Nitrogen Reduction Pilot Study
at the Fairhaven, MA
Water Pollution Control Facility

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FINAL

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Executive Summary

The Fairhaven Water Pollution Control Facility (WPCF) on Arsene Street in Fairhaven, MA provides secondary wastewater treatment for the majority of the Town of Fairhaven prior to discharging the treated effluent to the Acushnet River. In 2014, this facility discharged a monthly average of 308 pounds per day (lbs/day) of total nitrogen (TN), equating to approximately 15 milligrams per liter (mg/L) at the facility's annual average daily flow of 3.1 million gallons per day (MGD). Under the new draft National Pollutant Discharge Elimination System (NPDES) permit, the monthly average effluent limit for TN will be reduced to 125 lbs/day, or 3 mg/L at 5 MGD, the design average daily flow for the WPCF. In order to consistently comply with the new lower TN limits, the Fairhaven WPCF needs to install additional nitrogen removal facilities and modify the current operation of the WPCF.

Based on a detailed evaluation conducted by Stantec (formerly FST) for the Fairhaven WPCF as part of a Phase 2 Wastewater Management Plan (WMP), converting the existing activated sludge process to a 4-stage Bardenpho process with BioMag™ was found to constitute the most feasible alternative for nitrogen reduction. BioMag™ is an enhanced biological process that utilizes magnetite as a ballast material to combine with the biological floc in the aeration basins. In order to confirm the ability of the 4-stage Bardenpho process with BioMag™ to consistently reduce the TN concentration to less than 3 mg/L, the Town of Fairhaven applied for and received a grant from the Massachusetts Office of Coastal Zone Management, Buzzards Bay National Estuary Program to conduct a full-scale BioMag™ pilot study at the Fairhaven WPCF.

A full-scale "modified" 4-stage Bardenpho process with BioMag™ nutrient removal pilot study was conducted, with the entire flow for the plant handled in one aeration train. Since budget and time constraints made it impossible to modify one of the smaller existing secondary clarifiers to mimic a true 4-stage Bardenpho process, the pilot study's goal was to demonstrate the ability to achieve 5 mg/L TN in the final effluent, understanding that full-scale operation would have a second anoxic and reaeration process to polish from <5 mg/L to 3 mg/L TN.

Evoqua, the pilot plant vendor, set up a pilot trailer that housed the magnetite feed and recovery equipment and was located adjacent to the aeration train selected for the study. The Town rented a pump to provide internal recirculation through the aeration train, and return activated sludge (RAS) pumping rates were adjusted. The aeration system was turned off in the first aeration tank, and a mixer was installed to keep solids in suspension. From initial charge (magnetite addition) through plant stabilization, Evoqua took lead responsibility for the pilot plant's operation. During this phase, Evoqua trained the WPCF staff in the operation of the BioMag™ system and the conduct of the test protocols so that they could take primary responsibility for operating the plant during the test phase. Evoqua also set up an Excel spreadsheet in which WPCF staff entered monitoring data, and coordinated with the staff about data collection using modified WPCF laboratory sheets and a trailer checklist. In the test phase, Evoqua personnel maintained a presence on site and regularly monitored the pilot plant performance.

The pilot plant trailer arrived early in September 2015, magnetite addition began at the end of September 2015, process modifications were made to stabilize the system over the following month, the test phase began the third week of October 2015, supplemental carbon addition began in early November, and system parameters were optimized to try and demonstrate compliance with a 5 mg/L TN permit limit from mid-November through December 16, 2015, the final date of the pilot study.

The results of the pilot study demonstrated that operation of the modified 4-stage Bardenpho with BioMag™ system would result in significantly lower effluent TN concentrations than the WPCF was discharging prior to the study. However, the pilot study did not consistently produce the required effluent TN concentration of 5 mg/L; the average TN concentration in the final effluent after supplemental carbon addition at 100 gallons per day (gpd) (the desired supplemental carbon dosage), was 6.3 mg/L. The shortfall in meeting this limit could be due to several factors, including the internal recycle and RAS pumping rates being lower than desired for optimum TN removal, the need to consistently maintain a higher magnetite to biosolids ratio, and/or increasing the supplemental carbon addition. We believe adjusting one or more of these factors would have led to achieving 5 mg/L TN in the final effluent, and with modifications to the smaller existing clarifier to provide further polishing, a final effluent TN value of 3 mg/L would be attained, satisfying the draft NPDES permit requirement for this parameter. This treatment technology is thus an effective means for significantly reducing nitrogen discharged to the plant's receiving water, the Acushnet River, and could be applied to other area WPCFs, depending on existing tankage, process layout and operation, and effluent TN requirements.

The pilot plant also achieved excellent total suspended solids (TSS) and 5-day biochemical oxygen demand (BOD_5) removals, averaging 8 mg/L and 4 mg/L in the final effluent, respectively, over the course of the study.

Costs and energy use of this system are major issues, however, and should be investigated more thoroughly before proceeding with full-scale implementation. In 2014, the Phase 2 WMP estimated that the construction cost for the 4-stage Bardenpho with BioMag™ system would be about $9.8 million. The additional operational costs are very significant as well, expected to exceed $200,000 per year, and the increased energy requirements would greatly expand the carbon footprint of the Fairhaven WPCF. We note that the majority of the costs and energy requirements are inherent in the 4-stage Bardenpho process that would be a part of all the nitrogen reduction alternatives identified in the Phase 2 WMP for the Fairhaven WPCF.

Another issue encountered during the pilot study was damage to one of the final clarifier rake arms, believed to result from the magnetite sludge that is so effective in settling out solids and associated pollutants, and slightly heavier than normal secondary sludge. The rake arms were over 25 years old and in a deteriorated condition, making them susceptible to damage from the slightly heavier magnetite sludge.

1.0 INTRODUCTION

1.1 GENERAL

The Fairhaven, MA WPCF on Arsene Street is a secondary treatment plant, with a design capacity to process an average daily flow of 5.0 MGD and a peak hourly wet weather flow of 16 MGD; it is currently operating at an annual average daily flow of about 3.1 MGD. Following preliminary treatment, the liquid treatment train consists of two parallel trains, each with a primary clarifier, a three-chamber aeration tank and two final clarifiers. An ultraviolet irradiation system completes the liquid treatment process. Under present loading conditions, only one treatment train is normally placed in operation. Regarding sludge processing, primary sludge is sent to the onsite anaerobic digesters, waste activated sludge (WAS) is thickened by a gravity belt thickener, and the digested primary and thickened secondary sludges are transported offsite to a waste-to-energy facility where the sludge is incinerated. An onsite combined heat and power system uses the digester gas to generate electricity that offsets some of the plant's electrical use.

Secondary treatment at the WPCF is provided by a conventional activated sludge system, including two aeration trains, each with three aeration tanks, and two 45-foot diameter and two 75-foot diameter final settling tanks. Each aeration tank is equipped with fine bubble membrane diffusers and has an operational volume of 155,580 gallons. The 45-foot diameter settling tanks each have a volume of 119,000 gallons, and the 75-foot diameter settling tanks each have a volume of 429,600 gallons. Settled activated sludge is returned to the head of the aeration trains using seven RAS pumps, which provide an available total return flow rate of 9.7 MGD (with one large pump out of service).

Presently, the Fairhaven WPCF operates most of the time with two primary settling tanks, three aeration tanks (one aeration train) and two 75-foot diameter secondary settling tanks on-line. When flow rates are low, typically during July, August and September, only one primary and one 75-foot diameter secondary settling tank are on-line.

The final effluent discharges to the Acushnet River, also known as the New Bedford Inner Harbor, which has excessive nitrogen concentrations. The Massachusetts Department of Environmental Protection (MassDEP) has identified the Fairhaven WPCF as the major contributor of nitrogen to the New Bedford Inner Harbor in its Massachusetts Estuaries Project nitrogen modeling report for this water body.

INTRODUCTION

1.1.1 WATER QUALITY DATA

The following presents average water quality operating data for the Fairhaven WPCF in 2014:

Average Daily Flow (MGD):	3.1
Raw Influent TN	
mg/L:	29.1
lbs/day:	612
Final Effluent TN	
mg/L:	15.1
lbs/day:	308
Raw Influent TSS (mg/L):	129
Final Effluent TSS (mg/L):	8.4
Raw Influent BOD_5 (mg/L):	150
Final Effluent BOD_5 (mg/L):	6.6
Final Effluent Fecal Coliform (colony-forming-units per 100 milliliters [cfu/100 mL]):	10

The WPCF obtained a draft NPDES permit in 2010 from MassDEP and the U.S. Environmental Protection Agency (EPA). The draft NPDES permit requirements are listed in Table 1.

Table 1 - Draft NPDES Permit Requirements

Parameter	Average Monthly	Maximum Daily
Flow	5.0 MGD	Report
BOD_5	30 mg/L	45 mg/L
TSS	30 mg/L	45 mg/L
pH	6.5 – 8.5	
Fecal Coliform	88 cfu/100 mL	260 cfu/100 mL
Enterococci	35 cfu/100 mL	276 cfu/100 mL
Total Nitrogen	125 lbs/day	Report

This permit requires that the facility release less than 125 lbs/day TN on a monthly average basis, which equates to 3 mg/L at 5 MGD. The permit does not indicate that this is a seasonal limit, but other area WPCFs with a similar TN limit are only required to comply with this value from May to October. A copy of the draft NPDES permit is located in Appendix A. The current NPDES permit for the Fairhaven WPCF requires effluent monitoring for TN, but there are no TN limits.

1.1.2 PHASE 2 WASTEWATER MANAGEMENT PLAN RECOMMENDATIONS

Under the Phase 2 WMP completed in 2014, Stantec modeled several different options for reducing the final effluent TN discharge to within the new draft NPDES permit requirements. One of the alternatives investigated was a 4-Stage Bardenpho, or aerated anoxic process. In this arrangement, the first and third aeration tanks in each train would be set up as anoxic zones, with the second aeration basin and the smaller secondary clarifier used for aerobic zones. Recycle in the amount of 200 - 400% of the influent flow rate is returned from the end of the first aerobic zone to the start of the first anoxic zone. RAS from the secondary clarifiers, also in the amount of 200 - 400% of the influent flow rate, is returned to the first anoxic zone as well. Waste sludge would be thickened and sent along with primary sludge to the anaerobic digesters. Filtrate from the thickener is returned just downstream of the preliminary treatment facility. Modeling results indicated that the 4-stage Bardenpho process with methanol addition would result in TN levels in the plant effluent of approximately 4 or 5 mg/L, which exceeded the draft permit limit of 3 mg/L.

To further reduce the effluent TN content, the Phase 2 WMP recommended incorporating the BioMag™ process into the 4-stage Bardenpho process. BioMag™ is an enhanced biological process that utilizes magnetite as a ballast material to combine with the biological floc in the aeration basins. This combination of materials has a high specific gravity that rapidly settles out in the secondary clarifiers. This in turn enables the biological treatment system in the aeration tanks to operate at elevated mixed liquor solids concentrations, which can enable the processing of higher flows while also achieving enhanced suspended solids, nitrogen and phosphorus removal rates. When incorporating the BioMag™ process into the 4-stage Bardenpho process, the first aeration tank would be a pre-aerobic/anoxic zone, the second and third aeration tanks would be aerobic zones, and the smaller secondary clarifier would be converted to create post-anoxic and reaeration zones. As shown in Figure 1, magnetite is added at the beginning of the first pre-aerobic tank where it is blended with RAS from the secondary clarifiers that is also combined with magnetite. Excess magnetite is recovered from the WAS by means of a magnetic drum separator and returned to the head of the process. Internal recycle in the amount of 200 - 400% of the influent flow rate is returned from the end of the aerobic zone to the start of the pre-aerobic zone. Methanol is also added as a carbon food source to facilitate the denitrification process.

INTRODUCTION

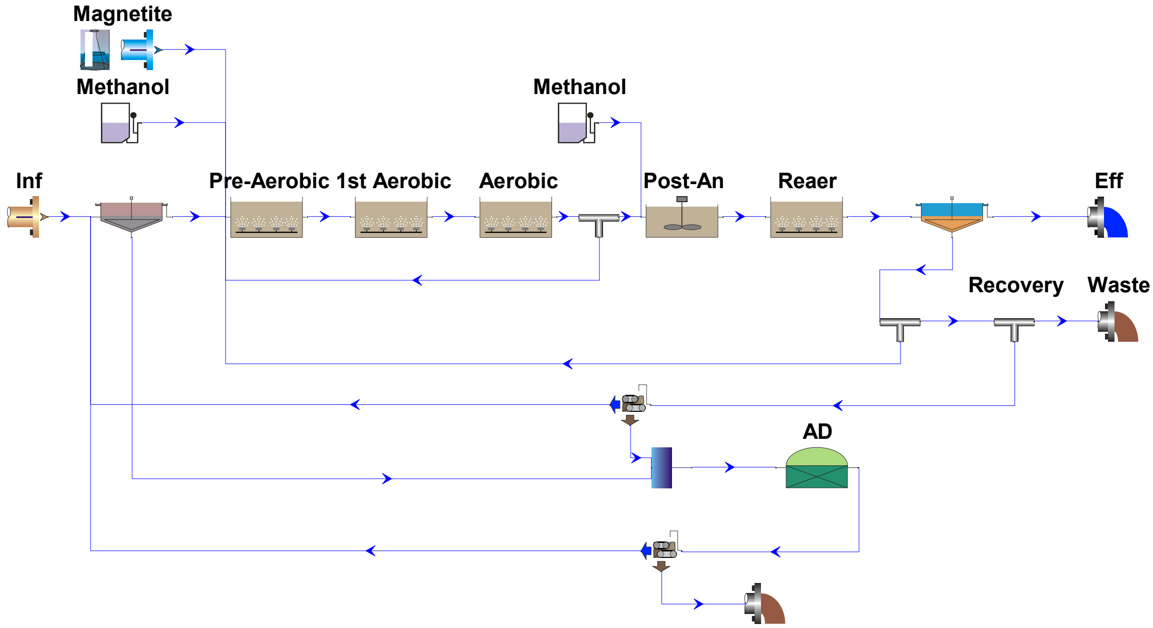

Figure 1 - 4-Stage Bardenpho with BioMag™

The results of the modeling indicated that with incorporation of the 4-stage Bardenpho and BioMag™ processes, including supplemental carbon addition, the WPCF would be capable of reducing the final effluent TN level to less than the permit required 3 mg/L. Previous studies have confirmed this achievement.[1] As stated earlier, Stantec modeling results indicated the final effluent TN level would be 4 or 5 mg/L without the benefit of the BioMag™ process.

Following the recommendations of the Phase 2 WMP, the Town of Fairhaven applied for and received a grant from the Massachusetts Office of Coastal Zone Management, Buzzards Bay National Estuary Program to conduct a full-scale BioMag™ pilot study to evaluate the effectiveness of the process to meet the draft NPDES permit limit for TN. This report describes the pilot study, the results achieved, and the applicability of using this technology in the future at the Fairhaven WPCF and other area WPCFs in an effort to reduce nitrogen loadings to meet future NPDES requirements and significantly reduce nitrogen concentrations in receiving waters.

1.2 PURPOSE AND SCOPE

The primary objective of this pilot study was to demonstrate that converting the existing activated sludge process at the Fairhaven WPCF to a 4-Stage Bardenpho process with BioMag™ would allow the plant to effectively maximize its treatment capacity and reliably achieve compliance with the proposed TN permit limits. The effluent TN was expected to be 3 mg/L with full-scale implementation of the process. However, since budget and time constraints made it impossible to modify one of the smaller existing secondary clarifiers to mimic a true 4-stage

Bardenpho process, the pilot study's goal was to demonstrate the ability to achieve 5 mg/L TN, understanding that full-scale operation would have a second anoxic and reaeration process to polish from <5 mg/L to 3 mg/L TN in the final effluent. Final effluent phosphorus levels would also be reduced with implementation of the "modified" 4-Stage Bardenpho process with BioMag™, but this nutrient was not monitored during the pilot study because there is no phosphorus limit in the draft NPDES permit.

2.0 PILOT STUDY

2.1 NARRATIVE SUMMARY OF PILOT STUDY PROCESS

A full-scale "modified" 4-stage Bardenpho process with BioMag™ nutrient reduction pilot study was conducted, with the entire flow for the plant handled in one aeration train. Primary effluent flowed by gravity to the first aeration tank, and from there to the second and third aeration tanks in a plug flow mode. Each aeration tank is 40 ft x 40 ft x 13 ft deep, for a combined volume of 0.47 million gallons (MG) - more than enough volume for the modified 4-stage Bardenpho with BioMag™ system established for this study. The target mixed liquor concentration was approximately 5,600 mg/L. The first zone (first aeration tank) was converted into an anoxic zone by turning the air off, and a mixer was installed to keep the solids in suspension. The second zone (second aeration tank) was aerated anoxic, and the third zone was aerobic. The Town rented an internal recirculation pump to pump 200 - 400% of the flow capacity from the last to the first aeration tank to effectively achieve the required TN levels (Figure 2).

Figure 2 - Internal Recirculation Pump Rented by Town

PILOT STUDY

Mixed liquor from the aerobic zone flowed by gravity to one of the existing secondary clarifiers. RAS pumps transported RAS from the secondary clarifiers in the range of 200 - 400% of the flow capacity to the first aeration tank. Secondary effluent flowed by gravity through existing piping to the existing disinfection system.

The BioMag™ trailer housed the magnetite feed and recovery equipment and was located adjacent to the first two aeration tanks of the train that was in operation for the pilot study. The equipment was similar to that used in previous full-scale BioMag™ pilot studies; the trailer at the Fairhaven WPCF is shown in Figure 3.

Figure 3 – BioMag™ Pilot Plant Trailer

PILOT STUDY

A pump located in the aeration tank effluent channel diverted a 100-gpm slipstream of the mixed liquor flow to the magnetite feed/ballast mix tank set up adjacent to the BioMag™ trailer. An automated feed system metered dry magnetite into the well-mixed ballast mix tank, where the magnetite was enmeshed in the biological floc (Figures 4 and 5). Ballasted mixed liquor was then pumped from the magnetite feed tank back to the first aeration tank. It took approximately three weeks to charge the mixed liquor with the initial dose of magnetite.

Figure 4 - Automated Magnetite Feed System

Figure 5 - Ballast Mix Tank

Another RAS slipstream was diverted, on the order of 10 - 20 gpm, to waste excess ballasted sludge to the magnetite recovery system using a pump located in the RAS chamber ahead of the first aeration tank. The waste sludge flowed through an in-line shear mill, and then onto the magnetic recovery drum, both of which were housed in the BioMag™ trailer (Figure 6). The recovered magnetite was dropped into the ballast mix tank. The waste biological solids were pumped from the bottom of the recovery drum to the first aeration tank in the off-line aeration train, where they flowed by gravity through a tank drain to the overflow primary settling tank, and were then pumped to the gravity belt thickener. The magnetite feed/recovery system had a high-level shutoff switch to prevent an inadvertent tank overflow.

Figure 6 - Shear Mill (Foreground) and Magnetic Recovery Drum (Background)

Figure 7 presents a schematic layout/process flow diagram of the Fairhaven WPCF, including the BioMag™ pilot study components described previously.

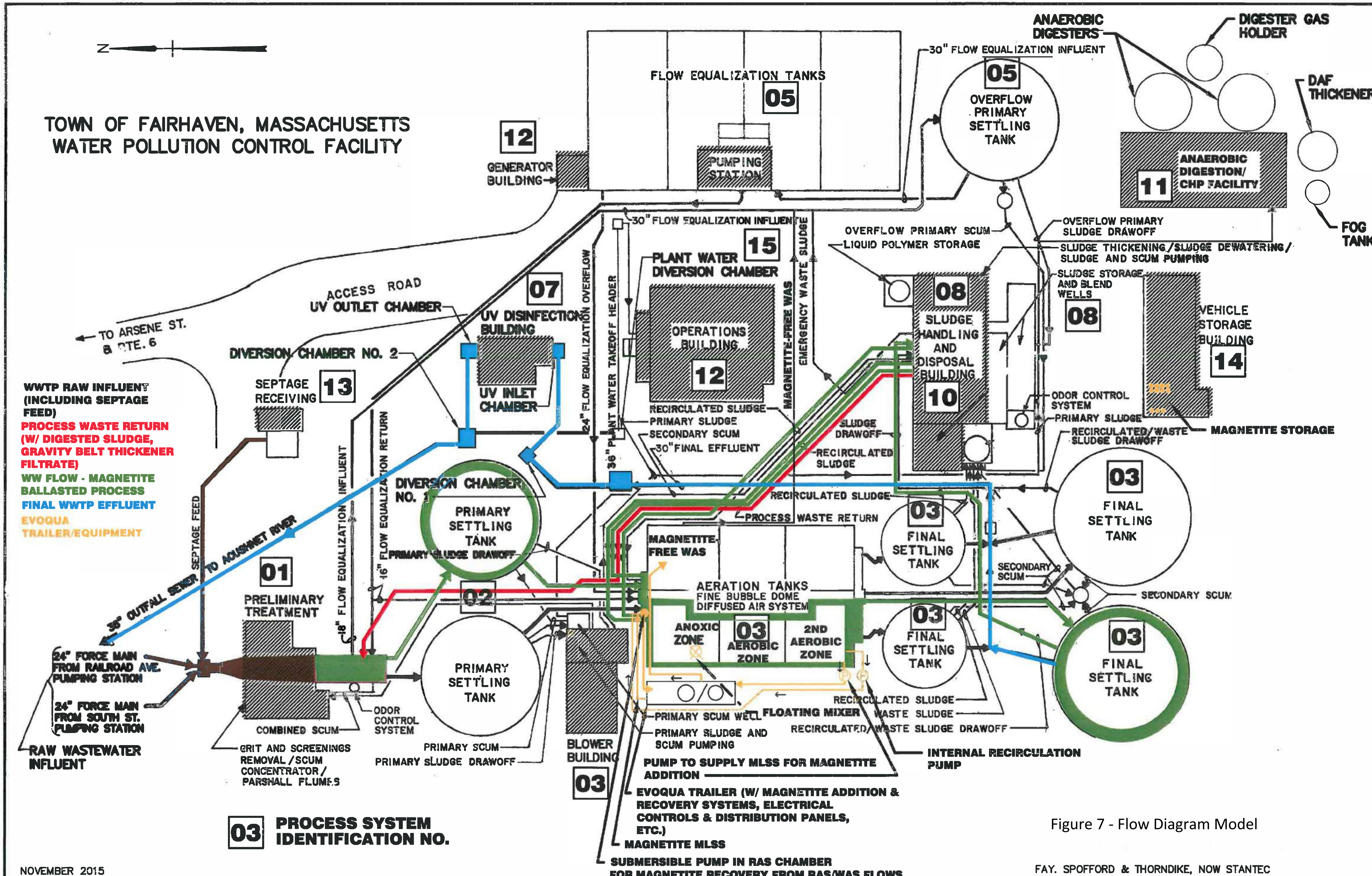

Figure 7 - Flow Diagram Model

2.2 PILOT PLANT PERFORMANCE PARAMETERS

Table 2 presents the main parameters assumed for the pilot plant operation.

Table 2 - Pilot Plant Performance Parameters

	Primary Effluent Characteristics	Required Performance Final Effluent	Measure
Flow	3 MGD		
TKN	42 mg/L		
TN		5.0 mg/L	Average Monthly
TSS	62 mg/L	<30 mg/L	Average Monthly
BOD	142 mg/L	<30 mg/L	Average Monthly

2.3 PROJECT SCHEDULE

Table 3 presents the schedule for the BioMag™ pilot study. This timeframe represented a "warm-weather" operation, with plant influent wastewater temperatures varying from 20.6 degrees Centigrade in early October 2015, to 14.5 degrees Centigrade on the last day of the pilot study, December 16, 2015.

Table 3 - Pilot Study Schedule

Phase	Date
1. Begin Mobilization	September 8, 2015
2. Begin Charging	September 28, 2015
3. Begin Testing	Upon achievement of stable operation, October 22, 2015
4. MicroC Addition @ 35 gal/day	November 8, 2015
5. MicroC Addition @ 70 gal/day	November 9, 2015
6. MicroC Addition @ 100 gal/day	November 12, 2015
7. Last day of pilot operation	December 16, 2015

2.4 PILOT OPERATIONS

From initial charge (magnetite addition) through plant stabilization, Evoqua, the pilot plant vendor, took lead responsibility for the pilot plant's operation. During this time, Evoqua also trained the WPCF staff in the operation of the BioMag™ system and the conduct of the test protocols so that they could take primary responsibility for operating the plant during the test phase. During the test phase, Evoqua personnel maintained a presence on site and regularly monitored the performance of the pilot plant and provided assistance and counsel as necessary.

2.4.1 Training

Town personnel and a Stantec intern providing weekday and weekend sampling and monitoring, respectively, were trained by Evoqua on sample collection and logging, as well as magnetite analysis, at the beginning of the project during pilot plant startup. Appendix B contains a copy of the training sign-in sheets.

Topics covered by the Town personnel training included BioMag™ basics of operation, ballasted treatment process, process flows, sampling locations, procedures and methods, trailer operations and alarming, troubleshooting alarms, targets for the project and system adjustments to achieve them. Topics covered by the Stantec intern training included wastewater treatment process and components, pilot plant components, environmental safety and health, emergency awareness, sludge blanket level measurement, and dissolved oxygen (DO), pH, temperature and oxidation reduction potential (ORP) meter measurements and recording.

2.5 ANALYTICAL TESTING

In addition to their normal duties for operating and maintaining the Fairhaven WPCF, town staff was tasked with taking the daily readings, conducting a routine walkthrough of the trailer, recording data, and recording the data in an Evoqua-supplied Excel file that was pertinent to the pilot study. Evoqua Process Engineers supplied guidance to town staff to make adjustments to the biological, ballasted, and chemical feed components of the system. This included routine inspections and adjustments of the BioMag™ test equipment, daily sampling rounds, chemical feed adjustments, and laboratory analyses. BioMag™ system monitoring included the following:

- Raw influent flow rate
- Primary effluent and final effluent BOD, TSS and VSS
- Final effluent ultraviolet intensity and percent transmittance
- Raw influent, primary effluent, final effluent and thickener filtrate nitrite (NO_2-N), nitrate (NO_3-N), ammonia (NH_3-N), total Kjeldahl nitrogen (TKN) and TN (by certified laboratory)
- Daily readings with Hach TNT vials for NH_3-N, NO_3-N and TN (by WPCF laboratory)

PILOT STUDY

- Primary effluent temperature
- Acidity (pH) in the primary effluent, aeration tanks (zones) 1, 2, 3 and final effluent
- Alkalinity in the raw influent, primary effluent and final effluent
- DO and ORP in zones 1, 2 and 3
- MLSS, MLVSS, magnetite and MLSS biological concentration in zones 1, 2 and 3
- 5-minute and 30-minute settle-o-meter, and sludge volume index (SVI) in zone 3
- Magnetite:biosolids ratio in zone 3
- RAS flow rate
- TSS, magnetite and biological solids concentration in the RAS
- Internal wastewater recycle speed
- Secondary clarifier sludge blanket level
- Polymer dial speed, level and feed rate (when applicable)
- Magnetic drum speed and shear mill current and speed
- WAS flow and TSS, magnetite and biological solids concentration and mass to and from magnetic drum
- Percent recovery of magnetite and biological solids from magnetic drum
- Pounds of TSS, magnetite and biological solids, and magnetite:biosolids ratio in zones 1, 2 and 3, final clarifier, and total plant inventory
- Target and actual solids retention time (SRT)
- Target WAS mass, concentration and flow rate
- Supplemental carbon (MicroC) feed rate

All sample collection and analyses, except for non-test kit nitrogen and some alkalinity analyses, were completed by town staff (and the Stantec intern on the weekend) in accordance with the collection, sampling and analytical procedures as detailed in the previously submitted Quality Assurance Project Plan (QAPP). All nitrogen analyses, and some alkalinity analyses, were completed by an outside certified laboratory, Microbac.

Appendix C contains a copy of the Excel spreadsheet set up by Evoqua personnel that shows the results of the parameters that were monitored, excluding MicroC, which was added as described in Section 3.4 - Nitrogen Data. We highlighted a few of the results in this spreadsheet that look "questionable", but kept them in the spreadsheet because the backup data support the results. We note there are some missing data in this spreadsheet during the first week of October 2015 as the systems were starting up, in the final week of the pilot study in December 2015 when the flow to the magnetite recovery drum was not recorded, and in the final two weeks of December 2015 following the end of the pilot study when the systems were shutting down.

Appendix D includes the pilot trailer checklist for readings taken by town personnel and the Stantec intern for items such as sludge blanket height, operation of magnetite feed, magnetic recovery drum, polymer feed, Kady (shear) mill, internal recycle pump, and air compressor and dryer, various control readings, and DO, pH, ORP and temperature in zones 1, 2 and 3.

OPERATING DATA AND ANALYSIS

Appendices E and F contain back-up Fairhaven WPCF laboratory data sheets for BOD and solids analyses, respectively, completed by town personnel. The solids backup sheets also contain temperature, pH and nitrogen data, with the nitrogen data determined by Hach TNT vials in the WPCF laboratory; we did not include this nitrogen data in Appendix C or in our later review of nitrogen results, relying instead on the nitrogen data from Microbac. Also, the pH data for the aeration tanks shown in the spreadsheet in Appendix C originates from the trailer checklist, and not the values shown on the solids backup sheets. Appendix G contains the laboratory reports completed by Microbac.

During the last few weeks of the pilot study, the company supplying MicroC provided a Nitratax probe made by Hach that gave real-time values and trends of combined NO_2-N and NO_3-N (NOX) concentrations leaving zone 1. This proved helpful in determining some of the limiting factors within the pilot system.

2.6 PILOT OPERATIONS AND STAFFING

Evoqua provided a Process Engineer to commission, train, provide technical support, and assist with an Operations Report. Fairhaven WPCF staff handled pilot operations and testing once the pilot plant was stabilized.

3.0 OPERATING DATA AND ANALYSIS

This report section presents and discusses the results of the full-scale BioMag™ trial. The demonstration began in early September 2015. The system experienced difficulties in the first few weeks of the trial until the "bugs" were eventually worked out, and steady state operation began in mid-October 2015. The early challenges were primarily due to two factors. First, the temporary pump layout had issues with entraining air and trapping it in the temporary hoses. This effect was exaggerated due to the shallow sump areas housing pumps along with the use of flexible hoses. Though the hose had an air relief point close to the pump, there was not enough time for the air to separate to the top of the pipe and escape. The air that continued downstream of the air relief then became trapped in the lines, eventually slowing and stopping flows to the trailer. To combat this, all the lines were pitched and additional air relief points were installed. The second major challenge revolved around filament growth. With all of the biological changes to the existing system including water temperature, rapidly increasing the SRT, achieving complete nitrification, gaining de-nitrification, changing the air configuration, adding a new mixing regime in the first cell, and stopping chemicals used to help reduce the septicity of the influent, the plant grew multiple filaments and ultimately an unhealthy biology. A third party was consulted to gain a better understanding. Jeffery MacDonald, M.S., of MacDonald Environmental Services based in Oak Creek, Wisconsin, reviewed the mixed liquor sample and reported a high level of Microthrix Parvicella along with other filaments. He also noted a lack of higher organisms. His independent report is incorporated as Appendix H. As a result of this report, the plant chlorinated the RAS to target the filament population.

Once the contributory factors were identified and addressed, the system was able to achieve a steady state of performance effectively and consistently, as detailed below. Pilot operations continued through December 16, 2015, and final pilot study samples were obtained on the morning of December 17, 2015. This report presents additional data through December 31, 2015 that reflects some of the study's impacts, as the major changes following December 16 were cessation of supplemental carbon addition, elimination of internal wastewater recirculation and no further magnetite addition to the WAS. Magnetite removal from the WAS did occur through the end of December 2015.

3.1 MAGNETITE RATIO

When looking at the stability of the BioMag™ system, the magnetite ratio is a key parameter. Magnetite at a ratio between 1:1 and 1.5:1, meaning 1 gram of magnetite per 1 gram of MLSS or higher, was ideal for the flows and loadings during the Fairhaven pilot. This correlation is seen in Figure 8, which shows the sludge blanket height in the final clarifier compared to the magnetite to biosolids ratio in zone 3 over the course of the trial. At the beginning of the pilot study, with lower ratios (<1:1), the blanket stability struggled, but once "charged" with magnetite in excess of the 1:1 ratio, the blanket was able to consistently maintain a very low level. In the last month of the pilot study, the blanket depth increased several feet when the ratio dropped below 1:1, and then decreased the last week when the 1:1 ratio was again achieved.

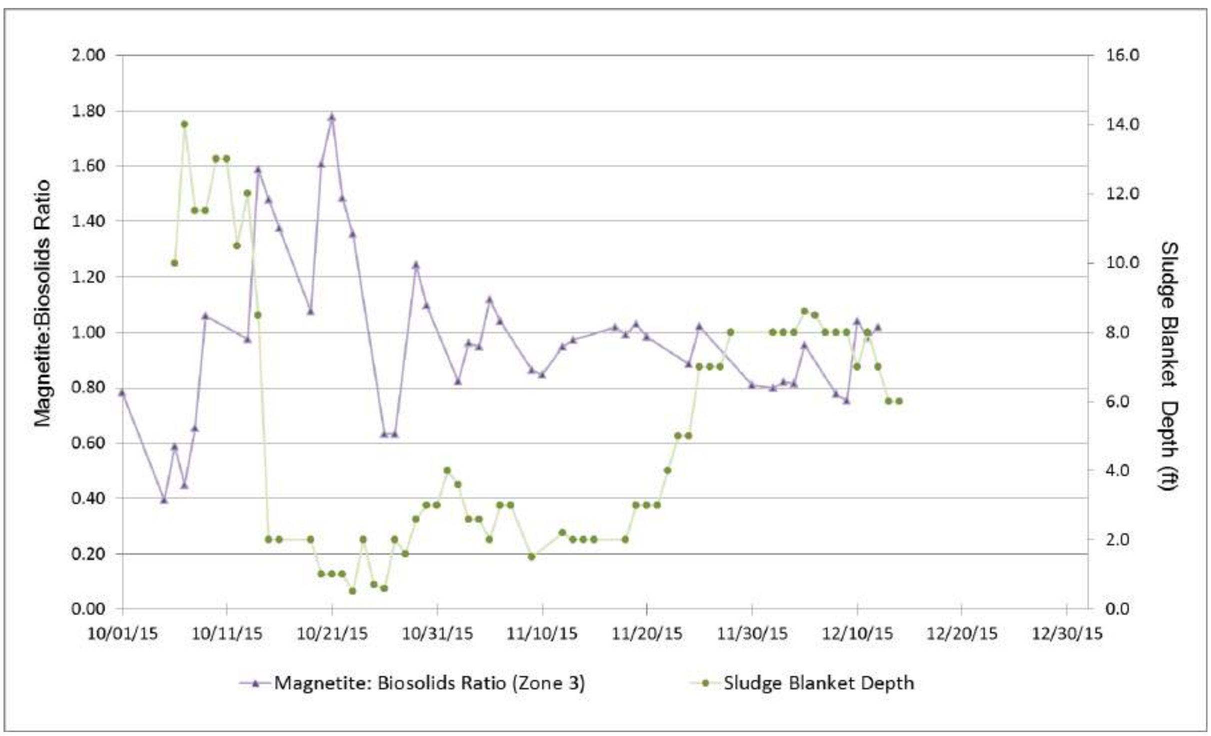

Figure 8 – Magnetite:Biosolids Ratio vs. Sludge Blanket Depth

3.2 TSS DATA

Once the target magnetite ratio is achieved, the solids are much heavier and will have increased settling velocities, leading to low TSS in the effluent. The primary effluent and final effluent TSS compared to the daily influent flow for the pilot study are shown in Figure 9. The dashed lines for the TSS data represent the 2-day moving average. The pilot study achieved permit compliance success in this category with an average of 8 mg/L TSS in the final effluent over the duration of the study. The draft NPDES permit has a monthly average limit of 30 mg/L. Figure 9 also indicates that the final effluent TSS remained low even as flows increased in the last week of the pilot study and through the end of December.

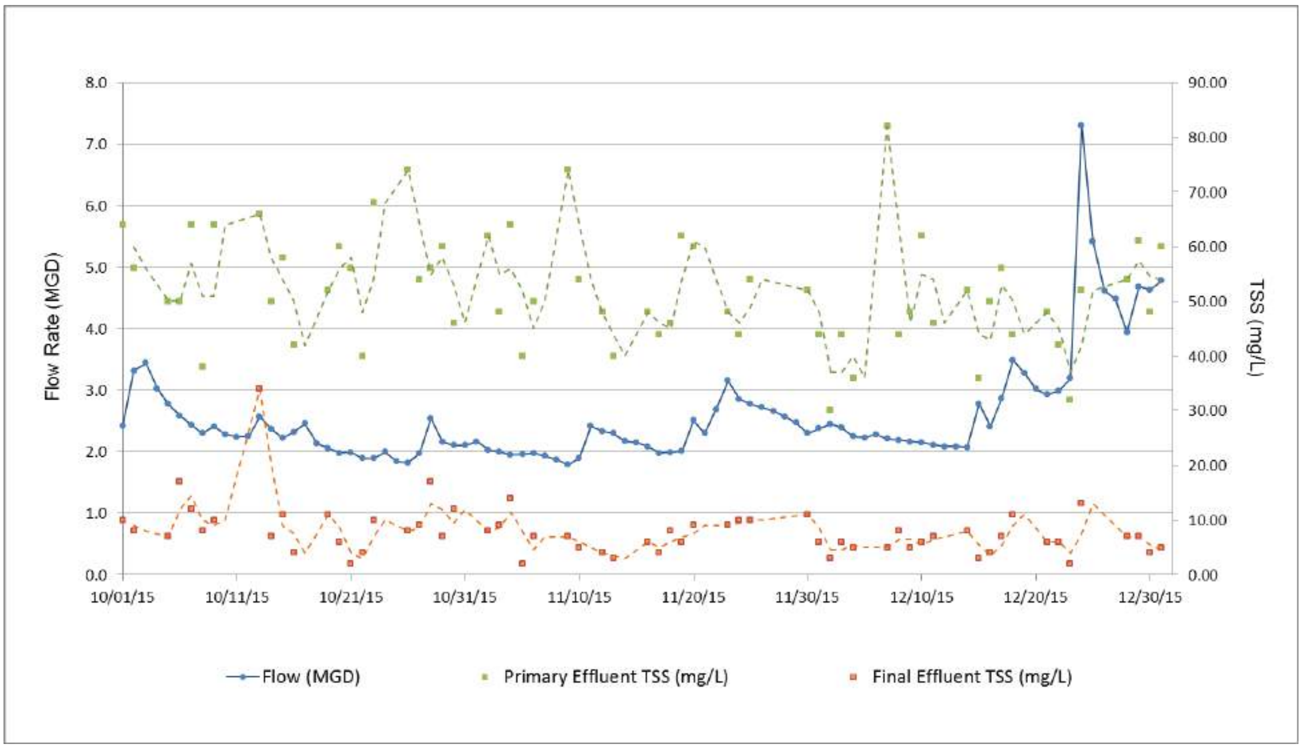

Figure 9 - Flow vs. Primary Effluent and Final Effluent TSS

An unintended consequence of the slightly heavier magnetite sludge, as compared to normal secondary sludge, is that it was likely the cause of damage to one of the 75-foot diameter final clarifier rake arms. The clarifier mechanisms were over 25 years old and in a deteriorated condition. When a portion of the metal rake arm broke several weeks into the pilot study, the final clarifier had to be taken down to repair the rake arm. The flow was diverted to the other 75-foot diameter secondary clarifier during the repair, and then transferred back again. The Town is currently designing replacement of the equipment in all of the WPCF's clarifiers.

3.3 BOD DATA

Final effluent BOD was another critical parameter monitored during the pilot study with a monthly average limit of 30 mg/L in the draft permit. The pilot study was able to reach compliance in this category with an average of 4 mg/L over the course of the study. The final effluent BOD decreased during the course of the pilot study despite the growing gap between the linear trend lines shown below in Figure 10, with the primary effluent gaining strength and the final effluent seeing more of a reduction.

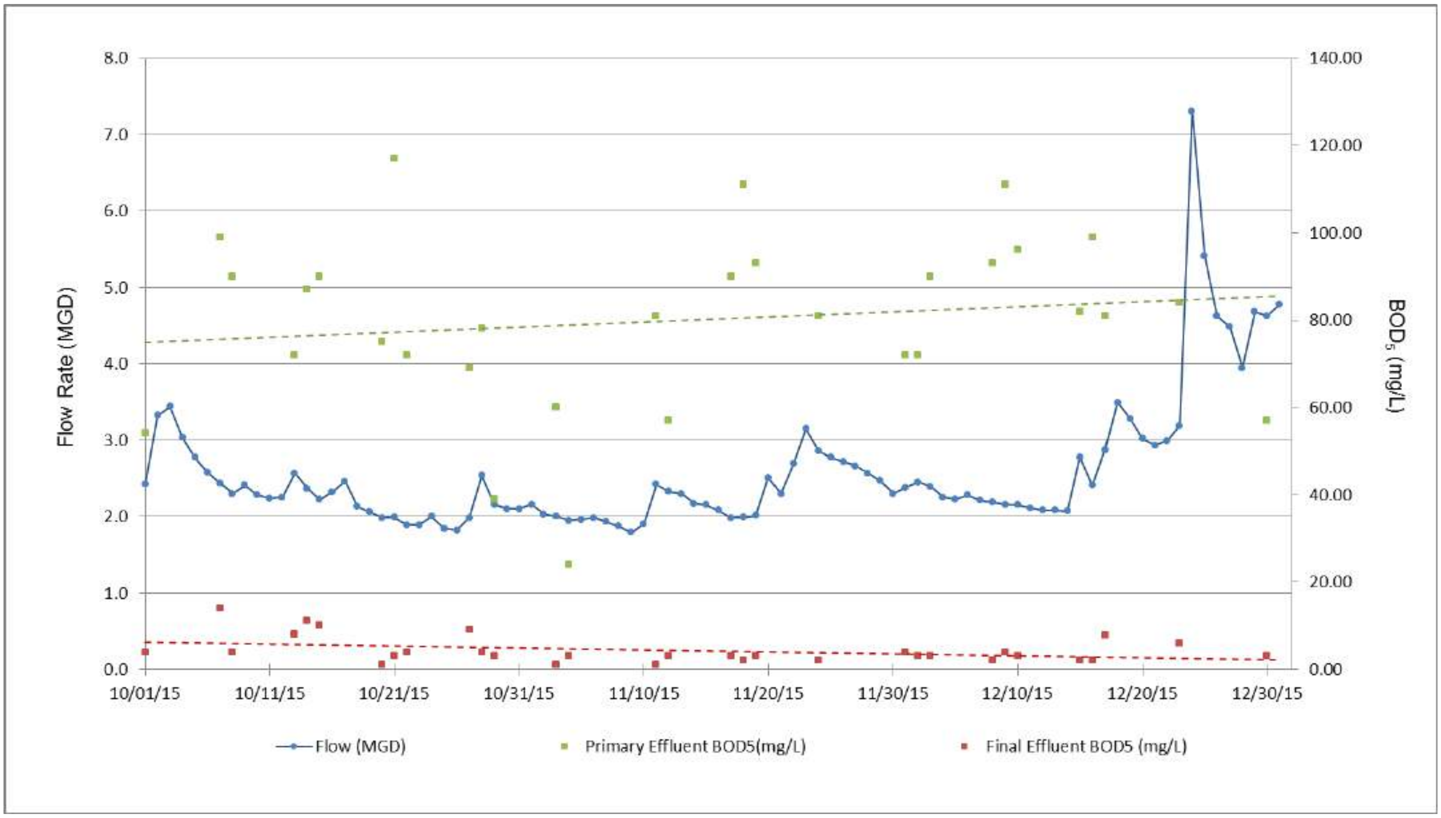

Figure 10 - Primary Influent BOD vs. Final Effluent BOD

3.4 NITROGEN DATA

TN removal, the main objective of this pilot study, is more difficult to achieve than the other tested parameters due to its complex nature and ideal removal requirements. The primary effluent at the WPCF has a low carbon-to-nitrogen ratio because much of the BOD is removed in the primary clarifiers (~50% removal during the pilot), while the vast majority of the nitrogen (95%) is retained in the primary effluent, leaving a carbon deficiency for TN removal. Consequently, while the raw influent has a more desirable ratio of 4.5:1 BOD to TN, the secondary treatment system is limited by a poor ratio of 2.7:1, making supplemental carbon addition necessary for efficient TN removal. Recognizing early on that the biological treatment system would be limited by the primary effluent carbon-to-nitrogen ratio, a plan to use MicroC to boost the influent carbon strength was implemented, simulating less BOD removal in the primary clarifiers and a more desirable BOD to TN ratio at the introduction to the aeration tanks.

Prior to implementing MicroC addition, the TN performance was baselined without change to the primary clarifiers or any chemical additions. After this was completed, MicroC addition was started. MicroC was introduced at 35 gpd on November 8, and increased to 70 gpd on November 9, 85 gpd on November 11, and finally 100 gpd on November 12. Figure 11 below shows how the change in MicroC addition affected the final effluent TN levels by providing a better carbon-to-nitrogen ratio and promoting better overall TN removal. After running the MicroC at 100 gpd for a few days, and in an effort to keep pilot costs down (MicroC costs approximately $6 per gallon), it was agreed by all parties involved in the study to only feed supplemental carbon just prior to and on sampling days. Town staff turned the carbon pump on Sunday morning and left it in operation until the carbon supply ran out, as explained below;

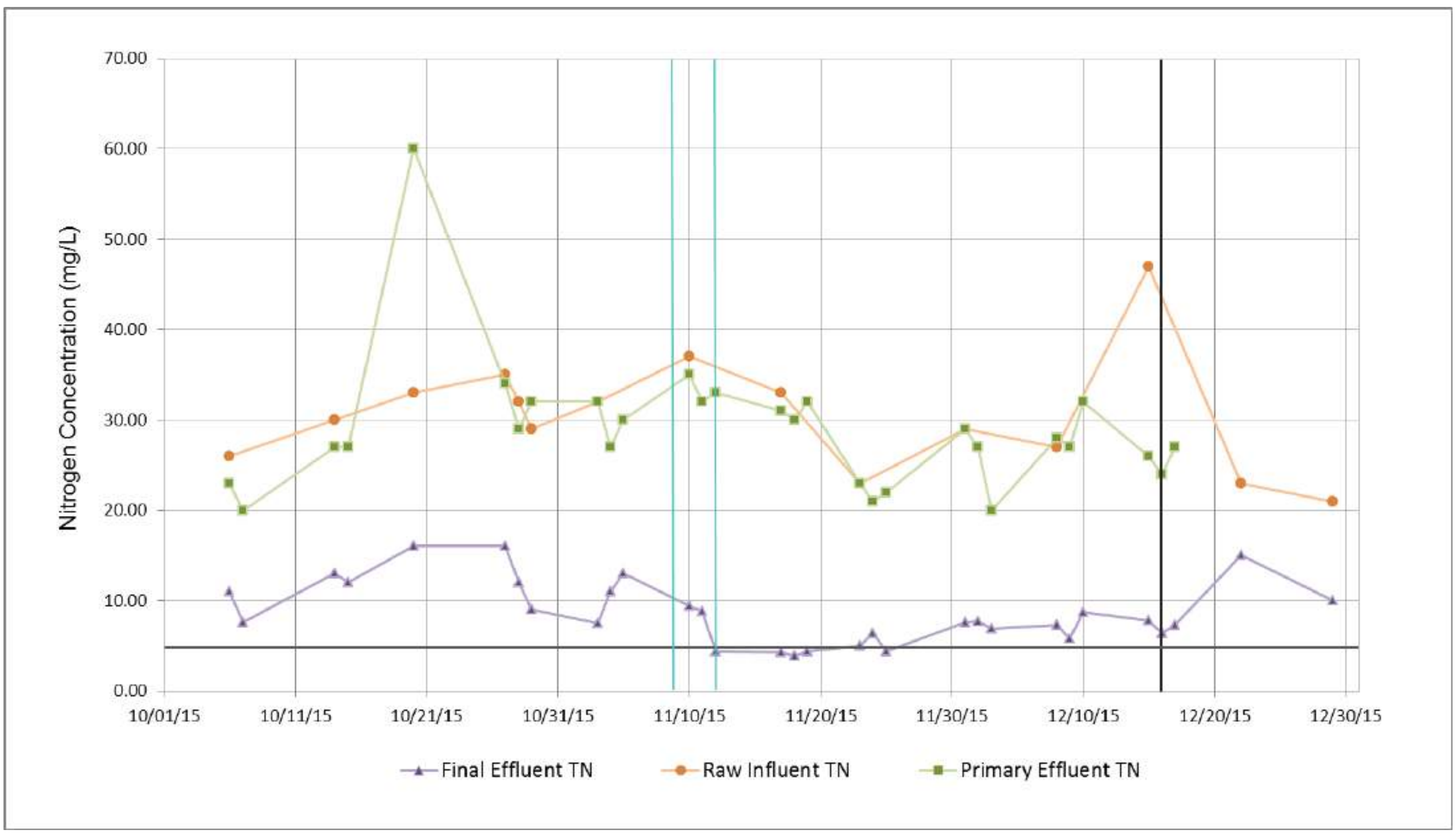

Figure 11 - Raw Influent, Primary Effluent and Final Effluent Total Nitrogen

OPERATING DATA AND ANALYSIS

24-hour composite samples were normally collected from Tuesday morning though Thursday morning. However, the Town was also trying to work within the budgetary constraints of using no more than one tote of MicroC a week, which only held 330 gallons. This resulted in less MicroC being applied prior to the last day of sampling (Thursday). The final effluent TN results for the Thursdays with reduced MicroC addition were not noticeably higher than the days with the full 100-gpd application rate, indicating that MicroC was still present in significant quantities in the RAS and internal recycle stream. We also note that during the Thanksgiving holiday week, MicroC was not turned on prior to the samples taken on November 23, 2015. In addition, the Phase 2 WMP recommended 230 gpd of MicroC addition for the 5-MGD design flow, which equates to about 110 gpd of MicroC for the average daily flow of 2.3 MGD during the pilot study. Thus, the 100-gpd of MicroC used for the pilot study may have been on the low side, but was the amount the Town could manage with existing resources.

3.4.1 Sampling Results

The nitrogen sampling data through December 10, 2015 included 24-hour composite samples that were analyzed for NH_3-N and TKN, and grab samples that were analyzed for NO_3–N and NO_2-N. In accordance with the QAPP, the testing should have been conducted on composite samples for NO_2-N and NO_3-N. The inadvertent sampling error was discovered on December 10, 2015, and all samples taken thereafter for NO_2-N and NO_3-N were composites. The certified laboratory conducting the nitrogen analyses, Microbac, was also able to determine the combined NO_3-N and NO_2-N (NOX) concentration from remaining composite samples used for testing NH_3-N and TKN at the laboratory between December 1 and 10, 2015. Composite samples obtained for nitrogen analyses throughout the study were preserved with sulfuric acid, and the certified laboratory explained that it would need a non-preserved sample to analyze for NO_3–N and NO_2-N individually, so all NO_3-N and NO_2-N analyses in December 2015 were a combination of the two parameters.

Figure 11 on the previous page illustrates the TN concentrations throughout the treatment process, including raw influent, primary effluent and final effluent concentrations. The first blue line represents when MicroC addition to the system was started at 70 gpd (November 9, 2015), and the second blue line represents when MicroC addition was boosted to 100 gpd (November 12, 2015). The black vertical line represents the finish date of the pilot study - December 16, 2015. The horizontal black line represents the pilot study final effluent TN goal of 5 mg/L. As can be seen from the graph, final effluent TN concentrations stabilized after introduction of MicroC at 100 gpd, even getting down to levels below 5 mg/L. The low final effluent TN levels were not maintained throughout the period with 100-gpd MicroC addition, however, averaging 6.3 mg/L from November 15 – December 17, 2015 (The December 17 samples were obtained in the morning, having the benefit of the MicroC addition and the modified 4-stage Bardenpho operation throughout the previous day.). Once the pilot study was completed on December 16, 2015, Figure 11 shows that the final effluent TN levels started to increase again, reaching 15 mg/L and 10 mg/L in the two samples taken December 22 and 29, 2015, respectively.

OPERATING DATA AND ANALYSIS

Figure 12 shows the final effluent concentrations of NO3-N, NO2-N, TKN and TN. The vertical blue and black lines are the same as those in Figure 11. As explained previously, the final effluent TKN and combined NO3-N+NO2-N (NOX) analyses were conducted on composite samples, while the individual final effluent NO2-N and final effluent NO3-N analyses were conducted on grab samples. Of the TN components shown, Figure 11 indicates that the major constituent was NO3-N, and when this parameter was reduced to <4 mg/L in the final effluent, TN stayed at or below 5 mg/L, the target goal for the pilot study. NO2-N levels were largely insignificant, especially following MicroC addition. The latter two statements would bear more weight if the study had included composite samples for these individual parameters, but we believe composite sample analyses would yield the same conclusions. Also, it appears that the composite samples analyzed for NOX starting on December 1, 2015 had higher concentrations through the end of the pilot study than the combination of the results for the grab samples analyzed for NO2-N and NO3-N individually from November 10 – 25, 2015. Again, we put more faith in the composite sample results, but achieving the goal of <5mg/L final effluent TN in mid-to-late November may have resulted in relaxing some of the parameters, such as the magnetite to biosolids ratio, which varied between 0.8 and 1.0 from November 10, 2015 through the end of the study (Figure 8).

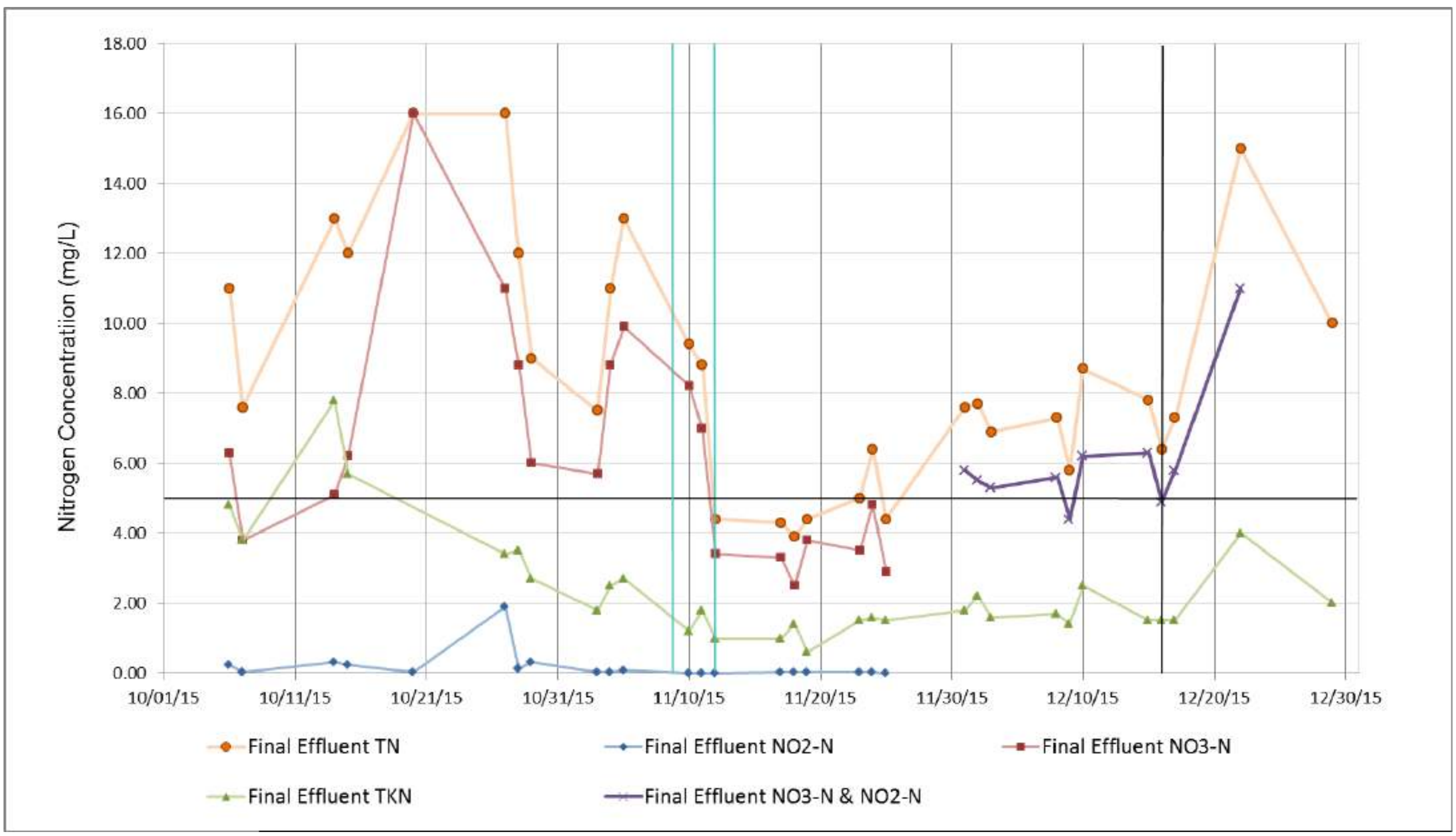

Figure 12 - Final Effluent Nitrogen

Keeping the magnetite to biosolids ratio at 1.0, increasing the MicroC addition beyond 100 gpd, and/or altering other factors discussed below, might have boosted the system performance in the direction of the <5 mg/L goal.

A Nitratax probe manufactured by Hach was installed on November 30, 2015 at the tail end of the anoxic cell (zone 1) before discharging into the aerobic zones, to provide real-time NOX levels in the system. The data provided by this probe was helpful in determining a limiting factor in the pilot performance, which was insufficient internal recycle, as discussed in the following section.

3.4.2 Internal and RAS Recycle Rates

During the pilot study, it was determined that as the influent flow goes up the internal recycle ratio decreases, and the NOX removal rate decreases because the internal recycle flow is constant and limited to the maximum capacity of the pump. To further explain the recycle rate shortfall, originally the pilot was slated to run side-by-side with one train being BioMag™ and the other running as a conventional activated sludge system. This plan was not used, as the flows to the plant were not high enough to split the flow and still demonstrate the pilot study's capabilities. The pump was specified to provide 3,000 gpm, and on-site flow measurement of this pump showed that it was pumping approximately 3,200 gpm of internal recycle, equivalent to twice the incoming average daily flow (2.0Q) during the pilot study (October 1 – December 16, 2015). Using Nitratax probe data, a comparison of real-time NOX levels leaving zone 1 with internal recycle ratios showed that NOX concentrations were on the order of 1 – 3 mg/L with recycle ratios around 2.8 – 3.8Q, but inched back up to 4 – 6 mg/L with recycle ratios of 1.6 – 2Q. This indicates that internal recycle flows on the order of 3 – 4Q would produce lower final effluent TN results.

In addition to the internal recycle, RAS was also pumped from the secondary clarifiers to the first aeration tank. Average RAS flow from October 6 to December 13, 2015 was approximately 1,833 gpm, or 1.15Q for the entire pilot study. The original intent of the pilot study was to pump 2 – 4Q RAS to the first aeration tank, so a higher RAS rate would likely have been more beneficial during the pilot study for achieving nitrogen reduction.

3.4.3 Impact of Thickener Filtrate on Influent Nitrogen Loading

Filtrate from the Gravity Belt Thickener (GBT) at the Fairhaven WPCF, which thickens WAS, is sent back to the headworks of the plant, downstream of the location where influent samples are taken. During the pilot study, the filtrate flow was sampled on three dates (a composite sample composed of grab samples taken over the course of the GBT operation on each date), and the additional nitrogen loading to the headworks was calculated based on the results of the sample analysis. As can be seen from Table 4 below, the GBT filtrate TN loading to the plant headworks

Table 4 – Gravity Belt Thickener Filtrate TN Loadings

	12/1/2015	12/8/2015	12/15/2015
Thickener Filtrate Total Flow (gpd)	13,200	15,400	33,200
Thickener Filtrate TN Conc. (mg/L)	530	190	240
Thickener Filtrate TN Loading (lbs.)	58.4	24.4	66.5
Raw Influent Flow Rate (MGD)	2.4	2.2	2.8
Raw Influent TN Conc. (mg/L)	29	27	47
Raw Influent TN Loading (lbs.)	581	496	1098
Ratio of Filtrate TN/(Raw Influent + Filtrate TN)	9.1%	4.7%	5.7%

can be significant, contributing about 5 – 10 percent additional TN loading to the plant headworks.

3.5 OPERATING COSTS

Compared to the current operation of the Fairhaven WPCF, the modified 4-stage Bardenpho with BioMag™ pilot study required significant additional electrical use to maintain pumping requirements and to operate the various processes associated with magnetite addition and recovery. Looking at the months of pilot study operation in 2015 compared to the same months in 2014, Table 5 below indicates the electricity consumed by the WPCF more than doubled in October, and increased by more than a factor of four in November and December. The December increase in particular is stunning, since the internal recirculation pump was removed December 17, 2015. As a gross approximation of the electrical cost increase associated with full-scale implementation of this study, we could apply the average of the cost difference for October and November in 2014 vs. 2015 (($23,166.83 - $11,716.70 + $24,131.63 - $6,398.25)/2 = $14,591.76) over six months, assuming the new permit would only have a TN limit of 3 mg/L from May – October. The draft permit did not specify a seasonal TN limitation, but this has been the case for other area WPCFs that have received final NPDES permits in the last few years. This cost

Table 5 - Electrical Consumption Comparison

	2014			2015		
	October	November	December	October	November	December
Usage (KWH)	89,000	44,220	37,640	184,180	195,920	161,760
Cost	$11,716.70	$6,398.25	$5,122.20	$23,166.83	$24,131.63	$20,776.51

is 6 x $14,591.76 = $87,550, and would be even higher with increased internal recycle and/or RAS pumping rates and a complete 4-stage Bardenpho process.

Besides the increased electrical consumption, the addition of MicroC to the BioMag™ system is another significant O&M cost that would be borne from the operation of the system. During the pilot study, MicroC was added at 100 gpd to achieve the desired effluent TN concentrations. At a cost of approximately $6 per gallon, the annual cost of MicroC addition, if added every day at 100 gpd for six months, would be about $109,200. If a higher rate of 110 gpd were needed, as indicated in the Phase 2 WMP, the annual cost would be about $120,100. To offset this cost, the Town investigated obtaining a waste carbon source from a local winery to use instead of MicroC. This alternative was not pursued for the pilot study, but would be worthwhile to investigate if the 4-stage Bardenpho process, with or without BioMag™, is chosen for implementation at the Fairhaven WPCF in the future.

The cost of magnetite is another operational expense to take into account. A rough estimate of this cost for the Fairhaven WPCF for six months is $10,000, plus freight and trucking. Combining this cost with those for MicroC at 100 gpd and additional electrical requirements yields an additional annual operating cost for the Fairhaven WPCF of about $207,000 for a six-month operation of a 4-stage Bardenpho with BioMag™ system. We caution that this cost is very preliminary, and does not include sufficient electrical backup information, or other costs associated with increasing internal recycle and RAS pumping rates to improve nitrogen removal, additional labor, increased pump maintenance, possible polymer addition, etc.

4.0 PILOT PLANT OPEN HOUSE

On December 16, 2015, the final day of pilot plant operation, the Town of Fairhaven held an open house at the Fairhaven WPCF to explain and demonstrate the operation of the pilot plant to town, state and federal officials who were invited to the open house. Several representatives from Evoqua, Stantec and the Fairhaven WPCF were on hand to talk about the various components of the modified 4-stage Bardenpho with BioMag™ system, and conduct a walk-through of the pilot trailer and the modified aeration tanks and pumping facilities. Invited attendees included officials from EPA Region 1, MassDEP, and the Town of Fairhaven Executive Secretary.

5.0 SUMMARY AND RECOMMENDATIONS

5.1 SUMMARY

The pilot study at the Fairhaven WPCF demonstrated that operation of the modified 4-stage Bardenpho with BioMag™ system resulted in significantly lower effluent TN concentrations than the WPCF was discharging prior to the study. However, the pilot study did not consistently produce the required effluent TN concentration of 5 mg/L; the average TN concentration in the effluent after MicroC addition at 100 gpd was 6.3 mg/L.

The shortfall in achieving the effluent TN value could be due to several factors, including the internal recycle and RAS pumping rates being lower than desired for optimum TN removal throughout the system. Another factor is that in the beginning of the pilot study the samples for NO_3-N and NO_2-N were analyzed using grab samples in lieu of composite samples as originally intended. The results of the grab sample analyses yielded lower concentrations than the composite samples (conducted subsequently), and indicated that the system was operating optimally. If the higher concentrations were originally recorded, operation of the BioMag™ system might have been altered further to achieve the lower effluent nitrogen levels required. These alterations might have included maintaining a consistent magnetite to biosolids ratio of 1:1, or increasing the MicroC addition from 100 gpd to 110 gpd, as the latter dose was indicated in the Phase 2 WMP. We believe that adjustment of one or more of these factors would have led to achieving a final effluent TN of 5 mg/L, and with modifications to the existing smaller final clarifier to provide further polishing, a final effluent TN value of 3 mg/l would be attained, satisfying the draft NPDES permit requirement for this parameter. We also believe this treatment technology is an effective means for significantly reducing the amount of nitrogen discharged to the plant’s receiving water, the Acushnet River, and could be applied to other area WPCFs, depending on existing tankage, process layout and operation, and effluent TN requirements.

The pilot study easily met the TSS and BOD requirements of the new draft NPDES permit.

Costs and energy use of this system are major issues, however, and should be investigated more thoroughly. In 2014, the Phase 2 WMP estimated that the construction cost for the 4-stage Bardenpho with BioMag™ system would be about $9.8 million. The additional operating costs are very significant as well, roughly estimated from this study to exceed $200,000/year for a six-month operation, and the increased energy requirements would greatly expand the carbon footprint of the Fairhaven WPCF. There may be alternative waste carbon sources to replace

MicroC, but there is no ready replacement for the internal recycle and significantly higher RAS pumping requirements associated with a 4-stage Bardenpho system.

One of the final clarifier rake arms was also damaged during the pilot study, likely as a result of the magnetite sludge that is effective in settling out solids and associated pollutants, and is slightly heavier than normal secondary sludge. The rake arms were over 25 years old and in a deteriorated condition, making them susceptible to damage from the slightly heavier magnetite sludge.

5.2 RECOMMENDATIONS

The results of the pilot study, given certain adjustments, showed that the 4-stage Bardenpho with BioMag™ process is an effective option for the Town to consider for meeting future NPDES permit limits for TN at the Fairhaven WPCF. However, the cost to build and operate this system is too great for the Town to manage at this time. The Town would like to investigate alternative processes that would be less expensive and energy-intensive, and would produce a lighter sludge with less impact on the WPCF's aging facilities. This investigation should involve the other processes recommended in the Phase 2 WMP – membrane bioreactor and denitrification filter. Both of these systems require working in conjunction with the 4-stage Bardenpho process to achieve sufficient nitrogen removal, and the Phase 2 WMP estimated that the operating costs would be comparable to or greater than the current study's alternative, but the sludge would be lighter. Our recommendation is to first identify where these systems are in place, what the results and associated costs have been, and if there are any concerns. We also recommend looking into other innovative options for nitrogen reduction that may not be fully proven, but have a more sustainable approach. A pilot study may follow the above investigations depending on the applicability for Fairhaven and the need to test the performance with Fairhaven's wastewater.

6.0 FUNDING ACKNOWLEDGEMENT

This project has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement CE-96185701 to the Massachusetts Executive Office of Energy and Environmental Affairs Buzzards Bay National Estuary Program. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does the EPA endorse trade names or recommend the use of commercial products mentioned in this document.

7.0 REFERENCES

1. Durson, D., and Jimenez, J. (2014), *Getting More Out of Activated Sludge Plants by Using a BioMag Process*, Florida Water Resources Journal, 67 (4), 62-66.

APPENDIX A

DRAFT NPDES PERMIT

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Clean Water Act as amended, (33 U.S.C. §§1251 et seq.; the "CWA"), and the Massachusetts Clean Waters Act, as amended, (M.G.L. Chap. 21, §§26-53),

Town of Fairhaven

is authorized to discharge from the facility located at

Fairhaven Wastewater Pollution Control Facility
Arsene Street
Fairhaven, MA 02719

to receiving water named

Acushnet River (New Bedford Inner Harbor; Buzzards Bay Watershed; State Code 95-42)

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective on **(See ** below)**

This permit and the authorization to discharge expire at midnight, five (5) years from the effective date.

This permit supersedes the permit issued on March 4, 2003.

This permit consists of 13 pages in Part I including effluent limitations and monitoring requirements, Part II including Standard Conditions and Definitions, and Attachments A (Toxicity Protocol) and B (Summary of Report Submittals).

Signed this day of

Director	Director
Office of Ecosystem Protection	Division of Watershed Management
Environmental Protection Agency	Department of Environmental Protection
Boston, MA	Commonwealth of Massachusetts
	Boston, MA

** This permit will become effective on the date of signature if no comments are received during public notice. If comments are received during public notice, this permit will become effective no sooner than 30 days after signature.

PART I

A.1. During the period beginning on the effective date and lasting through expiration, the permittee is authorized to discharge treated effluent from outfall serial number **001** to the Acushnet River. Such discharges shall be limited and monitored as specified below.

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITS					MONITORING REQUIREMENTS [3]	
PARAMETER	**AVERAGE MONTHLY**	**AVERAGE WEEKLY**	**AVERAGE MONTHLY**	**AVERAGE WEEKLY**	**MAXIMUM DAILY**	**MEASUREMENT FREQUENCY**	**SAMPLE[3] TYPE**
FLOW[2]	*********	*********	5.0 MGD	*********	Report MGD	CONTINUOUS	RECORDER
FLOW[2]	*********	*********	Report MGD	*********	*********	CONTINUOUS	RECORDER
BOD_5 [4]	1252 lbs/Day 569 kg/Day	1878 lbs/Day 854 kg/Day	30 mg/l	45 mg/l	Report mg/l	3/WEEK	24-HOUR COMPOSITE [5]
TSS [4]	1252 lbs/Day 569 kg/Day	1878 lbs/Day 854 kg/Day	30 mg/l	45 mg/l	Report mg/l	3/WEEK	24-HOUR COMPOSITE [5]
pH RANGE[1]	6.5 - 8.5 SU (SEE PERMIT PAGE 5 OF 13, PARAGRAPH I.A.1.b.)					1/DAY	GRAB
FECAL COLIFORM[1,6]	*********	**********	88 cfu/100 ml	*********	260 cfu/100ml	2/WEEK	GRAB
ENTEROCOCCI [6]	*********	**********	35 cfu/100 ml	*********	276 cfu/100ml	2/Week	GRAB
TOTAL NITROGEN (TKN + NITRATE + NITRITE) [4]	125 lbs/day 57 kg/day	**********	Report mg/l	**********	Report mg/l	3/WEEK	24-HOUR COMPOSITE [5]
WHOLE EFFLUENT TOXICITY [7, 8, 9, 10]	Acute $LC_{50} \geq 100\%$ Chronic C-NOEC $\geq 12.2\%$					2/YEAR	24-HOUR COMPOSITE [5]

Sampling Location: All effluent sampling shall be conducted at the outlet of the ultraviolet disinfection system.

Footnotes:

1. Required for State Certification.

2. Report annual average, monthly average, and the maximum daily flow. The limit is an annual average, which shall be reported as a rolling average. The value will be calculated as the arithmetic mean of the monthly average flow for the reporting month and the monthly average flows of the previous eleven months.

3. All required effluent samples shall be collected at the point specified on page 2. Any change in sampling location must be reviewed and approved in writing by EPA and MassDEP.

   A routine sampling program shall be developed in which samples are taken at the same location, same time and same days of the week each month. Occasional deviations from the routine sampling program are allowed, but the reason for the deviation shall be documented in correspondence appended to the applicable discharge monitoring report.

   All samples shall be tested using the analytical methods found in 40 CFR §136, or alternative methods approved by EPA in accordance with the procedures in 40 CFR §136.

4. Sampling required for influent and effluent.

5. 24-hour composite samples will consist of at least twenty four (24) grab samples taken during one consecutive 24 hour period, either collected at equal intervals and combined proportional to flow or continuously collected proportionally to flow.

6. The monthly average limits for fecal coliform and enterococci are expressed as a geometric mean.

7. The permittee shall conduct chronic (and modified acute) toxicity tests two times per year. The chronic test may be used to calculate the acute LC_{50} at the 48 hour exposure interval. The permittee shall test the Inland silverside and Sea urchin. Toxicity test samples shall be collected during months of March and September. The test results shall be submitted by the last day of the month following the completion of the test. The results are due April 30 and October 31 respectively. The tests must be performed in accordance with test procedures and protocols specified in **Attachment A** of this permit.

Test Dates	**Submit Results By:**	**Test Species**	**Acute Limit LC_{50}**	**Chronic Limit C-NOEC**
March and September	April 30 and October 31	Inland silverside and Sea urchin	≥ 100%	≥ 12.2%

After submitting **two years** and a **minimum** of **four** consecutive sets of WET test results, all of which demonstrate compliance with the WET permit limits, the permittee may request a reduction in the WET testing requirements. The permittee is required to continue testing at the frequency specified in the permit until notice is received by certified mail from the EPA that the WET testing requirement has been changed.

8. The LC_{50} is the concentration of effluent which causes mortality to 50% of the test organisms. Therefore, a 100% limit means that a sample of 100% effluent (no dilution) shall cause no more than a 50% mortality rate.

9. C-NOEC (chronic-no observed effect concentration) is defined as the highest concentration of toxicant or effluent to which organisms are exposed in a life cycle or partial life cycle test which causes no adverse effect on growth, survival, or reproduction at a specific time of observation as determined from hypothesis testing where the test results exhibit a linear dose-response relationship. However, where the test results do not exhibit a linear dose-response relationship, the permittee must report the lowest concentration where there is no observable effect. The "12.2% or greater" limit is defined as a sample which is composed of 12.2% (or greater) effluent, the remainder being dilution water.

10. The permittee will submit a map or GIS coordinates of the receiving water sampling point with the first toxicity test under this permit If toxicity test(s) using receiving water as diluent show the receiving water to be toxic or unreliable, the permittee shall either follow procedures outlined in **Attachment A (Toxicity Test Procedure and Protocol) Section IV., DILUTION WATER** in order to obtain an individual approval for use of an alternate dilution water, or the permittee shall follow the Self-Implementing Alternative Dilution Water Guidance which may be used to obtain automatic approval of an alternate dilution water, including the appropriate species for use with that water. This guidance is found in Attachment G of NPDES Program Instructions for the Discharge Monitoring Report Forms (DMRs) which is sent to all permittees with their annual set of DMRs and

may also be found on the EPA, Region I web site at http://www.epa.gov/region01/enforcementandassistance/dmr.html. If this guidance is revoked, the permittee shall revert to obtaining individual approval as outlined in **Attachment A**. Any modification or revocation to this guidance will be transmitted to the permittees as part of the annual DMR instruction package. However, at any time, the permittee may choose to contact EPA-New England directly using the approach outlined in **Attachment A**.

Part I.A.1. (Continued)

a. The discharge shall not cause a violation of the water quality standards of the receiving waters.

b. The pH of the effluent shall not be less than 6.5 or greater than 8.5 at any time.

c. The discharge shall not cause objectionable discoloration of the receiving waters.

d. The effluent shall not contain a visible oil sheen, foam, or floating solids at any time.

e. The permittee's treatment facility shall maintain a minimum of 85 percent removal of both total suspended solids and biochemical oxygen demand. The percent removal shall be based on monthly average values.

f. The results of sampling for any parameter done in accordance with EPA approved methods above its required frequency must also be reported.

g. If a future TMDL for the Acushnet River is completed and approved during the term of the permit, EPA may either modify or reissue the permit as necessary to incorporate any nitrogen limits mandated by the TMDL.

2. All POTWs must provide adequate notice to the Director of the following:

a. Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to section 301 or 306 of the Clean Water Act if it were directly discharging those pollutants; and

b. Any substantial change in the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.

c. For purposes of this paragraph, adequate notice shall include information on:

(1) The quantity and quality of effluent introduced into the POTW; and

(2) Any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

3. Prohibitions Concerning Interference and Pass Through:

a. Pollutants introduced into POTW's by a non-domestic source (user) shall not pass through the POTW or interfere with the operation or performance of the works.

4. Toxics Control

a. The permittee shall not discharge any pollutant or combination of pollutants in toxic amounts.

b. Any toxic components of the effluent shall not result in any demonstrable harm to aquatic life or violate any state or federal water quality standard which has been or may be promulgated. Upon promulgation of any such standard, this permit may be revised or amended in accordance with such standards.

5. Numerical Effluent Limitations for Toxicants

EPA or MassDEP may use the results of the toxicity tests and chemical analyses conducted pursuant to this permit, as well as national water quality criteria developed pursuant to Section 304(a)(1) of the Clean Water Act (CWA), state water quality criteria, and any other appropriate information or data, to develop numerical effluent limitations for any pollutants, including but not limited to those pollutants listed in Appendix D of 40 CFR Part 122.

B. PRETREATMENT

Within 120 days of the effective date of the permit, the permittee shall submit the results of an industrial user survey including identification of industrial users and the character and volume of pollutants contributed to the Publicly Owned Treatment Works (POTW) by the industrial users. The industrial user survey shall as a minimum include the following:

(i) Industries discharging wastes which are or may be in the future subject to local limitations or the national prohibited discharge standards found in 40 CFR Part 403.5; and

(ii) Industries discharging wastewater from processes in one or more primary industry categories (See Appendix A to 40 CFR Part 122 or Appendix C of 40 CFR Part 403).

C. UNAUTHORIZED DISCHARGES

The permittee is authorized to discharge only in accordance with the terms and conditions of this permit and only from the outfall listed in Part I A.1.of this permit. Discharges of wastewater from any other point sources, including sanitary sewer overflows (SSOs), are not authorized by this permit and shall be reported in accordance with Section D.1.e. (1) of the General Requirements of this permit (Twenty-four hour reporting).

Notification of SSOs to MassDEP shall be made on its SSO Reporting Form (which includes DEP Regional Office telephone numbers). The reporting form and instruction for its completion may be found on-line at http://www.mass.gov/dep/water/approvals/surffms.htm#sso.

Bypasses of treatment units are not authorized. If during peak flow there are emergency bypasses of any treatment unit, the permittee shall take hourly grab samples of the final effluent and test for fecal coliform and enterococci. Each incident shall be documented in a report that includes the monitoring results, and the date, time, duration of bypass and volume by`passed. This report shall be attached to the monthly DMR.

D. OPERATION AND MAINTENANCE OF THE SEWER SYSTEM

Operation and maintenance of the sewer system shall be in compliance with the General Requirements of Part II and the following terms and conditions:

1. Maintenance Staff

   The permittee shall provide an adequate staff to carry out the operation, maintenance, repair, and testing functions required to ensure compliance with the terms and conditions of this permit.

2. Preventative Maintenance Program

   The permittee shall maintain an ongoing preventative maintenance program to prevent overflows and bypasses caused by malfunctions or failures of the sewer system infrastructure. The program shall include an inspection program designed to identify all potential and actual unauthorized discharges.

3. Infiltration/Inflow Control Plan:

   The permittee shall update its plan to control infiltration and inflow (I/I) to the separate sewer system. The plan shall be submitted to EPA and MassDEP **within six months of the effective date of this permit** (see page 1 of this permit for the effective date) and shall describe the permittee's program for preventing infiltration/inflow related effluent limit violations, and all unauthorized discharges of wastewater, including overflows and by-passes due to excessive infiltration/inflow.

The plan shall include:

- An ongoing program to identify and remove sources of infiltration and inflow. The program shall include the necessary funding level and the source(s) of funding.

- An inflow identification and control program that focuses on the disconnection and redirection of illegal sump pumps and roof down spouts. Priority should be given to removal of public and private inflow sources that are upstream from, and potentially contribute to, known areas of sewer system backups and/or overflows.

- Identification and prioritization of areas that will provide increased aquifer recharge as the result of reduction/elimination of infiltration and inflow to the system.

- An educational public outreach program for all aspects of I/I control, particularly private inflow.

Reporting Requirements:

A summary report of all actions taken to minimize I/I during the previous calendar year shall be submitted to EPA and MassDEP annually, **by March 31**. The summary report shall, at a minimum, include:

- A map and a description of inspection and maintenance activities conducted and corrective actions taken during the previous year.

- Expenditures for any infiltration/inflow related maintenance activities and corrective actions taken during the previous year.

- A map with areas identified for I/I-related investigation/action in the coming year.

- A calculation of the annual average I/I and the maximum month I/I for the reporting year.

- A report of any infiltration/inflow related corrective actions taken as a result of unauthorized discharges reported pursuant to 314 CMR 3.19(20) and reported pursuant to the Unauthorized Discharges section of this permit.

4. Alternate Power Source

In order to maintain compliance with the terms and conditions of this permit, the permittee shall continue to provide an alternative power source with which to sufficiently operate its treatment works (as defined at 40 CFR §122.2).

E. SLUDGE CONDITIONS

1. The permittee shall comply with all existing federal and state laws and regulations that apply to sewage sludge use and disposal practices, including EPA regulations promulgated at 40 CFR Part 503, which prescribe "Standards for the Use or Disposal of Sewage Sludge" pursuant to Section 405(d) of the CWA, 33 U.S.C. § 1345(d).

2. If both state and federal requirements apply to the permittee's sludge use and/or disposal practices, the permittee shall comply with the more stringent of the applicable requirements.

3. The requirements and technical standards of 40 CFR Part 503 apply to the following sludge use or disposal practices.

   a. Land application - the use of sewage sludge to condition or fertilize the soil

   b. Surface disposal - the placement of sewage sludge in a sludge only landfill

   c. Sewage sludge incineration in a sludge only incinerator

4. The requirements of 40 CFR Part 503 do not apply to facilities which dispose of sludge in a municipal solid waste landfill. 40 CFR § 503.4. These requirements also do not apply to facilities which do not use or dispose of sewage sludge during the life of the permit but rather treat the sludge (e.g. lagoons, reed beds), or are otherwise excluded under 40 CFR § 503.6.

5. The 40 CFR. Part 503 requirements including the following elements:

   - General requirements
   - Pollutant limitations
   - Operational Standards (pathogen reduction requirements and vector attraction reduction requirements)
   - Management practices
   - Record keeping
   - Monitoring
   - Reporting

   Which of the 40 C.F.R. Part 503 requirements apply to the permittee will depend upon the use or disposal practice followed and upon the quality of material produced by a facility. The EPA Region 1 Guidance document, "EPA Region 1 - NPDES Permit Sludge Compliance Guidance" (November 4, 1999), may be used by the permittee to assist it in determining the applicable requirements.[1]

6. The sludge shall be monitored for pollutant concentrations (all Part 503 methods) and pathogen vector attraction reduction (land application and surface disposal) at the following frequency. This frequency is based upon the volume of sewage sludge generated at the facility in dry metric tons per year

less than 290	1/ year
290 to less than 1,500	1 /quarter
1,500 to less than 15,000	6 /year
15,000 +	1 /month

Sampling of the sewage sludge shall use the procedures detailed in 40 CFR 503.8.

7. Under 40 CFR § 503.9(r), the permittee is a "person who prepares sewage sludge" because it "is … the person who generates sewage sludge during the treatment of domestic sewage in a treatment works …." If the permittee contracts with *another* "person who prepares sewage sludge" under 40 CFR § 503.9(r) – i.e., with "a person who derives a material from sewage sludge" – for use or disposal of the sludge, then compliance with Part 503 requirements is the responsibility of the contractor engaged for that purpose. If the permittee does not engage a "person who prepares sewage sludge," as defined in 40 CFR § 503.9(r), for use or disposal, then the permittee remains responsible to ensure that the applicable requirements in Part 503 are met. 40 CFR §503.7. If the ultimate use or disposal method is land application, the permittee is responsible for providing the person receiving the sludge with notice and necessary information to comply with the requirements of 40 CFR Part 503 Subpart B.

8. The permittee shall submit an annual report containing the information specified in the 40 CFR Part 503 requirements (§ 503.18 (land application), § 503.28 (surface disposal), or § 503.48 (incineration)) by **February 19** (*see also* "EPA Region 1 - NPDES Permit Sludge Compliance Guidance"). Reports shall be submitted to the address contained in the reporting section of the permit. If the permittee engages a contractor or contractors for sludge preparation and ultimate use or disposal, the annual report need contain only the following information:

- Name and address of contractor(s) responsible for sludge preparation, use or disposal
- Quantity of sludge (in dry metric tons) from the POTW that is transferred to the sludge contractor(s), and the method(s) by which the contractor will prepare and use or dispose of the sewage sludge.

1 This guidance document is available upon request from EPA Region 1 and may also be found at: http://www.epa.gov/region1/npdes/permits/generic/sludgeguidance.pdf

F. MONITORING AND REPORTING

1. **For a period of one year from the effective date of the permit**, the permittee may either submit monitoring data and other reports to EPA in hard copy form, or report electronically using NetDMR, a web-based tool that allows permittees to electronically submit discharge monitoring reports (DMRs) and other required reports via a secure internet connection. **Beginning no later than one year after the effective date of the permit**, the permittee shall begin reporting using NetDMR, unless the facility is able to demonstrate a reasonable basis that precludes the use of NetDMR for submitting all DMRs and reports. Specific requirements regarding submittal of data and reports in hard copy form and for submittal using NetDMR are described below:

a. Submittal of Reports Using NetDMR

NetDMR is accessed from: http://www.epa.gov/netdmr. Within one year of the effective date of the Permit, the permittee shall begin submitting DMRs and reports required under this permit electronically to EPA using NetDMR, unless the facility is able to demonstrate a reasonable basis, such as technical or administrative infeasibility, that precludes the use of NetDMR for submitting DMRs and reports ("opt out request").

DMRs shall be submitted electronically to EPA no later than the 15th day of the month following the completed reporting period. All reports required under the permit shall be submitted to EPA, including the MassDEP Monthly Operations and Maintenance Report, as an electronic attachment to the DMR. Once a permittee begins submitting reports using NetDMR, it will no longer be required to submit hard copies of DMRs or other reports to EPA and will no longer be required to submit hard copies of DMRs to MassDEP. However, permittees shall continue to send hard copies of reports other than DMRs (including Monthly Operation and Maintenance Reports) to MassDEP until further notice from MassDEP.

b. Submittal of NetDMR Opt Out Requests

Opt out requests must be submitted in writing to EPA for written approval at least sixty (60) days prior to the date a facility would be required under the Permit to begin using NetDMR. This demonstration shall be valid for twelve (12) months from the date of EPA approval and shall thereupon expire. At such time, DMRs and reports shall be submitted electronically to EPA unless the permittee submits a renewed opt out request and such request is approved by EPA. All opt out requests should be sent to the following addresses:

Attn: NetDMR Coordinator
U.S. Environmental Protection Agency, Water Technical Unit
5 Post Office Square, Suite 100 (OES04-4)
Boston, MA 02109-3912

And

Massachusetts Department of Environmental Protection
Surface Water Discharge Permit Program
627 Main Street, 2nd Floor
Worcester, Massachusetts 01608

c. Submittal of Reports in Hard Copy Form

Hard copy DMR submittals shall be completed and postmarked no later than the 15th day of the month following the completed reporting period. MassDEP Monthly Operation and Maintenance Reports shall be submitted as an attachment to the DMRs. Signed and dated originals of the DMRs, and all other reports required herein, shall be submitted to the appropriate State addresses and to the EPA address listed below:

U.S. Environmental Protection Agency
Water Technical Unit
5 Post Office Square, Suite 100 (OES04-4)
Boston, MA 02109-3912

The State Agency addresses are:

Massachusetts Department of Environmental Protection
Southeast Regional Office - Bureau of Resource Protection
20 Riverside Drive
Lakeville, MA 02347

And

Massachusetts Department of Environmental Protection
Surface Water Discharge Permit Program
627 Main Street, 2nd Floor
Worcester, Massachusetts 01608

Signed and dated Industrial Pretreatment Program Reports should be sent to:

U.S. Environmental Protection Agency
Office of Ecosystem Protection
5 Post Office Square, Suite 100 (OEP06-03)
Boston, MA 02109-3912
Attn. Justin Pimpare

And

Massachusetts Department of Environmental Protection
Bureau of Waste Prevention
Industrial Wastewater Program
1 Winter Street
Boston, MA 02108

G. STATE PERMIT CONDITIONS

This Discharge Permit is issued jointly by the U. S. Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MassDEP) under Federal and State law, respectively. As such, all the terms and conditions of this Permit are hereby incorporated into and constitute a discharge permit issued by the Commissioner of the MassDEP pursuant to M.G.L. Chap.21, §43.

Each Agency shall have the independent right to enforce the terms and conditions of this Permit. Any modification, suspension or revocation of this permit shall be effective only with respect to the Agency taking such action, and shall not affect the validity or status of this Permit as issued by the other Agency, unless and until each Agency has concurred in writing with such modification, suspension or revocation. In the event any portion of this Permit is declared, invalid, illegal or otherwise issued in violation of State law such permit shall remain in full force and effect under Federal law as an NPDES Permit issued by the U.S. Environmental Protection Agency. In the event this Permit is declared invalid, illegal or otherwise issued in violation of Federal law, this Permit shall remain in full force and effect under State law as a Permit issued by the Commonwealth of Massachusetts.

Attachment B

Summary of Required Report Submittals*

Required Report	**Date Due**	**Submitted By:**	**Submitted To: ** (see bottom of page for key)**
Discharge Monitoring Report (DMR)	Monthly, postmarked by the 15th of the month following the monitoring month (e.g. the March DMR is due by April 15th.	Town of Fairhaven	1, 2, 3
Whole Effluent Toxicity (WET)Test Report (Part I.A.1)	April 30 and October 31 of each year	Town of Fairhaven	1, 2, 3
Pretreatment: Industrial User Survey (Part I.B.b.)	Within 120 days of permit effective date	Town of Fairhaven	1, 2, 4
I/I Control Plan (Part I.D.2)	Within 6 months of permit effective date	Town of Fairhaven	1,2
I/I Annual Report (Part I.D.2)	March 31 each year	Town of Fairhaven	1,2
Annual Sludge Report (Part I.E.8.)	February 19 each year	Town of Fairhaven	1,2

*This Table is a summary of reports required to be submitted under this NPDES permit as an aid to the permittee. If there are any discrepancies between the permit and this summary, the permittee shall follow the permit requirements.

**The addresses are for the submittal of hard copies. When the permittee begins reporting using NetDMR, submittal of hard copies of many of the required reports will not be necessary. See permit conditions for details.

1. Environmental Protection Agency
   Water Technical Unit
   5 Post Office Square, Suite 100 (OES04-4)
   Boston, Massachusetts 02109-3912

2. Massachusetts Department of Environmental Protection
   Bureau of Resource Protection
   Southeast Regional Office
   20 Riverside Drive
   Lakeville, MA 02347

3. Massachusetts Department of Environmental Protection
   Division of Watershed Management
   Surface Water Discharge Permit Program
   627 Main Street, 2nd Floor
   Worcester, Massachusetts 01608

4. EPA New England
   Attn: Justin Pimpare
   One Congress Street
   Suite 1100 - CMU
   Boston, MA 02114

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
EPA NEW ENGLAND OFFICE
5 POST OFFICE SQUARE, SUITE 100
BOSTON, MASSACHUSETTS 02109-3912

FACT SHEET

DRAFT NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT TO DISCHARGE TO WATERS OF THE UNITED STATES.

NPDES PERMIT NO.: MA0100765

NAME AND ADDRESS OF APPLICANT:

William Fitzgerald, Supervisor
Fairhaven Water Pollution Control Facility
Arsene Street
Fairhaven, MA 02719

NAME AND ADDRESS OF FACILITY WHERE DISCHARGE OCCURS:

Fairhaven Water Pollution Control Facility
Arsene Street
Fairhaven, MA 02719

RECEIVING WATER: Acushnet River (New Bedford Inner Harbor), Buzzards Bay Watershed (MA 95-42).

CLASSIFICATION: SB

I. Proposed Action, Type of Facility, and Discharge Location.

The above named applicant has requested that the U.S. Environmental Protection Agency (EPA) re-issue its NPDES permit to discharge into the designated receiving water. **Attachment A** shows the locations of the outfall and the wastewater treatment facility. The facility is engaged in collection and treatment of domestic wastewater. The discharge is from a secondary wastewater treatment facility.

The Town of Fairhaven owns and operates a 5 million gallon per day (MGD) activated sludge wastewater treatment facility. Wastewater treatment includes preliminary, primary and secondary processes. Final effluent is disinfected using ultraviolet rays and is discharged to the Acushnet River. Sludge is sent off-site to Woonsocket, RI for incineration.

The segment of the Acushnet River receiving the Fairhaven discharge (New Bedford Inner

Harbor) is classified as SB. The designated uses for SB waters include: habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation, and shall have consistently good aesthetic value. Where designated, SB waters shall be suitable for shellfish harvesting with depuration.

The Massachusetts Year 2008 Integrated List of Waters lists the receiving water (New Bedford Inner Harbor, Coggeshall Street Bridge to hurricane barrier, Fairhaven/New Bedford) as a Category 5 water, not achieving water quality standards and requiring a total maximum daily load (TMDL). The water is listed for priority organics, metals, nutrients, organic enrichment/low DO, pathogens, oil and grease, taste, odor and color, and objectionable deposits.

II. Description of Discharge.

A quantitative description of the discharge in terms of significant effluent parameters, based on Discharge Monitoring Reports (DMRs) from January 2006 to February 2008, is shown on **Attachment B**.

III. Limitations and Conditions.

The effluent limitations and the monitoring requirements may be found in the draft NPDES permit.

IV. Permit Basis and Explanation of Effluent Limitation Derivation

EPA is required to consider technology and water quality requirements when developing permit effluent limits. Technology-based treatment requirements represent the minimum level of control that must be imposed under Section 402 and 301(b) of the Act. Section 301(b)1)(B) requires that Publicly Owned Treatment Works achieve limits based on secondary treatment. Secondary treatment is defined at 40 CFR Section 133.102.

EPA regulations require NPDES permits to contain effluent limits more stringent than technology-based limits where more stringent limits are necessary to maintain or achieve federal or state water quality standards.

Under Section 301(b)(1)(C) of the CWA, discharges are subject to effluent limitations based on water quality standards. The Massachusetts Surface Water Quality Standards include requirements for the regulation and control of toxic constituents and also require that EPA criteria, established pursuant to Section 304(a) of the CWA, shall be used unless site specific criteria is established.

The permit must limit any pollutant or pollutant parameter (conventional, non-conventional, toxic and whole effluent toxicity) that is or may be discharged at a level that caused, has reasonable potential to cause, or contributes to an excursion above any water quality criterion. An excursion occurs if the projected or actual in-stream concentrations exceed the applicable criterion. In determining reasonable potential, EPA considers existing controls on point and non-point sources of pollution, variability to toxicity and where appropriate, the dilution of the effluent in the receiving water.

A permit may not be renewed, reissued or modified with less stringent limitations or conditions than those contained in the pervious permit unless in compliance with the anti-backsliding requirements of the CWA.

EPA's anti-backsliding provisions are found in Section 402(o) and 303(d)(4) of the CWA, and in 40 CFR 122.44(l), restrict the relaxation of permit limits, standards, and conditions. Anti-backsliding provisions require that limits in the reissued permit must be at least as stringent as those of the previous permit, unless specific conditions are met.

A. Conventional Pollutants

Under Section 301(b)(1)(B) of the CWA, POTWs must have achieved effluent limitations based upon secondary treatment by July 1, 1977. The secondary treatment requirements are set forth at 40 CFR Part 133. The regulations describe the secondary treatment requirements for biochemical oxygen demand (BOD), total suspended solids (TSS), and pH. The "Average Monthly" and "Average Weekly" BOD and TSS limitations are based on the requirements of 40 CFR 133.102. Numerical limitations for pH and fecal coliform requirements are based on state certification requirements under Section 401(a)(1) of the CWA, as described in 40 CFR 124.53.

Monitoring frequency for BOD and TSS have been increased from 1/week to 3/week and monitoring frequency for bacteria has been increased from 1/week to 2/week to conform with requirements of similar wastewater treatment facilities.

New monitoring requirements and effluent limitations for enterococci are included in the draft permit based on water quality criteria recently adopted by MassDEP and approved by EPA.

B. Non-Conventional Pollutants

1. Toxics

a. Whole Effluent Toxicity

EPA's *Technical Support Document for Water Quality-based Toxics Control*, EPA/505/2-90-001, March 1991, recommends using an "integrated strategy" containing both pollutant (chemical) specific approaches and whole effluent (biological) toxicity approaches to control toxic pollutants in effluent discharges entering the nation's waterways. EPA-New England adopted this "integrated strategy" on July 1, 1991, for use in permit development and issuance. These approaches are designed to protect aquatic life and human health. Pollutant-specific approaches such as those in the Gold Book and State regulations address individual chemicals, whereas, the whole effluent toxicity (WET) approach evaluates interactions between pollutants thus rendering an "overall" or "aggregate" toxicity assessment of the effluent. Furthermore, WET measures the "additive" and/or "antagonistic" effects of individual chemical pollutants which pollutant specific approaches do not, thus the need for both approaches. In addition, the presence of an unknown toxic pollutant can be discovered and addressed through this process.

Under Section 301(b)(1)(C) of the CWA, discharges are subject to effluent limitations based on water quality standards. The Massachusetts Surface Water Quality Standards (314 CMR 4.00), include the narrative statement that "All surface waters shall be free from pollutants in concentrations and combinations that are toxic to humans, aquatic life or wildlife." 314 CMR 4.05(5)(e).

Federal NPDES regulations at 40 CFR §122.44(d)(1)(v) require whole effluent toxicity limits in a permit when a discharge has a "reasonable potential" to cause or contribute to an excursion above the State's narrative criterion for toxicity. WET tests of the Fairhaven WPCF's effluent show consistent compliance with effluent limitations, however the low dilution ratio (1:7.2) calculated for the discharge contributes to a "reasonable potential" that the discharge could cause an excursion of the no toxics provision in the State's regulations. Inclusion of the whole effluent toxicity limit in the Draft Permit will ensure compliance with the State's narrative water quality criterion of "no toxics in toxic amounts".

Moreover, the Massachusetts Department of Environmental Protection's Division of Watershed Management's toxics policy requires whole effluent toxicity testing for all major dischargers such as the Fairhaven POTW (Implementation Policy for the Control of Toxic Pollutants in Surface Waters, MassDEP 1990).

Therefore, based on the potential for toxicity from domestic contributions, the low level of dilution, water quality standards and in accordance with EPA and MassDEP regulation and policy, the draft permit includes acute and chronic effluent toxicity limitation and monitoring requirements. (See, e.g., "Policy for the Development of Water Quality-Based Permit Limitations for Toxic Pollutants: 50 Fed. Reg. 30,784 (July 24, 1985); see also, EPA's Technical Support Document for Water Quality-Based Toxic Control). The principal advantages of biological techniques are: (1) the effects of complex discharges of many known and unknown constituents can be measured only by biological analyses; (2) bioavailability of pollutants after discharge is best measured by toxicity testing; and (3) pollutants for which there are inadequate chemical analytical methods or criteria can be addressed.

The type of test (acute and/or chronic) and the effluent limitations are based on available dilution. The Draft Permit requires the permittee to perform acute toxicity tests twice per year using Inland Silverside and Sea Urchin and contains an LC50 limit of 100% effluent concentration. The LC50 is defined as the concentration of toxicant, or in this draft permit, as the percentage of effluent lethal to 50% of the test organisms during a specific length of time.

The Draft Permit also requires chronic tests twice per year using Inland Silverside and Sea Urchin and contains a Chronic-No Observed Effect Concentration (C-NOEC) limit of 14 percent. C-NOEC is defined as the highest concentration to which test organisms are exposed in a life cycle or partial life cycle test, which causes no adverse effect on growth, survival or reproduction during a specific time of observation. The C-NOEC limit was calculated as follows;

Chronic NOEC Limit Calculation:

$$\frac{1.0 * 100}{8.2} = 12.2\%$$

As a condition of this permit, the testing requirements may be reduced by a certified letter from the EPA. This permit provision anticipates that the permittee may wish to request a reduction in WET testing. After four consecutive WET tests, demonstrating compliance with the permit limits for whole effluent toxicity, the permittee may submit a written request to the EPA seeking a review of the toxicity test results. The EPA will review the test results and pertinent information to make a determination. The permittee is required to continue testing at the frequency and species specified in the permit until the permit is either formally modified or until the permittee receives a certified letter from the EPA indicating a change in the permit conditions.

b. Chlorine

In April 2004, the Town of Fairhaven completed construction of an ultraviolet light (U/V) disinfection system and has ceased using chlorine as a disinfectant. Accordingly, limitations and monitoring requirements for total residual chlorine have been removed from the permit.

c. Metals

Certain metals like copper, lead, cadmium and zinc can be toxic to aquatic life. EPA has evaluated (see below) the reasonable potential of toxicity on the concentration of metals in the effluent. Based on this evaluation EPA has determined that there is no reasonable potential for adverse impact on the aquatic life and no need to monitor and limit these metals.

Calculation of reasonable potential for copper, lead, zinc and cadmium:

All effluent metals data are taken from the Toxicity Test Reports from the period March 2004 to March 2008.

Total allowable Receiving Water Concentration, C = Criteria (Tot. Rec.) x Dilution Factor/Conversion Factor

EPA 2002 National Recommended Water Quality Criteria for salt water and the dilution factor of 8.2 [calculated dilution ratio is 7.2:1 based on EPA approved UM Model with a discharge from a single 36 inches diameter port oriented at 90 degrees; dilution factor = (7.2 + 1)/1 = 8.2] are used to calculate effluent limits.

Copper: Chronic C = 3.1 x 8.2 / 0.83 = 30.6 ug/l which is greater than the monthly average effluent concentration range of 10 - 20 ug/l. So, reasonable potential does not exist.

	Acute	C = 4.8 x 8.2 / 0.83 = 47.4 ug/l which is greater than the maximum effluent concentration of 20 ug/l. So, reasonable potential does not exist.
Lead:	Chronic	C = 8.1 x 8.2 /0.951 = 69.8 ug/l which is greater than the monthly average effluent concentration range of 2.7 - 10 ug/l. So, reasonable potential does not exist.
	Acute	C = 210 x 8.2 /0.951 = 1811 ug/l which is greater than the maximum effluent concentration of 10 ug/l. So, reasonable potential does not exist.
Zinc:	Chronic	C = 81 x8.2 /0.946 = 702 ug/l which is far greater than the monthly average effluent concentration range of 12 - 50 ug/l. So, reasonable potential does not exist.
	Acute	C = 90 x8.2 /0.946 = 780 ug/l which is far greater than the maximum effluent concentration of 50 ug/l. So, reasonable potential does not exist.
Cadmium:	Chronic	C = 9.3 x 8.2 /0.994 =76.7 ug/l which is greater than the monthly average effluent concentration of 0.5 -10 ug/l. So, reasonable potential does not exist.
	Acute	C = 42 x 8.2 / .994 = 346 ug/l which is far greater than the maximum effluent concentration of 10 ug/l. So, reasonable potential does not exist.

2. <u>Nutrients</u>

a. Nitrogen

As described earlier, the receiving water is listed as impaired due to, among other things, nutrients, organic enrichment/low DO, taste, odor and color, and objectionable deposits. Numerous studies, as summarized below, have identified nitrogen enrichment as causing or contributing to these impairments. Excessive nitrogen causes algae blooms that deplete dissolved oxygen, causes visible color and turbidity, and ultimately decay causing objectionable odors and oxygen demanding sediments.

The current permit required the Town to evaluate and implement optimization of nitrogen removal processes at the WPCF. In November 2004, the Town completed a Draft Nitrogen Removal Optimization Study which evaluated influent nitrogen loadings and control options, and also evaluated the practicable extent to which nitrogen removal at the existing treatment facility could be further optimized. The study found that during the period from July 2000 to July

2004, the total nitrogen (TN) concentration in the treatment plant influent ranged from 11 to 53 mg/l with an average concentration of 29 mg/l. For the same period, TN in the effluent ranged between 5 to 22 mg/l with an average concentration of 13 mg/l. This translates to an average removal efficiency of 55%. The study concluded that with some operational changes, this efficiency could be improved to 70%. At an influent concentration of 29 mg/l and a removal rate of 70 %, the resulting effluent concentration would be about 9 mg/l.

Recent discharge monitoring reports (DMRs) for the months of January 2006 to February 2008 show an average effluent TN concentration of 15.3 mg/l, suggesting that the operational changes were not implemented.

Past Studies

The final Buzzards Bay Comprehensive Conservation and Management Plan dated August 1991, identified nitrogen loading as one of the most serious problems threatening many embayments around Buzzards Bay.

In 1994, the Buzzards Bay Project published a draft report titled " A Buzzards Bay Embayment Sub-watershed Evaluation: Establishing Priorities for Nitrogen Management Action". This report highlighted the major sources of nitrogen to New Bedford Inner Harbor and all other Buzzards Bay embayments. The report identified the Fairhaven wastewater treatment plant as the major source of nitrogen to the Inner Harbor.

On March 6, 1998 a refined evaluation of nitrogen loading and water quality of New Bedford Inner Harbor (Acushnet River) as it relates to the Fairhaven wastewater treatment facility was completed by the Buzzards Bay Project. The report concluded that the Fairhaven wastewater plant is the single largest source of nitrogen to the estuary.

On July 28, 2000, another report by the Buzzards Bay Project titled "A Preliminary Evaluation of Nitrogen Loading and Water Quality of New Bedford Inner Harbor (Acushnet River) as it relates to the Fairhaven Wastewater Treatment Facility", further refined the nitrogen loadings and again concluded that the Fairhaven wastewater plant is the single largest source of nitrogen.

MassDEP has completed a report (dated December 2008) entitled "Massachusetts Estuaries Project – Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for the New Bedford Inner Harbor Embayment System, New Bedford, MA." The report documents nitrogen-caused impacts on the Acushnet River - New Bedford Inner Harbor embayment system from its headwaters to the hurricane barrier in New Bedford. The report uses historic sources as well as data collected for the study, quantifies sources of nitrogen to the receiving waters, summarizes hydrodynamic and water quality models developed to analyze the impacts of nitrogen loads, establishes a target nitrogen concentration necessary to achieve water quality standards, and using the water quality model evaluates scenarios for achieving the nitrogen target.

In determining the nitrogen threshold for the embayment, the study focused on habitat parameters (particularly infauna[1] since eelgrass has not grown in the receiving waters for at least 50 years), sediment characteristics, and nutrient-related water quality information (particularly dissolved oxygen, chlorophyll *a*[2] and macroalgae).

Benthic animal populations are influenced by dissolved oxygen and sediment quality. Low organic matter loading and high dissolved oxygen (DO) concentrations generally support healthy habitat and high organic matter loading and low DO do not support healthy habitat. Depletion of oxygen may occur only infrequently yet may have severe effect on system health. High chlorophyll *a* indicates large amounts of algae in the receiving water, which can cause large diurnal swings in dissolved oxygen as the algae produce oxygen during daylight hours and consume it during hours of darkness. Algae blooms also reduce sunlight penetration into the water column, generate high sediment oxygen demands as it dies and decays, and cause odors and visual impairments.

The study found impairment of infaunal habitat quality due to oxygen depletion, the magnitude of daily oxygen excursions, and organic matter enrichment from phytoplankton production (chlorophyll *a* level) at all monitoring locations. These impacts are indicative of nutrient enriched waters, specifically moderate to high nitrogen loading rates.. The study concluded that nitrogen enrichment is related to the dissolved oxygen depletion. Additionally, due to the increased phytoplankton production, the dissolved oxygen levels can rise significantly during daylight hours, due to photosynthesis, to concentrations above atmospheric equilibration. Oxygen levels above atmospheric equilibration is indicative of enriched nitrogen and associated organic matter. All monitoring locations showed periodic oxygen depletions below 5 mg/l and generally less than 4 mg/l.

The upper basin has a moderately impaired benthic habitat due to macroalgal accumulation, high chlorophyll a levels, frequent depletions of DO, and a preponderance of stress tolerant species.

The middle basin is a depositional area with sediments consisting of organic rich mud. The middle basin has moderate to high chlorophyll levels, frequent DO depletions and a moderately impaired infaunal community.

The lower basin is slightly to moderately impaired by nitrogen enrichment with significant impairment in localized areas of physical disturbance or altered flushing. The lower basin experiences moderate oxygen depletions and elevated chlorophyll a levels.

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1 Infauna are benthic animals that live in the substrate of a body of water, especially in a soft sea bottom. Infauna usually construct tubes or burrows and are commonly found in deeper and subtidal waters. Clams, tubeworms, and burrowing crabs are infaunal animals.

2 Chlorophyll is the green pigment found in all plants. Chlorophyll *a* is measured to estimate the abundance of phytoplankton in the water. More chlorophyll a indicates that there are more phytoplankton present. Most chlorophyll a is found near the surface of the water because there is less light at depth. Chlorophyll a concentrations are often highest just below the surface, not at the surface of the water.

In general, the data indicate a gradient in oxygen depletion and chlorophyll a levels from the upper to the lower basins. Consistent with the estuarine response to over-enrichment from nitrogen, the extent of bottom water oxygen depletion parallels the levels of phytoplankton biomass.

Limit Derivation:

The "Massachusetts Estuaries Project – Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for the New Bedford Inner Harbor Embayment System, New Bedford, MA" report developed a loading scenario which would achieve the target total nitrogen concentration of 0.5 mg/l at the most highly impacted "sentinel" location at the head of the middle basin of the Acushnet River (see figure VIII-I) of the report.

The water quality model was first run assuming the elimination of loads from CSOs and the elimination of the Fairhaven WPCF discharge. Under this scenario, the desired nitrogen target of 0.5 mg/l was not achieved. A 13 percent reduction of loads from septic tank discharges was then added, resulting in attainment of the desired target. The estimated loads under this scenario were:

Current total nitrogen load = 310 kg/day (sum of loads from Fairhaven WPCF, New Bedford CSOs, septic, runoff, and fertilizer)

- CSO load eliminated = 25.7 kg/day reduction

- Fairhaven TN load is eliminated = 39236 kg/year = 107.5 kg/day reduction

- 13 percent of septic load eliminated = 11.4 kg/day reduction

Load meeting target TN concentration = 310 kg/day – 107.5 kg/day - 25.7 kg/day - 11.4 kg/day = 165.4 kg/day

The analysis shows that a TN load of about 165 kg/day is necessary to achieve the target concentration at the sentinel location. The Fairhaven treatment plant currently discharges about 256 lbs/day (116 kg/day) of TN (calculated 2006-2007 average load based on a flow of 1.99 MGD and 15.43 mg/l, which is somewhat greater than the 107.5 kg/day used for the study estimate). The treatment plant discharge of TN therefore has the reasonable potential to cause or contribute to the exceedance of the target concentration given that the current discharge represents about 37 percent of the current loading and 70 percent of the loading that will achieve the target concentration.

Regulations at 40 CFR Part 122.44(d)(1) require that effluent limitations must be included for any pollutant discharge at a level that has the reasonable potential to cause, or contribute to an excursion above any State water quality standard.

Additional scenarios evaluated in the Massachusetts Estuaries Project (MEP) report included the

Fairhaven treatment plant discharging at 3.0 mg/l total nitrogen and various levels of CSO remediation and septic system elimination (see page 173-176). These scenarios provide the necessary detail to determine the extent of CSO remediation and septic system elimination that will need to be accomplished in addition to reducing the Fairhaven treatment plant loading to the limit of technology (3.0 mg/l total nitrogen). Given the magnitude of the overall load reduction necessary to achieve the target load (about 165 kg/day) a high level of removal at Fairhaven, as well as high levels of removal from CSO and septic tank sources are necessary.

A TMDL has not been completed for this receiving water, but the information discussed above shows the reasonable potential for nitrogen discharges from the Fairhaven WPCF to cause or contribute to exceedances of water quality standards and shows that a total nitrogen effluent limit of 3 mg/l at the facility design flow of 5 MGD (coupled with significant reductions in other sources of nitrogen) is necessary to attain water quality standards. Accordingly, EPA and MassDEP have included a monthly average limitation of 57 kg/day (125 lbs/day), which corresponds to treatment plant flow of 5.0 MGD and an effluent concentration of 3 mg/l TN.

The draft permit requires total nitrogen monitoring three times per week. Following completion of the TMDL, EPA will either modify or reissue the permit as necessary to incorporate the nitrogen limits mandated by the TMDL.

C. Other Monitoring Requirements

The effluent monitoring requirements have been specified in accordance with 40 CFR 122.41(j), 122.44(i) and 122.48 to yield data representative of the discharge.

D. Pretreatment Program

Pollutants introduced into POTW's by a nondomestic source (user) shall not pass through the POTW or interfere with the operation or performance of the works.

The permittee will perform an Industrial User Survey as stated in the draft permit.

E. Sludge

In February 1993, the Environmental Protection Agency (EPA) promulgated standards for the use and disposal of sewage sludge. The regulations were promulgated under the authority of section 405(d) of the Clean Water Act (CWA). Section 405(d) of the CWA requires that sludge conditions be included in all municipal permits. The sludge conditions in the draft permit satisfy this requirement.

F. Essential Fish Habitat Determination (EFH)

Under the 1996 Amendments (PL 104-267) to the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C.§1801 et seq.(1998)), EPA is required to consult with NMFS if EPA's action or proposed actions that it funds, permits, or undertakes, may adversely impact any essential fish habitat.16 U.S.C.§1855(b). The Amendments broadly define essential fish habitat as: waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. 16 U.S.C.§1802(10). Adversely impact means any impact which reduces the quality and/or quantity of EFH. 50C.F.R.§600.910(a). Adverse effects may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, reduction in species' fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

Essential fish habitat is only designated for fish species for which federal Fisheries Management Plans exist. 16 U.S.C§1855(b)(1)(A). EFH designations for New England were approved by the U.S. Department of Commerce on March 3, 1999.

Attachment C is the list of 16 managed species that are believed to be present during one or more life-stage within EFH Area, which encompasses the existing discharge site. No "habitat areas of particular concern", as defined under §600.815(a)(9) of the Magnuson-Stevens Act, have been designated for this site. Although EFH has been designated for this general location, EPA has concluded that this activity is not likely to adversely affect EFH or its associated species for the following reasons:

- This is a re-issuance of an existing permit;
- The quantity of discharge from the WWTF is 5.0 mgd monthly average; Effluent receives as a minimum secondary treatment using activated sludge processes;
- Effluent is discharged into the Acushnet River (New Bedford Inner Harbor) with an estimated dilution ratio of 7.2:1;
- Use of chlorine has been discontinued due to installation of a new Ultra - Violet (U/V) ray system to disinfect fecal coliform;
- A new monthly average total nitrogen limit of 125 lbs/day is established in the draft permit;
- Acute and chronic toxicity tests will be conducted on Inland Silverside and Sea urchin two times per year;
- The permit will prohibit any violation of state water quality standards.

Accordingly, EPA has determined that a formal EFH consultation with NMFS is not required. If adverse impacts to EFH are detected as a result of this permit action, NMFS will be notified and an EFH consultation will be promptly initiated.

G. Endangered Species

Section 7(a) of the Endangered Species Act of 1973, as amended (ESA) grants authority to and imposes requirements upon Federal agencies regarding endangered or threatened species of fish, wildlife, or plants ("listed species") and habitat of such species that has been designated as critical (a "critical habitat"). The ESA requires every Federal agency, in consultation with and with the assistance of the Secretary of Interior, to insure that any action it authorizes, funds, or carries out, in the United States or upon the high seas, is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. The United States Fish and Wildlife Service (USFWS) typically administers Section 7 consultations for bird, terrestrial, and freshwater aquatic species. The National Marine Fisheries Service (NMFS) typically administers Section 7 consultations for marine species and anadromous fish.

EPA has reviewed the federal endangered or threatened species of fish and wildlife to see if any listed species might potentially be impacted by the re-issuance of this NPDES permit. The review has focused primarily on Bristol County since the discharge is into the Buzzards Bay. Sea Turtles (Green, Kemp's Ridley Leatherback) are listed as endangered species and Sea Turtles (Green and Loggerhead) are listed as threatened species. Based on the conditions in the permit, which are as, or more stringent than in the present permit, EPA has determined that there will be no adverse effects on these species (see section F, EFH for a discussion of the pertinent permit conditions).

EPA is coordinating a review of this finding with NMFS and/or USFWS through the Draft Permit and Fact Sheet and consultation under Section 7 of the ESA with NMFS and/or USFWS is not required. If adverse impacts are detected as a result of this permit action, NMFS and/or USFWS will be notified and a consultation will be promptly initiated.

H. Anti-degradation

This draft permit is being reissued with an allowable wasteload identical to the current permit with the same parameter coverage and no change in outfall location. The State of Massachusetts has indicated that there will be no lowering of water quality and no loss of existing water uses and that no additional anti-degradation review is warranted.

V. State Certification Requirements.

The staff of the Massachusetts Department of Environmental Protection has reviewed the draft permit. EPA has requested permit certification by the State pursuant to 40 CFR 124.53 and expects that the draft permit will be certified.

VI. Public Comment Period, and Procedures for Final Decision

All persons, including applicants, who believe any condition of the draft permit is inappropriate must raise all issues and submit all available arguments and all supporting material for the arguments in full by the close of the public comment period, to the U.S. EPA, MA NPDES Municipal Permit Branch 5, Post Office Square , Suite 100 (OEP 6-4), Boston, Massachusetts 02109-3912. Any person, prior to such date, may submit a request in writing for a public hearing to consider the draft permit to EPA and the State Agency. Such requests shall state the nature of the issues proposed to be raised in the hearing. A public hearing may be held after at least thirty days public notice whenever the Regional Administrator finds that response to this notice indicates significant public interest. In reaching a final decision on the draft permit the Regional Administrator will respond to all significant comments and make these responses available to the public at EPA's Boston office.

Following the close of the comment period, and after a public hearing, if such hearing is held, the Regional Administrator will issue a final permit decision and forward a copy of the final decision to the applicant and each person who has submitted written comments or requested notice.

VII. Monitoring and Reporting

The effluent monitoring requirements have been established to yield data representative of the discharge under authority of Section 308 (a) of the CWA in accordance with 40 CFR §§122.41 (j), 122.44 (l), and 122.48.

The Draft Permit includes new provisions related to Discharge Monitoring Report (DMR) submittals to EPA and the State. The Draft Permit requires that, no later than one year after the effective date of the permit, the permittee submit all monitoring data and other reports required by the permit to EPA using NetDMR, unless the permittee is able to demonstrate a reasonable basis, such as technical or administrative infeasibility, that precludes the use of NetDMR for submitting DMRs and reports ("opt out request").

In the interim (until one year from the effective date of the permit), the permittee may either submit monitoring data and other reports to EPA in hard copy form, or report electronically using NetDMR.

NetDMR is a national web-based tool for regulated Clean Water Act permittees to submit discharge monitoring reports (DMRs) electronically via a secure Internet application to U.S. EPA through the Environmental Information Exchange Network. NetDMR allows participants to discontinue mailing in hard copy forms under 40 CFR 122.41 and 403.12. NetDMR is accessed from the following url: http://www.epa.gov/netdmr Further information about NetDMR, including contacts for EPA Region 1, is provided on this website.

The Draft Permit requires the permittee to report monitoring results obtained during each calendar month using NetDMR no later than the 15th day of the month following the completed reporting period. All reports required under the permit shall be submitted to EPA as an electronic attachment to the DMR. Once a permittee begins submitting reports using NetDMR, it will no longer be required to submit hard copies of DMRs or other reports to EPA and will no longer be required to submit hard copies of DMRs to MassDEP. However, permittees must continue to send hard copies of reports other than DMRs to MassDEP until further notice from MassDEP.

The Draft Permit also includes an "opt out" requests process. Permittees who believe they can not use NetDMR due to technical or administrative infeasibilities, or other logical reasons, must demonstrate the reasonable basis that precludes the use of NetDMR. These permittees must submit the justification, in writing, to EPA at least sixty (60) days prior to the date the facility would otherwise be required to begin using NetDMR. Opt outs become effective upon the date of written approval by EPA and are valid for twelve (12) months from the date of EPA approval. The opt outs expire at the end of this twelve (12) month period. Upon expiration, the permittee must submit DMRs and reports to EPA using NetDMR, unless the permittee submits a renewed opt out request 60 days prior to expiration of its opt out, and such a request is approved by EPA.

Until electronic reporting using NetDMR begins, or for those permittees that receive written approval from EPA to continue to submit hard copies of DMRs, the Draft Permit requires that submittal of DMRs and other reports required by the permit continue in hard copy format.

VIII. EPA Contact

Additional information concerning the draft permit may be obtained between the hours of 9:00 a.m. and 5:00 p.m., Monday through Friday, excluding holidays from:

Suprokash Sarker, P.E.
Municipal Permits Branch
Environmental Protection Agency
5 Post Office Square, Suite 100 (OEP 6-4)
Boston, MA 02109-3912
Telephone: (617) 918-1693
E–Mail: sarker.soupy@epa.gov

____
Date

Stephen Perkins, Director
Office of Ecosystem Protection
U.S. Environmental Protection Agency

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
COMMONWEALTH OF MASSACHUSETTS
1 WINTER STREET
BOSTON, MASSACHUSETTS 02108

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ECOSYSTEM PROTECTION
REGION I
BOSTON, MASSACHUSETTS 02203

JOINT PUBLIC NOTICE OF A DRAFT NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT TO DISCHARGE INTO THE WATERS OF THE UNITED STATES UNDER SECTION 301 AND 402 OF THE CLEAN WATER ACT (THE "ACT"), AS AMENDED, AND REQUEST FOR STATE CERTIFICATION UNDER SECTION 401 OF THE ACT.

DATE OF NOTICE: July 8, 2010

PERMIT NUMBER: MA0100765

PUBLIC NOTICE NUMBER: MA-020-10

NAME AND MAILING ADDRESS OF APPLICANT:

Fairhaven Water Pollution Control Facility
Arsene Street
Fairhaven, Massachusetts 02719

NAME AND ADDRESS OF THE FACILITY WHERE DISCHARGE OCCURS:

Fairhaven Water Pollution Control Facility
Arsene Street
Fairhaven, Massachusetts 02719

RECEIVING WATER: Acushnet River (New Bedford Inner Harbor)

RECEIVING WATER CLASSIFICATION: Class SB

PREPARATION OF THE DRAFT PERMIT:

The U.S. Environmental Protection Agency, (EPA) and the Massachusetts Department of Environmental Protection (MassDEP) have cooperated in the development of a permit for the above identified facility. The effluent limits and permit conditions imposed have been drafted to assure that State Water Quality Standards and provisions of the Clean Water Act will be met. EPA has formally requested that the State certify this draft permit pursuant to Section 401 of the Clean Water Act and expects that the draft permit will be certified.

INFORMATION ABOUT THE DRAFT PERMIT:

A fact sheet or a statement of basis (describing the type of facility; type and quantity of wastes; a brief summary of the basis for the draft permit conditions; and significant factual, legal and policy questions considered in preparing the draft permit) may be obtained at no cost at http://www.epa.gov/region1/npdes/draft_permits_listing_ma.html or by writing or calling EPA's contact person named below:

Suprokash Sarker
US EPA
5 Post Office Square
Suite 100
Mail Code – OEP06-1
Boston, MA 02109-3912
Telephone: (617) 918-1693

The administrative record containing all documents relating to this draft permit is on file and may be inspected at the EPA Boston office mentioned above between 9:00 a.m. and 5:00 p.m., Monday through Friday, except holidays.

PUBLIC COMMENT AND REQUEST FOR PUBLIC HEARING:

All persons, including applicants, who believe any condition of this draft permit is inappropriate, must raise all issues and submit all available arguments and all supporting material for their arguments in full by **August 6, 2010**, to the U.S. EPA, 5 Post Office Square, Suite 100, (OEP 06-1) Boston, Massachusetts 02109-3912. Any person, prior to such date, may submit a request in writing to EPA and the State Agency for a public hearing to consider this draft permit. Such requests shall state the nature of the issues proposed to be raised in the hearing. A public hearing may be held after at least thirty days public notice whenever the Regional Administrator finds that response to this notice indicates significant public interest. In reaching a final decision on this draft permit the Regional Administrator will respond to all significant comments and make the responses available to the public at EPA's Boston office.

FINAL PERMIT DECISION:

Following the close of the comment period, and after a public hearing, if such hearing is held, the Regional Administrator will issue a final permit decision and forward a copy of the final decision to the applicant and each person who has submitted written comments or requested notice.

Glenn Haas, Director
DIVISION OF WATERSHED MANAGEMENT
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION

Stephen Perkins, Director
OFFICE OF ECOSYSTEM PROTECTION
ENVIRONMENTAL PROTECTION AGENCY

APPENDIX B

TRAINING SHEETS

Nitrogen Reduction Pilot Study at the Fairhaven, MA WPCF

Evoqua Training Record

Training Date and Time
September 28th & 29th, 10 am - 2 pm

Training Location
Fairhaven, MA WPCF, BioMag Trailer (on-site)

Trainer Name, Title, Signature
Matthew Vareika, Process Engineer, BioMag & CoMag Processes

Personnel Trained - Name, Title, Signature

Rene Robillard	Assistant Superintendent
Linda Schick	Superintendent
Kyle Winderlick	Maintenance Craftsman
Raymond Paczosa	Electrician
Joseph Bonneau	Maintenance Craftsman
Joseph Frates	Mechanic
Victor Oliveira	Maintenance Craftsman
Matt Manzone	Maintenance Craftsman
Doug Pinard	Operator
Robert Gomes	Operator
Dana Hathaway	Maintenance Craftsman

Topics Covered
BioMag basics of operation, ballasted treatment process, process flows, sampling locations/procedures/methods, trailer operations and alarming, troubleshooting alarms, targets for the project and system adjustments to achieve them.

Training Record Location
Fairhaven, MA WPCF

Nitrogen Reduction Pilot Study at the Fairhaven, MA WPCF

Evoqua Training Record

Training Date and Time

Sept 29, 2015 1-2:30 PM

Training Location

Fairhaven, MA WWTF

Trainer Name, Title, Signature

Matthew Vareika, Process Engineer [signature]

Personnel Trained - Name, Title, Signature

Jake Spinetto intern [signature]

Topics Covered

Wastewater treatment process/components
Pilot plant components
Environmental health & safety training
Emergency awareness
Sludge blanket level measurement
D.O., pH, temperature & ORP meter measurement & recording

Training Record Location

Fairhaven, MA WPCF

APPENDIX C

PILOT STUDY MASTER DATA SHEET

Questionable Data

Date	Day	MGD	Raw Influent									Primary Effluent												Final Effluent													
			pH	BOD_5	Alkalinity	NO3-N	NO2 - N	NO3 & NO2 - N	NH3-N	TKN	TN	pH	Temp	BOD_5	TSS	VSS	Alkalinity	NH3-N	TKN	NO3 & NO2 - N	NO3-N	NO2 - N	TN	pH	UV	UV Trans	BOD_5	TSS	% TSS Reduction	VSS	NH3-N	TKN	NO3 & NO2 - N	NO3-N	NO2 - N	TN	Alkalinity
			SU	mg/L	mg/L as $CaCO_3$	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	SU	°C	mg/L	mg/L	mg/L	mg/L as CaCO3	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	SU	MW/cm^2	%	mg/L	mg/L	%	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as CaCO3
10/01/15	1	2.4	7.1	99								6.9	20.4	54	64	64								6.7	16.2	70	4	10	84	10							
10/02/15	2	3.3	7.1									6.5	20.6		56	56								6.7	9.1	72		8	86	7							
10/03/15	3	3.4																						6.7	18.5	74											
10/04/15	4	3.0																						6.6	19.3	75											
10/05/15	5	2.8	7.1									6.8	19.7		50	50								6.6	18.5	74		7	86	5							
10/06/15	6	2.6	7.1			0.24	0.23		18	25	26	6.9	19.8		50	42		17	23		<0.050	0.03	23	6.7	19.8	76		17	66	12	2.4	4.8		6.3	0.24	11	
10/07/15	7	2.4	7.1	126								6.8	19.5	99	64	64		16	20		0.053	0.042	20	6.8	119.8	76	14	12	81	12	2.1	3.8		3.8	0.033	7.6	113
10/08/15	8	2.3	7.1	186								6.7	19.5	90	38	38								6.7	19.2	75	4	8	79	8							70
10/09/15	9	2.4	7.1									7	19.5		64	64								6.7	18.5	74		10	84	10							
10/10/15	10	2.3																						6.8	13.9	67											
10/11/15	11	2.2																						6.8	16.7	71											
10/12/15	12	2.3																						6.8	27.8	84											
10/13/15	13	2.6	7.1	192								7	19.2	72	66	33								6.8	14.7	67	8	34	48	28							140
10/14/15	14	2.4	7	204		<0.050	0.19		18	30	30	6.9	19.1	87	50	46		20	27		<0.050	0.078	27	6.7	7.3	69	11	7	86	7	6.1	7.8		5.1	0.31	13	80
10/15/15	15	2.2	7.1	204								6.9	18.9	90	58	58		20	27		<0.050	0.041	27	6.6	6.6	70	10	11	81	11	4.0	5.7		6.2	0.24	12	
10/16/15	16	2.3	7.2									7	19.2		42	42								6.6	7.6	74		4	90	4							
10/17/15	17	2.5																						6.6	7.6	74											
10/18/15	18	2.1																						6.7	7.6	74											
10/19/15	19	2.1	7.2									7	18.6		52	42								6.7	7.1	72		11	79	7							63
10/20/15	20	2.0	7.2	129		<0.050	0.043		25	33	33	6.8	18.4	75	60	56		24	60		<0.050	0.051	60	6.6	7.6	74	1	6	90	6	0.32	<2.0		16	0.035	16	
10/21/15	21	2.0	7	132								6.9	18.9	117	56	56								6.6	7.1	72	3	2	96	2							
10/22/15	22	1.9	7.2	126								6.8	18.4	72	40	40								6.7	15.7	69	4	4	90	4							62
10/23/15	23	1.9	7.3									6.9	18.4		68	68								6.6	6.6	70		10	85	10							
10/24/15	24	2.0																						6.7	6.6	70											
10/25/15	25	1.8																						6.8	16.6	70											
10/26/15	26	1.8	7.1									7	18.3		74	62								6.8	16.2	70		8	89	8							
10/27/15	27	2.0	7.2	84		<0.050	0.066		28	35	35	7	18.1	69	54	52		28	33		0.59	0.38	34	6.7	13.4	64	9	9	83	9	2.1	3.4		11	1.9	16	61
10/28/15	28	2.5	7.2	120	180	<0.050	0.024		26	32	32	7.1	18	78	56	56	160	25	29		<0.050	0.024	29	6.7	6.4	69	4	17	70	14	0.49	3.5		8.8	0.13	12	71
10/29/15	29	2.2	7.1	72	110	<0.050	0.043		20	29	29	7	17.9	39	60	56	120	25	32		<0.050	0.049	32	6.6	8.1	65	3	7	88	7	0.33	2.7		6.0	0.31	9.0	56
10/30/15	30	2.1	7.1									6.9	17.8		46	46								6.7	15.7	69		12	74	12							
10/31/15	31	2.1																						6.7	17.9	73											

Date	Day	Zone #1							Zone #2							Zone #3										
		MLSS - TSS	MLSS - VSS	MLSS - Magnetite	MLSS - Biological	pH	DO	ORP	MLSS - TSS	MLSS - VSS	MLSS - Magnetite	MLSS - Biological	pH	DO	ORP	MLSS - TSS	MLSS - VSS	MLSS - Magnetite	MLSS - Biological	pH	DO	ORP	Magnetite:Biosolids Ratio	5 Min Settle	30 Min Settle	SVI
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mV	mg/L	mg/L	mg/L	mg/L	SU	mg/L	mV	mg/L	mg/L	mg/L	mg/L	SU	mg/L	mV		mL/L	mL/L	mL/g
10/01/15	1	2820	1320	1280	1540	6.6	0.6		2180	1280	1050	1130	6.4	2.0		2460	1400	1080	1380		3.4		0.78	800	300	214
10/02/15	2	7700	4180	3700	4000	6.5	1.4		1740	900	750	990				1560		700	860				0.81			
10/03/15	3																									
10/04/15	4																									
10/05/15	5	8280	4020	2500	5780	6.6	1.4		2600	1460	720	1880	6.7	2.6		2620	1520	740	1880		4.6		0.39	900	520	342
10/06/15	6	3720	1920	1400	2320	6.8	0.7		3140	1640	1100	2040	6.6	1.7		3080	1620	1140	1940	6.6	3.5		0.59	900	550	340
10/07/15	7	4720	2700	1830	2890	6.9	0.5	-144.0	3680	2100	1310	2370	6.7	0.4	-127.9	4620	2580	1430	3190	6.6	4.3	-130.2	0.45	910	690	267
10/08/15	8	5360	2720	2300	3060	6.9	0.2	-147.2	4300	2220	1870	2430	6.8	0.7	-145.5	4300	2220	1860	2440	6.7	4.0	-132.5	0.76	960	700	315
10/09/15	9	4100	2040	1960	2140	6.9	0.5	-176.1	3600	1820	1730	1870	6.8	0.3	-154.0	3520	1800	1810	1710	6.7	0.3	-173.2	1.06	940	670	372
10/10/15	10					6.9	0.3	388.9					6.8	0.3	421.6					6.7	0.2	416.9		930	540	
10/11/15	11					6.9	0.4	405.0					6.8	0.3	571.9					6.7	0.3	562.4		930	700	
10/12/15	12					6.8	0.2						6.9	0.9						6.8	1.4			920	520	
10/13/15	13	5420	2500	2770	2650	6.9	0.2	-216.0	3220	1580	1620	1600	6.6	1.4	-147.9	3120	1500	1600	1520	6.7	2.6	-108.3	1.05	800	280	187
10/14/15	14	10540	4200	6290	4250	6.8	0.1	-243.7	5240	2060	3280	1960	6.6	2.5	-141.7	3520	1520	2160	1360	6.6	0.6	-148.0	1.59	520	220	145
10/15/15	15	6720	2760	3850	2870	6.8	0.2	-175.7	5160	2140	3280	1880	6.6	1.8	-144.3	3820	1620	2280	1540	6.7	0.3	-163.5	1.48	450	200	123
10/16/15	16	14200	5980	8140	6060	6.7	0.1	-71.9	4300	2220	2500	1800	6.7	1.6	-101.9	4040	2040	2340	1700	6.5	2.8	-102.9	1.38	420	180	88
10/17/15	17																									
10/18/15	18																									
10/19/15	19	10580	4360	6130	4450	6.8	0.2	-164.0	4480	1900	2630	1850	6.6	1.4	-470.0	4480	1900	2320	2160	6.6	3.1	-179.0	1.07	350	200	105
10/20/15	20	7780	3300	4750	3030	6.6	0.5	-125.4	4420	1900	2790	1630	6.5	1.7	-136.2	4120	1740	2540	1580	6.4	3.7	-87.2	1.61	340	200	115
10/21/15	21	5180	2200	3460	1720	6.9	0.2	-116.9	4540	2000	2920	1620	6.7	0.9	-116.0	5000	2180	3200	1800	6.6	1.4	-166.7	1.78	330	190	87
10/22/15	22	9440	4200	5320	4120	6.8	0.2	-190.8	4500	2100	2800	1700	6.7	0.6	-306.9	4720	2140	2820	1900	6.6	1.0	-174.9	1.48	330	190	89
10/23/15	23	4420	1960	2760	1660	6.8	0.4	-142.8	7860	3300	4630	3230	6.7	0.6	-134.4	4520	1960	2600	1920	6.5	0.8	-129.6	1.35	350	200	102
10/24/15	24					7.5	0.4	-79.0					7.5	0.1	-95.0					7.5	0.7	-70.0		370	200	
10/25/15	25					7.4	0.4	-80.0					7.4	0.1	-48.0					7.4	0.2	-66.0		380	200	
10/26/15	26	4160	1820	2450	1710	6.9	0.1	-277.8	4820	2200	4270	550	6.8	0.6	-108.9	4200	1960	1630	2570	6.7	1.0	-91.2	0.63	370	220	112
10/27/15	27	1940	1000	830	1110	7.0	0.3	-128.7	2100	1140	820	1280	6.9	3.2	-104.4	1520	840	590	930	6.8	4.6	-139.6	0.63	160	100	119
10/28/15	28	4400	2120	2230	2170	7.2	0.2	-221.0	5800	2780	3050	2750	6.7	1.3	-204.0	4580	2200	2230	2350	6.6	3.3	-140.0	0.95			
10/29/15	29	3700	1860	2650	1050	6.8	0.4	-129.6	6140	2960	3290	2850	6.6	1.7	-134.5	4420	2300	2450	1970	6.5	3.1	-124.6	1.24	360	200	87
10/30/15	30	5340	2760	2800	2540	6.9	0.5	189.3	8180	4080	4240	3940	6.6	0.9	-126.1	5140	2620	2690	2450	6.5	2.5	-104.4	1.10			
10/31/15	31					6.8	0.4	-239.0					6.6	1.3	-89.7					6.6	3.8	-137.6				

Date	Day	RAS 3 Flow	RAS 4 Flow	RAS 3 TSS	RAS 4 TSS	RAS 3 Magnetite SS	RAS 4 Magnetite SS	RAS 3 Biological SS	RAS 4 Biological SS	Thickener Filtrate NH3-N	Thickener Filtrate TKN	Thickener Filtrate NO3-N	Thickener Filtrate NO2 & NO3 - N	Thickener Filtrate NO2 - N	Thickener Filtrate TN	Internal Recycle (RFR) Speed	Clarifier 3 Blanket	Clarifier 4 Blanket	Polymer Pump Dial Speed	Polymer Level	Polymer Feed Rate
		GPM	GPM	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Hz	FT	FT	#	inches in barrel	gpd
10/01/15	1	700																		30	0
10/02/15	2	500		11720		4970		6,750												30	0
10/03/15	3	500																		30	0
10/04/15	4	500																		30	0
10/05/15	5	650		9340		3240		6,100												30	0
10/06/15	6	1100		8160		3200		4,960								55	10.0			30	0
10/07/15	7	1600		7080		2850		4,230									14.0			30	0
10/08/15	8	1750		6800		2650		4,150								30	11.5			30	0
10/09/15	9	750		6940		3150		3,790								30	13.0			30	0
10/10/15	10															25	13.0			30	0
10/11/15	11															25	13.0			30	0
10/12/15	12															25	10.5			30	0
10/13/15	13	1750		5980		3250		2,730								25	12.5			30	0
10/14/15	14	1750		5940		3720		2,220								25	8.5			30	0
10/15/15	15	1750		8480		5500		2,980								25	2.0			30	0
10/16/15	16	1750		10260		5960		4,300								25	2.0			30	0
10/17/15	17																			30	0
10/18/15	18																			30	0
10/19/15	19	1700		8840		5160		3,680								40	2.0			30	0
10/20/15	20	1700		12380		7300		5,080								45	1.0			30	0
10/21/15	21	864		10180		6600		3,580								45	1.0			30	0
10/22/15	22	1100		11100		6800		4,300								55	1.0			30	0
10/23/15	23			8020		4800		3,220								60	0.5			30	0
10/24/15	24															60	2.0			30	0
10/25/15	25															60	0.8			30	0
10/26/15	26	2029		9900		5730		4,170								60	0.5			30	0
10/27/15	27	1767														60	2.0			30	0
10/28/15	28		2847		10440		5330		5,110							60		1.5		30	0
10/29/15	29		2874		13220		7260		5,960									2.5		30	0
10/30/15	30	2809			11800		6250		5,550									3.0		30	0
10/31/15	31	2519														60		3.0		30	0

Date	Day	Equip. Data			TO Mag Drum								FROM Mag Drum								Mag Drum Recovery	
		Mag Drum Speed	Shear Mill Current	Shear Mill Speed	Flow		TSS	Mag	Bio	TSS	Mag	Bio	Flow		TSS	Mag	Bio	TSS	Mag	Bio	Mag	Bio
		Hz	Amps	Hz	gpm	Metered Flow GPD	mg/L	mg/L	mg/L	LBS	LBS	LBS	gpm	85% Metered Flow GPD	mg/L	mg/L	mg/L	LBS	LBS	LBS	%	%
10/01/15	1																					
10/02/15	2						11,720	4,970	6,750													
10/03/15	3																					
10/04/15	4																					
10/05/15	5						9,340	3,240	6,100													
10/06/15	6		30	38	20		8,160	3,200	4,960				17		5720	740	4,980					
10/07/15	7						7,080	2,850	4,230													
10/08/15	8		30	38	40	60,289	6,800	2,650	4,150	3,419	1,332	2,087	34	51,246	4700	950	3,750	2,009	406	1,603	70	77
10/09/15	9		30	37	40	54,894	6,940	3,150	3,790	3,177	1,442	1,735	34	46,660	4360	860	3,500	1,697	335	1,362	77	78
10/10/15	10		28	37	42	62,334							36	52,984								
10/11/15	11		29	37	41	74,757							35	63,543								
10/12/15	12				42	44,178							35	37,551								
10/13/15	13		30	37	40	71,112	5,980	3,250	2,730	3,547	1,927	1,619	34	60,445	3240	630	2,610	1,633	318	1,316	84	81
10/14/15	14		30		40	47,699	5,940	3,720	2,220	2,363	1,480	883	34	40,544	3060	640	2,420	1,035	216	818	85	93
10/15/15	15		30		33	26,155	8,480	5,500	2,980	1,850	1,200	650	28	22,232	2380	660	1,720	441	122	319	90	49
10/16/15	16		30		19	26,546	10,260	5,960	4,300	2,271	1,319	952	16	22,564	3800	610	3,190	715	115	600	91	63
10/17/15	17					26,546								22,564								
10/18/15	18					26,546								22,564								
10/19/15	19	60	30	32	19	29,000	8,840	5,160	3,680	2,138	1,248	890	16	24,650	4720	680	4,040	970	140	831	89	93
10/20/15	20	60	30	37	21	30,689	12,380	7,300	5,080	3,169	1,868	1,300	18	26,086	5200	1010	4,190	1,131	220	912	88	70
10/21/15	21	60	30	37	21	31,072	10,180	6,600	3,580	2,638	1,710	928	18	26,411	6180	950	5,230	1,361	209	1,152	88	124
10/22/15	22	60			21	24,980	11,100	6,800	4,300	2,312	1,417	896	18	21,233	5540	1020	4,520	981	181	800	87	89
10/23/15	23	60		37	18	26,000	8,020	4,800	3,220	1,739	1,041	698	15	22,100	4640	690	3,950	855	127	728	88	104
10/24/15	24	60	30	37	18	26,000							15	22,100								
10/25/15	25	60	30	37	18	27,735							15	23,575								
10/26/15	26	60		37	18	26,091	9,900	5,730	4,170	2,154	1,247	907	16	22,177	5540	630	4,910	1,025	117	908	91	100
10/27/15	27	60		38		0								0	8040	1630	6,410	0	0	0		
10/28/15	28	60				20,834	10,440	5,330	5,110	1,814	926	888		17,709								
10/29/15	29	60	31	38	18	9,071	13,220	7,260	5,960	1,000	549	451	15	7,710	6420	690	5,730	413	44	368	92	82
10/30/15	30	60	31	38	19	3,589	11,800	6,250	5,550	353	187	166	16	3,051								
10/31/15	31	60		38		-6								-5								

Date	Day	Reaction Tank				Clarifier				TOTAL INVENTORY				Target SRT	Target Waste				Actual SRT
		TSS LBS	Magnetite LBS	Biological LBS	Magnetite:Biosolids Ratio	TSS LBS	Magnetite LBS	Biological LBS	Magnetite:Biosolids Ratio	TSS LBS	Magnetite LBS	Biological LBS	Magnetite:Biosolids Ratio	days	lbs/d	Concentration Y (RAS)	Gallons at Concentration Y	Flow Rate gpm	days
10/01/15	1	9,643	4,233	5,409	0.8									11					
10/02/15	2	6,115	2,744	3,371	0.8									11		6,750			
10/03/15	3													11					
10/04/15	4													11					
10/05/15	5	10,270	2,901	7,369	0.4									11		6,100			
10/06/15	6	12,073	4,469	7,604	0.6	17,813	6,923	10,890	0.6	29,886	11,392	18,494	0.6	11	1,681	4,960	40,644	28	
10/07/15	7	18,109	5,605	12,504	0.4	24,141	9,165	14,976	0.6	42,251	14,771	27,480	0.5	11	2,498	4,230	70,813	49	
10/08/15	8	16,855	7,291	9,564	0.8	18,901	7,560	11,341	0.7	35,756	14,851	20,905	0.7	11	1,900	4,150	54,909	38	12
10/09/15	9	13,798	7,095	6,703	1.1	20,770	9,681	11,089	0.9	34,567	16,775	17,792	0.9	11	1,617	3,790	51,171	36	11
10/10/15	10													11					
10/11/15	11													11					
10/12/15	12													11					
10/13/15	13	12,230	6,272	5,958	1.1	17,308	9,297	8,011	1.2	29,538	15,568	13,969	1.1	11	1,270	2,730	55,775	39	7
10/14/15	14	13,798	8,467	5,331	1.6	12,019	7,493	4,527	1.7	25,817	15,959	9,858	1.6	11	896	2,220	48,401	34	10
10/15/15	15	14,974	8,937	6,036	1.5	3,816	2,439	1,377	1.8	18,790	11,376	7,414	1.5	11	674	2,980	27,118	19	14
10/16/15	16	15,836	9,172	6,664	1.4	4,510	2,619	1,891	1.4	20,346	11,791	8,555	1.4	11	778	4,300	21,687	15	13
10/17/15	17													11					
10/18/15	18													11					
10/19/15	19	17,561	9,094	8,467	1.1	4,069	2,321	1,748	1.3	21,630	11,415	10,215	1.1	11	929	3,680	30,257	21	10
10/20/15	20	16,150	9,956	6,193	1.6	2,652	1,574	1,078	1.5	18,801	11,530	7,271	1.6	11	661	5,080	15,602	11	7
10/21/15	21	19,599	12,543	7,056	1.8	2,329	1,506	823	1.8	21,928	14,049	7,878	1.8	11	716	3,580	23,988	17	7
10/22/15	22	18,501	11,054	7,448	1.5	2,472	1,508	964	1.6	20,973	12,562	8,412	1.5	11	765	4,300	21,323	15	10
10/23/15	23	17,717	10,191	7,526	1.4	944	560	384	1.5	18,661	10,752	7,910	1.4	11	719	3,220	26,776	19	9
10/24/15	24													11					
10/25/15	25													11					
10/26/15	26	16,463	6,389	10,074	0.6	1,102	601	501	1.2	17,565	6,990	10,575	0.7	11	961	4,170	27,642	19	10
10/27/15	27	5,958	2,313	3,645	0.6									11					
10/28/15	28	17,953	8,741	9,212	0.9	3,507	1,775	1,731	1.0	21,459	10,516	10,943	1.0	11	995	5,110	23,342	16	
10/29/15	29	17,326	9,604	7,722	1.2	7,084	3,895	3,188	1.2	24,409	13,499	10,910	1.2	11	992	5,960	19,954	14	22
10/30/15	30	20,148	10,544	9,604	1.1	7,917	4,184	3,732	1.1	28,065	14,729	13,336	1.1	11	1,212	5,550	26,192	18	
10/31/15	31													11					

Questionable Data

Raw Influent

Date	Day	MGD	pH	BOD_5	Alkalinity	NO3-N	NO2 - N	NO3 & NO2 - N	NH3-N	TKN	TN
			SU	mg/L	mg/L as $CaCO_3$	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
11/01/15	32	2.2									
11/02/15	33	2.0	7.1								
11/03/15	34	2.0	7.1	72		<0.050	0.043		24	32	32
11/04/15	35	2.0	7.3	129							
11/05/15	36	2.0	7.3								
11/06/15	37	2.0	7.2								
11/07/15	38	1.9									
11/08/15	39	1.9									
11/09/15	40	1.8	7.2								
11/10/15	41	1.9	7.1		170	<0.050	0.036		28	37	37
11/11/15	42	2.4		84							
11/12/15	43	2.3	7.2	147							
11/13/15	44	2.3	7.1								
11/14/15	45	2.2									
11/15/15	46	2.2									
11/16/15	47	2.1	7.2								
11/17/15	48	2.0	7.2	144		<0.050	0.054		23	33	33
11/18/15	49	2.0	7.4	180							
11/19/15	50	2.0	7.3	174							
11/20/15	51	2.5	7.2								
11/21/15	52	2.3									
11/22/15	53	2.7									
11/23/15	54	3.2	7.1			0.51	0.18		17	22	23
11/24/15	55	2.9	7.1	96							
11/25/15	56	2.8	7.2								
11/26/15	57	2.7									
11/27/15	58	2.7									
11/28/15	59	2.6									
11/29/15	60	2.5									
11/30/15	61	2.3	7.1								

Primary Effluent

Date	pH	Temp	BOD_5	TSS	VSS	Alkalinity	NH3-N	TKN	NO3 & NO2 - N	NO3-N	NO2 - N	TN
	SU	°C	mg/L	mg/L	mg/L	mg/L as CaCO3	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
11/01/15												
11/02/15	6.9	17.4		62	56							
11/03/15	6.9	17.7	60	48	48		26	32		<0.050	0.051	32
11/04/15	6.9	17.4	24	64	64		22	27		<0.050	0.031	27
11/05/15	7	17.3		40	40		25	30		<0.050	0.048	30
11/06/15	7	17.5		50	50							
11/07/15												
11/08/15												
11/09/15	7	17.4		74	68							
11/10/15	7	17.5		54	42	180	28	35		<0.050	0.050	35
11/11/15			81				23	32		<0.050	0.023	32
11/12/15	7	17	57	48	48		25	33		0.059	0.025	33
11/13/15	7	16.9		40	40							
11/14/15												
11/15/15												
11/16/15	7.1			48	48							
11/17/15	7.1	16.7	90	44	44		24	31		<0.050	0.024	31
11/18/15	7.1	16.5	111	46	46		25	30		<0.050	0.30	30
11/19/15	7	16.4	93	62	62		25	32		<0.050	0.029	32
11/20/15	7	16.1		60	60							
11/21/15												
11/22/15												
11/23/15	6.9			48	48		15	22		1.1	0.19	23
11/24/15	6.9	15.6	81	44	44		16	20		0.70	0.16	21
11/25/15	7			54	50		16	22		0.37	0.16	22
11/26/15												
11/27/15												
11/28/15												
11/29/15												
11/30/15	7.1			52	38							

Final Effluent

Date	pH	UV	UV Trans	BOD_5	TSS	% TSS Reduction	VSS	NH3-N	TKN	NO3 & NO2 - N	NO3-N	NO2 - N	TN	Alkalinity
	SU	MW/cm^2	%	mg/L	mg/L	%	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as CaCO3
11/01/15		17.3	72											
11/02/15	6.8	7.1	72		8	87	8							71
11/03/15	6.7	7.8	71	1	9	81	9	0.61	1.8		5.7	0.021	7.5	
11/04/15	6.6	7.8	71	3	14	78	14	0.15	2.5		8.8	0.021	11	33
11/05/15	6.6	6.7	66		2	95	2	0.87	2.7		9.9	0.079	13	
11/06/15	6.6	7.6	70		7	86	7							78
11/07/15	6.6	6.8	71											
11/08/15	6.7	6.8	71											
11/09/15	6.7	6.6	70		7	91	7							75
11/10/15	6.7	6.6	70		5	91	3	0.20	1.2		8.2	0.018	9.4	67
11/11/15	6.6	7.1	72	1				0.45	1.8		7.0	0.015	8.8	
11/12/15	6.7	7.6	74	3	4	92	4	0.16	1.0		3.4	0.012	4.4	
11/13/15	6.7	7.1	72		3	93	3							48
11/14/15	6.7	7.6	74											
11/15/15	6.7	6.8	44											
11/16/15	6.7	6.8	71		6	88	6							56
11/17/15	6.7	7.1	72	3	4	91	4	0.32	0.98		3.3	0.02	4.3	
11/18/15	6.7	6.8	71	2	8	83	8	0.15	1.4		2.5	0.029	3.9	56
11/19/15	6.7	7.1	72	2.8	6	90	6	0.40	0.61		3.8	0.03	4.4	
11/20/15	6.6	8.8	71		9	85	9							
11/21/15	6.5	7.9	75											
11/22/15	6.8	7.9	75											
11/23/15	6.6	9.3	76		9	81	9	0.40	1.5		3.5	0.035	5.0	57
11/24/15	6.6	7.6	74	2	10	77	10	0.87	1.6		4.8	0.021	6.4	
11/25/15	6.7	9.7	76		10	81	10	0.29	1.5		2.9	0.018	4.4	
11/26/15	6.7	7.9	75											
11/27/15	6.7	7.9	75											
11/28/15	6.7	8.8	78											
11/29/15	6.6	8.5	77											
11/30/15	6.8	7.6	74		11	79	9							56

Date	Day	Zone #1							Zone #2							Zone #3										
		MLSS - TSS	MLSS - VSS	MLSS - Magnetite	MLSS - Biological	pH	DO	ORP	MLSS - TSS	MLSS - VSS	MLSS - Magnetite	MLSS - Biological	pH	DO	ORP	MLSS - TSS	MLSS - VSS	MLSS - Magnetite	MLSS - Biological	pH	DO	ORP	Magnetite:Biosolids Ratio	5 Min Settle	30 Min Settle	SVI
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mV	mg/L	mg/L	mg/L	mg/L	SU	mg/L	mV	mg/L	mg/L	mg/L	mg/L	SU	mg/L	mV		mL/L	mL/L	mL/g
11/01/15	32					6.8	0.4	-193.7					6.6	1.3	-103.9					6.5	3.7	-125.8		680	360	
11/02/15	33	4660	2480	2180	2480	6.9	0.4	-217.7	6940	3560	2940	4000	6.8	0.6	-146.7	4920.0	2560.0	2220	2700	6.7	1.9	-133.8	0.82	650	300	117
11/03/15	34	8140	4300	3600	4540	6.8	0.2	-219.5	6180	3120	3200	2980	6.7	0.9	-295.9	5200.0	2660.0	2550	2650	6.6	2.8	-107.3	0.96	490	300	113
11/04/15	35	8920	4980	3530	5390	6.8	0.3	-147.7	6960	3660	3300	3660	6.7	0.7	-116.1	5180.0	2740.0	2520	2660	6.6	1.8	-89.2	0.95	480	280	102
11/05/15	36	7880	4080	3520	4360	6.8	0.2	-126.7	9500	4560	4780	4720	6.7	0.4	-129.1	5360.0	2520.0	2830	2530	6.6	0.9	-132.9	1.12	470	280	111
11/06/15	37	7180	3800	3030	4150	6.8	0.6	-141.4	7080	3480	3590	3490	6.7	1.0	-131.1	4940.0	2340.0	2520	2420	6.6	2.0	-104.5	1.04	480	270	115
11/07/15	38					6.8	0.3	-140.3					6.6	0.8	-141.2					6.5	2.6	-132.8		510	260	
11/08/15	39					7.1	0.4	-98.7					6.7	0.7	-126.7					6.6	2.6	-129.6		490	270	
11/09/15	40	6460	3360	2740	3720	6.9	0.7	-244.8	12600	6180	5560	7040	6.8	0.7	242.9	4380.0	2140.0	2030	2350	6.6	1.2	-171.1	0.86	400	220	103
11/10/15	41	8080	4420	2840	5240	6.9	0.3	-121.0	7940	4020	3510	4430	6.8	1.1	-116.6	4360.0	2120.0	2000	2360	6.6	1.8	-118.1	0.85	420	250	118
11/11/15	42																									
11/12/15	43	3980	2140	2200	1780	6.9	0.4	-92.9	6640	3520	3050	3590	6.8	0.7	15.3	4480.0	2400.0	2180	2300	6.6	2.1	-207.1	0.95	420	250	104
11/13/15	44	4260	2220	2250	2010	6.8	0.4	-131.7	13220	7260	5650	7570	6.7	0.8	-138.8	4140.0	2100.0	2040	2100	6.5	1.4	-114.6	0.97	390	230	110
11/14/15	45					6.7	0.3	-89.6					6.6	1.0	-253.4					6.5	3.0	-205.7				
11/15/15	46					7.2	0.3	-56.0					6.9	0.8	-116.3					6.7	1.9	-106.2				
11/16/15	47	4600	2500	2360	2240	6.9	0.4	-110.6	5620	3000	2820	2800	6.7	1.4	-79.3	4240.0	2280.0	2200	2040	6.6	2.3	5.2	1.08	450	270	118
11/17/15	48	4840	2520	2350	2490	6.9	0.4	-64.0	5660	2940	2720	2940	6.8	0.6	-231.7	4400.0	2240.0	2220	2180	6.6	2.4	129.2	1.02	490	280	125
11/18/15	49	5100	2740	2560	2540	6.9	0.5	-31.8	6680	3600	3200	3480	6.8	1.4	-36.5	4740.0	2560.0	2360	2380	6.7	2.7	-31.0	0.99	510	300	117
11/19/15	50	5520	3160	2720	2800	7.0	0.4	-120.9	7400	4160	3720	3680	6.8	1.2	-134.4	5400.0	3100.0	2740	2660	6.7	3.6	-116.0	1.03	550	320	103
11/20/15	51	5020	2740	2580	2440	6.9	0.4	-51.8	5120	2780	2600	2520	6.7	2.2	-184.8	4940.0	2640.0	2450	2490	6.5	4.3	-110.0	0.98	500	300	114
11/21/15	52					6.7	0.3	-44.1					6.6	0.6	-53.6					6.5	3.2	-121.5		700	410	
11/22/15	53					6.9	0.4	-155.7					6.7	0.8	-74.5					6.5	3.1	-109.7		820	450	
11/23/15	54	4340	2340	2000	2340	6.9	0.4	101.9	4380	2320	2050	2330	6.7	0.9	72.3	4060.0	2160.0	1960	2100	6.6	2.5	-7.9	0.93	520	300	139
11/24/15	55	4320	2200	2180	2140	6.9	0.4	89.9	6340	3360	2800	3540	6.7	1.2	70.6	4320.0	2200.0	2030	2290	6.6	4.1	145.2	0.89	530	300	136
11/25/15	56	4360	2380	2030	2330	7.0	0.3	133.4	5040	2740	2250	2790	6.8	1.6	2.0	3960.0	2100.0	2000	1960	6.6	3.2	-53.4	1.02	550	330	157
11/26/15	57					6.9	0.4	-107.4					6.7	1.2	-68.3					6.6	3.1	-77.3		550	320	
11/27/15	58					6.9	0.4	-120.6					6.7	1.2	-71.2					6.7	3.1	-48.9		890	550	
11/28/15	59					6.7	0.5	-136.5					6.7	1.6	-131.2					6.6	4.3	-126.5		900	580	
11/29/15	60					7.0	0.6	-103.0					6.8	1.5	-27.9					6.7	5.2	-113.7		900	570	
11/30/15	61	4160	2300	1850	2310	7.0	0.2	99.7	4640	2520	1830	2810	6.8	3.7	-139.2	4020.0	2180.0	1800	2220	6.7	5.7	100.3	0.81	800	340	156

Date	Day	RAS 3	RAS 4	RAS 3	RAS 4	RAS 3	RAS 4	RAS 3	RAS 4	Thickener Filtrate						Internal Recycle (RFR)	Clarifier 3 Blanket	Clarifier 4 Blanket	Polymer		
		Flow	Flow	TSS	TSS	Magnetite SS	Magnetite SS	Biological SS	Biological SS	NH3-N	TKN	NO3-N	NO2 & NO3 - N	NO2 - N	TN	Speed			Pump Dial Speed	Level	Polymer Feed Rate
		GPM	GPM	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Hz	FT	FT	#	inches in barrel	gpd
11/01/15	32															60		4.0		30	0
11/02/15	33		1415		10680		4660		6,020							60		3.5		29	1.80
11/03/15	34		1389		11720		6040		5,680							60		2.5		29	0
11/04/15	35		1358		11780		6000		5,780							60		2.5		29	0
11/05/15	36		1361		8700		5600		3,100							60		2.0		29	0
11/06/15	37		1378		7300		3800		3,500							60		2.5		29	0
11/07/15	38		1343													60		3.0		29	0
11/08/15	39		1301													60				29	0
11/09/15	40		1963		9780		4560		5,220							60		1.5		29	0
11/10/15	41		1960		8100		3860		4,240							60				29	0
11/11/15	42		1954													60				29	0
11/12/15	43		1939		9240		4490		4,750							60		2.2		29	0
11/13/15	44		1939		5820		3300		2,520							60		2.0		29	0
11/14/15	45		1955													60		2.0		29	0
11/15/15	46		1961													60		2.0		29	0
11/16/15	47		1958		9900		5000		4,900							60				29	0
11/17/15	48		1949		8840		4050		4,790							60				29	0
11/18/15	49		1947		11200		5210		5,990							60		2.0		29	0
11/19/15	50		1947		12800		6400		6,400							60		3.0		29	0
11/20/15	51		1938		12300		6180		6,120							60		3.0		29	0
11/21/15	52		1938													60		3.0		29	0
11/22/15	53		1932													60		4.0		29	0
11/23/15	54		1932		10020		4840		5,180							60		5.0		29	0
11/24/15	55		1934		5560		5430		130							60		5.0		29	0
11/25/15	56		1940		10260		4580		5,680							60		7.0		29	0
11/26/15	57		1939													60		7.0		29	0
11/27/15	58		1941													60		7.0		29	0
11/28/15	59		1940													60		8.0		29	0
11/29/15	60		1942													60		8.0		29	0
11/30/15	61		1948		10060		4250		5,810											29	0

Date	Day	Equip. Data			TO Mag Drum								FROM Mag Drum								Mag Drum Recovery	
		Mag Drum Speed	Shear Mill Current	Shear Mill Speed	Flow		TSS	Mag	Bio	TSS	Mag	Bio	Flow		TSS	Mag	Bio	TSS	Mag	Bio	Mag	Bio
		Hz	Amps	Hz	gpm	Metered Flow GPD	mg/L	mg/L	mg/L	LBS	LBS	LBS	gpm	85% Metered Flow GPD	mg/L	mg/L	mg/L	LBS	LBS	LBS	%	%
11/01/15	32			38		6,615								5,623								
11/02/15	33		32	38	39	31,984	10,680	4,660	6,020	2,849	1,243	1,606	33	27,186								
11/03/15	34		31	38	24	32,684	11,720	6,040	5,680	3,195	1,646	1,548	20	27,781								
11/04/15	35		32	38	24	28,500	11,780	6,000	5,780	2,800	1,426	1,374	20	24,225	6300	850	5,450	1,273	172	1,101	88	80
11/05/15	36		29	38	24	10,260	8,700	5,600	3,100	744	479	265	20	8,721	5420	750	4,670	394	55	340	89	128
11/06/15	37		32	38	22	21,953	7,300	3,800	3,500	1,337	696	641	19	18,660	5300	560	4,740	825	87	738	87	115
11/07/15	38		32	38	19	59,719							16	50,761								
11/08/15	39		31	38	25	36,899							21	31,364								
11/09/15	40		31	38	19	35,120	9,780	4,560	5,220	2,865	1,336	1,529	16	29,852	4820	430	4,390	1,200	107	1,093	92	71
11/10/15	41		31	38	18	22,381	8,100	3,860	4,240	1,512	720	791	16	19,024	4660	350	4,310	739	56	684	92	86
11/11/15	42					22,381								19,024								
11/12/15	43		31	38	15	22,890	9,240	4,490	4,750	1,764	857	907	12	19,457	5100	480	4,620	828	78	750	91	83
11/13/15	44		32	38	13	17,271	5,820	3,300	2,520	838	475	363	11	14,680	5360	480	4,880	656	59	597	88	165
11/14/15	45		31	38	14	16,970							12	14,425								
11/15/15	46		31	38	14	31,922							12	27,134								
11/16/15	47				17	25,284	9,900	5,000	4,900	2,088	1,054	1,033	14	21,491	5660	480	5,180	1,014	86	928	92	90
11/17/15	48				14	17,148	8,840	4,050	4,790	1,264	579	685	12	14,576	5420	450	4,970	659	55	604	91	88
11/18/15	49		31	38	14	19,947	11,200	5,210	5,990	1,863	867	996	12	16,955	5320	380	4,940	752	54	699	94	70
11/19/15	50		30	38	15	20,202	12,800	6,400	6,400	2,157	1,078	1,078	13	17,172	5980	490	5,490	856	70	786	93	73
11/20/15	51		31	38	14	17,604	12,300	6,180	6,120	1,806	907	899	12	14,963	6640	630	6,010	829	79	750	91	83
11/21/15	52		31	38	14	20,100							12	17,085								
11/22/15	53		31	38	14	23,854							12	20,276								
11/23/15	54		31	38	20	27,878	10,020	4,840	5,180	2,330	1,125	1,204	17	23,696	5880	400	5,480	1,162	79	1,083	93	90
11/24/15	55		31	38	22	28,617	5,560	5,430	130	1,327	1,296	31	19	24,324	5640	480	5,160	1,144	97	1,047	92	3,374
11/25/15	56		31	38	13	16,285	10,260	4,580	5,680	1,393	622	771	11	13,842	5940	360	5,580	686	42	644	93	84
11/26/15	57		31	38	13	16,285							11	13,842								
11/27/15	58		32	38	13	17,928							11	15,239								
11/28/15	59		32	38	12	97,953							11	83,260								
11/29/15	60		32	38	13	1,369							11	1,163								
11/30/15	61				33	1,369	10,060	4,250	5,810	115	49	66	28	1,163	5080	660	4,420	49	6	43	87	65

Date	Day	Reaction Tank				Clarifier				TOTAL INVENTORY				Target SRT	Target Waste				Actual SRT
		TSS LBS	Magnetite LBS	Biological LBS	Magnetite:Biosolids Ratio	TSS LBS	Magnetite LBS	Biological LBS	Magnetite:Biosolids Ratio	TSS LBS	Magnetite LBS	Biological LBS	Magnetite:Biosolids Ratio	days	lbs/d	Concentration Y (RAS)	Gallons at Concentration Y	Flow Rate gpm	days
11/01/15	32													11					
11/02/15	33	19,285	8,702	10,583	0.8	8,446	3,709	4,737	0.8	27,731	12,411	15,320	0.8	11	1,393	6,020	27,740	19	
11/03/15	34	20,383	9,995	10,387	1.0	6,574	3,358	3,216	1.0	26,957	13,354	13,603	1.0	11	1,237	5,680	26,106	18	
11/04/15	35	20,305	9,878	10,427	0.9	6,597	3,333	3,264	1.0	26,902	13,211	13,691	1.0	11	1,245	5,780	25,819	18	10
11/05/15	36	21,010	11,093	9,917	1.1	4,180	2,576	1,603	1.6	25,190	13,670	11,520	1.2	11	1,047	3,100	40,508	28	31
11/06/15	37	19,364	9,878	9,486	1.0	4,485	2,323	2,162	1.1	23,849	12,201	11,648	1.0	11	1,059	3,500	36,277	25	14
11/07/15	38													11					
11/08/15	39													11					
11/09/15	40	17,169	7,957	9,212	0.9	3,297	1,536	1,762	0.9	20,466	9,493	10,973	0.9	11	998	5,220	22,914	16	9
11/10/15	41	17,090	7,840	9,251	0.8									11		4,240			
11/11/15	42													11					
11/12/15	43	17,561	8,545	9,016	0.9	4,638	2,254	2,384	0.9	22,199	10,800	11,399	0.9	11	1,036	4,750	26,159	18	14
11/13/15	44	16,228	7,996	8,232	1.0	2,898	1,587	1,311	1.2	19,126	9,583	9,543	1.0	11	868	2,520	41,277	29	15
11/14/15	45													11					
11/15/15	46													11					
11/16/15	47	16,620	8,624	7,996	1.1									11		4,900			
11/17/15	48	17,247	8,702	8,545	1.0									11		4,790			
11/18/15	49	18,580	9,251	9,329	1.0	4,984	2,347	2,637	0.9	23,564	11,598	11,966	1.0	11	1,088	5,990	21,775	15	14
11/19/15	50	21,167	10,740	10,427	1.0	8,539	4,281	4,259	1.0	29,706	15,021	14,685	1.0	11	1,335	6,400	25,012	17	17
11/20/15	51	19,364	9,604	9,760	1.0	8,137	4,080	4,058	1.0	27,501	13,683	13,818	1.0	11	1,256	6,120	24,611	17	15
11/21/15	52													11					
11/22/15	53													11					
11/23/15	54	15,914	7,683	8,232	0.9									11		5,180			
11/24/15	55	16,934	7,957	8,976	0.9	7,089	5,918	1,171	5.1	24,022	13,875	10,147	1.4	11	922	130	850,807	591	8
11/25/15	56	15,522	7,840	7,683	1.0	15,734	7,173	8,561	0.8	31,257	15,013	16,244	0.9	11	1,477	5,680	31,173	22	19
11/26/15	57													11					
11/27/15	58													11					
11/28/15	59													11					
11/29/15	60													11					
11/30/15	61	15,758	7,056	8,702	0.8									11		5,810			

Questionable Data

Date	Day		Raw Influent									Primary Effluent												Final Effluent													
		MGD	pH	BOD_5	Alkalinity	NO3-N	NO2 - N	NO3 & NO2 - N	NH3-N	TKN	TN	pH	Temp	BOD_5	TSS	VSS	Alkalinity	NH3-N	TKN	NO3 & NO2 - N	NO3- N	NO2 - N	TN	pH	UV	UV Trans	BOD_5	TSS	% TSS Reduction	VSS	NH3-N	TKN	NO3 & NO2 - N	NO3- N	NO2 - N	TN	Alkalinity
			SU	mg/L	mg/L as $CaCO_3$	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	SU	°C	mg/L	mg/L	mg/L	mg/L as CaCO3	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	SU	MW/cm^2	%	mg/L	mg/L	%	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as CaCO3
12/01/15	62	2.4	7.1	144				<0.050	23	29	29	7.1	15.2	72	44	44		22	29	<0.050			29	6.7	7.9	75	4	6	86	6	0.57	1.8	5.8			7.6	52
12/02/15	63	2.5	7.1	156								7.1	15.4	72	30	30		21	27	<0.050			27	6.8	8.1	76	3	3	90	3	1.1	2.2	5.5			7.7	
12/03/15	64	2.4	7.2	126								7	15	90	44	44		14	20	0.42			20	6.7	7.6	74	3	6	86	6	0.44	1.6	5.3			6.9	
12/04/15	65	2.3	7.2									7	15.1		36	36								6.6	7.9	75		5	86	5							
12/05/15	66	2.2																						6.5	7.3	73											
12/06/15	67	2.3																						6.7	7.9	75											
12/07/15	68	2.2	7.1									6.9	14.8		82	68								6.8	8.4	73		5	94	5							71
12/08/15	69	2.2	7.1	306				0.6	19	26	27	6.9	14.7	93	44	44		22	28	<0.050			28	6.7	7.3	73	2	8	82	8	0.48	1.7	5.6			7.3	
12/09/15	70	2.2	7.1	504								7	14.6	111	48	48		22	27	<0.050			27	6.7	8.7	74	4	5	90	5	0.19	1.4	4.4			5.8	
12/10/15	71	2.2	7.2	156								7	14.6	96	62	66		24	32	<0.050			32	6.7	7.6	74	3	6	90	12	0.96	2.5	6.2			8.7	
12/11/15	72	2.1	7.2									7	14.6		46	46								6.6	7.9	75		7	85	7							
12/12/15	73	2.1																						6.6	7.3	73											
12/13/15	74	2.1																						6.7	7.1	72											
12/14/15	75	2.1	7.2									7.1	14.8		52	52								6.8	6.8	71		8	85	8							56
12/15/15	76	2.8	7.1	174				0.95	36	46	47	7	14.6	87	36	36		24	26	<0.050			26	6.7	16.3	76	2	3	92	3	0.74	1.5	6.3			7.8	
12/16/15	77	2.4	7.2	180								7	14.5	99	50	50		20	24	0.095			24	6.7	41.4	77	2	4	92	4	0.47	1.5	4.9			6.4	
12/17/15	78	2.9	7.2	105								7	14.5	81	56	56		20	27	<0.050			27	6.7	8.5	77	7.9	7	88	7	0.34	1.5	5.8			7.3	
12/18/15	79	3.5	7.0									6.9	14.4		44									6.7	11.5	73		11	75								
12/19/15	80	3.3																						6.9	7.3	73											
12/20/15	81	3.0																						6.8	17.6	92											
12/21/15	82	2.9	7.1									6.9	14.3		48									6.8	9.7	77		6	88								
12/22/15	83	3.0	7.0	102				0.050	17	23	23	6.9	14.1	84	42									6.7	7.9	75	6	6	86		4.1	4.0	11			15	
12/23/15	84	3.2	7.1									6.9	14.1		32									6.6	10.1	75		2	94								
12/24/15	85	7.3	6.9									6.7	13.7		52									6.6	17.5	76		13	75								
12/25/15	86	5.4																						6.8	25.6	81											
12/26/15	87	4.6																						6.7	21.8	80											
12/27/15	88	4.5																						6.9	34.2	81											
12/28/15	89	4.0	7.0									6.8	13.8		54									6.7	44.7	79		7	87								
12/29/15	90	4.7	7.0					0.45		21	21	6.9	13.5		61									6.8	48.6	80		7	89			2.0	8.0			10	
12/30/15	91	4.6	6.9	66								6.8	13.7	57	48									6.7	53	83	3.2	4	92								
12/31/15	92	4.8	6.8									6.8	13.5		60									6.7	51	82		5	92								

Date	Day	Zone #1							Zone #2							Zone #3										
		MLSS - TSS	MLSS - VSS	MLSS - Magnetite	MLSS - Biological	pH	DO	ORP	MLSS - TSS	MLSS - VSS	MLSS - Magnetite	MLSS - Biological	pH	DO	ORP	MLSS - TSS	MLSS - VSS	MLSS - Magnetite	MLSS - Biological	pH	DO	ORP	Magnetite:Biosolids Ratio	5 Min Settle	30 Min Settle	SVI
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mV	mg/L	mg/L	mg/L	mg/L	SU	mg/L	mV	mg/L	mg/L	mg/L	mg/L	SU	mg/L	mV		mL/L	mL/L	mL/g
12/01/15	62	4280	2520	1980	2300	7.0	0.3	-18.1	4680	2700	1560	3120	6.8	1.7	-88.9	4280	2420	1900	2380	6.7	2.8	-73.7	0.80	800	450	186
12/02/15	63	4460	2700	1850	2610	6.9	0.4	-97.2	4820	2920	2120	2700	6.7	0.9	-113.9	4040	2440	1820	2220	6.6	2.6	-96.9	0.82	780	400	164
12/03/15	64	5160	2960	2260	2900	6.9	0.4	-126.3	4760	2680	2280	2480	6.8	1.4	-141.8	4720	2680	2120	2600	6.7	3.6	-119.5	0.82	790	400	149
12/04/15	65	4680	2620	2130	2550	6.8	0.4	-51.4	4060	2240	2010	2050	6.7	2.5	-152.8	4220	2300	2060	2160	6.6	2.9	72.2	0.95	650	400	174
12/05/15	66					6.9	0.4	-76.3					6.8	2.1	-145.7					6.6	3.0	-74.9		880	490	
12/06/15	67					6.8	0.4	-25.1					6.6	2.6	-43.1					6.6	3.6	-104.1		890	520	
12/07/15	68	4340	2360	2030	2310	6.9	0.2	-146.5	5720	3100	2630	3090	6.7	1.5	-98.3	4120	1020	1800	2320	6.7	3.1	-102.3	0.78	800	420	412
12/08/15	69	4760	2940	2120	2640	7.0	0.3	-29.0	7340	4300	3050	4290	6.8	1.7	-32.3	4680	2840	2010	2670	6.7	2.5	-4.3	0.75	800	350	123
12/09/15	70	4700	2700	2130	2570	7.0	0.3	29.8	6520	3640	2800	3720	6.8	0.8	-270.9	4160	2300	2120	2040	6.7	1.7	71.6	1.04	860	440	191
12/10/15	71	4380	2540	2040	2340	6.9	0.3	-145.6	5840	3300	2650	3190	6.8	1.6	-141.0	4160	2400	2060	2100	6.7	2.3	-86.1	0.98	820	440	183
12/11/15	72	6760	4120	2720	4040	6.9	0.3	-123.5	4920	2960	2290	2630	6.7	1.8	-138.1	4640	2760	2340	2300	6.6	4.1	-108.5	1.02	650	350	127
12/12/15	73					6.8	0.9	290.5					6.6	1.2	-13.3					6.6	3.9	72.1				
12/13/15	74					6.8	0.4	-87.9					6.7	1.4	-90.0					6.6	5.4	-88.9		880	470	
12/14/15	75	7260	4240	2560	4700	6.9	0.4	-114.2	5660	3220	2260	3400	6.8	0.9	-142.7	5020	2760	2160	2860	6.7	1.9	-115.2	0.76			
12/15/15	76	4540	2620	2290	2250	6.9	0.4	-105.9	5600	3180	2820	2780	6.8	0.7	-124.6	5080	2880	2220	2860	6.6	1.9	-137.1	0.78			
12/16/15	77	5230	3100	2350	2880	7.0	0.4	52.7	5820	1820	2550	3270	6.8	1.0	-124.8	5280	3060	2320	2960	6.7	2.0	20.5	0.78			
12/17/15	78	4960	2960	2450	2510				6080	3580	2830	3250				4800	2800	2220	2580				0.86			
12/18/15	79																									
12/19/15	80																									
12/20/15	81																									
12/21/15	82	5760							6540							5080										
12/22/15	83	2940							3940							5540										
12/23/15	84	3840							6160							5020										
12/24/15	85	3100							2940							2680										
12/25/15	86																									
12/26/15	87																									
12/27/15	88																									
12/28/15	89	4500							5700							3920										
12/29/15	90								3080							3320										
12/30/15	91								3040							2440										
12/31/15	92								3200							2740										

Date	Day	RAS 3 Flow GPM	RAS 4 Flow GPM	RAS 3 TSS mg/L	RAS 4 TSS mg/L	RAS 3 Magnetite SS mg/L	RAS 4 Magnetite SS mg/L	RAS 3 Biological SS mg/L	RAS 4 Biological SS mg/L	Thickener Filtrate NH3-N mg/L	Thickener Filtrate TKN mg/L	Thickener Filtrate NO3-N mg/L	Thickener Filtrate NO2 & NO3 - N mg/L	Thickener Filtrate NO2 - N mg/L	Thickener Filtrate TN mg/L	Internal Recycle (RFR) Speed Hz	Clarifier 3 Blanket FT	Clarifier 4 Blanket FT	Polymer Pump Dial Speed #	Polymer Level inches in barrel	Polymer Feed Rate gpd
12/01/15	62		1949		8580		3890		4,690	110	530	0.48	0.7	0.22	530			8.0	677.0	28	1.80
12/02/15	63		1942		8840		3290		5,550									8.0	677.0	28	0
12/03/15	64		1942		9780		4430		5,350									8.0	677.0	28	0
12/04/15	65		1951		6620		3250		3,370									8.6	677.0	28	0
12/05/15	66		1953															8.5	677.0	27	1.80
12/06/15	67		1949															8.0	677.0	26	1.80
12/07/15	68		1947		9200		4050		5,150									8.0	677.0	28	-3.60
12/08/15	69		1946		10000		4290		5,710	110	170		23		190			8.0	677.0	27	1.80
12/09/15	70		1899		9480		4250		5,230									7.0	677.0	27	0
12/10/15	71		1949		9980		4530		5,450									8.0	677.0	24	5.40
12/11/15	72		1954		9960		4700		5,260									7.0		24	0
12/12/15	73		1927															6.0		24	0
12/13/15	74		1922															6.0		24	0
12/14/15	75				9580		4200		5,380									5.0		27	-5.40
12/15/15	76				11680		5350		6,330	150	210		33		240			3.0	677.0	22	8.99
12/16/15	77				11080		4730		6,350									2.5	702.0	20	3.60
12/17/15	78				18000		7490		10,510												
12/18/15	79				19460																
12/19/15	80																				
12/20/15	81																				
12/21/15	82			1980	24920																
12/22/15	83			2140	13840																
12/23/15	84			4200	12380																
12/24/15	85			4200	16600																
12/25/15	86																				
12/26/15	87																				
12/27/15	88																				
12/28/15	89			7000																	
12/29/15	90			7600	9220																
12/30/15	91			8860	21940																
12/31/15	92			9200	14300																

Date	Day	Equip. Data			TO Mag Drum								FROM Mag Drum								Mag Drum Recovery	
		Mag Drum Speed	Shear Mill Current	Shear Mill Speed	Flow		TSS	Mag	Bio	TSS	Mag	Bio	Flow		TSS	Mag	Bio	TSS	Mag	Bio	Mag	Bio
		Hz	Amps	Hz	gpm	Metered Flow GPD	mg/L	mg/L	mg/L	LBS	LBS	LBS	gpm	85% Metered Flow GPD	mg/L	mg/L	mg/L	LBS	LBS	LBS	%	%
12/01/15	62	60	31	38	15	12,285	8,580	3,890	4,690	879	399	481	13	10,442	5400	380	5,020	470	33	437	92	91
12/02/15	63	60	31	38	15	24,417	8,840	3,290	5,550	1,800	670	1,130	13	20,754	5140	320	4,820	890	55	834	92	74
12/03/15	64	60	31	38	17	25,769	9,780	4,430	5,350	2,102	952	1,150	14	21,904	5220	520	4,700	954	95	859	90	75
12/04/15	65	60	31	38	17	31,815	6,620	3,250	3,370	1,757	862	894	14	27,043	5200	440	4,760	1,173	99	1,074	88	120
12/05/15	66	60	31	38	15	8,998							13	7,648								
12/06/15	67	60	32	38	15	24,176							13	20,550								
12/07/15	68	60	31	38	16	24,034	9,200	4,050	5,150	1,844	812	1,032	14	20,429	5260	300	4,960	896	51	845	94	82
12/08/15	69	60	31	38	17	27,358	10,000	4,290	5,710	2,282	979	1,303	14	23,254	5220	490	4,730	1,012	95	917	90	70
12/09/15	70	60	32	38	22	29,435	9,480	4,250	5,230	2,327	1,043	1,284	19	25,020	5600	650	4,950	1,169	136	1,033	87	80
12/10/15	71	60	31	38	19	25,590	9,980	4,530	5,450	2,130	967	1,163	16	21,752	5380	540	4,840	976	98	878	90	75
12/11/15	72	60	31	38	20	24,464	9,960	4,700	5,260	2,032	959	1,073	17	20,794	5260	560	4,700	912	97	815	90	76
12/12/15	73	60	32	38	21	26,718							18	22,710								
12/13/15	74	60	32	38	16								14									
12/14/15	75		31	38	18		9,580	4,200	5,380				15		5380	360	5,020					
12/15/15	76		31	38	15		11,680	5,350	6,330				13		5980	800	5,180					
12/16/15	77		31	36	14		11,080	4,730	6,350				12		5660	730	4,930					
12/17/15	78						18,000	7,490	10,510						8680	1250	7,430					
12/18/15	79						19,460								5280							
12/19/15	80																					
12/20/15	81																					
12/21/15	82						13,450															
12/22/15	83						7,990															
12/23/15	84						8,290															
12/24/15	85						10,400															
12/25/15	86																					
12/26/15	87																					
12/27/15	88																					
12/28/15	89						7,000															
12/29/15	90						8,410															
12/30/15	91						15,400															
12/31/15	92						11,750															

Date	Day	Reaction Tank				Clarifier				TOTAL INVENTORY				Target SRT	Target Waste				Actual SRT
		TSS LBS	Magnetite LBS	Biological LBS	Magnetite:Biosolids Ratio	TSS LBS	Magnetite LBS	Biological LBS	Magnetite:Biosolids Ratio	TSS LBS	Magnetite LBS	Biological LBS	Magnetite:Biosolids Ratio	days	lbs/d	Concentration Y (RAS)	Gallons at Concentration Y	Flow Rate gpm	days
12/01/15	62	16,777	7,448	9,329	0.8	15,749	7,111	8,638	0.8	32,526	14,558	17,968	0.8	11	1,633	4,690	41,760	29	32
12/02/15	63	15,836	7,134	8,702	0.8	15,955	6,170	9,784	0.6	31,791	13,304	18,486	0.7	11	1,681	5,550	36,308	25	21
12/03/15	64	18,501	8,310	10,191	0.8	17,835	8,065	9,770	0.8	36,337	16,375	19,961	0.8	11	1,815	5,350	40,670	28	20
12/04/15	65	16,542	8,075	8,467	1.0	13,787	6,759	7,028	1.0	30,329	14,834	15,495	1.0	11	1,409	3,370	50,118	35	13
12/05/15	66													11					
12/06/15	67													11					
12/07/15	68	16,150	7,056	9,094	0.8	16,542	7,272	9,270	0.8	32,692	14,328	18,364	0.8	11	1,669	5,150	38,869	27	20
12/08/15	69	18,345	7,879	10,466	0.8	18,129	7,779	10,350	0.8	36,474	15,658	20,816	0.8	11	1,892	5,710	39,737	28	20
12/09/15	70	16,306	8,310	7,996	1.0	14,860	6,826	8,034	0.8	31,167	15,136	16,031	0.9	11	1,457	5,230	33,411	23	14
12/10/15	71	16,306	8,075	8,232	1.0	17,718	8,168	9,549	0.9	34,024	16,243	17,781	0.9	11	1,616	5,450	35,563	25	18
12/11/15	72	18,188	9,172	9,016	1.0	15,786	7,546	8,240	0.9	33,974	16,718	17,255	1.0	11	1,569	5,260	35,759	25	18
12/12/15	73													11					
12/13/15	74													11					
12/14/15	75	19,677	8,467	11,211	0.8	11,101	4,848	6,253	0.8	30,778	13,315	17,464	0.8	11	1,588	5,380	35,383	25	
12/15/15	76	19,913	8,702	11,211	0.8	7,834	3,559	4,275	0.8	27,747	12,261	15,486	0.8	11	1,408	6,330	26,667	19	
12/16/15	77	20,697	9,094	11,603	0.8	6,299	2,704	3,595	0.8	26,995	11,798	15,197	0.8	11	1,382	6,350	26,088	18	
12/17/15	78	18,815	8,702	10,113	0.9											10,510			
12/18/15	79																		
12/19/15	80																		
12/20/15	81																		
12/21/15	82	19,913																	
12/22/15	83	21,716																	
12/23/15	84	19,677																	
12/24/15	85	10,505																	
12/25/15	86																		
12/26/15	87																		
12/27/15	88																		
12/28/15	89	15,366																	
12/29/15	90	13,014																	
12/30/15	91	9,564																	
12/31/15	92	10,740																	

APPENDIX D

PILOT STUDY TRAILER CHECKLIST

	K.W. Monday	K.W. Tuesday	K.W. Wednesday	Thursday	Friday	Saturday	Sunday
Date	12-14-15	12-15-15	12-16-15				
Time	11:05	10:55	11:00				

Sludge blanket height (ft of Sludge)	5'	3'	2'6"				
TSS meter reading on MLSS cell 3	—	—	—				
5 min settleometer	660	640	640				
10 min settleometer	540	500	490				
15 min settleometer	460	440	430				
20 min settleometer	430	400	390				
25 min settleometer	390	370	360				
30 min settleometer	360	350	340				

Magnetite Feed							
120 V: ON	✓	✓	✓				
Green Light: ON	✓	✓	✓				
Weight lb	1172	2487	1173				

Air Dryer							
Switch: ON	✓	✓	✓				
Green Light: ON	✓	✓	✓				
Pressurized gauge reading (>80 psi)	110	110	115				

Mag Drum							
Rotating	✓	✓	✓				
No sludge build up (if wiper is on)	✓	✓	✓				

Kady Mill							
Flowrate (gpm)	18	15	14				
Oil is clear	Milky	Milky	Milky				
Amps	31	31	31				
Speed (Hz)	38	38	36				
Flow Totalizer (gallons)	7800023	7827081	7848066				

Polymer Feed Pump

Discharge Water flowrate (gpm)	off	1.0	1.3				
Mixing water flowrate (gpm)	off	0.7	1.2				
Polymer pump speed knob (0-999)	off	677	702				
Running position (H/O/A)	off	H	H				
Discharge Pressure <30 psi (or adjust water valve down)	off	22	27				
Drum Liquid Height (inches)	27"	22"	20"				

Controls

System Control Light: ON/OFF	ON	ON	ON				
DDM Mixer: ON/OFF (also check breaker (MX3))	ON	ON	ON				
Mix Tank Agitator: ON/OFF	ON	ON	ON				
Wasting Pump: ON/OFF	ON	ON	ON				
RAS Feed Pump: ON/OFF	ON	ON	ON				
WAS Discharge Pump: ON/OFF	ON	ON	ON				
Mag Drum: ON/OFF	ON	ON	ON				
Kady Mill: ON/OFF	ON	ON	ON				
RAS Discharge Pump: ON/OFF (also check breaker (RDP 1))	ON	ON	ON				
Stinger Power: ON/OFF	ON	ON	ON				

Air Compressor

Test Blow Down	✓	✓	✓				
Green Light lit	✓	✓	✓				
Pressure <100 psi	115	125	120				

Rain for Rent Pump

Running	✓	✓	✓				
Amps	✓	✓	✓				
Hertz	✓	✓	✓				

Notes

Alarms?	N/A	N/A	N/A				
Tripped Breakers?							

Bioreactor

Cell 1

	12/14/15	12/15/15	12/16/15				
DO (mg/L)	0.4	0.4	0.4				
pH	6.9	6.9	7.0				
ORP	-114.2	-105.9	52.7				
Temperature C	15.5	15.3	14.9				

Cell 2

DO (mg/L)	0.9	0.7	1.0				
pH	6.8	6.8	6.8				
ORP	-142.7	-124.6	-124.8				
Temperature C	15.6	15.3	15.0				

Cell 3

DO (mg/L)	1.9	1.9	2.0				
pH	6.7	6.6	6.7				
ORP	-115.2	-137.1	20.5				
Temperature C	15.6	15.4	15.1				

J.S

	Monday (K.W.)	Tuesday (K.W.)	Wednesday (K.W.)	Thursday	Friday (K.W.)	Saturday	Sunday
Date	12-7-15	12-8-15	12-9-15	12-10-15	12-11-15	12-12-15	12-13-15
Time	11:15	11:05	11:15	1:00	11:20	8:50	8:00

Sludge blanket height (ft of Sludge)	8'	8'	7'	8'	7'	6'	6'
TSS meter reading on MLSS cell 3	—	—	—	—	—		—
5 min settleometer	800	800	860	820	650		880
10 min settleometer	650	650	680	690	500		770
15 min settleometer	550	570	580	590	450		650
20 min settleometer	500	500	520	520	400		580
25 min settleometer	450	450	480	480	360		520
30 min settleometer	420	350	440	440	350		470

Magnetite Feed							
120 V: ON	✓	✓	✓	✓	✓	✓	✓
Green Light: ON	✓	✓	✓	✓	✓	✓	✓
Weight lb	1595	1177	2559	2005	1531	1238	1221

Air Dryer							
Switch: ON	✓	✓	✓	✓	✓	✓	✓
Green Light: ON	✓	✓	✓	✓	✓	✓	✓
Pressurized gauge reading (>80 psi)	115	120	105	110	105	118	115

Mag Drum							
Rotating	✓	✓	✓	✓	✓	✓	✓
No sludge build up (if wiper is on)	✓	✓	✓	✓	✓	✓	✓

Kady Mill							
Flowrate (gpm)	16	17	22	19	20	21	18.3
Oil is clear	MILKY	"	"	"	MILKY	milKY	milky
Amps	31	31	32	31	31	32	32.3
Speed (Hz)	38	38	38	38	38	38	38
Flow Totalizer (gallons)	7611762	7635796	7663154	7692589	7718179	7742643	7769361

Polymer Feed Pump

Discharge Water flowrate (gpm)	1.3	.5	1.0	—	off	off	off
Mixing water flowrate (gpm)	.6	.3	.8	—	—	—	off
Polymer pump speed knob (0-999)	677	"	"	"	—	—	off
Running position (H/O/A)	H	H	H	0	0	0	off
Discharge Pressure <30 psi (or adjust water valve down)	17	3	16	—	—	—	off
Drum Liquid Height (inches)	28"	27"	27"	24"	"	24"	24"

Controls

System Control Light: ON/OFF	✓	✓	✓	✓	✓	✓	✓
DDM Mixer: ON/OFF (also check breaker (MX3))	ON	ON	ON	ON	ON	ON	✓
Mix Tank Agitator: ON/OFF	ON	ON	ON	ON	ON	ON	✓
Wasting Pump: ON/OFF	ON	ON	ON	ON	ON	ON	✓
RAS Feed Pump: ON/OFF	ON	ON	ON	ON	ON	ON	✓
WAS Discharge Pump: ON/OFF	ON	ON	ON	ON	ON	ON	✓
Mag Drum: ON/OFF	ON	ON	ON	ON	ON	ON	✓
Kady Mill: ON/OFF	ON	ON	ON	ON	ON	ON	✓
RAS Discharge Pump: ON/OFF (also check breaker (RDP 1))	ON	ON	ON	ON	ON	ON	✓
Stinger Power: ON/OFF	ON	ON	ON	ON	ON	ON	✓

Air Compressor

Test Blow Down	✓	✓	✓	✓	✓	✓	✓
Green Light lit	✓	✓	✓	✓	✓	✓	✓
Pressure <100 psi	120	110	115	120	120	115	105

Rain for Rent Pump

Running	✓	✓	✓	✓	✓	✓	✓
Amps	✓	✓	✓	✓	✓	✓	✓
Hertz	✓	✓	✓	✓	✓	✓	✓

Notes

Alarms?	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tripped Breakers?							

Bioreactor

Cell 1

	12/7/15	12/8/15	12/9/15	12/10/15	12/11/15	12/12/15	12/13/15
DO (mg/L)	0.2	0.3	0.3	0.3	0.3	0.9	0.42
pH	6.9	7.0	7.0	6.9	6.9	6.8	6.79
ORP	-146.5	-29.0	29.8	-145.6	-123.5	290.5	-87.9
Temperature C	15.5	15.4	15.2	15.3	16.5	15.0	16.0

Cell 2

DO (mg/L)	1.5	1.7	0.8	1.6	1.8	1.2	1.37
pH	6.7	6.8	6.8	6.8	6.7	6.6	6.70
ORP	-98.3	-32.3	270.9	-141.0	-138.1	-13.3	-90
Temperature C	15.5	15.4	15.2	15.3	15.6	15.5	15.8

Cell 3

DO (mg/L)	3.1	2.5	1.7	2.3	4.1	3.9	5.49
pH	6.7	6.7	6.7	6.7	6.6	6.6	6.64
ORP	-102.3	-4.3	71.6	-86.1	-108.5	72.1	-88.9
Temperature C	15.5	15.5	15.3	15.4	15.6	15.5	15.9

	D.H. Monday	K.W. Tuesday	K.W. Wednesday	K.W. Thursday	K.W. Friday	J.S Saturday	J.S Sunday
Date	11-30-15	12-1-15	12-2-15	12-3-15	12-4-15	12-5-15	12-6-15
Time	8:45	11:15	11:20	11:00	11:20	11:00	8:00

Sludge blanket height (ft of Sludge)		8'	8'	8'	8'6"	8.5"	8'
TSS meter reading on MLSS cell 3	—	—	—	—	—		
5 min settleometer	800	800	780	790	650	880	840
10 min settleometer	650	680	620	690	600	740	800
15 min settleometer	550	580	550	500	540	690	720
20 min settleometer	500	520	490	450	470	600	640
25 min settleometer	460	480	430	430	440	550	570
30 min settleometer	420	450	400	400	400	490	520

Magnetite Feed							
120 V: ON	✓	✓	✓	✓	✓	✓	✓
Green Light: ON	✓	✓	✓	✓	✓	✓	✓
Weight lb	3024	1475	1089	1762	1135	2522	3141

Air Dryer							
Switch: ON	✓	✓	✓	✓	✓	✓	✓
Green Light: ON	✓	✓	✓	✓	✓	✓	✓
Pressurized gauge reading (>80 psi)	115	110	115	105	110	115	110

Mag Drum							
Rotating	✓	✓	✓	✓	✓	✓	✓
No sludge build up (if wiper is on)	✓	✓	✓	✓	✓	✓	✓

Kady Mill							
Flowrate (gpm)	33.	15	15	17	17	15.4	19.2
Oil is clear	milky	"	"	"	"	"	"
Amps	0.0 31 amps	31	31	31	31	31.6	31.7
Speed (Hz)	38.0 HZ	38 HZ	38 HZ	38 HZ	38 HZ	38	38
Flow Totalizer (gallons)	7442944	7474302	7496587	7521004	7546773	7574566	7587556

Polymer Feed Pump

Discharge Water flowrate (gpm)	1.4	1.5	"	"	"	1.6	1.4
Mixing water flowrate (gpm)	1.0	1.1	"	"	"	1.0	.8
Polymer pump speed knob (0-999)	12%	677	"	"	"	677	677
Running position (H/O/A)	✓	Hand	Hand	Hand	Hand	hand	hand
Discharge Pressure <30 psi (or adjust water valve down)	✓	30	30	30	30	30	30
Drum Liquid Height (inches)	5" from 29"	28"	28"	28"	28"	27"	26

Controls

System Control Light: ON/OFF	✓	✓	✓	✓	✓	✓	✓
DDM Mixer: ON/OFF (also check breaker (MX3))	✓	ON	ON	ON	ON	on	on
Mix Tank Agitator: ON/OFF	✓	ON	ON	ON	ON	on	on
Wasting Pump: ON/OFF	✓	ON	ON	ON	ON	on	on
RAS Feed Pump: ON/OFF	✓	ON	ON	ON	ON	on	on
WAS Discharge Pump: ON/OFF	✓	ON	ON	ON	ON	on	on
Mag Drum: ON/OFF	✓	ON	ON	ON	ON	on	on
Kady Mill: ON/OFF	off	ON	ON	ON	ON	on	on
RAS Discharge Pump: ON/OFF (also check breaker (RDP 1))	✓	ON	ON	ON	ON	on	on
Stinger Power: ON/OFF	✓	ON	ON	ON	ON	on	on

Air Compressor

Test Blow Down	✓	✓	✓	✓	✓	✓	✓
Green Light lit	✓	✓	✓	✓	✓	✓	
Pressure <100 psi	✓ 110	120	120	110	125	100	125

Rain for Rent Pump * serviced

Running	✓	✓	✓	✓	✓	✓	✓
Amps	✓	✓	✓	✓	✓	✓	✓
Hertz	✓	✓	✓	✓	✓	✓	✓

Notes

Alarms?	NA	N/A	N/A	N/A	N/A	N/A	N/A
Tripped Breakers?							

Bioreactor

Cell 1

		12/1	12/2	12/3	12/4	12/5	12/6
DO (mg/L)	0.2	0.3	0.4	0.4	0.4	0.4	0.42
pH	6.96	6.97	6.94	6.94	6.82	6.90	6.54
ORP	99.7	-18.1	-97.2	-126.3	-51.4	-76.3	-25.1
Temperature C	15.7	15.6	15.6	15.9	15.5	15.7	15.5

Cell 2

DO (mg/L)	3.7	1.65	0.9	1.43	2.5	2.1	2.62
pH	6.77	6.79	6.74	6.78	6.73	6.75	6.63
ORP	-139.2	-88.9	-113.9	-141.8	-152.8	-145.7	-43.1
Temperature C	15.7	15.6	15.6	15.9	15.5	15.7	15.5

Cell 3

DO (mg/L)	5.0	2.76	2.63	3.55	2.9	3.01	3.61
pH	6.72	6.65	6.64	6.66	6.6	6.6	6.57
ORP	100.3	-73.7	-96.9	-119.5	72.2	-74.9	-104.1
Temperature C	15.7	15.7	15.6	16.0	15.5	15.7	15.5

	K.W.	K.W.	K.W.	J.S	J.S	J.S	J.S
	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**
Date	11/23	11-24-15	11-25-15	11-26-15	11-27-15	11-28-15	11-29-15
Time	11:45	11:15	11-26-15	8:06	8:00	8:00	8:00

Sludge blanket height (ft of Sludge)	5'	5'	7'	7'	7'	8'	8'
TSS meter reading on MLSS cell 3	—	—	—				
5 min settleometer	520	530	550	550	890	900	900
10 min settleometer	410	430	460	450	810	810	800
15 min settleometer	360	370	410	390	730	740	750
20 min settleometer	330	350	380	376	660	680	690
25 min settleometer	310	310	350	350	540	620	610
30 min settleometer	300	300	330	320	550	580	570

Magnetite Feed							
120 V: ON	✓	✓	✓	✓	✓	✓	✓
Green Light: ON	✓	✓	✓	✓	✓	✓	✓
Weight lb	2910	1869	1883	1818	1201	1205	1195

Air Dryer							
Switch: ON	✓	✓	✓	✓	✓	✓	✓
Green Light: ON	✓	✓	✓	✓	✓	✓	✓
Pressurized gauge reading (>80 psi)	115	110	120	110	115	110	110

Mag Drum							
Rotating	✓	✓	✓	✓	✓	✓	✓
No sludge build up (if wiper is on)	✓	✓	✓	✓	✓	✓	✓

Kady Mill							
Flowrate (gpm)	20	22	13	12.5	12.5	12.4	12.5
Oil is clear	Milky	"	"	"	"	"	"
Amps	31	31	31	31	31.5	31.5	31.5
Speed (Hz)	38	38	38	38	38	38	38
Flow Totalizer (gallons)	7276620	7304498	7333115	[illegible]	7365684	7383613	7481565

Polymer Feed Pump	MON	Tues	Wed	Thurs	Fri	SAT	SUN
Discharge Water flowrate (gpm)	off	"	"	"	"	"	"
Mixing water flowrate (gpm)	off	"	"	"	"	"	"
Polymer pump speed knob (0-999)	off	"	"	"	"	"	"
Running position (H/O/A)	off	"	"	"	"	"	"
Discharge Pressure <30 psi (or adjust water valve down)	off	"	"	"	"	"	"
Drum Liquid Height (inches)	29"	29"	29"	29"	29"	29"	29"

Controls							
System Control Light: ON/OFF	ON	ON	ON	on	✓	✓	✓
DDM Mixer: ON/OFF (also check breaker (MX3))	ON	ON	ON	on	✓	✓	✓
Mix Tank Agitator: ON/OFF	ON	ON	ON	on	✓	✓	✓
Wasting Pump: ON/OFF	ON	ON	ON	on	✓	✓	✓
RAS Feed Pump: ON/OFF	ON	ON	ON	on	✓	✓	✓
WAS Discharge Pump: ON/OFF	ON	ON	ON	on	✓	✓	✓
Mag Drum: ON/OFF	ON	ON	ON	on	✓	✓	✓
Kady Mill: ON/OFF	ON	ON	ON	on	✓	✓	✓
RAS Discharge Pump: ON/OFF (also check breaker (RDP 1))	ON	ON	ON	on	✓	✓	✓
Stinger Power: ON/OFF	ON	ON	ON	on	✓	✓	✓

Air Compressor							
Test Blow Down	✓	✓	✓	✓	✓	✓	✓
Green Light lit	✓	✓	✓	✓	✓	✓	✓
Pressure <100 psi	115	125	120	125	105	120	110

Rain for Rent Pump							
Running	✓	✓	✓	✓	✓	✓	✓
Amps	✓	✓	✓	✓	✓	✓	✓
Hertz	✓	✓	✓	✓	✓	✓	✓

Notes							
Alarms?	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tripped Breakers?	N/A	N/A					

Bioreactor

Cell 1

	Mon.	Tues	Wed	Thurs	Fri	Sat	Sun
DO (mg/L)	0.4	0.4	0.3	0.39	0.41	0.53	0.56
pH	6.9	6.9	7.0	6.9	6.9	6.72	6.96
ORP	101.9	89.9	133.4	-167.9	-120.6	-136.5	-103.0
Temperature C	15.6	15.4	15.7	16.1	16.3	16.3	15.8

Cell 2

DO (mg/L)	0.9	1.2	1.6	1.16	1.21	1.58	1.47
pH	6.7	6.7	6.8	6.7	6.7	6.71	6.75
ORP	72.3	70.6	2.0	-68.3	-71.2	-131.2	-27.4
Temperature C	15.6	15.5	15.8	16.2	16.4	16.3	16.0

Cell 3

DO (mg/L)	2.5	4.1	3.2	3.13	3.09	4.26	5.20
pH	6.6	6.6	6.6	6.6	6.7	6.64	6.65
ORP	-7.9	145.2	-53.4	-77.2	-68.9	-126.5	-113.7
Temperature C	15.7	15.5	15.8	16.2	16.4	16.3	16.0

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
			K.W.	K.W.	K.W.	J.S	J.S
Date	11-16-15	11-17-15	11-18-15	11-19-15	11-20-15	11-21-15	11-22-15
Time	1:30pm	2:40	11:15	11:00	11:00	8:40	8:00

Sludge blanket height (ft of Sludge)			2'	3'	3'	3'	4'
TSS meter reading on MLSS cell 3	450	—	~~510~~	—	—	—	—
5 min settleometer	360	490	~~410~~ 510	550	500	700	820
10 min settleometer	360	390	~~360~~ 410	450	420	630	700
15 min settleometer	330	350	~~340~~ 360	400	350	540	610
20 min settleometer	300	320	340	360	330	490	540
25 min settleometer	280	300	310	350	310	440	500
30 min settleometer	270	280	300	320	300	410	450

Magnetite Feed							
120 V: ON	✓	✓	✓	✓	✓	✓	✓
Green Light: ON	✓	✓	✓	✓	✓	✓	✓
Weight lb	1097	2955	1687	1230	1123	1090	1095

Air Dryer							
Switch: ON	✓	✓	✓	✓	✓	✓	✓
Green Light: ON	✓	✓	✓	✓	✓	✓	✓
Pressurized gauge reading (>80 psi)	✓	✓	100	100	105	105	120

Mag Drum							
Rotating	✓	✓	✓	✓	✓	✓	✓
No sludge build up (if wiper is on)	✓	✓	✓	✓	✓	✓	✓

Kady Mill							
Flowrate (gpm)	17	19	14	15	14	14.1	13.8
Oil is clear	Milky	Milky	Milky	Milky	Milky	Cloudy	Cloudy
Amps			31	30	31	31.2	31.5
Speed (Hz)			38 HZ	38	38	38	38
Flow Totalizer (gallons)	7132481	7157765	7174913	7194860	7215062	7232666	7252766

Polymer Feed Pump

Discharge Water flowrate (gpm)			off	off	off	off	off
Mixing water flowrate (gpm)			off	off	off	off	off
Polymer pump speed knob (0-999)			off	off	off	off	off
Running position (H/O/A)			off	off	off	off	off
Discharge Pressure <30 psi (or adjust water valve down)			off	off	off	off	off
Drum Liquid Height (inches)	29"	29"	29"	29"	29"	29"	29"

Controls

System Control Light: ON/OFF	✓	✓	ON	ON	ON	✓	✓
DDM Mixer: ON/OFF (also check breaker (MX3))	✓	✓	ON	ON	ON	✓	✓
Mix Tank Agitator: ON/OFF	✓	✓	ON	ON	ON	✓	✓
Wasting Pump: ON/OFF	✓	✓	ON	ON	ON	✓	✓
RAS Feed Pump: ON/OFF	✓	✓	ON	ON	ON	✓	✓
WAS Discharge Pump: ON/OFF	✓	✓	ON	ON	ON	✓	✓
Mag Drum: ON/OFF	✓	✓	ON	ON	ON	✓	✓
Kady Mill: ON/OFF	✓	✓	ON	ON	ON	✓	✓
RAS Discharge Pump: ON/OFF (also check breaker (RDP 1))	✓	✓	ON	ON	ON	✓	✓
Stinger Power: ON/OFF	✓	✓	ON	ON	ON	✓	✓

Air Compressor

Test Blow Down	✓	✓	✓	✓	✓	✓	✓
Green Light lit	✓	✓	✓	✓	✓	✓	✓
Pressure <100 psi	✓	✓	✓	120	125	110	100

Rain for Rent Pump

Running	✓	✓	✓	✓	off	✓	✓
Amps	✓	✓	✓	✓	Being	✓	✓
Hertz	✓	✓	✓	✓	serviced	✓	✓

Notes

Alarms?	✓	✓	N/A	N/A	N/A	no	no
Tripped Breakers?		✓	N/A	N/A	N/A	no	no

Bioreactor

Cell 1

DO (mg/L)	0.4	0.4	0.5	0.4	0.4	0.34	0.39
pH	6.9	6.9	6.9	7.0	6.9	6.7	6.65
ORP	-110.6	-64.0	-31.8	-120.9	-51.8	-44.1	-155.7
Temperature C	17.3		16.7	16.8	17.0	16.7	16.8

Cell 2

DO (mg/L)	1.4	0.6	1.4	1.2	2.2	0.6	0.78
pH	6.7	6.8	6.8	6.8	6.7	6.6	6.7
ORP	-79.3	-23.1.7	-36.5	-134.4	-184.8	-53.6	-74.5
Temperature C	17.3	16.9	16.8	17.0	17.0	16.7	16.7

Cell 3

DO (mg/L)	2.3	2.9	2.7	3.6	4.3	3.22	3.14
pH	6.6	6.6	6.7	6.7	6.5	6.5	6.5
ORP	5.2	129.2	-31.0	-116.0	-110.0	-121.5	-109.7
Temperature C	17.4	17.1	16.8	17.0	17.0	16.6	16.7

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	JB	JB		DA	MM	J.S	J.S
Date	1:00pm	1:00pm			11/13	11/14	11/15
Time	11-9-15	11-10-15		11-	1PM	8:00 AM	5:00 A.M

Sludge blanket height (ft of Sludge)	1.5"			2'2"	2"	2"	2.5"
TSS meter reading on MLSS cell 3	X			X	X		
5 min settleometer	400			420	390	460	330
10 min settleometer	310			320	310	350	430
15 min settleometer	280			290	280	300	360
20 min settleometer	250			260	250	280	320
25 min settleometer	340			258	240	250	290
30 min settleometer	240			250	230	240	270

Magnetite Feed							
120 V: ON	✓	✓		✓	✓	✓	✓
Green Light: ON	✓	✓		✓	✓	✓	✓
Weight lb	1,097 lbs	1,088		3050	2855	2011	1244

Air Dryer							
Switch: ON	✓	✓		✓	✓	✓	✓
Green Light: ON	✓	✓		✓	✓	✓	✓
Pressurized gauge reading (>80 psi)	100psi	100psi		100psi	20 psi	100 psi	100 psi

Mag Drum							
Rotating	✓	✓		✓	✓	✓	✓
No sludge build up (if wiper is on)	✓	✓		✓	✓	✓	✓

Kady Mill							
Flowrate (gpm)	19.2gpm	18.4		14.5	13.0	14.0	14.3
Oil is clear	Cloudy	Cloudy		Cloudy	Cloudy	cloudy	cloudy
Amps	31.0	31.0		31.4	32	31.2	31.3
Speed (Hz)	38	38		38Hz	38 Hz	38	38
Flow Totalizer (gallons)	6963546	6998666		7834728	7866318	7553559	7185559

Polymer Feed Pump							
Discharge Water flowrate (gpm)	OFF	OFF		off	OFF	OFF	OFF
Mixing water flowrate (gpm)							
Polymer pump speed knob (0-999)							
Running position (H/O/A)							
Discharge Pressure <30 psi (or adjust water valve down)							
Drum Liquid Height (inches)	29"	29"		29"	29"	29"	29"

Controls							
System Control Light: ON/OFF	on ✓	✓		✓	✓	✓	✓
DDM Mixer: ON/OFF (also check breaker (MX3))	✓	✓		✓	✓	✓	✓
Mix Tank Agitator: ON/OFF	on ✓	✓		✓	✓	✓	✓
Wasting Pump: ON/OFF	on ✓	✓		✓	✓	✓	✓
RAS Feed Pump: ON/OFF	on ✓	✓		✓	✓	✓	✓
WAS Discharge Pump: ON/OFF	on ✓	✓		✓	✓	✓	✓
Mag Drum: ON/OFF	on ✓	✓		✓	✓	✓	✓
Kady Mill: ON/OFF	on ✓	✓		✓	✓	✓	✓
RAS Discharge Pump: ON/OFF (also check breaker (RDP 1))	on ✓	✓		✓	✓	✓	✓
Stinger Power: ON/OFF	✓	✓		✓	✓	✓	✓

Air Compressor							
Test Blow Down	✓	✓		✓	✓	X	x
Green Light lit	✓	✓		✓	✓	✓	✓
Pressure <100 psi	✓	✓		✓	✓	125	115

Rain for Rent Pump							
Running	✓	✓		✓	✓	✓	✓
Amps							
Hertz							

Notes							
Alarms?						no	no
Tripped Breakers?						no	no

Bioreactor

Cell 1

DO (mg/L)	0.7	0.3		0.9	0.4	0.27	0.34
pH	6.9	6.9		6.9	6.8	6.73	7.16
ORP	-244.8	-121.0		-92.9	-131.7	-58.6	-56.0
Temperature C	18.0			17.5	17.4	17.3	17.0

Cell 2

DO (mg/L)	0.7	1.1		0.7	0.8	1.03	0.78
pH	6.8	6.8		6.8	6.7	6.55	6.85
ORP	242.9	-116.6		153	-138.8	-253.4	-116.3
Temperature C	17.9	18.2		17.6	17.5	17.3	17.1

Cell 3

DO (mg/L)	1.2	1.8		2.1	1.4	3.03	1.87
pH	6.6	6.6		6.6	6.5	6.45	6.69
ORP	-171.1	-118.1		-207.1	-114.6	-205.7	-106.2
Temperature C	18.0	18.2		-17.6	17.5	17.3	17.1

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
(Initials)	DH	K.W.	K.W.	K.W.	K.W.	J.S	
Date	11-2-15	11/3/15	11/4/15	11/5/15	11/6/15	11/7/15	11/8/15
Time	10:45	11:40	11:20	11:25	11:10	5:00	5:00
Sludge blanket height (ft of Sludge)	3'6"	2'6"	2'6"	2'	2'6"	3'	
TSS meter reading on MLSS cell 3	X	X	X	X	X	X	X
5 min settleometer	650	490	480	470	480	510	490
10 min settleometer	520	410	390	390	380	400	380
15 min settleometer	450	380	350	340	340	340	350
20 min settleometer	410	350	320	320	300	300	300
25 min settleometer	380	310	300	300	280	270	280
30 min settleometer	350	300	280	280	270	260	270
Magnetite Feed							
120 V: ON	✓	✓	✓	✓	✓	✓	✓
Green Light: ON	✓	✓	✓	✓	✓	✓	✓
Weight lb	1100	1098	1091	1102	1103	1100	1093
Air Dryer							
Switch: ON	✓	✓	✓	✓	✓	✓	✓
Green Light: ON	✓	✓	✓	✓	✓	✓	✓
Pressurized gauge reading (>80 psi)	110	100	110	110	110	100	105
Mag Drum							
Rotating	✓	✓	✓	✓	✓	✓	✓
No sludge build up (if wiper is on)	✓	✓	✓	✓	✓	✓	✓
Kady Mill							
Flowrate (gpm)	39.2	24	24	24	22	18.8	25.2
Oil is clear	✓	cloudy	"	"	"	cloudy	Cloudy
Amps	32.0	31	32	29	32	31.8	31.3
Speed (Hz)	38	38	38	38	38	38	38
Flow Totalizer (gallons)	6741547	6773531	6806215	6834715	6866928	6894975	6926647

Polymer Feed Pump	MON	Tues	Wed	Thurs	Fri	SAT	SUN.
Discharge Water flowrate (gpm)	0	1.7	off	off	off	off	off
Mixing water flowrate (gpm)	0	1.2	off	off	off	off	off
Polymer pump speed knob (0-999)	0.0	0	off	off	Off	off	off
Running position (H/O/A)	off	Hand	off	off	Off	off	off
Discharge Pressure <30 psi (or adjust water valve down)	0.0	30+	off	off	off	off	off
Drum Liquid Height (inches)	29"	29"	29"	29"	29"	29"	29"

Controls							
System Control Light: ON/OFF	ON ✓	✓ ON	ON	ON	ON	✓	✓
DDM Mixer: ON/OFF (also check breaker (MX3))	ON	✓ ON	ON	ON	ON	✓	✓
Mix Tank Agitator: ON/OFF	ON	✓ ON	ON	ON	ON	✓	✓
Wasting Pump: ON/OFF	ON	✓ ON	ON	ON	ON	✓	✓
RAS Feed Pump: ON/OFF	ON	✓ ON	ON	ON	ON	✓	✓
WAS Discharge Pump: ON/OFF	ON	ON	ON	ON	ON	✓	✓
Mag Drum: ON/OFF	ON	ON	ON	ON	ON	✓	✓
Kady Mill: ON/OFF	ON	ON	ON	ON	ON	✓	✓
RAS Discharge Pump: ON/OFF (also check breaker (RDP 1))	ON	ON	ON	ON	ON	✓	✓
Stinger Power: ON/OFF	ON	ON	ON	ON	ON	✓	✓

Air Compressor							
Test Blow Down	Tested	✓	✓	✓	✓	✓	✓
Green Light lit	✓	✓	✓	✓	✓	✓	✓
Pressure <100 psi	125	115	120	120	125	no	120

Rain for Rent Pump							
Running	✓	✓	✓	✓	✓	✓	✓
Amps	162.3	165	167	167	167		
Hertz	60Hz	60 HZ	60 HZ	60 HZ	60 HZ		

Notes							
Alarms?	NO	No	NO	NO	NO	no	no
Tripped Breakers?	NO	NO	NO	NO	NO	no	no

Bioreactor

Cell 1

	Mon	Tue	Wed	Thur	Fri	Sat	Sun
DO (mg/L)	0.4	0.2	0.2	0.2	0.6	0.32	0.39
pH	6.9	6.8	6.9	6.8	6.8	6.8	7.06
ORP	-217.7	-219.5	-147.7	-126.7	-141.4	-140.3	-98.7
Temperature C	18.3	18.2	18.3	18.0	18.6	18.1	18.4

Cell 2

	Mon	Tue	Wed	Thur	Fri	Sat	Sun
DO (mg/L)	0.6	0.9	0.7	0.4	1.0	0.82	0.74
pH	6.8	6.7	6.7	6.7	6.7	6.57	6.67
ORP	-146.7	-295.9	-116.1	-129.1	-131.1	-141.2	-126.7
Temperature C	18.4	18.3	18.3	18.0	18.6	18.7	18.2

Cell 3

	Mon	Tue	Wed	Thur	Fri	Sat	Sun
DO (mg/L)	1.9	2.8	1.8	0.9	2.0	2.61	2.57
pH	6.7	6.6	6.6	6.6	6.6	6.45	6.58
ORP	-133.8	-107.3	-89.2	-132.9	-104.5	-132.8	-129.6
Temperature C	18.4	18.3	18.3	18.1	18.6	18.7	18.2

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	J.F.	K.W.	MV	K.W.	K.W.	J.S	J.S
Date	10/26	10/27	10/28	10/29	10/30	10/31	11/1
Time	8:30	11:10	10:05	11:10	11:30	7:05	6:46

Sludge blanket height (ft of Sludge)	6"	2'	1'6	2'6"	3'	3'	4'
TSS meter reading on MLSS cell 3	X	X	X	X	X	X	X
5 min settleometer	370	160	400	360	440	530	680
10 min settleometer	300	120	310	300	350	410	540
15 min settleometer	260	110	280	260	310	360	470
20 min settleometer	240	100	250	240	290	320	430
25 min settleometer	230	100	240	240	270	300	390
30 min settleometer	220	100	230	220	250	260	360

Magnetite Feed							
120 V: ON	✓	✓	X	✓	✓	✓	✓
Green Light: ON	✓	off	X	✓	✓	✓	✓
Weight lb	1072	off	1070	2088	1140	1101	1108

Air Dryer							
Switch: ON	✓	✓	✓	✓	✓	✓	✓
Green Light: ON	✓	✓	✓	✓	✓	✓	✓
Pressurized gauge reading (>80 psi)	110	120	115	115	120	120	105

Mag Drum							
Rotating	✓	✓	X	✓	✓	✓	✓
No sludge build up (if wiper is on)	✓	✓	X	✓	✓	✓	✓

Kady Mill							
Flowrate (gpm)	19.4	0	X	18 gpm	19 gpm	0	0
Oil is clear	cloudy	cloudy	cloudy	✓	cloudy	cloudy	cloudy
Amps	0	0	X	31	31	0	0
Speed (Hz)	36.9	37.8	X	38	38	37.6	37.8
Flow Totalizer (gallons)	6675353	6701444	6701444	6722278	6731349	6739938	6739932
			0	20834	9071	8589	-6

Polymer Feed Pump							
Discharge Water flowrate (gpm)	off	off	✓	off	off	off	off
Mixing water flowrate (gpm)	off	off	x	off	off	off	off
Polymer pump speed knob (0-999)	off	off	x	off	off	off	off
Running position (H/O/A)	off	off	x	off	off	off	off
Discharge Pressure <30 psi (or adjust water valve down)	off	off	x	off	off	off	off
Drum Liquid Height (inches)	30"	30"	30"	30"	30"	30"	30"

Controls							
System Control Light: ON/OFF	✓	✓	✓	✓	✓	✓	✓
DDM Mixer: ON/OFF (also check breaker (MX3))	✓	✓	✓	✓	✓	✓	✓
Mix Tank Agitator: ON/OFF	✓	✓	✓	✓	✓	✓	✓
Wasting Pump: ON/OFF	✓	off	x	✓	✓	✓	✓
RAS Feed Pump: ON/OFF	✓	ON	✓	✓	✓	✓	✓
WAS Discharge Pump: ON/OFF	off	off	x	✓	✓	✓	✓
Mag Drum: ON/OFF	on	✓	x	✓	✓	✓	✓
Kady Mill: ON/OFF	on	off	x	off	✓	stopped	stopped
RAS Discharge Pump: ON/OFF (also check breaker (RDP 1))	on	✓	✓	✓	✓	✓	✓
Stinger Power: ON/OFF	off	off	x	✓	✓	✓	✓

Air Compressor							
Test Blow Down	✓	✓	✓	✓	✓	✓	✓
Green Light lit	✓	✓	✓	✓	✓	✓	✓
Pressure <100 psi	115 psi	115	110	115	110	125	120

Rain for Rent Pump							
Running	✓	✓	✓	Serviced	off	✓	✓
Amps	160 A	160	160	Service	off	170.6	167
Hertz	60 Hz	60 HZ	60	Service	off	60	60

Notes							
Alarms?	✓	None	N/A	N/A	N/A	N/A	N/A
Tripped Breakers?	✓	None	N/A	N/A	N/A	N/A	N/A

Bioreactor

Cell 1

	10/26	10/27	10/28	10/29	10/30	10/31	11/1/15
DO (mg/L)	0.1	0.3	0.2	0.4	0.5	0.36	0.42
pH	6.9	7.0	7.2	6.8	6.9	6.84	6.81
ORP	-277.8	-128.7	-221	-129.6	189.3	-239	-193.7
Temperature C	18.5	18.1	18.2	18.6	18.0	17.9	18.0

Cell 2

	10/26	10/27	10/28	10/29	10/30	10/31	11/1/15
DO (mg/L)	0.6	3.2	1.3	1.7	0.9	1.25	1.33
pH	6.8	6.9	6.7	6.6	6.6	6.62	6.61
ORP	-108.9	-104.4	-206	-134.5	-126.1	-89.7	-102.9
Temperature C	18.5	18.1	18.1	18.6	18.1	18.1	18.1

Cell 3

	10/26	10/27	10/28	10/29	10/30	10/31	11/1/15
DO (mg/L)	1.0	4.6	3.3	3.1	2.5	3.81	3.72
pH	6.7	6.8	6.6	6.5	6.5	6.56	6.54
ORP	-91.2	-139.6	-140	-124.6	-104.4	-137.6	-135.8
Temperature C	18.4	18.1	18.2	18.7	18.2	18.1	18.2

	K.W.	K.W.	K.W.	K.W.	Rene	Jake	Jake
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Date	10/19	10/20	10/21	10/22	10/23	10/24	10/25
Time	10:45	10:45	10:40	10:45	8:26		

Sludge blanket height (ft of Sludge)	2'	1'	1'	1'	0.5	2'	0.75'
TSS meter reading on MLSS cell 3	X	X	X	X	X	X	X
5 min settleometer	350	340	330	330	350	370	380
10 min settleometer	300	270	250	260	280	300	290
15 min settleometer	250	240	220	220	240	250	250
20 min settleometer	230	210	210	210	220	220	230
25 min settleometer	210	200	200	200	200	200	210
30 min settleometer	200	200	190	190	200	200	200

Magnetite Feed							
120 V: ON	✓	✓	✓	✓	✓	✓	✓
Green Light: ON	✓	✓	✓	✓	✓	✓	✓
Weight lb	2929	1085	1237	1089	1080	1078	1084

Air Dryer							
Switch: ON	✓	✓	✓	✓	✓	✓	✓
Green Light: ON	✓	✓	✓	✓	✓	✓	✓
Pressurized gauge reading (>80 psi)	120	110	105	115	121	115	110

Mag Drum							
Rotating	✓	✓	✓	✓	✓	✓	✓
No sludge build up (if wiper is on)	✓	✓	✓	✓	✓	✓	✓

Kady Mill							
Flowrate (gpm)	19	21	21	21	18	18	18
Oil is clear	✓	✓	✓	✓	cloudy	Cloudy	Cloudy
Amps	29	30	30	off	off	30	30.4
Speed (Hz)	37	37	37	off	36.9	36.9	36.9
Flow Totalizer (gallons)		6508877	6539566	6570638	6595618	6621618	6647618

Polymer Feed Pump	OFF	OFF	off	off	off	off	off
Discharge Water flowrate (gpm)	X	X	X	X	X	X	X
Mixing water flowrate (gpm)	X	X	X	X	X	X	X
Polymer pump speed knob (0-999)	X	X	X	X	X	X	X
Running position (H/O/A)	X	X	X	X	X	O	O
Discharge Pressure <30 psi (or adjust water valve down)	X	X	X	X	X	X	X
Drum Liquid Height (inches)	X	X	X	X	30"	30"	30"

Controls							
System Control Light: ON/OFF	✓	✓	✓	✓	✓	✓	✓
DDM Mixer: ON/OFF (also check breaker (MX3))	✓	✓	✓	✓	✓	✓	✓
Mix Tank Agitator: ON/OFF	✓	✓	✓	✓	✓	✓	✓
Wasting Pump: ON/OFF	✓	✓	✓	✓	✓	✓	✓
RAS Feed Pump: ON/OFF	✓	✓	✓	✓	✓	✓	✓
WAS Discharge Pump: ON/OFF	✓	✓	✓	✓	✓	✓	✓
Mag Drum: ON/OFF	✓	✓	✓	✓	✓	✓	✓
Kady Mill: ON/OFF	✓	✓	✓	✓	✓	✓	✓
RAS Discharge Pump: ON/OFF (also check breaker (RDP 1))	✓	✓	✓	✓	✓	✓	✓
Stinger Power: ON/OFF	✓	✓	✓	✓	✓	✓	✓

Air Compressor							
Test Blow Down	✓	✓	✓	✓	✓	✓	✓
Green Light lit	✓	✓	✓	✓	✓	✓	✓
Pressure <100 psi	120	130	110	110	115	110	110

Rain for Rent Pump							
Running	✓	✓	✓	✓	✓	✓	✓
Amps	83	97	97	137	160	160	158
Hertz	40	45	45	55	60	60	60

Notes							
Alarms?	none	NONE	NONE	NONE	NONE	none	none
Tripped Breakers?	none	NONE	NONE	NONE	NONE	none	none

Bioreactor

Cell 1

	mon	Tues.	Wed	Thurs	Rene Fri	SAT	SUN
DO (mg/L)	0.2	0.5	0.2	0.2	0.35	0.42	0.38
pH	6.8	6.6	6.9	6.8	6.8	7.5	7.44
ORP	-164	-125.4	-116.9	-190.8	-142.8	-79	-80
Temperature C	18.4	18.9	19.2	19.3	19.0	16.9	18.3

Cell 2

DO (mg/L)	1.4	1.7	0.9	0.6	0.62	.11	.11
pH	6.6	6.5	6.7	6.7	6.7	7.5	7.43
ORP	-470	-136.2	-116.0	-306.9	-134.4	-95	-48
Temperature C	18.5	18.9	19.1	19.2	19.0	17.2	18.4

Cell 3

DO (mg/L)	3.1	3.7	1.4	1.0	0.83	.7	.24
pH	6.6	6.4	6.6	6.6	6.5	7.5	7.43
ORP	-179	-87.2	-166.7	-174.9	-129.6	-70	-66
Temperature C	18.5	18.9	19.2	19.3	19.0	18	18.5

ESP
Tot #3

	Monday	Tuesday	K.W. Wednesday	K.W. Thursday	K.W. Friday	Saturday	Sunday
Date			10/14/15	10/15/15	10/16/15		
Time			10:45A	10:55	11:05		
Sludge blanket height (ft of Sludge)			9'	3'	2'		
TSS meter reading on MLSS cell 3 (weekend)							
5 min settleometer			520	450	390		
10 min settleometer			400	350	300		
15 min settleometer			330	280	250		
20 min settleometer			280	240	230		
25 min settleometer			240	210	200		
30 min settleometer			220	200	190		
Magnetite Feed							
120 V: ON			off	off	off		
Green Light: ON			off	off	off		
Weight lb			—	—	—		
Air Dryer							
Switch: ON			✓	✓	✓		
Green Light: ON			✓	✓	✓		
Pressurized gauge reading (>80 psi)			120	118	115		
Mag Drum							
Rotating			✓	✓	✓		
No sludge build up (if wiper is on)			✓	✓	✓		
Kady Mill							
Flowrate (gpm)			38 gpm	33 gpm	19 gpm		
Oil is clear			✓	✓	✓		
Amps			off	off	off		
Speed (Hz)			37 HZ	off	off		
Totalizer			6316445				

			K.W. WED.	Thurs	Fri		
Flow Totalizer (gallons)			6316445	6365821	6396917		
Polymer Feed Pump							
Discharge Water flowrate (gpm)			off	off	0		
Mixing water flowrate (gpm)			off	off	.1		
Polymer pump speed knob (0-999)			999	999	999		
Running position (H/O/A)			off	off	off		
Discharge Pressure <30 psi (or adjust water valve down)			off	off	4		
Drum Liquid Height (inches)			Empty	Empty	30"		
Controls							
System Control Light: ON/OFF			✓	✓	✓		
DDM Mixer: ON/OFF (also check breaker (MX3))			✓	✓	✓		
Mix Tank Agitator: ON/OFF			✓	✓	✓		
Wasting Pump: ON/OFF			✓	✓	✓		
RAS Feed Pump: ON/OFF			✓	✓	✓		
WAS Discharge Pump: ON/OFF			✓	✓	✓		
Mag Drum: ON/OFF			✓	✓	✓		
Kady Mill: ON/OFF			✓	off	✓		
RAS Discharge Pump: ON/OFF (also check breaker (RDP 1))			✓	✓	✓		
Stinger Power: ON/OFF			✓	✓	✓		
Note any alarms:							
Note any tripped breakers:							
Rain for Rent Pump							
Running			✓	✓	✓		
Amps			54.4	54.9	55		
Hertz			25.0	25.0	25		

			WED.	Thurs	Fri		
Bioreactor							
Cell 1							
DO (mg/L)			0.1	0.2	0.1		
pH			6.8	6.8	6.7		
ORP			-243.7	-175.7	-71.9		
Temperature C			19.9	19.4	19.5		
Cell 2							
DO (mg/L)			2.5	1.8	1.6		
pH			6.6	6.6	6.7		
ORP			-141.7	-144.3	-101.9		
Temperature C			19.9	19.5	19.4		
Cell 3							
DO (mg/L)			0.6	0.3	2.8		
pH			6.6	6.7	6.5		
ORP			-148.0	-163.5	-102.9		
Temperature C			19.8	19.4	19.4		

	K.W. Tues. 10/13 ~~Monday~~	Rene Tuesday	Rene Wednesday	Rene/JoeB Thursday	K.W. Friday	Jake Saturday	Jake Sunday	Monday
Date		10/6/15	10/7/15	10/8/15	10/9/15	10/10/15	10/11/15	10/12/15
Time	8:20	8:50AM	9:35Am	8:32AM	8:20 AM	7:05AM	7:33 AM	1:41PM
Sludge blanket height (ft of Sludge)	12'6"	10'	Bulking	11'	13'	13'	13.5'	10.5'
TSS meter reading on MLSS cell 3 (WEEKEND)						4070	4110	
5 min settleometer	800	900	910	960	940	930	930	920
10 min settleometer	520	830	880	900	870	870	880	850
15 min settleometer	430	750	820	850	830	830	830	790
20 min settleometer	360	670	780	810	780	750	790	700
25 min settleometer	320	600	740	770	740	660	740	610
30 min settleometer	280	550	690	700	670	590	700	520

Magnetite Feed								
120 V: ON	off	✓	OFF	✓	✓	✓	✓	✓
Green Light: ON	off	✓	Today	✓	✓	✓	✓	✓
Weight lb	Empty	2857	1843	1092	2310	1918	1959	1089

Air Dryer								
Switch: ON	✓	✓	✓	✓	✓	✓	✓	✓
Green Light: ON ~	✓	✓	✓	✓	✓	✓	✓	✓
Pressurized gauge reading (>80 psi)	115	7102 PSI	7120	7110 psi	110 psi	110 psi	110 psi	104 psi

Mag Drum								
Rotating	✓	✓	✓	✓	✓	✓	✓	✓
No sludge build up (if wiper is on)	✓	✓	✓	✓	✓	✓	✓	✓

Kady Mill								
Flowrate (gpm)	38 g.p.m.	20 g.p.m	Off	35.0	41.9	42.2	41.4	41.6
Oil is clear	✓	✓	Today	✓	✓	✓	✓	✓
Amps	29 A	30AMPS		27.7Amp	28.8	28.1	28.3	0 AMPS
Speed (Hz)	37 HZ	38 HZ		38 HZ	37 HZ	36.9Hz	36.9	0 HZ
TOTALIZER →	6255274	5903399	5923672	5958822	6019111	6074005	6136339	6211096

Tues 10/13

Polymer Feed Pump								
Discharge Water flowrate (gpm)	.1	X	Some being added today.	1.5gpm	1.7 gpm	1.5	~~[illegible]~~ 1.55	1.2
Mixing water flowrate (gpm)	.1	X		1.5gpm	1.7 gpm.	1.5	~~[illegible]~~ 1.8	1.8
Polymer pump speed knob (0-999)	824	X		75%	300	197	197	824
Running position (H/O/A)	off	X		HAND	Hand	Hand	Hand	H
Discharge Pressure <30 psi (or adjust water valve down)	0	X		29	28	28	30	23
Drum Liquid Height (inches)	0	X		26 1/2	X	8 1/4	7	5"

Controls								
System Control Light: ON/OFF	✓	✓	✓	✓	✓	✓	✓	✓
DDM Mixer: ON/OFF (also check breaker (MX3))	✓	✓	✓	✓	✓	✓	✓	✓
Mix Tank Agitator: ON/OFF	✓	✓	✓	✓	✓	✓	✓	✓
Wasting Pump: ON/OFF	✓	✓	OFF	✓	✓	✓	✓	OFF
RAS Feed Pump: ON/OFF	✓	✓	✓	✓	✓	✓	✓	✓
WAS Discharge Pump: ON/OFF	✓	✓	OFF	✓	✓	✓	✓	✓
Mag Drum: ON/OFF	✓	✓	✓	✓	✓	✓	✓	✓
Kady Mill: ON/OFF	✓	✓	OFF	✓	✓	✓	✓	OFF
RAS Discharge Pump: ON/OFF (also check breaker (RDP 1))	✓	✓	✓	✓	✓	✓	✓	✓
Stinger Power: ON/OFF	✓	✓	OFF	OFF	ON	✓	✓	✓
Note any alarms:								
Note any tripped breakers:								

Rain for Rent Pump								
Running	✓	✓	Off today	✓	✓	✓	✓	✓
Amps	54	135 AMPS		54.5 AMPS	96.2 Amps	54.1 A	54.8 A	54.4
Hertz	25	55 Hertz		25.0	45.0	25 Hz	25 Hz	25

K.W.
Tues
10/13/15

Bioreactor								
Cell 1								
DO (mg/L)	0.2	0.70	0.50	0.2	0.5	.32	.37	0.23
pH	6.8	6.8	6.9	6.9	6.9	6.9	6.9	6.80
ORP	-216		-144	-147.2	-176.1	385.9	492.5	
Temperature C	20.0		-19.8	19.4	20.3	[illegible]	19.85	
Cell 2								
DO (mg/L)	1.4	1.7	0.4	0.7	0.3	.28	.24	0.89
pH	6.6	6.6	6.7	6.8	6.8	6.8	6.8	6.87
ORP	-147.9		-127.9	-145.5	-154.0	421.6	571.9	
Temperature C	19.9		19.9	20.0	20.2	14.96	14.8[illegible]	69.3°F
Cell 3								
DO (mg/L)	2.6	3.45	4.3	4.0	0.3	0.22	.2[illegible]	1.43
pH	6.7	6.6	6.6	6.7	6.7	6.7	6.7	6.75
ORP	-108.3		-130.2	-132.5	-173.2	616.9	562.4	
Temperature C	19.9		20.0	20.1	20.3	14.95	14.8	69.0°F

MAGNAtite
10/6/15 A1. 1.40 A2. 1.10 A3. 1.14 RAS. 3.20 WAS. 0.74
10/7/15 A1. 1.83 A2. 1.31 A3 1.43 RAS. 2.85 WAS. Off
10/8/15 A1. 2.30 A2. 1.87 A3 1.86 RAS. 2.60 WAS. 0.95
10/9/15 A1 1.96 A2 1.73 A3 1.81 RAS, 3.15 WAS 0.86
10/10/15 A1 1.0[illegible] A2 1.159 A3 1.[illegible] RAS WAS
10/11/15 A1 1.123 A2 1.088 A3 1.[illegible]
10/13/15 A1 2.27 A2 1.62 A3 1.60 RAS 3.25 WAS 0.63

APPENDIX E

WPCF LAB BOD BACKUP SHEETS

Date - 1/4/16

Time - 10:55

TEMP 18°C

FIVE DAY B.O.D.

Sampled- 12/29/15

DATE 12/30/15

BOTTLE NUMBER	110	111	112	113	114	115	116	117	118	119	120	121	122	123
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	10	15	20	5	10	15	20	100	150	200	250
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	30	20	15	60	30	20	15	3	2	1.5	1.2
C. DO MG/L OF #1 D. DO MG/L OF #1	9.4	9.4	9.4	9.3	9.3	9.2	9.4	9.3	9.3	9.2	9.2	9.1	9.0	8.9
E. DEP. AFTER 5 DAYS	9.4	9.3	8.2	7.0	5.8	4.8	8.5	7.4	6.4	5.4	8.1	7.4	6.8	6.2
F. BOD (MG/L) = D X B	0	0.1	1.2	2.3	3.5	4.4	0.9	1.9	2.9	3.8	1.1	1.7	2.2	2.7
G. RAW - FINAL = BOD REMOVAL MG/L						(4.4)				(3.8)				(2.7)

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL	DATE	NAME
	12/31/15	LB
Raw- 4.4 x 15 = 66 mg/L	1/1/16	[illegible]
Pri- 3.8 x 15 = 57 mg/L	1/2/16	[illegible]
Eff- 2.7 x 1.2 = 3.2 mg/L	1/3/16	LB

Date - 12/29/15

Time - 10:00

TEMP
19°

FIVE DAY B.O.D.

Sampled- 12/23/15

DATE 12/24/15

BOTTLE NUMBER	140	141	142	143	144	145	146	147	148	149	156	157	158	158
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	250	250	275	275
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	1.2	1.2	1.0	1.0
C. DO MG/L OF #1 / D. DO MG/L OF #1	9.0	8.9	8.9	8.9	8.8	8.8	8.9	8.9	8.8	8.8	7.5	7.5	7.4	7.4
E. DEP. AFTER 5 DAYS	9.0	8.9	7.1	7.1	5.4	5.6	7.8	7.8	6.5	6.6	1.2	1.6	1.0	0.9
F. BOD (MG/L) = D X B														

G. RAW - FINAL = BOD REMOVAL MG/L

H. $\frac{\text{BOD MG/L REMOVAL G X 100}}{\text{BOD MG/L RAW}}$ = % REMOVED

(No Good)

Depletion to Low

CHECKED SEAL

	DATE	NAME
	12/25	RJP
Raw-	12/26	RJP
Pri-	12/27	RJP
	12/28	LB
Eff-		

Date - 12/28/15

Time - 1:30

TEMP 20°C

FIVE DAY B.O.D.

Sampled- 12/22/15

DATE 12/23/15

BOTTLE NUMBER	163	164	165	166	168	169	171	172	173	175	176	178	179	180
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	100	150	200	250
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	.3	2	1.6	1.2
C. DO MG/L OF #1	8.9	8.9	8.8	8.8	8.7	8.7	8.9	8.9	8.8	8.8	8.6	8.4	8.2	8.1
D. DO MG/L OF #1 / E. DEP. AFTER 5 DAYS	8.9	8.8	7.3	7.1	5.3	5.4	7.9	8.0	6.0	6.1	6.5	5.4	4.4	3.5
F. BOD (MG/L) = D X B	0	0.1	1.5	1.6	3.4	3.3	1.0	0.9	2.8	2.7	1.1	3.0	3.8	4.6
G. RAW - FINAL = BOD REMOVAL MG/L					(3.4)				(2.8)				(3.8)	

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL	DATE	NAME
	12/24	VO
Raw- 3.4 × 30 = 102 mg/l	12/25	RJP
Pri- 2.8 × 30 = 84 mg/l	12/26	RJP
Eff- 3.8 × 1.5 = 6 mg/l	12/27	RJP

Date - 12/23/15

Time - 11:30

TEMP

19°

FIVE DAY B.O.D.

Sampled- 12/17/15

DATE 12/18/15

BOTTLE NUMBER	110	111	112	113	114	115	116	118	119	121	122	123	124	125
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	250	250	275	275
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	1.2	1.2	1.0	1.0
C. DO MG/L OF #1 / D. DO MG/L OF #1	8.9	9.1	9.0	9.0	8.9	9.0	9.1	9.1	9.0	9.0	7.8	7.8	7.7	7.7
E. DEP. AFTER 5 DAYS	8.2	9.0	7.3	7.3	5.3	5.6	8.0	7.9	6.3	6.3	1.2	1.2	0.8	0.7
F. BOD (MG/L) = D X B	.7	.1	1.7	1.7	3.6	3.4	1.1	1.2	2.7	2.7	6.6	6.6	6.9	7.0

G. RAW - FINAL = BOD REMOVAL MG/L (3.5) (2.7) (6.6)

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL	DATE	NAME
	12/19	JB
Raw- 3.5 X 30 = 105 Mg/L	12/20	JB
Pri- 2.7 X 30 = 81 Mg/L	12/21	VO
Eff- 6.6 X 1.2 = 7.9 Mg/L	12/22	VO

Date - 12/22/15

Time - 1:20

TEMP

19

FIVE DAY B.O.D.

Sampled- 12/16/15

DATE 12/17/15

BOTTLE NUMBER	140	141	142	143	144	145	146	147	148	149	156	157	158	159
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	250	250	275	275
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	1.2	1.2	1.0	1.0
C. DO MG/L OF #1 / D. DO MG/L OF #1	9.2	9.2	9.0	9.0	8.9	8.9	9.1	9.1	9.0	9.0	9.1	9.1	9.1	9.1
E. DEP. AFTER 5 DAYS	9.1	9.0	6.1	5.9	2.9	3.8	7.4	7.6	5.8	5.7	7.1	7.3	6.9	7.1
F. BOD (MG/L) = D X B	.1	.2	2.9	3.1	6.0	5.1	1.7	1.5	3.2	3.3	2.0	1.8	2.2	2.0
G. RAW - FINAL = BOD REMOVAL MG/L			(3.0)						(3.3)				(2.1)	

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL		DATE	NAME
Raw- 60 X 3.0 =	180 mg/L	12/18	JB
		12/19	JB
Pri- 30 X 3.3 =	99 mg/L	12/20	JB
Eff- 1 X 2.1 =	2 mg/L	12/21	VO

Date - 12/21/15

Time - 1:30

TEMP

19

FIVE DAY B.O.D.

Sampled- 12/15/15

DATE 12/16/15

BOTTLE NUMBER	163	164	165	166	168	169	171	172	173	175	176	178	179	180
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	250	250	275	275
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	1.2	1.2	1.0	1.0
C. DO MG/L OF #1 D. DO MG/L OF #1	9.0	9.0	9.0	9.0	8.9	8.9	9.0	9.0	8.9	8.9	8.9	9.0	9.0	9.0
E. DEP. AFTER 5 DAYS	9.0	9.0	6.1	6.2	2.6	2.6	7.7	7.7	6.0	6.1	7.0	6.9	7.0	7.0
F. BOD (MG/L) = D X B	0	0	2.9	2.8	6.3	6.3	1.3	1.3	2.9	2.8	1.9	2.1	2.0	2.0

G. RAW - FINAL = BOD REMOVAL MG/L (2.9) (2.9)(2.0)

H. $\frac{\text{BOD MG/L REMOVAL G X 100}}{\text{BOD MG/L RAW}}$ = % REMOVED

CHECKED SEAL	DATE	NAME
	12/17	VO
Raw- 60 x 2.9 = 174 mg/L	12/18	JB
Pri- 30 x 2.9 = 87 mg/L	12/19	JB
Eff- 1.2 x 2.0 = 2 mg/L	12/20	JB

Date - 12/16/15

Time - 11:15

TEMP
19° C

FIVE DAY B.O.D.

Sampled- 12/10/15

DATE 12/11/15

BOTTLE NUMBER	110	111	112	113	114	115	116	118	119	121	122	123	124	125
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	250	250	275	275
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	1.2	1.2	1.0	1.0
C. DO MG/L OF #1 D. DO MG/L OF #1	9.0	9.0	8.9	8.9	8.8	8.8	8.9	8.9	8.7	8.8	8.3	8.3	8.3	8.3
E. DEP. AFTER 5 DAYS	8.9	8.9	6.4	6.3	3.8	3.6	7.4	7.4	5.5	5.7	5.6	5.9	5.7	5.7
F. BOD (MG/L) = D X B	.1	.1	2.5	2.6	5.0	5.2	1.5	1.5	3.2	3.1	2.7	2.4	2.6	2.6

G. RAW - FINAL = BOD REMOVAL MG/L (2.6) (3.2)(2.6)

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL		DATE	NAME
		12/12/15	VO
Raw- 60 X 2.6 =	156 mg/L	12/13	VO
Pri- 30 X 3.2 =	96 mg/L	12/14	VO
Eff- 1.2 X 2.6 =	3 mg/L	12/15	VO

Date - 12/15/15

Time - 1:30

TEMP 19°

Too much Depletion on Raw

FIVE DAY B.O.D.

Sampled- 12/9/15

DATE 12/10/15

BOTTLE NUMBER	140	141	142	143	144	145	146	147	148	149	156	157	158	159
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	250	250	275	275
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	1.2	1.2	1.0	1.0
C. DO MG/L OF #1	9.0	9.0	8.9	8.9	8.7	8.7	8.9	9.0	8.9	8.8	8.7	8.7	8.7	8.7
D. DO MG/L OF #1														
E. DEP. AFTER 5 DAYS	9.0	9.0	0.5	0.5	0.1	0.1	7.0	7.3	5.2	5.2	5.1	5.4	5.1	5.1
F. BOD (MG/L) = D X B	0	0	8.4	8.4	8.6	8.6	1.9	1.7	3.7	3.6	3.6	3.3	3.6	3.6
G. RAW - FINAL = BOD REMOVAL MG/L									(3.7)				(3.6)	

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL	DATE	NAME
Raw- 60 x 8.4 = 504	12/11	VO
Pri- 30 x 3.7 = 111	12/12	VO
Eff- 1 x 3.6 = 4	12/13	VO
	12/14	VO

Date - 12/14/15

Time - 1:15

Too much

TEMP

19

FIVE DAY B.O.D.

Sampled- 12/8/15

DATE 12/9/15

BOTTLE NUMBER	163	164	165	166	168	169	171	172	173	175	176	178	179	180
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	250	250	225	225
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	1.2	1.2	1.0	1.0
C. DO MG/L OF #1 D. DO MG/L OF #1	9.3	9.3	9.1	9.1	8.9	8.9	9.1	9.2	9.0	9.0	9.2	9.2	9.2	9.2
E. DEP. AFTER 5 DAYS	9.2	9.1	4.1	4.0	0.4	0.6	7.6	7.6	5.9	5.9	7.0	7.2	7.1	7.0
F. BOD (MG/L) = D X B	.1	.2	5.0	5.1	8.5	8.3	1.5	1.6	3.1	3.1	2.2	2.0	2.1	2.2
G. RAW - FINAL = BOD REMOVAL MG/L			(5.1)						(3.1)				(2.2)	

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL		DATE	NAME
Raw- 5.1 X60 =	306 mg/L	12/10	K.W.
		12/11	VO
Pri- 3.1 X30 =	93 mg/L	12/12	VO
Eff- 2.2 X1.0 =	2 mg/L	12/13	VO

Date - 12/9/15

Time - 11:50

TEMP

19

FIVE DAY B.O.D.

Sampled- 12/3/15

DATE 12/4/15

BOTTLE NUMBER	110	111	112	113	114	115	116	118	119	121	122	123	124	125
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	250	250	235	235
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	1.2	1.2	1.0	1.0
C. DO MG/L OF #1 D. DO MG/L OF #1	9.1	9.0	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.5	8.5	8.5	8.5
E. DEP. AFTER 5 DAYS	9.0	8.9	6.8	6.8	4.1	4.3	7.4	7.6	5.9	6.0	5.7	5.8	5.8	5.9
F. BOD (MG/L) = D X B	.1	.1	2.1	2.1	4.8	4.6	1.5	1.3	3.0	2.9	2.8	2.7	2.7	2.6
G. RAW - FINAL = BOD REMOVAL MG/L			(2.1)						(3.0)		(2.8)			

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL	DATE	NAME
Raw- 60 x 2.1 = 126 mg/L	12/5	K.W.
	12/6	K.W.
Pri- 30 x 3.0 = 90 mg/L	12/7	VO
Eff- 1.2 x 2.8 = 3 mg/L	12/8	VO

Date - 12/8/15

Time - 11:35

TEMP
19

FIVE DAY B.O.D.

Sampled- 12/2/15

DATE 12/3/15

BOTTLE NUMBER	140	141	142	143	144	145	146	147	148	149	156	157	158	159
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	250	250	275	275
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	1.2	1.2	1.0	1.0
C. DO MG/L OF #1 / D. DO MG/L OF #1	8.9	8.9	8.9	8.9	8.8	8.8	8.8	8.9	8.8	8.8	8.7	8.8	8.8	8.8
E. DEP. AFTER 5 DAYS	8.8	8.8	6.3	6.4	3.5	3.5	7.6	7.7	6.5	6.4	6.2	6.3	6.2	6.2
F. BOD (MG/L) = D X B	.1	.1	2.6	2.5	5.3	5.3	1.2	1.2	2.3	2.4	2.5	2.5	2.6	2.6
G. RAW - FINAL = BOD REMOVAL MG/L			(2.6)						(2.4)				(2.6)	

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL	DATE	NAME
Raw- 60 X 2.6 = 156 mg/L	12/4	VO
	12/5	K.W.
Pri- 30 X 2.4 = 72 mg/L	12/6	K.W.
Eff- 1 X 2.6 = 3 mg/L	12/7	VO

Date - 12/7/15

Time - 1:20

TEMP

19°

FIVE DAY B.O.D.

Sampled- 12/1/15

DATE 12/2/15

BOTTLE NUMBER	163	164	165	166	168	169	171	172	173	175	176	178	179	180
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	250	250	275	275
B. DILUTION FACTOR (VOLUME OF BOTTLE / MG OF SAMPLE)	0	0	60	60	30	30	60	60	30	30	1.2	1.2	1.0	1.0
C. DO MG/L OF #1	8.9	8.9	8.8	8.8	8.7	8.7	8.9	8.9	8.8	8.8	8.4	8.4	8.3	8.4
D. DO MG/L OF #1														
E. DEP. AFTER 5 DAYS	8.8	8.8	6.3	6.5	3.1	3.1	7.6	7.6	6.4	6.4	5.0	5.2	5.0	5.1
F. BOD (MG/L) = D X B	.1	.1	2.5	2.3	5.6	5.6	1.3	1.3	2.4	2.4	3.4	3.2	3.3	3.3

G. RAW - FINAL = BOD REMOVAL MG/L (2.4) (2.4) (3.3)

H. $\frac{\text{BOD MG/L REMOVAL G X 100}}{\text{BOD MG/L RAW}}$ = % REMOVED

CHECKED SEAL		DATE	NAME
Raw- 2.4 X 60 =	144 mg/L	12/3	VO
Pri- 2.4 X 30 =	72 mg/L	12/4	VO
Eff- 3.3 X 1.2 =	4 mg/L	12/5	K.W.
		12/6	K.W.

Date - 11/30/15

Time - 1:50

TEMP

18

FIVE DAY B.O.D.

Sampled- 11/24/15

DATE 11/25/15

BOTTLE NUMBER	110	111	112	113	114	115	116	118	119	121	122	123	124	125
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	250	250	275	275
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	1.2	1.2	1.0	1.0
C. DO MG/L OF #1														
D. DO MG/L OF #1	9.3	9.3	9.3	9.3	9.2	9.2	9.3	9.3	9.2	9.2	9.2	9.3	9.2	9.3
E. DEP. AFTER 5 DAYS	9.2	9.2	7.6	7.6	6.0	6.1	8.0	8.0	6.5	6.6	7.3	7.4	7.1	7.2
F. BOD (MG/L) = D X B	.1	.1	1.7	1.7	3.2	3.1	1.3	1.3	2.7	2.6	1.9	1.9	2.1	2.1
G. RAW - FINAL = BOD REMOVAL MG/L					(3.2)				(2.7)				(2.1)	

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL		DATE	NAME
Raw- 30 X 3.2 =	96 mg/L	11/26	VO
		11/27	JF
Pri- 30 X 2.7 =	81 mg/L	11/28	JF
		11/29	JF
Eff- 2.1 X 1 =	2 mg/L		

Date - 11/25

Time - 11:55

TEMP 18°

FIVE DAY B.O.D.

Sampled- 11/19/15

DATE 11/20/15

BOTTLE NUMBER	163	164	165	166	168	169	171	172	173	175	176	178	179	180
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	250	250	275	275
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	1.2	1.2	1.0	1.0
C. DO MG/L OF #1	8.6	8.5	8.4	8.5	8.4	8.4	8.5	8.5	8.4	8.3	8.4	8.4	8.3	8.4
D. DO MG/L OF #1														
E. DEP. AFTER 5 DAYS	8.6	8.6	5.5	5.8	1.9	2.4	7.1	7.1	5.3	5.3	6.1	6.4	6.2	6.3
F. BOD (MG/L) = D X B	0	X	2.9	2.7	6.5	6.0	1.4	1.4	3.1	3.0	2.3	2.0	2.1	2.1
G. RAW - FINAL = BOD REMOVAL MG/L			(2.9)						(3.1)		(2.3)			

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL	DATE	NAME
	11/21	RJP
Raw- 2.9 X 60 = 174 Mg/L	11/22	RJP
Pri- 3.1 X 30 = 93 Mg/L	11/23	VO
Eff- 2.3 X 1.2 = 2.8 Mg/L	11/24	VO

Date - 11/24/15

Time - 11:20

TEMP

19

FIVE DAY B.O.D.

Sampled- 11/18/15

DATE 11/19/15

BOTTLE NUMBER	140	141	142	143	144	145	146	147	148	149	156	157	158	159
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	250	250	225	225
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	1.2	1.2	1.0	1.0
C. DO MG/L OF #1 D. DO MG/L OF #1	8.7	8.7	8.6	8.6	8.5	8.5	8.6	8.6	8.5	8.5	8.8	8.9	8.9	8.9
E. DEP. AFTER 5 DAYS	8.7	8.7	5.6	5.6	1.5	2.3	7.1	7.1	5.0	4.7	6.4	6.7	6.6	6.6
F. BOD (MG/L) = D X B	0	0	3.0	3.0	7.0	6.2	1.5	1.5	3.5	3.8	2.4	2.2	2.3	2.3

G. RAW - FINAL = BOD REMOVAL MG/L (3.0) (3.7) (2.3)

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL	DATE	NAME
Raw- 60 x 3.0 = 180 mg/L	11/20	VO
Pri- 30 x 3.7 = 111 mg/L	11/21	RJP
Eff- 1 x 2.3 = 2 mg/L	11/22	RJP
	11/23	VO

Date - 11/23/15

Time - 3:35

TEMP
19

FIVE DAY B.O.D.

Sampled- 11/17/15

DATE 11/18/15

BOTTLE NUMBER	110	111	112	113	114	115	116	118	119	121	122	123	124	125
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	250	250	225	225
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	1.2	1.2	1.0	1.0
C. DO MG/L OF #1 D. DO MG/L OF #1	8.7	8.7	8.5	8.5	8.3	8.3	8.6	8.6	8.4	8.4	9.1	9.1	9.1	9.20
E. DEP. AFTER 5 DAYS	8.7	8.7	6.3	6.2	3.5	3.5	7.1	7.1	5.4	5.5	6.4	6.4	6.0	6.3
F. BOD (MG/L) = D X B	0	0	2.2	2.3	4.8	4.8	1.5	1.5	3.0	2.9	2.7	2.7	3.1	2.9

G. RAW - FINAL = BOD REMOVAL MG/L (4.8) (3.0) (3.0)

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL	DATE	NAME
Raw- 30 x 4.8 = 144 mg/L	11/19	VO
	11/20	VO
Pri- 30 x 3.0 = 90 mg/L	11/21	RP
Eff- 3.0 x 1.0 = 3 mg/L	11/22	RP

Date - 11/18/15

Time - 11:20

TEMP

200

FIVE DAY B.O.D.

Sampled- 11/12/15

DATE 11/13/15

BOTTLE NUMBER	163	164	165	166	168	169	171	172	173	175	176	178	179	180
SAMPLE	Blank	RAW					PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	10	10	20	20	10	10	20	20	200	200	250	250
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	30	30	15	15	30	30	15	15	1.5	1.5	1.2	1.2
C. DO MG/L OF #1	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.1	9.0	8.9	9.0	9.0	8.9	8.9
D. DO MG/L OF #1 E. DEP. AFTER 5 DAYS	8.9	8.9	3.9	4.3	0.5	0.4	7.3	7.3	5.2	5.2	6.9	7.0	6.9	6.7
F. BOD (MG/L) = D X B	.1	.1	5.1	4.7	8.5	8.6	1.7	1.8	3.8	3.7	2.1	2.0	2.0	2.2

G. RAW - FINAL = BOD REMOVAL MG/L (4.9) (3.8) (2.1)

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL	DATE	NAME
Raw- 30 x 4.9 = 147 mg/L	11/14/1	JB
Pri- 15 X 3.8 = 57 mg/L	11/15	JB
Eff- 1.5 X 2.1 = 3 mg/L	11/16	VO
	11/17	VO

Date - 11/13/15

Time - 12:10

TEMP
19°

Failed
Not enough
Depletion
on Eff

FIVE DAY B.O.D.

Sampled- 11/12/15

DATE 11/12/15

BOTTLE NUMBER	140	141	142	143	144	145	146	147	148	149	156	157	158	159
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	10	10	20	20	10	10	20	20	200	200	250	250
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	30	30	15	15	30	30	15	15	1.5	1.5	1.2	1.2
C. DO MG/L OF #1 / D. DO MG/L OF #1	9.3	9.3	9.3	9.3	9.2	9.2	9.3	9.4	9.3	9.3	9.3	9.3	9.4	9.4
E. DEP. AFTER 5 DAYS	9.2	9.2	6.3	6.6	0.8	0.4	6.6	6.7	1.4	.9	8.5	8.6	8.9	8.5
F. BOD (MG/L) = D X B	.1	.1	3.0	2.7	8.4	8.8	2.7	2.7	7.9	8.4	.8	.7	.5	.5
G. RAW - FINAL = BOD REMOVAL MG/L			(2.8)				(2.7)				(.8)			

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL		DATE	NAME
Raw- 30 x 2.8 =	84 mg/L	11/13	VO
		11/14	JB
Pri- 30 x 2.7 =	81 mg/L	11/15	JB
Eff- 1.5 x .8 =	1 mg/L	11/16	VO

Date - 11/10/15

Time - 1:20

TEMP

20

FIVE DAY B.O.D.

Sampled- 11/4/15

DATE 11/5/15

BOTTLE NUMBER	110	111	112	113	114	115	116	118	119	121	122	123	124	125
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	150	150	200	200
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	2.0	2.0	1.5	1.5
C. DO MG/L OF #1	8.5	8.6	8.5	8.5	8.4	8.4	8.4	8.4	8.3	8.3	8.6	8.8	8.9	8.9
D. DO MG/L OF #1 / E. DEP. AFTER 5 DAYS	8.5	8.5	7.8	7.9	4.0	4.2	8.0	8.0	7.6	7.5	8.0	8.0	6.9	6.9
F. BOD (MG/L) = D X B	0	.1	0.7	0.6	4.4	4.2	.4	.4	.7	.8	.6	.8	2.0	2.0
G. RAW - FINAL = BOD REMOVAL MG/L					(4.3)				(.8)				(2.0)	

H. $\frac{\text{BOD MG/L REMOVAL G X 100}}{\text{BOD MG/L RAW}}$ = % REMOVED

CHECKED SEAL		DATE	NAME
Raw- 30 X 4.3 =	129 mg/L	11/6	VO
Pri- 30 X .8 =	24 mg/L	11/7	VO
		11/8	VO
Eff- 1.5 X 2.0 =	3 mg/L	11/9	VO

Date - 11/9/15

Time - 1:30

TEMP

20°

Failed
Not enough at EFF

FIVE DAY B.O.D.

Sampled- 11/3/15

DATE 11/4/15

BOTTLE NUMBER	163	164	165	166	168	169	171	172	173	175	176	178	179	180
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	150	150	200	200
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	.0	.0	60	60	30	30	60	60	30	30	2.0	2.0	1.5	1.5
C. DO MG/L OF #1														
D. DO MG/L OF #1	9.1	9.1	9.3	9.3	9.3	9.3	9.4	9.4	9.3	9.3	9.2	9.2	9.1	9.1
E. DEP. AFTER 5 DAYS	9.1	9.1	8.2	8.2	6.9	6.9	8.5	8.6	7.3	7.3	8.4	8.4	8.3	8.1
F. BOD (MG/L) = D X B	ø	ø	1.1	1.1	2.4	2.4	.9	.8	2.0	2.0	.8	.8	.8	1.0
G. RAW - FINAL = BOD REMOVAL MG/L				(2.4)					(2.0)				(.9)	

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL		DATE	NAME
Raw- 30x2.4 =	72 mg/L	11/5	VO
		11/6	VO
Pri- 30x2.0 =	60 mg/L	11/7	VO
Eff- .9X1.5 =	1 mg/L	11/8	VO

Date - 11/4/15

Time - 11:45

TEMP
20

FIVE DAY B.O.D.
Sampled- 10/29/15
DATE 10/30/15

BOTTLE NUMBER	140	141	142	143	144	145	146	147	148	149	156	157	158	159
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	150	150	200	200
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	2.0	2.0	1.5	1.5
C. DO MG/L OF #1 / D. DO MG/L OF #1	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.8	8.6	8.6	8.6	8.6	8.5	8.5
E. DEP. AFTER 5 DAYS	8.7	8.7	7.8	7.8	6.2	6.5	8.2	8.4	7.1	7.3	7.1	7.0	6.5	6.4
F. BOD (MG/L) = D X B			.9	.9	2.5	2.2	.5	.4	1.2	1.3	1.5	1.6	2.0	2.1
G. RAW - FINAL = BOD REMOVAL MG/L					(2.4)				(1.3)				(2.1)	

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL		DATE	NAME
Raw- 30 X 2.4 =	72 mg/L	10/31	K.W.
		11/1	K.W.
Pri- 30 X 1.3 =	39 mg/L	11/2	VO
Eff- 1.5 X 2.1 =	3 mg/L	11/3	VO

Date - 11/3/15

Time - 12:00

TEMP
19

FIVE DAY B.O.D.
Sampled- 10/28/15.
DATE 10/29/15

BOTTLE NUMBER	110	111	112	113	114	115	116	118	119	121	122	123	124	125
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	150	150	200	200
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	2.0	2.0	1.5	1.6
C. DO MG/L OF #1 / D. DO MG/L OF #1	9.3	9.3	9.3	9.3	9.2	9.2	9.3	9.3	9.2	9.2	9.3	9.4	9.4	9.4
E. DEP. AFTER 5 DAYS	9.3	9.3	7.3	7.4	3.8	3.8	8.3	8.3	6.7	6.6	7.5	7.5	6.7	6.7
F. BOD (MG/L) = D X B	ø	ø	2.0	1.9	5.4	5.4	1.0	1.0	2.5	2.6	1.8	1.9	2.7	2.7

G. RAW - FINAL = BOD REMOVAL MG/L (2.0) (2.6) (2.7)

H. $\frac{\text{BOD MG/L REMOVAL G X 100}}{\text{BOD MG/L RAW}}$ = % REMOVED

CHECKED SEAL	DATE	NAME
Raw- 60 X 2.0 = 120 mg/L	10/30	VO
	10/31	K.W.
Pri- 30 X 2.6 = 78 mg/L	11/1	K.W.
Eff- 1.5 X 2.7 = 4 mg/L	11/2	VO

Date - 11/2/15

Time - 1:30

TEMP

19°

FIVE DAY B.O.D.

Sampled- 10/29/15

DATE 10/28/15

BOTTLE NUMBER	163	164	165	166	168	169	171	172	173	175	176	178	179	180
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	150	150	200	200
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	2.0	2.0	1.5	1.5
C. DO MG/L OF #1														
D. DO MG/L OF #1	9.0	9.0	9.1	9.1	9.0	9.0	9.3	9.2	9.1	9.1	8.8	8.8	8.9	8.9
E. DEP. AFTER 5 DAYS	9.0	9.0	8.0	7.9	6.2	6.3	8.4	8.2	6.8	6.9	4.2	4.6	2.5	2.5
F. BOD (MG/L) = D X B	0	0	1.1	1.2	2.8	2.5	.9	1.0	2.3	2.2	4.6	4.2	6.4	6.2

G. RAW - FINAL = BOD REMOVAL MG/L (2.8) (2.3) (4.4)

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL		DATE	NAME
Raw- 30 X 2.8 =	84 mg/L	10/29	VO
		10/30	VO
Pri- 30 X 2.3 =	69 mg/L	10/31	K.W.
Eff- 20 X 4.4 =	9 mg/L	11/1	K.W.

Date - 10/28/15

Time - 11:10

TEMP

20°

FIVE DAY B.O.D.

Sampled- 10/22/15

DATE 10/23/15

BOTTLE NUMBER	140	141	142	143	144	145	146	147	148	149	156	157	158	159
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	100	100	150	150
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	3.0	3.0	2.0	2.0
C. DO MG/L OF #1 D. DO MG/L OF #1	8.1	8.1	8.0	8.0	8.0	8.0	8.1	8.1	7.9	8.0	7.9	7.9	7.8	7.8
E. DEP. AFTER 5 DAYS	8.1	8.1	5.9	5.9	2.1	2.0	7.2	7.3	5.6	5.5	6.0	6.0	5.8	5.8
F. BOD (MG/L) = D X B			2.1	2.1	5.9	6.0	.9	.8	2.3	2.5	1.9	1.9	2.0	2.0

G. RAW - FINAL = BOD REMOVAL MG/L (2.1) (2.4) (2.0)

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL	DATE	NAME
Raw- 60 X 2.1 = 126 mg/L	10/24/15	VO
	10/25/15	K.W.
Pri- 30 X 2.4 = 72 mg/L	10/26/16	K.W.
Eff- 2.0 X 2.0 = 4 mg/L	10/23/15	VO

Date - 10/27/15

Time - 11:17

TEMP

19°

FIVE DAY B.O.D.

Sampled- 10/21/15

DATE 10/22/15

BOTTLE NUMBER	110	111	112	113	114	115	116	118	119	121	122	123	124	125
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	100	100	150	150
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	3.0	3.0	2.0	2.0
C. DO MG/L OF #1 D. DO MG/L OF #1	8.6	8.6	8.5	8.5	8.4	8.4	8.5	8.5	8.5	8.4	8.4	8.1	8.0	8.0
E. DEP. AFTER 5 DAYS	8.5	8.5	6.4	6.3	3.0	3.4	7.0	7.0	4.6	4.6	7.5	7.5	6.7	6.7
F. BOD (MG/L) = D X B	.1	.1	2.1	2.2	5.4	5.0	1.5	1.5	3.9	3.8	.9	.6	1.3	1.3

G. RAW - FINAL = BOD REMOVAL MG/L (2.2) (3.9) (1.3)

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL	DATE	NAME
	10/23/15	VO
	10/24/15	VO
	10/25/15	K.W.
	10/26/15	K.W.

Raw- 60 × 2.2 = 132 mg/L

Pri- 30 × 3.9 = 117 mg/L

Eff- 2.0 × 1.3 = 3 mg/L

Date - 10/26/15

Time - 12:10

TEMP

19°

FIVE DAY B.O.D.

Sampled- 10/20/15

DATE 10/21/15

BOTTLE NUMBER	163	164	165	166	168	169	171	172	173	175	176	178	179	180
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	100	100	150	150
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	3.0	3.0	2.0	2.0
C. DO MG/L OF #1 D. DO MG/L OF #1	8.9	8.9	8.8	8.8	8.7	8.7	8.7	8.7	8.6	8.6	8.3	8.3	7.9	7.9
E. DEP. AFTER 5 DAYS	8.9	8.9	7.2	7.2	4.4	4.7	7.7	7.8	6.1	6.2	8.0	8.1	7.6	7.4
F. BOD (MG/L) = D X B	Ø	Ø	1.6	1.6	4.3	4.0	1.0	0.9	2.5	2.4	0.3	0.2	0.3	0.5
G. RAW - FINAL = BOD REMOVAL MG/L					(4.3)				(2.5)					(0.5)

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL	DATE	NAME
	10/22/15	VO
	10/23/15	VO
	10/24/15	VO
	10/25/15	K.W.

Raw- 4.3 X 30 = 129 Mg/L

Pri- 2.5 X 30 = 75 Mg/L

Eff- 0.5 x 2.0 = 1 Mg/L

Date - 10/21/75

Time - 1:20

TEMP

20°

FIVE DAY B.O.D.

Sampled- 10/15/75.

DATE 10/16/75

BOTTLE NUMBER	110	111	112	113	114	115	116	118	119	121	122	123	124	125
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	100	100	150	150
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	3.0	3.0	2.0	2.0
C. DO MG/L OF #1 D. DO MG/L OF #1	9.0	9.0	8.9	8.9	8.8	8.8	8.9	8.8	8.7	8.7	7.8	7.8	8.2	8.2
E. DEP. AFTER 5 DAYS	8.9	8.9	5.5	5.5	1.9	2.0	7.2	7.1	5.7	5.8	4.6	4.6	6.2	6.2
F. BOD (MG/L) = D X B	.1	.1	3.4	3.4	7.9	6.8	1.7	1.7	3.0	2.9	3.2	3.2	2.0	2.0
G. RAW - FINAL = BOD REMOVAL MG/L			(3.4)						(3.0)		(3.2)			

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL		DATE	NAME
Raw- 60 x 3.4 =	204 mg/L	10/17	VO
		10/18	VO
Pri- 30 x 3.0 =	90 mg/L	10/19	VO
Eff- 3.0 X 3.2 =	10 mg/L	10/20	VO

Date - 10/20/15

Time - 11:35

TEMP

20

FIVE DAY B.O.D.

Sampled- 10/14/15

DATE 10/15/15

BOTTLE NUMBER	140	141	142	143	144	145	146	147	148	149	156	157	158	159
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	100	100	150	150
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	3.0	3.0	2.0	2.0
C. DO MG/L OF #1														
D. DO MG/L OF #1	9.0	9.0	9.0	9.0	8.9	8.9	8.9	8.9	8.8	8.8	8.5	8.5	8.3	8.3
E. DEP. AFTER 5 DAYS	8.9	8.9	5.5	5.8	2.2	2.2	7.3	7.3	6.0	5.9	4.9	5.0	2.2	1.9
F. BOD (MG/L) = D X B	.1	.1	3.5	3.2	6.7	6.7	1.6	1.6	2.8	2.9	3.6	3.5	6.1	6.4

G. RAW - FINAL = BOD REMOVAL MG/L (3.4) (2.9)(3.6)

H. $\frac{\text{BOD MG/L REMOVAL G X 100}}{\text{BOD MG/L RAW}}$ = % REMOVED

CHECKED SEAL		DATE	NAME
Raw -	60 x 3.4 = 204 mg/L	10/16	VO
Pri -	30 x 2.9 = 87 mg/L	10/17	VO
		10/18	VO
Eff -	3 X 3.6 = 11 mg/L	10/19	VO

Date - 10/19/15

Time - 1:15

TEMP

20

FIVE DAY B.O.D.

Sampled- 10/13/75

DATE 10/14/15

BOTTLE NUMBER	163	164	165	166	168	169	171	172	173	175	176	178	179	180
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	100	100	150	150
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	3.0	3.0	2.0	2.0
C. DO MG/L OF #1 D. DO MG/L OF #1	9.0	9.0	8.9	8.9	8.8	8.8	8.9	8.9	8.8	8.7	8.6	8.6	8.3	8.3
E. DEP. AFTER 5 DAYS	8.9	8.9	5.7	5.7	2.1	2.1	7.8	7.8	6.4	6.4	6.2	6.2	4.4	4.6
F. BOD (MG/L) = D X B	.1	.1	3.2	3.2	6.7	6.7	1.1	1.1	2.4	2.3	2.4	2.4	3.9	3.7
G. RAW - FINAL = BOD REMOVAL MG/L			(3.2)						(2.4)				(3.8)	

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL	DATE	NAME
Raw- 60 X 3.2 = 192	10/15	VO
	10/16	VO
Pri- 30 X 2.4 = 72	10/17	VO
	10/18	VO
Eff- 2.0 X 3.8 = 8		

Date - 10/14/15

Time - 11:45

TEMP

20

FIVE DAY B.O.D.

Sampled- 10/8/15.

DATE 10/9/15

BOTTLE NUMBER	110	111	112	113	114	115	116	118	119	121	122	123	124	125
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	150	150	200	200
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	2.0	2.0	1.5	1.5
C. DO MG/L OF #1	8.8	8.8	8.7	8.7	8.6	8.6	8.7	8.7	8.5	8.6	7.7	7.7	7.4	7.5
D. DO MG/L OF #1														
E. DEP. AFTER 5 DAYS	8.8	8.8	5.5	5.8	2.0	2.0	7.4	7.4	5.5	5.6	5.7	5.7	4.8	4.9
F. BOD (MG/L) = D X B	0	0	3.2	2.9	6.6	6.6	1.3	1.3	3.0	3.0	2.0	2.0	2.6	2.6
G. RAW - FINAL = BOD REMOVAL MG/L			(3.1)						(3.0)				(2.6)	

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL	DATE	NAME
Raw- 60 X 3.1 = 186 mg/L	10/10	JB
	10/11	JB
Pri- 30 X 3.0 = 90 mg/L	10/12	JB
Eff- 1.5 X 2.6 = 4 mg/L	10/13	VO

Date - 10/13/15

Time - 11:05

TEMP

FIVE DAY B.O.D.

Sampled- 10/7/15

DATE 10/8/15

BOTTLE NUMBER	140	141	142	143	144	145	146	147	148	149	156	157	158	159
SAMPLE	Blank	RAW					PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	150	150	200	200
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	2.0	2.0	1.5	1.5
C. DO MG/L OF #1 / D. DO MG/L OF #1	9.2	9.3	9.1	9.2	9.0	9.0	9.2	9.2	9.0	9.0	7.9	7.9	7.4	7.4
E. DEP. AFTER 5 DAYS	9.1	9.1	7.0	7.1	4.7	4.9	7.5	7.5	5.8	5.7	0.7	0.7	0.2	0.2
F. BOD (MG/L) = D X B	.1	.2	2.1	2.1	4.3	4.1	1.7	1.7	3.2	3.3	7.2	7.2	7.2	7.2

G. RAW - FINAL = BOD REMOVAL MG/L (4.2) (3.3)

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL	DATE	NAME
	10/9	VO
Raw- 30 x 4.2 = 126 mg/L	10/10	JB
Pri- 30 x 3.3 = 99 mg/L	10/11	JB
Eff- 2.0 x 7.2 = 14 mg/L	10/12	JB

Date - 10/3/15

Time - 11:20

TEMP
20°

FIVE DAY B.O.D.

Sampled- 10/1/15.

DATE 10/2/15

BOTTLE NUMBER	163	164	165	166	168	169	171	172	173	175	176	178	179	180
SAMPLE	Blank		RAW				PRI				EFF			
A. ML OF SAMPLE ADDED TO DILUTION WATER	0	0	5	5	10	10	5	5	10	10	150	150	200	200
B. DILUTION FACTOR VOLUME OF BOTTLE / MG OF SAMPLE	0	0	60	60	30	30	60	60	30	30	2.0	2.0	1.5	1.5
C. DO MG/L OF #1 D. DO MG/L OF #1	9.1	9.1	9.1	9.1	9.0	9.0	9.0	9.1	9.0	9.0	7.8	7.9	7.4	7.4
E. DEP. AFTER 5 DAYS	8.9	9.0	7.5	7.5	5.8	5.7	8.0	8.1	7.2	7.2	5.8	5.9	5.0	5.0
F. BOD (MG/L) = D X B	.2	.1	1.6	1.6	3.2	3.3	1.0	1.0	1.8	1.8	2.0	2.0	2.4	2.4
G. RAW - FINAL = BOD REMOVAL MG/L					(3.3)				(1.8)				(2.4)	

H. BOD MG/L REMOVAL G X 100 / BOD MG/L RAW = % REMOVED

CHECKED SEAL		DATE	NAME
Raw- 30 X 3.3 =	99 mg/L	10/3	RQP
		10/4	RQP
Pri- 30 X 1.8 =	54 mg/L	10/5	VO
Eff- 1.5 X 2.4 =	4 mg/L	10/6	

APPENDIX F

WPCF LAB SOLIDS BACKUP SHEETS

FAIRHAVEN CONTROL DATA LOG

INITIALS: LB | DATE: 12/3/15

SETTLEOMETER

TIME	8:28		:	
	SSV	SSC	SSV	SSC
0	1000	2.2		
5	470			
10	360			
15	320			
20	290			
25	270			
30	260			
40	240			
50	220			
60	210			

1 2 3			ATC	1 2 3				
2.4 2.4 2.2								
1 2 3 4			RSC	1. 2 3 4				
7.0 13.0								
111R11R111A			DOB	1 2 3 4				
1 2 3 4			ADO	1 2 3 4				
5.1 6.3 7.2								

RESIDUAL CL_2

TIME	FLOW	LEVEL
:	plant	
:		
:		
:		
:		
:		
:		
:		
:	avg.	
:	H_2S	

SAMPLES

SAMPLES	INF 50	A3 5ml	PRI 50	EFF 100	F3 100	F4 100	R3 5ml	R4 5ml	A2 5ml
CRUCIBLE WT. + SAMPLE	21,4387	21,6228	21,7172	21,5731	16,5807	22,0318	21,3266	21,3201	21,2751
CRUCIBLE WT.	21,4335	21,6091	21,7142	21,5726	16,5800	22,0310	21,2806	21,2486	21,2591
DIFFERENCE PRE-FURNACE	.00052 104	.0137 2,740	.0030 60	.0005 5	.0007 7	.0008 8	.0460 9,200	.0715 14,300	.0160 3200
CRUCIBLE WT. + SAMPLE									
WT. POST FURNACE									
DIFFERENCE VOLATILE									
PRE-FURNACE VOLATILE	104	2,740	60	5	7	8	9,200	14,300	3,200
FIXED SOLIDS									

COLIFORM BACTERIA

SAMPLE	COLONIES	#/100ml

START:

FINISH:

OUT:

MICROORGANISM GROUP

MICROORGANISM GROUP	
AMOEBOIDS	
FLAGELLATES	
FREE SWIMMING CILIATES	
STALKED CILIATES	
ROTIFERS	
WORMS	

*NOTES

INF. TEMP. — 13.5

A1 ph — 6.4

A2 ph — 6.4

SEPTAGE

Fairhaven—

Mattapoisett—

Marion—

Rochester—

Acushnet—

total

TOTAL NITROGEN— NITRATE— NITRITE— ALKALINITY—

[signature]

SETTLEOMETER

TIME	9:05		:	
	SSV	SSC	SSV	SSC
0	1000	2.0		
5	410			
10	320			
15	270			
20	250			
25	230			
30	220			
40	200			
50	200			
60	190			

1 2 3 2.0 2.0 2.0	ATC	1 2 3
1 2 3 4 7.0 19.6	RSC	1. 2 3 4
1 2 3 4	DOB	1 2 3 4 3:00 pm
1 2 3 4 7.5 6.1 7.0	ADO	1 2 3 4 3.2 5.0 6.4

RESIDUAL CL_2

TIME	FLOW	LEVEL
:	plant	
:		
:		
:		
:		
:		
:		
:		
:		
:	avg.	
:	H_2S	

FAIRHAVEN CONTROL DATA LOG

INITIALS: LB | DATE: 12/30/15

SAMPLES	INF 50	A3 5ml	PRI 50	EFF 100	F3 100	F4 100	R3 5ml	R4 5ml	A2 5ml
CRUCIBLE WT. + SAMPLE	21,2600	19,4363	21,2829	22,0316	21,2494	21,6104	21,7590	21,8639	21,4487
CRUCIBLE WT.	21,2586	19,4241	21,2805	22,0312	21,2486	21,6098	21,7147	21,7542	21,4335
DIFFERENCE PRE-FURNACE	.0014 28	.0122 2440	.0024 48	.0004 4	.0008 8	.0006 6	.0443 8860	0.1097 21,940	.0152 3,040
CRUCIBLE WT. + SAMPLE									
WT. POST FURNACE									
DIFFERENCE VOLATILE									
PRE-FURNACE VOLATILE	28	2,440	48	4	8	6	8,860	21,940	3,040
FIXED SOLIDS									

COLIFORM BACTERIA

SAMPLE	COLONIES	#/100ml

START:

FINISH:

OUT:

MICROORGANISM GROUP	
AMOEBOIDS	
FLAGELLATES	
FREE SWIMMING CILIATES	
STALKED CILIATES	
ROTIFERS	
WORMS	

*NOTES

INF. TEMP. — 13.7

A1 ph — 6.7

A2 ph — 6.7

SEPTAGE

Fairhaven–

Mattapoisett–

Marion–

Rochester–

Acushnet–

total

TOTAL NITROGEN– NITRATE– NITRITE– ALKALINITY–

C Septage

FAIRHAVEN CONTROL DATA LOG | INITIALS: LB | DATE: 12/29/15

SETTLEOMETER

TIME	SSV (9:14)	SSC	SSV	SSC
0	1000			
5	670			
10	520			
15	440			
20	390			
25	350			
30	330			
40	300			
50	270			
60	260			

	1	2	3	4		1	2	3	4
ATC	1.4	2.0	2.4						
RSC	6.0	7.0							
DOB	1111	1111	1111	111					
ADO	3.9	7.3	7.8						

RESIDUAL CL_2

TIME	FLOW	LEVEL
:	plant	
:		
:		
:		
:		
:		
:		
:		
:	avg.	
:	H_2S	

SAMPLES	INF 50	A3 5ml	PRI 100	EFF 100	F3 100	F4 100	R3 5ml	R4 5ml	A2 5ml
CRUCIBLE WT. + SAMPLE	21.5774	21.2647	21.4398	22.0314	19.4248	21.2813	21.2974	21.6557	21.7683
CRUCIBLE WT.	21.5727	21.2481	21.4337	22.0307	19.4239	21.2802	21.2594	21.6096	21.7529
DIFFERENCE PRE-FURNACE	.0047 / 94	.0166 / 3320	.0061 / 61	.0007 / 7	.0009 / 9	.0011 / 11	.0380 / 7600	.0461 / 9220	.0154 / 3,080
CRUCIBLE WT. + SAMPLE									
WT. POST FURNACE									
DIFFERENCE VOLATILE									
PRE-FURNACE VOLATILE	94	3320	61	7	9	11	7600	9220	3,080
FIXED SOLIDS									

COLIFORM BACTERIA

SAMPLE	COLONIES	#/100ml
B		
100		
150		

START:

FINISH:

OUT:

MICROORGANISM GROUP	
AMOEBOIDS	
FLAGELLATES	
FREE SWIMMING CILIATES	
STALKED CILIATES	
ROTIFERS	
WORMS	

***NOTES**

INF. TEMP. — 13.5

A1 ph — 6.7

A2 ph — 6.3

SEPTAGE

Fairhaven—

Mattapoisett—

Marion—

Rochester—

Acushnet—

total

TOTAL NITROGEN— NITRATE— NITRITE— ALKALINITY—

SETTLEOMETER				
Time	9:30		:3.0	
	SSV	SSC	SSV	SSC
0	1000			
5	900			
10	800			
15	700			
20	620			
25	550			
30	500			
40	440			
50	400			
60	370			

1 2 3 3.0 4.5 3.0	ATC	1	2	3		
~~1~~ ~~2~~ 3 4 5.5 8.0	RSC	1	2	3	4	
1 2 3 4	DOB	1	2	3	4	
1 2 3 4 5.0 6.9 6.9	ADO	1	2	3	4	

NOTES	
INF. TEMP:	13.8
A1 pH:	6.8
A2 pH:	6.7
A3 pH:	6.7

FAIRHAVEN CONTROL DATA LOG

INITIALS: LB

DATE: 12/28/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 100	F4 100	R3 5	R4 5	A1 5	A2 5	A3 5	
CRUCIBLE WT. + SAMPLE	19.4279 19.4237	21.2608 21.2481	21.2597 21.2590	22.0324 22.0315	21.5740 21.5731	21.3155 21.2805	21.7629 21.7794	21.4559 21.4334	21.6385 21.6100	21.7737 21.7541	
CRUCIBLE WT.	.0042 84	.0027 54	.0007 7	.0009 9	.0009 9	.0350 7,000		.0225 4500	.0285 5700	.0196 3920	
DIFFERENCE PRE-FURNACE											
CRUCIBLE WT. + SAMPLE											
WT. POST FURNANCE											
DIFFERENCE VOLATILE											
PRE-FURNACE VOLATILE											
FIXED SOLIDS											

COLIFORM BACTERIA		
SAMPLE	COLONIES	#/100mL
50	0	
100	0	
150	1	
	1/250 × 100/1	
		0.4/100ml

START: 11:00

FINISH: 11:17

OUT: 9:17 - 11:17

%Removal $\frac{84-7}{84}$ x 100 = 92%

%Primary Removal $\frac{84-54}{84}$ x 100 = 35%

lb/day RAW 8.34 x 84 × 3.9 = 2732

lb/day PRI. 8.34 x 54 × 3.9 = 1756

lb/day EFF. 8.34 x 7 × 3.9 = 227

MLSS 8.34 x .467 x 3920 = 15,267

SVI $\frac{1000 \times 500}{3920}$ = 127 ml/g

CF $\frac{3920}{3.0}$ = 1306 mg/l/ml

SA 8.34 x .467 x 3920 = DAYS

8.34x 54 x

9

SETTLEOMETER				
Time	8:55		2.0	
	SSV	SSC	SSV	SSC
0	1000			
5	380			
10	300			
15	270			
20	240			
25	220			
30	210			
40	200			
50	200			
60	190			

1 2 3 20 20 20	ATC	1 2 3
~~1~~ ~~2~~ 3 4 3.0	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 4 .6 .5 .8 .5 .8	ADO	1 2 3 4

FAIRHAVEN CONTROL DATA LOG

INITIALS: JO

DATE: 12/24/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 100	F4 100	R3 5	R4 5	A1 5	A2 5	A3 5	
CRUCIBLE WT. + SAMPLE	19.4294	21.2855	21.4370	21.6132	21.7202	21.2772	22.1168	21.5912	21.2759	21.2643	
CRUCIBLE WT.	19.4262	21.2829	21.4357	21.6119	21.7170	21.2562	22.0338	21.5757	21.2612	21.2509	
DIFFERENCE PRE-FURNACE	.0032 64	.0026 52	.0013 13	.0013 13	.0032 32	.0210 4200	.0830 16600	.0155 3100	.0147 2940	.0134 2680	
CRUCIBLE WT. + SAMPLE											
WT. POST FURNANCE											
DIFFERENCE VOLATILE											
PRE-FURNACE VOLATILE											
FIXED SOLIDS											

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

%Removal (64 − 13) / 64 x 100 = 80%

%Primary Removal (64 − 52) / 64 x 100 = 19%

lb/day RAW 8.34 x 64 x 7.3 = 3,896

lb/day PRI. 8.34 x 52 x 7.3 = 3,165

lb/day EFF. 8.34 x 13 x 7.3 = 791

MLSS 8.34 x .467 x 2680 = 10,438

SVI 1000 x 210 / 2680 = 78 ml/g

CF 2680 / 2.0 = 1340 mg/l/ml

SA 8.34 x .467 x 2680 / 8.34x 52 x = DAYS 3

NOTES	
INF. TEMP:	13.7
A1 pH:	6.9
A2 pH:	6.5
A3 pH:	6.6

SETTLEOMETER				
Time	9:17		:	
	SSV	SSC	SSV	SSC
0	1000	3.0		
5	890			
10	780			
15	680			
20	600			
25	540			
30	490			
40	420			
50	380			
60	350			

1	2	3		ATC	1	2	3	
2.5	4.0	3.0						
~~1~~	~~2~~	3	4	RSC	1	2	3	4
2.25		10.0						
1	2	3	4	DOB	1	2	3	4
1	2	3	4	ADO	1	2	3	4
0.2	5.5	6.7						

NOTES	
INF. TEMP:	14.1
A1 pH:	6.9
A2 pH:	6.7
A3 pH:	6.6

FAIRHAVEN CONTROL DATA LOG

INITIALS: K.W. DATE: 12/23/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 100	F4 100	R3 5	R4 5	A1 5	A2 5	A3 5	
CRUCIBLE WT. + SAMPLE	21.2862	20.6036	19.1000	19.5582	16.5818	21.5125	19.4882	20.9949	19.5973	17.7609	
CRUCIBLE WT.	21.2825	20.6020	19.0998	19.5575	16.5813	21.4915	19.4263	20.9757	19.5665	17.7358	
DIFFERENCE PRE-FURNACE	.0037 74	.0016 32	.0002 2	.0007 7	.0005 5	.021 4,200	.0619 12,380	.0192 3,840	.0308 6,160	.0251 5,020	
CRUCIBLE WT. + SAMPLE											
WT. POST FURNANCE											
DIFFERENCE VOLATILE											
PRE-FURNACE VOLATILE	74	32	2	7	5	4,200	12,380	3,840	6,160	5,020	
FIXED SOLIDS											

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

%Removal $\frac{74 - 2}{74}$ x 100 = 97%

%Primary Removal $\frac{74 - 32}{74}$ x 100 = 57%

lb/day RAW 8.34 x 74 x 3.19 = 1969

lb/day PRI. 8.34 x 32 x 3.19 = 851

lb/day EFF. 8.34 x 2 x 3.19 = 53

MLSS 8.34 x .467 x 5,020 = 19,552

SVI $\frac{1000 \times 490}{5,020}$ = 98 ml/g

CF $\frac{5,020}{3.0}$ = 1,673 mg/l/ml

SA $\frac{8.34 \times .467 \times 5,020}{8.34 \times 32 \times 3.19}$ = 23 DAYS

SETTLEOMETER				
Time	9:10		:	
	SSV	SSC	SSV	SSC
0	1000	"		
5	850			
10	750			
15	650			
20	570			
25	540			
30	480			
40	430			
50	390			
60	370			

1	2	3		ATC	1	2	3	
3.5	5.0	3.5						
~~1~~	~~2~~	3	4	RSC	1	2	3	4
	1.5	11.0						
1	2	3	4	DOB	1	2	3	4
1	2	3	4	ADO	1	2	3	4
0.9	2.7	6.6						

FAIRHAVEN CONTROL DATA LOG INITIALS: VO DATE: 12/22/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 100	F4 100	R3 5	R4 5	A1 5	A2 5	A3 5	
CRUCIBLE WT. + SAMPLE	16.5846	20.6041	19.4268	21.6126	21.4369	19.5678	21.5607	21.2976	19.1197	20.0032	
CRUCIBLE WT.	16.5813	20.6020	19.4262	21.6119	21.4359	19.5571	21.4915	21.2829	19.1000	20.9755	
DIFFERENCE PRE-FURNACE	.0033 66	.0021 42	.0006 6	.0007 7	.0010 10	.0107 2140	.0692 13840	.0147 2940	.0197 3940	.0277 5540	
CRUCIBLE WT. + SAMPLE											
WT. POST FURNANCE											
DIFFERENCE VOLATILE											
PRE-FURNACE VOLATILE											
FIXED SOLIDS											

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

%Removal (66 − 6) / 66 x 100 = 91%

%Primary Removal (66 − 42) / 66 x 100 = 36%

lb/day RAW 8.34 x 66 x 2.99 = 1,646 lb/day

lb/day PRI. 8.34 x 42 x 2.99 = 1,047 lb/day

lb/day EFF. 8.34 x 6 x 2.99 = 150 lb/day

MLSS 8.34 x .467 x 5540 = 21577

SVI 1000 x 480 / 5540 = 87 ml/g

CF 5540 / 3.5 = 1583 mg/l/ml

SA 8.34 x .467 x 5540 / 8.34x 42 x 2.99 = 21 DAYS

NOTES	
INF. TEMP:	14.1
A1 pH:	6.9
A2 pH:	6.7
A3 pH:	6.6

SETTLEOMETER				
Time	9:30		:	
	SSV	SSC	SSV	SSC
0	1000			
5	880			
10	750			
15	650			
20	570			
25	520			
30	470			
40	410			
50	370			
60	350			

1 2 3 3.5 4.5 3.0	ATC	1	2	3	
~~1 2~~ 3 4 1.5 2.0	RSC	1	2	3	4
1 2 3 4	DOB	1	2	3	4
1 2 3 4 0.7 3.2 6.5	ADO	1	2	3	4

NOTES	
INF. TEMP:	14.3
A1 pH:	7.0
A2 pH:	6.6
A3 pH:	6.6

FAIRHAVEN CONTROL DATA LOG

INITIALS: VO DATE: ~~12~~ 12/1/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 100	F4 100	R3 5	R4 5	A1 5	A2 5	A3 5	
CRUCIBLE WT. + SAMPLE	16.5864	19.4284	21.4920	21.6125	20.5758	21.7270	19.2242	19.5945	21.3153	20.6275	
CRUCIBLE WT.	16.5817	19.4260	21.4914	21.6119	20.5751	21.7171	19.0996	19.5657	21.2826	20.6021	
DIFFERENCE PRE-FURNACE	.0047 94	.0024 48	.0006 6	.0006 6	.0007 7	.0099 1980	.1246 24920	.0288 5760	.0327 6540	.0254 5080	
CRUCIBLE WT. + SAMPLE											
WT. POST FURNANCE											
DIFFERENCE VOLATILE											
PRE-FURNACE VOLATILE											
FIXED SOLIDS											

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
B	0	
50	2/50	
100	7/100	

START: 1:00

FINISH: 1:20

OUT: 12:45

%Removal (94 − 6) / 94 x 100 = 94%

%Primary Removal (94 − 48) / 94 x 100 = 49%

lb/day RAW 8.34 x 94 x 2.93 = 2297

lb/day PRI. 8.34 x 48 x 2.93 = 1173

lb/day EFF. 8.34 x 6 x 2.93 = 1466

MLSS 8.34 x .467 x 5080 = 19785

SVI 1000 x 5080 / 470 = 10809 ml/g

CF 5080 / 3.0 = 1693 mg/l/ml

SA 8.34 x .467 x 5080 / 8.34 x 48 x = 17 DAYS

SETTLEOMETER

TIME	9:05 SSV	SSC	: SSV	SSC
0	1000			
5	740			
10	570			
15	490			
20	430			
25	400			
30	370			
40	340			
50	330			
60	300			

1 2 3 3.0 3.0 3.0	ATC	1 2 3
1 2 3 4 10.0	RSC	1 2 3 4
7/1/R/1/R/1/A	DOB	1 2 3 4
1 2 3 4 0.4 4.4 7.2	ADO	1 2 3 4

RESIDUAL CL_2

TIME	FLOW	LEVEL
:	plant	
:		
:		
:		
:		
:		
:		
:		
:	avg.	
:	H_2S	

FAIRHAVEN CONTROL DATA LOG

INITIALS VO DATE: 12/18/15

SAMPLES	INF 50	A3 5ml	PRI 50	EFF 100	F3 X	F4 100	R3 5ml	R4 5ml	A2 5ml
CRUCIBLE WT. + SAMPLE	22.0386	21.7824	19.5594	21.4368		21.5764		21.3482	17.7619
CRUCIBLE WT.	22.0339	21.7564	19.5572	21.4357		21.5756		21.2509	17.7355
DIFFERENCE	.0047	.0260	.0022	.0011		.0008		.0973	.0264
PRE–FURNACE	94	5200	44	11		8		19460	5280
CRUCIBLE WT. + SAMPLE									
WT. POST FURNACE									
DIFFERENCE VOLATILE									
PRE–FURNACE VOLATILE									
FIXED SOLIDS									

COLIFORM BACTERIA :

SAMPLE	COLONIES	#/100ml

START:

FINISH:

OUT:

MICROORGANISM GROUP	
AMOEBOIDS	
FLAGELLATES	
FREE SWIMMING CILIATES	
STALKED CILIATES	
ROTIFERS	
WORMS	

*NOTES

INF. TEMP. 14.4

A1 ph 6.9

A2 ph 6.6

SEPTAGE

Fairhaven–

Mattapoisett–

Marion–

Rochester–

Acushnet–

total

TOTAL NITROGEN– NITRATE– NITRITE– ALKALINITY–

21.2863

AI 5ml 21.2618

.0249

4980

% Removal $\frac{94 - 11}{94} \times 100 = 88\%$

% Primary Removal $\frac{94 - 44}{94} \times 100 = 53\%$

lb/day RAW 8.34 x 94 x 3.49 = 2736

lb/day PRI. 8.34 x 44 x 3.49 = 1281

lb/day EFF. 8.34 x 11 x 3.49 = 320

MLSS. 8.34 x .467 x 5200 = 20253

SVI $\frac{1000 \times 370}{5200}$ = 71 ml/g

CF $\frac{5200}{3.0}$ = 1733 mg/l/ml

SA $\frac{8.34 \times .467 \times 5200}{8.34 \times 44 \times 3.49}$ 16 DAYS

SETTLEOMETER				
Time	9:40		:	
	SSV	SSC	SSV	SSC
0	1000			
5	540			
10	440			
15	370			
20	340			
25	320			
30	300			
40	280			
50	270			
60	260			

1 2 3 2.7 3.2 2.7	ATC	1 2 3
~~1 2 3~~ 4 57 120	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 4 0.4 0.4 2.0	ADO	1 2 3 4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST INITIALS: LS DATE: 12/17/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 X	F4 100	R3 X	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.6149	17.7382	19.4265		21.2621		19.6474	21.7418	19.5969	22.0575	21.5347
CRUCIBLE WT.	21.6123	17.7354	19.4258		21.2612		19.5574	21.7170	19.5665	22.0335	21.4913
DIFFERENCE PRE-FURNACE	.0026 52	.0028 56	.0007 7		.0009 9		.0900 18000	.0248 4960	.0304 6080	.0240 4800	.0434 8680
CRUCIBLE WT. + SAMPLE	21.6149	17.7382	19.4265		21.2621		19.6474	21.7418	19.5969	22.0575	21.5347
WT. POST FURNANCE	21.6123	17.7354	19.4258		21.2612		19.5982	21.7270	19.5790	22.0433	21.5008
DIFFERENCE VOLATILE	.0026 52	.0028 56	.0007 7		.0009 9		.0492 9840	.0148 2960	.0179 3580	.0142 2840	.0339 6780
PRE-FURNACE VOLATILE											
FIXED SOLIDS	Ø	Ø	Ø		Ø		8160	2000	2500	1960	1900

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.45
MLSS A2	2.83
MLSS A3	2.22
~~RAS 3~~	—
RAS 4	7.49
WAS	1.25

NOTES	
INF. TEMP:	14.5
A1 pH:	6.9
A2 pH:	6.7
A3 pH:	6.6
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 7.2 NITRATE - 5.47 Ammonia ~~NITRITE~~ - 0.150

A1 5ml ____________

% Removal $\frac{52 - 7}{52}$ x 100 = 87%

% Primary Removal $\frac{52 - 54}{52}$ x 100 =

lb/day RAW 8.34 x 52x287 = 1245

lb/day PRI. 8.34 x 54x287 = 1293

lb/day EFF. 8.34 x 7x287 = 168

MLSS, 8.34 x .467 x 4800 = 18695

SVI $\frac{1000 \times 300}{4800}$ = 63 ml/g

CF $\frac{4800}{2.7}$ = 1778 mg/l/ml

SA $\frac{8.34 \times .467 \times 4800}{8.34 \times 54 \times 287}$ 14 DAYS

SETTLEOMETER				
Time	9:05		:	
	SSV	SSC	SSV	SSC
0	1000			
5	640			
10	490			
15	430			
20	390			
25	360			
30	340			
40	300			
50	290			
60	290			

1 2 3 2.7 3.0 2.7	ATC	1 2 3
~~1~~ ~~2~~ ~~3~~ 4 6.5	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 4 0.4 1.0 2.0	ADO	1 2 3 4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST INITIALS: VO DATE: 12/16/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 X	F4 100	R3 X	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.7592	17.7382	19.4269		22.0347		21.3724	21.2881	19.5955	19.5842	21.6411
CRUCIBLE WT.	21.7563	17.7357	19.4265		22.0333		21.3170	21.2615	19.5664	19.5578	21.6128
DIFFERENCE PRE-FURNACE	.0029 58	.0025 50	.0004 4		.0014 14		.0554 11080	.0266 5320	.0291 5820	.0264 5280	.0283 5660
CRUCIBLE WT. + SAMPLE	21.7592	17.7382	19.4269		22.0347		21.3724	21.2881	19.5955	19.5842	21.6411
WT. POST FURNANCE	21.7563	17.7357	19.4265		20.0333		21.3427	21.2726	19.5864	19.5689	21.6187
DIFFERENCE VOLATILE	.0029 58	.0025 50	.0004 4		.0014 14		.0297 5940	.0155 3100	.0091 1820	.0153 3060	.0224 4480
PRE-FURNACE VOLATILE											
FIXED SOLIDS	Ø	Ø	Ø		Ø		5140	2220	4000	2220	1180

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.35
MLSS A2	2.55
MLSS A3	2.32
~~RAS 3~~	—
RAS 4	4.73
WAS	0.73

NOTES	
INF. TEMP:	14.5
A1 pH:	7.0
A2 pH:	6.8
A3 pH:	6.7
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 6.11 NITRATE - NITRITE -

A1 5ml ____________

% Removal $\frac{58 - 4}{58}$ x 100 = 93%

% Primary Removal $\frac{58 - 50}{58}$ x 100 = 14%

lb/day RAW 8.34 x 58 x 2.41 = 1166

lb/day PRI. 8.34 x 50 x 2.41 = 1005

lb/day EFF. 8.34 x 4 x 2.41 = 80

MLSS, 8.34 x .467 x 5280 = 20564

SVI $\frac{1000 \times 340}{5280}$ = 64 ml/g

CF $\frac{5280}{2.7}$ = 1956 mg/1/ml

SA $\frac{8.34 \times .467 \times 5280}{8.34 \times 50 \times 2.41}$ 20 DAYS

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO

DATE: 12/15/15

SETTLEOMETER				
Time	9:00		:	
	SSV	SSC	SSV	SSC
0	1000			
5	640			
10	500			
15	440			
20	400			
25	370			
30	350			
40	330			
50	300			
60	290			

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 X	F4 100	R3 X	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.4984	21.7191	21.6131		19.4235		22.0926	19.5809	17.7644	21.2876	19.5967
CRUCIBLE WT.	21.4926	21.7173	21.6128		19.4232		22.0342	19.5582	17.7364	21.2622	19.5668
DIFFERENCE PRE-FURNACE	.0058 116	.0018 36	.0003 3		.0003 3		.0584 11680	.0227 4540	.0280 5600	.0254 5080	.0299 5980
CRUCIBLE WT. + SAMPLE	21.4984	21.7191	21.6131		19.4235		22.0926	19.5809	17.7644	21.2876	19.5967
WT. POST FURNANCE	21.4926	21.7173	21.6128		19.4232		22.0620	19.5678	17.7485	21.2732	19.5729
DIFFERENCE VOLATILE	.0058 116	.0018 36	.0003 3		.0003 3		.0306 6120	.0131 2620	.0159 3180	.0144 2880	.0238 4760
PRE-FURNACE VOLATILE											
FIXED SOLIDS	Ø	Ø	Ø		Ø		5560	1920	2420	2200	1220

1 2 3		1 2 3
2.7 3.2 2.5	ATC	
~~1 2 3~~ 4 6.7	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 4 0.4 0.7 1.9	ADO	1 2 3 4

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.29
MLSS A2	2.82
MLSS A3	2.22
~~RAS 3~~	~~—~~
RAS 4	5.35
WAS	0.80

NOTES	
INF. TEMP:	14.6
A1 pH:	6.9
A2 pH:	6.8
A3 pH:	6.6
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 7.55 NITRATE - 5.21 Ammonia ~~NITRITE~~ - 0.563

Al 5ml ____________

% Removal $\frac{116 - 3}{116}$ x 100 = 97%

% Primary Removal $\frac{116 - 36}{116}$ x 100 = 69%

lb/day RAW 8.34 x 116 x 2.78 = 2689

lb/day PRI. 8.34 x 36 x 2.78 = 835

lb/day EFF. 8.34 x 3 x 2.78 = 69

MLSS, 8.34 x .467 x 5080 = 19785

SVI $\frac{1000 \times 350}{5080}$ = 69 ml/g

CF $\frac{5080}{2.5}$ = 2032 mg/l/ml

SA $\frac{8.34 \times .467 \times 36}{8.34 \times 5080 \times 2.78}$ 24 DAYS

SETTLEOMETER				
Time	9:00		:	
	SSV	SSC	SSV	SSC
0	1000			
5	660			
10	540			
15	460			
20	430			
25	390			
30	360			
40	340			
50	310			
60	300			

1 2 3 4.0 3.0 3.0	ATC	1	2	3	
~~1 2 3~~ 4 6.0	RSC	1	2	3	4
1 2 3 4	DOB	1	2	3	4
1 2 3 4 0.4 0.9 1.9	ADO	1	2	3	4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO

DATE: 12/1/9/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 X	F4 100	R3 X	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	22.0371	19.5596	21.7172		19.5668		17.7839	21.5274	19.4543	21.6372	21.2885
CRUCIBLE WT.	22.0334	19.5570	21.7164		19.5659		17.7360	21.4911	19.4262	21.6121	21.2616
DIFFERENCE PRE-FURNACE	.0037 74	.0026 52	.0008 8		.0009 9		.0479 9580	.0363 7260	.0283 5660	.0251 5020	.0269 5380
CRUCIBLE WT. + SAMPLE	22.0371	19.5596	21.7172		19.5668		17.7839	21.5274	19.4545	21.6372	21.2885
WT. POST FURNANCE	22.0337	19.5570	21.7164		19.5659		17.7575	21.5062	19.4384	21.6234	21.2666
DIFFERENCE VOLATILE	.0034 68	.0026 52	.0008 8		.0009 9		.0264 5280	.0212 4240	.0161 3220	.0138 2760	.0219 4380
PRE-FURNACE VOLATILE											
FIXED SOLIDS	6	Ø	Ø		Ø		4300	3020	2440	2260	1000

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
Ø		
50	13/50	13/5
100	14/100	14/100

START: 11:05

FINISH: 11:15

OUT: 11:12

MAGNETITE (mg/L)	
MLSS A1	2.56
MLSS A2	2.26
MLSS A3	2.16
RAS ~~3~~	4.20
~~RAS 4~~	
WAS	0.36

NOTES	
INF. TEMP:	14.8
A1 pH:	6.9
A2 pH:	6.8
A3 pH:	6.7
FINAL EFF AKALINITY	56

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 4.87 NITRATE - Ammonia ~~NITRITE~~ -

Al 5ml ____________

% Removal $\frac{74 - 8}{74}$ x 100 = 89%

% Primary Removal $\frac{74 - 52}{74}$ x 100 = 30%

lb/day RAW 8.34 x 74 x 2.07 = 1278

lb/day PRI. 8.34 x 52 x 2.07 = 898

lb/day EFF. 8.34 x 8 x 2.07 = 138

MLSS, 8.34 x .467 x 5020 = 19552

SVI $\frac{1000 \times 5020}{360}$ = 13944 ml/g

CF $\frac{5020}{3.0}$ = 1673 mg/l/ml

SA $\frac{8.34 \times .467 \times 5020}{8.34 \times 52 \times 2.07}$ 22 DAYS

SETTLEOMETER				
Time	8:55		:	
	SSV	SSC	SSV	SSC
0	1000			
5	650			
10	500			
15	450			
20	400			
25	360			
30	350			
40	330			
50	300			
60	290			

1 2 3		1	2	3
32 25 2.7	ATC			

1 2 3 4		1	2	3	4
1 2 8 4 65	RSC				
	DOB				
0.3 7.8 4.1	ADO				

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST INITIALS: VO DATE: 12/11/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 X	F4 100	R3 X	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	19.5647	17.7378	21.4928		19.4276		21.7672	21.2954	19.5913	20.6357	21.6382
CRUCIBLE WT.	19.5575	17.7355	21.4921		19.4264		21.7174	21.2616	19.5667	20.6125	21.6119
DIFFERENCE PRE-FURNACE	.0072 144	.0023 46	.0007 7		.0012 12		.0498 9960	.0338 6760	.0246 4920	.0232 4640	.0263 5260
CRUCIBLE WT. + SAMPLE	19.5647	17.7378	21.4928		19.4276		21.7672	21.2954	19.5913	20.6357	21.6382
WT. POST FURNANCE	19.5575	17.7355	21.4921		19.4264		21.7398	21.2748	19.5765	20.6219	21.6158
DIFFERENCE VOLATILE	.0072 144	.0023 46	.0007 7		.0012 12		.0274 5480	.0206 4120	.0148 2960	.0138 2760	.0224 4480
PRE-FURNACE VOLATILE											
FIXED SOLIDS	Ø	Ø	Ø		Ø		4480	2640	1960	1880	780

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
START:		
FINISH:		
OUT:		

MAGNETITE (mg/L)	
MLSS A1	2.72
MLSS A2	2.29
MLSS A3	2.34
~~RAS 3~~	
RAS 4	4.70
WAS	0.56

NOTES	
INF. TEMP:	14.6
A1 pH:	6.9
A2 pH:	6.7
A3 pH:	6.6
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 9.51 NITRATE - NITRITE -

Al 5ml ______

% Removal $\frac{144-7}{144}$ x 100 = 95%

% Primary Removal $\frac{144-46}{144}$ x 100 = 68%

lb/day RAW 8.34 x 144x2.11 = 2534

lb/day PRI. 8.34 x 46x2.11 = 809

lb/day EFF. 8.34 x 7x2.11 = 123

MLSS, 8.34 x .467 x4640 = 18072

SVI $\frac{1000 \times 350}{4640}$ = 75 ml/g

CF $\frac{4640}{2.7}$ = 1719 mg/l/ml

SA $\frac{8.34 \times .467 \times 4640}{8.34 \times 46 \times 2.11}$ 22 DAYS

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS:

DATE: 12/01/15

SAMPLES - VOLUME	INF 25	PRI 50	EFF 100	F3 X	F4 100	R3 X	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	16.6023	21.7193	19.5575		21.2627		21.6623	21.5141	19.4552	17.7563	22.0601
CRUCIBLE WT.	16.5812	21.7162	19.5569		21.2611		21.6124	21.4922	19.4260	17.7355	22.0332
DIFFERENCE PRE-FURNACE	.0211 844	.0031 62	.0006 6		.0016 16		.0499 9,980	.0219 4,380	.0292 5,840	.0208 4,160	.0269 5,380
CRUCIBLE WT. + SAMPLE	16.6023	21.7193	19.5575		21.2627		21.6623	21.5141	19.4552	17.7563	22.0601
WT. POST FURNANCE	16.5872	21.7160	19.5563		21.2608		21.6346	21.5014	19.4387	17.7443	22.0377
DIFFERENCE VOLATILE	.0151 604	.0033 66	.0012 12		.0019 19		.0277 5,540	.0127 2,540	.0165 3,300	.012 2,400	.0224 4,480
PRE-FURNACE VOLATILE	844	62	6		16		9,980	4,380	5,840	4,160	5,380
FIXED SOLIDS	—	4	6		3		—	—	—	—	—

SETTLEOMETER

Time	9:20 SSV	SSC	: SSV	SSC
0	1000	3.0		
5	820			
10	690			
15	590			
20	520			
25	480			
30	440			
40	390			
50	360			
60	330			

1 2 3 2.5 3.5 3.0	ATC	1 2 3
1 2 3 4 6.5	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 4 0.3 1.6 2.3	ADO	1 2 3 4

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.04
MLSS A2	2.65
MLSS A3	2.06
RAS 3	—
RAS 4	4.53
WAS	0.54

NOTES	
INF. TEMP:	14.6
A1 pH:	6.9
A2 pH:	6.8
A3 pH:	6.7
FINAL EFF AKALINITY	6.7

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 7.8 NITRATE - 5.6 NITRITE - AMMONIA: 0.709

Al 5ml ________

% Removal $\frac{844-6}{844}$ x 100 = 99%

% Primary Removal $\frac{844-62}{844}$ x 100 = 93%

lb/day RAW 8.34 x 844 x 2.15 = 15[illegible]33

lb/day PRI. 8.34 x 62 x 2.15 = 1112

lb/day EFF. 8.34 x 6 x 2.15 = 108

MLSS, 8.34 x .467 x 4,160 = 16,202

SVI $\frac{1000 \times 440}{4,160}$ = 106 ml/g →

CF $\frac{4,160}{3.0}$ = 1,387 mg/l/ml

SA $\frac{8.34 \times .467 \times 4,160}{8.34 \times 62 \times 2.15}$ 15. DAYS

SETTLEOMETER

Time	9:10 SSV	SSC	: SSV	SSC
0	1000			
5	860			
10	680			
15	580			
20	520			
25	480			
30	440			
40	390			
50	360			
60	340			

1 2 3		1	2	3
2.7 6.0 2.7	ATC			

~~1 2 3~~ 4		1	2	3	4
6.0	RSC				

1 2 3 4		1	2	3	4
	DOB				

1 2 3 4		1	2	3	4
0.3 0.8 1.7	ADO				

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO DATE: 12/19/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 X	F4 100	R3 X	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.2920	21.2631	21.7569		21.5763		19.4732	19.1230	21.0075	16.6019	21.4637
CRUCIBLE WT.	21.2826	21.2607	21.7564		21.5748		19.4258	19.0995	20.9749	16.5811	21.4357
DIFFERENCE PRE-FURNACE	.0094 188	.0024 48	.0005 5		.0015 15		.0474 9480	.0235 4700	.0326 6520	.0208 4160	.0280 5600
CRUCIBLE WT. + SAMPLE	21.2920	21.2631	21.7569		21.5763		19.4732	19.1230	21.0075	16.6019	21.4637
WT. POST FURNANCE	21.2843	21.2607	21.7564		21.5748		19.4470	19.1095	20.9893	16.5904	21.4416
DIFFERENCE VOLATILE	.0077 154	.0024 48	.0005 5		.0015 15		.0262 5240	.0135 2700	.0182 3640	.0115 2300	.0221 4420
PRE-FURNACE VOLATILE											
FIXED SOLIDS	34	Ø	Ø		Ø		4240	2000	2880	1860	1180

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.13
MLSS A2	2.80
MLSS A3	2.12
~~RAS 3~~	
RAS 4	4.25
WAS	0.65

NOTES	
INF. TEMP:	14.6
A1 pH:	7.0
A2 pH:	6.8
A3 pH:	6.7
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 5.28 NITRATE - NITRITE -

A1 5ml ____________

% Removal $\frac{154 - 5}{154} \times 100 =$ 97%

% Primary Removal $\frac{154 - 48}{154} \times 100 -$ 69%

lb/day RAW 8.34 x 154 × 2.16 = 2,774

lb/day PRI. 8.34 x 48 x 2.16 = 865

lb/day EFF. 8.34 x 5 X 2.16 = 90

MLSS, 8.34 x .467 x 4160 = 16 202

SVI $\frac{1000 \times 440}{4160}$ = 106 ml/g

CF $\frac{4160}{2.7}$ = 1541 mg/1/ml

SA $\frac{8.34 \times .467 \times 4160}{8.34 \times 48 \times 2.16}$ 19 DAYS

SETTLEOMETER

Time	9:20		:	
	SSV	SSC	SSV	SSC
0	1000			
5	800			
10	650			
15	570			
20	500			
25	450			
30	430			
40	400			
50	350			
60				

1 2 3	ATC	1 2 3
2.7 5.0 2.7		

~~1 2 3~~ 4	RSC	1 2 3 4
6.5		

1 2 3 4	DOB	1 2 3 4

1 2 3 4	ADO	1 2 3 4
0.3 1.7 2.5		

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS:

DATE: 12/18/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 X	F4 100	R3 X	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.4408	20.9764	17.7354		21.6131		20.6517	21.5149	16.6177	21.7396	19.5827
CRUCIBLE WT.	21.4351	20.9742	17.7346		21.6117		20.6017	21.4911	16.5810	21.7162	19.5566
DIFFERENCE PRE-FURNACE	.0057 114	.0022 44	.0008 8		.0014 14		.0500 10000	.0238 4760	.0367 7340	.0234 4680	.0261 5220
CRUCIBLE WT. + SAMPLE	21.4408	20.9764	17.7354		21.6131		20.6517	21.5149	16.6177	21.7396	19.5827
WT. POST FURNANCE	21.4351	20.9742	17.7346		21.6117		20.6230	21.5002	16.5962	21.7254	19.5604
DIFFERENCE VOLATILE	.0057 114	.0022 44	.0008 8		.0014 14		.0287 5740	.0147 2940	.0215 4300	.0142 2840	.0223 4460
PRE-FURNACE VOLATILE											
FIXED SOLIDS	0	0	0		0		4260	1820	3040	1840	760

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.12
MLSS A2	3.05
MLSS A3	2.01
~~RAS 3~~	—
RAS 4	4.29
WAS	0.49

NOTES	
INF. TEMP:	14.7
A1 pH:	7.0
A2 pH:	6.8
A3 pH:	6.7
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 5.25 NITRATE - ~~NITRITE~~ Ammonia -

A1 5ml ______________

% Removal $\frac{114 - 8}{114}$ x 100 = 93%

% Primary Removal $\frac{114 - 44}{114}$ x 100 = 61%

lb/day RAW 8.34 x 114 x 2.2 = 2092

lb/day PRI. 8.34 x 44 x 2.2 = 807

lb/day EFF. 8.34 x 8 x 2.2 = 147

MLSS, 8.34 x .467 x 4680 = 18228

SVI $\frac{1000 \times 430}{4680}$ = 92 ml/g

CF $\frac{4680}{2.7}$ = 1733 mg/1/ml

SA $\frac{8.34 \times .467 \times 4680}{8.34 \times 44 \times 2.2}$ = 23 DAYS

SETTLEOMETER				
Time	9:20		:	
	SSV	SSC	SSV	SSC
0	1000			
5	800			
10	650			
15	550			
20	500			
25	450			
30	420			
40	380			
50	350			
60	330			

1 2 3		1	2	3	
2.7 3.5 2.7	ATC				

1 2 3 4		1	2	3	4
~~1 2 3~~ 4 6.0	RSC				
1 2 3 4	DOB	1	2	3	4
1 2 3 4 0.2 1.5 3.1	ADO	1	2	3	4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST INITIALS: VO DATE: 12/17/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 X	F4 100	R3 X	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	19.1155	21.4951	21.7169		20.6025		21.6574	19.5788	19.4543	21.5949	16.6072
CRUCIBLE WT.	19.0994	21.4910	21.7164		20.6014		21.6114	19.5571	19.4257	21.5743	16.5809
DIFFERENCE PRE-FURNACE	.0161 322	.0041 82	.0005 5		.0011 11		.0460 9200	.0217 4340	.0286 5720	.0206 4120	.0263 5260
CRUCIBLE WT. + SAMPLE	19.1155	21.4951	21.7169		20.6025		21.6574	19.5788	19.4543	21.5949	16.6072
WT. POST FURNANCE	19.1044	21.4917	21.7164		20.6015		21.6331	19.5670	19.4388	21.5898	16.5860
DIFFERENCE VOLATILE	.0111 222	.0034 68	.0005 5		.0010 10		.0243 4860	.0118 2360	.0155 3100	.0051 1020	.0212 4240
PRE-FURNACE VOLATILE											
FIXED SOLIDS	100	14	0	/	1		4340	1980	2620	3100	1020

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
B	0	0
50	2	2/50
100	8	8/100

START: 12:50

FINISH: 1:00

OUT: 1:00

MAGNETITE (mg/L)	
MLSS A1	2.03
MLSS A2	2.63
MLSS A3	1.80
~~RAS 3~~	
RAS 4	4.05
WAS	0.30

NOTES	
INF. TEMP:	14.8
A1 pH:	6.9
A2 pH:	6.7
A3 pH:	6.7
FINAL EFF AKALINITY	71

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 6.31 NITRATE - 5.99 ~~NITRITE~~ - Ammonia 0.082

A1 5ml ______________

% Removal $\frac{322 - 5}{322}$ x 100 = 98%

% Primary Removal $\frac{322 - 82}{322}$ x 100 = 75

lb/day RAW 8.34 x 322 x 2.2 = 5908

lb/day PRI. 8.34 x 82 x 2.2 = 1504

lb/day EFF. 8.34 x 5 x 2.2 = 92

MLSS. 8.34 x .467 x 4120 = 16046

SVI $\frac{1000 \times 420}{4120}$ = 102 ml/g

CF $\frac{4120}{2.7}$ = 1526 mg/l/ml

SA $\frac{8.34 \times .467 \times 4120}{8.34 \times 82 \times 2.2}$ 11 DAYS

SETTLEOMETER				
Time	9:25		:	
	SSV	SSC	SSV	SSC
0	1000			
5	650			
10	600			
15	540			
20	470			
25	440			
30	400			
40	360			
50	330			
60	320			

1 2 3 / 2.7 2.7 2.5	ATC	1	2	3		
~~1 2 3~~ 4 / 45	RSC	1	2	3	4	
1 2 3 4	DOB	1	2	3	4	
1 2 3 4 / 0.4 2.5 2.9	ADO	1	2	3	4	

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS:

DATE: 12/14/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 X	F4 100	R3 X	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.5762	19.5583	19.4261		21.7169		20.6350	19.1237	16.6007	21.6322	21.5169
CRUCIBLE WT.	21.5743	19.5565	19.4256		21.7160		20.6019	19.1003	16.5804	21.6111	21.4909
DIFFERENCE PRE-FURNACE	.0019 38	.0018 36	.0005 5		.0009 9		.0331 6620	.0234 4680	.0203 4060	.0211 4220	.0260 5200
CRUCIBLE WT. + SAMPLE	21.5762	19.5583	19.4261		21.7169		20.6350	19.1237	16.6007	21.6322	21.5169
WT. POST FURNANCE	21.5743	19.5565	19.4256		21.7160		20.6173	19.1106	16.5895	21.6207	21.4962
DIFFERENCE VOLATILE	.0019 38	.0018 36	.0005 5		.0009 9		.0177 3540	.0131 2620	.0112 2240	.0115 2300	.0207 4140
PRE-FURNACE VOLATILE											
FIXED SOLIDS	Ø	Ø	Ø		Ø		3080	2060	1820	1920	1060

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.13
MLSS A2	2.01
MLSS A3	2.06
~~RAS 3~~	~~—~~
RAS 4	3.25
WAS	0.44

NOTES	
INF. TEMP:	15.1
A1 pH:	6.8
A2 pH:	6.7
A3 pH:	6.6
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 6.8 NITRATE - ~~NITRITE~~ - Ammonia 0.209

Al 5ml ______

% Removal $\frac{38-5}{38} \times 100 =$ 87%

% Primary Removal $\frac{38-36}{38} \times 100 =$ 5%

lb/day RAW 8.34 x 38 x 2.25 = 713

lb/day PRI. 8.34 x 36 x 2.25 = 676

lb/day EFF. 8.34 x 5 x 2.25 = 94

MLSS, 8.34 x .467 x 4220 = 16436

SVI $\frac{1000 \times 400}{4220}$ = 95 ml/g

CF $\frac{4220}{2.5}$ = 1688 mg/l/ml

SA $\frac{8.34 \times .467 \times 4220}{8.34 \times 36 \times 2.25}$ 24 DAYS

SETTLEOMETER				
Time	8:55		:	
	SSV	SSC	SSV	SSC
0	1000			
5	790			
10	690			
15	500			
20	450			
25	430			
30	400			
40	360			
50	340			
60	320			

1	2	3		ATC	1	2	3	
3.0	3.2	2.7						
~~1~~	~~2~~	~~3~~	4	RSC	1	2	3	4
			65					
1	2	3	4	DOB	1	2	3	4
1	2	3	4	ADO	1	2	3	4
0.4	1.4	3.6						

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO

DATE: 12/13/15

SAMPLES - VOLUME	INF 60	PRI 60	EFF 100	F3 X	F4 100	R3 X	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.7183	20.9775	21.4361		16.5826		19.6057	21.6007	21.6352	21.5152	19.4530
CRUCIBLE WT.	21.7165	20.9753	21.4355		16.5818		19.5568	21.5749	21.6114	21.4916	19.4269
DIFFERENCE PRE-FURNACE	.0018 36	.0022 44	.0006 6		.0008 8		.0489 9780	.0258 5160	.0238 4760	.0236 4720	.0261 5220
CRUCIBLE WT. + SAMPLE	21.7183	20.9775	21.4361		16.5826		19.6057	21.6007	21.6352	21.5152	19.4530
WT. POST FURNANCE	21.7165	20.9753	21.4355		16.5818		19.5791	21.5859	21.6218	21.5018	19.4317
DIFFERENCE VOLATILE	.0018 36	.0022 44	.0006 6		.0008 8		.0266 5320	.0148 2960	.0134 2680	.0134 2680	.0213 4260
PRE-FURNACE VOLATILE											
FIXED SOLIDS	0	0	0		0		4460	2200	2080	2040	960

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.26
MLSS A2	2.28
MLSS A3	2.12
~~RAS 3~~	—
RAS 4	4.43
WAS	0.52

NOTES	
INF. TEMP:	15.0
A1 pH:	6.9
A2 pH:	6.8
A3 pH:	6.7
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 6.77 NITRATE - Ammonia ~~NITRITE~~ - 0.356

A1 5ml ______________

% Removal $\frac{48 - 3}{48}$ x 100 = 94%

% Primary Removal $\frac{48 - 30}{48}$ x 100 = 38%

lb/day RAW 8.34 x 48 x 2.45 = 981

lb/day PRI. 8.34 x 30 x 2.45 = 613

lb/day EFF. 8.34 x 3 x 2.45 = 61

MLSS, 8.34 x .467 x 4040 = 15735

SVI $\frac{1000 \times 400}{4040}$ = 99 ml/g

CF $\frac{4040}{2.5}$ = 1616 mg/l/ml

SA $\frac{8.34 \times .467 \times 4040}{8.34 \times 30 \times 2.45}$ 26 DAYS

SETTLEOMETER

Time	9:15		:	
	SSV	SSC	SSV	SSC
0	1000			
5	780			
10	620			
15	550			
20	490			
25	430			
30	400			
40	360			
50	340			
60	320			

1 2 3	ATC	1 2 3
2.5 3.5 2.5		

~~1 2 3~~ 4	RASC	1 2 3 4
6.0		

1 2 3 4	DOB	1 2 3 4

1 2 3 4	ADO	1 2 3 4
0.4 1.0 2.6		

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO

DATE: 12/12/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 X	F4 100	R3 X	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.7193	21.4374	19.5578		21.4926		22.0777	17.7576	21.5994	21.6320	21.3174
CRUCIBLE WT.	21.7169	21.4359	19.5575		21.4919		22.0335	17.7353	21.5753	21.6118	21.2917
DIFFERENCE PRE-FURNACE	.0024 48	.0015 30	.0003 3		.0007 7		.0442 8840	.0223 4460	.0241 4820	.0202 4040	.0257 5140
CRUCIBLE WT. + SAMPLE	21.7193	21.4374	19.5578		21.4926		22.0777	17.7576	21.5994	21.6320	21.3174
WT. POST FURNANCE	21.7169	21.4359	19.5575		21.4919		22.0528	17.7441	21.5848	21.6198	21.2954
DIFFERENCE VOLATILE	.0024 48	.0015 30	.0003 3		.0007 7		.0249 4980	.0135 2700	.0146 2920	.0122 2440	.0220 4400
PRE-FURNACE VOLATILE											
FIXED SOLIDS	Ø	Ø	Ø		Ø		3860	1760	1900	1600	740

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	1.85
MLSS A2	2.12
MLSS A3	1.87
~~RAS 3~~	~~~
RAS 4	3.29
WAS	0.32

NOTES	
INF. TEMP:	15.4
A1 pH:	6.9
A2 pH:	6.7
A3 pH:	6.6
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 7.15 NITRATE - Ammonia ~~NITRITE~~ - 0.896

SETTLEOMETER				
Time	9:30		:	
	SSV	SSC	SSV	SSC
0	1000			
5	800			
10	680			
15	580			
20	520			
25	480			
30	450			
40	400			
50	370			
60	350			

1 2 3 3.0 3.0 2.5			A T C	1	2	3
~~1~~ 2 ~~3~~ 4			R S C	1 2	3	4
1 2 3 4			D O B	1 2	3	4
1 2 3 4 0.3 1.7 2.8			A D O	1 2	3	4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO

DATE: 12/1/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 ╳	F4 100	R3 ╳	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.2559	20.9770	20.6020		21.2828		19.1419	21.7774	16.6046	19.5869	19.4528
CRUCIBLE WT.	21.2508	20.9748	20.6014		21.2820		19.0990	21.7560	16.5812	19.5655	19.4258
DIFFERENCE PRE-FURNACE	.0051 102	.0022 44	.0006 6		.0008 8		.0429 8580	.0214 4280	.0234 4680	.0214 4280	.0270 5400
CRUCIBLE WT. + SAMPLE	21.2559	20.9770	20.6020		21.2828		19.1419	21.7774	16.6046	19.5869	19.4528
WT. POST FURNANCE	21.2508	20.9748	20.6014		21.2820		19.1187	21.7648	16.5911	19.5748	19.4308
DIFFERENCE VOLATILE	.0051 102	.0022 44	.0006 6		.0008 8		.0232 4640	.0126 2520	.0135 2700	.0121 2420	.0220 4400
PRE-FURNACE VOLATILE											
FIXED SOLIDS	Ø	Ø	Ø		Ø		3940	1760	1980	1860	1000

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
B	0	
50	2	2/50
100	20	20/100

START: 11:15

FINISH: 11:25

OUT: 11:30

MAGNETITE (mg/L)	
MLSS A1	1.98
MLSS A2	1.56
MLSS A3	1.90
~~RAS 3~~	—
RAS 4	3.89
WAS	0.38

NOTES	
INF. TEMP:	15.2
A1 pH:	6.9
A2 pH:	6.8
A3 pH:	6.5
FINAL EFF AKALINITY	52

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 6.66 NITRATE - 5.40 Ammonia ~~NITRITE~~ - 0.415

A1 5ml ________

% Removal $\frac{102 - 6}{102}$ x 100 = 94%

% Primary Removal $\frac{102 - 44}{102}$ x 100 = 57%

lb/day RAW 8.34 x 102 x 2.38 = 2024

lb/day PRI. 8.34 x 44 x 2.38 = 873

lb/day EFF. 8.34 x 6 x 2.38 = 119

MLSS. 8.34 x .467 x 4280 = 16,670

SVI $\frac{1000 \times 450}{4280}$ = 105 ml/g →

CF $\frac{4280}{2.5}$ = 1712 mg/l/ml

SA $\frac{8.34 \times .467 \times 4280}{8.34 \times 44 \times 2.38}$ 19 DAYS

SETTLEOMETER				
Time	9:20		:	
	SSV	SSC	SSV	SSC
0	1000			
5	800			
10	650			
15	550			
20	500			
25	460			
30	420			
40	390			
50	350			
60	340			

1	2	3		A T C	1	2	3	
2.7	3.0	2.5						
~~1~~	~~2~~	~~3~~	4	R S C	1	2	3	4
			7.0					
1	2	3	4	D O B	1	2	3	4
1	2	3	4	A D O	1	2	3	4
0.2	3.75	7						

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST INITIALS: VO DATE: 11/30/15

SAMPLES - VOLUME	INF 50	PRI 50	~~EFF~~ F4 100	F3 X	~~F4~~ EFF 100	R3 X	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.7649	21.2849	16.5820		20.9759		20.6521	19.5861	19.4487	19.1192	21.2761
CRUCIBLE WT.	21.7552	21.2823	16.5812		20.9748		20.6018	19.5653	19.4255	19.0991	21.2507
DIFFERENCE PRE-FURNACE	.0097 194	.0026 52	.0008 8		.0011 11		.0503 10060	.0208 4160	.0232 4640	.0201 4020	.0254 5080
CRUCIBLE WT. + SAMPLE	21.7649	21.2849	16.5820		20.9759		20.6521	19.5861	19.4487	19.1192	21.2761
WT. POST FURNANCE	21.7576	21.2830	16.5814		20.9750		20.6250	19.5746	19.4361	19.1083	21.2567
DIFFERENCE VOLATILE	.0073 146	.0019 38	.0006 6		.0009 9		.0271 5420	.0115 2300	.0126 2520	.0109 2180	.0194 3880
PRE-FURNACE VOLATILE											
FIXED SOLIDS	48	14	2		2		4640	1860	2120	1840	1200

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	1.85
MLSS A2	1.83
MLSS A3	1.80
~~RAS 3~~	~~—~~
RAS 4	4.25
WAS	0.66

NOTES	
INF. TEMP:	15.4
A1 pH:	6.96
A2 pH:	6.77
A3 pH:	6.72
FINAL EFF AKALINITY	56

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 5.4 NITRATE - ~~NITRITE~~ -

Ammonia NH_3 = 0.063 mg/L

Al 5ml ____________

% Removal $\frac{194-11}{194}$ x 100 = 94%

% Primary Removal $\frac{194-52}{194}$ x 100 = 73%

lb/day RAW 8.34 x 194 x 2.3 = 3721

lb/day PRI. 8.34 x 52 x 2.3 = 997

lb/day EFF. 8.34 x 11 x 2.3 = 211

MLSS, 8.34 x .467 x 4020 = 15657

SVI $\frac{1000 \times 420}{4020}$ = 105 ml/g →

CF $\frac{4020}{2.5}$ = 1608 mg/1/ml

SA $\frac{8.34 \times .467 \times 4020}{8.34 \times 52 \times 2.3}$ 16 DAYS

SETTLEOMETER				
Time	9:10		:	
	SSV	SSC	SSV	SSC
0	1000			
5	550			
10	460			
15	410			
20	380			
25	350			
30	330			
40	300			
50	290			
60	280			

1 2 3			ATC	1	2	3
2.7	3.0	2.7				

~~1 2 3~~ 4	RSC	1	2	3	4
6.5					

1	2	3	4	DOB	1	2	3	4

1	2	3	4	ADO	1	2	3	4
0.3	1.6	3.2						

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS:

DATE: 11 /25/ 15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 X	F4 100	R3 X	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	20.6031	21.2852	19.0998		16.5825		21.3016	19.5879	19.4509	20.9945	21.7854
CRUCIBLE WT.	20.6011	21.2825	19.0988		16.5810		21.2503	19.5661	19.4257	20.9747	21.7557
DIFFERENCE PRE-FURNACE	.0020 40	.0027 54	.0010 10		.0015 15		.0513 10260	.0218 4360	.0252 5040	.0198 3960	.0297 5940
CRUCIBLE WT. + SAMPLE	20.6031	21.2852	19.0998		16.5825		21.3016	19.5879	19.4509	20.9945	21.7854
WT. POST FURNANCE	20.6013	21.2827	19.0988		16.5810		21.2751	19.5760	19.4372	20.9840	21.7617
DIFFERENCE VOLATILE	.0018 36	.0025 50	.0010 10		.0015 15		.0265 5300	.0119 2380	.0137 2740	.0105 2100	.0237 4740
PRE-FURNACE VOLATILE											
FIXED SOLIDS	4	4	0		0		4960	1980	2300	1860	1200

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.03
MLSS A2	2.25
MLSS A3	2.00
~~RAS 3~~	
RAS 4	4.58
WAS	0.36

NOTES	
INF. TEMP:	15.6
A1 pH:	7.0
A2 pH:	6.8
A3 pH:	6.6
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 7.78 NITRATE - 6.87 Ammonia ~~NITRITE~~ - .0113

A1 5ml ______________

% Removal $\frac{40 - 10}{40}$ x 100 = 75%

% Primary Removal $\frac{40 - 54}{40}$ x 100 =

lb/day RAW 8.34 x 40 x 2.77 = 924

lb/day PRI. 8.34 x 54 x 2.77 = 1247

lb/day EFF. 8.34 x 10 x 2.77 = 231

MLSS, 8.34 x .467 x 3960 = 15423

SVI $\frac{1000 \times 330}{3960}$ = 83 ml/g

CF $\frac{3960}{2.7}$ = 1467 mg/l/ml

SA $\frac{8.34 \times .467 \times 3960}{8.34 \times 54 \times 2.77}$ 12 DAYS

SETTLEOMETER				
Time	9:00		:	
	SSV	SSC	SSV	SSC
0	1000			
5	530			
10	430			
15	370			
20	350			
25	310			
30	300			
40	270			
50	260			
60	250			

1 2 3 2.7 4.5 2.7	ATC	1 2 3
~~1 2 3~~ 4 7.0	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 4 0.4 1.2 4.1	ADO	1 2 3 4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST INITIALS: VO DATE: 11/24/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 X	F4 100	R3 X	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.6133	19.5681	21.7571		21.2516		21.6029	16.6029	20.6337	21.3043	19.1277
CRUCIBLE WT.	21.6119	19.5659	21.7561		21.2503		21.5751	16.5813	20.6020	21.2827	19.0995
DIFFERENCE PRE-FURNACE	.0014 28	.0022 44	.0010 10		.0013 13		.0278 5560	.0216 4320	.0317 6340	.0216 4320	.0282 5640
CRUCIBLE WT. + SAMPLE	21.6133	19.5681	21.7571		21.2516		21.6029	16.6029	20.6337	21.3043	19.1277
WT. POST FURNANCE	21.6119	19.5659	21.7561		21.2503		21.5888	16.5919	20.6169	21.2933	19.1060
DIFFERENCE VOLATILE	.0014 28	.0022 44	.0010 10		.0013 13		.0141 2820	.0110 2200	.0168 3360	.0110 2200	.0217 4340
PRE-FURNACE VOLATILE											
FIXED SOLIDS	Ø	Ø	Ø		Ø		2740	2120	2980	2120	1300

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
B	Ø	0
50	1	1/50
100	3	3/100

START: 12:50

FINISH: 1:00

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.18
MLSS A2	2.80
MLSS A3	2.03
~~RAS 3~~	—
RAS 4	5.43
WAS	0.48

NOTES	
INF. TEMP:	15.6
A1 pH:	6.9
A2 pH:	6.7
A3 pH:	6.6
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 9.19 NITRATE - 6.98 Ammonia ~~NITRITE~~ - 0.698

A1 5ml ______________

% Removal $\frac{28 - 10}{28}$ x 100 = 64%

% Primary Removal $\frac{28 - 44}{44}$ x 100 =

lb/day RAW 8.34 x 28 x 2.86 = 668

lb/day PRI. 8.34 x 44 x 2.86 = 1050

lb/day EFF. 8.34 x 10 x 2.86 = 239

MLSS, 8.34 x .467 x 4320 = 16825

SVI $\frac{1000 \times 300}{4320}$ = 69 ml/g

CF $\frac{4320}{2.5}$ = 1600 mg/l/ml

SA $\frac{8.34 \times .467 \times 4320}{8.34 \times 44 \times 2.86}$ = 16 DAYS

SETTLEOMETER				
Time	9:05		:	
	SSV	SSC	SSV	SSC
0	1000			
5	520			
10	410			
15	360			
20	330			
25	310			
30	300			
40	270			
50	260			
60	250			

1 2 3 2.7 2.7 2.7	ATC	1	2	3	
~~1 2 3~~ 4 7.0	RSC	1	2	3	4
1 2 3 4	DOB	1	2	3	4
1 2 3 4 0.4 0.9 2.5	ADO	1	2	3	4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST INITIALS: VO DATE: 11/23/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 ✕	F4 100	R3 ✕	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	19.5680	19.1019	16.5817		21.6128		21.8063	20.6231	21.2722	21.5958	21.3121
CRUCIBLE WT.	19.5661	19.0995	16.5808		21.6119		21.7562	20.6014	21.2503	21.5755	21.2827
DIFFERENCE PRE-FURNACE	.0019 38	.0024 48	.0009 9		.0009 9		.0501 10020	.0217 4340	.0219 4380	.0203 4060	.0294 5880
CRUCIBLE WT. + SAMPLE	19.5680	19.1019	16.5817		21.6128		21.8063	20.6231	21.2722	21.5958	21.3121
WT. POST FURNANCE	19.5661	19.0995	16.5808		21.6119		21.7804	20.6114	21.2606	21.5850	21.2887
DIFFERENCE VOLATILE	.0019 38	.0024 48	.0009 9		.0009 9		.0259 5180	.0117 2340	.0116 2320	.0108 2160	.0234 4680
PRE-FURNACE VOLATILE											
FIXED SOLIDS	Ø	Ø	Ø		Ø		4840	2000	2060	1900	1200

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
B	No Good	
50		
100	Bag Floating.	

START: 12:55

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.00
MLSS A2	2.05
MLSS A3	1.96
~~RAS 3~~	~~—~~
RAS 4	4.84
WAS	0.40

NOTES	
INF. TEMP:	15.6
A1 pH:	6.9
A2 pH:	6.7
A3 pH:	6.6
FINAL EFF AKALINITY	57

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 7.29 NITRATE - 5.53 ~~NITRITE~~ Ammonia - 0.245

A1 5ml ____________

% Removal $\frac{38 - 9}{38}$ x 100 = 76%

% Primary Removal $\frac{38 - 48}{38}$ x 100 =

lb/day RAW 8.34 x 38 x 3.15 = 998

lb/day PRI. 8.34 x 48 x 3.15 = 1261

lb/day EFF. 8.34 x 9 x 3.15 = 236

MLSS. 8.34 x .467 x 4060 = 15813

SVI $\frac{1000 \times 300}{4060}$ = 74 ml/g

CF $\frac{4060}{2.7}$ = 1504 mg/1/ml

SA $\frac{8.34 \times .467 \times 4060}{8.34 \times 48 \times 3.15}$ 13 DAYS

SETTLEOMETER				
Time	9:05		:	
	SSV	SSC	SSV	SSC
0	1000			
5	500			
10	420			
15	350			
20	330			
25	310			
30	300			
40	270			
50	250			
60	250			

1 2 3			ATC	1	2	3	
2.7	2.7	2.7					
~~1~~	~~2~~	~~3~~	4 RSC	1	2	3	4
			7.5				
1 2 3 4			DOB	1	2	3	4
1 2 3 4			ADO	1	2	3	4
0.4 2.2 4.3							

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO DATE: 11/20/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3	F4 100	R3	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	19.5690	21.6147	19.1005		21.5767		21.3120	16.6061	21.3084	20.6267	21.7891
CRUCIBLE WT.	19.5659	21.6117	19.0996		21.5752		21.2505	16.5810	21.2828	20.6020	21.7559
DIFFERENCE PRE-FURNACE	.0031 62	.0030 60	.0009 9		.0015 15		.0615 12300	.0251 5020	.0256 5120	.0247 4940	.0332 6640
CRUCIBLE WT. + SAMPLE	19.5690	21.6147	19.1005		21.5767		21.3120	16.6061	21.3084	20.6267	21.7891
WT. POST FURNANCE	19.5659	21.6117	19.0996		21.5752		21.2808	16.5924	21.2945	20.6135	21.7627
DIFFERENCE VOLATILE	.0031 62	.0030 60	.0009 9		.0015 15		.0312 6240	.0137 2740	.0139 2780	.0132 2640	.0264 5280
PRE-FURNACE VOLATILE											
FIXED SOLIDS	0	0	0		0		6060	2280	2340	2300	1360

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.58
MLSS A2	2.60
MLSS A3	2.45
~~RAS 3~~	—
RAS 4	6.18
WAS	0.63

NOTES	
INF. TEMP:	16.1
A1 pH:	6.9
A2 pH:	6.5
A3 pH:	6.5
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 9.23 NITRATE - 8.46 Ammonia ~~NITRITE~~ - .09

[illegible]

A1 5ml ______________

% Removal $\frac{62 - 9}{62} \times 100 = 85\%$

% Primary Removal $\frac{62 - 60}{62} \times 100 = 3\%$

lb/day RAW $8.34 \times 62 \times 2.5 = 1293$

lb/day PRI. $8.34 \times 60 \times 2.5 = 1251$

lb/day EFF. $8.34 \times 9 \times 2.5 = 188$

MLSS, $8.34 \times .467 \times 4940 = 19240$

SVI $\frac{1000 \times 300}{4940} = 61$ ml/g

CF $\frac{4940}{2.7} = 1830$ mg/l/ml

SA $\frac{8.34 \times .467 \times 4940}{8.34 \times 60 \times 2.5}$ 15 DAYS

SETTLEOMETER

Time	8:55		:	
	SSV	SSC	SSV	SSC
0	1000			
5	550			
10	450			
15	400			
20	360			
25	350			
30	320			
40	300			
50	290			
60	280			

1 2 3 / 3.0 5.0 3.0	ATC	1	2	3
~~1 2 3~~ 4 / 8.0	RSC	1 2	3	4
1 2 3 4	DOB	1 2	3	4
1 2 3 4 / 0.4 1.2 3.6	ADO	1 2	3	4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST INITIALS: VO DATE: 11 17/19 15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3	F4 100	RAS 5	A1 5	A2 5	A3 5	WAS 5	
CRUCIBLE WT. + SAMPLE	19.4296	19.1022	21.7168		22.0338	21.3140	16.6092	21.6116	21.2882	20.6319	
CRUCIBLE WT.	19.4264	19.0991	21.7162		22.0331	21.2500	16.5816	21.5746	21.2612	20.6020	
DIFFERENCE PRE-FURNACE	.0032 64	.0031 62	.0006 6		.0007 7	.0064 12800	.0276 5520	.0370 7400	.0270 5400	.0299 5980	
CRUCIBLE WT. + SAMPLE	19.4296	19.1022	21.7168		22.0338	21.3140	16.6092	21.6116	21.2882	20.6319	
WT. POST FURNANCE	19.4264	19.0991	21.7162		22.0331	21.2810	16.5934	21.5908	21.2727	20.6067	
DIFFERENCE VOLATILE	.0032 64	.0031 62	.0006 6		.0007 7	.0330 6600	.0158 3160	.0208 4160	.0155 3100	.0252 5040	
PRE-FURNACE VOLATILE											
FIXED SOLIDS	0	0	0		0	6200	2360	3240	2300	940	

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.72
MLSS A2	3.72
MLSS A3	2.74
~~RAS 3~~	—
RAS 4	6.40
WAS	0.49

NOTES	
INF. TEMP:	16.4
A1 pH:	7.0
A2 pH:	6.8
A3 pH:	6.7
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 7.45 NITRATE - 7.06 ~~NITRITE~~ Ammonia - 0.222

A1 5ml ______________

% Removal $\frac{64 - 6}{64}$ x 100 = 91 %

% Primary Removal $\frac{64 - 62}{64}$ x 100 = 3 %

lb/day RAW 8.34 x 64 x 2.01 = 1073

lb/day PRI. 8.34 x 62 x 2.01 = 1039

lb/day EFF. 8.34 x 6 x 2.01 = 101

MLSS, 8.34 x .467 x 5400 = 21,032

SVI $\frac{1000 \times 320}{5400}$ = 59 ml/g

CF $\frac{5400}{3.0}$ = 1800 mg/l/ml

SA $\frac{8.34 \times .467 \times 5400}{8.34 \times 62 \times 2.01}$ 20 DAYS

SETTLEOMETER

Time	9:05 SSV	SSC	: SSV	SSC
0	1000			
5	510			
10	410			
15	360			
20	340			
25	310			
30	300			
40	280			
50	270			
60	260			

1 2 3		1 2 3
30 40 30	ATC	

1 2 3 4		1 2 3 4
~~1 2 3~~ 50	RSC	

1 2 3 4		1 2 3 4
	DOB	

1 2 3 4		1 2 3 4
0.5 1.4 2.7	ADO	

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO

DATE: 11 /18/ 15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3	F4 100	R3	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	16.5838	21.4935	21.2510		20.6020		21.6301	21.7416	19.4590	21.2838	22.0591
CRUCIBLE WT.	16.5809	21.4912	21.2502		20.6015		21.5741	21.7161	19.4256	21.2601	22.0325
DIFFERENCE PRE-FURNACE	.0029 58	.0023 46	.0008 8		.0005 5		.0560 11200	.0255 5100	.0334 6680	.0237 4740	.0266 5320
CRUCIBLE WT. + SAMPLE	16.5838	21.4935	21.2510		20.6020		21.6301	21.7416	19.4590	21.2838	22.0591
WT. POST FURNANCE	16.5809	21.4912	21.2502		20.6015		21.6019	21.7279	19.4410	21.2710	22.0373
DIFFERENCE VOLATILE	.0029 58	.0023 46	.0008 8		.0005 5		.0282 5640	.0137 2740	.0180 3600	.0128 2560	.0218 4360
PRE-FURNACE VOLATILE											
FIXED SOLIDS	Ø	Ø	Ø		Ø		5560	2360	3080	2180	960

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.56
MLSS A2	3.20
MLSS A3	2.36
~~RAS 3~~	—
RAS 4	5.21
WAS	0.38

NOTES	
INF. TEMP:	16.5
A1 pH:	6.9
A2 pH:	6.8
A3 pH:	6.7
FINAL EFF AKALINITY	56

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 5.31 NITRATE - 4.39 Amonia ~~NITRITE~~ - 0.089

Al 5ml ____________

% Removal $\frac{58 - 8}{58} \times 100 =$ 86%

% Primary Removal $\frac{58 - 46}{58} \times 100 =$ 20%

lb/day RAW 8.34 x 58 x 1.99 = 963

lb/day PRI. 8.34 x 46 x 1.99 = 763

lb/day EFF. 8.34 x 8 x 1.99 = 133

MLSS, 8.34 x .467 x 4740 = 18 461

SVI $\frac{1000 \times 300}{4740}$ = 63 ml/g

CF $\frac{4740}{3.0}$ = 1580 mg/l/ml

SA $\frac{8.34 \times .467 \times 4740}{8.34 \times 46 \times 1.99}$ 24 DAYS

SETTLEOMETER				
Time	8:55		:	
	SSV	SSC	SSV	SSC
0	1000			
5	490			
10	390			
15	350			
20	320			
25	300			
30	280			
40	270			
50	250			
60	250			

1	2	3		ATC	1	2	3	
25	32	27						
~~1~~	~~2~~	~~3~~	4	RSC	1	2	3	4
			6.5					
1	2	3	4	DOB	1	2	3	4
1	2	3	4	ADO	1	2	3	4
0.4	0.6	2.4						

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO DATE: 11 / 17 / 15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3	F4 100	R3	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.2524	21.2631	20.9755		16.5817		21.6194	21.5158	19.4551	19.1218	21.7438
CRUCIBLE WT.	21.2502	21.2609	20.9751		16.5812		21.5752	21.4916	19.4268	19.0998	21.7167
DIFFERENCE PRE-FURNACE	.0022 44	.0022 44	.0004 4		.0005 5		.0442 8840	.0242 4840	.0283 5660	.0220 4400	.0271 5420
CRUCIBLE WT. + SAMPLE	21.2524	21.2631	20.9755		16.5817		21.6194	21.5158	19.4551	19.1218	21.7438
WT. POST FURNANCE	21.2502	21.2609	20.9751		16.5812		21.5969	21.5032	19.4404	19.1106	21.7221
DIFFERENCE VOLATILE	.0022 44	.0022 44	.0004 4		.0005 5		.0225 4500	.0126 2520	.0147 2940	.0112 2240	.0217 4340
PRE-FURNACE VOLATILE											
FIXED SOLIDS	0	0	0		0		4340	2320	2720	2160	1080

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
START:		
FINISH:		
OUT:		

MAGNETITE (mg/L)	
MLSS A1	2.35
MLSS A2	2.72
MLSS A3	2.22
~~RAS 3~~	—
RAS 4	4.05
WAS	0.45

NOTES	
INF. TEMP:	16.7
A1 pH:	6.9
A2 pH:	6.8
A3 pH:	6.6
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 10.6 NITRATE - 5.96 ~~NITRITE~~ Amonia - 0.161

A1 5ml ______________

% Removal $\frac{44 - 4}{44}$ x 100 = 90

% Primary Removal $\frac{44 - 44}{44}$ x 100 = 0

lb/day RAW 8.34 x 44 x 1.98 = 727

lb/day PRI. 8.34 x 44 x 1.98 = 727

lb/day EFF. 8.34 x 4 x 1.98 = 66

MLSS, 8.34 x .467 x 4400 = 17137

SVI $\frac{1000 \times 280}{4400}$ = 64 ml/g

CF $\frac{4400}{2.7}$ = 1630 mg/l/ml

SA $\frac{8.34 \times .467 \times 4400}{8.34 \times 44 \times 1.98}$ 24 DAYS

SETTLEOMETER				
Time	9:05		:	
	SSV	SSC	SSV	SSC
0	1000			
5	450			
10	360			
15	330			
20	300			
25	280			
30	270			
40	250			
50	250			
60	240			

1 2 3	ATC	1	2	3
27 3.2 2.5				

~~1 2 3~~ 4	RSC	1	2	3	4
6.5					

1 2 3 4	DOB	1	2	3	4

1 2 3 4	ADO	1	2	3	4
0.4 1.4 2.3					

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS:

DATE: 11/16/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3	F4 100	R3	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	22.0385	20.9773	21.7171		19.4265		21.6242	21.5142	21.2883	19.1210	16.6093
CRUCIBLE WT.	22.0330	20.9749	21.7165		19.4256		21.5747	21.4912	21.2602	19.0998	16.5810
DIFFERENCE PRE-FURNACE	.0055 110	.0024 48	.0006 6		.0009 9		.0495 9900	.0230 4600	.0281 5620	.0212 4240	.0283 5660
CRUCIBLE WT. + SAMPLE	22.0385	20.9773	21.7171		19.4265		21.6242	21.5142	21.2883	19.1210	16.6093
WT. POST FURNANCE	22.0333	20.9749	21.7165		19.4256		21.5991	21.5017	21.2733	19.1096	16.5862
DIFFERENCE VOLATILE	.0052 104	.0024 48	.0006 6		.0009 9		.0251 5020	.0125 2500	.0150 3000	.0114 2280	.0231 4620
PRE-FURNACE VOLATILE											
FIXED SOLIDS	6	0	0		0		4880	2100	2620	1960	1040

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
5	0	
50	6	
100	8	

START: 10:40

FINISH: 10:50

OUT: 10:30

MAGNETITE (mg/L)	
MLSS A1	2.36
MLSS A2	2.82
MLSS A3	2.70
~~RAS 3~~	
RAS 4	5.00
WAS	0.48

NOTES	
INF. TEMP:	16.7
A1 pH:	6.9
A2 pH:	6.7
A3 pH:	6.6
FINAL EFF AKALINITY	56

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 8.56 NITRATE - 6.12 Amonia ~~NITRITE~~ - 0.134

Al 5ml ____________

% Removal $\frac{110 - 6}{110} \times 100 =$ 95%

% Primary Removal $\frac{110 - 48}{110} \times 100 =$ 56%

lb/day RAW 8.34 x 110 x 2.08 = 1908

lb/day PRI. 8.34 x 48 x 2.08 = 833

lb/day EFF. 8.34 x 6 x 2.08 = 104

MLSS, 8.34 x .467 x 4240 = 16514

SVI $\frac{1000 \times 270}{4240} =$ 64 ml/g

CF $\frac{4240}{2.5} =$ 1696 mg/l/ml

SA $\frac{8.34 \times .467 \times 4240}{8.34 \times 48 \times 2.08}$ 20 DAYS

SETTLEOMETER				
Time	9:05		:	
	SSV	SSC	SSV	SSC
0	1000			
5	390			
10	310			
15	280			
20	250			
25	240			
30	230			
40	220			
50	210			
60	200			

1	2	3		ATC	1	2	3	
2.2	8.0	2.7						
~~1~~	~~2~~	~~3~~	4	RSC	1	2	3	4
			4.6					
1	2	3	4	DOB	1	2	3	4
1	2	3	4	ADO	1	2	3	4
0.4	0.8		1.4					

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS:

DATE: 11/13/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3	F4 100	R3	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.4925	19.1019	19.4266		16.5815		22.0625	20.9962	21.3278	21.5959	21.7440
CRUCIBLE WT.	21.4910	19.0999	19.4263		16.5809		22.0334	20.9749	21.2617	21.5252	21.7172
DIFFERENCE PRE-FURNACE	.0015 30	.0020 40	.0003 3		.0006 6		.0291 5820	.0213 4260	.0661 13220	.0207 4140	.0268 5360
CRUCIBLE WT. + SAMPLE	21.4925	19.1019	19.4266		16.5815		22.0625	20.9962	21.3278	21.5959	21.7440
WT. POST FURNANCE	21.4910	19.099	19.4263		16.5809		22.0473	20.9851	21.2915	21.5854	21.7228
DIFFERENCE VOLATILE	.0015 30	.0020 40	.0003 3		.0006 6		.0152 3040	.0111 2220	.0363 7260	.0105 2100	.0212 4240
PRE-FURNACE VOLATILE											
FIXED SOLIDS	Ø	Ø	Ø		Ø		2780	2040	5960	2040	1120

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
START:		
FINISH:		
OUT:		

MAGNETITE (mg/L)	
MLSS A1	2.25
MLSS A2	5.65
MLSS A3	2.04
~~RAS 3~~	—
RAS 4	3.30
WAS	0.48

NOTES	
INF. TEMP:	16.9
A1 pH:	6.8
A2 pH:	6.7
A3 pH:	6.5
FINAL EFF AKALINITY	48

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 8.50 NITRATE - 7.45 Amonia ~~NITRITE~~ - 0.687

Influent NH3-N = 21

20:1 Ratio

Al 5ml ___________

% Removal $\frac{30 - 3}{30}$ x 100 = 90

% Primary Removal $\frac{30 - 40}{30}$ x 100 =

lb/day RAW 8.34 x 30 x 2.3 = 575

lb/day PRI. 8.34 x 40 x 2.3 = 767

lb/day EFF. 8.34 x 3 x 2.3 = 58

MLSS, 8.34 x .467 x 4140 = 16124

SVI $\frac{1000 \times 230}{4140}$ = 56 ml/g

CF $\frac{4140}{2.7}$ = 1533 mg/l/ml

SA $\frac{8.34 \times .467 \times 4140}{8.34 \times 40 \times 2.3}$ 21 DAYS

SETTLEOMETER				
Time	9:20		:	
	SSV	SSC	SSV	SSC
0	1000			
5	420			
10	320			
15	290			
20	260			
25	250			
30	250			
40	240			
50	230			
60	230			

1 2 3		1	2	3	
2.5 4.0 2.7	ATC				
~~1 2 3~~ 4 6.0	RSC	1	2	3	4
1 2 3 4	DOB	1	2	3	4
1 2 3 4 0.4 0.7 2.1	ADO	1	2	3	4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO

DATE: 11/12/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3	F4 100	R3	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.5781	21.2531	19.1006		20.6027		16.6278	19.4465	21.5246	22.0561	21.0005
CRUCIBLE WT.	21.5750	21.2507	19.1002		20.6019		16.5816	19.4266	21.4914	22.0337	20.9750
DIFFERENCE PRE-FURNACE	.0031 62	.0024 48	.0004 4		.0008 8		.0462 9240	.0199 3980	.0332 6640	.0224 4480	.0255 5100
CRUCIBLE WT. + SAMPLE	21.5781	21.2531	19.1006		20.6027		16.6278	19.4465	21.5246	22.0561	21.0005
WT. POST FURNANCE	21.5750	21.2507	19.1002		20.6019		16.6043	19.4358	21.5070	22.0441	20.9801
DIFFERENCE VOLATILE	.0031 62	.0024 48	.0004 4		.0008 8		.0235 4700	.0107 2140	.0176 3520	.0120 2400	.0204 4080
PRE-FURNACE VOLATILE											
FIXED SOLIDS	Ø	Ø	Ø		Ø		4540	1840	3120	2080	1020

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.20
MLSS A2	3.05
MLSS A3	2.18
~~RAS 3~~	
RAS 4	4.49
WAS	0.48

NOTES	
INF. TEMP:	17.0
A1 pH:	6.9
A2 pH:	6.8
A3 pH:	6.6
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 3.8 mg/L NITRATE - 6.03 mg/L ~~NITRITE~~ Ammonia = 0.06 mg/L

7.27

Influent NH_3-N = 26 mg/L

20:1 RATIO

Al 5ml ______________

% Removal $\frac{62 - 4}{62} \times 100 =$ 94%

% Primary Removal $\frac{62 - 48}{62} \times 100 =$ 23%

lb/day RAW $8.34 \times 62 \times 2.33 = 1205$

lb/day PRI. $8.34 \times 48 \times 2.33 = 933$

lb/day EFF. $8.34 \times 4 \times 2.33 = 78$

MLSS, $8.34 \times .467 \times 4480 = 17449$

SVI $\frac{1000 \times 250}{4480} = 56$ ml/g

CF $\frac{4480}{2.7} = 1659$ mg/l/ml

SA $\frac{8.34 \times .467 \times 4480}{8.34 \times 48 \times 2.33}$ 19 DAYS

SETTLEOMETER				
Time	9:10		:	
	SSV	SSC	SSV	SSC
0	1000			
5	420			
10	340			
15	300			
20	270			
25	260			
30	250			
40	240			
50	230			
60	230			

1 2 3 4.0 5.0 2.5	ATC	1 2 3
~~1 2 3~~ 4 4.5	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 4 0.3 1.1 1.8	ADO	1 2 3 4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST INITIALS: JO DATE: 11 / 10 / 15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3	F4 100	R3	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	16.5850	21.4941	21.2616		19.1006		21.2906	22.0736	19.4654	20.6240	21.5985
CRUCIBLE WT.	16.5812	21.4914	21.2611		19.1000		21.2501	22.0332	19.4257	20.6022	21.5752
DIFFERENCE PRE-FURNACE	.0038 76	.0027 54	.0005 5		.0006 6		.0405 8100	.0404 8080	.0397 7940	.0218 4360	.0233 4660
CRUCIBLE WT. + SAMPLE	16.5850	21.4941	21.2616		19.1006		21.2906	22.0736	19.4654	20.6240	21.5985
WT. POST FURNANCE	16.5820	21.4920	21.2613		19.1002		21.2712	22.0515	19.4453	20.6134	21.5805
DIFFERENCE VOLATILE	.0030 60	.0021 42	.0003 3		.0004 4		.0194 3880	.0221 4420	.0201 4020	.0106 2120	.0180 3600
PRE-FURNACE VOLATILE											
FIXED SOLIDS	16	12	2		2		4220	3660	3920	2240	1060

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
START:		
FINISH:		
OUT:		

MAGNETITE (mg/L)	
MLSS A1	2.84
MLSS A2	3.51
MLSS A3	2.0
~~RAS 3~~	
RAS 4	3.86
WAS	0.35

NOTES	
INF. TEMP:	12.5
A1 pH:	6.9
A2 pH:	6.8
A3 pH:	6.6
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 10.3 NITRATE - 8.77 Amonia ~~NITRITE~~ - 0.069

Al 5ml ______________

% Removal $\frac{76 - 5}{76}$ x 100 = 93%

% Primary Removal $\frac{76-54}{76}$ x 100 = 29%

lb/day RAW 8.34 x 76 × 1.90 = 1204

lb/day PRI. 8.34 x 54 × 1.90 = 856

lb/day EFF. 8.34 x 5 × 1.90 = 79

MLSS, 8.34 x .467 x 4360 = 16981

SVI $\frac{1000 \times 250}{4360}$ = 57 ml/g

CF $\frac{4360}{2.5}$ = 1744 mg/l/ml

SA $\frac{8.34 \times .467 \times 4360}{8.34 \times 54 \times 1.90}$ 20 DAYS

SETTLEOMETER				
Time	9:10		:	
	SSV	SSC	SSV	SSC
0	1000			
5	400			
10	310			
15	280			
20	250			
25	240			
30	240			
40	230			
50	230			
60	220			

1 2 3	A T C	1 2 3
3.0 7.0 2.2		

~~1 2 3~~ 4	R S C	1 2 3 4
5.0		

1 2 3 4	D O B	1 2 3 4

1 2 3 4	A D O	1 2 3 4
0.7 0.7 1.2		

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO DATE: 11/9/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3	F4 100	R3 5	R4	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	22.0404	20.9786	19.1007		16.5818	21.5402		21.6070	21.3239	19.4487	21.2744
CRUCIBLE WT.	22.0332	20.9749	19.1000		16.5813	21.4913		21.5747	21.2609	19.4268	21.2503
DIFFERENCE PRE-FURNACE	.0072 144	.0037 74	.0007 7		.0005 5	.0489 9780		.0323 6460	.0630 12600	.0219 4380	.0241 4820
CRUCIBLE WT. + SAMPLE	22.0404	20.9786	19.1007		16.5818	21.5402		21.6070	21.3239	19.4487	21.2744
WT. POST FURNANCE	22.0348	20.9752	19.1000		16.5813	21.5179		21.5902	21.2930	19.4380	21.2560
DIFFERENCE VOLATILE										.0107 2140	
PRE-FURNACE VOLATILE											
FIXED SOLIDS											

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
B	0	
50	4	4/50
100	4	4/100

START: 12:50

FINISH: 1:00

OUT: 11:45

MAGNETITE (mg/L)	
MLSS A1	2.74
MLSS A2	5.56
MLSS A3	2.03
~~RAS 3~~	—
RAS 4	4.56
WAS	6.43

NOTES	
INF. TEMP:	17.4
A1 pH:	6.9
A2 pH:	6.8
A3 pH:	6.6
FINAL EFF AKALINITY	75

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 6.7 NITRATE - 8.7 ~~NITRITE~~ Amonia - 0.072

A1 5ml ______________

% Removal $\frac{144 - 7}{144}$ x 100 = 95 %

% Primary Removal $\frac{144 - 74}{144}$ x 100 = 49 %

lb/day RAW 8.34 x 144 x 1.79 = 2150

lb/day PRI. 8.34 x 74 x 1.79 = 1105

lb/day EFF. 8.34 x 7 x 1.79 = 105

MLSS, 8.34 x .467 x 4380 = 17 059

SVI $\frac{1000 \times 240}{4380}$ = 55 ml/g

CF $\frac{4380}{2.2}$ = 1991 mg/1/ml

SA $\frac{8.34 \times .467 \times 4380}{8.34 \times 74 \times 1.79}$ 15 DAYS

SETTLEOMETER				
Time	10:40		:	
	SSV	SSC	SSV	SSC
0	1000			
5	480			
10	380			
15	340			
20	300			
25	280			
30	270			
40	260			
50	260			
60	260			

1 2 3 3.2 4.0 2.5	ATC	1	2	3	
~~1 2 3~~ 4 6.0	RSC	1	2	3	4
1 2 3 4	DOB	1	2	3	4
1 2 3 4 0.6 1.0 2.0	ADO	1	2	3	4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO

DATE: 11 / 16 / 15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3	F4 100	R3	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.5773	16.5841	22.0344		19.1013		21.0120	21.2968	21.5268	20.6265	19.4529
CRUCIBLE WT.	21.5745	16.5816	22.0337		19.1005		20.9755	21.2609	21.4914	20.6018	19.4264
DIFFERENCE PRE-FURNACE	.0028 56	.0025 50	.0007 7		.0008 8		.0365 7300	.0359 7180	.0354 7080	.0247 4940	.0265 5300
CRUCIBLE WT. + SAMPLE	21.5773	16.5814	22.0344		19.1013		21.0120	21.2968	21.5268	20.6265	19.4529
WT. POST FURNANCE	21.5745	16.5816	22.0337		19.1005		20.9946	21.2778	21.5094	20.6148	19.4328
DIFFERENCE VOLATILE	.0028 56	.0025 50	.0007 7		.0008 8		.0174 3480	.0190 3800	.0174 3480	.0117 2340	.0201 4020
PRE-FURNACE VOLATILE											
FIXED SOLIDS	0	0	0		0		3820	3380	3600	2600	1280

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	3.03
MLSS A2	3.59
MLSS A3	2.52
~~RAS 3~~	—
RAS 4	3.80
WAS	0.56

NOTES	
INF. TEMP:	17.5
A1 pH:	6.8
A2 pH:	6.7
A3 pH:	6.6
FINAL EFF AKALINITY	78

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 11.5 NITRATE - 9.24 Amonia ~~NITRITE~~ - 0.472

A1 5ml ______________

% Removal $\frac{56 - 7}{56}$ x 100 = 88%

% Primary Removal $\frac{56 - 50}{56}$ x 100 = 11%

lb/day RAW 8.34 x 56 x 1.98 = 925

lb/day PRI. 8.34 x 50 x 1.98 = 826

lb/day EFF. 8.34 x 7 x 1.98 = 116

MLSS, 8.34 x .467 x 4940 = 19240

SVI $\frac{1000 \times 270}{4940}$ = 55 ml/g

CF $\frac{4940}{2.5}$ = 1976 mg/1/ml

SA $\frac{8.34 \times .467 \times 4940}{8.34 \times 50 \times 1.98}$ 23 DAYS

SETTLEOMETER

Time	9:35		:	
	SSV	SSC	SSV	SSC
0	1000			
5	470			
10	390			
15	340			
20	320			
25	300			
30	280			
40	260			
50	250			
60	250			

1 2 3 3.2 5.2 2.7	ATC	1 2 3
~~1~~ ~~2~~ ~~3~~ 4 6.0	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 4 0.2 0.4 0.9	ADO	1 2 3 4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO

DATE: 11/5/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3	F4 100	R3	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	19.1505	20.9768	21.5752		21.2615		20.6449	19.4658	19.1475	16.6079	21.5180
CRUCIBLE WT.	19.1470	20.9748	21.5750		21.2609		20.6014	19.4264	19.1000	16.5811	21.4909
DIFFERENCE PRE-FURNACE	.0035 70	.0020 40	.0002 2		.0006 6		.0435 8700	.0394 7880	.0475 9500	.0268 5360	.0271 5420
CRUCIBLE WT. + SAMPLE	19.1505	20.9768	21.5752		21.2615		20.6449	19.4658	19.1475	16.6079	21.5180
WT. POST FURNANCE	19.1473	20.9748	21.5750		21.2609		20.6250	19.4454	19.1247	16.5953	21.4985
DIFFERENCE VOLATILE	.0032 64	.0020 40	.0002 2		.0006 6		.0199 3980	.0204 4080	.0228 4560	.0126 2520	.0195 3900
PRE-FURNACE VOLATILE											
FIXED SOLIDS	6	0	0		0		4720	3800	4940	2840	1520

COLIFORM BACTERIA

SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)

MLSS A1	3.52
MLSS A2	4.38
MLSS A3	2.83
~~RAS 3~~	—
RAS 4	5.60
WAS	0.75

NOTES

INF. TEMP:	17.3
A1 pH:	6.8
A2 pH:	6.7
A3 pH:	6.6
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 12.0 NITRATE - 10.5 Amonia ~~NITRITE~~ - 0.688

Al 5ml ____________

% Removal $\frac{70 - 2}{70}$ x 100 = 97%

% Primary Removal $\frac{70 - 40}{70}$ x 100 = 43%

lb/day RAW 8.34 x 70 x 1.96 = 1144

lb/day PRI. 8.34 x 40 x 1.96 = 654

lb/day EFF. 8.34 x 2 x 1.96 = 33

MLSS, 8.34 x .467 x 5360 = 20,876

SVI $\frac{1000 \times 280}{5360}$ = 52 ml/g

CF $\frac{5360}{2.7}$ = 1985 mg/l/ml

SA $\frac{8.34 \times .467 \times 5360}{8.34 \times 40 \times 1.96}$ 32 DAYS

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS:

DATE: 1/14/15

SETTLEOMETER

Time	9:15 SSV	SSC	: SSV	SSC
0	1000			
5	480			
10	390			
15	350			
20	320			
25	300			
30	280			
40	260			
50	250			
60	250			

1 2 3		1	2	3	
4.5 3.5 2.5	ATC				

~~1 2 3~~ 4		1	2	3	4
6.7	RSC				

1 2 3 4		1	2	3	4
	DOB				

1 2 3 4		1	2	3	4
0.3 0.7 1.8	ADO				

Control Data Log

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3	F4 100	R3	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	22.0384	20.6051	21.2521		21.4931		16.6405	19.1916	21.6094	19.4520	21.2926
CRUCIBLE WT.	22.0332	20.6019	21.2507		21.4916		16.5816	19.1470	21.5746	19.4261	21.2611
DIFFERENCE PRE-FURNACE	.0052 104	.0032 64	.0014 14		.0015 15		.0589 11780	.0446 8920	.0348 6960	.0259 5180	.0315 6300
CRUCIBLE WT. + SAMPLE	22.0384	20.6051	21.2521		21.4931		16.6405	19.1916	21.6094	19.4520	21.2926
WT. POST FURNANCE	22.0332	20.6019	21.2507		21.4916		16.6122	19.1667	21.5911	19.4383	21.2695
DIFFERENCE VOLATILE	.0052 104	.0032 64	.0014 14		.0015 15		.0283 5660	.0249 4980	.0183 3660	.0137 2740	.0231 4620
PRE-FURNACE VOLATILE											
FIXED SOLIDS	Ø	Ø	Ø		Ø	/	6120	3940	3300	2440	1680

COLIFORM BACTERIA

SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)

MLSS A1	3.53
MLSS A2	3.30
MLSS A3	2.52
~~RAS 3~~	———
RAS 4	6.00
WAS	0.85

NOTES

INF. TEMP:	17.4
A1 pH:	6.89
A2 pH:	6.71
A3 pH:	6.57
FINAL EFF AKALINITY	33

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 8.28 NITRATE - 8.9 ~~NITRITE~~ Amonia - 0.073

A1 5ml ______________

% Removal $\frac{104 - 64}{104}$ x 100 = 86%

% Primary Removal $\frac{104 - 64}{104}$ x 100 = 38%

lb/day RAW 8.34 x 104 x 1.95 = 1691

lb/day PRI. 8.34 x 64 x 1.95 = 1040

lb/day EFF. 8.34 x 14 x 1.95 = 228

MLSS, 8.34 x .467 x 5180 = 20 175

SVI $\frac{1000 \times 280}{5180}$ = 54 ml/g →

CF $\frac{5180}{2.5}$ = 2072 mg/1/ml

SA $\frac{8.34 \times .467 \times 5180}{8.34 \times 64 \times 1.95}$ 19 DAYS

SETTLEOMETER

Time	9:20 SSV	9:20 SSC	2:30 SSV	2:30 SSC
0	1000			
5	490			
10	410			
15	380			
20	350			
25	310			
30	300			
40	280			
50	270			
60	270			

1 2 3 4.5 3.22.3	ATC	1 2 3
~~1 2 3~~ 4 30	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 ~~4~~ 0.2 0.9 2.8	ADO	1 2 3 4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO   DATE: 11/18/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 "	F4 100	R3	R4 5	A1 5	A2 5	A3 5	~~WAS~~ 5
CRUCIBLE WT. + SAMPLE	19.1498	21.4933	22.0339		21.5753		19.4844	20.6420	21.2808	16.6073	/
CRUCIBLE WT.	19.1469	21.4909	22.0330		21.5745		19.4258	20.6013	21.2499	16.5813	~~21.2611~~
DIFFERENCE PRE-FURNACE	.0029 58	.0024 48	.0009 9		.0008 8		.0586 11720	.0407 8140	.0309 6180	.0260 5200	/
CRUCIBLE WT. + SAMPLE	19.1498	21.4933	22.0339		21.5753		19.4844	20.6420	21.2808	16.6073	/
WT. POST FURNANCE	19.1472	21.4909	22.0330		21.5745		19.4567	20.6205	21.2652	16.5940	/
DIFFERENCE VOLATILE	.0026 52	.0024 48	.0009 9		.0008 8		.0277 5540	.0215 4300	.0156 3120	.0133 2660	/
PRE-FURNACE VOLATILE											/
FIXED SOLIDS	6	0	0		0		6180	3840	3060	2540	/

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	3.60
MLSS A2	3.20
MLSS A3	2.50
~~RAS 3~~	—
RAS 4	6.04
~~WAS~~	—

NOTES	
INF. TEMP:	17.7
A1 pH:	6.8
A2 pH:	6.7
A3 pH:	6.6
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 7.33   NITRATE - 5.06   ~~NITRITE~~ - Amonia 0.106

A1 5ml ______________

% Removal $\frac{58 - 9}{58}$ x 100 = 84%

% Primary Removal $\frac{58 - 48}{58}$ x 100 = 17%

lb/day RAW 8.34 x 58 x 2.0 = 967

lb/day PRI. 8.34 x 48 x 2.0 = 801

lb/day EFF. 8.34 x 9 x 2.0 = 150

MLSS, 8.34 x .467 x 5200 = 20 253

SVI $\frac{1000 \times 300}{5200}$ = 58 ml/g

CF $\frac{5200}{2.7}$ = 1926 mg/l/ml

SA $\frac{8.34 \times .467 \times 5200}{8.34 \times 48 \times 2.0}$ 25 DAYS

SETTLEOMETER				
Time	9:15		2:?7	
	SSV	SSC	SSV	SSC
0	1000			
5	650			
10	520			
15	450			
20	410			
25	380			
30	350			
40	330			
50	310			
60	300			

1 2 3 2.7 4.0 2.7	ATC	1	2	3
~~1 2 3~~ 4 6.5	RSC	1 2	3	4
1 2 3 4	DOB	1 2	3	4
1 2 3 ~~4~~ 0.4 0.6 1.9	ADO	1 2	3	4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS:

DATE: 11/12/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3	F4 100	R3	R4 5	A1 5	A2 5	A3 5	~~WAS~~ 5
CRUCIBLE WT. + SAMPLE	21.2727	20.6052	21.5760		21.4923		16.6350	19.1711	19.4613	22.0586	
CRUCIBLE WT.	21.2505	20.6021	21.5752		21.4914		16.5816	19.1478	19.4266	22.0340	~~20.9752~~
DIFFERENCE PRE-FURNACE	.0222 444	.0031 62	.0008 8		.0009 9		.0534 10680	.0233 4660	.0347 6940	.0246 4920	
CRUCIBLE WT. + SAMPLE	21.2727	20.6052	21.5760		21.4923		16.6350	19.1711	19.4613	22.0586	
WT. POST FURNANCE	21.2584	20.6024	21.5752		21.4914		16.6079	19.1587	19.4435	22.0458	
DIFFERENCE VOLATILE	.0143 286	.0028 56	.0008 8		.0009 9		.0271 5420	.0124 2480	.0178 3560	.0128 2560	
PRE-FURNACE VOLATILE											
FIXED SOLIDS	158	6	Ø		Ø		5260	2180	3380	2360	

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
B	0	
50	5	5/50
100	1	1/100

START: 12:00

FINISH: 1:15

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.78
MLSS A2	2.94
MLSS A3	2.22
~~RAS 3~~	—
RAS 4	4.66
~~WAS~~	—

NOTES	
INF. TEMP:	17.4
A1 pH:	6.9
A2 pH:	6.8
A3 pH:	6.7
FINAL EFF AKALINITY	71

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 4.63 NITRATE - 3.06 Amonia ~~NITRITE~~ - .078

Al 5ml ____________

% Removal $\frac{444-8}{444}$ x 100 = 98

% Primary Removal $\frac{444-62}{444}$ x 100 = 86

lb/day RAW 8.34 x 444 x 2.03 = 7517

lb/day PRI. 8.34 x 62 x 2.03 = 1049

lb/day EFF. 8.34 x 8 x 2.03 = 135

MLSS. 8.34 x .467 x 4920 = 19162

SVI $\frac{1000 \times 350}{4920}$ = 71 ml/g →

CF $\frac{4920}{2.7}$ = 1822 mg/l/ml

SA $\frac{8.34 \times .467 \times 4920}{8.34 \times 62 \times 2.03}$ 18 DAYS

SETTLEOMETER				
Time	9:10		:	
	SSV	SSC	SSV	SSC
0	1000			
5	440			
10	350			
15	310			
20	290			
25	270			
30	250			
40	240			
50	230			
60	230			

1 2 3 2.5 4.725	ATC	1 2 3
~~1 2 3~~ 4 6.0	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 4 0.5 0.9 2.5	ADO	1 2 3 4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS:

DATE: 10/30/15

SAMPLES - VOLUME	INF ~~50~~	PRI ~~50~~	EFF 100	F3	F4 100	R3	R4 5	A1 5	A2 5	A3 5	~~WAS 5~~
CRUCIBLE WT. + SAMPLE	20.6053	22.0357	16.5824		21.2514		21.6339	21.5182	19.1881	19.4520	
CRUCIBLE WT.	20.6018	22.0334	16.5812		21.2500		21.5748	21.4915	19.1472	19.4263	~~20.9743~~
DIFFERENCE PRE-FURNACE	.0035 70	.0023 46	.0012 12		.0014 14		.0590 11800	.0267 5340	.0409 8180	.0257 5140	
CRUCIBLE WT. + SAMPLE	20.6053	22.0357	16.5824		21.2514		21.6338	21.5182	19.1881	19.4520	
WT. POST FURNANCE	20.6018	22.0334	16.5812		21.2500		21.6055	21.5044	19.1677	19.4389	
DIFFERENCE VOLATILE	.0035 70	.0023 46	.0012 12		.0014 14		.0283 5660	.0138 2760	.0204 4080	.0131 2620	
PRE-FURNACE VOLATILE											
FIXED SOLIDS	Ø	Ø	Ø		Ø		6140	2580	4100	2520	

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.80
MLSS A2	4.24
MLSS A3	2.69
~~RAS 3~~	—
RAS 4	6.25
~~WAS~~	—

NOTES	
INF. TEMP:	17.8
A1 pH:	6.9
A2 pH:	6.6
A3 pH:	6.5
FINAL EFF AKALINITY	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 10.1 NITRATE - 7.63 Amonia ~~NITRITE~~ - 0.157

Al 5ml ____________

% Removal $\frac{70 - 12}{70}$ x 100 = 83%

% Primary Removal $\frac{70 - 46}{70}$ x 100 = 34%

lb/day RAW 8.34 x 70 x 2.16 = 1261

lb/day PRI. 8.34 x 46 x 2.16 = 829

lb/day EFF. 8.34 x 12 x 2.16 = 216

MLSS, 8.34 x .467 x 5140 = 20 019

SVI $\frac{1000 \times 250}{5140}$ = 49 ml/g

CF $\frac{5140}{2.5}$ = 2056 mg/l/ml

SA $\frac{8.34 \times .467 \times 5140}{8.34 \times 46 \times 2.16}$ 24 DAYS

SETTLEOMETER				
Time	9:30		:	
	SSV	SSC	SSV	SSC
0	1000			
5	360			
10	300			
15	260			
20	240			
25	240			
30	220			
40	210			
50	200			
60	200			

1 2 3 2.) 3.022	A T C	1 2 3
~~1 2 3~~ 4 7.0	R S C	1 2 3 4
1 2 3 4	D O B	1 2 3 4
1 2 3 4 0.4 1.) 3.1	A D O	1 2 3 4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST **INITIALS:** VO **DATE:** 10/29/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3	F4 100	R3	R4 5	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	19.4360	21.5778	16.5818		19.1012		~~20~~21.0409	21.2796	21.7470	20.6238	21.5237
CRUCIBLE WT.	19.4265	21.5748	16.5811		19.0998		20.9748	21.2611	21.7163	20.6017	21.4916
DIFFERENCE PRE-FURNACE	.0095 190	.0030 60	.0007 7		.0014 14		.0661 13220	.0185 3700	.0307 6140	.0221 4420	.0321 6420
CRUCIBLE WT. + SAMPLE	19.4360	21.5778	16.5818		19.1012		21.0409	21.2796	21.7470	20.6238	21.5237
WT. POST FURNANCE	19.4276	21.5750	16.5811		19.0999		21.0108	21.2703	21.7322	20.6123	21.4999
DIFFERENCE VOLATILE	.0084 168	.0028 56	.0007 7		.0013 13		.0301 6020	.0093 1860	.0148 2960	.0115 2300	.0238 4760
PRE-FURNACE VOLATILE											
FIXED SOLIDS	22	4	0		1		7200	1840	3180	2120	1660

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.65
MLSS A2	3.29
MLSS A3	2.45
~~RAS 3~~	~~9~~
RAS 4	7.26
WAS	0.69

NOTES	
INF. TEMP:	17.9
A1 pH:	6.80
A2 pH:	6.60
FINAL EFF AKALINITY	56

SEPTAGE	
Fairhaven	
Mattapoisett	
Marion	
Rochester	
Acushnet	
TOTAL	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 5.76 NITRATE - 3.89 ~~NITRITE -~~ ~~ALKALINITY~~ Amonia - 0.09

A1 5ml ______________

% Removal $\frac{190 - 7}{190}$ x 100 = 96%

% Primary Removal $\frac{190 - 60}{190}$ x 100 = 68%

lb/day RAW 8.34 x 190 x 2.54 = 4025

lb/day PRI. 8.34 x 60 x 2.54 = 1271

lb/day EFF. 8.34 x 7 x 2.54 = 148

MLSS, 8.34 x .467 x 4420 = 17215

SVI $\frac{1000 \times 220}{4420}$ = 50 ml/g

CF $\frac{4420}{2.2}$ = 2009 mg/1/ml

SA $\frac{8.34 \times .467 \times 4420}{8.34 \times 60 \times 2.54}$ 14 DAYS

SETTLEOMETER				
Time	9:35		:	
	SSV	SSC	SSV	SSC
0	1000			
5	400			
10	310			
15	280			
20	250			
25	240			
30	230			
40	220			
50	220			
60	220			

1 2 3 2.2 3.0 2.2	A T C	1	2	3
~~1 2 3~~ 4 5.5	R S C	1	2	3 4
1 2 3 4	D O B	1	2	3 4
1 2 3 4 0.2 1.3 3.3	A D O	1	2	3 4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST INITIALS: VO DATE: 10/28/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 ~~100~~	F4 100	R3	R4 5	A1 5	A2 5	A3 5	~~WAS 5~~
CRUCIBLE WT. + SAMPLE	20.6034	21.5778	16.5828		19.4267		19.1512	20.9967	21.7454	21.2837	~~21~~
CRUCIBLE WT.	20.6012	21.5745	16.5811		19.4259		19.0990	20.9747	21.7164	21.2608	21.7553
DIFFERENCE PRE-FURNACE	.0022 44	.0028 56	.0017 17		.0008 8		.0522 10440	.0220 4400	.0290 5800	.0229 4580	
CRUCIBLE WT. + SAMPLE	20.6034	21.5773	16.5828		19.4267		19.1512	20.9967	21.7454	21.2837	
WT. POST FURNANCE	20.6012	21.5745	16.5814		19.4259		19.1273	20.9861	21.7315	21.2727	
DIFFERENCE VOLATILE	.0022 44	.0028 56	.0014 14		.0008 8		.0239 4780	.0106 2120	.0139 2780	.0110 2200	
PRE-FURNACE VOLATILE											
FIXED SOLIDS	0	0	3		0		5660	2280	3020	2380	

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.23
MLSS A2	3.05
MLSS A3	2.23
~~RAS 3~~	—
RAS 4	↑
~~WAS~~	5.33

NOTES	
INF. TEMP:	18.0
A1 pH:	6.9
A2 pH:	6.7
FINAL EFF AKALINITY	71

SEPTAGE	
Fairhaven	
Mattapoisett	
Marion	
Rochester	
Acushnet	
TOTAL	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 9.23 NITRATE - 8.31 ~~NITRITE~~ - Ammonia 0.258 ALKALINITY - 71.

A1 5ml ______________

% Removal $\frac{44 - 17}{44} \times 100 =$ 61%

% Primary Removal $\frac{44 - 56}{44} \times 100 =$

lb/day RAW 8.34 x 44 x 1.98 = 727

lb/day PRI. 8.34 x 56 x 1.98 = 925

lb/day EFF. 8.34 x 17 x 1.98 = 281

MLSS, 8.34 x .467 x 4580 = 17838

SVI $\frac{1000 \times 230}{4580}$ = 50 ml/g

CF $\frac{4580}{2.2}$ = 2082 mg/l/ml

SA $\frac{8.34 \times .467 \times 4580}{8.34 \times 56 \times 1.98}$ 19 DAYS

No Return Due to Switching Tanks
333 – 334

SETTLEOMETER				
Time	9:25		1:0	
	SSV	SSC	SSV	SSC
0	1000			
5	160			
10	120			
15	110			
20	100			
25	100			
30	100			
40	100			
50	90			
60	90			

1 2 3 1.0 1.0 1.0	A T C	1	2	3		
~~1 2 3 4~~	R S C	1	2	3	4	
1 2 3 4	D O B	1	2	3	4	
1 2 3 4 0.3 3.2 4.6	A D O	1	2	3	4	

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST INITIALS: VO DATE: 10/27/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F~~4~~ 100	F4	R3 5	R4	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.2859	19.1500	22.0343	21.4931				20.3072	21.2614	17.7431	19.5978
CRUCIBLE WT.	21.2824	19.1473	22.0334	21.4915		~~16.5815~~		20.2975	21.2509	17.7355	19.5576
DIFFERENCE PRE-FURNACE	.0035 70	.0027 54	.0009 9	.0016 16				.0097 1940	.0105 2100	.0076 1520	.0402 8040
CRUCIBLE WT. + SAMPLE	21.2859	19.1500	22.0343	21.4931				20.3072	21.2614	17.7431	19.5978
WT. POST FURNANCE	21.2825	19.1474	22.0334	21.4915				20.3022	21.2557	17.7389	19.5701
DIFFERENCE VOLATILE	.0034 68	.0026 52	.0009 9	.0016 16				.0050 1000	.0057 1140	.0042 840	.0277 5540
PRE-FURNACE VOLATILE											
FIXED SOLIDS	2	2	0	0				940	960	680	2500

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	0.83
MLSS A2	0.82
MLSS A3	0.59
~~RAS 3~~	
~~RAS 4~~	
WAS	1.63

NOTES	
INF. TEMP:	18.1
A1 pH:	7.0
A2 pH:	6.9
FINAL EFF AKALINITY	61

SEPTAGE	
Fairhaven	
Mattapoisett	
Marion	
Rochester	
Acushnet	
TOTAL	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - 12.3 NITRATE - 6.21 ~~NITRITE~~ Amonia - 1.7 ALKALINITY - 61.

1135 AM

Al 5ml ______________

% Removal $\frac{70 - 9}{70}$ x 100 = 87%

% Primary Removal $\frac{70 - 54}{70}$ x 100 = 23%

lb/day RAW 8.34 x 70 x 1.82 = 1063

lb/day PRI. 8.34 x 54 x 1.82 = 820

lb/day EFF. 8.34 x 9 x 1.82 = 137

MLSS, 8.34 x .467 x 1520 = 5920

SVI $\frac{1000 \times 100}{1520}$ = 66 ml/g →

CF $\frac{1520}{1.0}$ = 1520 mg/l/ml

SA $\frac{8.34 \times .467 \times 1520}{8.34 \times 54 \times 1.82}$ = 7 DAYS

SETTLEOMETER				
Time	9 :27		:	
	SSV	SSC	SSV	SSC
0	1000	2.0		
5	370			
10	300			
15	260			
20	240			
25	230			
30	220			
40	210			
50	210			
60	210			

1 2 3 2.0 4.0 2.0	ATC	1 2 3
~~1~~ ~~2~~ 3 ~~4~~ 5.0	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 4 0.1 0.6 1.0	ADO	1 2 3 4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: K.W.

DATE: 10/26/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 100	F4	R3 5	R4	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	20.9825	21.4392	21.7171	19.1005		19.6157		21.2817	21.6356	19.4472	21.7837
CRUCIBLE WT.	20.9751	21.4355	21.7163	19.0999		19.5662		21.2609	21.6115	19.4262	21.7560
DIFFERENCE PRE-FURNACE	.0074 148	.0037 74	.0008 8	.0006 6		.0495 9,900		.0208 4,160	.0241 4,820	.021 4,200	.0277 5,540
CRUCIBLE WT. + SAMPLE	20.9825	21.4392	21.7171	19.1005		19.6157		21.2817	21.6356	19.4472	21.7837
WT. POST FURNANCE	20.9756	21.4361	21.7162	19.0996		19.5939		21.2726	21.6246	19.4374	21.7632
DIFFERENCE VOLATILE	.0069 138	.0031 62	.0009 9	.0009 9		.0218 4,360		.0091 1,820	.011 2,200	.0098 1,960	.0205 4,100
PRE-FURNACE VOLATILE	148	74	8	6		9,900		4,160	4,820	4,200	5,540
FIXED SOLIDS	70	12	—	—		5,540		2,340	2,620	2,240	1,440

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
0	0	
100	8	8/100
150	2	2/50

START: 12:45

FINISH: 1:00

OUT: 11:00 - 1:00

MAGNETITE (mg/L)	
MLSS A1	2.45
MLSS A2	4.27
MLSS A3	1.63
RAS 3	5.73
RAS 4	—
WAS	0.63

NOTES	
INF. TEMP:	18.3
A1 pH:	6.9
A2 pH:	6.8
FINAL EFF AKALINITY	

SEPTAGE	
Fairhaven	
Mattapoisett	
Marion	
Rochester	
Acushnet	
TOTAL	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - NITRATE - NITRITE - ALKALINITY -

Al 5ml 4,160

% Removal $\frac{148-8}{148}$ x 100 = 95%

% Primary Removal $\frac{148-74}{148}$ x 100 = 50%

lb/day RAW 8.34 x 148 x 1.84 = 2271

lb/day PRI. 8.34 x 74 x 1.84 = 1136

lb/day EFF. 8.34 x 8 x 1.84 = 123

MLSS, 8.34 x .467 x 4,200 = 16,358

SVI $\frac{1000 \times 220}{4,200}$ = 52 ml/g

CF $\frac{4,200}{2.0}$ = 2,100 mg/l/ml

SA $\frac{8.34 \times .467 \times 4,200}{8.34 \times 74 \times 1.84}$ 14 DAYS

SETTLEOMETER				
Time	9:15		2:0	
	SSV	SSC	SSV	SSC
0	1000			
5	350			
10	280			
15	240			
20	220			
25	200			
30	200			
40	190			
50	190			
60	190			

1 2 3				ATC	1	2	3
2.2 3.2 2.0							
~~1~~ ~~2~~ 3 4				RSC	1 2 3 4		
4.0							
1 2 3 4				DOB	1 2 3 4		
1 2 3 4				ADO	1 2 3 4		
0.4 0.6 0.8							

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO

DATE: 10/23/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 100	F4	R3 .5	R4	A1 .5	A2 .5	A3 .5	WAS .5
CRUCIBLE WT. + SAMPLE	21.2848	21.6150	20.6025	21.7177		21.4760		21.2834	19.4657	20.9976	21.7796
CRUCIBLE WT.	21.2826	21.6116	20.6015	21.7165		21.4359		21.2613	19.4264	20.9750	21.7564
DIFFERENCE PRE-FURNACE	.0022 44	.0034 68	.0010 10	.0012 12		.0401 8020		.0221 4420	.0393 7860	.0226 4520	.0232 4640
CRUCIBLE WT. + SAMPLE	21.2848	21.6150	20.6025	21.7177		21.4760		21.2834	19.4657	20.9976	21.7796
WT. POST FURNANCE	21.2826	21.6118	20.6015	21.7165		21.4592		21.2736	19.4492	20.9878	21.7630
DIFFERENCE VOLATILE	.0022 44	.0032 64	.0010 10	.0012 12		.0168 3360		.0098 1960	.0165 3300	.0098 1960	.0166 3320
PRE-FURNACE VOLATILE											
FIXED SOLIDS	0	4	0	0		4660		2460	4560	2560	1320

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	2.76
MLSS A2	4.63
MLSS A3	2.60
RAS 3	4.80
~~RAS 4~~	
WAS	0.69

NOTES	
INF. TEMP:	18.4
A1 pH:	6.9
A2 pH:	6.7
FINAL EFF AKALINITY	

SEPTAGE	
Fairhaven	
Mattapoisett	
Marion	
Rochester	
Acushnet	
TOTAL	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - NITRATE - NITRITE - ALKALINITY -

AI 5ml ____________

% Removal $\frac{44 - 10}{44}$ x 100 = 77%

% Primary Removal $\frac{44 - 68}{44}$ x 100 =

lb/day RAW 8.34 x 44 x 1.89 = 694

lb/day PRI. 8.34 x 68 x 1.89 = 1072

lb/day EFF. 8.34 x 10 x 1.89 = 158

MLSS, 8.34 x .467 x 4520 = 17604

SVI $\frac{1000 \times 200}{4520}$ = 44 ml/g

CF $\frac{4520}{20}$ = 2260 mg/1/ml

SA $\frac{8.34 \times .467 \times 4520}{8.34 \times 68 \times 1.89}$ = 16 DAYS

SETTLEOMETER				
Time	9:00		:2.2	
	SSV	SSC	SSV	SSC
0	1000			
5	330			
10	260			
15	220			
20	210			
25	200			
30	190			
40	190			
50	190			
60	190			

1 2 3 4.5 2.2 2.2	ATC	1 2 3
~~1~~ ~~2~~ 3 ~~4~~ 6.0	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 4 0.2 0.6 1.0	ADO	1 2 3 4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST **INITIALS:** VO **DATE:** 10/21/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 100	F4	R3 5	R4	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.7188	19.4281	21.2616	21.7571		19.2033		21.3299	20.9977	20.6255	21.4944
CRUCIBLE WT.	21.7166	19.4261	21.2612	21.7565		19.1478		21.2827	20.9752	20.6019	21.4667
DIFFERENCE PRE-FURNACE	.0022 44	.0020 40	.0004 4	.0006 6		.0555 11100		.0472 9440	.0225 4500	.0236 4720	.0277 5540
CRUCIBLE WT. + SAMPLE	21.7188	19.4281	21.2616	21.7571		19.2033		21.3299	20.9977	20.6255	21.4944
WT. POST FURNANCE	21.7166	19.4261	21.2612	21.7565		19.1799		21.3089	20.9872	20.6148	21.4748
DIFFERENCE VOLATILE	.0022 44	40	.0004 4	.0006 6		.0234 4680		.0210 4200	.0105 2100	.0107 2140	.0196 3920
PRE-FURNACE VOLATILE											
FIXED SOLIDS	Ø	Ø	Ø	Ø		6420		5240	2400	2580	1620

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
START:		
FINISH:		
OUT:		

MAGNETITE (mg/L)	
MLSS A1	5.32
MLSS A2	2.80
MLSS A3	2.82
RAS 3	6.80
~~RAS 4~~	
WAS	1.02

NOTES	
INF. TEMP:	18.4
A1 pH:	6.8
A2 pH:	6.7
FINAL EFF AKALINITY	

SEPTAGE	
Fairhaven	
Mattapoisett	
Marion	
Rochester	
Acushnet	
TOTAL	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - NITRATE - NITRITE - ALKALINITY -

Al 5ml ______________

% Removal $\frac{44 - 4}{44}$ x 100 = 91%

% Primary Removal $\frac{44 - 40}{44}$ x 100 = 9%

lb/day RAW 8.34 x 44 x 1.99 = 730

lb/day PRI. 8.34 x 40 x 1.99 = 664

lb/day EFF. 8.34 x 4 x 1.99 = 66

MLSS, 8.34 x .467 x 4720 = 18383

SVI $\frac{1000 \times 190}{4720}$ = 40 ml/g

CF $\frac{4720}{2.2}$ = 2145 mg/l/ml

SA $\frac{8.34 \times .467 \times 4720}{8.34 \times 40 \times 1.99}$ = 28 DAYS

SETTLEOMETER				
Time	9:30		:	
	SSV	SSC	SSV	SSC
0	1000			
5	330			
10	250			
15	220			
20	210			
25	200			
30	190			
40	190			
50	190			
60	190			

1 2 3 2.5 2.0 2.5	ATC	1	2	3			
~~1~~ ~~2~~ 3 ~~4~~ 5.0	RSC	1	2	3	4		
1 2 3 4	DOB	1	2	3	4		
1 2 3 4 0.2 0.9 1.4	ADO	1	2	3	4		

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: JB

DATE: 10/21/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 100	F4	R3 5	R4	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	19.1502	21.7198	21.4361	20.9759		21.3339		21.7824	19.4495	20.6272	21.2927
CRUCIBLE WT.	19.1477	21.7170	21.4359	20.9750		21.2830		21.7565	19.4268	20.6022	21.2618
DIFFERENCE PRE-FURNACE	.0025 50	.0028 56	.0002 2	.0009 9		.0509 10180		.0259 5180	.0227 4540	.0250 5000	.0309 6180
CRUCIBLE WT. + SAMPLE	19.1502	21.7198	21.4361	20.9759		21.3339		21.7824	19.4495	20.6272	21.2927
WT. POST FURNANCE	19.1477	21.7170	21.4359	20.9750		21.3138		21.7714	19.4395	20.6163	21.2703
DIFFERENCE VOLATILE	.0025 50	.0028 56	.0002 2	.0009 9		.0201 4020		.0110 2200	.0100 2000	.0109 2180	.0224 4480
PRE-FURNACE VOLATILE											
FIXED SOLIDS	Ø	6	Ø	Ø		6160		2980	2540	2820	1700

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
START:		
FINISH:		
OUT:		

MAGNETITE (mg/L)	
MLSS A1	3.46
MLSS A2	2.92
MLSS A3	3.20
RAS 3	6.60
~~RAS 4~~	
WAS	0.95

NOTES	
INF. TEMP:	18.9
A1 pH:	6.9
A2 pH:	6.8
FINAL EFF AKALINITY	62

SEPTAGE	
Fairhaven	
Mattapoisett	
Marion	
Rochester	
Acushnet	
TOTAL	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - NITRATE - NITRITE - ALKALINITY -

Al 5ml ____________

% Removal $\frac{50-2}{50}$ x 100 = 96%

% Primary Removal $\frac{50-56}{50}$ x 100 =

lb/day RAW 8.34 x 50 x 1.98 = 826

lb/day PRI. 8.34 x 56 x 1.98 = 925

lb/day EFF. 8.34 x 2 x 1.98 = 33

MLSS, 8.34 x .467 x 5000 = 19 474

SVI $\frac{1000 \times 190}{5000}$ = 38 ml/g

CF $\frac{5000}{2.5}$ = 2000 mg/1/ml

SA $\frac{8.34 \times .467 \times 5000}{8.34 \times 56 \times 1.98}$ 21 DAYS

SETTLEOMETER

Time	9:00 SSV	9:00 SSC	2:0 SSV	2:0 SSC
0	1000			
5	340			
10	270			
15	240			
20	210			
25	200			
30	200			
40	190			
50	180			
60				

1 2 3 40 222.0	ATC	1 2 3
~~1 2~~ 3 ~~4~~ 6.5	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 4 0.5 1.7 3.7	ADO	1 2 3 4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO

DATE: 10 120115

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 100	F4	R3 5	R4	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	20.9809	20.6047	21.7569	21.2616		21.3449		21.4745	21.7385	19.1678	19.4526
CRUCIBLE WT.	20.9751	20.6017	21.7563	21.2607		21.2830		21.4356	21.7164	19.1472	19.4266
DIFFERENCE PRE-FURNACE	.0058 116	.0030 60	.0006 6	.0009 9		.0619 12380		.0389 7780	.0221 4420	.0206 4120	.0260 5200
CRUCIBLE WT. + SAMPLE	20.9809	20.6047	21.7569	21.2616		21.3449		21.4745	21.7385	19.1678	19.4526
WT. POST FURNANCE	20.9756	20.6019	21.7563	21.2607		21.3200		21.4580	21.7290	19.1591	19.4352
DIFFERENCE VOLATILE	.0053 106	.0028 56	.0006 6	.0009 9		.0249 4980		.0165 3300	.0095 1900	.0087 1740	.0174 3480
PRE-FURNACE VOLATILE											
FIXED SOLIDS	10	4	0	0		7400		4480	2520	2380	1720

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	4.75
MLSS A2	2.79
MLSS A3	2.54
RAS 3	7.30
~~RAS 4~~	
WAS	1.01

NOTES	
INF. TEMP:	18.4
A1 pH:	0.5
A2 pH:	1.7
FINAL EFF AKALINITY	

SEPTAGE	
Fairhaven	
Mattapoisett	
Marion	
Rochester	
Acushnet	
TOTAL	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN -

NITRATE -

NITRITE -

ALKALINITY -

Al 5ml ________

% Removal $\frac{116 - 6}{116}$ x 100 = 95%

% Primary Removal $\frac{116 - 60}{116}$ x 100 = 48%

lb/day RAW 8.34 x 116 x 2.0 = 1935

lb/day PRI. 8.34 x 60 x 2.0 = 1001

lb/day EFF. 8.34 x 6 x 2.0 = 100

MLSS, 8.34 x .467 x 4120 = 16046

SVI $\frac{1000 \times 200}{4120}$ = 49 ml/g

CF $\frac{4120}{2.0}$ = 2060 mg/l/ml

SA $\frac{8.34 \times .467 \times 4120}{8.34 \times 60 \times 2.0}$ = 16 DAYS

SETTLEOMETER

Time	9:05		:	
	SSV	SSC	SSV	SSC
0	1000			
5	350			
10	300			
15	250			
20	230			
25	210			
30	200			
40	190			
50	190			
60	190			

1 2 3		1 2 3
50 2.225	A T C	
~~1~~ ~~2~~ 3 ~~4~~ 5.0	R S C	1 2 3 4
1 2 3 4	D O B	1 2 3 4
1 2 3 4 0.2 1.5 3.0	A D O	1 2 3 4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS:

DATE: 10/19/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 100	F4	R3 5	R4	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.4416	21.7582	19.4270	20.9759		21.3049		21.7696	21.3051	20.6239	19.1718
CRUCIBLE WT.	21.4355	21.7556	19.4259	20.9749		21.2607		21.7167	21.2827	20.6015	19.1482
DIFFERENCE PRE-FURNACE	.0061 122	.0026 52	.0011 11	.0010 10		.0442 8840		.0529 10580	.0224 4480	.0224 4480	.0236 4720
CRUCIBLE WT. + SAMPLE	21.4416 21.4361	21.7582 21.7561	19.4270 19.4265	20.9759 20.9752		21.3049 21.2868		21.7696 21.7478	21.3051 21.2956	20.6239 20.6144	19.1718 19.1551
WT. POST FURNANCE	.0055 110	.0021 42	.0005 5	.0007 7		.0181 3620		.0218 4360	.0095 1900	.0095 1900	.0167 3340
DIFFERENCE VOLATILE											
PRE-FURNACE VOLATILE											
FIXED SOLIDS	12	10	6	3		5220		6220	2580	2580	1380

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
B	0	
50	2	2/50
100	0	

START: 12:55

FINISH: 1:10

OUT: 12:50

MAGNETITE (mg/L)	
MLSS A1	6.13
MLSS A2	2.63
MLSS A3	2.32
RAS 3	5.16
~~RAS 4~~	
WAS	0.68

NOTES	
INF. TEMP:	18.6
A1 pH:	6.8
A2 pH:	6.6
FINAL EFF AKALINITY	63

SEPTAGE	
Fairhaven	
Mattapoisett	
Marion	
Rochester	
Acushnet	
TOTAL	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN -

NITRATE -

NITRITE -

ALKALINITY -

A1 5ml ______________

% Removal $\frac{122 - 11}{122}$ x 100 = 91%

% Primary Removal $\frac{122 - 52}{122}$ x 100 = 57%

lb/day RAW 8.34 x 122 x 2.06 = 2096

lb/day PRI. 8.34 x 52 x 2.06 = 893

lb/day EFF. 8.34 x 11 x 2.06 = 189

MLSS, 8.34 x .467 x 4480 = 17 449

SVI $\frac{1000 \times 200}{4480}$ = 45 ml/g →

CF $\frac{4480}{2.5}$ = 1792 mg/l/ml

SA $\frac{8.34 \times .467 \times 4480}{8.34 \times 52 \times 2.06}$ 20 DAYS

SETTLEOMETER				
Time	10:45		:20	
	SSV	SSC	SSV	SSC
0	1000			
5	390			
10	300			
15	250			
20	230			
25	200			
30	190			
40	180			
50	180			
60	180			

1 2 3 6.7 20 20	A T C	1 2 3
~~1 2~~ 3 4 5.0	R S S C	1 2 3 4
~~1 2 3 4~~	D O B	1 2 3 4
1 2 3 4 0.1 1.7 28	A D O	1 2 3 4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST INITIALS: VO DATE: 10/16/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 100	F4	R3 5	R4	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.5767	21.4384	20.6026	20.9765		21.3124		21.7878	19.4486	21.7769	21.3020
CRUCIBLE WT.	21.5752	21.4363	20.6022	20.9758		21.2611		21.7168	19.4271	21.7567	21.2830
DIFFERENCE PRE-FURNACE	.0015 30	.0021 42	.0004 4	.0007 7		.0513 10260		.0710 14200	.0215 4300	.0202 4040	.0190 3800
CRUCIBLE WT. + SAMPLE	21.5767	21.4384	20.6026	20.9765		21.3124		21.7878	19.4486	21.7769	21.3020
WT. POST FURNANCE	21.5752	21.4363	20.6022	20.9758		21.2907		21.7579	19.4375	21.7667	21.2876
DIFFERENCE VOLATILE	.0015 30	.0021 42	.0004 4	.0007 7		.0217 4340		.0299 5980	.0111 2220	.0102 2040	.0144 2880
PRE-FURNACE VOLATILE											
FIXED SOLIDS	Ø	Ø	Ø	Ø		5920		8220	2080	2000	920

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
START:		
FINISH:		
OUT:		

MAGNETITE (mg/L)	
MLSS A1	8.14
MLSS A2	2.50
MLSS A3	2.34
RAS 3	5.96
~~RAS 4~~	
WAS	0.61

NOTES	
INF. TEMP:	19.2
A1 pH:	6.7
A2 pH:	6.7
FINAL EFF AKALINITY	

SEPTAGE	
Fairhaven	
Mattapoisett	
Marion	
Rochester	
Acushnet	
TOTAL	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - NITRATE - NITRITE - ALKALINITY -

A1 5ml ____________

% Removal $\frac{30 - 4}{30}$ x 100 = 87%

% Primary Removal $\frac{30 - 42}{30}$ x 100 =

lb/day RAW 8.34 x 30 x 2.32 = 580

lb/day PRI. 8.34 x 42 x 2.32 = 813

lb/day EFF. 8.34 x 4 x 2.32 = 77

MLSS, 8.34 x .467 x 4040 = 15735

SVI $\frac{1000 \times 190}{4040}$ = 47 ml/g →

CF $\frac{4040}{2.0}$ = 2020 mg/1/ml

SA $\frac{8.34 \times .467 \times 4040}{8.34 \times 42 \times 2.32}$ 19 DAYS

SETTLEOMETER

Time	9:20 SSV	9:20 SSC	2.0 SSV	2.0 SSC
0	1000			
5	450			
10	350			
15	280			
20	240			
25	210			
30	200			
40	180			
50	170			
60	170			

1 2 3 2.7 2.5 2.0	ATC	1 2 3
~~1~~ ~~2~~ 3 ~~4~~ 40	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 4 0.7 1.8 0.3	ADO	1 2 3 4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO

DATE: 10/15/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 100	F4	R3 5	R4	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.7592	19.4291	21.4369	21.6131		20.6439		22.0684	21.7425	21.2803	20.9868
CRUCIBLE WT.	21.7567	19.4262	21.4358	21.6115		20.6015		22.0348	21.7167	21.2612	20.9749
DIFFERENCE PRE-FURNACE	.0025 50	.0029 58	.0011 11	.0016 16		.0424 8480		.0336 6720	.0258 5160	.0191 3820	.0119 2380
CRUCIBLE WT. + SAMPLE	21.7592	19.4291	21.4369	21.6131		20.6439		22.0684	21.7425	21.2803	20.9868
WT. POST FURNANCE	21.7567	19.4262	21.4358	21.6115		20.6271		22.0546	21.7318	21.2722	20.9787
DIFFERENCE VOLATILE	.0025 50	.0029 58	.0011 11	.0016 16		.0168 3360		.0138 2760	.0107 2140	.0081 1620	.0081 1620
PRE-FURNACE VOLATILE											
FIXED SOLIDS	0	0	0	0		5120		3960	3020	2200	760

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	3.85
MLSS A2	3.28
MLSS A3	2.28
RAS 3	5.50
~~RAS 4~~	
WAS	0.66

NOTES	
INF. TEMP:	18.9
A1 pH:	6.80
A2 pH:	6.62
FINAL EFF AKALINITY	

SEPTAGE	
Fairhaven	
Mattapoisett	
Marion	
Rochester	
Acushnet	
TOTAL	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN -

NITRATE -

NITRITE -

ALKALINITY -

A1 5ml ____________

% Removal $\frac{50 - 11}{50}$ x 100 = 78%

% Primary Removal $\frac{50 - 58}{50}$ x 100 =

lb/day RAW 8.34 x 50 x 2.22 = 926

lb/day PRI. 8.34 x 58 x 2.22 = 1074

lb/day EFF. 8.34 x 11 x 2.22 = 204

MLSS, 8.34 x .467 x 3820 = 14878

SVI $\frac{1000 \times 200}{3820}$ = 52 ml/g →

CF $\frac{3820}{2.0}$ = 1910 mg/l/ml

SA $\frac{8.34 \times .467 \times 3820}{8.34 \times 58 \times 2.22}$ 14 DAYS

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO

DATE: 10/14/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 100	F4	R3 5	R4	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.7223	21.6149	21.0076	19.4280		21.2911		22.0865	21.7829	21.4539	20.6173
CRUCIBLE WT.	21.7166	21.6124	21.0069	19.4269		21.2614		22.0338	21.7567	21.4363	20.6020
DIFFERENCE PRE-FURNACE	.0057 114	.0025 50	.0007 7	.0011 11		.0297 5940		.0527 10540	.0262 5240	.0176 3520	.0153 3060
CRUCIBLE WT. + SAMPLE	21.7223	21.6149	21.0076	19.4280		21.2911 21.2794		22.0865	21.7829	21.4539	20.6173
WT. POST FURNANCE	21.7176	21.6126	21.0069	19.4269		.0117		22.0655	21.7726	21.4463	206072
DIFFERENCE VOLATILE	.0047 94	.0023 46	.0007 7	.0011 11		2340		.0210 4200	.0103 2060	.0076 1520	.0101 2020
PRE-FURNACE VOLATILE											
FIXED SOLIDS	20	4	0	0		3600		6340	3180	2000	1040

SETTLEOMETER

Time	9:05		:	
	SSV	SSC	SSV	SSC
0	1000			
5	520			
10	400			
15	330			
20	280			
25	240			
30	220			
40	190			
50	180			
60	170			

1 2 3		1 2 3
5.0 2.5 20	ATC	

~~1~~ ~~2~~ 3 ~~4~~ 2.5	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 4 0.1 2.5 0.8	ADO	1 2 3 4

COLIFORM BACTERIA

SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)

MLSS A1	6.29
MLSS A2	3.28
MLSS A3	2.16
RAS 3	3.72
~~RAS 4~~	
WAS	0.64

NOTES

INF. TEMP:	19.1
A1 pH:	6.7
A2 pH:	6.6
FINAL EFF AKALINITY	80

SEPTAGE

Fairhaven	
Mattapoisett	
Marion	
Rochester	
Acushnet	
TOTAL	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN -

NITRATE -

NITRITE -

ALKALINITY -

Al 5ml ______________

% Removal $\frac{114 - 7}{114} \times 100 =$ 94%

% Primary Removal $\frac{114 - 50}{114} \times 100 =$ 56%

lb/day RAW 8.34 x 114 x 2.37 = 2253

lb/day PRI. 8.34 x 50 x 2.37 = 988

lb/day EFF. 8.34 x 7 x 2.37 = 138

MLSS, 8.34 x .467 x 3520 = 13709

SVI $\frac{1000 \times 220}{3520} =$ 63 ml/g

CF $\frac{3520}{2.0} =$ 1760 mg/l/ml

SA $\frac{8.34 \times .467 \times 3520}{8.34 \times 50 \times 2.37}$ 14 DAYS

SETTLEOMETER

Time	9:10 SSV	SSC	:15 SSV	SSC
0	1000			
5	800			
10	520			
15	430			
20	360			
25	320			
30	280			
40	230			
50	200			
60	190			

1 2 3		1 2 3
2.5 1.5 1.5	ATC	

1 2 3 4		1 2 3 4
2.7	RSC	
	DOB	
0.2 1.5 2.6	ADO	

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS:

DATE: 10/13/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 100	~~F4~~	R3 5	~~R4~~	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	20.6074	21.7196	21.6156	20.9794		21.2916		22.0612	19.4430	21.7723	21.4520
CRUCIBLE WT.	20.6011	21.7163	21.6122	20.9758		21.2617		22.0341	19.4269	21.7567	21.4358
DIFFERENCE PRE-FURNACE	.0063 126	.0033 66	.0034 34	.0036 36		.0299 5980		.0271 5420	.0161 3220	.0156 3120	.0162 3240
CRUCIBLE WT. + SAMPLE	20.6074	21.7196	21.6156	20.9794		21.2916		22.0612	19.4430	21.7723	21.4520
WT. POST FURNANCE	20.6014	21.7163	21.6128	20.9765		21.2783		22.0487	19.4351	21.7648	21.4410
DIFFERENCE VOLATILE	.0060	.0033	.0028	.0029		.0133		.0125	.0079	.0075	.0110
PRE-FURNACE VOLATILE	120	33	28	29		2660		2500	1580	1500	2200
FIXED SOLIDS	6	0	6	9		3320		2920	1640	1620	1040

COLIFORM BACTERIA

SAMPLE	COLONIES	#/100mL
B	0	
50	6	6/50
100	4	4/100

START: 1:30

FINISH: 1:40

OUT: 12:40

MAGNETITE (mg/L)

MLSS A1	2.77
MLSS A2	1.62
MLSS A3	1.60
RAS 3	3.25
~~RAS 4~~	
WAS	0.63

NOTES

INF. TEMP:	19.2
A1 pH:	6.90
A2 pH:	6.60
FINAL EFF AKALINITY	140

SEPTAGE

Fairhaven	
Mattapoisett	
Marion	
Rochester	
Acushnet	
TOTAL	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN -

NITRATE -

NITRITE -

ALKALINITY -

A1 5ml ____________

% Removal $\frac{126 - 34}{126} \times 100 = 73\%$

% Primary Removal $\frac{126 - 66}{126} \times 100 = 48\%$

lb/day RAW $8.34 \times 126 \times 2.57 = 2701$

lb/day PRI. $8.34 \times 66 \times 2.57 = 1415$

lb/day EFF. $8.34 \times 34 \times 2.57 = 729$

MLSS, $8.34 \times .467 \times 3120 = 12{,}151$

SVI $\frac{1000 \times 280}{3120} = 90$ ml/g

CF $\frac{3120}{1.5} = 2080$ mg/l/ml

SA $\frac{8.34 \times .467 \times 3120}{8.34 \times 66 \times 2.57}$ 9 DAYS

SETTLEOMETER				
Time	10:20		:	
	SSV	SSC	SSV	SSC
0	1000			
5	940			
10	870			
15	830			
20	780			
25	740			
30	670			
40	620			
50	480			
60	400			

1 2 3 20 20 22	ATC	1 2 3
~~1~~ ~~2~~ 3 ~~4~~ 40	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 4 0.2 0.4 1.8	ADO	1 2 3 4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST INITIALS: DATE: 10/9/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 100	F4 X	R3 5	R4 X	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.7590	21.2645	22.0340	17.7441		19.4604		20.3169	19.5758	21.5085	20.9967
CRUCIBLE WT.	21.7556	21.2613	22.0330	17.7361		19.4257		20.2964	19.5578	21.4909	20.9749
DIFFERENCE PRE-FURNACE	.0034 68	.0032 64	.0010 10	.0080 80		.0347 6940		.0205 4100	.0180 3600	.0176 3520	.0218 4360
CRUCIBLE WT. + SAMPLE	21.7590	21.2645	22.0340	17.7441		19.4604		20.3169	19.5758	21.5085	20.9967
WT. POST FURNANCE	21.7556	21.2613	22.0330	17.7390		19.4438		20.3067	19.5667	21.4995	20.9823
DIFFERENCE VOLATILE	.0034 68	.0032 64	.0010 10	.0051 51		.0166 3320		.0102 2040	.0091 1820	.0090 1800	.0144 2880
PRE-FURNACE VOLATILE											
FIXED SOLIDS	0	0	0	29		3620		2060	1780	1720	1480

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	1.96
MLSS A2	1.73
MLSS A3	1.81
RAS 3	3.15
~~RAS 4~~	
WAS	0.86

NOTES	
INF. TEMP:	19.5
A1 pH:	6.9
A2 pH:	6.8
FINAL EFF AKALINITY	

SEPTAGE	
Fairhaven	
Mattapoisett	
Marion	
Rochester	
Acushnet	
TOTAL	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - NITRATE - NITRITE - ALKALINITY -

Al 5ml ____________

% Removal $\frac{68 - 10}{68}$ x 100 = 85%

% Primary Removal $\frac{68 - 64}{68}$ x 100 = 6%.

lb/day RAW 8.34 x 68 x 2.4 = 1361

lb/day PRI. 8.34 x 64 x 2.4 = 1281

lb/day EFF. 8.34 x 10 x 2.4 = 200

MLSS, 8.34 x .467 x 3520 = 13709

SVI $\frac{1000 \times 670}{3520}$ = 190 ml/g →

CF $\frac{3520}{2.2}$ = 1600 mg/l/ml

SA $\frac{8.34 \times .467 \times 3520}{8.34 \times 64 \times 2.4}$ 11 DAYS

SETTLEOMETER				
Time	9:10		:	
	SSV	SSC	SSV	SSC
0	1000			
5	960			
10	900			
15	850			
20	810			
25	770			
30	700			
40	1000			
50	910			
60	850			

1 2 3 3.0 2.5 2.5	ATC	1 2 3
~~1 2~~ 3 ~~4~~ 45	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 4 0.2 0.7 4.0	ADO	1 2 3 4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: UO

DATE: 10/8/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 100	F4		R3 5	~~R4~~	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.2567 21.2507	21.4373 21.4354	21.6129 21.6121	21.2830 21.2824			19.1817 19.1477	19.1280 19.1012	19.5880 19.5665	21.5967 21.5752	16.6051 16.5816	~~21.7767~~
CRUCIBLE WT.												
DIFFERENCE PRE-FURNACE	.0060 120	.0019 38	.0008 8	.0006 6			.0034 6800	.0268 5360	.0215 4300	.0215 4300	.0235 4700	
CRUCIBLE WT. + SAMPLE	21.2567	21.4373	21.6129	21.2830			19.1817	19.1280	19.5880	21.5967	16.6051	
WT. POST FURNANCE	21.2509	21.4354	21.6121	21.2804			19.1647	19.1144	19.5769	21.5856	16.5893	
DIFFERENCE VOLATILE	.0058 116	.0019 38	.0008 8	.0006 6			.0170 3400	.0136 2720	.0111 2220	.0111 2220	.0158 3160	
PRE-FURNACE VOLATILE												
FIXED SOLIDS	4	0	0	0			3400	2640	2080	2080	1540	

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL
START:		
FINISH:		
OUT:		

MAGNETITE (mg/L)	
MLSS A1	2.30
MLSS A2	1.87
MLSS A3	1.86
RAS 3	2.65
~~RAS 4~~	
WAS	0.95

NOTES	
INF. TEMP:	19.4
A1 pH:	6.9
A2 pH:	6.8
FINAL EFF AKALINITY	70

SEPTAGE	
Fairhaven	
Mattapoisett	
Marion	
Rochester	
Acushnet	
TOTAL	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - NITRATE - NITRITE - ALKALINITY -

Al 5ml ____________

% Removal $\frac{120 - 8}{120}$ x 100 = 93%

% Primary Removal $\frac{120 - 38}{120}$ x 100 = 68%

lb/day RAW 8.34 x 120 x 2.3 = 2302

lb/day PRI. 8.34 x 38 x 2.3 = 729

lb/day EFF. 8.34 x 8 x 2.3 = 153

MLSS. 8.34 x .467 x 4300 = 16748

SVI $\frac{1000 \times 700}{4300}$ = 163 ml/g

CF $\frac{4300}{2.5}$ = 1720 mg/1/ml

SA $\frac{8.34 \times .467 \times 4300}{8.34 \times 38 \times 2.3}$ 22 DAYS

SETTLEOMETER				
Time	9:35		2.2	
	SSV	SSC	SSV	SSC
0	1000			
5	910			
10	880			
15	820			
20	780			
25	740			
30	690			
40	650			
50	560			
60	490			

1 2 3 3.0 2.2 2.2	ATC	1 2 3
~~1~~ ~~2~~ 3 ~~4~~ 6.0	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 4 0.5 0.4 4.3	ADO	1 2 3 4

Bulking.

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST												
INITIALS: VO								DATE: 10/7/15				
SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 25	F4	R3 5	R4	A1 5	A2 5	A3 5	~~WAS 5~~
CRUCIBLE WT. + SAMPLE	21.2874	19.5683	19.1003	21.6464		21.2862		19.1711	21.4539	21.5981	
CRUCIBLE WT.	21.2824	19.5651	19.0991	21.6124		21.2508		19.1475	21.4355	21.5750	~~[illegible]~~
DIFFERENCE PRE-FURNACE	.0050 100	.0032 64	.0012 12	.0340 1360		.0354 7080		.0236 4720	.0184 3680	.0231 4620	
CRUCIBLE WT. + SAMPLE	21.2874	19.5683	19.1003	21.6464		21.2862		19.1711	21.4539	21.5981	
WT. POST FURNANCE	21.2824	19.5651	19.0991	21.6282		21.2677		19.1576	21.4434	21.5852	
DIFFERENCE VOLATILE	.0050 100	.0032 64	.0012 12	.0182 728		.0185 3700		.0135 2700	.0105 2100	.0129 2580	
PRE-FURNACE VOLATILE											
FIXED SOLIDS	Ø	Ø	Ø	632		3380		2020	1580	2040	

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	1.83
MLSS A2	1.31
MLSS A3	1.43
RAS 3	2.85
~~RAS 4~~	
~~WAS~~	

NOTES	
INF. TEMP:	19.5
A1 pH:	6.9
A2 pH:	6.7
FINAL EFF AKALINITY	113

SEPTAGE	
Fairhaven	
Mattapoisett	
Marion	
Rochester	
Acushnet	
TOTAL	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - NITRATE - NITRITE - ALKALINITY -

Al 5ml ____________

% Removal $\frac{100 - 12}{100}$ x 100 = 88%

% Primary Removal $\frac{100 - 64}{100}$ x 100 = 36%

lb/day RAW 8.34 x 100 = 2.44 = 2035

lb/day PRI. 8.34 x 64 = 2.44 = 1302

lb/day EFF. 8.34 x 12 = 2.44 = 244

MLSS, 8.34 x .467 x 4620 = 17 993

SVI $\frac{1000 \times 690}{4620}$ = 149 ml/g →

CF $\frac{4620}{2.2}$ = 2100 mg/1/ml

SA $\frac{8.34 \times .467 \times 4620}{8.34 \times 64 \times 2.44}$ 14 DAYS

SETTLEOMETER				
Time	9:10		:22	
	SSV	SSC	SSV	SSC
0	1000			
5	900			
10	830			
15	750			
20	670			
25	600			
30	550			
40	440			
50	350			
60	300			

1 2 3 2.1 1.9 2.2	ATC	1	2	3	
~~1~~ ~~2~~ 3 4 55	RSC	1	2	3	4
~~1~~ ~~2~~ ~~3~~ ~~4~~	DOB	1	2	3	4
1 2 3 4 0.7 1.7 3.4	ADO	1	2	3	4

FAIRHAVEN CONTROL DATA LOG - BIOMAG TEST

INITIALS: VO

DATE: 10/6/15

SAMPLES - VOLUME	INF 50	PRI 50	EFF 100	F3 100	F4	R3 5	R4	A1 5	A2 5	A3 5	WAS 5
CRUCIBLE WT. + SAMPLE	21.2660 21.2608	22.0357 22.0332	20.2987 20.2970	19.4276 19.4264		16.6224 16.5816		21.5103 21.4917	21.7715 21.7558	19.5722 19.5568	20.6300 20.6014
CRUCIBLE WT.											
DIFFERENCE PRE-FURNACE	.0052 104	.0025 50	.0017 17	.0012 12		.0408 8160		.0186 3720	.0157 3140	.0154 3080	.0286 5720
CRUCIBLE WT. + SAMPLE	21.2660	22.0357	20.2987	19.4276		16.6224		21.5103	21.7715	19.5722	20.6300
WT. POST FURNANCE	21.2610	22.0336	20.2974	19.4264		16.6022		21.5007	21.7633	19.5641	20.6109
DIFFERENCE VOLATILE	.0050 100	.0021 42	.0013 13	.0012 12		.0202 4040		.0096 1920	.0082 1640	.0081 1620	.0191 3820
PRE-FURNACE VOLATILE											
FIXED SOLIDS	4	8	4	0		4120		1800	1500	1460	1900

COLIFORM BACTERIA		:
SAMPLE	COLONIES	#/100mL

START:

FINISH:

OUT:

MAGNETITE (mg/L)	
MLSS A1	1.40
MLSS A2	1.10
MLSS A3	1.14
RAS 3	3.2
RAS 4	—
WAS	0.74

NOTES	
INF. TEMP:	19.8
A1 pH:	6.9
A2 pH:	6.7
FINAL EFF AKALINITY	

SEPTAGE	
Fairhaven	
Mattapoisett	
Marion	
Rochester	
Acushnet	
TOTAL	

TSS TESTING: (CRUCIBLE WT. + SAMPLE - CRUICIBLE WT.) / VOLUME (mL) x 1,000,000

TOTAL NITROGEN - NITRATE - NITRITE - ALKALINITY -

% Removal $\frac{104-17}{104}$ × 100 = 84%

% Pri Removal $\frac{104-50}{104}$ × 100 = 52%

lb/Day Raw 8.34 × 104 × 2.58 = 2238

" Pri 8.34 × 50 × 2.58 = 1076

" EFF 8.34 × 17 × 2.58 = 366

MLSS 8.34 × .467 × 3080 = 11996

SVI $\frac{1000 \times 550}{3080}$ 179 ml/g

CF $\frac{3080}{2.2}$ = 1400 mg/L/ml

SA $\frac{8.34 \times .467 \times 3080}{8.34 \times 50 \times 2.58}$ 11 Days

FAIRHAVEN CONTROL DATA LOG

INITIALS: 10 | DATE: 10/5/15

SETTLEOMETER

TIME	9:22 SSV	SSC	: SSV	SSC
0	1000			
5	900			
10	820			
15	740			
20	660			
25	590			
30	520			
40	410			
50	360			
60	290			

	1	2	3	4
ATC	5.5	1.7	1.7	
RSC	1	1	3	4
	6.5			
DOB	1	1	1	1
ADO	1.4	2.6	4.6	

RESIDUAL CL_2

TIME	FLOW	LEVEL
:	plant	
:		
:		
:		
:		
:		
:		
:		
:		
:	avg.	
:	H_2S	

SAMPLES

SAMPLES	INF 50	A3 5ml	PRI 50	EFF 100	F3 100	F4	R3 5ml	R4 5ml	A2 5ml
CRUCIBLE WT. + SAMPLE									
CRUCIBLE WT.	21.2649 21.2607	22.0466 22.0335	21.7586 21.7561	21.4918 21.4911	19.5579 19.5574		19.4729 19.4262		20.3098 20.2968
DIFFERENCE PRE-FURNACE	.0042 84	.0131 2620	.0025 50	.0007 7	.0005 5		.0467 9340		.0130 2600
CRUCIBLE WT. + SAMPLE	21.2649	22.0466	21.7586	21.4918	19.5579		19.4729		20.3098
WT. POST FURNACE	21.2607	22.0390	21.7561	21.4911	19.5574		19.4486		20.3025
DIFFERENCE VOLATILE	.0042 82	.0076 1520	.0025 50	.0007 7	.0005 5		.0243 4860		.0073 1460
PRE-FURNACE VOLATILE	0	1100	0	0	0		4480		1140
FIXED SOLIDS									

COLIFORM BACTERIA

SAMPLE	COLONIES	#/100ml
B	0	
50	3	3/150
100	0	

START: 11:22 — 3/150

FINISH: 11:35 — .02

OUT: 11:49

MICROORGANISM GROUP

MICROORGANISM GROUP	
AMOEBOIDS	
FLAGELLATES	
FREE SWIMMING CILIATES	
STALKED CILIATES	
ROTIFERS	
WORMS	

*NOTES

INF. TEMP. — 19.7

A1 ph — 6.6

A2 ph — 6.7

SEPTAGE

Fairhaven—

Mattapoisett—

Marion—

Rochester—

Acushnet—

total

TOTAL NITROGEN— NITRATE— NITRITE— ALKALINITY—

SETTLEOMETER

TIME	9:15 SSV	SSC	:10 SSV	SSC
0	1000			
5	380			
10	260			
15	200			
20	160			
25	140			
30	120			
40	110			
50	110			
60	110			

1 2 3 4.7 1.0 1.0	ATC	1 2 3
1 D 3 4 7.0	RSC	1. 2 3 4
711R11R114	DOB	1 2 3 4
1 2 3 N 1.4 1.8 3.0	ADO	1 2 3 4

RESIDUAL CL_2

TIME	FLOW	LEVEL
:	plant	
:		
:		
:		
:		
:		
:		
:		
:	avg.	
:	H_2S	

FAIRHAVEN CONTROL DATA LOG

INITIALS: VO — DATE: 10/2/15

SAMPLES	INF 25	A3 5ml	PRI 25	EFF 100	F3 100	F4	R3 5ml	R4 5ml	A2 5ml
CRUCIBLE WT. + SAMPLE	21.2635	20.3052	16.5830	19.4274	21.7564		22.0925		19.3661
CRUCIBLE WT.	21.2610	20.2974	16.5816	19.4266	21.7556		22.0339		19.5574
DIFFERENCE PRE-FURNACE	.0025 100	.0078 1560	.0014 56	.0008 8	.0008 8		.0586 11720		.0087 1740
CRUCIBLE WT. + SAMPLE	21.2635	20.3052	16.5830	19.4274	21.7564		22.0925		19.5661
WT. POST FURNACE	21.2610	20.3010	16.5816	19.4266	21.7557		22.0653		19.5616
DIFFERENCE VOLATILE	.0025 100	.0042 840	.0014 56	.0008 8	.0007 7		.0272 5440		.0045 900
PRE-FURNACE VOLATILE	0	720	0	0	1		6280		840
FIXED SOLIDS									

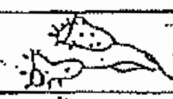
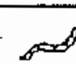
COLIFORM BACTERIA

SAMPLE	COLONIES	#/100ml

START:

FINISH:

OUT:

MICROORGANISM GROUP	
AMOEBOIDS 	
FLAGELLATES 	
FREE SWIMMING CILIATES 	
STALKED CILIATES 	
ROTIFERS 	
WORMS 	

*NOTES

INF. TEMP. 20.6

A1 ph 6.5

A2 ph 6.7

SEPTAGE

Fairhaven–

Mattapoisett–

Marion–

Rochester–

Acushnet–

total

TOTAL NITROGEN– NITRATE– NITRITE– ALKALINITY–

FAIRHAVEN CONTROL DATA LOG

INITIALS: JO | DATE: 10/1/15

SETTLEOMETER

TIME	9:20 SSV	SSC	:15 SSV	SSC
0	1000			
5	800			
10	550			
15	460			
20	390			
25	340			
30	300			
40	240			
50	200			
60	180			

1 2 3 2.0 1.5 1.5	ATC	1 2 3
1 2 3 4 6.0	RSC	1 2 3 4
1 2 3 4	DOB	1 2 3 4
1 2 3 4 0.6 2.0 3 4	ADO	1 2 3 4

RESIDUAL CL_2

TIME	FLOW	LEVEL
:	plant	
:		
:		
:		
:		
:		
:		
:		
:		
:	avg.	
:	H 2 S	

SAMPLES

SAMPLES	INF 25	A3 5ml	PRI 25	EFF 100	F3 100	F4	R3 5ml	R4 5ml	A2 5ml
CRUCIBLE WT. + SAMPLE	21.2621	21.3069	22.0346	16.5819	21.3179		21.7572		19.4372
CRUCIBLE WT.	21.2618	21.2946	22.0330	16.5809	21.2824		21.7557		19.4263
DIFFERENCE PRE–FURNACE	.0003 12	.0123 2460	.0016 64	.0010 10	.0355 355		.0015 300		.0109 2180
CRUCIBLE WT. + SAMPLE	21.2621	21.3069	22.0346	16.5819	21.3179		21.7572		19.4372
WT. POST FURNACE	21.2618	21.2999	22.0330	16.5809	21.3000		21.7561		19.4308
DIFFERENCE VOLATILE	.0003 12	.0070 1400	.0016 64	.0010 10	.0179 179		.0011 220		.0064 1280
PRE–FURNACE VOLATILE	0	1060	0	0	176		80		900
FIXED SOLIDS									

COLIFORM BACTERIA

SAMPLE	COLONIES	#/100ml

START:

FINISH:

OUT:

MICROORGANISM GROUP	
AMOEBOIDS	
FLAGELLATES	
FREE SWIMMING CILIATES	
STALKED CILIATES	
ROTIFERS	
WORMS	

*NOTES

INF. TEMP 20.4

A1 ph 6.6

A2 ph 6.4

SEPTAGE

Fairhaven–

Mattapoisett–

Marion–

Rochester–

Acushnet–

total

TOTAL NITROGEN– NITRATE– NITRITE– ALKALINITY–