/A

Instructions / Remarks

Chain of Custody.xls
Rev.Date 11/19/01

Chain of Custody

Ackuritlabs, Inc.

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

Environmental Services Section

REPORT OF MICROBIOLOGICAL ANALYSIS

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

Report #: 22089
Report Date: December 5, 2012
NELAC#: E81350
FDEPQA#: 920087G
Project#: 211296
Sampled By: Mark Busby
Sample Site: [redacted] Drive Septic System
Sample Date: 11-28-12

Table 1. Samples received 11-28-12.

	Fecal Coliform	Dilution	*E. coli*	Dilution
Units:	# colonies/100 mL	Factor	# colonies/100 mL	Factor
Methodology:	SM 9222D		EPA 1603	
Detection Limit:	2.0		2.0	
Analysis Date:	11-28-12		11-28-12	
Analysis Time:	14:55		14:55	
Analyst:	TA		TA	
Sample Location/Time:				
Lab Number:				
Nitrex Tank, 10:52				
#113270	2.0 U	2	2.0 U	2
Aerocell Tank, 11:22				
#113271	590	10	550	10
Pump Tank, 11:54				
#113272	460	10	440	10
STE Tank, 12:08				
#113273	198,000 B	1,000	124,000 B	1,000

Data Qualifiers that may apply:
U = Analyte was not detected and the indicated value is the detection limit.
B = Colony count exceeded the ideal of 20-60 (fecal coliform) or 20-80 (*E. coli*) colonies per plate.

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 #: 22089
Report Date: December 5, 2012
NELAC#: E81350
FDEPQA#: 920087G
Project#: 211296
Sampled By: Mark Busby
Sample Site: [redacted] Drive
Sample Date: 11-28-12

Table 2. Samples received 11-28-12.

	pH	Temperature	Conductivity	DO	ORP
Nitrex Tank, 10:52 #113270	6.62	17.6	778	0.17	-227
Aerocell Tank, 11:22 #113271	6.52	17.7	876	2.67	53
Pump Tank, 11:54 #113272	6.79	18.1	893	3.32	100
STE Tank, 12:08 #113273	7.11	19.5	1,261	0.09	-230

Data Qualifiers that may apply:
U = Analyte was not detected and the indicated value is the detection limit.
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.

12-5-12

Todd J. Acker, Laboratory Director

Ackuritlabs, Inc.

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

№ 22089

CHAIN OF CUSTODY RECORD

Page 1 of 1

CLIENT NAME & ADDRESS: Hazen & Sawyer

LAB PROJECT #: 211296

PROJECT NAME: [redacted] Septic

CONTACT PERSON: Harmons

SAMPLE CONTAINERS	PRESERVATIVE									PLASTIC CONTAINERS								GLASS CONTAINERS									
	A	N	S	H	B	Z	T																				
QUANTITY	NH_4Cl	HNO_3	H_2SO_4	HCl	NaOH	$Zn(C_2H_3O_2)_2$	$Na_2S_2O_3$			125 mL	250 mL	500 mL	1 Liter	WHIRLPAK - DW	WHIRLPAK - WW	WHIRLPAK - ICE		40 mL	125 mL	250 mL	500 mL	1 Liter			TRIP BLANK	REMARKS

PRECLEANED CONTAINERS RELINQUISHED BY: MARK Busby — DATE: 11-28-12 — TIME: 0800 — RECEIVED BY: MARK Busby — DATE: 11-28-12 — TIME: 0800

RELINQUISHED BY: — DATE: — TIME: — RECEIVED BY: — DATE: — TIME:

SAMPLE COLLECTION 2012

SAMPLERS: (PRINT NAME) MARK Busby

SAMPLERS: (SIGNATURE) Mark Busby

FIELD ID NUMBER	DATE MM/DD/YY	TIME	STATION LOCATION/NUMBER	MATRIX	GRAB OR COMPOSITE	NO. OF CONTAINERS	ANALYSES REQUESTED: Fecal E. coli								LAB ID#
#1	11-28-12	1052	Nitrex Tank	ww	G	1	X	X							113270
#2	"	1122	Aerocell Tank	"	"	1	X	X							113271
#3	"	1154	Pump Tank	"	"	1	X	X							113272
#4	"	1208	STE Tank	"	"	1	X	X							113273

COMMENTS:

SAMPLES RECEIVED: ICED (Y) / N

TEMP: _____ ° C HOLD TIME (Y) / N PROPER PRESERVATION (Y) / N

RELINQUISHED BY(SIGNATURE) / AFFILIATION / DATE & TIME: MARK Busby / ACK / 11-28-12 1300

RECEIVED BY(SIGNATURE) / AFFILIATION / DATE & TIME: 11-28-12 1300

RELINQUISHED BY(SIGNATURE) / AFFILIATION / DATE & TIME:

RECEIVED BY(SIGNATURE) / AFFILIATION / DATE & TIME:

RELINQUISHED BY(SIGNATURE) / AFFILIATION / DATE & TIME:

RECEIVED BY(SIGNATURE) / AFFILIATION / DATE & TIME:

MATRIX TYPES:

SW SURFACE WATER	DW DRINKING WATER	SL SLUDGE	HZ HAZARDOUS WASTE
WW WASTE WATER	FT FISH TISSUE	MI MICROBENTHIC INVERTEBRATES	SE SEDIMENT
GW GROUND WATER	SO SOIL	SH SHELLFISH	OT OTHER

[redacted] 11-28-12

DEP-SOP-001/01
FT 1100 Field Measurement of Hydrogen Ion Activity (pH)
Field Instrument Calibration Records

INSTRUMENT (MAKER/MODEL#) YSI **INSTRUMENT #** 55

PARAMETER: *[check only one]*

☐ TEMPERATURE ☐ CONDUCTIVITY ☐ SALINITY ☐ pH ☐ ORP
☐ TURBIDITY ☐ RESIDUAL CL ☑ DO ☐ OTHER _____

STANDARDS: *[Specify the type(s) of standards used for calibration, the origin of the standards, the standard values, and the date the standards were prepared or purchased]*

Standard A Air ✓ membrane

Standard B _____

Standard C _____

DATE (yy/mm/dd)	TIME (hr:min)	STD (A, B, C)	STD VALUE	INSTRUMENT RESPONSE	% DEV	CALIBRATED (YES, NO)	TYPE (INIT, CONT)	SAMPLER INITIALS
11-28-12	0820	A	Air	Cal	Ø	Yes	Init	MB
11-28-12	1220	A	Air	Cal	Ø	Yes	Cont	MB

[redacted] 11-28-12

DEP-SOP-001/01 Page 1 of 1
FT 1100 Field Measurement of Hydrogen Ion Activity (pH)
Field Instrument Calibration Records

INSTRUMENT (MAKER/MODEL#) YSI **INSTRUMENT #** 60

PARAMETER: *[check only one]*

☑ TEMPERATURE ☐ CONDUCTIVITY ☐ SALINITY ☐ pH ☐ ORP
☐ TURBIDITY ☐ RESIDUAL CL ☐ DO ☐ OTHER _____

STANDARDS: *[Specify the type(s) of standards used for calibration, the origin of the standards, the standard values, and the date the standards were prepared or purchased]*

Standard A Calibrate U.S. NIST thermometer 0.0°C
Standard B _____ Diff @ 20.0°C
Standard C _____

DATE (yy/mm/dd)	TIME (hr:min)	STD (A, B, C)	STD VALUE	INSTRUMENT RESPONSE	% DEV	CALIBRATED (YES, NO)	TYPE (INIT, CONT)	SAMPLER INITIALS
11-28-12	0830							
11-28-12	1220							

[redacted] 11-28-12

DEP-SOP-001/01
FT 1100 Field Measurement of Hydrogen Ion Activity (pH)
Field Instrument Calibration Records

INSTRUMENT (MAKER/MODEL#) YSI **INSTRUMENT #** 60

PARAMETER: *[check only one]*

☐ TEMPERATURE ☐ CONDUCTIVITY ☐ SALINITY ☑ pH ☐ ORP
☐ TURBIDITY ☐ RESIDUAL CL ☐ DO ☐ OTHER _____

STANDARDS: *[Specify the type(s) of standards used for calibration, the origin of the standards, the standard values, and the date the standards were prepared or purchased]*

Standard A 4.0
Standard B 7.0
Standard C 10.0

DATE (yy/mm/dd)	TIME (hr:min)	STD (A, B, C)	STD VALUE	INSTRUMENT RESPONSE	% DEV	CALIBRATED (YES, NO)	TYPE (INIT, CONT)	SAMPLER INITIALS
11-28-12	0830	A	4.0	4.02	.2%	Yes	Init	MB
		B	7.0	7.01	.1%	Yes	Init	MB
		C	10.0	10.01	.1%	Yes	Init	MB
11-28-12	1220	A	4.0	4.02	.2%	Yes	Cont	MB
		B	7.0	7.1	.1%	Yes	Cont	MB
		C	10.0	10.01	.1%	Yes	Cont	MB

[redacted] 11-20-12
11-28-12

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FT 1100 Field Measurement of Hydrogen Ion Activity (pH)

Field Instrument Calibration Records

INSTRUMENT (MAKER/MODEL#) YSI **INSTRUMENT #** 1

PARAMETER: *[check only one]*

☐ TEMPERATURE ☑ CONDUCTIVITY ☐ SALINITY ☐ pH ☐ ORP

☐ TURBIDITY ☐ RESIDUAL CL ☐ DO ☐ OTHER _____

STANDARDS: *[Specify the type(s) of standards used for calibration, the origin of the standards, the standard values, and the date the standards were prepared or purchased]*

Standard A 0.0 us

Standard B 1000

Standard C 1413

DATE (yy/mm/dd)	TIME (hr:min)	STD (A, B, C)	STD VALUE	INSTRUMENT RESPONSE	% DEV	CALIBRATED (YES, NO)	TYPE (INIT, CONT)	SAMPLER INITIALS
11-28-12	0830	A	0.0	0.1	.1%	Yes	Init	MB.
		B	1000	1000	Ø	Yes	Init	MB
		C	1413	1414	.1%	Yes	Init	MB
11-28-12	1220	A	0.0	0.1	.1%	Yes	Cont	MB
		B	1000	998	.2%	Yes	Cont	MB
		C	1413	1414	.1%	Yes	Cont	MB

[redacted]

11-28-12

DEP-SOP-001/01 Page 1 of 1

FT 1100 Field Measurement of Hydrogen Ion Activity (pH)

Field Instrument Calibration Records

INSTRUMENT (MAKER/MODEL#) Lamotte **INSTRUMENT #** 2020

PARAMETER: *[check only one]*

☐ TEMPERATURE ☐ CONDUCTIVITY ☐ SALINITY ☐ pH ☐ ORP

☑ TURBIDITY ☐ RESIDUAL CL ☐ DO ☐ OTHER _____

STANDARDS: *[Specify the type(s) of standards used for calibration, the origin of the standards, the standard values, and the date the standards were prepared or purchased]*

Standard A 40.0 NTU

Standard B 4.0 NTU

Standard C 1.0 NTU

DATE (yy/mm/dd)	TIME (hr:min)	STD (A, B, C)	STD VALUE	INSTRUMENT RESPONSE	% DEV	CALIBRATED (YES, NO)	TYPE (INIT, CONT)	SAMPLER INITIALS
11-28-12	0830	A	40.0	40.0	0%	Yes	Init	MB
		B	4.0	4.0	0%	Yes	Init	MB
		C	1.0	1.0	0%	Yes	Init	MB
11-28-12	1220	A	40.0	40.0	0%	Yes	Cont	MB
		B	4.0	4.0	0%	Yes	Cont	MB
		C	1.0	1.0	0%	Yes	Cont	MB

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.

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.

Appendix C: Vericomm PLC Data

System Status			28-Nov-12	5-Nov-12	26-Oct-12
Point	Description	Status	Value	Value	Value
1	**Alarm Status**	Automatic	OK	OK	OK
2	**Alert Status**	Automatic	OK	OK	OK
3	**System Mode**	Automatic	Normal	Normal	Normal
5	**Timer Mode**	Automatic	Normal	Normal	Off
6	**Active Off Time**	Automatic	15.0 Minutes	15.0 Minutes	15.0 Minutes
7	**Active On Time**	Automatic	2.0 Minutes	2.0 Minutes	2.0 Minutes
9	**Pump Mode**	Automatic	OffCycl	OffCycl	Off
10	**Pump Status**	Automatic	Off	Off	Off
12	**Pump Cycles Today**	Automatic	35.0 Cycles	8.0 Cycles	22.0 Cycles
13	**Override Cycles Today**	Automatic	0.0 Cycles	0.0 Cycles	0.0 Cycles
14	**Pump Run Time Today**	Automatic	70.6 Minutes	16.2 Minutes	44.8 Minutes
Settings					
Point	Description	Status	Value	Value	Value
17	**Off Cycle Time**	Constant/Setpoint	15.0 Minutes	15.0 Minutes	15.0 Minutes
18	**On Cycle Time**	Constant/Setpoint	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
20	**Override On Cycle Time**	Constant/Setpoint	1.7 Minutes	1.7 Minutes	1.7 Minutes
21	**Minimum Override Cycles**	Automatic	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
24	**Time Limit per Day**	Constant/Setpoint	200.0 Minutes	200.0 Minutes	200.0 Minutes
25	**High Level Pump Test**	Automatic	2.0 Minutes	2.0 Minutes	2.0 Minutes
28	**Alarm Update Interval**	Timing Override	120.0 Minutes	120.0 Minutes	120.0 Minutes
29	**Page Delay**	Automatic	960.0 Minutes	960.0 Minutes	960.0 Minutes
30	**Page Interval**	Automatic	30.0 Minutes	30.0 Minutes	30.0 Minutes
31	**Local Alarm Delay**	Constant/Setpoint	1140.0 Minutes	1140.0 Minutes	1140.0 Minutes
32	**Local Reactivate Delay**	Automatic	120.0 Minutes	120.0 Minutes	120.0 Minutes
Troubleshooting					
Point	Description	Status	Value	Value	Value
33	**Top Float Status**	Automatic	OK	OK	OK
34	**Middle Float Status**	Automatic	OK	OK	OK
35	**Bottom Float Status**	Automatic	OK	OK	OK
37	**Contactor Status**	Automatic	OK	OK	OK
38	**Pump Status**	Automatic	OK	OK	OK
40	**Filter Status**	Automatic	OK	OK	OK
41	**Tank Status**	Automatic	OK	OK	OK
43	**Power Status**	Automatic	OK	OK	OK
Flow Data					
Point	Description	Status	Value	Value	Value
49	**Pump Run Time Today**	Automatic	70.6 Minutes	16.2 Minutes	44.8 Minutes
50	**Override Cycles Today**	Automatic	0	0	0
51	**Pump Cycles Today**	Automatic	35.0 Cycles	8.0 Cycles	22.0 Cycles
52	**Average Run Time per Cycle Today**	Automatic	2.0 Minutes	2.0 Minutes	2.0 Minutes
54	**Brownouts Today**	Automatic	0	0	0

System Status			28-Nov-12	5-Nov-12	26-Oct-12
30-Day History Data					
Point	Description	Status	Value	Value	Value
65	**30 Day Average Run Time per Day**	Automatic	101.3 Minutes	85.2 Minutes	82.1 Minutes
66	**30 Day Average Override Cycles per Day**	Automatic	0.0 Cycles	0.0 Cycles	0.0 Cycles
67	**30 Day Average Cycles per Day**	Automatic	50.3 Cycles	42.3 Cycles	40.7 Cycles
68	**30 Day Average Run Time per Cycle**	Automatic	2.0 Minutes	2.0 Minutes	2.0 Minutes
71	**30 Day Total Pump Run Time**	Automatic	3038.9 Minutes	2555.5 Minutes	2462.2 Minutes
72	**30 Day Total Override Cycles**	Automatic	0.0 Cycles	0.0 Cycles	0.0 Cycles
73	**30 Day Total Cycles**	Automatic	1508.0 Cycles	1268.0 Cycles	1222.0 Cycles
76	**30 Day Total Brownouts**	Automatic	0	0	0
Totalized Pump Data					
Point	Description	Status	Value	Value	Value
82	**Pump Total Run Time**	Automatic	743.8 Hours	701.7 Hours	688.3 Hours
83	**Pump Total Cycles**	Automatic	23021.0 Cycles	21768.0 Cycles	21368.0 Cycles
Miscellaneous					
Point	Description	Status	Value	Value	Value
145	**Pump On Auto**	Automatic	Off	Off	Off
147	**Pump Test Today**	Automatic	Off	Off	Off
148	**Pump Check Enable**	Automatic	Off	Off	Off
149	**Total Override Cycles**	Automatic	0	0	0
150	**High Level Condition**	Automatic	Off	Off	Off
151	**Leak Check Enable**	Automatic	On	On	Off
152	**Brownout State**	Automatic	Off	Off	Off
153	**Test Mode**	Automatic	Off	Off	Off
Alarm Points					
Point	Description	Status	Value	Value	Value
161	**General Alarm**	Automatic	Off	Off	Off
162	**New Alarm**	Automatic	Off	Off	Off
163	**Update Central Enable**	Automatic	On	On	On
167	**Page Alarm Start**	Automatic	Off	Off	Off
168	**Pager Signal**	Override Off	Off	Off	Off
169	**Local Alarm Start**	Automatic	Off	Off	Off
170	**Local Alarm Silence**	Automatic	Off	Off	Off
Inputs & Outputs					
Point	Description	Status	Value	Value	Value
177	**High Level/Override Timer Float Input**	Automatic	Off	Off	Off
178	**Timer Float Input**	Automatic	On	On	Off
179	**Redundant Off Float & Low Level Alarm Input**	Automatic	On	On	On
181	**Push To Silence Input**	Automatic	Off	Off	Off
182	**Auxiliary Contact Input**	Automatic	Off	Off	Off
186	**Pump Output**	Automatic	Off	Off	Off
188	**Alarm Light Output**	Automatic	Off	Off	Off
189	**Audible Alarm Output**	Override Off	Off	Off	Off