Florida Department of Health
Onsite Nitrogen Reduction Strategies Study

Contract CORCL

TASK B.6

Installation Report for Passive Nitrogen Reduction System B-HS1

June 30, 2011

Task B of the Florida Onsite 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. To meet this objective, full scale treatment systems will be installed at various residential sites in Florida, operated on septic tank effluent under actual onsite conditions, and monitored over an extended timeframe. 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 installation of a passive nitrogen reduction system at a home site in Wakulla County, Florida (B-HS1).

System Overview

The system installed in Wakulla County, Florida (B-HS1) in June 2011 consists of a 1,500 gallon two chamber concrete tank with 1,000 gallon primary treatment tank (1st chamber) and 500 gallon pump chamber (2nd chamber); an Aerocell unsaturated media filter chamber, and a 1,500 gallon single chamber upflow tank containing Nitrex media. Figure 1 is a site schematic showing the system components and layout of the installation. A complete as-built system diagram is included in the Operation and Maintenance manual which is attached as Appendix A. A few of the details in Figure 1 were revised during the installation and are detailed in the next section of this report.

Household wastewater enters the 1st (i.e. septic) chamber of the primary tank and exits as septic tank effluent through a "filter" into the 2nd chamber. A Quanics pump vault within the 2nd chamber serves as another "filter" and contains the pump, float switches, and a post pump filter. The 2nd chamber contents are pumped to the top of the unsaturated Aerocell chamber, after which all wastewater flow is by gravity. Wastewater proceeds downward through the Aerocell media where nitrification occurs. Aerocell effluent then flows into an adjustable split recirculation device which allows for a portion of the Aerocell chamber effluent to be sent back to the 2nd chamber of the primary tank (recirculation) with the rest proceeding to the Nitrex tank. Recirculation back to the 2nd chamber increases the hydraulic loading on the Aerocell unit. Following the Aerocell unit, the nitrified effluent flows into the Nitrex tank where denitrification occurs. The denitrified treated effluent is discharged into the soil via Infiltrator chambers.

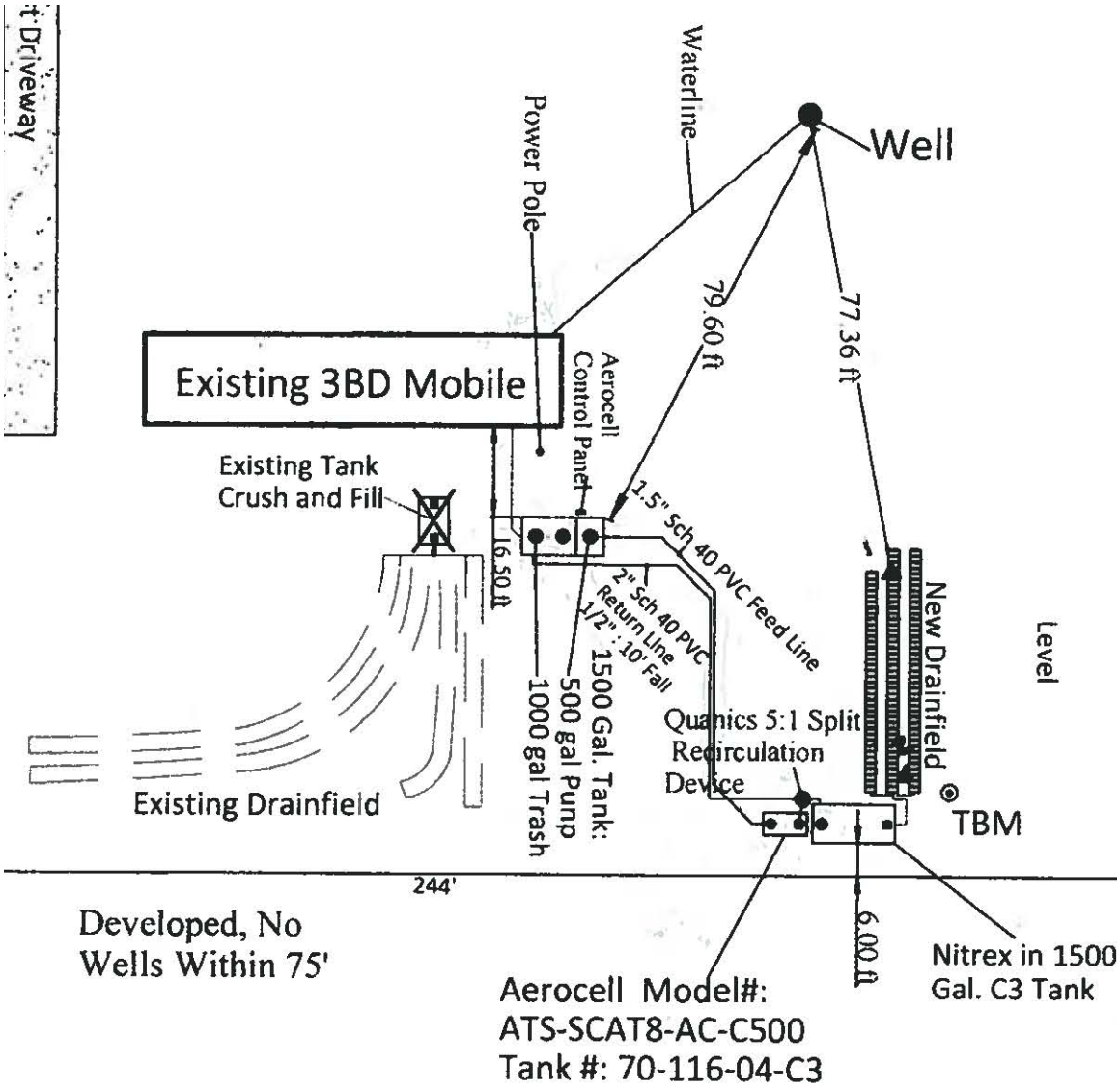


Figure 1
Schematic of PNRS Installed in Wakulla County

Installation

Installation of the system commenced June 7, 2011 and was completed on June 10, 2011. The installation began with a pump out and abandonment of the existing conventional septic system. After the pump out was completed, the old septic tank was crushed and filled with a backhoe (Figure 2).

Figure 2
Old Septic Tank Crushed and Filled

A 1,500 gallon, two compartment tank was installed next to the abandoned tank. The first larger chamber (1,000 gallon) serves as a primary receiving tank, receiving the raw sewage from the household. The second smaller (500 gallon) chamber serves as the pump chamber (Figure 3). Care was taken to assure the tank was installed level. The sewer pipe from the house was plumbed into the side hole at the bottom of Figure 3.

Figure 3
1,500 Gallon Two Chamber Primary Tank

A single chamber (1,500 gallon) concrete tank was then installed towards the back of the property near the planned area of the future drainfield. The purpose of this tank was to hold the Nitrex media. The tank manufacturer delivered a two chamber tank by mistake; therefore the baffle wall was removed using a concrete saw to create a one chamber tank (Figure 4).

Figure 4
1,500 Gallon Single Chamber Nitrex Tank

The Aerocell chamber and the split recirculation device were installed adjacent to the Nitrex tank and leveled. Copper sulfate was applied to the soil underneath these two components to prevent root growth from causing the Aerocell and split recirculation device to become unleveled. Once the Nitrex tank, Aerocell chamber, and the split recirculation device were installed and leveled, plumbing connections were installed (Figure 5). An inline flow meter was installed prior to the Aerocell chamber to record the cumulative flow in gallons pumped from the 2nd chamber of the primary tank (Figure 6). At this location, the flowmeter measurement includes the forward wastewater flow and the recirculation flow. Figure 5 shows the line leading into the Aerocell chamber with water meter, the line coming out of the Aerocell chamber into the split recirculation device, the line from the split recirculation device to the Nitrex tank, and the line from the split recirculation device back to the 2nd chamber of the two chambered primary tank. Flow from the split recirculation device is by gravity to both the Nitrex tank and the 2nd chamber of the primary tank.

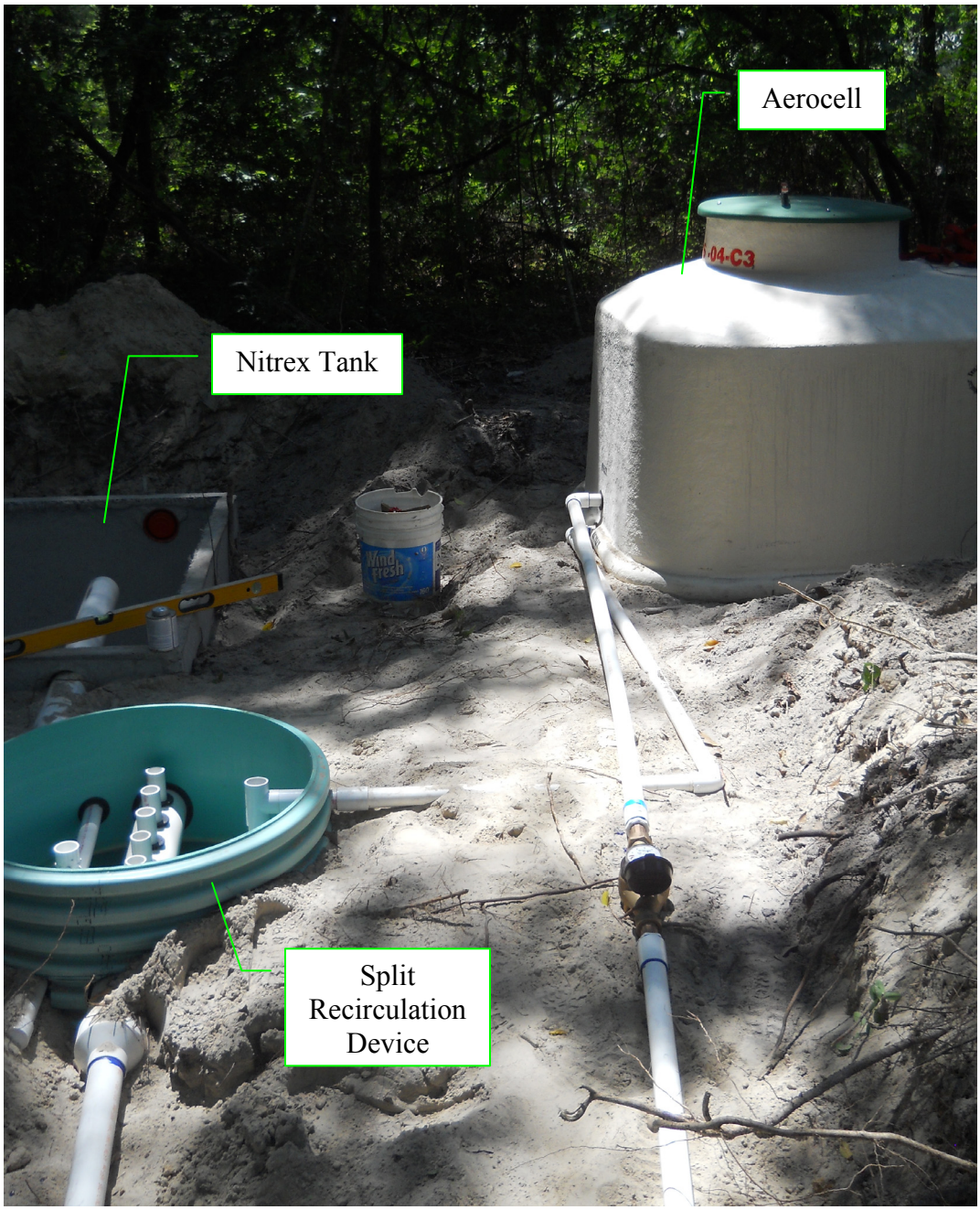


Figure 5
Layout and Plumbing of the Nitrex Tank, Aerocell Chamber and Split Recirculation Device

Figure 6
Aerocell Flow Meter

The Aerocell chamber is a single chamber filled with high density foam cubes. Effluent is applied to the top of the Aerocell high density foam cubes (Figure 7) by four spray nozzles located above the cubes. Not shown are the pressure gauge and the ball valve which allows the pressure of the pumped effluent to be adjusted. The target pressure is between 5 and 10 PSI, with 7 PSI being optimal. The spray nozzles are removable for cleaning in the event clogging occurs despite the filter in the STE tank, the pump tank filter, and the filter installed following the pump (Figure 8).

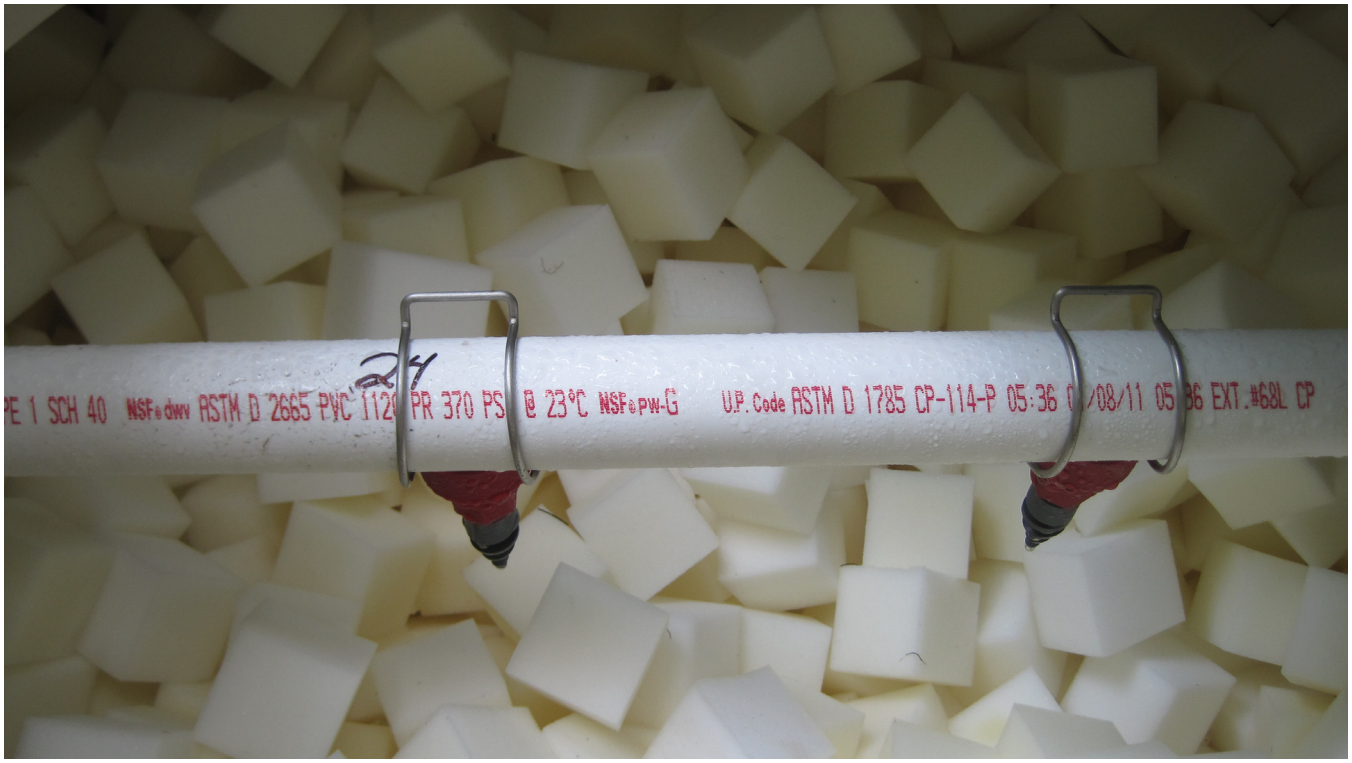


Figure 7
Spray Nozzles and High Density Foam Cubes Inside One Side of Aerocell Chamber

Figure 8
Removable Nozzle from Aerocell Chamber

Although Figure 1 indicates a 5 to 1 split recirculation device, the device installed is capable of a 7 to 1 split. The amount of recirculation is adjustable from 7 parts recirculation back to the 2nd chamber of the primary tank and 1 part going to the Nitrex tank, down to no recirculation to the 2nd chamber. The split recirculation device consists of 7 adjustable PVC pipes that deliver effluent back to the two chamber tank and one fixed PVC pipe that delivers effluent to the Nitrex tank. To reduce the amount of effluent recirculated back to the two chamber tank, one or more of the 7 PVC pipes are simply raised above the water line. The inlet pipe from the Aerocell chamber is shown with a PVC tee. This piece was left unglued so that it can be removed to gather an effluent sample from the Aerocell chamber (Figure 9).

Figure 9
Split Recirculation Device

Figure 1 shows the recirculating effluent flowing back to the 1st chamber of the primary tank via a 2 inch pipe, however the design was modified. As installed, the 2 inch PVC pipe was increased to 4 inch PVC pipe which was fitted with a "Y" and a "bull run" valve (Figure 10 and 11). This gives the option of having the recirculation effluent flow to either the 2nd chamber or the 1st chamber of the primary tank. A riser pipe was installed to grade over the valve, so that the valve can be turned after installation is complete. The valve is turned with a wrench on a rod which is long enough to reach with the riser installed (Figure 11). The valve was initially set so the recirculation goes to the 2nd chamber. Not shown in Figure 10 is the screw cap covering the riser pipe. Shown in the lower left corner of Figure 10, is the sewer pipe from the home.

Figure 10
Split of Recirculation Pipe back towards the Two Chamber Tank

Figure 11
Valve being turned with Tool

The 1st chamber filter was installed in the hole in the baffle separating the first and second chambers (Figure 12). Concrete was used to seal the pipe in the baffle wall. Effluent enters the filter from a 4 inch PVC tee located at the midpoint of the tank depth. The pipe shown extending from the tee downwards is to provide support for the filter. A 4 inch PVC tee was also installed on the recirculation line in the 1st chamber. The down leg of pipe was cut to the midpoint of the tank.

Figure 12
Filter between 1st Chamber and 2nd Chamber of Primary Tank

The tank lid has three risers as shown in Figure 13. The riser to the right allows access to the 1st chamber, which provides the ability to pump out as needed. The middle riser allows the 1st chamber filter to be serviced. STE samples will also be taken from this riser. The riser to the left gives access to the 2nd chamber. The blue cylinder shown in Figure 13 is the pump vault. Figure 14 shows the installed pump vault, the valve for sample access, and the final filter on the pipe leading to the Aerocell chamber. Samples taken from the pump vault represent the water quality characteristics of Aerocell

influent. The hose shown in Figure 14 was used to fill the 2nd chamber with potable water prior to testing the system.

Figure 13
Primary Tank Lid and Pump Vault

Figure 14
Plumbing and Filter installed in Pump Vault inside of 2nd Chamber

Four float switches were installed to maintain the effluent level in the 2nd chamber of the primary tank and are attached to a "float tree" installed in the pump vault and connected to the control panel. The height of the floats is adjustable and once the proper heights were established, screws were used to secure the floats to the float tree. Figure 15 shows the float tree being placed into the pump vault after adjustment.

Figure 15
Placing Float Tree into the Pump Vault

A power meter was installed between the main power box of the house and the control panel to record cumulative power usage of the pump in kilowatts. The equipment connected to the power meter are the recirculation pump and the control panel. Figure 16 shows the power meter located above the control panel.

Figure 16
Control Panel and Power Meter

The system control panel (Figure 17) allows for a timed pump cycle which can be overridden if the effluent levels are too low or too high in the 2nd chamber of the primary tank. If the floats indicate a low effluent level in the tank, the timed cycle is turned off to protect the pump. If the floats indicate a high effluent tank level, then the pump cycles faster (off cycle reduced) until the water level reaches the optimal range. An alarm will indicate if the water level goes above a critical level.

Figure 17
Control Panel

The inlet pipe into the Nitrex tank was routed down to the bottom of the tank and a 90 degree bend was used to attach a 4 inch pipe with a row of drilled holes. This allows for the tank to be filled from the bottom in a uniform manner (Figure 18). The pipe shown across the top of the tank is the outlet pipe to be connected at the top.

Figure 18
Inlet Pipe installed in the Nitrex Tank

After the inlet pipe was in place, the tank was filled with the Nitrex media (Figure 19). This media consisted of pine wood chips and pine sawdust. The pipe extending upwards from the inlet tee was used temporarily during media filling to prevent media from entering the inlet pipe.

Figure 19
Filling the Nitrex Tank with Media

After the media was installed to the desired height, the outlet pipe for the tank was installed (Figure 20). The outlet pipe which has two rows of drilled holes on the top and is wrapped with a plastic mesh to prevent wood chips from entering the pipe collects the wastewater for discharge to the drainfield. The PVC pipe underneath the outlet pipe shown in Figure 20 was used to level the pipe above the media.

Figure 20
Outlet Pipe in the Nitrex Tank

Following the outlet pipe install, additional media was used to fill the tank to the level of the influent pipe (Figure 21), and the lid was installed (Figure 22).

Figure 21
Nitrex Tank filled with Media

Figure 22
Nitrex Tank with Lid Installed

Two Risers were cemented over the tank openings and the drainfield was installed (Figure 23). The drainfield consists of Infiltrator chambers in 4 trenches spaced two feet apart. Three rows are 40 feet in length, and the fourth is 36 feet long. The original design shown in Figure 1 only showed three rows, two 44 feet long and the third shorter row being 40 feet long. However, in some areas of the drainfield, the clay layer was shallower than anticipated from the original soil borings, and the drainfield area was therefore enlarged. The chambers were covered in protective fabric to prevent sand from washing into and filling the chambers.

Figure 23
Four Rows of Infiltrator Drainfield Chamber

On the pipe between the Nitrex tank and the drainfield, a catch basin was installed so that the final effluent discharged to the drainfield can be sampled (Figure 24). The black piece extends into the ground approximately three inches. The riser pipe shown was cut at the final grade and capped with a screw cap.

Figure 24
Sampling Port for the Effluent being discharged to the Drainfield

During final testing of the system, leaks were discovered from the split recirculation device around the grommets. The grommets were sealed with PVC glue (Figure 25). The drainfield trenches were filled and all disturbed areas on the property were graded. Sod will be laid after consulting the homeowner concerning placement of the sod.

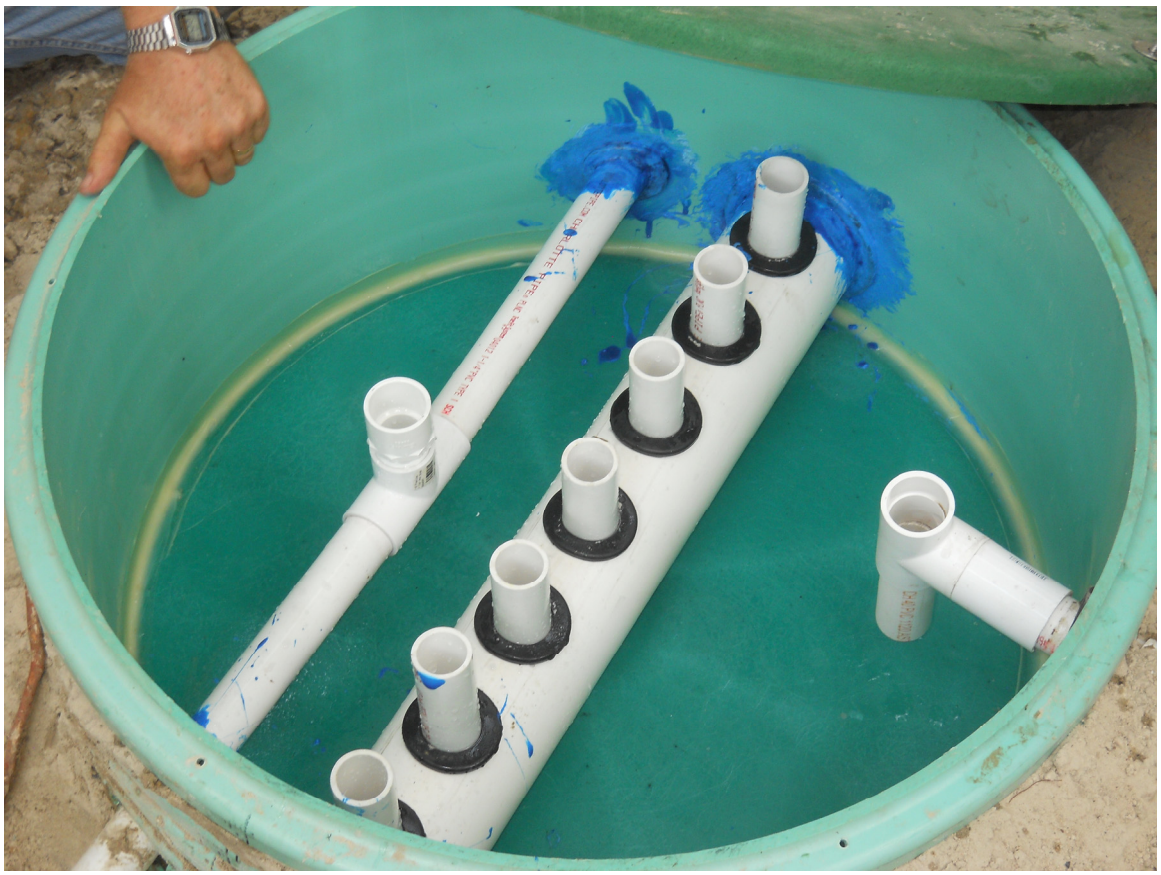


Figure 25
Sealing Leaks around Grommets

A water meter was installed on the water line from the household well. The water line for the one hose bib on the home was re-plumbed so that the junction came before the water meter. This allows for the measurement of the household water use independent of water use outside the home (Figure 26). So we will assume this represents flow to the treatment system.

Figure 26
Water Meter on line leading into the home, installed after junction for hose bib

Operation and Verification

On June 9, 2011, the 2nd chamber of the primary tank was filled with potable water for system operational testing. The pump was tested and found to deliver approximately 26 gallons of water to the Aerocell unit per minute. It was also found that there is a six second delay between pushing the manual pump button (labeled "Hand") on the control panel and water arriving to the Aerocell chamber. At the end of the day, the split recirculation device was set to a 7 to 1 recycle split, with 7 parts going back to the 2nd chamber of the primary tank and 1 part going to the tank with the Nitrex media. The on and off cycles were set, and the data from the control panel and two water meters were read and recorded (Table 1). The next morning, it was decided that the recirculation was too great as it took approximately 50 cycles to decrease the level of the 2nd chamber of the primary tank to the level when the time dose is turned off. (At this time the 1st chamber had less than 160 gallons, so no other water was added to the 2nd chamber). The split recirculation device was then set so that 5 parts went back to the 2nd chamber and 1 part went to the Nitrex tank by the vendor. At the control panel, the on and off cycles were set for longer times with the decreased recirculation (Table 1). Before leaving the site, the settings and readings on the control panel, the electric meter, and two water meters were read and recorded.

Table 1
Initial Settings and Readings Recorded

	6/9/11 18:15	6/10/11 12:35	Notes
Recirculation Ratio	7:1	5:1	
Control Panel Settings			
Pump Run Time (hr:min)	0:05	1:48	
Pump Activations	9	61	Some from testing floats
Alarm Counter	0	3	From testing alarm
Float Error	0	0	
Timer Override	0	0	
On time cycle (min:sec)	1:36	2:06	
Off time cycle (min:sec)	13:48	18:24	
Electric Meter	1 KW	2KW	Installed with 1 KW on dial
House Water Meter	87.3 (17:10)	148.2 (12:25)	Installed 6/8/11 14:10
Septic Pump Water Meter	NR	629.2 (12:30)	Installed with reading 2.1 gal

Notes: The On Time Cycle and Off Time Cycle are settings. The rest of the parameters are cumulative readings. For both water meters, the actual time read on each date is given in parenthesis.

The Nitrex^{TM} system inspection checklist from July 26th is provided in Appendix B. The system operating permit was issued June 24, 2011, and the construction inspection and final approval was issued August 31, 2011. Both these documents are included in Appendix C. The final construction costs for the installed system was $23,600 as detailed in Appendix D.

APPENDIX A

OPERATION & MAINTENANCE MANUAL
NITREX NITROGEN REMOVAL SYSTEM

OPERATION & MAINTENANCE (O&M) MANUAL

Nitrogen Removal System

[redacted] Dr.

Crawfordville, FL 32327

Parcel ID: [redacted]

October 17, 2011

Environmental Engineers/ Consultants

LOMBARDO ASSOCIATES, INC.

188 Church Street

Newton, Massachusetts 02458

www.LombardoAssociates.com

Table of Contents

List of Figures

List of Tables

1 Introduction

This Operation and Maintenance (O&M) Manual describes the procedures that need to be followed for proper operation of the Nitrex™ System to achieve wastewater purification and low effluent Total Nitrogen levels.

1.1 Contact Information

Should there be any alarms or issues that require immediate attention, the System Operator should be contacted as soon as possible. Contact information for the System Operator is as follows:

System Operator

Apalachee Backhoe and Septic Tank, LLC

Mike Sundin

P.O. Box 13028
Tallahassee, FL 32317
(850) 877-2820 FAX
Office: (850) 877-2824

Cell: (850) 528-6354

Email: Office@ApalacheeSeptic.com

Any questions on the system design, function or other issues should be forwarded to the System Designer Engineer and Equipment Supplier at:

System Design Engineer and Equipment Supplier

Lombardo Associates, Inc.

Pio Lombardo, P.E. or Gary Rubenstein

Office: (617) 964-2924

Email: Pio@LombardoAssociates.com

GaryR@LombardoAssociates.com

Property Owner information is as follows:

Property Owner

Pat [redacted]

Home: [redacted]

The Nitrex™ System consists of:

- Septic tank;
- Recirculating media filter (RMF) pretreatment system, or other pretreatment nitrifying system approved by Lombardo Associates, Inc. (LAI), with the technology dictated by site issues and other factors;
- Nitrex™ Denitrification Filter;
- Drainfield;
- Associated appurtenances

The Nitrex™ Filter pre-treatment system selected for the [redacted] Crawfordville, FL site is the AeroCell™ ATS SCAT-8-AC-C50 System, which must be operated and maintained in accordance with the manufacturer's and LAI's requirements, as described herein.

1.2 Nitrex™ Filter System Configuration

The Nitrex™ Filter is a component of a complete wastewater treatment and dispersal system and is configured as illustrated schematically in Figure 1.

Figure 1. Nitrex™ Nitrogen Removal System Schematic

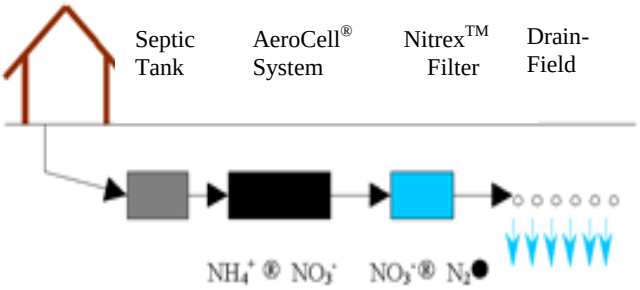


Figure 2 is the As-Built site plan for the installation, which includes the drinking water well setback information. A schematic of the septic tank and pump chamber is shown on Figure 3. This unit accepts flow from the building into the first compartment where solids settle out. The second compartment is the recirculation tank that contains a pump station housed within a screened pump vault. This pump station, which is the only pump in the treatment system, discharges wastewater to the AeroCell™ unit, after which based upon recirculation ratio settings, the wastewater flows by gravity either back to the recirculation tank or to the Nitrex™ Filter.

Figure 4 shows the flow path and hydraulic grade line starting at the AeroCell™ unit drain, through the recirculation splitter device, through the Nitrex™ Filter and ultimately to the Infiltrator drainfield.

Figure 2. Site Plan – Complete Nitrex™ System

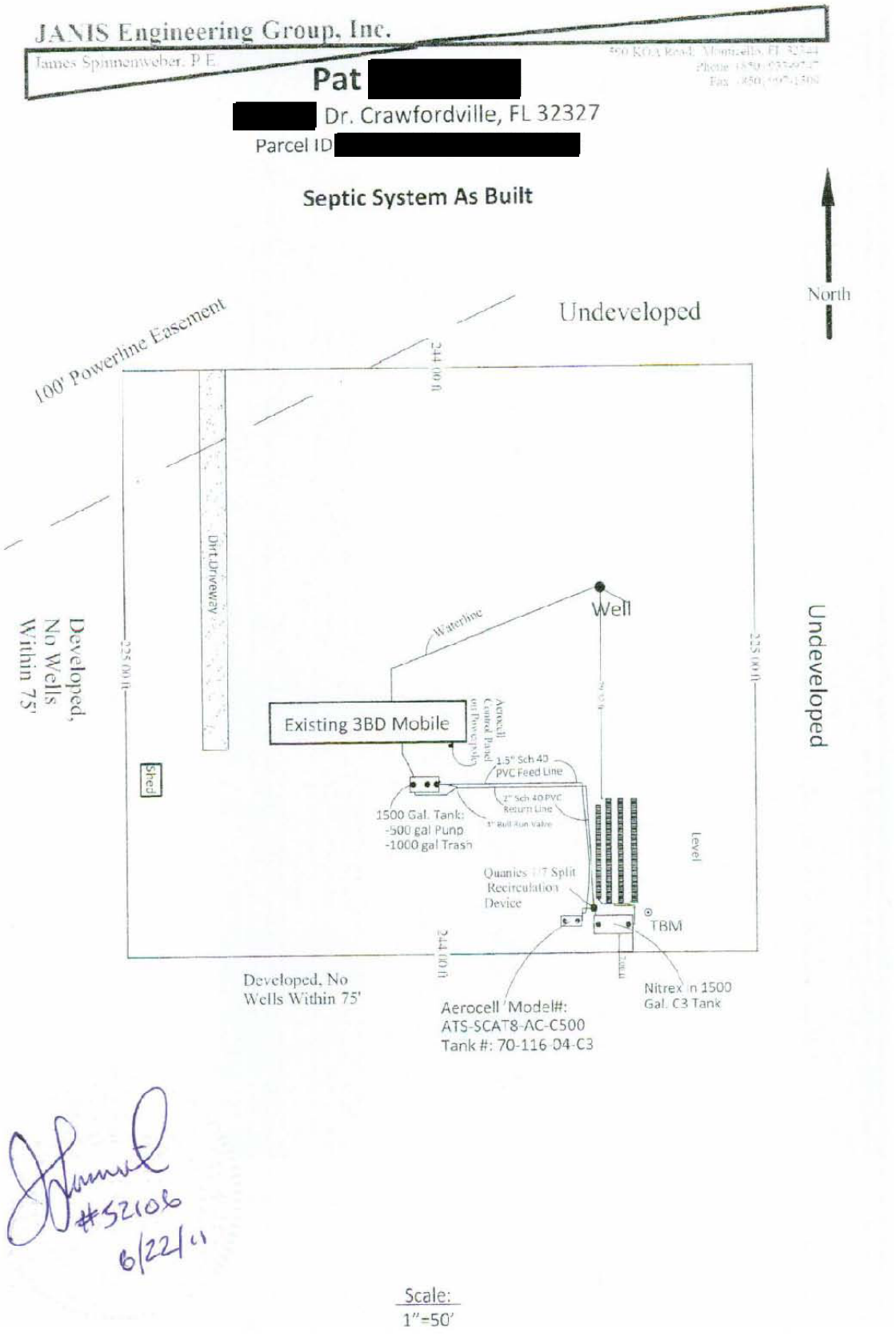


Figure 3. Schematic of Septic Tank

Tank Compartment Dimensions	1st Comp. Septic	Pump Chamber
Length (ft)	7	3.5
Width (ft)	5.5	5.5
Height (ft)	3.54	3.54
Volume (gal)	1,020	510

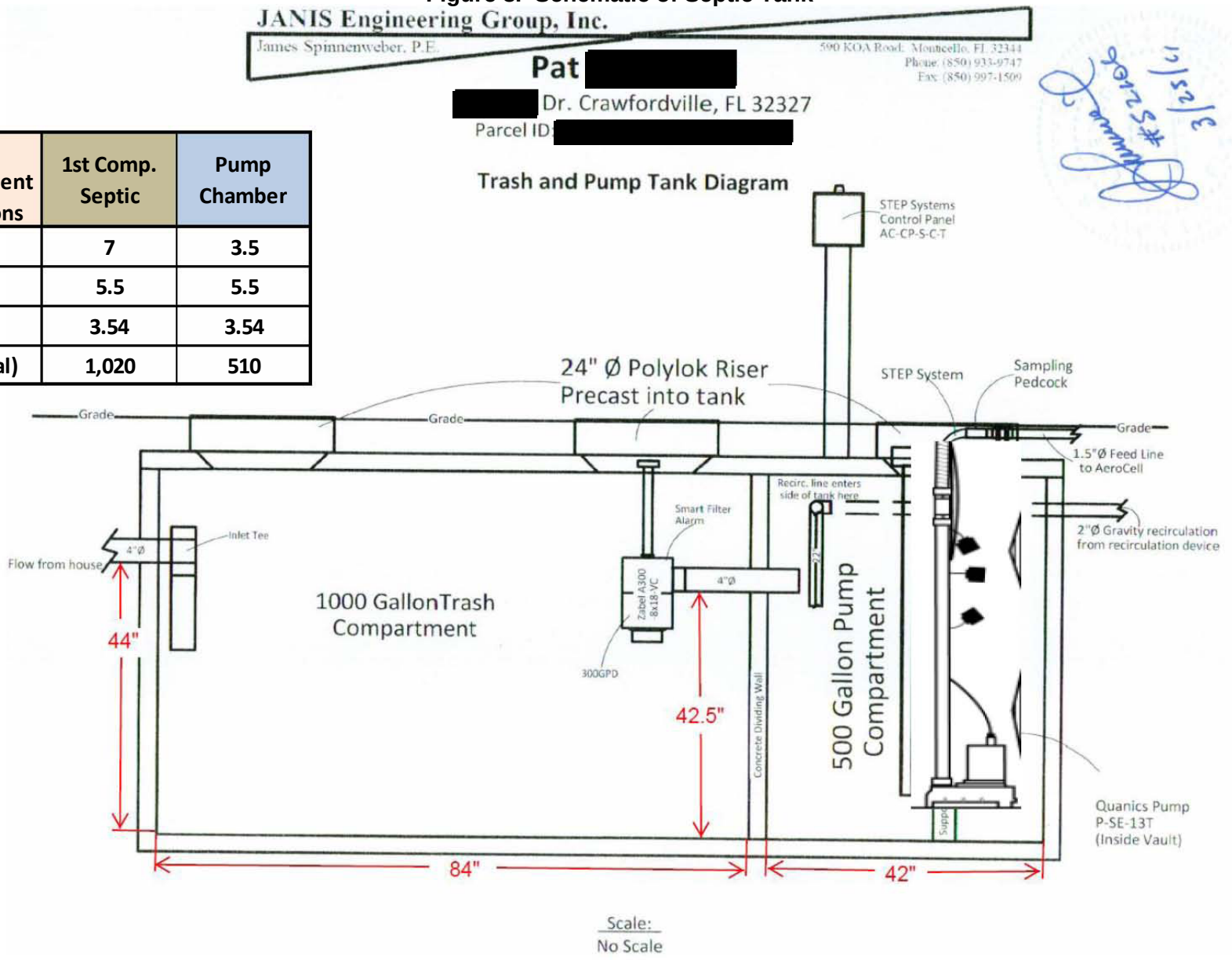
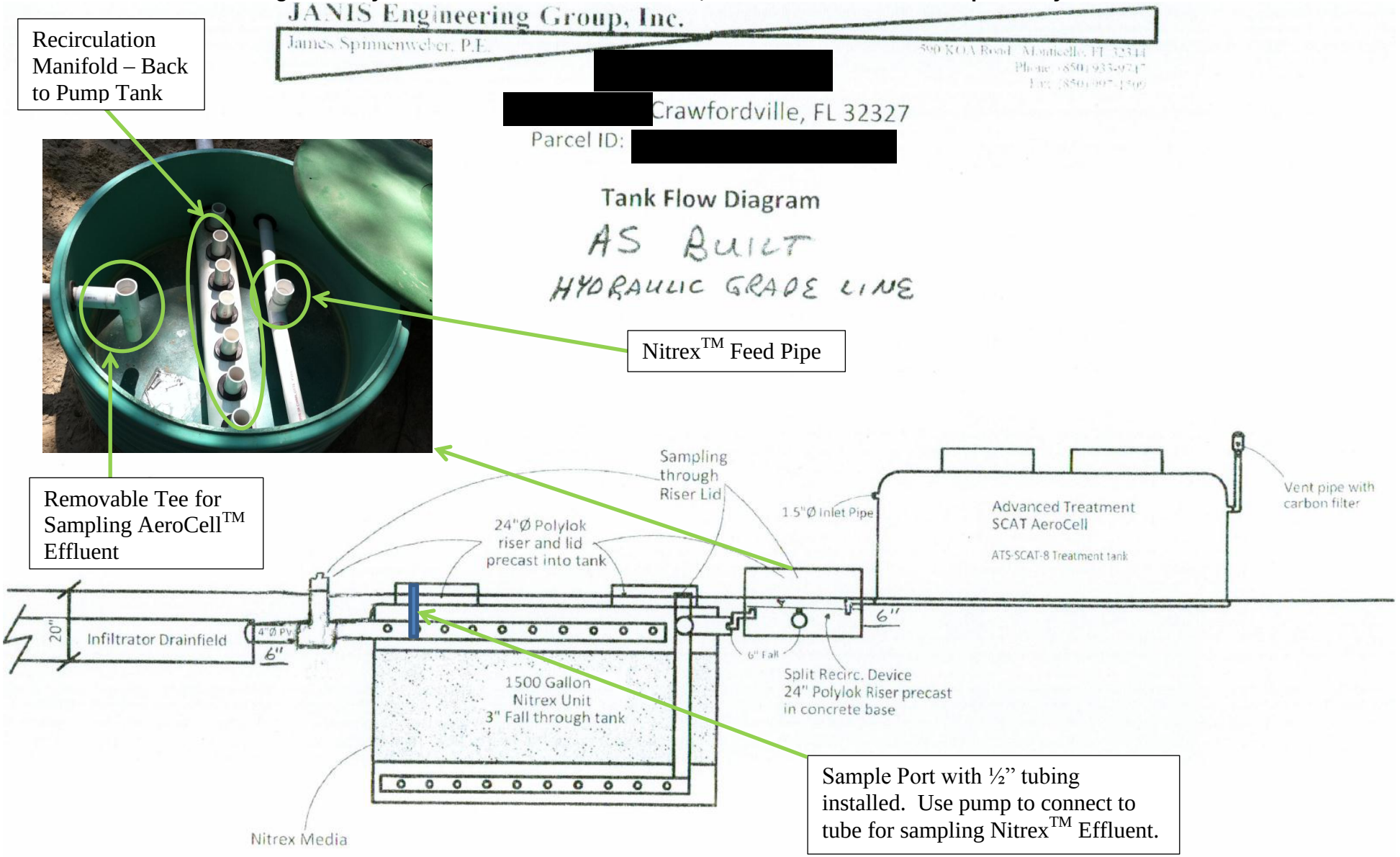


Figure 4. Hydraulic Grade Line - AeroCell™, Nitrex™ and Infiltrator Dispersal System



2 Treatment Process and Performance Expectations

2.1 Pretreatment System – Nitrification Issue

For wastewater treatment applications, ammonium (NH_4^+) must first be converted to nitrate (NO_3^-), i.e. nitrification, before the Nitrex™ filter will reduce the nitrate to nitrogen gas (denitrification). Nitrification occurs in the pretreatment system, and can be achieved with a number of the existing oxidative technologies used in wastewater treatment and approved by the State of Florida and LAI. Currently approved pre-treatment systems include the following:

- Intermittent Sand Filter
- Recirculating Gravel Filter
- Advantex™ 20x Mode 1
- Advantex™ 20x Mode 3
- Advantex™ AX20N
- AeroCell™ ATS SCAT-8-AC-C500
- Puraflow P150N*3B
- Premier Tech STB-500

This Nitrex™ System installed at [redacted] is equipped with the AeroCell™ ATS SCAT-8-AC-C500.

2.2 Nitrex™ Start-Up & Treatment performance

The nitrate reduced effluent from the Nitrex™ filter is discharged to an Infiltrator soil absorption system. Typical Nitrex™ filter effluent quality of < 5 ppm Total Nitrogen is anticipated following start-up.

During start-up, the Nitrex™ filter effluent $cBOD_5$ levels and color may be high while the media stabilizes. Typical $cBOD_5$ concentrations are < 20 ppm after start-up.

2.3 Flow Monitoring

Flow Monitoring is provided for total and recirculation flows through the use of the following two water meters:

- Main house water meter, located downstream from the connection for the outside hose
- AeroCell™ flow meter, located on the AeroCell feed pipe.

2.4 Maintenance and Monitoring

The Nitrex™ filter is passive and requires little maintenance – see Table 1 Checklist. Appendix A describes the maintenance procedures associated with the AeroCell™ system. Performance verification and monitoring should be performed routinely, as required by FLDoH and LAI as described herein.

The key adjustable parameter for the complete system is the AeroCell™ recirculation ratio. This can be monitored by comparing the two flow measurements discussed above. The procedure for measuring the recirculation ratio is as follows:

1. Take 2 measurements from each flow meter, taken at the same time and separated by a minimum of 3-4 days of normal use. If there is little or no water use, a longer period is required. A minimum of 300 gallons of water should have been recorded on the house water meter. Longer intervals and higher water use is preferred.
2. The difference between the 2 reading is the total water passing through each meter.
3. The recirculation ratio is calculated as follows:

(AeroCell™ Flow) / (House Flow) – 1.0 = Recirculation Ratio

The initial target recirculation ration is 5. The acceptable range at start-up is 4.0 – 6.0. This parameter may be adjusted based on water quality sampling results.

The recirculation ratio can be checked while the Operator is at the site using the following procedure:

1. Take a reading on the water meter feeding the Aerocell™
2. Make sure the level in the pump chamber is below the baffle penetration prior to starting the test
3. Measure the initial water level, in inches from the bottom of the tank
4. Manually run the pump for a minimum of 4 minutes. Measure and record the total pump time.
5. Shut off pump and take a second measurement on the water meter feeding the Aerocell™.
6. Wait 5 minutes to make sure all or most of the water pumped to the Aerocell™ has time to drain to the flow splitter.
7. Measure the final water level in the pump chamber, in inches from the bottom of the tank.

The recirculation ratio is calculated using data gathered in the above procedure and the following formula:

[(AeroCell™ Flow) – (Drawdown Volume)] / (AeroCell™ Flow) = Recirculation Ratio

The Nitrex™ reactive media is eventually consumed and must be replenished. Media life is currently estimated at 40+ years of operation. New media is installed via the access manholes.

2.5 NITREX™ Inspection Checklist and Monitoring Requirements

Table 1 is a checklist of information that is to be gathered during Nitrex™ filter system inspections.

Table 1. Nitrex™ FILTER CHECKLIST

Observer: _____

Site/Address: _____

Date: _____ Time: _____

	Current		Previous		Total	
Aerocell Water Meter Reading (gal)	_____	*gal.*	_____	*gal.*	_____	*gal.*
House Water Meter Reading (gal)	_____	*gal.*	_____	*gal.*	_____	*gal.*
Pump Tank Level / Net Vol. Change PC only	_____	*in.*	_____	*in.*	0	*gal.*

Recirculation Ratio _____

Average Water Use (gpd) _____

Tank Pump Chamber Inside Dimensions

Length	=	***3.5***	***ft.***	***Length***	=	***10.5***	
Width	=	***5.5***	***ft.***	***Width***	=	***5.5***	
Volume per Inch	=	***12.00***	***gal.***	if water level is >		9.25	in. from top
Volume per Inch	=	***36.00***	***gal.***	if water level is >		9.25	in. from top

Pretreatment System **Comments**

1. Observe flow splitter system for signs of solids carryover _____

Nitrex™ System **Comments**

1. Observe inlet sampling port - confirm no blockage _____
2. Observe and comment on media - color _____ _____
3. Observe outlet sampling port - confirm no blockage _____
   - is ponding occurring? _____ _____
4. Describe odor if any _____ _____

General Notes and Comments: _____

Water quality monitoring of samples taken from the Nitrex™ System is conducted to document performance and to determine any needed. Initially, sampling will be conducted by a field representative acting on behalf of FDoH.

Table 2 shows the samples FDoH will be collecting. The frequency has not been determined, however the maximum number of samples will be eight within the first year, per the Quality Assurance Project Plan (QAPP) that covers this project. Sampling will be conducted by Appalachee Backhoe on behalf of LAI for the second and third year of operation.

Table 3 details the sampling that will be conducted during the second and third year of operation.

2.6 Control Panel Settings

The control panel receives signals from the floats in the pump chamber and uses this information to control the operation of the pumps. The following pump timer settings were programmed during startup and are adjustable:

1. Normal Operation (average or low flow)
    a. Pump "ON" Time – Initial Setting 1.5 (min)
    b. Pump "OFF" Time – Initial Setting 14.0 (min)
2. High Water Level Conditions
    a. Pump "ON" Time – Initial Setting 1.7 (min)
    b. Pump "OFF" Time – Initial Setting 7.0 (min)

2.7 Sampling Locations

Sampling locations are shown on Figure 4, with descriptions added below.

2.7.1 Septic Tank Effluent

Septic tank effluent data is to be collected from inside the effluent filter located in the first chamber of the septic tank.

2.7.2 AeroCell™ Effluent

The AeroCell™ effluent sampling location is the recirculation splitter unit. The inlet tee to this device is not glued on and can be easily removed to facilitate taking a grab sample.

2.7.3 Nitrex™ Effluent

Nitrex™ effluent represents the final effluent for the system. A sample port is installed on the Nitrex™ effluent pipe within the Nitrex™ tank under the effluent access opening. This location requires the use of a hand pump that can be connected to a ½" nylon tube. Care should be taken not to cause excessive turbulence that may draw particles into the sample.

Table 2. First Year Sampling – FLDoH Study

Sample points	Analytes
Influent, effluent, intermediate point(s) where applicable	Temperature
	pH
	DO
	ORP
	Alkalinity
	TKN
	NH_4^+-N
	(NO_3+NO_2)-N
	TSS
	VSS
	$CBOD_5$
	COD
	Total phosphorus
	Orthophosphorus
	E. Coli
	Fecal Coliform

Table 3. Second Year and Beyond Sampling

Analysis	Septic Tank Effluent	Aerocell Effluent	Nitrex™ Filter Effluent
pH*			**1**
$cBOD_5$	**1**		**1**
TSS			**1**
Alkalinity			**1**
TKN	**1**	**1**	**1**
NH_4		**1**	
Nitrate+Nitrite		**1**	**1**
Temperature*			**1**

Field data kits/probes/strips - lab analysis not needed

Appendix A: AeroCell™ Operation and Maintenance Manual

Prepared for the [redacted] Residence

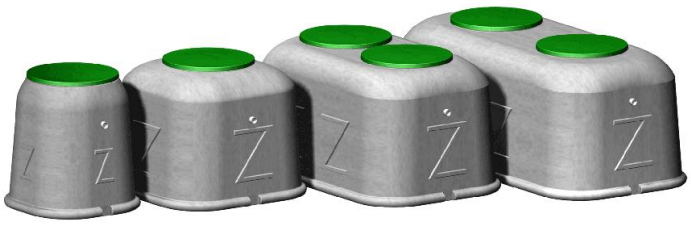
[redacted]

Crawfordville, FL

By Quanics, Inc.

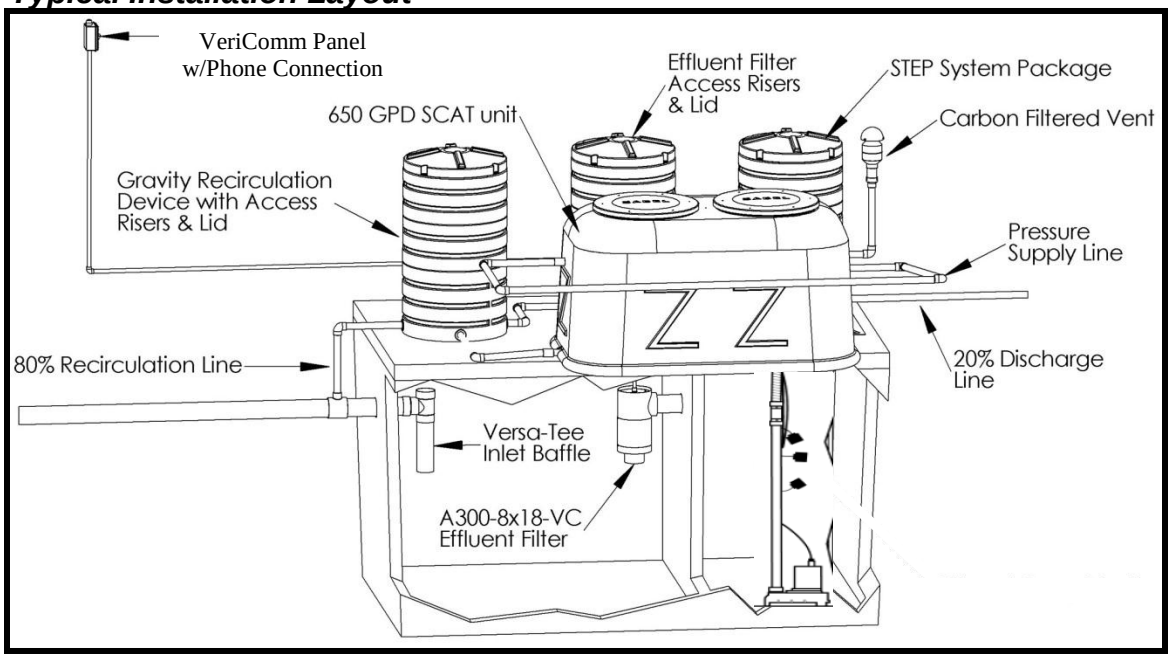
July 2011

1-877-782-6427
www.quanics.net



INSTALLATION

Typical Installation Layout

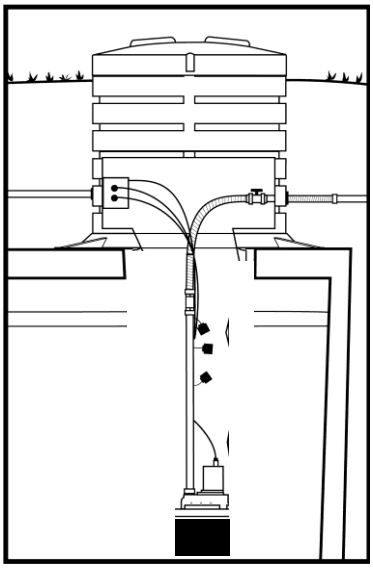


Pretreatment System

The pretreatment system includes the primary septic and dosing tank. These units shall be installed level and on a stable base to reduce the possibility of settling. The tanks shall be installed to allow gravity flow into the tank. The inlet and outlet shall be sealed and rendered watertight. Please follow the guidelines and practices required by the Wakulla County Health Department. A ZABEL A300 Effluent Filter should be attached to the outlet of the primary septic tank or as shown in the figure above. Please follow the installation instruction contained in the filter-shipping container

Pumping Package

Dosing of the effluent from the dosing tank to the AeroCell® BioFilter unit will be accomplished through the use of a Pumping System. Installation instructions for all of the components included in the Pumping package will be included with the package.



AeroCell BioFilter

The single container fiberglass unit is a pre-assembled ready to install advanced treatment module. The module contains open cell foam media, spray nozzle(s), pressure gauge, true union ball valve and is outfitted with air vent that discharges through a carbon filter.

Each AeroCell® BioFilter unit arrives pre-plumbed on the inside with only a few simple connections required to the unit for installation. General guidelines for installing the unit include the following:

1. Locate the AeroCell BioFilter in an area that provides good ventilation and rainwater run-off. The unit may be placed directly on the pretreatment unit or it may be located in another area. Prepare an excavation with a width and depth that will allow any and all inlet/outlet connections. If gravity recirculation is utilized ensure there is positive flow from the outlet of the module into the gravity recirculation device and then back into the primary tank. The plant access cover(s) should extend above the final surface grade in such a way to prevent surface water from entering the unit.
2. Using a leveling instrument ensure the unit is placed level and on a stable base. Using four (4) inches of sand or fine-grained gradable material in the bottom of the excavation should provide a solid stable base. Before placing the gradable material remove any sharp objects or rocks.
3. When the bottom of the excavation is graded, smooth, tamped and level, gently lower the module into the excavation.
4. Connect the pump discharge line to the 1 ¼" module inlet hub. All piping is SCH 40 and should be primed and glued using the proper PVC products.
5. The module may arrive with the nozzle discharge assembly disconnected to protect it during shipping. Attach nozzle discharge assembly to the corresponding true unions by threading the housing. Hand tighten each true union to prevent water leaks when system is pressurized.
6. The spray nozzles are attached to the nozzle discharge assembly via a clamp attached to the nozzle. Align the opening in the nozzle with the hole in the nozzle discharge assembly. Pull the clamp up and over the discharge assembly locking in into place.
7. Connect the recirculation line to the1 ¼" module outlet hub. Attach the 1 ¼" vent pipe to the module venting hub. The included carbon filter vent may then be placed at any location. Ensure the carbon filter vent is above grade and protected.
8. Once all connection are made, pressurize the system to check for leaks and set the pressure gauge mounted on the nozzle discharge assembly to 5 psi using the ball valve attached to the assembly. Check all connections for leaks.

Recirculation Device

Follow the instruction guide for the 7:1 Gravity Recirculation device. Ensure the levelness of the device by filling the basin with water and adjusting pipe heights up or down until the desired recirculation ratio is achieved.

MAINTENANCE

All onsite wastewater treatment and dispersal systems should be inspected and maintained periodically in order to provide years of trouble free operation. The frequency and type of maintenance required is based upon the complexity of the system. Since the AeroCell systems are very basic in operation, they only require an inspection and minimal maintenance every 6 months. This will allow the service provider an opportunity to educate the homeowner in regards to the proper use of the system as well as establish a working knowledge of individual system performance. Most onsite professionals are familiar with all of the components because they use them routinely in other systems. The open cell foam is the only component that may be unfamiliar and because it does not clog readily, little maintenance is required. The following components should be inspected every six months and serviced as required.

SEPTIC TANK

1. The septic tank should be inspected for excessive scum and solids build up. There are several commercial devices that can be used to measure the sludge layer and determine the pumping frequency of the tank. The tank shall be pumped and the contents completely removed at least every three to five years with the exact frequency to be determined by the Registered Maintenance Entity.

2. Homeowners must not use excessive amounts of cleaners and bleach, which can upset the digestion process in the septic tank. Other non-degradable materials such as greases, garbage disposal byproducts, personal hygiene products, cigarettes, paints, chemicals, and diapers should not be disposed of into the septic tank. Acetone (such as used in nail polish remover and rental rug shampooers) should be strictly kept out of the system.

SEPTIC TANK FILTER AND PUMP VAULT

Inspect the filtered pump vault filter plates and clean them as needed. Installation and maintenance instructions are included with each Zabel product.

PUMP SYSTEM

1. Inspect the wiring connections and control panel for proper operation. Correct as necessary.
2. Inspect the floats for proper placement and make certain they are not tangled.
3. Activate the pump through the panel or manually trip the floats to test for proper pump operation.
4. Activate the alarm system to verify proper operation.

AeroCell® Module

1. A gray biomat on the surfaces of the foam should be present and is normal. An excessive accumulation of solids on the foam may indicate that the septic tank is functioning poorly due to excessive household chemical use or a need for maintenance. Check with the homeowner about what types of materials have been discharged. Excessive bleach, cleaning materials, and other chemicals can upset the septic tank. The owner shall restrict the use of such materials.
2. If necessary, remove the upper layer(s) of foam and replace the clogged foam with new foam. When replacing the foam, make sure to compact it below the spray nozzle by approximately 4-6 inches to make certain that the spray nozzles function properly.
3. Remove the spray nozzle by unclipping the stainless steel saddle from the pipe. Clean any debris and replace them. The spray nozzle piping can be removed at the unions and cleaned with a bottlebrush or water pressure if desired.

RECIRCULATION DEVICE

Check the gravity recirculation system for the design recirculation rate by comparing the water meter readings for the house and the AeroCell® feed line. The recirculation ratio is initially set to be approximately 5:1. Should the measured recirculation ratio fall outside the range of 4:1 to 7:1, an adjustment may be required. The recirculation ratio may also be adjusted in response to water quality data, specifically nitrification and/or denitrification performance. The recirculation

ratio should only be adjusted by the system operator under the guidance of Lombardo Associates, Inc.

WARRANTY

All Quanics® components are warranted to be free from defects in material and workmanship for a minimum of two years from the date of original installation. The open cell foam is warranted to be free from defects and workmanship for a period of ten years. Some Quanics components may carry longer warranties than stated.

Appendix B: Nitrex™ System FLDoH Permit

FLORIDA DEPARTMENT OF HEALTH

Charlie Crist
Governor

Ana M. Viamonte Ros, M.D., M.P.H.
State Surgeon General

October 3, 2008

Pio Lombardo
Lombardo Associates, Inc.
49 Edge Hill Road
Newton, MA 02467

RE: Innovative Onsite System Permit for Nitrex Denitrification Filter, Lombardo Associates, Inc.

Dear Mr. Lombardo:

Your application has been reviewed and approved with the following provisions:

A: Limitations:

- This innovative system permit will expire five years after it is issued unless Lombardo Associates, Inc. (LAI) previously applies for reclassification or requests an extension in writing at least three months prior to expiration.
- This innovative system permit allows the installation of at least five and up to twenty innovative systems upon approval of site-specific construction applications by the respective County Health Department and this office.
- This innovative system permit has the objective to evaluate how much nitrogen reduction the permitted system can achieve, while maintaining low cBOD5 levels.
- Application for reclassification shall require sampling results from at least 30 quarterly sampling events of both influent and effluent obtained from the installed innovative systems, of which at least one system will be no less than one year old at time of application for reclassification.
- All systems will be designed, constructed, and installed as innovative performance-based treatment systems in accordance with this permit, Chapter 64E-6, Florida Administrative Code, (FAC) "Standards for Onsite Sewage Treatment and Disposal Systems", and LAI's Nitrex Design and Installation Manual, dated August 23, 2008.
- All sites covered by this innovative permit shall be single-family residences, except in the Florida Keys and where performance-based treatment systems are required by local ordinances. Use of a performance-based treatment system for other than single family residences would require a variance under Florida Statute.

This permit can be amended as necessary to address the experiences and new information in the field during the innovative system testing period.

B: System components covered:

- A primary tank with an effective capacity and pumps as required for the pretreatment system.
- A pretreatment system approved by Lombardo Associates, Inc. and also approved for use in Florida by the Department. At this time, approved pretreatment systems are:
    - Intermittent sand filter (effective size ~2mm; uniformity coefficient <3; %passing #200 sieve <2%; design hydraulic load ~ 1gpd/sqft)
    - Recirculating gravel filter (effective size 2-6 mm; uniformity coefficient <3; %passing #200 sieve <2%; design hydraulic load 3-5 gpd/sqft)
    - Advantex (20x or AX20N in mode1 or mode 3)
    - Aerocell ATS SCAT-8-AC-C500
    - Puraflo P150N*xB (where x is the number of modules)
    - Premier Tech STB-500
- Gravity or pump-dosing to
- A Nitrex nitrogen removal filter, consisting of an approved Florida onsite sewage treatment receptacle filled with Nitrex treatment media in a configuration described in the Nitrex Design and Installation Manual dated August 23, 2008 and generally sized according to tables A-1 and A-2 of that manual. Nitrex treatment media will be between two and ten feet thick in the vertical direction. The site-specific application shall indicate thickness and surface loading rate for the Nitrex media, any hydraulic modules within the filter and any recirculation of effluent from the Nitrex filter to a prior component.
- When the system is designed for an annual average effluent concentration standard of less than 10 mg/L cBOD5 and TSS, a polishing effluent filter shall be included. This effluent filter may be:
    - One of the approved pretreatment systems listed above with a design hydraulic loading rate up to five times the design hydraulic loading rate used for domestic sewage.
    - A gravel filter in accordance with 64E-6.0181(3)(a)2.e Florida Administrative Code (Florida Keys mineral aggregate filter)
- A control/telemetry panel approved by LAI that provides flow information
- Sampling access ports to sample influent to the pretreatment unit, effluent from the pretreatment unit, effluent from the Nitrex filter, effluent from the polishing filter (when installed)
- All tanks shall be approved under 64E-6, FAC, as onsite sewage receptacles.

C: Operation, Maintenance and Monitoring

- An operating permit in accordance with 64E-6.027(6) will be required for any system installed under this permit. This operating permit will also include the pretreatment system.
- Identify to this office at least one maintenance entity permitted in Florida before the construction permit of the first system is approved, and provide this office with a copy of the operation and maintenance manual issued to the maintenance entity per 64E-6.027(6)(e)1.

- Samples may be grab samples or composite samples. The maintenance entity or LAI-specified alternative shall obtain samples using an established protocol such as the applicable sections of Standard Operating Procedure FS-2400 of the Florida Department of Environmental Protection http://www.dep.state.fl.us/labs/qa/sops.htm) or LAI-approved alternative submitted to this office. A NELAC-certified laboratory shall analyze the required samples for cBOD5, TSS, and nitrogen species specified below. Field testing kits are acceptable for other parameters and diagnostic sampling.
- The operating permit shall specify :
    - A maximum of six months start-up period during which the Nitrex filter effluent will be sampled at least monthly for cBOD5 to determine if it meets a standard of 20 mg/L cBOD5.
    - Sampling starting six months after begin of operation or after the Nitrex effluent filter meets 20m mg/L cBOD5, whichever comes first: quarterly sampling of influent for cBOD5 and TKN; pretreatment unit effluent for TKN, ammonia-N, nitrate-N and nitrite-N; Nitrex effluent for TKN, nitrate-N, nitrite-N, alkalinity, pH, temperature, cBOD5, TSS; polishing filter effluent (if installed) for cBOD5 and TSS. This monitoring shall extend for the duration of innovative system evaluation.
    - maintenance and monitoring per the Nitrex Operation&Maintenance Manual dated August 23, 2008 or subsequent editions.
    - Replacement of the Nitrex media as required to maintain effluent quality. Partial replenishment will be considered every ten years; unless inspection of the media and analysis of effluent show that the media continues to be effective.
    - any additional monitoring as required due to site-specific permit conditions
- The maintenance entities shall copy this office on maintenance and monitoring reports sent to the County Health Departments.

D: Construction Permitting:

- Engineers licensed in the State of Florida shall design, sign and seal site-specific system construction permit applications in accordance with 64E-6.026(2), FAC. The application shall be submitted to the county health department responsible for each site and indicate that LAI approves of the design specifications. The application shall include an empty form DH3145 and a completed form DH3144. The county health department shall review the application for compliance with 64E-6 and shall forward DH3145 to this office for approval of the innovative system together with any questions that may arise for clarification.
- Specified performance level per 64E-6.026(2)(a) may be baseline treatment. Data submitted for the application showed the following results for the components of the innovative system

Component	Nitrex Filter after Recirculating Sand Filter		
Test	MASSTC Oct 01- Mar 04		
	Influent (n)	Out RSF (n)	Out Nitrex (n)
cBOD5 (mg/L)	180 (9)	6 (34)	26 (44)
TSS (mg/L)	154 (31)	5 (35)	5 (44)
TN (mg/L)	38.8 (30)	19.3 (35)	5.4 (45)
Test	MASSTC Dec 04- Oct 05		
	Influent (n)	Out RSF (n)	Out Nitrex (n)
cBOD5 (mg/L)	226 (38)	7 (39)	6 (39)
TSS (mg/L)	222 (38)	6 (39)	3 (39)
TN (mg/L)	39.8 (37)	22.6 (39)	7.1 (39)

- In accordance with 64E-6.028(3), for pressure dosed drainfields, a drainfield size reduction by up to 25% can be permitted when the site-specific application is designed to reduce the wastewater strength to secondary wastewater treatment levels (20mg/L cBOD5; 20 mg/L TSS). When the design includes an effluent polishing filter to meet advanced secondary wastewater treatment levels (10mg/L cBOD5; 10 mg/L TSS), a drainfield size reduction of up to 30% can be permitted. To provide for site-specific monitoring per Chapter 64E6.029(2)(a)1, FAC, two drainfield inspection ports shall be installed at each system and monitored for ponding depth. Ponding depth exceeding 6 inches shall be considered a failure relative to this parameter.
- This innovative system may be used with other approved components to achieve specific treatment levels for other parameters such as total phosphorus. In this case the respective parameter shall be added to the monitoring parameters at the same frequency as the innovative system. Examples would be designs to meet the Florida Keys standard in conjunction with a site-specific treatment system that is designed to reduce total phosphorus to 1 mg/L. Another example would be designs to address setback and authorized lot flow modifications allowed per Chapter 64E-6.028 (F.A.C.) in conjunction with a site-specific treatment system that is designed to reduce fecal coliforms to the applicable levels.

After expiration of the innovative system permit the installed innovative systems may remain in place as performance-based treatment systems if they meet the site-specific applicable performance standards. If they fail by not meeting applicable performance standards, the systems must at your expense either be reengineered, which may require a new or modified innovative system permit, or replaced with a system approved by the Department. If we may be of further assistance or should you have any additional questions regarding this letter, please contact Dr. Eberhard Roeder at (850) 245-4070.

Sincerely

Gerald Briggs, Chief
Bureau of Onsite Sewage Programs

Enclosure

NOTICE OF RIGHTS

A party whose substantial interest is affected by this order may petition for an administrative hearing pursuant to sections 120.569 and 120.57, Florida Statues. Such proceedings are governed by Rule 28-106, Florida Administrative Code. A petition for administrative hearing must be in writing and must be received by the Agency Clerk for the Department, within twenty-one (21) days from the receipt of this order. The address of the Agency Clerk is 4052 Bald Cypress Way, BIN # A02, Tallahassee, Florida 32399-1703. The Agency Clerk's facsimile number is 850-410-1448.

Mediation is not available as an alternative remedy.

Your failure to submit a petition for hearing within 21 days from receipt of this order will constitute a waiver of your right to an administrative hearing, and this order shall become a 'final order'.

Should this order become a final order, a party who is adversely affected by it is entitled to judicial review pursuant to Section 120.68, Florida Statutes. Review proceedings are governed by the Florida Rules of Appellate Procedure. Such proceedings may be commenced by filing one copy of a Notice of Appeal with the Agency Clerk of the Department of Health and a second copy, accompanied by the filing fees required by law, with the Court of Appeal in the appropriate District Court. The notice must be filed within 30 days of rendition of the final order.

Appendix C: Nitrex™ and AeroCell™ Installation Certification Forms

Installation Certification Form for Residential Nitrex™ System

[redacted] Dr.
Crawfordville, FL

AeroCell™ System	*Required*	*Installed*
Septic Tank	1,500-gallon 2-compartment top-seam tank	1,500-gallon 2-compartment top-seam tank
Recirculation Pipe Outlet Location	2nd compartment of septic tank	2nd compartment of septic tank
Manufacturer's Certification Received?	**Yes**	
Nitrex™ System	*Required*	*Installed*
Installed Tank	1,500-gallon single compartment top-seam tank	1,500-gallon single compartment top-seam tank
Tank Installed Level?	**Yes**	
Drop Between Splitter Invert and Nitrex™ Invert	0.50 ft. minimum	0.50 ft.
Hydraulic Drop Across Nitrex™ Tank	0.25 ft. minimum	0.25 ft.
Hydraulic Drop Prior to Gravity Nitrex™ Tank	0.50 ft. minimum	0.50 ft.
Certification Statement		

By signing below, I hereby certify that the Nitrex System installed at the above location is in compliance with the design intent and the permitted drawings for this site.

Gary Rubenstein

6/9/2010
Installation Date

[redacted] Dr. Crawfordville, FL
June 9, 2011

Inspection checklist

Septic/ recirculation tank	Pass	Fail
Risers to grade?	√	
Watertight?	√	
Structurally sound?	√	
Filled w/ water to prevent floating?	√	
Place pump on 'hand'		
Is pump activated?	√	
Place pump on 'auto'		
Can alarm be activated?	√	
Visual alarm?	√	
Audio alarm?	√	
Treatment Module		
Spray nozzles attached?	√	
Air vent installed?	√	
Charcoal filter present?	√	
Recirculation device		
Level?	√	
If gravity splitter, grade from module to device even and sloping down?	√	
Does flow split evenly?	√	

Kevin M. Sherman, P.E., Ph.D., D. WRE

APPENDIX B

NITREX™ SYSTEM INSPECTION CHECKLIST

Nitrex™ System Inspection Checklist

Project Site: [redacted] ***Dr.***
Crawfordville, FL

Date: 7/26/2011 ***Time:*** 3:50 PM

	Current		Previous		Total	
Aerocell Water Meter Reading (gal)	40,887	*gal.*	40,756	*gal.*	131	*gal.*
House Water Meter Reading (gal)	4,910	*gal.*	4,254	*gal.*	655.5	*gal.*

Recirculation Ratio ***n/a - pump switched off at control panel***

	Current	Previous	Total
Float Error Alarm Count	194		
High Water Alarm Count	216		

Recirculation Ratio Check (only perform if an adjustment has been made to splitter device)

Measure Starting Water Level	37.5	*(inches from tank bottom)*
Starting Aerocell Flow Meter Reading	40,920	*gal.*

Manually run pump for a minimum of 4 minutes

Total Pump Run Time	4	*(Total pump run time in minutes)*
Measure Final Water Level	36.75	*(inches from tank bottom)*
Final Aerocell Flow Meter Reading	40,973	*gal.*
Total Volume Pumped (Flow Meter)	53	*gal.*
Net Volume Pumped (drawdown)	9.0	*gal.*
Pump Flow Rate	13.25	*gpm*
Current Recirculation Ratio	4.9	

Tank Pump Chamber Inside Dimensions

Length	=	***3.5***	***ft.***
Width	=	***5.5***	***ft.***
Volume per Inch	=	***12.00***	***gal.***

APPENDIX C

OPERATING PERMIT & FINAL APPROVAL

FLORIDA DEPARTMENT OF HEALTH

STATE OF FLORIDA
DEPARTMENT OF HEALTH
OPERATING PERMIT

For: OSTDS - Operating and Performance Based,

Issued To:
[redacted] Dr
Crawfordville, FL 32327

Billing ID [redacted]
Permit Number: 65-QW-[redacted]
County: 65 - Wakulla
Issue Date: ~~01/01/1900~~ 6/24/11
Permit Expires On: ~~01/01/1900~~ 6/24/13

The facility shown above has been inspected by a duly authorized representative of the Department of Health, and was found in conformance with those rules promulgated by the department under the authority of Chapters 381, 386 and 489 Part III, Florida Statutes, and set forth in Rule 64E-6, Florida Administrative code.

This permit grants authority to operate the above referenced facility, service, or system in conformance with department rules and the conditions of operation shown below. This permit is revocable, upon service of notice, when it is determined by the department that the operational conditions and department standards are not being maintained.

Issued by: Wakulla County Health Department
48 Oak St, Crawfordville, FL 32327

DO NOT DETACH HERE (Non-Transferable)

DO NOT SEPARATE FROM OPERATING PERMIT

FLORIDA DEPARTMENT OF HEALTH

STATE OF FLORIDA
DEPARTMENT OF HEALTH
CONDITIONS OF OPERATION

For: OSTDS - Operating and Performance Based,
AB, [redacted] DrCrawfordville, FL 32327

Issued To: [redacted]

Billing ID: [redacted]
Permit Number: 65-QW-[redacted]
Permit Expires On: ~~01/01/1900~~ 6/24/13

The operating permit for the facility shown above has been issued with the following conditions of operation:

DH-4013 (03/97)

DISPLAY OPERATING PERMIT AND CONDITIONS OF OPERATION IN A CONSPICUOUS PLACE (Non-Transferable)

DETACH HERE - RETAIN THIS PORTION FOR YOUR RECORDS

FLORIDA DEPARTMENT OF HEALTH

STATE OF FLORIDA
DEPARTMENT OF HEALTH
RECEIPT

For: OSTDS - Operating and Performance Based,

Issued To:
[redacted] Dr
Crawfordville, FL 32327

Mailed To:
[redacted] Dr
Crawfordville, FL 32327

Billing ID: [redacted]5
Permit Number: 65-QW-[redacted]
County: 65 - Wakulla
Issue Date: ~~01/01/1900~~ 6/24/11
Amount Paid: 50.00
Date Paid: 06/24/2011
CheckNumber:
Receipt Number: 65-PID-1656549
Operator ID: McdonaldLA
Fee paid by:

Issued By: Wakulla County Health Department

RETAIN FOR YOUR RECORDS

STATE OF FLORIDA
DEPARTMENT OF HEALTH
ONSITE SEWAGE TREATMENT AND DISPOSAL SYSTEM
CONSTRUCTION INSPECTION AND FINAL APPROVAL

PERMIT NO: Apdo11
DATE PAID: 7/14/11
FEE PAID: 360.00
RECEIPT #: 5556-Bud

APPLICANT: [redacted]

AGENT: [redacted]

CHECKED [X] ITEMS ARE NOT IN COMPLIANCE WITH STATUTE OR RULE AND MUST BE CORRECTED.

TANK INSTALLATION

[ ] [01] TANK SIZE [1] 1000 [2] _____
[ ] [02] TANK MATERIAL Concrete
[ ] [03] OUTLET DEVICE
[ ] [04] MULTI-CHAMBERED [Y / N]
[ ] [05] OUTLET FILTER _____
[ ] [06] LEGEND 69-090-20P-C3
[N] [07] WATERTIGHT
[N] [08] LEVEL
[X] [09] DEPTH TO LID

DRAINFIELD INSTALLATION

[N] [10] AREA [1] 456 [2] _____ SQFT
[N] [11] DISTRIBUTION BOX ____ HEADER ____
[N] [12] NUMBER OF DRAINLINES 4
[N] [13] DRAINLINE SEPARATION
[N] [14] DRAINLINE SLOPE
[X] [15] DEPTH OF COVER
[X] [16] ELEVATION [ABOVE/BELOW] BM 40
[ ] [17] SYSTEM LOCATION
[ ] [18] DOSING PUMPS 1
[ ] [19] AGGREGATE SIZE
[ ] [20] AGGREGATE EXCESSIVE FINES
[ ] [21] AGGREGATE DEPTH

FILL / EXCAVATION MATERIAL

[ ] [22] FILL AMOUNT
[ ] [23] FILL TEXTURE
[ ] [24] EXCAVATION DEPTH
[ ] [25] AREA REPLACED
[ ] [26] REPLACEMENT MATERIAL

SETBACKS

[ ] [27] SURFACE WATER _____ FT
[ ] [28] DITCHES _____ FT
[N] [29] PRIVATE WELLS 84 FT
[ ] [30] PUBLIC WELLS _____ FT
[ ] [31] IRRIGATION WELLS _____ FT
[N] [32] POTABLE WATER LINES _____ FT
[N] [33] BUILDING FOUNDATION 12 FT
[N] [34] PROPERTY LINES 7 FT
[ ] [35] OTHER _____ FT

FILLED / MOUND SYSTEM

[ ] [36] DRAINFIELD COVER
[ ] [37] SHOULDERS
[ ] [38] SLOPES
[ ] [39] STABILIZATION _____

ADDITIONAL INFORMATION

[N] [40] UNOBSTRUCTED AREA
[N] [41] STORMWATER RUNOFF
[X] [42] ALARMS
[X] [43] MAINTENANCE AGREEMENT
[ ] [44] BUILDING AREA
[ ] [45] LOCATION CONFORMS WITH SITE PLAN
[X] [46] FINAL SITE GRADING
[ ] [47] CONTRACTOR Adam Barber
[ ] [48] OTHER _____

ABANDONMENT

[N] [49] TANK PUMPED 6/10/11
[N] [50] TANK CRUSHED & FILLED 6/10/11

EXPLANATION OF VIOLATIONS / REMARKS:

[ ] 39 Chambers EQ35 - Barely
[ ] _____
[ ] _____
[ ] _____

CONSTRUCTION [APPROVED/DISAPPROVED]: Tiffany Wakulla CHD DATE: 6/10/11

FINAL SYSTEM [APPROVED/DISAPPROVED]: Tiffany Wakulla CHD DATE: 8/31/11

APPENDIX D

CONSTRUCTION COSTS

Environmental Engineers/ Consultants
LOMBARDO ASSOCIATES, INC.
188 Church Street
Newton, Massachusetts 02467
(617) 964-2924
Portable: (617) 529-4191
Fax: (617) 332-5477
E-mail: pio@lombardoAssociates.com

January 25, 2011

Damann L. Anderson, P.E., V. P.
Hazen and Sawyer, P.C.
10002 Princess Palm Ave., Suite 200
Tampa, FL 33619

Dear Mr. Anderson,

re: Nitrex™ System – Crawfordville, FL
Design, Furnish and Install Cost Estimate

Per our recent discussions, LAI is providing a turn-key price for a Nitrex™ denitrification system complete with a new septic tank and mounded drainfield. As discussed, the pricing for this initial system is higher than it will be for future scenarios where multiple installations in a specific area would occur and economies of scale would be achieved.

Pricing for this installation is broken down into the following three conditions:

1. Pricing for this project which includes a new septic tank, mounded drainfield and associated design, installation and site restoration work.
2. Pricing for a similar project done in an area where multiple installations would occur.
3. Pricing for a true retrofit, where the septic tank and drainfield are retained.

The costs for these three scenarios are detailed below.

Cost Item Description	Initial Project Costs	Future / Volume Project Costs	Retrofit Project Costs (No ST or DF)
Wakulla County Perf. Based System Permit	$515	$515	$515
Design Engineering	$2,200	$1,500	$1,200
Aerocell Equipment	$7,900	$7,900	$7,900
Nitrex Equipment	$5,000	$4,500	$4,500
Septic / Recirculation Tank	$1,200	$1,200	$0
Install Equipment & Mounded Drainfield	$5,900	$4,500	$3,200
Operating Permit + 2-year O&M (no sampling)	$800	$800	$800
Total Design, Furnish and Install Cost	**$23,600**	**$21,000**	**$18,200**

If you have any questions on this matter, please contact myself at 617-964-2924 or Pio@lombardoassociates.com, or Gary Rubenstein at GaryR@lombardoassociates.com.

Yours truly,

Pio Lombardo, P.E.
President

cc: Mike Sundin, Apalachee Backhoe & Septic Tank, LLC
Kevin Sherman, Quanics

Table D.1
As-built Construction Cost Summary

Cost Item Description	As-Built Costs
Wakulla County Perf. Based System Permit	$515
Design Engineering	$2,200
Aerocell Equipment	$7,900
Nitrex Equipment	$5,000
Septic / Recirculation Tank	$1,200
Install Equipment & Mounded Drainfield	
Pump, crush, and fill old septic tank	$325
Plumb in new 1,500 gallon trash/pump tank	$125
Electrical connection from main breaker panel to pump tank and aerobic treatment Unit	$750
Install Aerocell module and flow splitter with accompanied plumbing	$800
Install 468 square feet of gravity distribution EQ36 Quick 4 infiltrator drainfield	$2,106
Install 3,000 square feet of centipede sod at $0.30 per square foot	$900
Installation inspection, as built engineering, and certification of installation as required by Florida State Code	$275
Subtotal	$22,096
Research and Monitoring Equipment	$824
Operating permit and 2-year maintenance agreement (Does not include sampling for first 2 years)	$680
Total Installation Costs	**$23,600**