Florida Department of Health
Onsite Nitrogen Reduction Strategies Study

Contract CORCL

TASK B.6

Installation Report for Passive Nitrogen Reduction System B-HS3

June 2013

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 and pilot tested in FOSNRS Task A. 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 Seminole County, Florida (B-HS3).

System Overview

The B-HS3 system was installed in Seminole County, Florida in June 2013. It consists of a replacement septic tank which was upgraded to a 1,500 gallon two chamber concrete primary tank; 600 gallon concrete STE dose tank; a two zone drip system, a Stage 1 lined drip zone and a reclaimed water dispersal drip zone, and a 1,050 gallon concrete tank Stage 2 saturated media biofilter. Figure 1 is a site schematic showing the system components and layout of the installation. The complete as-built system drawings are included in the attached Appendix A.

Household wastewater enters the 1st chamber of the primary tank and exits the second chamber as septic tank effluent through an effluent screen into the STE dose tank. The STE dose tank contents are pumped through the drip system hydraulic unit and discharged to the Stage 1 drip system (Zone 1). Effluent is dispersed above an 18-inch layer of mound sand (slightly limited sand) and proceeds downward through the sand media where nitrification occurs. Underlying the sand is a 9-inch layer of lignocellulosic and sand media mixture above a 30-mil PVC liner where there is the potential for denitrification prior to the Stage 2 biofilter. The liner effluent is conveyed to the bottom of the Stage 2 biofilter (denitrification) tank containing elemental sulfur reactive media and flows upward through the media for additional treatment. The Stage 2 biofilter contains 12-inches of elemental sulfur mixed with oyster shell media. The outlet is above the media; therefore, denitrification occurs in the saturated environment. The denitrified effluent is pumped through the drip system hydraulic unit and discharged to the reclaimed water drip irrigation system (Zone 2). The denitrified effluent is discharged to the natural soil. A flow schematic of the system is shown on Figure 2.

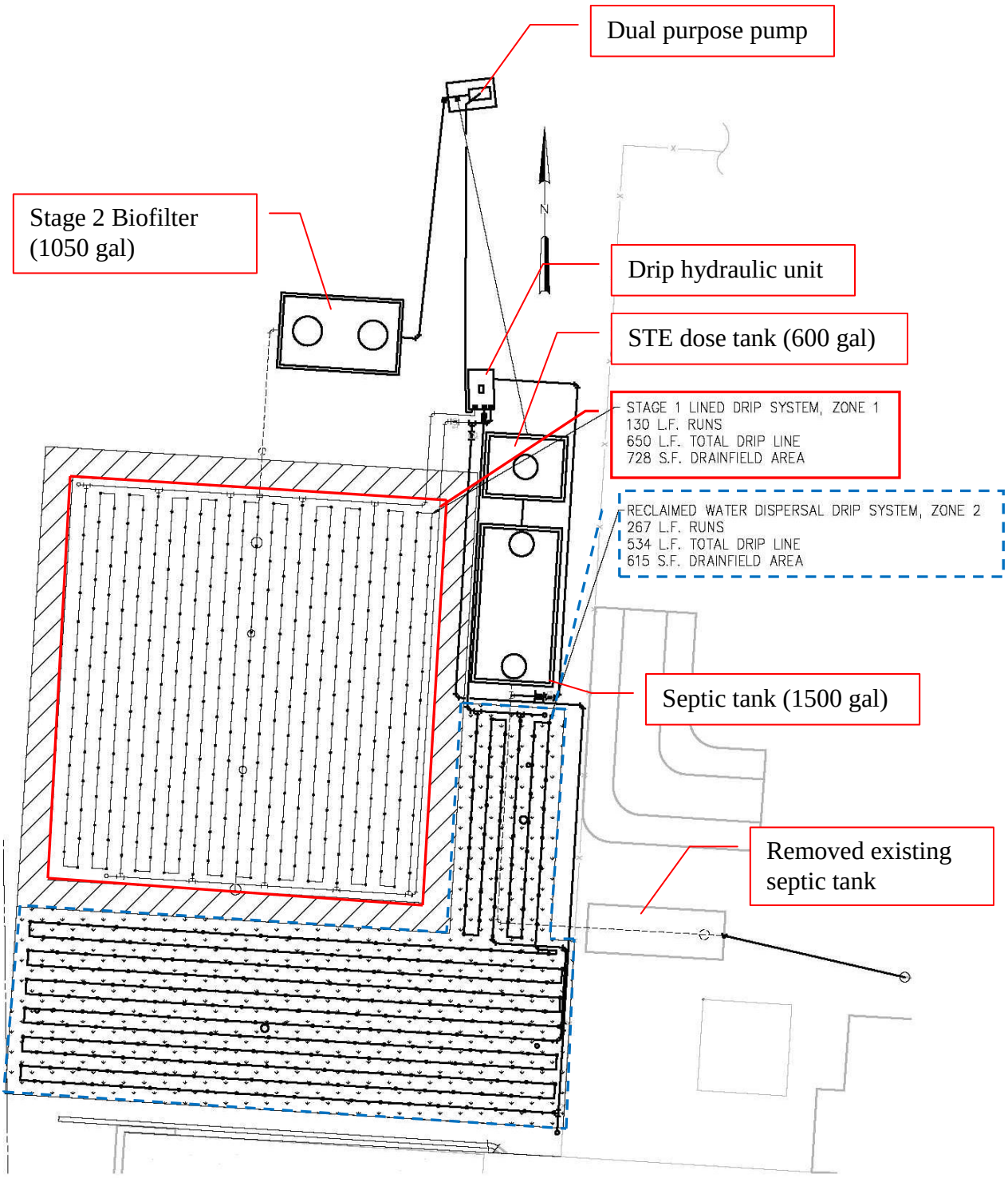


Figure 1
Schematic of B-HS3 PNRS installed in Seminole county

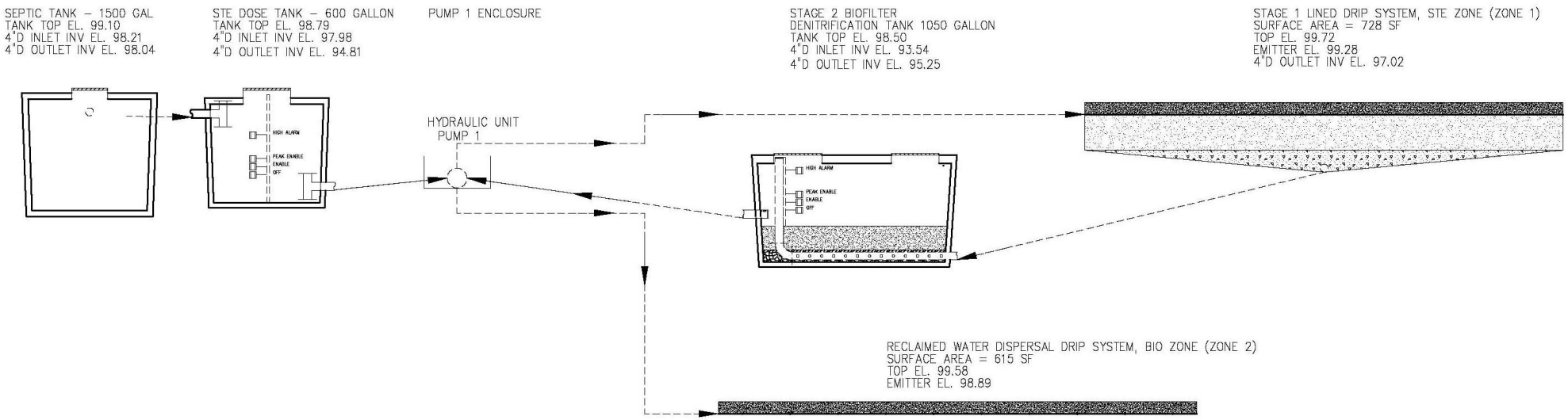


Figure 2
Flow Schematic of B-HS3 PNRS installed in Seminole county

Installation

Installation of the system commenced June 17, 2013 and was completed on June 28, 2013. The installation began with a pump out and removal of the existing 1,050 gallon fiberglass septic tank. After the pump out was completed, the old septic tank was removed (Figure 3).

Figure 3
Old septic tank pumped out and removed

A 1,500 gallon, two compartment replacement concrete primary tank was installed. The first larger chamber serves as a primary receiving tank, receiving the raw sewage from the household. The sewer

pipe from the house was plumbed into the 4”D (diameter) inlet hole shown in Figure 4. An effluent screen (Polylok™, PL-68) was installed in the outlet tee of the second chamber (Figure 5).

Figure 4
1,500 gallon, two chamber, primary Tank

Figure 5
Primary tank effluent screen

Following the primary tank installation, the remaining passive nitrogen reduction system components were installed (Table 1). A STE dose tank (600 gallon) concrete tank was installed beside the primary tank (Figure 6). The purpose of this tank is to hold the septic tank effluent to be pumped to the Stage 1 lined drip area. The 4”D inlet of the STE dose tank is connected (gravity flow) to the primary tank

discharge. The 2”D outlet is connected to the pump. The 2”D outlet (Figure 7) is located near the bottom of the tank.

Table 1
Passive Nitrogen Reduction System Components

	Tank Volume (gal)	Surface Area (ft^2)	Media
Primary Tank	1,500		none
STE Dose Tank	600		none
Stage 1 Biofilter, lined drip area	N/A	728	• 18” sand • 9” lignocellulosic and sand mixture
Stage 2 Biofilter, upflow	1,050	37	12” Elemental sulfur (90%) & oyster shell mixture (10%)

Figure 6
600 gallon, single chamber, STE Dose Tank

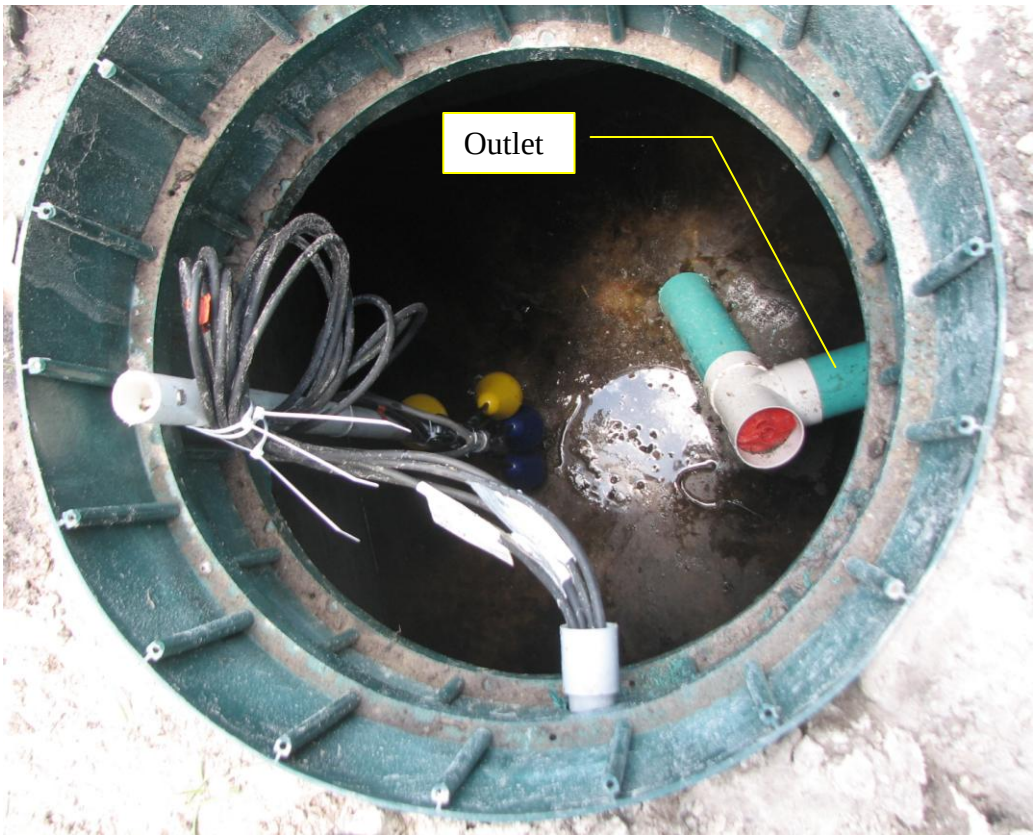
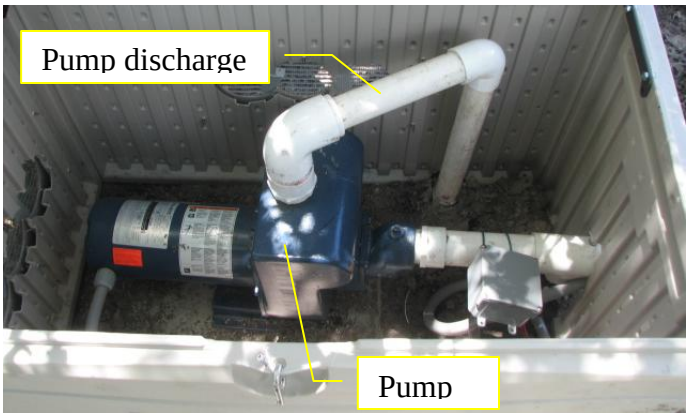


Figure 7
STE Dose Tank outlet pipe

The STE dose tank effluent is pumped (Figure 8) through the drip system hydraulic unit (Figure 9) and discharged to the Stage 1 drip system (Zone 1). The Stage 1 drip system area was prepared by grading a V-shape (Figure 10) so that effluent would collect on the liner (Figure 11) and flow to the center where a perforated pipe within a gravel underdrain conveys the nitrified effluent to the denitrification tank through a pipe boot within the liner (Figure 11). A 9-inch layer of lignocellulosic and sand media mixture was placed above the liner (Figure 12). Overlying the lignocellulosic media mixture is an 18-inch layer of mound sand (slightly limited sand) and the drip emitter lines (Figure 13). An additional 6-inch layer of mound sand was placed above the drip emitter lines (Figure 13).



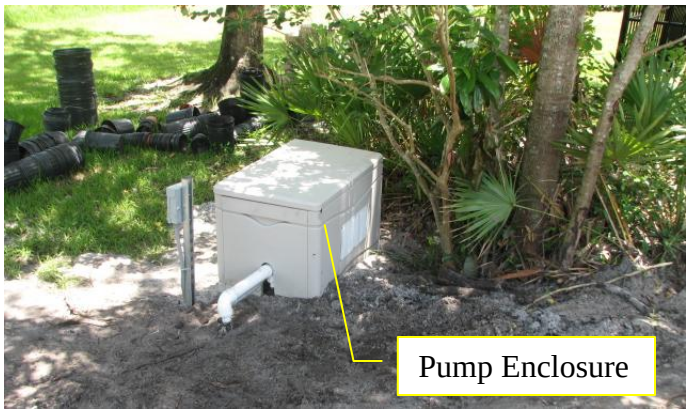
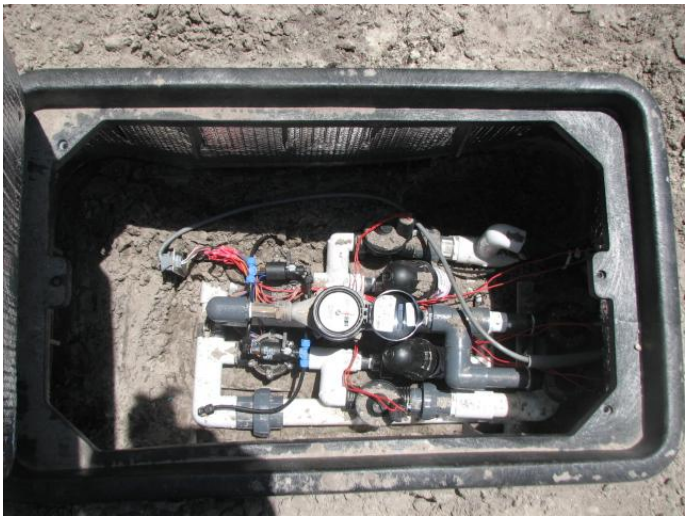


Figure 8
Dual-purpose pump



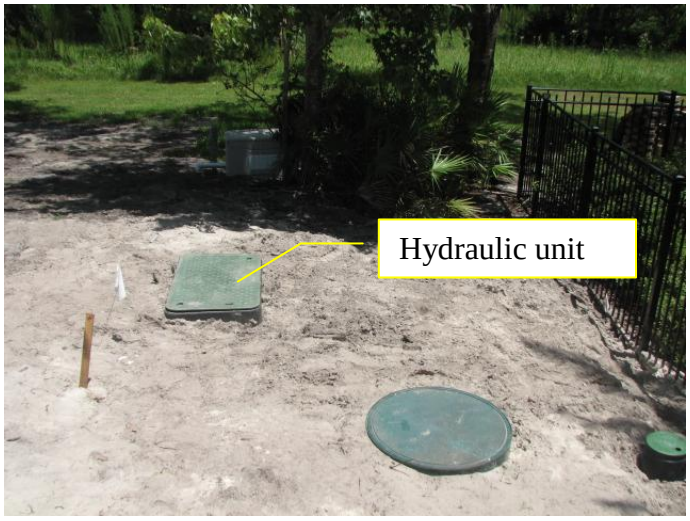


Figure 9
Drip system hydraulic unit

Figure 10
Stage 1 liner area preparation

Figure 11
Stage 1 Liner

Figure 12
Lignocellulosic and sand mixture above liner

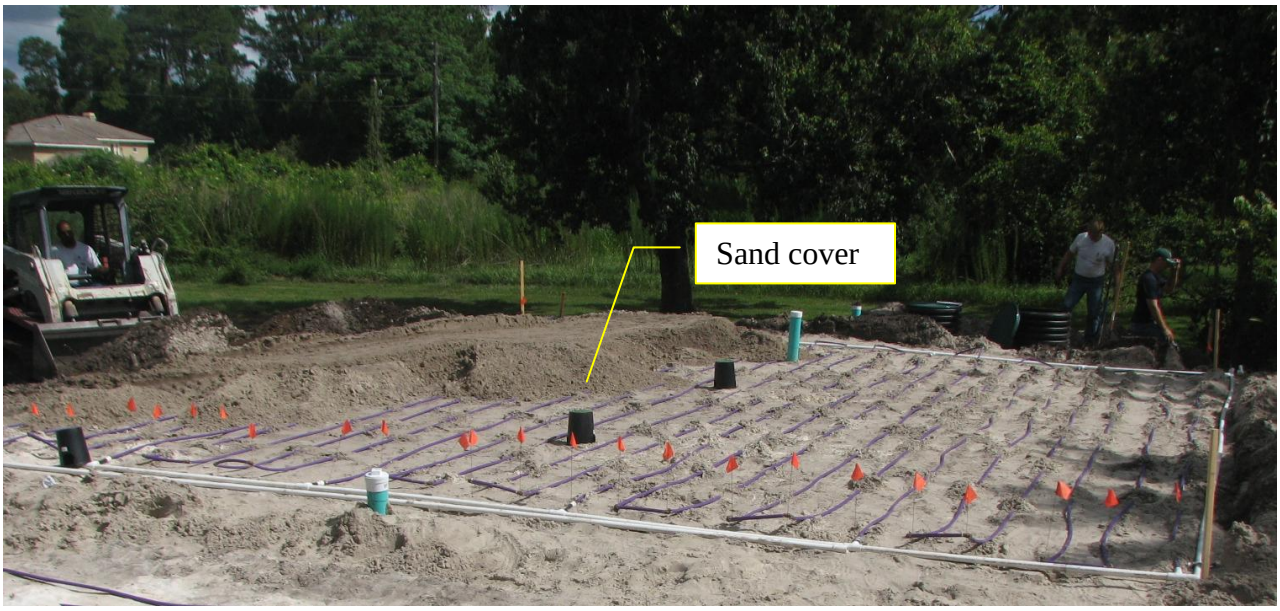


Figure 13
Stage 1 drip emitter lines (Zone 1)

The liner effluent is conveyed to a Stage 2 biofilter (1,050 gallon) containing elemental sulfur reactive media (Figure 14) for additional treatment (denitrification). The denitrified effluent is pumped through the drip system hydraulic unit (Figure 9) and discharged to the reclaimed water drip system (Zone 2) (Figure 15). The denitrified effluent is discharged to the natural soil. A flow schematic of the system is shown on Figure 2.

Figure 14
Stage 2 Biofilter

Figure 15
Reclaimed Water Drip Area (Zone 2)

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

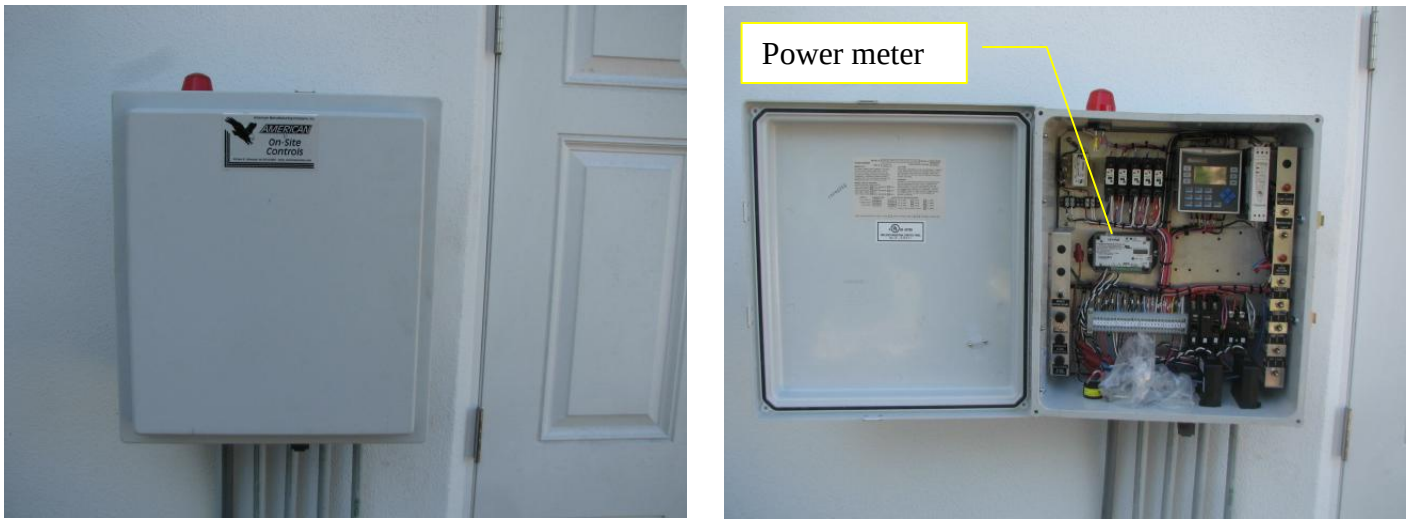


Figure 16
Control Panel

The system control panel (Figure 16) allows for a timed pump cycle which can be overridden if the effluent levels are too low or too high in the dose tanks (STE dose tank and Stage 2 Biofilter). 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. The control panel is connected to a phone line which transmits data for monitoring.

During final testing of the system, the system operated with no visible signs of leaks, etc. The system area was filled and all disturbed areas on the property were graded (Figure 17).


Figure 28
Overall PNRS system installed

Estimated Cost

The final construction cost for the installed system was $40,129.79 as detailed in Appendix B.

System Start-up

The system was started up July 11, 2013, when all flow was diverted to the new passive system. Routine checks of the system will be made, and preliminary sampling will begin in July to monitor nitrification.

APPENDIX A

RECORD DRAWINGS

APPENDIX B

CONSTRUCTION COSTS