



**BIOMICROBICS AEROBIC TREATMENT UNIT FIELD TESTING
FINAL REPORT
SEPTEMBER 27, 2018**

Background

In accordance with 12VAC5-613-30L of the Virginia Department of Health (VDH) *Alternative Onsite Sewage System Regulations*, BioMicrobics entered into a Memorandum of Understanding (MOU)¹ with VDH on March 17, 2017 for field testing and evaluation of MicroFAST® Models 0.5, 0.625, 0.75, 0.9 and 1.5 (also known as the "Treatment Units"). The contact person for BioMicrobics during the field evaluation was Jim Bell, Executive Vice President.

The independent third party selected by BioMicrobics to oversee and administer the testing and evaluation protocol was Nokesville Design PLC (Tom Basham, PE, LS). Nokesville Design coordinated field sampling and transport responsibilities with Pamela Pruet, LSE, LOSO of Environmental Systems Consulting, LLC.

All samples were collected and transported in accordance with recommendations by *Standard Methods for the Examination of Water & Wastewater* and approved EPA methods. Standard Chain of Custody procedures for sample transport and delivery were followed.

Joiner MicroLabs in Warrenton, VA was selected for analyses of the wastewater samples. Joiner MicorLabs is an accredited laboratory that follows NELAP quality control/quality assurance practices that include precision, accuracy and equipment standardization. All sample containers were provided by Joiner MicroLabs.

General Information

In accordance to the requirements of the MOU, Nokesville Design submitted a list of 28 properties in the Woodland Farms subdivision in Prince William County, VA to VDH. On June 13, 2017, Kemper Loyd, VDH PE, responded that the list of properties with treatment units was acceptable to VDH for field evaluation.

During August of 2017 and prior to commencement of sampling, all 28 units were evaluated for accessibility and general condition. SeptiClean, Inc. provided routine maintenance via pumping the residuals from all 28 treatment units. All of the units had been in service for a number of years and their residuals were at various levels in the different treatment units. Removal of residuals from the test units assured a uniform condition of the treatment systems for the start of the testing.

¹ Attachment 1

Quarterly Testing

The initial round of sampling of the treatment units occurred on October 10 and 11, 2017. During this sampling event, the influent and effluent were analyzed for five day biochemical oxygen demand (BOD₅) and total suspended solids (TSS). In addition, influent and effluent samples were analyzed for the nitrogen reduction.

The Chesapeake Bay Watershed States Data Sharing Program, Test Plan Application Template for Field Verification of Advanced Onsite Pretreatment Units for Nitrogen Reduction Chesapeake Bay Watershed States was followed for the nitrogen evaluation. This testing procedure calls for analysis of 24 hour effluent composite samples for nitrogen. Attempts were made to procure composite samplers, however; lack of availability of composite sampling devices made collection of composite samples impossible. Discussions with VDH staff concerning this issue resulted in the approval of the collection of effluent grab samples.

Laboratory results revealed higher effluent BOD₅ concentrations than were expected. A Variance Request was submitted to VDH by BioMicrobics to allow a change from effluent BOD₅ analysis to CBOD₅ analysis with a conversion from CBOD₅ to BOD₅ of 1.2. It is noteworthy that the Chesapeake Bay Field Verification Test Plan calls for analysis of CBOD₅ in lieu of BOD₅ in effluent samples. The variance request was approved in December, 2017.

Additional effluent samples were collected on December 13, 2017 for analysis of CBOD₅ and TSS. As the October 10 and 11 sampling collected samples for analysis of the influent BOD₅ and TSS and nitrogen concentrations for both influent and effluent, these parameters were not evaluated in the samples collected on December 13, 2017. The combined sampling events of October and December provided the first quarter of testing required per the MOU.

Second quarter sample collection took place on March 13, 2018. This sample date fulfilled the requirements of the Chesapeake Bay Field Verification Test Plan to provide one sampling event between December 15 and March 15 for a cold weather sample. During this sampling event, there was miscommunication with the laboratory so that the influent BOD₅ was measured as CBOD₅ instead of as BOD₅. A factor of 1.2 was applied to convert the CBOD₅ to BOD₅.

It may be questionable to apply the 1.2 factor as there should not be any nitrifying bacteria in the influent. If there are no nitrifying bacteria in the influent, then theoretically the CBOD₅ should equal the BOD₅. To provide all options to consider for this error, the sampling data includes the CBOD₅ and the measured the BOD₅ obtained using the 1.2 factor.

Five of the test sites utilize gravity conveyance from the treatment unit to the absorption area. Samples from the gravity systems were collected from a sample box or sample port installed for said use. During sample collection, flow was induced through the system by a property owner running water in the home or by use of an outside spigot

and garden hose running water into the inlet tee of the treatment unit. During the December 13 and March 13 collection dates, 3 of the homes with gravity effluent conveyance were excluded from field sampling because no one was home to induce flow in the home and the water supply to the outside fixtures had been turned off. Property owners were onsite to induce flow in the home to the systems for the remaining 2 gravity conveyance sites.

Some of the sites had higher total nitrogen (TN) in the effluent as compared to the influent sample. The influent samples were true grab samples. Most of the effluent samples were collected from pump tanks. Sites with pump tanks were designed to convey effluent on a time-dosed basis; therefore, the pump tanks hold a number of hours of effluent flow. The evaluation team believed the samples collected from the pump tanks are more equivalent to composite samples and therefore submitted a letter to VDH in May, 2018 to request that a default value for the influent TN of 60 mg/l be allowed as is specified in the Chesapeake Bay Field Verification Test Plan. This request was honored via VDH correspondence dated May 30, 2018.

The third quarter sampling event took place on June 12 and 13, 2018. All treatment units were evaluated for sludge and scum accumulation. Gravity conveyance sites that had not been sampled during the winter months were not sampled. Two additional sites were not sampled as access to one of the units was buried in mulch and the other unit appeared to have suffered a toxic event—the mechanical portions of the aerobic treatment unit appeared to be operating properly; however, the biology in the unit was “dead”. It was assumed that there may be a medication issue at this address. (Follow up conversations with the O & M provider for the site revealed the property owners have been unresponsive to scheduling requests for routine monitoring inspections.)

During the third quarter sampling event there was again miscommunication with the laboratory so that the influent BOD was measured as CBOD₅ instead of as BOD₅. A factor of 1.2 was applied to convert the CBOD₅ to BOD₅.

The fourth quarter sampling event took place on August 7 and 8, 2018. All influent sample results reflect BOD₅ analysis.

Influent and effluent BOD₅ sample results from one site, 9959 Summerwood Dr., appear to be reversed. An effluent turbidity reading was collected via turbidimeter at the time of the sample collection and found to be 1.77 NTU. The laboratory was contacted and asked to review all paperwork and quality control for the samples collected at the referenced site. The lab reported that all paperwork and quality control are in order and within acceptable ranges. The results have been reported as received from the lab; however, the possibility that the samples were improperly labeled exists.

Laboratory results for one of the sites, 7525 Hunter Woods Dr., indicated ammonia nitrogen levels greater than Kjeldahl nitrogen levels. Quality control specifications were reviewed with the laboratory and found to be within acceptable tolerance limits. It is

possible that matrix interference from the sample occurred and skewed the results for these parameters.

Data & Results

The field testing program began with 28 year round residential homes. Due to various factors, 5 sites were eliminated from the program. Addresses of dropped site and reasons for removal from the program are identified in Table 1.

Table 1

Address	Reason
7550 Hunter Woods Dr.	Toxic ATU-influent & effluent biology death
7425 Signal Hill Rd.	Tanks access buried, infiltration into pump tank
9910 Summerwood Dr.	Gravity conveyance, no water in winter months
9920 Summerwood Dr.	Gravity conveyance, no water in winter months
9930 Summerwood Dr.	Gravity conveyance, no water in winter months

The largest single cause that excluded homes from the program was the lack of water to induce flow in gravity conveyance during winter sampling events in December and March.

An Excel file, created by VDH staff and entitled *MicroFAST@ VDH 2018-02-05 Spreadsheet Final*, is attached. The excel file contains 2 spreadsheets: the original spreadsheet provided by VDH for data reporting and a modified VDH spreadsheet. The original spreadsheet contains all data and the modified spreadsheet removes sites without 4 quarter sample collection. Further, the modified spreadsheet contains a change to the “cleaned” data. Instructions in the original reporting spreadsheet indicate that test results at less than the analytical detection limits were to be reported as one half of the detection limit.

The cleaned data has been changed to the detection limit of the analysis in order to prevent the potential for influencing more favorable overall statistical results. Both spreadsheets indicate the treatment units are providing treatment of effluent to the required standards for VDH TL-3 treatment unit approval.

The MicroFAST® spreadsheet includes all of the sampling data for the four quarters and all of the homes that were sampled. The nitrogen reduction data is included with all of the sampling data for these four quarters. The combined nitrogen data for all four quarters is included in the Combined Spreadsheet.

This data is shown again in the Modified Combined Spreadsheet; however, the modified spreadsheet excludes the residential systems that were not tested for 4 quarters. In addition, homes with gravity conveyance to the absorption area(s) have been excluded.

The Chesapeake Bay Field Verification Test Plan requires effluent samples to be composite samples. Because the pump tanks accumulate effluent over a number of

hours, samples collected from the pump tanks are more equivalent to composite samples. Sites without effluent pump tanks are considered to be true grab samples.

Conclusions

The attached data indicates the MicroFAST® aerobic treatment units are consistently treating effluent to standards as set forth by the Virginia Department of Health for reduction to Treatment Level 3 (TL3) effluent standards of 10 mg/l BOD₅ and 10 mg/l TSS.

Further, total nitrogen is reduced by the MicroFAST® aerobic treatment units by at least 50%.

Summary

BioMicrobics entered into an MOU with VDH for field testing and evaluation of MicroFAST® treatment Units. Twenty eight treatment units in the same neighborhood were selected and approved for evaluation and testing.

Routine pump out of the treatment units was conducted prior to initial sample collection of influent and effluent from treatment units in the program.

Influent and effluent samples were collected and analyzed on a quarterly basis units.

Five treatment units were completely dropped from test program for various reasons. This left 23 units with quarterly sample collection for BOD₅, CBOD₅, TSS, and TN. Of the 23 units, consideration of the nitrogen concentrations for 3 additional units was eliminated. A total of 20 units had nitrogen evaluation.

Results of analytical testing indicate units are performing with acceptable ranges for VDH approval of BOD₅, TSS, and nitrogen removal for TL3 treatment unit approval.



D. Thomas Basham, PE

