FLORIDA DEPARTMENT OF HEALTH

Florida Onsite Sewage Nitrogen Reduction Strategies Study

Task A.25

PNRS II Test Facility Sample Event Report No. 3

Progress Report

November 2010

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In association with

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AET
Applied Environmental Technology

OTIS ENVIRONMENTAL CONSULTANTS, LLC

Florida Onsite Sewage Nitrogen Reduction Strategies Study

TASK A.25
PROGRESS REPORT

PNRS II Test Facility
Sample Event Report No. 3

Prepared for:

Florida Department of Health
Division of Environmental Health
Bureau of Onsite Sewage Programs
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1.0 Background

Task A of the Florida Onsite Sewage Nitrogen Reduction Strategies Study includes the evaluation of passive treatment systems to remove nitrogen from septic tank effluent. The Passive Nitrogen Removal Study II (PNRS II) is a follow-up to the previous experimental evaluations of passive nitrogen removal technologies conducted in Passive Nitrogen Removal Study I. The objective of the PNRS II study is to extend and expand into field pilot testing the two-stage biofiltration process that was initiated in PNRS I. A unique test facility was constructed for the purpose of this evaluation. The Task A.15 PNRS II Quality Assurance Project Plan (QAPP) documents the objectives, experimental biofiltration systems, monitoring framework, sample frequency and duration, and analytical methods to be used at the PNRS II Test Facility.

2.0 Purpose

This sample event report documents data collected from the third PNRS II monitoring and sampling event which was conducted November 10, 2010. This monitoring event consisted of an assessment and evaluation of PNRS II operation, measurement of flowrates for all systems, measurement of field parameters, and collection of biofilter influent and effluent samples and their analyses in a NELAC certified laboratory.

3.0 Materials and Methods

3.1 Project Site

The PNRS II Test Facility is located at the University of Florida Gulf Coast Research and Education Center (GCREC) in southeast Hillsborough County, Florida. The specially designed facility enables the simultaneous operation and performance testing of numerous biofilter treatment trains in parallel using the same wastewater source. The source of the influent wastewater is the septic tank effluent from the existing onsite wastewater system serving the GCREC. Details of the design and construction of the PNRS II test facility were presented previously in Task A.17, A.18, A.19, and A.24 documents.

3.2 Monitoring and Sampling Locations and Identification

A schematic of the PNRS II test facility is shown in Figure 1. Septic tank effluent (STE) from GCREC is pumped from PNRS II-STE-T1 into the PNRS II systems through four points of entry: Hydro-1, Hydro-2, UNSAT-IS-1, and UNSAT-IS3. PNRS II biofilters are grouped into the four types of systems shown in Figure 1. The nomenclature and reactor/sample identification used for the PNRS II test facility sampling events are listed in Table 1. The sample designations listed in Table 1 also largely correspond to the locations at which flow volumes are measured in each sample event.

The previously submitted Data Summary Report No. 2 recommended several modifications to address performance issues with the test systems. Modifications that were implemented before this sample event include:

- The unsaturated single pass biofilter with polystyrene media (UNSAT-PS1) was re-configured to a recirculation biofilter.
- A fifth recirculation tank (RC5) was installed upstream of UNSAT-PS1.
- A pump tank (P15-T) was installed downstream of UNSAT-PS1 to feed UNSAT-LS4.
- The media within upflow denitrification biofilter (DENIT-LS2) was revised to be a mixture of 25% lignocellulosic and 75% expanded clay media.
- The sodium sesquicarbonate supplied as an alkalinity supplement in one upflow denitrification biofilter (DENIT-SU4) and one horizontal denitrification biofilter (DENIT-SU2) was replaced with limestone. The media composition in both biofilters was modified to 30% elemental sulfur, 10% limestone, and 60% expanded clay.
- Two additional in-situ simulators containing vertically stacked media layers were constructed to evaluate alternative media designs. UNSAT-IS3 will receive STE and UNSAT-IS4 will receive nitrified STE. The media configuration of UNSAT-IS3 from top to bottom is: 3 in. coarse sand, 9 in. filter sand, 10 in. mixed lignocellulosic media and expanded clay, 2 in. pea gravel, 3 in. elemental sulfur, and 2 in. gravel as underdrain. The media configuration of UNSAT-IS4 from top to bottom is: 12 in. filter sand, 10 in. mixed lignocellulosic media and expanded clay, 2 in. pea gravel, 3 in. elemental sulfur, and 2 in. gravel as underdrain.
- Additional and revised sample locations are included in Table 1 and Figure 1.

Table 1
PNRS II Sample Identification

Group (Figure 1)	Sample Location	Sample Identification
	STE PNRS II Storage Tank 1	PNRS II-STE-T1
I	Stage 1 Single Pass Biofilters	UNSAT-EC1
		UNSAT-EC3
		UNSAT-CL1
		UNSAT-CL3
	Stage 2 Single Pass Upflow Biofilters	DENIT-SU4
		DENIT-LS3
		DENIT-SU3
		DENIT-LS2
		DENIT-LS4
II	Recirculation Tanks	RC1
		RC2
		RC3
		RC4
		RC5
	Stage 1 Recirculating Biofilters	UNSAT-SA2
		UNSAT-EC4
		UNSAT-CL2
		UNSAT-CL4
		UNSAT-PS1
	Pump 15 Tank	P15-T
III	Denite Feed Collection Tank	DFT
	Stage 2 Horizontal Biofilters	UNSAT-SU1
		UNSAT-SU2
		UNSAT-LS1
		UNSAT-GL1
IV	In-Situ In-Tank Simulator Single Pass Biofilter	UNSAT-IS1
		UNSAT-IS2
		UNSAT-IS3
		UNSAT-IS4

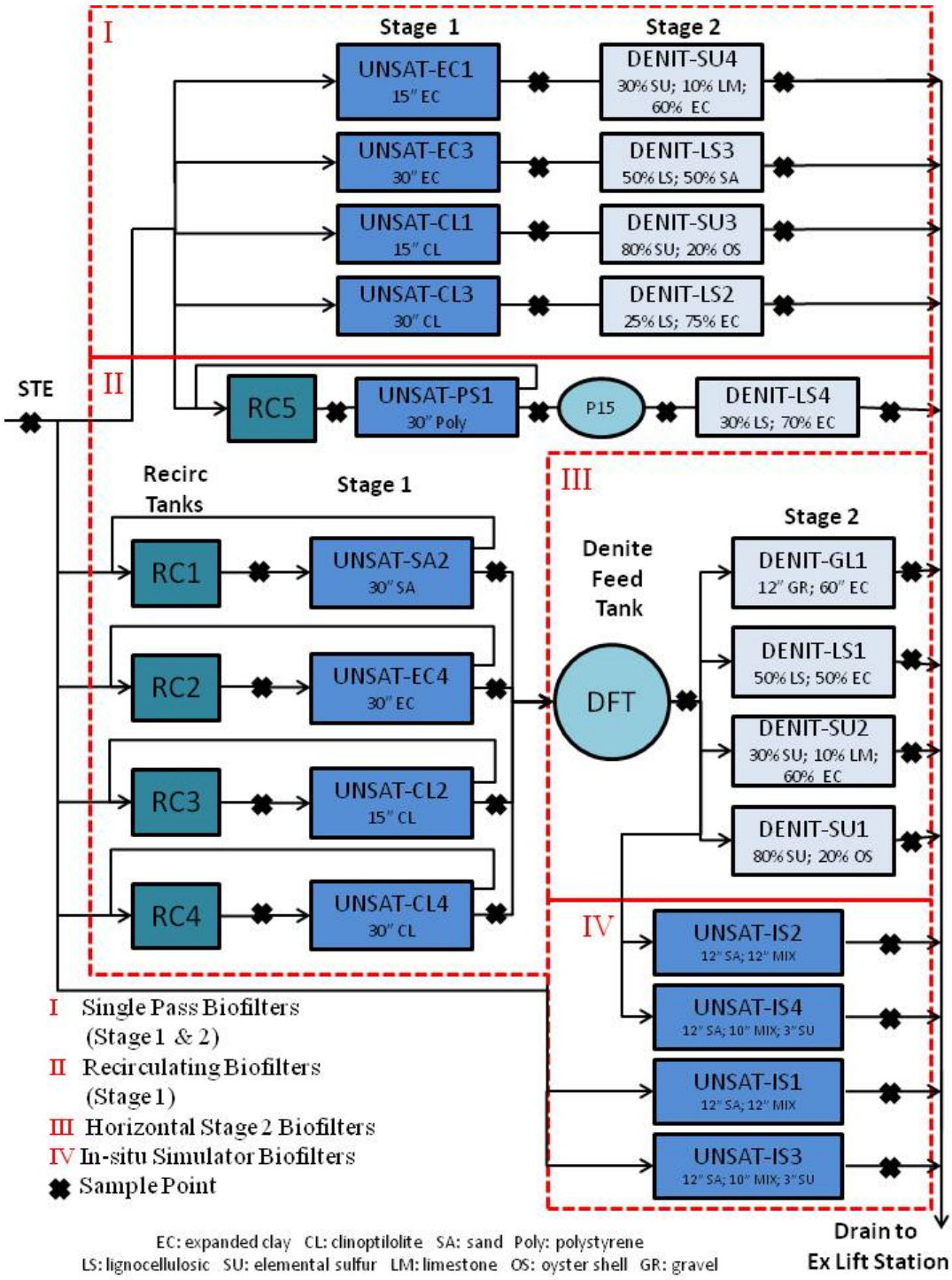

Figure 1
PNRS II Test Facility System Schematic

3.3 Operational Monitoring

Start-up of the PNRS II test facility occurred on May 17th, 2010 and all systems have operated continually since that time. The entire facility operation is checked at least once per week and a detailed log of operational observations and activities is maintained. In addition, the programmable logic controller (PLC) which controls many of the dosing and pump controls also records pump run times and flow data from flow meters at the facility, and these data can provide useful insight into facility operations. Appendix A provides summary tables of the PLC recorded data of daily runtimes and flows for the test facility between September 1st and November 9th (Day 107 through Day 176 since start-up) used to check general pump operation and performance.

3.4 Water Quality Sample Collection and Analyses

Influent and effluent water quality samples from the PNRS II test systems for Sample Event 3 were collected November 10, 2010. A sample of STE was collected from the feed line connecting STE Storage Tank 1 (PNRS II-STE-T1) to Hydrosplitter 1 which supplies STE to the single pass Stage 1 biofilters (Figure 1). A manual dose event was initiated on the control panel until sufficient STE sample volume was collected in a clean sample container. Stage 1, 2, and in-situ simulator biofilter and recirculation tank effluents were each sampled by directing the entire flow from the biofilter into a large, clean sample container over a period of time sufficient to obtain the desired sample volume (approximately 3.5 liters). Sample containers were immediately placed in coolers on ice prior to subdivision of the composited sample.

The composite samples in the 3.5 liter sample containers were then subdivided into analysis-specific sample containers. 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 laboratory. 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 D, were used to document the transfer of samples from field personnel to the analytical laboratory. One chain of custody form was filled out for each set of samples and placed inside the cooler.

Equipment blank, field blank, and field sample duplicates were taken. The equipment blank was collected using a previously cleaned STE sample collection bottle. The bottle was filled with distilled water provided by the laboratory and allowed to sit for eight minutes. The sample containers were then analyzed for the same parameters as the samples. The field blank was collected by filling sample containers with distilled water that had been transported from the laboratory into the field along with other sample contain-

ers. The field sample duplicate was collected immediately subsequent to the regular STE sample. The duplicate sample containers were filled with PNRS II T1-STE effluent.

Field parameters were measured using portable electronic probes and included temperature (Temp), dissolved oxygen (DO), oxidation-reduction potential (ORP), pH, and specific conductance. Temperature (Temp), dissolved oxygen (DO), and oxidation-reduction potential (ORP) were measured with probe tips placed in flow through samplers located directly in the outlet pipe at each sample location. Specific conductance and pH were measured using external sample collection reservoirs. Field parameter results are listed in Appendix B. The influent and effluent samples were analyzed by the laboratory for: total alkalinity, total Kjeldahl nitrogen (TKN-N), ammonia nitrogen (NH_3-N), nitrate/nitrite nitrogen (NO_X-N), carbonaceous biochemical oxygen demand ($CBOD_5$), total dissolved solids (TDS), total suspended solids (TSS), and chemical oxygen demand (COD). For the denitrification biofilters containing elemental sulfur media, influent and effluent sample analyses were also conducted for sulfate (SO_4) and hydrogen sulfide (H_2S). Table 2 lists the analytical parameters, analytical methods, and detection limits for these analyses.

Table 2
Analytical Parameters, Method of Analysis, and Detection Limits

Analytical Parameter	Method of Analysis	Laboratory Detection Limit (mg/L)
Total Alkalinity as $CaCO_3$	SM 2320B	2 mg/L
Total Kjeldahl Nitrogen (TKN-N)	EPA351.2	0.05 mg/L
Ammonia Nitrogen (NH_3-N)	EPA350.1	0.01 mg/L
Nitrate/Nitrite Nitrogen (NO_X-N)	EPA353.2	0.01 mg/L
Carbonaceous BOD ($CBOD_5$)	SM 5210B	2 mg/L
Total Dissolved Solids (TDS)	SM 2540C	10 mg/L
Total Suspended Solids (TSS)	SM 2540D	1 mg/L
Chemical Oxygen Demand (COD)	EPA 410.4	10 mg/L
Total Phosphorus (TP)	SM 4500PE	0.01 mg/L
Fecal Coliform (fecal)	SM9222D	1 ct/100mL
Sulfate (SO_4)	EPA300.0	0.2 mg/L
Hydrogen Sulfide Unionized (H_2S)	SM4500S F	0.01 mg/L
Sulfide	SM4500S F	0.1 mg/L

3.5 Flow Monitoring

Flow rates for all PNRS II systems were calibrated at initial start-up. The flow rates are measured at each sampling event and adjusted as necessary to maintain flow rates consistent with the experimental design. Flow measurements and adjustments are made after collection of liquid samples and field parameter analyses.

A flow test was conducted November 19, 2010. These flow measurements are considered to represent those in effect leading up to and during the Sample Event 3. The measured volumes and relative errors between measured and target flow rates are presented in Appendix C, Table 1. For the Group 1 systems, measured STE inputs to four of the five Stage 1 biofilters were within the 15% operational target that is considered acceptable for PNRS II flow rates. The measured influent volume of UNSAT-PS1 was -36.2% of the target volume. Measured effluent volumes for Stage 1 single pass biofilters (Stage 2 influent) were within 13% of the target volume for four of the five systems (Appendix C, Table 1). The DENIT-LS4 measured influent volume was substantially less than the target volume. The low measured flow to the DENIT-LS4 (RE = -27.1%) is associated with the low influent volume of the directly connected UNSAT-PS1 biofilter.

For the Group 2 systems, all measured STE volumes to the Stage 1 recirculation tanks were within 9% of target volumes. All recycle flow volumes as recorded by the PLC were within 6% of target volumes based on the experimental design recycle ratio of 3.0. The calculated recycle ratios (i.e. recycle flow volume divided by the STE flow volume) for four of the five recirculation systems were within 5% of the target recycle ratio of 3.0. Although the recycle rate to the UNSAT-PS1 was close to target, the recycle ratio was high due to the low influent STE flow that was previously discussed.

For Group 3 systems, the measured influent volumes to the Stage 2 horizontal denitrification biofilters were all within 5% of target.

For Group 4 biofilters, the measured influent volumes were within 10% of target volumes for three of the four in-situ simulators. The measured influent volume of UNSAT-IS 1 was -26.9% of the target volume. The system tubing was replaced and recalibrated December 3rd; the influent volume to UNSAT-IS1 and UNSAT-IS2 was then measured to be within 8% of target.

After evaluating the influent flow test results, a few maintenance items were conducted:

- Peristaltic Pump 10 pump tubing was calibrated November 19th
- Peristaltic Pump 5 pump and system tubing was replaced and calibrated December 3rd
- Pump 4 (which feeds Hydrosplitter 1) runtime was modified December 8th from 31 seconds to 44 seconds
- Hydrosplitter 1 petcock valves were adjusted December 8th to provide equal distribution of flow to each of the five Stage 1 biofilters with input volumes as close to the target volume as possible

The flows were rechecked after modifications to the systems were made and are provided in Appendix C, Table 2. The UNSAT-PS1 measured influent volume is closer to the target as measured on December 8th which will continue to be monitored. After replacing and calibrating the Pump 5 pump and system tubing on December 3rd, the influent doses to UNSAT-IS1 and UNSAT-IS2 were closer to the target volume. After calibrating the Pump 10 pump tubing on November 19th, the influent doses to UNSAT-IS3 and UNSAT-IS4 were equal to the target volume.

Appendix A: PLC Data

Table A.1
Summary of PLC Recorded Daily Flows
(9/1/10 – 11/9/10)

	Average Recorded Flow (gpd)	Std. Dev.	MIN (gpd)	MAX (gpd)	Target Flow (gpd)	Relative Error[1] (%)
Pump 4 to Hydro 1	70	2.52	65	76	73.7	-4.8%
Pump 14 to Hydro 2	62	1.38	59	68	58.9	4.6%
Pump 6 to Recirc. System 1	44	0.97	43	51	44.2	0.2%
Pump 7 to Recirc. System 2	45	1.65	43	52	44.2	2.5%
Pump 8 to Recirc. System 3	44	0.46	43	45	44.2	-0.4%
Pump 9 to Recirc. System 4	44	0.64	42	45	44.2	-0.5%
Pump 15 to Recirc. System 5	42	0.60	41	43	44.2	-5.4%

[1]Relative Error = (Recorded Flow – Target Flow)/ Target Flow *100

Table A.2
Summary of PLC Recorded Daily Runtimes
(9/1/10 – 11/9/10)

	Average Recorded Daily Runtime (minutes/day)	Std. Dev.	MIN (minutes)	MAX (minutes)	Target Daily Runtime (minutes)	Relative Error[1] (%)
Pump 4 to Hydro 1	12.8	0.4	12.0	13.0	12.4	3.0%
Pump 14 to Hydro 2	10.8	0.4	10.0	11.0	10.4	3.7%
Pump 6 to Recirc. System 1	6.4	0.5	6.0	7.0	6.0	6.4%
Pump 7 to Recirc. System 2	6.5	0.5	6.0	7.0	6.0	8.1%
Pump 8 to Recirc. System 3	6.4	0.5	6.0	7.0	6.0	6.4%
Pump 9 to Recirc. System 4	6.4	0.5	6.0	7.0	6.0	6.4%
Pump 15 to Recirc. System 5	6.4	0.5	6.0	7.0	6.0	6.5%

[1]Relative Error = (Recorded Runtime – Target Runtime)/ Target Runtime *100

Appendix B: Field Parameter Analyses

Table B.1
Field Parameter Results
(November 10, 2010)

Sample Identification	pH	Temperature (°C)	Specific Conductance (µS)	Dissolved Oxygen (mg/L)	ORP (mV)
STE					
STE-Tank 1	7.2	25.1	1,250	2.40	-235.0
STE-Tank 1-D	7.3	25.3	1,250	2.20	-230.0
Stage 1 Single Pass Biofilter Effluent					
UNSAT-EC1	6.9	20.6	1,150	7.1	108.0
UNSAT-EC3	6.8	21.5	1,250	6.8	105.0
UNSAT-CL1	7.1	22.0	1,130	7.3	105.5
UNSAT-CL3	7.4	22.0	1,280	7.6	100.5
Stage 2 Single Pass Upflow Biofilter Effluent					
DENIT-SU4	7.3	21.0	1,510	7.8	-118.0
DENIT-LS3	6.9	20.0	1,200	4.7	67.5
DENIT-SU3	7.2	21.4	1,480	7.7	-180.0
DENIT-LS2	7.4	21.5	1,200	4.1	71.0
DENIT-LS4	7.3	20.0	900	3.8	81.0
Recirculation Tank Effluent					
RC1	7.3	20.6	1,000	2.1	57.0
RC2	7.2	19.5	1,020	1.6	58.5
RC3	7.2	19.2	1,040	2.3	57.5
RC4	7.4	19.7	1,090	1.9	49.3
RC5	7.3	22.0	1,050	3.3	96.0
Stage 1 Recirculating Biofilter Effluent					
UNSAT-CL4	7.2	23.5	1,040	8.0	52.8
UNSAT-CL2	7.0	23.1	1,000	5.4	50.2
UNSAT-EC4	6.9	22.2	980	7.3	46.5
UNSAT-SA2	6.9	22.5	930	7.7	47.5
UNSAT-PS1	7.2	23.8	950	7.8	90.0
P15-Tank	7.4	20.7	970	7.1	18.8

Sample Identification	pH	Temperature (°C)	Specific Conductance (µS)	Dissolved Oxygen (mg/L)	ORP (mV)
Denite Feed Tank (Tank 3)					
DFT	7.2	18.5	980	8.3	62.2
Stage 2 Horizontal Biofilters Effluent					
DENIT-SU1	6.9	28.0	1,250	1.6	-270.0
DENIT-SU2	7.0	25.5	1,350	0.2	-90.0
DENIT-LS1	7.4	21.4	970	1.1	-120.0
DENIT-GL1	6.9	21.0	900	0.8	-180.0
In-situ Simulator Biofilter Effluent					
UNSAT-IS1 (STE)	6.8	20.5	1,120	1.9	-161.0
UNSAT-IS2 (Nitrified STE)	6.8	19.2	1,300	0.8	-130.0
UNSAT-IS3 (STE)	6.67	18.7	1,505	0.4	158.3
UNSAT-IS4 (Nitrified STE)	7.48	18.3	0.01	9.0	152.8
Blanks					
Field Blank	6.5	24.5	25	8.0	12.5
Equipment Blank	6.7	23.0	28	8.5	-80.0

Appendix C: Flow Test Results

Table C.1
Flow Test Results

Group (Figure 1)	Biofilter/Flow	Target Input			Measured Input		Recycle Ratio	
		Target Input Volume	Dose/day	Target Input Volume	Measured Input Volume	Relative Error (%)	Calculated Recycle Ratio (RR)	Relative Error (%)
		(mL/day)	(Dose/day)	(mL/dose)	(mL/dose)	(Measured Input -Target Input) / Target Input * 100	Volume Recycle / Volume STE	Measured RR - Target RR / Measured RR * 100
1	**Stage 1 Single Pass Biofilters (Hydrosplitter 1)**							
	Date				11/19/2010 Dose @ 9:00 am			
	UNSAT-PS1	55,656	24	2,319	1,480	-36.2%		
	UNSAT-CL3				2,000	-13.8%		
	UNSAT-CL1				2,320	0.0%		
	UNSAT-EC3				1,970	-15.0%		
	UNSAT-EC1				2,115	-8.8%		
	Mean				1,977	-14.7%		
	Stage 2 Single Pass Upflow Biofilters							
	Date				11/19/2010 8:00-9:00 am			
	DENIT-LS4	55,656	24	2,319	1,690	-27.1%		
	DENIT-LS2				2,090	-9.9%		
	DENIT-SU3				2,425	4.6%		
	DENIT-LS3				2,025	-12.7%		
	DENIT-SU4				2,120	-8.6%		
	Mean				2,070	-10.7%		
2	**Stage 1 Recirculating Biofilters (Hydrosplitter 2)**							
	Date				(11/19/10) dose @ 9:30 am			
	RC1 : UNSAT-SA2	55,656	24	2,319	2,105	-9.2%		
	RC2 : UNSAT-EC4				2,270	-2.1%		
	RC3 : UNSAT-CL2				2,345	1.1%		
	RC4 : UNSAT-CL4				2,220	-4.3%		
	Mean				2,235	-3.6%		
	Stage 1 Recirculating Biofilters (Recycle)				Flowmeter 11/19/10 8:30 am			
	RC1 : UNSAT-SA2	166,968	24	6,957	6,586	-5.3%	3.13	4.1%
	RC2 : UNSAT-EC4				7,116	2.3%	3.13	4.3%
	RC3 : UNSAT-CL2				7,002	0.7%	2.99	-0.5%
	RC4 : UNSAT-CL4				6,586	-5.3%	2.97	-1.1%
	RC5 : UNSAT-PS1				6,662	-4.2%	4.50	33.3%
	Mean				6,790	-2.4%	3.34	10.3%
	Stage 1 Recirculating Biofilters (Hydrosplitter + Recycle)							
	RC1 : UNSAT-SA2	222,624	24	9,276	8,691			
	RC2 : UNSAT-EC4				9,386			
	RC3 : UNSAT-CL2				9,347			
	RC4 : UNSAT-CL4				8,806			
	RC5 : UNSAT-PS1				8,142			
	Mean				8,874			
3	**Horizontal Denitrification Biofilters**							
	Date				11/19/10 dose @ 8:25 am			
	DENIT-SU1	7,409	24	308.7	302	-2.2%		
	DENIT-SU2				295	-4.4%		
	DENIT-GL1				295	-4.4%		
	DENIT-LS1				300	-2.8%		
	Mean				298	-3.5%		
4	**In-Situ Simulators**							
	Date				11/19/2010 manual dose			
	UNSAT-IS1 (STE)	14,814	6	2,469	1,805	-26.9%		
	UNSAT-IS2 (Nitrified STE)				2,715	10.0%		
	UNSAT-IS3 (STE)	594	6	99	93	-6.1%		
	UNSAT-IS4 (Nitrified STE)				93	-6.1%		

Notes: Yellow-shaded cells are measured values; grey-shaded cells are calculated values

Table C.2
Flow Test Results following Modifications

Group (Figure 1)	Biofilter/Flow	Target Input			Measured Input		Recycle Ratio	
		Target Input Volume	Dose/day	Target Input Volume	Measured Input Volume	Relative Error (%)	Calculated Recycle Ratio (RR)	Relative Error (%)
		(mL/day)	(Dose/day)	(mL/dose)	(mL/dose)	(Measured Input -Target Input) / Target Input * 100	Volume Recycle / Volume STE	Measured RR - Target RR / Measured RR * 100
1	**Stage 1 Single Pass Biofilters (Hydrosplitter 1)**							
	Date				(12/8/10) manual dose @ 8:45 am			
	UNSAT-PS1	55,656	24	2,319	2,320	0.0%		
	UNSAT-CL3				2,395	3.3%		
	UNSAT-CL1				2,340	0.9%		
	UNSAT-EC3				2,300	-0.8%		
	UNSAT-EC1				2,340	0.9%		
	Mean				2,339	0.9%		
	Stage 2 Single Pass Upflow Biofilters							
	Date				11/19/2010 8:00-9:00 am			
	DENIT-LS4	55,656	24	2,319	1,690			
	DENIT-LS2				2,090			
	DENIT-SU3				2,425			
	DENIT-LS3				2,025			
	DENIT-SU4				2,120			
	Mean							
2	**Stage 1 Recirculating Biofilters (Hydrosplitter 2)**							
	Date				(11/19/10) dose @ 9:30 am			
	RC1 : UNSAT-SA2	55,656	24	2,319	2,105	-9.2%		
	RC2 : UNSAT-EC4				2,270	-2.1%		
	RC3 : UNSAT-CL2				2,345	1.1%		
	RC4 : UNSAT-CL4				2,220	-4.3%		
	Mean				2,235	-3.6%		
	Stage 1 Recirculating Biofilters (Recycle)				Flowmeter 11/19/10 8:30			
	RC1 : UNSAT-SA2	166,968	24	6,957	6,586	-5.3%	3.13	4.1%
	RC2 : UNSAT-EC4				7,116	2.3%	3.13	4.3%
	RC3 : UNSAT-CL2				7,002	0.7%	2.99	-0.5%
	RC4 : UNSAT-CL4				6,586	-5.3%	2.97	-1.1%
	RC5 : UNSAT-PS1				6,662	-4.2%	2.98	-0.7%
	Mean				6,822	-1.9%	3.05	1.8%
	Stage 1 Recirculating Biofilters (Hydrosplitter + Recycle)							
	RC1 : UNSAT-SA2	222,624	24	9,276	8,691			
	RC2 : UNSAT-EC4				9,386			
	RC3 : UNSAT-CL2				9,347			
	RC4 : UNSAT-CL4				8,806			
	RC5 : UNSAT-PS1				8,982			
	Mean				9,042			
3	**Horizontal Denitrification Biofilters**							
	Date				11/19/10 dose @ 8:25 am			
	DENIT-SU1	7,409	24	308.7	302	-2.2%		
	DENIT-SU2				295	-4.4%		
	DENIT-GL1				295	-4.4%		
	DENIT-LS1				300	-2.8%		
	Mean				298	-3.5%		
4	**In-Situ Simulators**							
	Date				12/3/2010 manual dose			
	UNSAT-IS1 (STE)	14,814	6	2,469	2,600	5.3%		
	UNSAT-IS2 (Nitrified STE)				2,660	7.7%		
	Date				11/19/2010 manual dose			
	UNSAT-IS3 (STE)	594	6	99	99	0.0%		
	UNSAT-IS4 (Nitrified STE)				99	0.0%		

Notes: Green-shaded cells are measured values following completion of system modifications; yellow-shaded cells are measured values; grey-shaded cells are calculated values

Appendix D: Chain of Custody Forms

SOUTHERN ANALYTICAL LABORATORIES, INC.

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

SAL Project No. 1001627

Client Name	Contact / Phone:
Hazan and Sawyer	Josephin Edeback-Hirst 813-630-4498
Project Name / Location	jedeback@hazanandsawyer.com
PNRS II Wastewater System Analyses	
Samplers: (Signature)	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	PARAMETER / CONTAINER DESCRIPTION: 1LP, Cool Alkalinity, CBOD, TSS, TDS	1LP, Cool SO4	1LP, Zn Acetate/NaOH Hydrogen Sulfide No Headspace	250ml P, H2SO4 (TKN/NH3/NOx)	ORP (Client meter)	Field pH	Field Temp	Field Cond	Field DO
01	PNRS II STE-T1	11/10/10	1350	WW		X	1	1	1	1					
02	RC31		1250	WW		X	1			1					
03	RC2		1300	WW		X	1			1					
04	RC3		1310	WW		X	1			1					
05	RC4		1320	WW		X	1			1					
06	RC5		1610	WW		X	1			1					
07	P15-T		1345	WW		X	1			1					
08	UNSAT-IS1		1000	WW		X	1	1	1	1					
09	UNSAT-IS2		0945	WW		X	1	1	1	1					
10	UNSAT-IS3		—	WW		X	~~1~~	~~1~~	~~1~~	~~1~~					
11	UNSAT-IS4		1515	WW		X	~~1~~	(1)	~~1~~	(1)					
12	UNSAT-EC1	↓	1600	WW		X	1	1	1	1					

Containers Prepared/ Relinquished:	Date/Time: 1130 11-08-10	Received:	Date/Time: 11/09/10 1430
Relinquished:	Date/Time: 11/10/10 1750	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact?	Y	N	N/A
Samples intact upon arrival?	Y	N	N/A
Received on ice? Temp_____	Y	N	N/A
Proper preservatives indicated?	Y	N	N/A
Rec'd within holding time?	Y	N	N/A
Volatiles rec'd w/out headspace	Y	N	N/A
Proper containers used?	Y	N	N/A

Instructions / Remarks

#11 (IS-4) NOx (1) SO4 (2) NH3 (3) TKN (4) (Limited Volume Sample)

#10 (IS-3) No Sample

1001627

SOUTHERN ANALYTICAL LABORATORIES, INC.

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

SAL Project No. 1001627

Client Name	Contact / Phone:
Hazan and Sawyer	Josephin Edeback-Hirst 813-630-4498
Project Name / Location	jedeback@hazanandsawyer.com
PNRS II Wastewater System Analyses	
Samplers: (Signature)	

Matrix Codes:
DW-Drinking Water WW-Wastewater
SW-SurfaceWater SL-Sludge SO-Soil
GW-Groundwater SA-Saline Water O-Other
R-Reagent Water

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	1LP, Cool Alkalinity, CBOD, TSS, TDS	1LP, Cool SO4	1LP, Zn Acetate/NaOH Hydrogen Sulfide **No Headspace**	250ml P, H2SO4 TKN, NH3, NoX, COD	**ORP (Client meter)**	**Field pH**	**Field Temp**	**Field Cond**	**Field DO**
	PARAMETER / CONTAINER DESCRIPTION														
13	UNSAT-SA2	11/10/10	1110	WW		X	1			1					
14	UNSAT-EC3		1530	WW		X	1			1					
15	UNSAT-EC4		1120	WW		X	1			1					
16	UNSAT-CL1		1540	WW		X	1	1	1	1					
17	UNSAT-CL2		1130	WW		X	1			1					
18	UNSAT-CL3		1550	WW		X	1			1					
19	UNSAT-CL4		1140	WW		X	1			1					
20	UNSAT-PS1		1350	WW		X	1			1					
21	DENIT-SU1		1015	WW		X	1	1	1	1					
22	DENIT-SU2		1025	WW		X	1	1	1	1					
23	DENIT-SU3		1330	WW		X	1	1	1	1					
24	DENIT-SU4		1340	WW		X	1	1	1	1					

Containers Prepared/ Relinquished:	Date/Time: 1130 11-08-10	Received:	Date/Time: 1430 11/09/10
Relinquished:	Date/Time: 1750 11/10/10	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact?	Y	N	N/A
Samples intact upon arrival?	Y	N	N/A
Received on ice? Temp_____	Y	N	N/A
Proper preservatives indicated?	Y	N	N/A
Rec'd within holding time?	Y	N	N/A
Volatiles rec'd w/out headspace	Y	N	N/A
Proper containers used?	Y	N	N/A

Instructions / Remarks

1001627

SOUTHERN ANALYTICAL LABORATORIES, INC.

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

SAL Project No. 1001627

Client Name	Contact / Phone:
Hazan and Sawyer	Josephin Edeback-Hirst 813-630-4498
Project Name / Location: PNRS II Wastewater System Analyses	jedeback@hazanandsawyer.com
Samplers: (Signature)	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

PARAMETER / CONTAINER DESCRIPTION

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	1LP, Cool Alkalinity, CBOD, TSS, TDS	1LP, Cool SO4	1LP, Zn Acetate/NaOH Hydrogen Sulfide No Headspace	250ml P, H2SO4 TKN, NH3, NoX, COD	ORP (Client meter)	Field pH	Field Temp	Field Cond	Field DO
25	DENIT-LS1	11/10/10	1040	WW		X	1			1					
26	DENIT-LS2		1215	WW		X	1			1					
27	DENIT-LS3		1230	WW		X	1			1					
28	DENIT-LS4		1205	WW		X	1			1					
29	DENIT-GL1		1055	WW		X	1			1					
30	DFT		1150	WW		X	1	1	1	1					
31	T1-D		1400	WW		X	1			1					
32	FB		1500	WW		X	1			1					
33	EB		1410	WW		X	1			1					

Containers Prepared/ Relinquished:	Date/Time: 1130 11-08-10	Received:	Date/Time: 1430 11/09/10
Relinquished:	Date/Time: 1750 11/10/10	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact?	Y	N	N/A
Samples intact upon arrival?	Y	N	N/A
Received on ice? Temp_____	Y	N	N/A
Proper preservatives indicated?	Y	N	N/A
Rec'd within holding time?	Y	N	N/A
Volatiles rec'd w/out headspace	Y	N	N/A
Proper containers used?	Y	N	N/A

Instructions / Remarks

1001627

SOUTHERN ANALYTICAL LABORATORIES, INC.

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

SAL Project No. 1002218

Client Name	Contact / Phone:
Hazan and Sawyer	Josephin Edeback-Hirst 813-630-4498
Project Name / Location	jedeback@hazanandsawyer.com
PNRS II Wastewater System Analyses	

Samplers: (Signature) Josephin Hirst

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	1LP, Cool Alkalinity, CBOD, TSS, TDS	1LP, Cool SO4	1LP, Zn Acetate/NaOH Hydrogen Sulfide **No Headspace**	250ml P, H2SO4 TKN, NH3, NoX, COD	**ORP (Client meter)**	**Field pH**	**Field Temp**	**Field Cond**	**Field DO**
01	UNSAT-IS1	11/12/10	06:45	WW		X	1	1	1	1	221.6	7.07	17.0	1168	1.95
02	UNSAT-IS2	11/12/10	06:45	WW		X	1	1	1	1	-213.6	6.48	17.1	365	0.75
03	~~UNSAT-IS3~~ DID NOT SAMPLE			~~WW~~		X	~~1~~	~~1~~	~~1~~	~~1~~					
04	~~UNSAT-IS4~~ DID NOT SAMPLE			~~WW~~		X	~~1~~	~~1~~	~~1~~	~~1~~					
03	UNSAT-IS3	11/15/10	0830	WW		X	1	1	1	1	158.3	6.67	18.7	1505	0.44

Containers Prepared/ Relinquished: HH	Date/Time: 1640 11-11-10	Received:	Date/Time:	Seal intact? Y N N/A
Relinquished: Josephin Hirst	Date/Time: 11/12/10 08:58	Received: courier	Date/Time: 11/12/10 08:58	Samples intact upon arrival? Y N N/A
Relinquished: courier (01-02)	Date/Time: 11/12/10 10:25	Received: courier	Date/Time:	Received on ice? Temp ____ Y N N/A
Relinquished: courier (03-01)	Date/Time:	Received: K Mudmann	Date/Time: 1450 11/15/10	Proper preservatives indicated? Y N N/A
Relinquished:	Date/Time:	Received:	Date/Time:	Rec'd within holding time? Y N N/A
				Volatiles rec'd w/out headspace Y N N/A
				Proper containers used? Y N N/A

Instructions / Remarks

Start time: 11/11/10 16:05

BOTH IS1 & IS2

SOUTHERN ANALYTICAL LABORATORIES, INC.

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

SAL Project No. 1002218

Client Name	Contact / Phone:
Hazan and Sawyer	Josephin Edeback-Hirst 813-630-4498
Project Name / Location: ~~Septic Tank Effluent Analyses~~ MRS II	jedeback@hazanandsawyer.com
Samplers: (Signature)	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	1LP, Cool Alkalinity, ~~CBOD5, TSS~~ SO4	250 ml P, H_2SO_4 TKN, NH_3, NOx, COD		ORP	DO	Field Temp	Field Cond	Field pH	No. of Containers (Total per each location)
03 01	~~UNSAT-153~~	~~11/15/10~~	~~8:30am~~	~~WW~~	X	~~X~~	+	+		158.3	0.84	18.7	1505	6.67	Y
04	UNSAT-154	11/15/10	8:45am	WW	X		1	1		152.8	8.96	18.3	0.01	7.48	2
							INV 11/15/10								

Containers Prepared/ Relinquished:	Date/Time:	Received:	Date/Time:
Travis	8-10-10 1400		11/12/10
Relinquished: GCH	Date/Time: 11/15/10	Received: Victor Perez	Date/Time: 1115 am
Relinquished: Courier	Date/Time:	Received: K Mudmark	Date/Time: 1450 11/15/10
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact? Y N (N/A)
Samples intact upon arrival? (Y) N N/A
Received on ice? Temp_____ (Y) N N/A
Proper preservatives indicated? (Y) N N/A
Rec'd within holding time? (Y) N N/A
Volatiles rec'd w/out headspace Y N (N/A)
Proper containers used? (Y) N N/A

Instructions / Remarks

started 11/10 4:45pm collecting