



Florida Onsite Sewage Nitrogen Reduction Strategies Study

Task B.7

B-HS2 Field System Monitoring Report No. 6

Progress Report

October 2013

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Environmental Engineers & Scientists

In association with:



AET
Applied Environmental Technology

**Otis Environmental
Consultants, LLC**

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TASK B.7 PROGRESS REPORT

B-HS2 Field System Monitoring Report No. 6

Prepared for:

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Bureau of Environmental Health
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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 and pilot tested in PNRS II. 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 sixth sample event of the passive nitrogen reduction system at a home site B-HS2 in Hillsborough County, Florida.

2.0 Purpose

This monitoring report documents data collected from the sixth B-HS2 monitoring and sampling event conducted on October 7, 2013. This monitoring event consisted of collecting flow measurements from the household water use meter and the treatment system internal water meters, 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-HS2 field site is located in Hillsborough County, FL. The nitrogen reducing onsite treatment system for the single family residence was installed in September 2012. Design and construction details were presented previously in the Task B.6 document. Figure 1 is a system schematic showing the system components and layout of the installation. A flow schematic of the system is shown in Figure 2. The B-HS2 system tankage consists of a 1,050 gallon two chamber concrete primary tank; 300 gallon concrete recirculation tank; 900 gallon concrete Stage 1 unsaturated media biofilter; 300

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gallon concrete pump tank; and 1,500 gallon two chamber concrete Stage 2 saturated media biofilter. Based on measured average wastewater flow and tank volumes, there is over a ten day transit time through the treatment system prior to dispersal. The denitrified treated effluent is discharged into the soil via the existing mounded drainfield (P.T.I.TM bundles).

3.2 PNRS System Modification

As recommended in the fifth sample event report, the recirculation mode of operation was modified prior to the sixth sample event. The pump tank discharge is split via two throttling globe valves which allow for a portion of the Stage 1 biofilter effluent to be sent back for recirculation with the rest proceeding to the Stage 2 biofilter. The system was designed with two recirculation modes of operation. The first option (which was initially tested) is to have the recirculated effluent return to the recirculation tank for mixing with incoming septic tank effluent. Following the fifth sample event, the recirculation mode of operation was modified to test the second option. In the second option, recirculated effluent does not pass through the recirculation tank, but is dispersed by three spray nozzles directly to the top of the Stage 1 biofilter along with recirculation tank effluent (STE).

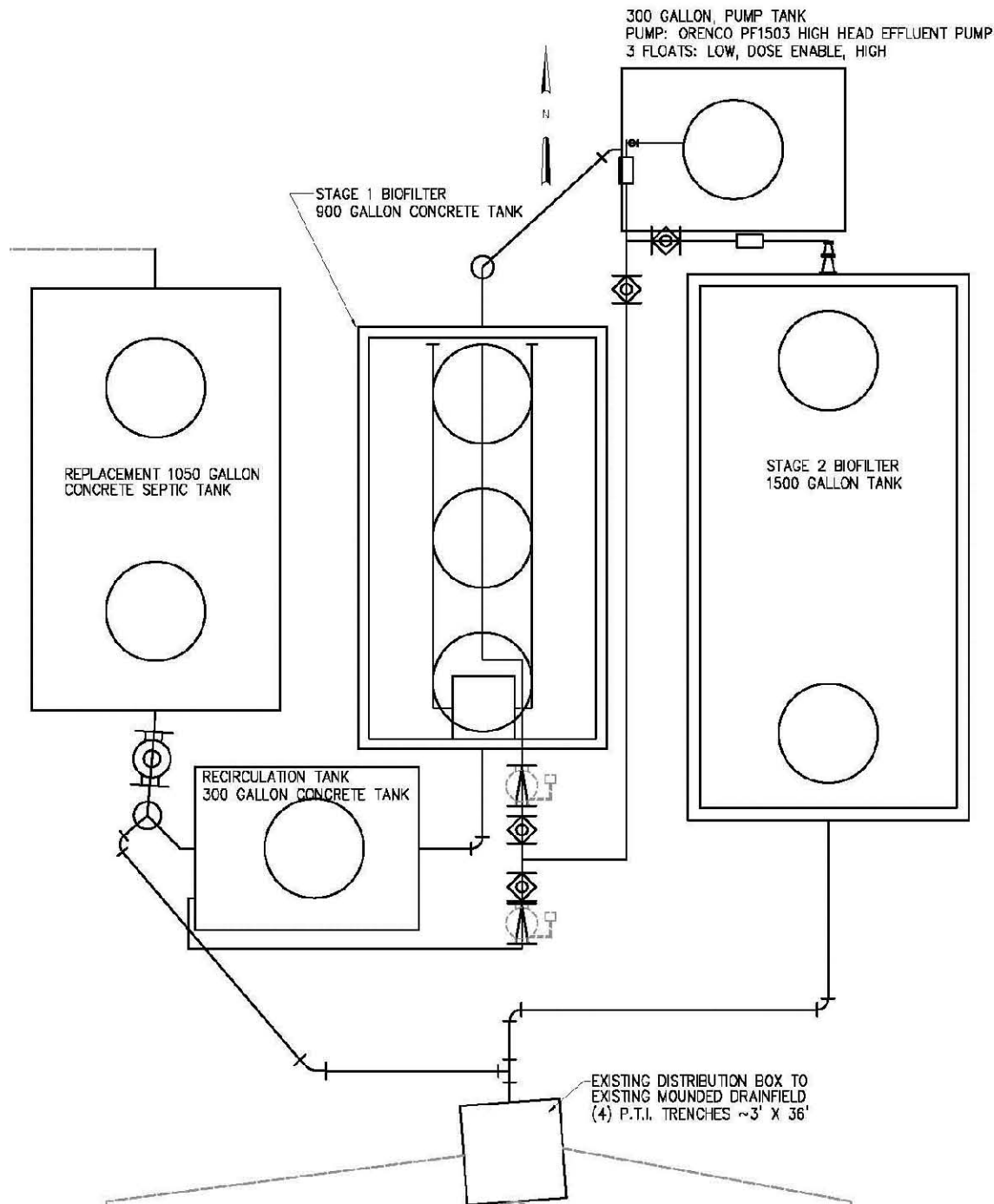


Figure 1
Plan view of B-HS2 System Layout

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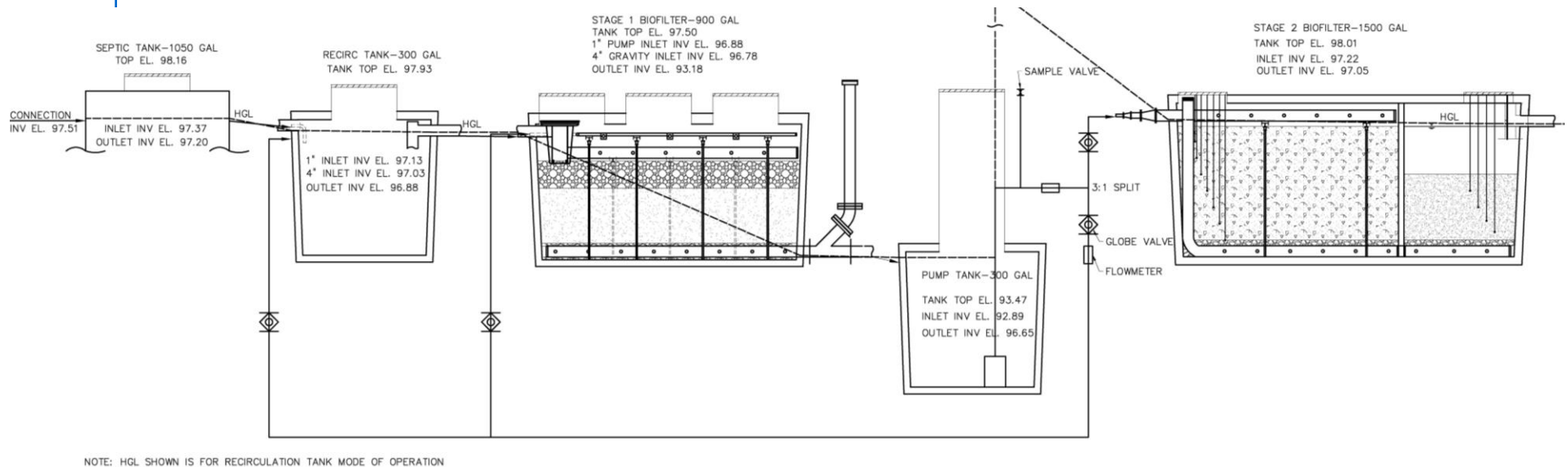


Figure 2
Flow Schematic of B-HS2 PNRS installed in Hillsborough County

3.3 Monitoring and Sample Locations and Identification

The four primary monitoring points for this sample event are shown in Figure 3. Household wastewater enters the 1st chamber of the primary tank and exits the second chamber as septic tank effluent through an effluent screen into the recirculation tank. The first primary monitoring point, B-HS2-STE, is the effluent sampled approximately 1.5 feet below the surface of the second chamber of the primary tank (Figure 4), which is referred to as primary effluent or septic tank effluent (STE). Samples from monitoring point B-HS2-STE are the whole household wastewater after it has had some residence time in the primary tank; it represents the influent to the remainder of the onsite nitrogen reduction system.

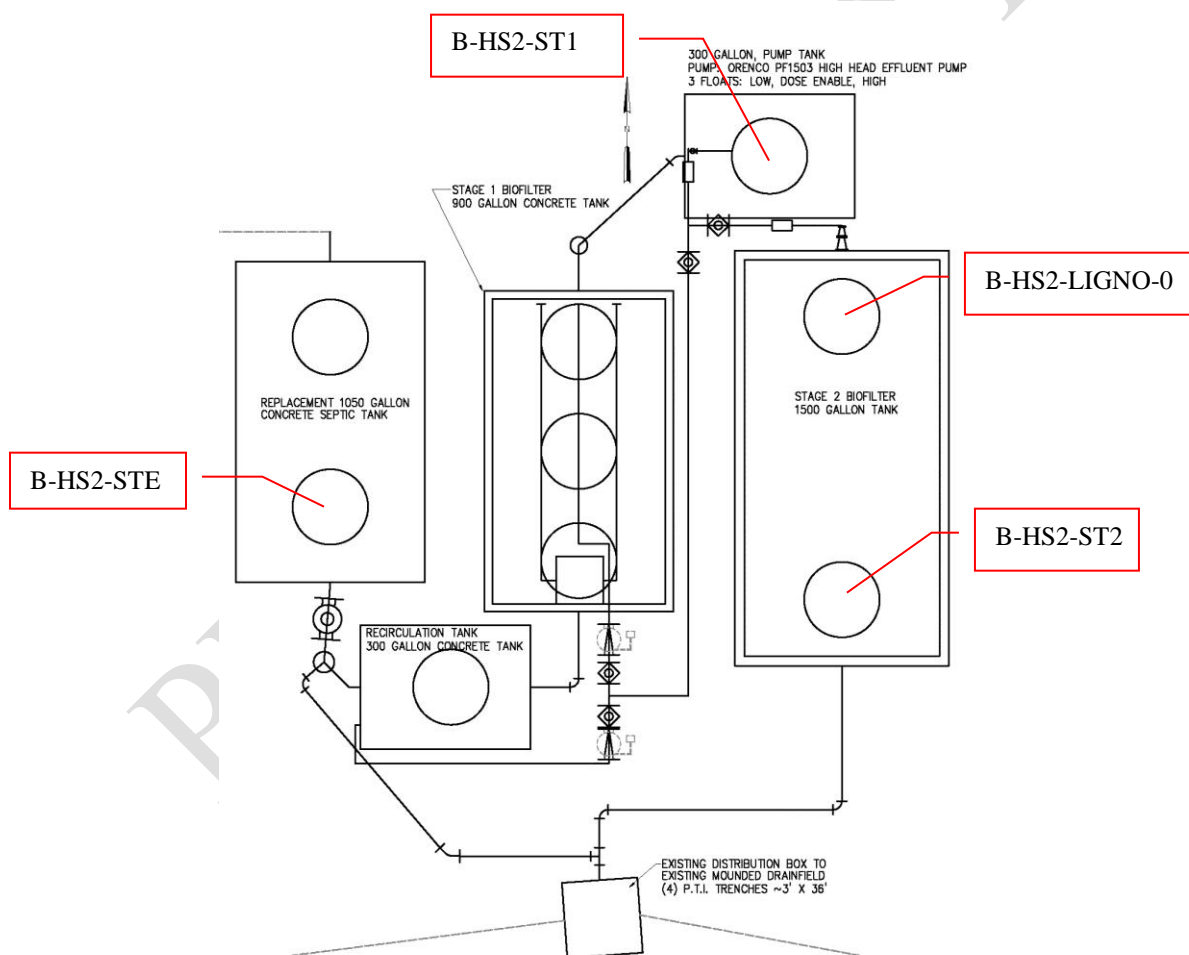


Figure 3
B-HS2 Sample and Monitoring Locations

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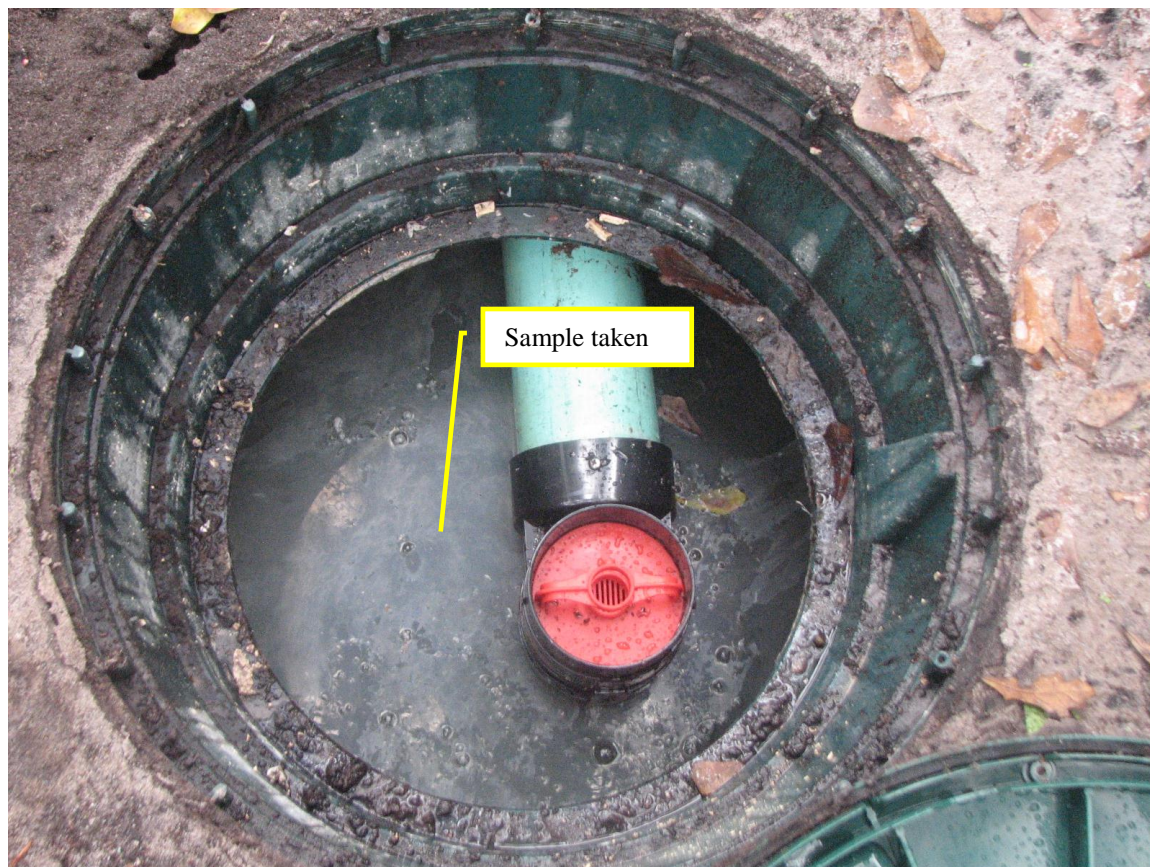


Figure 4
Second chamber of Primary Tank (B-HS2-STE sample)

Following the modification to the recirculation mode of operation, the recirculation tank only receives septic tank effluent. The recirculation tank contents are discharged by gravity to a distribution box, located inside the Stage 1 biofilter, which splits the flow between two perforated distribution pipes along the top of the unsaturated Stage 1 biofilter media. In the Stage 1 biofilter, wastewater percolates downward through the unsaturated expanded clay media where nitrification occurs. Stage 1 biofilter effluent flows into the pump tank (which contains the pump and float switches). The second primary monitoring point, B-HS2-ST1, is the Stage 1 effluent sampled approximately 1.5 feet below the surface of the pump tank (Figure 5).



Figure 5
Stage 1 effluent sample taken in pump tank (B-HS2-ST1 sample)

The pump tank discharge is split via two throttling globe valves which allow for a portion of the Stage 1 biofilter effluent to be sent back for recirculation with the rest proceeding to the Stage 2 biofilter. The system was designed with two recirculation modes of operation. The first option (which was initially tested) is to have the recirculated effluent return to the recirculation tank for mixing with incoming septic tank effluent. The second option is to have the recirculated effluent return to the top of the Stage 1 biofilter, dispersed by three spray nozzles (which is currently being tested). Effluent from the unsaturated (Stage 1) media tank enters the saturated denitrification (Stage 2) biofilter into a standing water column lying above the media in the first chamber (lignocellulosic media), flows downward through the media, moves laterally in a perforated 4-inch pipe through the baffle wall to the bottom of the second chamber, and upward through the media in the second chamber (elemental sulfur and oyster shell).

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The first chamber of the Stage 2 biofilter contains 42-inches of lignocellulosic media. Stainless steel samplers are positioned at 6-inch increments for vertical profiling throughout the lignocellulosic media. The third primary sampling point is a stainless steel sampler positioned at the bottom of the lignocellulosic media (B-HS2-LIGNO-0). The B-HS2-LIGNO-0 sample represents the lignocellulosic media effluent (Figure 6).

A collection pipe along the bottom transfers the first chamber (lignocellulosic media) effluent to the second chamber, which contains 24-inches of elemental sulfur mixed with oyster shell media. Similar to the lignocellulosic media chamber, stainless steel samplers are positioned to create a vertical profile. The fourth primary sampling point, B-HS2-ST2, is the second chamber of the Stage 2 biofilter effluent which is sampled approximately 1 foot below the surface of the effluent baffle tee. This sample location is after passage through the sulfur media; it is the final effluent from the treatment system prior to being discharged to the existing soil infiltration system, or drainfield (Figure 7).



Figure 6
First chamber of Stage 2 biofilter (B-HS2-LIGNO-0 sample)



Figure 7
Second chamber of Stage 2 biofilter (B-HS2-ST2 sample)

3.4 Operational Monitoring

Start-up of the system occurred on September 25, 2012 (Experimental Day 0) and the system has operated continually since that date. For this sixth formal sampling event, the water meter for the house and the treatment system flow meters were read and recorded on October 7, 2013 (Experimental Day 377). As previously discussed, the pump tank discharge is split via two throttling globe valves which allow for a portion of the Stage 1 biofilter effluent to be sent back for recirculation with the rest proceeding to the Stage 2 biofilter. The combined flow meter is located on the pump tank discharge line prior to the split, and records the cumulative flow in gallons pumped from the pump chamber. Therefore the measurement of the combined flow meter includes both the forward wastewater flow from the household and the recirculation flow. The Stage 2 flow meter is located following the split on the line from the pump tank to the Stage 2 biofilter and records the cumulative forward flow in gallons pumped to the Stage 2 biofilter. The control panel includes telemetry where reports are generated regarding alarms, pump cycles, and other information using a Vericom control panel system.

3.5 Energy 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 Stage 2 biofilter media (lignocellulosic and sulfur) are “reactive” media which will be consumed during operation. The Stage 2 biofilter was initially filled with 42 inches of lignocellulosic media and 24 inches of sulfur media, which ostensibly will last for many years without replenishment or replacement.

3.6 Water Quality Sample Collection and Analyses

A full suite of influent, intermediate and effluent water quality samples from the system were collected for the sixth formal sample event on October 7, 2013 for water quality analysis. Samples were collected at each of the four monitoring points described in Section 3.2: B-HS2-STE, B-HS2-ST1, B-HS2-LIGNO-0 and B-HS2-ST2. 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.

In addition, equipment blank (B-HS2-EB) sample was taken. The equipment blank was collected by pumping deionized water through the cleaned pump tubing. This sample was then analyzed for the same parameters as the monitoring samples.

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 laboratories. 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, chemical oxygen demand (COD), 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), volatile suspended solids (VSS), total organic carbon (TOC), fecal coliform (fecal), and E.coli. The influent and sulfur media samples included sulfate, sulfide, and hydrogen sulfide (unionized). All analyses were performed by independent and fully NELAC certified analytical laboratories (Southern Analytical Laboratory and Benchmark EnviroAnalytical Inc.). Table 1 lists the analytical parameters, analytical methods, and detection limits for laboratory 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
Nitrate+Nitrite Nitrogen (NOX-N)	EPA 300.0	0.02 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
Total Organic Carbon (TOC)	SM5310B	0.06 mg/L
Sulfate	EPA 300.0	2.0 mg/L
Sulfide	SM 4500SF	0.10 mg/L
Hydrogen Sulfide (unionized)	SM 4550SF	0.01 mg/L
Fecal Coliform (fecal)	SM9222D	2 ct/100mL
E.coli	EPA1603	2 ct/100mL

4.0 Results and Discussion

4.1 Operational Monitoring

Table 2 provides a summary of the household water use since water meter installation on March 6, 2012. The treatment system flow meter readings and corresponding recirculation ratio for the B-HS2 field site are summarized in Table 3. The operation and maintenance log which includes actions taken since start-up is provided in Appendix B. Summary tables of the Vericom 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 Household Water Use

Date	Cumulative Volume (gallons)	Average Daily Household Flow, Q (gpd)
3/6/2012	7,790	INSTALLED
4/3/2012	11,490	132
5/1/2012	14,960	124
6/5/2012	19,560	131
7/3/2012	23,120	127
8/7/2012	26,730	103
9/4/2012	29,800	110
10/2/2012	33,240	123
11/6/2012	36,510	93
12/4/2012	40,080	128
1/1/13	43,240	113
2/5/13	47,741	129
3/5/2013	50,000	81
4/16/2013	54,010	95
5/7/2013	55,940	92
5/28/2013	57,620	80
6/11/2013	58,620	71
7/24/2013	62,422	88
8/7/2013	63,964	109
9/7/2013	66,830	94
10/7/2013	69,070	73
Total average start-up to 10/7/13		105

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Table 3
Summary of System Flow

Date and Time Read	Combined Pumped Flow, Q+R Water Meter Reading	Average Daily Combined, Q+R Flow	Stage 2, Q Flow Meter Reading	Average Daily Stage 2, Q Flow	Average Daily, R Flow	Average Recycle Ratio
	Cumulative Volume (gallons)	Gallons/day	Cumulative Volume (gallons)	Gallons/Day	Gallons/Day	Recycle: Forward Flow
Recirculation mode of operation: to recirculation tank						
9/25/2012 11:00	351.9	Installed	102.2	Installed		
9/27/2012 9:45	570.5	Valves set	149.5	Valves set		
10/5/2012 8:07	3,898.3	419.5	880.6	92.2	327.4	3.55
10/11/2012 7:55	7,888.5	525.6	1,716.6	112.5	413.0	3.67
10/23/2012 9:00	15,092.9	559.2	3,228.2	118.6	440.7	3.72
10/30/2012 14:30	18,090.1	527.7	3,904.7	113.1	414.6	3.67
11/13/2012 14:00	22,944.4	474.3	5,007.3	103.0	371.3	3.61
12/3/2012 8:00	35,555.0	522.7	7,886.8	115.6	407.1	3.52
1/3/2013 8:00	51,563.3	520.7	11,542.3	116.3	404.4	3.48
2/5/2013 8:23	72,069.0	546.0	16,185.3	122.5	423.6	3.46
2/27/2013 11:00	81,937.3	531.6	18,441.6	119.5	412.1	3.45
4/16/13 10:15	105,376.0	521.4	23,809.3	117.7	403.7	3.43
6/4/13 7:30	126,085.7	502.2	28,513.7	113.5	388.7	3.43
7/8/2013 8:30	140,549.5	493.0	31,800.5	111.5	381.5	3.42
7/24/2013 8:39	145,987.7	484.8	33,032.0	109.6	375.2	3.42
8/7/2013 7:45	152,531.6	484.1	34,570.7	109.7	374.4	3.41
Average through 8/7/13		508.1		112.5	395.5	3.52:1
Recirculation mode of operation: to Stage 1 sprayers						
8/7/2013 13:04	152,720.1		34,616.4			
9/6/2013 9:15	163,910.2	375.0	37,404.3	93.4	281.6	3.01
10/7/2013 10:10	174,601.7	359.4	40,102.7	90.1	269.3	2.99
Average through 10/7/13		367.2		91.8	275.4	3.00:1
Total average start-up to 10/7/13		490.5		109.9	380.5	3.45:1

The two throttling globe valves control the fraction of Stage 1 effluent that is recirculated and the fraction sent to the Stage 2 biofilter. As previously discussed, the recirculation mode of operation was modified following the fifth sample event. The globe valves were set so that 3 parts went back to the Stage 1 sprayers and 1 part went to the Stage 2 tank

(3:1 recycle ratio). From start-up to October 7, 2013, the household flow average was 105 gallons per day with periods of higher and lower flows (Table 2). The average combined pumped flow (recirculation and forward flow to the Stage 2 biofilter) following the modification to the recirculation mode of operation was 367.2 gallons per day, and the average forward flow to the Stage 2 biofilter was 91.8 gallons per day. Therefore, the average recirculation flow was 275.4 gallons per day, with a corresponding average recirculation ratio of 3.0:1 following the modification to the recirculation mode of operation.

4.2 Energy 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 4.

Table 4
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)
Recirculation mode of operation: to recirculation tank			
9/25/2012 11:05	0.2	Installed	
9/27/2012 9:58	0.3	Start-up	
10/5/2012 8:07	2.6	0.29	0.0031
10/11/2012 7:55	5.0	0.40	0.0036
10/23/2012 9:00	9.5	0.37	0.0032
10/30/2012 14:30	11.8	0.32	0.0028
11/13/2012 14:00	14.8	0.21	0.0021
12/3/2012 8:00	22.8	0.41	0.0035
1/3/2013 8:00	33.0	0.33	0.0028
2/5/2013 7:45	45.5	0.38	0.0031
2/27/2013 11:00	51.5	0.27	0.0023
4/16/2013 10:15	65.8	0.30	0.0025
6/4/2013 9:00	78.3	0.26	0.0023
7/8/2013 8:30	86.9	0.25	0.0023
7/24/2013 8:39	90.2	0.21	0.0019
8/7/2013 7:45	94.1	0.28	0.0025
Recirculation mode of operation: to Stage 1 sprayers			
9/6/2013 9:15	101.2	0.24	0.0025
10/7/2013 10:10	107.8	0.21	0.0024
Average to 10/7/13		0.22	0.0024
Total average start-up to 10/7/13		0.30	0.0027

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The total average electrical use through October 7, 2013 was 0.22 kWh per day. The average electrical use per gallon treated since start-up was 0.0027 kWh per gallon treated, and this parameter has been fairly stable since start-up.

4.3 Water Quality

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, $\text{NH}_3\text{-N}$, and $\text{NO}_x\text{-N}$), as well as supporting water quality parameters. The nitrogen results are graphically displayed in Figure 8. Water quality analytical results for Sample Event No. 6 are listed in Table 5. A summary of the water quality data collected to date for the test system is presented in Table 6. The laboratory report containing the raw analytical data is included in Appendix A.

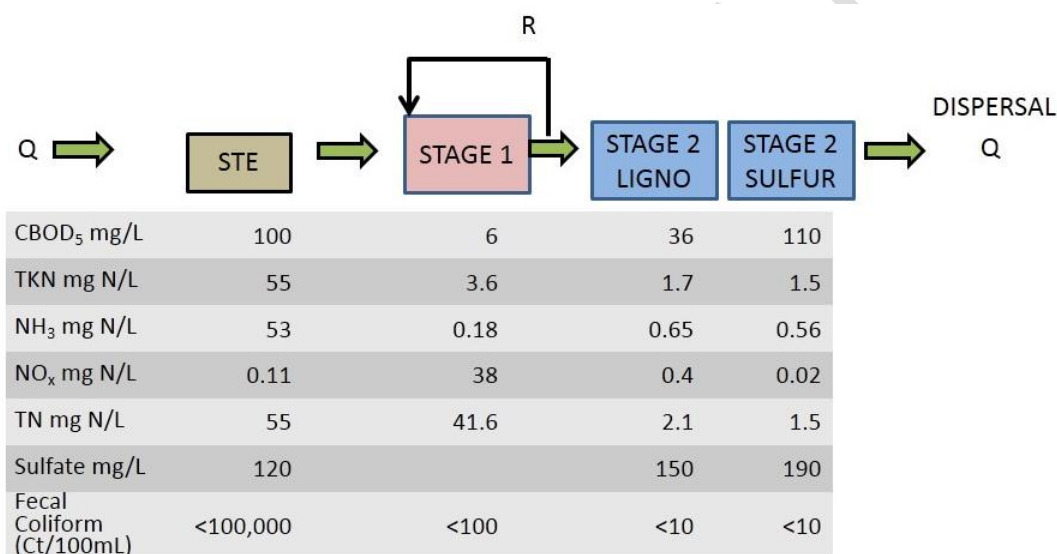


Figure 8
Graphical Representation of Nitrogen Results

Septic Tank Effluent (STE) Quality: The water quality characteristics of STE collected in Sample Event 6 were within the typical range generally expected for domestic STE. The measured STE total nitrogen (TN) concentration was 55 mg/L, which is within the range that has been typically reported for Florida single family residence STE.

Stage 1 Effluent (ST1): The Stage 1 effluent $\text{NH}_3\text{-N}$ levels was 0.18 mg/L with a DO level at 4.71 mg/L in the Stage 1 effluent (Table 5). The Stage 1 effluent TSS concentra-

tion was below the method detection limit of 1 mg/L, and CBOD₅ was 6 mg/L. The Stage 1 effluent NO_x-N was 38 mg/L. These results indicate pre-denitrification (approximately 25% reduction of STE nitrogen) was occurring as the effluent was recirculated back to the Stage 1 biofilter. The Stage 1 biofilter showed fairly complete nitrification with an effluent NH₃-N concentration of 0.18 mg/L and TKN of 3.6 mg/L.

Stage 2 Biofilter Effluent (LIGNO-0 and ST2): Effluent NO_x-N from the Stage 2 biofilter monitoring point was below the method detection limit of 0.02 mg/L. The low NO_x-N was accompanied by a measured 0.07 mg/L DO and -275.5 mV ORP. The lignocellulosic media effluent NO_x-N was 0.40 mg/L. The Stage 2 system produced a highly reducing environment and achieved essentially complete NO_x-N reduction. Final total nitrogen (TN) in the treatment system effluent was 1.52 mg/L. The Stage 2 biofilter lignocellulosic media effluent CBOD₅ was 36 mg/L and the sulfur media effluent was 110 mg/L increases in CBOD₅ and TN have been reported previously for lignocellulosic denitrification. The Stage 2 effluent sulfate concentration was 190 mg/L, which was approximately 70 mg/L higher than the STE.

Equipment Blank (EB): The equipment blank (EB) was collected by pumping deionized water through the cleaned pump tubing. This sample was then analyzed for the same parameters as the monitoring samples. As expected, all parameters measured were at or below the method detection limit.

Table 5
Water Quality Analytical Results

Sample ID	Sample Date/Time	Temp (°C)	pH	Specific Conductance (uS/cm)	DO (mg/L)	ORP (mV)	Total Alkalinity (mg/L)	TSS (mg/L)	VSS (mg/L)	CBOD ₅ (mg/L)	COD (mg/L)	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)	NO _x (mg/L N)	TIN (mg/L N) ³	TP (mg/L)	Ortho P (mg/L P)	Sulfate (mg/L)	Hydrogen Sulfide (mg/L)	Sulfide (mg/L)	Fecal (Ct/100 mL)	E-coli (Ct/100 mL)
BHS2-STE-SAL ⁴	10/7/13 10:50	27.0	7.22	1425	0.08	-363.4	1200	532	58	100	190	55.11	55	2	53	0.11	0.01	0.11	53.11	17	0.65	120	9.5	26		
BHS2-STE-BENCHMARK ⁴	10/7/13 10:50																								100000	100000
BHS2-ST1-SAL	10/7/13 10:38	25.6	6.80	1267	4.71	49.9	190	1	1	6	10	41.6	3.6	3.42	0.18	38	0.01	38	38.18	7.1	2.6					
BHS2-ST1-BENCHMARK	10/7/13 10:38																								100	31
BHS2-LIGNO-0-SAL	10/7/13 10:28	25.5	6.77	1213	0.11	-276.9	370	2	2	36	67	2.1	1.7	1.05	0.65	0.4	0.01	0.4	1.05	7.9	2.3	150	7.4	12		
BHS2-LIGNO-0-BENCHMARK	10/7/13 10:28																								10	1
BHS2-ST2-SAL	10/7/13 10:15	25.8	7.05	1134	0.07	-275.5	350	1	1	110	130	1.52	1.5	0.94	0.56	0.01	0.01	0.02	0.58	6.5	2.1	190	37	83		
BHS2-ST2-BENCHMARK	10/7/13 10:15																								10	1
BHS2-EB-SAL	10/7/13 11:00	21.8	7.61	1.8	7.91	58.7	2.4	1	1	2	10	0.07	0.05	0.041	0.009	0.01	0.01	0.02	0.029	0.01	0.01	0.2	0.01	0.1		
BHS2-EB-BENCHMARK	10/7/13 11:00																								10	1

Notes:

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

²Organic Nitrogen (ON) is a calculated value equal to the difference of TKN and NH₃.

³Total Inorganic Nitrogen (TIN) is a calculated value equal to the sum of NH₃ and NO_x.

⁴The septic tank outlet filter was accidentally pulled up for inspection prior to collecting the STE sample.

SAL = Southern Analytical Laboratories; BENCHMARK = Benchmark EnviroAnalytical Inc.

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.

Too many colonies were present. The numeric value represents the filtration volume.

Results based on colony counts outside the ideal range.

Recirculation mode = to Stage 1 sprayers

Table 6
Summary of Water Quality Data

Sample ID	Statistical Parameter	Temp (°C)	pH	Specific Conductance (uS/cm)	DO (mg/L)	ORP (mV)	Total Alkalinity (mg/L)	TSS (mg/L)	VSS (mg/L)	CBOD ₅ (mg/L)	COD (mg/L)	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)	Sulfate (mg/L)	Hydrogen Sulfide (mg/L)	Sulfide (mg/L)	Fecal (Ct/100 mL)	E-coli (Ct/100 mL)	TOC (mg/L)	
Septic tank effluent (STE)	n	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	4	
	MEAN	24.3	7.3	1,371	0.2	-369.0	585.0	112.2	30.2	104.7	298.3	51.2	51.2	7.7	43.5	0.1	0.01	0.06	43.6	9.7	3.3	89.5	13.9	48.8	112,691	115,558	48	
	STD. DEV.	3.3	0.2	50.7	0.2	12.1	303.4	205.8	15.6	22.9	111.3	5.2	5.2	7.4	6.7	0.05	0.00	0.05	6.7	6.1	1.4	42.6	3.4	14.3	594,587	445,676	23	
	MIN	18.8	7.2	1,296	0.1	-392.5	410	18	15	73	150	42.0	42.0	1.0	36.0	0.01	0.01	0.02	36.0	4.8	0.7	31	10	26	800	2,420	3	
	MAX	27.8	7.6	1,425	0.6	-360.0	1200	532	58	140	430	56.1	56.0	18.0	53.0	0.13	0.01	0.13	53.1	18.0	4.3	150	17	65	1,600,000	1,200,000	82	
Recirculation tank (DBOX)	n	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	0	0	0	0	5	5	4
	MEAN	23.2	7.0	1,218	1.0	-127.9	286.0	20.6	16.0	25.2	69.6	18.9	12.8	3.8	9.0	5.5	1.1	6.1	15.1	6.0	2.3				38,350	34,064	19.3	
	STD. DEV.	3.79	0.2	32.1	0.78	43.18	18.17	11.22	13.78	31.87	40.88	5.26	2.84	1.76	1.86	5.97	1.26	6.34	4.61	3.95	1.09				337,381		8.4	
	MIN	17.4	6.8	1,173	0.1	-181.8	270.0	12.0	6.0	2.0	10	14.4	8.8	0.7	7.1	0.01	0.01	0.02	11.0	3.7	1.1				1,000	2,420	11.0	
	MAX	27.7	7.2	1,245	1.8	-71.2	310.0	40.0	40	77	110	26.0	16.0	5.0	11.0	14.0	2.8	14.0	21.1	13.0	3.6				790,000	345,000	31.0	
Stage 1 effluent (ST1 and PUMP)	n	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	0	0	0	6	6	4	
	MEAN	23.2	6.8	1,219	3.8	-63.4	225.0	22.8	10.8	13.7	20.7	23.4	3.2	2.3	0.8	19.9	0.2	20.2	21.0	5.8	1.8				153	102	12.3	
	STD. DEV.	3.8	0.1	48.5	1.5	96.3	21.7	27.6	12.7	17.1	10.8	10.3	1.7	0.7	1.4	11.0	0.3	10.9	10.0	3.3	0.8				1,658	1,827	3.6	
	MIN	16.1	6.7	1,137	2.0	-180.0	190.0	1.0	1.0	2.0	10.0	12.5	1.6	1.3	0.1	6.3	0.01	6.3	9.9	3.5	0.7				6	2	8.3	
	MAX	26.9	7.1	1,267	5.7	-50.8	250.0	68	35	45	36	41.6	6.2	3.4	3.6	38.0	0.8	38.0	38.2	12.0	2.6				4,200	4,611	17.0	
Stage 2 lignocellulosic effluent (LIGNO-0)	n	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	6	6	6	3	
	MEAN	23.3	6.9	1,197	0.4	-323.2	383.3	8.0	7.7	45.7	110.0	2.7	2.6	1.2	1.4	0.08	0.01	0.09	1.5	5.5	2.1	157.7	11.7	26.1	30.7	13	18.7	
	STD. DEV.	2.9	0.1	41.2	0.3	37.4	51.3	10.9	11.0	27.3	55.9	1.5	1.5	0.3	1.3	0.16	0.00	0.15	1.2	3.8	0.7	48.3	6.5	13.6	522.7	803.3	2.3	
	MIN	18.7	6.8	1,141	0.1	-362.1	290.0	1.0	1.0	20.0	67	1.5	1.5	1.0	0.4	0.01	0.01	0.02	0.4	2.6	0.7	86.0	4.2	7.3	10.0	1.0	16.0	
	MAX	26.7	7.1	1,230	0.8	-276.9	440.0	30	30	96	220	4.6	4.6	1.8	3.3	0.4	0.01	0.4	3.3	12.0	2.7	220	19	40	1,300	1986	20	
Stage 2 sulfur effluent (ST2)	n	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	6	6	6	4	
	MEAN	23.1	6.9	1,207	0.1	-315.3	336.7	5.8	3.7	74.7	163	3.1	3.1	1.2	1.9	0.01	0.01	0.02	1.9	5.2	2.4	192	27.2	48.7	39.92	14.78	22.0	
	STD. DEV.	3.5	0.2	68.8	0.1	58.3	68.9	5.2	2.6	33.7	92	2.3	2.3	0.3	2.1	0.00	0.00	0.00	2.1	3.2	1.1	24.8	12.2	25.3	116.35	62.58	2.2	
	MIN	16.5	6.5	1,134	0.1	-372.0	220.0	1.0	1.0	32.0	10	1.4	1.4	0.9	0.4	0.01	0.01	0.02	0.4	2.4	0.9	170	14	23	10	1	20.0	
	MAX	26.1	7.1	1,303	0.2	-218.8	410.0	15.0	8.0	110	260	6.5	6.5	1.5	5.0	0.01	0.01	0.02	5.0	11.0	4.1	240	40	83	300	155	25.0	
FB-TAP (potable water)	n	5	5	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	5	4	1	4	
	MEAN	23.5	7.5	827	4.6	22.2	155.0	5.8	4.8	2.5	15.0	0.5	0.3	0.2	0.03	0.2	0.01	0.2	0.3	0.02	0.02	246	0.01	0.1	2		5.5	
	STD. DEV.	3.4	0.4	9.5	1.2	91.7	5.8	4.0	4.1	1.0	3.5	0.2	0.2	0.1	0.04	0.1	0.00	0.1	0.1	0.01	0.01	20.7	0.01	0.1	4.5		2.0	
	MIN	18.3	7.1	812	2.8	-113.0	150.0	1.0	1.0	2.0	10.0	0.3	0.1	0.1	0.01	0.1	0.01	0.1	0.1	0.01	0.01	230	0.01	0.0	1		3.1	
	MAX	27.6	8.0	835	5.7	86.9	160.0	10.0	10.0	4.0	18.0	0.7	0.4	0.4	0.09	0.4	0.01	0.4	0.4	0.03	0.03	280	0.02	0.2	10		8.0	
Equipment blank (EB)	n	6	6	6	6	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	6	6	6	4	
	MEAN	23.5	7.8	234	6.8	-64.1	2.1	2.0	1.5	3.0	10.7	0.1	0.1	0.0	0.01	0.01	0.01	0.02	0.03	0.01	0.01	0.20	0.01	0.10	8.27	1	0.4	
	STD. DEV.	4.99	0.3	567.8	3.38	187.15	0.16	2.45	1.22	1.67	1.63	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.06	10.36	3.67	0.2	
	MIN	14.2	7.4	1.56	0.1	-392.5	2.0	1.0	1.0	2.0	10.0	0.1	0.1	0.0	0.01	0.01	0.01	0.02	0.03	0.01	0.01	0.20	0.01	0.01	1	1	0.1	
	MAX	27.7	8.2	1,393	9.2	58.7	2.4	7.0	4.0	6.0	14.0	0.1	0.1	0.1	0.01	0.01	0.01	0.02	0.03	0.02	0.01	0.20	0.01	0.20	32.0	10	0.0	

Notes:

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

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

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

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.

Too many colonies were present. The numeric value represents the filtration volume.

Results based on colony counts outside the ideal range.

5.0 B-HS2 Sample Event No. 6: Summary and Recommendations

5.1 Summary

The results of the sixth sampling event indicate that the system continues to operate well and perform consistently. The Sample Event No. 6 results indicate that:

- Septic tank effluent (STE) quality is characteristic of typical household STE quality. The total nitrogen concentration of 55 mg/L is within the range of values typically reported for Florida single family residence STE.
- The Stage 1 biofilter converted most of the ammonia N to oxidized nitrogen; effluent contained 3.6 mg/L TKN, of which 0.18 mg/L was ammonia.
- The Stage 2 biofilter produced a reducing environment and effluent $\text{NO}_x\text{-N}$ was below the method detection limit of 0.01 mg N/L.
- The total nitrogen concentration in the final effluent from the total treatment system was 1.5 mg/L, an approximately 97% reduction from STE.
- The modification in mode of recirculation to the Stage 1 sprayers does not appear to have changed the overall performance of the treatment system. However, from this first dataset, it appears that the level of pre-denitrification may be less with the sprayer mode of operation as compared to the previously reported results with the recirculation tank mode of operation. It will be interesting to continue to monitor the performance level of pre-denitrification.



Appendix A: Laboratory Report

PRELIMINARY

o:\44237-001\Wpdocs\Report\Draft

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

October 24, 2013
Work Order: 1310337

Laboratory Report

Project Name		B-HS2 SE#6						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS2-STE						
Matrix		Wastewater						
SAL Sample Number		1310337-01						
Date/Time Collected		10/07/13 10:50						
Collected by		Josefin Hirst						
Date/Time Received		10/07/13 12:20						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	9.5	SM 4550SF	0.04	0.01		10/08/13 15:00	1
Ammonia as N	mg/L	53	EPA 350.1	2.0	0.47		10/09/13 12:31	50
Carbonaceous BOD	mg/L	100	SM 5210B	2	2	10/07/13 15:45	10/12/13 09:25	1
Chemical Oxygen Demand	mg/L	190	EPA 410.4	25	10	10/17/13 11:19	10/17/13 15:30	1
Nitrate (as N)	mg/L	0.11	EPA 300.0	0.04	0.01		10/08/13 16:29	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		10/08/13 16:29	1
Orthophosphate as P	mg/L	0.65	EPA 300.0	0.040	0.010		10/08/13 16:29	1
Phosphorous - Total as P	mg/L	17	SM 4500P-E	0.40	0.10	10/08/13 13:31	10/14/13 13:58	10
Sulfate	mg/L	120	EPA 300.0	6.0	2.0		10/14/13 19:05	10
Sulfide	mg/L	26	SM 4500SF	0.40	0.10		10/08/13 15:00	1
Total Alkalinity	mg/L	1,200	SM 2320B	8.0	2.0		10/18/13 16:27	1
Total Kjeldahl Nitrogen	mg/L	55	EPA 351.2	0.20	0.05	10/15/13 12:05	10/23/13 09:18	20.83
Total Suspended Solids	mg/L	532	SM 2540D	1	1	10/08/13 11:19	10/10/13 08:55	1
Volatile Suspended Solids	mg/L	58	EPA 160.4	1	1	10/08/13 11:19	10/10/13 08:55	1
Nitrate+Nitrite (N)	mg/L	0.11	EPA 300.0	0.08	0.02		10/08/13 16:29	1
Sample Description		BHS2-ST1						
Matrix		Wastewater						
SAL Sample Number		1310337-02						
Date/Time Collected		10/07/13 10:38						
Collected by		Josefin Hirst						
Date/Time Received		10/07/13 12:20						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.18	EPA 350.1	0.040	0.009		10/09/13 11:22	1
Carbonaceous BOD	mg/L	6	SM 5210B	2	2	10/07/13 15:45	10/12/13 09:25	1
Chemical Oxygen Demand	mg/L	10 U	EPA 410.4	25	10	10/16/13 11:18	10/17/13 15:17	1
Nitrate (as N)	mg/L	38	EPA 300.0	0.04	0.01		10/08/13 16:39	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		10/08/13 16:39	1
Orthophosphate as P	mg/L	2.6	EPA 300.0	0.040	0.010		10/08/13 16:39	1
Phosphorous - Total as P	mg/L	7.1	SM 4500P-E	0.20	0.050	10/08/13 13:31	10/14/13 13:38	5
Total Alkalinity	mg/L	190	SM 2320B	8.0	2.0		10/17/13 16:08	1
Total Kjeldahl Nitrogen	mg/L	3.6	EPA 351.2	0.20	0.05	10/15/13 12:05	10/22/13 15:16	1
Total Suspended Solids	mg/L	1 U	SM 2540D	1	1	10/08/13 11:19	10/10/13 08:55	1
Volatile Suspended Solids	mg/L	1 U	EPA 160.4	1	1	10/08/13 11:19	10/10/13 08:55	1
Nitrate+Nitrite (N)	mg/L	38	EPA 300.0	0.08	0.02		10/08/13 16:39	1

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Tampa, FL 33619

October 24, 2013
Work Order: 1310337

Laboratory Report

Project Name		B-HS2 SE#6						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS2-LIGNO-0						
Matrix		Wastewater						
SAL Sample Number		1310337-03						
Date/Time Collected		10/07/13 10:28						
Collected by		Josefin Hirst						
Date/Time Received		10/07/13 12:20						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	7.4	SM 4550SF	0.04	0.01		10/08/13 15:00	1
Ammonia as N	mg/L	0.65	EPA 350.1	0.040	0.009		10/09/13 11:24	1
Carbonaceous BOD	mg/L	36	SM 5210B	2	2	10/07/13 15:45	10/12/13 09:25	1
Chemical Oxygen Demand	mg/L	67	EPA 410.4	25	10	10/16/13 11:18	10/17/13 15:17	1
Nitrate (as N)	mg/L	0.40	EPA 300.0	0.04	0.01		10/08/13 16:48	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		10/08/13 16:48	1
Orthophosphate as P	mg/L	2.3	EPA 300.0	0.040	0.010		10/08/13 16:48	1
Phosphorous - Total as P	mg/L	7.9	SM 4500P-E	0.20	0.050	10/08/13 13:31	10/14/13 13:39	5
Sulfate	mg/L	150	EPA 300.0	6.0	2.0		10/17/13 22:56	10
Sulfide	mg/L	12	SM 4500SF	0.40	0.10		10/08/13 15:00	1
Total Alkalinity	mg/L	370	SM 2320B	8.0	2.0		10/17/13 16:19	1
Total Kjeldahl Nitrogen	mg/L	1.7	EPA 351.2	0.20	0.05	10/15/13 12:05	10/22/13 15:17	1
Total Suspended Solids	mg/L	2	SM 2540D	1	1	10/08/13 11:19	10/10/13 08:55	1
Volatile Suspended Solids	mg/L	2	EPA 160.4	1	1	10/08/13 11:19	10/10/13 08:55	1
Nitrate+Nitrite (N)	mg/L	0.40	EPA 300.0	0.08	0.02		10/08/13 16:48	1
Sample Description		BHS2-ST2						
Matrix		Wastewater						
SAL Sample Number		1310337-04						
Date/Time Collected		10/07/13 10:15						
Collected by		Josefin Hirst						
Date/Time Received		10/07/13 12:20						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	37	SM 4550SF	0.04	0.01		10/08/13 15:00	1
Ammonia as N	mg/L	0.56	EPA 350.1	0.040	0.009		10/09/13 11:26	1
Carbonaceous BOD	mg/L	110	SM 5210B	2	2	10/07/13 15:45	10/12/13 09:25	1
Chemical Oxygen Demand	mg/L	130	EPA 410.4	25	10	10/16/13 11:18	10/17/13 15:17	1
Nitrate (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		10/08/13 16:58	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		10/08/13 16:58	1
Orthophosphate as P	mg/L	2.1	EPA 300.0	0.040	0.010		10/08/13 16:58	1
Phosphorous - Total as P	mg/L	6.5	SM 4500P-E	0.20	0.050	10/08/13 13:31	10/14/13 13:40	5
Sulfate	mg/L	190	EPA 300.0	6.0	2.0		10/17/13 23:05	10
Sulfide	mg/L	83	SM 4500SF	0.40	0.10		10/08/13 15:00	1
Total Alkalinity	mg/L	350	SM 2320B	8.0	2.0		10/17/13 16:32	1
Total Kjeldahl Nitrogen	mg/L	1.5	EPA 351.2	0.20	0.05	10/15/13 12:05	10/22/13 15:19	1
Total Suspended Solids	mg/L	1 U	SM 2540D	1	1	10/08/13 11:19	10/10/13 08:55	1

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October 24, 2013
Work Order: 1310337

Laboratory Report

Project Name		B-HS2 SE#6						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS2-ST2						
Matrix		Wastewater						
SAL Sample Number		1310337-04						
Date/Time Collected		10/07/13 10:15						
Collected by		Josefin Hirst						
Date/Time Received		10/07/13 12:20						
Volatile Suspended Solids	mg/L	1 U	EPA 160.4	1	1	10/08/13 11:19	10/10/13 08:55	1
Nitrate+Nitrite (N)	mg/L	0.02 U	EPA 300.0	0.08	0.02		10/08/13 16:58	1
Sample Description		BHS2-EB						
Matrix		Reagent Water						
SAL Sample Number		1310337-05						
Date/Time Collected		10/07/13 11:00						
Collected by		Josefin Hirst						
Date/Time Received		10/07/13 12:20						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	0.01 U	SM 4550SF	0.04	0.01		10/08/13 15:00	1
Ammonia as N	mg/L	0.009 U	EPA 350.1	0.040	0.009		10/09/13 11:28	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	10/07/13 15:45	10/12/13 09:25	1
Chemical Oxygen Demand	mg/L	10 U	EPA 410.4	25	10	10/16/13 11:18	10/17/13 15:17	1
Nitrate (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		10/08/13 17:07	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		10/08/13 17:07	1
Orthophosphate as P	mg/L	0.010 U	EPA 300.0	0.040	0.010		10/08/13 17:07	1
Phosphorous - Total as P	mg/L	0.010 U	SM 4500P-E	0.040	0.010	10/08/13 13:31	10/14/13 13:41	1
Sulfate	mg/L	0.20 U	EPA 300.0	0.60	0.20		10/08/13 17:07	1
Sulfide	mg/L	0.10 U	SM 4500SF	0.40	0.10		10/08/13 15:00	1
Total Alkalinity	mg/L	2.4 I	SM 2320B	8.0	2.0		10/17/13 16:35	1
Total Kjeldahl Nitrogen	mg/L	0.05 U	EPA 351.2	0.20	0.05	10/15/13 12:05	10/23/13 09:19	1
Total Suspended Solids	mg/L	1 U	SM 2540D	1	1	10/08/13 11:19	10/10/13 08:55	1
Volatile Suspended Solids	mg/L	1 U	EPA 160.4	1	1	10/08/13 11:19	10/10/13 08:55	1
Nitrate+Nitrite (N)	mg/L	0.02 U	EPA 300.0	0.08	0.02		10/08/13 17:07	1

SOUTHERN ANALYTICAL LABORATORIES, INC.

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October 24, 2013
Work Order: 1310337

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ30729 - Ammonia by SEAL										
Blank (BJ30729-BLK1)					Prepared & Analyzed: 10/09/13					
Ammonia as N	0.009 U	0.040	0.009	mg/L						
LCS (BJ30729-BS1)					Prepared & Analyzed: 10/09/13					
Ammonia as N	0.52	0.040	0.009	mg/L	0.50		104	90-110		
Matrix Spike (BJ30729-MS1)					Source: 1310658-07 Prepared & Analyzed: 10/09/13					
Ammonia as N	0.53	0.040	0.009	mg/L	0.50	0.012	103	90-110		
Matrix Spike (BJ30729-MS2)					Source: 1310685-01 Prepared & Analyzed: 10/09/13					
Ammonia as N	0.54	0.040	0.009	mg/L	0.50	ND	107	90-110		
Matrix Spike Dup (BJ30729-MSD1)					Source: 1310658-07 Prepared & Analyzed: 01/01/80					
Ammonia as N	0.49	0.040	0.009	mg/L	0.50	0.012	95	90-110	8	10
Matrix Spike Dup (BJ30729-MSD2)					Source: 1310685-01 Prepared & Analyzed: 10/09/13					
Ammonia as N	0.54	0.040	0.009	mg/L	0.50	ND	108	90-110	1	10
Batch BJ30744 - BOD										
Blank (BJ30744-BLK1)					Prepared: 10/07/13 Analyzed: 10/12/13					
Carbonaceous BOD	2 U	2	2	mg/L						
Blank (BJ30744-BLK2)					Prepared: 10/07/13 Analyzed: 10/12/13					
Carbonaceous BOD	2 U	2	2	mg/L						
LCS (BJ30744-BS1)					Prepared: 10/07/13 Analyzed: 10/12/13					
Carbonaceous BOD	186	2	2	mg/L	200		93	85-115		

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Tampa, FL 33619

October 24, 2013
Work Order: 1310337

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ30744 - BOD										
LCS (BJ30744-BS2)					Prepared: 10/07/13 Analyzed: 10/12/13					
Carbonaceous BOD	183	2	2	mg/L	200		92	85-115		
LCS Dup (BJ30744-BSD1)					Prepared: 10/07/13 Analyzed: 10/12/13					
Carbonaceous BOD	187	2	2	mg/L	200		94	85-115	0.8	200
LCS Dup (BJ30744-BSD2)					Prepared: 10/07/13 Analyzed: 10/12/13					
Carbonaceous BOD	188	2	2	mg/L	200		94	85-115	2	200
Duplicate (BJ30744-DUP1)					Source: 1310676-01		Prepared: 10/07/13 Analyzed: 10/12/13			
Carbonaceous BOD	140	2	2	mg/L		140			3	25
Duplicate (BJ30744-DUP2)					Source: 1310337-03		Prepared: 10/07/13 Analyzed: 10/12/13			
Carbonaceous BOD	39	2	2	mg/L		36			8	25
Batch BJ30813 - Ion Chromatography 300.0 Prep										
Blank (BJ30813-BLK1)					Prepared & Analyzed: 10/08/13					
Sulfate	0.20 U	0.60	0.20	mg/L						
Nitrate (as N)	0.01 U	0.04	0.01	mg/L						
Orthophosphate as P	0.010 U	0.040	0.010	mg/L						
Nitrite (as N)	0.01 U	0.04	0.01	mg/L						
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
LCS (BJ30813-BS1)					Prepared & Analyzed: 10/08/13					
Orthophosphate as P	0.975	0.040	0.010	mg/L	0.90		108	85-115		
Nitrite (as N)	1.39	0.04	0.01	mg/L	1.4		99	85-115		
Sulfate	8.83	0.60	0.20	mg/L	9.0		98	85-115		
Nitrate (as N)	1.64	0.04	0.01	mg/L	1.7		97	85-115		
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		

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Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ30813 - Ion Chromatography 300.0 Prep										
LCS Dup (BJ30813-BSD1)					Prepared & Analyzed: 10/08/13					
Nitrite (as N)	1.40	0.04	0.01	mg/L	1.4		100	85-115	0.6	200
Orthophosphate as P	0.981	0.040	0.010	mg/L	0.90		109	85-115	0.6	200
Sulfate	8.90	0.60	0.20	mg/L	9.0		99	85-115	0.8	200
Nitrate (as N)	1.64	0.04	0.01	mg/L	1.7		97	85-115	0.06	200
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
Matrix Spike (BJ30813-MS1)					Source: 1310723-01 Prepared & Analyzed: 10/08/13					
Orthophosphate as P	0.953	0.040	0.010	mg/L	0.90	0.111	94	85-115		
Nitrate (as N)	1.95	0.04	0.01	mg/L	1.7	0.333	95	85-115		
Sulfate	17.8	0.60	0.20	mg/L	9.0	8.51	104	85-115		
Nitrite (as N)	1.40	0.04	0.01	mg/L	1.4	ND	100	85-115		
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
Matrix Spike (BJ30813-MS2)					Source: 1310694-03 Prepared & Analyzed: 10/08/13					
Orthophosphate as P	9.87	0.40	0.10	mg/L	9.0	0.740	101	85-115		
Nitrite (as N)	14.9	0.40	0.10	mg/L	14	ND	107	85-115		
Sulfate	123	6.0	2.0	mg/L	90	31.5	101	85-115		
Nitrate (as N)	16.6	0.40	0.10	mg/L	17	ND	98	85-115		
Surrogate: Dichloroacetate	1.12			mg/L	1.0		112	90-115		
Surrogate: Dichloroacetate	1.12			mg/L	1.0		112	90-115		
Surrogate: Dichloroacetate	1.12			mg/L	1.0		112	90-115		
Surrogate: Dichloroacetate	1.12			mg/L	1.0		112	90-115		

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ30816 - VSS Prep										
Blank (BJ30816-BLK1)					Prepared: 10/08/13 Analyzed: 10/10/13					
Total Suspended Solids	1 U	1	1	mg/L						
Volatile Suspended Solids	1 U	1		mg/L						
LCS (BJ30816-BS1)					Prepared: 10/08/13 Analyzed: 10/10/13					
Total Suspended Solids	48.5	1	1	mg/L	50		97	85-115		
Duplicate (BJ30816-DUP1)					Source: 1310337-01		Prepared: 10/08/13 Analyzed: 10/10/13			
Total Suspended Solids	520	1	1	mg/L		532			2	30
Volatile Suspended Solids	57.0	1		mg/L		58.0			2	20
Batch BJ30826 - Digestion for TP by EPA 365.2/SM4500PE										
Blank (BJ30826-BLK1)					Prepared: 10/08/13 Analyzed: 10/14/13					
Phosphorous - Total as P	0.010 U	0.040	0.010	mg/L						
LCS (BJ30826-BS1)					Prepared: 10/08/13 Analyzed: 10/14/13					
Phosphorous - Total as P	0.816	0.040	0.010	mg/L	0.80		102	90-110		
Matrix Spike (BJ30826-MS1)					Source: 1310337-05		Prepared: 10/08/13 Analyzed: 10/14/13			
Phosphorous - Total as P	0.968	0.040	0.010	mg/L	1.0	ND	97	90-110		
Matrix Spike Dup (BJ30826-MSD1)					Source: 1310337-05		Prepared: 10/08/13 Analyzed: 10/14/13			
Phosphorous - Total as P	1.04	0.040	0.010	mg/L	1.0	ND	104	90-110	7	25
Batch BJ30841 - Sulfide prep										
Blank (BJ30841-BLK1)					Prepared & Analyzed: 10/08/13					
Sulfide	0.10 U	0.40	0.10	mg/L						

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ30841 - Sulfide prep										
LCS (BJ30841-BS1)					Prepared & Analyzed: 10/08/13					
Sulfide	4.88	0.40	0.10	mg/L	5.0		98	85-115		
Matrix Spike (BJ30841-MS1)					Source: 1310504-06 Prepared & Analyzed: 10/08/13					
Sulfide	4.88	0.40	0.10	mg/L	5.0	ND	98	85-115		
Matrix Spike Dup (BJ30841-MSD1)					Source: 1310504-06 Prepared & Analyzed: 10/08/13					
Sulfide	4.88	0.40	0.10	mg/L	5.0	ND	98	85-115	0	14
Batch BJ31401 - Ion Chromatography 300.0 Prep										
Blank (BJ31401-BLK1)					Prepared & Analyzed: 10/14/13					
Sulfate	0.20 U	0.60	0.20	mg/L						
Surrogate: Dichloroacetate	0.974			mg/L	1.0		97	90-115		
LCS (BJ31401-BS1)					Prepared & Analyzed: 10/14/13					
Sulfate	9.19	0.60	0.20	mg/L	9.0		102	85-115		
Surrogate: Dichloroacetate	0.977			mg/L	1.0		98	90-115		
LCS Dup (BJ31401-BSD1)					Prepared & Analyzed: 10/14/13					
Sulfate	9.20	0.60	0.20	mg/L	9.0		102	85-115	0.1	200
Surrogate: Dichloroacetate	1.00			mg/L	1.0		100	90-115		
Matrix Spike (BJ31401-MS1)					Source: 1310912-01 Prepared & Analyzed: 10/14/13					
Sulfate	124	6.0	2.0	mg/L	90	37.1	97	85-115		
Surrogate: Dichloroacetate	1.00			mg/L	1.0		100	90-115		
Matrix Spike (BJ31401-MS2)					Source: 1310337-01 Prepared & Analyzed: 10/14/13					
Sulfate	214	6.0	2.0	mg/L	90	119	105	85-115		
Surrogate: Dichloroacetate	0.996			mg/L	1.0		100	90-115		

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
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Batch BJ31521 - Digestion for TKN by EPA 351.2

Blank (BJ31521-BLK1)					Prepared: 10/15/13 Analyzed: 10/22/13					
Total Kjeldahl Nitrogen	0.05 U	0.20	0.05	mg/L						
LCS (BJ31521-BS1)					Prepared: 10/15/13 Analyzed: 10/23/13					
Total Kjeldahl Nitrogen	2.60	0.20	0.05	mg/L	2.5		102	90-110		
Matrix Spike (BJ31521-MS1)					Source: 1311021-02 Prepared: 10/15/13 Analyzed: 10/22/13					
Total Kjeldahl Nitrogen	3.26	0.20	0.05	mg/L	2.5	0.723	100	90-110		
Matrix Spike (BJ31521-MS2)					Source: 1311022-02 Prepared: 10/15/13 Analyzed: 10/22/13					
Total Kjeldahl Nitrogen	3.00	0.20	0.05	mg/L	2.5	0.452	101	90-110		
Matrix Spike Dup (BJ31521-MSD1)					Source: 1311021-02 Prepared: 10/15/13 Analyzed: 10/22/13					
Total Kjeldahl Nitrogen	3.10	0.20	0.05	mg/L	2.5	0.723	94	90-110	5	20
Matrix Spike Dup (BJ31521-MSD2)					Source: 1311022-02 Prepared: 10/15/13 Analyzed: 10/23/13					
Total Kjeldahl Nitrogen	3.80	0.20	0.05	mg/L	2.5	0.452	132	90-110	24	20

Batch BJ31610 - COD prep

Blank (BJ31610-BLK1)					Prepared: 10/16/13 Analyzed: 10/17/13					
Chemical Oxygen Demand	10 U	25	10	mg/L						
LCS (BJ31610-BS1)					Prepared: 10/16/13 Analyzed: 10/17/13					
Chemical Oxygen Demand	45	25	10	mg/L	50		90	90-110		
Matrix Spike (BJ31610-MS1)					Source: 1310759-02 Prepared: 10/16/13 Analyzed: 10/17/13					
Chemical Oxygen Demand	50	25	10	mg/L	50	ND	100	85-115		

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Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ31610 - COD prep										
Matrix Spike Dup (BJ31610-MSD1)		Source: 1310759-02			Prepared: 10/16/13 Analyzed: 10/17/13					
Chemical Oxygen Demand	45	25	10	mg/L	50	ND	90	85-115	11	32
Batch BJ31719 - alkalinity										
Blank (BJ31719-BLK1)				Prepared & Analyzed: 10/17/13						
Total Alkalinity	2.0 U	8.0	2.0	mg/L						
LCS (BJ31719-BS1)				Prepared & Analyzed: 10/17/13						
Total Alkalinity	130	8.0	2.0	mg/L	120		106	90-110		
Matrix Spike (BJ31719-MS1)		Source: 1310887-01			Prepared & Analyzed: 10/17/13					
Total Alkalinity	280 L2	8.0	2.0	mg/L	120	200	67	80-120		
Matrix Spike Dup (BJ31719-MSD1)		Source: 1310887-01			Prepared & Analyzed: 10/17/13					
Total Alkalinity	270 L2	8.0	2.0	mg/L	120	200	61	80-120	3	26
Batch BJ31723 - COD prep										
Blank (BJ31723-BLK1)				Prepared & Analyzed: 10/17/13						
Chemical Oxygen Demand	10 U	25	10	mg/L						
LCS (BJ31723-BS1)				Prepared & Analyzed: 10/17/13						
Chemical Oxygen Demand	45	25	10	mg/L	50		90	90-110		
Matrix Spike (BJ31723-MS1)		Source: 1311064-02			Prepared & Analyzed: 10/17/13					
Chemical Oxygen Demand	50	25	10	mg/L	50	ND	100	85-115		

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ31723 - COD prep										
Matrix Spike Dup (BJ31723-MSD1)		Source: 1311064-02			Prepared & Analyzed: 10/17/13					
Chemical Oxygen Demand	50	25	10	mg/L	50	ND	100	85-115	0	32
Batch BJ31735 - Ion Chromatography 300.0 Prep										
Blank (BJ31735-BLK1)		Prepared & Analyzed: 10/17/13								
Sulfate	0.20 U	0.60	0.20	mg/L						
Surrogate: Dichloroacetate	0.966			mg/L	1.0		97	90-115		
LCS (BJ31735-BS1)		Prepared & Analyzed: 10/17/13								
Sulfate	9.07	0.60	0.20	mg/L	9.0		101	85-115		
Surrogate: Dichloroacetate	0.948			mg/L	1.0		95	90-115		
LCS Dup (BJ31735-BSD1)		Prepared & Analyzed: 10/17/13								
Sulfate	9.08	0.60	0.20	mg/L	9.0		101	85-115	0.09	200
Surrogate: Dichloroacetate	0.953			mg/L	1.0		95	90-115		
Matrix Spike (BJ31735-MS1)		Source: 1311172-01			Prepared & Analyzed: 10/17/13					
Sulfate	13.7	0.60	0.20	mg/L	9.0	4.37	104	85-115		
Surrogate: Dichloroacetate	0.955			mg/L	1.0		96	90-115		
Matrix Spike (BJ31735-MS2)		Source: 1310768-01			Prepared & Analyzed: 10/18/13					
Sulfate	145	6.0	2.0	mg/L	90	51.6	104	85-115		
Surrogate: Dichloroacetate	0.939			mg/L	1.0		94	90-115		
Batch BJ31744 - alkalinity										
Blank (BJ31744-BLK1)		Prepared & Analyzed: 10/18/13								
Total Alkalinity	2.0 U	8.0	2.0	mg/L						

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ31744 - alkalinity										
LCS (BJ31744-BS1)					Prepared & Analyzed: 10/18/13					
Total Alkalinity	130	8.0	2.0	mg/L	120		107	90-110		
Matrix Spike (BJ31744-MS1)					Source: 1309167-01 Prepared & Analyzed: 10/18/13					
Total Alkalinity	480	8.0	2.0	mg/L	120	380	81	80-120		
Matrix Spike (BJ31744-MS2)					Source: 1309167-06 Prepared & Analyzed: 10/18/13					
Total Alkalinity	220	8.0	2.0	mg/L	120	100	93	80-120		
Matrix Spike Dup (BJ31744-MSD1)					Source: 1309167-01 Prepared & Analyzed: 10/18/13					
Total Alkalinity	480	8.0	2.0	mg/L	120	380	82	80-120	0.02	26
Matrix Spike Dup (BJ31744-MSD2)					Source: 1309167-06 Prepared & Analyzed: 10/18/13					
Total Alkalinity	220	8.0	2.0	mg/L	120	100	94	80-120	0.6	26

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* 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 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.

L2 Analyte level in sample invalidated Matrix Spike.

Questions regarding this report should be directed to :

Kathryn Nordmark

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

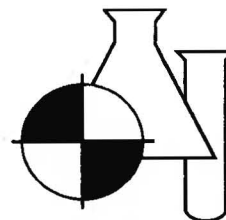
Kathryn@southernanalyticallabs.com



Client Name Hazen and Sawyer																		
Project Name / Location B-HS2 SE#6																		
Samplers: (Signature) <i>Joseph L. [Signature]</i>																		
PARAMETER / CONTAINER DESCRIPTION																		
Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water		Date	Time	Matrix	Composite	Grab	500mL P, Cool Total Alkalinity, TSS, VSS, CBOD, NOx, OP, SO ₄	125mL P, H ₂ SO ₄ COD, TKN, NH ₃ , TP	500mL P, NaOH, Zn Acetate H ₂ S	500mL P, Cool Total Alkalinity, TSS, VSS, CBOD, NOx, OP	Field Temperature	Field pH	Field Conductivity	Field DO				No. of Containers (Total per each location)
SAL Use Only Sample No.	Sample Description																	
01	BHS2-STE	10/2/13	10:50	WW		X	1	1	1		27.0	7.22	1425	0.08				
02	BHS2-ST1	10/2/13	10:38	WW		X		1		1	25.6	6.80	1267	4.71				
03	BHS2-LIGNO-0	10/2/13	10:28	WW		X	1	1	1		25.5	6.77	1213	0.49				
04	BHS2-ST2	10/2/13	10:15	WW		X	1	1	1		25.8	7.05	1134	0.07				
05	BHS2-EB	10/2/13	11:00	R		X	1	1	1		21.8	7.61	1.75	7.91				
Containers Prepared		Date/Time: 1400	Received:		Date/Time: 9/24/13 1200		Seal intact? <input checked="" type="radio"/> N N/A Samples intact upon a <input checked="" type="radio"/> N N/A Received on ice? Ten <input checked="" type="radio"/> N N/A Proper preservatives i <input checked="" type="radio"/> N N/A Rec'd within holding tir <input checked="" type="radio"/> N N/A Volatiles rec'd w/out r Y <input checked="" type="radio"/> N <input checked="" type="radio"/> Proper containers use <input checked="" type="radio"/> N N/A				Instructions / Remarks:							
Relinquished: <i>[Signature]</i>		Date/Time: 09-23-13	Received: <i>Joseph L. [Signature]</i>		Date/Time: 9/24/13 1200													
Relinquished: <i>Joseph L. [Signature]</i>		Date/Time: 10/2/13	Received: <i>[Signature]</i>		Date/Time: 10-7-13 1220													
Relinquished:		Date/Time:	Received:		Date/Time:													
Relinquished:		Date/Time:	Received:		Date/Time:													
Relinquished:		Date/Time:	Received:		Date/Time:													

BENCHMARK

EnviroAnalytical Inc.



NELAC Certification # E84167

ANALYTICAL TEST REPORT

THESE RESULTS MEET NELAC STANDARDS

Submission Number : 13100282

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

Project Name : BHS2 SE # 6
Date Received : 10/07/2013
Time Received : 1545

Submission Number 13100282

Sample Number: 001 Sample Description: B-H2S-STE
Sample Date: 10/07/2013 Sample Method: Grab
Sample Time: 1050

Parameter	Result	Units	MDL	PQL	Procedure	Analysis		Analyst
						Date	Time	
FECAL COLIFORM	100000 U	#/100 ML	100000	100000	SM9222D	10/07/2013	16:58	KD
E-COLI BY MPN	100000 U	#/100 ML	100000	100000	SM9223B	10/07/2013	16:05	MR

Submission Number 13100282

Sample Number: 002 Sample Description: B-H2S-ST1
Sample Date: 10/07/2013 Sample Method: Grab
Sample Time: 1038

Parameter	Result	Units	MDL	PQL	Procedure	Analysis		Analyst
						Date	Time	
FECAL COLIFORM	100 U	#/100 ML	100	100	SM9222D	10/07/2013	16:58	KD
E-COLI BY MPN	31	#/100 ML	10	10	SM9223B	10/07/2013	16:05	MR

Submission Number 13100282

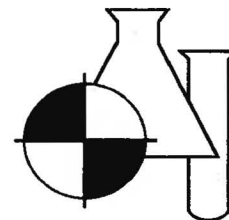
Sample Number: 003 Sample Description: B-H2S-LIGNO-0
Sample Date: 10/07/2013 Sample Method: Grab
Sample Time: 1028

Parameter	Result	Units	MDL	PQL	Procedure	Analysis		Analyst
						Date	Time	

1711 12th Street East * Palmetto, FL 34221 * Phone (941) 723-9986 * Fax (941) 723-6061

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FECAL COLIFORM	10 U	#/100 ML	10	10	SM9222D	10/07/2013	16:58	KD
E-COLI BY MPN	1 U	#/100 ML	1	1	SM9223B	10/07/2013	16:05	MR

Submission Number 13100282

Sample Number: 004

Sample Description: B-H2S-ST2

Sample Date: 10/07/2013

Sample Method: Grab

Sample Time: 1015

Parameter	Result	Units	MDL	PQL	Procedure	Analysis		Analyst
						Date	Time	
FECAL COLIFORM	10 U	#/100 ML	10	10	SM9222D	10/07/2013	16:58	KD
E-COLI BY MPN	1 U	#/100 ML	1	1	SM9223B	10/07/2013	16:05	MR

Submission Number 13100282

Sample Number: 005

Sample Description: B-H2S-EB

Sample Date: 10/07/2013

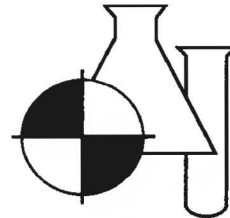
Sample Method: Grab

Sample Time: 1100

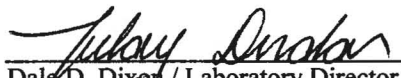
Parameter	Result	Units	MDL	PQL	Procedure	Analysis		Analyst
						Date	Time	
FECAL COLIFORM	10 U	#/100 ML	10	10	SM9222D	10/07/2013	16:58	KD
E-COLI BY MPN	1 U	#/100 ML	1	1	SM9223B	10/07/2013	16:05	MR

BENCHMARK

EnviroAnalytical Inc.



NELAC Certification # E84167


Dale D. Dixon / Laboratory Director
Tülay Tanrisever / QC Officer
Jennifer Hatfield / QC Officer

10/09/2013

Date

DATA QUALIFIERS THAT MAY APPLY:

A = Value reported is an average of two or more determinations.

B = Results based upon colony counts outside the ideal range.

H = Value based on field kit determination. Results may not be accurate.

I = Reported value is between the laboratory MDL and the PQL.

J = Estimated value.

J1 = Est. value surrogate recovery limits exceeded.

J2 = Est. value. No quality control criteria exists for component.

J3 = Est. value quality control criteria for precision or accuracy not met.

J4 = Est. value. Sample matrix interference suspected.

J5 = Est. value. Data questionable due to improper lab or field protocols

K = Off-scale low. Value is known to be < the value reported.

L = Off-scale high. Value is known to be > the value reported

NOTES:

PQL = 4xMDL.

MBAS calculated as LAS; molecular weight = 340.

X = Value exceed MCL.

N = Presumptive evidence of presence of material.

O = Sampled, but analysis lost or not performed.

Q = Sample held beyond accepted hold time.

T = Value reported is < MDL. Reported for informational purposes only and shall not be used in statistical analysis.

U = Analyte analyzed but not detected at the value indicated.

V = Analyte detected in sample and method blank. Results for this analyte in associated samples may be biased high. Standard, Duplicate and Spike values are within control limits. Reported data are usable

Y = Analysis performed on an improperly preserved sample. Data may be inaccurate.

Z = Too many colonies were present (TNTC). The numeric value represents the filtration volume.

! = Data deviate from historically established concentration ranges.

? = Data rejected and should not be used. Some or all of QC data were outside criteria, and the Presence or absence of the analyte cannot be determined from the data.

* = Not reported due to interference

ND = Not Detected at or above adjusted reporting limit.

NOTES:

For questions and comments regarding these results, please contact Bettina Beilfuss at (941) 723-9986

Results relate only to the samples.

Benchmark EnviroAnalytical, Inc
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www.benchmarkea.com

Client Information: **Hazen & Sawyer**

Address 10002 Princess Palm Ave. Suite 200

Tampa FL 33619

Phone # 813-630-4498

Fax # 813-630-1967

Email

Project Name: **DHS2 SE #6**

Laboratory Submission #

13100282

Sample Name	Sample Type ¹	Sample Matrix ²	Parameters, Preservation ⁴ , Container Type ³		Laboratory Sample #
			Fecal Coliform (MF) E-Coli		
			2 x 100mL Sterile Plastic		
			NaThio		
			Known Concentration:		
B-H2S-STE	G	WW	Date & Time: 10/07/13 10:50am	• 10 ⁴ -10 ⁸	1
B-H2S-ST1	G	WW	Date & Time: 10/07/13 10:38am	• 10-10 ⁵	2
B-H2S-LIGNO-0	G	WW	Date & Time: 10/07/13 10:28am	• 0-10 ³	3
B-H2S-ST2	G	WW	Date & Time: 10/07/13 10:15am	• 0-10 ³	4
B-H2S-EB (water)	G	WW	Date & Time: 10/07/13 11:00 am	• 0-10 ³	5
	G	WW	Date & Time:		
	G	WW	Date & Time:		
	G	WW	Date & Time:		

1 "Sample Type" is used to indicate whether the sample was a grab (G) or whether it was a composite (C).
2 "Sample Matrix" is used to indicate whether the sample is being discharged to drinking water (DW), groundwater (GW), surface water (SW), soil, sediment (SDMNT), or sludge (SLDG).
3 "Container Type" is used to indicate whether the container is plastic (P) or glass (G).
4 Sample must be refrigerated or stored in wet ice after collection. The temperature during storage should be less than or equal to 6°C (42.8°F).
Under "Preservative," list any preservatives that were added to the sample container.

Instructions:

- Each bottle has a label identifying sample ID, preservative contained in the bottle, sample type, client ID, and parameters for analysis.
- The following information should be added to each bottle label after collection with permanent black ink: date and time of collection, sampler's name or initials, and any field number or ID.
- All bottles not containing preservative may be rinsed with appropriate sample prior to collection.
- The client is responsible for documentation of the sampling event. Please note special sampling events on the sample custody form.

Laboratory Sample Acceptability: pH < 2 : *p*

BEA Temperature: 24°C

1	Collected By: <i>George H...</i>	Date: 10/7/13	Time:	Received By: <i>Charles Pirtle</i>	Date: 10/7/13	Time: 305
2	Relinquished By: <i>Charles Pirtle</i>	Date: 10/7/13	Time: 1545	Received By: <i>[Signature]</i>	Date: 10/7/13	Time: 1545
3	Relinquished By:	Date:	Time:	Received By:	Date:	Time:

1730 7



Appendix B: Operation & Maintenance Log

Table B.1
Operation and Maintenance Log

Date	Description
7/31/12	Existing system evaluation performed. Septic tank was pumped out.
8/15/2012	Local DOH performed site evaluation
9/10/2012	System construction started
9/25/2012	System start-up
9/27/2012	Globe valves were set at 3.5:1 recirculation ratio
10/5/2012	Tanks full
10/11/2012	Preliminary sample event 1
10/23/2012	Preliminary sample event 2
10/30/2012	Preliminary sample event 3. Low level in pump tank.
11/7/2012	Very high level in pump tank.
	Pulled float tree up (reset floats), and pump immediately came on.
11/13/2012	Water level below top float in pump tank
12/3/2012	Sample Event No. 1
12/21/2012	Very high level in pump tank.
	Pulled float tree up (reset floats), and pump immediately came on.
12/22/2012	Very high level in pump tank. Audio alarm came on and was reset.
1/3/2013	Water level below top float in pump tank
	Re-positioned floats and zip-tied wires to tree.
1/10/2013	Very high level in pump tank.
	Pulled float tree up (reset floats), and pump immediately came on.
1/11/2013	Water level below top float in pump tank
1/15/2013	Low level in pump tank
1/16/2013	Floats not registering in panel
	Pulled float tree up (reset floats)
1/17/2013	Moved bottom float down
	Re-wrapped wires and checked lights in panel, floats registered.
2/5/2013	Sample Event No. 2
2/27/2013	Site visit. Cleaned out leaves from DBOX.
4/16/2013	Sample Event No. 3
5/29/2013	Site visit.

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Table B.1 (continued)
Operation and Maintenance Log

6/4/2013	Sample Event No. 4
7/8/2013	System check
8/7/2013	Sample Event No. 5
	Revised recirculation mode of operation to Stage 1 biofilter spray nozzles
	Cleaned STE effluent screen
9/3/2013	System check
	Recirculation ratio still at 3:1
9/6/2013	System check
	Recirculation ratio still at 3:1
9/24/2013	System check
	Recirculation ratio still at 3:1
10/7/2013	Sample Event No. 6
	Recirculation ratio still at 3:1



Appendix C: Vericomm PLC Data

System Status			10/7/2013	9/23/2013	9/6/2013	8/23/2013
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	Off
6	Active Off Time	Automatic	58.8 Minutes	58.8 Minutes	4.0 Minutes	58.8 Minutes
7	Active On Time	Automatic	1.2 Minutes	1.2 Minutes	1.2 Minutes	1.2 Minutes
9	Pump Mode	Automatic	OffCycl	OffCycl	OnCycl	Off
10	Pump Status	Automatic	Off	Off	On	Off
12	Pump Cycles Today	Automatic	4.0 Cycles	2.0 Cycles	7.0 Cycles	2.0 Cycles
13	Override Cycles Today	Automatic	0.0 Cycles	0.0 Cycles	0.0 Cycles	0.0 Cycles
14	Pump Run Time Today	Automatic	4.3 Minutes	2.4 Minutes	6.9 Minutes	2.2 Minutes
Settings						
Point	Description	Status	Value	Value	Value	Value
17	Off Cycle Time	Constant/Setpoint	58.8 Minutes	58.8 Minutes	4.0 Minutes	58.8 Minutes
18	On Cycle Time	Constant/Setpoint	1.2 Minutes	1.2 Minutes	1.2 Minutes	1.2 Minutes
19	Override Off Cycle Time	Constant/Setpoint	15.0 Minutes	15.0 Minutes	15.0 Minutes	15.0 Minutes
20	Override On Cycle Time	Constant/Setpoint	1.2 Minutes	1.2 Minutes	1.2 Minutes	1.2 Minutes
21	Minimum Override Cycles	Automatic	3.0 Cycles	3.0 Cycles	3.0 Cycles	3.0 Cycles
23	Override Cycle Limit per Day	Automatic	10.0 Cycles	10.0 Cycles	10.0 Cycles	10.0 Cycles
24	Time Limit per Day	Constant/Setpoint	40.0 Minutes	40.0 Minutes	40.0 Minutes	40.0 Minutes
25	High Level Pump Test	Automatic	2.0 Minutes	2.0 Minutes	2.0 Minutes	2.0 Minutes
28	Alarm Update Interval	Automatic	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	4.3 Minutes	2.4 Minutes	7.1 Minutes	2.2 Minutes
50	Override Cycles Today	Automatic	0	0	0	0
51	Pump Cycles Today	Automatic	4.0 Cycles	2.0 Cycles	7.0 Cycles	2.0 Cycles
52	Average Run Time per Cycle Today	Automatic	1.1 Minutes	1.2 Minutes	1.0 Minutes	1.1 Minutes
54	Brownouts Today	Automatic	0	0	0	0

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			10/7/2013	9/23/2013	9/6/2013	8/23/2013
30-Day History Data						
Point	Description	Status	Value	Value	Value	Value
65	30 Day Average Run Time per Day	Automatic	17.6 Minutes	18.1 Minutes	19.4 Minutes	21.9 Minutes
66	30 Day Average Override Cycles per Day	Automatic	1.3 Cycles	1.4 Cycles	1.6 Cycles	2.0 Cycles
67	30 Day Average Cycles per Day	Automatic	16.0 Cycles	16.3 Cycles	17.7 Cycles	19.9 Cycles
68	30 Day Average Run Time per Cycle	Automatic	1.1 Minutes	1.1 Minutes	1.1 Minutes	1.1 Minutes
71	30 Day Total Pump Run Time	Automatic	529.1 Minutes	542.2 Minutes	580.5 Minutes	657.8 Minutes
72	30 Day Total Override Cycles	Automatic	38.0 Cycles	41.0 Cycles	48.0 Cycles	61.0 Cycles
73	30 Day Total Cycles	Automatic	481.0 Cycles	489.0 Cycles	532.0 Cycles	597.0 Cycles
76	30 Day Total Brownouts	Automatic	0	0	0	0
Totalized Pump Data						
Point	Description	Status	Value	Value	Value	Value
82	Pump Total Run Time	Automatic	148.2 Hours	144.0 Hours	139.1 Hours	134.8 Hours
83	Pump Total Cycles	Automatic	7715.0 Cycles	7485.0 Cycles	7218.0 Cycles	6985.0 Cycles
Miscellaneous						
Point	Description	Status	Value	Value	Value	Value
145	Pump On Auto	Automatic	Off	Off	On	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	Off	On	Off	Off
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	Off
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	On	Off
186	Pump Output	Automatic	Off	Off	On	Off
188	Alarm Light Output	Automatic	Off	Off	Off	Off
189	Audible Alarm Output	Automatic	Off	Off	Off	Off

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