



Florida Onsite Sewage Nitrogen Reduction Strategies Study

Task B.7

B-HS4 Field System Monitoring Report No. 4

Progress Report

April 2014

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Environmental Engineers & Scientists

In association with:



AET
Applied Environmental Technology

**Otis Environmental
Consultants, LLC**

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TASK B.7 PROGRESS REPORT

B-HS4 Field System Monitoring Report No. 4

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 fourth sample event of the passive nitrogen reduction system at home site B-HS4 in Seminole County, Florida.

2.0 Purpose

Operation of the B-HS4 system was initiated on July 9, 2013. This monitoring report documents data collected from the fourth B-HS4 monitoring and sampling event conducted on April 3, 2014 (Experimental Day 269). This monitoring event consisted of conducting flow measurements from the household water use meter, recording electricity use, monitoring of field parameters, collection of water samples from four points in the treatment system, and chemical analyses of water samples by a NELAC certified laboratory.

3.0 Materials and Methods

3.1 Project Site

The B-HS4 field site is located in Seminole County, FL. The nitrogen reducing onsite treatment system for the single family residence was installed in June 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. Prior to the installation of the nitrogen removal system, the property had two existing onsite sewage treatment and disposal systems. The pre-existing 1,200 gallon concrete septic tank, located on the

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west side of the property, continues to provide primary treatment, now as part of the PNRS system. The pre-existing 900 gallon septic tank, located on the northeast side of the property, was converted to a lift station. In the new configuration, it pumps the raw sewage from that system to the head end of the new gravity flow PNRS. All subsequent flow is by gravity. The passive nitrogen reduction system consists of an addition of two tanks and a new drainfield to the existing permitted systems. The B-HS4 tankage includes a 2,800 gallon concrete Stage 1 unsaturated media biofilter and 1,500 gallon two chamber concrete Stage 2 saturated media biofilter. Based on measured average wastewater flow and tank volumes, there is over a ten day transit time through the treatment system prior to dispersal. The treated effluent from the Stage 2 biofilter is discharged into the soil via the new drainfield (EQ36-LP™ chambers).

April 2014

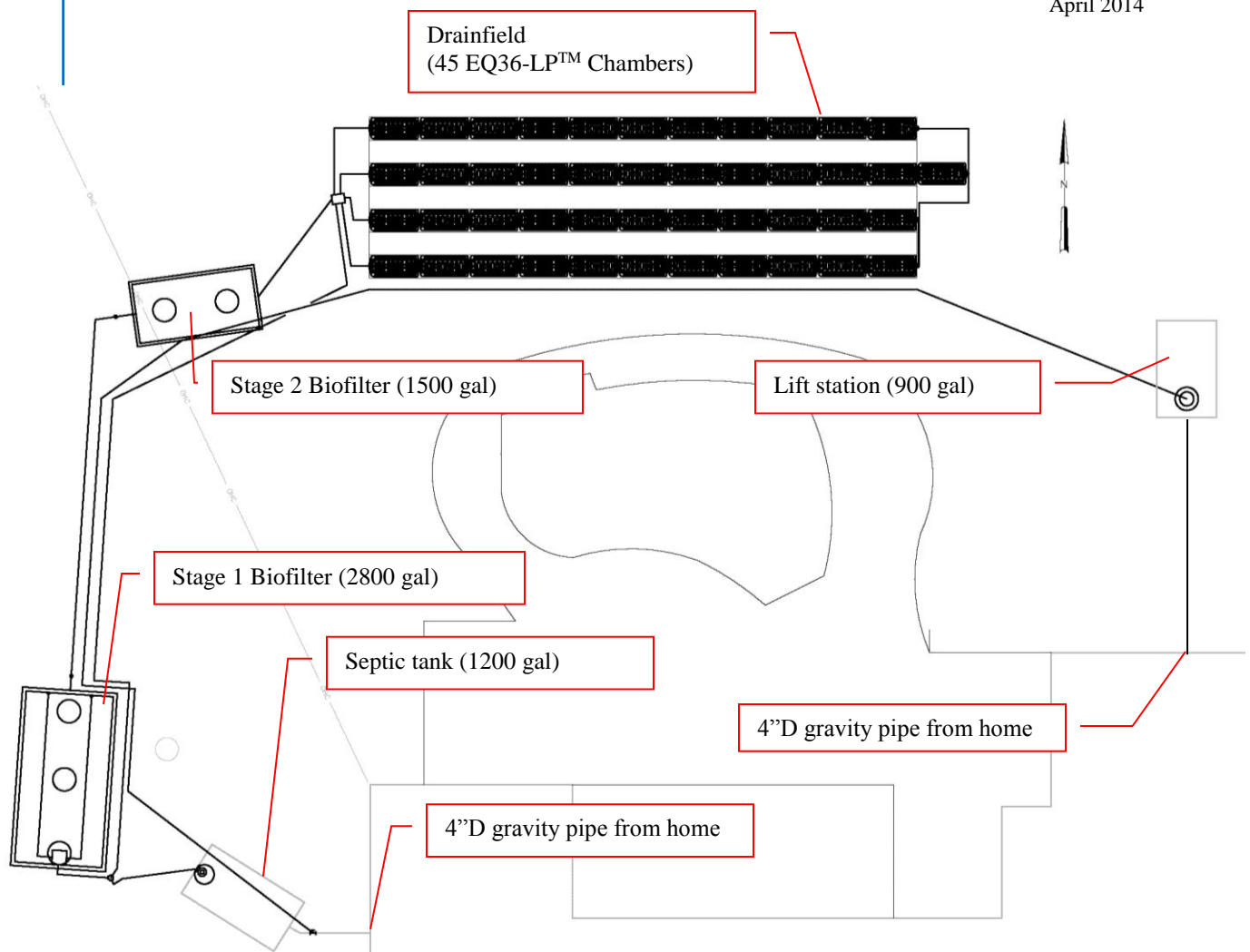


Figure 1
Plan View of B-HS4 System Layout

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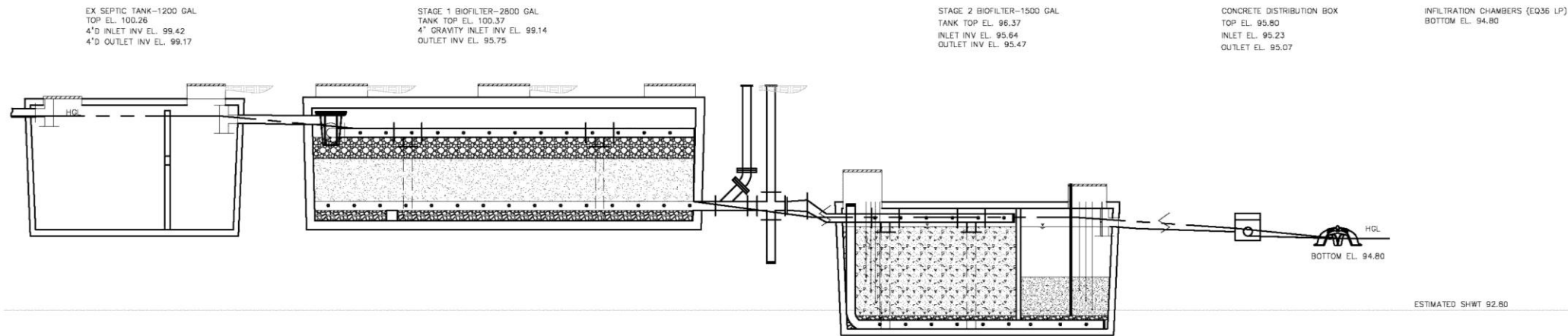


Figure 2
Flow Schematic of B-HS4 PNRS

3.2 Monitoring and Sample Locations and Identification

The four monitoring points for this sample event are shown in Figure 3. Household wastewater enters the primary tank and exits as septic tank effluent through an effluent filter screen into the Stage 1 biofilter. The first monitoring point, B-HS4-STE, is the effluent sampled approximately 1.5 feet below the surface of the primary tank before the effluent filter screen (Figure 4), which is referred to as primary effluent or septic tank effluent (STE). The lift station wastewater is pumped into the inlet side of the primary tank; therefore, samples from monitoring point B-HS4-STE are representative of the whole household wastewater and represent the influent to the remainder of the onsite nitrogen reduction system.

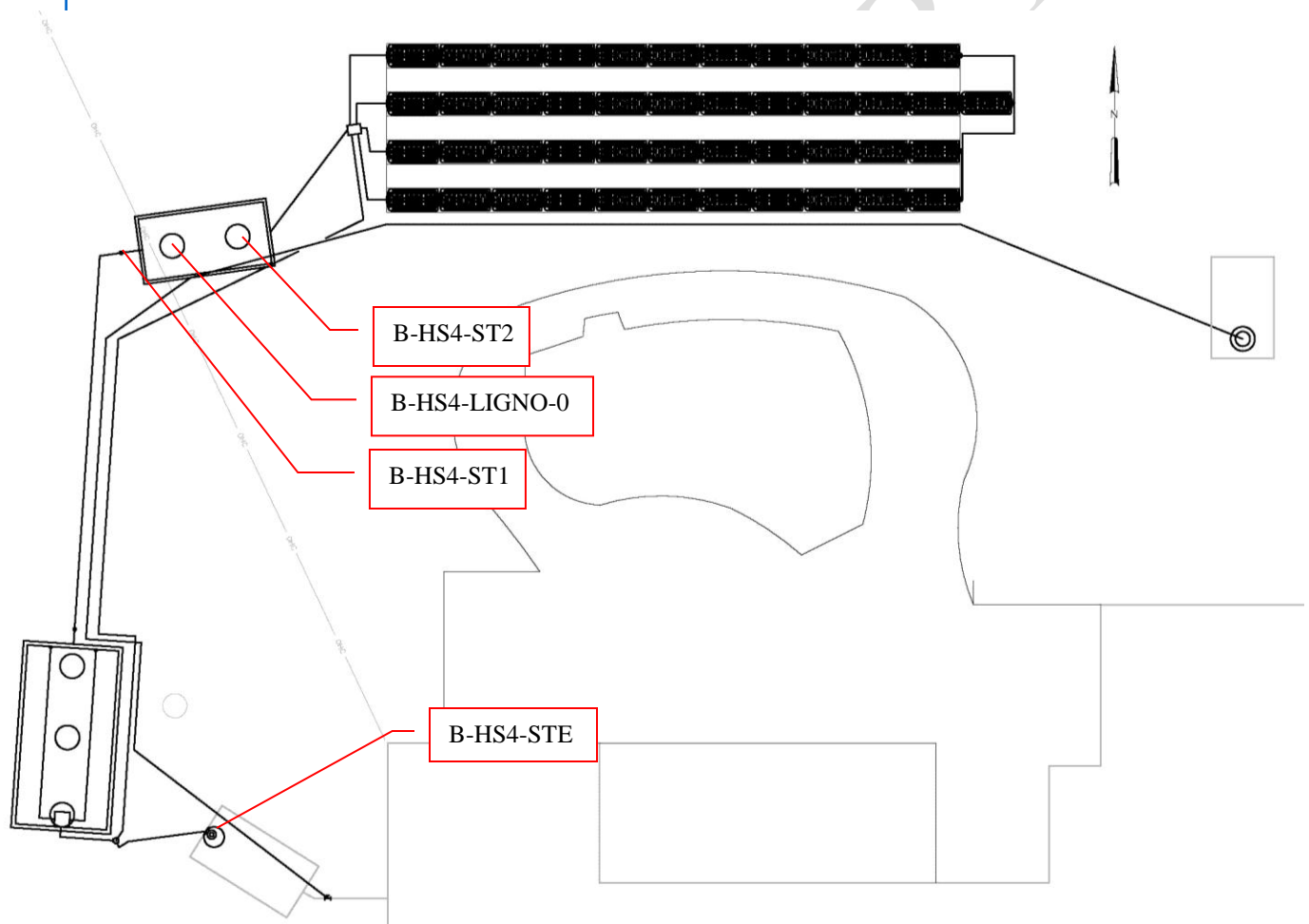


Figure 3
B-HS4 Sample and Monitoring Locations



Figure 4
Primary Tank (B-HS4-STE Sample)

The primary tank contents are discharged by gravity to a distribution box, located inside the Stage 1 biofilter, which splits the flow between two perforated distribution pipes along the top of the unsaturated Stage 1 biofilter media. In the Stage 1 biofilter, wastewater percolates downward through 30-inches of unsaturated expanded clay media where nitrification occurs. Stage 1 biofilter effluent flows into the Stage 2 biofilter by gravity. The second sampling point (B-HS4-ST1) is taken from a sample port in the gravity pipe connecting the Stage 1 biofilter outlet to the Stage 2 biofilter inlet representing the Stage 1 biofilter effluent.

Effluent from the unsaturated (Stage 1) media tank enters the saturated denitrification (Stage 2) biofilter into a standing water column lying above the media in the first chamber (type of lignocellulosic media), flows downward through the media into under-drain media, moves laterally in a perforated 4-inch pipe through the baffle wall to the

bottom of the second chamber, and upward through the media in the second chamber (elemental sulfur and oyster shell).

The first chamber of the Stage 2 biofilter contains 42-inches of lignocellulosic media as a supplemental carbon source for denitrification, a blended urban waste wood from Mother's Organics, Inc., Thonotosassa, FL. Stainless steel samplers are positioned at 12-inch increments for vertical profiling throughout the lignocellulosic media. The third sampling point is a stainless steel sampler positioned at the bottom of the lignocellulosic media (B-HS4-LIGNO-0) with tubing to the surface. The B-HS4-LIGNO-0 sample represents the lignocellulosic media effluent (Figure 5).



Figure 5
First Chamber of Stage 2 Biofilter (B-HS4-LIGNO-0 Sample)

A collection pipe along the bottom transfers the first chamber (lignocellulosic media) effluent to the second chamber, which contains 18-inches of elemental sulfur mixed with

oyster shell media. The fourth sampling point, B-HS4-ST2, is the second chamber of the Stage 2 biofilter effluent which is sampled approximately 1 foot below the surface of the effluent baffle tee. This sample location is after passage through the sulfur media; it is the final effluent from the treatment system prior to being discharged to the soil infiltration system, or drainfield (Figure 6).



Figure 6
Second Chamber of Stage 2 Biofilter (B-HS4-ST2 Sample)

3.3 Operational Monitoring

Start-up of the system occurred on July 9, 2013 (Experimental Day 0). Preliminary sampling for several key parameters was conducted July 29, 2013 (Experimental Day 20) to evaluate start-up performance. It was noted during sampling that the incoming lift station wastewater flow into the primary tank was causing mixing in the primary tank and the carryover of solids into the Stage 1 biofilter d-box. Therefore, the PNRS system was bypassed on August 15, 2013. On September 5, 2013 a smaller (less horsepower) pump was installed in the lift station with a mechanical float switch to cause the lift station to dose less volume but more frequent doses to the primary tank which resulted in less mixing within the primary tank. The PNRS system has operated continually since that date. For the fourth formal sampling event, Sample Event No. 4, the water meter for the house was read and recorded on April 3, 2014. The household water meter is located on the potable water line from the onsite well prior to entering the household plumbing. The water meter does not include the irrigation water use. Therefore, the water meter reading should be indicative of the wastewater flow to the system.

3.4 Energy Consumption

Energy consumption was monitored using an electrical meter installed between the main power box for the house and the control panel. The electrical meter records the cumulative power usage of the system in kilowatt-hours. The power usage of the system is primarily due to the single lift station pump installed within the second chamber of the lift station. There are no chemicals added to the system. However, the Stage 2 biofilter media (lignocellulosic and sulfur) are "reactive" media which will be consumed during operation. The Stage 2 biofilter was initially filled with 42 inches of lignocellulosic media and 18 inches of sulfur and oyster shell mixture media, which ostensibly will last for many years without replenishment or replacement.

3.5 Water Quality Sample Collection and Analyses

The fourth formal sample event was conducted on April 3, 2014. A full suite of samples were collected for water quality analysis, including influent, intermediate and effluent points. Samples were collected at each of the four monitoring points described in Section 3.2: B-HS4-STE, B-HS4-ST1, B-HS4-LIGNO-0, and B-HS4-ST2. A peristaltic pump was used to collect samples and route them directly into analysis-specific containers after sufficient flushing of the tubing had occurred. Field parameters were then recorded.

Immediately subsequent to the regular samples for each primary monitoring point, additional sample was collected to be filtered at the laboratory (0.45 micron filter) for analysis of CBOD₅ and the nitrogen species to allow for comparison to the unfiltered sample water quality results.

Lastly, field blank (FB) and field duplicate samples 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 field sample duplicate (B-HS4-ST1) was 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-N), ammonia nitrogen ($\text{NH}_3\text{-N}$), nitrate nitrogen ($\text{NO}_3\text{-N}$), nitrite nitrogen ($\text{NO}_2\text{-N}$), total phosphorus (TP), orthophosphate (Ortho P), total suspended solids (TSS), volatile suspended solids (VSS), total organic carbon (TOC), fecal coliform (fecal), and E.coli. The influent and sulfur media samples included sulfate, sulfide, and hydrogen sulfide (unionized). All analyses were performed by an 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 Solids (TS)	EPA 160.3	.01 % by wt
Total Suspended Solids (TSS)	SM 2540D	1 mg/L
Volatile Suspended Solids (VSS)	EPA 160.4	1 mg/L
Total Organic Carbon (TOC)	SM5310B	0.06 mg/L
Sulfate	EPA 300.0	2.0 mg/L
Sulfide	SM 4500SF	0.10 mg/L
Hydrogen Sulfide (unionized)	SM 4550SF	0.01 mg/L
Fecal Coliform (fecal)	SM9222D	1 ct/100mL
E.coli	SM9223B	2 ct/100mL

4.0 Results and Discussion

4.1 Operational Monitoring

Table 2 provides a summary of the household water use since the water meter installation on February 8, 2013. The operation and maintenance log which includes actions taken since start-up is provided in Appendix B.

Table 2
Summary of Household Water Use

Date and Time Read	Cumulative Volume (gallons)	Average Daily Household Flow between readings, Q (gpd)
2/8/2013 13:45	0.0	INSTALLED
2/21/2013 11:25	4,391.0	340.3
2/28/2013 12:00	6,292.5	270.7
6/7/2013 8:00	34,417.4	284.6
6/14/2013 8:00	36,179.5	251.7
6/20/2013 12:40	37,981.2	290.9
7/17/2013 14:30	45,422.8	274.8
7/23/2013 13:32	47,051.9	273.4
7/29/2013 11:25	48,658.8	271.8
8/6/2013 12:15	50,922.9	281.8
8/12/2013 10:24	52,614.2	285.6
8/15/2013 8:20	53,328.4	245.1
8/27/2013 10:20	56,550.0	266.6
9/5/2013 9:59	58,748.1	244.6
9/30/2013 13:15	65,633.7	273.9
11/8/2013 11:00	76,559.6	280.8
11/27/2013 11:15	82,039.9	288.3
12/2/2013 13:30	83,048.8	198.1
12/23/2013 13:00	88,271.2	248.9
1/23/2014 10:30	98,116.0	318.6
1/31/2014 10:48	100,521.0	300.2
2/3/2014 11:20	101,475.3	315.8
2/4/2014 10:05	101,844.6	389.6
2/5/2014 8:05	102,095.7	273.9
2/6/2014 9:25	102,275.2	170.1
2/7/2014 9:11	102,557.9	285.5
2/12/2014 11:30	103,986.0	280.2
3/14/2014 9:00	112,449.7	283.1
4/3/2014 12:00	118,146.5	283.1
Total average through 4/3/14		282.0

From start-up through April 3, 2014, the household water use average was 282 gallons per day with periods of higher and lower flows (Table 2).

4.2 Energy Consumption

Energy consumption is monitored using an electrical meter installed between the main power box for the house and the lift station pump outlet to record cumulative power usage of the pump in kilowatt-hours. The recorded electrical use for the system is summarized in Table 3.

Table 3
Summary of System Electrical Use

Date and Time Read	Electrical Meter Reading	Average Daily Electrical Use between readings
	Cumulative (kWh)	(kWh/day)
6/20/2013 14:00		Installed
7/9/2013 15:45	0.3	Start Up
7/17/2013 10:41	0.5	0.026
7/23/2013 13:34	0.6	0.016
7/29/2013 11:30	0.8	0.034
8/6/2013 11:42	0.9	0.012
8/12/2013 10:24	1.2	0.050
8/15/2013 8:20	1.3	0.034
8/27/2013 10:20	1.8	0.041
9/5/2013 9:59	2.2	0.045
9/30/2013 13:15	5.8	0.143
11/8/2013 11:00	12.3	0.167
11/27/2013 11:15	14.1	0.095
12/2/2013 12:55	14.5	0.079
12/23/2013 13:00	17.3	0.133
1/23/2014 10:30	21.1	0.123
1/31/2014 10:48	22.2	0.137
2/3/2014 11:20	22.7	0.165
2/4/2014 10:05	22.9	0.211
2/5/2014 8:05	23.0	0.109
2/6/2014 9:25	23.1	0.095
2/7/2014 9:11	23.1	0.000
2/12/2014 11:30	23.9	0.157
3/14/2014 9:00	29.7	0.194
4/3/2014 12:00	62.2	1.615
Total average through 4/3/14		0.231

The total average electrical use through February 7, 2014 was 0.231 kWh per day. The cause for the increase in electrical use between the March 14th and April 3rd readings is

unknown. One possible reason is a clog in the lift station pump intake, but that did not appear to be the cause upon evaluation.

4.3 Water Quality

Water quality analytical results, for Sample Event No. 4 are listed in Table 4 and nitrogen results are graphically displayed in Figure 7. A summary of the water quality data collected to date for the test system is presented in Table 5. The laboratory report containing the raw analytical data is included in Appendix A. The following discussion summarizes the water quality analytical results. The performance of the various system components was compared by considering the changes through treatment of nitrogen species (TKN, $\text{NH}_3\text{-N}$, and $\text{NO}_x\text{-N}$), as well as supporting water quality parameters.

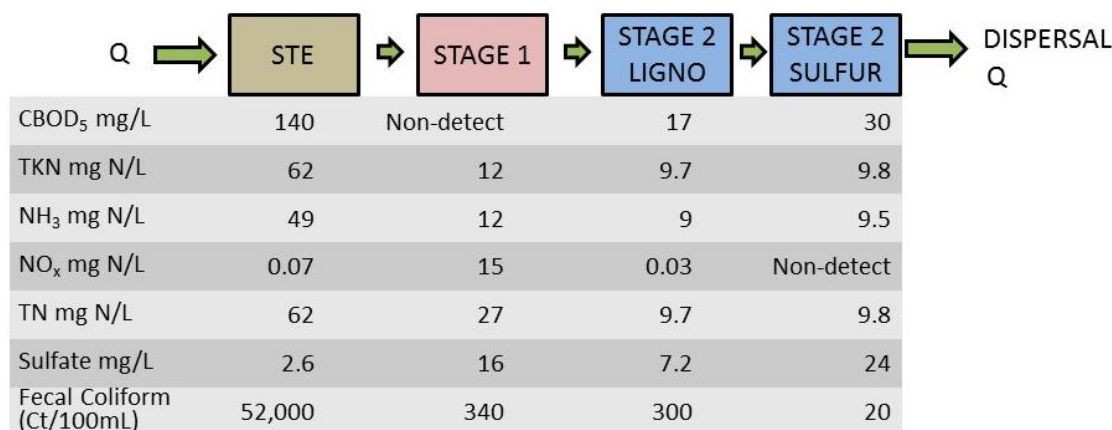


Figure 7
Graphical Representation of Nitrogen Results
Sample Event No. 4 April 3, 2014 (Experimental Day 269)

Septic Tank Effluent (STE) Quality: The water quality characteristics of STE collected in Sample Event 4 were within the typical range generally expected for domestic STE. The measured STE total nitrogen (TN) concentration was 62 mg/L, which is within the range that has been typically reported for Florida single family residence STE.

Stage 1 Effluent (ST1): The Stage 1 effluent $\text{NH}_3\text{-N}$ level was 12 mg/L with a DO level at 1.64 mg/L (Table 4). The Stage 1 effluent TSS concentration was 7 mg/L and CBOD₅ was below the method detection limit of 2 mg/L. The Stage 1 biofilter showed incomplete nitrification with an effluent $\text{NH}_3\text{-N}$ concentration of 12 mg/L and TKN of 12 mg/L. The Stage 1 effluent $\text{NO}_x\text{-N}$ was 15 mg/L. The Stage 1 effluent TN of 27 mg/L was 56% lower than that in STE, suggesting denitrification in the Stage 1 biofilter.

Stage 2 Biofilter Effluent (LIGNO-0" and ST2): The Stage 2 system produced a highly reducing environment and achieved complete $\text{NO}_x\text{-N}$ reduction. Effluent $\text{NO}_x\text{-N}$ from the Stage 2 biofilter monitoring point was below the method detection limit of 0.02 mg/L. The low $\text{NO}_x\text{-N}$ was accompanied by a measured 0.44 mg/L DO and -140 mV ORP. The lignocellulosic media effluent $\text{NO}_x\text{-N}$ was 0.03 mg/L. However, the only partially successful $\text{NH}_3\text{-N}$ reduction through the Stage 1 biofilter, was evidenced in the Stage 2 effluent $\text{NH}_3\text{-N}$ concentration of 9.5 mg/L and TKN of 9.8 mg/L. Final total nitrogen (TN) in the treatment system effluent was 9.8 mg/L. The Stage 2 biofilter lignocellulosic media effluent and sulfur media effluent CBOD_5 were 17 and 30 mg/L, respectively. The Stage 2 effluent sulfate concentration was 24 mg/L.

Field Blank (FB): Described in Section 3.5, the field blank (FB) results for all parameters measured were at or below the method detection limit.

Table 4
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)	NOx (mg/L N)	TIN (mg/L N) ³	TP (mg/L)	Ortho P (mg/L P)	Sulfate (mg/L)	Hydrogen Sulfide (mg/L)	Sulfide (mg/L)	Fecal (Ct/100 mL)	E-coli (Ct/100 mL)	TOC (mg/L)
BHS4-STE	4/3/14 12:50	22.57	6.77	1027	0.79	-148	400	62	57	140	270	62.07	62	13	49	0.07	0.01	0.07	49.07	8.6	6.9	2.6	3.5	5.4	52000	24000	52
BHS4-STE-FILTERED	4/3/14 12:50	22.57	6.77	1027	0.79	-148				78		61.07	61	13	48	0.07	0.01	0.07	48.07								
BHS4-ST1	4/3/14 12:30	21.16	6.42	978	1.64	39.7	340	7	6	2	120	27	12	0	12	15	0.01	15	27	4.1	3.4	16			340	260	12
BHS4-ST1-DUP	4/3/14 12:35	21.16	6.42	978	1.64	39.7	350	6	6	2	100	28	12	0	12	16	0.01	16	28	4.1	3.5	17			260	230	12
BHS4-ST1-FILTERED	4/3/14 12:30	21.16	6.42	978	1.64	39.7				2		27	12	1	11	15	0.01	15	26								
BHS4-LIGNO-0	4/3/14 12:23	23.80	6.55	1068	0.8	-177	420	4	4	17	47	9.73	9.7	0.7	9	0.03	0.01	0.03	9.03	3.6	3	7.2			300	260	14
BHS4-LIGNO-0-FILTERED	4/3/14 12:23	23.80	6.55	1068	0.8	-177				2		8.73	8.7	0.7	8	0.03	0.01	0.03	8.03								
BHS4-ST2	4/3/14 12:05	21.34	5.79	1092	0.44	-140	440	2	1	30	52	9.82	9.8	0.3	9.5	0.01	0.01	0.02	9.52	3.3	2.7	24	9.9	10	20	10	14
BHS4-ST2-FILTERED	4/3/14 12:05	21.34	5.79	1092	0.44	-140				2		9.52	9.5	0.2	9.3	0.01	0.01	0.02	9.32			25					
BHS4-FB	4/3/14 13:22	21.34	5.79	1092	0.44	-140	2	1	1	2	10	0.07	0.05	0.041	0.009	0.01	0.01	0.02	0.029	0.01	0.01	0.2	0.01	0.1	1	2	0.06

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.

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

Results based on colony counts outside the ideal range.

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Table 5
Summary of Water Quality Data

Sample ID	Statistical Parameter	Temp (°C)	pH	Specific Conductance (uS/cm)	DO (mg/L)	ORP (mV)	Total Alkalinity (mg/L)	TSS (mg/L)	VSS (mg/L)	CBOD ₅ (mg/L)	COD (mg/L)	TN (mg/L N) ¹	TKN (mg/L N)	Organic N (mg/L N) ²	NH ₃ -N (mg/L N)	NO ₃ -N (mg/L N)	NO ₂ -N (mg/L N)	NOx (mg/L N)	TIN (mg/L N) ³	TP (mg/L)	Ortho P (mg/L P)	Sulfate (mg/L)	Hydrogen Sulfide (mg/L)	Sulfide (mg/L)	Fecal (Ct/100 mL)	E-coli (Ct/100 mL)	TOC (mg/L)	
STE	n	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7	8	
	MEAN	21.60	6.78	1126.13	0.20	-231.40	432.50	65.00	61.38	140.00	206.00	69.30	69.25	8.88	60.38	0.04	0.01	0.05	60.42	9.65	5.94	2.08	3.29	5.20	40,695	15,564	70.88	
	STD. DEV.	2.74	0.00	97.66	0.25	56.02	28.16	24.42	23.18	36.19	125.48	9.71	9.69	7.24	7.60	0.04	0.00	0.04	7.59	2.47	2.46	1.65	1.14	1.62			13.36	
	MIN	19.50	6.52	1027.00	0.01	-321.80	400.00	38.00	38.00	92.00	10.00	58.02	58.00	1.00	49.00	0.01	0.01	0.02	49.07	7.60	0.01	0.62	1.50	2.60	23,000	10,000	52.00	
	MAX	27.80	6.94	1277.00	0.79	-148.40	470.00	118.00	111.00	180.00	330.00	87.14	87.00	23.00	75.00	0.14	0.01	0.14	75.02	14.00	7.50	5.40	4.50	6.80	71,000	24,000	85.00	
Stage 1	n	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	6	5	5	8	7	8
	MEAN	21.26	6.84	1141.00	2.88	27.96	332.50	11.38	10.13	10.38	51.00	44.03	15.15	4.56	10.59	28.63	0.20	28.88	39.47	3.83	3.09	18.00	0.32	0.58	4,577	2,864	17.38	
	STD. DEV.	2.76	0.00	158.68	1.54	52.76	36.94	6.63	5.44	6.86	35.39	10.96	7.22	4.44	9.07	16.10	0.35	15.95	10.50	1.32	0.99	1.55	0.39	0.71			5.07	
	MIN	19.00	6.42	978.00	1.21	-69.70	290.00	3.00	3.00	2.00	10.00	27.00	6.30	0.00	0.38	12.00	0.01	12.00	27.00	1.80	1.50	16.00	0.01	0.10	100	41	12.00	
	MAX	27.60	7.39	1385.00	5.16	97.00	390.00	22.00	18.00	18.00	120.00	63.30	25.00	14.44	23.00	57.00	0.85	57.00	58.80	5.50	4.10	20.00	1.00	1.80	32,000	24,000	24.00	
Stage 2 Ligno	n	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7	6	6	8	7	8	
	MEAN	21.60	6.67	1096.75	0.62	-195.84	435.00	6.13	5.75	13.38	46.38	12.91	11.48	3.47	8.01	1.43	0.01	1.43	9.44	2.95	2.36	10.77	1.18	1.73	1,371	744	16.13	
	STD. DEV.	3.15	0.00	97.74	0.67	27.45	19.27	4.12	3.73	7.31	12.22	3.65	5.68	4.10	6.40	2.39	0.00	2.39	4.88	1.57	1.35	5.94	0.71	1.03			2.30	
	MIN	18.20	6.55	956.00	0.13	-238.00	400.00	2.00	2.00	2.00	30.00	8.00	2.70	0.70	0.51	0.03	0.01	0.03	1.21	0.42	0.18	5.70	0.00	0.00	30	10	13.00	
	MAX	27.50	6.80	1247.00	2.16	-157.60	460.00	12.00	12.00	23.00	64.00	17.04	17.00	13.49	15.00	5.90	0.01	5.90	15.04	4.10	3.30	23.00	2.10	3.00	17,200	6,100	19.00	
Stage 2 Sulfur	n	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7	8	
	MEAN	21.28	6.76	1142.63	0.19	-237.05	458.75	4.63	4.13	12.75	46.00	8.38	8.34	2.51	5.83	0.04	0.01	0.04	5.87	2.86	2.34	33.00	4.83	6.78	430	242	15.13	
	STD. DEV.	2.67	0.52	100.62	0.12	58.32	24.75	2.56	2.70	8.88	10.66	4.32	4.31	3.77	4.18	0.03	0.00	0.02	4.18	1.30	1.20	9.89	2.83	3.57			2.53	
	MIN	19.60	5.79	1054.00	0.04	-348.90	440.00	2.00	1.00	3.00	30.00	1.32	1.30	0.30	0.56	0.01	0.01	0.02	0.58	0.70	0.32	21.00	1.30	1.30	1	2	11.00	
	MAX	27.10	7.66	1306.00	0.44	-140.20	510.00	9.00	8.00	30.00	64.00	13.07	13.00	11.70	10.00	0.07	0.01	0.07	10.04	4.10	3.50	50.00	9.90	11.00	5,400	1,400	18.00	
Well	n	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	MEAN	27.90	7.32	529.00	5.10	101.30	150.00	1.00	1.00	2.00	10.00	1.58	0.18	0.16	0.02	1.40	0.01	1.40	1.42	0.49	0.20	8.70	0.13	0.41	1	2	2.10	
	STD. DEV.																											
	MIN	27.90	7.32	529.00	5.10	101.30	150.00	1.00	1.00	2.00	10.00	1.58	0.18	0.16	0.02	1.40	0.01	1.40	1.42	0.49	0.20	8.70	0.13	0.41	1	2	2.10	
	MAX	27.90	7.32	529.00	5.10	101.30	150.00	1.00	1.00	2.00	10.00	1.58	0.18	0.16	0.02	1.40	0.01	1.40	1.42	0.49	0.20	8.70	0.13	0.41	1	2	2.10	

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

⁴Fecal coliform and pH values are reported as geometric mean.

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-HS4 Sample Event No. 4: Summary and Recommendations

5.1 Summary

The results of the fourth sampling event indicate that:

- Septic tank effluent (STE) quality is characteristic of typical household STE quality. The total nitrogen concentration of 62 mg/L is within the range of values typically reported for Florida single family residence STE.
- The Stage 1 biofilter reduced TN and TKN by 56 and 80%, respectively.
- The Stage 1 biofilter was only partially successful in removing ammonia N; effluent TKN and ammonia N were both 12 mg/L.
- The Stage 2 biofilter effluent NO_x-N was below the method detection limit of 0.02 mg N/L. However, as expected, the NH₃-N from the Stage 1 biofilter passed through the Stage 2 biofilter as evidenced in the Stage 2 effluent NH₃-N concentration of 9.5 mg/L and TKN of 9.8 mg/L.
- The total nitrogen concentration in the final effluent from the total treatment system was 9.8 mg/L, an approximately 84% reduction in STE TN.

5.2 Recommendations

An investigation into possible reasons for the significantly reduced nitrification performance of the Stage 1 biofilter are ongoing. Continued sampling should provide additional insight to system performance.



Appendix A: Laboratory Report

PRELIMINARY

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

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

April 21, 2014
Work Order: 1403467

Laboratory Report

Project Name		B-HS4 SE#8						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS4-STE						
Matrix		Wastewater						
SAL Sample Number		1403467-01						
Date/Time Collected		04/03/14 12:50						
Collected by		Josephine Edeback-Hirst						
Date/Time Received		04/03/14 15:35						
<u>Client Provided Field Data</u>								
pH		6.77						
Temperature		22.57 °C						
Conductivity		1027 umhos						
Dissolved Oxygen		0.78 mg/L						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	3.5	SM 4550SF	0.04	0.01	04/08/14 16:57	04/17/14 09:38	1
Ammonia as N	mg/L	49	EPA 350.1	2.0	0.47		04/12/14 09:06	50
Carbonaceous BOD	mg/L	140	SM 5210B	2	2	04/03/14 16:20	04/08/14 11:34	1
Chemical Oxygen Demand	mg/L	270	EPA 410.4	25	10	04/07/14 10:00	04/07/14 13:59	1
Nitrate (as N)	mg/L	0.07	EPA 300.0	0.04	0.01		04/04/14 19:14	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		04/04/14 19:14	1
Orthophosphate as P	mg/L	6.9	EPA 300.0	0.040	0.010		04/04/14 19:14	1
Phosphorous - Total as P	mg/L	8.6	SM 4500P-E	0.80	0.20	04/10/14 12:25	04/15/14 13:13	20
Sulfate	mg/L	2.6	EPA 300.0	0.60	0.20		04/04/14 19:14	1
Sulfide	mg/L	5.4	SM 4500SF	0.40	0.10		04/08/14 16:57	1
Total Alkalinity	mg/L	400	SM 2320B	8.0	2.0		04/11/14 09:28	1
Total Kjeldahl Nitrogen	mg/L	62	EPA 351.2	4.0	1.0	04/10/14 12:25	04/15/14 13:13	20
Total Organic Carbon	mg/L	52	SM 5310B	1.0	0.060		04/07/14 11:51	1
Total Suspended Solids	mg/L	62	SM 2540D	1	1	04/07/14 09:06	04/09/14 16:50	1
Volatile Suspended Solids	mg/L	57	EPA 160.4	1	1	04/07/14 09:06	04/09/14 16:53	1
Nitrate+Nitrite (N)	mg/L	0.07 I	EPA 300.0	0.08	0.02		04/04/14 19:14	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	24,000	SM 9223B	2.0	2.0	04/03/14 17:07	04/04/14 11:07	1
Fecal Coliforms	CFU/100 ml	52,000	SM 9222D	1	1	04/03/14 16:56	04/04/14 14:56	1

Sample Description **BHS4-STE-FILTERED**
 Matrix **Wastewater**
 SAL Sample Number **1403467-02**
 Date/Time Collected **04/03/14 12:50**
 Collected by **Josephine Edeback-Hirst**
 Date/Time Received **04/03/14 15:35**

Client Provided Field Data

pH 6.77
 Temperature 22.57 °C
 Conductivity 1027 umhos
 Dissolved Oxygen 0.79 mg/L

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Tampa, FL 33619

April 21, 2014
Work Order: 1403467

Laboratory Report

Project Name		B-HS4 SE#8						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS4-STE-FILTERED						
Matrix		Wastewater						
SAL Sample Number		1403467-02						
Date/Time Collected		04/03/14 12:50						
Collected by		Josephine Edeback-Hirst						
Date/Time Received		04/03/14 15:35						
<u>Inorganic, Dissolved</u>								
Ammonia as N	mg/L	48	EPA 350.1	2.0	0.47		04/10/14 14:41	50
Carbonaceous BOD	mg/L	78	SM 5210B	2	2	04/04/14 10:39	04/09/14 09:43	1
Nitrate (as N)	mg/L	0.07	EPA 300.0	0.04	0.01		04/04/14 19:26	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		04/04/14 19:26	1
Total Kjeldahl Nitrogen	mg/L	61	EPA 351.2	0.20	0.050	04/10/14 13:39	04/15/14 15:16	20
Nitrate+Nitrite (N)	mg/L	0.07 I	EPA 300.0	0.08	0.02		04/04/14 19:26	1
Lab filtration for diss. analytes							04/03/14 16:00	
Sample Description		BHS4-ST1						
Matrix		Wastewater						
SAL Sample Number		1403467-03						
Date/Time Collected		04/03/14 12:30						
Collected by		Josephine Edeback-Hirst						
Date/Time Received		04/03/14 15:35						
<u>Client Provided Field Data</u>								
pH		6.42						
Temperature		21.16 °C						
Conductivity		978 umhos						
Dissolved Oxygen		1.64 mg/L						
<u>Inorganics</u>								
Ammonia as N	mg/L	12	EPA 350.1	0.40	0.095		04/10/14 13:14	10
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	04/03/14 16:20	04/08/14 11:34	1
Chemical Oxygen Demand	mg/L	120	EPA 410.4	25	10	04/07/14 10:00	04/07/14 13:59	1
Nitrate (as N)	mg/L	15	EPA 300.0	0.04	0.01		04/04/14 19:37	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		04/04/14 19:37	1
Orthophosphate as P	mg/L	3.4	EPA 300.0	0.040	0.010		04/04/14 19:37	1
Phosphorous - Total as P	mg/L	4.1	SM 4500P-E	0.040	0.010	04/10/14 12:25	04/15/14 13:14	1
Sulfate	mg/L	16	EPA 300.0	0.60	0.20		04/04/14 19:37	1
Total Alkalinity	mg/L	340	SM 2320B	8.0	2.0		04/11/14 09:37	1
Total Kjeldahl Nitrogen	mg/L	12	EPA 351.2	1.0	0.25	04/10/14 12:25	04/15/14 13:14	5
Total Organic Carbon	mg/L	12	SM 5310B	1.0	0.060		04/07/14 11:51	1
Total Suspended Solids	mg/L	7	SM 2540D	1	1	04/07/14 09:06	04/09/14 16:50	1
Volatile Suspended Solids	mg/L	6	EPA 160.4	1	1	04/07/14 09:06	04/09/14 16:53	1
Nitrate+Nitrite (N)	mg/L	15	EPA 300.0	0.08	0.02		04/04/14 19:37	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	260	SM 9223B	2.0	2.0	04/03/14 17:07	04/04/14 11:07	1

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April 21, 2014
Work Order: 1403467

Laboratory Report

Project Name		B-HS4 SE#8						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS4-ST1						
Matrix		Wastewater						
SAL Sample Number		1403467-03						
Date/Time Collected		04/03/14 12:30						
Collected by		Josephine Edeback-Hirst						
Date/Time Received		04/03/14 15:35						
Fecal Coliforms	CFU/100 ml	340	SM 9222D	1	1	04/03/14 16:56	04/04/14 14:56	1
Sample Description		BHS4-ST1-DUP						
Matrix		Wastewater						
SAL Sample Number		1403467-04						
Date/Time Collected		04/03/14 12:35						
Collected by		Josephine Edeback-Hirst						
Date/Time Received		04/03/14 15:35						
<u>Client Provided Field Data</u>								
pH		6.42						
Temperature		21.16 °C						
Conductivity		978 umhos						
Dissolved Oxygen		1.64 mg/L						
<u>Inorganics</u>								
Ammonia as N	mg/L	12	EPA 350.1	0.40	0.095		04/10/14 13:16	10
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	04/03/14 16:20	04/08/14 11:34	1
Chemical Oxygen Demand	mg/L	100	EPA 410.4	25	10	04/07/14 10:00	04/07/14 13:59	1
Nitrate (as N)	mg/L	16	EPA 300.0	0.04	0.01		04/04/14 19:48	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		04/04/14 19:48	1
Orthophosphate as P	mg/L	3.5	EPA 300.0	0.040	0.010		04/04/14 19:48	1
Phosphorous - Total as P	mg/L	4.1	SM 4500P-E	0.040	0.010	04/10/14 12:25	04/15/14 13:19	1
Sulfate	mg/L	17	EPA 300.0	0.60	0.20		04/04/14 19:48	1
Total Alkalinity	mg/L	350	SM 2320B	8.0	2.0		04/11/14 09:44	1
Total Kjeldahl Nitrogen	mg/L	12	EPA 351.2	1.0	0.25	04/10/14 12:25	04/15/14 13:19	5
Total Organic Carbon	mg/L	12	SM 5310B	1.0	0.060		04/07/14 11:51	1
Total Suspended Solids	mg/L	6	SM 2540D	1	1	04/07/14 09:06	04/09/14 16:50	1
Volatile Suspended Solids	mg/L	6	EPA 160.4	1	1	04/07/14 09:06	04/09/14 16:53	1
Nitrate+Nitrite (N)	mg/L	16	EPA 300.0	0.08	0.02		04/04/14 19:48	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	230	SM 9223B	2.0	2.0	04/03/14 17:07	04/04/14 11:07	1
Fecal Coliforms	CFU/100 ml	260	SM 9222D	1	1	04/03/14 16:56	04/04/14 14:56	1

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April 21, 2014
Work Order: 1403467

Laboratory Report

Project Name		B-HS4 SE#8						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS4-ST1-FILTERED						
Matrix		Wastewater						
SAL Sample Number		1403467-05						
Date/Time Collected		04/03/14 12:30						
Collected by		Josephine Edeback-Hirst						
Date/Time Received		04/03/14 15:35						
<u>Client Provided Field Data</u>								
pH		6.42						
Temperature		21.16 °C						
Conductivity		978 umhos						
Dissolved Oxygen		1.64 mg/L						
<u>Inorganic, Dissolved</u>								
Ammonia as N	mg/L	11	EPA 350.1	0.40	0.095		04/10/14 14:43	10
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	04/04/14 10:39	04/09/14 09:43	1
Nitrate (as N)	mg/L	15	EPA 300.0	0.04	0.01		04/04/14 20:00	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		04/04/14 20:00	1
Total Kjeldahl Nitrogen	mg/L	12	EPA 351.2	0.20	0.050	04/10/14 13:39	04/15/14 15:17	10
Nitrate+Nitrite (N)	mg/L	15	EPA 300.0	0.08	0.02		04/04/14 20:00	1
Lab filtration for diss. analytes							04/03/14 16:00	

Sample Description **BHS4-LIGNO-0**
 Matrix **Wastewater**
 SAL Sample Number **1403467-06**
 Date/Time Collected **04/03/14 12:23**
 Collected by **Josephine Edeback-Hirst**
 Date/Time Received **04/03/14 15:35**

Client Provided Field Data

pH 6.55
 Temperature 23.8 °C
 Conductivity 1068 umhos
 Dissolved Oxygen 0.80 mg/L

Inorganics

Ammonia as N	mg/L	9.0	EPA 350.1	0.20	0.047		04/10/14 14:34	5
Carbonaceous BOD	mg/L	17	SM 5210B	2	2	04/03/14 16:20	04/08/14 11:34	1
Chemical Oxygen Demand	mg/L	47	EPA 410.4	25	10	04/07/14 10:00	04/07/14 13:59	1
Nitrate (as N)	mg/L	0.03 I	EPA 300.0	0.04	0.01		04/04/14 20:11	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		04/04/14 20:11	1
Orthophosphate as P	mg/L	3.0	EPA 300.0	0.040	0.010		04/04/14 20:11	1
Phosphorous - Total as P	mg/L	3.6	SM 4500P-E	0.040	0.010	04/10/14 12:25	04/15/14 13:20	1
Sulfate	mg/L	7.2	EPA 300.0	0.60	0.20		04/04/14 20:11	1
Total Alkalinity	mg/L	420	SM 2320B	8.0	2.0		04/11/14 10:00	1
Total Kjeldahl Nitrogen	mg/L	9.7	EPA 351.2	1.0	0.25	04/10/14 12:25	04/15/14 13:20	5
Total Organic Carbon	mg/L	14	SM 5310B	1.0	0.060		04/07/14 11:51	1

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April 21, 2014
Work Order: 1403467

Laboratory Report

Project Name		B-HS4 SE#8						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS4-LIGNO-0						
Matrix		Wastewater						
SAL Sample Number		1403467-06						
Date/Time Collected		04/03/14 12:23						
Collected by		Josephine Edeback-Hirst						
Date/Time Received		04/03/14 15:35						
Total Suspended Solids	mg/L	4	SM 2540D	1	1	04/07/14 09:06	04/09/14 16:50	1
Volatile Suspended Solids	mg/L	4	EPA 160.4	1	1	04/07/14 09:06	04/09/14 16:53	1
Nitrate+Nitrite (N)	mg/L	0.03 I	EPA 300.0	0.08	0.02		04/04/14 20:11	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	260	SM 9223B	2.0	2.0	04/03/14 17:07	04/04/14 11:07	1
Fecal Coliforms	CFU/100 ml	300	SM 9222D	1	1	04/03/14 16:56	04/04/14 14:56	1
Sample Description		BHS4-LIGNO-0-FILTERED						
Matrix		Wastewater						
SAL Sample Number		1403467-07						
Date/Time Collected		04/03/14 12:23						
Collected by		Josephine Edeback-Hirst						
Date/Time Received		04/03/14 15:35						
<u>Client Provided Field Data</u>								
pH		6.55						
Temperature		23.8 °C						
Conductivity		1068 umhos						
Dissolved Oxygen		0.80 mg/L						
<u>Inorganic, Dissolved</u>								
Ammonia as N	mg/L	8.0	EPA 350.1	0.20	0.047		04/10/14 15:16	5
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	04/04/14 10:39	04/09/14 09:43	1
Nitrate (as N)	mg/L	0.03 I	EPA 300.0	0.04	0.01		04/04/14 20:22	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		04/04/14 20:22	1
Total Kjeldahl Nitrogen	mg/L	8.7	EPA 351.2	0.20	0.050	04/10/14 13:39	04/15/14 15:18	10
Nitrate+Nitrite (N)	mg/L	0.03 I	EPA 300.0	0.08	0.02		04/04/14 20:22	1
Lab filtration for diss. analytes							04/03/14 16:00	
Sample Description		BHS4-ST2						
Matrix		Wastewater						
SAL Sample Number		1403467-08						
Date/Time Collected		04/03/14 12:05						
Collected by		Josephine Edeback-Hirst						
Date/Time Received		04/03/14 15:35						
<u>Client Provided Field Data</u>								
pH		5.79						
Temperature		21.34 °C						

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April 21, 2014
Work Order: 1403467

Laboratory Report

Project Name		B-HS4 SE#8						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS4-ST2						
Matrix		Wastewater						
SAL Sample Number		1403467-08						
Date/Time Collected		04/03/14 12:05						
Collected by		Josephine Edeback-Hirst						
Date/Time Received		04/03/14 15:35						
Conductivity		1092 umhos						
Dissolved Oxygen		0.44 mg/L						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	9.9	SM 4550SF	0.04	0.01	04/08/14 16:57	04/17/14 09:38	1
Ammonia as N	mg/L	9.5	EPA 350.1	0.40	0.095		04/12/14 10:43	10
Carbonaceous BOD	mg/L	30	SM 5210B	2	2	04/04/14 10:38	04/09/14 09:40	1
Chemical Oxygen Demand	mg/L	52	EPA 410.4	25	10	04/07/14 10:00	04/07/14 13:59	1
Nitrate (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		04/04/14 20:33	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		04/04/14 20:33	1
Orthophosphate as P	mg/L	2.7	EPA 300.0	0.040	0.010		04/04/14 20:33	1
Phosphorous - Total as P	mg/L	3.3	SM 4500P-E	0.040	0.010	04/10/14 12:25	04/15/14 13:21	1
Sulfate	mg/L	24	EPA 300.0	0.60	0.20		04/04/14 20:33	1
Sulfide	mg/L	10	SM 4500SF	0.40	0.10		04/08/14 16:57	1
Total Alkalinity	mg/L	440	SM 2320B	8.0	2.0		04/11/14 10:10	1
Total Kjeldahl Nitrogen	mg/L	9.8	EPA 351.2	1.0	0.25	04/10/14 12:25	04/15/14 13:21	5
Total Organic Carbon	mg/L	14	SM 5310B	1.0	0.060		04/07/14 11:51	1
Total Suspended Solids	mg/L	2	SM 2540D	1	1	04/07/14 09:06	04/09/14 16:50	1
Volatile Suspended Solids	mg/L	1 U	EPA 160.4	1	1	04/07/14 09:06	04/09/14 16:53	1
Nitrate+Nitrite (N)	mg/L	0.02 U	EPA 300.0	0.08	0.02		04/04/14 20:33	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	10	SM 9223B	2.0	2.0	04/03/14 17:07	04/04/14 11:07	1
Fecal Coliforms	CFU/100 ml	20	SM 9222D	1	1	04/03/14 16:56	04/04/14 14:56	1

Sample Description **BHS4-ST2-FILTERED**
 Matrix **Wastewater**
 SAL Sample Number **1403467-09**
 Date/Time Collected **04/03/14 12:05**
 Collected by **Josephine Edeback-Hirst**
 Date/Time Received **04/03/14 15:35**

Client Provided Field Data

pH 5.79
 Temperature 21.34 °C
 Conductivity 1092 umhos
 Dissolved Oxygen 0.44 mg/L

Inorganics

Sulfate	mg/L	25	EPA 300.0	0.60	0.20	04/04/14 20:45	1
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Inorganic, Dissolved

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April 21, 2014
Work Order: 1403467

Laboratory Report

Project Name		B-HS4 SE#8						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS4-ST2-FILTERED						
Matrix		Wastewater						
SAL Sample Number		1403467-09						
Date/Time Collected		04/03/14 12:05						
Collected by		Josephine Edeback-Hirst						
Date/Time Received		04/03/14 15:35						
Ammonia as N	mg/L	9.3	EPA 350.1	0.20	0.047		04/10/14 15:18	5
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	04/04/14 10:39	04/09/14 09:43	1
Nitrate (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		04/04/14 20:45	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		04/04/14 20:45	1
Total Kjeldahl Nitrogen	mg/L	9.5	EPA 351.2	0.20	0.050	04/10/14 13:39	04/15/14 15:19	5
Nitrate+Nitrite (N)	mg/L	0.02 U	EPA 300.0	0.08	0.02		04/04/14 20:45	1
Lab filtration for diss. analytes							04/03/14 16:00	

Sample Description	BHS4-FB
Matrix	Reagent Water
SAL Sample Number	1403467-10
Date/Time Collected	04/03/14 13:22
Collected by	Josephine Edeback-Hirst
Date/Time Received	04/03/14 15:35

Client Provided Field Data

pH	7.07
Temperature	28.4 °C
Conductivity	3.25 umhos
Dissolved Oxygen	7.61 mg/L

Inorganics

Hydrogen Sulfide (Unionized)	mg/L	0.01 U	SM 4550SF	0.04	0.01	04/08/14 16:57	04/17/14 09:38	1
Ammonia as N	mg/L	0.009 U	EPA 350.1	0.040	0.009		04/10/14 13:20	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	04/04/14 10:38	04/09/14 09:40	1
Chemical Oxygen Demand	mg/L	10 U	EPA 410.4	25	10	04/07/14 10:00	04/07/14 13:59	1
Nitrate (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		04/04/14 22:03	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		04/04/14 22:03	1
Orthophosphate as P	mg/L	0.010 U	EPA 300.0	0.040	0.010		04/04/14 22:03	1
Phosphorous - Total as P	mg/L	0.010 U	SM 4500P-E	0.040	0.010	04/10/14 12:25	04/15/14 13:22	1
Sulfate	mg/L	0.20 U	EPA 300.0	0.60	0.20		04/04/14 22:03	1
Sulfide	mg/L	0.10 U	SM 4500SF	0.40	0.10		04/08/14 16:57	1
Total Alkalinity	mg/L	2.0 U	SM 2320B	8.0	2.0		04/11/14 10:14	1
Total Kjeldahl Nitrogen	mg/L	0.05 U	EPA 351.2	0.20	0.05	04/10/14 12:25	04/15/14 13:22	1
Total Organic Carbon	mg/L	0.060 U	SM 5310B	1.0	0.060		04/07/14 11:51	1
Total Suspended Solids	mg/L	1 U	SM 2540D	1	1	04/07/14 09:06	04/09/14 16:50	1
Volatile Suspended Solids	mg/L	1 U	EPA 160.4	1	1	04/07/14 09:06	04/09/14 16:53	1
Nitrate+Nitrite (N)	mg/L	0.02 U	EPA 300.0	0.08	0.02		04/04/14 22:03	1

Microbiology

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April 21, 2014
Work Order: 1403467

Laboratory Report

Project Name		B-HS4 SE#8						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS4-FB						
Matrix		Reagent Water						
SAL Sample Number		1403467-10						
Date/Time Collected		04/03/14 13:22						
Collected by		Josephine Edeback-Hirst						
Date/Time Received		04/03/14 15:35						
E. Coli	MPN/100 mL	2.0 U	SM 9223B	2.0	2.0	04/03/14 17:07	04/04/14 11:07	1
Fecal Coliforms	CFU/100 ml	1 U	SM 9222D	1	1	04/03/14 16:56	04/04/14 14:56	1

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April 21, 2014
Work Order: 1403467

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BD40314 - BOD										
Blank (BD40314-BLK1)					Prepared: 04/03/14 Analyzed: 04/08/14					
Carbonaceous BOD	2 U	2	2	mg/L						
LCS (BD40314-BS1)					Prepared: 04/03/14 Analyzed: 04/08/14					
Carbonaceous BOD	205	2	2	mg/L	200		103	85-115		
LCS Dup (BD40314-BSD1)					Prepared: 04/03/14 Analyzed: 04/08/14					
Carbonaceous BOD	206	2	2	mg/L	200		103	85-115	0.2	200
Duplicate (BD40314-DUP1)					Source: 1403407-01 Prepared: 04/03/14 Analyzed: 04/08/14					
Carbonaceous BOD	150	2	2	mg/L		160			3	25
Batch BD40409 - BOD										
Blank (BD40409-BLK1)					Prepared: 04/04/14 Analyzed: 04/09/14					
Carbonaceous BOD	2 U	2	2	mg/L						
Blank (BD40409-BLK2)					Prepared: 04/04/14 Analyzed: 04/09/14					
Carbonaceous BOD	2 U	2	2	mg/L						
LCS (BD40409-BS1)					Prepared: 04/04/14 Analyzed: 04/09/14					
Carbonaceous BOD	202	2	2	mg/L	200		101	85-115		
LCS (BD40409-BS2)					Prepared: 04/04/14 Analyzed: 04/09/14					
Carbonaceous BOD	195	2	2	mg/L	200		98	85-115		
LCS Dup (BD40409-BSD1)					Prepared: 04/04/14 Analyzed: 04/09/14					
Carbonaceous BOD	203	2	2	mg/L	200		101	85-115	0.2	200

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April 21, 2014
Work Order: 1403467

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BD40409 - BOD										
LCS Dup (BD40409-BSD2)					Prepared: 04/04/14 Analyzed: 04/09/14					
Carbonaceous BOD	206	2	2	mg/L	200		103	85-115	5	200
Duplicate (BD40409-DUP1)					Source: 1403476-01 Prepared: 04/04/14 Analyzed: 04/09/14					
Carbonaceous BOD	140	2	2	mg/L		140			0.1	25
Duplicate (BD40409-DUP2)					Source: 1403509-01 Prepared: 04/04/14 Analyzed: 04/09/14					
Carbonaceous BOD	210	2	2	mg/L		240			13	25
Batch BD40414 - Ion Chromatography 300.0 Prep										
Blank (BD40414-BLK1)					Prepared & Analyzed: 04/04/14					
Sulfate	0.20 U	0.60	0.20	mg/L						
Nitrite (as N)	0.01 U	0.04	0.01	mg/L						
Orthophosphate as P	0.010 U	0.040	0.010	mg/L						
Nitrate (as N)	0.01 U	0.04	0.01	mg/L						
Surrogate: Dichloroacetate	0.917			mg/L	1.0		92	90-115		
Surrogate: Dichloroacetate	0.917			mg/L	1.0		92	90-115		
Surrogate: Dichloroacetate	0.917			mg/L	1.0		92	90-115		
Surrogate: Dichloroacetate	0.917			mg/L	1.0		92	90-115		
LCS (BD40414-BS1)					Prepared & Analyzed: 04/04/14					
Nitrate (as N)	1.59	0.04	0.01	mg/L	1.7		93	85-115		
Nitrite (as N)	1.32	0.04	0.01	mg/L	1.4		94	85-115		
Orthophosphate as P	0.858	0.040	0.010	mg/L	0.90		95	85-115		
Sulfate	8.65	0.60	0.20	mg/L	9.0		96	85-115		
Surrogate: Dichloroacetate	1.04			mg/L	1.0		104	90-115		
Surrogate: Dichloroacetate	1.04			mg/L	1.0		104	90-115		
Surrogate: Dichloroacetate	1.04			mg/L	1.0		104	90-115		
Surrogate: Dichloroacetate	1.04			mg/L	1.0		104	90-115		

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April 21, 2014

Work Order: 1403467

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BD40414 - Ion Chromatography 300.0 Prep										
LCS Dup (BD40414-BSD1)					Prepared & Analyzed: 04/04/14					
Sulfate	8.70	0.60	0.20	mg/L	9.0		97	85-115	0.6	200
Orthophosphate as P	0.963	0.040	0.010	mg/L	0.90		107	85-115	12	200
Nitrate (as N)	1.60	0.04	0.01	mg/L	1.7		94	85-115	0.8	200
Nitrite (as N)	1.34	0.04	0.01	mg/L	1.4		96	85-115	1	200
Surrogate: Dichloroacetate	1.07			mg/L	1.0		107	90-115		
Surrogate: Dichloroacetate	1.07			mg/L	1.0		107	90-115		
Surrogate: Dichloroacetate	1.07			mg/L	1.0		107	90-115		
Surrogate: Dichloroacetate	1.07			mg/L	1.0		107	90-115		
Matrix Spike (BD40414-MS1)					Source: 1403440-01 Prepared & Analyzed: 04/04/14					
Sulfate	30.1	0.60	0.20	mg/L	9.0	21.9	92	85-115		
Orthophosphate as P	0.850	0.040	0.010	mg/L	0.90		94	85-115		
Nitrite (as N)	1.42	0.04	0.01	mg/L	1.4	ND	102	85-115		
Nitrate (as N)	1.68	0.04	0.01	mg/L	1.7	ND	99	85-115		
Surrogate: Dichloroacetate	0.968			mg/L	1.0		97	90-115		
Surrogate: Dichloroacetate	0.968			mg/L	1.0		97	90-115		
Surrogate: Dichloroacetate	0.968			mg/L	1.0		97	90-115		
Surrogate: Dichloroacetate	0.968			mg/L	1.0		97	90-115		
Matrix Spike (BD40414-MS2)					Source: 1403467-09 Prepared & Analyzed: 04/04/14					
Nitrate (as N)	1.60	0.04	0.01	mg/L	1.7	ND	94	85-115		
Nitrite (as N)	1.44	0.04	0.01	mg/L	1.4	ND	103	85-115		
Orthophosphate as P	3.56	0.040	0.010	mg/L	0.90	2.68	98	85-115		
Sulfate	33.9	0.60	0.20	mg/L	9.0	25.2	97	85-115		
Surrogate: Dichloroacetate	0.937			mg/L	1.0		94	90-115		
Surrogate: Dichloroacetate	0.937			mg/L	1.0		94	90-115		
Surrogate: Dichloroacetate	0.937			mg/L	1.0		94	90-115		
Surrogate: Dichloroacetate	0.937			mg/L	1.0		94	90-115		

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April 21, 2014
Work Order: 1403467

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BD40415 - Ion Chromatography 300.0 Prep										
Blank (BD40415-BLK1)					Prepared & Analyzed: 04/04/14					
Orthophosphate as P	0.010 U	0.040	0.010	mg/L						
Sulfate	0.20 U	0.60	0.20	mg/L						
Nitrite (as N)	0.01 U	0.04	0.01	mg/L						
Nitrate (as N)	0.01 U	0.04	0.01	mg/L						
Surrogate: Dichloroacetate	0.912			mg/L	1.0		91	90-115		
Surrogate: Dichloroacetate	0.912			mg/L	1.0		91	90-115		
Surrogate: Dichloroacetate	0.912			mg/L	1.0		91	90-115		
Surrogate: Dichloroacetate	0.912			mg/L	1.0		91	90-115		
LCS (BD40415-BS1)					Prepared & Analyzed: 04/04/14					
Sulfate	8.80	0.60	0.20	mg/L	9.0		98	85-115		
Nitrate (as N)	1.71	0.04	0.01	mg/L	1.7		100	85-115		
Nitrite (as N)	1.36	0.04	0.01	mg/L	1.4		97	85-115		
Orthophosphate as P	0.984	0.040	0.010	mg/L	0.90		109	85-115		
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
Surrogate: Dichloroacetate	1.08			mg/L	1.0		108	90-115		
LCS Dup (BD40415-BSD1)					Prepared & Analyzed: 04/04/14					
Nitrate (as N)	1.77	0.04	0.01	mg/L	1.7		104	85-115	3	200
Orthophosphate as P	0.968	0.040	0.010	mg/L	0.90		108	85-115	2	200
Sulfate	9.00	0.60	0.20	mg/L	9.0		100	85-115	2	200
Nitrite (as N)	1.38	0.04	0.01	mg/L	1.4		98	85-115	2	200
Surrogate: Dichloroacetate	1.14			mg/L	1.0		114	90-115		
Surrogate: Dichloroacetate	1.14			mg/L	1.0		114	90-115		
Surrogate: Dichloroacetate	1.14			mg/L	1.0		114	90-115		
Surrogate: Dichloroacetate	1.14			mg/L	1.0		114	90-115		

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April 21, 2014
Work Order: 1403467

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BD40415 - Ion Chromatography 300.0 Prep										
Matrix Spike (BD40415-MS1)		Source: 1403468-09			Prepared & Analyzed: 04/04/14					
Orthophosphate as P	0.880	0.040	0.010	mg/L	0.90	ND	98	85-115		
Sulfate	90.0 L	0.60	0.20	mg/L	9.0	108	NR	85-115		
Nitrate (as N)	1.59	0.04	0.01	mg/L	1.7	ND	94	85-115		
Nitrite (as N)	1.38	0.04	0.01	mg/L	1.4	ND	99	85-115		
Surrogate: Dichloroacetate	0.910			mg/L	1.0		91	90-115		
Surrogate: Dichloroacetate	0.910			mg/L	1.0		91	90-115		
Surrogate: Dichloroacetate	0.910			mg/L	1.0		91	90-115		
Surrogate: Dichloroacetate	0.910			mg/L	1.0		91	90-115		
Matrix Spike (BD40415-MS2)		Source: 1403468-20			Prepared & Analyzed: 04/07/14					
Sulfate	17.6	0.60	0.20	mg/L	9.0	8.54	101	85-115		
Nitrate (as N)	4.48	0.04	0.01	mg/L	1.7	2.83	97	85-115		
Nitrite (as N)	1.55	0.04	0.01	mg/L	1.4	ND	111	85-115		
Orthophosphate as P	0.897	0.040	0.010	mg/L	0.90	ND	100	85-115		
Surrogate: Dichloroacetate	0.969			mg/L	1.0		97	90-115		
Surrogate: Dichloroacetate	0.969			mg/L	1.0		97	90-115		
Surrogate: Dichloroacetate	0.969			mg/L	1.0		97	90-115		
Surrogate: Dichloroacetate	0.969			mg/L	1.0		97	90-115		
Batch BD40451 - COD prep										
Blank (BD40451-BLK1)		Prepared & Analyzed: 04/07/14								
Chemical Oxygen Demand	10 U	25	10	mg/L						
LCS (BD40451-BS1)		Prepared & Analyzed: 04/07/14								
Chemical Oxygen Demand	52	25	10	mg/L	50		104	90-110		

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April 21, 2014
Work Order: 1403467

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BD40451 - COD prep										
Matrix Spike (BD40451-MS1)		Source: 1403453-02			Prepared & Analyzed: 04/07/14					
Chemical Oxygen Demand	52	25	10	mg/L	50	ND	104	85-115		
Matrix Spike Dup (BD40451-MSD1)		Source: 1403453-02			Prepared & Analyzed: 04/07/14					
Chemical Oxygen Demand	54	25	10	mg/L	50	ND	108	85-115	4	32
Batch BD40705 - TSS prep										
Blank (BD40705-BLK1)		Prepared: 04/07/14 Analyzed: 04/09/14								
Volatile Suspended Solids	1 U	1		mg/L						
Total Suspended Solids	1 U	1	1	mg/L						
LCS (BD40705-BS1)		Prepared: 04/07/14 Analyzed: 04/09/14								
Total Suspended Solids	51.5	1	1	mg/L	50		103	85-115		
Duplicate (BD40705-DUP1)		Source: 1403467-01			Prepared: 04/07/14 Analyzed: 04/09/14					
Total Suspended Solids	63.0	1	1	mg/L		62.0			2	30
Volatile Suspended Solids	61.0	1		mg/L		57.0			7	20
Batch BD40710 - TOC prep										
Blank (BD40710-BLK1)		Prepared & Analyzed: 04/07/14								
Total Organic Carbon	0.060 U	1.0	0.060	mg/L						
LCS (BD40710-BS1)		Prepared & Analyzed: 04/07/14								
Total Organic Carbon	10.3	1.0	0.060	mg/L	10		103	90-110		

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April 21, 2014
Work Order: 1403467

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BD40710 - TOC prep										
Matrix Spike (BD40710-MS1)		Source: 1403507-04			Prepared & Analyzed: 04/07/14					
Total Organic Carbon	19.5	1.0	0.060	mg/L	10	9.43	101	85-115		
Matrix Spike Dup (BD40710-MSD1)		Source: 1403507-04			Prepared & Analyzed: 04/07/14					
Total Organic Carbon	20.3	1.0	0.060	mg/L	10	9.43	109	85-115	4	10
Batch BD40840 - Sulfide prep										
Blank (BD40840-BLK1)					Prepared & Analyzed: 04/08/14					
Sulfide	0.10 U	0.40	0.10	mg/L						
LCS (BD40840-BS1)					Prepared & Analyzed: 04/08/14					
Sulfide	4.65	0.40	0.10	mg/L	5.0		93	85-115		
Matrix Spike (BD40840-MS1)		Source: 1403468-21			Prepared & Analyzed: 04/08/14					
Sulfide	4.85	0.40	0.10	mg/L	5.0	ND	97	85-115		
Matrix Spike Dup (BD40840-MSD1)		Source: 1403468-21			Prepared & Analyzed: 04/08/14					
Sulfide	4.65	0.40	0.10	mg/L	5.0	ND	93	85-115	4	14
Batch BD40935 - Ammonia by SEAL										
Blank (BD40935-BLK1)					Prepared & Analyzed: 04/10/14					
Ammonia as N	0.009 U	0.040	0.009	mg/L						
LCS (BD40935-BS1)					Prepared & Analyzed: 04/10/14					
Ammonia as N	0.54	0.040	0.009	mg/L	0.50		107	90-110		

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Tampa, FL 33619

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BD40935 - Ammonia by SEAL										
Matrix Spike (BD40935-MS1)		Source: 1403467-10			Prepared & Analyzed: 04/10/14					
Ammonia as N	0.51	0.040	0.009	mg/L	0.50	ND	102	90-110		
Matrix Spike (BD40935-MS2)		Source: 1403663-07			Prepared & Analyzed: 04/10/14					
Ammonia as N	0.53	0.040	0.009	mg/L	0.50	0.031	99	90-110		
Matrix Spike Dup (BD40935-MSD1)		Source: 1403467-10			Prepared & Analyzed: 04/10/14					
Ammonia as N	0.54	0.040	0.009	mg/L	0.50	ND	108	90-110	6	10
Matrix Spike Dup (BD40935-MSD2)		Source: 1403663-07			Prepared & Analyzed: 04/10/14					
Ammonia as N	0.53	0.040	0.009	mg/L	0.50	0.031	101	90-110	1	10
Batch BD41015 - Digestion for TP and TKN										
Blank (BD41015-BLK1)		Prepared: 04/10/14 Analyzed: 04/15/14								
Phosphorous - Total as P	0.010 U	0.040	0.010	mg/L						
Total Kjeldahl Nitrogen	0.05 U	0.20	0.05	mg/L						
LCS (BD41015-BS1)		Prepared: 04/10/14 Analyzed: 04/15/14								
Phosphorous - Total as P	0.474	0.040	0.010	mg/L	0.50		95	90-110		
Total Kjeldahl Nitrogen	0.909	0.20	0.05	mg/L	1.0		91	90-110		
Matrix Spike (BD41015-MS1)		Source: 1403453-02			Prepared: 04/10/14 Analyzed: 04/15/14					
Phosphorous - Total as P	0.533	0.040	0.010	mg/L	0.50	0.0211	102	90-110		
Total Kjeldahl Nitrogen	1.15	0.20	0.05	mg/L	1.0	0.125	103	90-110		
Matrix Spike (BD41015-MS2)		Source: 1403467-10			Prepared: 04/10/14 Analyzed: 04/15/14					
Phosphorous - Total as P	0.518	0.040	0.010	mg/L	0.50	ND	104	90-110		
Total Kjeldahl Nitrogen	0.979	0.20	0.05	mg/L	1.0	ND	98	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 BD41015 - Digestion for TP and TKN										
Matrix Spike Dup (BD41015-MSD1)		Source: 1403453-02			Prepared: 04/10/14 Analyzed: 04/15/14					
Phosphorous - Total as P	0.519	0.040	0.010	mg/L	0.50	0.0211	100	90-110	3	25
Total Kjeldahl Nitrogen	1.15	0.20	0.05	mg/L	1.0	0.125	102	90-110	0.6	20
Matrix Spike Dup (BD41015-MSD2)		Source: 1403467-10			Prepared: 04/10/14 Analyzed: 04/15/14					
Total Kjeldahl Nitrogen	0.990	0.20	0.05	mg/L	1.0	ND	99	90-110	1	20
Phosphorous - Total as P	0.506	0.040	0.010	mg/L	0.50	ND	101	90-110	2	25
Batch BD41104 - alkalinity										
Blank (BD41104-BLK1)					Prepared & Analyzed: 04/11/14					
Total Alkalinity	2.0 U	8.0	2.0	mg/L						
LCS (BD41104-BS1)					Prepared & Analyzed: 04/11/14					
Total Alkalinity	130	8.0	2.0	mg/L	120		104	90-110		
Matrix Spike (BD41104-MS1)		Source: 1403467-10			Prepared & Analyzed: 04/11/14					
Total Alkalinity	130	8.0	2.0	mg/L	120	ND	105	80-120		
Matrix Spike Dup (BD41104-MSD1)		Source: 1403467-10			Prepared & Analyzed: 04/11/14					
Total Alkalinity	130	8.0	2.0	mg/L	120	ND	107	80-120	2	26
Batch BD41137 - Ammonia by SEAL										
Blank (BD41137-BLK1)					Prepared & Analyzed: 04/12/14					
Ammonia as N	0.009 U	0.040	0.009	mg/L						

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BD41137 - Ammonia by SEAL										
LCS (BD41137-BS1)					Prepared & Analyzed: 04/12/14					
Ammonia as N	0.50	0.040	0.009	mg/L	0.50		99	90-110		
Matrix Spike (BD41137-MS1)					Prepared & Analyzed: 04/12/14					
Ammonia as N	0.45	0.040	0.009	mg/L	0.50	ND	90	90-110		
Matrix Spike (BD41137-MS2)					Prepared & Analyzed: 04/12/14					
Ammonia as N	0.53	0.040	0.009	mg/L	0.50	ND	106	90-110		
Matrix Spike Dup (BD41137-MSD1)					Prepared & Analyzed: 04/12/14					
Ammonia as N	0.45	0.040	0.009	mg/L	0.50	ND	91	90-110	0.2	10
Matrix Spike Dup (BD41137-MSD2)					Prepared & Analyzed: 04/12/14					
Ammonia as N	0.54	0.040	0.009	mg/L	0.50	ND	108	90-110	2	10

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Inorganic, Dissolved - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BD40410 - BOD Dissolved										
Blank (BD40410-BLK1)					Prepared: 04/04/14 Analyzed: 04/09/14					
Carbonaceous BOD	2 U	2	2	mg/L						
LCS (BD40410-BS1)					Prepared: 04/04/14 Analyzed: 04/09/14					
Carbonaceous BOD	195	2	2	mg/L	200		98	85-115		
LCS Dup (BD40410-BSD1)					Prepared: 04/04/14 Analyzed: 04/09/14					
Carbonaceous BOD	197	2	2	mg/L	200		98	85-115	0.8	200
Duplicate (BD40410-DUP1)					Source: 1403468-09 Prepared: 04/04/14 Analyzed: 04/09/14					
Carbonaceous BOD	2 U	2	2	mg/L		ND				25
Batch BD40414 - Ion Chromatography 300.0 Prep										
Blank (BD40414-BLK1)					Prepared & Analyzed: 04/04/14					
Nitrate (as N)	0.01 U	0.04	0.01	mg/L						
Nitrite (as N)	0.01 U	0.04	0.01	mg/L						
Surrogate: Dichloroacetate	0.917			mg/L	1.0		92	90-115		
Surrogate: Dichloroacetate	0.917			mg/L	1.0		92	90-115		
LCS (BD40414-BS1)					Prepared & Analyzed: 04/04/14					
Nitrate (as N)	1.59	0.04	0.01	mg/L	1.7		93	85-115		
Nitrite (as N)	1.32	0.04	0.01	mg/L	1.4		94	85-115		
Surrogate: Dichloroacetate	1.04			mg/L	1.0		104	90-115		
Surrogate: Dichloroacetate	1.04			mg/L	1.0		104	90-115		
LCS Dup (BD40414-BSD1)					Prepared & Analyzed: 04/04/14					
Nitrite (as N)	1.34	0.04	0.01	mg/L	1.4		96	85-115	1	200
Nitrate (as N)	1.60	0.04	0.01	mg/L	1.7		94	85-115	0.8	200
Surrogate: Dichloroacetate	1.07			mg/L	1.0		107	90-115		
Surrogate: Dichloroacetate	1.07			mg/L	1.0		107	90-115		

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Inorganic, Dissolved - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BD40414 - Ion Chromatography 300.0 Prep										
Matrix Spike (BD40414-MS1)		Source: 1403440-01			Prepared & Analyzed: 04/04/14					
Nitrite (as N)	1.42	0.04	0.01	mg/L	1.4		102	85-115		
Nitrate (as N)	1.68	0.04	0.01	mg/L	1.7		99	85-115		
Surrogate: Dichloroacetate	0.968			mg/L	1.0		97	90-115		
Surrogate: Dichloroacetate	0.968			mg/L	1.0		97	90-115		
Matrix Spike (BD40414-MS2)		Source: 1403467-09			Prepared & Analyzed: 04/04/14					
Nitrite (as N)	1.44	0.04	0.01	mg/L	1.4	ND	103	85-115		
Nitrate (as N)	1.60	0.04	0.01	mg/L	1.7	ND	94	85-115		
Surrogate: Dichloroacetate	0.937			mg/L	1.0		94	90-115		
Surrogate: Dichloroacetate	0.937			mg/L	1.0		94	90-115		
Batch BD40936 - Ammonia by SEAL										
Blank (BD40936-BLK1)		Prepared & Analyzed: 04/10/14								
Ammonia as N	0.009 U	0.040	0.009	mg/L						
LCS (BD40936-BS1)		Prepared & Analyzed: 04/10/14								
Ammonia as N	0.51	0.040	0.009	mg/L	0.50		102	90-110		
Matrix Spike (BD40936-MS1)		Source: 1403468-06			Prepared & Analyzed: 04/10/14					
Ammonia as N	0.62	0.040	0.009	mg/L	0.50	0.11	101	90-110		
Matrix Spike Dup (BD40936-MSD1)		Source: 1403468-06			Prepared & Analyzed: 04/10/14					
Ammonia as N	0.64	0.040	0.009	mg/L	0.50	0.11	106	90-110	4	10
Batch BD41020 - Digestion for TP and TKN										
Blank (BD41020-BLK1)		Prepared: 04/10/14 Analyzed: 04/15/14								
Total Kjeldahl Nitrogen	0.050 U	0.20	0.050	mg/L						

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Inorganic, Dissolved - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BD41020 - Digestion for TP and TKN										
LCS (BD41020-BS1)					Prepared: 04/10/14 Analyzed: 04/15/14					
Total Kjeldahl Nitrogen	1.08	0.20	0.050	mg/L	1.0		108	90-110		
Matrix Spike (BD41020-MS1)					Source: 1403467-07 Prepared: 04/10/14 Analyzed: 04/15/14					
Total Kjeldahl Nitrogen	9.55	0.20	0.050	mg/L	1.0	8.66	89	90-110		
Matrix Spike Dup (BD41020-MSD1)					Source: 1403467-07 Prepared: 04/10/14 Analyzed: 04/15/14					
Total Kjeldahl Nitrogen	9.64	0.20	0.050	mg/L	1.0	8.66	99	90-110	1	20

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Microbiology - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BD40401 - FC-MF										
Blank (BD40401-BLK1)					Prepared: 04/03/14 Analyzed: 04/04/14					
Fecal Coliforms	1 U	1	1	CFU/100 ml						
Duplicate (BD40401-DUP1)					Source: 1403467-10 Prepared: 04/03/14 Analyzed: 04/04/14					
Fecal Coliforms	1 U	1	1	CFU/100 ml		ND				200
Duplicate (BD40401-DUP2)					Source: 1403468-21 Prepared: 04/03/14 Analyzed: 04/04/14					
Fecal Coliforms	1 U	1	1	CFU/100 ml		ND				200

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*** Qualifiers, Notes and Definitions**

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

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

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

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

L Off-scale high. Result exceeded highest calibration standard.

Questions regarding this report should be directed to :

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Kathryn@southernanalyticalabs.com



SOUTHERN ANALYTICAL LABORATORIES, INC.

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SAL Project No. 1403467

Client Name Hazen and Sawyer										Contact / Phone:											
Project Name / Location B-HS4 SE#8																					
Samplers: (Signature) <i>[Signature]</i>										PARAMETER / CONTAINER DESCRIPTION											
Matrix Codes: DW-Drinking Water WW-Wastewater SW-Surface Water SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water																					
SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	125mLP, Na ₂ S ₂ O ₃ FC-MF, FC-QT	500mLP, Cool Total Alkalinity, TSS, VSS, CBOD, NOx OP, SO ₄	125mLP, H ₂ SO ₄ COD, TKN, NH ₃ , TP	500mLP, NaOH, Zn Acetate H ₂ S	40mLaV, HCl TOC	500mLP, Cool Lab Filtered (CBOD, TKN, NH ₃ , NOx)	500mLP, Cool Lab Filtered (CBOD, TKN, NH ₃ , NOx, SO ₄)					pH	Temperature	Conductivity	DO
01	BHS4-STE	4/3/14	12:50	WW		X	4	2	1	1	2							6.77	22.57	1027	0.79
02	BHS4-STE-FILTERED		12:50	WW		X						1						6.77	22.57	1027	0.79
03	BHS4-ST1		12:32	WW		X	4	2	1		2							6.42	21.16	978	1.64
04	BHS4-ST1-DUP		12:35	WW		X	4	2	1		2							6.42	21.16	978	1.64
05	BHS4-ST1-FILTERED		12:30	WW		X						1						6.42	21.16	978	1.64
06	BHS4-LIGNO-0		12:23	WW		X	4	2	1		2							6.55	23.8	1068	0.80
07	BHS4-LIGNO-0-FILTERED		12:23	WW		X						1						6.55	23.8	1068	0.80
08	BHS4-ST2		12:05	WW		X	4	2	1	1	2							5.79	21.34	1092	0.44
09	BHS4-ST2-FILTERED		12:05	WW		X							1					5.79	21.34	1092	0.44
10	BHS4- SB FB		13:22	R		X	4	2	1	1	2							7.07	28.4	3.25	7.61
Containers Prepared/ Relinquished:		Date/Time: 3-25-14 12:00	Received: <i>[Signature]</i>		Date/Time: 3/26/14 12:00		Seal intact? Y N <input checked="" type="radio"/> Samples intact upon arrival? <input checked="" type="radio"/> N N/A Received on ice? Temp _____ <input checked="" type="radio"/> N N/A Proper preservatives indicated? <input checked="" type="radio"/> N N/A Rec'd w/in holding time? <input checked="" type="radio"/> N N/A Volatiles rec'd w/out headspace? Y N <input checked="" type="radio"/> Proper containers used? <input checked="" type="radio"/> N N/A														
Relinquished:		Date/Time: 4/5/14	Received: <i>[Signature]</i>		Date/Time: 4/3/14 1535																
Relinquished:		Date/Time:	Received:		Date/Time:																
Relinquished:		Date/Time:	Received:		Date/Time:																
Relinquished:		Date/Time:	Received:		Date/Time:																

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

Chain of Custody



Appendix B: Operation & Maintenance Log

Table B.1
Operation and Maintenance Log

Date	Description
6/19/2013	Construction - Stage 1 and Stage 2 tank installed
6/20/2013	Construction - drainfield installed
6/21/2013	Construction - electrical work
7/9/2013	System Start-up
	Bull run valve switched from drainfield to Stage 1 biofilter
7/17/2013	System check
7/23/2013	Construction - sod installation
7/29/2013	Preliminary sampling event
8/6/2013	System check
	Back-up in STE tank, water level above outlet effluent screen
8/12/2013	Back-up in STE tank again
	Removed filter screen
	Lift station pump causing lots of mixing in STE tank
	Shortened float swing on lift station pump to reduce pump runtime
	Lots of solids in Stage 1 Biofilter
	During lift station pump dose, ponding in Stage 1 biofilter
8/15/2013	Bull run valve switched to drainfield
9/5/2013	Lift station pump replaced with smaller pump
	Smaller pump installed in second chamber of old septic tank
	Switched bull run valve to PNRS system
9/10/2013	System check
9/30/2013	Sample Event No. 1
11/8/2013	System check
11/27/2013	System check
12/2/2013	Sample Event No. 2
	Cleaned STE effluent filter screen
	A little bit of ponding in Stage 1 biofilter influent side
	No ponding in all 4 drainfield observation ports
	*homeowners were out of town for Thanksgiving holiday
12/23/2013	System check. No ponding in all 4 drainfield observation ports

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Date	Description
1/23/2014	System check
	Ponding near Stage 1 d-box, adjusted pipe and raked media
	No ponding in all 4 drainfield observation ports
1/31/2014	System check
	Fixed Stage 1 biofilter distribution pipe (east side) which was off support
	No ponding in all 4 drainfield observation ports
2/3/2014	Sample Event No. 3
	No ponding in all 4 drainfield observation ports
2/4/2014	Sample Event No. 4
	No ponding in all 4 drainfield observation ports
2/5/2014	Sample Event No. 5
	No ponding in all 4 drainfield observation ports
2/6/2014	Sample Event No. 6
	No ponding in all 4 drainfield observation ports
2/7/2014	Sample Event No. 7
	No ponding in all 4 drainfield observation ports
2/12/2014	System check
	No visible ponding in Stage 1 biofilter.
3/14/2014	System check
	No visible ponding in Stage 1 biofilter.
4/3/2014	Sample Event No. 8
	No ponding in all 4 drainfield observation ports
	No visible ponding in Stage 1 biofilter.
	High power meter reading. Checked lift station pump which was ok.