



Florida Onsite Sewage Nitrogen Reduction Strategies Study

Task B.7

B-HS4 Field System Monitoring Report No. 7

Progress Report

November 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. 7

Prepared for:

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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 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 seventh B-HS4 monitoring and sampling event conducted on October 23, 2014 (Experimental Day 471). 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

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disposal systems. The pre-existing 1,200 gallon concrete septic tank, located on the 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, raw sewage is pumped from the 900 gallon lift station to the head end of the new gravity flow PNRS. All subsequent flow through the PNRS is by gravity. The passive nitrogen reduction system consists of the septic tank, two treatment tanks and a new drainfield that replaced the two existing permitted systems. The B-HS4 PNRS tankage includes a 2,800 gallon concrete tank that houses a Stage 1 unsaturated media biofilter and 1,500 gallon two chamber concrete tank that houses a 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).

November 2014

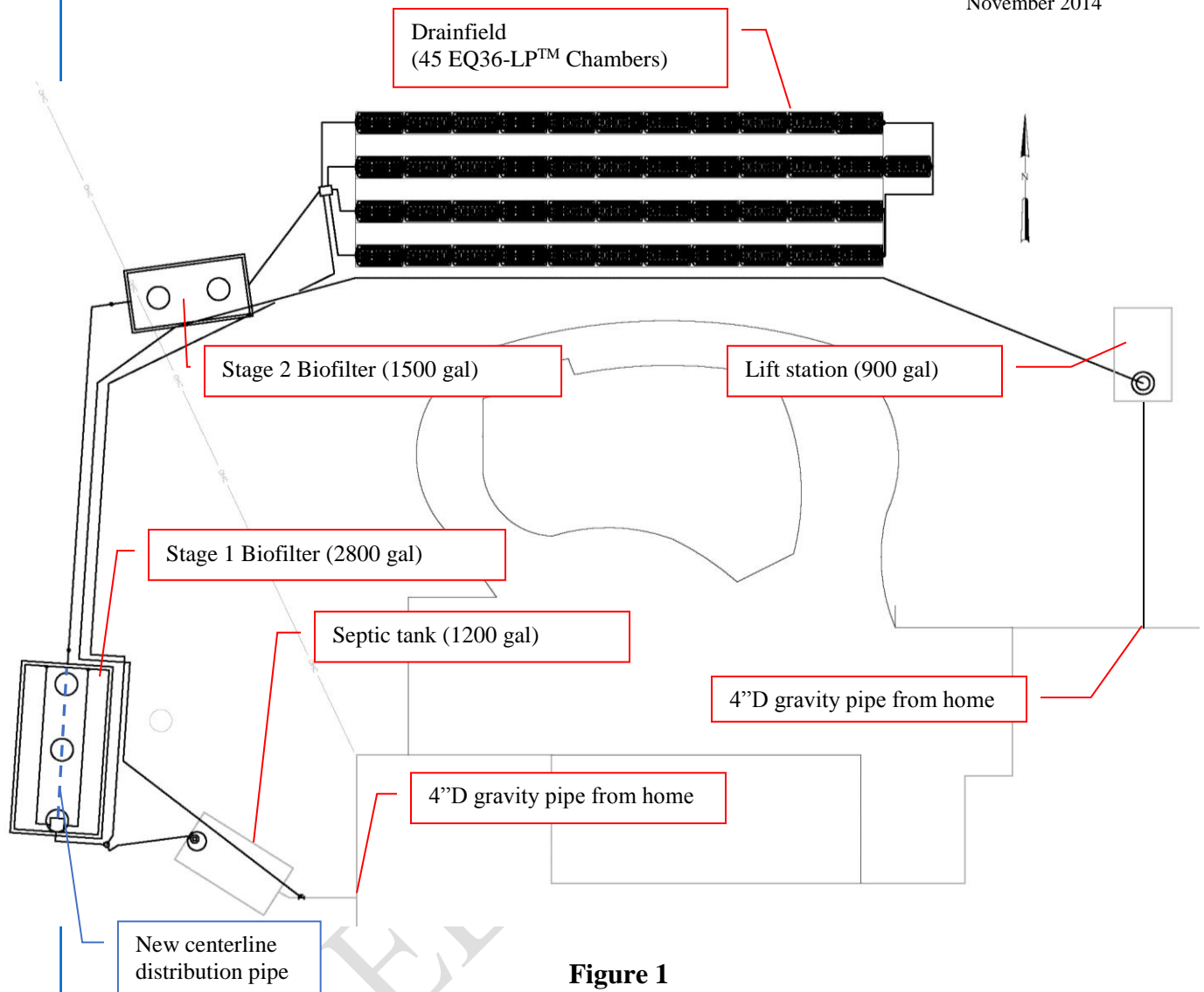


Figure 1
Plan View of B-HS4 System Layout

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November 2014

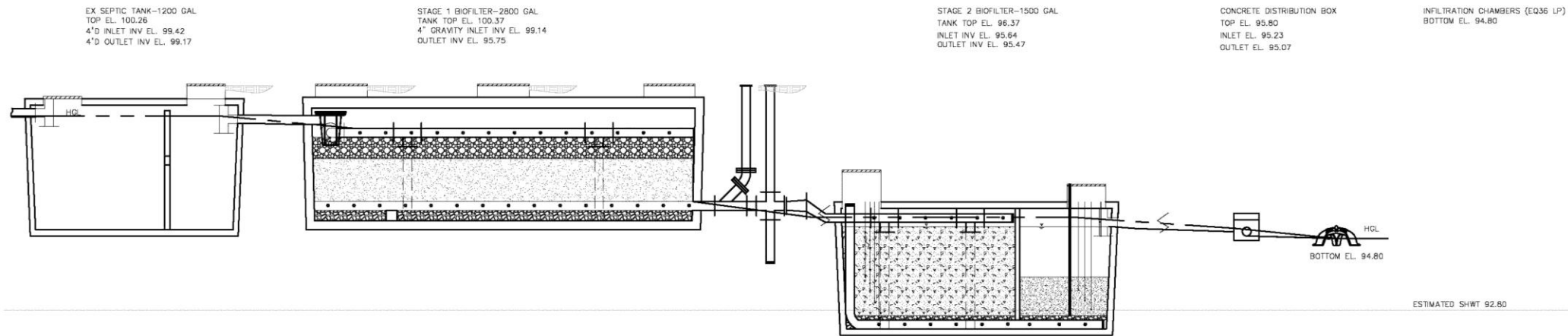


Figure 2
Flow Schematic of B-HS4 PNRS

3.2 Monitoring and Sample Locations and Identification

The four primary monitoring points 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 are the influent to the remainder of the onsite nitrogen reduction system.

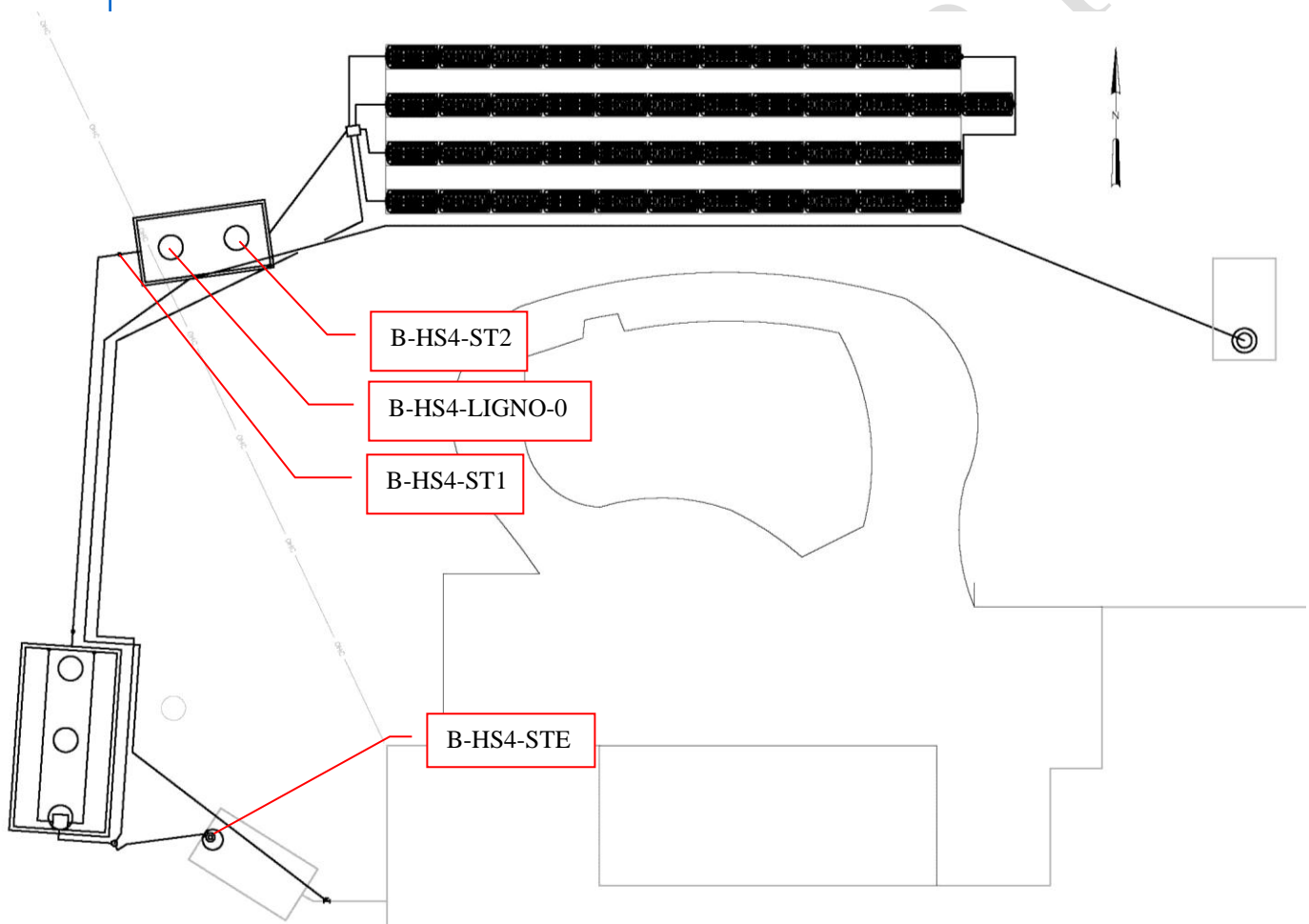


Figure 3
B-HS4 Sample and Monitoring Locations

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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 three perforated distribution pipes which run 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) represents the Stage 1 biofilter effluent, and is taken from a sample port in the gravity pipe connecting the Stage 1 biofilter outlet to the Stage 2 biofilter inlet (Figure 3).

Effluent from the unsaturated (Stage 1) media tank enters the saturated denitrification (Stage 2) biofilter above the media in the first chamber (lignocellulosic media), flows downward through the media, moves laterally in a perforated 4-inch pipe through the

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

The first chamber of the Stage 2 biofilter contains 42-inches of lignocellulosic media. Stainless steel samplers are positioned at 12-inch increments for vertical profiling throughout the lignocellulosic media. The third primary sampling point is a stainless steel sampler positioned at the bottom of the lignocellulosic media (B-HS4-LIGNO-0) with tubing to the surface. The B-HS4-LIGNO-0 sample represents effluent from the lignocellulosic media biofilter (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 primary 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 pump (lower horsepower) was installed in the lift station with a mechanical float switch. This modification results in more frequent and lower volume doses from the lift station to the primary tank and reduced mixing within the primary tank. The PNRS system has operated continually since September 5, 2013 (Experimental Day 58). For the seventh formal sampling event, Sample Event No. 7, the water meter for the house was read and recorded on October 23, 2014. The household water meter is located on the potable water line from the on-site 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

The new PNRS system at this site is a gravity flow system and uses no energy for wastewater treatment. As indicated previously however, a small lift station pump was required to transfer wastewater from the second existing OSTDS to the new gravity PNRS. Energy consumption by this lift station pump 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. 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 seventh formal sample event was conducted on October 23, 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 3.3: 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 (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. 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. From PNRS system start-up through October 23, 2014, the household water use average was 309 gallons per day with period of higher and lower flows (Table 2).

Table 2
Summary of Household Water Use

Date and Time Read	Cumulative Volume (gallons)	Average Daily Household Flow between readings, Q (gpd)	Average Household Flow since PNRS start-up, 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	
7/9/2013 15:35	42334.44	227.7	PNRS start-up
7/17/2013 14:30	45,422.8	388.2	388.2
7/23/2013 13:32	47,051.9	273.4	339.0
7/29/2013 11:25	48,658.8	271.8	319.0
8/6/2013 12:15	50,922.9	281.8	308.3
8/12/2013 10:24	52,614.2	285.6	304.3
8/15/2013 8:20	53,328.4	245.1	299.6
8/27/2013 10:20	56,550.0	266.6	291.4
9/5/2013 9:59	58,748.1	244.6	284.1
9/30/2013 13:15	65,633.7	273.9	281.0
11/8/2013 11:00	76,559.6	280.8	281.0
11/27/2013 11:15	82,039.9	288.3	282.0
12/2/2013 13:30	83,048.8	198.1	279.0
12/23/2013 13:00	88,271.2	248.9	275.2
1/23/2014 10:30	98,116.0	318.6	282.0
1/31/2014 10:48	100,521.0	300.2	282.7
2/3/2014 11:20	101,475.3	315.8	283.2
2/4/2014 10:05	101,844.6	389.6	283.7
2/5/2014 8:05	102,095.7	273.9	283.6
2/6/2014 9:25	102,275.2	170.1	283.1
2/7/2014 9:11	102,557.9	285.5	283.1
2/12/2014 11:30	103,986.0	280.2	283.0
3/14/2014 9:00	112,449.7	283.1	283.0
4/3/2014 12:00	118,146.5	283.1	283.0
4/25/2014 8:50	124,728.7	301.0	284.4
4/29/2014 11:15	125,962.6	300.9	284.6
5/29/2014 11:20	136,114.3	338.4	289.6
6/9/2014 11:15	138,848.1	248.6	288.3
7/11/2014 10:30	147,011.9	255.4	285.4
7/29/2014 14:15	152,624.1	309.1	286.5
8/22/2014 9:30	166,932.8	601.2	304.8
9/19/14 11:20	175,287.4	297.6	304.4
10/23/2014 8:00	187,775.5	368.8	309.0

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4.2 Energy Consumption

As mentioned previously, the PNRS at this site is a gravity system and uses no electrical energy for treatment. However, energy is required to transfer wastewater from the second existing OSTDS to the head end of the PNRS system. The energy consumption by the lift station pump that transfers flow from the second existing OSTDS 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. The total average electrical use through October 23, 2014 was 0.164 kWh per day. The cause for the increase in electrical use between the March 14th and April 3rd, 2014 readings is attributed to a clog in the lift station throttling valve (ball valve). The clog was causing the pump to run longer with a very slow flow rate.

Table 3
Summary of System Electrical Use

Date and Time Read	Cumulative Electrical Meter Reading (kWh)	Average Daily Electrical Use btwn readings (kWh/day)
6/20/2013 14:00		Installed
7/9/2013 15:45	0.3	PNRS 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
4/25/2014 8:50	66.8	0.210
4/29/2014 11:15	68.4	0.390
5/29/2014 11:20	73.7	0.177
6/9/2014 11:15	73.9	0.018
7/11/2014 10:30	74.7	0.025
8/22/2014 9:30	75.9	0.029
9/19/2014 11:20	76.6	0.025
10/23/2014 8:00	77.5	0.027
Total average through 10/23/14		0.164

4.3 Water Quality

Water quality analytical results, for Sample Event No. 7 are listed in Table 4 and key 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. 7 October 23, 2014 (Experimental Day 471)

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 for all parameters. The measured STE total nitrogen (TN) concentration was 82.8 mg/L, which is within the high end of the range that has been typically reported for Florida single family residence STE. The measured CBOD₅ concentration was 110 mg/L.

Stage 1 Effluent (ST1): The Stage 1 effluent $\text{NH}_3\text{-N}$ level was 2.5 mg/L with a DO level at 4.14 mg/L (Table 4). The Stage 1 effluent TSS and CBOD₅ concentrations were 3 mg/L. The Stage 1 biofilter showed substantial nitrification with an effluent $\text{NH}_3\text{-N}$ concentration of 2.5 mg/L and TKN of 3.2 mg/L. The Stage 1 effluent $\text{NO}_x\text{-N}$ was 55 mg/L. The Stage 1 effluent TN of 58.2 mg/L was 30% lower than that in the 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 $\text{NO}_x\text{-N}$ reduction was virtually complete. Effluent $\text{NO}_x\text{-N}$ from the Stage 2 biofilter monitoring point was 0.04 mg/L and was accompanied by a measured DO of 0.29 mg/L and ORP of -179 mV. The effluent $\text{NO}_x\text{-N}$ of the lignocellulosic media biofilter was 13.3 mg/L. Final total nitrogen (TN) in the treatment system ef-

fluent was 1.03 mg/L. The Stage 2 biofilter lignocellulosic media effluent and sulfur media effluent CBOD₅ were 6 and 7 mg/L, respectively. The Stage 2 effluent sulfate concentration was 71 mg/L.

Field Blank (EB): Described in Section 3.5, the field blank (FB) results for most of the parameters measured were at or below the method detection limit. The slightly elevated parameters were total alkalinity 2.9 mg/L, orthophosphate 0.014 mg/L and total organic carbon 0.14 mg/L.

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)	NO _x (mg/L N)	TIN (mg/L N) ³	TP (mg/L)	Ortho P (mg/L P)	Sulfate (mg/L)	Hydrogen Sulfide (mg/L)	Sulfide (mg/L)	Fecal (Ct/100 mL)	E-coli (Ct/100 mL)	TOC (mg/L)
BHS4-STE	10/23/2014 9:20	24.53	6.79	1278	0.08	-201.3	490	45	44	110	310	82.76	82	16	66	0.66	0.1	0.76	66.76	10	9.2	0.2	3.1	6.4	67000	200000	59
BHS4-STE-FILTERED	10/23/2014 9:20	24.53	6.79	1278	0.08	-201.3				87		74.11	74	14	60	0.01	0.1	0.11	60.11								
BHS4-ST1	10/23/2014 8:55	25.40	7.21	1317	4.14	508.2	300	3	3	5	18	58.33	3.2	0.7	2.5	55	0.13	55.13	57.63	3.2	2.8	24	0.44	1.2	530	200	7.9
BHS4-ST1-DUP	10/23/2014 9:00	25.40	7.21	1317	4.14	508.2	300	4	4	3	20	59.14	3	0.5	2.5	56	0.14	56.14	58.64	3	2.6	24			290	280	7.7
BHS4-ST1-FILTERED	10/23/2014 8:55	25.40	7.21	1317	4.14	508.2				3		59.04	2.9	1.1	1.8	56	0.14	56.14	57.94								
BHS4-LIGNO-0	10/23/2014 8:54	25.73	6.54	1149	1.57	58.2	400	1	1	6	79	16.97	3.7	3.02	0.68	13	0.27	13.27	13.95	2.6	2.5	20	0.29	0.4	830	820	8.9
BHS4-LIGNO-0-FILTERED	10/23/2014 8:54	25.73	6.54	1149	1.57	58.2				3		15.98	3.7	3.09	0.61	12	0.28	12.28	12.89								
BHS4-ST2	10/23/2014 8:32	24.88	6.58	1200	0.29	-178.6	450	2	1	7	31	1.03	0.99	0.29	0.7	0.02	0.02	0.04	0.74	2.2	2.1	71	3.4	4.8	410	370	8.4
BHS4-ST2-FILTERED	10/23/2014 8:32	24.88	6.58	1200	0.29	-178.6				3		1.01	0.98	0.44	0.54	0.01	0.02	0.03	0.57			71					
BHS4-FB	10/23/2014 9:45	20.30	6.27	2.03	8.39	425.9	2.9	1	1	2	10	0.08	0.05	0.041	0.009	0.02	0.01	0.03	0.039	0.01	0.014	0.2	0.01	0.1	1	2	0.14

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 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)	NO _x (mg/L N)	TIN (mg/L N) ³	TP (mg/L)	Ortho P (mg/L P)	Sulfate (mg/L)	Hydrogen Sulfide (mg/L)	Sulfide (mg/L)	Fecal (Ct/100 mL)	E-coli (Ct/100 mL)	TOC (mg/L)
STE	n	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	10	11
	MEAN	22.89	6.79	1175.36	0.16	-217.47	442.73	61.36	58.18	133.91	213.45	69.38	69.27	8.00	61.27	0.09	0.02	0.11	61.38	9.55	6.42	1.66	3.14	5.13	42,638	14,075	65.18
	STD. DEV.	3.29	0.00	118.00	0.22	55.93	30.69	21.97	20.71	54.54	112.57	10.09	9.98	7.81	6.63	0.19	0.03	0.22	6.68	2.13	2.29	1.57	1.02	1.50			16.08
	MIN	19.50	6.52	1027.00	0.01	-321.80	400.00	38.00	38.00	23.00	10.00	56.06	56.00	-5.00	49.00	0.01	0.01	0.02	49.07	7.60	0.01	0.20	1.50	2.60	21,000	690	34.00
	MAX	28.32	6.94	1329.00	0.79	-131.40	490.00	118.00	111.00	220.00	330.00	87.14	87.00	23.00	75.00	0.66	0.10	0.76	75.02	14.00	9.20	5.40	4.50	6.80	80,000	200,000	85.00
Stage 1	n	11	11	11	11	11	11	11	11	11	11	11	11	11	11	10	10	11	11	11	11	9	8	8	11	10	11
	MEAN	22.57	6.83	1170.27	2.68	95.83	321.82	9.64	8.55	8.64	42.18	44.52	12.33	3.80	8.53	31.80	0.17	32.19	40.72	3.60	2.86	19.00	0.30	0.60	3,510	1,811	15.40
	STD. DEV.	3.28	0.00	144.71	1.55	153.29	37.10	6.34	5.34	6.48	33.27	10.40	7.76	4.02	8.41	16.46	0.31	15.50	10.49	1.17	0.96	2.35	0.32	0.61			5.89
	MIN	19.00	6.42	978.00	0.87	-69.70	270.00	3.00	3.00	2.00	10.00	27.00	3.20	0.00	0.38	12.00	0.01	12.00	27.00	1.80	1.50	16.00	0.01	0.10	100	41	6.50
	MAX	27.60	7.39	1385.00	5.16	508.20	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	24.00	1.00	1.80	32,000	24,000	24.00
Stage 2 Ligno	n	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	10	9	9	11	10	11
	MEAN	22.99	6.64	1103.82	0.63	-149.88	426.36	5.27	5.00	13.09	46.55	12.04	9.15	3.08	6.08	2.86	0.03	2.89	8.96	2.83	2.24	13.34	1.13	1.67	1,226	622	14.83
	STD. DEV.	3.62	0.00	83.42	0.66	96.94	22.03	3.82	3.46	6.79	16.29	4.58	6.20	3.52	6.30	4.12	0.08	4.19	5.01	1.36	1.19	6.38	0.65	0.96			4.21
	MIN	18.20	6.46	956.00	0.13	-238.00	400.00	1.00	1.00	2.00	25.00	3.30	2.00	0.70	0.13	0.03	0.01	0.03	1.21	0.42	0.18	5.70	0.00	0.00	30	10	6.20
	MAX	28.51	6.80	1247.00	2.16	58.20	460.00	12.00	12.00	23.00	79.00	17.04	17.00	13.49	15.00	13.00	0.27	13.27	15.04	4.10	3.30	23.00	2.10	3.00	17,200	6,100	19.00
Stage 2 Sulfur	n	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	10	11
	MEAN	22.46	6.73	1162.36	0.18	-222.68	462.73	4.00	3.45	12.36	44.73	6.81	6.77	2.27	4.51	0.03	0.01	0.04	4.54	2.74	2.23	34.36	4.55	6.46	343	212	13.99
	STD. DEV.	3.11	0.45	90.92	0.11	59.91	24.53	2.41	2.58	8.54	12.71	4.55	4.54	3.24	4.18	0.02	0.00	0.02	4.18	1.12	1.02	15.40	2.45	3.06			3.98
	MIN	19.60	5.79	1054.00	0.04	-348.90	440.00	2.00	1.00	3.00	29.00	1.03	0.99	0.29	0.51	0.01	0.01	0.02	0.53	0.70	0.32	21.00	1.30	1.30	1	2	6.50
	MAX	27.60	7.66	1306.00	0.44	-132.60	510.00	9.00	8.00	30.00	64.00	13.07	13.00	11.70	10.00	0.07	0.02	0.07	10.04	4.10	3.50	71.00	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. 7: Summary and Recommendations

5.1 Summary

The results of the seventh sampling event indicate that:

- Septic tank effluent (STE) quality is characteristic of typical household STE quality. The total nitrogen concentration of 82.8 mg/L is within the high end of the range of values typically reported for Florida single family residence STE.
- The Stage 1 biofilter reduced TN and TKN by 30 and 96%, respectively.
- The Stage 1 biofilter substantially reduced TKN and ammonium; effluent TKN and ammonia N were 3.2 and 2.5 mg/L, respectively.
- The Stage 2 biofilter effluent NO_x-N was 0.04 mg N/L.
- The total nitrogen concentration in the final effluent from the total treatment system was 1.0 mg/L, an approximately 99% reduction in STE TN.



Appendix A: Laboratory Report

PRELIMINARY

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

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10002 Princess Palm Ave, Suite 200
Tampa, FL 33619

November 12, 2014
Work Order: 1410747

Laboratory Report

Project Name		B-HS4 SE#11						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS4-STE						
Matrix		Wastewater						
SAL Sample Number		1410747-01						
Date/Time Collected		10/23/14 09:20						
Collected by		Josefin Hirst						
Date/Time Received		10/23/14 14:58						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	3.1	SM 4550SF	0.04	0.01	10/28/14 15:46	10/28/14 15:48	1
Ammonia as N	mg/L	66	EPA 350.1	3.6	0.85		10/24/14 16:50	90
Carbonaceous BOD	mg/L	110	SM 5210B	2	2	10/24/14 11:12	10/29/14 13:49	1
Chemical Oxygen Demand	mg/L	310	EPA 410.4	25	10	10/30/14 12:16	10/30/14 14:30	1
Nitrate+Nitrite (N)	mg/L	0.76	EPA 353.2	0.40	0.10		11/07/14 16:43	10
Nitrite (as N)	mg/L	0.10	SM	0.04	0.01	10/24/14 10:50	10/24/14 10:57	1
			4500NO2-B					
Orthophosphate as P	mg/L	9.2	SM 4500P-E	0.20	0.060		10/24/14 10:54	5
Phosphorous - Total as P	mg/L	10	SM 4500P-E	0.040	0.010	10/24/14 08:35	10/24/14 15:20	1
Sulfate	mg/L	0.20 U	EPA 300.0	0.60	0.20		10/30/14 21:15	1
Sulfide	mg/L	6.4	SM 4500SF	0.40	0.10		10/28/14 16:22	1
Total Alkalinity	mg/L	490	SM 2320B	8.0	2.0		10/27/14 11:56	1
Total Kjeldahl Nitrogen	mg/L	82	EPA 351.2	0.20	0.05	10/24/14 08:35	10/24/14 15:20	1
Total Organic Carbon	mg/L	59	SM 5310B	10	0.60		10/29/14 15:58	10
Total Suspended Solids	mg/L	45	SM 2540D	1	1	10/24/14 09:13	10/27/14 15:54	1
Volatile Suspended Solids	mg/L	44	EPA 160.4	1	1	10/24/14 09:13	10/27/14 15:54	1
Nitrate (as N)	mg/L	0.66	EPA 353.2	0.44	0.11		11/07/14 16:43	10
<u>Microbiology</u>								
E. Coli	MPN/100 mL	200,000	SM 9223B	2.0	2.0	10/23/14 16:03	10/24/14 10:35	1
Fecal Coliforms	CFU/100 ml	67,000	SM 9222D	1	1	10/23/14 15:54	10/24/14 14:22	1
Sample Description		BHS4-STE-FILTERED						
Matrix		Wastewater						
SAL Sample Number		1410747-02						
Date/Time Collected		10/23/14 09:20						
Collected by		Josefin Hirst						
Date/Time Received		10/23/14 14:58						
<u>Inorganic, Dissolved</u>								
Ammonia as N	mg/L	60	EPA 350.1	3.6	0.85		10/31/14 11:44	90
Carbonaceous BOD	mg/L	87	SM 5210B	2	2	10/24/14 11:10	10/29/14 13:47	1
Nitrate (as N)	mg/L	0.01 U	EPA 353.2	0.04	0.01		10/24/14 12:18	1
Nitrite (as N)	mg/L	0.10	SM	0.04	0.01	10/24/14 10:50	10/24/14 10:58	1
			4500NO2-B					
Total Kjeldahl Nitrogen	mg/L	74	EPA 351.2	0.20	0.050	10/29/14 08:38	10/29/14 17:16	1
Nitrate+Nitrite (N)	mg/L	0.01 U	EPA 353.2	0.04	0.01		10/24/14 12:18	1
Lab filtration for diss. analytes							10/24/14 11:06	

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November 12, 2014
Work Order: 1410747

Laboratory Report

Project Name		B-HS4 SE#11						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS4-ST1						
Matrix		Wastewater						
SAL Sample Number		1410747-03						
Date/Time Collected		10/23/14 08:55						
Collected by		Josefin Hirst						
Date/Time Received		10/23/14 14:58						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	0.44	SM 4550SF	0.04	0.01	10/28/14 15:46	10/28/14 15:48	1
Ammonia as N	mg/L	2.5	EPA 350.1	0.40	0.095		10/24/14 16:22	10
Carbonaceous BOD	mg/L	5	SM 5210B	2	2	10/24/14 11:12	10/29/14 13:49	1
Chemical Oxygen Demand	mg/L	18	EPA 410.4	25	10	10/30/14 12:16	10/30/14 14:30	1
Nitrate+Nitrite (N)	mg/L	55	EPA 353.2	4.8	1.2		10/24/14 15:19	120
Nitrite (as N)	mg/L	0.13	SM 4500NO2-B	0.04	0.01	10/24/14 10:50	10/24/14 10:58	1
Orthophosphate as P	mg/L	2.8	SM 4500P-E	0.20	0.060		10/24/14 10:55	5
Phosphorous - Total as P	mg/L	3.2	SM 4500P-E	0.040	0.010	10/24/14 08:35	10/24/14 15:20	1
Sulfate	mg/L	24	EPA 300.0	6.0	2.0		10/29/14 23:47	10
Sulfide	mg/L	1.2	SM 4500SF	0.40	0.10		10/28/14 16:22	1
Total Alkalinity	mg/L	300	SM 2320B	8.0	2.0		10/27/14 12:05	1
Total Kjeldahl Nitrogen	mg/L	3.2	EPA 351.2	0.20	0.05	10/24/14 08:35	10/24/14 15:20	1
Total Organic Carbon	mg/L	7.9	SM 5310B	1.0	0.060		10/29/14 15:58	1
Total Suspended Solids	mg/L	3	SM 2540D	1	1	10/24/14 09:13	10/27/14 15:54	1
Volatile Suspended Solids	mg/L	3	EPA 160.4	1	1	10/24/14 09:13	10/27/14 15:54	1
Nitrate (as N)	mg/L	55	EPA 353.2	4.8	1.2		10/24/14 15:19	120
<u>Microbiology</u>								
E. Coli	MPN/100 mL	200	SM 9223B	2.0	2.0	10/23/14 16:03	10/24/14 10:35	1
Fecal Coliforms	CFU/100 ml	530	SM 9222D	1	1	10/23/14 15:54	10/24/14 14:22	1
Sample Description		BHS4-ST1-DUP						
Matrix		Wastewater						
SAL Sample Number		1410747-04						
Date/Time Collected		10/23/14 09:00						
Collected by		Josefin Hirst						
Date/Time Received		10/23/14 14:58						
<u>Inorganics</u>								
Ammonia as N	mg/L	2.5	EPA 350.1	0.40	0.095		10/24/14 16:23	10
Carbonaceous BOD	mg/L	3	SM 5210B	2	2	10/24/14 11:12	10/29/14 13:49	1
Chemical Oxygen Demand	mg/L	20	EPA 410.4	25	10	10/30/14 12:16	10/30/14 14:30	1
Nitrate+Nitrite (N)	mg/L	56	EPA 353.2	4.8	1.2		10/24/14 15:20	120
Nitrite (as N)	mg/L	0.14	SM 4500NO2-B	0.04	0.01	10/24/14 10:50	10/24/14 10:59	1
Orthophosphate as P	mg/L	2.6	SM 4500P-E	0.20	0.060		10/24/14 10:56	5
Phosphorous - Total as P	mg/L	3.0	SM 4500P-E	0.040	0.010	10/24/14 08:35	10/24/14 15:20	1
Sulfate	mg/L	24	EPA 300.0	6.0	2.0		10/30/14 00:00	10

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November 12, 2014
Work Order: 1410747

Laboratory Report

Project Name		B-HS4 SE#11						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS4-ST1-DUP						
Matrix		Wastewater						
SAL Sample Number		1410747-04						
Date/Time Collected		10/23/14 09:00						
Collected by		Josefin Hirst						
Date/Time Received		10/23/14 14:58						
Total Alkalinity	mg/L	300	SM 2320B	8.0	2.0		10/27/14 12:13	1
Total Kjeldahl Nitrogen	mg/L	3.0	EPA 351.2	0.20	0.05	10/24/14 08:35	10/24/14 15:20	1
Total Organic Carbon	mg/L	7.7	SM 5310B	1.0	0.060		10/29/14 15:58	1
Total Suspended Solids	mg/L	4	SM 2540D	1	1	10/24/14 09:13	10/27/14 15:54	1
Volatile Suspended Solids	mg/L	4	EPA 160.4	1	1	10/24/14 09:13	10/27/14 15:54	1
Nitrate (as N)	mg/L	56	EPA 353.2	4.8	1.2		10/24/14 15:20	120
<u>Microbiology</u>								
E. Coli	MPN/100 mL	280	SM 9223B	2.0	2.0	10/23/14 16:03	10/24/14 10:35	1
Fecal Coliforms	CFU/100 ml	290	SM 9222D	1	1	10/23/14 15:54	10/24/14 14:22	1
Sample Description		BHS4-ST1-FILTERED						
Matrix		Wastewater						
SAL Sample Number		1410747-05						
Date/Time Collected		10/23/14 08:55						
Collected by		Josefin Hirst						
Date/Time Received		10/23/14 14:58						
<u>Inorganic, Dissolved</u>								
Ammonia as N	mg/L	1.8	EPA 350.1	0.040	0.009		10/31/14 10:24	1
Carbonaceous BOD	mg/L	3	SM 5210B	2	2	10/24/14 11:10	10/29/14 13:47	1
Nitrate (as N)	mg/L	56	EPA 353.2	4.8	1.2		10/24/14 15:21	120
Nitrite (as N)	mg/L	0.14	SM 4500NO2-B	0.04	0.01	10/24/14 10:50	10/24/14 11:03	1
Total Kjeldahl Nitrogen	mg/L	2.9	EPA 351.2	0.20	0.050	10/29/14 08:38	10/29/14 17:16	1
Nitrate+Nitrite (N)	mg/L	56	EPA 353.2	4.8	1.2		10/24/14 15:21	120
Lab filtration for diss. analytes							10/24/14 11:06	
Sample Description		BHS4-LIGNO-0						
Matrix		Wastewater						
SAL Sample Number		1410747-06						
Date/Time Collected		10/23/14 08:54						
Collected by		Josefin Hirst						
Date/Time Received		10/23/14 14:58						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	0.29	SM 4550SF	0.04	0.01	10/28/14 15:46	10/28/14 15:48	1
Ammonia as N	mg/L	0.68	EPA 350.1	0.040	0.009		10/24/14 15:17	1
Carbonaceous BOD	mg/L	6	SM 5210B	2	2	10/24/14 11:12	10/29/14 13:49	1
Chemical Oxygen Demand	mg/L	79	EPA 410.4	25	10	10/30/14 12:16	10/30/14 14:30	1

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November 12, 2014
Work Order: 1410747

Laboratory Report

Project Name		B-HS4 SE#11						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS4-LIGNO-0						
Matrix		Wastewater						
SAL Sample Number		1410747-06						
Date/Time Collected		10/23/14 08:54						
Collected by		Josefin Hirst						
Date/Time Received		10/23/14 14:58						
Nitrate+Nitrite (N)	mg/L	13	EPA 353.2	0.96	0.24		10/24/14 14:14	24
Nitrite (as N)	mg/L	0.27 I	SM	0.40	0.10	10/24/14 10:50	10/24/14 11:30	10
			4500NO2-B					
Orthophosphate as P	mg/L	2.5	SM 4500P-E	0.20	0.060		10/24/14 10:57	5
Phosphorous - Total as P	mg/L	2.6	SM 4500P-E	0.040	0.010	10/24/14 08:35	10/24/14 15:20	1
Sulfate	mg/L	20	EPA 300.0	6.0	2.0		10/30/14 12:12	10
Sulfide	mg/L	0.40	SM 4500SF	0.40	0.10		10/28/14 16:22	1
Total Alkalinity	mg/L	400	SM 2320B	8.0	2.0		10/27/14 12:25	1
Total Kjeldahl Nitrogen	mg/L	3.7	EPA 351.2	0.20	0.05	10/24/14 08:35	10/24/14 15:20	1
Total Organic Carbon	mg/L	8.9	SM 5310B	1.0	0.060		10/29/14 15:58	1
Total Suspended Solids	mg/L	1 U	SM 2540D	1	1	10/24/14 09:13	10/27/14 15:54	1
Volatile Suspended Solids	mg/L	1 U	EPA 160.4	1	1	10/24/14 09:13	10/27/14 15:54	1
Nitrate (as N)	mg/L	13	EPA 353.2	1.4	0.34		10/24/14 14:14	24
Microbiology								
E. Coli	MPN/100 mL	820	SM 9223B	2.0	2.0	10/23/14 16:03	10/24/14 10:35	1
Fecal Coliforms	CFU/100 ml	830	SM 9222D	1	1	10/23/14 15:54	10/24/14 14:22	1
Sample Description		BHS4-LIGNO-0-FILTERED						
Matrix		Wastewater						
SAL Sample Number		1410747-07						
Date/Time Collected		10/23/14 08:54						
Collected by		Josefin Hirst						
Date/Time Received		10/23/14 14:58						
Inorganic, Dissolved								
Ammonia as N	mg/L	0.61	EPA 350.1	0.040	0.009		10/31/14 10:26	1
Carbonaceous BOD	mg/L	3	SM 5210B	2	2	10/24/14 11:10	10/29/14 13:47	1
Nitrate (as N)	mg/L	12	EPA 353.2	0.96	0.24		10/24/14 14:15	24
Nitrite (as N)	mg/L	0.28 I	SM	0.40	0.10	10/24/14 10:50	10/24/14 11:31	10
			4500NO2-B					
Total Kjeldahl Nitrogen	mg/L	3.7	EPA 351.2	0.20	0.050	10/29/14 08:38	10/29/14 17:16	1
Nitrate+Nitrite (N)	mg/L	13	EPA 353.2	0.96	0.24		10/24/14 14:15	24
Lab filtration for diss. analytes		10/24/14 11:06						

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November 12, 2014
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Laboratory Report

Project Name		B-HS4 SE#11						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS4-ST2						
Matrix		Wastewater						
SAL Sample Number		1410747-08						
Date/Time Collected		10/23/14 08:32						
Collected by		Josefin Hirst						
Date/Time Received		10/23/14 14:58						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	3.4	SM 4550SF	0.04	0.01	10/28/14 15:46	10/28/14 15:48	1
Ammonia as N	mg/L	0.70	EPA 350.1	0.040	0.009		11/07/14 16:59	1
Carbonaceous BOD	mg/L	7	SM 5210B	2	2	10/24/14 11:12	10/29/14 13:49	1
Chemical Oxygen Demand	mg/L	31	EPA 410.4	25	10	10/30/14 12:16	10/30/14 14:30	1
Nitrate+Nitrite (N)	mg/L	0.03 I	EPA 353.2	0.04	0.01		10/24/14 12:40	1
Nitrite (as N)	mg/L	0.02 I	SM 4500NO2-B	0.04	0.01	10/24/14 10:50	10/24/14 11:05	1
Orthophosphate as P	mg/L	2.1	SM 4500P-E	0.20	0.060		10/24/14 10:58	5
Phosphorous - Total as P	mg/L	2.2	SM 4500P-E	0.040	0.010	10/24/14 08:35	10/24/14 15:20	1
Sulfate	mg/L	71	EPA 300.0	6.0	2.0		10/30/14 21:26	10
Sulfide	mg/L	4.8	SM 4500SF	0.40	0.10		10/28/14 16:22	1
Total Alkalinity	mg/L	450	SM 2320B	8.0	2.0		10/27/14 12:43	1
Total Kjeldahl Nitrogen	mg/L	0.99	EPA 351.2	0.20	0.05	10/24/14 08:35	10/24/14 15:20	1
Total Organic Carbon	mg/L	8.4	SM 5310B	1.0	0.060		10/29/14 15:58	1
Total Suspended Solids	mg/L	2	SM 2540D	1	1	10/24/14 09:13	10/27/14 15:54	1
Volatile Suspended Solids	mg/L	1 U	EPA 160.4	1	1	10/24/14 09:13	10/27/14 15:54	1
Nitrate (as N)	mg/L	0.02 U	EPA 353.2	0.08	0.02		10/24/14 12:40	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	370	SM 9223B	2.0	2.0	10/23/14 16:03	10/24/14 10:35	1
Fecal Coliforms	CFU/100 ml	410	SM 9222D	1	1	10/23/14 15:54	10/24/14 14:22	1
Sample Description		BHS4-ST2-FILTERED						
Matrix		Wastewater						
SAL Sample Number		1410747-09						
Date/Time Collected		10/23/14 08:32						
Collected by		Josefin Hirst						
Date/Time Received		10/23/14 14:58						
<u>Inorganics</u>								
Sulfate	mg/L	71	EPA 300.0	6.0	2.0		10/30/14 22:00	10
<u>Inorganic, Dissolved</u>								
Ammonia as N	mg/L	0.54	EPA 350.1	0.040	0.009		10/31/14 10:34	1
Carbonaceous BOD	mg/L	3	SM 5210B	2	2	10/24/14 11:10	10/29/14 13:47	1
Nitrate (as N)	mg/L	0.01 U	EPA 353.2	0.04	0.01		10/24/14 12:42	1
Nitrite (as N)	mg/L	0.02 I	SM 4500NO2-B	0.04	0.01	10/24/14 10:50	10/24/14 11:05	1
Total Kjeldahl Nitrogen	mg/L	0.98	EPA 351.2	0.20	0.050	10/29/14 08:38	10/29/14 17:16	1

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November 12, 2014
Work Order: 1410747

Laboratory Report

Project Name		B-HS4 SE#11						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS4-ST2-FILTERED						
Matrix		Wastewater						
SAL Sample Number		1410747-09						
Date/Time Collected		10/23/14 08:32						
Collected by		Josefin Hirst						
Date/Time Received		10/23/14 14:58						
Nitrate+Nitrite (N)	mg/L	0.01 I	EPA 353.2	0.04	0.01		10/24/14 12:42	1
Lab filtration for diss. analytes							10/24/14 11:06	
Sample Description		BHS4-FB						
Matrix		Reagent Water						
SAL Sample Number		1410747-10						
Date/Time Collected		10/23/14 09:45						
Collected by		Josefin Hirst						
Date/Time Received		10/23/14 14:58						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	0.01 U	SM 4550SF	0.04	0.01	10/28/14 15:46	10/28/14 15:48	1
Ammonia as N	mg/L	0.009 U	EPA 350.1	0.040	0.009	11/11/14 15:41	11/11/14 15:49	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	10/24/14 11:12	10/29/14 13:49	1
Chemical Oxygen Demand	mg/L	10 U	EPA 410.4	25	10	10/30/14 12:16	10/30/14 14:30	1
Nitrate+Nitrite (N)	mg/L	0.01 I	EPA 353.2	0.04	0.01		10/24/14 12:44	1
Nitrite (as N)	mg/L	0.01 U	SM 4500NO2-B	0.04	0.01	10/24/14 10:50	10/24/14 11:06	1
Orthophosphate as P	mg/L	0.014 I	SM 4500P-E	0.040	0.012		10/24/14 10:22	1
Phosphorous - Total as P	mg/L	0.010 U	SM 4500P-E	0.040	0.010	10/24/14 08:35	10/24/14 15:20	1
Sulfate	mg/L	0.20 U	EPA 300.0	0.60	0.20		10/30/14 22:22	1
Sulfide	mg/L	0.10 U	SM 4500SF	0.40	0.10		10/28/14 16:22	1
Total Alkalinity	mg/L	2.9 I	SM 2320B	8.0	2.0		10/27/14 12:46	1
Total Kjeldahl Nitrogen	mg/L	0.05 U	EPA 351.2	0.20	0.05	10/24/14 08:35	10/24/14 15:20	1
Total Organic Carbon	mg/L	0.14 I	SM 5310B	1.0	0.060		10/29/14 15:58	1
Total Suspended Solids	mg/L	1 U	SM 2540D	1	1	10/24/14 09:13	10/27/14 15:54	1
Volatile Suspended Solids	mg/L	1 U	EPA 160.4	1	1	10/24/14 09:13	10/27/14 15:54	1
Nitrate (as N)	mg/L	0.02 U	EPA 353.2	0.08	0.02		10/24/14 12:44	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	2.0 U	SM 9223B	2.0	2.0	10/23/14 16:03	10/24/14 10:35	1
Fecal Coliforms	CFU/100 ml	1 U	SM 9222D	1	1	10/23/14 15:54	10/24/14 14:22	1

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November 12, 2014
Work Order: 1410747

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ42402 - Ortho phosphorus SM4500P-E by seal										
Blank (BJ42402-BLK1)					Prepared & Analyzed: 10/24/14 10:03					
Orthophosphate as P	0.0163 I,V	0.040	0.012	mg/L						
LCS (BJ42402-BS1)					Prepared & Analyzed: 10/24/14 10:04					
Orthophosphate as P	0.805	0.040	0.012	mg/L	0.80		101	90-110		
LCS (BJ42402-BS2)					Prepared & Analyzed: 10/24/14 10:06					
Orthophosphate as P	0.819	0.040	0.012	mg/L	0.80		102	90-110		
LCS (BJ42402-BS3)					Prepared & Analyzed: 10/24/14 10:07					
Orthophosphate as P	0.779	0.040	0.012	mg/L	0.80		97	90-110		
LCS (BJ42402-BS4)					Prepared & Analyzed: 10/24/14 10:08					
Orthophosphate as P	0.825	0.040	0.012	mg/L	0.80		103	90-110		
LCS (BJ42402-BS5)					Prepared & Analyzed: 10/24/14 10:09					
Orthophosphate as P	0.783	0.040	0.012	mg/L	0.80		98	90-110		
Matrix Spike (BJ42402-MS1)		Source: 1410752-27			Prepared & Analyzed: 10/24/14 10:11					
Orthophosphate as P	1.04	0.040	0.012	mg/L	1.0	0.0141	103	90-110		
Matrix Spike (BJ42402-MS2)		Source: 1410747-10			Prepared & Analyzed: 10/24/14 10:13					
Orthophosphate as P	1.04	0.040	0.012	mg/L	1.0	0.0137	103	90-110		
Matrix Spike Dup (BJ42402-MSD1)		Source: 1410752-27			Prepared & Analyzed: 10/24/14 10:12					
Orthophosphate as P	0.981	0.040	0.012	mg/L	1.0	0.0141	97	90-110	6	20
Matrix Spike Dup (BJ42402-MSD2)		Source: 1410747-10			Prepared & Analyzed: 10/24/14 10:14					
Orthophosphate as P	1.02	0.040	0.012	mg/L	1.0	0.0137	100	90-110	3	20

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November 12, 2014
Work Order: 1410747

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ42403 - Digestion for TP and TKN										
Blank (BJ42403-BLK1)					Prepared & Analyzed: 10/24/14 15:20					
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 (BJ42403-BS1)					Prepared & Analyzed: 10/24/14 15:20					
Total Kjeldahl Nitrogen	0.992	0.20	0.05	mg/L	1.0		99	90-110		
Phosphorous - Total as P	1.03	0.040	0.010	mg/L	1.0		103	90-110		
Matrix Spike (BJ42403-MS1)					Source: 1410747-10		Prepared & Analyzed: 10/24/14 15:20			
Total Kjeldahl Nitrogen	1.05	0.20	0.05	mg/L	1.0	ND	105	90-110		
Phosphorous - Total as P	1.08	0.040	0.010	mg/L	1.0	ND	108	90-110		
Matrix Spike (BJ42403-MS2)					Source: 1410752-27		Prepared & Analyzed: 10/24/14 15:20			
Phosphorous - Total as P	1.09	0.040	0.010	mg/L	1.0	ND	109	90-110		
Total Kjeldahl Nitrogen	1.05	0.20	0.05	mg/L	1.0	ND	105	90-110		
Matrix Spike Dup (BJ42403-MSD1)					Source: 1410747-10		Prepared & Analyzed: 10/24/14 15:20			
Phosphorous - Total as P	1.09	0.040	0.010	mg/L	1.0	ND	109	90-110	1	25
Total Kjeldahl Nitrogen	1.09	0.20	0.05	mg/L	1.0	ND	109	90-110	4	20
Matrix Spike Dup (BJ42403-MSD2)					Source: 1410752-27		Prepared & Analyzed: 10/24/14 15:20			
Total Kjeldahl Nitrogen	1.05	0.20	0.05	mg/L	1.0	ND	105	90-110	0.5	20
Phosphorous - Total as P	1.08	0.040	0.010	mg/L	1.0	ND	108	90-110	0.8	25
Batch BJ42405 - Nitrite SM 4500NO2-B by seal										
Blank (BJ42405-BLK1)					Prepared & Analyzed: 10/24/14 10:54					
Nitrite (as N)	0.01 U	0.04	0.01	mg/L						

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November 12, 2014
Work Order: 1410747

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ42405 - Nitrite SM 4500NO2-B by seal										
Blank (BJ42405-BLK2)					Prepared & Analyzed: 10/24/14 16:09					
Nitrite (as N)	0.01 U	0.04	0.01	mg/L						
LCS (BJ42405-BS1)					Prepared & Analyzed: 10/24/14 10:55					
Nitrite (as N)	0.0774	0.04	0.01	mg/L	0.080		97	90-110		
LCS (BJ42405-BS2)					Prepared & Analyzed: 10/24/14 16:39					
Nitrite (as N)	0.0974	0.04	0.01	mg/L	0.10		97	90-110		
Matrix Spike (BJ42405-MS1)					Source: 1410747-01		Prepared & Analyzed: 10/24/14 10:56			
Nitrite (as N)	0.161 J2	0.04	0.01	mg/L	0.10	0.0990	62	77-119		
Matrix Spike (BJ42405-MS2)					Source: 1410752-07		Prepared & Analyzed: 10/24/14 11:01			
Nitrite (as N)	0.0905	0.04	0.01	mg/L	0.10	ND	90	77-119		
Matrix Spike (BJ42405-MS3)					Source: 1410752-10		Prepared & Analyzed: 10/24/14 11:08			
Nitrite (as N)	0.112	0.04	0.01	mg/L	0.10	0.0356	77	77-119		
Matrix Spike Dup (BJ42405-MSD1)					Source: 1410747-01		Prepared & Analyzed: 10/24/14 10:56			
Nitrite (as N)	0.162 J2	0.04	0.01	mg/L	0.10	0.0990	63	77-119	0.5	20
Matrix Spike Dup (BJ42405-MSD2)					Source: 1410752-07		Prepared & Analyzed: 10/24/14 11:02			
Nitrite (as N)	0.0926	0.04	0.01	mg/L	0.10	ND	93	77-119	2	20
Matrix Spike Dup (BJ42405-MSD3)					Source: 1410752-10		Prepared & Analyzed: 10/24/14 11:09			
Nitrite (as N)	0.117	0.04	0.01	mg/L	0.10	0.0356	82	77-119	4	20
Batch BJ42411 - VSS Prep										
Blank (BJ42411-BLK1)					Prepared: 10/24/14 Analyzed: 10/27/14 15:54					
Volatile Suspended Solids	1 U	1		mg/L						
Total Suspended Solids	1 U	1	1	mg/L						

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November 12, 2014
Work Order: 1410747

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ42411 - VSS Prep										
LCS (BJ42411-BS1)					Prepared: 10/24/14 Analyzed: 10/27/14 15:54					
Total Suspended Solids	49.0	1	1	mg/L	50		98	85-115		
Duplicate (BJ42411-DUP1)					Source: 1410747-01		Prepared: 10/24/14 Analyzed: 10/27/14 15:54			
Total Suspended Solids	41.0	1	1	mg/L		45.0			9	30
Volatile Suspended Solids	30.0 J3	1		mg/L		44.0			38	20
Batch BJ42416 - Nitrate 353.2 by seal										
Blank (BJ42416-BLK1)					Prepared & Analyzed: 10/24/14 12:08					
Nitrate+Nitrite (N)	0.01 U	0.04	0.01	mg/L						
LCS (BJ42416-BS1)					Prepared & Analyzed: 10/24/14 12:10					
Nitrate+Nitrite (N)	0.797	0.04	0.01	mg/L	0.80		100	90-110		
Matrix Spike (BJ42416-MS1)					Source: 1410747-03		Prepared & Analyzed: 10/24/14 15:17			
Nitrate+Nitrite (N)	49.2 L2	4.8	1.2	mg/L	1.0	55.0	NR	90-110		
Matrix Spike (BJ42416-MS2)					Source: 1410747-06		Prepared & Analyzed: 10/24/14 14:11			
Nitrate+Nitrite (N)	12.6 L2	0.96	0.24	mg/L	1.0	12.8	NR	90-110		
Matrix Spike Dup (BJ42416-MSD1)					Source: 1410747-03		Prepared & Analyzed: 10/24/14 15:18			
Nitrate+Nitrite (N)	50.5 L2	4.8	1.2	mg/L	1.0	55.0	NR	90-110	3	20
Matrix Spike Dup (BJ42416-MSD2)					Source: 1410747-06		Prepared & Analyzed: 10/24/14 14:12			
Nitrate+Nitrite (N)	12.4 L2	0.96	0.24	mg/L	1.0	12.8	NR	90-110	1	20

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November 12, 2014
Work Order: 1410747

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ42421 - BOD										
Blank (BJ42421-BLK1)					Prepared: 10/24/14 Analyzed: 10/29/14 13:49					
Carbonaceous BOD	2 U	2	2	mg/L						
Blank (BJ42421-BLK2)					Prepared: 10/24/14 Analyzed: 10/29/14 13:49					
Carbonaceous BOD	2 U	2	2	mg/L						
LCS (BJ42421-BS1)					Prepared: 10/24/14 Analyzed: 10/29/14 13:49					
Carbonaceous BOD	201	2	2	mg/L	200		101	85-115		
LCS (BJ42421-BS2)					Prepared: 10/24/14 Analyzed: 10/29/14 13:49					
Carbonaceous BOD	217	2	2	mg/L	200		109	85-115		
LCS Dup (BJ42421-BSD1)					Prepared: 10/24/14 Analyzed: 10/29/14 13:49					
Carbonaceous BOD	195	2	2	mg/L	200		97	85-115	3	200
LCS Dup (BJ42421-BSD2)					Prepared: 10/24/14 Analyzed: 10/29/14 13:49					
Carbonaceous BOD	206	2	2	mg/L	200		103	85-115	5	200
Duplicate (BJ42421-DUP1)					Source: 1410747-01 Prepared: 10/24/14 Analyzed: 10/29/14 13:49					
Carbonaceous BOD	92	2	2	mg/L		110			15	25
Duplicate (BJ42421-DUP2)					Source: 1411489-01 Prepared: 10/24/14 Analyzed: 10/29/14 13:49					
Carbonaceous BOD	200	2	2	mg/L		200			0	25
Batch BJ42422 - Ammonia by SEAL										
Blank (BJ42422-BLK1)					Prepared & Analyzed: 10/24/14 15:05					
Ammonia as N	0.009 U	0.040	0.009	mg/L						

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November 12, 2014
Work Order: 1410747

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ42422 - Ammonia by SEAL										
LCS (BJ42422-BS1)					Prepared & Analyzed: 10/24/14 15:07					
Ammonia as N	0.48	0.040	0.009	mg/L	0.50		95	90-110		
Matrix Spike (BJ42422-MS1)					Source: 1410747-01 Prepared & Analyzed: 10/24/14 16:17					
Ammonia as N	2.7 L2	0.40	0.095	mg/L	0.50	66	NR	90-110		
Matrix Spike (BJ42422-MS2)					Source: 1410752-08 Prepared & Analyzed: 10/24/14 15:22					
Ammonia as N	0.49	0.040	0.009	mg/L	0.50	0.038	91	90-110		
Matrix Spike Dup (BJ42422-MSD1)					Source: 1410747-01 Prepared & Analyzed: 10/24/14 16:19					
Ammonia as N	2.8 L2	0.40	0.095	mg/L	0.50	66	NR	90-110	3	10
Matrix Spike Dup (BJ42422-MSD2)					Source: 1410752-08 Prepared & Analyzed: 10/24/14 15:24					
Ammonia as N	0.52	0.040	0.009	mg/L	0.50	0.038	96	90-110	4	10
Batch BJ42439 - alkalinity										
Blank (BJ42439-BLK1)					Prepared & Analyzed: 10/27/14 11:24					
Total Alkalinity	2.0 U	8.0	2.0	mg/L						
Blank (BJ42439-BLK2)					Prepared & Analyzed: 10/27/14 11:27					
Total Alkalinity	2.0 U	8.0	2.0	mg/L						
LCS (BJ42439-BS1)					Prepared & Analyzed: 10/27/14 11:36					
Total Alkalinity	130	8.0	2.0	mg/L	120		107	90-110		
LCS (BJ42439-BS2)					Prepared & Analyzed: 10/27/14 11:42					
Total Alkalinity	140	8.0	2.0	mg/L	120		109	90-110		

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November 12, 2014
Work Order: 1410747

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ42439 - alkalinity										
Matrix Spike (BJ42439-MS1)		Source: 1410747-10			Prepared & Analyzed: 10/27/14 12:52					
Total Alkalinity	130	8.0	2.0	mg/L	120	2.9	103	80-120		
Matrix Spike (BJ42439-MS2)		Source: 1410752-27			Prepared & Analyzed: 10/27/14 15:20					
Total Alkalinity	140	8.0	2.0	mg/L	120	ND	110	80-120		
Matrix Spike Dup (BJ42439-MSD1)		Source: 1410747-10			Prepared & Analyzed: 10/27/14 12:57					
Total Alkalinity	140	8.0	2.0	mg/L	120	2.9	106	80-120	3	26
Matrix Spike Dup (BJ42439-MSD2)		Source: 1410752-27			Prepared & Analyzed: 10/27/14 15:26					
Total Alkalinity	140	8.0	2.0	mg/L	120	ND	110	80-120	0.5	26
Batch BJ42819 - TOC prep										
Blank (BJ42819-BLK1)		Prepared & Analyzed: 10/29/14 15:58								
Total Organic Carbon	0.060 U	1.0	0.060	mg/L						
LCS (BJ42819-BS1)		Prepared & Analyzed: 10/29/14 15:58								
Total Organic Carbon	9.54	1.0	0.060	mg/L	10		95	90-110		
Matrix Spike (BJ42819-MS1)		Source: 1411420-01			Prepared & Analyzed: 10/29/14 15:58					
Total Organic Carbon	10.3	1.0	0.060	mg/L	10	ND	103	85-115		
Matrix Spike Dup (BJ42819-MSD1)		Source: 1411420-01			Prepared & Analyzed: 10/29/14 15:58					
Total Organic Carbon	10.2	1.0	0.060	mg/L	10	ND	102	85-115	0.8	10
Batch BJ42825 - Sulfide prep										
Blank (BJ42825-BLK1)		Prepared & Analyzed: 10/28/14 16:22								
Sulfide	0.10 U	0.40	0.10	mg/L						

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November 12, 2014
Work Order: 1410747

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ42825 - Sulfide prep										
Blank (BJ42825-BLK2)					Prepared & Analyzed: 10/28/14 16:22					
Sulfide	0.10 U	0.40	0.10	mg/L						
LCS (BJ42825-BS1)					Prepared & Analyzed: 10/28/14 16:22					
Sulfide	5.21	0.40	0.10	mg/L	5.0		104	85-115		
LCS (BJ42825-BS2)					Prepared & Analyzed: 10/28/14 16:22					
Sulfide	5.21	0.40	0.10	mg/L	5.0		104	85-115		
Matrix Spike (BJ42825-MS1)					Source: 1410747-10		Prepared & Analyzed: 10/28/14 16:22			
Sulfide	5.21	0.40	0.10	mg/L	5.0	ND	104	85-115		
Matrix Spike (BJ42825-MS2)					Source: 1410748-10		Prepared & Analyzed: 10/28/14 16:22			
Sulfide	5.21	0.40	0.10	mg/L	5.0	ND	104	85-115		
Matrix Spike Dup (BJ42825-MSD1)					Source: 1410747-10		Prepared & Analyzed: 10/28/14 16:22			
Sulfide	5.01	0.40	0.10	mg/L	5.0	ND	100	85-115	4	14
Matrix Spike Dup (BJ42825-MSD2)					Source: 1410748-10		Prepared & Analyzed: 10/28/14 16:22			
Sulfide	4.81	0.40	0.10	mg/L	5.0	ND	96	85-115	8	14
Batch BJ42925 - Ion Chromatography 300.0 Prep										
Blank (BJ42925-BLK1)					Prepared & Analyzed: 10/29/14 17:14					
Sulfate	0.20 U	0.60	0.20	mg/L						
Surrogate: Dichloroacetate	0.814			mg/L	1.0		81	78-120		
LCS (BJ42925-BS1)					Prepared & Analyzed: 10/29/14 17:27					
Sulfate	9.13	0.60	0.20	mg/L	9.0		101	85-115		
Surrogate: Dichloroacetate	0.981			mg/L	1.0		98	78-120		

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November 12, 2014
Work Order: 1410747

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ42925 - Ion Chromatography 300.0 Prep										
LCS (BJ42925-BS2)					Prepared & Analyzed: 10/29/14 17:55					
Sulfate	9.25	0.60	0.20	mg/L	9.0		103	85-115		
Surrogate: Dichloroacetate	1.03			mg/L	1.0		103	78-120		
LCS (BJ42925-BS3)					Prepared & Analyzed: 10/29/14 18:08					
Sulfate	9.24	0.60	0.20	mg/L	9.0		103	85-115		
Surrogate: Dichloroacetate	1.01			mg/L	1.0		101	78-120		
LCS (BJ42925-BS4)					Prepared & Analyzed: 10/29/14 18:22					
Sulfate	9.24	0.60	0.20	mg/L	9.0		103	85-115		
Surrogate: Dichloroacetate	0.988			mg/L	1.0		99	78-120		
LCS (BJ42925-BS5)					Prepared & Analyzed: 10/29/14 18:36					
Sulfate	9.21	0.60	0.20	mg/L	9.0		102	85-115		
Surrogate: Dichloroacetate	1.03			mg/L	1.0		103	78-120		
LCS Dup (BJ42925-BSD1)					Prepared & Analyzed: 10/29/14 17:41					
Sulfate	9.08	0.60	0.20	mg/L	9.0		101	85-115	0.5	200
Surrogate: Dichloroacetate	1.02			mg/L	1.0		102	78-120		
Matrix Spike (BJ42925-MS1)					Source: 1411389-02		Prepared & Analyzed: 10/29/14 21:32			
Sulfate	10,900	600	200	mg/L	9000	1820	100	85-115		
Surrogate: Dichloroacetate	1.01			mg/L	1.0		101	78-120		
Matrix Spike (BJ42925-MS2)					Source: 1410747-06		Prepared & Analyzed: 10/30/14 12:23			
Sulfate	109	6.0	2.0	mg/L	90	20.4	98	85-115		
Surrogate: Dichloroacetate	1.10			mg/L	1.0		110	78-120		

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November 12, 2014
Work Order: 1410747

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ43022 - COD prep										
Blank (BJ43022-BLK1)					Prepared & Analyzed: 10/30/14 14:30					
Chemical Oxygen Demand	10 U	25	10	mg/L						
Blank (BJ43022-BLK2)					Prepared & Analyzed: 10/30/14 14:30					
Chemical Oxygen Demand	10 U	25	10	mg/L						
LCS (BJ43022-BS1)					Prepared & Analyzed: 10/30/14 14:30					
Chemical Oxygen Demand	47	25	10	mg/L	50		94	90-110		
LCS (BJ43022-BS2)					Prepared & Analyzed: 10/30/14 14:30					
Chemical Oxygen Demand	45	25	10	mg/L	50		90	90-110		
Matrix Spike (BJ43022-MS1)					Source: 1410747-10 Prepared & Analyzed: 10/30/14 14:30					
Chemical Oxygen Demand	50	25	10	mg/L	50	ND	100	85-115		
Matrix Spike (BJ43022-MS2)					Source: 1410748-10 Prepared & Analyzed: 10/30/14 14:30					
Chemical Oxygen Demand	54	25	10	mg/L	50	ND	108	85-115		
Matrix Spike Dup (BJ43022-MSD1)					Source: 1410747-10 Prepared & Analyzed: 10/30/14 14:30					
Chemical Oxygen Demand	52	25	10	mg/L	50	ND	104	85-115	4	32
Matrix Spike Dup (BJ43022-MSD2)					Source: 1410748-10 Prepared & Analyzed: 10/30/14 14:30					
Chemical Oxygen Demand	50	25	10	mg/L	50	ND	100	85-115	8	32
Batch BJ43023 - Ion Chromatography 300.0 Prep										
Blank (BJ43023-BLK1)					Prepared & Analyzed: 10/30/14 17:07					
Sulfate	0.20 U	0.60	0.20	mg/L						
Surrogate: Dichloroacetate	0.929			mg/L	1.0		93	78-120		

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November 12, 2014
Work Order: 1410747

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ43023 - Ion Chromatography 300.0 Prep										
LCS (BJ43023-BS1)					Prepared & Analyzed: 10/30/14 17:19					
Sulfate	9.60	0.60	0.20	mg/L	9.0		107	85-115		
Surrogate: Dichloroacetate	1.04			mg/L	1.0		104	78-120		
LCS Dup (BJ43023-BSD1)					Prepared & Analyzed: 10/30/14 17:30					
Sulfate	9.55	0.60	0.20	mg/L	9.0		106	85-115	0.6	200
Surrogate: Dichloroacetate	1.03			mg/L	1.0		103	78-120		
Matrix Spike (BJ43023-MS1)					Source: 1411273-04		Prepared & Analyzed: 10/30/14 20:07			
Sulfate	9.73	0.60	0.20	mg/L	9.0	0.930	98	85-115		
Surrogate: Dichloroacetate	0.980			mg/L	1.0		98	78-120		
Matrix Spike (BJ43023-MS2)					Source: 1410747-09		Prepared & Analyzed: 10/30/14 22:11			
Sulfate	167	6.0	2.0	mg/L	90	70.8	107	85-115		
Surrogate: Dichloroacetate	1.06			mg/L	1.0		106	78-120		

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November 12, 2014
Work Order: 1410747

Inorganic, Dissolved - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ42405 - Nitrite SM 4500NO2-B by seal										
Blank (BJ42405-BLK1)					Prepared & Analyzed: 10/24/14 10:54					
Nitrite (as N)	0.01 U	0.04	0.01	mg/L						
Blank (BJ42405-BLK2)					Prepared & Analyzed: 10/24/14 16:09					
Nitrite (as N)	0.01 U	0.04	0.01	mg/L						
LCS (BJ42405-BS1)					Prepared & Analyzed: 10/24/14 10:55					
Nitrite (as N)	0.0774	0.04	0.01	mg/L	0.080		97	90-110		
LCS (BJ42405-BS2)					Prepared & Analyzed: 10/24/14 16:39					
Nitrite (as N)	0.0974	0.04	0.01	mg/L	0.10		97	90-110		
Matrix Spike (BJ42405-MS1)					Source: 1410747-01 Prepared & Analyzed: 10/24/14 10:56					
Nitrite (as N)	0.0905 J2	0.04	0.01	mg/L	0.10	0.0990	NR	77-119		
Matrix Spike (BJ42405-MS2)					Source: 1410752-07 Prepared & Analyzed: 10/24/14 11:01					
Nitrite (as N)	0.0905	0.04	0.01	mg/L	0.10	ND	90	77-119		
Matrix Spike (BJ42405-MS3)					Source: 1410752-10 Prepared & Analyzed: 10/24/14 11:08					
Nitrite (as N)	0.112	0.04	0.01	mg/L	0.10	0.0356	77	77-119		
Matrix Spike Dup (BJ42405-MSD1)					Source: 1410747-01 Prepared & Analyzed: 10/24/14 10:56					
Nitrite (as N)	0.162 J2	0.04	0.01	mg/L	0.10	0.0990	63	77-119	57	20
Matrix Spike Dup (BJ42405-MSD2)					Source: 1410752-07 Prepared & Analyzed: 10/24/14 11:02					
Nitrite (as N)	0.0926	0.04	0.01	mg/L	0.10	ND	93	77-119	2	20
Matrix Spike Dup (BJ42405-MSD3)					Source: 1410752-10 Prepared & Analyzed: 10/24/14 11:09					
Nitrite (as N)	0.117	0.04	0.01	mg/L	0.10	0.0356	82	77-119	4	20

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November 12, 2014
Work Order: 1410747

Inorganic, Dissolved - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ42416 - Nitrate 353.2 by seal										
Blank (BJ42416-BLK1)					Prepared & Analyzed: 10/24/14 12:08					
Nitrate+Nitrite (N)	0.01 U	0.04	0.01	mg/L						
LCS (BJ42416-BS1)					Prepared & Analyzed: 10/24/14 12:10					
Nitrate+Nitrite (N)	0.797	0.04	0.01	mg/L	0.80		100	90-110		
Matrix Spike (BJ42416-MS1)					Source: 1410747-03 Prepared & Analyzed: 10/24/14 15:17					
Nitrate+Nitrite (N)	49.2 L2	4.8	1.2	mg/L	1.0	55.0	NR	80-120		
Matrix Spike (BJ42416-MS2)					Source: 1410747-06 Prepared & Analyzed: 10/24/14 14:11					
Nitrate+Nitrite (N)	12.6 L2	0.96	0.24	mg/L	1.0	12.8	NR	80-120		
Matrix Spike Dup (BJ42416-MSD1)					Source: 1410747-03 Prepared & Analyzed: 10/24/14 15:18					
Nitrate+Nitrite (N)	50.5 L2	4.8	1.2	mg/L	1.0	55.0	NR	80-120	3	20
Matrix Spike Dup (BJ42416-MSD2)					Source: 1410747-06 Prepared & Analyzed: 10/24/14 14:12					
Nitrate+Nitrite (N)	12.4 L2	0.96	0.24	mg/L	1.0	12.8	NR	80-120	1	20
Batch BJ42420 - BOD Dissolved										
Blank (BJ42420-BLK1)					Prepared: 10/24/14 Analyzed: 10/29/14 13:47					
Carbonaceous BOD	2 U	2	2	mg/L						
LCS (BJ42420-BS1)					Prepared: 10/24/14 Analyzed: 10/29/14 13:47					
Carbonaceous BOD	201	2	2	mg/L	200		101	85-115		
LCS Dup (BJ42420-BSD1)					Prepared: 10/24/14 Analyzed: 10/29/14 13:47					
Carbonaceous BOD	194	2	2	mg/L	200		97	85-115	4	200

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November 12, 2014
Work Order: 1410747

Inorganic, Dissolved - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ42420 - BOD Dissolved										
Duplicate (BJ42420-DUP1)		Source: 1410747-02			Prepared: 10/24/14 Analyzed: 10/29/14 13:47					
Carbonaceous BOD	84	2	2	mg/L		87			4	25
Batch BJ42906 - Digestion for TP and TKN										
Blank (BJ42906-BLK1)		Prepared & Analyzed: 10/29/14 17:16								
Total Kjeldahl Nitrogen	0.050 U	0.20	0.050	mg/L						
LCS (BJ42906-BS1)		Prepared & Analyzed: 10/29/14 17:16								
Total Kjeldahl Nitrogen	1.06	0.20	0.050	mg/L	1.0		106	90-110		
Matrix Spike (BJ42906-MS1)		Source: 1410747-07			Prepared & Analyzed: 10/29/14 17:16					
Total Kjeldahl Nitrogen	4.72	0.20	0.050	mg/L	1.0	3.65	107	90-110		
Matrix Spike Dup (BJ42906-MSD1)		Source: 1410747-07			Prepared & Analyzed: 10/29/14 17:16					
Total Kjeldahl Nitrogen	4.63	0.20	0.050	mg/L	1.0	3.65	98	90-110	2	20
Batch BJ42924 - Ammonia by SEAL										
Blank (BJ42924-BLK1)		Prepared & Analyzed: 10/31/14 10:16								
Ammonia as N	0.009 U	0.040	0.009	mg/L						
LCS (BJ42924-BS1)		Prepared & Analyzed: 10/31/14 10:17								
Ammonia as N	0.47	0.040	0.009	mg/L	0.50		93	90-110		
Matrix Spike (BJ42924-MS1)		Source: 1410919-08			Prepared & Analyzed: 10/31/14 10:19					
Ammonia as N	0.47 J2	0.040	0.009	mg/L	0.50	ND	94	90-110		

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November 12, 2014
Work Order: 1410747

Inorganic, Dissolved - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ42924 - Ammonia by SEAL										
Matrix Spike (BJ42924-MS2)		Source: 1410919-13			Prepared & Analyzed: 10/31/14 10:31					
Ammonia as N	0.51	0.040	0.009	mg/L	0.50	0.018	98	90-110		
Matrix Spike Dup (BJ42924-MSD1)		Source: 1410919-08			Prepared & Analyzed: 10/31/14 10:21					
Ammonia as N	0.44 J2	0.040	0.009	mg/L	0.50	ND	88	90-110	7	10
Matrix Spike Dup (BJ42924-MSD2)		Source: 1410919-13			Prepared & Analyzed: 10/31/14 13:58					
Ammonia as N	0.51	0.040	0.009	mg/L	0.50	0.018	98	90-110	0.4	10

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November 12, 2014
Work Order: 1410747

Microbiology - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BJ42339 - FC-MF										
Blank (BJ42339-BLK1)					Prepared: 10/23/14 Analyzed: 10/24/14 14:22					
Fecal Coliforms	1 U	1	1	CFU/100 ml						
Duplicate (BJ42339-DUP1)					Source: 1410752-27 Prepared: 10/23/14 Analyzed: 10/24/14 14:22					
Fecal Coliforms	1 U	1	1	CFU/100 ml		ND				200
Duplicate (BJ42339-DUP2)					Source: 1410747-10 Prepared: 10/23/14 Analyzed: 10/24/14 14:22					
Fecal Coliforms	1 U	1	1	CFU/100 ml		ND				200

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November 12, 2014
Work Order: 1410747

* 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.

- V Analyte was detected in both the sample and the associated method blank.
- L2 Analyte level in sample invalidated Matrix Spike.
- J3 Quality control value for precision was outside control limits.
- J2 Quality control value for accuracy was outside control limits.

Questions regarding this report should be directed to :

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Kathryn@southernanalyticalabs.com



Client Name Hazen and Sawyer										Contact / Phone:											
Project Name / Location B-HS4 SE#11																					
Samplers: (Signature) <i>[Signature]</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>																					
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	40mL aV, HCl TOC	500mLP, Cool Lab Filter (CBOD, TKN, NH ₃ , NOx)	500mLP, Cool Lab Filter (CBOD, TKN, NH ₃ , NOx, SO ₄)					pH	Temperature	Conductivity	DO
01	BHS4-STE	10/23/14	9:20	WW		X	4	2	1	1	2							6.77	24.53	1278	0.08
02	BHS4-STE-FILTERED		9:20	WW		X						1						6.77	24.53	1278	0.08
03	BHS4-ST1		8:55	WW		X	4	2	1	1	2							7.31	25.4	1317	4.14
04	BHS4-ST1-DUP		9:00	WW		X	4	2	1		2							7.21	25.4	1317	4.14
05	BHS4-ST1-FILTERED		8:55	WW		X						1						7.21	25.4	1317	4.14
06	BSH4-LIGNO-0		8:54	WW		X	4	2	1	1	2							6.54	25.73	1149	1.57
07	BSH4-LIGNO-0-FILTERED		8:54	WW		X						1						6.54	25.73	1149	1.57
08	BHS4-ST2		8:52	WW		X	4	2	1	1	2							6.58	24.88	1200	0.29
09	BHS4-ST2-FILTERED		8:52	WW		X							1					6.58	24.88	1200	0.29
10	BHS4-EB <i>FB (field blank)</i>		9:45	R		X	4	2	1	1	2							6.27	20.3	2.03	8.39

Containers Prepared/ Relinquished: <i>[Signature]</i>	Date/Time: 100614	Received: <i>[Signature]</i>	Date/Time: 100814 12:00	Seal intact? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Samples intact upon arrival? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Received on ice? Temp _____ <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Proper preservatives indicated? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Rec'd w/in holding time? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Volatiles rec'd w/out headspace? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Proper containers used? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N	Instructions / Remarks:
Relinquished: <i>[Signature]</i>	Date/Time: 102314	Received: <i>[Signature]</i>	Date/Time: 10-23-14 1300		
Relinquished: <i>[Signature]</i>	Date/Time: 10-23-14	Received: <i>[Signature]</i>	Date/Time: 10/23/14 1458		
Relinquished:	Date/Time:	Received:	Date/Time:		
Relinquished:	Date/Time:	Received:	Date/Time:		



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	Site visit. System ok.
7/23/2013	Construction - sod installation
7/29/2013	Preliminary sampling event
8/6/2013	Site visit.
	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	Site visit. System ok.
9/30/2013	Sample Event No. 1
11/8/2013	Site visit. System ok.
11/27/2013	Site visit. System ok.
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	Site visit. System ok. No ponding in all 4 drainfield observation ports
1/23/2014	Site visit.

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Date	Description
1/23/2014	Ponding near Stage 1 d-box, adjusted pipe and raked media
	No ponding in all 4 drainfield observation ports
1/31/2014	Site visit.
	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	Site visit. System ok. No visible ponding in Stage 1 biofilter.
3/14/2014	Site visit. System ok. 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.
4/25/2014	Site visit. System ok.
	Installed piezometer in Stage 1 biofilter to monitor water level.
	Leveled Stage 1 biofilter distribution pipes
	Adjusted weirs inside Stage 1 d-box
4/29/2014	Site visit. System ok.
	Installed third Stage 1 distribution pipe along centerline of biofilter
5/19/2014	Septic tank effluent screen severely clogged.
	Cleaned STE effluent screen
	Also cleared clog within ball valve from lift station
5/29/2014	Sample Event No. 9
	No ponding in all 4 drainfield observation ports
	No visible ponding in Stage 1 biofilter.
6/9/2014	Re-sampled B-HS4-ST2 for toxicity testing.
	Measured lift station dose runtime
7/11/2014	Site visit.

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Date	Description
7/11/2014	STE effluent screen severely clogged again.
	Cleaned STE effluent screen
7/29/2014	Site visit. System ok.
	Cleaned STE effluent screen, it was not severely clogged.
	Black biomat present in Stage 1
8/22/2014	Sample Event No. 10
	Cleaned STE effluent screen, it was not severely clogged.
	Repositioned Stage 1 center distribution pipe.
	Stage 1 center distribution pipe seal in d-box needs to be replaced.
	No ponding in all 4 drainfield observation ports
9/19/2014	Site visit. System ok.
	Cleaned STE effluent screen.
	Black biomat present in Stage 1
10/23/2014	Sample Event No. 11
	Cleaned STE effluent screen, it was not severely clogged.
	No ponding in all 4 drainfield observation ports