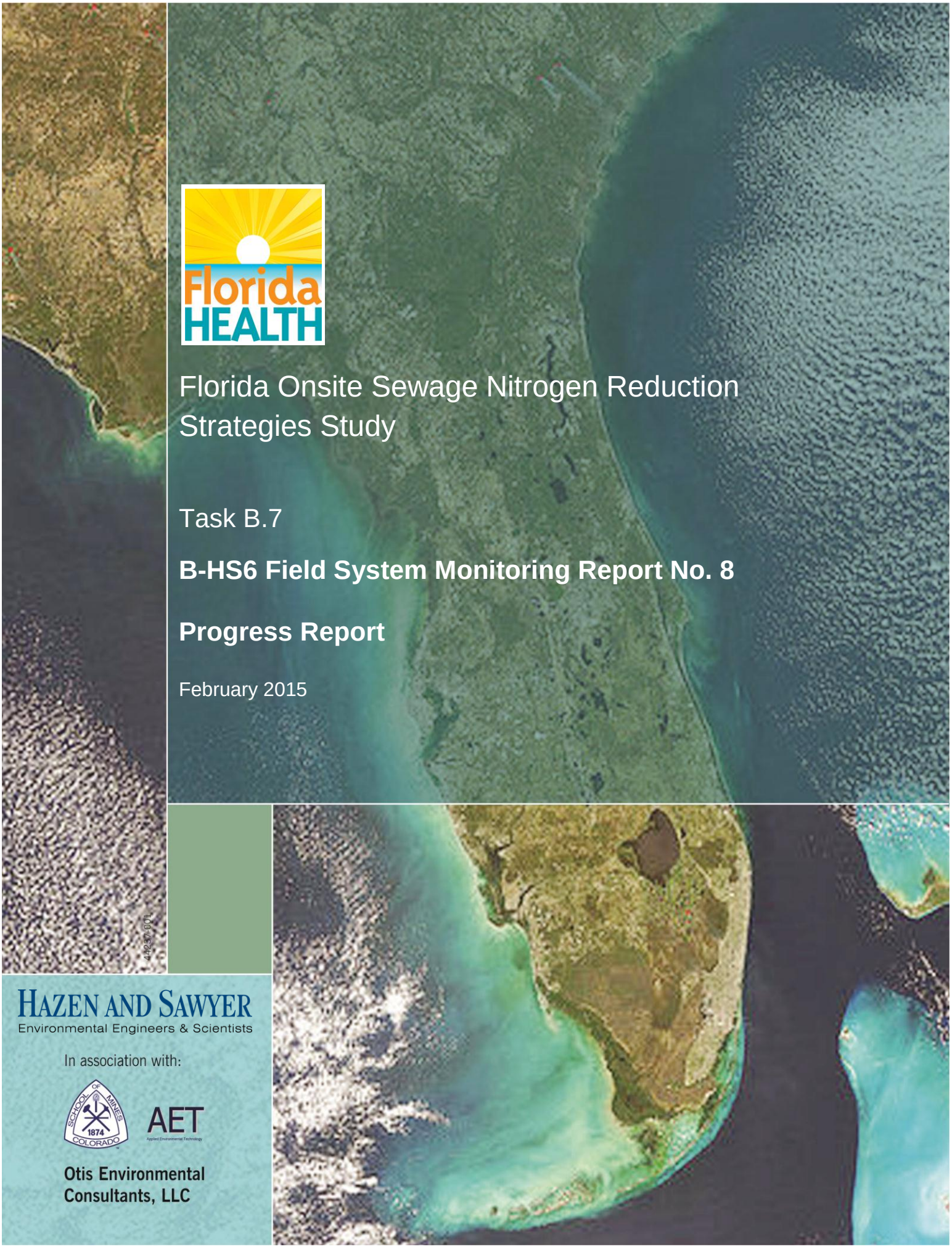

Florida HEALTH

Florida Onsite Sewage Nitrogen Reduction Strategies Study

Task B.7

B-HS6 Field System Monitoring Report No. 8

Progress Report

February 2015

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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-HS6 Field System
Monitoring Report No. 8

Prepared for:

Florida Department of Health
Division of Disease Control and Health Protection
Bureau of Environmental Health
Onsite Sewage Programs
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February 2015

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B-HS6 Field System
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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 eighth and final sample event of the passive nitrogen reduction system at home site B-HS6 in Wakulla County, Florida.

2.0 Purpose

This monitoring report documents data collected from the eighth B-HS6 monitoring and sampling event conducted on January 29, 2015 (Experimental Day 441). This monitoring event consisted of collecting flow measurements from the household water use meter, treatment system flow meter, recording electricity use, monitoring of field parameters, collection of water samples from four points in the treatment system, and chemical analyses of water samples by a NELAC certified laboratory.

3.0 Materials and Methods

3.1 Project Site

The B-HS6 field site is located in Wakulla County, FL. The nitrogen reducing onsite treatment system for the single family residence was installed in November 2013. Operation commenced on November 14, 2013. 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 new system replaced the previously installed PNRS system installed at field site B-HS1. The previously installed components that were removed

were the Aerocell™ unsaturated media filter chamber, Nitrex™ media and split recirculation device. The existing 1,500 gallon dual chamber septic tank will continue to provide primary treatment for the new PNRS system. However, the effluent screen was moved to the outlet from the hole in the wall between the two chambers and a vented tee was installed between the chambers per 64E-6.013(2)(h). The existing pump and floats were moved from the second chamber of the primary tank into a new 275 gallon pump tank. A 1,650 gallon concrete tank was installed to house a combined Stage 1 and Stage 2a media biofilter. The existing 1,500 gallon concrete single chamber tank which had contained the Nitrex™ media was converted to a Stage 2b saturated sulfur media biofilter. The denitrified treated effluent is discharged into the soil via the existing drainfield (standard Infiltrator EQ36 Quick 4 trenches).

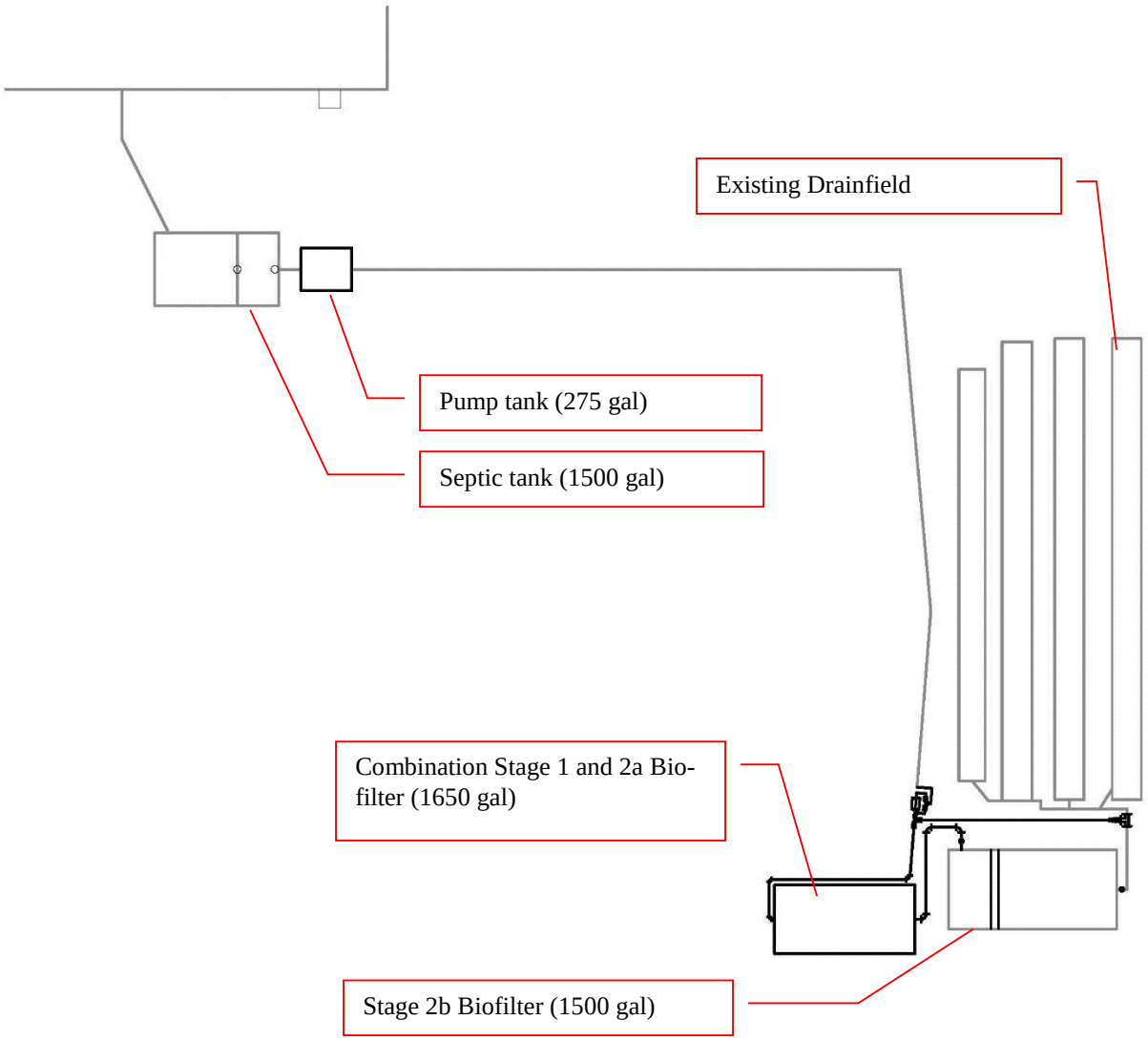

Figure 1
Plan view of B-HS6 system layout installed in Wakulla County

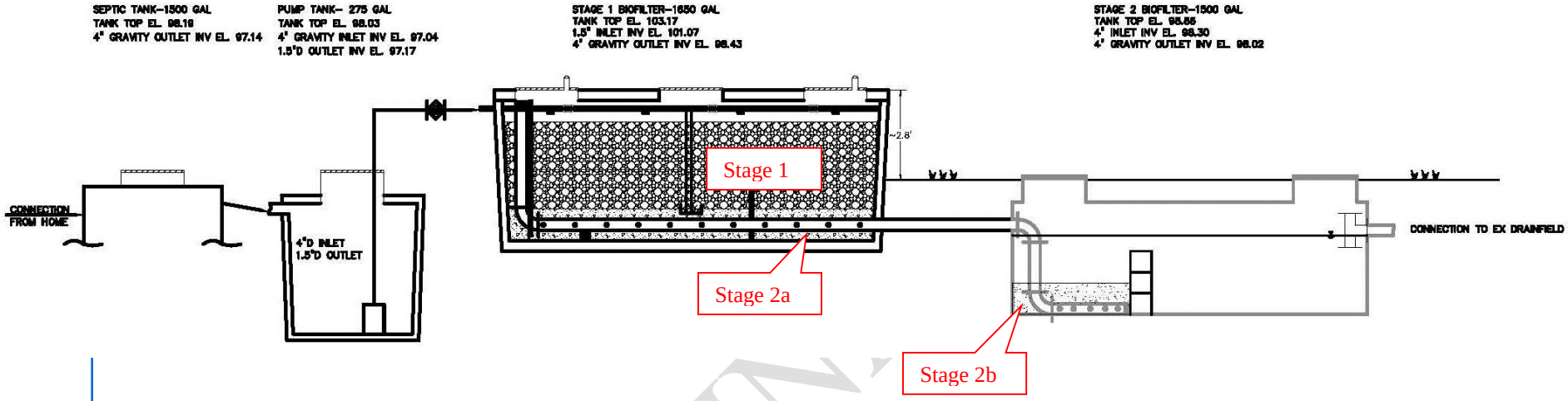

Figure 2
Flow Schematic of B-HS6 PNRS installed in Wakulla County

3.2 Monitoring and Sample Locations and Identification

Four of the eight monitoring points shown in Figure 3 (B-HS6-STE; B-HS6-DP2; B-HS6-ST1&2a; and B-HS6-ST2b-P) were sampled for this sample event. Monitoring point B-HS6-ST2b-T was not sampled as the water quality was very similar to the adjacent monitoring point B-HS6-ST2b-P. B-HS6-DP1, B-HS6-DP3, B-HS6-DP4 located in the Stage 1&2a tank were also not sampled during this sample event.

Household wastewater enters the 1st chamber of the primary tank and exits the second chamber through an effluent screen into the pump tank (which contains the pump and float switches). The first monitoring point, B-HS6-STE, is the effluent sampled from a sample port on the pump discharge line (Figure 4), which is downstream of the effluent screen and referred to as primary effluent or septic tank effluent (STE). Samples from monitoring point B-HS6-STE are representative of the whole household wastewater and represent the influent to the remainder of the onsite nitrogen reduction system.

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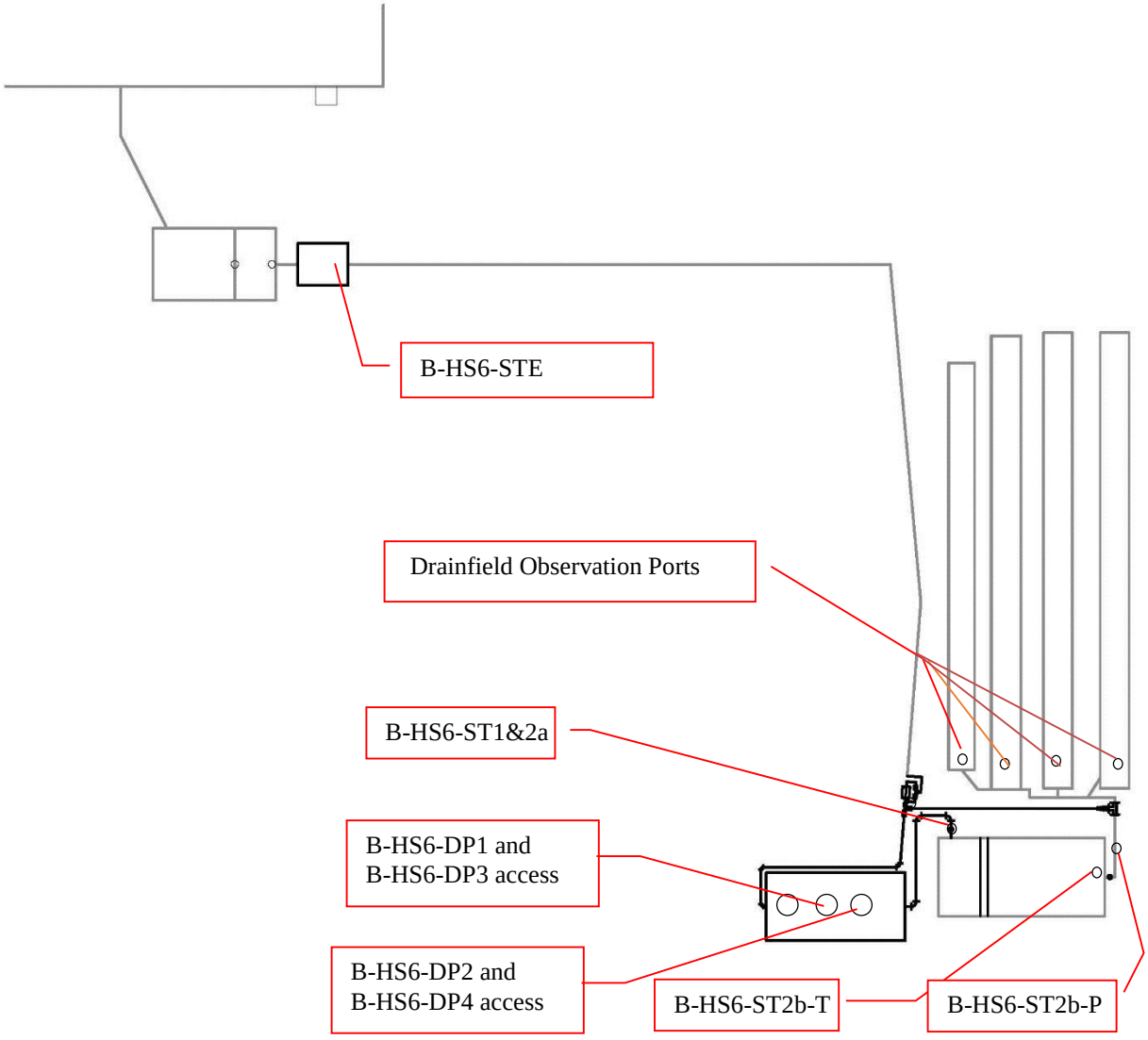


Figure 3
B-HS6 Treatment System Sampling and Monitoring Locations

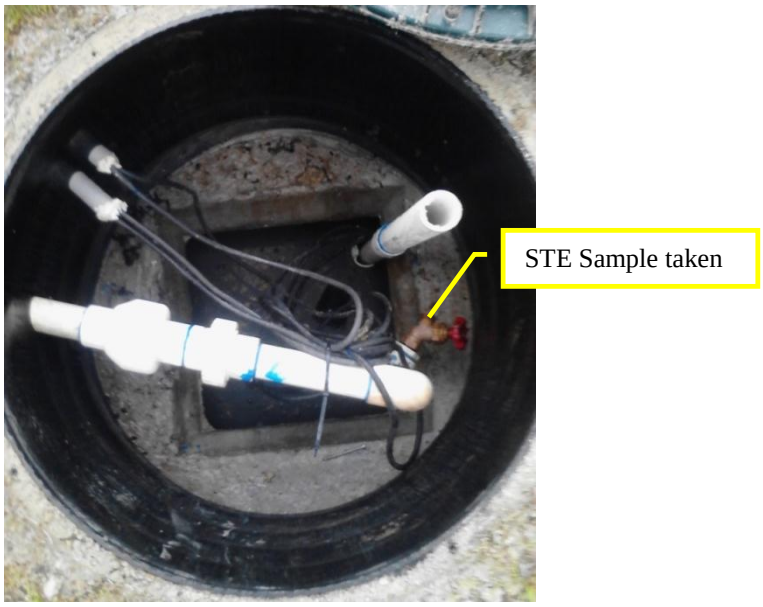


Figure 4
Primary Effluent (B-HS6-STE sample)

The pump tank contents are discharged to the top of the Stage 1 biofilter through three Orenco™ spin nozzles. The spin nozzles visually appear to adequately cover the surface area of the biofilter and provide relatively uniform flow distribution. The four spray nozzles that were originally installed were replaced with the three spin nozzle sprayers on March 20, 2014. In the Stage 1 biofilter, wastewater percolates downward through expanded clay media where unsaturated conditions provide for ammonium oxidation and nitrification. The Stage 1 biofilter contains 30 inches of coarse expanded clay media (Riverlite™ 1/4; 1.1 to 4.8 mm). Two shallow pans, each containing a drive point sampler, were installed underneath the expanded clay layer and on top of the Stage 2a lignocellulosic media (see Figure 5). The second and third sampling points (B-HS6-DP1 and B-HS6-DP2) are sampled by connecting a peristaltic pump to the drivepoint tubing of each pan. Each sample represents effluent from the unsaturated Stage 1 biofilter.

Figure 5
Stage 1 Unsaturated Biofilter Effluent (B-HS6-DP1 and B-HS6-DP2 sample)

Twelve inches of lignocellulosic media, a blended waste wood from AAA Tree Experts, Tallahassee, FL, was installed underneath the expanded clay media as a supplemental carbon source for denitrification. A single 4-inch diameter outlet pipe connected the Stage 1&2a tank to the Stage 2b tank. The pipe was installed along the centerline of the Stage 1&2a tank with the invert at 4-inches above the interior bottom of the tank. Therefore, approximately 4-inches of the lignocellulosic media is saturated, promoting oxygen depletion and denitrification of the nitrified effluent. Two additional stainless steel drive points were installed at the bottom of the Stage 2a saturated lignocellulosic media (see Figure 6). These drive points sampled water from near the very bottom of the tank. The fourth and fifth sampling points (B-HS6-DP3 and B-HS6-DP4) are each sampled by connecting a peristaltic pump to the drive point tubing. Samples from each of the two monitoring points possibly represent the effluent from the Stage 2a saturated biofilter.

Figure 6
Stage 2a Saturated Biofilter Effluent (B-HS6-DP3 and B-HS6-DP4) sample tubing

The tubing for sample points B-HS6-DP1 and B-HS6-DP3 are accessed via the middle tank cover (Figure 7), and B-HS6-DP2 and B-HS6-DP4 are accessed through the tank cover on the outlet side of the tank.

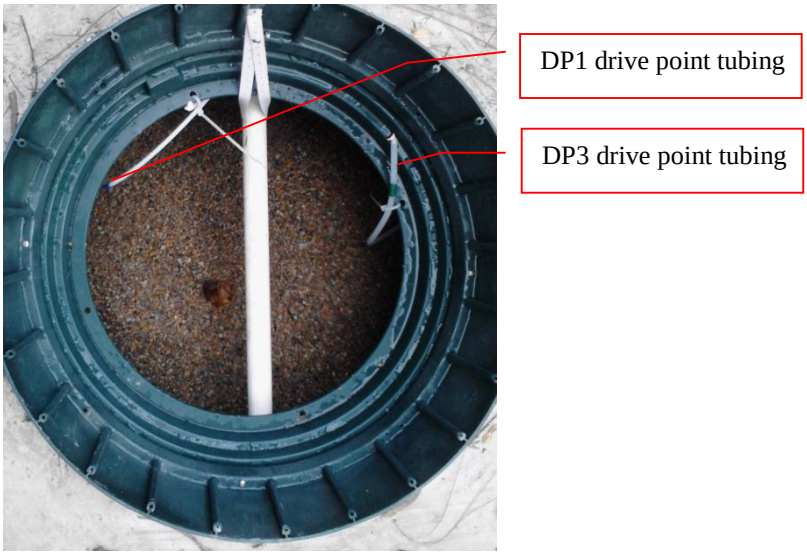


Figure 7
Drivepoint tubing access (B-HS6-DP1 and B-HS6-DP3 sample)

The effluent from the Stage 1&2a biofilter flows into the Stage 2b biofilter by gravity. The sixth sampling point (B-HS6-ST1&2a) is taken from a sample port in the gravity pipe con-

necting the Stage 1&2a biofilter outlet to the Stage 2b biofilter inlet representing the Stage 1&2a biofilter effluent (see Figure 8).

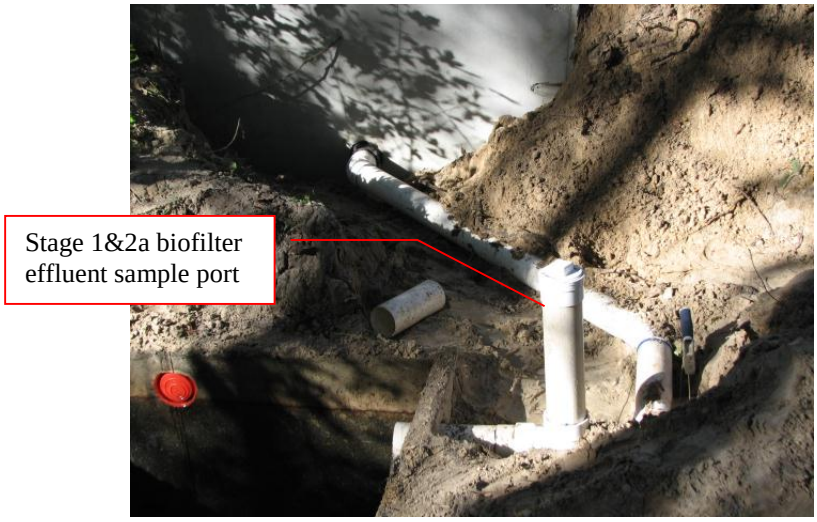


Figure 8
Stage 1&2a Biofilter Effluent Sample Port (B-HS6-ST1&2a sample)

Effluent from the Stage 1&2a biofilter enters the saturated denitrification (Stage 2b) biofilter at the bottom of the tank through a 4-inch diameter perforated pipe, flows upward through the 12-inches of elemental sulfur and oyster shell media mixture, and moves laterally over a concrete block wall to the second chamber. The Stage 2b biofilter effluent discharges near the top of the tank; therefore denitrification occurs in the saturated environment. The seventh primary sampling point, (B-HS6-ST2b-T) 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 soil infiltration system, or drainfield (Figure 9).

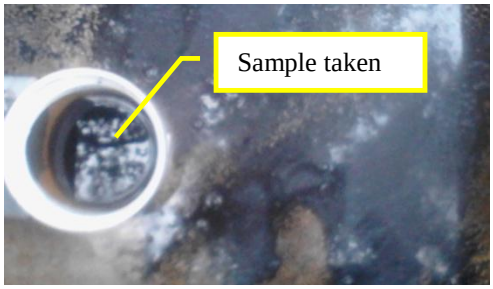


Figure 9
Stage 2b Biofilter Effluent (B-HS6-ST2b-T sample)

The eighth sampling point (B-HS6-ST2b-P) is from a sample port in the gravity pipe connecting the Stage 2b biofilter outlet to the drainfield inlet also representing the treated effluent (Figure 10).

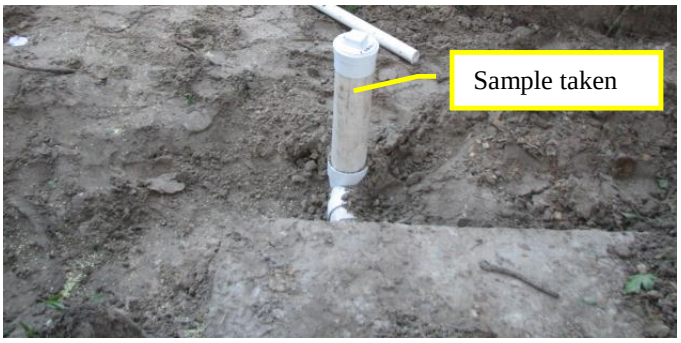


Figure 10
Stage 2b Biofilter Effluent (B-HS6-ST2b-P sample)

Treated effluent 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. The layout of the system and a flow schematic are shown in Figures 1 and 2, respectively.

3.3 Operational Monitoring

Start-up of the system occurred on November 14, 2013 (Experimental Day 0). The PNRS system has operated continually since that date. For this seventh formal sampling event, the water meter for the house and treatment system flow meter were read and recorded on January 29, 2015 (Experimental Day 441).

The household water meter is located on the potable water line from the onsite well prior to entering the household plumbing. The water meter does not include the irrigation water use. Therefore, the water meter reading should be indicative of the wastewater flow to the PNRS system.

The PNRS treatment system flow meter (Figure 11) is located on the pump tank discharge line and records the cumulative flow in gallons pumped from the pump chamber to the combined Stage 1&2a biofilter. The control panel includes telemetry where reports are generated regarding alarms, pump cycles, and other information using a Vericomm control panel system.

Figure 11
Treatment system flow meter

3.4 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 lift station pump installed within the pump tank, 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 1&2a biofilter was initially filled with 12 inches of lignocellulosic media. The Stage 2b biofilter was filled with 12 inches of sulfur and oyster shell mixture media, which ostensibly will last for many years without replenishment or replacement.

3.5 Water Quality Sample Collection and Analyses

The eighth formal sample event (Sample Event No. 8), which is the subject of this report, was conducted on January 29, 2015 (Experimental Day 441). A full suite of influent, intermediate and effluent water quality samples were collected from the system for water quality analysis. Samples were collected at four monitoring points described in Section 3.2: B-HS6-STE, B-HS6-DP2, B-HS6-ST1&2a, B-HS6-ST2b-P. A duplicate sample was also taken at B-HS6-ST1&2a. 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. For sample B-HS6-STE, the system pump was briefly turned on to collect sample from the spigot. In addition, a field blank and equipment blank (EB) were taken. The field blank was collected by filling sample containers with deionized water that had been transported into the field along with other sample containers. The equipment blank was collected by pumping deionized water through the cleaned pump tubing.

The analysis-specific containers were supplied by the analytical laboratories 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. Field parameters were measured directly in the tank/port for the B-HS6-STE, B-HS6-ST1, and B-HS6-ST2b-P samples. Due to the design of the probe, ORP was measured in a container overflowing with sample water. Due to low sample volume, no field parameters were taken during sampling of B-HS6-DP2.

The influent, intermediate, and effluent samples were analyzed by the laboratory for: total alkalinity, chemical oxygen demand (COD), total Kjeldahl nitrogen (TKN), 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), 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). Due to the small sample volume, B-HS6-DP2 was only analyzed for the nitrogen species and $CBOD_5$. 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 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)	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 (NO_X-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)	EPA 160.4	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	1 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 the new treatment system installation on November 6, 2013. The treatment system flow meter readings for the B-HS6 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 Flowmeters

Date and Time Read	House-hold Water Meter Reading	Average Daily Household Flow be-tween read-ings	PNRS Flow Meter Reading	Average PNRS Flow be-tween read-ings	Ratio PNRS flow to Household flow
	Cumula-tive Volume (gallons)	gallons/ day	Cumulative Volume (gallons)	gallons/ day	PNRS:HH
11/6/2013 12:15	99,030.4	Installed	1,027,435.3	Installed	Installed
11/14/2013 12:30	100,113.9	Start-up	1,027,435.3	Start-up	Start-up
11/20/2013 8:04	100,925.7	139.6	1,028,375.4	161.7	1.16
12/4/2013 7:52	102,616.8	120.9	1,030,645.4	162.3	1.34
12/20/2013 12:46	104,570.6	120.6	1,033,374.2	168.4	1.40
1/9/2014 11:49	107,163.1	129.9	1,036,306.1	146.9	1.13
1/22/2014 8:55	109,061.5	147.4	1,038,248.5	150.8	1.02
3/7/2014 10:30	115,093.0	136.9	1,045,302.0	160.1	1.17
3/20/2014 11:45	116,543.0	111.1	1,047,111.1	138.6	1.25
3/24/2014 10:50	116,979.0	110.1	1,047,597.8	122.9	1.12
4/10/2014 9:29	118,873.3	111.8	1,050,015.7	142.7	1.28
4/14/2014 19:15	119,370.5	112.8	1,050,622.9	137.8	1.22
4/16/2014 14:29	119,594.6	124.4	1,050,904.4	156.3	1.26
4/28/2014 12:47	120,956.3	114.1	1,052,696.0	150.2	1.32
5/7/2014 9:33	122,109.1	130.0	1,054,174.5	166.8	1.28
5/27/2014 12:26	124,623.2	125.0	1,057,401.8	160.4	1.28
5/30/2014 9:45	124,853.9	79.9	1,057,698.3	102.6	1.28
6/23/2014 9:00	127,482.8	109.7	1,060,658.0	123.5	1.13
7/21/2014 11:34	130,874.8	120.7	1,064,238.6	127.4	1.06
8/26/2014 8:54	135,223.9	121.2	1,068,857.5	128.7	1.06
8/27/2014 10:05	135,334.0	104.9	1,069,055.3	188.4	1.80
9/26/2014 11:27	139,560.0	140.6	1,074,161.6	169.9	1.21
10/3/2014 9:59	140,410.5	122.6	1,075,072.1	131.2	1.07
10/16/2014 11:36	142,525.8	161.9	1,077,527.8	187.9	1.16
10/30/2014 9:30	144,872.7	168.7	1,080,135.5	187.4	1.11
11/26/2014 12:38	148,920.8	149.2	1,084,870.1	174.5	1.17
12/29/2014 12:46	153,837.0	149.0	1,090,591.4	173.3	1.16
1/16/2015 14:37	155,830.5	110.3	1,092,977.0	132.0	1.20
1/29/2015 9:52	157,836.0	156.7	1,095,321.6	183.1	1.17
Average since start-up to January 29, 2015		130.9		154.0	1.18

On November 14, 2013, an alarm indicated a pump failure and upon inspection loose wiring was discovered and repaired. PNRS flow readings indicated that the pump had

not run since installation until the time the wiring was repaired, therefore the official start-up of the PNRS system was November 14, 2013 (Experimental Day 0). From system start-up through January 29, 2015, the household water use average was 130.9 gallons per day with periods of higher and lower flows (Table 2). The average pumped flow to the PNRS was 154.0 gallons per day from start-up through January 29, 2015. The metered PNRS flow is continuously reading higher (by approximately 20 percent) than the household water meter. The reason for the difference in the two meter readings is not known. There is a possibility that there is some drainage back to the pump tank following each dose cycle, because a check valve was not installed on the pump discharge line.

Based on the hydraulic design of the system, a normally expected water level in the Stage 1&2a tank would be approximately 98.52 ft. elevation, or a depth above tank bottom of 4.8 inches. The normal operation level in the Stage 1&2a tanks therefore could be expected to vary between 4 and 6 inches above the tank bottom. Water levels above these values could adversely affect treatment performance and would suggest hydraulic blockages in the system. While purging the Stage 1 effluent drive points DP1 and DP2 during Sample Event No. 2, it was observed that the water level in the Stage 1&2a tank was elevated above the pans holding the drive points. The water level in the Stage 1&2a tank was found to be elevated approximately 10-inches above the invert of the collection pipe during that sample event. This water level would saturate all 12-inches of the lignocellulosic media and approximately 2-inches of the expanded clay media. The elevated water level could quite possibly have affected the performance of the system as monitored in Sample Event 2. A piezometer was installed within the Stage 1&2a tank on April 10, 2014 to provide better access to water level observations (Figure 12).

Figure 12
Piezometer installed on April 19, 2014 in the Stage 1&2a Tank

Table 3 summarizes the water level readings recorded. On April 14, 2014, it was determined the clog in the system was in the inlet pipe on the Stage 2b sulfur tank. An unsuccessful attempt was made with a plumbing snake to clear the clog. On April 16, 2014, the clog was cleared using compressed air and a 4-inch rubber bladder; the water level in the Stage 1&2a tank was restored to normal operational levels. During the following monitoring event, Sample Event No. 3, the water level in the Stage 1&2a tank was at normal operational levels. A system check on May 27, 2014 indicated that the water level was elevated approximately 8 inches above the tank bottom. A repair on the inlet pipe to the Stage 2b sulfur tank was completed on May 31, 2014. The repair included drilling additional holes in the inlet pipe and replacing the mesh material surrounding the pipe with a different type with larger mesh size to prevent future clogging. During a system check on September 26, 2014, the water level in the Stage 1&2a tank piezometer was again elevated by approximately 8 inches. This could have resulted in greater saturation of lignocellulosic media in Stage 2a, but submergence of the pans holding drive points DP1 and DP2 would not be expected. It was determined that the outflow pipe of the Stage 1&2a tank was partially clogged. A clean out was installed on the outflow pipe, just downgradient of the Stage 1&2a tank on October 9, 2014 which allowed access to clean the perforations from inside the effluent collection pipe. In addition, additional holes were drilled in the effluent collection pipe (from inside the pipe) inside the tank.

During Sample Event No. 8, which is the subject of this report, the water level in the Stage 1&2a tank was at normal operational levels.

Table 3
Summary of Stage 1&2a Water Level

Date and Time Read	Water level In Stage1&2a PZ from TOC	Water Elev	Water level above bottom of tank[1]	Water level above outlet invert
	(ft)	(ft)	(in)	(in)
4/14/2014 19:20	3.74	99.57	17.63	13.63
4/14/2014 19:35	3.75	99.56	17.51	13.51
4/16/2014 14:35	3.77	99.54	17.27	13.27
4/16/2014 16:16	4.76	98.55	5.39	1.39
4/16/2014 16:25	4.79	98.52	5.03	1.03
4/16/2014 16:49	4.81	98.50	4.79	0.79
5/6/2014 9:35	4.71	98.60	5.99	1.99
5/6/2014 9:58	4.66	98.65	6.59	2.59
5/7/2014 9:39	4.68	98.63	6.35	2.35
5/7/2014 10:51	4.70	98.61	6.11	2.11
5/27/2014 12:00	4.02	99.29	14.27	10.27
5/30/2014 9:51	4.09	99.22	13.43	9.43
5/30/2014 15:10	4.79	98.52	5.03	1.03
5/31/2014 19:03	4.79	98.52	5.03	1.03
6/23/2014 9:06	4.61	98.70	7.19	3.19
6/23/2014 12:25	4.52	98.79	8.27	4.27
7/21/2014 11:43	4.49	98.82	8.63	4.63
8/26/2014 9:05	4.36	98.95	10.19	6.19
8/27/2014 10:13	4.33	98.98	10.55	6.55
9/26/2014 12:32	4.04	99.27	14.03	10.03
10/3/2014 10:03	4.11	99.20	13.19	9.19
10/20/2014 15:58	4.70	98.61	6.11	2.11
10/29/2014 13:19	4.71	98.60	5.99	1.99
10/30/2014 9:33	4.71	98.60	5.99	1.99
11/26/2014 12:42	4.65	98.66	6.71	2.71
12/29/2014 12:44	4.66	98.65	6.59	2.59
1/16/2015 14:42	4.71	98.60	5.99	1.99
1/29/2015 9:50	4.72	98.59	5.87	1.87

[1]Stage 1&2a tank interior bottom elev = 98.10

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 and has been fairly consistent through system operation.

Table 4
Summary of System Electrical Use

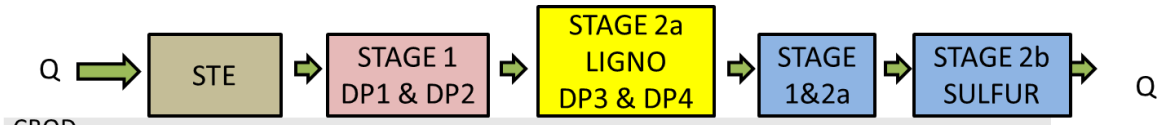
Date and Time Read	Electrical Meter Reading	Average Daily Electrical Use	Average Electrical Use per Gallon Treated	Average Electrical Use per 1,000 Gallons Treated
	Cumulative (kWh)	(kWh/day)	(kWh/gal)	(kWh/ 1,000 gal)
11/6/2013 12:22	2,749	0.00		
11/14/2013 12:32	2,749	0.00		
11/20/2013 8:08	2,751	0.34	0.0021	2.127
12/4/2013 7:54	2,757	0.43	0.0026	2.643
12/20/2013 12:48	2,764	0.43	0.0026	2.565
1/9/2014 11:53	2,772	0.40	0.0027	2.729
1/22/2014 8:57	2,777	0.39	0.0026	2.574
3/7/2014 10:32	2,797	0.45	0.0028	2.836
3/20/14 11:47	2,802	0.38	0.0028	2.764
3/24/2014 10:51	2,803	0.25	0.0021	2.054
4/10/2014 9:32	2,811	0.47	0.0033	3.309
4/14/2014 19:17	2,813	0.45	0.0033	3.293
4/16/2014 14:31	2,814	0.56	0.0036	3.552
4/28/2014 12:48	2,820	0.50	0.0033	3.349
5/7/2014 9:34	2,825	0.99	0.0034	3.382
5/27/2014 12:27	2,835	0.50	0.0031	3.099
5/30/2014 9:47	2,836	0.35	0.0034	3.373
6/23/2014 9:01	2,846	0.42	0.0034	3.379
7/21/2014 11:36	2,857	0.39	0.0031	3.072
8/27/2014 10:03	2,876	0.51	0.0024	2.417
9/26/2014 11:25	2,897	0.70	0.0041	4.113
10/3/2014 9:57	2,901	0.58	0.0044	4.393
10/16/2014 11:35	2,910	0.69	0.0037	3.665
10/30/2014 9:28	2,918	0.58	0.0031	3.068
11/26/2014 12:36	2,932	0.52	0.0030	2.957
12/29/2014 12:44	2,951	0.58	0.0033	3.321
1/16/2015 14:35	2,959	0.44	0.0034	3.353
1/29/2015 9:50	2,967	0.62	0.0034	3.412
Total average start-up to 1/29/2015		0.49	0.0032	3.211

The total average electrical use through January 29, 2015 was 0.49 kWh per day. The average electrical use per 1,000 gallons treated was 3.21 kWh per 1,000 gallons treated, and this parameter has been fairly stable since start-up.

4.3 Water Quality

As discussed in the Sample Event No. 1 (SE1) report, the preliminary sampling results indicated that ammonia reduction through the Stage 1 biofilter was limited. During preliminary sampling, it was observed that the sprayers were not spraying uniformly over the Stage 1 media surface. Therefore on December 21, 2013, the sprayers were rotated to spray up on the tank lid rather than straight down for better distribution over the media surface. The results from the SE1 DP1 and DP2 samples indicated significant nitrification was occurring with this sprayer set-up; however, the long-term operation and maintenance of the sprayers in this set-up was a concern. Therefore, on March 20, 2014, the four originally installed spray nozzles were replaced by three Orenco™ spin nozzles positioned under the tank lids allowing for easy maintenance and maximum spray coverage. During a system check on October 3, 2014, two of the Orenco™ spin nozzles were observed to be spinning slowly and not providing full coverage. New nozzles were installed on October 20, 2014 prior to SE6 and were working prior to and during SE8.

Water quality results for the eighth full sampling event (Sample Event No. 8) are listed in Table 5. Nitrogen results are graphically displayed in Figure 13. The laboratory report containing the raw analytical data is included in Appendix A. The following discussion summarizes the water quality analytical results for Sample Event No. 8. The performance of the various system components was compared by considering the changes through treatment of nitrogen species (TKN, NH_3-N, and NO_X-N), as well as supporting water quality parameters.



$CBOD_5$ mg/L	96	5	7	5
TKN mg N/L	62	6.2	2.9	8.3
NH_3 mg N/L	55	5.7	1.8	6.2
NO_x mg N/L	0.3	50	45	23
TN mg N/L	62	56	48	31
Sulfate mg/L	12	NA	22	110
Fecal Coliform (Ct/100mL)	210,000	NA	12,000	108

NA = not analyzed

Figure 13
Graphical Representation of Nitrogen Results
Sample Event 8 January 29, 2015 (Experimental Day 441)

Septic Tank Effluent (STE) Quality: The water quality characteristics of STE collected in Sample Event 8 were within the typical range generally expected for domestic STE. The measured TN concentration for this sample event was approximately 62 mg-N/L, which is in the range typically seen for this household.

Stage 1 Unsaturated Effluent (DP2): Stage 1 effluent NO_x-N concentration was 50 mg/L for sample DP2. The TKN and NH_3-N concentrations were 6.2 mg/L and 5.7 mg/L, respectively. These results indicate incomplete nitrification in the Stage 1 unsaturated media biofilter.

Stage 2a Saturated Effluent (DP3 and DP4): Not sampled for Sample Event 8.

Stage 1&2a Tank Effluent (ST1&2a): The sample port between the Stage 1&2a combination tank and the Stage 2b sulfur tank represents the effluent from the Stage 1&2a tank and the influent to the Stage 2b biofilter. The Stage 1&2a sample port effluent TKN was 2.9 mg/L of which 1.8 mg/L was NH_3-N. The NO_x-N concentration was 45 mg/L and was accompanied by a measured DO of 1.78 mg/L DO and ORP of 88 mV. The Stage 1&2a effluent TSS concentration was 2 mg/L and $CBOD_5$ was 6 mg/L. The ST1&2a sample indicates incomplete ammonia removal and limited nitrate removal in the Stage 1&2a biofilter.

Stage 2b Tank Effluent (ST2b): In Sample Events 1 and 2 the monitoring points, B-HS6-ST2b-T and B-HS6-ST2b-P had nearly identical nitrogen concentrations. For this sample event, B-HS6-ST2b-T was not sampled. B-HS6-ST2b-P was chosen as the preferred sample point as it is located in the pipe leading from the PNRS system to the drainfield.

Effluent NO_x-N from the Stage 2b biofilter was approximately 23 mg/L. The NO_x-N was accompanied by a measured DO of 1.70 mg/L and ORP of 138 mV. The Stage 2b biofilter achieved incomplete NO_x-N reduction. The NH_3-N concentration was 6.2 mg/L and TKN was 8.3 mg/L. Final total nitrogen (TN) in the treatment system effluent was 31 mg/L. The Stage 2b effluent sulfate concentration was 110 mg/L.

Lastly, the Stage 1 sample (DP2) showed incomplete nitrification with an NH_3-N concentration 5.7 mg/L. However, the NH_3-N concentration at the following monitoring point (ST1&2a) was lower at 1.8 mg/L. Interestingly, the NH_3-N concentration in the ST2b effluent was slightly higher than the DP2 sample with a concentration of 6.2 mg/L. The unexpected differences in water quality at the various sample locations as discussed above cannot be explained at this time; however, could be attributed to hydraulic residence time, sampling methodology, an artifact from hydraulic issues previously discussed, or other factors.

Field Blank and Equipment Blank (FB & EB): Described in Section 3.5, the equipment blank (EB) and field blank (FB) results for most of the parameters measured were at or below the method detection limit. The only slightly elevated parameters was total Kjeldahl nitrogen and total phosphorous in the equipment blank sample (0.08 and 0.071 mg/L, respectively), and total phosphorus in the field blank sample (0.055 mg/L).

Table 5
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 (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)	Sulfate (mg/L)	H_2S (mg/L)	Sulfide (mg/L)	Fecal (Ct/100 mL)	E-coli (Ct/100 mL)
BHS6-STE	1/29/15 10:36	G	16.4	7.35	520	0.33	-237	1137	27	96	140	62.3	62	7.0	55	0.25	0.08	0.33	55.33	7.3	12	0.2	0.72	210,000	180,000
BHS6-DP02	1/29/15 11:22	G			150				66	5	16	56.2	6.2	0.5	5.7	50	0.03	50	55.7						
BHS6-ST1&2a	1/29/15 10:48	G	14.3	6.31	180	1.78	88	865	2	7	23	47.9	2.9	1.1	1.8	45	0.09	45	46.8	2.7	22	0.34	0.41	12,000	11,000
BHS6-ST1&2a-DUP	1/29/15 10:50	G	14.2	6.31	160	1.64	88	864	8	9	22	48.9	2.9	1.1	1.8	45	0.09	46	47.8	2.7	20	0.34	0.41	8,000	7,300
BHS6-ST2b-Port	1/29/15 10:24	G	13.9	6.51	210	1.70	138	938	2	5	25	31.3	8.3	2.1	6.2	23	0.05	23	29.2	5	110	0.15	0.21	108	98
BHS6-EB	1/29/15 11:04	G	16.5	7.44	3.5	9.26	102	3.2	1	2	10	0.1	0.08	0.1	0.009	0.02	0.01	0.01	0.019	0.071	0.2	0.01	0.1	2.0	2.0
BHS6-FB	1/29/15 11:14	G	16.9	7.19	2.5	9.17	190	2.1	1	2	10	0.1	0.05	0.0	0.009	0.02	0.01	0.01	0.019	0.055	0.2	0.01	0.1	2.0	2.0

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

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.

4.4 Water Quality Monitoring Summary

A summary of the water quality data collected for the test system is presented in Table 6. Figure 14 provides a time series of influent and effluent TN over the study period. Figures 15 through 20 show box and whisker plots of the various monitoring points for the key parameters measured during the study period. The preliminary sample events conducted November 20, 2013 (Experimental Day 6) and December 4, 2013 (Experimental Day 20) were not included in the long term analyses as the system was still in the start-up period.

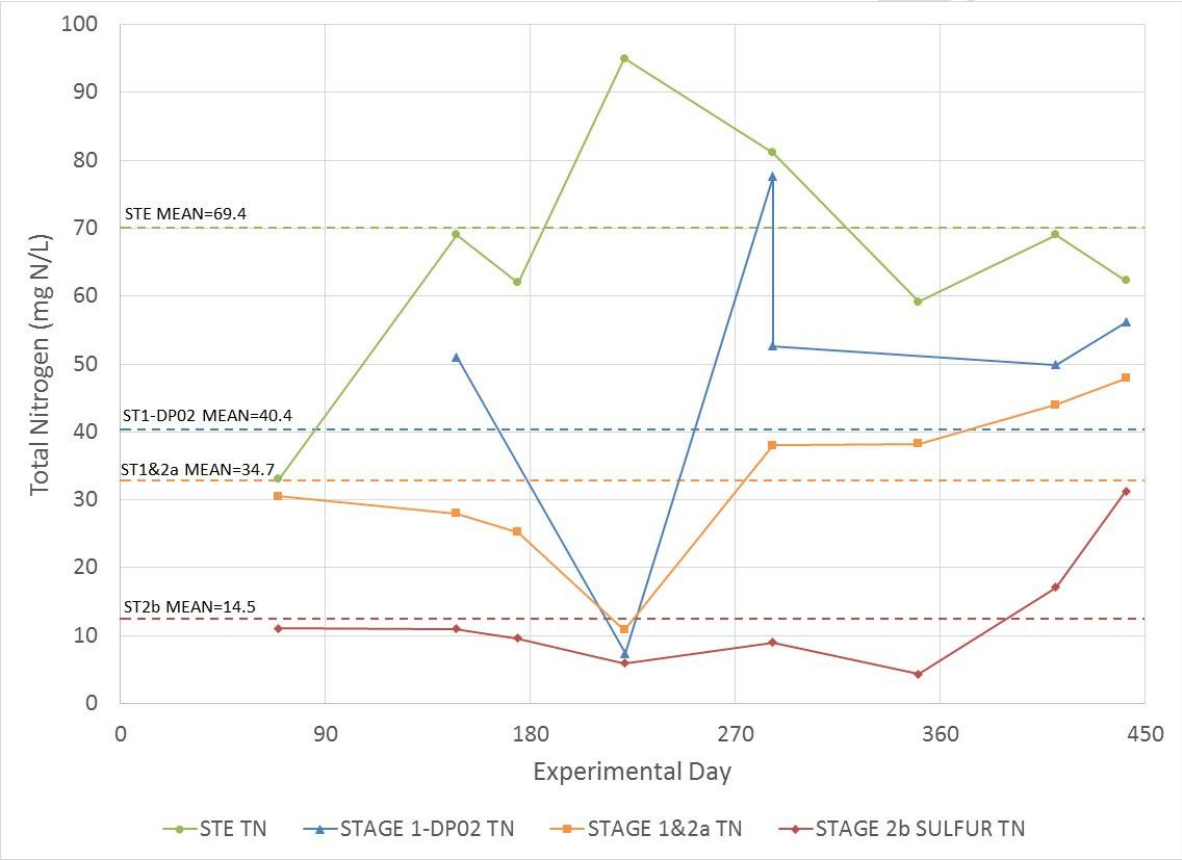


Figure 14
Total Nitrogen Time Series Graph

Table 6
Summary of Water Quality Analytical Results

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)	$CBOD_5$ (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)	H2S (mg/L)	Sulfide (mg/L)	Fecal[4] (Ct/100 mL)	E-coli[4] (Ct/100 mL)
BHS6-STE	n	8	8	8	8	8	8	8	6	8	8	8	8	8	8	8	8	8	8	8	6	8	8	8	8	8
	MEAN	20.3	7.2	512.5	0.2	-189.8	1,148.8	27.8	23.3	80.0	168.8	66.3	55.3	-2.8	58.1	0.1	0.1	0.1	58.2	8.1	5.4	5.3	1.2	2.7	338,145	238,769
	STD. DEV.	3.6		43.0	0.1	57.3	91.1	9.4	7.9	26.8	27.5	17.9	23.7	34.4	20.7	0.1	0.0	0.1	20.7	1.9	0.7	3.9	1.1	1.9		
	MIN	16.1	7.1	460.0	0.0	-245.0	1,018.0	16.0	15.0	61.0	140.0	33.0	7.4	-87.6	23.0	0.0	0.0	0.0	23.0	6.3	4.5	1.1	0.0	0.4	150,000	64,000
	MAX	25.9	7.4	600.0	0.4	-98.0	1,278.0	42.0	38.0	140.0	200.0	95.0	81.0	15.0	95.0	0.3	0.1	0.3	95.0	12.0	6.3	12.0	2.6	4.9	1,900,000	1,800,000
BHS6-ST1&2a	n	8	8	8	8	8	8	8	6	8	8	8	8	8	8	8	8	8	8	8	6	8	8	8	8	8
	MEAN	19.1	6.4	251.3	1.0	-31.6	875.3	4.9	5.8	24.5	49.0	32.8	8.0	2.1	5.9	24.4	0.6	24.8	30.8	4.1	2.6	18.0	0.6	0.9	9,938	8,463
	STD. DEV.	4.2		58.7	0.8	108.4	46.0	3.6	3.6	24.1	24.2	11.8	4.9	1.6	4.0	14.8	0.5	14.4	12.5	1.0	0.8	5.3	1.2	1.7		
	MIN	13.8	6.2	180.0	0.2	-146.0	790.0	1.0	1.0	6.0	23.0	10.8	2.9	0.3	1.8	0.0	0.1	0.9	9.6	2.7	1.4	9.0	0.0	0.1	3,700	3,600
	MAX	26.5	6.7	350.0	2.1	167.0	926.0	10.0	10.0	69.0	97.0	47.9	18.0	5.0	13.0	45.0	1.5	45.0	46.8	5.2	3.4	27.0	3.5	5.0	15,000	13,000
BHS6-ST2b-Port	n	8	8	8	8	8	8	8	6	8	8	8	8	8	8	8	8	8	8	8	6	8	8	8	8	8
	MEAN	18.9	6.6	310.0	0.5	-73.3	1014.9	3.6	3.5	8.3	41.8	12.4	8.0	2.2	5.8	4.4	0.0	4.4	10.2	4.1	2.5	135.5	1.5	2.3	2,964	2,787
	STD. DEV.	4.4		74.6	0.5	191.5	80.1	1.3	0.8	9.5	11.8	8.5	2.6	1.0	2.8	8.6	0.0	8.6	8.2	0.8	0.4	37.1	1.7	2.7		
	MIN	13.6	6.5	210.0	0.2	-219.0	895.0	2.0	2.0	2.0	25.0	4.3	4.2	1.0	0.9	0.0	0.0	0.0	3.1	3.0	2.0	64.0	0.1	0.2	108	98
	MAX	25.7	6.9	430.0	1.7	300.0	1133.0	6.0	4.0	31.0	58.0	31.3	11.0	4.2	9.5	23.0	0.1	23.0	29.2	5.0	3.0	190.0	4.5	7.7	6,000	6,000
BHS6-ST2b-Tee	n	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	MEAN	15.8	6.7	365.0	0.1	-153.0	1015.5	12.5	11.0	20.0	49.5	11.5	11.5	2.4	9.1	0.0	0.0	0.0	9.1	3.3	2.5	96.5	3.4	5.5	6,693	5,367
	STD. DEV.	3.0		91.9	0.0	116.0	167.6	14.8	14.1	7.1	0.7	0.7	0.7	1.3	0.6	0.0	0.0	0.0	0.5	0.4	0.7	47.4	3.4	5.8		
	MIN	13.7	6.6	300.0	0.1	-235.0	897.0	2.0	1.0	15.0	49.0	11.0	11.0	1.5	8.7	0.0	0.0	0.0	8.8	3.0	2.0	63.0	1.0	1.4	5,600	4,800
	MAX	17.9	6.9	430.0	0.1	-71.0	1134.0	23.0	21.0	25.0	50.0	12.1	12.0	3.3	9.5	0.1	0.0	0.1	9.5	3.6	3.0	130.0	5.8	9.6	8,000	6,000
BHS6-DP01	n	1	1	3	1	1	1	2	2	4	3	5	5	5	6	5	6	6	6	0	0	0	0	0	0	0
	MEAN	19.7	6.9	119.0	2.5	40.0	929.0	41.0	28.0	55.8	32.3	49.7	6.0	2.6	3.2	51.2	0.4	43.0	46.1							
	STD. DEV.			28.2				46.7	33.9	96.2	18.8	28.4	5.9	2.2	4.5	15.4	0.6	25.0	24.5							
	MIN	19.7	6.9	87.0	2.5	40.0	929.0	8.0	4.0	5.0	20.0	3.3	0.5	0.1	0.1	38.0	0.0	0.1	3.2							
	MAX	19.7	6.9	140.0	2.5	40.0	929.0	74.0	52.0	200.0	54.0	81.0	16.0	5.1	12.0	76.0	1.6	76.0	77.5							
BHS6-DP02	n	1	1	4	1	1	1	4	2	5	3	6	6	6	7	6	7	7	7	0	0	0	0	0	0	0
	MEAN	19.8	7.0	144.5	3.4	12.0	917.0	103.2	61.5	4.3	19.2	40.4	5.4	1.6	2.5	47.6	0.1	15.8	37.9							
	STD. DEV.							55.5	29.7	3.1	3.1	22.9	3.9	2.6	3.5	11.0	0.3	20.9	21.0							
	MIN	19.8	7.0	95.0	3.4	12.0	917.0	66.0	44.0	2.0	16.0	7.4	0.5	0.4	0.1	38.0	0.0	0.0	5.6							
	MAX	19.8	7.0	180.0	3.4	12.0	917.0	192.0	86.0	10.0	22.0	77.6	12.0	7.5	9.7	68.0	0.6	68.0	75.3							
BHS6-DP03	n	5	5	3	5	5	5	3	3	5	2	5	5	5	5	5	5	5	5	1	0	0	0	0	1	1
	MEAN	21.1	6.5	374.3	0.4	-133.8	900.4	3.8	3.5	22.6	49.5	20.9	8.9	2.4	6.4	11.6	0.7	12.1	18.5	0.2					11,000	9,000
	STD. DEV.	5.0		81.9	0.2	35.8	77.9	2.5	2.6	14.7	6.4	11.8	6.4	1.8	5.4	9.3	0.8	8.8	10.5							
	MIN	14.4	6.3	310.0	0.2	-184.0	795.0	2.0	2.0	2.0	45.0	5.6	0.5	0.1	0.4	1.8	0.0	1.8	3.8	0.2					11,000	9,000
	MAX	26.8	6.8	470.0	0.8	-93.0	1015.0	7.0	7.0	33.0	54.0	34.0	16.0	4.6	14.0	22.0	2.1	22.0	29.4	0.2					11,000	9,000
BHS6-DP04	n	5	5	3	5	5	5	3	3	5	3	5	5	5	5	5	5	5	5	0	0	3	0	0	1	1
	MEAN	21.1	6.4	353.3	0.4	-155.2	941.6	4.0	4.0	41.6	99.3	10.9	7.0	2.1	4.9	3.5	0.4	3.9	8.8			8.0			1,400	760
	STD. DEV.	5.1		56.9	0.3	36.7	51.7	4.4	4.4	34.6	27.6	8.1	6.6	1.2	6.1	3.6	0.5	3.7	7.6			7.8				
	MIN	14.2	6.4	290.0	0.2	-184.0	888.0	1.0	1.0	13.0	68.0	3.8	0.5	0.3	0.2	0.6	0.0	0.8	1.2			3.4			1,400	760
	MAX	26.7	6.5	400.0	0.9	-92.0	1015.0	9.0	9.0	100.0	120.0	21.0	16.0	3.7	14.0	8.3	1.1	9.0	17.3			17.0			1,400	760

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.

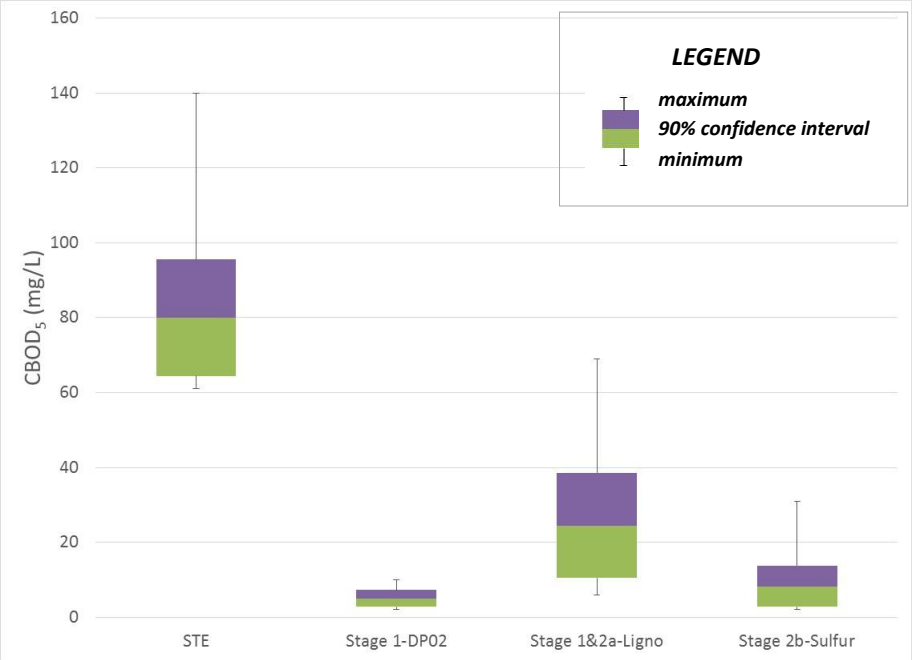


Figure 15
$CBOD_5$ Box and Whisker Plot

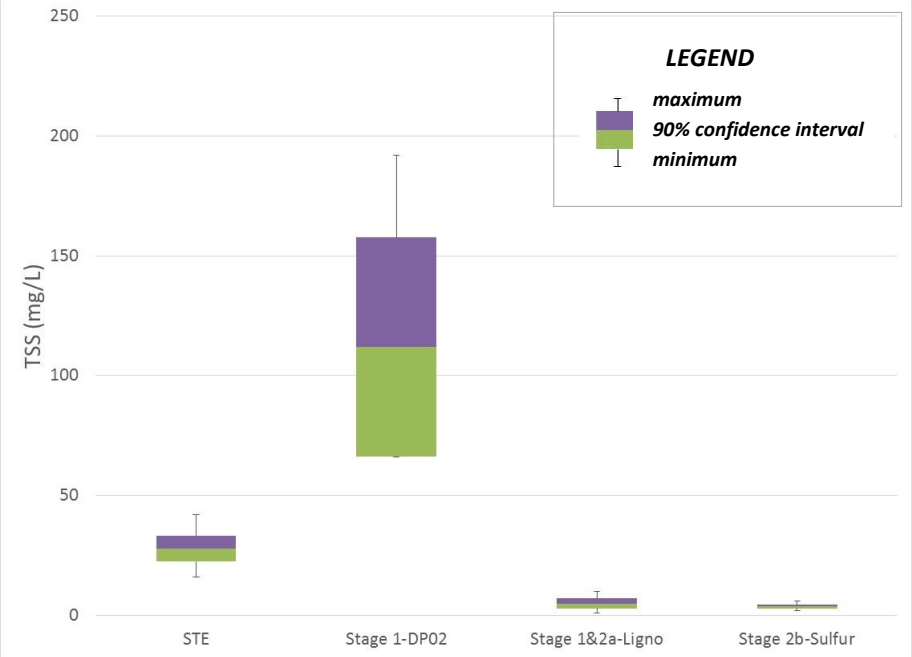


Figure 16
TSS Box and Whisker Plot

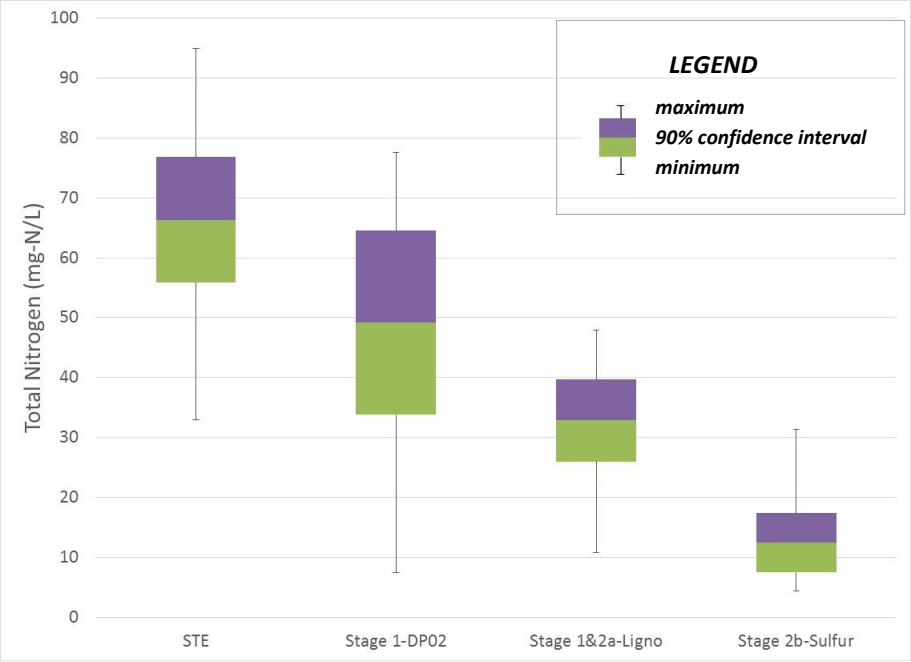


Figure 17
Total Nitrogen (TN) Box and Whisker Plot

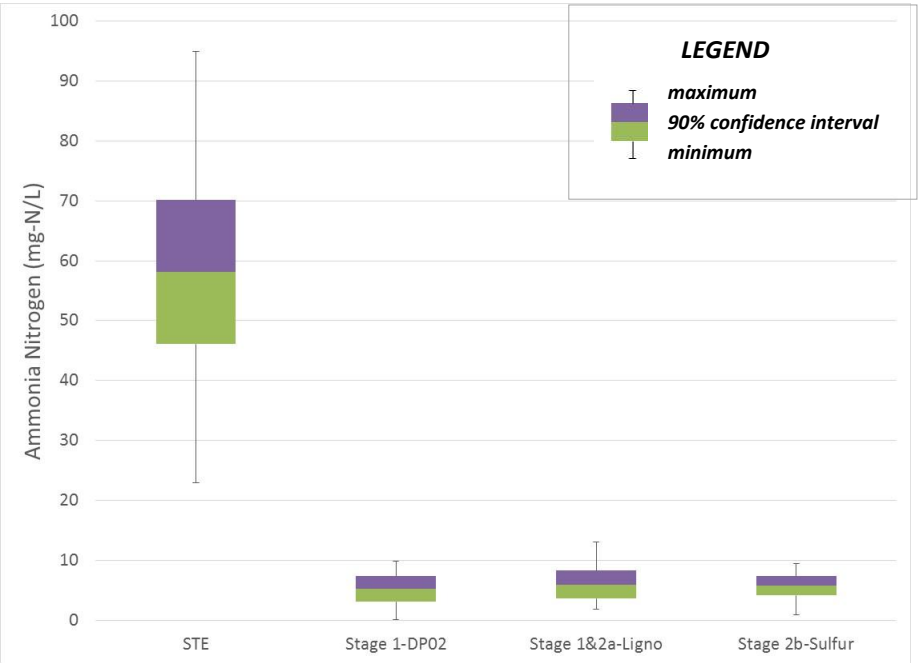


Figure 18
Ammonia N (NH3-N) Box and Whisker Plot

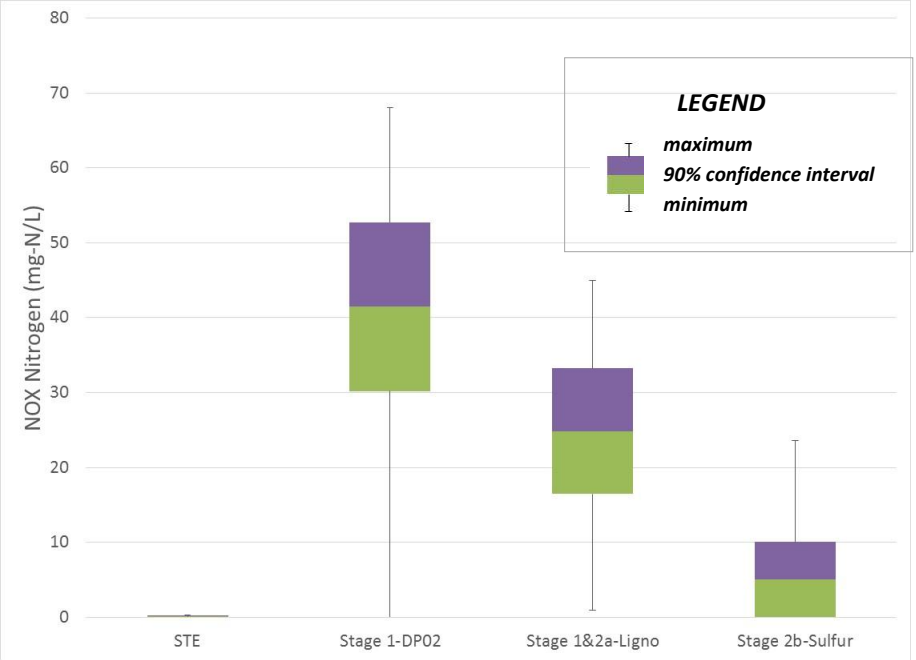


Figure 19
Nitrate+Nitrite Nitrogen (NO_X-N) Box and Whisker Plot

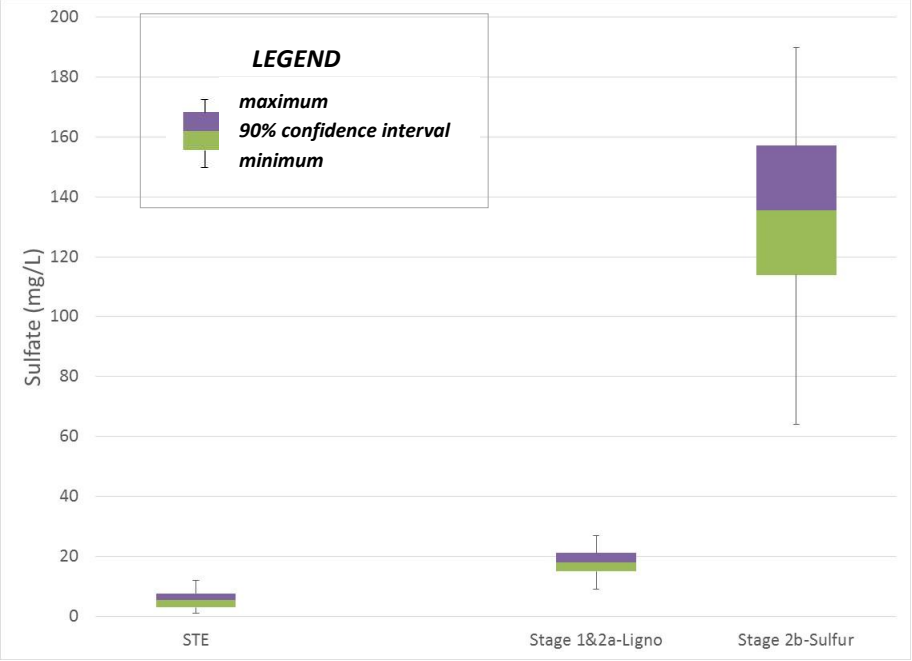


Figure 20
Sulfate (SO_4) Box and Whisker Plot

5.0 B-HS6 Sample Event No. 8: Summary

5.1 Summary

The Sample Event No. 8 results indicate that:

- Septic tank effluent (STE) quality is characteristic of typical household STE quality, and within the range previously measured at this household. The TKN of 62 mg/L is in the range of values typically reported for Florida single family residence STE.

- The Stage 1 biofilter sample DP2 showed 90% reduction in ammonia concentration; effluent in the DP2 sample had an ammonia-N concentration of 5.7 mg/L.

- The Stage 1&2a effluent sample port (ST1&2a) between the Stage 1&2a combination tank outlet and the Stage 2b sulfur tank inlet, showed 97% reduction in ammonium concentration from STE. The ammonia-N concentration in both the ST1&2a sample and duplicate were 1.8 mg/L.

- The Stage 2b sulfur biofilter (ST2b) effluent NO_x-N was 23 mg/L. The NO_x-N removal was not as high as typically seen through this system, and the reasons for this are unknown.

- The total nitrogen concentration in the final effluent from the total treatment system was 31 mg/L, an approximately 50% reduction from STE.

5.2 Conclusions

Sample Event 8 was the last funded sample event for the B-HS6 treatment system. Sections 4.4 summarized the water quality data collected over the 1.2 year monitoring period for this system. These results indicate that:

- The septic tank effluent average total nitrogen concentration of 66.3 mg/L is in the upper range of values typically reported for Florida single family residence STE.

- The Stage 1 biofilter sample DP2 showed significant ammonia removal with an average NH_3-N concentration of 2.5 mg/L and average TKN of 5.4 mg/L. The DP2 average NO_x-N was 15.8 mg/L.

- The Stage 1&2a effluent sample port (ST1&2a) between the Stage 1&2a combination tank outlet and the Stage 2b sulfur tank inlet, showed similar ammonia removal with an average NH_3-N concentration of 5.9 mg/L and average TKN of 8.0 mg/L. The ST1&2a average NO_x-N was 24.8 mg/L.
- The Stage 2b biofilter was effective in producing a reducing environment and achieving significant NO_x-N removal (average NO_x-N concentration of 4.4 mg/L). The average final total nitrogen (TN) in the treatment system effluent was 12.4 mg/L, primarily TKN (average TKN concentration of 8.0 mg/L), which represents an 81.3 percent average total nitrogen reduction from this PNRS.

Further analysis of the results obtained at this site will occur as Task B results are compiled and summarized. The results of the data collected to date have provided insights into the performance of a full-scale passive single pass nitrogen reduction system monitored over an extended timeframe (441 experimental days) under actual onsite conditions.

Appendix A: Laboratory Report

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

February 16, 2015
Work Order: 1500624

Laboratory Report

Project Name		**BHS6 SE#9**						
Parameters	**Units**	**Results ***	**Method**	**PQL**	**MDL**	**Prepared**	**Analyzed**	**Dilution**
Sample Description		**BHS6-STE**						
Matrix		**Wastewater**						
SAL Sample Number		**1500624-01**						
Date/Time Collected		**01/29/15 10:36**						
Collected by		**Harmon Harden**						
Date/Time Received		**01/30/15 10:00**						
Inorganics								
Hydrogen Sulfide (Unionized)	mg/L	0.20	SM 4550SF	0.04	0.01	02/02/15 10:19	02/02/15 11:10	1
Ammonia as N	mg/L	55	EPA 350.1	0.40	0.095		01/30/15 12:00	10
Carbonaceous BOD	mg/L	96	SM 5210B	2	2	01/30/15 13:36	02/04/15 10:06	1
Chemical Oxygen Demand	mg/L	140	EPA 410.4	25	10	02/11/15 09:23	02/11/15 15:55	1
Nitrate+Nitrite (N)	mg/L	0.33	EPA 353.2	0.04	0.01		01/30/15 12:00	1
Nitrite (as N)	mg/L	0.08	SM 4500NO2-B	0.04	0.01		01/30/15 16:34	1
Phosphorous - Total as P	mg/L	7.3	SM 4500P-E	2.0	0.50	02/02/15 09:16	02/09/15 15:05	50
Sulfate	mg/L	12	EPA 300.0	0.60	0.20		02/10/15 18:08	1
Sulfide	mg/L	0.72	SM 4500SF	0.40	0.10		02/02/15 11:12	1
Total Alkalinity	mg/L	520	SM 2320B	8.0	2.0		02/09/15 11:29	1
Total Kjeldahl Nitrogen	mg/L	62	EPA 351.2	10	2.5	02/02/15 09:16	02/09/15 15:05	50
Total Suspended Solids	mg/L	27	SM 2540D	1	1	02/02/15 08:21	02/03/15 15:57	1
Nitrate (as N)	mg/L	0.25	EPA 353.2	0.08	0.02		01/30/15 16:34	1
Sample Description		**BHS6-DP02**						
Matrix		**Wastewater**						
SAL Sample Number		**1500624-02**						
Date/Time Collected		**01/29/15 11:22**						
Collected by		**Harmon Harden**						
Date/Time Received		**01/30/15 10:00**						
Inorganics								
Ammonia as N	mg/L	5.7	EPA 350.1	0.040	0.009		01/30/15 12:00	1
Carbonaceous BOD	mg/L	5	SM 5210B	2	2	01/30/15 13:36	02/04/15 10:06	1
Chemical Oxygen Demand	mg/L	16 I	EPA 410.4	25	10	02/11/15 09:23	02/11/15 15:55	1
Nitrate+Nitrite (N)	mg/L	50	EPA 353.2	0.04	0.01		01/30/15 12:00	1
Nitrite (as N)	mg/L	0.03 I	SM 4500NO2-B	0.04	0.01		01/30/15 16:35	1
Total Alkalinity	mg/L	150	SM 2320B	8.0	2.0		02/09/15 11:36	1
Total Kjeldahl Nitrogen	mg/L	6.2	EPA 351.2	2.0	0.50	02/02/15 09:16	02/09/15 15:05	10
Total Suspended Solids	mg/L	66	SM 2540D	1	1	02/02/15 08:21	02/03/15 15:57	1
Nitrate (as N)	mg/L	50	EPA 353.2	0.08	0.02		01/30/15 16:35	1

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February 16, 2015
Work Order: 1500624

Laboratory Report

Project Name		**BHS6 SE#9**						
Parameters	**Units**	**Results ***	**Method**	**PQL**	**MDL**	**Prepared**	**Analyzed**	**Dilution**
Sample Description		**BHS6-ST1&2a**						
Matrix		**Wastewater**						
SAL Sample Number		**1500624-03**						
Date/Time Collected		**01/29/15 10:48**						
Collected by		**Harmon Harden**						
Date/Time Received		**01/30/15 10:00**						
Inorganics								
Hydrogen Sulfide (Unionized)	mg/L	0.34	SM 4550SF	0.04	0.01	02/02/15 10:19	02/02/15 11:10	1
Ammonia as N	mg/L	1.8	EPA 350.1	0.040	0.009		01/30/15 12:00	1
Carbonaceous BOD	mg/L	7	SM 5210B	2	2	01/30/15 13:36	02/04/15 10:06	1
Chemical Oxygen Demand	mg/L	23 I	EPA 410.4	25	10	02/11/15 09:23	02/11/15 15:55	1
Nitrate+Nitrite (N)	mg/L	45	EPA 353.2	0.04	0.01		01/30/15 12:00	1
Nitrite (as N)	mg/L	0.09	SM 4500NO2-B	0.04	0.01		01/30/15 16:35	1
Phosphorous - Total as P	mg/L	2.7	SM 4500P-E	0.080	0.020	02/02/15 09:16	02/09/15 15:05	2
Sulfate	mg/L	22	EPA 300.0	0.60	0.20		02/10/15 18:20	1
Sulfide	mg/L	0.41	SM 4500SF	0.40	0.10		02/02/15 11:12	1
Total Alkalinity	mg/L	180	SM 2320B	8.0	2.0		02/09/15 11:43	1
Total Kjeldahl Nitrogen	mg/L	2.9	EPA 351.2	0.40	0.10	02/02/15 09:16	02/09/15 15:05	2
Total Suspended Solids	mg/L	2	SM 2540D	1	1	02/02/15 08:21	02/03/15 15:57	1
Nitrate (as N)	mg/L	45	EPA 353.2	0.08	0.02		01/30/15 16:35	1
Sample Description		**BHS6-ST1&2a-DUP**						
Matrix		**Wastewater**						
SAL Sample Number		**1500624-04**						
Date/Time Collected		**01/29/15 10:50**						
Collected by		**Harmon Harden**						
Date/Time Received		**01/30/15 10:00**						
Inorganics								
Hydrogen Sulfide (Unionized)	mg/L	0.34	SM 4550SF	0.04	0.01	02/02/15 10:19	02/02/15 11:10	1
Ammonia as N	mg/L	1.8	EPA 350.1	0.040	0.009		01/30/15 12:00	1
Carbonaceous BOD	mg/L	9	SM 5210B	2	2	01/30/15 13:36	02/04/15 10:06	1
Chemical Oxygen Demand	mg/L	22 I	EPA 410.4	25	10	02/11/15 09:23	02/11/15 15:55	1
Nitrate+Nitrite (N)	mg/L	46	EPA 353.2	0.04	0.01		01/30/15 12:00	1
Nitrite (as N)	mg/L	0.09	SM 4500NO2-B	0.04	0.01		01/30/15 16:36	1
Phosphorous - Total as P	mg/L	2.7	SM 4500P-E	0.080	0.020	02/02/15 09:16	02/09/15 15:05	2
Sulfate	mg/L	20	EPA 300.0	0.60	0.20		02/10/15 18:31	1
Sulfide	mg/L	0.41	SM 4500SF	0.40	0.10		02/02/15 11:12	1
Total Alkalinity	mg/L	160	SM 2320B	8.0	2.0		02/09/15 11:50	1
Total Kjeldahl Nitrogen	mg/L	2.9	EPA 351.2	0.40	0.10	02/02/15 09:16	02/09/15 15:05	2
Total Suspended Solids	mg/L	8	SM 2540D	1	1	02/02/15 08:21	02/03/15 15:57	1
Nitrate (as N)	mg/L	45	EPA 353.2	0.08	0.02		01/30/15 16:36	1

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February 16, 2015
Work Order: 1500624

Laboratory Report

Project Name		**BHS6 SE#9**						
Parameters	**Units**	**Results ***	**Method**	**PQL**	**MDL**	**Prepared**	**Analyzed**	**Dilution**
Sample Description		**BHS6-ST2b-P**						
Matrix		**Wastewater**						
SAL Sample Number		**1500624-05**						
Date/Time Collected		**01/29/15 10:24**						
Collected by		**Harmon Harden**						
Date/Time Received		**01/30/15 10:00**						
Inorganics								
Hydrogen Sulfide (Unionized)	mg/L	0.15	SM 4550SF	0.04	0.01	02/02/15 10:19	02/02/15 11:10	1
Ammonia as N	mg/L	6.2	EPA 350.1	0.040	0.009		01/30/15 12:00	1
Carbonaceous BOD	mg/L	5	SM 5210B	2	2	01/30/15 13:36	02/04/15 10:06	1
Chemical Oxygen Demand	mg/L	25	EPA 410.4	25	10	02/11/15 09:23	02/11/15 15:55	1
Nitrate+Nitrite (N)	mg/L	23	EPA 353.2	0.04	0.01		01/30/15 12:00	1
Nitrite (as N)	mg/L	0.05	SM 4500NO2-B	0.04	0.01		01/30/15 16:36	1
Phosphorous - Total as P	mg/L	5.0	SM 4500P-E	0.40	0.10	02/02/15 09:16	02/09/15 15:05	10
Sulfate	mg/L	110	EPA 300.0	6.0	2.0		02/12/15 19:05	10
Sulfide	mg/L	0.21 I	SM 4500SF	0.40	0.10		02/02/15 11:12	1
Total Alkalinity	mg/L	210	SM 2320B	8.0	2.0		02/09/15 11:57	1
Total Kjeldahl Nitrogen	mg/L	8.3	EPA 351.2	2.0	0.50	02/02/15 09:16	02/09/15 15:05	10
Total Suspended Solids	mg/L	2	SM 2540D	1	1	02/02/15 08:21	02/03/15 15:57	1
Nitrate (as N)	mg/L	23	EPA 353.2	0.08	0.02		01/30/15 16:36	1
Sample Description		**BHS6-EB**						
Matrix		**Reagent Water**						
SAL Sample Number		**1500624-06**						
Date/Time Collected		**01/29/15 11:04**						
Collected by		**Harmon Harden**						
Date/Time Received		**01/30/15 10:00**						
Inorganics								
Hydrogen Sulfide (Unionized)	mg/L	0.01 U	SM 4550SF	0.04	0.01	02/02/15 10:19	02/02/15 11:10	1
Ammonia as N	mg/L	0.009 U	EPA 350.1	0.040	0.009		01/30/15 12:00	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	01/30/15 13:36	02/04/15 10:06	1
Chemical Oxygen Demand	mg/L	10 U	EPA 410.4	25	10	02/11/15 09:23	02/11/15 15:55	1
Nitrate+Nitrite (N)	mg/L	0.01 U	EPA 353.2	0.04	0.01		01/30/15 12:00	1
Nitrite (as N)	mg/L	0.01 U	SM 4500NO2-B	0.04	0.01		01/30/15 16:37	1
Phosphorous - Total as P	mg/L	0.071	SM 4500P-E	0.040	0.010	02/02/15 09:16	02/09/15 15:05	1
Sulfate	mg/L	0.20 U	EPA 300.0	0.60	0.20		02/11/15 09:52	1
Sulfide	mg/L	0.10 U	SM 4500SF	0.40	0.10		02/02/15 11:12	1
Total Alkalinity	mg/L	3.5 I	SM 2320B	8.0	2.0		02/09/15 12:00	1
Total Kjeldahl Nitrogen	mg/L	0.08 I	EPA 351.2	0.20	0.05	02/02/15 09:16	02/09/15 15:05	1
Total Suspended Solids	mg/L	1 U	SM 2540D	1	1	02/02/15 08:21	02/03/15 15:57	1
Nitrate (as N)	mg/L	0.02 U	EPA 353.2	0.08	0.02		01/30/15 16:37	1

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February 16, 2015
Work Order: 1500624

Laboratory Report

Project Name		**BHS6 SE#9**						
Parameters	**Units**	**Results ***	**Method**	**PQL**	**MDL**	**Prepared**	**Analyzed**	**Dilution**
Sample Description		**BHS6-FB**						
Matrix		**Reagent Water**						
SAL Sample Number		**1500624-07**						
Date/Time Collected		**01/29/15 11:14**						
Collected by		**Harmon Harden**						
Date/Time Received		**01/30/15 10:00**						
Inorganics								
Hydrogen Sulfide (Unionized)	mg/L	0.01 U	SM 4550SF	0.04	0.01	02/02/15 10:19	02/02/15 11:10	1
Ammonia as N	mg/L	0.009 U	EPA 350.1	0.040	0.009		01/30/15 12:00	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	01/30/15 13:36	02/04/15 10:06	1
Chemical Oxygen Demand	mg/L	10 U	EPA 410.4	25	10	02/11/15 09:23	02/11/15 15:55	1
Nitrate+Nitrite (N)	mg/L	0.01 U	EPA 353.2	0.04	0.01		01/30/15 12:00	1
Nitrite (as N)	mg/L	0.01 U	SM 4500NO2-B	0.04	0.01		01/30/15 16:37	1
Phosphorous - Total as P	mg/L	0.055	SM 4500P-E	0.040	0.010	02/02/15 09:16	02/09/15 15:05	1
Sulfate	mg/L	0.20 U	EPA 300.0	0.60	0.20		02/11/15 10:03	1
Sulfide	mg/L	0.10 U	SM 4500SF	0.40	0.10		02/02/15 11:12	1
Total Alkalinity	mg/L	2.5 I	SM 2320B	8.0	2.0		02/09/15 12:10	1
Total Kjeldahl Nitrogen	mg/L	0.05 U	EPA 351.2	0.20	0.05	02/02/15 09:16	02/09/15 15:05	1
Total Suspended Solids	mg/L	1	SM 2540D	1	1	02/02/15 08:21	02/03/15 15:57	1
Nitrate (as N)	mg/L	0.02 U	EPA 353.2	0.08	0.02		01/30/15 16:37	1

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BA53010 - Sulfide prep										
Blank (BA53010-BLK1)					Prepared & Analyzed: 02/02/15 11:12					
Sulfide	0.10 U	0.40	0.10	mg/L						
LCS (BA53010-BS1)					Prepared & Analyzed: 02/02/15 11:12					
Sulfide	4.73	0.40	0.10	mg/L	5.0		95	85-115		
Matrix Spike (BA53010-MS1)		**Source: 1500624-06**			Prepared & Analyzed: 02/02/15 11:12					
Sulfide	4.73	0.40	0.10	mg/L	5.0	ND	95	85-115		
Matrix Spike Dup (BA53010-MSD1)		**Source: 1500624-06**			Prepared & Analyzed: 02/02/15 11:12					
Sulfide	4.73	0.40	0.10	mg/L	5.0	ND	95	85-115	0	14
Batch BA53016 - Nitrate 353.2 by seal										
Blank (BA53016-BLK1)					Prepared & Analyzed: 01/30/15 12:00					
Ammonia as N	0.009 U	0.040	0.009	mg/L						
Nitrate+Nitrite (N)	0.01 U	0.04	0.01	mg/L						
Blank (BA53016-BLK2)					Prepared & Analyzed: 01/30/15 12:00					
Ammonia as N	0.009 U	0.040	0.009	mg/L						
Nitrate+Nitrite (N)	0.01 U	0.04	0.01	mg/L						
Blank (BA53016-BLK3)					Prepared & Analyzed: 01/30/15 12:00					
Ammonia as N	0.009 U	0.040	0.009	mg/L						
Nitrate+Nitrite (N)	0.01 U	0.04	0.01	mg/L						
LCS (BA53016-BS1)					Prepared & Analyzed: 01/30/15 12:00					
Nitrate+Nitrite (N)	0.969	0.04	0.01	mg/L	1.0		97	90-110		
Ammonia as N	1.0	0.040	0.009	mg/L	1.0		102	90-110		

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BA53016 - Nitrate 353.2 by seal										
LCS (BA53016-BS2)					Prepared & Analyzed: 01/30/15 12:00					
Nitrate+Nitrite (N)	0.956	0.04	0.01	mg/L	1.0		96	90-110		
Ammonia as N	1.0	0.040	0.009	mg/L	1.0		100	90-110		
LCS (BA53016-BS3)					Prepared & Analyzed: 01/30/15 12:00					
Ammonia as N	1.0	0.040	0.009	mg/L	1.0		100	90-110		
Nitrate+Nitrite (N)	0.972	0.04	0.01	mg/L	1.0		97	90-110		
Matrix Spike (BA53016-MS1)		**Source: 1500956-01**			Prepared & Analyzed: 01/30/15 12:00					
Nitrate+Nitrite (N)	1.23	0.04	0.01	mg/L	1.0	0.218	101	90-110		
Ammonia as N	1.1	0.040	0.009	mg/L	1.0	0.020	108	90-110		
Matrix Spike (BA53016-MS2)		**Source: 1500960-07**			Prepared & Analyzed: 01/30/15 12:00					
Nitrate+Nitrite (N)	0.975	0.04	0.01	mg/L	1.0	0.0130	96	90-110		
Ammonia as N	1.0	0.040	0.009	mg/L	1.0	0.018	101	90-110		
Matrix Spike (BA53016-MS3)		**Source: 1501014-11**			Prepared & Analyzed: 01/30/15 12:00					
Nitrate+Nitrite (N)	0.977	0.04	0.01	mg/L	1.0	ND	98	90-110		
Ammonia as N	1.0	0.040	0.009	mg/L	1.0	0.016	101	90-110		
Matrix Spike (BA53016-MS4)		**Source: 1501024-07**			Prepared & Analyzed: 01/30/15 12:00					
Nitrate+Nitrite (N)	1.80	0.04	0.01	mg/L	1.0	0.887	91	90-110		
Ammonia as N	1.1	0.040	0.009	mg/L	1.0	ND	106	90-110		
Matrix Spike (BA53016-MS5)		**Source: 1500624-07**			Prepared & Analyzed: 01/30/15 12:00					
Nitrate+Nitrite (N)	0.963	0.04	0.01	mg/L	1.0	ND	96	90-110		
Ammonia as N	1.0	0.040	0.009	mg/L	1.0	ND	101	90-110		
Matrix Spike Dup (BA53016-MSD1)		**Source: 1500956-01**			Prepared & Analyzed: 01/30/15 12:00					
Nitrate+Nitrite (N)	1.20	0.04	0.01	mg/L	1.0	0.218	98	90-110	2	20
Ammonia as N	1.1	0.040	0.009	mg/L	1.0	0.020	105	90-110	3	10

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BA53016 - Nitrate 353.2 by seal										
Matrix Spike Dup (BA53016-MSD2)		**Source: 1500960-07**			Prepared & Analyzed: 01/30/15 12:00					
Nitrate+Nitrite (N)	0.982	0.04	0.01	mg/L	1.0	0.0130	97	90-110	0.7	20
Ammonia as N	1.0	0.040	0.009	mg/L	1.0	0.018	102	90-110	1	10
Matrix Spike Dup (BA53016-MSD3)		**Source: 1501014-11**			Prepared & Analyzed: 01/30/15 12:00					
Nitrate+Nitrite (N)	1.02	0.04	0.01	mg/L	1.0	ND	102	90-110	4	20
Ammonia as N	1.0	0.040	0.009	mg/L	1.0	0.016	103	90-110	3	10
Matrix Spike Dup (BA53016-MSD4)		**Source: 1501024-07**			Prepared & Analyzed: 01/30/15 12:00					
Nitrate+Nitrite (N)	1.82	0.04	0.01	mg/L	1.0	0.887	94	90-110	1	20
Ammonia as N	1.0	0.040	0.009	mg/L	1.0	ND	104	90-110	2	10
Matrix Spike Dup (BA53016-MSD5)		**Source: 1500624-07**			Prepared & Analyzed: 01/30/15 12:00					
Nitrate+Nitrite (N)	0.986	0.04	0.01	mg/L	1.0	ND	99	90-110	2	20
Ammonia as N	1.0	0.040	0.009	mg/L	1.0	ND	102	90-110	1	10
Batch BA53027 - Nitrite SM 4500NO2-B by seal										
Blank (BA53027-BLK1)					Prepared & Analyzed: 01/30/15 16:32					
Nitrite (as N)	0.01 U	0.04	0.01	mg/L						
LCS (BA53027-BS1)					Prepared & Analyzed: 01/30/15 16:33					
Nitrite (as N)	0.0774	0.04	0.01	mg/L	0.080		97	90-110		
Matrix Spike (BA53027-MS1)		**Source: 1500624-01**			Prepared & Analyzed: 01/30/15 16:33					
Nitrite (as N)	0.123 J2	0.04	0.01	mg/L	0.10	0.0826	40	77-119		
Matrix Spike Dup (BA53027-MSD1)		**Source: 1500624-01**			Prepared & Analyzed: 01/30/15 16:34					
Nitrite (as N)	0.122 J2	0.04	0.01	mg/L	0.10	0.0826	40	77-119	0.6	20

Hazen and Sawyer
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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BA53030 - BOD										
Blank (BA53030-BLK1)					Prepared: 01/30/15 Analyzed: 02/04/15 10:06					
Carbonaceous BOD	2 U	2	2	mg/L						
LCS (BA53030-BS1)					Prepared: 01/30/15 Analyzed: 02/04/15 10:06					
Carbonaceous BOD	181	2	2	mg/L	200		91	85-115		
LCS Dup (BA53030-BSD1)					Prepared: 01/30/15 Analyzed: 02/04/15 10:06					
Carbonaceous BOD	207	2	2	mg/L	200		104	85-115	13	200
Duplicate (BA53030-DUP1)		**Source: 1501031-01**			Prepared: 01/30/15 Analyzed: 02/04/15 10:06					
Carbonaceous BOD	280	2	2	mg/L		270			2	25
Batch BB50203 - TSS prep										
Blank (BB50203-BLK1)					Prepared: 02/02/15 Analyzed: 02/03/15 15:57					
Total Suspended Solids	1 U	1	1	mg/L						
LCS (BB50203-BS1)					Prepared: 02/02/15 Analyzed: 02/03/15 15:57					
Total Suspended Solids	54.2	1	1	mg/L	50		108	85-115		
Duplicate (BB50203-DUP1)		**Source: 1501031-01**			Prepared: 02/02/15 Analyzed: 02/03/15 15:57					
Total Suspended Solids	95.0	1	1	mg/L		88.0			8	30
Batch BB50205 - Digestion for TP and TKN										
Blank (BB50205-BLK1)					Prepared: 02/02/15 Analyzed: 02/09/15 15:05					
Phosphorous - Total as P	0.010 U	0.040	0.010	mg/L						
Total Kjeldahl Nitrogen	0.05 U	0.20	0.05	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 BB50205 - Digestion for TP and TKN										
LCS (BB50205-BS1)					Prepared: 02/02/15 Analyzed: 02/09/15 15:05					
Total Kjeldahl Nitrogen	1.02	0.20	0.05	mg/L	1.0		102	90-110		
Phosphorous - Total as P	1.10	0.040	0.010	mg/L	1.0		110	90-110		
Matrix Spike (BB50205-MS1)		**Source: 1500624-06**			Prepared: 02/02/15 Analyzed: 02/09/15 15:05					
Total Kjeldahl Nitrogen	1.08	0.20	0.05	mg/L	1.0	0.0810	100	90-110		
Phosphorous - Total as P	1.07	0.040	0.010	mg/L	1.0	0.0710	100	90-110		
Matrix Spike (BB50205-MS2)		**Source: 1500624-07**			Prepared: 02/02/15 Analyzed: 02/09/15 15:05					
Phosphorous - Total as P	1.09	0.040	0.010	mg/L	1.0	0.0550	103	90-110		
Total Kjeldahl Nitrogen	1.20 J2	0.20	0.05	mg/L	1.0	ND	120	90-110		
Matrix Spike Dup (BB50205-MSD1)		**Source: 1500624-06**			Prepared: 02/02/15 Analyzed: 02/09/15 15:05					
Total Kjeldahl Nitrogen	1.09	0.20	0.05	mg/L	1.0	0.0810	101	90-110	0.7	20
Phosphorous - Total as P	1.08	0.040	0.010	mg/L	1.0	0.0710	101	90-110	1	25
Matrix Spike Dup (BB50205-MSD2)		**Source: 1500624-07**			Prepared: 02/02/15 Analyzed: 02/09/15 15:05					
Total Kjeldahl Nitrogen	1.12 J2	0.20	0.05	mg/L	1.0	ND	112	90-110	6	20
Phosphorous - Total as P	1.12	0.040	0.010	mg/L	1.0	0.0550	106	90-110	3	25
Batch BB50912 - alkalinity										
Blank (BB50912-BLK1)					Prepared & Analyzed: 02/09/15 11:08					
Total Alkalinity	2.0 U	8.0	2.0	mg/L						
LCS (BB50912-BS1)					Prepared & Analyzed: 02/09/15 11:18					
Total Alkalinity	130	8.0	2.0	mg/L	120		107	90-110		

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BB50912 - alkalinity										
Matrix Spike (BB50912-MS1)		**Source: 1501186-01**			Prepared & Analyzed: 02/09/15 12:34					
Total Alkalinity	250	8.0	2.0	mg/L	120	130	98	80-120		
Matrix Spike Dup (BB50912-MSD1)		**Source: 1501186-01**			Prepared & Analyzed: 02/09/15 12:39					
Total Alkalinity	250	8.0	2.0	mg/L	120	130	99	80-120	0.2	26
Batch BB51017 - Ion Chromatography 300.0 Prep										
Blank (BB51017-BLK1)					Prepared & Analyzed: 02/10/15 16:49					
Sulfate	0.20 U	0.60	0.20	mg/L						
Surrogate: Dichloroacetate	*1.01*			*mg/L*	*1.0*		*101*	*78-120*		
LCS (BB51017-BS1)					Prepared & Analyzed: 02/10/15 17:01					
Sulfate	9.25	0.60	0.20	mg/L	9.0		103	85-115		
Surrogate: Dichloroacetate	*1.05*			*mg/L*	*1.0*		*105*	*78-120*		
LCS Dup (BB51017-BSD1)					Prepared & Analyzed: 02/10/15 17:12					
Sulfate	9.01	0.60	0.20	mg/L	9.0		100	85-115	3	200
Surrogate: Dichloroacetate	*1.00*			*mg/L*	*1.0*		*100*	*78-120*		
Matrix Spike (BB51017-MS1)		**Source: 1500624-05**			Prepared & Analyzed: 02/11/15 13:49					
Sulfate	122 L	0.60	0.20	mg/L	9.0	109	150	85-115		
Surrogate: Dichloroacetate	*0.900*			*mg/L*	*1.0*		*90*	*78-120*		
Matrix Spike (BB51017-MS2)		**Source: 1501393-07**			Prepared & Analyzed: 02/11/15 12:41					
Sulfate	912	60	20	mg/L	900	92.9	91	85-115		
Surrogate: Dichloroacetate	*1.11*			*mg/L*	*1.0*		*111*	*78-120*		

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BB51104 - COD prep										
Blank (BB51104-BLK1)					Prepared & Analyzed: 02/11/15 15:55					
Chemical Oxygen Demand	10 U	25	10	mg/L						
Blank (BB51104-BLK2)					Prepared & Analyzed: 02/11/15 15:55					
Chemical Oxygen Demand	10 U	25	10	mg/L						
LCS (BB51104-BS1)					Prepared & Analyzed: 02/11/15 15:55					
Chemical Oxygen Demand	45	25	10	mg/L	50		90	90-110		
LCS (BB51104-BS2)					Prepared & Analyzed: 02/11/15 15:55					
Chemical Oxygen Demand	49	25	10	mg/L	50		98	90-110		
Matrix Spike (BB51104-MS1)		**Source: 1500624-07**			Prepared & Analyzed: 02/11/15 15:55					
Chemical Oxygen Demand	50	25	10	mg/L	50	ND	100	85-115		
Matrix Spike (BB51104-MS2)		**Source: 1500627-20**			Prepared & Analyzed: 02/11/15 15:55					
Chemical Oxygen Demand	47	25	10	mg/L	50	ND	94	85-115		
Matrix Spike Dup (BB51104-MSD1)		**Source: 1500624-07**			Prepared & Analyzed: 02/11/15 15:55					
Chemical Oxygen Demand	49	25	10	mg/L	50	ND	98	85-115	2	32
Matrix Spike Dup (BB51104-MSD2)		**Source: 1500627-20**			Prepared & Analyzed: 02/11/15 15:55					
Chemical Oxygen Demand	49	25	10	mg/L	50	ND	98	85-115	4	32
Batch BB51215 - Ion Chromatography 300.0 Prep										
Blank (BB51215-BLK1)					Prepared & Analyzed: 02/12/15 15:20					
Sulfate	0.20 U	0.60	0.20	mg/L						
Surrogate: Dichloroacetate	*1.04*			*mg/L*	*1.0*		*104*	*78-120*		

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BB51215 - Ion Chromatography 300.0 Prep										
LCS (BB51215-BS1)					Prepared & Analyzed: 02/12/15 15:31					
Sulfate	9.35	0.60	0.20	mg/L	9.0		104	85-115		
Surrogate: Dichloroacetate	*1.06*			*mg/L*	*1.0*		*106*	*78-120*		
LCS Dup (BB51215-BSD1)					Prepared & Analyzed: 02/12/15 15:42					
Sulfate	8.93	0.60	0.20	mg/L	9.0		99	85-115	5	200
Surrogate: Dichloroacetate	*1.01*			*mg/L*	*1.0*		*101*	*78-120*		
Matrix Spike (BB51215-MS1)		**Source: 1501552-01**			Prepared & Analyzed: 02/13/15 10:20					
Sulfate	9.97	0.60	0.20	mg/L	9.0	1.54	94	85-115		
Surrogate: Dichloroacetate	*1.08*			*mg/L*	*1.0*		*108*	*78-120*		
Matrix Spike (BB51215-MS2)		**Source: 1501213-01**			Prepared & Analyzed: 02/12/15 20:24					
Sulfate	196	6.0	2.0	mg/L	90	99.0	108	85-115		
Surrogate: Dichloroacetate	*1.04*			*mg/L*	*1.0*		*104*	*78-120*		

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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 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.

L	Off-scale high. Result exceeded highest calibration standard.
J2	Quality control value for accuracy was outside control limits.

Questions regarding this report should be directed to :

Kathryn Nordmark
Telephone (813) 855-1844 FAX (813) 855-2218
Kathryn@southernanalyticallabs.com

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

SAL Project No. 1500624

Client Name	Contact / Phone:
Hazen and Sawyer	
Project Name / Location: BHS6 SE#9	
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	500mLP, Cool Total Alkalinity, TSS, CBOD, NOx, SO_4	125mLP, H_2SO_4 COD, TKN, NH_3, TP	500mLP, NaOH, Zn Acetate H_2S	500mLP, Cool Total Alkalinity, TSS, CBOD, NOx	125mLP, H_2SO_4 COD, TKN, NH_3					Field pH	Field Temperature	Field Conductivity	Field DO			No. of Containers (Total per each location)
01	BHS6-STE	1/29	10:36	WW		X	2	1	1							7.35	16.4	1137	.33			
02	BHS5-DP02	1/29	11:22	WW		X				1	1											
03	BHS6-ST1&2a	1/29	10:48	WW		X	2	1	1							6.31	14.3	865	1.78			
04	BHS6-ST1&2a-DUP	1/29	10:50	WW		X	2	1	1							6.31	14.2	864	1.64			
05	BHS6-ST2b-P	1/29	10:24	WW		X	2	1	1							6.51	13.9	938	1.47			
06	BHS6-EB	1/29	11:04	R		X	2	1	1							7.39	17.0	3.4	9.13			
07	BHS6-FB	1/29	11:14	R		X	2	1	1							7.22	16.9	2.1	9.17			

Containers Prepared/ Relinquished:	Date/Time: 0900 01/19/15	Received:	Date/Time: 1/22/15 15:00
Relinquished:	Date/Time: 1/29/15 13:30	Received: FedEx	Date/Time:
Relinquished: FedEx	Date/Time:	Received:	Date/Time: 1/30/15 1000
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact?	Y N N/A
Samples intact upon arrival?	Y N N/A
Received on ice? Temp 2.6	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:
Ship to:
Harmon Harden
1825 Cottage Grove Rd.
Talahassee, FL 32303 850-212-4378

1500624

Chain of Custody xls
Rev Date 11/19/01

Chain of Custody

2.6

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 #: 25692
Report Date: February 2, 2015
NELAC#: E81350
FDEPQA#: 920087G
Project#: 211296
Sampled By: Mark Busby
Sample Site: [redacted] Drive Septic System
Sample Date: 01-29-15

Table 1. Samples received 01-29-15.

	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:	01-29-15		01-29-15	
Analysis Time:	14:40		14:40	
Analyst:	AL		AL	
Sample Location/Time:				
Lab Number:				
ST2-P, 10:24				
#127670	108	2	98	2
STE, 10:36				
#127671	210,000	10,000	180,000	10,000
ST1, 10:48				
#127672	12,000	1,000	11,000	1,000
ST1 Dup, 10:50				
#127673	8,000	1,000	7,300	100
Equipment Blank, 11:04				
#127674	2.0 U	2	2.0 U	2
Field Blank, 11:14				
#127675	2.0 U	2	2.0 U	2

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.

Amanda Lawhon 2-2-15
Amanda Lawhon, QA Officer

Ackuritlabs, Inc.

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

№ 125692

CHAIN OF CUSTODY RECORD

Page 1 of 1

CLIENT NAME & ADDRESS: Hazen & Sawyer

LAB PROJECT #: 211296

PROJECT NAME: [redacted] Septic System

CONTACT PERSON:

	PRESERVATIVE									PLASTIC CONTAINERS								GLASS CONTAINERS									
SAMPLE 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: DATE: 1-25-15 TIME: 1640 RECEIVED BY: Mark Busby DATE: 1-28-15 TIME: 1650

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

SAMPLE COLLECTION 2015

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 Ecoli								LAB ID#
#1	1-29-15	1024	STE-P	WW	G	1	X	X							127670
2		1036	STE												127671
3		1048	ST1												127672
4		1050	ST1 Dup												127673
5		1104	Equ. Blank												127674
6	↓	1114	Field Blank	↓	↓	↓	↓	↓							127675

COMMENTS: KEB

SAMPLES RECEIVED: ICED Y / N

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

RELINQUISHED BY(SIGNATURE) / AFFILIATION / DATE & TIME: Mark Busby / HAZ / 1-29-15 1410

RECEIVED BY(SIGNATURE) / AFFILIATION / DATE & TIME: Amanda Lawton 1-29-15 @ 1410

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

Appendix B: Operation & Maintenance Log

Table B.1
Operation and Maintenance Log

Date	Description
9/12/2013	Checked system. Met with contractor regarding second system construction.
11/5/2013	Started installation of second passive treatment system.
11/6/2013	Finished installation
11/14/2013	High water alarm in pump tank. Pump was not working.
	Contractor repaired loose wiring. Pump had not run from time of installation.
	Cleaned two Stage 1 sprayers clogged with construction debris.
11/20/2013	Preliminary Sample Event No. 1 (STE and ST1).
	No ponding in drainfield observation ports.
	Cleaned all four Stage 1 sprayers - not clogged but were not spraying properly.
12/4/2013	Preliminary Sample Event No. 2
	Ponding of 1.5 inches in drainfield obs. port #2, other three ports were dry.
12/20/2013	Preliminary sampling indicated nitrification was insufficient
	Checked and cleaned Stage 1 sprayers.
	Even after cleaning, majority of spray going straight down.
12/21/2013	Rotated Stage 1 sprayers so they are spraying straight up on the tank lid.
	Observed better coverage of Stage 1 media
1/9/2014	Site visit. System ok.
	Observed that vents on Stage 1 tank were pushed down (kids had pushed down).
	Vents were pulled back up and resealed with existing mastic.
	The owner has not mentioned any odor concerns.
1/22/2014	Sample Event No. 1
3/7/2014	Site visit. System ok. Observed one of the sprayers had a broken tip.
	Ponding of ¼ inch in observation port #2, all others dry.
3/20/2014	Removed existing sprayers. Installed 3 Orenco sprayers.
3/24/2014	Site visit. System ok. Ponding of 1/4 inch in observation port #2, all others dry.
	Sprayers working well.
4/10/2014	Sample Event No. 2
	Water level within Stage 1&2a tank elevated approximately 14-inches.
4/10/2014	Installed piezometer in the Stage 1&2a tank.
4/14/2014	Attempt to clear clog in the inlet pipe to Stage 2b tank with plumbing snake.
4/16/2014	Cleared clog in inlet pipe to Stage 2b tank with compressed air and rubber bladder.
	Water level in piezometer in Stage 1&2a tank dropped by approximately 12 inches.
4/28/2014	System Check. Ponding of 1/4 inch in observation port #2, all others dry.
	Sprayers working well. Water level in ST1 sample port elevated by less than 2 inches.

Table B.1 (con't)
Operation and Maintenance Log

5/7/2014	Sample Event No. 3.
	Water level in ST1 sample port elevated by approximately 4 inches.
5/27/2014	System Check
	Water level in ST1 sample port elevated by approximately 8 inches
5/30/2014	Started repair of sulfur tank inlet pipe. Drained tank, removed a portion of sulfur.
5/31/2014	Finished removing sulfur from the tank to access inlet pipe at the bottom of media.
	Repaired inlet pipe to sulfur tank and placed sulfur back into the tank.
6/23/2014	Sample Event No. 4
	Water level in Stage 1 tank at normal operational level.
7/21/2014	System Check
	Water level in Stage 1 tank elevated by approximately 1 inch.
8/27/2014	Sample Event No. 5
	Water level in Stage 1 tank elevated by approximately 2 inches.
9/26/2014	System Check
	Water level in Stage 1 tank elevated by approximately 8 inches.
10/3/2014	System Check
	Water level in Stage 1 tank elevated by approximately 7 inches.
	Two end sprayers are spinning slow, not full coverage.
10/7/2014	System repair
	Began installation of cleanout on outflow pipe of Stage 1&2a tank.
10/9/2014	System repair
	Finished installation of cleanout on outflow pipe of Stage 1&2a tank.
10/16/2014	System repair
	Drilled holes in Stage1&2a effluent collection pipe, inside of Stage 1&2a tank.
	Cleaned PNRS flowmeter. This increased dose volume back to normal level.
10/19/2014	System repair
	Drilled additional holes in Stage1&2a effluent collection pipe, inside tank.
10/20/2014	System repair
	Replaced all three sprayers with new ones.
10/30/2014	Sample Event No. 6
	Water level in Stage1&2a tank at normal operational level.
11/26/2014	System Check
	Water level in Stage1&2a tank at normal operational level.
12/29/2014	Sample Event No. 7
	Water level in Stage1&2a tank at normal operational level.
1/16/2015	System Check
	Water level in Stage1&2a tank at normal operational level.
1/29/2015	Sample Event No. 8
	Water level in Stage1&2a tank at normal operational level.

Appendix C: Vericomm PLC Data

System Status			1/29/2015 11:52	1/25/2015 1:14	1/16/2015 14:36	1/5/2015 22:06
Point	Description	Status			Status	Status
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	Overide
6	Active Off Time	Automatic	180.0 Minutes	180.0 Minutes	180.0 Minutes	30.0 Minutes
7	Active On Time	Automatic	2.0 Minutes	2.0 Minutes	2.0 Minutes	2.0 Minutes
9	Pump Mode	Automatic	OffCycl	OffCycl	OffCycl	OffCycl
10	Pump Status	Automatic	Off	Off	Off	Off
Settings						
Point	Description	Status	Value	Value	Value	Value
17	Off Cycle Time	Constant/Setpoint	180.0 Minutes	180.0 Minutes	180.0 Minutes	180.0 Minutes
18	On Cycle Time	Constant/Setpoint	2.0 Minutes	2.0 Minutes	2.0 Minutes	2.0 Minutes
19	Override Off Cycle Time	Constant/Setpoint	30.0 Minutes	30.0 Minutes	30.0 Minutes	30.0 Minutes
20	Override On Cycle Time	Constant/Setpoint	2.0 Minutes	2.0 Minutes	2.0 Minutes	2.0 Minutes
21	Minimum Override Cycles	Automatic	3.0 Cycles	3.0 Cycles	3.0 Cycles	3.0 Cycles
23	Override Cycle Limit per Day	Constant/Setpoint	21.0 Cycles	21.0 Cycles	21.0 Cycles	21.0 Cycles
24	Time Limit per Day	Constant/Setpoint	200.0 Minutes	200.0 Minutes	200.0 Minutes	200.0 Minutes
25	High Level Pump Test	Automatic	5.0 Minutes	5.0 Minutes	5.0 Minutes	5.0 Minutes
28	Alarm Update Interval	Timing Override	240.0 Minutes	480.0 Minutes	120.0 Minutes	240.0 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 (at the time of Vericomm call-in)						
Point	Description	Status	Value	Value	Value	Value
49	Pump Run Time Today	Automatic	8.1 Minutes	4.1 Minutes	10.1 Minutes	23.2 Minutes
50	Override Cycles Today	Automatic	0.0	3.0	0.0	2.0
51	Pump Cycles Today	Automatic	4.0 Cycles	3.0 Cycles	5.0 Cycles	10.0 Cycles
52	Average Run Time per Cycle Today	Automatic	2.0 Minutes	1.4 Minutes	2.0 Minutes	2.3 Minutes
54	Brownouts Today	Automatic	0.0	0.0	0.0	0.0

30-Day History Data			1/29/2015 11:52	1/25/2015 1:14	1/16/2015 14:36	1/5/2015 22:06
Point	Description	Status	Value	Value	Value	Value
65	30 Day Average Run Time per Day	Automatic	17.8 Minutes	17.3 Minutes	17.5 Minutes	16.7 Minutes
66	30 Day Average Override Cycles per Day	Automatic	2.1 Cycles	1.6 Cycles	1.8 Cycles	1.5 Cycles
67	30 Day Average Cycles per Day	Automatic	8.6 Cycles	8.2 Cycles	8.3 Cycles	7.9 Cycles
68	30 Day Average Run Time per Cycle	Automatic	2.1 Minutes	2.1 Minutes	2.1 Minutes	2.1 Minutes
71	30 Day Total Pump Run Time	Automatic	532.8 Minutes	517.7 Minutes	526.3 Minutes	500.9 Minutes
72	30 Day Total Override Cycles	Automatic	62.0 Cycles	49.0 Cycles	55.0 Cycles	44.0 Cycles
73	30 Day Total Cycles	Automatic	257.0 Cycles	247.0 Cycles	249.0 Cycles	236.0 Cycles
76	30 Day Total Brownouts	Automatic	0.0	0.0	0.0	0.0
Totalized Pump Data						
Point	Description	Status	Value	Value	Value	Value
82	Pump Total Run Time	Automatic	1702.1 Hours	1700.4 Hours	1697.5 Hours	1694.0 Hours
83	Pump Total Cycles	Automatic	51217.0 Cycles	51166.0 Cycles	51084.0 Cycles	50981.0 Cycles
Miscellaneous						
Point	Description	Status	Value	Value	Value	Value
145	Pump On Auto	Automatic	Off	Off	Off	Off
147	Pump Test Today	Automatic	Off	On	Off	On
148	Pump Check Enable	Automatic	Off	Off	Off	Off
149	Total Override Cycles	Automatic	0.0	0.0	0.0	2.0
150	High Level Condition	Automatic	Off	Off	Off	Off
151	Leak Check Enable	Automatic	On	On	On	On
152	Brownout State	Automatic	Off	Off	Off	Off
153	Test Mode	Automatic	Off	Off	Off	Off
Alarm Points						
Point	Description	Status	Value	Value	Value	Value
161	General Alarm	Automatic	Off	Off	Off	Off
162	New Alarm	Automatic	Off	Off	Off	Off
163	Update Central Enable	Automatic	On	On	On	On
167	Page Alarm Start	Automatic	Off	Off	Off	Off
168	Pager Signal	Override Off	Off	Off	Off	Off
169	Local Alarm Start	Automatic	Off	Off	Off	Off
170	Local Alarm Silence	Automatic	Off	Off	Off	Off
Inputs & Outputs						
Point	Description	Status	Value	Value	Value	Value
177	High Level/Override Timer Float Input	Automatic	Off	Off	Off	Off
178	Timer Float Input	Automatic	On	On	On	On
179	Redundant Off Float & Low Level Alarm Input	Automatic	On	On	On	On
181	Push To Silence Input	Automatic	Off	Off	Off	Off
182	Auxiliary Contact Input	Automatic	Off	Off	Off	Off
186	Pump Output	Automatic	Off	Off	Off	Off
188	Alarm Light Output	Automatic	Off	Off	Off	Off
189	Audible Alarm Output	Automatic	Off	Off	Off	Off