



Florida Onsite Sewage Nitrogen Reduction Strategies Study

Task B.7

B-HS7 Field System Monitoring Report No. 8

Progress Report

February 2015

442-27-001

HAZEN AND SAWYER
Environmental Engineers & Scientists

In association with:



AET
Applied Environmental Technology

**Otis Environmental
Consultants, LLC**

Florida Onsite Sewage Nitrogen Reduction Strategies Study

TASK B.7 PROGRESS REPORT

B-HS7 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
4042 Bald Cypress Way Bin #A-08
Tallahassee, FL 32399-1713

FDOH Contract CORCL

February 2015

Prepared by:

HAZEN AND SAWYER
Environmental Engineers & Scientists

In Association With:

AET
Applied Environmental Technology



B-HS7 Field System Monitoring Report No. 8

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 Task A.26. 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 sample event of the passive nitrogen reduction system at a home site B-HS7 in Marion County, Florida.

2.0 Purpose

This monitoring report documents data collected from the eighth B-HS7 monitoring and sampling event conducted on February 4, 2015 (Experimental Day 442). This monitoring event consisted of conducting 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 fifteen 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-HS7 field site is located in Marion County, FL. The nitrogen reducing onsite treatment system for the single family residence was installed in November 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 existing 900 gallon dual chamber septic tank will continue to provide primary treatment for the new PNRS system. The PNRS system consists of a 300 gallon concrete pump tank, low-pressure distribution network, and an in-ground Stage 1 nitrification biofilter directly over

c:\4237-001R004\Wpdocs\Report\Final

a lined Stage 2 denitrification biofilter. The treated effluent is discharged into the soil around the perimeter of the liner. There were no changes to the physical configuration of the treatment system or system operation since the last monitoring report.

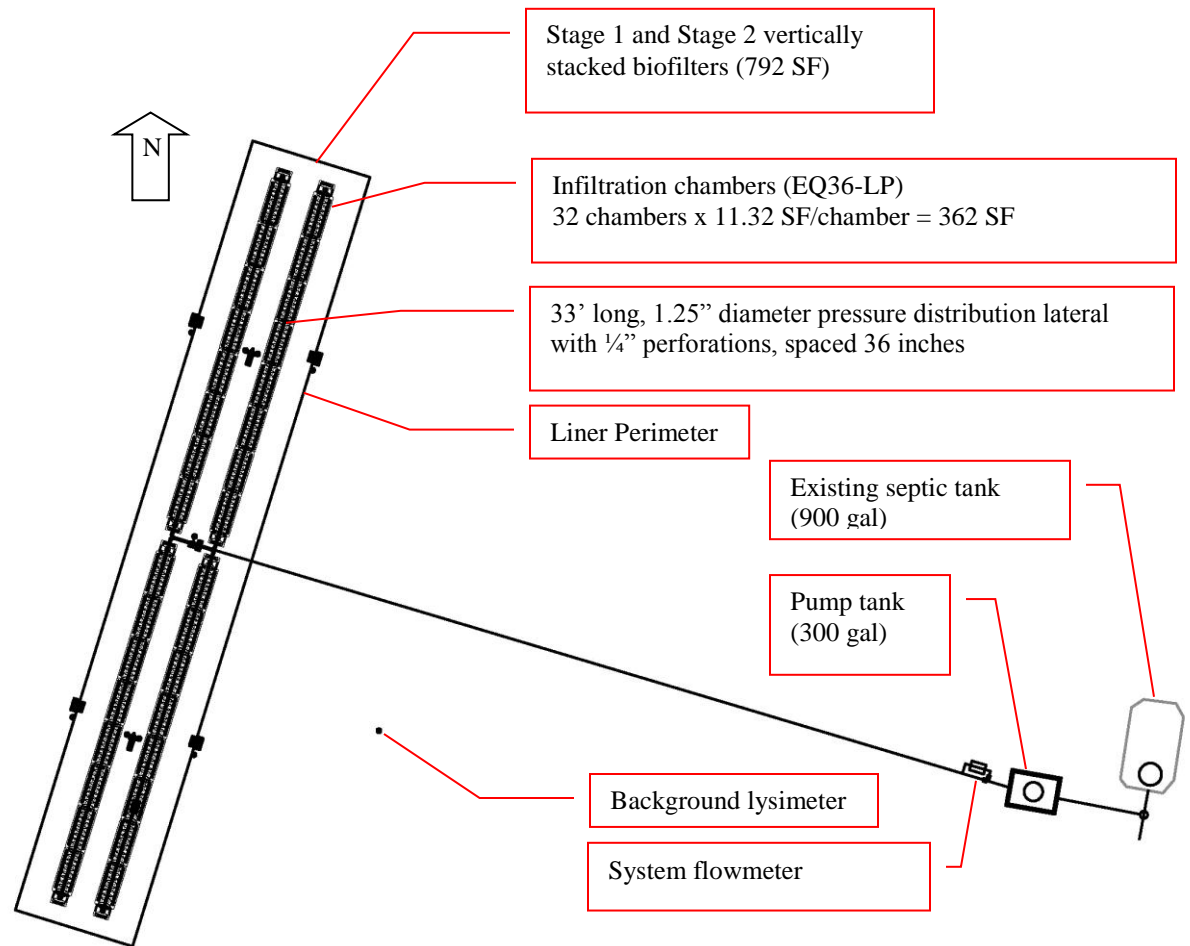


Figure 1
Plan view of B-HS7 System Layout

February 2015

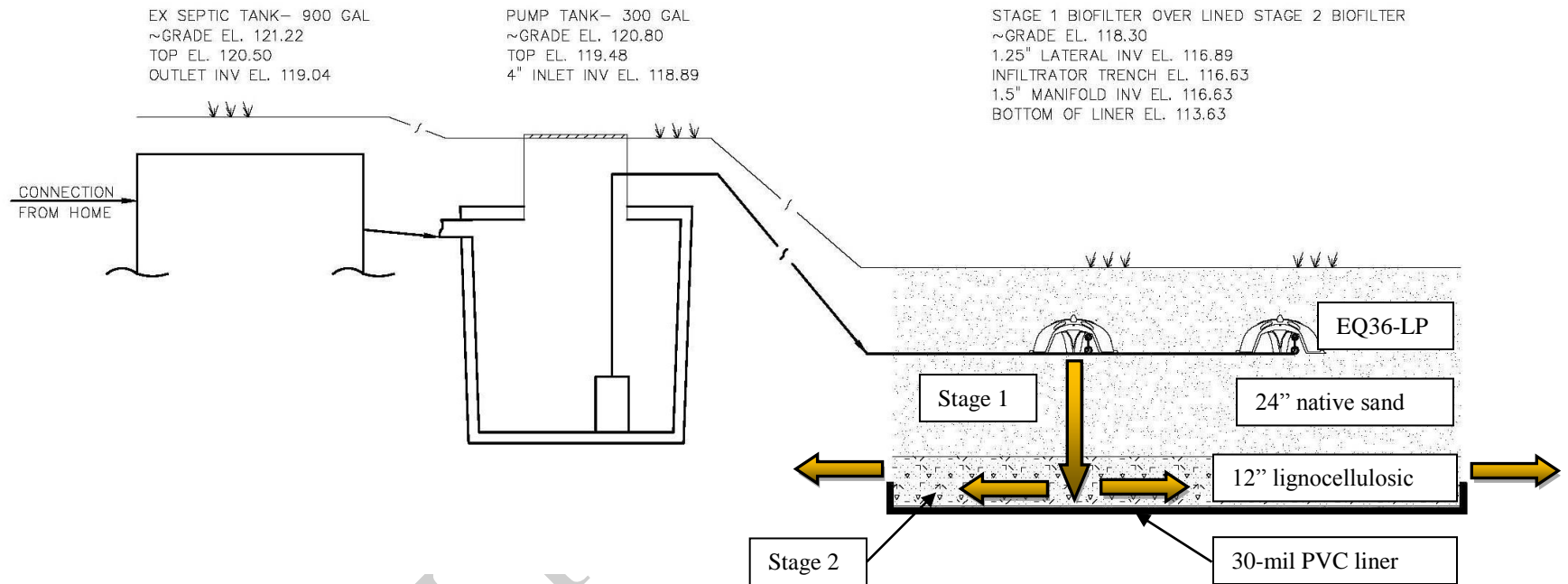


Figure 2
Flow Schematic of B-HS7 PNRS Installed in Marion County

3.3 Monitoring and Sample Locations and Identification

The monitoring points are shown in Figure 3. The monitoring points used for treatment evaluation are shown on a cross section in the southwest side of the treatment area on Figure 4.

PRELIMINARY

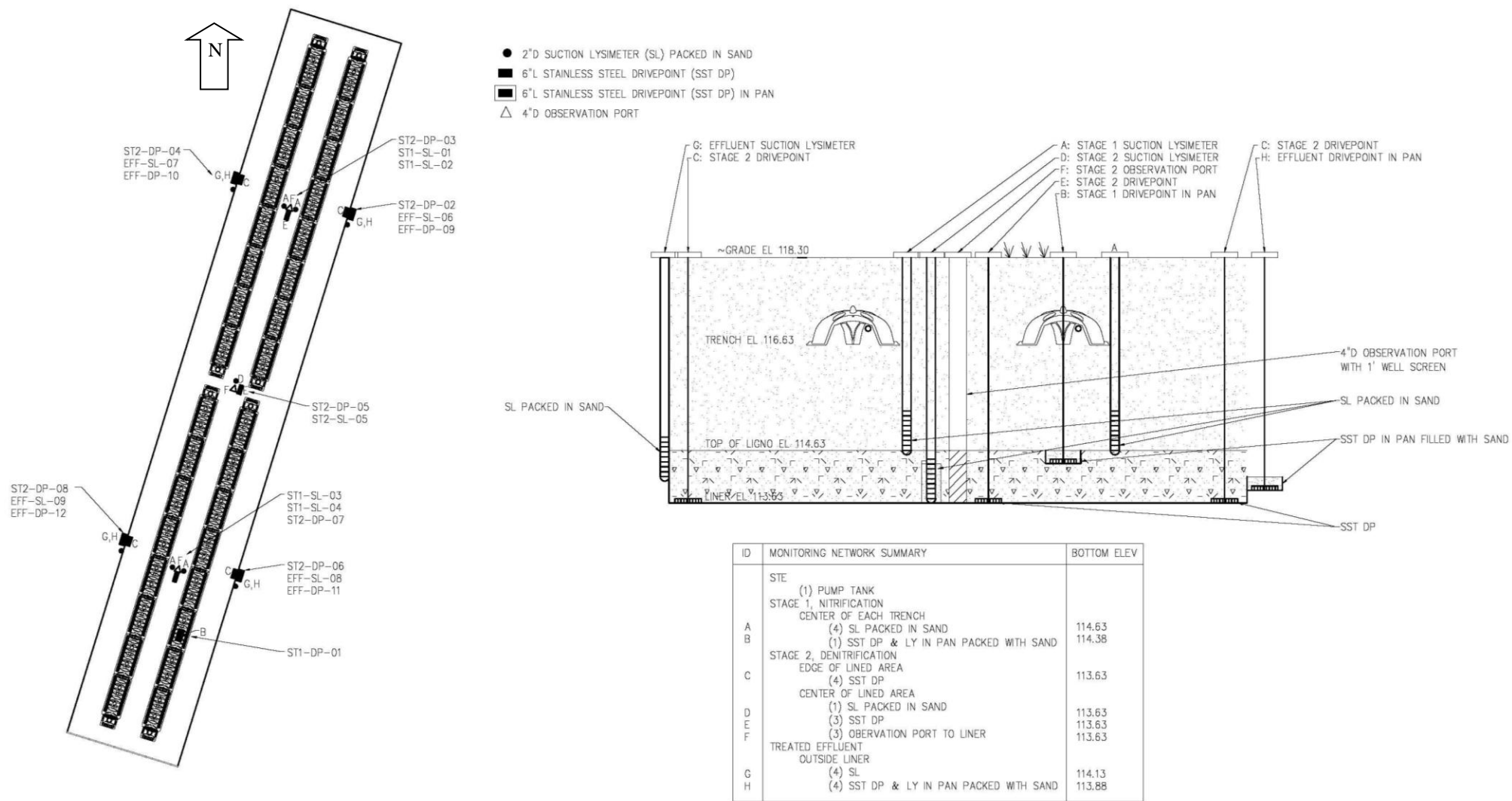


Figure 3
B-HS7 Sample and Monitoring Locations

February 2015

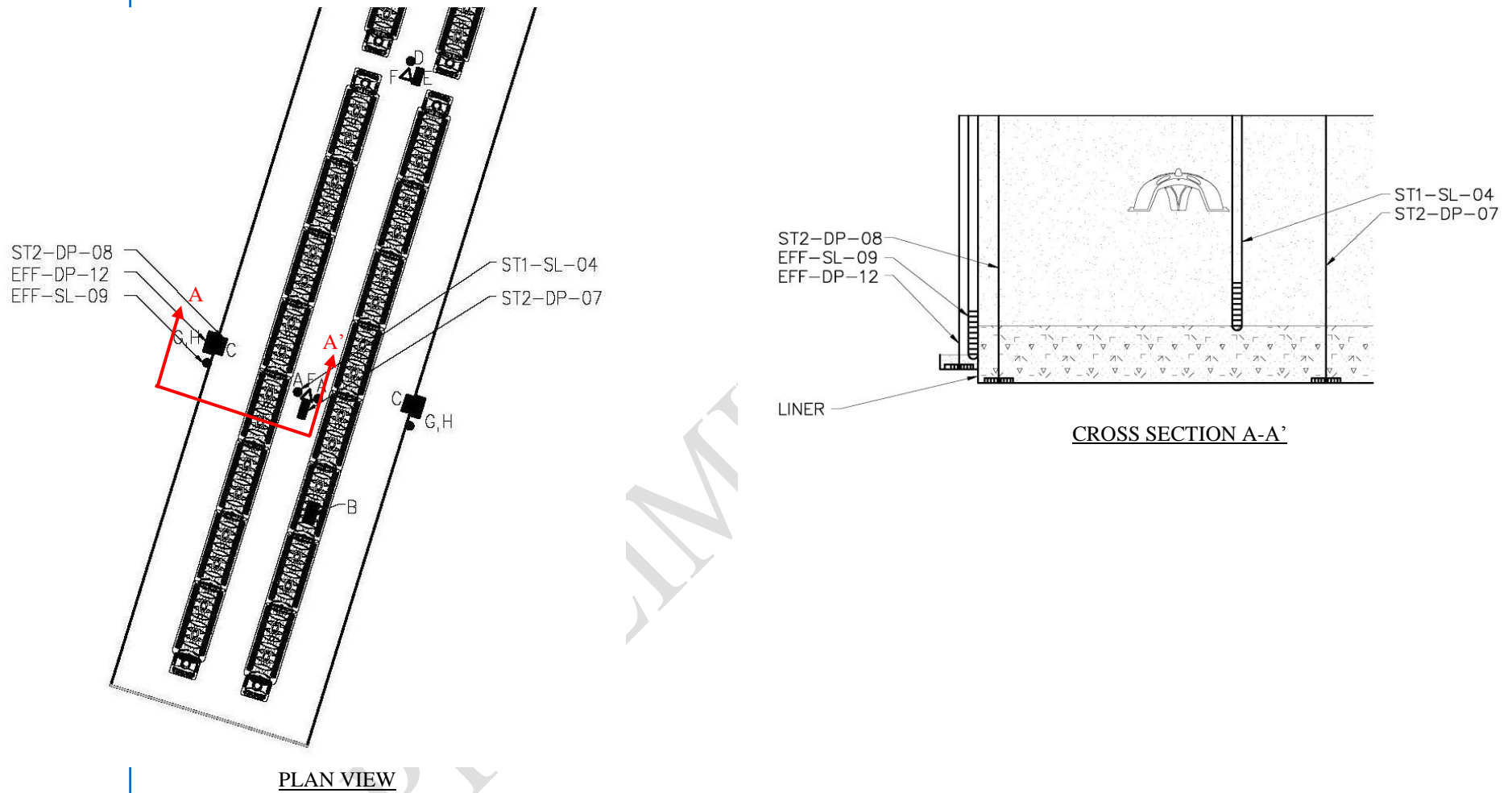


Figure 4
B-HS7 Treatment Evaluation Cross Section

Primary Effluent: Household wastewater enters the 1st chamber of the primary tank and exits the second chamber as septic tank effluent (STE) through an effluent screen. Screened effluent is directed to the pump tank which contains the pump and float switches. The first monitoring point, B-HS7-STE, is the STE sampled approximately 1.5 feet below the surface of the pump tank (Figure 5). Samples from monitoring point B-HS7-STE are the whole household wastewater after it has had some residence time in the primary tank.

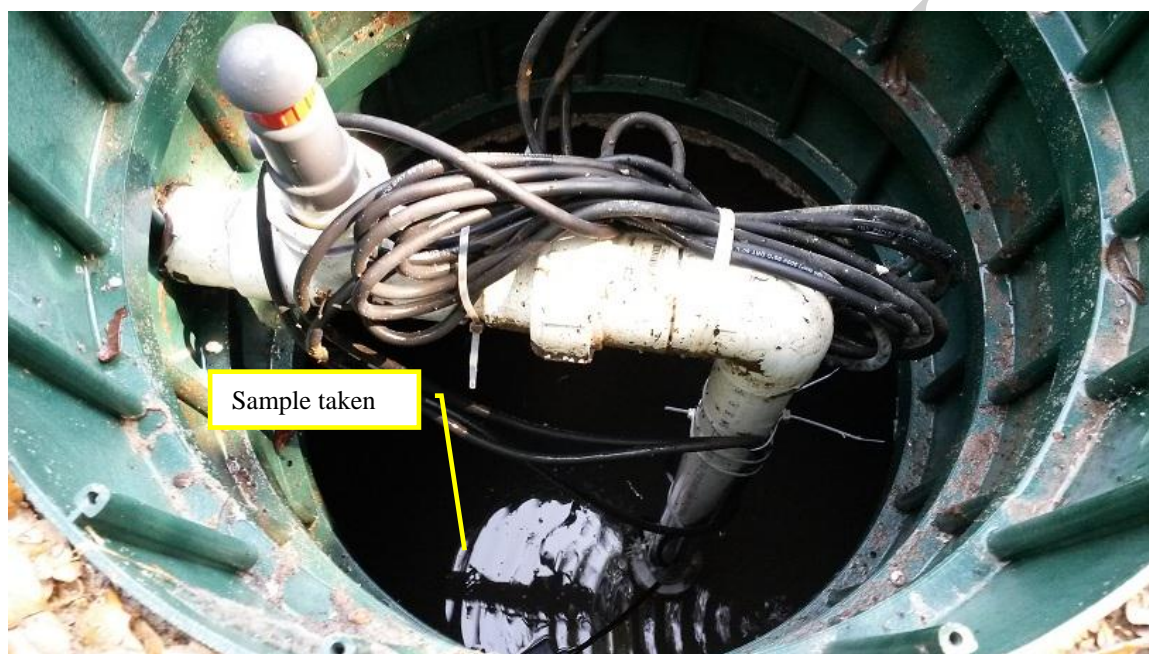


Figure 5
Pump Tank (B-HS7-STE sample)

Stage 1 Effluent: STE in the pump tank is discharged through a low-pressure distribution network installed inside Infiltrator EQ36-LP™ chambers. The low-pressure distribution network consists of a central manifold design with (4) 33-foot long, 1.25-inch diameter perforated laterals installed along the top of the 24-inch native sand media (unsaturated Stage 1 biofilter). In the Stage 1 biofilter, wastewater percolates downward through the unsaturated native sand media where nitrification occurs. Ceramic cup suction lysimeters (BHS7-ST1-SL-01, BHS7-ST1-SL-02, BHS7-ST1-SL-03, and BHS7-ST1-SL-04) were installed with the cup at the bottom of the native sand layer to represent water quality after downward passage through the sand layer (see Figure 6). In addition, one stainless steel drivepoint (BHS7-ST1-DP-01) was installed in a shallow pan at the bottom of the native sand layer (see Figure 7). However, during this sample

event the drivepoint was not sampled. The Stage 1 monitoring point in the treatment evaluation cross section is BHS7-ST1-SL-04, which is located in the center of the south end of the lined area.



Figure 6
Stage 1 biofilter effluent sample taken from suction lysimeter (BHS7-ST1-SL samples)

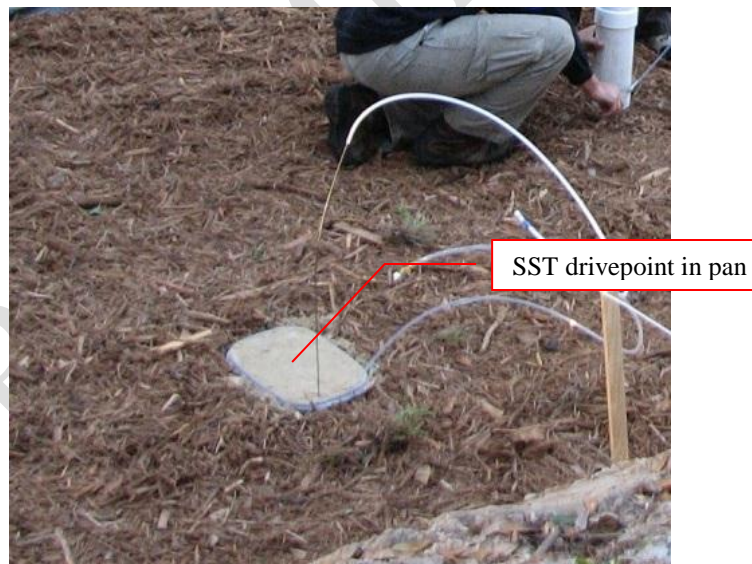


Figure 7
Stage 1 biofilter effluent sample taken from drivepoint in pan
(BHS7-ST1-DP-01 sample)

Stage 2 Effluent: Directly below the 24-inch native sand Stage 1 biofilter is a 12-inch layer of lignocellulosic media as a supplemental carbon source for denitrification (Stage 2 biofilter). This material is a blended urban waste wood from Wood Resource Recovery, Ocala, FL. The Stage 2 biofilter treatment area was prepared with a 30 mil PVC liner installed below the lignocellulosic media. The liner was installed with a 6 inch lip around the outside perimeter. Therefore, approximately 6-inches of the lignocellulosic media can reach saturation from applied wastewater, promoting oxygen depletion and denitrification of the nitrified effluent. At the bottom of the Stage 2 biofilter lignocellulosic media, directly above the liner, stainless steel drivepoint samplers were installed (see Figure 8) including: BHS7-ST2-DP-02, BHS7-ST2-DP-03, BHS7-ST2-DP-04, BHS7-ST2-DP-05, BHS7-ST2-DP-06, BHS7-ST2-DP-07, and BHS7-ST2-DP-08. The Stage 2 monitoring points in the treatment evaluation cross section are BHS7-ST2-DP-07 (which is located in the center of the south end of the lined area) and BHS7-ST2-DP-08 (which is located on the southwest edge of the lined area).



Figure 8
Stage 2 biofilter effluent sample taken from drivepoint (BHS7-ST2-DP samples)

Perimeter Monitoring Points: The treated effluent is discharged from the liner under saturated conditions by flowing over the lip of the liner and into the soil surrounding the perimeter of the lined area. Ceramic cup suction lysimeters (BHS7-EFF-SL-06, BHS7-EFF-SL-07, BHS7-EFF-SL-08, and BHS7-EFF-SL-09) were installed around the perimeter of the liner, with the bottom of the cup approximately 6-inches below the lip of the liner within the native sand (see Figure 9) to represent treated effluent. In addition, stainless steel drivepoints (BHS7-EFF-DP-09, BHS7-EFF-DP-10, BHS7-EFF-DP-11, BHS7-EFF-DP-12) were installed in shallow pans adjacent to the lip of the liner (see Figure 10). The treated effluent monitoring points in the treatment evaluation cross section are BHS7-EFF-SL-09 and BHS7-EFF-DP-12, which are located adjacent to the southwest lined area.

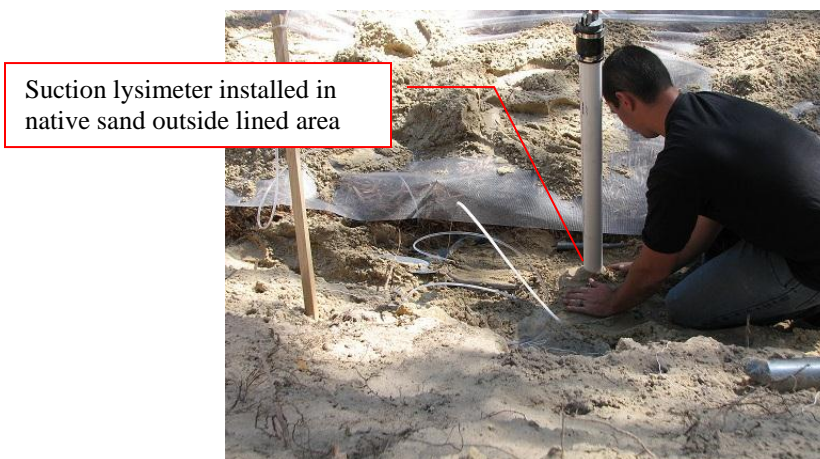


Figure 9
Treated effluent sample taken from suction lysimeter (BHS7-EFF-SL samples)



Figure 10
Treated effluent sample taken from drivepoint in pan (BHS7-EFF-DP samples)

3.4 Operational Monitoring

Start-up of the system occurred on November 19, 2013 (Experimental Day 0). However, during the 2013 Thanksgiving holiday, the homeowners projected having between thirty and forty additional people staying at the home. Therefore, since this was so soon after start-up, on November 26, 2013, the Bull Run™ diversion valve was flipped so that all the wastewater flow was diverted to the old drainfield. The diversion valve was flipped back to the PNRS system on December 2, 2013. Shortly thereafter, the homeowners planned a holiday party with a projected eighty people in attendance. Therefore on De-

cember 6, 2013, the diversion valve was flipped again so that all the wastewater flow was diverted to the old drainfield. The diversion valve was flipped back to the PNRS system on December 9, 2013, and the PNRS system has operated almost continually since that date. During July 2014, it was observed that the power breaker to the system had been flipped. This was likely due to a severe thunderstorm. With no power to the system, the pump had not run for several days, and the water elevation within the primary tank and pump tank was very high. Upon further inspection, the breaker that was installed within the panel was a GFI breaker. The contractor was contacted and came to the site to install a non-GFI breaker for the pump.

The eighth formal sampling event was conducted February 4, 2015 (Experimental Day 442). For this eighth formal sampling event, the water meter for the house and treatment system flow meters were read and recorded on February 4, 2015. The household water meter is located on the potable water line from the onsite well prior to entering the household plumbing following the water softener. The water meter does not include the irrigation water use. Therefore, the water meter reading should be indicative of the wastewater flow to the 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 low-pressure distribution network.

Three observation ports are installed along the centerline of the Stage 2 biofilter lined area (north, center and south). The observation ports are 4-inch diameter well screens that were installed with the bottom positioned on the liner. Therefore, the water level within the lined area can be monitored within the observation ports.



Figure 11
PNRS system flow meter

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 pump in the pump tank. There are no chemicals added to the system. However, the Stage 2 biofilter media (lignocellulosic) is “reactive” media which will be consumed during operation. The Stage 2 biofilter was initially filled with 12 inches of lignocellulosic media, which ostensibly will last for many years without replenishment or replacement.

3.6 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 February 4, 2015 (Experimental Day 442). A full suite of influent, intermediate and effluent water quality samples were collected from the system for water quality analysis. Samples were collected at each of the monitoring points described in Section 3.2. 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, a field blank (FB), equipment blank (EB), and field sample duplicates 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 field sample duplicates (BHS7-PUMP and SC-BHS7-ST1-SL-03) were collected

immediately subsequent to the regular samples. These samples were 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), ammonia nitrogen (NH₃-N), nitrate nitrogen (NO₃-N), nitrite nitrogen (NO₂-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. All analyses were performed by independent and fully NELAC certified analytical laboratory (Southern Analytical Laboratory). 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 Suspended Solids (TSS)	SM 2540D	1 mg/L
Volatile Suspended Solids (VSS)	SM 2540E	1 mg/L
Chloride	EPA 300.0	0.50 mg/L
Fecal Coliform (fecal)	SM9222D	2 ct/100mL
E.coli	SM9223B	2 ct/100mL

p:\44237-001R004\Wpdocs\Report\Final

4.0 Results and Discussion

4.1 Operational Monitoring

Table 2 provides a summary of the household water use since the household water meter installation on October 15, 2013. The treatment system flow meter readings for the B-HS7 field site are also summarized in Table 2. The operation and maintenance log which includes actions taken since start-up is provided in Appendix B.

Table 2
Summary of Flowmeters

Date and Time Read	Household Water Meter Reading	Average Daily Household Flow between readings	PNRS Flow Meter Reading	Average Daily PNRS Flow between readings
	Cumulative Volume (gallons)	gallons/day	Cumulative Volume (gallons)	gallons/day
10/15/2013 13:51	2.9	XX		
10/23/2013 12:20	1,186.9	149.2		
11/14/2013 8:50	3,602.5	110.5		
11/15/2013 14:40	3,800.0	158.9		
11/19/2013 14:18	4,997.5	300.5	652.0	PNRS Start-up
11/26/2013 10:30	7,901.4	424.4	2,480.0	267.2
11/26/2013	Flow to old drainfield			
12/2/2013	Flow to PNRS			
12/2/2013 9:45	9,148.6	209.0	2,480.0	0.0
12/6/2013 9:00	10,470.4	333.1	3,134.0	164.8
12/6/2013	Flow to old drainfield			
12/9/2013	Flow to PNRS			
12/10/2013 10:00	11,218.9	185.2	3,302.0	0.0
12/12/2013 9:00	11,519.1	153.3	3,635.0	170.0
1/3/2014 10:50	14,722.0	145.1	6,774.0	142.2
1/17/2014 10:00	16,940.8	158.9	8,621.0	132.3
1/20/2014 12:37	17,483.4	174.5	9,134.0	165.0
3/5/2014 12:00	26,166.5	197.5	11,575.0	55.5
3/13/2014 13:30	27,382.4	150.8	12,609.0	128.2

o:\44237-001R004\Wpdocs\Report\Final

Table 2 (con't)
Summary of Flowmeters

Date and Time Read	Household Water Meter Reading	Average Daily Household Flow between readings	PNRS Flow Meter Reading	Average Daily PNRS Flow between readings
	Cumulative Volume (gallons)	gallons/day	Cumulative Volume (gallons)	gallons/day
3/19/2014 11:30	28,122.6	125.1	13,167.5	94.4
3/20/2014 12:30	28,281.8	152.8	13,318.0	144.5
4/28/2014 10:05	34,294.9	154.6	18,259.0	127.0
5/8/2014 9:00	36,055.4	176.9	19,521.0	126.8
5/27/2014 11:00	39,320.1	171.1	22,272.0	144.2
6/19/2014 12:00	43,520.7	182.3	25,837.0	154.7
7/16/2014 9:45	47,666.8	154.1	26,991.0	42.9
8/20/2014 12:20	53,342.4	161.7	32,037.0	143.7
9/23/2014 9:25	58,882.6	163.5	36,743.0	138.9
10/22/2014 8:45	62,854.7	137.1	40,005.0	112.6
11/24/2014 9:30	67,695.7	146.6	44,290.0	129.7
12/18/2014 10:00	71,528.4	159.6	47,851.0	148.2
1/14/2015 9:30	75,239.6	137.6	50,655.0	103.9
2/4/2015 8:35	77,920.5	127.9	52,826.0	103.6
Average since December 10, 2013 through February 4, 2015		158.5		117.7

As discussed in Section 3.4, there were two periods during the 2013 holidays when the wastewater was diverted to the old drainfield. Following these interruptions in flow, the household water use average was 158.5 gallons per day through February 4, 2015 with periods of higher and lower flows (Table 2). The average pumped flow to the PNRS system for the same time period was 117.7 gallons per day. The difference in flow could be due to outdoor water use such as filling the pool, car washing, hose bibbs for hand watering the garden, flowmeter error, etc. The irrigation system is not part of the metered flow.

An additional water input to consider for evaluation of the system treatment performance is precipitation. A weather station was installed at the site on the roof of the home on January 6, 2014. Data from this weather station is available from the homeowner. Recorded meteorological data is provided in Appendix C, Table C.1. A summary of monthly precipitation is provided in Appendix C, Figure C.1. Table 3 provides daily precipitation totals leading up to and during the sample event.

Table 3
Precipitation Data Daily Totals Measured
January 5, 2015 through February 4, 2015

Date	Precipitation (inches)
January 5, 2015	0.00
January 6, 2015	0.00
January 7, 2015	0.01
January 8, 2015	0.00
January 9, 2015	0.02
January 10, 2015	0.00
January 11, 2015	0.06
January 12, 2015	2.39
January 13, 2015	0.01
January 14, 2015	0.00
January 15, 2015	0.21
January 16, 2015	0.02
January 17, 2015	0.01
January 18, 2015	0.00
January 19, 2015	0.01
January 20, 2015	0.00
January 21, 2015	0.00
January 22, 2015	0.01
January 23, 2015	1.60
January 24, 2015	0.52
January 25, 2015	0.01
January 26, 2015	0.09
January 27, 2015	0.00
January 28, 2015	0.00
January 29, 2015	0.00
January 30, 2015	0.00
January 31, 2015	0.00
February 1, 2015	0.00
February 2, 2015	0.24
February 3, 2015	0.00
February 4, 2015	0.16

As discussed in Section 3.4, three observation ports are installed along the centerline of the Stage 2 biofilter lined area (north, center and south). The observation port measurements are summarized in Table 4 which indicate that the monitored liner water level is continuously below the overflow elevation (114.03 ft). During this sample event, the water elevation was at a range between 5.3 and 6.1 inches below the overflow elevation.

Table 4
Liner Water Level within Observation Ports

Date Read	North Observation Port water elevation		Center Observation Port water elevation		South Observation Port water elevation		Range
	Water elevation (ft)	Depth below overflow (in)	Water elevation (ft)	Depth below overflow (in)	Water elevation (ft)	Depth below overflow (in)	
11/26/2014	113.65	4.6	113.70	4.0	113.69	4.1	4.0-4.6
12/2/2014	113.60	5.2	113.63	4.8	113.59	5.3	4.8-5.3
12/6/2014	113.64	4.7	113.67	4.3	113.64	4.7	4.3-4.7
12/12/2014	113.65	4.5	113.67	4.4	113.59	5.3	4.4-5.3
1/3/2014	113.67	4.3	113.69	4.1	113.61	5.0	4.1-5.0
1/17/2014	113.67	4.3	113.73	3.6	113.65	4.5	3.6-4.5
3/20/2014	113.67	4.3	113.73	3.6	113.76	3.3	3.3-4.3
4/28/2014	113.72	3.8	113.69	4.1	113.69	4.0	3.8-4.1
5/8/2014	113.74	3.5	113.73	3.6	113.69	4.0	3.5-4.0
5/27/2014	113.67	4.3	113.73	3.6	113.69	4.0	3.6-4.3
6/18/2014	113.69	4.0	113.69	4.1	113.65	4.5	4.0-4.5
6/19/2014	113.67	4.3	113.67	4.4	113.63	4.8	4.3-4.8
7/16/2014	113.74	3.5	113.71	3.9	113.65	4.5	3.5-4.5
8/19/2014	113.59	5.3	113.58	5.4	113.59	5.3	5.3-5.4
9/23/2014	113.58	5.4	113.59	5.2	113.59	5.3	5.2-5.5
10/22/2014	DRY	DRY	113.54	5.9	113.57	5.5	5.5-5.9
11/24/2014	DRY	DRY	DRY	DRY	DRY	DRY	
12/18/2014	113.57	5.5	113.52	6.1	113.59	5.3	5.3-6.1
1/14/2015	113.75	3.4	113.73	3.6	113.74	3.5	3.4-3.6
2/2/2015	113.61	5.0	113.59	5.2	113.57	5.5	5.0-5.5
2/4/2015	113.59	5.3	113.57	5.5	DRY	DRY	5.3-5.5

Overflow elevation is 114.03 ft which is approximately 6 inches above the liner.

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 kWh. The recorded electrical use for the system is summarized in Table 5.

Table 5
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/ 1000 gal)
11/19/2013 14:18	0.2	0.03	PNRS Start-up
11/26/2013 10:30	0.6	0.06	0.219
11/26/2013	Flow to old drainfield		
12/2/2013	Flow to PNRS		
12/2/2013 9:45	0.6	0.00	No flow
12/6/2013 9:00	0.8	0.05	0.306
12/6/2013	Flow to old drainfield		
12/9/2013	Flow to PNRS		
12/10/2013 10:00	0.8	0.00	0.000
12/12/2013 9:00	0.9	0.05	0.300
1/3/2014 10:50	1.7	0.04	0.255
1/17/2014 10:00	2.3	0.04	0.325
1/20/2014 12:37	2.4	0.03	0.195
3/5/2014 12:00	3.1	0.02	0.287
3/13/2014 13:30	3.5	0.05	0.387
3/19/2014 11:30	3.7	0.03	0.358
3/20/2014 12:30	3.7	0.00	0.000
4/28/2014 10:05	5.5	0.05	0.364
5/8/2014 9:00	6.0	0.05	0.396
5/27/2014 11:00	6.9	0.05	0.327
6/19/2014 12:00	8.0	0.05	0.309
7/16/2014 9:45	8.1	0.00	0.087
8/20/2014 12:20	9.6	0.04	0.297
9/23/2014 9:25	11.1	0.04	0.319
10/22/2014 8:45	12.0	0.03	0.276
11/24/2014 9:30	13.3	0.04	0.303
12/18/2014 10:00	14.4	0.05	0.309
1/14/2015 9:30	16.1	0.06	0.606
2/4/2015 8:35	17.0	0.05	0.461
Average since December 10, 2013 through February 4, 2015		0.04	0.329

o:\44237-001R004\Wpdocs\Report\Final

The total average electrical use through February 4, 2015 was 0.04 kWh per day. The average electrical use per 1,000 gallons treated since start-up was 0.329 kWh per 1,000 gallons treated, and this parameter has been fairly stable since start-up.

4.3 Water Quality

Water quality results for the eighth sampling event (Sample Event No. 8) are listed in Table 6. A summary of the water quality data collected for the test system since start-up is presented in Table 7. Nitrogen results for the treatment evaluation cross section displayed in Figure 4 are graphically displayed in Figure 12. 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, $\text{NH}_3\text{-N}$, and $\text{NO}_x\text{-N}$), as well as supporting water quality parameters.

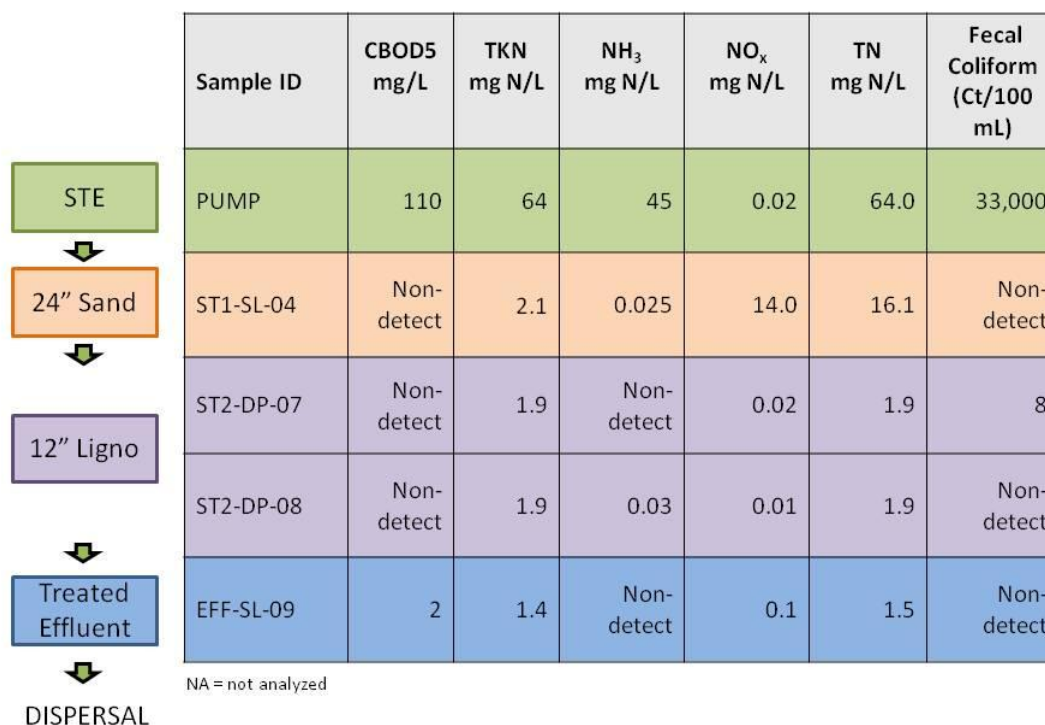


Figure 12
Graphical Representation of Water Quality Results

Septic Tank Effluent (STE) Quality: The water quality characteristics of STE collected in Sample Event 8 were within the typical range generally expected for domestic STE.

The measured STE total nitrogen (TN) concentration was approximately 64 mg/L, which is within the upper range that has been typically reported for Florida single family residence STE.

Stage 1 Effluent (native sand): The sample points considered representative of Stage 1 effluent included: BHS7-ST1-SL-01, BHS7-ST1-SL-02, BHS7-ST1-SL-03, and BHS7-ST1-SL-04. Based on these samples (n=4), the mean concentration \pm the standard deviation are evaluated. Stage 1 effluent mean $\text{NH}_3\text{-N}$ level was 0.20 ± 0.18 mg/L with a mean DO level of 6.47 ± 0.24 mg/L in the Stage 1 effluent (Table 6). These results indicate a substantial reduction of ammonia through the Stage 1 biofilter and nearly complete nitrification. The Stage 1 effluent mean $\text{NO}_x\text{-N}$ concentration was 12.49 ± 4.39 mg/L, implying significant denitrification may also be occurring in the 24-inch sand layer based on comparison with the applied STE total nitrogen concentration.

Stage 2 Biofilter Effluent (lignocellulosic): The sample points considered representative of the effluent of the Stage 2 biofilter (lignocellulosic media) included: BHS7-ST2-DP-03, BHS7-ST2-DP-05, BHS7-ST2-DP-06, BHS7-ST2-DP-07, and BHS7-ST2-DP-08. Based on these samples (n=5), the mean concentration \pm the standard deviation are evaluated. The Stage 2 effluent mean $\text{NO}_x\text{-N}$ concentration was 0.06 ± 0.04 mg/L with a mean DO level at 3.0 ± 1.1 mg/L. The Stage 2 system achieved nearly complete $\text{NO}_x\text{-N}$ reduction. The mean total nitrogen (TN) concentration was 2.7 ± 1.1 mg/L, and was comprised primarily of organic nitrogen. The Stage 2 effluent mean CBOD_5 was 2.0 ± 0.0 mg/L.

Perimeter Monitoring Points: The perimeter monitoring points included: BHS7-EFF-SL-06, BHS7-EFF-SL-07, BHS7-EFF-SL-08, BHS7-EFF-SL-09. Based on these samples (n=4), the mean concentration \pm the standard deviation are evaluated. The perimeter monitoring points mean TN was 4.5 ± 6.1 mg/L of which mean TKN was 1.4 ± 0.3 and mean $\text{NO}_x\text{-N}$ was 3.1 ± 5.9 mg/L.

It is unclear why the $\text{NO}_x\text{-N}$ levels in one of the perimeter monitoring points is higher than $\text{NO}_x\text{-N}$ levels in samples collected within the Stage 2 media. The observation port measurements at the time of sampling showed that the water level within the liner was between 5.3 and 5.5 inches below the periphery overflow elevation, which indicate that the lined area is nearly dry. The water sampled at the perimeter points is therefore not likely to be water that was recently discharged off of the lined area. One hypothesis is that the $\text{NO}_x\text{-N}$ plume beneath the wastewater application zone extends laterally past the width of the Stage 2 biofilter liner area. The overlying Stage 1 biofilter is a 24-inch layer of native sand media which is classified as Candler fine sand. During site reconnaissance, two soil profiles indicated that the water table was below 72 inches, which would

provide a free drainage condition for the Stage 1 domain. As depicted in the Task D.7 Hydrus 2-D Simulation, Scenario 45 graphic (Figure 13), it is possible that the nitrate plume may extend approximately +100 cm (3.28 ft) from the exterior trench wall. The Stage 2 biofilter was designed to extend only 2.5 ft from the exterior trench wall, therefore a portion of the unsaturated plume could be missing the liner and causing the high $\text{NO}_x\text{-N}$ results along the perimeter.

Scenario 45

Configuration: trench, equal distribution
 Soil Type: more permeable sand
 Loading Rate: 2.67 cm/d (0.65 gpd/ft²)
 Effluent Nitrogen: 60 mg-N/L as NH₄
 Depth to Water Table: free drainage

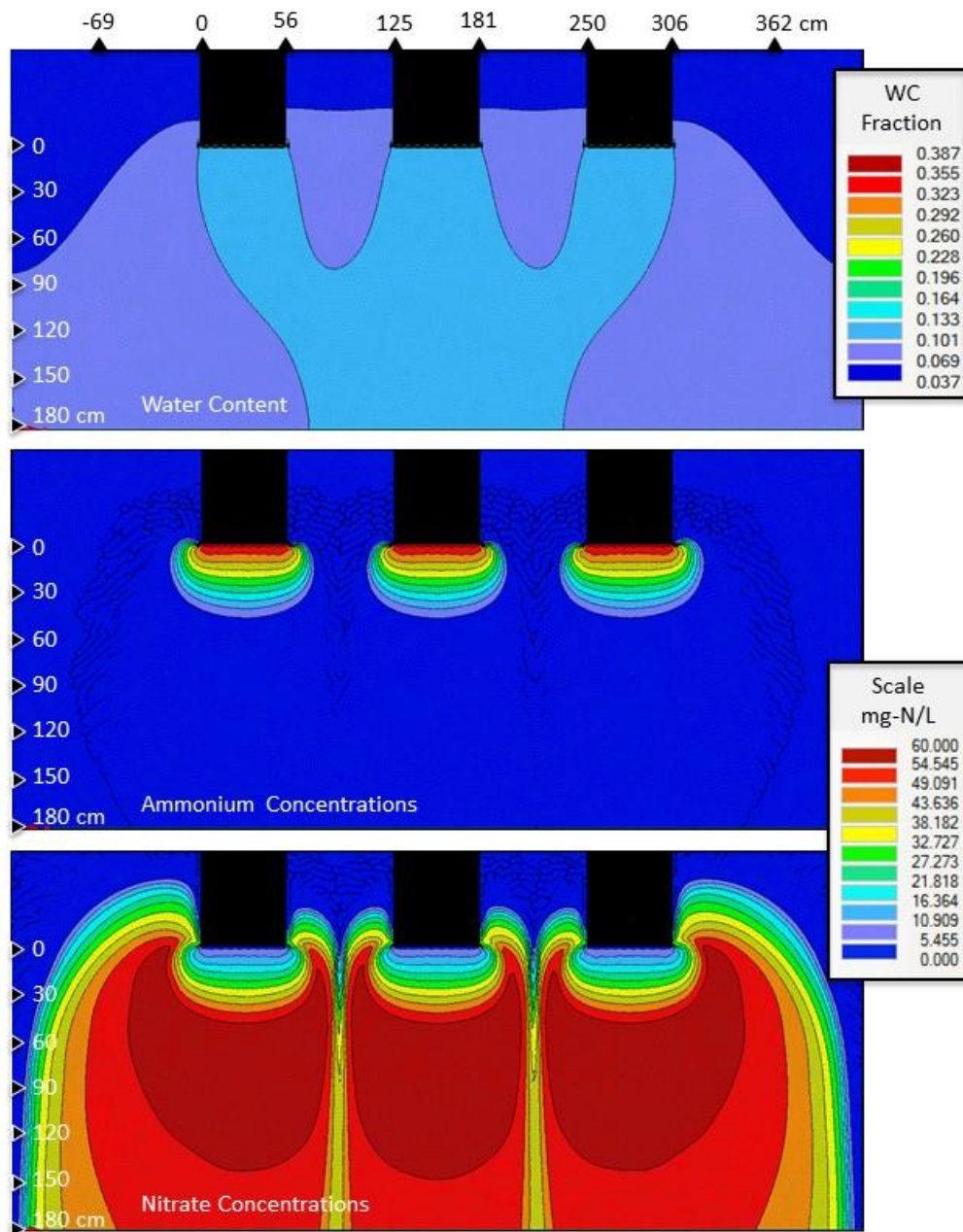


Figure 13
Graphic Representation of Task D.7 Hydrus 2-D Simulation, Scenario 45

Field Blank (FB) and Equipment Blank (EB): Described in Section 3.5, the field blank and equipment blank (EB) results for most of the parameters measured were at or below the method detection limit. The slightly elevated parameter was total phosphorus in the equipment blank sample.

It still unclear why chloride concentrations vary greatly across the system with several very high concentrations during the previous sample events. During this sample event (Sample Event No. 8), one sample location (SW-BHS7-EFF-SL-09) continued to show a relatively high chloride concentration of 1,200 mg/L. Historically the average STE chloride concentration is 401 mg/L with a maximum concentration of 700 mg/L. Based on water level measurements in the liner, it appears that there is significant evaporation and/or transpiration of the applied wastewater. If this is the case, the increased chloride concentrations could result from this evaporation.

Table 6
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)	Fecal (Ct/100 mL)	E-coli (Ct/100 mL)	Chloride (mg/L)
BHS7-PUMP	2/4/2015 11:15	18.3	7.52	2102	0.16	-247.2	310	60	53	110	180	64.03	64	19	45	0.02	0.01	0.03	45.03	6.3	5.1	33000	28000	420
BHS7-PUMP-DUP	2/4/2015 11:20	18.3	7.52	2102	0.16	-247.2	310	65	51	100	200	61.03	61	23	38	0.02	0.01	0.03	38.03	6.7	5.1	26000	25000	380
NC-BHS7-ST1-SL-01	2/4/2015 8:40	13.9	5.74	2220	6.66	149.8						13.01	3.9	3.46	0.44	9.1	0.01	9.11	9.55					560
NC-BHS7-ST1-SL-02	2/4/2015 8:55	13.9	5.8	2034	6.3	173.9						12.91	4.1	3.89	0.21	8.8	0.01	8.81	9.02					540
SC-BHS7-ST1-SL-03	2/4/2015 9:15	13.9	4.56	2081	6.69	218.5						22.11	4.1	3.98	0.12	18	0.01	18.01	18.13					740
SC-BHS7-ST1-SL-03-DUP	2/4/2015 9:20	13.9	4.56	2081	6.69	218.5						20.91	1.9	1.817	0.083	19	0.01	19.01	19.09					720
SC-BHS7-ST1-SL-04	2/4/2015 9:30	13.9	5.39	1625	6.23	216.9	15	7	7	2	22	16.11	2.1	2.075	0.025	14	0.01	14.01	14.04	0.9	0.3	1		490
NC-BHS7-ST2-DP-03	2/4/2015 9:55	17.2	6.16	1774	1.96	152.4						4.3	4.2	4.148	0.052	0.07	0.03	0.10	0.15					450
C-BHS7-ST2-DP-05	2/4/2015 10:05	16.2	6.07	1773	1.94	109.1						3.19	3.1	2.94	0.16	0.07	0.02	0.09	0.25					470
SE-BHS7-ST2-DP-06	2/4/2015 10:28	16.9	6.06	1685	2.68	111.4						2.03	2	1.965	0.035	0.02	0.01	0.03	0.07					430
SC-BHS7-ST2-DP-07	2/4/2015 10:25	16.4	6.06	1649	4.12	110.4	140	1	1	2	99	1.93	1.9	1.891	0.009	0.02	0.01	0.03	0.04	1.1	0.47	8	5.1	460
SW-BHS7-ST2-DP-08	2/4/2015 10:08	16.1	6.05	1763	4.29	113.4	150	6	6	2	91	1.93	1.9	1.87	0.03	0.02	0.01	0.03	0.06	0.56	0.24	1		490
N-BHS7-ST2-OB-01	2/4/2015 10:56	16	6.19	1535	3.34	139.2						6.95	6.9	6.826	0.074	0.02	0.03	0.05	0.12					440
NE-BHS7-EFF-SL-06	2/4/2015 8:46	15.6	5.49	79.9	8.02	141						1.25	0.98	0.86	0.12	0.26	0.01	0.27	0.39					10
NW-BHS7-EFF-SL-07	2/4/2015 9:06	15.4	6	2270	8.35	174.3						1.44	1.4	1.382	0.018	0.03	0.01	0.04	0.06					730
SE-BHS7-EFF-SL-08	2/4/2015 9:22	15	5.15	1889	7.41	215.2	8.2	1	1	7	12	13.61	1.6	1.577	0.023	12	0.01	12.01	12.03	0.093	0.012	1		590
SW-BHS7-EFF-SL-09	2/4/2015 9:44	15.5	5.71	4050	8.24	206.2	2.2			2	41	1.51	1.4	1.391	0.009	0.1	0.01	0.11	0.12	0.094	0.012	1		1200
BHS7-FB	2/4/2015 10:45	14.4	6.25	2.09	9.18	99.3	2	1	1	2	10	0.08	0.05	0.041	0.009	0.02	0.01	0.03	0.04	0.01	0.012	1	2	1
BHS7-EB	2/4/2015 11:00	14.3	5.77	1.33	9.57	77.4	2	1	1	2	10	0.08	0.05	0.041	0.009	0.02	0.01	0.03	0.04	0.016	0.012	1	2	1
BHS7-TAP	2/4/2015 11:30	17.3	7.71	181.7	6.32	86.9																		3.3

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.

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 7. As discussed in Section 4.3 and depicted in Figure 14, it is unclear why the perimeter monitoring points (EFF) NO_x-N concentrations significantly varied throughout time and some perimeter monitoring points had higher NO_x-N levels than in samples collected within the Stage 2 media. The water sampled at the perimeter points is not likely to be water that was recently discharged off of the lined area. One hypothesis is that the NO_x-N plume beneath the wastewater application zone extends laterally past the width of the Stage 2 biofilter liner area. Therefore, the perimeter monitoring points are not included in further analyses of the water quality data.

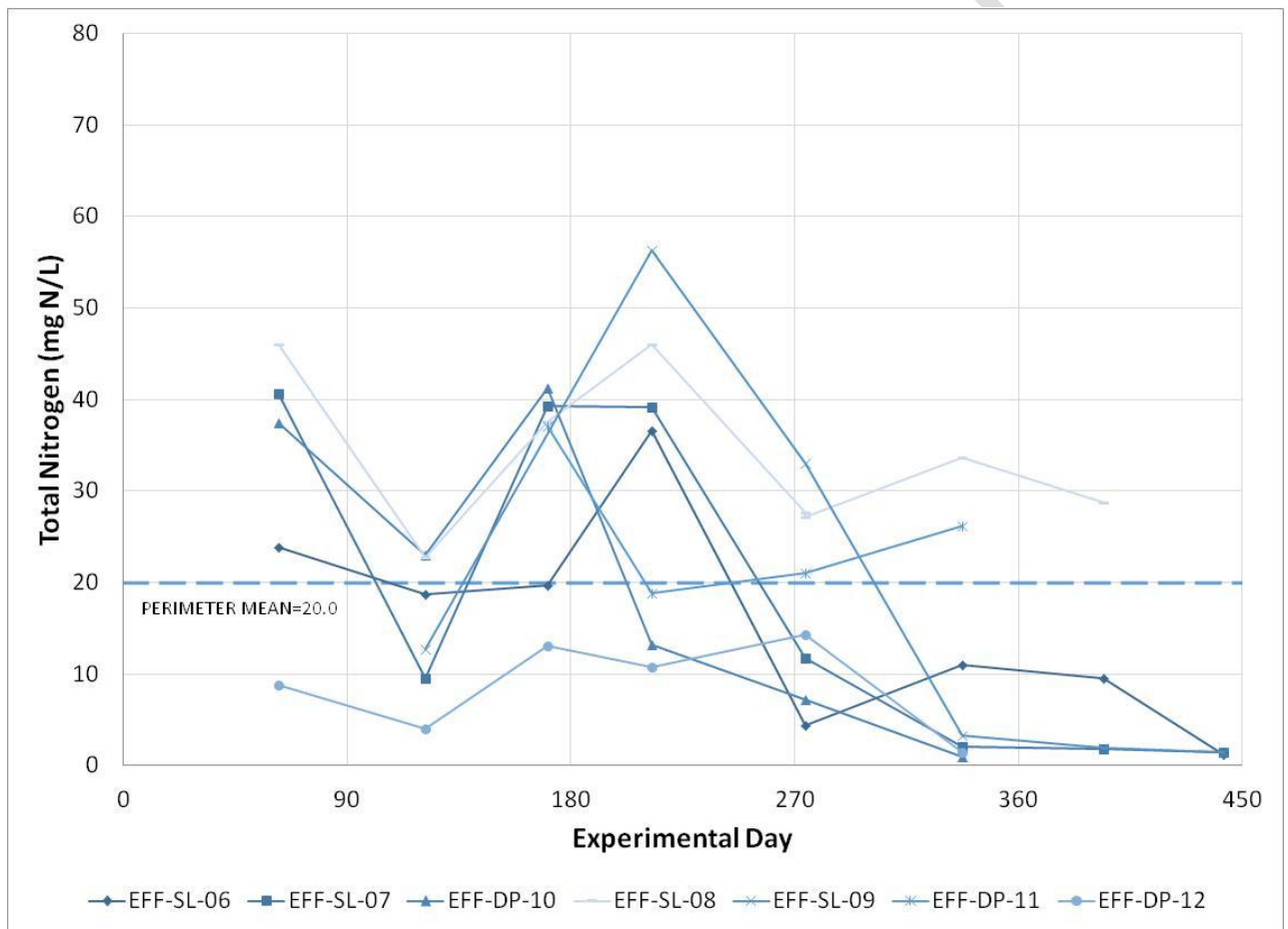


Figure 14
Perimeter Monitoring Points - Total Nitrogen Time Series Graph

Table 7
Summary of Water Quality Analytical Results

Sample ID		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)	Fecal (Ct/100 mL)	E-coli (Ct/100 mL)	Cl (mg/L)
BHS7-PUMP	n	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
	MEAN	21.98	7.26	1987.25	0.11	-182.28	296.25	35.50	32.63	98.75	177.75	54.93	54.88	11.01	43.86	0.03	0.03	0.05	43.92	6.93	5.01	31754	2250	401.25
	STD. DEV.	3.65		247.06	0.09	62.98	35.43	12.44	10.88	34.21	75.71	9.79	9.78	14.63	15.97	0.02	0.03	0.03	15.99	1.24	1.12			156.79
	MIN	18.22	6.92	1609.00	0.01	-247.20	250.00	22.00	22.00	38.00	22.00	46.02	46.00	0.00	6.90	0.01	0.01	0.02	6.92	5.70	3.90	20000	96	190.00
	MAX	27.82	7.63	2454.00	0.25	-95.20	370.00	60.00	53.00	150.00	250.00	72.10	72.00	43.10	62.00	0.07	0.08	0.10	62.10	9.30	7.40	51000	28000	700.00
BHS7-ST1-SL-01	n	8	8	8	8	7	0	0	0	0	0	8	8	8	8	8	8	8	8	0	0	0	0	6
	MEAN	21.00	5.49	1881.38	5.54	169.01						25.92	3.15	2.76	0.39	21.16	0.01	22.77	23.16					795.00
	STD. DEV.	5.76		473.36	1.09	30.09						15.68	1.27	1.02	0.62	15.36	0.00	14.93	15.18					938.82
	MIN	13.90	5.23	1077.00	4.34	128.90						2.42	1.60	1.57	0.03	0.01	0.01	0.02	0.06					270.00
	MAX	28.90	5.74	2370.00	7.55	203.40						50.21	5.20	4.90	1.90	45.00	0.01	45.01	45.31					2700.00
BHS7-ST1-SL-02	n	8	8	8	8	8	0	0	0	0	0	8	8	8	8	8	8	8	8	0	0	0	0	6
	MEAN	20.90	5.46	1593.13	4.86	156.04						19.65	3.41	2.79	0.62	16.23	0.01	16.24	16.86					661.67
	STD. DEV.	5.52		395.62	1.28	34.53						20.22	2.02	1.61	1.08	19.44	0.00	19.44	19.53					810.59
	MIN	13.90	5.04	1156.00	3.04	92.20						1.32	1.30	1.25	0.01	0.01	0.01	0.02	0.05					220.00
	MAX	28.60	5.91	2062.00	6.67	196.70						53.20	7.40	6.20	3.10	51.00	0.02	51.00	51.35					2300.00
BHS7-ST1-SL-03	n	8	8	8	8	8	0	0	0	0	0	8	8	8	8	7	8	8	8	0	0	0	0	5
	MEAN	20.90	5.13	1933.75	5.21	182.19						36.95	3.56	2.96	0.61	30.57	0.55	33.38	33.99					472.00
	STD. DEV.	6.27		372.26	1.19	41.08						17.68	1.97	1.22	1.34	16.76	1.52	16.92	17.27					160.53
	MIN	13.70	4.55	1348.00	3.95	115.20						2.22	1.60	1.49	0.02	0.01	0.01	0.02	0.10					310.00
	MAX	29.10	5.87	2360.00	6.69	231.80						55.91	7.10	5.36	3.90	50.00	4.30	50.01	50.55					740.00
BHS7-ST1-DP-01	n	2	2	2	2	2	0	0	0	0	0	2	2	2	2	2	2	2	2	0	0	0	0	0
	MEAN	17.85	5.08	1556.50	5.21	138.95						27.56	5.05	3.31	1.74	22.51	0.01	22.51	24.25					
	STD. DEV.	1.48		675.29	0.23	73.19						36.68	4.88	2.53	2.35	31.81	0.00	31.81	34.15					
	MIN	16.80	5.04	1079.00	5.05	87.20						1.62	1.60	1.52	0.08	0.01	0.01	0.02	0.10					
	MAX	18.90	5.12	2034.00	5.37	190.70						53.50	8.50	5.10	3.40	45.00	0.01	45.00	48.40					
BHS7-ST1-SL-04	n	8	8	8	8	8	6	7	7	8	8	8	8	8	8	7	8	8	8	8	8	5	5	7
	MEAN	20.54	5.35	1537.38	4.79	176.01	21.17	3.71	3.29	9.13	43.38	33.12	3.49	2.84	0.65	26.72	0.01	29.63	30.28	0.24	0.05	2	2	367.14
	STD. DEV.	6.42		407.67	1.14	42.63		2.81	2.50	18.55	52.18	18.27	2.62	1.10	1.72	16.38	0.00	17.25	17.79	0.28	0.10			86.74
	MIN	12.80	5.11	635.00	3.16	106.90	15.00	1.00	1.00	2.00	14.00	2.62	1.40	1.39	0.01	0.01	0.01	0.02	0.10	0.04	0.01	1	2	230.00
	MAX	29.50	5.80	1933.00	6.34	221.00	31.00	8.00	7.00	55.00	170.00	52.20	9.70	4.80	4.90	48.00	0.01	50.00	50.03	0.90	0.30	10	2	490.00

Table 7 (continued)
Summary of Water Quality Analytical Results

Sample ID		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)	Fecal (Ct/100 mL)	E-coli (Ct/100 mL)	Cl (mg/L)
BHS7-ST2-DP-02	n	2	2	2	2	2	0	0	0	0	0	2	2	2	2	2	2	2	2	0	0	0	0	0
	MEAN	19.25	6.00	1732.50	0.12	24.70						10.74	10.40	9.73	0.68	0.34	0.06	0.34	1.02					
	STD. DEV.	0.35		369.82	0.01	142.69						8.00	7.92	8.27	0.35	0.08	0.06	0.08	0.26					
	MIN	19.00	5.99	1471.00	0.11	-76.20						5.08	4.80	3.88	0.43	0.28	0.01	0.28	0.83					
	MAX	19.50	6.01	1994.00	0.12	125.60						16.40	16.00	15.57	0.92	0.40	0.10	0.40	1.20					
BHS7-ST2-DP-03	n	8	8	8	8	8	0	0	0	0	0	8	8	8	8	8	8	8	8	0	0	0	0	6
	MEAN	21.10	6.08	1573.38	1.91	69.61						4.10	3.94	3.83	0.11	0.13	0.03	0.16	0.27					272.00
	STD. DEV.	4.24		356.89	1.96	96.91						1.55	1.58	1.55	0.05	0.13	0.04	0.14	0.16					154.48
	MIN	14.10	5.88	1059.00	0.13	-109.60						1.73	1.70	1.62	0.03	0.01	0.01	0.02	0.06					32.00
	MAX	27.28	6.44	2068.00	5.87	196.50						5.81	5.70	5.56	0.17	0.39	0.12	0.39	0.47					450.00
BHS7-ST2-DP-04	n	2	2	2	2	2	0	0	0	0	0	2	2	2	2	2	2	2	2	0	0	0	0	0
	MEAN	19.80	6.02	1828.50	0.08	-5.45						3.77	3.75	3.66	0.09	0.01	0.01	0.02	0.11					
	STD. DEV.	0.71		375.47	0.00	208.38						1.34	1.34	1.35	0.01	0.00	0.00	0.00	0.01					
	MIN	19.30	5.94	1563.00	0.08	-152.80						2.82	2.80	2.71	0.08	0.01	0.01	0.02	0.10					
	MAX	20.30	6.10	2094.00	0.08	141.90						4.72	4.70	4.62	0.09	0.01	0.01	0.02	0.11					
BHS7-ST2-DP-05	n	7	7	7	7	7	0	0	0	0	0	7	7	7	7	7	7	7	7	0	0	0	0	5
	MEAN	21.06	6.13	1659.86	1.81	28.07						2.95	2.90	2.81	0.09	0.04	0.01	0.05	0.14					332.00
	STD. DEV.	5.48		332.25	2.01	105.35						0.50	0.50	0.50	0.04	0.03	0.01	0.03	0.05					102.08
	MIN	12.80	6.05	1183.00	0.08	-147.60						2.22	2.20	2.09	0.05	0.01	0.01	0.02	0.10					220.00
	MAX	28.31	6.20	2133.00	4.65	126.30						3.52	3.50	3.40	0.16	0.07	0.03	0.09	0.25					470.00
BHS7-ST2-SL-05	n	2	2	2	2	2	0	0	0	0	0	2	2	2	2	2	2	2	2	0	0	0	0	0
	MEAN	19.25	6.02	1585.50	2.30	97.20						8.80	3.45	3.36	0.09	5.35	0.01	5.35	5.44					
	STD. DEV.	4.60		651.25	1.56	59.40						2.26	1.63	1.66	0.03	0.64	0.00	0.64	0.61					
	MIN	16.00	5.94	1125.00	1.20	55.20						7.20	2.30	2.19	0.07	4.90	0.01	4.90	5.01					
	MAX	22.50	6.10	2046.00	3.40	139.20						10.40	4.60	4.53	0.11	5.80	0.01	5.80	5.87					
BHS7-ST2-DP-06	n	7	7	7	7	7	0	0	0	0	0	7	7	7	7	7	7	7	7	0	0	1	1	5
	MEAN	20.70	6.12	1665.00	1.74	54.29						4.20	4.13	4.03	0.10	0.05	0.03	0.07	0.17			1.00	2.00	286.40
	STD. DEV.	3.54		425.76	1.85	89.76						1.94	1.96	1.91	0.07	0.06	0.03	0.08	0.10					176.71
	MIN	16.20	5.95	1092.00	0.06	-120.40						2.03	2.00	1.97	0.01	0.01	0.01	0.02	0.06			1.00	2.00	32.00
	MAX	25.99	6.63	2280.00	4.31	153.50						7.92	7.90	7.76	0.20	0.14	0.10	0.21	0.34			1.00	2.00	430.00
BHS7-ST2-DP-07	n	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7
	MEAN	22.11	6.22	1777.38	2.11	49.01	192.50	11.50	8.63	26.25	172.38	3.05	3.01	2.94	0.07	0.02	0.02	0.04	0.11	10.63	6.51	14	5	395.71
	STD. DEV.	4.86		361.01	2.28	95.12	29.64	7.33	5.40	28.88	129.42	1.88	1.90	1.86	0.06	0.02	0.02	0.04	0.05	20.28	11.88			106.12
	MIN	16.40	5.99	1201.00	0.10	-117.30	140.00	1.00	1.00	2.00	50.00	1.42	1.40	1.36	0.01	0.01	0.01	0.02	0.04	1.10	0.47	1	2	190.00
	MAX	29.36	6.44	2350.00	6.60	181.50	240.00	27.00	17.00	79.00	380.00	7.22	7.20	7.07	0.15	0.06	0.08	0.14	0.17	60.00	35.00	1200	200	470.00
BHS7-ST2-DP-08	n	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7	7
	MEAN	21.38	6.09	1584.00	1.74	39.04	185.00	9.50	6.88	30.38	261.50	2.45	2.40	2.33	0.07	0.04	0.02	0.05	0.12	7.58	4.42	1	2	350.00
	STD. DEV.	4.94		330.95	1.73	108.79	25.63	4.72	4.39	29.94	347.85	1.11	1.11	1.09	0.04	0.05	0.01	0.05	0.06	12.82	7.25			106.93
	MIN	14.80	5.97	1067.00	0.08	-161.00	150.00	1.00	1.00	2.00	91.00	1.35	1.30	1.27	0.01	0.01	0.01	0.02	0.06	0.56	0.24	1	2	190.00
	MAX	28.07	6.17	2070.00	4.29	151.10	220.00	16.00	13.00	78.00	1100.00	4.72	4.70	4.61	0.13	0.15	0.04	0.15	0.26	37.00	20.00	10	3	490.00

Table 7 (continued)
Summary of Water Quality Analytical Results

Sample ID		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)	Fecal (Ct/100 mL)	E-coli (Ct/100 mL)	Cl (mg/L)
BHS7-EFF-SL-06	n	8	8	8	8	8	0	0	0	0	0	8	8	8	8	7	8	8	8	0	0	0	0	6
	MEAN	20.13	5.68	572.99	6.12	173.08						15.64	1.99	1.82	0.16	10.59	0.01	13.65	13.81					76.67
	STD. DEV.	5.82		375.48	1.18	32.69						11.50	0.90	0.96	0.16	7.78	0.00	11.24	11.16					56.24
	MIN	12.40	5.49	79.90	4.94	124.10						1.25	0.98	0.86	0.03	0.26	0.01	0.27	0.39					10.00
	MAX	27.50	5.94	1073.00	8.02	215.80						36.60	3.90	3.84	0.46	20.00	0.02	35.00	35.05					170.00
BHS7-EFF-DP-09	n	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0
	MEAN	17.70	6.06	431.00	6.36	131.50						7.20	2.50	1.59	0.91	4.70	0.01	4.70	5.61					
	STD. DEV.																							
	MIN	17.70	6.06	431.00	6.36	131.50						7.20	2.50	1.59	0.91	4.70	0.01	4.70	5.61					
	MAX	17.70	6.06	431.00	6.36	131.50						7.20	2.50	1.59	0.91	4.70	0.01	4.70	5.61					
BHS7-EFF-SL-07	n	8	8	8	8	8	0	0	0	0	0	8	8	8	8	7	8	8	8	0	0	0	0	6
	MEAN	20.39	5.59	1753.25	6.70	169.04						18.23	1.61	1.17	0.44	13.70	0.01	16.61	17.05					895.00
	STD. DEV.	5.06		1140.86	1.06	27.11						18.17	0.34	0.66	0.72	17.40	0.00	18.09	17.81					1143.25
	MIN	13.40	4.61	367.00	5.51	126.70						1.44	1.20	0.10	0.01	0.03	0.01	0.04	0.06					230.00
	MAX	27.30	6.59	3970.00	8.35	199.80						40.60	2.20	2.15	1.60	39.00	0.01	39.00	39.01					3200.00
BHS7-EFF-DP-10	n	6	6	6	6	6	0	0	0	0	0	6	6	6	6	6	6	6	6	0	0	0	0	4
	MEAN	21.57	5.97	1646.50	5.76	141.05						20.51	2.05	1.89	0.16	18.46	0.01	18.46	18.61					807.50
	STD. DEV.	4.96		411.77	1.21	31.44						16.35	0.75	0.91	0.22	15.85	0.00	15.85	15.73					873.82
	MIN	13.30	5.74	1147.00	4.40	85.30						0.93	0.89	0.29	0.02	0.03	0.01	0.04	0.64					220.00
	MAX	27.30	6.18	2187.00	7.18	182.80						41.20	3.00	2.88	0.60	39.00	0.01	39.00	39.06					2100.00
BHS7-EFF-SL-08	n	8	8	8	8	8	1	1	1	1	1	8	8	8	8	7	8	8	8	1	1	1	1	6
	MEAN	20.65	5.25	1673.63	6.10	171.61	8.20	1.00	1.00	7.00	12.00	32.03	2.53	2.37	0.15	27.43	0.01	29.50	29.66	0.09	0.01	1.00		758.33
	STD. DEV.	4.93		230.56	1.05	41.89						11.20	0.94	0.79	0.30	9.74	0.00	10.75	10.90					908.83
	MIN	15.00	4.88	1331.00	4.49	110.70	8.20	1.00	1.00	7.00	12.00	13.61	1.60	1.58	0.01	12.00	0.01	12.01	12.03	0.09	0.01	1.00		280.00
	MAX	27.60	6.25	1898.00	7.43	215.20	8.20	1.00	1.00	7.00	12.00	46.00	4.00	3.79	0.88	42.00	0.01	44.00	44.03	0.09	0.01	1.00		2600.00
BHS7-EFF-SL-09	n	8	8	8	8	8	5	5	5	7	7	6	6	6	8	7	8	8	8	7	8	1	1	7
	MEAN	21.15	5.76	2729.38	6.24	146.73	1101.24	1.00	1.40	14.43	54.57	18.15	2.03	1.87	0.15	15.66	0.01	20.46	20.61	0.13	0.04		2.00	1085.57
	STD. DEV.	5.74		2353.65	1.45	67.94	2088.00	0.00	0.89	23.59	38.27	22.22	0.49	0.56	0.16	16.80	0.01	20.63	20.65	0.10	0.08			1176.54
	MIN	14.60	5.09	269.00	4.58	53.80	2.20	1.00	1.00	2.00	10.00	1.51	1.40	1.29	0.01	0.04	0.01	0.05	0.12	0.01	0.01		2.00	34.00
	MAX	29.10	6.57	6120.00	8.51	219.20	4800.00	1.00	3.00	64.00	120.00	56.30	2.80	2.77	0.41	40.00	0.03	54.00	54.06	0.29	0.24		2.00	3300.00
BHS7-EFF-DP-11	n	4	4	4	4	4	0	0	0	0	0	4	4	4	4	5	5	5	4	0	0	0	0	4
	MEAN	24.58	5.88	1665.00	5.23	168.40						25.78	3.03	2.81	0.22	25.40	0.01	25.40	22.97					380.00
	STD. DEV.	3.41		350.21	0.72	31.36						8.16	0.17	0.41	0.35	9.15	0.00	9.15	7.92					111.65
	MIN	19.90	5.75	1356.00	4.34	137.20						18.80	2.80	2.26	0.03	16.00	0.01	16.00	16.07					280.00
	MAX	28.00	6.06	2151.00	6.02	202.40						37.10	3.20	3.17	0.74	36.00	0.02	36.00	34.04					500.00
BHS7-EFF-DP-12	n	6	6	6	6	6	4	4	4	4	4	6	6	6	6	6	6	6	6	4	4	2	2	4
	MEAN	22.78	6.12	1751.17	4.31	112.62	1255.00	12.25	9.00	20.00	87.00	8.74	2.95	2.85	0.10	5.79	0.01	5.79	5.89	1.84	0.77	1.00	2.00	410.00
	STD. DEV.	4.31		289.72	0.47	91.12	2230.06	6.45	6.73	21.66	20.77	5.10	1.05	1.02	0.05	4.65	0.00	4.64	4.66	0.72	0.24			76.16
	MIN	17.20	5.90	1309.00	3.66	-36.30	120.00	3.00	1.00	4.00	56.00	1.44	1.40	1.39	0.01	0.02	0.01	0.04	0.05	0.96	0.44	1.00	2.00	330.00
	MAX	28.20	6.25	2173.00	5.01	211.90	4600.00	18.00	17.00	52.00	100.00	14.30	4.60	4.47	0.15	11.00	0.02	11.00	11.08	2.60	1.00	1.00	2.00	480.00

Table 7 (continued)
Summary of Water Quality Analytical Results

Sample ID		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)	Fecal (Ct/100 mL)	E-coli (Ct/100 mL)	Cl (mg/L)
BHS7-BKG-LY	n	3	3	3	3	3	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2	1	1	2
	MEAN	27.07	5.71	78.87	5.92	182.07	11.00	1.00	8.50	16.00	30.50	3.25	0.89	0.82	0.08	2.36	0.01	2.36	2.44	0.05	0.01	1.00	2.00	3.90
	STD. DEV.	2.74		37.47	0.35	24.52		0.00	10.61		26.16	3.18	0.16	0.14	0.02	3.03	0.00	3.03	3.04	0.01	0.00			0.99
	MIN	24.10	5.43	35.80	5.67	155.60	11.00	1.00	1.00	16.00	12.00	1.00	0.78	0.72	0.06	0.22	0.01	0.22	0.28	0.04	0.01	1.00	2.00	3.20
	MAX	29.50	5.96	104.00	6.32	204.00	11.00	1.00	16.00	16.00	49.00	5.50	1.00	0.91	0.09	4.50	0.01	4.50	4.59	0.05	0.01	1.00	2.00	4.60
BHS7-TAP	n	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	MEAN	20.03	7.37	178.30	6.43	95.47	82.50	2.00	2.00	2.00	10.00	0.24	0.05	0.04	0.01	0.11	0.08	0.19	0.20	0.15	0.12	1.00	2.00	3.65
	STD. DEV.	2.70		3.99	0.67	54.95	6.36	1.41	1.41	0.00	0.00	0.04	0.00	0.00	0.00	0.03	0.01	0.04	0.04	0.04	0.04			
	MIN	17.30	7.14	173.90	5.83	45.30	78.00	1.00	1.00	2.00	10.00	0.21	0.05	0.04	0.01	0.09	0.07	0.16	0.17	0.12	0.10	1.00	2.00	3.30
	MAX	22.70	7.71	181.70	7.15	154.20	87.00	3.00	3.00	2.00	10.00	0.27	0.05	0.04	0.01	0.13	0.09	0.22	0.23	0.17	0.15	1.00	2.00	4.00
BHS7-EB	n	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6
	MEAN	21.54	6.08	1.69	8.13	111.96	2.41	1.00	1.00	2.00	10.00	0.10	0.07	0.06	0.01	0.01	0.01	0.02	0.03	0.02	0.01	1.00	2.00	0.53
	STD. DEV.	6.80		0.44	1.56	55.80	0.97	0.00	0.00	0.00	0.00	0.06	0.06	0.05	0.01	0.01	0.00	0.01	0.01	0.01	0.00			0.52
	MIN	14.30	4.62	1.20	5.16	43.10	2.00	1.00	1.00	2.00	10.00	0.06	0.05	0.04	0.01	0.01	0.01	0.01	0.02	0.01	0.01	1.00	2.00	0.05
	MAX	30.90	7.39	2.26	9.57	181.20	4.60	1.00	1.00	2.00	10.00	0.24	0.22	0.18	0.04	0.02	0.01	0.03	0.06	0.04	0.01	1.00	2.00	1.00

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.

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.

Figure 15 provides a time series of influent and effluent TN over the study period for the treatment evaluation cross section displayed in Figure 4. Figures 16 through 20 show box and whisker plots of the various monitoring points for the key parameters measured during the study period. The Stage 1 monitoring points include the suction lysimeters located with the cup at the bottom of the native sand layer at the sand and lignocellulosic interface: ST1-SL-01, ST1-SL-02, ST1-SL-03, and ST1-SL-04. The Stage 2 monitoring points include the drivepoints installed within the lignocellulosic media on the liner: ST2-DP-03, ST2-DP-04, ST2-DP-05, ST2-DP-06, ST2-DP-07 and ST2-DP-08. The preliminary sample event conducted December 12, 2013 (Experimental Day 23) was not included in the long term analyses as the system was still in the start-up period.

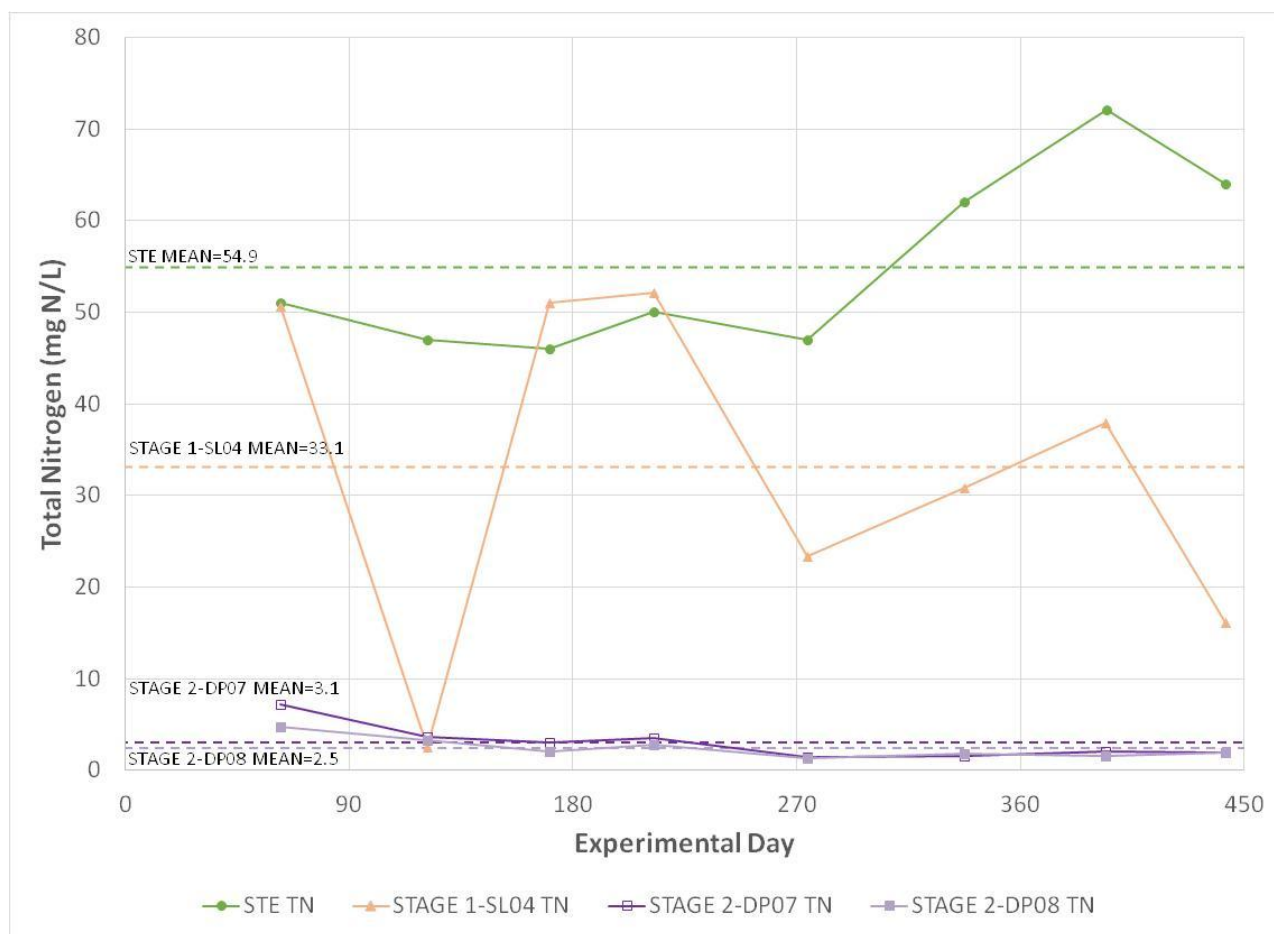


Figure 15
Total Nitrogen Time Series Graph

c:\44237-001R004\Wpdocs\Report\Final

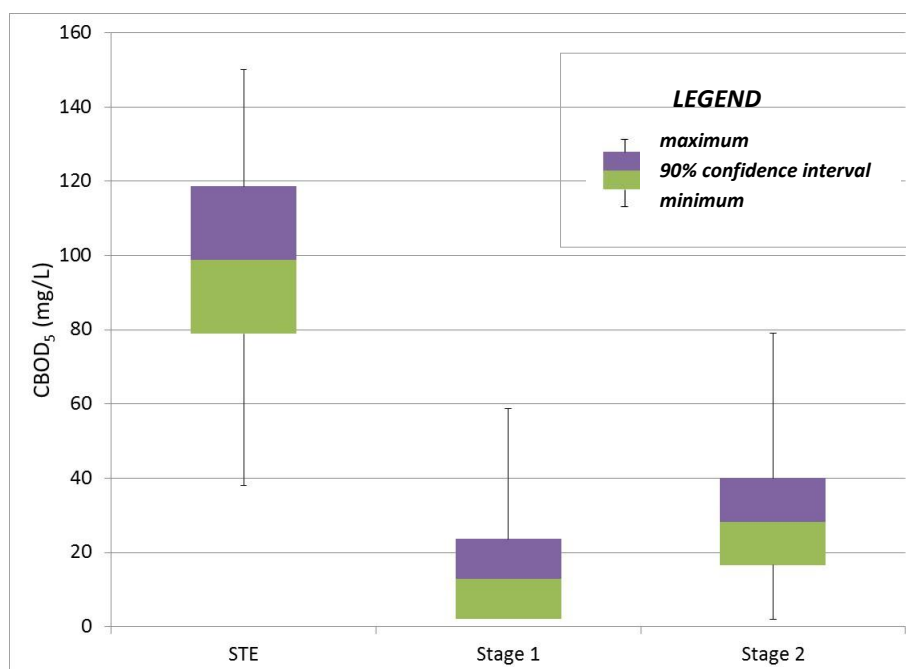


Figure 16
CBOD₅ Box and Whisker Plot

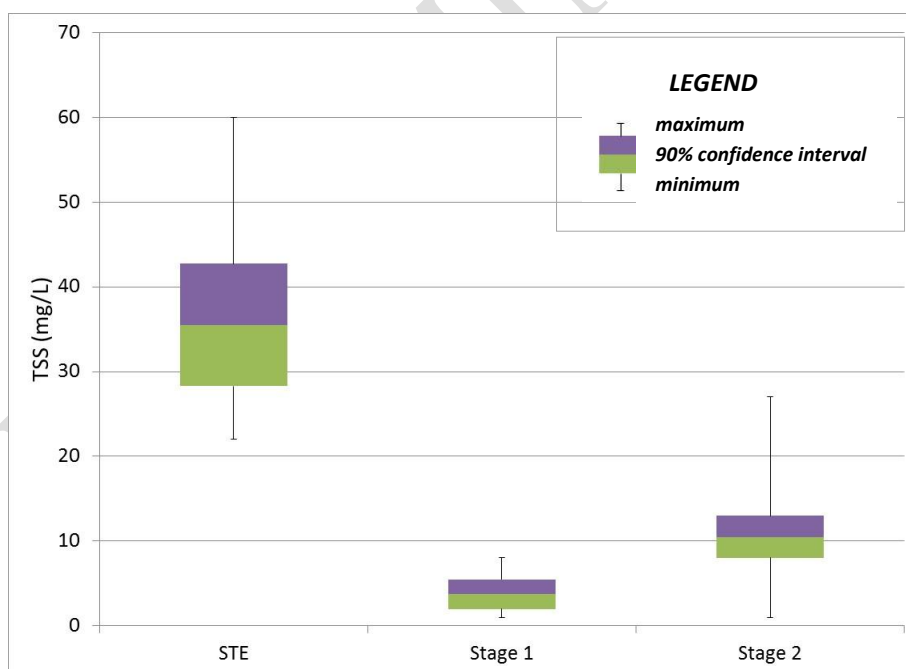


Figure 17
TSS Box and Whisker Plot

o:\44237-001R004\Wpdocs\Report\Final

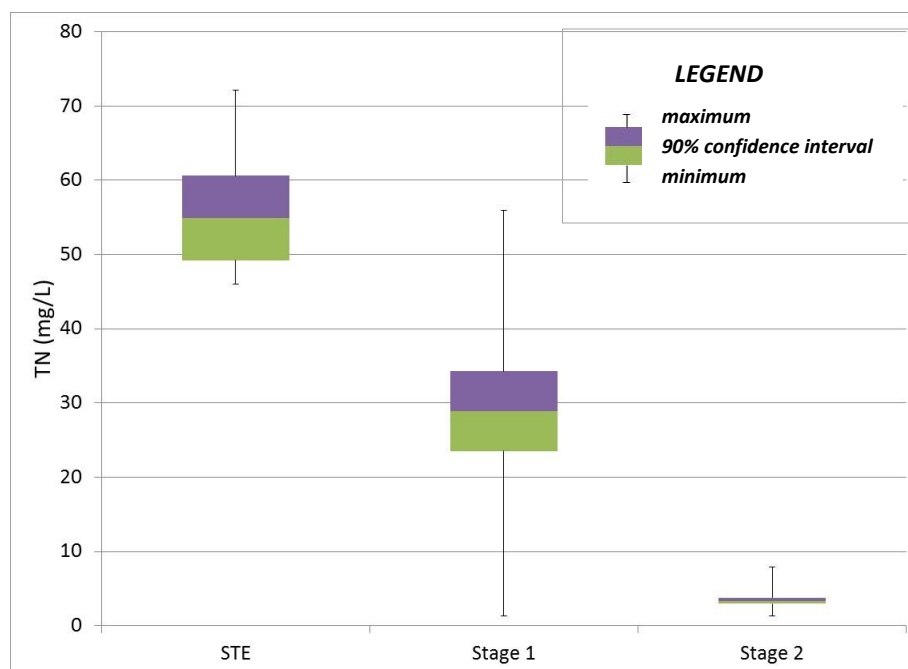


Figure 18
Total Nitrogen (TN) Box and Whisker Plot

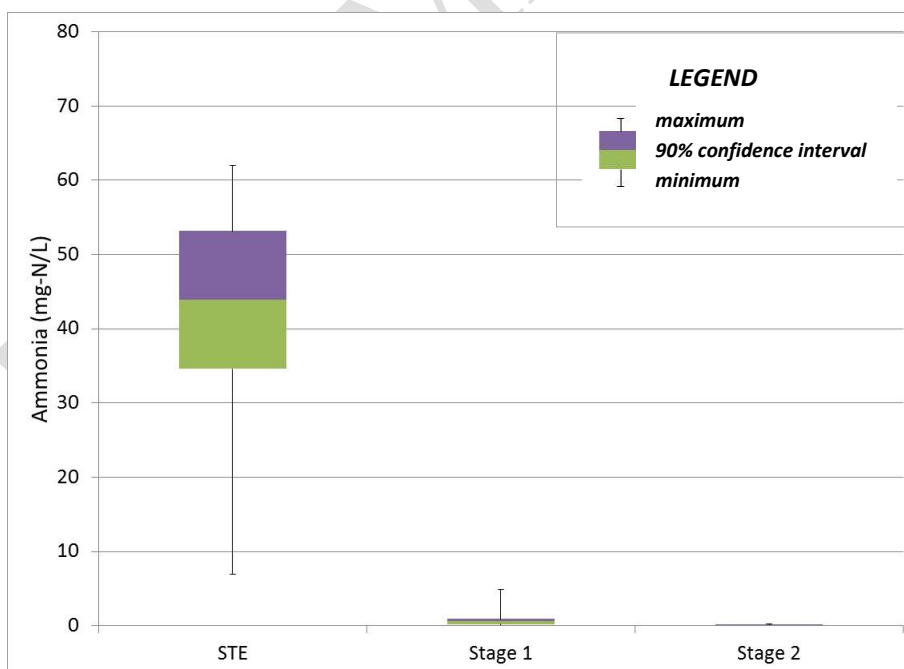


Figure 19
Ammonia N (NH3-N) Box and Whisker Plot

o:\44237-001R004\Wpdocs\Report\Final

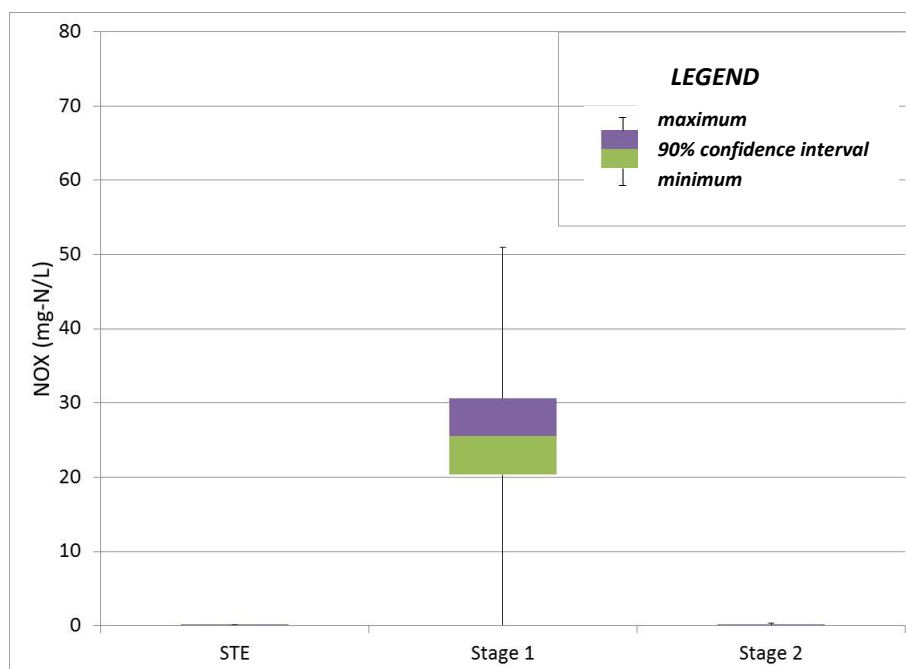


Figure 20
Nitrate+Nitrite Nitrogen (NO_x-N) Box and Whisker Plot

o:\44237-001R004\Wpdocs\Report\Final

5.0 B-HS7 Sample Event No. 8: Summary and Recommendations

5.1 Summary

The Sample Event No. 8 results indicate that:

- Septic tank effluent (STE) quality is characteristic of typical household STE quality. The total nitrogen concentration of approximately 64 mg/L is within the range of values typically reported for Florida single family residence STE.
- The Stage 1 biofilter converted the majority of ammonium to oxidized nitrogen; mean effluent values contained 3.6 ± 1.0 mg/L TKN, of which 0.2 ± 0.2 mg/L was ammonia.
- The Stage 2 biofilter mean effluent $\text{NO}_x\text{-N}$ within the biofilter media was 0.06 ± 0.04 mg N/L.
- The total nitrogen concentration in the perimeter monitoring points surrounding the treatment system was 4.5 ± 6.1 mg/L of which mean TKN was 1.4 ± 0.3 and mean $\text{NO}_x\text{-N}$ was 3.1 ± 5.9 mg/L. It is unclear why one of the perimeter monitoring points (SE-BHS7-EFF-SL-08) has higher $\text{NO}_x\text{-N}$ levels than samples taken from within the Stage 2 media. Since the observation port measurements indicated that the liner water level was between 5.3 and 5.5 inches below the overflow elevation at the time of sampling, the water sampled at the perimeter points is not likely to be water that was recently discharged off of the lined area.

5.2 Conclusions

Sample Event 8 was the last funded sample event for the B-HS7 treatment system. Section 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 54.9 mg/L is in the range of values typically reported for Florida single family residence STE.
- The Stage 1 monitoring points located at the sand and lignocellulosic interface (ST1-SL-01, ST1-SL-02, ST1-SL-03, and ST1-SL-04) showed significant ammonia removal with an average $\text{NH}_3\text{-N}$ concentration of 0.6 mg/L and average TKN of 3.4 mg/L. The average $\text{NO}_x\text{-N}$ was 25.5 mg/L.

- The Stage 2 monitoring points located within the lignocellulosic media on the liner (ST2-DP-03, ST2-DP-04, ST2-DP-05, ST2-DP-06, ST2-DP-07 and ST2-DP-08) showed similar ammonia removal with an average $\text{NH}_3\text{-N}$ concentration of 0.1 mg/L and average TKN of 3.3 mg/L. The Stage 2 biofilter was effective in producing a reducing environment and achieving significant $\text{NO}_x\text{-N}$ removal (average $\text{NO}_x\text{-N}$ concentration of 0.1 mg/L). The average final total nitrogen (TN) in the treatment system effluent was 3.4 mg/L, primarily TKN (average TKN concentration of 3.3 mg/L), which represents a 93.8 percent average total nitrogen reduction from this PNRS.
- As discussed, it is unclear why the perimeter monitoring points (EFF samples) $\text{NO}_x\text{-N}$ concentrations significantly varied throughout time and some perimeter monitoring points had higher $\text{NO}_x\text{-N}$ levels than in samples collected within the Stage 2 media. The water sampled at the perimeter points is not likely to be water that was recently discharged off of the lined area. One hypothesis is that the $\text{NO}_x\text{-N}$ plume beneath the wastewater application zone extends laterally past the width of the Stage 2 biofilter liner area.

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 (442 experimental days) under actual onsite conditions.



Appendix A: Laboratory Report

PRELIMINARY

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

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

March 2, 2015
Work Order: 1500627

Laboratory Report

Project Name		B-HS7 SE#8						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS7-PUMP						
Matrix		Wastewater						
SAL Sample Number		1500627-01						
Date/Time Collected		02/04/15 11:15						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	45	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Carbonaceous BOD	mg/L	110	SM 5210B	2	2	02/05/15 08:52	02/10/15 10:21	1
Chemical Oxygen Demand	mg/L	180	EPA 410.4	25	10	02/11/15 09:23	02/11/15 15:55	1
Chloride	mg/L	420	SM 4500Cl-E	400	100		02/06/15 10:38	100
Nitrate+Nitrite (N)	mg/L	0.02 I	EPA 353.2	0.04	0.01		02/07/15 12:03	1
Nitrite (as N)	mg/L	0.01 U,Q	SM	0.04	0.01		02/17/15 15:30	1
			4500NO2-B					
Orthophosphate as P	mg/L	5.1	SM 4500P-E	0.20	0.060		02/05/15 11:37	5
Phosphorous - Total as P	mg/L	6.3	SM 4500P-E	2.0	0.50	02/05/15 10:20	02/06/15 15:20	50
Total Alkalinity	mg/L	310	SM 2320B	8.0	2.0		02/16/15 12:12	1
Total Kjeldahl Nitrogen	mg/L	64	EPA 351.2	10	2.5	02/05/15 10:20	02/06/15 15:20	50
Total Suspended Solids	mg/L	60	SM 2540D	1	1	02/09/15 08:58	02/10/15 16:22	1
Volatile Suspended Solids	mg/L	53	EPA 160.4	1	1	02/09/15 08:58	02/10/15 16:22	1
Nitrate (as N)	mg/L	0.02 I	EPA 353.2	0.08	0.02		02/17/15 15:30	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	28,000	SM 9223B	2.0	2.0	02/04/15 15:27	02/05/15 10:11	1
Fecal Coliforms	CFU/100 ml	33,000	SM 9222D	1	1	02/04/15 15:20	02/05/15 13:47	1
Sample Description		BHS7-PUMP-DUP						
Matrix		Wastewater						
SAL Sample Number		1500627-02						
Date/Time Collected		02/04/15 11:20						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	38	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Carbonaceous BOD	mg/L	100	SM 5210B	2	2	02/05/15 08:52	02/10/15 10:21	1
Chemical Oxygen Demand	mg/L	200	EPA 410.4	25	10	02/11/15 09:23	02/11/15 15:55	1
Chloride	mg/L	380	SM 4500Cl-E	40	10		02/06/15 10:38	10
Nitrate+Nitrite (N)	mg/L	0.02 I	EPA 353.2	0.04	0.01		02/07/15 12:03	1
Nitrite (as N)	mg/L	0.01 U,Q	SM	0.04	0.01		02/17/15 15:30	1
			4500NO2-B					
Orthophosphate as P	mg/L	5.1	SM 4500P-E	0.20	0.060		02/05/15 11:37	5
Phosphorous - Total as P	mg/L	6.7	SM 4500P-E	0.80	0.20	02/05/15 10:30	02/06/15 15:34	20
Total Alkalinity	mg/L	310	SM 2320B	8.0	2.0		02/16/15 12:19	1
Total Kjeldahl Nitrogen	mg/L	61	EPA 351.2	4.0	1.0	02/05/15 10:30	02/06/15 15:34	20
Total Suspended Solids	mg/L	65	SM 2540D	1	1	02/09/15 08:58	02/10/15 16:22	1

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

March 2, 2015
Work Order: 1500627

Laboratory Report

Project Name		B-HS7 SE#8						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS7-PUMP-DUP						
Matrix		Wastewater						
SAL Sample Number		1500627-02						
Date/Time Collected		02/04/15 11:20						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
Volatile Suspended Solids	mg/L	51	EPA 160.4	1	1	02/09/15 08:58	02/10/15 16:22	1
Nitrate (as N)	mg/L	0.02 I	EPA 353.2	0.08	0.02		02/17/15 15:30	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	25,000	SM 9223B	2.0	2.0	02/04/15 15:27	02/05/15 10:11	1
Fecal Coliforms	CFU/100 ml	26,000	SM 9222D	1	1	02/04/15 15:20	02/05/15 13:47	1
Sample Description		NC-BHS7-ST1-SL-01						
Matrix		Wastewater						
SAL Sample Number		1500627-03						
Date/Time Collected		02/04/15 08:40						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.44	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Chloride	mg/L	560	SM 4500Cl-E	400	100		02/06/15 10:39	100
Nitrate+Nitrite (N)	mg/L	9.1	EPA 353.2	0.04	0.01		02/07/15 12:03	1
Nitrite (as N)	mg/L	0.01 U	SM 4500NO2-B	0.04	0.01		02/04/15 15:42	1
Total Kjeldahl Nitrogen	mg/L	3.9	EPA 351.2	0.20	0.05	02/05/15 10:30	02/06/15 15:34	1
Nitrate (as N)	mg/L	9.1	EPA 353.2	0.08	0.02		02/07/15 12:03	1
Sample Description		NC-BHS7-ST1-SL-02						
Matrix		Wastewater						
SAL Sample Number		1500627-04						
Date/Time Collected		02/04/15 08:55						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.21	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Chloride	mg/L	540	SM 4500Cl-E	400	100		02/06/15 10:40	100
Nitrate+Nitrite (N)	mg/L	8.8	EPA 353.2	0.04	0.01		02/07/15 12:03	1
Nitrite (as N)	mg/L	0.01 I	SM 4500NO2-B	0.04	0.01		02/04/15 15:43	1
Total Kjeldahl Nitrogen	mg/L	4.1	EPA 351.2	0.20	0.05	02/05/15 10:30	02/06/15 15:34	1
Nitrate (as N)	mg/L	8.8	EPA 353.2	0.08	0.02		02/07/15 12:03	1

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

March 2, 2015
Work Order: 1500627

Laboratory Report

Project Name		B-HS7 SE#8						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		SC-BHS7-ST1-SL-03						
Matrix		Wastewater						
SAL Sample Number		1500627-05						
Date/Time Collected		02/04/15 09:15						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.12	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Chloride	mg/L	740	SM 4500Cl-E	400	100		02/06/15 11:04	100
Nitrate+Nitrite (N)	mg/L	18	EPA 353.2	0.04	0.01		02/07/15 12:03	1
Nitrite (as N)	mg/L	0.01 I	SM	0.04	0.01		02/05/15 12:49	1
			4500NO2-B					
Total Kjeldahl Nitrogen	mg/L	4.1	EPA 351.2	0.20	0.05	02/05/15 10:30	02/06/15 15:34	1
Nitrate (as N)	mg/L	18	EPA 353.2	0.08	0.02		02/07/15 12:03	1
Sample Description		SC-BHS7-ST1-SL-03-DUP						
Matrix		Wastewater						
SAL Sample Number		1500627-06						
Date/Time Collected		02/04/15 09:20						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.083	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Chloride	mg/L	720	SM 4500Cl-E	400	100		02/06/15 11:05	100
Nitrate+Nitrite (N)	mg/L	19	EPA 353.2	0.04	0.01		02/07/15 12:03	1
Nitrite (as N)	mg/L	0.01 U	SM	0.04	0.01		02/05/15 12:50	1
			4500NO2-B					
Total Kjeldahl Nitrogen	mg/L	1.9	EPA 351.2	0.20	0.05	02/05/15 10:30	02/06/15 15:34	1
Nitrate (as N)	mg/L	19	EPA 353.2	0.08	0.02		02/07/15 12:03	1
Sample Description		SC-BHS7-ST1-SL-04						
Matrix		Wastewater						
SAL Sample Number		1500627-07						
Date/Time Collected		02/04/15 09:30						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.025 I	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	02/05/15 08:52	02/10/15 10:21	1
Chemical Oxygen Demand	mg/L	22 I	EPA 410.4	25	10	02/11/15 09:23	02/11/15 15:55	1
Chloride	mg/L	490	SM 4500Cl-E	40	10		02/06/15 10:52	10
Nitrate+Nitrite (N)	mg/L	14	EPA 353.2	0.04	0.01		02/07/15 12:03	1

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

March 2, 2015
Work Order: 1500627

Laboratory Report

Project Name		B-HS7 SE#8						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		SC-BHS7-ST1-SL-04						
Matrix		Wastewater						
SAL Sample Number		1500627-07						
Date/Time Collected		02/04/15 09:30						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
Nitrite (as N)	mg/L	0.01 U	SM 4500NO2-B	0.04	0.01		02/05/15 12:50	1
Orthophosphate as P	mg/L	0.30	SM 4500P-E	0.040	0.012		02/05/15 11:02	1
Phosphorous - Total as P	mg/L	0.90	SM 4500P-E	0.040	0.010	02/05/15 10:30	02/06/15 15:34	1
Total Alkalinity	mg/L	15	SM 2320B	8.0	2.0		02/16/15 12:23	1
Total Kjeldahl Nitrogen	mg/L	2.1	EPA 351.2	0.20	0.05	02/05/15 10:30	02/06/15 15:34	1
Total Suspended Solids	mg/L	7	SM 2540D	1	1	02/09/15 08:58	02/10/15 16:22	1
Volatile Suspended Solids	mg/L	7	EPA 160.4	1	1	02/09/15 08:58	02/10/15 16:22	1
Nitrate (as N)	mg/L	14	EPA 353.2	0.08	0.02		02/07/15 12:03	1
Microbiology								
Fecal Coliforms	CFU/100 ml	1 U	SM 9222D	1	1	02/04/15 15:20	02/05/15 13:47	1
Sample Description		NC-BHS7-ST2-DP-03						
Matrix		Wastewater						
SAL Sample Number		1500627-08						
Date/Time Collected		02/04/15 09:55						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
Inorganics								
Ammonia as N	mg/L	0.052	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Chloride	mg/L	450	SM 4500Cl-E	40	10		02/06/15 10:42	10
Nitrate+Nitrite (N)	mg/L	0.10	EPA 353.2	0.04	0.01		02/07/15 12:03	1
Nitrite (as N)	mg/L	0.03 I	SM 4500NO2-B	0.04	0.01		02/05/15 12:51	1
Total Kjeldahl Nitrogen	mg/L	4.2	EPA 351.2	0.40	0.10	02/05/15 10:30	02/06/15 15:34	2
Nitrate (as N)	mg/L	0.07 I	EPA 353.2	0.08	0.02		02/07/15 12:03	1
Sample Description		C-BHS7-ST2-DP-05						
Matrix		Wastewater						
SAL Sample Number		1500627-09						
Date/Time Collected		02/04/15 10:05						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
Inorganics								
Ammonia as N	mg/L	0.16	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Chloride	mg/L	470	SM 4500Cl-E	40	10		02/06/15 10:42	10
Nitrate+Nitrite (N)	mg/L	0.09	EPA 353.2	0.04	0.01		02/07/15 12:03	1

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

March 2, 2015
Work Order: 1500627

Laboratory Report

Project Name		B-HS7 SE#8						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		C-BHS7-ST2-DP-05						
Matrix		Wastewater						
SAL Sample Number		1500627-09						
Date/Time Collected		02/04/15 10:05						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
Nitrite (as N)	mg/L	0.02 I	SM 4500NO2-B	0.04	0.01		02/05/15 12:51	1
Total Kjeldahl Nitrogen	mg/L	3.1	EPA 351.2	0.20	0.05	02/05/15 10:30	02/06/15 15:34	1
Nitrate (as N)	mg/L	0.07 I	EPA 353.2	0.08	0.02		02/07/15 12:03	1
Sample Description		SE-BHS7-ST2-DP-06						
Matrix		Wastewater						
SAL Sample Number		1500627-10						
Date/Time Collected		02/04/15 10:28						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.035 I	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Chloride	mg/L	430	SM 4500Cl-E	40	10		02/06/15 10:45	10
Nitrate+Nitrite (N)	mg/L	0.03 I	EPA 353.2	0.04	0.01		02/07/15 12:03	1
Nitrite (as N)	mg/L	0.01 I	SM 4500NO2-B	0.04	0.01		02/05/15 12:52	1
Total Kjeldahl Nitrogen	mg/L	2.0	EPA 351.2	0.40	0.10	02/05/15 10:30	02/06/15 15:34	2
Nitrate (as N)	mg/L	0.02 I	EPA 353.2	0.08	0.02		02/07/15 12:03	1
Sample Description		SC-BHS7-ST2-DP-07						
Matrix		Wastewater						
SAL Sample Number		1500627-11						
Date/Time Collected		02/04/15 10:25						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.009 U	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	02/05/15 08:52	02/10/15 10:21	1
Chemical Oxygen Demand	mg/L	99	EPA 410.4	25	10	02/11/15 09:23	02/11/15 15:55	1
Chloride	mg/L	460	SM 4500Cl-E	40	10		02/06/15 10:46	10
Nitrate+Nitrite (N)	mg/L	0.02 I	EPA 353.2	0.04	0.01		02/07/15 12:03	1
Nitrite (as N)	mg/L	0.01 I	SM 4500NO2-B	0.04	0.01		02/05/15 12:52	1
Orthophosphate as P	mg/L	0.47	SM 4500P-E	0.040	0.012		02/05/15 11:03	1
Phosphorous - Total as P	mg/L	1.1	SM 4500P-E	0.080	0.020	02/05/15 10:30	02/06/15 15:34	2
Total Alkalinity	mg/L	140	SM 2320B	8.0	2.0		02/16/15 12:30	1

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

March 2, 2015
Work Order: 1500627

Laboratory Report

Project Name		B-HS7 SE#8						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		SC-BHS7-ST2-DP-07						
Matrix		Wastewater						
SAL Sample Number		1500627-11						
Date/Time Collected		02/04/15 10:25						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
Total Kjeldahl Nitrogen	mg/L	1.9	EPA 351.2	0.40	0.10	02/05/15 10:30	02/06/15 15:34	2
Total Suspended Solids	mg/L	1	SM 2540D	1	1	02/09/15 08:58	02/10/15 16:22	1
Volatile Suspended Solids	mg/L	1 U	EPA 160.4	1	1	02/09/15 08:58	02/10/15 16:22	1
Nitrate (as N)	mg/L	0.02 U	EPA 353.2	0.08	0.02		02/07/15 12:03	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	5.1	SM 9223B	2.0	2.0	02/04/15 15:27	02/05/15 10:11	1
Fecal Coliforms	CFU/100 ml	8	SM 9222D	1	1	02/04/15 15:20	02/05/15 13:47	1
Sample Description		SW-BHS7-ST2-DP-08						
Matrix		Wastewater						
SAL Sample Number		1500627-12						
Date/Time Collected		02/04/15 10:08						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.030 I	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	02/05/15 08:52	02/10/15 10:21	1
Chemical Oxygen Demand	mg/L	91	EPA 410.4	25	10	02/11/15 09:23	02/11/15 15:55	1
Chloride	mg/L	490	SM 4500Cl-E	40	10		02/06/15 10:46	10
Nitrate+Nitrite (N)	mg/L	0.01 I	EPA 353.2	0.04	0.01		02/07/15 12:03	1
Nitrite (as N)	mg/L	0.01 U	SM 4500NO2-B	0.04	0.01		02/05/15 12:53	1
Orthophosphate as P	mg/L	0.24	SM 4500P-E	0.040	0.012		02/05/15 11:04	1
Phosphorous - Total as P	mg/L	0.56	SM 4500P-E	0.040	0.010	02/05/15 10:30	02/06/15 15:34	1
Total Alkalinity	mg/L	150	SM 2320B	8.0	2.0		02/16/15 12:45	1
Total Kjeldahl Nitrogen	mg/L	1.9	EPA 351.2	0.20	0.05	02/05/15 10:30	02/06/15 15:34	1
Total Suspended Solids	mg/L	6	SM 2540D	1	1	02/09/15 08:58	02/10/15 16:22	1
Volatile Suspended Solids	mg/L	6	EPA 160.4	1	1	02/09/15 08:58	02/10/15 16:22	1
Nitrate (as N)	mg/L	0.02 U	EPA 353.2	0.08	0.02		02/07/15 12:03	1
<u>Microbiology</u>								
Fecal Coliforms	CFU/100 ml	1 U	SM 9222D	1	1	02/04/15 15:20	02/05/15 13:47	1

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

March 2, 2015
Work Order: 1500627

Laboratory Report

Project Name		B-HS7 SE#8						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		N-BHS7-ST2-OB-01						
Matrix		Wastewater						
SAL Sample Number		1500627-13						
Date/Time Collected		02/04/15 10:56						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.074	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Chloride	mg/L	440	SM 4500Cl-E	40	10		02/06/15 10:47	10
Nitrate+Nitrite (N)	mg/L	0.03 I	EPA 353.2	0.04	0.01		02/07/15 12:03	1
Nitrite (as N)	mg/L	0.03 I	SM	0.04	0.01		02/05/15 12:55	1
			4500NO2-B					
Total Kjeldahl Nitrogen	mg/L	6.9	EPA 351.2	0.20	0.05	02/05/15 10:30	02/06/15 15:34	1
Nitrate (as N)	mg/L	0.02 U	EPA 353.2	0.08	0.02		02/07/15 12:03	1
Sample Description		NE-BHS7-EFF-SL-06						
Matrix		Wastewater						
SAL Sample Number		1500627-16						
Date/Time Collected		02/04/15 08:46						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.12	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Chloride	mg/L	10 U	SM 4500Cl-E	40	10		02/06/15 10:47	10
Nitrate+Nitrite (N)	mg/L	0.26	EPA 353.2	0.04	0.01		02/07/15 12:03	1
Nitrite (as N)	mg/L	0.01 U	SM	0.04	0.01		02/05/15 12:56	1
			4500NO2-B					
Total Kjeldahl Nitrogen	mg/L	0.98	EPA 351.2	0.20	0.05	02/05/15 10:30	02/06/15 15:34	1
Nitrate (as N)	mg/L	0.26	EPA 353.2	0.08	0.02		02/07/15 12:03	1
Sample Description		NW-BHS7-EFF-SL-07						
Matrix		Wastewater						
SAL Sample Number		1500627-17						
Date/Time Collected		02/04/15 09:06						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.018 I	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Chloride	mg/L	730	SM 4500Cl-E	400	100		02/06/15 11:05	100
Nitrate+Nitrite (N)	mg/L	0.03 I	EPA 353.2	0.04	0.01		02/07/15 12:03	1
Nitrite (as N)	mg/L	0.01 U	SM	0.04	0.01		02/05/15 12:56	1
			4500NO2-B					
Total Kjeldahl Nitrogen	mg/L	1.4	EPA 351.2	0.20	0.05	02/05/15 10:30	02/06/15 15:34	1

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

March 2, 2015
Work Order: 1500627

Laboratory Report

Project Name		B-HS7 SE#8						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		NW-BHS7-EFF-SL-07						
Matrix		Wastewater						
SAL Sample Number		1500627-17						
Date/Time Collected		02/04/15 09:06						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
Nitrate (as N)	mg/L	0.03 I	EPA 353.2	0.08	0.02		02/07/15 12:03	1
Sample Description		SE-BHS7-EFF-SL-08						
Matrix		Wastewater						
SAL Sample Number		1500627-18						
Date/Time Collected		02/04/15 09:22						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.023 I	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Carbonaceous BOD	mg/L	7	SM 5210B	2	2	02/05/15 08:52	02/10/15 10:21	1
Chemical Oxygen Demand	mg/L	12 I	EPA 410.4	25	10	02/11/15 09:23	02/11/15 15:55	1
Chloride	mg/L	590	SM 4500Cl-E	400	100		02/06/15 11:06	100
Nitrate+Nitrite (N)	mg/L	12	EPA 353.2	0.04	0.01		02/07/15 12:03	1
Nitrite (as N)	mg/L	0.01 U	SM 4500NO2-B	0.04	0.01		02/05/15 12:57	1
Orthophosphate as P	mg/L	0.012 U	SM 4500P-E	0.040	0.012		02/05/15 11:05	1
Phosphorous - Total as P	mg/L	0.093	SM 4500P-E	0.040	0.010	02/05/15 10:30	02/06/15 15:34	1
Total Alkalinity	mg/L	8.2	SM 2320B	8.0	2.0		02/16/15 12:49	1
Total Kjeldahl Nitrogen	mg/L	1.6	EPA 351.2	0.20	0.05	02/05/15 10:30	02/06/15 15:34	1
Total Suspended Solids	mg/L	1	SM 2540D	1	1	02/09/15 08:58	02/10/15 16:22	1
Volatile Suspended Solids	mg/L	1 U	EPA 160.4	1	1	02/09/15 08:58	02/10/15 16:22	1
Nitrate (as N)	mg/L	12	EPA 353.2	0.08	0.02		02/07/15 12:03	1
<u>Microbiology</u>								
Fecal Coliforms	CFU/100 ml	1 U	SM 9222D	1	1	02/04/15 15:20	02/05/15 13:47	1
Sample Description		SW-BHS7-EFF-SL-09						
Matrix		Wastewater						
SAL Sample Number		1500627-19						
Date/Time Collected		02/04/15 09:44						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.009 U	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Carbonaceous BOD	mg/L	2	SM 5210B	2	2	02/05/15 08:52	02/10/15 10:21	1
Chemical Oxygen Demand	mg/L	41	EPA 410.4	25	10	02/11/15 09:23	02/11/15 15:55	1
Chloride	mg/L	1,200	SM 4500Cl-E	400	100		02/06/15 11:43	100

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

March 2, 2015
Work Order: 1500627

Laboratory Report

Project Name		B-HS7 SE#8						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		SW-BHS7-EFF-SL-09						
Matrix		Wastewater						
SAL Sample Number		1500627-19						
Date/Time Collected		02/04/15 09:44						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
Nitrate+Nitrite (N)	mg/L	0.10	EPA 353.2	0.04	0.01		02/07/15 12:03	1
Nitrite (as N)	mg/L	0.01 U	SM	0.04	0.01		02/05/15 12:57	1
			4500NO2-B					
Orthophosphate as P	mg/L	0.012 U	SM 4500P-E	0.040	0.012		02/05/15 11:06	1
Phosphorous - Total as P	mg/L	0.094	SM 4500P-E	0.040	0.010	02/05/15 10:30	02/06/15 15:34	1
Total Alkalinity	mg/L	2.2 I	SM 2320B	8.0	2.0		02/16/15 12:52	1
Total Kjeldahl Nitrogen	mg/L	1.4	EPA 351.2	0.20	0.05	02/05/15 10:30	02/06/15 15:34	1
Nitrate (as N)	mg/L	0.10	EPA 353.2	0.08	0.02		02/07/15 12:03	1
Microbiology								
Fecal Coliforms	CFU/100 ml	1 U	SM 9222D	1	1	02/04/15 15:20	02/05/15 13:47	1
Sample Description		BHS7-FB						
Matrix		Reagent Water						
SAL Sample Number		1500627-20						
Date/Time Collected		02/04/15 10:45						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
Inorganics								
Ammonia as N	mg/L	0.009 U	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	02/05/15 08:52	02/10/15 10:21	1
Chemical Oxygen Demand	mg/L	10 U	EPA 410.4	25	10	02/11/15 09:23	02/11/15 15:55	1
Chloride	mg/L	1.0 U	SM 4500Cl-E	4.0	1.0		02/06/15 11:43	1
Nitrate+Nitrite (N)	mg/L	0.01 I	EPA 353.2	0.04	0.01		02/07/15 12:03	1
Nitrite (as N)	mg/L	0.01 U	SM	0.04	0.01		02/05/15 12:58	1
			4500NO2-B					
Orthophosphate as P	mg/L	0.012 U	SM 4500P-E	0.040	0.012		02/05/15 11:08	1
Phosphorous - Total as P	mg/L	0.010 U	SM 4500P-E	0.040	0.010	02/19/15 15:10	02/19/15 15:19	1
Total Alkalinity	mg/L	2.0 U	SM 2320B	8.0	2.0		02/16/15 12:55	1
Total Kjeldahl Nitrogen	mg/L	0.05 U	EPA 351.2	0.20	0.05		02/19/15 15:10	1
Total Suspended Solids	mg/L	1 U	SM 2540D	1	1	02/09/15 08:58	02/10/15 16:22	1
Volatile Suspended Solids	mg/L	1 U	EPA 160.4	1	1	02/09/15 08:58	02/10/15 16:22	1
Nitrate (as N)	mg/L	0.02 U	EPA 353.2	0.08	0.02		02/07/15 12:03	1
Microbiology								
E. Coli	MPN/100 mL	2.0 U	SM 9223B	2.0	2.0	02/04/15 15:27	02/05/15 10:11	1
Fecal Coliforms	CFU/100 ml	1 U	SM 9222D	1	1	02/04/15 15:20	02/05/15 13:47	1

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

March 2, 2015
Work Order: 1500627

Laboratory Report

Project Name		B-HS7 SE#8						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS7-EB						
Matrix		Reagent Water						
SAL Sample Number		1500627-21						
Date/Time Collected		02/04/15 11:00						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.009 U	EPA 350.1	0.040	0.009		02/07/15 12:03	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	02/05/15 08:52	02/10/15 10:21	1
Chemical Oxygen Demand	mg/L	10 U	EPA 410.4	25	10	02/11/15 09:23	02/11/15 15:55	1
Chloride	mg/L	1.0 U	SM 4500Cl-E	4.0	1.0		02/06/15 11:43	1
Nitrate+Nitrite (N)	mg/L	0.01 U	EPA 353.2	0.04	0.01		02/07/15 12:03	1
Nitrite (as N)	mg/L	0.01 U	SM 4500NO2-B	0.04	0.01		02/05/15 12:58	1
Orthophosphate as P	mg/L	0.012 U	SM 4500P-E	0.040	0.012		02/05/15 11:13	1
Phosphorous - Total as P	mg/L	0.016 I	SM 4500P-E	0.040	0.010	02/19/15 15:10	02/19/15 15:19	1
Total Alkalinity	mg/L	2.0 U	SM 2320B	8.0	2.0		02/16/15 12:57	1
Total Kjeldahl Nitrogen	mg/L	0.05 U	EPA 351.2	0.20	0.05		02/19/15 15:10	1
Total Suspended Solids	mg/L	1	SM 2540D	1	1	02/09/15 08:58	02/10/15 16:22	1
Volatile Suspended Solids	mg/L	1 U	EPA 160.4	1	1	02/09/15 08:58	02/10/15 16:22	1
Nitrate (as N)	mg/L	0.02 U	EPA 353.2	0.08	0.02		02/07/15 12:03	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	2.0 U	SM 9223B	2.0	2.0	02/04/15 15:27	02/05/15 10:11	1
Fecal Coliforms	CFU/100 ml	1 U	SM 9222D	1	1	02/04/15 15:20	02/05/15 13:47	1
Sample Description		BHS7-TAP						
Matrix		Drinking Water						
SAL Sample Number		1500627-23						
Date/Time Collected		02/04/15 11:30						
Collected by		Josefin Hirst						
Date/Time Received		02/04/15 14:15						
<u>Inorganics</u>								
Chloride	mg/L	3.3 I	SM 4500Cl-E	4.0	1.0		02/06/15 11:43	1

SOUTHERN ANALYTICAL LABORATORIES, INC.

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



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

March 2, 2015
Work Order: 1500627

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BB50406 - Nitrite SM 4500NO2-B by seal										
Blank (BB50406-BLK1)					Prepared & Analyzed: 02/04/15 15:38					
Nitrite (as N)	0.01 U	0.04	0.01	mg/L						
LCS (BB50406-BS1)					Prepared & Analyzed: 02/04/15 15:39					
Nitrite (as N)	0.0767	0.04	0.01	mg/L	0.080		96	90-110		
Matrix Spike (BB50406-MS1)					Source: 1500627-01 Prepared & Analyzed: 02/04/15 15:40					
Nitrite (as N)	0.135	0.04	0.01	mg/L	0.16	ND	84	77-119		
Matrix Spike (BB50406-MS2)					Source: 1501175-01 Prepared & Analyzed: 02/04/15 15:46					
Nitrite (as N)	0.0766	0.04	0.01	mg/L	0.080	ND	96	77-119		
Matrix Spike Dup (BB50406-MSD1)					Source: 1500627-01 Prepared & Analyzed: 02/04/15 15:41					
Nitrite (as N)	0.136	0.04	0.01	mg/L	0.16	ND	85	77-119	0.8	20
Matrix Spike Dup (BB50406-MSD2)					Source: 1501175-01 Prepared & Analyzed: 02/04/15 15:47					
Nitrite (as N)	0.0759	0.04	0.01	mg/L	0.080	ND	95	77-119	0.9	20
Batch BB50432 - Nitrite SM 4500NO2-B by seal										
Blank (BB50432-BLK1)					Prepared & Analyzed: 02/05/15 12:47					
Nitrite (as N)	0.01 U	0.04	0.01	mg/L						
LCS (BB50432-BS1)					Prepared & Analyzed: 02/05/15 12:48					
Nitrite (as N)	0.0800	0.04	0.01	mg/L	0.080		100	90-110		
Matrix Spike (BB50432-MS1)					Source: 1500627-05 Prepared & Analyzed: 02/05/15 12:48					
Nitrite (as N)	0.0931	0.04	0.01	mg/L	0.10	0.0115	82	77-119		

SOUTHERN ANALYTICAL LABORATORIES, INC.

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



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

March 2, 2015
Work Order: 1500627

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BB50432 - Nitrite SM 4500NO2-B by seal										
Matrix Spike (BB50432-MS2)		Source: 1500627-17			Prepared & Analyzed: 02/05/15 12:54					
Nitrite (as N)	0.0917	0.04	0.01	mg/L	0.10	ND	92	77-119		
Matrix Spike Dup (BB50432-MSD1)		Source: 1500627-05			Prepared & Analyzed: 02/05/15 12:49					
Nitrite (as N)	0.0905	0.04	0.01	mg/L	0.10	0.0115	79	77-119	3	20
Matrix Spike Dup (BB50432-MSD2)		Source: 1500627-17			Prepared & Analyzed: 02/05/15 12:55					
Nitrite (as N)	0.0915	0.04	0.01	mg/L	0.10	ND	92	77-119	0.2	20
Batch BB50505 - BOD										
Blank (BB50505-BLK1)					Prepared: 02/05/15 Analyzed: 02/10/15 10:21					
Carbonaceous BOD	2 U	2	2	mg/L						
Blank (BB50505-BLK2)					Prepared: 02/05/15 Analyzed: 02/10/15 10:21					
Carbonaceous BOD	2 U	2	2	mg/L						
LCS (BB50505-BS1)					Prepared: 02/05/15 Analyzed: 02/10/15 10:21					
Carbonaceous BOD	189	2	2	mg/L	200		95	85-115		
LCS (BB50505-BS2)					Prepared: 02/05/15 Analyzed: 02/10/15 10:21					
Carbonaceous BOD	182	2	2	mg/L	200		91	85-115		
LCS Dup (BB50505-BSD1)					Prepared: 02/05/15 Analyzed: 02/10/15 10:21					
Carbonaceous BOD	181	2	2	mg/L	200		91	85-115	4	200
LCS Dup (BB50505-BSD2)					Prepared: 02/05/15 Analyzed: 02/10/15 10:21					
Carbonaceous BOD	180	2	2	mg/L	200		90	85-115	1	200

SOUTHERN ANALYTICAL LABORATORIES, INC.

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



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

March 2, 2015
Work Order: 1500627

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BB50505 - BOD										
Duplicate (BB50505-DUP1)		Source: 1501158-01			Prepared: 02/05/15 Analyzed: 02/10/15 10:21					
Carbonaceous BOD	190	2	2	mg/L		190			1	25
Duplicate (BB50505-DUP2)		Source: 1501209-01			Prepared: 02/05/15 Analyzed: 02/10/15 10:21					
Carbonaceous BOD	330	2	2	mg/L		330			2	25
Batch BB50512 - Ortho phosphorus SM4500P-E by seal										
Blank (BB50512-BLK1)		Prepared & Analyzed: 02/05/15 10:55								
Orthophosphate as P	0.012 U	0.040	0.012	mg/L						
LCS (BB50512-BS1)		Prepared & Analyzed: 02/05/15 10:56								
Orthophosphate as P	0.850	0.040	0.012	mg/L	0.78		110	90-110		
Matrix Spike (BB50512-MS1)		Source: 1500627-01			Prepared & Analyzed: 02/05/15 11:35					
Orthophosphate as P	5.61 L2	0.20	0.060	mg/L	0.97	5.08	55	90-110		
Matrix Spike (BB50512-MS2)		Source: 1501158-02			Prepared & Analyzed: 02/05/15 11:11					
Orthophosphate as P	1.15	0.040	0.012	mg/L	0.97	0.122	106	90-110		
Matrix Spike Dup (BB50512-MSD1)		Source: 1500627-01			Prepared & Analyzed: 02/05/15 11:36					
Orthophosphate as P	5.56 L2	0.20	0.060	mg/L	0.97	5.08	49	90-110	1	20
Matrix Spike Dup (BB50512-MSD2)		Source: 1501158-02			Prepared & Analyzed: 02/05/15 11:12					
Orthophosphate as P	1.12	0.040	0.012	mg/L	0.97	0.122	103	90-110	3	20
Batch BB50523 - Digestion for TP and TKN										
Blank (BB50523-BLK1)		Prepared: 02/05/15 Analyzed: 02/06/15 15:20								
Total Kjeldahl Nitrogen	0.05 U	0.20	0.05	mg/L						
Phosphorous - Total as P	0.010 U	0.040	0.010	mg/L						

SOUTHERN ANALYTICAL LABORATORIES, INC.

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



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

March 2, 2015
Work Order: 1500627

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BB50523 - Digestion for TP and TKN										
LCS (BB50523-BS1)					Prepared: 02/05/15 Analyzed: 02/06/15 15:20					
Total Kjeldahl Nitrogen	1.09	0.20	0.05	mg/L	1.0		109	90-110		
Phosphorous - Total as P	1.08	0.040	0.010	mg/L	1.0		108	90-110		
Matrix Spike (BB50523-MS1)					Source: 1501169-01		Prepared: 02/05/15 Analyzed: 02/06/15 15:20			
Phosphorous - Total as P	1.91	0.040	0.010	mg/L	2.0	ND	95	90-110		
Total Kjeldahl Nitrogen	1.95 J2	0.20	0.05	mg/L	2.0	0.196	88	90-110		
Matrix Spike (BB50523-MS2)					Source: 1501209-07		Prepared: 02/05/15 Analyzed: 02/06/15 15:20			
Total Kjeldahl Nitrogen	3.27	0.20	0.05	mg/L	2.0	1.09	109	90-110		
Phosphorous - Total as P	2.22	0.040	0.010	mg/L	2.0	0.244	99	90-110		
Matrix Spike Dup (BB50523-MSD1)					Source: 1501169-01		Prepared: 02/05/15 Analyzed: 02/06/15 15:20			
Total Kjeldahl Nitrogen	1.99 J2	0.20	0.05	mg/L	2.0	0.196	90	90-110	2	20
Phosphorous - Total as P	1.94	0.040	0.010	mg/L	2.0	ND	97	90-110	2	25
Matrix Spike Dup (BB50523-MSD2)					Source: 1501209-07		Prepared: 02/05/15 Analyzed: 02/06/15 15:20			
Total Kjeldahl Nitrogen	3.51	0.20	0.05	mg/L	2.0	1.09	121	90-110	7	20
Phosphorous - Total as P	2.34	0.040	0.010	mg/L	2.0	0.244	105	90-110	5	25
Batch BB50524 - Digestion for TP and TKN										
Blank (BB50524-BLK1)					Prepared: 02/05/15 Analyzed: 02/06/15 15:34					
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						
LCS (BB50524-BS1)					Prepared: 02/05/15 Analyzed: 02/06/15 15:34					
Phosphorous - Total as P	1.10	0.040	0.010	mg/L	1.0		110	90-110		
Total Kjeldahl Nitrogen	1.10	0.20	0.05	mg/L	1.0		110	90-110		

SOUTHERN ANALYTICAL LABORATORIES, INC.

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



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

March 2, 2015
Work Order: 1500627

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BB50524 - Digestion for TP and TKN										
Matrix Spike (BB50524-MS1)		Source: 1500627-20			Prepared: 02/05/15 Analyzed: 02/06/15 15:34					
Phosphorous - Total as P	1.13	0.040	0.010	mg/L	1.0	ND	113	90-110		
Total Kjeldahl Nitrogen	1.09	0.20	0.05	mg/L	1.0	ND	109	90-110		
Matrix Spike (BB50524-MS2)		Source: 1500627-21			Prepared: 02/05/15 Analyzed: 02/06/15 15:34					
Total Kjeldahl Nitrogen	1.03	0.20	0.05	mg/L	1.0	ND	103	90-110		
Phosphorous - Total as P	1.08	0.040	0.010	mg/L	1.0	0.0160	107	90-110		
Matrix Spike Dup (BB50524-MSD1)		Source: 1500627-20			Prepared: 02/05/15 Analyzed: 02/06/15 15:34					
Total Kjeldahl Nitrogen	1.06 J2	0.20	0.05	mg/L	1.0	ND	106	90-110	3	20
Phosphorous - Total as P	1.10	0.040	0.010	mg/L	1.0	ND	110	90-110	3	25
Matrix Spike Dup (BB50524-MSD2)		Source: 1500627-21			Prepared: 02/05/15 Analyzed: 02/06/15 15:34					
Phosphorous - Total as P	1.07	0.040	0.010	mg/L	1.0	0.0160	105	90-110	2	25
Total Kjeldahl Nitrogen	1.03 J2	0.20	0.05	mg/L	1.0	ND	103	90-110	0.4	20
Batch BB50535 - Chloride by Seal										
Blank (BB50535-BLK1)		Prepared & Analyzed: 02/06/15 10:35								
Chloride	1.0 U	4.0	1.0	mg/L						
LCS (BB50535-BS1)		Prepared & Analyzed: 02/06/15 10:35								
Chloride	9.9	4.0	1.0	mg/L	10		99	90-110		
Matrix Spike (BB50535-MS1)		Source: 1500627-01			Prepared & Analyzed: 02/06/15 10:36					
Chloride	1,400	400	100	mg/L	1000	420	98	80-120		
Matrix Spike (BB50535-MS2)		Source: 1500627-18			Prepared & Analyzed: 02/06/15 10:44					
Chloride	480 L2	400	100	mg/L	100	590	NR	80-120		

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

March 2, 2015
Work Order: 1500627

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BB50535 - Chloride by Seal										
Matrix Spike Dup (BB50535-MSD1)					Source: 1500627-01		Prepared & Analyzed: 02/06/15 10:37			
Chloride	1,400	400	100	mg/L	1000	420	99	80-120	1	20
Matrix Spike Dup (BB50535-MSD2)					Source: 1500627-18		Prepared & Analyzed: 02/06/15 10:45			
Chloride	480 L2	400	100	mg/L	100	590	NR	80-120	0.2	20
Batch BB50554 - Ammonia by SEAL										
Blank (BB50554-BLK1)					Prepared & Analyzed: 02/07/15 12:03					
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 (BB50554-BS1)					Prepared & Analyzed: 02/07/15 12:03					
Ammonia as N	1.0	0.040	0.009	mg/L					90-110	
Nitrate+Nitrite (N)	0.907	0.04	0.01	mg/L					90-110	
Matrix Spike (BB50554-MS1)					Source: 1500627-20		Prepared & Analyzed: 02/07/15 12:03			
Ammonia as N	1.0	0.040	0.009	mg/L	1.0	ND	100	90-110		
Nitrate+Nitrite (N)	1.04	0.04	0.01	mg/L	1.0	0.0120	103	90-110		
Matrix Spike (BB50554-MS2)					Source: 1500627-21		Prepared & Analyzed: 02/07/15 12:03			
Ammonia as N	1.0	0.040	0.009	mg/L	1.0	ND	101	90-110		
Nitrate+Nitrite (N)	1.01	0.04	0.01	mg/L	1.0	ND	101	90-110		
Matrix Spike Dup (BB50554-MSD1)					Source: 1500627-20		Prepared & Analyzed: 02/07/15 12:03			
Nitrate+Nitrite (N)	1.05	0.04	0.01	mg/L	1.0	0.0120	104	90-110	0.9	20
Ammonia as N	1.0	0.040	0.009	mg/L	1.0	ND	102	90-110	2	10

SOUTHERN ANALYTICAL LABORATORIES, INC.

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



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

March 2, 2015
Work Order: 1500627

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BB50554 - Ammonia by SEAL										
Matrix Spike Dup (BB50554-MSD2)		Source: 1500627-21			Prepared & Analyzed: 02/07/15 12:03					
Nitrate+Nitrite (N)	1.06	0.04	0.01	mg/L	1.0	ND	106	90-110	5	20
Ammonia as N	1.1	0.040	0.009	mg/L	1.0	ND	107	90-110	6	10
Batch BB50901 - VSS Prep										
Blank (BB50901-BLK1)		Prepared: 02/09/15 Analyzed: 02/10/15 16:22								
Volatile Suspended Solids	1 U	1		mg/L						
Total Suspended Solids	1 U	1	1	mg/L						
LCS (BB50901-BS1)		Prepared: 02/09/15 Analyzed: 02/10/15 16:22								
Total Suspended Solids	50.0	1	1	mg/L	50		100	85-115		
LCS Dup (BB50901-BSD1)		Prepared: 02/09/15 Analyzed: 02/10/15 16:22								
Total Suspended Solids	49.5	1	1	mg/L	50		99	85-115	1	200
Duplicate (BB50901-DUP1)		Source: 1501284-02			Prepared: 02/09/15 Analyzed: 02/10/15 16:22					
Volatile Suspended Solids	2,060	1		mg/L		2010			2	20
Total Suspended Solids	3,760	1	1	mg/L		3270			14	30
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						

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

March 2, 2015
Work Order: 1500627

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BB51104 - COD prep										
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 BB51611 - alkalinity										
Blank (BB51611-BLK1)					Prepared & Analyzed: 02/16/15 11:48					
Total Alkalinity	2.0 U	8.0	2.0	mg/L						
Blank (BB51611-BLK2)					Prepared & Analyzed: 02/16/15 11:51					
Total Alkalinity	2.0 U	8.0	2.0	mg/L						
LCS (BB51611-BS1)					Prepared & Analyzed: 02/16/15 11:57					
Total Alkalinity	130	8.0	2.0	mg/L	120		106	90-110		

SOUTHERN ANALYTICAL LABORATORIES, INC.

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



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

March 2, 2015
Work Order: 1500627

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BB51611 - alkalinity										
LCS (BB51611-BS2)					Prepared & Analyzed: 02/16/15 12:03					
Total Alkalinity	130	8.0	2.0	mg/L	120		106	90-110		
Matrix Spike (BB51611-MS1)					Source: 1501394-05 Prepared & Analyzed: 02/16/15 13:47					
Total Alkalinity	320	8.0	2.0	mg/L	120	200	102	80-120		
Matrix Spike (BB51611-MS2)					Source: 1501576-01 Prepared & Analyzed: 02/16/15 14:26					
Total Alkalinity	250	8.0	2.0	mg/L	120	120	99	80-120		
Matrix Spike Dup (BB51611-MSD1)					Source: 1501394-05 Prepared & Analyzed: 02/16/15 13:52					
Total Alkalinity	320	8.0	2.0	mg/L	120	200	96	80-120	2	26
Matrix Spike Dup (BB51611-MSD2)					Source: 1501576-01 Prepared & Analyzed: 02/16/15 14:29					
Total Alkalinity	250	8.0	2.0	mg/L	120	120	100	80-120	0.4	26

SOUTHERN ANALYTICAL LABORATORIES, INC.

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



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

March 2, 2015
Work Order: 1500627

Microbiology - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BB50426 - FC-MF										
Blank (BB50426-BLK1)					Prepared: 02/04/15 Analyzed: 02/05/15 13:47					
Fecal Coliforms	1 U	1	1	CFU/100 ml						
Duplicate (BB50426-DUP1)					Source: 1500627-21 Prepared: 02/04/15 Analyzed: 02/05/15 13:47					
Fecal Coliforms	1 U	1	1	CFU/100 ml		ND				200

Hazen and Sawyer**10002 Princess Palm Ave, Suite 200****Tampa, FL 33619****March 2, 2015****Work Order: 1500627**

*** 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.

- Q Sample held beyond the accepted holding time.
L2 Analyte level in sample invalidated Matrix Spike.
J2 Quality control value for accuracy was outside control limits.

Questions regarding this report should be directed to :

Kathryn Nordmark

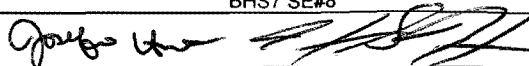
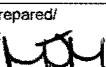

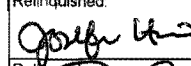
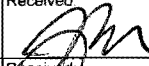
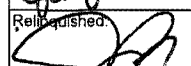
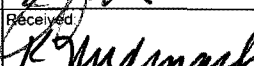
Telephone (813) 855-1844 FAX (813) 855-2218

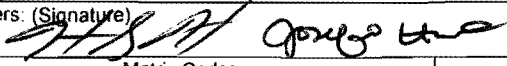
Kathryn@southernanalyticallabs.com

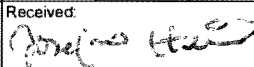
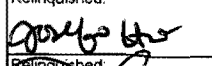
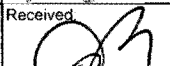
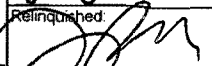
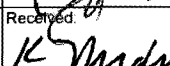
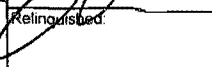
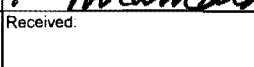
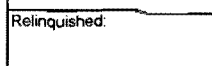

The results for the duplicate Ammonia and TKN analysis of sample NC-BHS7-5T1-SL2 and NC-BHS7-5T1-SL2-DUP do not match. The values for SC-BHS7-5T1-SL03 match NC-BHS7-5T1-SL2. It appears that NC-BHS7-5T1-SL2-DUP and SC-BHS7-5T1-SL03 may have been switched in the field. All other data for these samples looks appropriate.

LCB 02/26/2015



Client Name Hazen and Sawyer										Josefin Hirst										
Project Name / Location BHS7 SE#8																				
Samplers: (Signature) 										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	125mLP, Na ₂ S ₂ O ₃ , Sterile FC-QT, FC-MF	500mLP, Cool Total Alkalinity, TSS, VSS, CBOD, NOx, Cl, OP	125mLP, H ₂ SO ₄ COD, TKN, NH ₃ , TP	125mLP, H ₂ SO ₄ TKN, NH ₃	500mLP, Cool NOx, Cl					Field pH	Field Temperature	Field Conductivity	Field DO	No. of Containers (Total per each location)
SAL Use Only Sample No.	Sample Description																			
01	BHS7-PUMP	2/4/15	11:15	WW		X	4	2	1							7.52	18.3	2102	0.16	
02	BHS7-PUMP-DUP		11:20	WW		X	4	2	1							7.52	18.3	2102	0.16	
03	NC-BHS7-ST1-SL-01		8:40	WW		X				1	1					5.74	13.9	2220	6.66	
04	NC-BHS7-ST1-SL-02		8:55	WW		X				1	1					5.80	13.9	2034	6.30	
05	SC-BHS7-ST1-SL-03		9:15	WW		X				1	1					4.56	13.9	2081	6.69	
06	SC-BHS7-ST1-SL-03-DUP		9:20	WW		X				1	1					4.56	13.9	2031	6.69	
07	SC-BHS7-ST1-SL-04		9:30	WW		X	4	2	1							5.39	13.9	1625	6.23	
08	NC-BHS7-ST2-DP-03		9:55	WW		X				1	1					6.16	17.2	1774	1.96	
09	C-BHS7-ST2-DP-05		10:05	WW		X				1	1					6.07	16.2	1773	1.94	
10	SE-BHS7-ST2-DP-06		10:28	WW		X				1	1					6.06	16.9	1685	2.68	
11	SC-BHS7-ST2-DP-07		10:25	WW		X	4	2	1							6.06	16.4	1649	4.12	
12	SW-BHS7-ST2-DP-08		10:08	WW		X	4	2	1							6.05	16.1	1703	4.29	
Containers Prepared/ Relinquished: 		Date/Time: 1000 01/19/15	Received: 		Date/Time: 12:00pm 1/20/15		Seal intact? Y N <input checked="" type="radio"/> Samples intact upon arrival? O N N/A Received on ice? Temp _____ <input checked="" type="radio"/> N N/A Proper preservatives indicated? <input checked="" type="radio"/> N N/A Rec'd within holding time? <input checked="" type="radio"/> N N/A Volatiles rec'd w/out headspace? Y N <input checked="" type="radio"/> Proper containers used? <input checked="" type="radio"/> N N/A										Instructions / Remarks: <div style="text-align: right; font-size: 1.5em;">1500627</div>			
Relinquished: 		Date/Time: 11:50 020415	Received: 		Date/Time: 11:50 020415															
Relinquished: 		Date/Time: 1415 2/4/15	Received: 		Date/Time: 1415 2/4/15															
Relinquished:		Date/Time:	Received:		Date/Time:															
Relinquished:		Date/Time:	Received:		Date/Time:															

Client Name Hazen and Sawyer										Josefin Hirst										
Project Name / Location BHS7 SE#8																				
Samplers: (Signature) 										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																				
SAL Use Only	Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	125mLP, Na ₂ S ₂ O ₃ , Sterile FC-QT, FC-MF	500mLP, Cool Total Alkalinity, TSS, VSS, CBOD, NOx, Cl, OP	125mLP, H ₂ SO ₄ COD, TKN, NH ₃ , TP	125mLP, H ₂ SO ₄ TKN, NH ₃	500mLP, Cool NOx, Cl	500mLP, Cool Cl			Field pH	Field Temperature	Field Conductivity	Field DO	No. of Containers (Total per each location)
	13	N-BHS7-ST2-OB-01	2/4/15	10:56	WW		X				1	1				6.19	16.0	1535	3.34	
	14	C-BHS7-ST2-OB-02	2/4	—	WW		X				1	1								
	15	S-BHS7-ST2-OB-03	2/4	—	WW		X	4	2	1										
	16	NE-BHS7-EFF-SL-06	2/4	8:46	WW		X				1	1				5.49	15.6	79.9	8.02	
	17	NW-BHS7-EFF-SL-07	2/4	9:06	WW		X				1	1				6.00	15.4	174.3	8.35	
	18	SE-BHS7-EFF-SL-08	2/4	9:22	WW		X	4	2	1						5.15	15.0	1889	7.41	
	19	SW-BHS7-EFF-SL-09	2/4	9:44	WW		X	4	2	1						5.71	15.5	4050	8.24	
	20	BHS7-FB	2/4/15	10:45	R		X	4	2	1						6.25	14.4	2.09	9.18	
	21	BHS7-EB	2/4/15	11:00	R		X	4	2	1						5.32	14.3	1.33	9.52	
	22	BHS7-BKG	Dry	—	WW		X	4	2	1										
	23	BHS7-TAP	2/4/15	11:30	DW		X						1			7.71	17.3	181.7	6.32	
							X													

Containers Prepared/Relinquished:	Date/Time: <u>01/19/15</u>	Received: 	Date/Time: <u>12:04/15</u>	Seal intact? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N <input checked="" type="checkbox"/> NA Samples intact upon arrival? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> NA Received on ice? Temp: _____ <input checked="" type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> NA Proper preservatives indicated? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> NA Rec'd w/in holding time? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> NA Volatiles rec'd w/out headspace? <input type="checkbox"/> Y <input type="checkbox"/> N <input checked="" type="checkbox"/> NA Proper containers used? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> NA	Instructions / Remarks:
Relinquished: 	Date/Time: <u>11:50</u>	Received: 	Date/Time: <u>11:50</u>		
Relinquished: 	Date/Time: <u>02/04/15</u>	Received: 	Date/Time: <u>02/04/15</u>		
Relinquished: 	Date/Time: <u>14:15</u>	Received: 	Date/Time: <u>14:15</u>		
Relinquished: 	Date/Time: <u>2/4/15</u>	Received: 	Date/Time: <u>2/4/15</u>		
Relinquished:	Date/Time:	Received:	Date/Time:		



Appendix B: Operation & Maintenance Log

Table B.1
Operation and Maintenance Log

Date	Description
11/13/2013	Construction - Pump tank, liner and lignocellulosic media installed
11/14/2013	Construction - Pump, feed line, laterals, infiltrator chambers installed, wet pressure test
11/15/2013	Construction - final grading, hay and seed applied
11/18/2013	Construction - electrician finished electrical work
11/19/2013	System Start-up
	Bull run valve (BRV) switched from old drainfield to PNRS system
11/26/2013	Site visit. System ok
	Flipped BRV to old drainfield for Thanksgiving holiday ~ 30-40 people staying at the house
12/2/2013	Site visit. System ok
	Flipped BRV back to PNRS system
12/6/2013	Site visit. System ok
	Flipped BRV to old drainfield for holiday party ~ 80 people attending
12/9/2013	Homeowner flipped BRV back to PNRS system
12/10/2013	Site visit. System ok
	Preparation for preliminary sample event
12/12/2013	Preliminary sample event No. 1
1/3/2014	Site visit. System ok
1/17/2014	Preparation for Sample Event No. 1
1/20/2014	Sample Event No. 1
3/5/2014	Site visit. System ok
3/13/2014	Site visit. System ok
3/19/2014	Preparation for Sample Event No. 2
3/20/2014	Sample Event No. 2
4/28/2014	Site visit. System ok
5/7/2014	Preparation for Sample Event No. 3
5/8/2014	Sample Event No. 3
5/27/2014	Site visit. System ok
6/18/2014	Preparation for Sample Event No. 4
6/19/2014	Sample Event No. 4

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

Date	Description
7/16/2014	Site visit.
	Primary tank and pump tank high water level.
	System was still on GFI breaker which had tripped.
	Pump came on and lowered the levels.
	Cleaned primary tank effluent screen.
8/19/2014	Preparation for Sample Event No. 5
8/20/2014	Sample Event No. 5
	Checked primary tank effluent screen- ok no maintenance required.
9/23/2014	Site visit. System ok
10/20/2014	Preparation for Sample Event No. 6
10/22/2014	Sample Event No. 6
	Cleaned primary tank effluent screen.
11/24/2014	Site visit. System ok
12/16/2014	Preparation for Sample Event No. 7
	Fixed leaky valve on the background lysimeter (BHS7-BKG)
12/18/2014	Sample Event No. 7
	Cleaned primary tank effluent screen which was severely clogged (high water level in tank).
01/14/15	Site visit. System ok
02/02/15	Preparation for Sample Event No. 8
02/04/15	Sample Event No. 8
	Cleaned primary tank effluent screen

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



Appendix C: Weather Station Data

Table C.1
Weather Station Data

MONTHLY CLIMATOLOGICAL SUMMARY FOR JANUARY 2015												
DAY	RAIN (inches)	MEAN TEMP (F)	HIGH TEMP (F)	TIME	LOW TEMP (F)	TIME	HEAT DEG DAYS	COOL DEG DAYS	AVG. WIND SPEED (mph)	HIGH WIND SPEED (mph)	TIME	WIND DIR
1	0.00	59.7	68.0	3:00p	53.4	7:00a	5.7	0.4	2.1	12.0	12:00p	NNW
2	0.00	64.7	77.7	4:30p	57.2	4:00a	3.0	2.6	0.8	7.0	4:00a	NE
3	0.00	71.8	84.5	4:00p	64.3	2:30a	0.2	7.0	0.8	13.0	11:30a	SSW
4	0.07	72.8	84.4	2:00p	65.9	4:30a	0.0	7.8	1.3	15.0	10:30a	SW
5	0.00	59.0	67.0	12:30a	48.0	12:00m	6.1	0.1	1.3	15.0	8:30a	NNW
6	0.00	58.0	77.4	2:00p	45.5	6:30a	9.4	2.4	0.6	11.0	2:00p	SW
7	0.01	52.6	69.3	4:00p	40.4	8:30a	12.8	0.4	0.6	15.0	11:00p	NW
8	0.00	41.9	52.2	3:30p	31.1	7:30a	23.1	0.0	3.9	21.0	5:30a	NNW
9	0.02	45.2	58.0	4:00p	39.0	12:00m	19.8	0.0	1.0	11.0	10:00a	NNW
10	0.00	49.9	63.4	2:30p	39.0	8:00a	15.1	0.0	2.0	16.0	3:30p	NNW
11	0.06	60.1	72.0	1:30p	49.0	12:30a	6.0	1.1	1.1	13.0	1:30p	NNW
12	2.39	65.6	75.9	11:30a	61.6	12:00m	1.1	1.7	0.5	12.0	3:00p	ENE
13	0.01	64.2	73.8	3:00p	58.4	7:00a	2.4	1.7	1.2	9.0	8:00p	NNW
14	0.00	57.9	67.8	3:00p	51.0	12:00m	7.3	0.1	2.1	10.0	12:30a	NNW
15	0.21	50.0	54.3	1:30p	48.3	6:00a	15.0	0.0	1.2	10.0	4:00p	NNW
16	0.02	51.1	62.9	3:30p	42.0	12:00m	13.9	0.0	1.1	12.0	3:30a	NNW
17	0.01	55.1	74.0	3:00p	39.8	6:00a	11.3	1.4	0.6	10.0	3:30p	NNW
18	0.00	58.0	71.8	2:30p	47.5	12:00m	8.1	1.1	0.9	12.0	12:00p	SW
19	0.01	52.5	71.7	4:30p	40.0	7:30a	13.2	0.7	0.3	8.0	11:30a	NNW
20	0.00	57.3	76.8	3:30p	43.3	5:00a	9.5	1.8	0.3	9.0	2:00p	SSW
21	0.00	61.3	78.1	4:00p	50.5	6:30a	6.3	2.6	0.2	7.0	2:30p	E
22	0.01	61.2	76.2	3:30p	49.7	6:00a	6.3	2.5	0.5	13.0	4:00p	NE
23	1.60	67.0	78.0	1:30p	56.5	12:30a	1.7	3.8	1.2	15.0	2:00p	SSW
24	0.52	58.8	68.6	4:30a	40.2	12:00m	6.9	0.7	2.6	17.0	11:00a	SW
25	0.01	49.6	66.0	3:00p	34.8	8:00a	15.5	0.0	0.7	10.0	3:30p	SW
26	0.09	55.6	64.5	3:00p	46.5	12:00m	9.4	0.0	2.1	17.0	1:00p	SW
27	0.00	51.8	66.9	3:30p	37.7	7:30a	13.4	0.2	1.6	18.0	3:30p	SW
28	0.00	46.2	60.8	4:00p	34.7	7:00a	18.8	0.0	1.0	12.0	1:00p	NNW
29	0.00	51.6	72.9	3:30p	34.5	3:30a	14.6	1.2	0.5	9.0	2:00p	SW
30	0.00	56.1	73.0	2:30p	44.9	4:00a	9.9	1.0	1.0	12.0	1:00p	NNW
31	0.00	53.1	69.4	2:00p	38.0	6:30a	12.5	0.5	1.2	14.0	11:30a	NE
TOTAL	5.04											

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

Table C.1
Weather Station Data (continued)

MONTHLY CLIMATOLOGICAL SUMMARY FOR FEBRUARY 2015												
DAY	RAIN (inches)	MEAN TEMP (F)	HIGH TEMP (F)	TIME	LOW TEMP (F)	TIME	HEAT DEG DAYS	COOL DEG DAYS	AVG. WIND SPEED (mph)	HIGH WIND SPEED (mph)	TIME	WIND DIR
1	0.00	59.2	75.5	3:30p	44.7	6:30a	8.4	2.6	0.9	17.0	2:30p	SSW
2	0.24	62.1	71.1	2:00p	45.6	12:00m	4.1	1.2	2.5	15.0	6:00a	SW
3	0.00	48.7	60.9	3:00p	36.5	7:00a	16.3	0.0	1.6	15.0	9:30a	NNW
4	0.16	57.8	70.8	3:30p	49.1	12:30a	7.9	0.7	1.1	10.0	9:30p	NE
5	0.48	57.6	66.8	4:00p	44.3	12:00m	7.5	0.0	1.7	15.0	11:30a	NNW
6	0.00	51.6	64.4	3:30p	42.8	3:00a	13.4	0.0	2.2	17.0	12:30p	NNW
7	0.00	54.8	73.3	4:00p	42.0	6:30a	11.6	1.4	0.6	10.0	2:30p	ENE
8	0.01	59.4	77.9	4:00p	45.4	7:00a	8.6	3.0	0.5	9.0	11:00a	SW
9	0.18	58.0	74.5	2:00p	46.7	3:00a	8.1	1.1	0.1	5.0	1:00p	ESE
10	0.00	55.7	64.4	4:00p	46.8	12:00m	9.3	0.0	1.1	13.0	4:00p	NW
11	0.01	52.1	69.9	4:00p	38.7	8:00a	13.3	0.4	0.8	12.0	12:00p	NNW
12	0.01	54.4	71.2	4:00p	39.4	3:30a	11.8	1.2	1.2	13.0	3:00p	SW
13	0.00	47.0	58.9	3:30p	36.1	12:00m	18.0	0.0	1.3	13.0	9:00a	NNW
14	0.00	47.6	66.1	3:30p	30.6	7:30a	17.5	0.0	1.3	12.0	3:30p	SW
15	0.00	57.2	73.1	2:30p	43.0	12:00m	9.4	1.6	1.6	13.0	6:30p	SW
16	0.00	59.9	76.8	2:30p	42.0	4:00a	8.1	3.0	1.5	16.0	11:30a	SSW
17	0.94	62.2	73.2	11:00a	52.4	11:30p	4.1	1.3	1.9	18.0	10:30a	SW
18	0.24	50.0	61.7	4:30p	42.7	8:00a	15.0	0.0	1.7	15.0	3:00p	SW
19	0.00	40.9	51.9	3:30p	32.5	11:00p	24.1	0.0	1.5	17.0	11:00a	NW
20	0.00	39.0	57.0	3:00p	24.1	3:30a	26.0	0.0	0.9	11.0	10:00a	NNW
21	0.00	53.3	73.3	2:00p	32.2	12:30a	13.2	1.5	0.9	16.0	3:00p	SSW
22	0.00	66.4	85.1	3:00p	51.7	3:30a	4.5	5.8	0.7	12.0	10:00a	SW
23	0.00	68.2	80.3	2:30p	59.8	5:00a	1.4	4.5	1.0	11.0	1:00p	SW
24	0.06	62.6	66.8	4:30p	57.7	12:00m	2.7	0.2	1.0	12.0	1:30a	SW
25	0.00	61.5	70.0	10:00p	55.4	9:00a	4.4	0.9	1.3	21.0	11:00p	SSW
26	0.30	63.6	73.2	3:30a	53.4	12:00m	3.4	2.0	2.6	24.0	3:30a	SW
27	0.00	53.1	63.5	2:30p	48.0	7:00a	11.9	0.0	3.2	16.0	9:30p	NNW
28	0.18	59.0	64.3	3:30p	52.5	12:30a	6.0	0.0	2.1	18.0	12:30a	NNW
TOTAL	2.81											

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

Figure C.1
Summary of Monthly Precipitation
January 2013 through February 2015

