Onsite Wastewater Technology Testing Report

Massachusetts Alternative Septic SystemTest Center
Air Station Cape Cod, Massachusetts 02542
Telephone: 508-563-6757
MASSTC@cape.com

Massachusetts
Alternative
Septic
System
Test
Center

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ClearPod™
Enhanced Septic System Treatment

Technology Vendor

ClearPod
Ottawa, Ontario
Telephone: 1 819 598 7153
http://www.clearpodwater.com/

I certify that I represent the Massachusetts Alternative Septic System Test Center, a project of the Barnstable County Department of Health and Environment, Barnstable County Massachusetts. I further certify that I am authorized to report the testing results for this proprietary treatment product. I attestthat the details described in this report to include details regarding the test protocol and results are true and accurate to the best of my knowledge.

George Heufelder, M.S., R.S.
Director, Barnstable County Department of Health and Environment
Massachusetts Alternative Septic System Test Center

Glossary of Terms

Biochemical Oxygen Demand ($BOD_{5\text{-}day}$) – Alternately known as 5-day BOD. The concentration of oxygen (expressed in mg/L) utilized by microorganisms in the oxidation of organic matter during a five-day period at a temperature of 20 °C.

Carbonaceous Biochemical Oxygen Demand ($cBOD_{5\text{-}day}$) – Alternately known as 5-day cBOD. The concentration of oxygen (expressed in mg/L) utilized by microorganisms in the non-nitrogenous oxidation of organic matter during a 5-day period at a temperature of 20 °C.

Colony Forming Units (CFU) – This is a measure based on the ability of a bacterium in a sample to form a colony on poured plate media. The colony is visible to the human eye after 24 hours. The visible colony represents one bacterium in the original sample.Thus, a count of colonies after the incubation period is an indication of the number of bacteria originally present. All fecal coliform counts are expressed as CFU per 100 ml of sample by convention despite the volume actually filtered.

Total Suspended Solids (TSS)–Those solids (expressed in mg/L) which are retained by a glass fiber filter and dried to constant weight at 103–105^{o}C.

1.0 Introduction

The Massachusetts Alternative Septic System Test Center (MASSTC) is located at the Otis Air National Guard military base in Falmouth, Massachusetts. The Test Center, also known as the Buzzards Bay Test Facility, is operated by the Barnstable County Department of Health and Environment under the direction of a Steering Committee with members from the Massachusetts Department of Environmental Protection, the United States Environmental Protection Agency, Barnstable County, Massachusetts Coastal Zone Management and the University of Massachusetts School of Marine Science and Technology.

The mission of MASSTC is to provide a location for the verification and testing of onsite wastewater treatment technologies and components. The facility conducts testing under various protocols, some of which are widely recognized. Of note, the National Sanitation Foundation International (NSF) has employed MASSTC to conduct its standard protocol NSF-40 on a number of onsite septic system technologies. In addition, a number of verification tests were performed in accordance with a nutrient testing protocol jointly developed with industry, NSF and US EPA known as the Environmental Technology Verification Program (ETV). Finally, MASSTC has been used to conduct the more recently developed nitrogen reduction standard NSF/ANSI 245.

This report describes testing of the ClearPod™. The manufacturer claims that the system can be retrofitted into an existing septic system and restore and/or extend the life of a soil absorption system. The vendor claims that the unit is capable of achieving reductions in Biochemical Oxygen Demand ($BOD_{5\text{-}day}$) and Total Suspended Solids (TSS) that are comparable with secondary treatment. In order to test this claim, MASSTC oversaw the construction of a test-cell equipped with sampling ports capable of supplying representative samples.

2.0Dimensions and Description of the Test Unit

2.1 Test-Cell Construction

Two test locations were constructed for the purpose of testing ClearPod™ against a control location. Each test location was equipped with a 1500-gallon single compartment tank a distribution box and a leaching trench. The septic tank complied with the Commonwealth of Massachusetts Regulation 15.223 (310 CRM 15.000 – Title 5). The distribution box following the septic tank was equipped with three discharge ports, one which supplied the test trench and two that allowed the diversion of septic tank effluent to the SAS or to void. Two single leaching trenches were constructed to serve each of the two septic tanks. SAS were constructed in lined 5 ft. wide cells to allow for trenches 30 ft. long x 2 ft. wide with an effective depth of 12". Trenches were constructed of ¾ in double-washed aggregate and perforated pipe. Three observation ports were placed in each trench at approximate distances of 7.5 ft., 15 ft. and 22.5 ft. from the proximal end of the trench. Designations for these observation ports were as follows: most proximal port to the septic tank is "Port A", the center observation port is "Port B", and the distal-most observation port is "Port C". Six inches of ASTM C33 sand were placed beneath each aggregate trench. Each test cells drained through a sample collection point prior to conveyance to a wastewater treatment facility. Each septic tank received wastewater from a common source and volumes were verified daily by means of calibrated spill buckets..

2.2Test Unit Description

Clear Pod Inc. is a Canadian septic system technology company focused on commercializing solutions for septic system waste water treatment. The ClearPod™ technology functions as a drop-in retrofit, designed to significantly improve septic system performance (Figures 1 and 2)

The ClearPod™ technology functions by delivering oxygen to a fixed film polymer surface that is used to retain aerobic microbial populations. The ClearPod™ technology delivers 0.92 cfm of air to a polymer mesh material that has a surface area of approximately100 m^2/m^3.

The ClearPod™ technology uses a 25W air-pump to deliver the required oxygen to the system. Based on a daily wastewater flow of 1.246 m^3 this correlates to a daily energetic cost of treating wastewater of 0.6 kWh / 1.246 m^3 wastewater or 0.48 kWh / m3 wastewater.

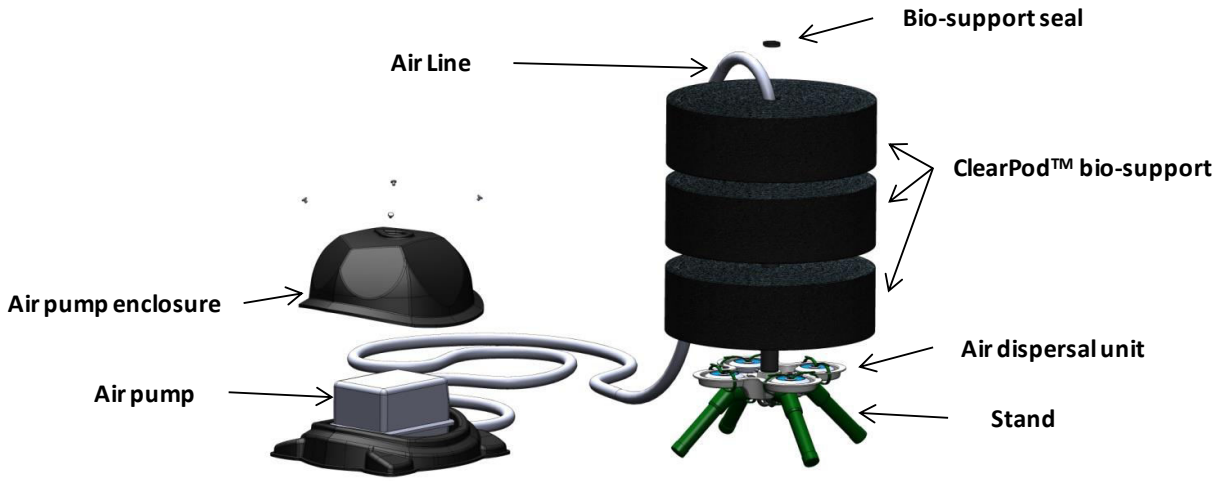

Figure 1ClearPod™ fixed film aeration unit

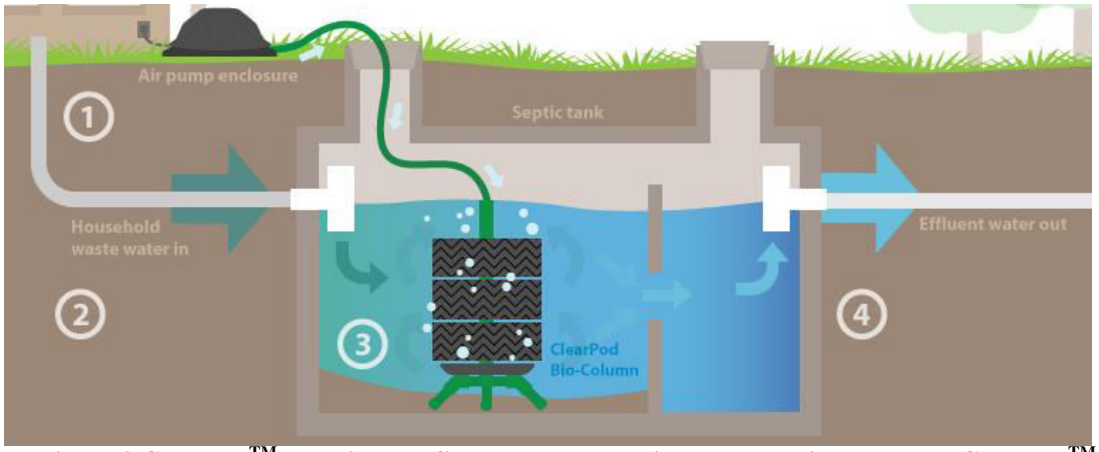

Figure 2 ClearPod™ drop-in retrofit technology showing external air-pump and ClearPod™ bio-column placed in the first chamber of a 5,700 L septic tank.

System Design Specifications.

Treatment capacity = 330 gallons / day (1249 L/day)
Treatment capacity = 3 bedrooms (in the Commonwealth of Massachusetts and certain other jurisdictions)
Tank volume = 1500gal (5678L)
Tanks chambers = 2
Pump aeration = 0.92 cfm
Pump power requirement = 25 W

2.3 Influent Wastewater Source

Initially the septic tank was filled with influent wastewater that originated from residential households. Wastewater was dosed to the septic tank using timed pumps which were calibrated for accuracy within 10% of the desired rate on a weekly basis. Design loading was apportioned during the day with 35% of the flow administered between 0600h and 0900h, 25% between 1100h and 1400h, and 40% between 1700h and 2000h. The total daily inflow to each tank was 330 gallons. The maximum dose volume to the septic tank was 10 gallons. Wastewater characteristics are provided below.

3.0 Test Description

3.1 Testing Protocol

During the testing period reported here, the test unit was supplied with wastewater for approximately 33 weeks. All samples were taken with composite samplers and assayed according to the appropriate methods in APHA's Standard Methods for the Examination of Water and Wastewater.

During the 33 weeks of testing, samples were collected daily Monday – Friday except where noted and during stress loading periods. Four stress events were performed as listed in Table 1.

Stress Period	Stress *One wash load = one 12-gallon wash plus two12-gallon rinses
November 17 – 21, 2014 (three days during the five day period)	Three wash loads* introduced during the first two dosing periods of the day.
November 30 – December 5, 2014	Septic tank was provided 40% of the daily flow between 0600h and 0900h. Remaining 60% of capacity was introduced to the septic tank between 1700h and 200h and included one wash load*.
December 12 – December 16, 2014	Introduction of 40% of the daily flow between 1700h and 2000h; power was turned off to the pump chamber at 2100h. Flow to the system was interrupted for 48 hours after which 60% of the daily flow was introduced to the septic tank within a three-hour period, which included one wash load*.
December 22 – January 1, 2015	Normal dosing during the first two dosing periods of the day (35% of hydraulic capacity between 0600h and 0900h; 25% of hydraulic capacity between 1100 and 1400h), and a discontinuation of dosing for eight consecutive days. On the ninth day, 60% of the hydraulic capacity was dosed to the system between 1700h and 2000h and included three wash loads*.

Table 1.Description of stress events. Samples were taken for four consecutive days following 24 hours of the first stress event, six consecutive days following the second stress event, five days following the power interruption stress, and six consecutive days following the final stress event.

All influent and effluent samples were composite flow-proportional 24 hour samples.

Soil Absorption System: When a SAS is said to "fail", it usually means that wastewater is no longer percolating away from the SAS. This situation usually presents as a backup of wastewater to the home or a surfacing of wastewater to the surface of the ground in the area of the SAS. A surrogate measure of SAS failure is excessive "ponding". Ponding is the accumulation of wastewater above the soil-aggregate interface and can be measured by using observation ports. In this study three observation ports were installed in each trench and ponding was measured five times per week at 1045 – 1100 h. In addition, continuous monitoring with data-logging devices was performed in the middle inspection port. A profile representation of the SAS with sampling ports is presented in Figure 3.

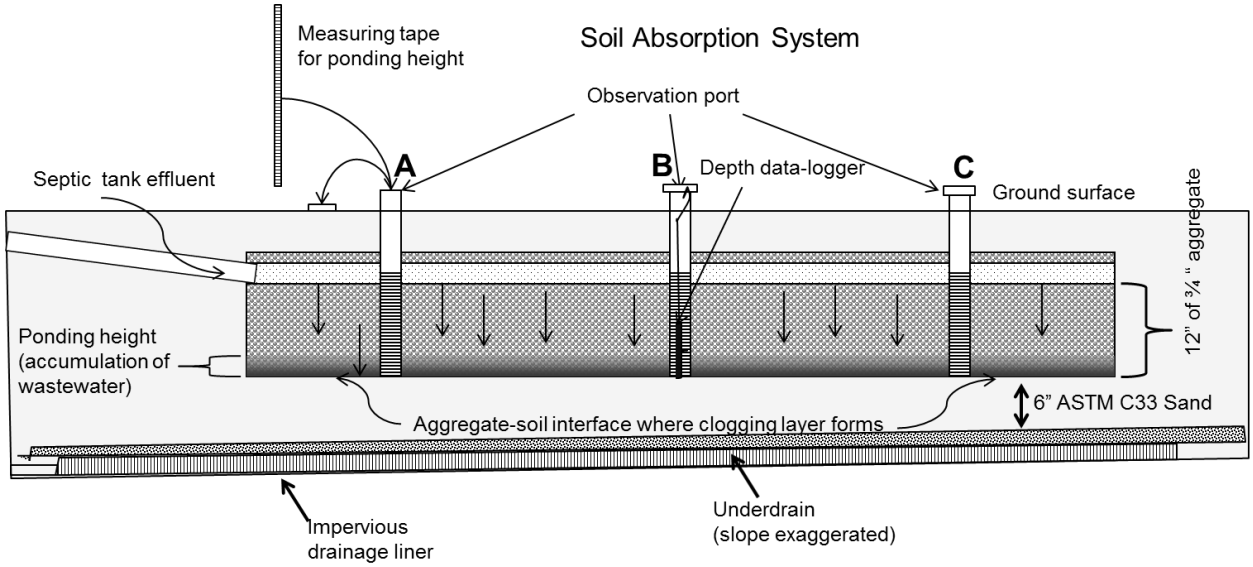

Figure 3 Soil Absorption System used in the study.

The ponding measurements were taken by recording the height of the observation port and then measuring from a benchmark location on the upper rim of the port the liquid surface. Ponding depth was determined by subtraction (total observation port height - liquid height). The standard time of measurement was arbitrarily chosen to occur 1030 – 1100 which coincides with a hiatus in the daily dosing. Design loading was apportioned during the day with 35% of the flow administered between 0600h and 0900h, 25% between 1100h and 1400h, and 40% between 1700h and 2000h. The total daily inflow to each tank was between 300 and 450 gallons (see table 1). Accordingly, the period for ponding measurement was just prior to the second dosing series of the day. In addition to ponding measurements, periodic measurements and assays were conducted at the exit of the septic tank and the percolate or the field.

4.0 Results

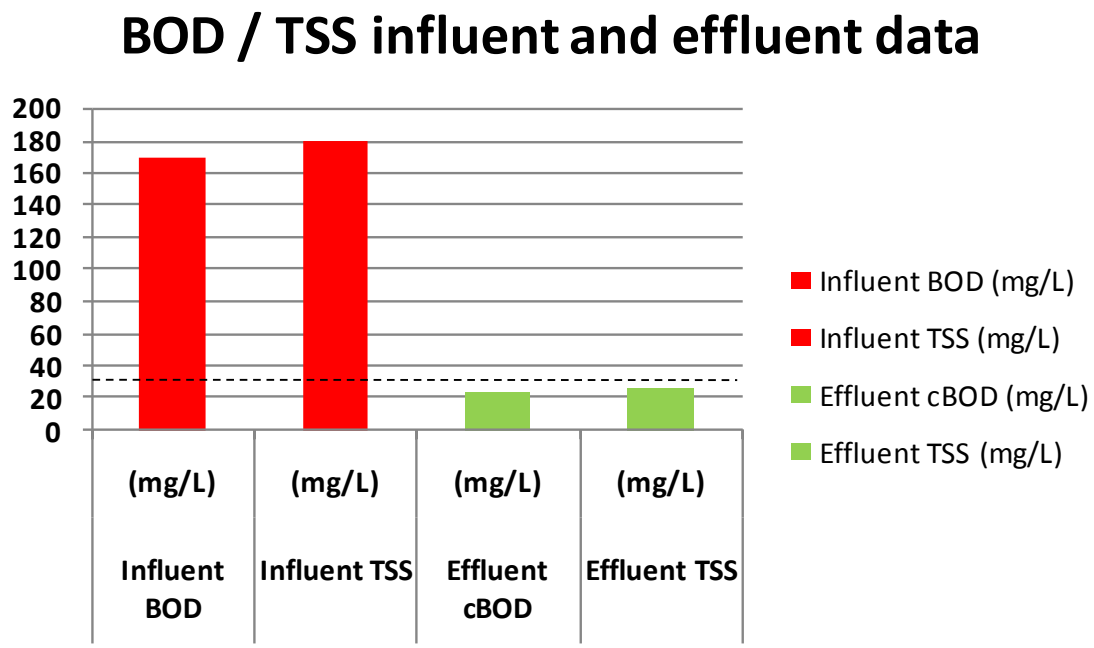

Figure 3 Comparison of influent and effluent data from a ClearPod: Enhanced septic system. Average effluent for both cBOD (23.2 mg/L) and TSS (26.5 mg/L) are both below 30 mg/L thresholds.

	Influent BOD (mg/L)	Influent TSS (mg/L)	Effluent cBOD (mg/L)	Effluent TSS (mg/L)
Average	169	180	23.2	26.5
Median	160	180	21.0	22.5
Low	70	81	8.0	6.3
High	310	400	52.0	98.0
Count	126	126	124	124

BOD removal	**86.3%**
TSS removal	**85.3%**

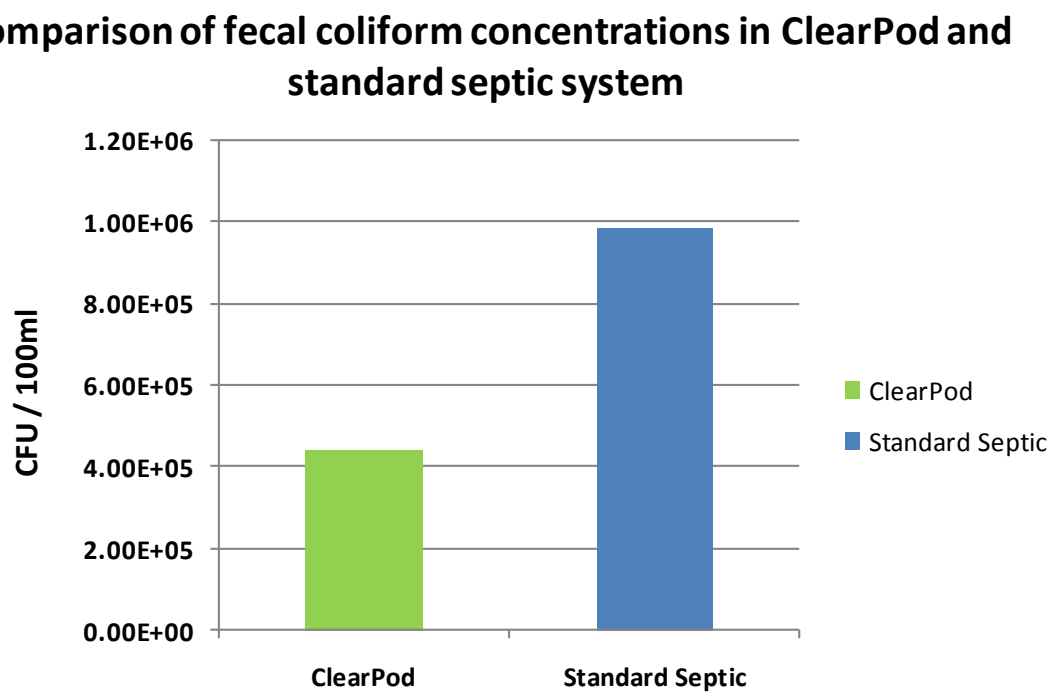

Figure 4 Comparison of fecal coliform concentrations for ClearPod™: enhanced septic system and standard septic system.

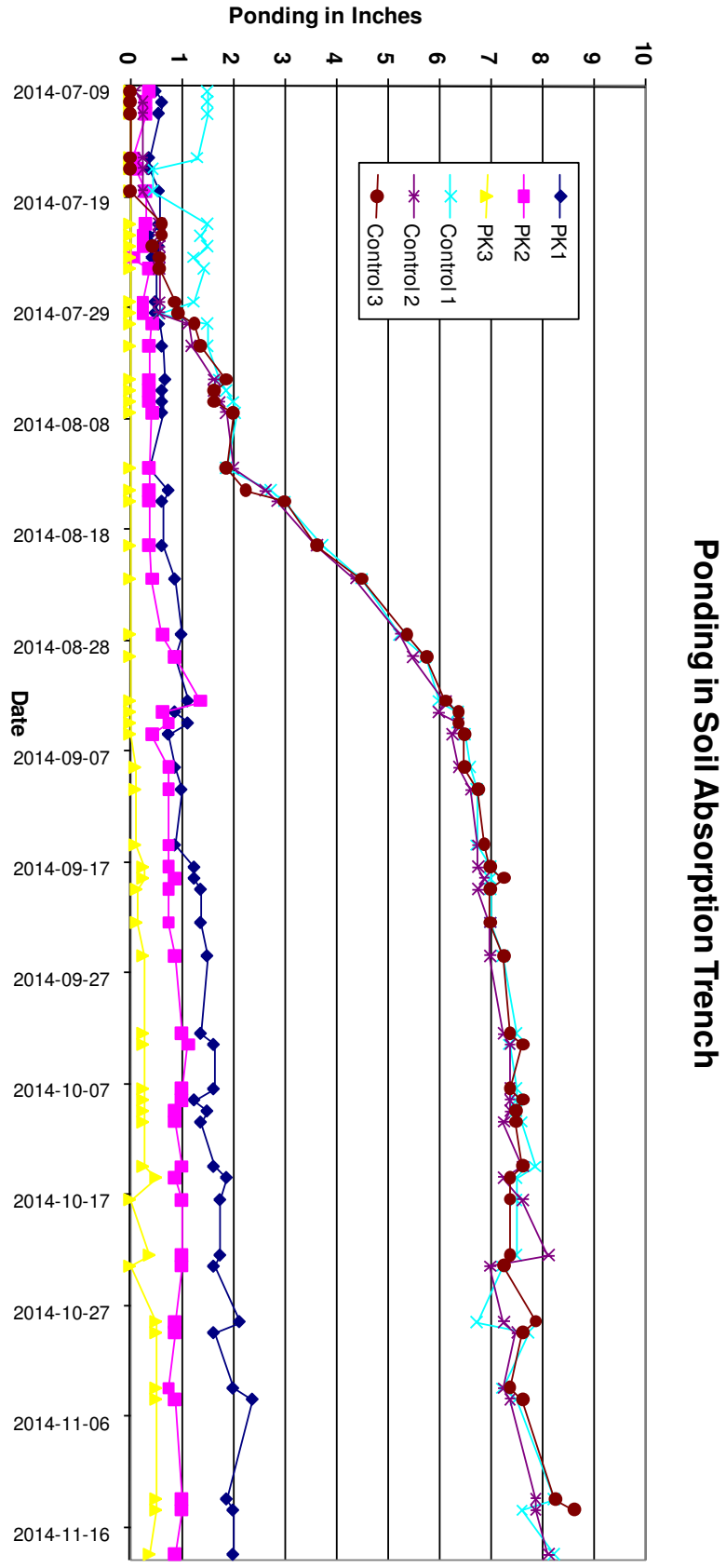

Figure 5 Comparison of ClearPod™: Enhanced septic system and standard septic system for ponding in soil absorption trench.