



Florida Onsite Sewage Nitrogen Reduction Strategies Study

Task B.7

B-HS7 Field System Monitoring Report No. 7

Progress Report

December 2014

442-27-001

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In association with:



AET
Applied Environmental Technology

**Otis Environmental
Consultants, LLC**

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TASK B.7 PROGRESS REPORT

B-HS7 Field System Monitoring Report No. 7

Prepared for:

Florida Department of Health
Division of Disease Control and Health Protection
Bureau of Environmental Health
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1.0 Background

Task B of the Florida Onsite Sewage Nitrogen Reduction Strategies Study (FOSNRS) includes performing field experiments to critically evaluate the performance of nitrogen removal technologies that were identified in FOSNRS Task A.9 and pilot tested in 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 seventh 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 seventh B-HS7 monitoring and sampling event conducted on December 18, 2014 (Experimental Day 394). 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 sixteen 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

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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 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.

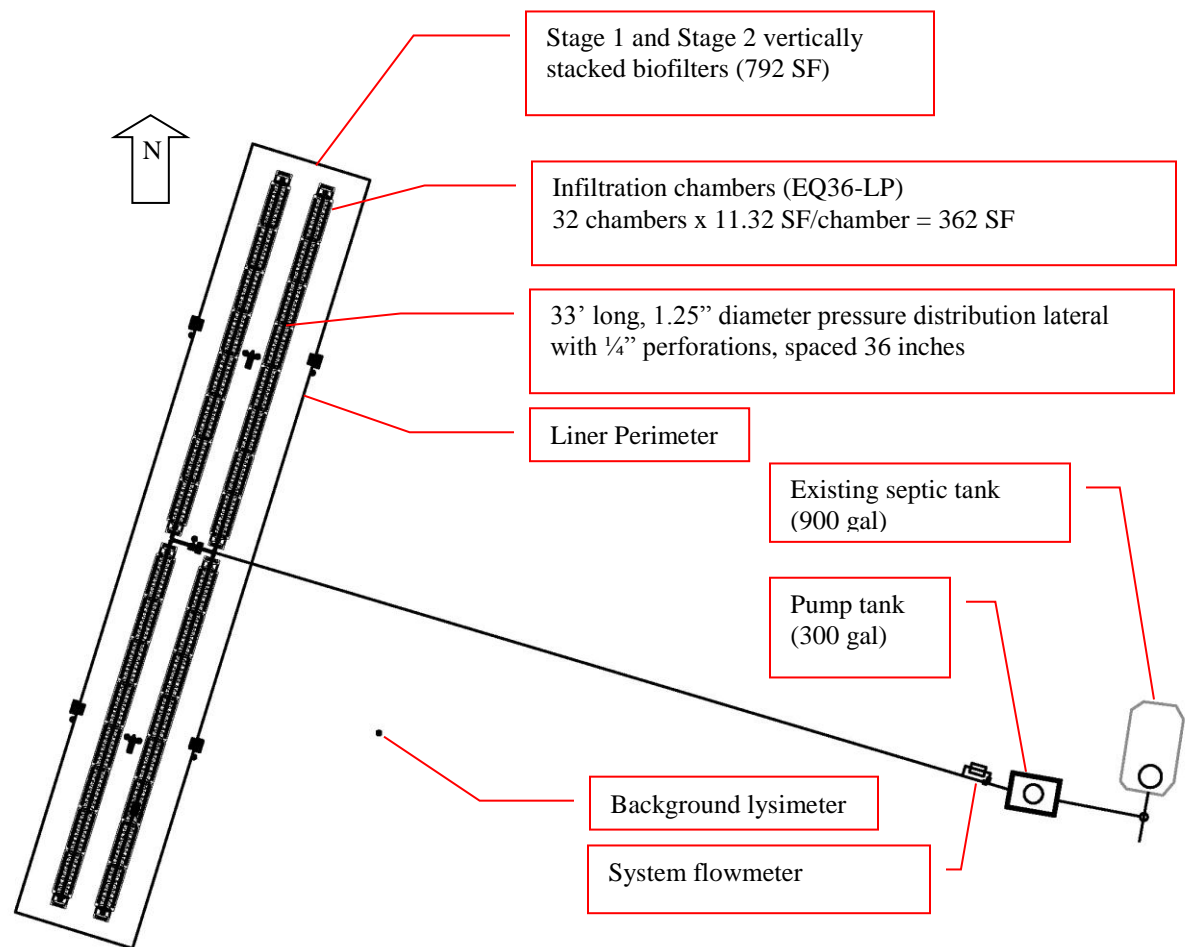


Figure 1
Plan view of B-HS7 System Layout

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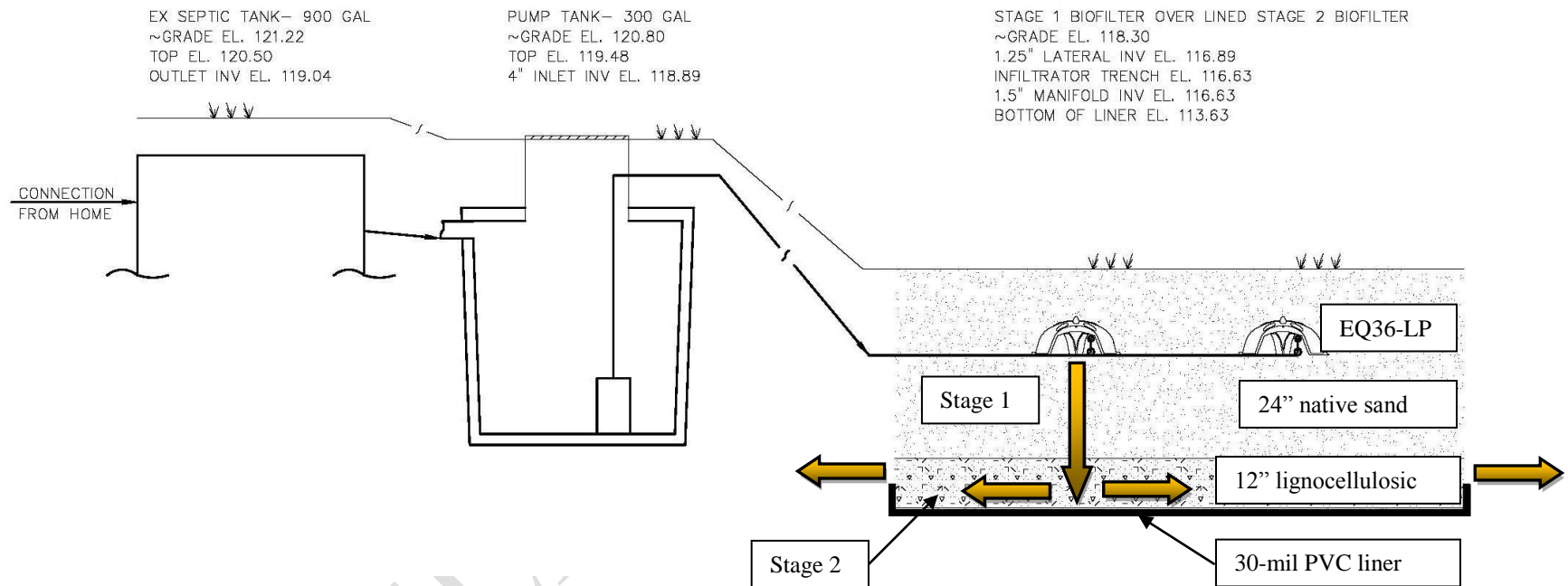


Figure 2
Flow Schematic of B-HS7 PNRS Installed in Marion County

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.

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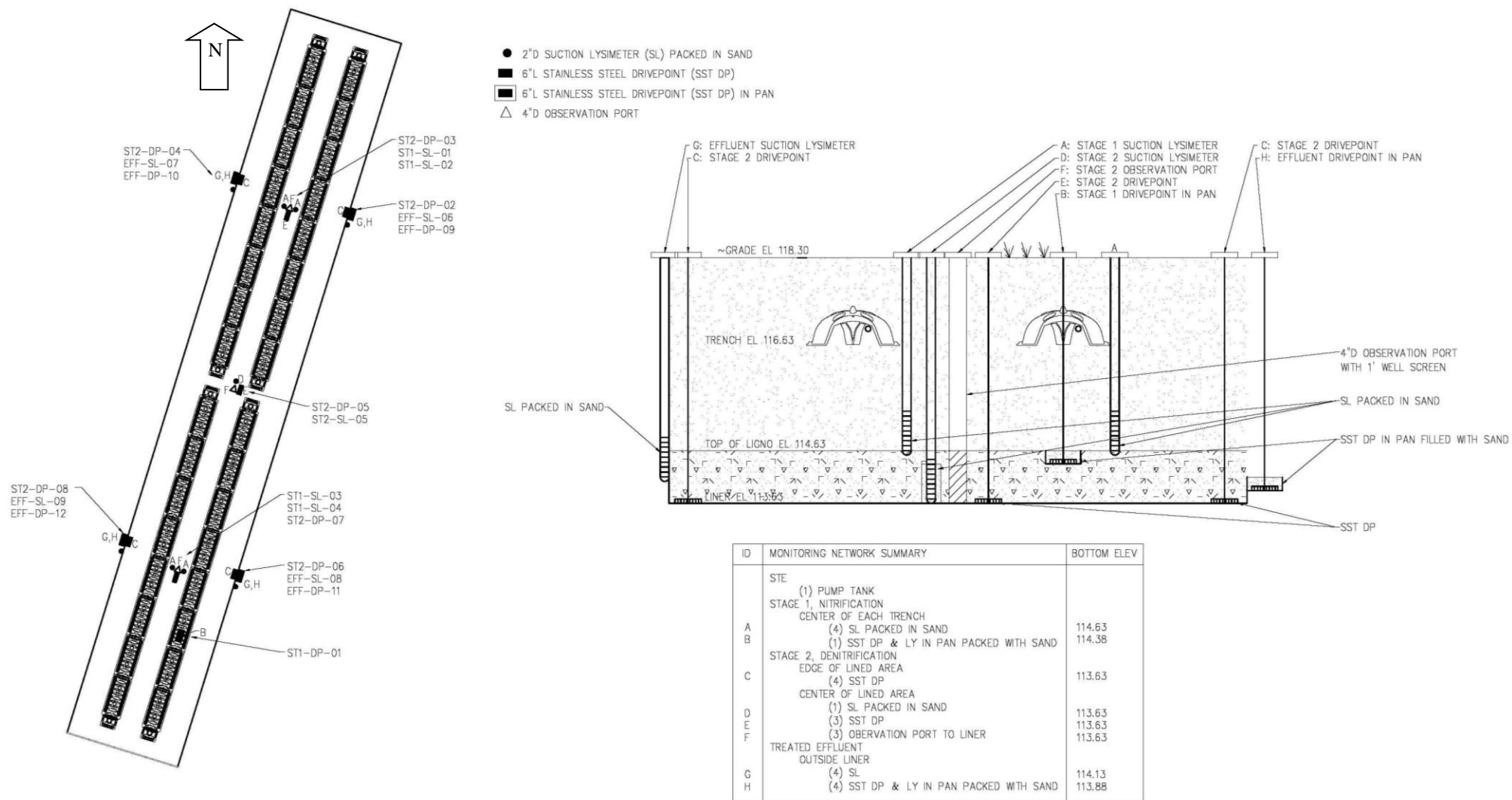


Figure 3
B-HS7 Sample and Monitoring Locations

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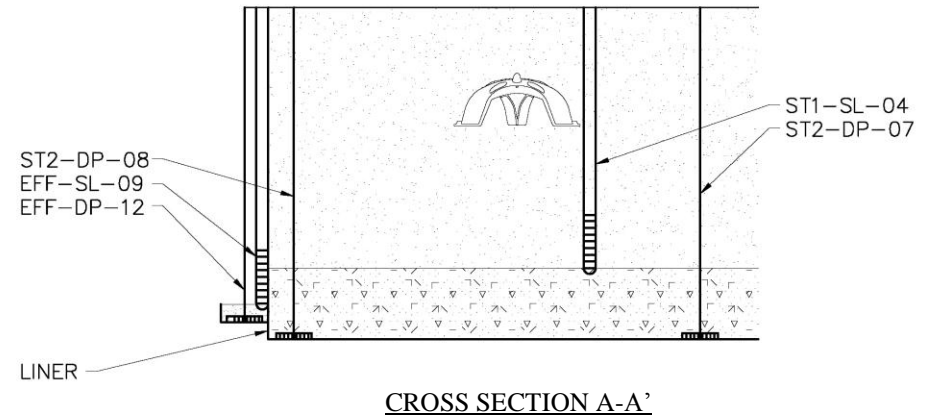
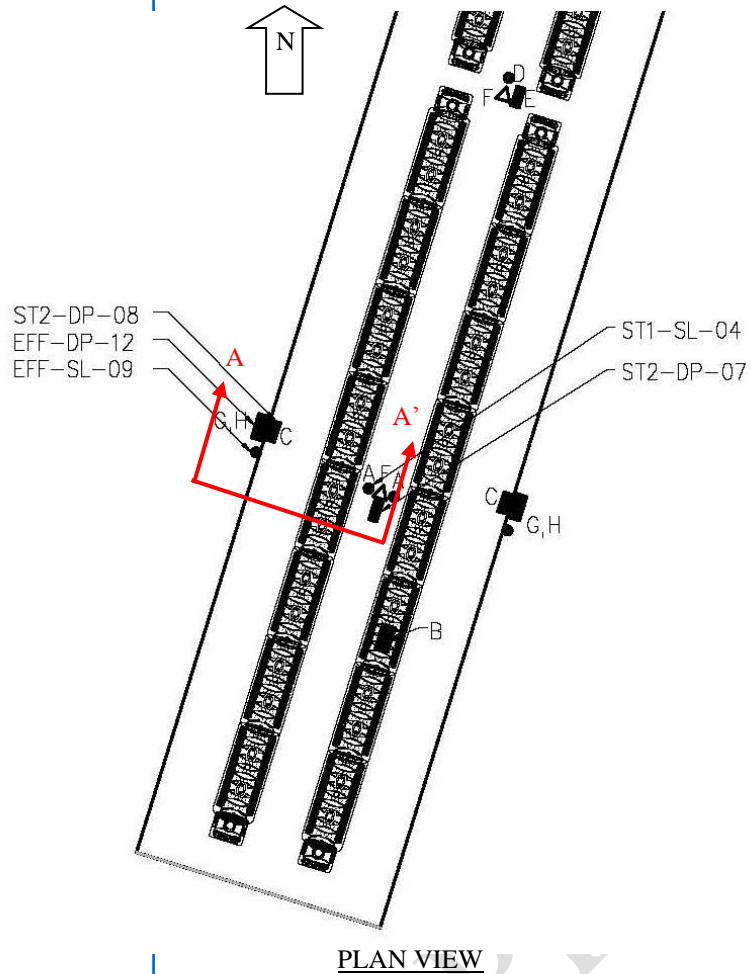


Figure 4
B-HS7 Treatment Evaluation Cross Section

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.

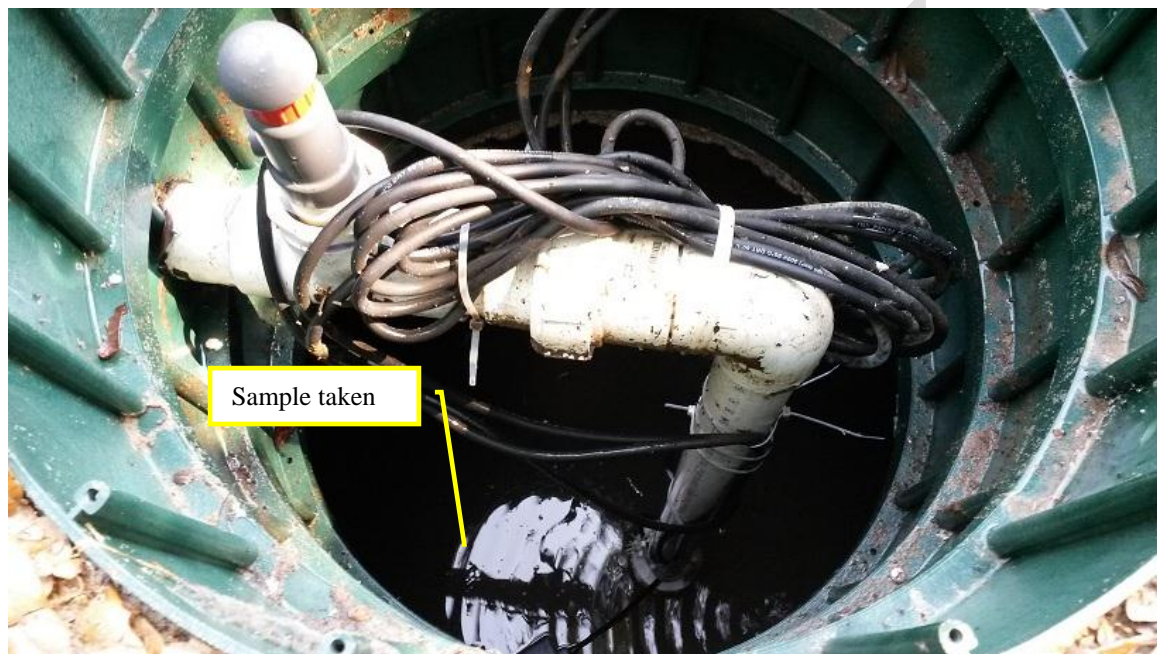


Figure 5
Pump Tank (B-HS7-STE sample)

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 did not produce any sample (dry). 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)

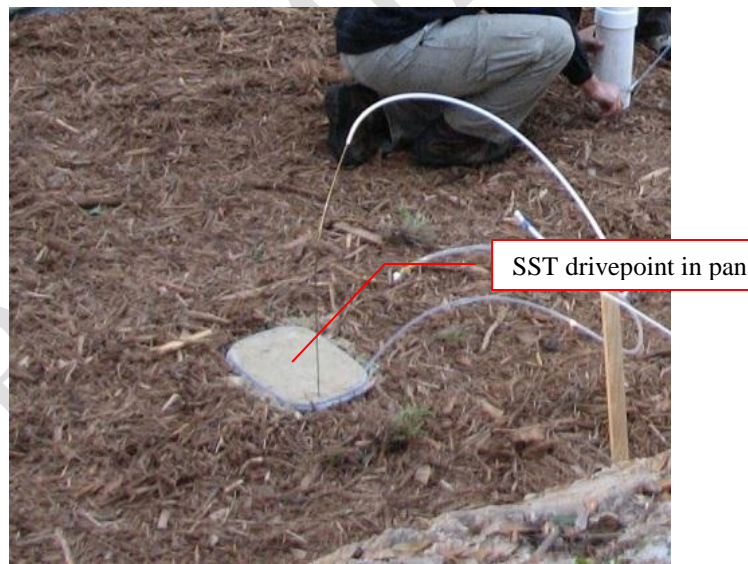


Figure 7
Stage 1 biofilter effluent sample taken from drivepoint in pan (BHS7-ST1-DP-01 sample)

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), a blended urban waste wood from Wood Resource Recovery, Ocala, FL. The new 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.

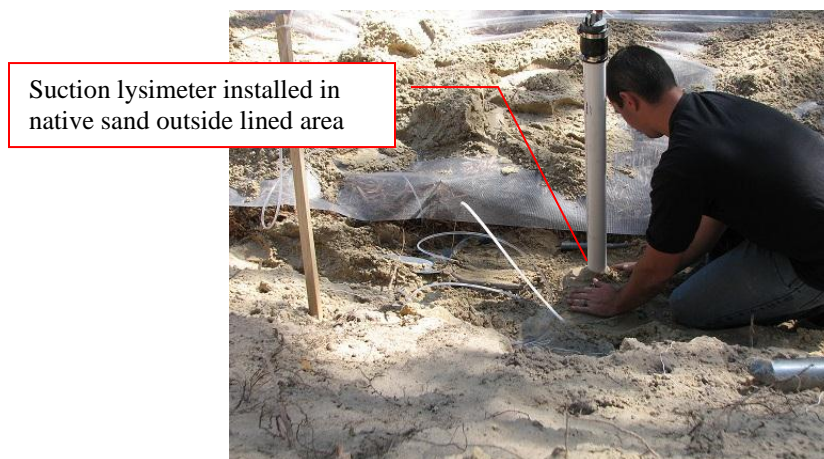


Figure 9
Treated effluent sample taken from suction lysimeter (BHS7-EFF-SL samples)



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 seventh formal sampling event was conducted December 18, 2014 (Experimental Day 394). For this seventh formal sampling event, the water meter for the house and treatment system flow meters were read and recorded on December 18, 2014. 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 seventh formal sample event (Sample Event No. 7), which is the subject of this report, was conducted on December 18, 2014 (Experimental Day 394). 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

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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
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
12/10/2013 10:00	11,218.9	Flow to PNRS	3,302.0	Flow to PNRS
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
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
Average since flow to PNRS through December 18, 2014		161.7		119.4

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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 161.7 gallons per day through December 18, 2014 with periods of higher and lower flows (Table 2). The average pumped flow to the PNRS system for the same time period was 119.4 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, 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
November 29, 2014 through December 18, 2014

Date	Precipitation (inches)
November 29, 2014	0.00
November 30, 2014	0.01
December 1, 2014	0.01
December 2, 2014	0.06
December 3, 2014	0.02
December 4, 2014	0.00
December 5, 2014	0.01
December 6, 2014	0.00
December 7, 2014	0.00
December 8, 2014	0.00
December 9, 2014	0.00
December 10, 2014	0.00
December 11, 2014	0.01
December 12, 2014	0.00
December 13, 2014	0.00
December 14, 2014	0.00
December 15, 2014	0.01
December 16, 2014	0.00
December 17, 2014	0.01
December 18, 2014	0.00

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

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 kilowatt-hours. 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
12/2/2013 9:45	0.6	0.00	No flow
12/6/2013 9:00	0.8	0.05	0.306
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
Average since flow to PNRS through December 18, 2014		0.04	0.305

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The total average electrical use through December 18, 2014 was 0.04 kWh per day. The average electrical use per 1,000 gallons treated since start-up was 0.305 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 seventh sampling event (Sample Event No. 7) 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 13. The laboratory report containing the raw analytical data is included in Appendix A. The following discussion summarizes the water quality analytical results for Sample Event No. 7. 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 13
Graphical Representation of Water Quality Results

Septic Tank Effluent (STE) Quality: The water quality characteristics of STE collected in Sample Event 7 were within the typical range generally expected for domestic STE. The measured STE total nitrogen (TN) concentration was approximately 72 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 0.51 ± 0.51 mg/L with a mean DO level of 6.80 ± 0.52 mg/L in the Stage 1 effluent (Table 6). These results indicate a substantial reduction of ammonia through the Stage 1 biofilter. The Stage 1 effluent mean $\text{NO}_x\text{-N}$ concentration was 42.75 ± 6.70 mg/L, implying significant nitrification.

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 ± 0.03 mg/L with a mean DO level at 5.1 ± 1.0 mg/L. The Stage 2 system achieved nearly complete $\text{NO}_x\text{-N}$ reduction. The mean total nitrogen (TN) concentration was 3.1 ± 1.6 mg/L. The effluent mean CBOD_5 was 3.0 ± 1.4 mg/L.

Perimeter Monitoring Points: The sample points considered representative of system effluent 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 treated effluent mean TN was 10.5 ± 12.7 mg/L of which mean TKN was 2.4 ± 1.0 and mean $\text{NO}_x\text{-N}$ was 8.2 ± 11.7 mg/L.

It is unclear why the $\text{NO}_x\text{-N}$ levels in two of the perimeter monitoring points are 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 6.1 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 14), 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

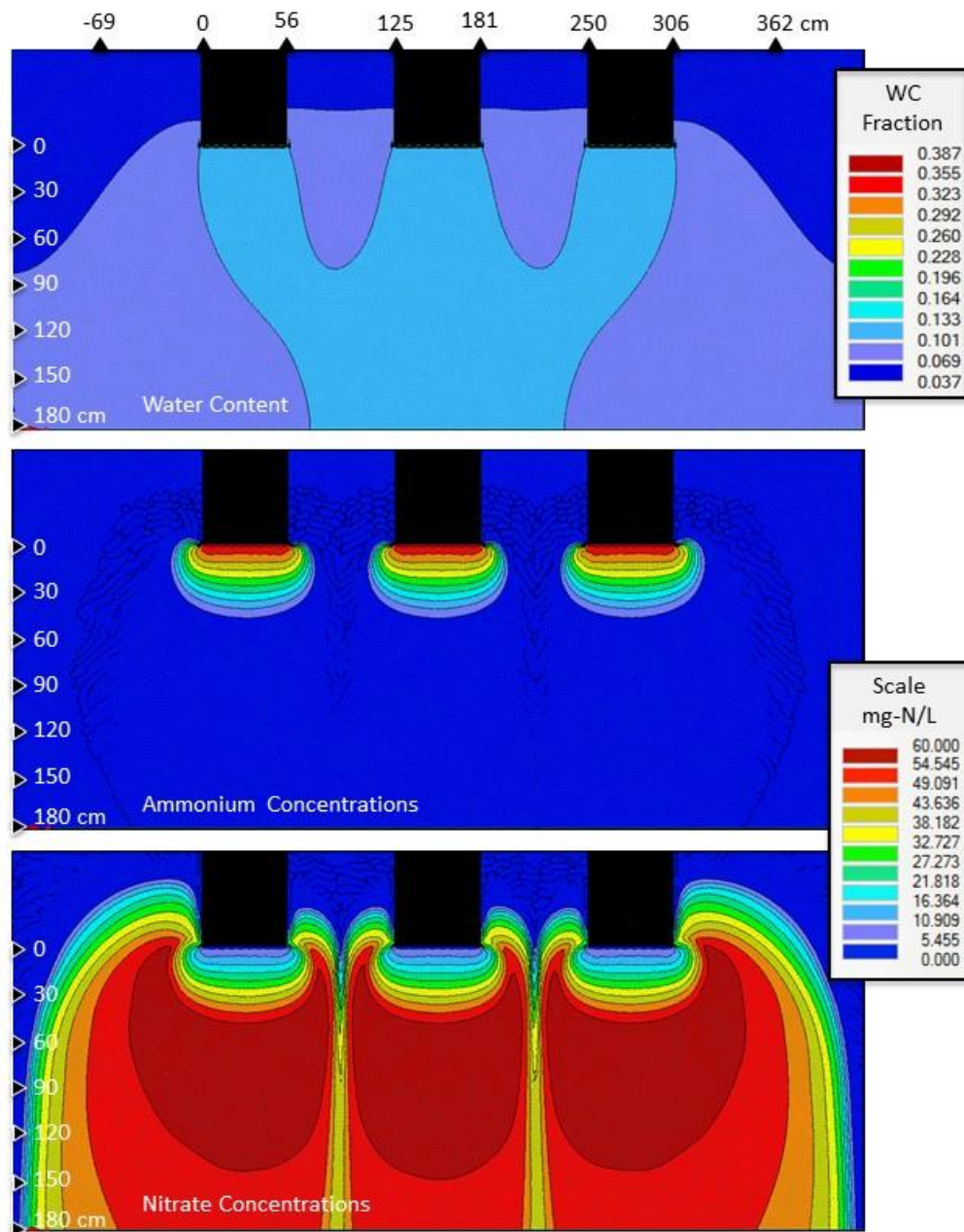


Figure 14
Graphic Representation of Task D.7 Hydrus 2-D Simulation, Scenario 45

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 parameters were total alkalinity and total phosphorus in both samples.

It still unclear why chloride concentrations vary greatly across the system with several very high concentrations during the previous sample event (Sample Event No. 6). During this sample event (Sample Event No. 7), one sample location (SW-BHS7-EFF-SL-09) had a relatively high chloride concentration of 1,500 mg/L which is more similar to Sample Event No. 5 results where the same sample location was the only high chloride concentration being 1,400 mg/L. Historically the average STE chloride concentration is 399 mg/L with a maximum concentration of 700 mg/L.

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	12/18/2014 11:05	18.22	7.19	1609	0.22	-161.2	370	22	22	150	250	72.10	72	10.00	62	0.02	0.08	0.1	62.10	7.8	7.4	34000	1200	190
BHS7-PUMP-DUP	12/18/2014 11:10	18.22	7.19	1609	0.22	-161.2	360	28	28	150	240	65.08	65	8.00	57	0.02	0.06	0.08	57.08	6.9	7.3	20000	1200	240
NC-BHS7-ST1-SL-01	12/18/2014 8:40	14.8	5.54	2270	7.55							50.21	5.2	4.90	0.3	45	0.01	45.01	45.31					400
NC-BHS7-ST1-SL-02	12/18/2014 8:55	15.8	5.74	2018	6.67	92.2						49.41	7.4	6.20	1.2	42	0.01	42.01	43.21					330
SC-BHS7-ST1-SL-03	12/18/2014 9:05	13.7	4.55	2360	6.65	130.8						55.91	5.9	5.36	0.54	50	0.01	50.01	50.55					460
SC-BHS7-ST1-SL-03-DUP	12/18/2014 9:10	13.7	4.55	2360	6.65	130.8						62.61	6.6	5.91	0.69	56	0.01	56.01	56.70					480
SC-BHS7-ST1-SL-04	12/18/2014 9:20	12.8	5.21	1705	6.34	121.9	18	1	1	4	14	38.01	4	3.99	0.009	34	0.01	34.01	34.02	0.11	0.012	1	2	340
NC-BHS7-ST2-DP-03	12/18/2014 8:34	14.1	6.09	1181	5.87	89						5.81	5.7	5.56	0.14	0.04	0.07	0.11	0.25					210
C-BHS7-ST2-DP-05	12/18/2014 9:05	12.8	6.14	1337	4.65	126.3						3.35	3.3	3.25	0.047	0.02	0.03	0.05	0.10					220
SE-BHS7-ST2-DP-06	12/18/2014 10:30	16.2	6.08	1187	4.31	114						2.75	2.7	2.69	0.01	0.02	0.03	0.05	0.06					170
SC-BHS7-ST2-DP-07	12/18/2014 10:00	16.4	6.44	1201	6.6	124.6	180	9	9	4	120	2.04	2	1.99	0.009	0.02	0.02	0.04	0.05	1.4	1.2	280	200	190
SW-BHS7-ST2-DP-08	12/18/2014 9:35	14.8	6.05	1067	4.18	138.8	190	12	12	2	100	1.64	1.6	1.54	0.062	0.02	0.02	0.04	0.10	0.89	0.68	10	3.1	190
NE-BHS7-EFF-SL-06	12/18/2014 9:35	12.7	5.76	239	7.95	184.2						9.51	2	1.54	0.46	7.5	0.01	7.51	7.97					69
NW-BHS7-EFF-SL-07	12/18/2014 9:45	13.4	6.59	2390	8.22	149.5						1.89	1.7	0.10	1.6	0.18	0.01	0.19	1.79					490
SE-BHS7-EFF-SL-08	12/18/2014 10:05	15.8	5.5	1796	7.43	110.7						28.81	3.8	3.79	0.009	25	0.01	25.01	25.02					310
SW-BHS7-EFF-SL-09	12/18/2014 10:15	14.6	6.57	4710	8.51	105.3	680			2	89	1.95	1.9	1.77	0.13	0.04	0.01	0.05	0.18	0.2	0.022			1500
BHS7-FB	12/18/2014 10:45	17.6	5.6	1.05	10.05	170.1	4.9	1	1	2	10	0.08	0.05	0.04	0.009	0.02	0.01	0.03	0.04	0.038	0.012	1	2	1
BHS7-EB	12/18/2014 10:40	16.7	5.9	1.44	9.39	165.5	4.6	1	1	2	10	0.08	0.05	0.04	0.009	0.02	0.01	0.03	0.04	0.038	0.012	1	2	1

Notes:

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

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

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

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.

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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)	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-PUMP	n	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
	MEAN	22.51	7.22	1970.86	0.10	-173.00	294.29	32.00	29.71	97.14	177.43	53.63	53.57	9.87	43.70	0.03	0.03	0.06	43.76	7.01	5.00	31580	1569	398.57
	STD. DEV.	3.60		262.11	0.10	61.84	37.80	8.14	7.67	36.62	81.77	9.81	9.78	15.41	17.25	0.03	0.03	0.04	17.27	1.31	1.21			169.16
	MIN	18.22	6.92	1609.00	0.01	-240.10	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
BHS7-ST1-SL-01	MAX	27.82	7.63	2454.00	0.25	-95.20	370.00	43.00	40.00	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	10000	700.00
	n	7	7	7	7	6	0	0	0	0	0	7	7	7	7	6	7	7	7	0	0	0	0	5
	MEAN	22.01	5.46	1833.00	5.38	172.22						27.76	3.04	2.66	0.38	23.17	0.01	24.72	25.10					842.00
	STD. DEV.	5.40		489.46	1.07	31.63						15.97	1.33	1.06	0.67	15.79	0.00	14.98	15.28					1041.71
BHS7-ST1-SL-02	MIN	14.80	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	5.67	2370.00	7.55	203.40						50.21	5.20	4.90	1.90	45.00	0.01	45.01	45.31					2700.00
	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	21.90	5.42	1530.14	4.65	153.49						20.61	3.31	2.63	0.68	17.29	0.01	17.30	17.98					686.00
BHS7-ST1-SL-03	STD. DEV.	5.12		381.55	1.23	36.48						21.64	2.16	1.67	1.15	20.75	0.00	20.75	20.81					903.81
	MIN	15.40	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
	n	7	7	7	7	7	0	0	0	0	0	7	7	7	7	6	7	7	7	0	0	0	0	4
BHS7-ST1-SL-04	MEAN	21.89	5.22	1912.71	5.00	177.00						39.06	3.49	2.81	0.68	32.67	0.62	35.58	36.25					405.00
	STD. DEV.	6.05		396.92	1.11	41.45						17.97	2.12	1.24	1.43	17.32	1.62	17.00	17.32					66.58
	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	6.65	231.80						55.91	7.10	5.36	3.90	50.00	4.30	50.01	50.55					460.00
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					
BHS7-ST1-SL-04	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					
	n	7	7	7	7	7	5	6	6	7	7	7	7	7	7	6	7	7	7	7	7	4	5	6
	MEAN	21.49	5.35	1524.86	4.58	170.17	22.40	3.17	2.67	10.14	46.43	35.55	3.69	2.95	0.74	28.84	0.01	31.86	32.60	0.15	0.01	2	2	346.67
	STD. DEV.	6.30		438.68	1.06	42.44		2.64	2.07	19.79	55.59	18.28	2.77	1.14	1.84	16.85	0.00	17.34	17.86	0.11	0.01			74.21
BHS7-ST1-SL-04	MIN	12.80	5.11	635.00	3.16	106.90	17.00	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	6.00	55.00	170.00	52.20	9.70	4.80	4.90	48.00	0.01	50.00	50.03	0.38	0.03	10	2	440.00

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	7	7	7	7	7	0	0	0	0	0	7	7	7	7	7	7	7	7	0	0	0	0	5
	MEAN	21.65	6.07	1544.71	1.90	57.79						4.07	3.90	3.78	0.12	0.14	0.03	0.17	0.28					236.40
	STD. DEV.	4.26		375.41	2.12	98.25						1.67	1.71	1.67	0.05	0.14	0.04	0.14	0.16					142.57
	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					400.00
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	6	6	6	6	6	0	0	0	0	0	6	6	6	6	6	6	6	6	0	0	0	0	4
	MEAN	21.87	6.13	1641.00	1.79	14.57						2.91	2.87	2.79	0.08	0.04	0.01	0.05	0.12					297.50
	STD. DEV.	5.53		359.84	2.20	108.56						0.54	0.54	0.55	0.03	0.02	0.01	0.02	0.02					77.19
	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	0.11	0.07	0.03	0.07	0.16					390.00
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	6	6	6	6	6	0	0	0	0	0	6	6	6	6	6	6	6	6	0	0	1	1	4
	MEAN	21.33	6.13	1661.67	1.59	44.77						4.56	4.48	4.37	0.11	0.05	0.03	0.08	0.19			1.00	2.00	250.50
	STD. DEV.	3.42		466.30	1.97	94.38						1.85	1.88	1.85	0.07	0.06	0.04	0.08	0.10					181.77
	MIN	16.20	5.95	1092.00	0.06	-120.40						2.75	2.70	2.69	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	410.00
BHS7-ST2-DP-07	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	22.93	6.25	1795.71	1.82	40.24	200.00	13.00	9.71	29.71	182.86	3.21	3.17	3.09	0.08	0.02	0.02	0.04	0.12	11.99	7.37	15	5	385.00
	STD. DEV.	4.62		385.89	2.30	99.19	22.36	6.45	4.79	29.34	136.07	1.98	1.99	1.95	0.06	0.02	0.03	0.04	0.05	21.51	12.55			112.03
	MIN	16.40	5.99	1201.00	0.10	-117.30	180.00	8.00	1.00	4.00	50.00	1.42	1.40	1.36	0.01	0.01	0.01	0.02	0.05	1.30	0.82	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	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6
	MEAN	22.14	6.10	1558.43	1.37	28.41	190.00	10.00	7.00	34.43	285.86	2.53	2.47	2.40	0.07	0.04	0.02	0.06	0.13	8.58	5.02	1	2	326.67
	STD. DEV.	4.81		348.82	1.50	112.93	23.09	4.86	4.73	29.88	368.28	1.18	1.18	1.16	0.04	0.05	0.01	0.05	0.06	13.51	7.62			95.64
	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	0.08	0.89	0.68	1	2	190.00
	MAX	28.07	6.17	2070.00	4.18	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	460.00

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	7	7	7	7	7	0	0	0	0	0	7	7	7	7	6	7	7	7	0	0	0	0	5
	MEAN	20.77	5.70	643.43	5.85	177.66						17.69	2.13	1.96	0.17	12.32	0.01	15.56	15.73					90.00
	STD. DEV.	5.97		343.77	0.97	32.42						10.72	0.87	0.95	0.17	6.91	0.00	10.64	10.54					51.19
	MIN	12.40	5.53	239.00	4.94	124.10						4.40	1.40	1.05	0.03	3.00	0.01	3.00	3.35					30.00
	MAX	27.50	5.94	1073.00	7.95	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	7	7	7	7	7	0	0	0	0	0	7	7	7	7	6	7	7	7	0	0	0	0	5
	MEAN	21.10	5.54	1679.43	6.46	168.29						20.62	1.64	1.14	0.50	15.98	0.01	18.98	19.48					928.00
	STD. DEV.	5.01		1211.45	0.89	29.19						18.21	0.36	0.71	0.75	17.88	0.00	18.15	17.75					1275.00
	MIN	13.40	4.61	367.00	5.51	126.70						1.89	1.20	0.10	0.01	0.18	0.01	0.19	0.59					230.00
	MAX	27.30	6.59	3970.00	8.22	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	7	7	7	7	7	0	0	0	0	0	7	7	7	7	6	7	7	7	0	0	0	0	5
	MEAN	21.46	5.26	1642.86	5.91	165.39						34.66	2.66	2.49	0.17	30.00	0.01	32.00	32.17					792.00
	STD. DEV.	4.72		230.61	0.98	41.05						9.04	0.93	0.78	0.32	7.64	0.00	8.75	8.92					1011.91
	MIN	15.80	4.88	1331.00	4.49	110.70						22.80	1.70	1.69	0.01	21.00	0.01	21.00	21.08					280.00
	MAX	27.60	6.25	1898.00	7.43	211.20						46.00	4.00	3.79	0.88	42.00	0.01	44.00	44.03					2600.00
BHS7-EFF-SL-09	n	7	7	7	7	7	4	5	5	6	6	5	5	5	7	6	7	7	7	6	7	0	1	6
	MEAN	21.96	5.76	2540.71	5.95	138.23	1376.00	1.00	1.40	16.50	56.83	21.47	2.16	1.96	0.17	18.26	0.01	23.37	23.54	0.13	0.05		2.00	1066.50
	STD. DEV.	5.69		2476.04	1.29	68.63	2304.28	0.00	0.89	25.14	41.40	23.11	0.42	0.56	0.16	16.80	0.01	20.43	20.43	0.11	0.09			1287.65
	MIN	14.60	5.09	269.00	4.58	53.80	11.00	1.00	1.00	2.00	10.00	1.95	1.70	1.29	0.01	0.04	0.01	0.05	0.18	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
	MEAN	21.40	7.21	176.60	6.49	99.75	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	4.00
	STD. DEV.	1.84		3.82	0.93	77.00	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	20.10	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	4.00
	MAX	22.70	7.28	179.30	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	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5
	MEAN	22.75	6.13	1.75	7.89	117.72	2.48	1.00	1.00	2.00	10.00	0.10	0.08	0.06	0.01	0.01	0.01	0.02	0.03	0.02	0.01	1.00	2.00	0.43
	STD. DEV.	6.57		0.45	1.56	58.80	1.04	0.00	0.00	0.00	0.00	0.07	0.07	0.06	0.01	0.01	0.00	0.01	0.02	0.01	0.00			0.52
	MIN	15.90	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	9.39	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.

5.0 B-HS7 Sample Event No. 7: Summary and Recommendations

5.1 Summary

The Sample Event No. 7 results indicate that:

- Septic tank effluent (STE) quality is characteristic of typical household STE quality. The total nitrogen concentration of approximately 72 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 5.6 ± 1.4 mg/L TKN, of which 0.5 ± 0.5 mg/L was ammonia.
- The Stage 2 biofilter mean effluent $\text{NO}_x\text{-N}$ within the biofilter media was 0.06 ± 0.03 mg N/L.
- The total nitrogen concentration in the perimeter monitoring points surrounding the treatment system was 10.5 ± 12.7 mg/L of which mean TKN was 2.4 ± 1.0 and mean $\text{NO}_x\text{-N}$ was 8.2 ± 11.7 mg/L. It is unclear why several of the perimeter monitoring points show higher $\text{NO}_x\text{-N}$ levels than in samples taken from within the Stage 2 media. Since the observation port measurements indicated that the liner water level was between 5.3 and 6.1 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. One hypothesis is that the unsaturated zone $\text{NO}_x\text{-N}$ plume extends past the width of the Stage 2 biofilter liner area. This hypothesis will be further evaluated as more data is collected and analyzed at the site.

5.2 Recommendations

Several of the perimeter monitoring point samples continue to show high total nitrogen mostly comprised of $\text{NO}_x\text{-N}$. It is possible that water sampled at the perimeter monitoring points may not have passed through the Stage 2 media. One possible method to track the wastewater plume without compromising nitrogen analyses is to introduce rhodamine dye or other tracer into the system.



Appendix A: Laboratory Report

PRELIMINARY

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

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

December 31, 2014
Work Order: 1412946

Laboratory Report

Project Name		B-HS7 SE#7						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS7-PUMP						
Matrix		Wastewater						
SAL Sample Number		1412946-01						
Date/Time Collected		12/18/14 11:05						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
<u>Inorganics</u>								
Ammonia as N	mg/L	62	EPA 350.1	4.0	0.95		12/19/14 16:48	100
Carbonaceous BOD	mg/L	150	SM 5210B	2	2	12/19/14 08:43	12/24/14 10:59	1
Chemical Oxygen Demand	mg/L	250	EPA 410.4	25	10	12/22/14 10:37	12/22/14 12:39	1
Chloride	mg/L	190	SM 4500Cl-E	40	10		12/22/14 12:28	10
Nitrate+Nitrite (N)	mg/L	0.04	EPA 353.2	0.04	0.01		12/19/14 13:19	1
Nitrite (as N)	mg/L	0.08 J5	SM 4500NO2-B	0.04	0.01		12/19/14 11:39	1
Orthophosphate as P	mg/L	7.4 J5	SM 4500P-E	0.20	0.060		12/19/14 11:21	5
Phosphorous - Total as P	mg/L	7.8	SM 4500P-E	0.040	0.010	12/18/14 16:30	12/23/14 15:07	1
Total Alkalinity	mg/L	370	SM 2320B	8.0	2.0		12/30/14 10:30	1
Total Kjeldahl Nitrogen	mg/L	72	EPA 351.2	0.20	0.05	12/18/14 16:30	12/23/14 15:07	1
Total Suspended Solids	mg/L	22	SM 2540D	1	1	12/22/14 10:09	12/23/14 16:39	1
Volatile Suspended Solids	mg/L	22	EPA 160.4	1	1	12/22/14 10:09	12/23/14 16:39	1
Nitrate (as N)	mg/L	0.02 U	EPA 353.2	0.08	0.02		12/19/14 13:19	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	1,200	SM 9223B	2.0	2.0	12/18/14 16:39	12/19/14 10:45	1
Fecal Coliforms	CFU/100 ml	34,000	SM 9222D	1	1	12/18/14 16:28	12/19/14 15:00	1
Sample Description		BHS7-PUMP-DUP						
Matrix		Wastewater						
SAL Sample Number		1412946-02						
Date/Time Collected		12/18/14 11:10						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
<u>Inorganics</u>								
Ammonia as N	mg/L	57	EPA 350.1	4.0	0.95		12/19/14 16:49	100
Carbonaceous BOD	mg/L	150	SM 5210B	2	2	12/19/14 08:43	12/24/14 10:59	1
Chemical Oxygen Demand	mg/L	240	EPA 410.4	25	10	12/22/14 10:37	12/22/14 12:39	1
Chloride	mg/L	240	SM 4500Cl-E	40	10		12/22/14 12:29	10
Nitrate+Nitrite (N)	mg/L	0.04	EPA 353.2	0.04	0.01		12/19/14 13:19	1
Nitrite (as N)	mg/L	0.06	SM 4500NO2-B	0.04	0.01		12/19/14 11:39	1
Orthophosphate as P	mg/L	7.3	SM 4500P-E	0.20	0.060		12/19/14 11:22	5
Phosphorous - Total as P	mg/L	6.9	SM 4500P-E	0.040	0.010	12/18/14 16:30	12/23/14 15:07	1
Total Alkalinity	mg/L	360	SM 2320B	8.0	2.0		12/30/14 10:39	1
Total Kjeldahl Nitrogen	mg/L	65	EPA 351.2	0.20	0.05	12/18/14 16:30	12/23/14 15:07	1
Total Suspended Solids	mg/L	28	SM 2540D	1	1	12/22/14 10:09	12/23/14 16:39	1

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December 31, 2014
Work Order: 1412946

Laboratory Report

Project Name		B-HS7 SE#7						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS7-PUMP-DUP						
Matrix		Wastewater						
SAL Sample Number		1412946-02						
Date/Time Collected		12/18/14 11:10						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
Volatile Suspended Solids	mg/L	28	EPA 160.4	1	1	12/22/14 10:09	12/23/14 16:39	1
Nitrate (as N)	mg/L	0.02 U	EPA 353.2	0.08	0.02		12/19/14 13:19	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	1,200	SM 9223B	2.0	2.0	12/18/14 16:39	12/19/14 10:45	1
Fecal Coliforms	CFU/100 ml	20,000	SM 9222D	1	1	12/18/14 16:28	12/19/14 15:00	1
Sample Description		NC-BHS7-ST1-SL-01						
Matrix		Wastewater						
SAL Sample Number		1412946-03						
Date/Time Collected		12/18/14 08:40						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.30	EPA 350.1	0.040	0.009		12/19/14 15:08	1
Chloride	mg/L	400	SM 4500Cl-E	40	10		12/22/14 12:30	10
Nitrate+Nitrite (N)	mg/L	45	EPA 353.2	4.0	1.0		12/19/14 14:08	100
Nitrite (as N)	mg/L	0.01 U	SM 4500NO2-B	0.04	0.01		12/19/14 11:40	1
Total Kjeldahl Nitrogen	mg/L	5.2	EPA 351.2	0.20	0.05	12/18/14 16:30	12/23/14 15:07	1
Nitrate (as N)	mg/L	45	EPA 353.2	4.0	1.0		12/19/14 14:08	100
Sample Description		NC-BHS7-ST1-SL-02						
Matrix		Wastewater						
SAL Sample Number		1412946-04						
Date/Time Collected		12/18/14 08:55						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
<u>Inorganics</u>								
Ammonia as N	mg/L	1.2	EPA 350.1	0.040	0.009		12/19/14 15:10	1
Chloride	mg/L	330	SM 4500Cl-E	40	10		12/22/14 12:31	10
Nitrate+Nitrite (N)	mg/L	42	EPA 353.2	4.0	1.0		12/19/14 14:09	100
Nitrite (as N)	mg/L	0.01 U	SM 4500NO2-B	0.04	0.01		12/19/14 11:40	1
Total Kjeldahl Nitrogen	mg/L	7.4	EPA 351.2	0.20	0.05	12/18/14 16:30	12/23/14 15:07	1
Nitrate (as N)	mg/L	42	EPA 353.2	4.0	1.0		12/19/14 14:09	100

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December 31, 2014
Work Order: 1412946

Laboratory Report

Project Name		B-HS7 SE#7						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		SC-BHS7-ST1-SL-03						
Matrix		Wastewater						
SAL Sample Number		1412946-05						
Date/Time Collected		12/18/14 09:05						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.54	EPA 350.1	0.040	0.009		12/19/14 15:12	1
Chloride	mg/L	460	SM 4500Cl-E	40	10		12/22/14 12:31	10
Nitrate+Nitrite (N)	mg/L	50	EPA 353.2	4.0	1.0		12/19/14 14:10	100
Nitrite (as N)	mg/L	0.01 U	SM 4500NO2-B	0.04	0.01		12/19/14 11:41	1
Total Kjeldahl Nitrogen	mg/L	5.9	EPA 351.2	0.20	0.05	12/18/14 16:30	12/23/14 15:07	1
Nitrate (as N)	mg/L	50	EPA 353.2	4.0	1.0		12/19/14 14:10	100
Sample Description		SC-BHS7-ST1-SL-04						
Matrix		Wastewater						
SAL Sample Number		1412946-06						
Date/Time Collected		12/18/14 09:20						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.009 U	EPA 350.1	0.040	0.009		12/19/14 15:13	1
Carbonaceous BOD	mg/L	4	SM 5210B	2	2	12/19/14 08:43	12/24/14 10:59	1
Chemical Oxygen Demand	mg/L	14 I	EPA 410.4	25	10	12/22/14 10:37	12/22/14 12:39	1
Chloride	mg/L	340	SM 4500Cl-E	40	10		12/22/14 12:32	10
Nitrate+Nitrite (N)	mg/L	34	EPA 353.2	4.0	1.0		12/19/14 14:11	100
Nitrite (as N)	mg/L	0.01 U	SM 4500NO2-B	0.04	0.01		12/19/14 11:41	1
Orthophosphate as P	mg/L	0.012 U	SM 4500P-E	0.040	0.012		12/19/14 10:52	1
Phosphorous - Total as P	mg/L	0.11	SM 4500P-E	0.040	0.010	12/18/14 16:30	12/23/14 15:07	1
Total Alkalinity	mg/L	18	SM 2320B	8.0	2.0		12/30/14 10:43	1
Total Kjeldahl Nitrogen	mg/L	4.0	EPA 351.2	0.20	0.05	12/18/14 16:30	12/23/14 15:07	1
Total Suspended Solids	mg/L	1 U	SM 2540D	1	1	12/22/14 10:09	12/23/14 16:39	1
Volatile Suspended Solids	mg/L	1 U	EPA 160.4	1	1	12/22/14 10:09	12/23/14 16:39	1
Nitrate (as N)	mg/L	34	EPA 353.2	4.0	1.0		12/19/14 14:11	100
<u>Microbiology</u>								
E. Coli	MPN/100 mL	2.0 U	SM 9223B	2.0	2.0	12/18/14 16:39	12/19/14 10:45	1
Fecal Coliforms	CFU/100 ml	1 U	SM 9222D	1	1	12/18/14 16:28	12/19/14 15:00	1

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Project Name		B-HS7 SE#7						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		NC-BHS7-ST2-DP-03						
Matrix		Wastewater						
SAL Sample Number		1412946-07						
Date/Time Collected		12/18/14 08:34						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.14	EPA 350.1	0.040	0.009		12/19/14 15:15	1
Chloride	mg/L	210	SM 4500Cl-E	40	10		12/22/14 12:33	10
Nitrate+Nitrite (N)	mg/L	0.11	EPA 353.2	0.04	0.01		12/19/14 13:26	1
Nitrite (as N)	mg/L	0.07	SM	0.04	0.01		12/19/14 11:42	1
			4500NO2-B					
Total Kjeldahl Nitrogen	mg/L	5.7	EPA 351.2	0.20	0.05	12/18/14 16:30	12/23/14 15:07	1
Nitrate (as N)	mg/L	0.04 I	EPA 353.2	0.08	0.02		12/19/14 13:26	1
Sample Description		SC-ST1-SL-03-DUP						
Matrix		Wastewater						
SAL Sample Number		1412946-08						
Date/Time Collected		12/18/14 09:10						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.69	EPA 350.1	0.040	0.009		12/19/14 15:17	1
Chloride	mg/L	480	SM 4500Cl-E	40	10		12/22/14 12:34	10
Nitrate+Nitrite (N)	mg/L	56	EPA 353.2	4.8	1.2		12/23/14 17:25	120
Nitrite (as N)	mg/L	0.01 U	SM	0.04	0.01		12/19/14 11:42	1
			4500NO2-B					
Total Kjeldahl Nitrogen	mg/L	6.6	EPA 351.2	0.20	0.05	12/18/14 16:30	12/23/14 15:07	1
Nitrate (as N)	mg/L	56	EPA 353.2	4.8	1.2		12/23/14 17:25	120
Sample Description		C-BHS7-ST2-DP-05						
Matrix		Wastewater						
SAL Sample Number		1412946-09						
Date/Time Collected		12/18/14 09:05						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.047	EPA 350.1	0.040	0.009		12/19/14 15:25	1
Chloride	mg/L	220	SM 4500Cl-E	40	10		12/22/14 12:37	10
Nitrate+Nitrite (N)	mg/L	0.03 I,J5	EPA 353.2	0.04	0.01		12/23/14 17:27	1
Nitrite (as N)	mg/L	0.03 I	SM	0.04	0.01		12/19/14 11:45	1
			4500NO2-B					
Total Kjeldahl Nitrogen	mg/L	3.3	EPA 351.2	0.20	0.05	12/18/14 16:30	12/23/14 15:07	1

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Project Name		B-HS7 SE#7						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		C-BHS7-ST2-DP-05						
Matrix		Wastewater						
SAL Sample Number		1412946-09						
Date/Time Collected		12/18/14 09:05						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
Nitrate (as N)	mg/L	0.02 U	EPA 353.2	0.08	0.02		12/23/14 17:27	1
Sample Description		SE-BHS7-ST2-DP-06						
Matrix		Wastewater						
SAL Sample Number		1412946-10						
Date/Time Collected		12/18/14 10:30						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.010 I	EPA 350.1	0.040	0.009		12/26/14 13:53	1
Chloride	mg/L	170	SM 4500Cl-E	40	10		12/22/14 12:38	10
Nitrate+Nitrite (N)	mg/L	0.03 I	EPA 353.2	0.04	0.01		12/23/14 17:29	1
Nitrite (as N)	mg/L	0.03 I	SM 4500NO2-B	0.04	0.01		12/19/14 11:45	1
Total Kjeldahl Nitrogen	mg/L	2.7	EPA 351.2	0.20	0.05	12/18/14 16:30	12/23/14 15:07	1
Nitrate (as N)	mg/L	0.02 U	EPA 353.2	0.08	0.02		12/23/14 17:29	1
Sample Description		SC-BHS7-ST2-DP-07						
Matrix		Wastewater						
SAL Sample Number		1412946-11						
Date/Time Collected		12/18/14 10:00						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.009 U	EPA 350.1	0.040	0.009		12/26/14 13:55	1
Carbonaceous BOD	mg/L	4	SM 5210B	2	2	12/19/14 08:43	12/24/14 10:59	1
Chemical Oxygen Demand	mg/L	120	EPA 410.4	25	10	12/22/14 10:37	12/22/14 12:39	1
Chloride	mg/L	190	SM 4500Cl-E	40	10		12/22/14 12:38	10
Nitrate+Nitrite (N)	mg/L	0.02 I	EPA 353.2	0.04	0.01		12/23/14 17:31	1
Nitrite (as N)	mg/L	0.02 I	SM 4500NO2-B	0.04	0.01		12/19/14 11:46	1
Orthophosphate as P	mg/L	1.2	SM 4500P-E	0.040	0.012		12/19/14 10:53	1
Phosphorous - Total as P	mg/L	1.4	SM 4500P-E	0.040	0.010	12/18/14 16:30	12/23/14 15:07	1
Total Alkalinity	mg/L	180	SM 2320B	8.0	2.0		12/30/14 10:50	1
Total Kjeldahl Nitrogen	mg/L	2.0	EPA 351.2	0.20	0.05	12/18/14 16:30	12/23/14 15:07	1
Total Suspended Solids	mg/L	9	SM 2540D	1	1	12/22/14 10:09	12/23/14 16:39	1
Volatile Suspended Solids	mg/L	9	EPA 160.4	1	1	12/22/14 10:09	12/23/14 16:39	1

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Project Name		B-HS7 SE#7						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		SC-BHS7-ST2-DP-07						
Matrix		Wastewater						
SAL Sample Number		1412946-11						
Date/Time Collected		12/18/14 10:00						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
Nitrate (as N)	mg/L	0.02 U	EPA 353.2	0.08	0.02		12/23/14 17:31	1
Microbiology								
E. Coli	MPN/100 mL	200	SM 9223B	2.0	2.0	12/18/14 16:39	12/19/14 10:45	1
Fecal Coliforms	CFU/100 ml	280	SM 9222D	1	1	12/18/14 16:28	12/19/14 15:00	1
Sample Description		SW-BHS7-ST2-DP-08						
Matrix		Wastewater						
SAL Sample Number		1412946-12						
Date/Time Collected		12/18/14 09:35						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
Inorganics								
Ammonia as N	mg/L	0.062	EPA 350.1	0.040	0.009		12/22/14 16:01	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	12/19/14 08:43	12/24/14 10:59	1
Chemical Oxygen Demand	mg/L	100	EPA 410.4	25	10	12/22/14 10:37	12/22/14 12:39	1
Chloride	mg/L	190	SM 4500Cl-E	40	10		12/22/14 12:39	10
Nitrate+Nitrite (N)	mg/L	0.01 U	EPA 353.2	0.04	0.01		12/23/14 17:33	1
Nitrite (as N)	mg/L	0.02 I	SM 4500NO2-B	0.04	0.01		12/19/14 11:46	1
Orthophosphate as P	mg/L	0.68	SM 4500P-E	0.040	0.012		12/19/14 10:54	1
Phosphorous - Total as P	mg/L	0.89	SM 4500P-E	0.040	0.010	12/18/14 16:30	12/23/14 15:07	1
Total Alkalinity	mg/L	190	SM 2320B	8.0	2.0		12/30/14 10:57	1
Total Kjeldahl Nitrogen	mg/L	1.6	EPA 351.2	0.20	0.05	12/18/14 16:30	12/23/14 15:07	1
Total Suspended Solids	mg/L	12	SM 2540D	1	1	12/22/14 10:09	12/23/14 16:39	1
Volatile Suspended Solids	mg/L	12	EPA 160.4	1	1	12/22/14 10:09	12/23/14 16:39	1
Nitrate (as N)	mg/L	0.02 U	EPA 353.2	0.08	0.02		12/23/14 17:33	1
Microbiology								
E. Coli	MPN/100 mL	3.1	SM 9223B	2.0	2.0	12/18/14 16:39	12/19/14 10:45	1
Fecal Coliforms	CFU/100 ml	10	SM 9222D	1	1	12/18/14 16:28	12/19/14 15:00	1
Sample Description		NE-BHS7-EFF-SL-06						
Matrix		Wastewater						
SAL Sample Number		1412946-16						
Date/Time Collected		12/18/14 09:35						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						

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Project Name		B-HS7 SE#7						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		NE-BHS7-EFF-SL-06						
Matrix		Wastewater						
SAL Sample Number		1412946-16						
Date/Time Collected		12/18/14 09:35						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.46	EPA 350.1	0.040	0.009		12/22/14 16:03	1
Chloride	mg/L	69	SM 4500Cl-E	40	10		12/22/14 12:39	10
Nitrate+Nitrite (N)	mg/L	7.5	EPA 353.2	0.20	0.05		12/23/14 17:35	5
Nitrite (as N)	mg/L	0.01 U	SM	0.04	0.01		12/19/14 11:47	1
			4500NO2-B					
Total Kjeldahl Nitrogen	mg/L	2.0	EPA 351.2	0.20	0.05	12/18/14 16:30	12/23/14 15:07	1
Nitrate (as N)	mg/L	7.5	EPA 353.2	0.24	0.06		12/23/14 17:35	5
Sample Description		NW-BHS7-EFF-SL-07						
Matrix		Wastewater						
SAL Sample Number		1412946-17						
Date/Time Collected		12/18/14 09:45						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
<u>Inorganics</u>								
Ammonia as N	mg/L	1.6	EPA 350.1	0.040	0.009		12/22/14 16:05	1
Chloride	mg/L	490	SM 4500Cl-E	40	10		12/22/14 12:40	10
Nitrate+Nitrite (N)	mg/L	0.18	EPA 353.2	0.04	0.01		12/23/14 17:37	1
Nitrite (as N)	mg/L	0.01 U	SM	0.04	0.01		12/19/14 11:47	1
			4500NO2-B					
Total Kjeldahl Nitrogen	mg/L	1.7	EPA 351.2	0.20	0.05	12/18/14 16:30	12/23/14 15:07	1
Nitrate (as N)	mg/L	0.18	EPA 353.2	0.08	0.02		12/23/14 17:37	1
Sample Description		SE-BHS7-EFF-SL-08						
Matrix		Wastewater						
SAL Sample Number		1412946-18						
Date/Time Collected		12/18/14 10:05						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.009 U	EPA 350.1	0.040	0.009		12/22/14 16:07	1
Chloride	mg/L	310	SM 4500Cl-E	40	10		12/22/14 12:40	10
Nitrate+Nitrite (N)	mg/L	25	EPA 353.2	0.96	0.24		12/23/14 18:21	24
Nitrite (as N)	mg/L	0.01 U	SM	0.04	0.01		12/19/14 11:48	1
			4500NO2-B					
Total Kjeldahl Nitrogen	mg/L	3.8	EPA 351.2	0.20	0.05	12/18/14 16:30	12/23/14 15:07	1

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Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		SE-BHS7-EFF-SL-08						
Matrix		Wastewater						
SAL Sample Number		1412946-18						
Date/Time Collected		12/18/14 10:05						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
Nitrate (as N)	mg/L	25	EPA 353.2	1.0	0.25		12/23/14 18:21	24
Sample Description		SW-BHS7-EFF-SL-09						
Matrix		Wastewater						
SAL Sample Number		1412946-19						
Date/Time Collected		12/18/14 10:15						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.13 I	EPA 350.1	0.40	0.095		12/22/14 16:54	10
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	12/19/14 08:43	12/24/14 10:59	1
Chemical Oxygen Demand	mg/L	89	EPA 410.4	25	10	12/22/14 10:37	12/22/14 12:39	1
Chloride	mg/L	1,500	SM 4500Cl-E	400	100		12/22/14 12:41	100
Nitrate+Nitrite (N)	mg/L	0.04	EPA 353.2	0.04	0.01		12/23/14 17:50	1
Nitrite (as N)	mg/L	0.01 U	SM 4500NO2-B	0.04	0.01		12/19/14 11:48	1
Orthophosphate as P	mg/L	0.022 I	SM 4500P-E	0.040	0.012		12/19/14 10:55	1
Phosphorous - Total as P	mg/L	0.20	SM 4500P-E	0.040	0.010	12/18/14 16:30	12/23/14 15:07	1
Total Alkalinity	mg/L	680	SM 2320B	8.0	2.0		12/30/14 11:17	1
Total Kjeldahl Nitrogen	mg/L	1.9	EPA 351.2	0.20	0.05	12/18/14 16:30	12/23/14 15:07	1
Nitrate (as N)	mg/L	0.04 I	EPA 353.2	0.08	0.02		12/23/14 17:50	1
Sample Description		BHS7-FB						
Matrix		Reagent Water						
SAL Sample Number		1412946-20						
Date/Time Collected		12/18/14 10:45						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.009 U	EPA 350.1	0.040	0.009		12/22/14 16:10	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	12/19/14 08:43	12/24/14 10:59	1
Chemical Oxygen Demand	mg/L	10 U	EPA 410.4	25	10	12/22/14 10:37	12/22/14 12:39	1
Chloride	mg/L	1.0 U	SM 4500Cl-E	4.0	1.0		12/22/14 12:42	1
Nitrate+Nitrite (N)	mg/L	0.01 U	EPA 353.2	0.04	0.01		12/23/14 17:52	1
Nitrite (as N)	mg/L	0.01 U	SM 4500NO2-B	0.04	0.01		12/19/14 11:50	1
Orthophosphate as P	mg/L	0.012 U	SM 4500P-E	0.040	0.012		12/19/14 10:56	1

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Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS7-FB						
Matrix		Reagent Water						
SAL Sample Number		1412946-20						
Date/Time Collected		12/18/14 10:45						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
Phosphorous - Total as P	mg/L	0.038 I	SM 4500P-E	0.040	0.010	12/18/14 16:30	12/23/14 15:07	1
Total Alkalinity	mg/L	4.9 I	SM 2320B	8.0	2.0		12/30/14 11:28	1
Total Kjeldahl Nitrogen	mg/L	0.05 U	EPA 351.2	0.20	0.05	12/18/14 16:30	12/23/14 15:07	1
Total Suspended Solids	mg/L	1	SM 2540D	1	1	12/22/14 10:09	12/23/14 16:39	1
Volatile Suspended Solids	mg/L	1 U	EPA 160.4	1	1	12/22/14 10:09	12/23/14 16:39	1
Nitrate (as N)	mg/L	0.02 U	EPA 353.2	0.08	0.02		12/23/14 17:52	1
Microbiology								
E. Coli	MPN/100 mL	2.0 U	SM 9223B	2.0	2.0	12/18/14 16:39	12/19/14 10:45	1
Fecal Coliforms	CFU/100 ml	1 U	SM 9222D	1	1	12/18/14 16:28	12/19/14 15:00	1
Sample Description		BHS7-EB						
Matrix		Reagent Water						
SAL Sample Number		1412946-21						
Date/Time Collected		12/18/14 10:40						
Collected by		Josefin Hirst						
Date/Time Received		12/18/14 15:30						
Inorganics								
Ammonia as N	mg/L	0.009 U	EPA 350.1	0.040	0.009		12/22/14 16:12	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	12/19/14 08:43	12/24/14 10:59	1
Chemical Oxygen Demand	mg/L	10 U	EPA 410.4	25	10	12/22/14 10:37	12/22/14 12:39	1
Chloride	mg/L	1.0 U	SM 4500Cl-E	4.0	1.0		12/22/14 12:43	1
Nitrate+Nitrite (N)	mg/L	0.01 U	EPA 353.2	0.04	0.01		12/23/14 17:54	1
Nitrite (as N)	mg/L	0.01 U	SM 4500NO2-B	0.04	0.01		12/19/14 11:50	1
Orthophosphate as P	mg/L	0.012 U	SM 4500P-E	0.040	0.012		12/19/14 10:57	1
Phosphorous - Total as P	mg/L	0.038 I	SM 4500P-E	0.040	0.010	12/18/14 16:30	12/23/14 15:07	1
Total Alkalinity	mg/L	4.6 I	SM 2320B	8.0	2.0		12/30/14 11:45	1
Total Kjeldahl Nitrogen	mg/L	0.05 U	EPA 351.2	0.20	0.05	12/18/14 16:30	12/23/14 15:07	1
Total Suspended Solids	mg/L	1 U	SM 2540D	1	1	12/22/14 10:09	12/23/14 16:39	1
Volatile Suspended Solids	mg/L	1 U	EPA 160.4	1	1	12/22/14 10:09	12/23/14 16:39	1
Nitrate (as N)	mg/L	0.02 U	EPA 353.2	0.08	0.02		12/23/14 17:54	1
Microbiology								
E. Coli	MPN/100 mL	2.0 U	SM 9223B	2.0	2.0	12/18/14 16:39	12/19/14 10:45	1
Fecal Coliforms	CFU/100 ml	1 U	SM 9222D	1	1	12/18/14 16:28	12/19/14 15:00	1

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Laboratory Report

Project Name		B-HS7 SE#7						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS3-PZE06-S						
Matrix		Wastewater						
SAL Sample Number		1412946-23						
Date/Time Collected		12/17/14 12:24						
Collected by		Client						
Date/Time Received		12/18/14 15:30						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.22	EPA 350.1	0.040	0.009		12/22/14 16:13	1
Chloride	mg/L	21	EPA 300.0	0.20	0.050		12/24/14 18:02	1
Nitrate+Nitrite (N)	mg/L	0.01 U	EPA 353.2	0.04	0.01		12/23/14 17:56	1
Nitrite (as N)	mg/L	0.01 U	SM	0.04	0.01		12/19/14 11:51	1
			4500NO2-B					
Sulfate	mg/L	59	EPA 300.0	0.60	0.20		12/24/14 18:02	1
Total Kjeldahl Nitrogen	mg/L	1.5	EPA 351.2	0.20	0.05	12/22/14 08:45	12/23/14 15:59	1
Nitrate (as N)	mg/L	0.02 U	EPA 353.2	0.08	0.02		12/23/14 17:56	1
Sample Description		BHS3-PZC10-S						
Matrix		Wastewater						
SAL Sample Number		1412946-24						
Date/Time Collected		12/17/14 12:06						
Collected by		Client						
Date/Time Received		12/18/14 15:30						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.084 J5	EPA 350.1	0.040	0.009		12/22/14 16:22	1
Chloride	mg/L	5.8	EPA 300.0	0.20	0.050		12/24/14 18:11	1
Nitrate+Nitrite (N)	mg/L	1.8	EPA 353.2	0.04	0.01		12/23/14 17:58	1
Nitrite (as N)	mg/L	0.02 I	SM	0.04	0.01		12/19/14 11:51	1
			4500NO2-B					
Sulfate	mg/L	15	EPA 300.0	0.60	0.20		12/24/14 18:11	1
Total Kjeldahl Nitrogen	mg/L	2.8	EPA 351.2	0.20	0.05	12/22/14 08:45	12/23/14 15:59	1
Nitrate (as N)	mg/L	1.8	EPA 353.2	0.08	0.02		12/23/14 17:58	1

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BL41829 - Digestion for TP and TKN										
Blank (BL41829-BLK1)					Prepared: 12/18/14 Analyzed: 12/23/14 15:07					
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						
Blank (BL41829-BLK2)					Prepared: 12/18/14 Analyzed: 12/23/14 15:07					
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						
LCS (BL41829-BS1)					Prepared: 12/18/14 Analyzed: 12/23/14 15:07					
Total Kjeldahl Nitrogen	0.927	0.20	0.05	mg/L	1.0		93	90-110		
Phosphorous - Total as P	1.05	0.040	0.010	mg/L	1.0		105	90-110		
LCS (BL41829-BS2)					Prepared: 12/18/14 Analyzed: 12/23/14 15:07					
Total Kjeldahl Nitrogen	0.971	0.20	0.05	mg/L	1.0		97	90-110		
Phosphorous - Total as P	1.06	0.040	0.010	mg/L	1.0		106	90-110		
Matrix Spike (BL41829-MS1)					Source: 1412946-21		Prepared: 12/18/14 Analyzed: 12/23/14 15:07			
Phosphorous - Total as P	1.05	0.040	0.010	mg/L	1.0	0.0381	101	90-110		
Total Kjeldahl Nitrogen	1.04	0.20	0.05	mg/L	1.0	ND	104	90-110		
Matrix Spike (BL41829-MS2)					Source: 1412946-20		Prepared: 12/18/14 Analyzed: 12/23/14 15:07			
Total Kjeldahl Nitrogen	1.09	0.20	0.05	mg/L	1.0	ND	109	90-110		
Phosphorous - Total as P	1.06	0.040	0.010	mg/L	1.0	0.0384	102	90-110		
Matrix Spike (BL41829-MS3)					Source: 1413305-07		Prepared: 12/18/14 Analyzed: 12/23/14 15:07			
Phosphorous - Total as P	1.35	0.040	0.010	mg/L	1.0	0.385	97	90-110		
Total Kjeldahl Nitrogen	1.69	0.20	0.05	mg/L	1.0	0.728	96	90-110		
Matrix Spike (BL41829-MS4)					Source: 1413282-02		Prepared: 12/18/14 Analyzed: 12/23/14 15:07			
Phosphorous - Total as P	2.25	0.040	0.010	mg/L	1.0	1.28	97	90-110		
Total Kjeldahl Nitrogen	1.90	0.20	0.05	mg/L	1.0	0.946	96	90-110		

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Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	Limits	RPD	RPD Limit
Batch BL41829 - Digestion for TP and TKN										
Matrix Spike Dup (BL41829-MSD1)		Source: 1412946-21			Prepared: 12/18/14 Analyzed: 12/23/14 15:07					
Total Kjeldahl Nitrogen	1.02	0.20	0.05	mg/L	1.0	ND	102	90-110	2	20
Phosphorous - Total as P	1.04	0.040	0.010	mg/L	1.0	0.0381	100	90-110	0.4	25
Matrix Spike Dup (BL41829-MSD2)		Source: 1412946-20			Prepared: 12/18/14 Analyzed: 12/23/14 15:07					
Total Kjeldahl Nitrogen	1.07	0.20	0.05	mg/L	1.0	ND	107	90-110	3	20
Phosphorous - Total as P	1.06	0.040	0.010	mg/L	1.0	0.0384	102	90-110	0.5	25
Matrix Spike Dup (BL41829-MSD3)		Source: 1413305-07			Prepared: 12/18/14 Analyzed: 12/23/14 15:07					
Total Kjeldahl Nitrogen	1.70	0.20	0.05	mg/L	1.0	0.728	97	90-110	0.6	20
Phosphorous - Total as P	1.47	0.040	0.010	mg/L	1.0	0.385	109	90-110	9	25
Matrix Spike Dup (BL41829-MSD4)		Source: 1413282-02			Prepared: 12/18/14 Analyzed: 12/23/14 15:07					
Total Kjeldahl Nitrogen	1.77	0.20	0.05	mg/L	1.0	0.946	83	90-110	7	20
Phosphorous - Total as P	2.21	0.040	0.010	mg/L	1.0	1.28	93	90-110	2	25
Batch BL41902 - BOD										
Blank (BL41902-BLK1)					Prepared: 12/19/14 Analyzed: 12/24/14 10:59					
Carbonaceous BOD	2 U	2	2	mg/L						
LCS (BL41902-BS1)					Prepared: 12/19/14 Analyzed: 12/24/14 10:59					
Carbonaceous BOD	187	2	2	mg/L	200		94	85-115		
LCS Dup (BL41902-BSD1)					Prepared: 12/19/14 Analyzed: 12/24/14 10:59					
Carbonaceous BOD	188	2	2	mg/L	200		94	85-115	0.5	200
Duplicate (BL41902-DUP1)		Source: 1413305-01			Prepared: 12/19/14 Analyzed: 12/24/14 10:59					
Carbonaceous BOD	270	2	2	mg/L		290			7	25

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Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BL41909 - Ortho phosphorus SM4500P-E by seal										
Blank (BL41909-BLK1)					Prepared & Analyzed: 12/19/14 10:45					
Orthophosphate as P	0.012 U	0.040	0.012	mg/L						
LCS (BL41909-BS1)					Prepared & Analyzed: 12/19/14 10:46					
Orthophosphate as P	0.724	0.040	0.012	mg/L	0.80		90	90-110		
Matrix Spike (BL41909-MS1)					Source: 1412946-01 Prepared & Analyzed: 12/19/14 11:19					
Orthophosphate as P	7.59 J2	0.20	0.060	mg/L	1.0	7.37	22	90-110		
Matrix Spike (BL41909-MS2)					Source: 1413282-01 Prepared & Analyzed: 12/19/14 11:23					
Orthophosphate as P	4.28 J2	0.20	0.060	mg/L	1.0	3.48	80	90-110		
Matrix Spike Dup (BL41909-MSD1)					Source: 1412946-01 Prepared & Analyzed: 12/19/14 11:20					
Orthophosphate as P	7.51 J2	0.20	0.060	mg/L	1.0	7.37	14	90-110	1	20
Matrix Spike Dup (BL41909-MSD2)					Source: 1413282-01 Prepared & Analyzed: 12/19/14 11:24					
Orthophosphate as P	4.18 J2	0.20	0.060	mg/L	1.0	3.48	70	90-110	2	20
Batch BL41914 - Nitrite SM 4500NO2-B by seal										
Blank (BL41914-BLK1)					Prepared & Analyzed: 12/19/14 11:36					
Nitrite (as N)	0.01 U	0.04	0.01	mg/L						
LCS (BL41914-BS1)					Prepared & Analyzed: 12/19/14 11:36					
Nitrite (as N)	0.0770	0.04	0.01	mg/L	0.080		96	90-110		
Matrix Spike (BL41914-MS1)					Source: 1412946-01 Prepared & Analyzed: 12/19/14 11:37					
Nitrite (as N)	0.136 J2	0.04	0.01	mg/L	0.10	0.0786	57	77-119		

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Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BL41914 - Nitrite SM 4500NO2-B by seal										
Matrix Spike (BL41914-MS2)		Source: 1412946-17			Prepared & Analyzed: 12/19/14 11:44					
Nitrite (as N)	0.0795	0.04	0.01	mg/L	0.10	ND	80	77-119		
Matrix Spike Dup (BL41914-MSD1)		Source: 1412946-01			Prepared & Analyzed: 12/19/14 11:38					
Nitrite (as N)	0.138 J2	0.04	0.01	mg/L	0.10	0.0786	59	77-119	1	20
Matrix Spike Dup (BL41914-MSD2)		Source: 1412946-17			Prepared & Analyzed: 12/19/14 11:44					
Nitrite (as N)	0.0820	0.04	0.01	mg/L	0.10	ND	82	77-119	3	20
Batch BL41916 - Nitrate 353.2 by seal										
Blank (BL41916-BLK1)					Prepared & Analyzed: 12/19/14 12:35					
Nitrate+Nitrite (N)	0.0160 I	0.04	0.01	mg/L						
LCS (BL41916-BS1)					Prepared & Analyzed: 12/19/14 12:37					
Nitrate+Nitrite (N)	0.833	0.04	0.01	mg/L	0.80		104	90-110		
Matrix Spike (BL41916-MS1)		Source: 1412942-05			Prepared & Analyzed: 12/19/14 14:56					
Nitrate+Nitrite (N)	1.02	0.04	0.01	mg/L	1.0	0.0800	94	90-110		
Matrix Spike (BL41916-MS2)		Source: 1412946-02			Prepared & Analyzed: 12/19/14 13:04					
Nitrate+Nitrite (N)	1.00	0.04	0.01	mg/L	1.0	0.0410	96	90-110		
Matrix Spike Dup (BL41916-MSD1)		Source: 1412942-05			Prepared & Analyzed: 12/19/14 14:58					
Nitrate+Nitrite (N)	0.985	0.04	0.01	mg/L	1.0	0.0800	90	90-110	3	20
Matrix Spike Dup (BL41916-MSD2)		Source: 1412946-02			Prepared & Analyzed: 12/19/14 13:06					
Nitrate+Nitrite (N)	0.951	0.04	0.01	mg/L	1.0	0.0410	91	90-110	6	20

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BL41924 - Ammonia by SEAL										
Blank (BL41924-BLK1)					Prepared & Analyzed: 12/19/14 14:58					
Ammonia as N	0.009 U	0.040	0.009	mg/L						
LCS (BL41924-BS1)					Prepared & Analyzed: 12/19/14 15:00					
Ammonia as N	0.51	0.040	0.009	mg/L	0.50		103	90-110		
Matrix Spike (BL41924-MS1)					Source: 1412946-01 Prepared & Analyzed: 12/19/14 16:45					
Ammonia as N	50 L2	4.0	0.95	mg/L	0.50	62	NR	90-110		
Matrix Spike (BL41924-MS2)					Source: 1413339-01 Prepared & Analyzed: 12/19/14 15:22					
Ammonia as N	1.1	0.040	0.009	mg/L	0.50	0.60	94	90-110		
Matrix Spike Dup (BL41924-MSD1)					Source: 1412946-01 Prepared & Analyzed: 12/19/14 16:46					
Ammonia as N	51 L2	4.0	0.95	mg/L	0.50	62	NR	90-110	3	10
Matrix Spike Dup (BL41924-MSD2)					Source: 1413339-01 Prepared & Analyzed: 12/19/14 15:24					
Ammonia as N	1.1	0.040	0.009	mg/L	0.50	0.60	94	90-110	0.3	10
Batch BL41930 - Nitrate 353.2 by seal										
Blank (BL41930-BLK1)					Prepared & Analyzed: 12/23/14 17:14					
Nitrate+Nitrite (N)	0.01 U	0.04	0.01	mg/L						
LCS (BL41930-BS1)					Prepared & Analyzed: 12/23/14 17:16					
Nitrate+Nitrite (N)	0.805	0.04	0.01	mg/L	0.80		101	90-110		
Matrix Spike (BL41930-MS1)					Source: 1412946-09 Prepared & Analyzed: 12/23/14 17:18					
Nitrate+Nitrite (N)	1.04 J2	0.04	0.01	mg/L	0.80	0.0270	126	90-110		

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BL41930 - Nitrate 353.2 by seal										
Matrix Spike (BL41930-MS2)		Source: 1413285-01			Prepared & Analyzed: 12/23/14 17:44					
Nitrate+Nitrite (N)	2.46	0.40	0.10	mg/L	0.80	1.68	97	90-110		
Matrix Spike Dup (BL41930-MSD1)		Source: 1412946-09			Prepared & Analyzed: 12/23/14 17:20					
Nitrate+Nitrite (N)	0.866	0.04	0.01	mg/L	0.80	0.0270	105	90-110	18	20
Matrix Spike Dup (BL41930-MSD2)		Source: 1413285-01			Prepared & Analyzed: 12/23/14 17:46					
Nitrate+Nitrite (N)	2.29 J2	0.40	0.10	mg/L	0.80	1.68	77	90-110	7	20
Batch BL41946 - Chloride by Seal										
Blank (BL41946-BLK1)					Prepared & Analyzed: 12/22/14 12:25					
Chloride	1.0 U	4.0	1.0	mg/L						
LCS (BL41946-BS1)					Prepared & Analyzed: 12/22/14 12:26					
Chloride	10	4.0	1.0	mg/L	10		100	90-110		
Matrix Spike (BL41946-MS1)		Source: 1412946-01			Prepared & Analyzed: 12/22/14 12:26					
Chloride	210 L2	40	10	mg/L	10	190	198	80-120		
Matrix Spike (BL41946-MS2)		Source: 1412946-17			Prepared & Analyzed: 12/22/14 12:36					
Chloride	550 L2	400	100	mg/L	10	490	619	80-120		
Matrix Spike Dup (BL41946-MSD1)		Source: 1412946-01			Prepared & Analyzed: 12/22/14 12:27					
Chloride	230 L2	40	10	mg/L	10	190	378	80-120	8	20
Matrix Spike Dup (BL41946-MSD2)		Source: 1412946-17			Prepared & Analyzed: 12/22/14 12:37					
Chloride	490 L2	400	100	mg/L	10	490	38	80-120	11	20

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BL42203 - Digestion for TP and TKN										
Blank (BL42203-BLK1)					Prepared: 12/22/14 Analyzed: 12/23/14 15:59					
Total Kjeldahl Nitrogen	0.05 U	0.20	0.05	mg/L						
LCS (BL42203-BS1)					Prepared: 12/22/14 Analyzed: 12/23/14 15:59					
Total Kjeldahl Nitrogen	1.02	0.20	0.05	mg/L	1.0		102	90-110		
Matrix Spike (BL42203-MS1)					Source: 1413351-07 Prepared: 12/22/14 Analyzed: 12/23/14 15:59					
Total Kjeldahl Nitrogen	1.56	0.20	0.05	mg/L	1.0	0.649	91	90-110		
Matrix Spike Dup (BL42203-MSD1)					Source: 1413351-07 Prepared: 12/22/14 Analyzed: 12/23/14 15:59					
Total Kjeldahl Nitrogen	1.74	0.20	0.05	mg/L	1.0	0.649	109	90-110	11	20
Batch BL42208 - VSS Prep										
Blank (BL42208-BLK1)					Prepared: 12/22/14 Analyzed: 12/23/14 16:39					
Total Suspended Solids	1 U	1	1	mg/L						
Volatile Suspended Solids	1 U	1		mg/L						
LCS (BL42208-BS1)					Prepared: 12/22/14 Analyzed: 12/23/14 16:39					
Total Suspended Solids	49.5	1	1	mg/L	50		99	85-115		
Duplicate (BL42208-DUP1)					Source: 1412946-01 Prepared: 12/22/14 Analyzed: 12/23/14 16:39					
Volatile Suspended Solids	22.0	1		mg/L		22.0			0	20
Total Suspended Solids	22.0	1	1	mg/L		22.0			0	30
Batch BL42212 - COD prep										
Blank (BL42212-BLK1)					Prepared & Analyzed: 12/22/14 12:39					
Chemical Oxygen Demand	10 U	25	10	mg/L						

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Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BL42212 - COD prep										
Blank (BL42212-BLK2)					Prepared & Analyzed: 12/22/14 12:39					
Chemical Oxygen Demand	10 U	25	10	mg/L						
Blank (BL42212-BLK3)					Prepared & Analyzed: 12/22/14 12:39					
Chemical Oxygen Demand	10 U	25	10	mg/L						
LCS (BL42212-BS1)					Prepared & Analyzed: 12/22/14 12:39					
Chemical Oxygen Demand	49	25	10	mg/L	50		98	90-110		
LCS (BL42212-BS2)					Prepared & Analyzed: 12/22/14 12:39					
Chemical Oxygen Demand	47	25	10	mg/L	50		94	90-110		
LCS (BL42212-BS3)					Prepared & Analyzed: 12/22/14 12:39					
Chemical Oxygen Demand	45	25	10	mg/L	50		90	90-110		
Matrix Spike (BL42212-MS1)					Source: 1412942-19 Prepared & Analyzed: 12/22/14 12:39					
Chemical Oxygen Demand	45	25	10	mg/L	50	ND	90	85-115		
Matrix Spike (BL42212-MS2)					Source: 1412944-11 Prepared & Analyzed: 12/22/14 12:39					
Chemical Oxygen Demand	47	25	10	mg/L	50	ND	94	85-115		
Matrix Spike (BL42212-MS3)					Source: 1412946-21 Prepared & Analyzed: 12/22/14 12:39					
Chemical Oxygen Demand	45	25	10	mg/L	50	ND	90	85-115		
Matrix Spike Dup (BL42212-MSD1)					Source: 1412942-19 Prepared & Analyzed: 12/22/14 12:39					
Chemical Oxygen Demand	45	25	10	mg/L	50	ND	90	85-115	0	32
Matrix Spike Dup (BL42212-MSD2)					Source: 1412944-11 Prepared & Analyzed: 12/22/14 12:39					
Chemical Oxygen Demand	45	25	10	mg/L	50	ND	90	85-115	4	32

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Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BL42212 - COD prep										
Matrix Spike Dup (BL42212-MSD3)		Source: 1412946-21			Prepared & Analyzed: 12/22/14 12:39					
Chemical Oxygen Demand	43	25	10	mg/L	50	ND	86	85-115	5	32
Batch BL42226 - Ammonia by SEAL										
Blank (BL42226-BLK1)				Prepared & Analyzed: 12/22/14 15:54						
Ammonia as N	0.009 U	0.040	0.009	mg/L						
LCS (BL42226-BS1)				Prepared & Analyzed: 12/22/14 15:56						
Ammonia as N	0.51	0.040	0.009	mg/L	0.50		103	90-110		
Matrix Spike (BL42226-MS1)		Source: 1412946-12			Prepared & Analyzed: 12/22/14 15:58					
Ammonia as N	0.52	0.040	0.009	mg/L	0.50	0.062	91	90-110		
Matrix Spike (BL42226-MS2)		Source: 1412946-24			Prepared & Analyzed: 12/22/14 16:19					
Ammonia as N	0.38 J2	0.040	0.009	mg/L	0.50	0.084	59	90-110		
Matrix Spike Dup (BL42226-MSD1)		Source: 1412946-12			Prepared & Analyzed: 12/24/14 08:55					
Ammonia as N	0.51	0.040	0.009	mg/L	0.50	0.062	89	90-110	2	10
Matrix Spike Dup (BL42226-MSD2)		Source: 1412946-24			Prepared & Analyzed: 12/22/14 16:20					
Ammonia as N	0.32 J2	0.040	0.009	mg/L	0.50	0.084	47	90-110	17	10
Batch BL42414 - Ion Chromatography 300.0 Prep										
Blank (BL42414-BLK1)				Prepared & Analyzed: 12/24/14 17:26						
Sulfate	0.20 U	0.60	0.20	mg/L						
Chloride	0.050 U	0.20	0.050	mg/L						
Surrogate: Dichloroacetate	0.966			mg/L	1.0		97	78-120		
Surrogate: Dichloroacetate	0.966			mg/L	1.0		97	78-120		

SOUTHERN ANALYTICAL LABORATORIES, INC.

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



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

December 31, 2014
Work Order: 1412946

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BL42414 - Ion Chromatography 300.0 Prep										
LCS (BL42414-BS1)					Prepared & Analyzed: 12/24/14 17:35					
Sulfate	8.76	0.60	0.20	mg/L	9.0		97	85-115		
Chloride	2.98	0.20	0.050	mg/L	3.0		99	85-115		
Surrogate: Dichloroacetate	1.05			mg/L	1.0		105	78-120		
Surrogate: Dichloroacetate	1.05			mg/L	1.0		105	78-120		
LCS Dup (BL42414-BSD1)					Prepared & Analyzed: 12/24/14 17:53					
Chloride	3.11	0.20	0.050	mg/L	3.0		104	85-115	4	200
Sulfate	9.16	0.60	0.20	mg/L	9.0		102	85-115	4	200
Surrogate: Dichloroacetate	1.04			mg/L	1.0		104	78-120		
Surrogate: Dichloroacetate	1.04			mg/L	1.0		104	78-120		
Matrix Spike (BL42414-MS1)					Source: 1413401-01		Prepared & Analyzed: 12/24/14 19:37			
Sulfate	453	6.0	2.0	mg/L	90	372	90	85-115		
Chloride	91.9	2.0	0.50	mg/L	30	64.9	90	80-120		
Surrogate: Dichloroacetate	1.10			mg/L	1.0		110	78-120		
Surrogate: Dichloroacetate	1.10			mg/L	1.0		110	78-120		
Matrix Spike (BL42414-MS2)					Source: 1412944-10		Prepared & Analyzed: 12/26/14 11:40			
Chloride	98.5	2.0	0.50	mg/L	30	71.0	91	80-120		
Sulfate	395	6.0	2.0	mg/L	90	314	90	85-115		
Surrogate: Dichloroacetate	1.07			mg/L	1.0		107	78-120		
Surrogate: Dichloroacetate	1.07			mg/L	1.0		107	78-120		
Batch BL42604 - Ammonia by SEAL										
Blank (BL42604-BLK1)					Prepared & Analyzed: 12/26/14 11:24					
Ammonia as N	0.009 U	0.040	0.009	mg/L						

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Tampa, FL 33619

December 31, 2014
Work Order: 1412946

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BL42604 - Ammonia by SEAL										
LCS (BL42604-BS1)					Prepared & Analyzed: 12/26/14 11:26					
Ammonia as N	0.53	0.040	0.009	mg/L	0.50		106	90-110		
Matrix Spike (BL42604-MS1)					Source: 1413341-01 Prepared & Analyzed: 12/26/14 11:27					
Ammonia as N	0.46	0.040	0.009	mg/L	0.50	ND	93	90-110		
Matrix Spike (BL42604-MS2)					Source: 1413386-02 Prepared & Analyzed: 12/26/14 11:48					
Ammonia as N	0.49	0.040	0.009	mg/L	0.50	ND	98	90-110		
Matrix Spike Dup (BL42604-MSD1)					Source: 1413341-01 Prepared & Analyzed: 12/26/14 11:29					
Ammonia as N	0.43	0.040	0.009	mg/L	0.50	ND	85	90-110	8	10
Matrix Spike Dup (BL42604-MSD2)					Source: 1413386-02 Prepared & Analyzed: 12/26/14 11:50					
Ammonia as N	0.48	0.040	0.009	mg/L	0.50	ND	97	90-110	1	10
Batch BL42930 - alkalinity										
Blank (BL42930-BLK1)					Prepared & Analyzed: 12/30/14 10:13					
Total Alkalinity	2.0 U	8.0	2.0	mg/L						
LCS (BL42930-BS1)					Prepared & Analyzed: 12/30/14 10:20					
Total Alkalinity	130	8.0	2.0	mg/L	120		108	90-110		
Matrix Spike (BL42930-MS1)					Source: 1412946-20 Prepared & Analyzed: 12/30/14 11:35					
Total Alkalinity	130	8.0	2.0	mg/L	120	4.9	104	80-120		
Matrix Spike Dup (BL42930-MSD1)					Source: 1412946-20 Prepared & Analyzed: 12/30/14 11:41					
Total Alkalinity	140	8.0	2.0	mg/L	120	4.9	105	80-120	1	26

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December 31, 2014
Work Order: 1412946

Microbiology - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BL41830 - FC-MF										
Blank (BL41830-BLK1)					Prepared: 12/18/14 Analyzed: 12/19/14 15:00					
Fecal Coliforms	1 U	1	1	CFU/100 ml						
Duplicate (BL41830-DUP1)					Source: 1412946-21 Prepared: 12/18/14 Analyzed: 12/19/14 15:00					
Fecal Coliforms	1 U	1	1	CFU/100 ml		ND				200

Hazen and Sawyer
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Tampa, FL 33619

December 31, 2014
Work Order: 1412946

* Qualifiers, Notes and Definitions

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

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

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

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

- L2 Analyte level in sample invalidated Matrix Spike.
- J5 Matrix spike of this sample was outside typical range. All other QC criteria were acceptable.
- 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



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

Client Name Hazen and Sawyer										Josefin Hirst																
Project Name / Location BHS7 SE#7																										
Samplers: (Signature) <i>Josefin Hirst</i>										PARAMETER / CONTAINER DESCRIPTION																
<p>Matrix Codes: DW-Drinking Water WW-Wastewater SW-Surface Water SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water</p>																										
<p>SAL Use Only Sample No.</p>																										
Sample Description										Date	Time	Matrix	Composite	Grab	125mLP, Sterile, Na ₂ S ₂ O ₃ FC-MF, FC-QT	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	125mLP, H ₂ SO ₄ Ammonia, TKN, TP	500mLP, Cool NOx, Cl	Field pH	Field Temperature	Field Conductivity	Field DO	No. of Containers (Total per each location)
13 N-BHS7-ST2-OB-01 DRY												WW		X				1	1							
14 G-BHS7-ST2-OB-02 DRY												WW		X				1	1							
15 S-BHS7-ST2-OB-03 DRY												WW		X	4	2	1									
16 NE-BHS7-EFF-SL-06										12/18/14	9:35	WW		X				1	1		5.36	12.7	239	7.95		
17 NW-BHS7-EFF-SL-07											9:45	WW		X				1	1		6.59	13.7	2390	8.22		
18 SE-BHS7-EFF-SL-08											10:05	WW		X				1	1		5.50	15.8	1796	7.43		
19 SW-BHS7-EFF-SL-09											10:15	WW		X	4	2	1				6.57	14.6	4910	8.51		
20 BHS7-FB											10:45	R		X	4	2	1				5.60	17.6	1.05	10.05		
21 BHS7-EB											10:40	R		X	4	2	1				5.90	16.7	1.47	9.37		
22 BHS7-BKG - DRY												WW		X	4	2	1									
23 BHS3-P2C06-S										12/17/14	12:24									6.00	21.91	226	1.22	276		
24 BHS3-P2C10-S										12/17/14	12:06									5.67	21.25	498	3.16			
Containers Prepared/Relinquished:										Date/Time:	Received:	Date/Time:	Instructions / Remarks:													
<i>Josefin Hirst</i>										11:00	<i>Josefin Hirst</i>	12:10/14	Seal intact? Y N NA Samples intact upon arrival? Y N NA Received on ice? Temp _____ Y N NA Proper preservatives indicated? Y N NA Rec'd within holding time? Y N NA Volatiles rec'd w/out headspace? Y N NA Proper containers used? Y N NA													
<i>Josefin Hirst</i>										12:09/14	12:15															
<i>Josefin Hirst</i>										12:18/14	12:18-14															
<i>Josefin Hirst</i>										12:18-17	12:18-14															
<i>Josefin Hirst</i>										1530	1530															

1412946



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

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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).



Appendix C: Weather Station Data

Table C.1
Weather Station Data

MONTHLY CLIMATOLOGICAL SUMMARY FOR NOVEMBER 2014												
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	52.7	61.5	4:30p	43.0	10:00p	12.3	0.0	1.4	16.0	3:30p	NW
2	0.00	49.5	67.6	4:00p	37.5	3:30a	15.7	0.1	0.7	9.0	5:30a	NNW
3	0.00	55.9	72.4	2:30p	39.3	1:00a	10.6	1.5	1.1	14.0	12:00p	NNW
4	0.00	63.5	79.8	3:00p	51.0	6:00a	5.2	3.7	0.8	13.0	12:30p	NNW
5	0.00	69.3	83.5	2:00p	59.9	12:30a	1.6	5.8	0.5	12.0	3:00p	ENE
6	0.00	69.3	85.3	1:30p	57.5	7:30a	1.7	6.0	0.5	9.0	2:00p	SW
7	0.00	62.9	74.4	4:00p	49.0	11:00p	3.9	1.8	1.1	11.0	9:00a	NNW
8	0.26	58.9	72.7	12:30p	46.2	5:00a	7.4	1.3	0.5	8.0	5:30p	N
9	0.25	60.0	69.9	1:00p	54.4	12:00m	5.5	0.5	0.4	9.0	1:00p	NNW
10	0.06	60.3	73.0	4:30p	53.9	2:30a	5.5	0.8	0.4	8.0	7:30p	NNW
11	0.00	63.8	81.2	1:30p	53.0	6:00a	5.1	3.9	0.7	13.0	3:30p	NW
12	0.00	61.7	79.9	3:30p	49.0	7:30a	6.2	2.9	0.3	7.0	10:30a	N
13	0.00	65.7	80.9	2:00p	54.6	4:00a	3.4	4.1	0.3	7.0	2:30p	NW
14	0.00	59.7	70.9	2:30p	47.6	12:00m	5.9	0.7	0.9	10.0	4:30p	NW
15	0.00	56.7	72.9	3:00p	43.3	3:00a	9.5	1.2	1.5	15.0	4:30p	NNW
16	0.00	65.3	82.6	4:00p	49.2	5:30a	4.7	5.0	0.5	11.0	12:00p	SSW
17	0.83	69.3	80.4	12:30p	64.3	12:30a	0.0	4.3	1.4	15.0	9:30a	SSW
18	0.01	46.8	66.0	12:30a	38.7	8:00p	18.2	0.0	1.7	15.0	4:00a	NNW
19	0.00	43.9	59.0	3:30p	34.0	7:00a	21.1	0.0	1.8	13.0	8:30a	NNW
20	0.00	47.3	62.7	2:30p	33.6	6:30a	17.7	0.0	0.8	10.0	1:00p	NNW
21	0.00	57.4	70.7	1:30p	43.9	7:30a	8.6	0.9	1.8	17.0	11:30a	NE
22	0.16	64.4	70.7	11:30a	55.3	1:30a	2.2	1.5	1.2	13.0	12:30p	ENE
23	0.07	73.5	84.1	3:00p	67.7	12:30a	0.0	8.5	1.4	14.0	11:00a	SSW
24	0.01	76.3	86.3	1:30p	70.4	12:30a	0.0	11.3	1.5	13.0	3:00p	SSW
25	4.28	69.3	72.9	12:00p	65.1	3:30p	0.0	4.3	0.5	12.0	4:00p	SSW
26	0.58	54.9	69.5	2:00a	43.1	11:30p	10.5	0.5	0.9	13.0	4:30a	SW
27	0.01	51.9	68.1	2:30p	40.0	4:00a	13.4	0.3	0.8	12.0	2:00p	SW
28	0.00	47.0	59.5	3:00p	38.6	7:00a	18.0	0.0	1.6	13.0	7:30a	NNW
29	0.00	54.3	73.2	2:00p	40.1	6:00a	12.0	1.3	0.5	9.0	1:00p	ENE
30	0.01	60.3	78.3	2:00p	48.2	6:30a	7.4	2.7	0.5	8.0	12:30p	E
TOTAL	6.53											

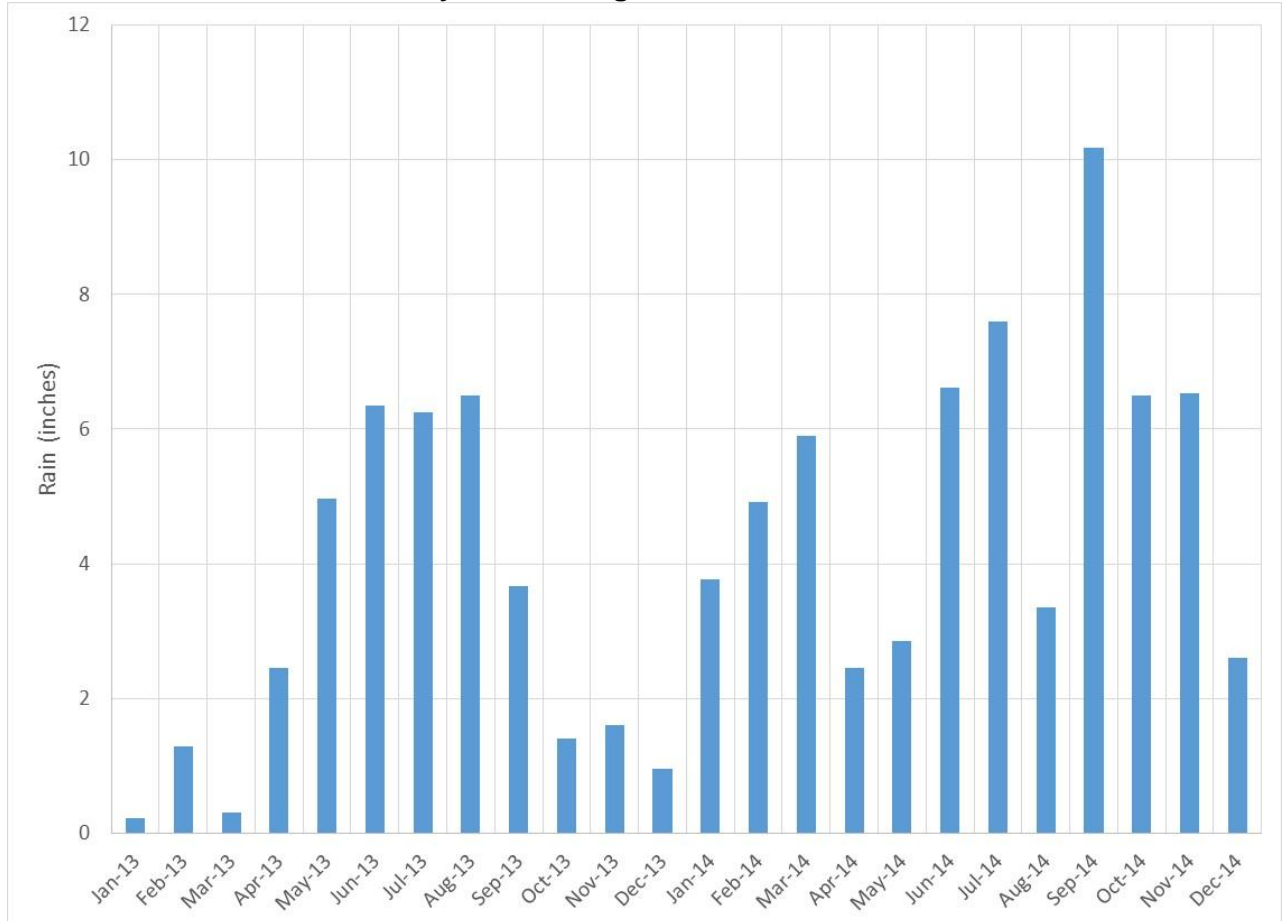
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Table C.1
Weather Station Data (continued)

MONTHLY CLIMATOLOGICAL SUMMARY FOR DECEMBER 2014												
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	0.01	65.3	79.1	3:00p	55.0	6:30a	3.4	3.8	0.9	11.0	2:30p	NE
2	0.06	67.0	80.3	2:00p	58.0	7:00a	2.0	4.0	0.9	13.0	11:30a	ENE
3	0.02	67.2	80.2	2:30p	60.1	6:30a	1.7	3.9	0.9	14.0	4:00p	NE
4	0.00	66.7	79.5	3:00p	57.1	6:00a	2.2	3.9	1.3	14.0	1:30p	NE
5	0.01	67.8	77.7	1:30p	61.7	7:00a	0.8	3.6	1.5	13.0	2:00p	NE
6	0.00	69.9	83.2	3:30p	63.2	7:30a	0.4	5.2	0.6	7.0	2:00p	SW
7	0.00	61.9	66.9	12:30p	56.2	12:00m	3.3	0.2	1.7	13.0	4:00p	NNW
8	0.00	57.1	60.6	9:00a	51.2	12:00m	7.9	0.0	2.8	16.0	11:30a	NNW
9	0.00	52.3	64.5	2:30p	41.4	11:30p	12.7	0.0	1.1	16.0	1:00p	NW
10	0.00	47.7	64.7	3:00p	36.5	7:00a	17.3	0.0	0.4	8.0	12:30p	SW
11	0.01	46.8	63.9	3:00p	35.5	4:00a	18.2	0.0	0.6	9.0	2:00p	SW
12	0.00	48.4	66.6	4:00p	39.0	11:30p	16.6	0.0	0.2	7.0	9:00a	N
13	0.00	49.0	70.1	4:00p	34.3	7:00a	16.5	0.5	0.2	7.0	2:30p	NW
14	0.00	51.4	74.5	4:00p	36.0	7:30a	15.0	1.3	0.2	6.0	2:30p	SW
15	0.01	51.5	72.7	4:00p	36.4	8:00a	14.4	0.9	0.2	5.0	2:30p	SW
16	0.00	56.9	75.8	3:30p	41.3	6:30a	9.8	1.7	0.8	11.0	12:30p	SW
17	0.01	58.0	73.4	3:30p	45.1	11:30p	8.2	1.3	0.3	6.0	8:30a	SW
18	0.00	52.9	69.4	3:00p	41.2	7:30a	12.5	0.4	0.3	7.0	1:00p	NNW
19	0.00	56.6	74.3	3:30p	47.7	6:30a	9.5	1.1	0.2	7.0	1:00p	NNW
20	0.00	61.3	77.0	12:30p	48.2	1:30a	5.9	2.2	0.4	6.0	12:30p	NE
21	0.77	63.9	68.6	2:30p	60.1	4:30a	1.8	0.7	0.6	9.0	1:30a	NE
22	1.30	69.2	77.1	1:00p	63.4	2:00a	0.3	4.5	0.6	14.0	1:00p	SSW
23	0.00	71.0	78.9	3:00p	66.9	4:00a	0.0	6.0	0.8	11.0	10:30a	SSW
24	0.36	72.3	82.5	1:30p	62.6	12:00m	0.2	7.4	2.4	18.0	4:30p	SSW
25	0.00	56.2	65.0	4:00p	46.9	11:00p	8.8	0.0	0.4	9.0	1:30a	NNW
26	0.01	57.3	73.9	2:30p	44.0	4:30a	9.1	1.3	0.5	8.0	12:30p	NE
27	0.00	67.0	82.4	3:30p	57.3	12:30a	2.6	4.7	0.5	8.0	12:30p	ENE
28	0.00	69.7	82.0	3:00p	62.7	11:00p	0.3	4.9	0.4	8.0	2:00p	SW
29	0.01	68.0	80.9	3:00p	59.3	3:00a	1.2	4.2	0.6	12.0	1:00p	SW
30	0.03	66.3	70.9	2:00p	59.9	12:00m	0.9	2.2	1.0	11.0	7:30p	SW
31	0.00	57.8	60.3	6:00a	55.0	11:30p	7.2	0.0	2.9	17.0	11:30a	NNW
TOTAL	2.61											

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Figure C.1
Summary of Monthly Precipitation
January 2013 through December 2014



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