BRP WS 22D PILOT STUDY APPROVAL APPLICATION
WELLFIELD 2

Town of Sharon, Massachusetts
PWS 4266000

August 2023

Transmittal Number X289810

ENVIRONMENTAL
PARTNERS
— An Apex Company —

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August 25, 2023

Mr. James McLaughlin
Department of Environmental Protection
Southeast Regional Office
20 Riverside Drive
Lakeville, MA 02347

RE: Town of Sharon, PWS # 4266000
BRP WS 22D: Pilot Study Approval
DEP Transmittal No. X289810

Dear Mr. McLaughlin,

On behalf of the Town of Sharon (Town), Environmental Partners (EP) submits the following information for Massachusetts Department of Environmental Protection (MassDEP) review and approval in association with our recently completed water treatment pilot study:

- Attachment A – Blueleaf, Inc. Pilot Study Report
- Attachment B – WS Certification Form
- Attachment C – Wells 2, 3, and 4 Water Treatment Plant Preliminary Process Flow Diagrams and Process Mechanical Layouts

Over the past two years, Well 2 water quality samples have exceeded the Secondary Maximum Contaminant Level (SMCL) of 0.3 milligrams per liter (mg/L) for iron and 0.05 mg/L for manganese. This pilot study evaluated the removal of source water iron and manganese from Well 2 using oxide coated media filtration and biologically activated media filtration technologies. The results of this pilot study were incorporated into the design of a proposed centralized treatment plant for three of the Town's groundwater wells (Well 2, Well 3, and Well 4), which has treatment for both iron and manganese and PFAS. The iron and manganese treatment system will treat water from Wells 2 and 3 only.

In coordination with EP, Blueleaf, Inc. (Blueleaf) provided the pilot study equipment for each pilot test. Blueleaf performed two pilot studies in parallel between December 2022 and March 2023 to evaluate the use of pressure filtration technology for the removal of iron and manganese from Sharon's Well #2 (MassDEP Source ID: 4266000-01G). The wellfield is located on Moose Hill Parkway in the central portion of the Town. The first pilot study, referred to as Pilot Study #1, evaluated the oxidation and subsequent removal of iron and manganese using oxide coated media filtration (also called "adsorptive media filtration" in Blueleaf's pilot study report, Attachment C). The second pilot study, referred to as Pilot Study #2, evaluated the removal of iron and manganese using biologically activated media filtration. Due to the longer duration of Pilot Study #2, this pilot study began approximately two months before Pilot Study #1. Table 1 shows the overall pilot schedule.

Table 1: Pilot Study Schedule

Date	Description
December 12, 2022	Pilot Study #2 Mobilized, Iron Filters Begin Operation
January 16, 2023	Manganese Filter for Pilot Study #2 Installed and Begins Operation
February 15, 2023	Pilot Study #1 Mobilized and Begins Operation
March 10, 2023	Pilot Study #1 and #2 End

Each pilot test included a trailer with chemical feed equipment, 6-inch filter columns (four for Pilot Study #1 and three for Pilot Study #2), and online water quality analyzers. Blueleaf operated the equipment and conducted field water quality analyses during the 44 filter runs of Pilot Study #1 and 45 filter runs of Pilot Study #2 at the well. Phoenix Environmental Labs in Manchester, Connecticut provided certified laboratory analyses for this study. Blueleaf prepared a comprehensive and detailed pilot study report, included in Attachment C, which provides tabular and graphical summaries and interpretation of the pilot study results.

The remainder of this letter describes key observations, results, conclusions from the pilot study, and basis of design recommendations for a full-scale treatment facility.

PROPOSED FULL SCALE TREATMENT PROCESSES

The full-scale water treatment plant (WTP) will treat water from Wells #2, #3, and #4. The WTP will remove iron and manganese present in raw water from Wells #2 and #3, as well as PFAS present in raw water from all three wells. Removal of iron and manganese prior to PFAS treatment mitigates the potential for PFAS removal media fouling. Raw water from Wells #2 and #3 will combine and enter the iron and manganese treatment system. The iron and manganese filter effluent will then combine with raw water from Well #4 and enter the PFAS treatment system. Following PFAS treatment, the filtered water will receive final chemical addition before entering the distribution system.

Historically, raw water from Well #2 and Well #3 has exceeded the Secondary Maximum Contaminant Level (SMCL) of 0.3 milligrams per liter (mg/L) for iron and 0.05 mg/L for manganese. EP and Blueleaf conducted pilot studies for the Well #2 raw water only because iron and manganese levels at this well are the highest of the two wells. Raw water from Well #4 does not historically exceed the SMCLs for iron and manganese; therefore, this well was omitted from the iron and manganese treatment system and therefore omitted from these pilot studies.

EP did not perform a pilot study for PFAS removal. Based on the results of initial testing performed in the spring of 2021, Well #4 had the highest levels of PFAS of the three wells. PFAS levels at Well #4 exceeded the MassDEP regulation for six PFAS compounds (PFAS6). In response to exceeding the MassDEP regulation, the Town designed, constructed, and is now operating a full-scale, temporary ion exchange treatment system for the removal of PFAS from Well #4 raw water. This system has proved effective at removing raw water PFAS to non-detect levels for all PFAS compounds regulated by MassDEP. Due to the success of PFAS treatment at Well #4, and the relatively lower levels of

PFAS6 at Well #2 and Well #3, EP did not propose a pilot study for PFAS removal for Well #2 or Well #3.

On November 9, 2022, the Town received approval from MassDEP to conduct the pilot study, including filtration and chemical addition, to remove iron and manganese from the Well 2 raw water.

RAW WATER

When Blueleaf mobilized and began operation of Pilot Study #2 in December 2022, initial iron and manganese concentrations were lower than expected based on historical data and well flow. Following initial start-up, the Town increased the Well #2 flow rate twice during a month-long start-up period to help simulate historic water quality during the pilot study. Table 2 below highlights the instances during Pilot Study #2 where operators increased flow from Well #2.

Table 2: Well #2 Flow Adjustments Schedule

Date	Description
December 12, 2022[1]	Well Flow at 112 gallons per minute (gpm)
December 19, 2022	Well Flow increased to 186 gpm
January 4, 2023	Well Flow increased to 290 gpm

[1] Start of Pilot Study #2.

After the Town increased the flow to 290 gpm, iron and manganese concentrations in the raw water became more representative of historical conditions. In general, Blueleaf's statistical analyses suggest that throughout both pilot studies, concentrations of iron were lower than historic averages and concentrations of manganese were similar to historic averages. Table 3 includes a summary of the results of Blueleaf's field analyses of iron and manganese at Well #2 compared to historic iron and manganese data from this well. The pilot study data includes raw water data collected during both Pilot Study #1 and Pilot Study #2.

Table 3: Well #2 Average Source Water Quality – Historic vs. Pilot Study

Parameter	Historic	Pilot Study
Total Iron Concentration (mg/L)	1.78	0.62
Total Manganese Concentration (mg/L)	0.240	0.134

Blueleaf also collected raw water quality data for color and total organic carbon (TOC). Apparent color, measured before filtering the water sample, was detected at 15 color units. True color, measured after filtering the water sample, was not detected in the raw water. This is similar to the well's historic average color of 15 color units. The results of Blueleaf's field analyses of TOC indicate an average TOC level of 0.35 mg/L, which is lower than the TOC level of 1.90 mg/L measured in 2021 during the Town's supplemental sampling event.

Blueleaf collected samples for a Biological Activity Reaction Test (BART), which identified the presence and level of activity of several potential inhibiting bacteria that can be found in water and wastewater sources. The results of the BART test identified an elevated number of iron reducing and slime forming bacteria in the raw groundwater and a small population of sulfate reducing bacteria.

Please refer to Blueleaf's Pilot Study Report for further documentation of raw water quality results.

PILOT STUDY #1 – OXIDE COATED MEDIA FILTRATION

Pilot Study Setup

The primary goal of Pilot Study #1 was to evaluate oxide coated media filtration for the removal of iron and manganese from Well #2. Blueleaf studied two oxide coated medias: GreensandPlus^{TM} (Greensand) and Pureflow© PM-200 pyrolusite media (pyrolusite).

Iron, manganese, and turbidity were the primary target water quality constituents evaluated during this pilot study. In addition, pilot study operators monitored other water quality parameters such as pH, nitrate, and TOC. Table 4 below includes a summary of the water quality goals for this pilot study. The treatment goals for iron and manganese were half of each parameter's SMCL, which is 0.30 mg/L for iron and 0.05 mg/L for manganese.

Table 4: Treated Water Quality Goals

Location	Parameter	Goal
Filtered Water	Iron	< 0.15 mg/L
Filtered Water	Manganese	< 0.025 mg/L
Filtered Water	Turbidity	< 0.01 NTU

Blueleaf mobilized the oxide coated media pilot trailer at Well #2 on February 15, 2023. After mobilizing the pilot trailer equipment, Blueleaf optimized filter performance using sodium hypochlorite as a pre-oxidant. Blueleaf conducted Pilot Study #1 for just over three weeks, which included backwash recycle trials.

Table 5 lists the four filters used in Pilot Study #1 and their designations. Filters A and C contained Greensand media and Filters B and D contained pyrolusite. All filters contained 24 inches of their respective oxide coated media and a 12-inch anthracite cap. To study the performance of the filters with different target pH values, Filters A and B had an influent target pH of 6.4 (ambient raw water pH), while Filters C and D had an influent target pH of 8.0 to match the Town's finished water pH goal. In terms of loading rates, Blueleaf operated the filters at filter surface loading rates (FSLRs) ranging from 5 gallons per minute per square foot (gpm/sf) to 10 gpm/sf.

Table 5: Pilot Filter Designations

Name	Influent Target pH	Media
Filter A	6.4	Greensand
Filter B	6.4	Pyrolusite
Filter C	8.0	Greensand
Filter D	8.0	Pyrolusite

Pre-treatment

For Pilot Study #1, Blueleaf used sodium hypochlorite as a pre-oxidant for all four filter columns. Blueleaf based their dosing on a target filtered water free chlorine residual between 0.25 mg/L and 0.50 mg/L. The exact dose of sodium hypochlorite varied between 1.5 and 2.8 mg/L depending on the strength of bleach used in the chemical storage container. Sodium hypochlorite was effective as a pre-oxidant for all four filter columns, therefore testing of alternative oxidants was not required. EP recommends a sodium hypochlorite dose of 1.50-2.80 mg/L to attain a residual filter effluent chlorine level of 0.5 mg/L.

The Town uses potassium hydroxide for pH adjustment and corrosion control at their water sources. During this pilot study, Blueleaf compared the performance of the filters at a raw water ambient pH of 6.4 and an adjusted pH of 8.0. With sodium hypochlorite as the pre-oxidant, Blueleaf found a pre-oxidation pH of 6.4 to be more effective than 8.0 in meeting pilot study goals. EP recommends that the full-scale plant does not include pre-filtration pH adjustment to minimize the number of potassium hydroxide chemical feed injection points and simplify operations.

Please refer to Blueleaf's Pilot Study Report for further documentation of sodium hypochlorite and potassium hydroxide dose calculations and usage.

Filtration

Once Blueleaf optimized pretreatment chemistry as described above, the filters successfully met the treated water quality goals for iron, manganese, and turbidity. Blueleaf measured filter effluent turbidity in the filter effluent water as a surrogate for iron breakthrough, as turbidity is not regulated for groundwater treatment.

A comparison of online filter effluent turbidity readings with filter terminal headloss readings suggests that during many of the trials, turbidity began to rise after the filter reaches terminal headloss (greater than 10 psi differential pressure), especially at higher loading rates. However, Filter D experienced several trials that were terminated due to turbidity breakthrough (greater than 0.1 NTU). Filters C and D, which had a higher target pH, generally had more instances of turbidity reaching breakthrough levels, even if breakthrough occurred after the filters reached terminal headloss.

EP recommends the installation of filter effluent turbidity meters in the future WTP to help monitor for water quality breakthrough events and trigger backwashes when turbidity readings exceed 0.1 NTU. This is particularly important for filter operations at a pH of 8.0 since water quality breakthrough typically preceded terminal differential pressure for the filter runs at this higher pH target.

Filter runtimes for all four filters varied from approximately 11 hours to approximately 65 hours depending on the loading rate, type of media, and influent pH. Filter Surface Loading Rates (FSLRs) of 5 gpm/sf, 7.5 gpm/sf, and 10 gpm/sf were studied during this pilot study. Based on the pilot study data, to achieve runtimes of at least 24 hours, filters should typically be operated with loading rates that do not exceed approximately 8 gpm/sf, which is a typical maximum operating point for pressure filtration with Greensand media.

If oxide coated media is selected as the treatment technology for the WTP, EP recommends the use of Greensand over pyrolusite because there is less breakthrough with Greensand. Greensand also required a lower backwash frequency than pyrolusite media. EP recommends an average FSLR of up to 5 gpm/sf and a peak FSLR of up to 8 gpm/sf for the design of a future WTP using Greensand filtration.

pH and Alkalinity

pH and alkalinity are two important parameters to consider relative to corrosion control. Raw water pH ranged from approximately 6.14 to approximately 6.95 and raw water alkalinity ranged from 45.5 mg/L as $CaCO_3$ to 52 mg/L as $CaCO_3$. As discussed above, EP used raw water ambient pH as the target for Filters A and B and an influent target pH of 8.0 for Filters C and D. Blueleaf added potassium hydroxide to maintain the target pH for Filters C and D. Alkalinity data for the Pilot Study #1 filter trials is limited; however, a review of available filter effluent alkalinity results suggest that while alkalinity levels remained within the raw water alkalinity range for Filters A and B, alkalinity levels rose up to the low 80s for Filters C and D.

Based on the performance of the filters, the filters operating at an ambient raw water pH of 6.4 provided longer filter run times at higher FSLRs than the filters operating at an influent pH of 8.0. Therefore, EP does not recommend pH adjustment prior to the iron and manganese removal system.

The Town currently uses potassium hydroxide for pH adjustment and corrosion control at each of their sources to maintain a finished water pH of approximately 8.0. To increase the filter effluent water pH to 8.0, EP recommends a potassium hydroxide dose of approximately 36.5 mg/L, which is based on titrations performed by Blueleaf to assess chemical doses at different pH levels.

Disinfection

The Town is currently in compliance with the requirements of the Groundwater Rule, the Revised Total Coliform Rule, and Lead and Copper Rule. Compliance with these regulations requires a delicate balance between the use of disinfectants and distribution system pH levels. While disinfection is required to ensure the protection against waterborne pathogens, the misuse of disinfectants can result in unallowable levels of disinfection by-products.

Blueleaf conducted bench-scale filter effluent sodium hypochlorite titrations. Blueleaf's titrations continued to an endpoint of approximately 1.8 mg/L free chlorine, which is above the Town's finished water goal of 0.2 mg/L to 1.2 mg/L free chlorine. Based on the results of the titrations, the

Town will need to add approximately 0.2 mg/L to 1.2 mg/L sodium hypochlorite to the filter effluent to meet the target free chlorine residual in the filtered water of 0.2 mg/L to 1.2 mg/L.

Residuals Management

The filtration process will generate residuals during backwashes and filter-to-waste (e.g. filter ripening) operations. Blueleaf typically backwashed the filters for 10 minutes at 12 gpm/sf. Blueleaf found no significant negative impacts backwashing the oxide coated media filters. A backwash of 12 gpm/sf is typical for Greensand media. While pyrolusite could be backwashed at rates up to 20 gpm/sf, high backwash rates could blow out the anthracite cap on top of the pyrolusite media. Therefore, backwash rates for the pyrolusite filters remained at 12 gpm/sf for Pilot Study #1 and may not be representative of actual backwash capacity for that media.

Blueleaf collected backwash waste water to evaluate the settlement of solids in the water. Blueleaf used Imhoff settling cones to collect backwash waste water after backwashes and observed the settlement of solids in the first five hours after the backwash. Blueleaf performed water quality testing on the backwash waste water and supernatant water to observe changes in water quality after the solids had time to settle (over 24 hours). Blueleaf also used the backwash supernatant to perform recycle trials and evaluate how supernatant recycling affected filter effluent water quality. Blueleaf used a recycle rate of 5% of the raw water flow during recycle trials.

Blueleaf successfully piloted recycling of settled backwash supernatant at 5% of raw water flow. Filtered water iron and manganese concentrations and the rate of differential pressure gain remained unaffected by backwash recycling. In addition, a review of combined backwash and settled supernatant water quality data suggests that the backwash water largely consists of readily settleable solids. The results of the Imhoff cone test indicate that after five hours, 30-40 mL (3-4%) of the iron and manganese settled in the cones. Therefore, EP recommends designing the future water treatment facility to include the option to recycle settled supernatant into the process at up to 5% of raw water flow. Additionally, EP recommends allowing solids to settle for at least 2 hours after each backwash before commencing recycle operations.

PILOT STUDY #2 – BIOLOGICAL FILTRATION

Pilot Study Setup

The primary goal of Pilot Study #2 was to evaluate biological filtration for the removal of iron and manganese from Well #2. Like Pilot Study #1, iron and manganese were the primary target water quality constituents evaluated during this pilot study. However, Blueleaf did not monitor turbidity during Pilot Study #2. In Pilot Study #2, Blueleaf aerated the iron filter effluent prior to the manganese filter, and the microbubbles that form during aeration can interfere with turbidity readings. Blueleaf also monitored other water quality parameters such as pH, nitrate, and TOC. The water quality goals listed in Table 4 (excluding turbidity) were also used for this pilot study.

Blueleaf mobilized their biological filtration pilot trailer at Well #2 on December 12, 2022. As mentioned previously, it took approximately 2 to 3 weeks for raw water iron and manganese concentrations to reach representative levels. Blueleaf conducted Pilot Study #2 for approximately 9 weeks, which included the completion of backwash recycle trials.

Pilot Study #2 included two pilot columns for biological iron filtration (F1 and F2) and one pilot column for biological manganese filtration (M1). Blueleaf employed two pilot columns for biological iron filtration to achieve high levels of iron removal prior to sending water to M1 and to allow for more experimentation with biological iron filter loading rates. The biological iron filtration columns contained 48 inches of 1.3 millimeter (mm) sand. Blueleaf acclimated the media for F1 and F2 with the Town's raw water, which took approximately four days.

The biological manganese filtration column contained 48 inches of 0.95 mm sand. Blueleaf acclimated the media for M1 at a full-scale biological treatment plant in Shrewsbury, Massachusetts and delivered the media to the Well #2 pilot trailer on January 16, 2023. Blueleaf acclimated M1 off-site to reduce the acclimation time of the filter and to prevent high levels of iron from entering the filter while F1 and F2 acclimated. M1 adapted to the Well #2 raw water source. It is important to note that the acclimation period for the biological manganese filter during this pilot study is not representative of full-scale acclimation. A full-scale biological manganese removal filter may take weeks to acclimate and mature.

The biological iron filters operated at FSLRs between 5 gpm/sf and 25 gpm/sf. Blueleaf used F1 to test higher surface loading rates, and operated F2 at more conservative loading rates of 5 gpm/sf to 10 gpm/sf lower than F1. Blueleaf operated the biological manganese filter at a filter surface loading rate of 5 gpm/sf to 15 gpm/sf.

Pre-treatment

The biological iron filters used ambient raw water pH and dissolved oxygen. Iron removal was effective without the use of any pH adjustment or air injection pre-treatment.

Prior to entering M1, Blueleaf treated effluent from the iron filters with approximately 28 mg/L of potassium hydroxide to increase the pH from 6.4 to 7.6. Please refer to Blueleaf's Pilot Study Report for further documentation of potassium hydroxide dose calculation and usage. Additionally, iron filter effluent flowed through an in-line air contactor without air injection to increase the dissolved oxygen concentration prior to manganese removal. This method of aeration provided enough dissolved oxygen to meet the target level of at least 4 mg/L.

Biological filtration does not require any pre-treatment chlorine dose. In fact, chlorine would destroy the biological mass that helps remove iron and manganese from the water.

Filtration

The biological iron and manganese filters successfully met the pilot study goals for iron and manganese removal at the range of loading rates described above. For F1 and F2, filter runtimes varied from 14 hours at 25 gpm/sf to almost 90 hours at 5 gpm/sf. For M1, the filter runtimes were 365 hours for the trials running at 10 gpm/sf. Blueleaf terminated two of the manganese trial filter runs early. The first filter run, which operated for 337 hours at 5 gpm/sf, ended due to scheduling purposes (i.e. needing to proceed with trials with higher surface loading rates). The last filter run, which operated at 15 gpm/sf, ended due to the end of the pilot study. Blueleaf did not observe any breakthrough during any of the biological filtration trials.

Based on the pilot study data, the biological filters have longer potential runtimes than the oxide coated media filters. EP estimates that both the iron and manganese filters could be operated at an average loading rate of 7 gpm/sf and a conservative design peak loading rate of 15 gpm/sf.

pH and Alkalinity

As mentioned previously, raw water pH ranged from approximately 6.14 to approximately 6.95 and raw water alkalinity ranged from 45.5 mg/L as $CaCO_3$ to 52 mg/L as $CaCO_3$. The average pH of the effluent from the iron filters remained within the pH range for the raw water. Due to the air contactor between the iron filters and the manganese filter, pH increased to an average of 7.6 before entering the manganese filter. However, pH tended to decrease through the manganese filter. The average pH of the manganese effluent was 7.2. This is common for healthy biological manganese filters, as it indicates that the biomass is eating the manganese and expelling acid in the process. The alkalinity of the iron filter effluent remained within the alkalinity range for the raw water. However, the alkalinity of the manganese effluent increased to the mid-70s/low-80s.

To bring the manganese filter effluent to a pH of 8.0, EP recommends a potassium hydroxide dose of 8 mg/L, which is based on titrations performed by Blueleaf to assess chemical doses at different pH levels.

Disinfection

EP does not recommend the addition of pre-filtration sodium hypochlorite because chlorine can kill the biomass in the filters. To provide a chlorine residual of 0.2 mg/L to 1.2 mg/L in the filtered water, EP recommends a chlorine dose of 0.2 mg/L to 1.2 mg/L, which is based on titrations performed by Blueleaf to assess the relation between chlorine doses and residuals.

Residuals Management

Like the oxide coated media filters, the biological filtration process will generate residuals during backwashes and filter-to-waste (e.g. filter ripening) operations. However, biological filters require less frequent and lower volume backwashing than the oxide coated media filters (refer to Table 6). In Pilot Study #2, Blueleaf backwashed the iron and manganese filters with a low-rate wash of 6 gpm/sf for three minutes followed by a high-rate wash of 8 gpm/sf for five minutes. The biological manganese filter required less frequent backwashing than the biological iron filter, which is typical for biological filters.

Similar to Pilot Study #1, Blueleaf collected backwash waste water to evaluate the settlement of solids in the water. Blueleaf used Imhoff settling cones to collect backwash waste water after backwashes and observed the settlement of solids in the first five hours after the backwash. Blueleaf performed water quality testing on the backwash waste water and supernatant water to observe changes in water quality after the solids had time to settle (over 24 hours). Blueleaf also used the backwash supernatant to perform recycle trials and evaluate how supernatant recycling affected filter effluent water quality. Blueleaf used a recycle rate of 5% of the raw water flow during the recycle trials.

Blueleaf successfully piloted recycling of settled backwash supernatant at 5% of raw water flow. Filtered water iron and manganese concentrations and the rate of differential pressure gain were unaffected by recycling. However, the suspended supernatant remained cloudy even after the backwash water had time to settle. The results of the Imhoff cone test indicate that after five hours approximately 20 mL (2%) of solids in the iron filter (F1 and F2) backwash waste settled. The solids in the manganese filter (M1) backwash waste settled slower than the iron filter backwash waste, but the final settled volume was approximately 40 mL (4%) of solids. The cloudy supernatant and the limited solids settling in the iron filters likely indicates the presence of some unsettled or dissolved iron and/or manganese in the supernatant.

As previously recommended, Environmental Partners recommends designing the future water treatment facility to include the option to recycle settled supernatant into the process at up to 5% of raw water flow. Additionally, EP recommends allowing solids to settle for at least 3-5 hours after each backwash before commencing recycle operations.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the pilot study, EP developed the following conclusions regarding the performance of each treatment technology (Greensand, pyrolusite, and biological filtration).

Pre-Filtration Treatment Requirements

EP compared the pre-filtration treatment requirements for each treatment technology. For the full-scale treatment design, the pre-treatment requirements and complexity of providing pre-treatment are factors in determining which treatment technology is preferred.

The use of Greensand or pyrolusite media requires pre-treatment with sodium hypochlorite for pre-oxidation. As mentioned previously, pH adjustment is not necessary for improving the performance of either oxide coated media filtration.

The use of biological filtration does not require sodium hypochlorite for pre-oxidation. The iron filter influent does not require any additional treatment; however, the iron filter effluent requires pH adjustment and aeration before entering the manganese filter. Although the in-line air contactor was effective during Pilot Study #2, the full-scale treatment plant may require air injection if in-line air contactors do not provide enough dissolved oxygen to the manganese filter. Common aeration technologies, such as side stream injection or aeration towers, would add complexity to the overall treatment plant operation. Additionally, aeration towers may require more space outside of the treatment plant building, as well as intermediate storage tanks and pumps.

Filter Runtimes and Backwash Frequency

EP evaluated the estimated filter run times for each treatment technology to estimate backwash frequency for each alternative. Longer filter runtimes are preferred in the full-scale treatment plant, as they allow for less frequent backwashing and longer treatment durations.

The target average and peak loading rates above are based on the results of the pilot study with one exception. The oxide coated media filter peak loading rate is based on the maximum peak loading rate that MassDEP has approved on previous projects. EP considered the average and maximum flow scenarios for this calculation. EP estimated run times for the scenario in which all filters are operation (n filters) and the scenario in which one filter is offline (n-1 filters).

EP used the following assumptions for estimating filter run times:

- Average design flow (from Well 2 and 3): 408 gpm
- Maximum design flow (from Well 2 and 3): 590 gpm
- Average design FSLR (Oxide Coated Media): 5 gpm/sf
- Peak design FSLR (Oxide Coated Media): 8 gpm/sf
- Average design FSLR (Biological): 7 gpm/sf
- Peak design FSLR (Biological): 15 gpm/sf

Based on the pilot study results, EP defined the design FSLRs for oxide coated media and biological filters, as listed above. The oxide coated media showed effective iron and manganese removal at 10 gpm/sf; however, based on experience, EP expects that MassDEP will not permit a peak FSLR higher than 8 gpm/sf. To estimate filter run times for each design FSLR, EP plotted Blueleaf's data for FSLR versus the run time and derived a line of best fit. Refer to Figure 1 below for the data for the oxide coated media filters with an ambient raw water pH of 6.4. Refer to Figure 2 below for the biological iron and manganese data.

Figure 1: Oxide Coated Media FSLR vs. Runtime

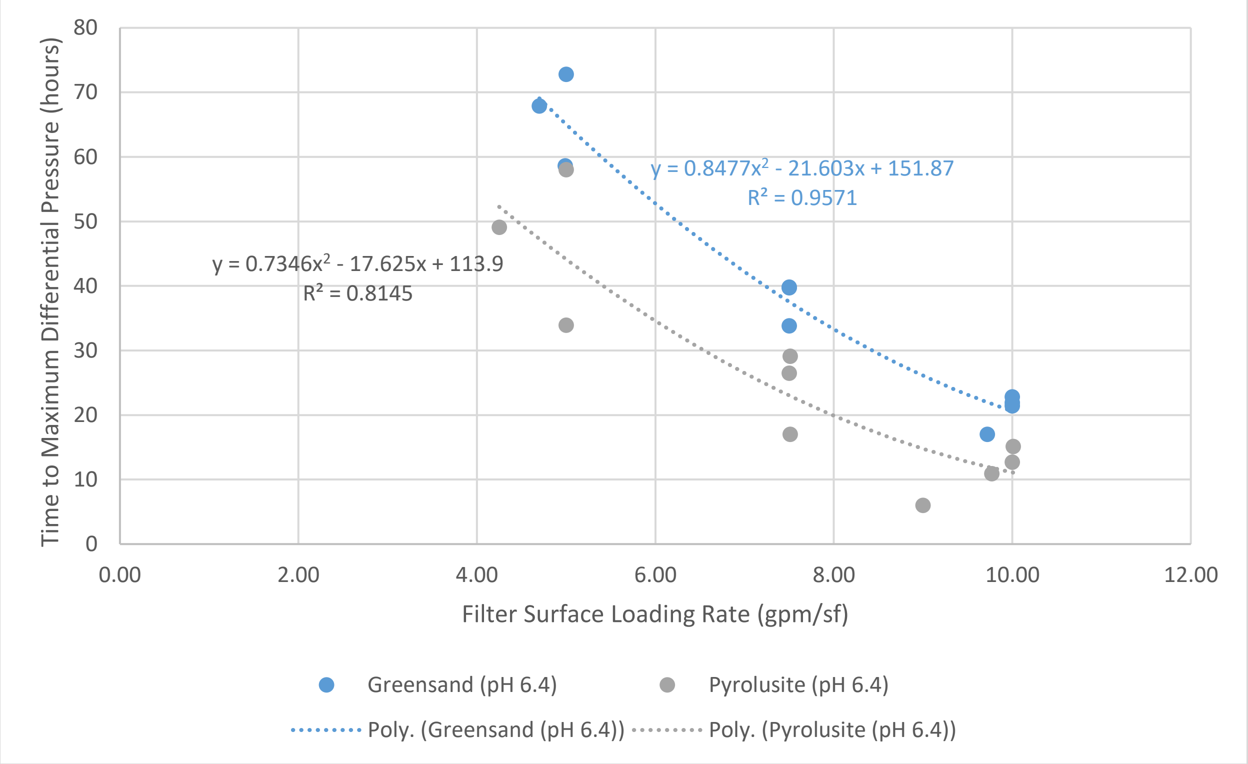
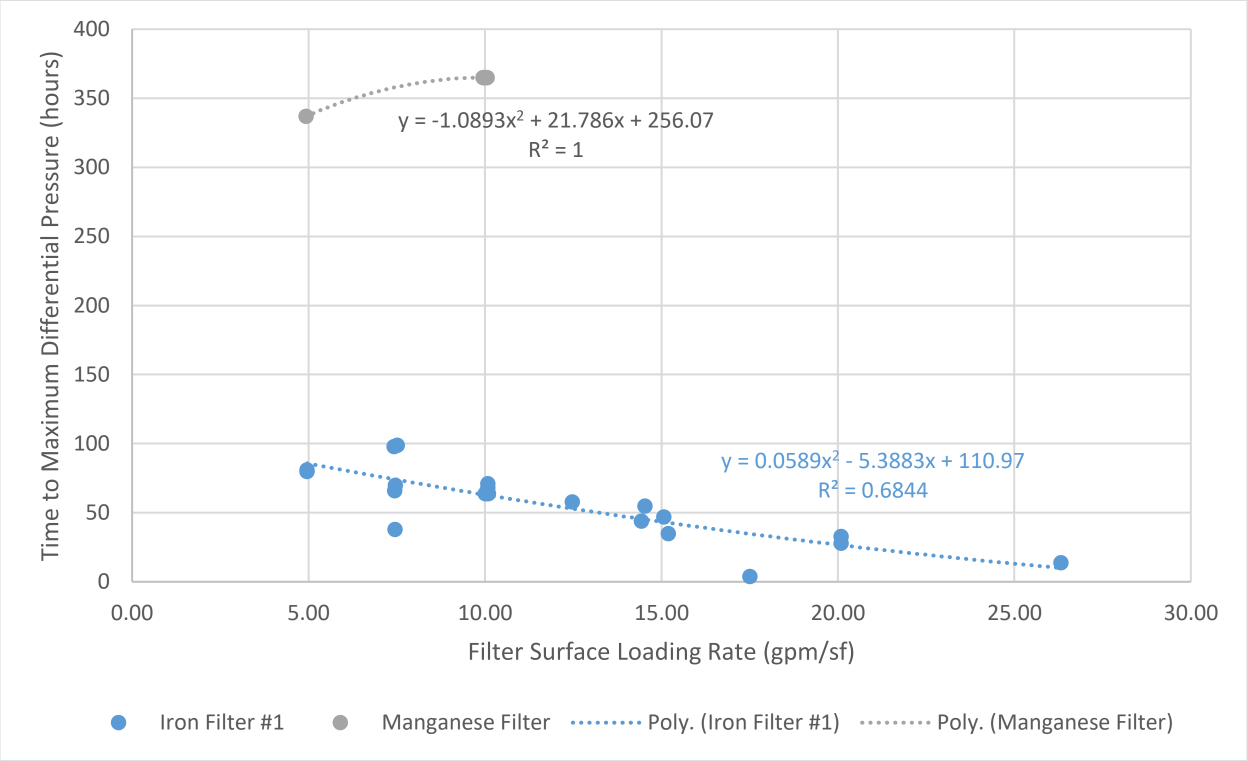


Figure 2: Biological Iron and Manganese FSLR vs. Runtime



The dashed lines in Figures 1 and 2 indicate the best fit lines for each data set. EP used the best-fit line equations and design FSLRs to estimate the filter run time, which EP summarized in Table 6 below.

Table 6: Estimated Filter Run Times at Average and Peak FSLRs

Treatment Technology	Average Loading Rate (gpm/sf)	Average Flow Filter Runtime (hours)	Peak Loading Rate (gpm/sf)	Peak Flow Filter Runtime (hours)
Greensand	5	65	8	36
Pyrolusite	5	44	8	22
Biological Iron	7	76	15	43
Biological Manganese	7	355	15	337

As indicated in Table 6, the pyrolusite filters have the lowest filter run times of all three treatment techniques. Therefore, these filters would require the most frequent backwashes and generate the most backwash volume. The biological iron and manganese filters have the longest combined filter runtimes at the highest FSLRs of the three treatment techniques. While runtimes, and therefore backwash frequency, for the biological iron filters are comparable to the Greensand filters, the biological manganese filters have significantly longer runtimes and would require the least frequent backwashes of all types of filters.

EP calculated the specific backwash volume, in units of gallons of backwash per square foot per day, for each treatment technology. The specific backwash volume is a function of the piloted backwash FSLR, backwash duration, and estimated backwash frequency. The estimated backwash frequency is based on an average FSLR. This information is summarized in Table 7 below.

Table 7: Backwash Frequency and Volume

Treatment Technology	Backwash FSLR (gpm/sf)	Estimated Backwash Frequency (per day)	Specific Backwash Volume (gal/sf-day)
Greensand	12 (for 10 minutes)	1.1	132
Pyrolusite	12 (for 10 minutes)	1.6	192
Biological Iron	6 (for 3 minutes) 8 (for 5 minutes)	0.6	35
Biological Manganese	6 (for 3 minutes) 8 (for 5 minutes)	0.1	6

As shown in Table 7, the pyrolusite filters are estimated to have the highest specific backwash volume, due to a higher backwash frequency. Conversely, the biological iron and manganese filters generate less backwash volume than both oxide coated media filters, due to a lower backwash frequency.

Post-Filtration Treatment Requirements

EP compared the post-filtration treatment requirements for each treatment technology. Post-filtration treatment requirements are particularly important because in the full-scale treatment plant the iron and manganese treatment system effluent will flow to the PFAS treatment system. The PFAS treatment system will utilize either granular activated carbon or ion exchange resin to remove PFAS from the filtered water. Both media are sensitive to chlorine loading, and ion exchange resin can be rendered ineffective if it is in long-term contact with chlorine.

Because Greensand and pyrolusite media require pre-filtration sodium hypochlorite for oxidation, the filter effluent will require dechlorination before entering the PFAS treatment system. This will add a chemical injection point to the treatment plant process and increase the amount of chemical storage required in the building.

Biological filtration will not require dechlorination, as chlorine is not used as a pre-treatment chemical; however, because aeration is required prior to the manganese filters, the filter effluent will require degassing prior to entering the PFAS treatment systems. Degassing can be a complex and costly process and may require the addition of interim storage tanks and pumps.

Operational Complexity

EP compared each treatment technology based on operational complexity. Currently, the Town only has chemical injection at its well stations. The proposed full-scale treatment plant will be the first iron/manganese/PFAS treatment facility in the Town. It is important that the plant treats the raw water to meet finished water quality goals and regulations, without being too complex for the treatment operators.

Greensand and pyrolusite have similar operational complexity, with the exception that pyrolusite will require more backwashing. Pressure filtration with these media is a conventional method used across New England, and there are many examples and opportunities for facility tours and trainings for the Town's operators. While both oxide coated medias will require pre- and post-filtration chemical treatment, chemical injection is common in water treatment facilities and will not require any highly specialized equipment.

Biological filtration, on the other hand, is not common in New England and is generally more complex than oxide coated media filtration. Biological filtration requires more filters and piping, as there are separate filters for removing iron and removing manganese. Additional pumping will be required to pump through iron filters and manganese filters, which could increase power consumption in the facility. The biomass inside the filters can be sensitive to changes in oxygen, raw water quality, and flow, and the biomass can be killed if it is in contact with chlorine or other drastic changes to the water quality. As discussed previously, biological filtration will require aeration and degassing, which can be complex and costly additions to the treatment plant. Aeration equipment or structures may increase the overall footprint of the iron and manganese system at the treatment plant. Biological filtration will also require more analyzers to monitor water quality before and after the biological iron and manganese filters.

Recommendation

EP developed a decision matrix to determine the preferred iron and manganese treatment technology for the full-scale WTP. The decision matrix includes the parameters discussed in this section and ranks each treatment technique from 1 to 3, based on the description of each criteria above. Higher scores indicate that the treatment technology meets the parameter well, while lower scores indicate that the treatment technology does not meet the parameter or that meeting the parameter is complex.

Table 8 displays the decision matrix and how each treatment technology ranks within each parameter.

Table 8: Iron and Manganese Treatment Decision Matrix

Treatment Technology	**Pre-Filtration Treatment Requirements**	**Filter Runtimes and Backwash Frequency**	**Post-Filtration Treatment Requirements**	**Operational Complexity**	**Total Score**
Greensand	3	2	3	3	11
Pyrolusite	3	1	3	2	9
Biological	1	3	1	1	6

Based on the results of the decision matrix, EP recommends the use of Greensand media for iron and manganese treatment. Greensand is conventionally used across New England and is effective at removing iron and manganese from groundwater. Additionally, Greensand filter operation is not as complex as biological filtration and provides longer filter run times comparted to pyrolusite media.

RECOMMENDED DESIGN CRITERIA

Based on a review and evaluation of the pilot study results, EP recommends the following design criteria for the iron and manganese treatment system in the proposed Sharon Wells #2, #3, and #4 WTP:

• **Method:**	Oxide Coated Media Filtration
• **Media:**	GreensandPlus™
• **pH Adjustment:**	Pre-filtration Potassium Hydroxide: None Post-filtration Potassium Hydroxide: 36.5 mg/L Target finished water pH: 7.8-8.2
• **Pre-oxidation:**	Sodium hypochlorite: 1.5-2.8 mg/L (dry dose) Target filter effluent free chlorine residual: 0.5 mg/L
• **Disinfection:**	Sodium Hypochlorite: 0.2-1.2 mg/L (dry dose) Target finished water free chlorine residual: 0.2-1.2 mg/L
• **Direct Pressure Filtration:**	Average loading rate of up to 5 gpm/sf Peak loading rate of up to 8 gpm/sf 12-in anthracite cap 24-in GreensandPlus™ filter media 12-in gravel base 3 filters
• **Backwash:**	10-15 minutes, at least 12 gpm/sf Extended filter ripening time Includes air scour
• **Filter Run Termination:**	>10 psi differential pressure or > 0.1 NTU Estimated filter run time 36 hours at peak FSLR
• **Residuals Management:**	Settle residuals for at least 2 hours Recycle settled supernatant at up to 5% of the raw water flow

Refer to Attachment D for the preliminary design drawings of the proposed WTP for Wells #2, #3, and #4.

SUMMARY

Environmental Partners and Blueleaf conducted a successful pilot study for treating water from Well #2 in the Town of Sharon. EP recommends the implementation of GreensandPlus™ filters for iron and manganese removal, including sodium hypochlorite for pre-oxidation. As supported by the results from Pilot Study #1, the GreensandPlus™ filters successfully removed iron and manganese from the Well #2 source water. The iron and manganese treatment system in the future WTP for Wells #2, #3, and #4 can be designed, permitted, and constructed based on the recommended design criteria outlined above.

On behalf of the Town of Sharon, we look forward to receiving feedback from MassDEP on the pilot study report findings and recommendations. If you should have any questions or require additional information, please do not hesitate to contact me by phone or email.

Very Truly Yours,

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ATTACHMENT A

Blueleaf, Inc. Pilot Study Report

Blueleaf, Inc.

RESEARCH · INVESTIGATE · EXPERIMENT · SOLVE · AUDIT · ANALYZE · EXPLORE · INSPECT · EVALUATE · CHARACTERIZE · DEMONSTRATE · PILOT

PILOT STUDY REPORT FOR IRON AND MANGANESE REMOVAL BY BIOLOGICAL FILTRATION AND ADSORPTIVE FILTRATION

WELLFIELD 2
MOOSE HILL PARKWAY
SHARON DPW – WATER DIVISION
SHARON, MASSACHUSETTS

DECEMBER 2022 TO MARCH 2023

Submitted by: Blueleaf, Inc.
57 Dresser Hill Road
Charlton, MA 01507

For: Environmental Partners
1900 Crown Colony Drive
Quincy MA 02169

Submitted: May 05, 2023
Revised: June 30, 2023
Revised: July 19, 2023

SUMMARY

This report details the methods and results of a pilot study for iron and manganese removal at the Sharon Wellfield 2 source in Sharon, MA operated by the Town of Sharon DPW – Water Division. The field component of the pilot study was conducted from December 12, 2022, through March 10, 2023. The pilot study evaluated two alternative iron and manganese removal treatment processes: biological filtration, and adsorptive filtration.

The median raw water concentrations of iron and manganese during the pilot for Wellfield 2 (iron = 0.62 mg/L and manganese = 0.133 mg/L) exceeded the Secondary Maximum Contaminant Levels (SMCL) of 0.3 mg/L Fe and 0.05 mg/L Mn.

The raw iron and manganese concentrations for Wellfield 2 were initially below historical concentrations. The wellfield flow was increased on two occasions early in the study to produce contaminant concentrations more similar to historical data.

BIOLOGICAL FILTRATION

The biological filtration pilot process operated at Sharon Wellfield 2 from December 12, 2322, until March 10, 2023.

The pilot study evaluated biological filtration using two biological iron filters in parallel followed by a downstream biological manganese filter. The additional upstream iron filter provided flexibility in testing different loading rates. The biological iron removal filters contained 48-inches of 1.30 mm sand. The biological manganese removal filter contained 48 inches of 0.95 mm sand media. The iron removal filters contained virgin sand media which was acclimated onsite. The manganese removal filter contained media previously used for biological manganese treatment.

The study evaluated pretreatment using potassium hydroxide (KOH) for pH adjustment and air for dissolved oxygen (DO) addition. The biological iron filters were operated at loading rates from 5 to 25 gpm/sf and the biological manganese filter was operated at loading rates from 5 to 15 gpm/sf. A total of 45 individual biological filter trials were completed with the biological iron removal filter (F1 and F2) and four trials were completed with the biological manganese removal filter (M1).

Major findings related to the biological filtration process include:

1. The iron removal filter acclimated to the water source in approximately four days.
2. This mature manganese removal filter adapted to the Sharon Wellfield 2 raw water source, and continued to develop a biomass of microorganisms within the media bed for adsorption of manganese. This transfer is not representative of the acclimation period for virgin media.
3. The sequential biological process (Filters F1 and F2 followed by M1) met the goals for iron and manganese removal.

4. Effective treatment was achieved at all loading rates tested including 5 to 25 gpm/sf for the iron removal filters and 5 to 15 gpm/sf for the manganese removal filter.
5. Contaminant concentrations in the filtered water increased as the filter surface loading rate (FSLR) was increased but remained below treatment goals.
6. Run times were limited by terminal headloss at 10 psi of differential pressure which occurred prior to contaminant breakthrough. Representative runtimes for iron removal filters ranged from 14 hours at 25 gpm/sf to approximately 90 hours at 5 gpm/sf.
7. Runtimes for the manganese removal filter were 365 hours for two trials operated at 10 gpm/sf and projected to 420 hours when operating at 5 gpm/sf.
8. Stepped increases in headloss were noted after upstream iron filter backwashes. A filter to waste period after iron filter backwashes would further increase manganese filter run times
9. Contaminant breakthrough was not observed.
10. Recycling 5% suspended supernatant did not have an adverse effect on filtered water quality or filter performance.

ADSORPTIVE FILTRATION

The adsorptive filtration pilot system operated at Sharon Wellfield 2 from February 15 to March 10, 2023. The pilot study evaluated pressure filtration using four individual filters with adsorptive media. Filters A and C contained 24 inches of GreensandPlus™ media with a 12-inch anthracite cap and Filters B and D contained 24 inches of pyrolusite media with a 12-inch anthracite cap. The four filters operated in parallel during testing. The study evaluated pretreatment using NaOCl for oxidation. Filters A and B were operated at the ambient raw pH of 6.4 while Filters C and D were operated with KOH for pH adjustment to 8.0. The filters were operated at filter surface loading rates from 5 to 10 gpm/sf.

A total of 44 individual adsorptive filter runs were completed. Major findings related to the adsorptive filtration process include:

1. The adsorptive filtration process met the goals for iron and manganese removal.
2. Iron and manganese removal was effective for both medias tested and at both pH ranges.
3. Effective treatment was achieved for both medias at the following conditions:
    a. Filter surface loading rates of 5, 7.5, and 10 gpm/sf,
    b. A chlorine dose of approximately 2.7 mg/L to target a 0.5 mg/L residual,
    c. With no pH adjustment at ambient pH of 6.4,
    d. With pH adjustment to 8.0 by KOH dose of 33 mg/L.
4. Filter run times were limited by terminal headloss to 10 psi in 33 of 44 filter runs. Four filter runs were discontinued at the end of the study. Contaminant breakthrough was observed during 7 trials.
5. Filter runtimes were slightly lower than the Inversand model.
    a. Filter runtimes for Filter A operating with Greensand media and at pH 6.4 ranged from approximately 65 hours at 5 gpm/sf to 20 hours at 10 gpm/sf.
    b. Filter runtimes for Filter B operating with Pyrolusite media and at pH 6.4 ranged from approximately 38 hours at 5 gpm/sf to 11 hours at 10 gpm/sf.

  c. Filter runtimes for Filter C operating with Greensand media and at pH 8.0 ranged from approximately 54 hours at 5 gpm/sf to 17 hours at 10 gpm/sf.
  d. Filter runtimes for Filter D operating with Pyrolusite media and at pH 8.0 ranged from approximately 46 hours at 5 gpm/sf to 16 hours at 10 gpm/sf.

6. Recycling of 5% suspended supernatant did not appear to have an adverse effect on water quality or filter performance.

The Pilot Study Report has been organized to provide the reader with the methods, results, and interpretation of the data in separate sections. Section 2 “Methods” describes the equipment and methods used during the field testing. Section 3 “Results” contains data that was developed without interpretation, thus allowing the reader to form their own opinion of the data. Section 4 “Data Analysis” is included to provide interpretation of results and to combine disparate pieces of information into a comprehensive evaluation.

This Report does not include recommendations for full-scale implementation of any process, as interpreting the results of the pilot study for use at this site is an engineering function, and the narrow scope of research undertaken by the pilot study does not consider other issues and factors that are normally relevant to process selection and full-scale design.

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LIMITATIONS

This pilot test report was prepared for Environmental Partners and the Town of Sharon Water Division, for the purpose of evaluating treatment of iron and manganese in water supplied from Wellfield 2 in Sharon, MA. The findings provided in this report are based solely on the information contained and referenced herein. All field operations, field analyses, data compilation, data analysis and reporting were completed in a fair and impartial manner and are intended to be an accurate representation of treatment performance. Additional quantitative information regarding the raw water, or other treatment goals and concerns that were not available to Blueleaf, Inc. at the time of the pilot study may result in modification of the stated findings. Note that bench and/or pilot scale studies may not identify issues arising from long-term changes to source water quality, nor predict long-term performance of the treatment processes tested.

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ABBREVIATIONS

ANOVA	Analysis of Variance
ATP	Adenosine Triphosphate
BDL	Below Detection Limit
DO	Dissolved Oxygen
FSLR	Filter Surface Loading Rate
gal	gallon
gpm	Gallons per Minute
gpm/sf	Gallons per Minute per Square Foot (of surface area)
gpd	Gallons per Day
gr	Gram
HP	Horsepower
hr	hour
IDI	Infilco Degremont, Inc.
KOH	Potassium Hydroxide
L	Liter
MADEP	Commonwealth of Massachusetts Department of Environmental Protection
MEFF	Manganese filter effluent
mg	Milligram
MG	Million Gallons
MGD	Million Gallons per Day
min	minute
MnOx	Manganese Oxide
MPOKA	Post-Aeration, Post-KOH Addition from manganese train
NaOCl	Sodium Hypochlorite
µg/L	Micrograms per Liter (equivalent to ppb)
mg/L	Milligrams per Liter (equivalent to ppm)
min	Minutes
mV	Millivolt
NTU	nephalometric turbidity units
N/A	Not Available / Not Applicable
ND	Not Detected
ORP	Oxidation Reduction Potential
ORSG	Massachusetts Office of Research and Standards Guidelines
PFAS	per and polyfluoroalkyl substances
PID	Proportional Integral Derivative
ppb	Parts per Billion
ppm	Parts per Million
PSI	Pounds Per Square Inch of Pressure
PSID	Differential Pressure in PSI
sf	Square foot

SM	Standard Methods
SMCL	Secondary Maximum Contaminant Level
S.U.	Standard Units
SWD	Sharon Water Division
TSS	Total Suspended Solids
UFRV	Unit Filter Run Volume

1 INTRODUCTION

1.1 BACKGROUND

The consulting engineer for the Sharon Water Division, Environmental Partners (EP), provided the background information for this pilot study in the October, 2022, *BRP WS 21D APPROVAL TO CONDUCT PILOT STUDY WELL 2.* This pilot study protocol was submitted to the Massachusetts Department of Environmental Protection (MADEP) under transmittal # X289311**.**

The Town of Sharon Water Division (SWD) operates four wells (Wells 3, 4, 5 and 6) and two wellfields (Wellfields 2 and 7) which supply public drinking water to the Town of Sharon. Wellfield 2 is located on Moose Hill Parkway and is currently offline due to elevated concentrations of iron and manganese. Iron and manganese concentrations exceed Secondary Maximum Contaminant Levels (SMCL). PFAS concentrations have been reported slightly below the Maximum Contaminant Level (MCL) for the six PFAS compounds currently regulated by MADEP.

Wellfield 2 was comprised of nine interconnected wells which are vacuum pumped. Well #8 in Wellfield 2 was previously cut and capped due to historic positive bacteria results leaving eight contributing wells. The Well 2 station is equipped with chemical feed equipment for pH adjustment, corrosion control, disinfection and fluoridation. Potassium hydroxide (KOH) is added for pH adjustment and corrosion control, sodium hypochlorite is added for disinfection, and sodium fluoride is added for fluoridation. Currently there is no filtration for iron and manganese.

SWD is conducting this pilot study to identify effective treatment processes for removal of iron and manganese from Wellfield 2. SWD retained Environment Partners to provide consulting engineering services. Environmental Partners hired Blueleaf to perform the pilot study for evaluation of iron and manganese removal by two alternative processes: (1) adsorptive filtration and (2) biological filtration. While the pilot study protocol identified the adsorptive filtration process as Pilot Study #1 and the biological filtration process as Pilot Study #2 the information is this report is presented with biological filtration descriptions and data preceding the same adsorptive filtration descriptions and data. This is because the biological pilot system was started chronologically earlier (Dec 2022) than the biological pilot system (Mar 2023).

Environmental Partners (EP) prepared and submitted the Pilot Study Protocol to the Southeast Region of the Massachusetts Department of Environmental Protection under Transmittal # X289311. The study conducted complied with the Pilot Study Protocol, and this report describes the methods and results of the field work in partial fulfillment of the requirements for the overall pilot study. It is anticipated that this report will be appended to a report prepared by Environmental Partners with additional analyses, recommendations, and costs which will fulfill the requirements of MADEP Policy 90-04.

1.2 REGULATORY REQUIREMENTS

Iron and manganese concentrations were compared to the Secondary Maximum Contaminant Levels (SMCL) of 0.3 mg/L for iron and 0.05 mg/L for manganese per the secondary standards of the National Secondary Drinking Water Regulations (NSDWR). The current Massachusetts Office of Research and

Standards Guidelines (ORSG) also has a standard of 0.3 mg/L for manganese. During data analysis in Section 4 half of the Secondary Maximum Contaminant Level was used as the pilot study treatment goal for iron and manganese removal.

1.3 PILOT STUDY GOALS

The pilot study scope and objectives were defined in Section 1 of the October, 2022, pilot study protocol, *BRP WS 21D APPROVAL TO CONDUCT PILOT STUDY WELL 2,* repeated here:

> *The scope of the pilot treatability study is to evaluate oxide coated media filtration (Pilot Study #1) and biologically activated media filtration (Pilot Study #2) for the production of high-quality drinking water, meeting or exceeding applicable drinking water standards. The objectives of the pilot treatability study include:*
> *1. Pilot Study #1: Assess the role of oxidation (type, dose, and contact time) using sodium hypochlorite and/or potassium permanganate for the precipitation of source water iron and manganese;*
> *2. Pilot Study #1: Assess the effectiveness of direct pressure filtration with two (2) types of oxide coated media for the removal of precipitated iron and manganese solids;*
> *3. Pilot Study #2: Assess the effectiveness of compressed air and potassium hydroxide for the optimization of iron and manganese removal;*
> *4. Pilot Study #2: Assess the effectiveness of direct pressure filtration with biological activated media for the removal of iron and manganese;*
> *5. Pilot Studies #1 and #2: Identify process design and operating parameters including chemical dosages, mixing, and contact times; plant and process hydraulics; process sizing, loading rates, and filter run times; process cleaning cycles; and residuals management.*

When evaluating iron and manganese removal in the data analysis section of this report a pilot study goal of one half of the SMCL was utilized.

1.4 TREATMENT APPROACH

1.4.1 Iron and Manganese Treatment by Adsorptive Media Filtration

The pilot study tested iron and manganese treatment by pressure filtration using adsorptive filtration media. Raw iron and manganese are typically oxidized by chemical pretreatment before filtration. Oxidation converts dissolved ferrous iron to ferric hydroxide, and dissolved manganese to any of several oxides of manganese (MnO_x). Oxidation can be accomplished with chlorination using sodium hypochlorite or with other alternative oxidants.

The adsorptive properties of the filtration media must be maintained by regeneration. Regeneration consists of exposing the media to an oxidant. With Continuous Regeneration (CR) the oxidant is fed continuously during filtration at a dose that is sufficient to both (1) satisfy the oxidant demand of the raw water, and (2) provide an excess for media regeneration.

Iron precipitates are often large enough to be removed by mechanical filtration, i.e. entrapment within the interstices of the filtration media. Iron can also be removed by adsorption to the filtration media. The manganese precipitates are usually too small to be effectively removed by mechanical filtration. The primary mechanism for manganese removal is adsorption.

Iron and manganese removal are usually not highly sensitive to pH within the normal pH range for drinking water sources. pH control is sometimes necessary for effective treatment at some sites, but this must usually be determined by piloting. pH control is sometimes required for purposes unrelated to contaminant removal, for example to minimize corrosion or leaching within the distribution system.

1.4.2 Iron and Manganese Treatment by Biological Filtration

The pilot study also evaluated biological oxidation and filtration. Biological filtration is an adsorptive process where the media develops an iron-based or manganese-based coating, and the bacteria that occur naturally in the raw water help to form and maintain the coatings.

Several studies have suggested that iron and manganese removal on a mature biofilter is primarily a function of autocatalytic adsorption (Katysoyiannis 2004, Sahabi 2009). Bruins (2016) and Wonjae Chang (Austin paper, 2018) identified the coating as bernissite. Bruins (2016) suggests that the primary role of microorganisms is in the development of the surface onto virgin media, and the autocatalytic surface maintenance is eventually physical-chemical, using only the dissolved oxygen in the water as the oxidant.

Organisms which use oxygen use adenosine triphosphate (ATP) to produce and store energy. Free radicals are oxygen atoms with unpaired electrons and are a waste product of ATP formation. All cells require a mechanism of quenching the free radicals internally or expelling them into the environment to get quenched externally. The cofactors that are most reactive with free radicals are: Cu/Zn, Fe, Mn, and Ni (in order from most reactive to least reactive). The products of these reactions are metal oxides.

The optimal pH and DO conditions often vary for removal of iron compared with removal of manganese. These conditions differentiate the biological iron-removal process from the biological manganese-removal process. In treatment systems where both iron and manganese are present, separate iron-removal and manganese-removal filters are utilized in series so that each filter provides the appropriate environment for the removal of each contaminant.

2 METHODS AND MATERIALS

Section 2 - Methods and Materials describes the equipment, procedures, and analytical methods utilized during the pilot testing effort.

2.1 PILOT EQUIPMENT DESCRIPTION

2.1.1 Raw Water Connection – Wellfield 2

Raw water from Wellfield 2 was supplied to the pilot from a raw water hydrant (Figure 2.01) adjacent to the Wellfield 2 pump station. The hydrant supplied raw water without chemical addition. Blueleaf connected 200 feet of 1-inch nylobraid hose to one side of the hydrant which supplied raw water to the pilot systems. At the end of the 200-foot hose run a tee was installed to split flow between the pilot system and flow to waste. Flow to waste was maintained to protect against freezing. A valve on the waste branch of the tee was regulated to provide approximately 35 psi of feed pressure to the pilot system.

SWD flushed water from the opposite side of the hydrant to keep the flowrate from the wellfield high and to provide representative production from the wellfield during the pilot study. Flow was initially wasted through a blow-off connected directly to the hydrant. The wellfield vacuum pumping system was started up on December 12, 2022, at 112 gpm to feed the biological pilot system. Due to relatively low iron and manganese concentrations the flow was increased to 186 gpm on December 19, 2022, which was closer to the typical full scale operating rate of 220 gpm. The flow was again increased on January 4, 2023 to 290 gpm. Additionally, the blow-off was replaced with a fire hose to direct flow away from the driveway during the winter months. The fire hose discharged raw water into the nearby wetland (Figure 2.02). The wellfield was operated to waste through the duration of the study and no water was supplied to the SWD distribution system.

On February 15, 2023 the adsorptive pilot system was mobilized to the site and a tee was installed at the pilot connection to the raw water hydrant. A second 1-inch hose was installed from the tee to the adsorptive pilot trailer. Both pilots were supplied raw water continuously with this arrangement until the completion of the pilot study on March 10, 2023.

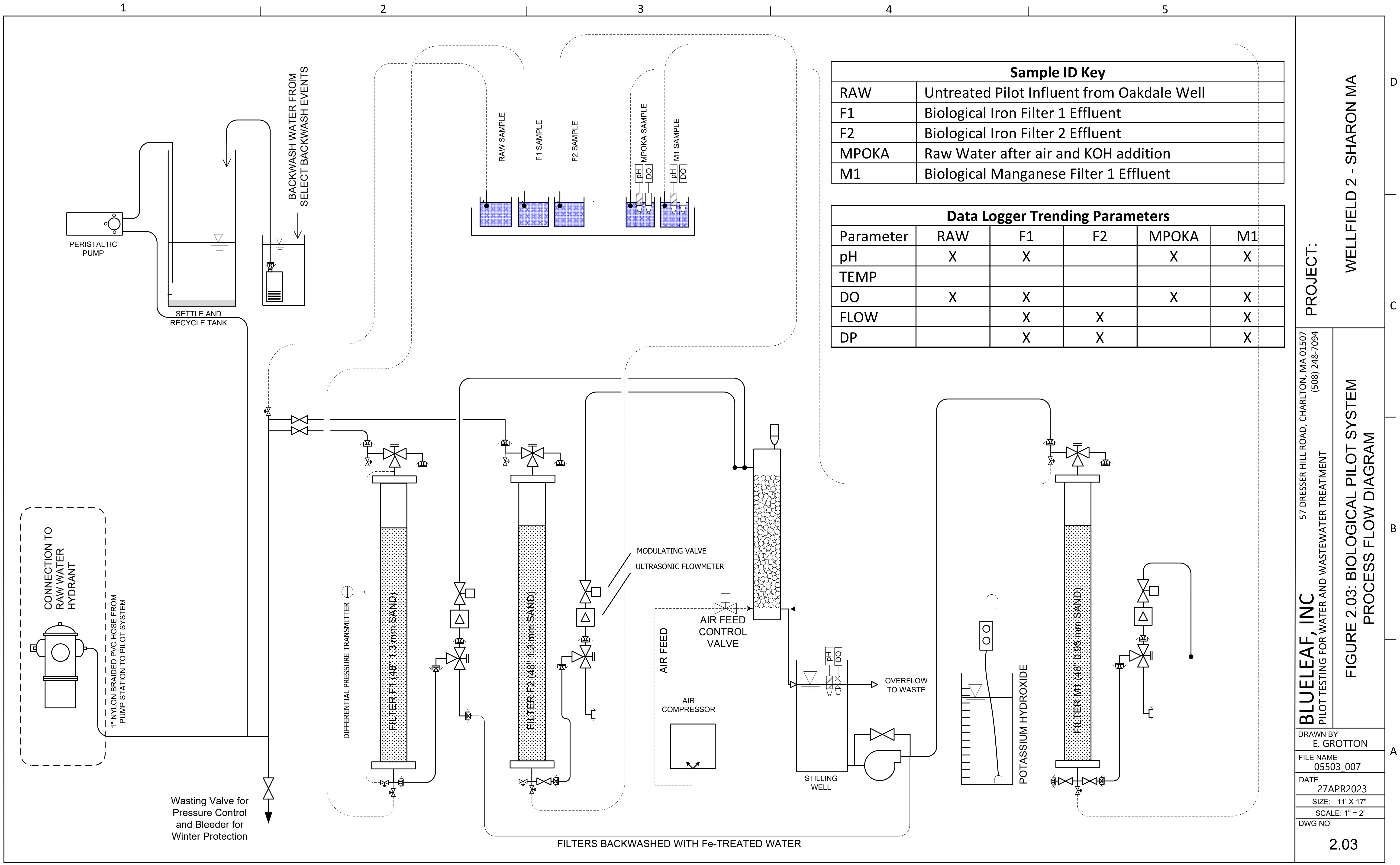
Figure 2.01: Pilot Connection at Wellfield 2 Raw Water Hydrant

Figure 2.02: Raw Water Discharged to Waste

2.1.2 Biological Pilot System

The biological pilot equipment was mobilized to the Wellfield 2 station on December 08, 2022, and began treating water on December 12. The pilot equipment was located in a 20 foot by 8 foot ground level storage container. The container was situated on the lawn to the rear of the pump station. A process flow diagram of the pilot equipment is included as Figure 2.03.

The pilot system was initially operated with two iron removal filters (F1 and F2) operating in parallel and without a manganese removal filter during initial acclimation to the Wellfield 2 source. Once acceptable iron removal was established and the raw water was determined to be representative, the manganese removal Filter M1 was installed (operating in series downstream of Filters F1 and F2). On January 16, 2023, an acclimated pilot filter operating at a full-scale biological treatment plant in Shrewsbury, MA was removed, transported to Sharon and installed into the pilot system. Delaying the delivery of the acclimated manganese filter protected the manganese removal filter from receiving non-representative iron loading.



Sample ID Key

RAW	Untreated Pilot Influent from Oakdale Well
F1	Biological Iron Filter 1 Effluent
F2	Biological Iron Filter 2 Effluent
MPOKA	Raw Water after air and KOH addition
M1	Biological Manganese Filter 1 Effluent

Data Logger Trending Parameters

Parameter	RAW	F1	F2	MPOKA	M1
pH	X	X		X	X
TEMP					
DO	X	X		X	X
FLOW		X	X		X
DP		X	X		X

PROJECT: WELLFIELD 2 - SHARON MA

BLUELEAF, INC
57 DRESSER HILL ROAD, CHARLTON, MA 01507
(508) 248-7094
PILOT TESTING FOR WATER AND WASTEWATER TREATMENT

FIGURE 2.03: BIOLOGICAL PILOT SYSTEM PROCESS FLOW DIAGRAM

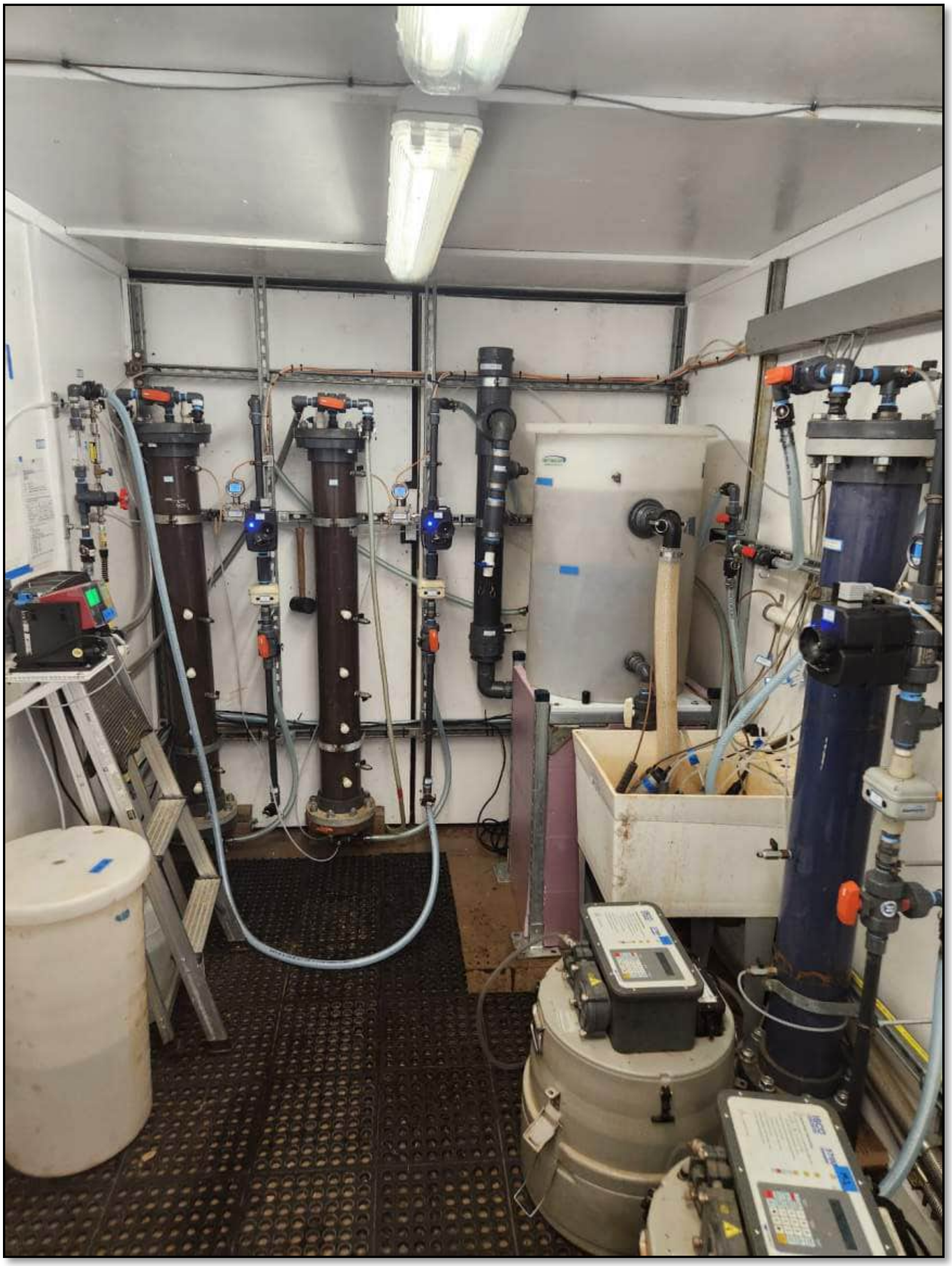
DRAWN BY E. GROTTON
FILE NAME 05503_007
DATE 27APR2023
SIZE: 11' X 17"
SCALE: 1" = 2'
DWG NO 2.03

Figure 2.04 shows the ground level storage container.

Figure 2.04: Ground Level Storage Container with Biological Pilot Equipment

Figure 2.05 shows the interior of the biological pilot trailer.

Figure 2.05: Interior of the Biological Pilot Trailer



The pilot filtration system included equipment for chemical pretreatment, flow control, two pressure filters operating in series, a data acquisition system, autosamplers, and sample points for all relevant sample streams.

2.1.2.1 Pretreatment Equipment

The biological iron removal filters operated at ambient pH and dissolved oxygen (DO) with no pretreatment.

Pretreatment for the biological manganese filter included the addition of potassium hydroxide for pH adjustment and an air contactor to increase the dissolved oxygen concentration in pilot filter influent. Pretreatment of the water entering the manganese filter was required to meet the specific pH and DO conditions suitable for manganese removal.

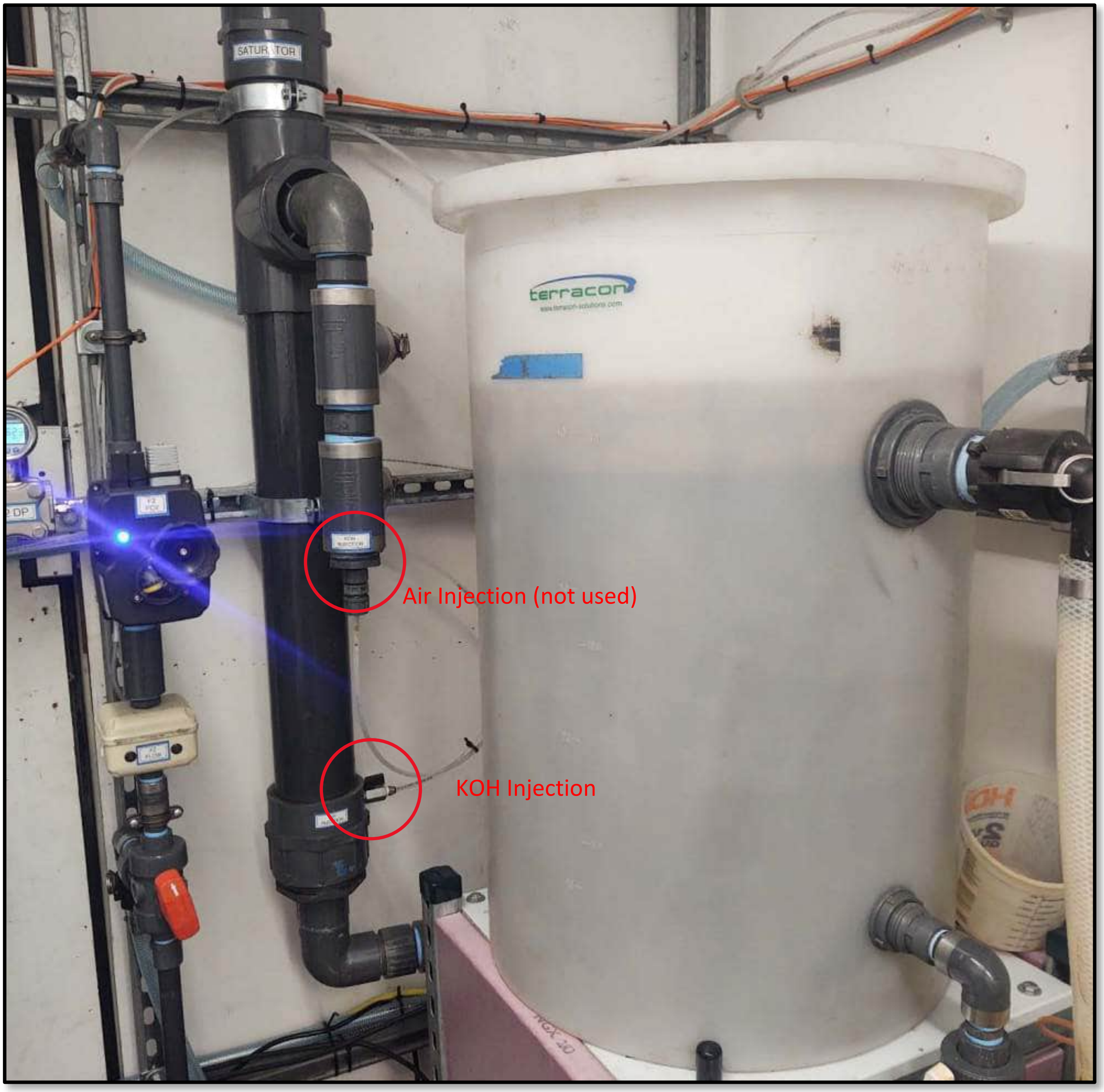
A solution of potassium hydroxide (KOH) was added downstream of the biological iron filters using a chemical feed pump controlled by a programmabe logic controller (PLC) connected to an online pH meter. The pH target was set by the operator, and the PLC controlled the speed of the pump to maintain the target pH.

Figure 2.06 shows the Grundfos DDA diaphragm pump which was used to feed KOH. The ¼" suction tubing for the feed pump withdrew diluted NaOCl stored in a 55-liter day tank located below the pump. The day tank was graduated in 1-liter intervals.

Figure 2.06: Air Contactor and Biological Manganese Filter Feed Tank

An air contactor was used to introduce air and increase the dissolved oxygen concentration in the filter influent. The air contactor contained aeration spheres to increase surface area for air to water contact. The DO of the aerated water was monitored downstream of the contactor. Figure 2.07 shows the air contactor with air and KOH injection locations.

Figure 2.07: Air Contactor and Biological Manganese Filter Feed Tank



2.1.2.2 Biological Filter Operation

All biological filters were 60-inches in height and were constructed from 6-inch diameter clear PVC schedule 40 pipe. The filter media was supported by an underdrain consisting of a 2-inch stainless steel slotted media-retention nozzle with No. 8-12 garnet surrounding the nozzle. Filters F1 and F2 contained 48 inches of 1.30 mm virgin media which was matured onsite. Filter M1 contained 48 inches of 0.95 mm sand media matured by long-term exposure to pre-treated water at the Home Farm Water Treatment Plant in Shrewsbury MA.

Iron removal filters (Figure 2.08) were supplied with raw water via a ¾-inch nylobraid hose connected to a three-way valve at the top of the filter. A sample tap at the top of the filters provided the inlet pressure for the differential pressure sensors. Water flowed downward through the filter media and was conveyed through ¾-inch hose to the filter flow control assembly and then to the air contactor. Sample points in the flow control assemblies were connected to ¼-inch tubing which provided a continuous filter effluent sample stream to containers located in the sample sink.

Iron filter effluent was discharged into connections at the air contactor shown above in Figure 2.07. Potassium hydroxide (KOH) was also injected at the air contactor. The water flowed downward through the column containing spherical aeration media. The pretreated (aerated and pH adjusted) water was conveyed by a 2-inch hose from the base of the air contactor to a 50-gallon storage tank.

An overflow in the tank maintained a constant volume of pretreated water in the tank and the overflow drained to waste. A 1/2 HP booster pump supplied the pretreated water from the tank to the biological manganese removal Filter M1. Filter M1 was constructed in the same manner as described for Filters F1 and F2 above. Filter M1 effluent was discharged directly to the sample sink.

Each flow control assembly included components for filtration and backwash operations. Forward flow had automated control capability. A flow meter controlled an automatic modulating valve via a PC-based PLC program with a PID loop. The PLC continuously monitored and logged filter flow rates, differential pressures, and filter effluent turbidities. The three-way valves upstream and downstream of each filter could be configured for forward flow, or for backwash operations.

Figure 2.08: Filter Vessels F1 (left) and F2 (right)

Taps were installed in a tee immediately upstream and downstream of each filter and were connected to differential pressure sensors (Figure 2.09). Differential pressure data for each filter was recorded on an onsite computer and downloaded at intervals of 3 minutes.

Figure 2.09: Differential Pressure Gauge for Filter F2 (typical of 3)

2.1.2.3 Instrumentation

Tubing was installed from five sample taps throughout the process to the sample sink to provide continuously running samples for online and grab analyses. Online Sensors for pH were HACH pHd (HACH #DRC1R5N) sensors and an SC200 controller. Online sensors for DO were HACH LDO Probes with HACH SC200 controllers. The five sample cups were:

- Raw Water
- Filter F1 Effluent
- Filter F2 Effluent
- Pretreated Influent to Filter M1 (MPOKA)
- Filter M1 Effluent

Online sensors were placed into 1,000 mL sample containers in the sample sink. Each sample container was continuously filled by the appropriate sample line, and sensors were placed into the cups for continuous monitoring. The sample containers were continuously overflowing with sample, and the flow rate was controlled to limit the surface agitation and prevent air entrainment at the sample containers. Two autosamplers were utilized during the study to collect filter effluent samples while the operators were not present.

All online instrumentation was connected to a digital recorder for data logging capability. Online measurements included:

1. Raw Influent pH
2. Raw DO
3. F1 Flow Rate
4. F1 Differential Pressure
5. F2 Flow Rate
6. F2 Differential Pressure
7. MPOKA pH
8. MPOKA DO
9. M1 Flow Rate
10. M1 differential pressure
11. M1 pH
12. M1 DO

2.1.2.4 Biological Filter Configurations

Two biological iron removal pilot filters were operated in parallel followed by a downstream manganese removal filter. Each of the three pilot filters were 6 inches in diameter by 60 inches high. Pilot filters were constructed from 6-inch clear PVC schedule 40 pipe. Each filter had an underdrain consisting of a 2-inch stainless steel slotted media-retention nozzle. The two iron removal filters contained 48 inches of 1.3 mm sand. The manganese removal filter contained 48 inches of 0.95 mm sand.

Table 2.01 summarizes the pilot filter configurations.

Table 2.01: Biological Pilot Filter Configurations

Parameter	Iron Removal Filters F1 and F2	Manganese Removal Filter M1
Filtration media	1.3 mm sand	0.95 mm sand
Media depth	48 inches	48 inches
Media volume	0.8 ft^3	0.8 ft^3
Freeboard above filter surface	12 inches	12 inches
Filter vessel diameter	6 inches	6 inches
Filter surface area	0.2 ft^2	0.2 ft^2
Filter vessel height	60 inches	60 inches
Filter vessel empty volume	7.5 gallons	7.5 gallons

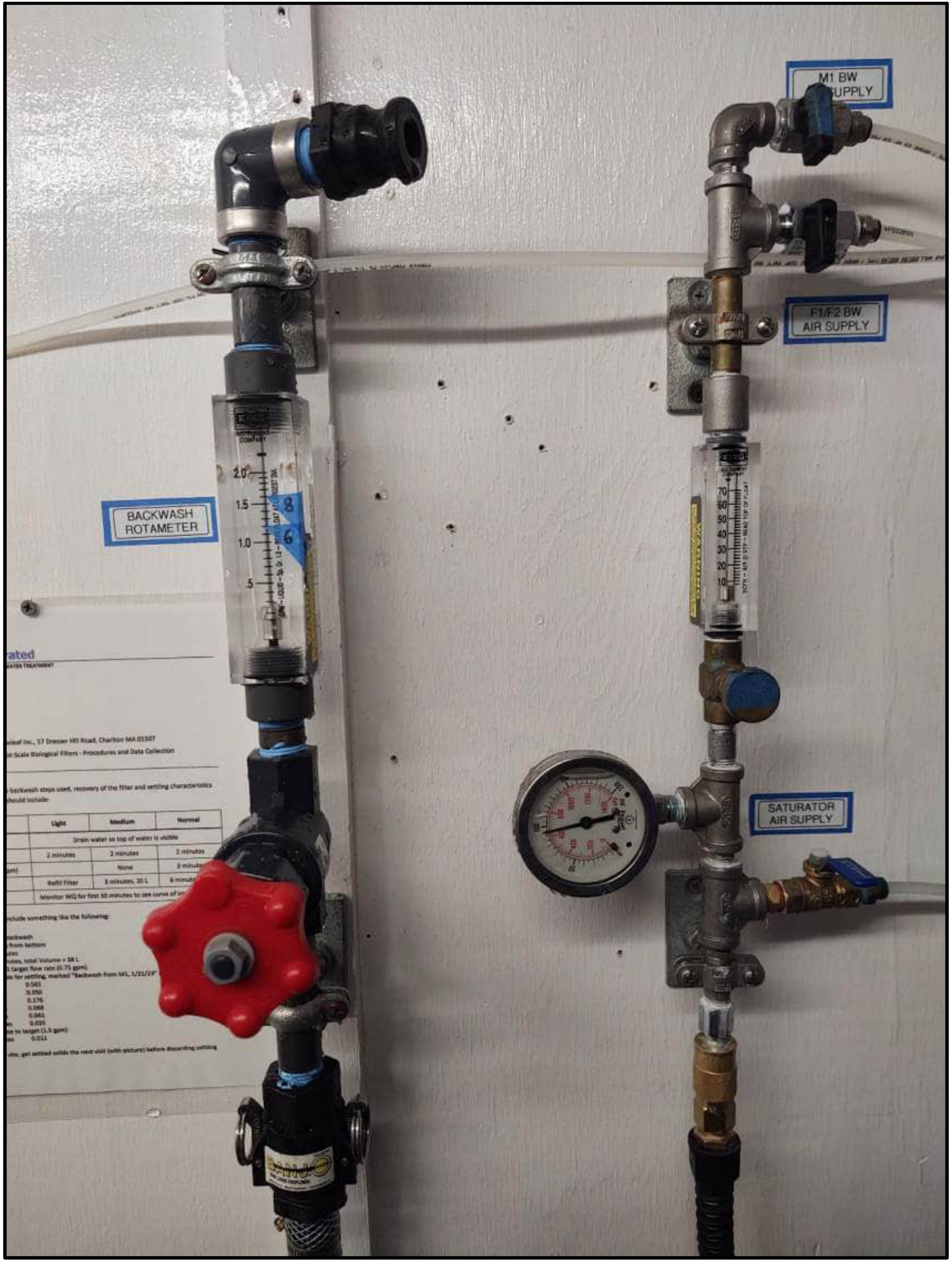
The sand for the biological pilot filters was obtained from Hopkinton Sand Co., Inc., a producer of custom filtration sands located in Burrillville, RI.

2.1.2.5 Backwash Water Feed Tank, Pump, and Connections

Iron filter effluent, with DO and pH adjusted for feeding to the manganese filter was used to backwash all three pilot filters (iron and manganese). A 1/2 HP sump pump was used to pump water into the filters for backwashing. Three-way valves were installed on the influent and effluent from each filter and were positioned during backwashes to allow air and water to enter the bottom of the filter and exit the top of the filter. All backwash water was discharged to a 15-gallon plastic tank. The contents of selected backwashes were stored in a 200-gallon tank for use in supernatant recycle trials, while others were discharged to drain.

Flow rates for the air scour and backwash rinse were controlled by a rotameter. Figure 2.10 shows the backwash control panel. The rotameter and globe valve on the far right were used to control the flow rate from the backwash supply sump pump to the filter. The air connection for the air compressor can be seen on the far left. The small rotameters and needle valves were for controlling air flow rates during air scour. The compressed air and backwash supply water were injected into the outlet assembly on the bottom of each filter. Filters were backwashed one-at-a-time, not simultaneously.

Figure 2.10: Backwash Rotameters for Air Scour and Water Rinse of Biological Pilot Filters



The spent backwash water from all filters was stored in a 200-gallon tank for settling. The settled supernatant was then recycled into the raw water flow during the supernatant recycle trial. A Masterflex peristaltic pump fed the supernatant into the raw water at a rate calibrated to equal 5% of the total pilot system influent flow rate. The intake for the supernatant pump was suspended above the sludge layer in the backwash settling tank to avoid the withdrawal of solids. Figure 2.11 shows the supernatant recycle feed pump and the backwash storage tank.

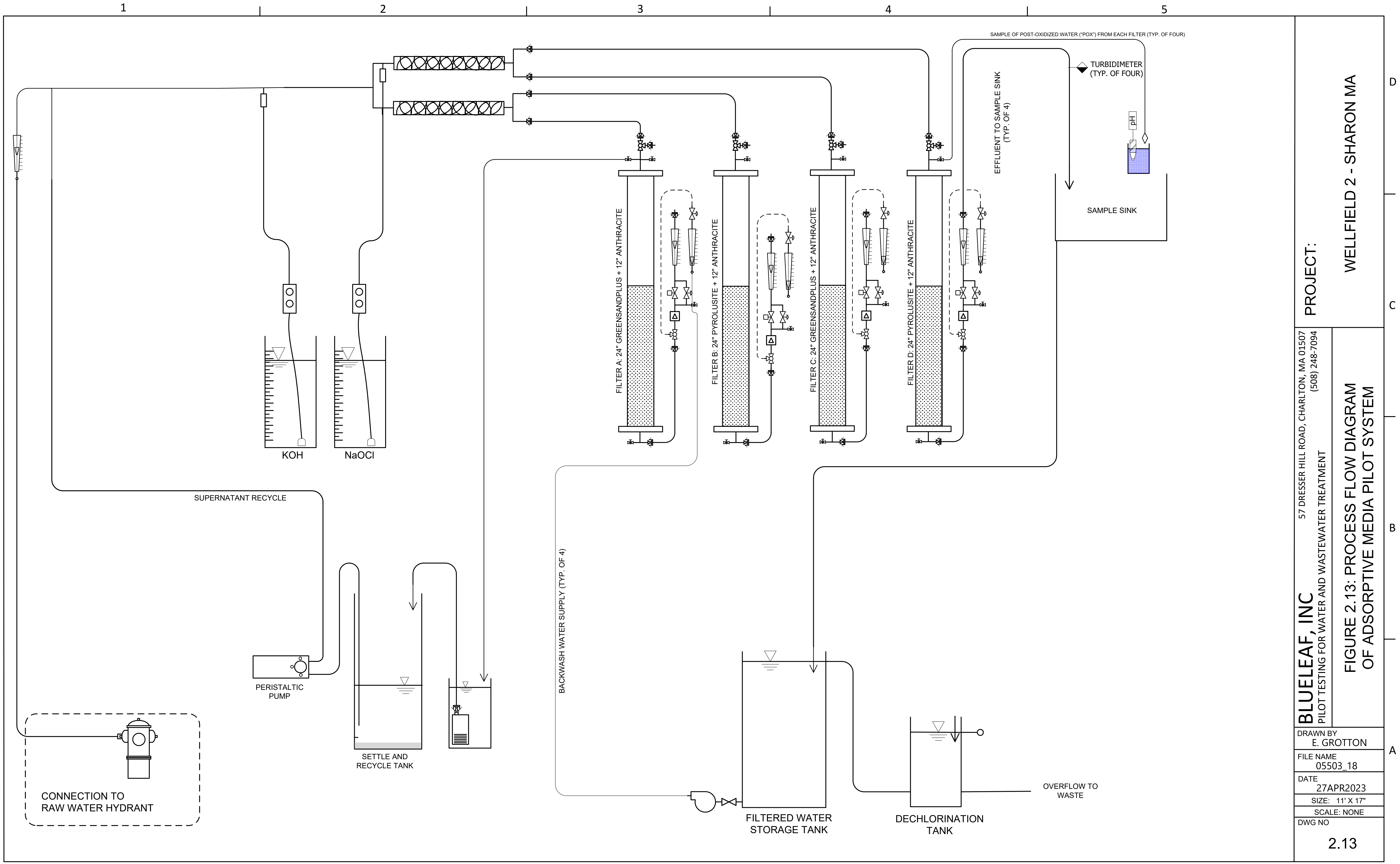
Figure 2.11: Peristaltic Recycle Feed Pump and Biological Filter Backwash Water Storage Tank

2.1.3 Adsorptive Pilot System

The adsorptive pilot system was delivered to the Wellfield 2 Station on February 15, 2023. The pilot system was started up the same day and operated continuously until trials concluded on March 10. The pilot filtration system and field laboratory were contained in a cargo style trailer. Figure 2.12 shows the adsorptive pilot trailer on the left and biological pilot container on the right, set up at the Wellfield 2 Station.

Figure 2.12: Exterior of Pilot Systems at Sharon Wellfield 2 Station

Figure 2.13 is a process flow diagram of the adsorptive media pilot filtration system.



PROJECT:
WELLFIELD 2 - SHARON MA

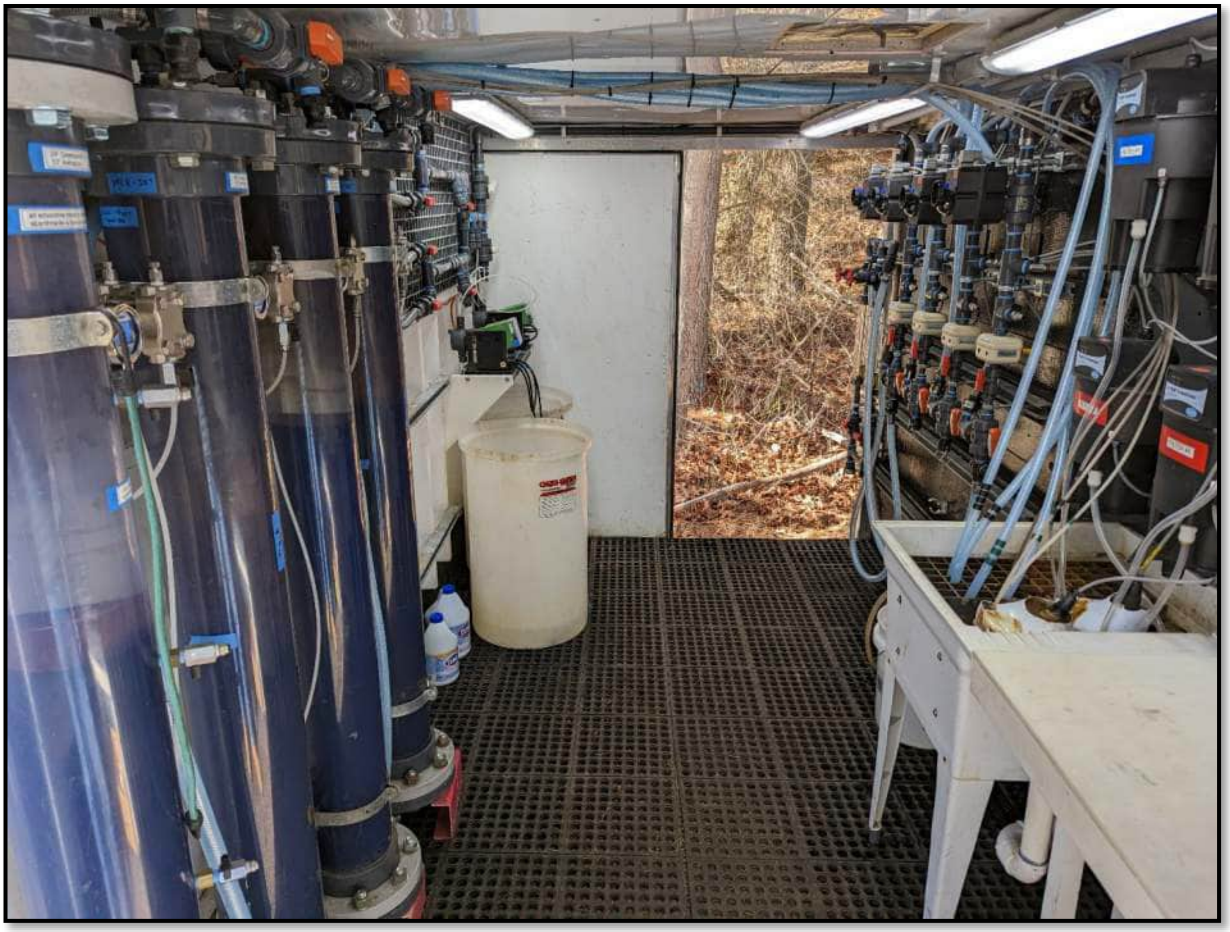
BLUELEAF, INC
PILOT TESTING FOR WATER AND WASTEWATER TREATMENT
57 DRESSER HILL ROAD, CHARLTON, MA 01507
(508) 248-7094

FIGURE 2.13: PROCESS FLOW DIAGRAM
OF ADSORPTIVE MEDIA PILOT SYSTEM

DRAWN BY
E. GROTTON
FILE NAME
05503_18
DATE
27APR2023
SIZE: 11' X 17"
SCALE: NONE
DWG NO
2.13

Figure 2.14 shows the interior of the adsorptive media pilot trailer including the pilot filters and chemical feed equipment on the left wall and flow control assemblies on the right wall. Turbidimeters are shown over the lab sink.

Figure 2.14: Interior of the Adsorptive Filtration Pilot Trailer



The pilot filtration system included equipment for chemical pretreatment, flow control, four pressure filters operating in parallel, a data acquisition system, and sample points for all relevant sample streams.

2.1.3.1 Pretreatment Equipment

The adsorptive pilot influent was pretreated using potassium hydroxide (KOH) for pH adjustment, and sodium hypochlorite for oxidation and media regeneration. Figure 2.15 shows the chemical feed area, with two Grundfos chemical feed pumps, and two chemical day tanks located below the pumps. The day tanks were 100-liter tanks. Each of the four pilot filters were supplied with chemically pretreated water via 3/4-inch nylon braided hose, seen above the feed pumps. There were two branches that allow different chemical pretreatment scenarios to be tested side-by-side. NaOCl was injected into the common supply for all four filters, indicated by the yellow circle. KOH was injected into the bottom branch so that Filters C and D operated at an increased pH while Filters A and B operated at the ambient raw pH. The direction of flow is indicated by the blue arrows.

The chemical feed pumps were Grundfos DDA diaphragm pumps. The pumps withdrew diluted chemical from the day tanks through ¼-inch suction tubing. The pumps had a maximum capacity of 7.5 lph (liters per hour) and a minimum capacity of 2.5 mL/hour (milliliters per hour). Typical feed rates were 200 to 400 mL/hr. The feed rates were calibrated by recording the drawdown versus elapsed time in the graduated day tank. The feed pumps injected into the 1-inch PVC raw water supply line via an injection quill.

Figure 2.15: Pilot Trailer Chemical Feed Area

Figure 2.16 shows the chemical feed area and hoses which connect to the tops of the downstream pilot filters.

Figure 2.16: Sodium Hypochlorite Feed Pump

Pretreated water was sampled via ¼-inch sample lines connected to the filter inlets. The pretreated sample was used to monitor various water quality parameters, typically including chlorine (free and total), iron (total and dissolved), manganese (total and dissolved), and pH.

2.1.3.2 Adsorptive Filter Configurations

Four pilot filters were operated in parallel during all trials. Each pilot filter was 6 inches in diameter by 60 inches high. Pilot filters were constructed from 6-inch clear PVC schedule 40 pipe. Each filter had an underdrain consisting of a 2-inch stainless steel slotted media-retention nozzle with No. 8-12 garnet surrounding the nozzle. Two filters contained 24 inches of GreensandPlus™ (GSP) filtration media, with a 12-inch anthracite cap and two filters contained 24 inches of pyrolusite media with a 12-inch anthracite cap.

Table 2.02 summarizes the pilot filter configurations.

Table 2.02: Adsorptive Pilot Filter Configurations

Parameter	Filters A and C	Filters B and D
Filtration media	GreensandPlus ™ with Anthracite	PM-200 Pyrolusite
Adsorptive media depth	24 inches	24 inches
Anthracite media depth	12 inches	12 inches
Total filter bed depth	36 inches	36 inches
Adsorptive media volume	0.4 ft^3	0.4 ft^3
Anthracite volume	0.2 ft^3	0.2 ft^3
Total media volume	0.6 ft^3	0.6 ft^3
Freeboard above filter surface	24 inches	24 inches
Filter vessel diameter	6 inches	6 inches
Filter surface area	0.2 ft^2	0.2 ft^2
Filter vessel height	60 inches	60 inches
Filter vessel empty volume	7.5 gallons	7.5 gallons

2.1.3.3 Adsorptive Media Descriptions

2.1.3.3.1 GreensandPlus™ Filter Media

GreensandPlus™ (GSP) is a non-proprietary filtration media with the same adsorptive coating and treatment performance as standard manganese greensand, but the adsorptive coating is fused to a silica core. This allows GreensandPlus™ to withstand higher differential pressures than standard greensand without breakdown of the particles, and without stripping the adsorptive coating from the substrate. GreensandPlus™ can operate at filter loading rates 8 gpm/sf or greater, depending upon water quality, compared to 2 to 5 gpm/sf for standard manganese greensand.

GreensandPlus™ has a manganese dioxide coating that both catalyzes the oxidation/reduction of manganese and is adsorptive to manganese. The manganese dioxide coating is maintained by feeding an oxidant, typically either permanganate or chlorine. Pre-oxidation for contaminant removal or disinfection can provide sufficient oxidant to also maintain the adsorptive qualities of the media, but it is sometimes necessary to perform specific media regeneration procedures. Regeneration can be performed continuously by feeding permanganate or chlorine during filter service (continuous regeneration, CR), or intermittently by occasionally backwashing or soaking with a solution of permanganate or chlorine (intermittent regeneration, IR).

GreensandPlus™ filters are typically backwashed at 12 gpm/sf minutes, with or without air scour. A terminal differential pressure (DP) of 10 psi is often used to trigger backwash, but the manufacturer claims GreensandPlus™ is capable of withstanding DPs substantially greater than 10 psi.

2.1.3.3.2 Pyrolusite Media

Pureflow© Filtration Division of Whittier, CA provided the PM-200 media used for the pilot study. PM-200 is a high-rate pyrolusite media that is adsorptive to manganese, and is often used as an alternative to, or replacement for, manganese greensand. PM-200 can operate at filter loading rates up to 15 gpm/sf. A typical filter is composed of 24 to 48 inches of PM-200 without an anthracite filter cap. PM-200 does not require any regeneration procedures to maintain the adsorptive qualities of the filter media. It is composed of homogeneous mineral particles, as opposed to coated particles. Chemical pretreatment normally includes chlorine to oxidize dissolved metals. Alternative oxidants may also be used when appropriate. Full-scale systems are usually backwashed at 20 gpm/sf for 6 minutes to remove accumulated solids and restore the full filtration capacity of the media.

2.1.3.4 *Flow Control and Instrumentation*

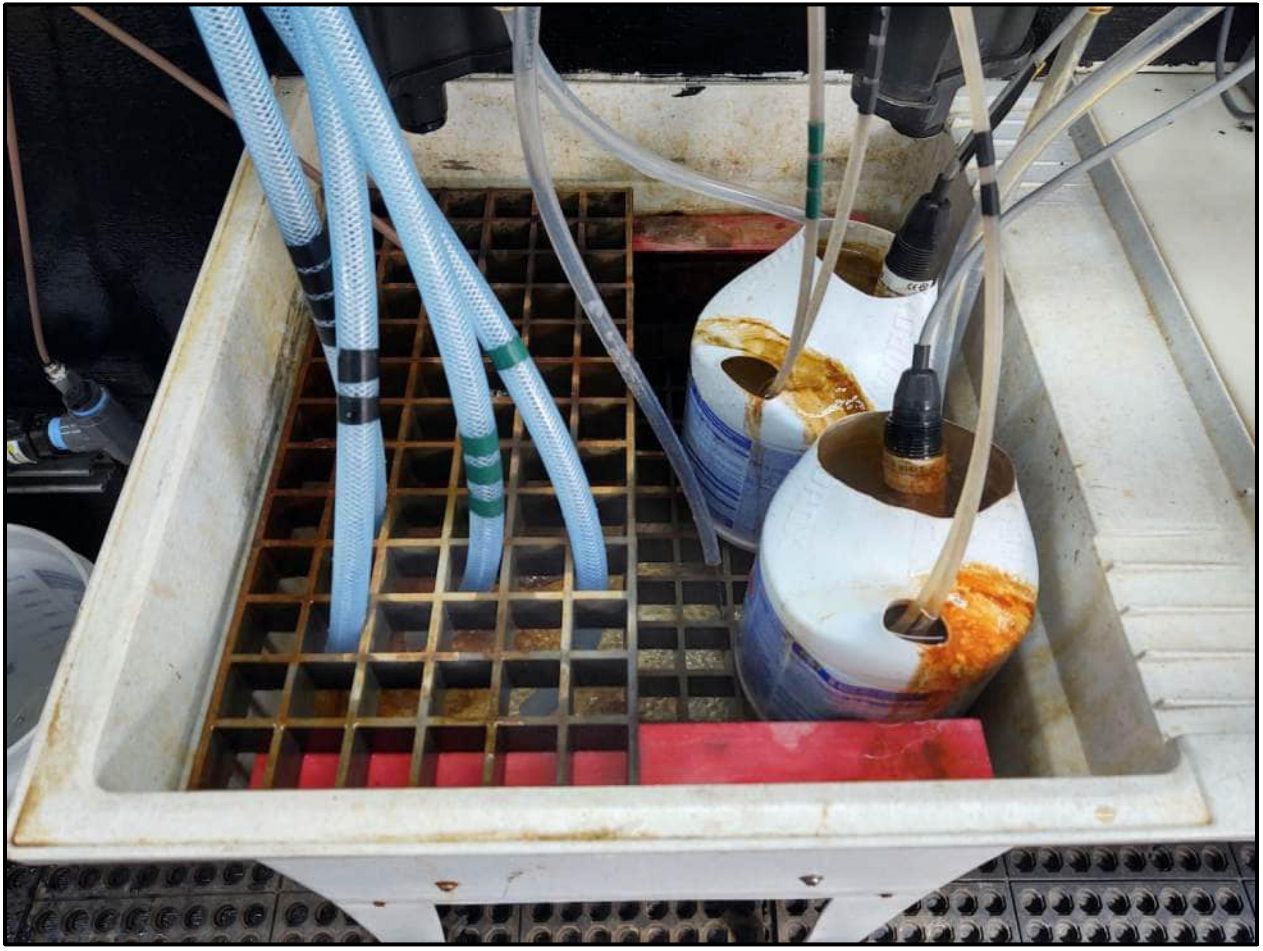
There were four parallel flow control assemblies, one per filter. Each flow control assembly included separate components for filtration and backwash operations. Forward flow had automated control capability. A flow meter controlled an automatic modulating valve via a PC-based PLC program with a PID loop. The PLC continuously monitored and logged filter flow rates, filter inlet and outlet pressures, filter effluent turbidities, and filter influent pH. The flow rate to the turbidimeters was manually adjusted and periodically measured.

Figure 2.17 shows the flow control assembly for the pilot filters.

Figure 2.17: Adsorptive Filter Flow Control Assemblies

Figure 2.18 shows the sample sink, with ½-inch hoses for pilot filter effluent, ⅜-inch lines for discharge from the four Hach 1720e flow-through turbidimeters, and the ¼-inch sample lines for untreated raw water, and pretreated filter influent. The pretreated filter influent sample lines flowed into two sample cups with an online pH meter, connected to a Hach SC200 controller. One cup received pretreated water for Filters A and B operating at ambient pH and the second cup received pretreated water for Filters C and D operating at increased pH. The target influent pH was maintained by PID control of the potassium hydroxide feed pump.

Figure 2.18: Adsorptive Pilot Trailer Sample Sink



Each filter effluent flow had a dedicated flow-through Hach 1720E low range turbidimeter. The four effluent turbidimeters were connected to two Hach SC200 2-channel controllers. Filter effluent turbidimeters and SC200 controllers are shown in Figure 2.19. Filter effluent grab samples were collected from the individual filter effluent streams at the points of discharge into the sample sink.

Figure 2.19: Hach 1720E Low Range Turbidimeters

The sample sink drained into a 150-gallon tank outside of the trailer. The filters were backwashed using filter effluent stored in the 150-gallon effluent tank. The effluent tank was equipped with an overflow which discharged to the dechlorination tank which contained dechlorination tablets. Both tanks are shown in Figure 2.20.

Figure 2.20: Pilot Effluent Tank and Waste Discharge

2.1.3.5 Backwash Water Feed Tank, Pump, and Connections

A booster pump supplied backwash water from the effluent storage tank to the pilot system. Backwash flows were controlled on the upstream, clean-water side of the filters while in reverse flow mode. A 0-5 gpm rotameter and flow control valve were used to control backwash flow rate.

All filters were backwashed at a flow rate of 2.4 gpm (12 gpm/sf) for a period of 10 minutes. While pyrolusite media can be backwashed at loading rates as high as 20 gpm/sf, Filters B and D contained an anthracite cap above the pyrolusite. The lower density anthracite would be susceptible to blowing out at a backwash rate of 20 gpm/sf and therefore Filters B and D were also backwashed at 12 gpm/sf. For each filter, the entire backwash volume was collected in a 30-gallon tank, and backwashing continued until a volume of 24-gallons was collected. The collected bulk backwash sample was typically sampled to characterize the backwash water and settleability. After sampling, the backwash water was either discharged to waste or transferred to a 200-gallon storage tank for eventual use as supernatant recycle.

The spent backwash water from all filters was stored in a 200-gallon tank for settling. The settled supernatant was then recycled into the raw water flow during the supernatant recycle trial. A Masterflex peristatic pump fed the supernatant into the raw water at a rate calibrated to equal 5% of the total pilot system influent flow rate. The intake for the supernatant pump was suspended above the sludge layer in the backwash settling tank to avoid the withdrawal of solids. Figure 2.21 shows the supernatant recycle feed pump and the backwash storage tank.

Figure 2.21: Peristaltic Recycle Feed Pump and Adsorptive Filter Backwash Water Storage Tank

2.1.4 Field Laboratory and Analytical Testing Equipment

Both pilot systems were equipped with a field laboratory built into the pilot container to provide an area to complete the field analyses. Figure 2.22 shows the field laboratory in the biological pilot container which was used as the primary field lab during the study. Glassware, reagents, and analytical equipment necessary to complete the analyses described in Section 2.3 were included in the field laboratory.

Figure 2.22: Biological Pilot Container Field Laboratory

The following sample locations were used during the pilot study:

Common Pilot Samples

- RAW Wellfield 2 – Raw water sample collected from pilot influent tap.

Adsorptive Pilot Samples

- POX AB – Pretreated influent to Filters A and B collected from filter influent taps.
- POX CD – Pretreated influent to Filters C and D collected from filter influent taps.
- FILTER A – Filter Effluent from Filter A collected at the point of discharge to the sample sink.
- FILTER B – Filter Effluent from Filter B collected at the point of discharge to the sample sink.
- FILTER C – Filter Effluent from Filter C collected at the point of discharge to the sample sink.
- FILTER D – Filter Effluent from Filter D collected at the point of discharge to the sample sink.
- CBW A – Combined Backwash Filter A collected from homogenized backwash.
- CBW B – Combined Backwash Filter B collected from homogenized backwash.
- CBW C – Combined Backwash Filter C collected from homogenized backwash.
- CBW D – Combined Backwash Filter D collected from homogenized backwash.
- SSN A – Settled Supernatant Filter A collected from top of settled CBW A.
- SSN B – Settled Supernatant Filter B collected from top of settled CBW B.
- SSN C – Settled Supernatant Filter C collected from top of settled CBW C.
- SSN D – Settled Supernatant Filter D collected from top of settled CBW D.

Biological Pilot Sample Locations

- F1 - Filter F1 Effluent sampled at the point of discharge to the sample sink.
- F2 - Filter F2 Effluent sampled at the point of discharge to the sample sink.
- MPOKA - Pretreated influent Post-Aeration, Post-KOH addition to Filter M1 collected from the filter influent sample tap.
- M1 – Filter M1 Effluent sampled at the point of discharge to the sample sink.
- CBW F1 – Combined Backwash Filter F1 collected from homogenized backwash.
- CBW F2 – Combined Backwash Filter F2 collected from homogenized backwash.
- CBW M1 – Combined Backwash Filter M1 collected from homogenized backwash.
- SSN F1 – Settled Supernatant Filter A collected from top of settled CBW F1.
- SSN F2 – Settled Supernatant Filter A collected from top of settled CBW F2.
- SSN M1 – Settled Supernatant Filter B collected from top of settled CBW M1.

2.2 PRETREATMENT

Liquid pretreatment chemicals were diluted with filtered water at measured volumetric ratios to produce feed stocks with the desired concentrations. The objective was to maintain chemical feed rates within the mid-range of the feed pumps to allow for dose adjustments as required.

Sodium hypochlorite (NaOCl) was used for oxidation of dissolved iron and manganese for all adsorptive filtration trials. NaOCl was injected into the common raw feed for all four filters. Potassium hydroxide (KOH) was used for pH control of all adsorptive filtration trials and for pretreatment of the biological manganese filter trials. KOH was dosed to achieve the target pH of each filter.

The liquid chemicals were added to graduated day tanks, which allowed measurement of daily drawdown rates. The drawdown rates were used to calculate chemical feed rates and doses.

2.2.1 Dose Calculation for NaOCl

NaOCl doses were calculated based on the specific gravity and stock concentration of the product, the dilution of the stock product with make-up water, the chemical feed rate, and the flow rate of the process water. The doses were calculated in terms of mg/L as Cl_2. Typical store-bought sodium hypochlorite stock solution is assumed to have an available chlorine concentration of 7.5% Cl_2. Doses were calculated as:

$$Cl_2\ Dose\ (\mathrm{mg/L}) = \left[\frac{(R)(D)(7.5\%)(10^6\ mg/L)(1.1)}{(Q)(3{,}785\ mL/gal)(60\ min/hr)}\right]$$

Where:
R = chemical feed rate (mL/hour) per day tank drawdown measurements
Q = process water flow rate (gpm)
1.10 = specific gravity of the product (dimensionless)
7.5% = weight percentage of the product (% available chlorine)
D = dilution factor of chemical in day dank (dimensionless ratio)

2.2.2 Dose Calculation for KOH

KOH doses were calculated based on the specific gravity and stock concentration of the product, the dilution of the stock product with make-up water, the chemical feed rate, and the flow rate of the process water. The doses were calculated in terms of mg/L as KOH. The product had a weight percentage of 45%, a specific gravity of 1.45. Doses were calculated as:

$$KOH\ Dose\ (mg/L) = \left[\frac{(R)(D)(1.45)(45\%)(10^6\ mg/L)}{(Q)(3{,}785\ mL/gal)(60\ min/hr)}\right]$$

Where:
R = chemical feed rate (mL/hour) per day tank drawdown measurements
Q = process water flow rate (gpm)
1.45 = specific gravity of the product (dimensionless)
45% = weight percentage of the product (% KOH)
D = dilution factor of chemical in day dank (dimensionless ratio)

2.3 FIELD ANALYTICAL METHODS

2.3.1 Iron - FerroVer

Iron samples for raw water, pilot influent and intermediate filtrations steps were analyzed in accordance with Hach (Loveland CO) FerroVer® method #8008. Samples with iron concentrations above 3.3 mg/L were diluted with distilled water by a ratio appropriate to bring them into a measurable range. Samples were distributed to 25 ml sample vials. FerroVer iron reagent was added to each sample vial and mixed, and 3 minutes were allowed for reaction. The samples were read using a Hach DR 5000, or DR 890 colorimeter. The colorimeter was zeroed with each set of readings using a blank from the appropriate sample site. The results were displayed in mg/L of total iron. The estimated detection limit for the method was 0.04 mg/L.

2.3.2 Manganese – PAN Method (Field Method)

Manganese samples were analyzed using the PAN (1-(2 Pyridylazo)-2 Napthol) method in accordance with Hach method #8149. 10 mL samples were measured into 25 ml sample vials. Ascorbic acid, alkaline cyanide and 0.1% PAN indicator solution were added using autoburettes set to dispense 0.5 mLs of ascorbic acid, 0.4 mLs of alkaline cyanide, and 0.4 mLs of PAN reagent. The vials were mixed and 2 minutes were allowed for reaction. The samples were read using a Hach DR 5000 or DR 890 colorimeter. The colorimeter was zeroed with each set of readings with a blank of DI water, prepared identically to the samples according to the PAN method. A new blank was prepared with each set of manganese samples that were analyzed. The results were displayed in mg/L of total manganese. The estimated detection limit for the method was 0.006 mg/L.

2.3.3 Nitrate – NitraVer5

Nitrate samples for raw water, pilot effluent were analyzed in accordance with Hach (Loveland CO) NitraVer5® method #8039. Samples were distributed to 25 ml sample vials. NitraVer5 reagent was added to each sample vial and mixed, and 5 minutes were allowed for reaction. The samples were read using a Hach DR 5000, or DR 890 colorimeter. The colorimeter was zeroed with each set of readings using a blank from the appropriate sample site. The results were displayed in mg/L of total nitrate. The estimated detection limit for the method was 0.5 mg/L.

2.3.4 Alkalinity

Alkalinity was analyzed in accordance with the Standard Methods 2320 Titration Method. Either 100 or 200 mL samples were titrated using 0.020N H_2SO_4. The endpoint of the titration was a pH of 4.5 SU.

For alkalinity samples of 30 mg/L or greater, the total alkalinity was determined as follows:

$$Total\ Alkalinity\ (mg/L\ CaCO_3) = \frac{A\ \times\ N\ \times\ 50{,}000}{mL\ Sample}$$

Where:

A = mL titrant to recorded pH (4.5 SU), and
N = Normality of Titrant (0.02 N)

Results were expressed as milligrams of calcium carbonate per liter (mg $CaCO_3$/L).

2.3.5 Carbon Dioxide

Carbon dioxide was determined in accordance with Standard Method 4500-CO_2 and an Orion 3-star pH meter. A titration was performed on 100 mL samples using 0.02 N NaOH while pH was continously monitored. The titration was complete when the pH reached approximately 8.3. The volume of titrant added was then used to calculate the concentration of carbon dioxide using the following formula:

$$\frac{mg\ CO_2}{L} = \frac{Volume\ of\ Titrant\ (mL)\ x\ 0.02\ N\ NaOH\ x\ 44{,}000}{100\ mL}$$

2.3.6 pH Measurements

Manual pH measurements were made in accordance with Standard Methods 4500-H+B using an Orion glass pH Triode with temperature compensation, and an Orion 3-Star pH meter. A two-point calibration was performed using standard buffer solutions of pH 4.00 SU and pH 7.00 SU, or pH 7.00 SU and pH 10.00 SU.

Online pH was monitored continuously by placing the probe in a sample container in the sample sink; the sample container was continuously filling with fresh sample, and overflowing at a constant level.

2.3.7 Dissolved Oxygen

DO measurements were made using an HACH LDO® Process Dissolved Oxygen Probe with a Hach SC200 controller. A calibration was performed by sampling the oxygen in air (typically 20.9%). Calibration was performed periodically during the pilot study. DO was monitored continuously by placing the probe in a sample container in the sample sink; the sample container was continuously filling with fresh sample, and overflowing at a constant level.

2.3.8 BART

The Biological Activity Reaction Test (BART) was used to identify the presence and level of activity of several potential inhibiting bacteria which may be present in water/wastewater sources. The test consists of two vials, an outer vial and an inner vial. The outer vial is filled with at least 20 mL of sample which is used to fill the inner tube up to a marked level. The inner tube is then placed inside the outer tube which is screwed shut. The tube is then monitored for 8 days. The amount of growth and color the slime/film which develops within the vial is the indicator of a particular type of inhibiting bacteria. Table 2.03 is the BART matrix for identifying the class of bacteria and the activity level. Appendix E contains a description of the test method.

Table 2.03: BART Matrix	**Days until Observed Reactions (days) - Approximate Population (cfu/mL)**			**Determination of Present/Absent (8 Days)**		**Determination of Dominant Bacteria**	
	Aggressive	*Moderate*	*Not Aggressive*	*Absent*	*Present*	*Classification*	*Observation*
Iron Related Bacteria (IRB)	1 - 570,000 2 - 140,000 3 - 35,000 4 - 9,000	5 - 2,200 6 - 500 7 - 150 8 - 25	9 - 8 10 - <1	The solution has NO Brown slime	A Brown slime ring or foam around the ball and/or A Brown slime growth at the base of the tube	**Anaerobic Bacteria**	Foam around the ball
						IRB	Brown Rings, Gel, and/or Clouds
						Pseudomonads	Green-Cloudy
						Enteric Bacteria	Red-Cloudy
						Heterotrophic Bacteria	Cloudy
						Pseudomonads and Enteric	Black Solution
Sulphate Reducing Bacteria (SRB)	1 - 2,200,000 2 - 500,000 3 - 115,000 4 - 27,000 5 - 6,000	6 - 1,400 7 - 325 8 - 75	9 - 20 10 - 5 11 - <1	The solution has NO Black slime	A Black slime ring beneath the ball, and/or A Black slime growth at the base of tube.	**Dense slime bacterial and SRB consortium**	Black only at in Base
						Aerobic slime bacterial and SRB consortium	Black only around Ball/Top
						Complex bacterial consortium with SRB present	Black in Base and around Ball
						Anaerobic bacteria present	Solution is cloudy
Slime Forming Bacteria	1 - 1,750,000 2 - 440,000 3 - 67,000	4 - 13,000 5 - 2,500 6 - 500	7 - 100 8 - <20	The solution remains clear (not cloud) with NO slime or glowing under U.V. Light.	Cloudy solution, glowing ring around ball under U.V. light, and/or Slime growth at base of tube.	**Dense Slime Bacteria**	Dense slime in base or slime ring around ball
						Slime Forming Bacteria	Cloudy growth or layered plates
						Fluorescing Pseudomonads	Pale blue glowing around ball (UV light)
						Pseudomonads and Enteric	Blackened liquid
						Tight Slime Bacteria	Thread-like strands

2.4 LABORATORY ANALYSES

Phoenix Environmental Labs (Manchester, CT) was utilized as the certified laboratory for off-site analyses. Samples were collected by Blueleaf personnel by filling laboratory-prepared bottles, which were delivered to the lab on the day of sampling.

2.5 STATISTICAL METHODS

2.5.1 Paired t-test

The paired t-test procedure is used to analyze the differences between paired observations. The procedures are used to determine if the mean difference for the population is likely to be different from zero. The paired t-procedure is used to compare two opposing hypotheses:

H_o (the null hypothesis): That the mean of the differences in the population is equal to zero
- or -
H_1 (the alternative hypothesis): That the mean of the differences in the population is not equal to zero.

The paired t-test results are normally displayed as a confidence interval, which is a range of likely values for the difference between the two sample sets. Confidence intervals that contain zero normally indicate that the null hypothesis has not been disproven, i.e. that there was not a significant difference in paired values.

The t-test results also provide two statistics to test of the mean difference: a t-value and a p-value. The t-value is not very informative by itself, but it is used to determine the p-value. The p-value indicates how likely it is that H_o is true. High p-values suggest that there is no difference between paired values, while low p-values suggest that there is a statistically significant difference between paired values.

2.5.2 Analysis Of Variance (ANOVA)

When appropriate, Minitab software was used to perform an Analysis Of Variance (ANOVA) to compare the effects of two or more factors upon a specific response. For example, an ANOVA might be used to compare effluent iron concentrations (the response) at different surface loading rates (the factor). The following explanation was adapted from the software documentation.

An ANOVA tests the hypothesis that the means of two or more populations are equal. The procedure uses variances to determine whether the means are different, by comparing the variance between group means versus the variance within groups. In this way the ANOVA determines whether the different groups are all part of one larger population, or can be statistically distinguished as separate populations with different characteristics. An ANOVA requires data from normally distributed populations with roughly equal variances between factor levels.

An example of the output from an ANOVA is shown below in Table 2.04. The ANOVA tested a data set to determine whether the Factor had a statistically significant affect upon the Response. The Factor had two levels. Level 1 included 22 data points, and Level 2 included 10 data points.

Table 2.04: Example of One-Way ANOVA Response versus Factor with Two Levels

```
Source  DF        SS        MS       F      P
Trial    1  0.071783  0.071783  234.91  0.000
Error   30  0.009167  0.000306
Total   31  0.080950

S = 0.01748   R-Sq = 88.68%   R-Sq(adj) = 88.30%

                             Individual 90% CIs For Mean Based on
                             Pooled StDev
Level   N     Mean    StDev  ------+---------+---------+---------+---
1      22  0.12318  0.02009                                   (-*-)
2      10  0.02100  0.00876  (--*--)
                             ------+---------+---------+---------+---
                                 0.030     0.060     0.090     0.120

Pooled StDev = 0.01748
```

The most important aspects of the ANOVA are described below.

2.5.2.1 Null Hypothesis

The ANOVA determines whether the null hypothesis should be accepted or rejected. For all ANOVAs herein, the null hypothesis and its alternative hypothesis were as follows:

- The Null Hypothesis (Ho) states that all population means are equal.
- The Alternative Hypothesis (H_1) states that at least one population mean is different.

If the null hypothesis is rejected, it indicates that the population means were different, and it follows that the Factor had a statistically significant effect upon the Response. If the null hypothesis is accepted, then it follows that the factor did not have a significant effect upon the response.

2.5.2.2 Probability Value

The probability value (p-value) reports the probability that the null hypothesis can be accepted. The p-value is tested against an alpha value (α), often called the level of significance. Alpha was chosen to be 0.05 (5%) for all ANOVAs herein. If the p-value is greater than alpha ($p>0.01$) then there was greater than 10% probability that the population means were the same (or alternatively less than 90% probability that the means were different) and the null hypothesis cannot be rejected. If the p-value is less than alpha ($p<\alpha$), then the null hypothesis can be rejected, and it can be concluded that at least one mean is different than the others to a certainty of >95%.

In the example above, the p-value was 0.000, which indicates <0.1% probability that the null hypothesis is correct, or conversely >99.9% probability that the null hypothesis can confidently be rejected.

2.5.2.3 Confidence Intervals

A confidence level of 95% was chosen for all ANOVAs herein. The ANOVA output includes a plot of the 95% confidence intervals. For each data set (Levels 1 and 2) the asterisk (*) indicates the mean value, and 9 out of 10 data fall within the 95% confidence interval indicated between the parentheses.

In the example above, there is no overlap of the confidence intervals. The data sets corresponding to Level 1 and Level 2 are clearly different. This indicates that the Factor at Levels 1 and 2 had a significant effect upon the response.

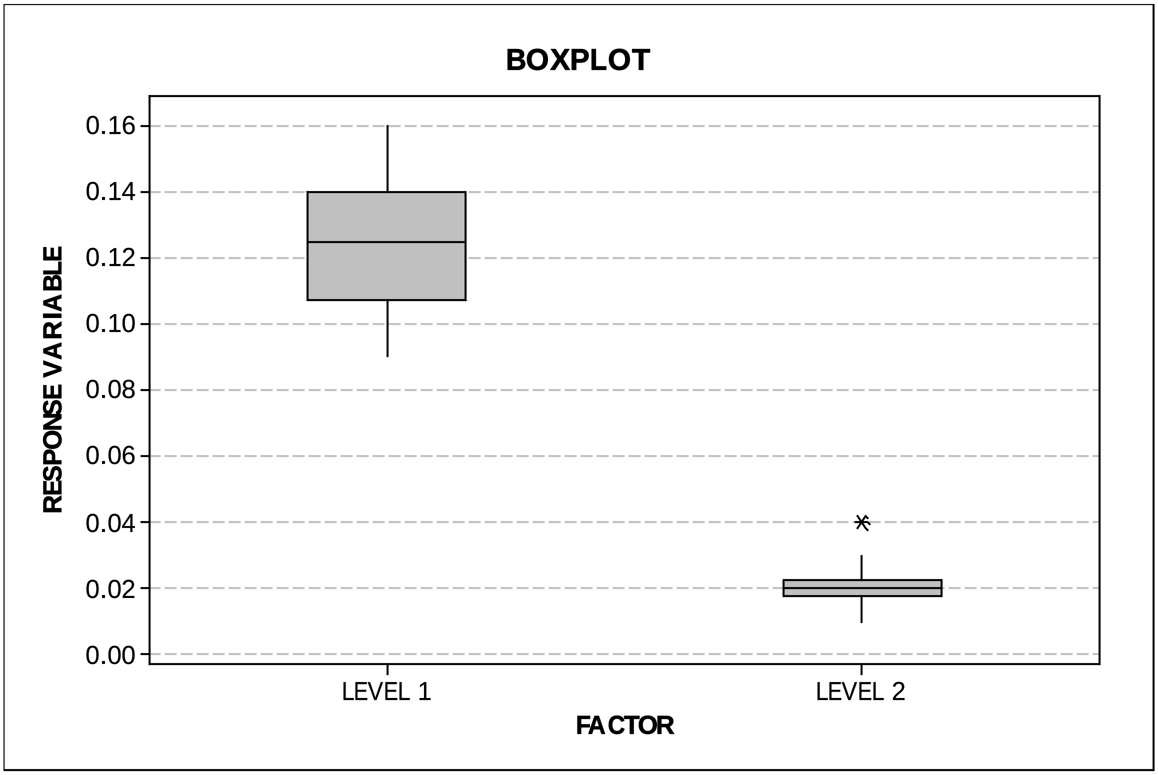
2.5.2.4 Mean and Standard Deviation

The ANOVA reports the mean, standard deviation, and sample count (N) for each data set. In the example above, Level 1 had a mean of 0.123 and a standard deviation of 0.020, while Level 2 had a mean of 0.021 and a standard deviation of 0.009. Level 2 had a lower mean and a smaller standard deviation than Level 1.

2.5.3 Boxplots

Boxplots are used to provide a graphical summary of the distribution of a sample. Minitab can include a boxplot as part of the output of an ANOVA. A boxplot shows the shape, central tendency, and variability of the sample. Figure 2.23 was from the same data used for the ANOVA example, above. One factor was tested at two levels. The boxplot shown here suggests that Level 2 resulted in a lower median response than Level 1, and also had a narrower range of variation than Level 1.

Figure 2.23: Boxplot Example



The important aspects of the boxplot are described below:

1. The upper whisker extends to the maximum data point within 1.5 box heights from the top of the box.
2. The interquartile range box contains the middle 50% of the data.
    a. The top line indicates the third quartile (Q3). 75% of the data are less than or equal to this value.
    b. The middle line indicates the median (Q2). 50% of the data are less than or equal to this value, and 50% of the data are greater than this value.
    c. The bottom line indicates the first quartile (Q1). 25% of the data are less than or equal to this value.
3. The lower whisker extends to the minimum data point within 1.5 box heights from the bottom of the box.
4. An asterisk (*) denotes an outlier, an observation that is beyond the upper or lower

3 RESULTS

Section 3 provides the data collected during the pilot study without analysis of the data or comparison between process alternatives. Much of the data is summarized in tabular format. Please note that blank spaces in the tables represent that there were no samples collected during the sample event for a particular sample point. Some parameters are included in the tables with no data so that the results tables have a consistent format.

The data throughout the results section is presented in two formats:

Grab samples are typically shown as: **Median** (minimum – maximum) [number of samples]

Online analyses are typically shown as: Average ± Standard Deviation [number of samples]

3.1 RAW WATER QUALITY – SHARON WELLFIELD 2

Table 3.01 summarizes the raw water quality results from field analyses. Table 3.02 summarizes the results of lab analyses. Table 3.03 provides the results of BART analyses. Field analyses of raw water from both the adsorptive filtration and biological filtration pilot studies were combined in Tables 3.01 through 3.03.

Table 3.01: Raw Water Quality for Sharon Wellfield 2 by Field Analyses

Parameter	**Units**	**Field Analysis**
Total Fe	mg/L	**0.62** (0.13-1.08) [71]
Dissolved Fe	mg/L	**0.46** (0.043-0.77) [57]
Total Mn	mg/L	**0.134** (0.034-0.168) [76]
Dissolved Mn	mg/L	**0.133** (0.033-0.162) [57]
pH	s.u.	**6.40** (6.14-6.95) [58]
Temperature	°C	**12.4** (10.8-14.1) [53]
Alkalinity	mg/L as $CaCO_3$	**47** (45.5-52) [8]
Carbon Dioxide	mg/L	**39** (31-49) [7]
Nitrate	mg/L	**2.8** (0.5-4.2) [26]
Total Organic Carbon	mg/L	**0.35** (0.12-2.39) [11]
DO	mg/L	**3.10** ± 1.42 [38,946]

Table 3.02: Raw Water Quality for Wellfield 2 by Lab Analyses

	Analysis	Units	Laboratory Report #								
			L2013401 CN23857	CN30219	CN33583	L2309640 CN48043	CN41560	CN52084	CN52089	L2311800 CN55216	CN59353
			Sample Date								
			1/13/23	1/25/23	2/01/23	2/13/23	2/22/23	3/01/23	3/02/23	3/07/23	3/09/23
Laboratory Analyses by Alpha Analytical	Total Iron	mg/L	0.644	0.768	1.34		0.855	0.802	0.993	0.732	1.21
	Total Manganese	mg/L	0.155	0.153	0.154		0.157	0.161	0.161	0.159	0.161
	Dissolved Iron	mg/L	<0.011	0.011	0.058			0.013		0.016	
	Dissolved Manganese	mg/L	0.144	0.153	0.152			0.153		0.154	
	Turbidity	NTU					1.1	1.1		1.2	
	True Color	C.U.					<1	<1		<1	
	Apparent Color	C.U.	15	<1	15		15	15		15	
	Total Coliform	Col/100mL	Negative		Negative		Negative			Negative	
	Escherichia Coliform	Col/100mL	Negative		Negative		Negative			Negative	
	Heterotrophic Plate Count	CFU/ml						63		140	
	Hydrogen Sulfide	mg/L	<0.05	<0.05	<0.05			<0.05			
	VOCs	µg/L						Below RLs			
	Phosphates	mg/L	0.032	0.08							
	Total Organic Carbon	mg/L	<1.0	<1.0							
	Silica	mg/L	18.9								
	Carbon Dioxide	mg/L					16	16			
	Total Hardness	mg/L					111			107	
	Conductivity		364	332							
	Alkalinity	mg/L	45	44			45	45		49	
	pH	s.u.					6.83	7.03		7.45	
	Total Dissolved Solids	mg/L	230	230			240	240		250	
	Sulfate	mg/L	13.0	12.6			13.5	13.8		14.1	
	Nitrogen, Nitrite	mg/L	<0.01	<0.01				<0.01		<0.01	
	Nitrogen, Nitrate	mg/L	4.05	3.64		3.59		3.52		3.51	
	Nitrogen, Ammonia	mg/L	0.05	0.15				<0.05		<0.05	
	Chloride	mg/L					71.6	83.1		79.8	
	Zinc	mg/L	<0.004	<0.004							

Table 3.03: Results of BART Test on Well 7A Raw Groundwater

Type of Bacteria	Observation	Absent/Present	Dominant Bacteria	Days until Reaction	Approximate Bacterial Population (cfu/mL)
Iron Related Bacteria	Solution brown	Present	Iron Related Bacteria	1	570,000
Sulfate Reducing Bacteria	Cloudy	Present	Anaerobic Bacteria	8	75
Slime Forming Bacteria	Cloudy	Present	Slime Forming Bacteria	3	67,000

The results of the BART test suggested an elevated number of iron reducing and slime forming bacteria in the raw groundwater and a smaller population of sulfate reducing bacteria. The number of bacteria is estimated by the amount of time before a reaction was observed during the analysis. The appearance of the test vials utilized during the BART test is shown in Figure 3.01, on Day 1, and Figure 3.02, on Day 8. Additional observation with photos were conducted in between.

Figure 3.01: Well 7A BART Test, Day 1

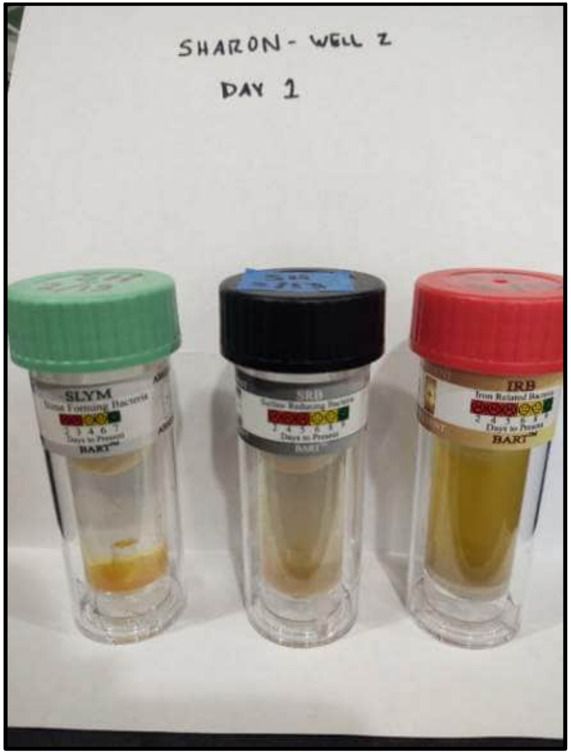
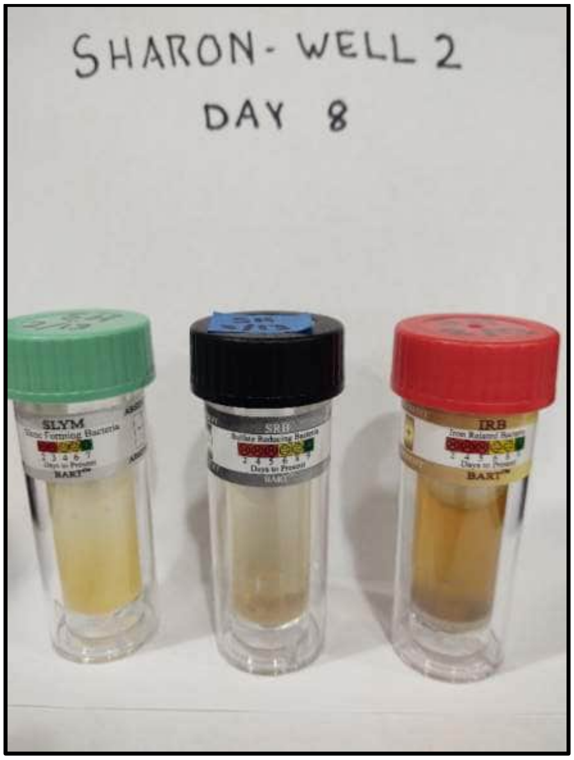


Figure 3.02: Well 7A BART Test, Day 8



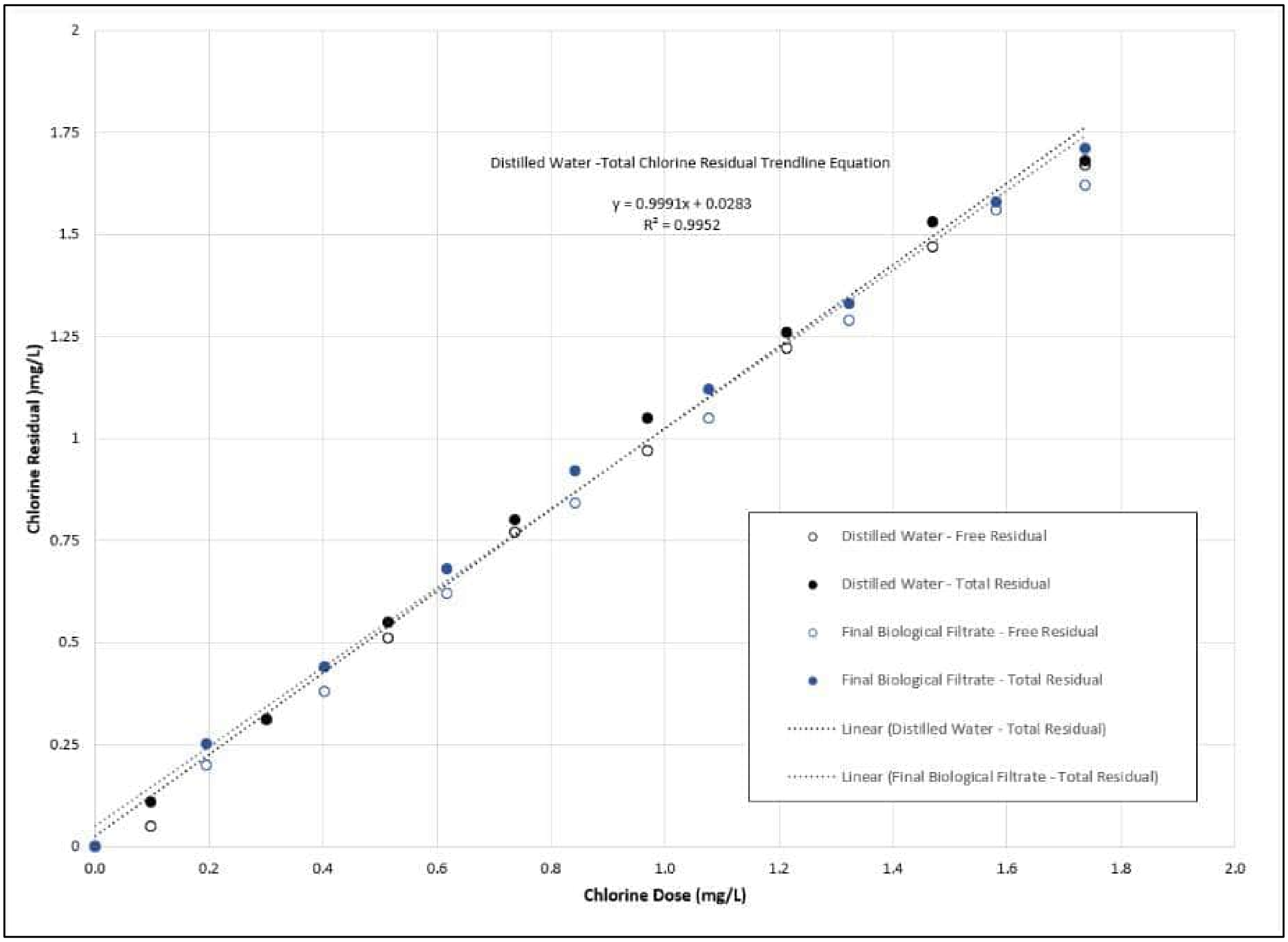
3.2 CHEMICAL DOSES

3.2.1 NaOCl Doses

3.2.1.1 NaOCl Doses for Final Biological Filter Effluent from Titration

The dose of NaOCl required for future disinfection of biological filter effluent was evaluated by bench titration. 7.5% NaOCl bleach was diluted 1 part in 250 and titrated into 1000 mL samples. The free and total chlorine residuals were measured with each titration. Figure 3.03 plots the NaOCl dose vs the chlorine residual for both distilled water and the final biological filtration system effluent.

Figure 3.03: NaOCl Dose vs Chlorine Residual by Titration



Notes and observations from the NaOCl titrations:

1. A titration was performed on distilled water to determine the actual strength of the NaOCl in the bleach stock utilized for the titrations. Because there is no chlorine demand in distilled water the dose should match the residual. After completing an initial plot of the data, it was apparent that the stock concentration had degraded from the 7.5% noted on the bleach label. Back calculating the

actual concentration to produce a slope of 1.0 indicated the actual NaOCl concentration in the bleach was 4.5 %.

2. The NaOCL titration for the final biological filtrate was similar to that for distilled water. The chlorine demand was very low after iron and manganese removal combined with the low TOC concentration of the raw water.
3. The NaOCl dose based on mass was determined using the following formula:

$$NaOCl\ Dose\ (mg/L) = \left[\frac{(Vt)(D)(1.10)(4.5\%)(10^6\ mg/L)}{(Vs)(3{,}785\ mL/gal)(60\ min/hr)}\right]$$

Where:
Vt = Volume of Titrant into the sample measured in mLs
Vs = Volume of Sample measured in mLs. 1000 mL samples were used.
1.10 = specific gravity of the product (dimensionless)
4.5% = weight percentage of the product (% NaOCl)
D = dilution of NaOCl for titration (1/250- dimensionless ratio)

3.2.1.2 Adsorptive Media Pilot – Sodium Hypochlorite Doses

The sodium hypochlorite dose necessary for oxidation of iron and manganese were also determined for the adsorptive media filtration system and calculated as described in Section 2.2.1. Two occasions of overnight usage data were used to calculate the doses presented in Table 3.04. During these trials the operator was targeting a free chlorine residual between 0.25 and 0.50 mg/L. The table provides two doses, one based on fresh bleach with a 7.5% concentration as labeled, and a second based on degraded 4.5% concentration in bleach as was utilized during the titrations described above in Section 3.2.1.1. Multiple containers of bleach are utilized while preparing batches of NaOCl day tank stock and the actual concentration of each container is unknown.

Table 3.04: Pretreatment Sodium Hypochlorite Doses

Trial No.	Chlorine Dose (mg/L) Based on Fresh 7.5% Bleach	Chlorine Dose (mg/L) Based on Degraded 4.5% Bleach
5	2.8	1.7
7-8	2.5	1.5

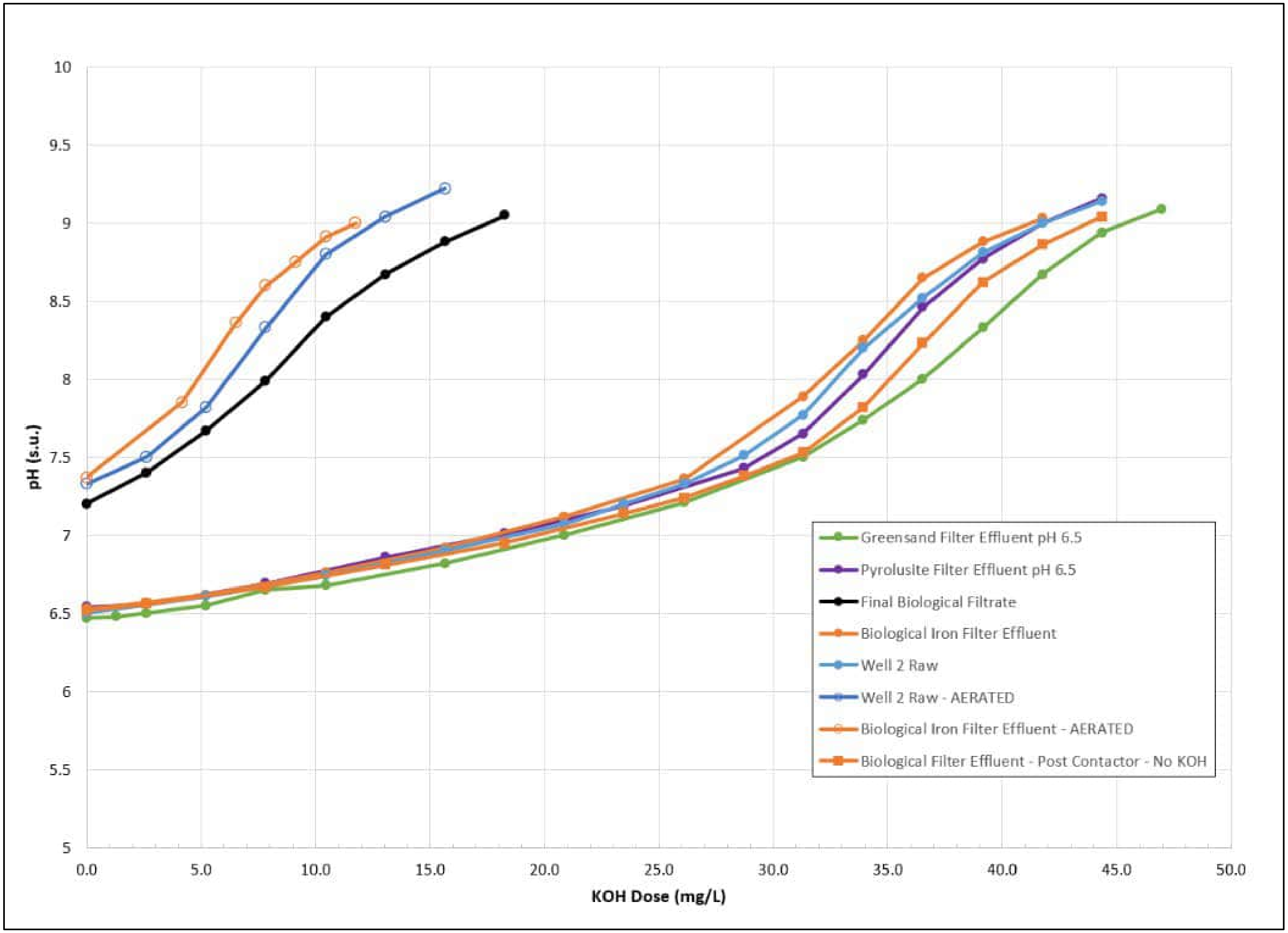
3.2.2 KOH Doses

The dose of KOH required for pH adjustment was evaluated by bench titration. KOH titrations were conducted on eight different samples.

1. Raw Water
2. Raw Water after 5 minutes of aeration in a beaker
3. Biological Iron Filter Effluent
4. Biological Iron Filter Effluent after 5 minutes of aeration in a beaker
5. Biological Iron Filter Effluent after pilot scale air contactor
6. Biological Manganese Filter Effluent
7. Greensand Filter Effluent for Filter A operating at ambient pH.
8. Pyrolusite Filter Effluent for Filter B operating at ambient pH.

45% KOH was diluted 1/250 and titrated into 1000 mL samples while the pH was continuously monitored. Two of the eight samples were aerated in a beaker prior to titration to evaluate whether the KOH dose for pH adjustment could be reduced by aeration which strips dissolved carbon dioxide (CO_2). Figure 3.04 shows the results (adjusted pH vs. KOH dose in mg/L) of the KOH titrations.

Figure 3.04: KOH Titrations



Notes and observations from the KOH titrations:

1. KOH titrations for (1) raw water, (3) biological iron filter effluent operating at ambient pH, (7) Greensand filter effluent operating at ambient pH, and (8) pyrolusite filter effluent operating at ambient pH produced similar titrations requiring a KOH dose of 32 to 37 mg/L to increase the pH to 8.0. This can be seen on the figure by comparing the blue, green, purple and orange lines with solid round markers.
2. A titration into (5) biological iron filter effluent post air contactor with the KOH off was also in the same range indicating that the pilot scale air contactor is not contributing to the pH increase upstream of the manganese filter which is, therefore, primarily due to KOH addition. This titration is plotted as the orange line with solid square markers on the figure.
3. Titrations into (2) raw water and (4) iron filter effluent were conducted after 5 minutes of aeration to determine the potential reduction in caustic dose. The two titrations produced similar results requiring a dose of 5 to 7 mg/L to increase pH to 8.0. This can be seen on the figure by comparing the blue and orange lines with hollow round markers. This indicates that aeration reduced the KOH demand by 25 to 30 mg/L.
4. The biological manganese filter was being operated at a target pH of 7.6. To increase the biological manganese filter effluent from 7.6 to 8.0 would require an additional 8 mg/L dose of KOH. This titration is plotted as the black line with solid round markers. Alternatively, the biological manganese filter could be operated at a pH of 8.0 with a pretreatment KOH dose in the range identified in item 1.
5. KOH doses were calculated based on the specific gravity and stock concentration of the product, the dilution of the stock product with distilled water, the volume of titrant, and the volume of sample. KOH titrant was made up at a 1/250 dilution. The doses were calculated in terms of mg/L as KOH. The product had a weight percentage of 45%, a specific gravity of 1.45. Doses were calculated as:

$$KOH\ Dose\ (mg/L) = \left[\frac{(Vt)(D)(1.45)(45\%)(10^6\ mg/L)}{(Vs)(3{,}785\ mL/gal)(60\ min/hr)}\right]$$

   Where:
   Vt = Volume of Titrant into the sample measured in mLs
   Vs = Volume of Sample measured in mLs. 1000 mL samples were used.
   1.45 = specific gravity of the product (dimensionless)
   45% = weight percentage of the product (% KOH)
   D = dilution of KOH for titration (1/250- dimensionless ratio)

3.2.3 Air/Oxygen Doses

The DO concentration was increased in the biological iron filter effluent upstream of the manganese removal filter through use of the aeration spheres in the air contactor. Additional use of compressed air was not needed. The air contactor increased the DO concentration from near 2 mg/L to near 5 mg/L.

3.3 BIOLOGICAL TREATMENT SYSTEM RESULTS

3.3.1 Biological Pretreated Water Quality

The biological iron removal filters received raw water without any pretreatment so there is no new data to be presented here (raw water data presented in Section 3.1 represents water entering the biological iron filter).

Table 3.05 summarizes the pretreated water quality for the manganese removal Filter M1 influent (MPOKA) for all filter trials.

Table 3.05: MPOKA Water Quality by Field Analyses

Parameter	Units	Field Analysis
Total Fe	mg/L	**0.07** [1]
Dissolved Fe	mg/L	0.00-0.04 [2]
Total Mn	mg/L	**0.134** (0.108-0.170) [26]
Dissolved Mn	mg/L	**0.129** (0.108-0.149) [27]
pH	S.U.	**7.60** ± 0.57 [5325]
DO	mg/L	**4.56** ± 0.48 [5325]

3.3.2 Biological Filter Performance

3.3.2.1 Biological Filter Operational Summary Tables

A total of 24 trials were completed on Filter F1, 21 trials on Filter F2, and 4 trials completed on Filter M1. Filters have a differing number of trials based on runtimes and backwash frequency. Each filter trial was preceded by a backwash with air scour.

For each filter run, the online data listed in Section 2.1.2.3 (Instrumentation) were collected every 3 minutes. Grab samples were collected periodically. Individual observations and results from field analyses of grab samples are included in the Daily Data Sheets in Appendix A. The results of laboratory analyses are included in Appendix C.

For Tables 3.06 through 3.08 the following information is tabulated for each filter:

- Source – Indicates the raw water source for the pilot system.
- Trial Number – Filter ID x Trial Sequence. Recycle Trials are subdivided into pre-recycle, during recycle, and post recycle.
- Figure – Indicates the corresponding figure plotting operational parameters by filter runtime. The biological filter trial figures are included in Appendix D.
- Start - Indicates the start time of the filter run, i.e. the start of filter forward flow.
- End - Indicates the end time of the filter run.

- Duration of Trial (hours) - The length of the trial (or sub-trial) in hours.
- Filter Surface Loading Rate (gpm/sf) - The filter surface loading rate, calculated by dividing the flowrate by the surface area of the pilot filter (0.2 sf). The data is presented as: average ± standard deviation [number of samples].
- Influent pH - (shown only on the manganese removal filter table) reports the median pH, the standard deviation of the data, and the number of data, for the pretreated filter influent during the filter trial.
- Influent DO - (shown only on the manganese removal filter table) reports the median DO, the standard deviation of the data, and the number of data, for the pretreated filter influent during the filter trial.
- Clean Bed Headloss - is the headloss at the start of a filter run just after backwash. It is plotted on the filter trial figures in Appendix D as the y-intercept. The intercept is reported in psid.
- Run Time to 10 psid - is the is the observed runtime to 10 psid.
- Average Rate of Headloss - is the calculated rate of headloss development in psid/hour. The “Clean Bed Headloss” is subtracted from the terminal headloss of 10 psid and divided by the “Run Time to 10 psid”.
- Termination Criteria - is the factor which determined the end of the trial. Most trials were operated to terminal headloss and are noted as “THL” in the table. Trials which were terminated due to schedule, such as to move on to a new trial or the completion of the study are noted as “Trial”.
- Unit Filter Run Volume - is the volume of water treated per one square foot of the media bed during the duration of the filter run to terminal headloss.

Supernatant recycling occurred during Trials F1.22, F2.19 and M1.03 which were concurrent trials. The Supernatant recycle trial began without supernatant addition to confirm initial treatment. Settled supernatant from prior backwashes was then injected into the raw water influent at a feed rate of 5% of the total pilot flow rate. The recycle period lasted 6.1 hours and was dependent on the pilot flow rate and the available volume of supernatant. The filter trial continued to its conclusion without supernatant addition. Water quality data during the recycle trial was grouped in the following tables by pre-recycle, during-recycle and post-recycle.

Table 3.06: Summary of Operating Conditions by Trial for Filter F1

Trial	Figure	Start	End	Duration (Hours)	Filter Surface Loading Rate (gpm/sf)	Clean Bed Headloss (psid)	Run Time to 10 psid (hours)	Average Rate of Headloss (psi/hr)	Termination Criteria	UFRV (gal/sf)
F1.01	D-1	12/12/22 08:39	12/26/22 11:36	338.9	5.07 ± 0.25 [6775]	0.30	260	0.0373	Headloss	N/A
F1.02	D-2	12/26/22 11:54	01/03/23 10:24	190.5	7.42 ± 1.13 [3811]	0.70	98	0.0949	Headloss	222000
F1.03	D-3	01/03/23 11:09	01/06/23 13:39	74.5	7.45 ± 0.10 [1491]	2.00	38	0.2083	Headloss	86988
F1.04	D-4	01/06/23 13:48	01/10/23 13:21	95.6	4.96 ± 0.15 [1912]	0.80	81	0.1141	Headloss	120900
F1.05	D-5	01/10/23 13:24	01/16/23 09:57	140.5	4.96 ± 0.38 [2812]	0.80	80	0.1150	Headloss	120000
F1.06	D-6	01/16/23 11:24	01/20/23 09:03	93.7	7.44 ± 0.12 [1874]	1.20	66	0.1333	Headloss	149510
F1.07	D-7	01/20/23 09:12	01/23/23 13:00	75.8	7.46 ± 0.08 [1517]	1.40	70	0.1229	Headloss	158571
F1.08	D-8	01/23/23 13:15	01/25/23 09:30	44.3	7.51 ± 0.44 [886]	1.10	N/A	N/A	Time, Trial	N/A
F1.09	D-9	01/25/23 09:45	01/27/23 14:12	52.5	12.47 ± 0.07 [1050]	1.55	58	0.1470	Headloss	211224
F1.10	N/A	01/27/23 14:22	01/30/23 12:04	69.7	12.5	N/A	N/A	N/A	Headloss	N/A
F1.11	N/A	01/30/23 12:12	02/02/23 09:33	69.4	15	N/A	N/A	N/A	Headloss	N/A
F1.12	D-10	02/02/23 09:33	02/06/23 09:27	95.9	7.51 ± 0.10 [1394]	1.10	99	0.0904	Headloss	226148
F1.13	D-11	02/06/23 09:42	02/08/23 13:24	51.7	14.43 ± 0.73 [1035]	2.40	44	0.1747	Headloss	186429
F1.14	D-12	02/08/23 13:39	02/13/23 11:12	117.6	14.53 ± 0.35 [2348]	1.80	55	0.1483	Headloss	237000
F1.15	D-13	02/13/23 11:27	02/15/23 09:39	46.2	26.32 ± 3.15 [925]	6.40	14	0.2571	Headloss	111429
F1.16	D-14	02/15/23 09:51	02/16/23 10:27	24.6	15.21 ± 4.86 [492]	4.00	N/A	N/A	Time, Trial	N/A
F1.17	D-15	02/16/23 12:09	02/17/23 13:09	25.0	17.51 ± 2.62 [501]	4.40	4	1.3023	Headloss	22378
F1.18	D-16	02/17/23 13:21	02/20/23 13:45	72.4	15.19 ± 1.30 [1449]	3.70	35	0.1780	Headloss	162551
F1.19	D-17	02/20/23 14:00	02/22/23 11:12	45.2	20.09 ± 0.77 [905]	3.70	28	0.2291	Headloss	168367
F1.20	D-18	02/22/23 11:30	02/24/23 13:03	49.5	20.09 ± 0.37 [992]	3.50	33	0.1949	Headloss	204184
F1.21	D-19	02/24/23 13:15	02/27/23 12:00	70.7	15.07 ± 0.46 [1416]	2.60	47	0.1580	Headloss	215128
F1.22	D-20	02/27/23 12:15	03/03/23 12:06	95.9	10.02 ± 0.29 [1918]	1.80	64	0.1281	Headloss	195918
F1.22.Pre	D-20	02/27/23 12:15	03/01/23 09:42	45.5	10.08 ± 0.38 [910]	1.80	64	0.1281	Headloss	195918
F1.22.Dur	D-20	03/01/23 09:45	03/01/23 14:48	5.1	10.10 ± 0.11 [102]	1.80	64	0.1281	Headloss	195918
F1.22.Post	D-20	03/01/23 14:51	03/03/23 12:06	45.2	10.01 ± 0.18 [906]	1.80	64	0.1281	Headloss	195918
F1.23	D-21	03/03/23 12:21	03/06/23 12:27	72.1	10.08 ± 0.31 [1443]	1.80	71	0.1163	Headloss	215816
F1.24	D-22	03/06/23 12:42	03/10/23 09:45	93.0	10.08 ± 0.39 [1862]	2.00	68	0.1176	Headloss	208163

Table 3.07: Summary of Operating Conditions by Trial for Filter F2

Trial	Figure	Start	End	Duration (Hours)	Filter Surface Loading Rate (gpm/sf)	Clean Bed Headloss (psid)	Run Time to 10 psid (hours)	Average Rate of Headloss (psi/hr)	Termination Criteria	UFRV (gal/sf)
F2.01	D-23	12/12/22 08:39	12/26/22 12:00	339.3	5.06 ± 0.23 [6784]	0.30	267.0	0.0363	Headloss	N/A
F2.02	D-24	12/26/22 12:09	01/03/23 10:24	190.3	7.57 ± 1.35 [3806]	0.70	98.5	0.0944	Headloss	226148
F2.03	D-25	01/03/23 11:09	01/06/23 13:54	74.8	7.56 ± 0.09 [1496]	2.20	34.0	0.2294	Headloss	78061
F2.04	D-26	01/06/23 14:03	01/10/23 13:24	95.3	5.03 ± 0.21 [1908]	0.65	90.0	0.1039	Headloss	137755
F2.05	D-27	01/10/23 13:45	01/16/23 11:39	141.9	5.08 ± 0.17 [2820]	0.80	108.0	0.0852	Headloss	165306
F2.06	D-28	01/16/23 11:24	01/20/23 09:18	93.9	7.62 ± 0.14 [1879]	1.05	79.5	0.1126	Headloss	184959
F2.07	D-29	01/20/23 09:27	01/23/23 13:12	75.8	7.62 ± 0.10 [1516]	1.20	73.0	0.1205	Headloss	169837
F2.08	D-30	01/23/23 13:42	01/27/23 11:39	94.0	7.64 ± 0.23 [1880]	0.90	94.0	0.0968	Headloss	218694
F2.09	N/A	01/27/23 11:52	01/30/23 12:41	72.8	7.5	N/A	N/A	N/A	Headloss	N/A
F2.10	N/A	01/30/23 12:53	02/02/23 09:53	69.0	12.5	N/A	N/A	N/A	Headloss	N/A
F2.11	D-31	02/02/23 10:04	02/06/23 09:54	95.8	7.63 ± 0.44 [1403]	0.70	93.2	0.0998	Headloss	216833
F2.12	D-32	02/06/23 10:09	02/08/23 13:57	51.8	12.72 ± 0.55 [1037]	1.60	45.5	0.1846	Headloss	167143
F2.13	D-33	02/08/23 14:09	02/13/23 11:45	117.6	12.81 ± 0.44 [2353]	1.45	55.0	0.1555	Headloss	202041
F2.14	D-34	02/13/23 11:57	02/15/23 10:09	46.2	12.93 ± 0.08 [925]	2.00	37.0	0.2162	Headloss	135918
F2.15	D-35	02/15/23 10:21	02/17/23 13:45	51.4	12.60 ± 1.74 [1029]	1.65	36.8	0.2269	Headloss	135184
F2.16	D-36	02/17/23 13:57	02/20/23 14:12	72.2	12.85 ± 0.42 [1446]	1.50	54.3	0.1565	Headloss	199469
F2.17	D-37	02/20/23 14:27	02/23/23 08:27	66.0	12.83 ± 0.40 [1321]	1.80	52.5	0.1562	Headloss	192857
F2.18	D-38	02/23/23 08:42	02/27/23 12:33	99.8	12.80 ± 0.35 [1998]	2.00	56.1	0.1426	Headloss	206082
F2.19	D-39	02/27/23 12:45	03/03/23 11:30	94.7	10.17 ± 0.31 [1896]	1.80	66.0	0.1242	Headloss	202041
F2.19.Pre	D-39	02/27/23 12:45	03/01/23 09:42	45.0	10.23 ± 0.39 [900]	1.80	66.0	0.1242	Headloss	202041
F2.19.Dur	D-39	03/01/23 09:45	03/01/23 14:48	5.1	10.16 ± 0.13 [102]	1.80	66.0	0.1242	Headloss	202041
F2.19.Post	D-39	03/01/23 14:51	03/03/23 11:30	44.6	10.08 ± 0.19 [894]	1.80	66.0	0.1242	Headloss	202041
F2.20	D-40	03/03/23 11:42	03/06/23 13:00	73.3	10.20 ± 0.41 [1467]	1.70	68.1	0.1219	Headloss	208469
F2.21	D-41	03/06/23 13:15	03/10/23 09:54	92.6	10.19 ± 0.37 [1854]	2.00	64.0	0.1250	Headloss	195918

Table 3.08: Summary of Operating Conditions by Trial for Filter M1

Trial	Figure	Start	End	Duration (Hours)	Filter Surface Loading Rate (gpm/sf)	Influent pH (s.u.)	Influent DO (mg/L)	Clean Bed Headloss (psid)	Run Time to 10 psid (hours)	Average Rate of Headloss (psi/hr)	Termination Criteria	UFRV (gal/sf)
M1.01	D-42	01/16/23 12:00	01/31/23 09:26	357.4	4.93 ± 0.25 [5343]	7.60 ± 0.57 [5343]	4.56 ± 0.49 [5343]	2.50	337.0	0.0178	Headloss	N/A
M1.02	D-43	01/31/23 09:39	02/16/23 09:57	384.3	9.99 ± 0.19 [6201]	7.60 ± 0.07 [6204]	5.00 ± 0.66 [6204]	1.00	365.0	0.0247	Headloss	1106173
M1.03	D-44	02/16/23 12:15	03/06/23 11:54	431.7	10.03 ± 0.38 [8634]	7.60 ± 0.07 [8634]	3.78 ± 1.32 [8634]	1.60	365.0	0.0230	Headloss	1117347
M1.03.Pre	D-44	02/16/23 12:15	03/01/23 09:42	309.5	10.06 ± 0.41 [6190]	7.60 ± 0.08 [6190]	3.77 ± 0.14 [6190]	1.60	365.0	0.0230	Headloss	N/A
M1.03.Dur	D-44	03/01/23 09:45	03/01/23 14:48	5.1	9.96 ± 0.10 [102]	7.59 ± 0.07 [102]	3.59 ± 0.07 [102]	1.60	365.0	0.0230	Headloss	N/A
M1.03.Post	D-44	03/01/23 14:51	03/06/23 11:54	117.0	9.94 ± 0.31 [2342]	7.59 ± 0.06 [2342]	5.71 ± 1.99 [2342]	1.60	365.0	0.0230	Headloss	N/A
M1.04	D-45	03/06/23 12:06	03/10/23 09:48	93.7	14.52 ± 0.91 [1875]	7.59 ± 0.45 [1875]	3.59 ± 1.48 [1875]	2.00	93.7	N/A	End of Study	N/A

3.3.2.2 Biological Filter Hydraulic Performance

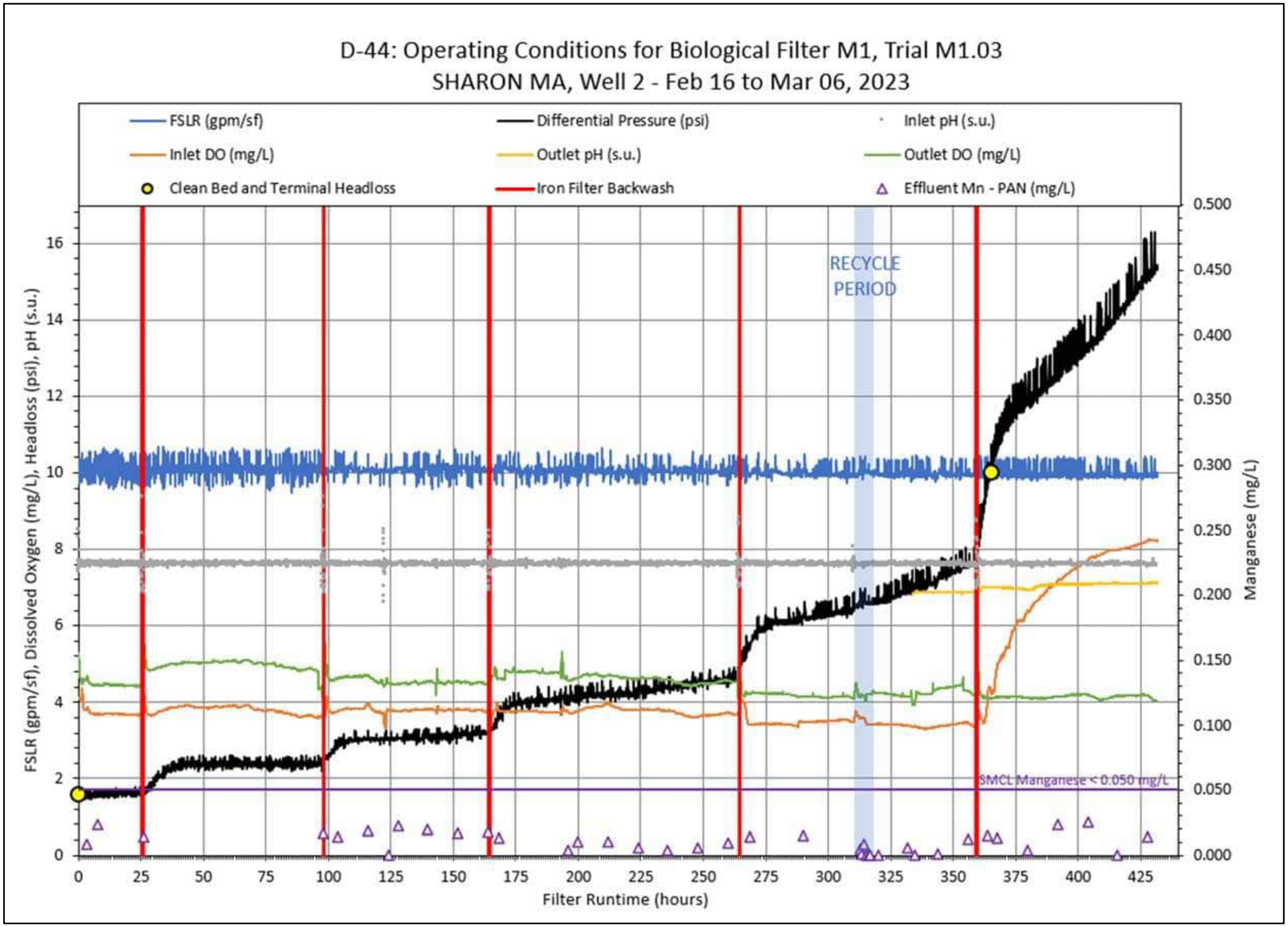
Figure 3.05 is an example figure showing important operating conditions and performance data for the filter trials. Filter M1 Trial 4 operated 365 hours until terminal headloss from February 16 through March 06, 2023. The figure is also presented in Appendix D as Figure F.44. Individual figures for all Filter F1, Filter F2, and Filter M1 trials are included in Appendix D.

The figure numbers are also indicated in the other tables throughout this section to allow comparison of the figures to the operational, water quality, and filter performance data. Filters have a differing number of trials based on runtimes and backwash frequency.

The parameters of the figures are described below:

1. The title of the figure identifies the filter (F1, F2, or M1) and the trial number. The figure also identifies the raw water source and the dates of operation.
2. The horizontal axis (x-axis) shows the filter run time. The units are hours. Timing began when the filter began forward flow, following backwash. Start and end times are shown in Tables 3.06 through 3.08.
3. The primary y-axis (left vertical) scales the following parameters: differential pressure (DP); dissolved oxygen (DO); filter surface loading rate (FSLR); and pH.
4. The secondary y-axis (right vertical) scales total iron or manganese in mg/L depending on whether the filter is an iron or manganese removal filter.
5. Inlet DO data were from the online instrumentation and data logger. The units are ppm.
6. Inlet pH data are presented in standard units (SU) and were measured from the online pH meter. The sample stream was MPOKA. The KOH feed pump control was automated to maintain a setpoint pH level. Inlet pH is only plotted for the pretreated manganese removal filter. The iron removal filters received untreated raw water.
7. Outlet pH data are presented in standard units (SU) and were measured from the online pH meter.
8. Outlet DO data were from the online instrumentation and data logger.
9. FSLR data were calculated from the effluent flow rate and the surface area of the filter (0.2 sf). The units are gpm/sf. The FSLR data are included to show when flow rates were stable, when flow rate adjustments were made, and when the filter experienced declining rate conditions. The flow rate control was automated to maintain a setpoint value.
10. Differential Pressure was calculated from the differential pressure transducer connected to the inlet and outlet of the filter. The units are psid.
11. Effluent Fe and Mn indicates the total iron and manganese concentration in filter effluent samples, from field analyses (orange triangles are iron concentrations, purple triangles are manganese measured with the HACH PAN method. The units are mg/L. Iron and manganese concentrations are scaled to the right vertical axis.
12. Markers for Clean Bed Headloss and Terminal Headloss are shown as yellow circles.

Figure 3.05: Example Figure – Biological Filter M1 Operational Data, Trial M1.03



3.3.2.3 Biological Filter Effluent Water Quality

Water quality results from samples analyzed in the field are shown in Tables 3.09 through 3.11. The tables summarize water quality by trial.

Laboratory data for Filters F1, F2 and M1 are reported in Tables 3.12 to 3.14.

Table 3.09: Biological Pilot - Filtered Water Quality Data by Trial for Filter F1 by Field Analyses

Trial	FSLR (gpm/sf)	Total Iron (mg/L)	Total Manganese (mg/L)	pH (s.u.)	Total Organic Carbon (mg/L)	Nitrate (mg/L)	Alkalinity (mg/L)	Carbon Dioxide (mg/L)
F1.01	5.07 ± 0.25 [6775]	**0.03** (0.00-0.25) [39]	**0.067** (0.034-0.088) [39]	**6.38** (6.17-6.53) [12]	No Data [0]	No Data [0]	**42**	**31**
F1.02	7.42 ± 1.13 [3811]	**0.01** (0.00-0.03) [18]	**0.078** (0.068-0.088) [14]	6.16-6.43 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
F1.03	7.45 ± 0.10 [1491]	**0.02** (0.00-0.05) [8]	**0.098** (0.085-0.115) [4]	6.30-6.40 [2]	No Data [0]	No Data [0]	**41**	**46**
F1.04	4.96 ± 0.15 [1912]	**0.01** (0.00-0.05) [19]	**0.083** (0.068-0.115) [15]	**6.30** (6.16-6.40) [3]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
F1.05	4.96 ± 0.38 [2812]	**0.02** (0.00-0.03) [14]	**0.124** (0.123-0.134) [4]	**6.37** (6.22-6.47) [4]	No Data [0]	**2.2** (1.9-3.0) [3]	**46**	No Data [0]
F1.06	7.44 ± 0.12 [1874]	**0.02** (0.01-0.07) [10]	**0.136** (0.133-0.162) [4]	**6.33** (6.30-6.38) [4]	No Data [0]	**2.5** (1.4-2.8) [3]	No Data [0]	No Data [0]
F1.07	7.46 ± 0.08 [1517]	**0.04** (0.01-0.08) [7]	**0.139** [1]	**6.33** [1]	No Data [0]	**2.2** [1]	**47**	**46**
F1.08	7.51 ± 0.44 [886]	**0.03** (0.00-0.04) [5]	**0.137** [1]	**6.41** [1]	No Data [0]	**1.9** [1]	No Data [0]	No Data [0]
F1.09	12.47 ± 0.07 [1050]	**0.03** (0.02-0.05) [5]	**0.131** [1]	**6.43** [1]	0.30 [1]	**1.3** [1]	**46**	**39**
F1.10	12.5	**0.04** (0.02-0.08) [7]	**0.118** [1]	**6.38** [1]	0.30 [1]	**1.7** [1]	No Data [0]	No Data [0]
F1.11	15	**0.04** (0.02-0.14) [9]	**0.130** (0.128-0.139) [3]	**6.45** (6.45-6.48) [3]	**0.26** (0.14-0.36) [3]	1.2-1.9 [2]	No Data [0]	No Data [0]
F1.12	7.51 ± 0.10 [1394]	**0.05** (0.02-0.09) [9]	**0.127** (0.125-0.127) [3]	**6.38** (6.35-6.39) [3]	**0.55** (0.34-0.83) [3]	**1.7** (0.8-2.1) [3]	**46**	**38**
F1.13	14.43 ± 0.73 [1035]	**0.02** (0.00-0.06) [5]	**0.138** [1]	**6.45** [1]	**1.09** [1]	**0.6** [1]	No Data [0]	No Data [0]
F1.14	14.53 ± 0.35 [2348]	**0.03** (0.00-0.06) [10]	0.127-0.134 [2]	**6.44** [1]	**1.65** [1]	**2.3** [1]	**48**	**51**
F1.15	26.32 ± 3.15 [925]	**0.04** (0.02-0.16) [5]	**0.143** [1]	**6.39** [1]	No Data [0]	**0.0** [1]	No Data [0]	No Data [0]
F1.16	15.21 ± 4.86 [492]	No Data [0]	No Data [0]	No Data [0]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
F1.17	17.51 ± 2.62 [501]	**0.13** (0.03-0.40) [4]	0.134-0.145 [2]	6.29-6.35 [2]	No Data [0]	1.2-1.9 [2]	No Data [0]	No Data [0]
F1.18	15.19 ± 1.30 [1449]	**0.03** (0.01-0.06) [7]	**0.128** [1]	**6.39** [1]	No Data [0]	**0.9** [1]	No Data [0]	No Data [0]
F1.19	20.09 ± 0.77 [905]	**0.03** (0.01-0.10) [5]	**0.129** [1]	**6.51** [1]	No Data [0]	**0.9** [1]	No Data [0]	No Data [0]
F1.20	20.09 ± 0.37 [992]	**0.10** (0.07-0.11) [3]	**0.144** [1]	**6.38** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
F1.21	15.07 ± 0.46 [1416]	**0.01** (0.00-0.12) [7]	**0.154** [1]	**6.59** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
F1.22	10.02 ± 0.29 [1918]	**0.03** (0.00-0.11) [17]	**0.128** (0.122-0.159) [8]	**6.32** (6.28-6.37) [3]	No Data [0]	**1.2** [1]	No Data [0]	No Data [0]
F1.22.Pre	10.08 ± 0.38 [910]	**0.03** (0.02-0.07) [5]	0.137-0.159 [2]	6.32-6.37 [2]	No Data [0]	**1.2** [1]	No Data [0]	No Data [0]
F1.22.Dur	10.10 ± 0.11 [102]	**0.05** (0.02-0.11) [6]	**0.124** (0.122-0.125) [3]	No Data [0]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
F1.22.Pos	10.01 ± 0.18 [906]	**0.02** (0.00-0.03) [6]	**0.130** (0.122-0.135) [3]	**6.28** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
F1.23	10.08 ± 0.31 [1443]	**0.03** (0.00-0.06) [8]	**0.156** [1]	**6.17** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
F1.24	10.08 ± 0.39 [1862]	**0.03** (0.00-0.07) [10]	**0.136** (0.131-0.144) [4]	**6.16** (6.12-6.22) [3]	**2.67** [1]	**2.7** [1]	**49**	**49**

Table 3.10: Biological Pilot – Filtered Water Quality Data by Trial for Filter F2 by Field Analyses

Trial	FSLR (gpm/sf)	Total Iron (mg/L)	Total Manganese (mg/L)	pH (s.u.)	Total Organic Carbon (mg/L)	Nitrate (mg/L)	Alkalinity (mg/L)	Carbon Dioxide (mg/L)
F2.01	5.06 ± 0.23 [6784]	**0.04** (0.00-0.21) [27]	**0.063** (0.035-0.078) [27]	**6.36** (6.17-6.52) [12]	No Data [0]	No Data [0]	**42**	**31**
F2.02	7.57 ± 1.35 [3806]	**0.01** (0.00-0.04) [14]	**0.083** (0.069-0.096) [14]	6.21-6.43 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
F2.03	7.56 ± 0.09 [1496]	**0.03** (0.02-0.07) [8]	**0.105** (0.088-0.124) [4]	6.18-6.42 [2]	No Data [0]	No Data [0]	**42**	**49**
F2.04	5.03 ± 0.21 [1908]	**0.02** (0.00-0.09) [10]	**0.094** [1]	**6.43** [1]	No Data [0]	**2.9** [1]	No Data [0]	No Data [0]
F2.05	5.08 ± 0.17 [2820]	**0.02** (0.00-0.03) [14]	**0.117** (0.116-0.140) [3]	**6.37** (6.19-6.46) [3]	No Data [0]	**2.6** (2.5-3.0) [3]	**43**	No Data [0]
F2.06	7.62 ± 0.14 [1879]	**0.03** (0.02-0.04) [4]	**0.134** (0.133-0.171) [4]	**6.36** (6.29-6.39) [4]	No Data [0]	2.7-2.8 [2]	No Data [0]	No Data [0]
F2.07	7.62 ± 0.10 [1516]	**0.00** [1]	**0.135** [1]	**6.31** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
F2.08	7.64 ± 0.23 [1880]	0.04-0.05 [2]	0.137-0.137 [2]	6.40-6.42 [2]	**0.23** [1]	1.7-2.5 [2]	No Data [0]	No Data [0]
F2.09	7.5	**0.05** [1]	**0.123** [1]	**6.39** [1]	**0.32** [1]	**1.5** [1]	No Data [0]	No Data [0]
F2.10	12.5	**0.05** (0.03-0.12) [3]	**0.121** (0.117-0.153) [3]	**6.44** (6.35-6.45) [3]	**0.29** (0.24-0.33) [3]	1.7-2.1 [2]	No Data [0]	No Data [0]
F2.11	7.63 ± 0.44 [1403]	**0.07** (0.04-0.19) [3]	**0.127** (0.121-0.127) [3]	**6.39** (6.38-6.40) [3]	**1.43** (0.62-1.70) [3]	**1.3** (1.3-1.5) [3]	No Data [0]	No Data [0]
F2.12	12.72 ± 0.55 [1037]	**0.03** [1]	**0.128** [1]	**6.46** [1]	**0.80** [1]	**0.6** [1]	No Data [0]	No Data [0]
F2.13	12.81 ± 0.44 [2353]	0.02-0.03 [2]	0.130-0.143 [2]	**6.43** [1]	**1.86** [1]	No Data [0]	No Data [0]	No Data [0]
F2.14	12.93 ± 0.08 [925]	**0.03** [1]	**0.129** [1]	**6.31** [1]	No Data [0]	**0.0** [1]	No Data [0]	No Data [0]
F2.15	12.60 ± 1.74 [1029]	0.00-0.15 [2]	0.109-0.134 [2]	6.30-6.39 [2]	No Data [0]	0.6-1.0 [2]	No Data [0]	No Data [0]
F2.16	12.85 ± 0.42 [1446]	**0.12** [1]	**0.123** [1]	**6.43** [1]	No Data [0]	**0.5** [1]	No Data [0]	No Data [0]
F2.17	12.83 ± 0.40 [1321]	**0.03** [1]	**0.135** [1]	**6.46** [1]	No Data [0]	**1.3** [1]	No Data [0]	No Data [0]
F2.18	12.80 ± 0.35 [1998]	0.04-0.10 [2]	0.135-0.161 [2]	6.38-6.41 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
F2.19	10.17 ± 0.31 [1896]	**0.04** (0.02-0.09) [11]	**0.130** (0.119-0.158) [6]	**6.32** (6.27-6.33) [3]	No Data [0]	**1.4** [1]	No Data [0]	No Data [0]
F2.19.Pre	10.23 ± 0.39 [900]	**0.04** (0.02-0.05) [3]	0.144-0.158 [2]	6.32-6.33 [2]	No Data [0]	**1.4** [1]	No Data [0]	No Data [0]
F2.19.Dur	10.16 ± 0.13 [102]	**0.05** (0.03-0.09) [6]	**0.128** (0.119-0.129) [3]	No Data [0]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
F2.19.Pos	10.08 ± 0.19 [894]	0.04-0.04 [2]	**0.131** [1]	**6.27** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
F2.20	10.20 ± 0.41 [1467]	0.07-0.08 [2]	**0.145** [1]	**6.20** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
F2.21	10.19 ± 0.37 [1854]	**0.04** (0.02-0.15) [6]	**0.136** (0.127-0.141) [4]	**6.18** (6.13-6.20) [3]	**2.67** [1]	**2.2** [1]	**45**	**77**

Table 3.11: Biological Pilot - Filtered Water Quality Data by Trial for Filter M1 by Field Analyses

Trial	FSLR (gpm/sf)	Total Iron (mg/L)	Total Manganese (mg/L)	pH (s.u.)	Total Organic Carbon (mg/L)	Nitrate (mg/L)	Alkalinity (mg/L)	Carbon Dioxide (mg/L)
M1.01	4.93 ± 0.25 [5343]	**0.01** (0.00-0.04) [9]	**0.008** (0.000-0.032) [58]	**7.18** (6.46-7.29) [9]	**0.24** (0.10-0.36) [3]	**2.7** (0.3-2.8) [7]	75-82 [2]	11-35 [2]
M1.02	9.99 ± 0.19 [6201]	**0.02** (0.00-0.08) [9]	**0.011** (0.000-0.034) [45]	**7.07** (6.99-7.22) [8]	**0.55** (0.22-1.55) [7]	**1.6** (0.3-3.0) [8]	71-79 [2]	12-12 [2]
M1.03	10.03 ± 0.38 [8634]	**0.02** (0.00-0.07) [19]	**0.010** (0.000-0.025) [40]	**7.12** (6.75-7.25) [9]	No Data [0]	**0.5** (0.2-1.8) [5]	No Data [0]	No Data [0]
M1.03.Pre	10.06 ± 0.41 [6190]	**0.02** (0.00-0.07) [8]	**0.014** (0.000-0.023) [21]	**7.13** (6.91-7.25) [7]	No Data [0]	**0.5** (0.2-1.8) [5]	No Data [0]	No Data [0]
M1.03.Dur	9.96 ± 0.10 [102]	**0.03** (0.01-0.05) [6]	**0.001** (0.000-0.008) [6]	No Data [0]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
M1.03.Pos	9.94 ± 0.31 [2342]	**0.01** (0.01-0.03) [5]	**0.006** (0.000-0.025) [13]	6.75-7.04 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
M1.04	14.52 ± 0.91 [1875]	**0.03** (0.01-0.04) [5]	**0.023** (0.000-0.030) [11]	**7.27** (6.40-7.35) [3]	**2.65** [1]	**2.4** [1]	**66**	**29**

Table 3.12: Filtered Water Quality for Filter F1 by Lab Analyses

	Analysis	Units	Laboratory Report #			
			CN33583	L2309640 CN48043	CN52084	L2311800 CN55216
			Trial F1.11	Trial F1.14	Trial F1.22	Trial F1.24
			2/01/23	2/13/23	3/01/23	3/07/23
Laboratory Analyses by Alpha Analytical	Total Iron	mg/L	0.017		0.044	0.041
	Total Manganese	mg/L	0.147		0.151	0.151
	Dissolved Iron	mg/L			<0.011	<0.011
	Dissolved Manganese	mg/L			0.140	0.149
	Turbidity	NTU			0.45	
	True Color	C.U.			<1	
	Apparent Color	C.U.			5	
	Heterotrophic Plate Count	CFU/ml			741	27
	Alkalinity	mg/L			46	46
	pH	s.u.			6.85	
	Total Dissolved Solids	mg/L			240	230
	Nitrogen, Nitrate	mg/L		3.63		

Table 3.13: Filtered Water Quality for Filter F2 by Lab Analyses

Laboratory Analyses by Alpha Analytical	Analysis	Units	Laboratory Report #			
			CN33583	L2309640 CN48043	CN52084	L2311800 CN55216
			Trial F2.10	Trial F2.13	Trial F2.19	Trial F2.21
			2/01/23	2/13/23	3/01/23	3/07/23
	Total Iron	mg/L	0.017		0.052	0.015
	Total Manganese	mg/L	0.146		0.149	0.154
	Dissolved Iron	mg/L			<0.011	<0.011
	Dissolved Manganese	mg/L			0.145	0.148
	Turbidity	NTU			0.45	
	True Color	C.U.			<1	
	Apparent Color	C.U.			5	
	Heterotrophic Plate Count	CFU/ml			178	23
	Alkalinity	mg/L			46	46
	pH	s.u.			6.87	
	Total Dissolved Solids	mg/L			240	240
	Nitrogen, Nitrate	mg/L		3.68		

Table 3.14: Filtered Water Quality for Filter M1 by Lab Analyses

	Analysis	Units	Laboratory Report #			
			CN33583	L2309640 CN48043	CN52084	L2311800 CN55216
			M1.02	M1.02	M1.03	M1.04
			2/01/23	2/13/23	3/01/23	3/07/23
Laboratory Analyses by Alpha Analytical	Total Iron	mg/L	<0.010		0.020	0.015
	Total Manganese	mg/L	0.026		0.003	0.003
	Dissolved Iron	mg/L			<0.011	<0.011
	Dissolved Manganese	mg/L			0.001	0.003
	Turbidity	NTU			0.25	
	True Color	C.U.			<1	
	Apparent Color	C.U.			5	
	Heterotrophic Plate Count	CFU/ml			770	
	Hydrogen Sulfide	mg/L			<0.05	
	Carbon Dioxide	mg/L			12	
	Alkalinity	mg/L			67	83
	Total Hardness	mg/L				104
	pH	s.u.			7.35	
	Total Dissolved Solids	mg/L			240	270
	Sulfate	mg/L			13.9	13.2
	Nitrogen, Nitrite	mg/L			<0.004	<0.004
	Nitrogen, Nitrate	mg/L		3.66	3.47	3.60
	Nitrogen, Ammonia	mg/L			<0.05	<0.05
	Chloride	mg/L			81.5	78.6

3.3.3 Biological Filter Backwash Data

3.3.3.1 Biological Filter Backwash Water Quality

Tables 3.15 and 3.16 summarize the results of laboratory analyses conducted on samples of composite backwash and settled supernatant.

Table 3.15: Combined Backwash Water Quality Data by Laboratory Analysis for Filters F1, F2 and M1

Parameter	Lab Report #					
	CN33583	CN35613		CN48048	CN48938	CN53948
	Trial M1.01	Trial F1.11	Trial F2.10	Trial F1.19	Trial F2.17	Trial M1.03
	1/31/2023	2/02/2023		2/22/2023	2/23/2023	3/06/2023
	Filter M1	Filter F1	Filter F2	Filter F1	Filter F2	Filter M1
Total Iron (mg/L)	53.6	213	92.9	551	204	54.4
Dissolved Iron (mg/L)	<0.001	0.056	0.055	0.082	0.062	<0.011
Total Manganese (mg/L)	364	0.551	0.258	0.939	0.366	337
Dissolved Manganese (mg/L)	<0.001	0.047	0.060	0.046	0.019	0.001
TSS (mg/L)	1,300	360	300	720	200	1,400
Settleable Solids (ml/L)	32.0	6.0	1.5	9.0	5.5	30.2

Table 3.16: Suspended Supernatant Water Quality Data by Laboratory Analysis for Filters F1, F2 and M1

Parameter	Lab Report #						
	CN33583	CN35613		CN45841	CN48048	CN48938	CN53948
	Trial M1.01	Trial F1.11	Trial F2.10	Trial M1.02	Trial F1.19	Trial F2.17	Trial M1.03
	1/31/2023	2/02/2023		2/16/2023	2/22/2023	2/23/2023	3/06/2023
	Filter M1	Filter F1	Filter F2	Filter M1	Filter F1	Filter F2	Filter M1
Total Iron (mg/L)	1.86	13.5	11.1		33.1	20.8	1.84
Dissolved Iron (mg/L)	<0.011	0.072	0.059		0.098	0.078	0.016
Total Manganese (mg/L)	5.07	0.116	0.100		0.121	0.133	4.48
Dissolved Manganese (mg/L)	0.003	0.100	0.084		0.054	0.111	0.002
TSS (mg/L)	18	30	31		83	18	16
Settleable Solids (ml/L)		<0.10	<0.10	1.40	0.10	<0.10	<0.10

3.3.3.2 Biological Filter Settling Time

Settling tests were conducted after most backwashes during operation of the biological pilot system. The combined backwash volume (typically 40L) for iron removal filters and the manganese removal filter was mixed at the completion of a backwash and a 1000 mL sample collected in an Imhoff settling cone. Each test was conducted using separate Imhoff cones for each filter backwash and was allowed to settle for a minimum of four hours.

Figure 3.06 is a side by side comparison of photos of the iron removal filter backwash water and the manganese removal filter backwash water. Figure 3.07 is a photo of the backwash water while settling in Imhoff cones.

Figure 3.06: Iron Filter Backwash Water (left) and Manganese Filter Backwash Water (right)

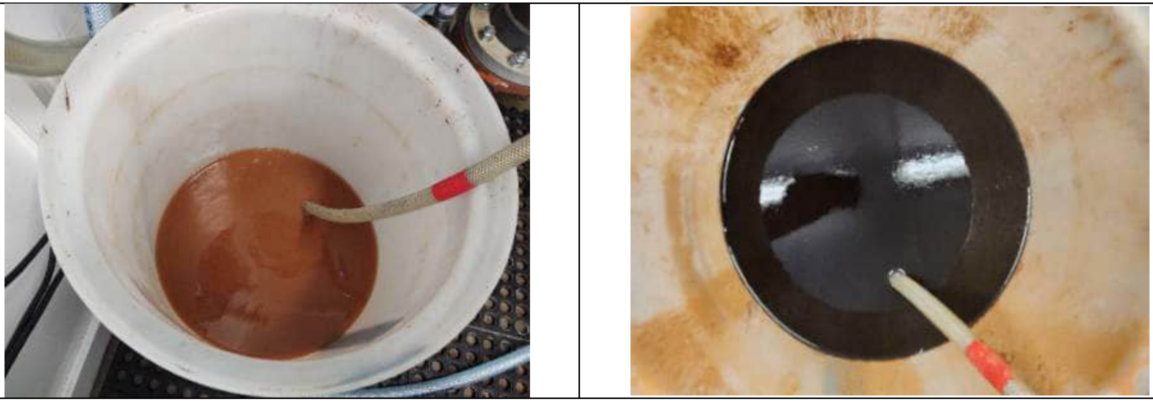
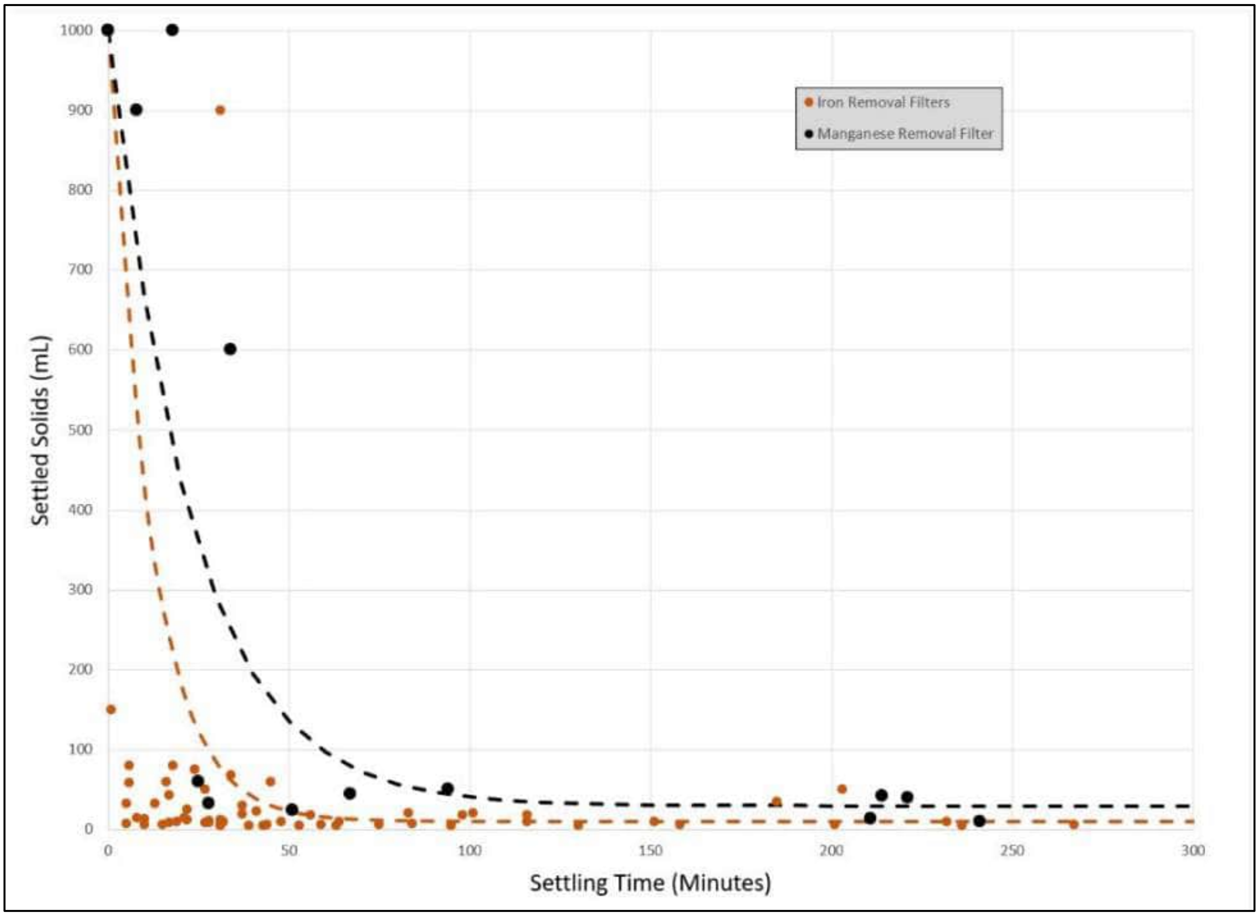


Figure 3.07: Photo of Imhoff Settling Cones

The iron removal filter cones, F1 and F2, had settled for four days at the time of the photo while the manganese removal filter cone, M1, had just been collected. The settled solids are apparent at the bottom of the two iron removal filter cones on the left.

The results of all settling tests were combined and plotted in Figure 3.08.

Figure 3.08: Settling Tests for Biological Filter Backwash



The iron filter backwash solids typically settled to less than 10% of the total volume within one hour and to less than 5% within two hours. The final settled volume was typically less than 20 mL (2%) in the Imhoff cone.

The manganese filter backwash solids settled slower than the iron solids but were also less than 10% of the total volume after one hour. The final settled volume was approximately 40 mL (4%) in two of the three manganese filter backwashes.

3.4 ADSORPTIVE TREATMENT SYSTEM RESULTS

3.4.1 Adsorptive Filter Pretreated Water Quality

Table 3.17 summarizes the pretreated water quality for all adsorptive filter trials. The precipitated fractions for iron and manganese are calculated and included in the table.

Table 3.17: Pretreated Water Quality by Field Analyses

Parameter	**Units**	**Field Analysis**	
		Filters A & B	**Filter C & D**
Free Cl_2	mg/L	**0.53** (0.19-1.87) [16]	**0.43** (0.23-0.83) [15]
Total Cl_2	mg/L	**0.66** (0.44-2.17) [14]	**0.61** (0.33-1.19) [13]
Dissolved Fe	mg/L	**0.03** (0.00-0.13) [15]	**0.05** (0.00-0.11) [15]
Precipitated Fraction Fe*	%	**95%**	**92%**
Dissolved Mn	mg/L	**0.087** (0.078-0.106) [14]	**0.090** (0.051-0.108) [14]
Precipitated Fraction Mn*	%	**34%**	**33%**
pH	S.U.	**6.40** (6.23-6.46) [15]	**8.04** ± 0.51 [10615]

*Precipitated fraction calculations were based on a median raw Fe of 0.63 mg/L and a median raw Mn of 0.134 mg/L.

3.4.2 Adsorptive Filter Performance

3.4.2.1 Adsorptive Filter Operational Summary Tables

Tables 3.18 through 3.21 summarize the operating conditions, and performance of each filter trial. The following information is included for each filter trial:

- Trial Number – Filter ID x Trial Sequence. Recycle Trials are subdivided into pre-recycle, during recycle, and post recycle.
- Figure – Indicates the corresponding figure plotting operational parameters by filter runtime. The biological filter trial figures are included in Appendix D
- Start - Indicates the start time of the filter run, i.e. the start of filter forward flow.
- End - Indicates the end time of the filter run.
- Duration of Trial (hours) - The length of the trial (or sub-trial) in hours.
- Filter Surface Loading Rate (gpm/sf) - The filter surface loading rate, calculated by dividing the flowrate by the surface area of the pilot filter (0.2 sf).
- Clean Bed Headloss - is the headloss at the start of a filter run just after backwash. It is plotted on the filter trial figures in Appendix D as the y-intercept. The intercept is reported in psid.
- Run Time to 10 psid - is the is the observed runtime to 10 psid.
- Average Rate of Headloss - is the calculated rate of headloss development in psid/hour. The “Clean Bed Headloss” is subtracted from the terminal headloss of 10 psid and divided by the “Run Time to 10 psid”.
- Runtime to Breakthrough - is the run time to contaminant breakthrough defined as turbidity >0.10 NTU.
- Termination Criteria - is the factor which determined the end of the trial. Most trials were operated to terminal headloss and are noted as “THL” in the table. Trials which were terminated due to schedule, such as to move on to a new trial or the completion of the study are noted as “Trial”.
- Unit Filter Run Volume - is the volume of water treated per one square foot of the media bed during the duration of the filter run to terminal headloss.
- All Turbidity Data - includes all the logged turbidity data, including non-representative data from post-breakthrough operation, turbidity spikes, etc. Turbidity data are presented as Mean ± standard deviation [sample count] in units of NTU.
- Representative Turbidity Data - includes only representative turbidity data, excluding non-representative data from post-breakthrough operations, short-term turbidity spikes caused by operational upsets, the presumed filter-to-waste period following backwashing, etc. Turbidity data are presented as Mean ± standard deviation [sample count] in units of NTU.

Supernatant recycling occurred during Trial 11. A single recycle trial with all four filters operating concurrently was conducted. The Supernatant recycle trial began without supernatant addition to confirm initial treatment. Settled supernatant from prior backwashes was then injected into the raw water influent at a feed rate of 5% of the total pilot flow rate. The recycle period lasted 6.2 hours and was dependent on the pilot flow rate and the available volume of supernatant. The filter trial continued to its conclusion without supernatant addition. Water quality data for Trial 11 was grouped in the following tables by pre-recycle, during-recycle and post-recycle.

Table 3.18: Adsorptive Filter Pilot - Filter A Performance Summary

Trial	Figure	Start	End	Duration (hrs)	FSLR (gpm/sf)	Clean Bed Headloss (psid)	Observed Run Time to 10 psid (hours)	Average Rate of Headloss (psid/hour)	Run Time to Breakthrough (hours)	Termination Criteria	UFRV (gal/sf)	All Turbidity Data (NTU)	Representative Turbidity Data (NTU)
A.1	E-1	02/16/23 15:51	02/20/23 12:57	93.1	4.70 ± 0.34 [1863]	0.4	67.9	0.14	-	THL	97,765	0.001 ± 0.045 [1863]	0.000 ± 0.001 [1860]
A.2	E-2	02/20/23 13:12	02/21/23 12:06	22.9	9.72 ± 1.16 [459]	2.8	17.0	0.42	-	THL	50,331	0.003 ± 0.041 [459]	0.001 ± 0.003 [457]
A.3	E-3	02/21/23 12:36	02/22/23 10:21	21.8	10.00 ± 0.05 [435]	3.0	21.4	0.33	-	THL	65,357	0.000 ± 0.009 [436]	-0.001 ± 0.001 [435]
A.4	E-4	02/22/23 10:39	02/23/23 10:03	23.4	10.00 ± 0.04 [469]	2.8	22.8	0.32	-	THL	69,643	0.000 ± 0.002 [469]	0.000 ± 0.002 [469]
A.5	E-5	02/23/23 10:15	02/24/23 12:00	25.7	10.00 ± 0.04 [516]	2.8	21.9	0.33	-	THL	67,041	0.003 ± 0.023 [516]	0.002 ± 0.003 [515]
A.6	E-6	02/24/23 12:15	02/27/23 13:51	73.6	5.00 ± 0.08 [1473]	1.6	72.8	0.12	-	THL	111,505	0.001 ± 0.008 [1473]	0.001 ± 0.001 [1472]
A.7	E-7	02/27/23 14:03	03/01/23 10:33	44.5	7.50 ± 0.08 [891]	2.2	33.8	0.23	-	THL	77,487	0.003 ± 0.010 [891]	0.002 ± 0.004 [890]
A.8	E-8	03/01/23 10:51	03/03/23 13:03	50.2	7.50 ± 0.08 [1005]	2.0	39.7	0.20	-	THL	91,263	0.002 ± 0.005 [1005]	0.002 ± 0.002 [1004]
A.9	E-9	03/03/23 13:18	03/06/23 14:27	73.1	7.50 ± 0.06 [1464]	2.0	39.8	0.20	-	THL	91,378	0.009 ± 0.014 [1464]	0.009 ± 0.014 [1464]
A.10	E-10	03/06/23 14:42	03/09/23 08:09	65.4	4.99 ± 0.16 [1310]	1.4	58.6	0.15	-	THL	87,975	0.001 ± 0.008 [1301]	0.001 ± 0.002 [1300]
A.11	E-11	03/09/23 08:24	03/10/23 09:21	24.9	5.01 ± 0.30 [500]	#N/A	-	-	-	TRIAL	-	0.002 ± 0.002 [500]	0.002 ± 0.002 [500]
A.11-Pre	E-11	03/09/23 08:24	03/09/23 09:15	0.8	5.30 ± 1.58 [18]	#N/A	-	-	-	TRIAL	-	0.004 ± 0.007 [18]	0.004 ± 0.007 [18]
A.11-Dur	E-11	03/09/23 09:18	03/09/23 15:24	6.1	4.99 ± 0.04 [123]	#N/A	-	-	-	TRIAL	-	0.002 ± 0.000 [123]	0.002 ± 0.000 [123]
A.11-Post	E-11	03/09/23 15:27	03/10/23 09:21	17.9	5.00 ± 0.03 [359]	#N/A	-	-	-	TRIAL	-	0.002 ± 0.001 [359]	0.002 ± 0.001 [359]

Table 3.19: Adsorptive Filter Pilot - Filter B Performance Summary

Trial	Figure	Start	End	Duration (hrs)	FSLR (gpm/sf)	Clean Bed Headloss (psid)	Observed Run Time to 10 psid (hours)	Average Rate of Headloss (psid/hour)	Run Time to Breakthrough (hours)	Termination Criteria	UFRV (gal/sf)	All Turbidity Data (NTU)	Representative Turbidity Data (NTU)
B.1	E-12	02/16/23 15:51	02/20/23 13:09	93.3	4.25 ± 0.56 [1867]	1.2	49.1	0.18	32.9	BRK	42,300	0.262 ± 0.210 [1867]	0.033 ± 0.013 [654]
B.2	E-13	02/20/23 13:21	02/21/23 12:06	22.7	9.00 ± 1.23 [456]	4.0	6.0	1.00	-	THL	16,531	0.056 ± 0.247 [456]	0.037 ± 0.007 [443]
B.3	E-14	02/21/23 12:36	02/22/23 10:36	22.0	10.01 ± 0.24 [441]	2.7	15.1	0.48	-	THL	46,224	0.059 ± 0.243 [441]	0.037 ± 0.016 [397]
B.4	E-15	02/22/23 10:54	02/23/23 09:57	23.0	10.00 ± 0.05 [462]	2.4	12.7	0.60	-	THL	38,724	0.070 ± 0.234 [462]	0.037 ± 0.014 [398]
B.5	E-16	02/23/23 10:12	02/24/23 12:00	25.8	9.77 ± 0.40 [517]	2.6	10.9	0.68	-	THL	32,218	0.058 ± 0.312 [517]	0.036 ± 0.007 [512]
B.6	E-17	02/24/23 12:15	02/27/23 13:51	73.6	5.00 ± 0.09 [1473]	1.2	58.0	0.15	-	THL	88,852	0.053 ± 0.176 [1473]	0.034 ± 0.013 [1286]
B.7	E-18	02/27/23 14:03	02/28/23 13:33	23.5	7.51 ± 0.12 [471]	2.5	17.0	0.44	-	THL	38,916	0.078 ± 0.458 [471]	0.032 ± 0.006 [460]
B.8	E-19	02/28/23 13:48	03/02/23 10:03	44.3	7.51 ± 0.11 [886]	1.8	29.1	0.28	-	THL	66,811	0.081 ± 0.093 [886]	0.036 ± 0.014 [626]
B.9	E-20	03/02/23 10:21	03/06/23 14:27	100.1	7.50 ± 0.07 [2003]	0.8	26.5	0.35	-	THL	60,727	0.232 ± 0.183 [2003]	0.035 ± 0.011 [768]
B.10	E-21	03/06/23 14:42	03/08/23 08:33	41.8	5.00 ± 0.08 [838]	2.0	33.9	0.24	-	THL	51,888	0.056 ± 0.273 [835]	0.034 ± 0.004 [821]
B.11	E-22	03/08/23 08:45	03/10/23 09:21	48.6	3.72 ± 1.69 [973]	#N/A	-	-	-	TRIAL	-	0.046 ± 0.097 [970]	0.037 ± 0.005 [943]
B.11-Pre	E-22	03/08/23 08:45	03/09/23 09:15	24.5	4.99 ± 0.24 [491]	#N/A	-	-	-	TRIAL	-	0.052 ± 0.136 [488]	0.036 ± 0.006 [470]
B.11-Dur	E-22	03/09/23 09:18	03/09/23 15:24	6.1	4.88 ± 0.13 [123]	#N/A	-	-	-	TRIAL	-	0.036 ± 0.001 [123]	0.036 ± 0.001 [123]
B.11-Post	E-22	03/09/23 15:27	03/10/23 09:21	17.9	1.60 ± 0.73 [359]	#N/A	-	-	-	TRIAL	-	0.041 ± 0.021 [359]	0.038 ± 0.004 [350]

Table 3.20: Adsorptive Filter Pilot - Filter C Performance Summary

Trial	Figure	Start	End	Duration (hrs)	FSLR (gpm/sf)	Clean Bed Headloss (psid)	Observed Run Time to 10 psid (hours)	Average Rate of Headloss (psid/hour)	Run Time to Breakthrough (hours)	Termination Criteria	UFRV (gal/sf)	All Turbidity Data (NTU)	Representative Turbidity Data (NTU)
C.1	E-23	02/16/23 16:03	02/20/23 13:18	93.3	4.90 ± 0.17 [1866]	0.8	60.1	0.15	43.4	BRK	65,175	0.193 ± 0.220 [1866]	0.028 ± 0.012 [863]
C.2	E-24	02/20/23 13:33	02/21/23 12:33	23.0	9.79 ± 0.99 [461]	3.6	13.4	0.48	-	THL	39,790	0.110 ± 0.349 [461]	0.033 ± 0.015 [317]
C.3	E-25	02/21/23 12:54	02/22/23 10:51	21.9	10.01 ± 0.07 [440]	2.9	15.9	0.45	-	THL	48,673	0.030 ± 0.058 [440]	0.026 ± 0.009 [437]
C.4	E-26	02/22/23 11:06	02/23/23 09:51	22.7	10.00 ± 0.06 [456]	2.6	19.2	0.39	-	THL	58,776	0.029 ± 0.049 [456]	0.025 ± 0.004 [452]
C.5	E-27	02/23/23 10:06	02/24/23 12:24	26.3	10.00 ± 0.05 [527]	3.1	17.2	0.40	-	THL	52,653	0.089 ± 0.394 [527]	0.028 ± 0.008 [414]
C.6	E-28	02/24/23 12:36	02/27/23 13:30	72.9	5.00 ± 0.15 [1459]	1.2	61.7	0.14	-	THL	94,439	0.027 ± 0.085 [1459]	0.025 ± 0.002 [1455]
C.7	E-29	02/27/23 13:42	03/01/23 10:33	44.9	7.50 ± 0.12 [898]	2.2	28.2	0.28	-	THL	64,630	0.071 ± 0.169 [898]	0.029 ± 0.009 [697]
C.8	E-30	03/01/23 10:51	03/03/23 13:03	50.2	7.50 ± 0.12 [1005]	1.8	37.0	0.22	-	THL	84,834	0.075 ± 0.154 [1005]	0.029 ± 0.010 [796]
C.9	E-31	03/03/23 13:18	03/06/23 14:57	73.6	7.50 ± 0.12 [1474]	1.8	39.0	0.21	-	THL	89,656	0.147 ± 0.279 [1474]	0.027 ± 0.005 [982]
C.10	E-32	03/06/23 15:12	03/09/23 08:09	65.0	5.00 ± 0.19 [1300]	1.9	52.0	0.16	-	THL	79,668	0.039 ± 0.151 [1291]	0.030 ± 0.012 [1244]
C.11	E-33	03/09/23 08:24	03/10/23 09:21	24.9	5.01 ± 0.14 [500]	#N/A	-	-	-	TRIAL	-	0.035 ± 0.109 [500]	0.029 ± 0.003 [496]
C.11-Pre	E-33	03/09/23 08:24	03/09/23 09:15	0.8	5.10 ± 0.72 [18]	#N/A	-	-	-	TRIAL	-	0.207 ± 0.562 [18]	0.040 ± 0.006 [14]
C.11-Dur	E-33	03/09/23 09:18	03/09/23 15:24	6.1	5.00 ± 0.04 [123]	#N/A	-	-	-	TRIAL	-	0.030 ± 0.002 [123]	0.030 ± 0.002 [123]
C.11-Post	E-33	03/09/23 15:27	03/10/23 09:21	17.9	5.00 ± 0.03 [359]	#N/A	-	-	-	TRIAL	-	0.028 ± 0.001 [359]	0.028 ± 0.001 [359]

Table 3.21: Adsorptive Filter Pilot - Filter D Performance Summary

Trial	Figure	Start	End	Duration (hrs)	FSLR (gpm/sf)	Clean Bed Headloss (psid)	Observed Run Time to 10 psid (hours)	Average Rate of Headloss (psid/hour)	Run Time to Breakthrough (hours)	Termination Criteria	UFRV (gal/sf)	All Turbidity Data (NTU)	Representative Turbidity Data (NTU)
D.1	E-34	02/16/23 16:03	02/20/23 13:30	93.5	5.01 ± 0.12 [1870]	0.2	64.6	0.15	37.5	BRK	57,321	0.166 ± 0.225 [1870]	0.027 ± 0.015 [743]
D.2	E-35	02/20/23 13:45	02/21/23 12:33	22.8	9.87 ± 0.88 [457]	1.8	15.7	0.52	12.4	BRK	37,200	0.137 ± 0.275 [457]	0.043 ± 0.016 [234]
D.3	E-36	02/21/23 12:54	02/22/23 11:03	22.2	10.05 ± 0.32 [444]	2.2	16.9	0.46	-	THL	51,735	0.079 ± 0.316 [444]	0.031 ± 0.014 [376]
D.4	E-37	02/22/23 11:18	02/23/23 09:45	22.5	10.04 ± 0.23 [450]	2.1	19.0	0.42	18.2	BRK	55,714	0.057 ± 0.112 [450]	0.031 ± 0.013 [366]
D.5	E-38	02/23/23 10:00	02/24/23 12:24	26.4	10.05 ± 0.54 [529]	2.2	18.0	0.43	15.8	BRK	48,214	0.135 ± 0.354 [529]	0.030 ± 0.012 [314]
D.6	E-39	02/24/23 12:36	02/27/23 13:30	72.9	5.02 ± 0.26 [1459]	0.9	65.2	0.14	-	THL	99,872	0.028 ± 0.146 [1459]	0.023 ± 0.004 [1455]
D.7	E-40	02/27/23 13:42	02/28/23 13:33	23.9	7.51 ± 0.11 [478]	1.8	23.6	0.35	-	THL	54,069	0.055 ± 0.332 [478]	0.028 ± 0.011 [468]
D.8	E-41	02/28/23 13:48	03/02/23 10:18	44.5	7.50 ± 0.18 [891]	1.6	29.4	0.29	-	THL	67,500	0.067 ± 0.114 [891]	0.029 ± 0.016 [698]
D.9	E-42	03/02/23 10:33	03/06/23 14:57	100.4	7.51 ± 0.09 [2009]	0.6	33.5	0.28	25.5	BRK	58,431	0.389 ± 0.413 [2009]	0.041 ± 0.079 [551]
D.10	E-43	03/06/23 15:12	03/08/23 08:33	41.3	5.02 ± 0.11 [828]	1.2	40.6	0.22	-	THL	62,219	0.041 ± 0.195 [825]	0.028 ± 0.006 [812]
D.11	E-44	03/08/23 08:45	03/10/23 09:21	48.6	3.71 ± 1.80 [973]	#N/A	-	-	-	TRIAL	N/A	0.066 ± 0.270 [970]	0.033 ± 0.009 [919]
D.11-Pre	E-44	03/08/23 08:45	03/09/23 09:15	24.5	5.00 ± 0.31 [491]	#N/A	-	-	-	TRIAL	N/A	0.062 ± 0.215 [488]	0.032 ± 0.008 [470]
D.11-Dur	E-44	03/09/23 09:18	03/09/23 15:24	6.1	5.02 ± 0.08 [123]	#N/A	-	-	-	TRIAL	N/A	0.046 ± 0.035 [123]	0.040 ± 0.011 [119]
D.11-Post	E-44	03/09/23 15:27	03/10/23 09:21	17.9	1.49 ± 0.94 [359]	#N/A	-	-	-	TRIAL	N/A	0.078 ± 0.365 [359]	0.033 ± 0.009 [330]

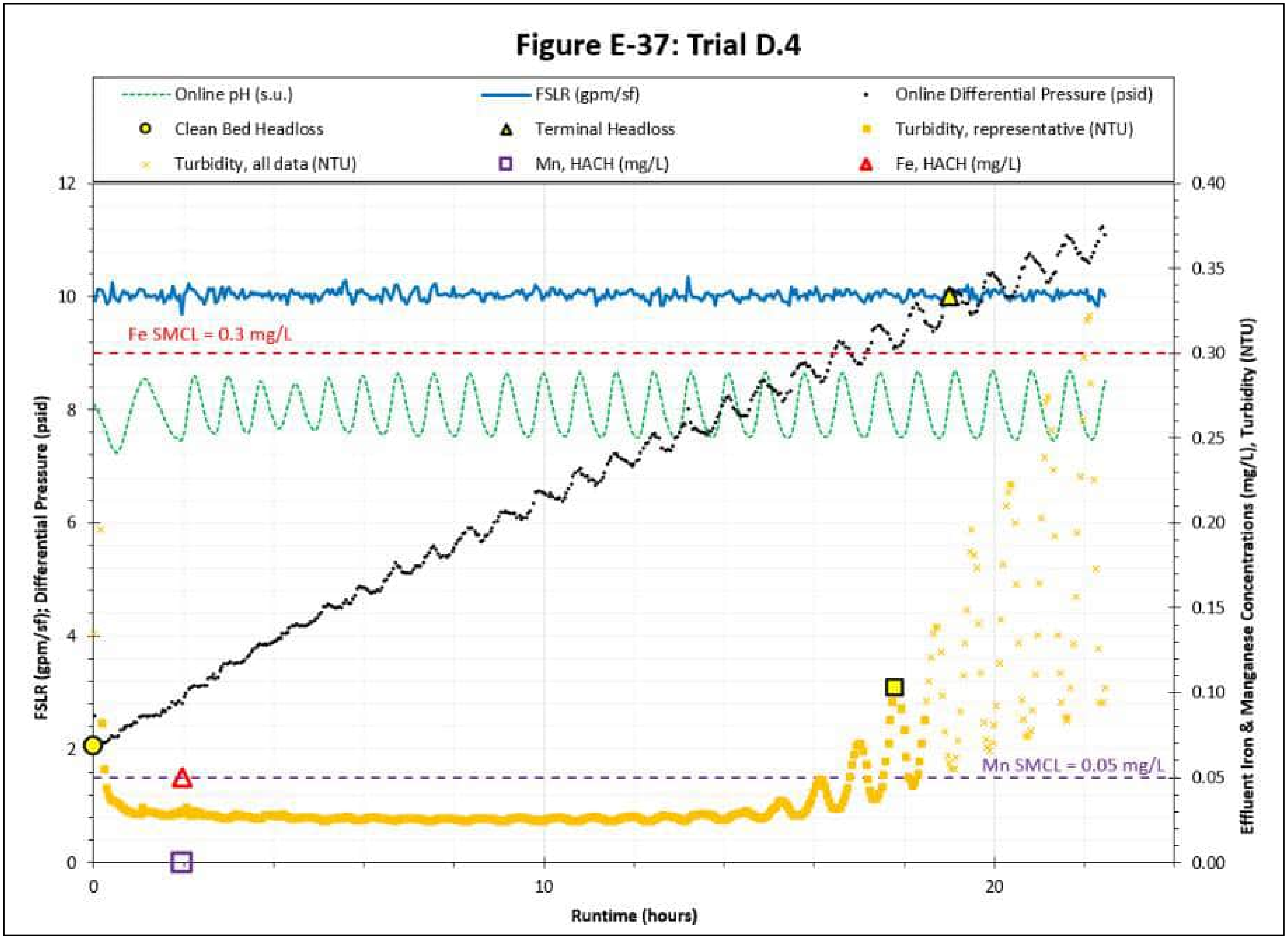
3.4.2.2 Adsorptive Filter Hydraulic Performance

For each filter run, online data was logged every 3 minutes by the PLC, and grab samples were collected and analyzed periodically throughout the day.

Figures E.01 to E.44 in Appendix E show important operating conditions and effluent iron and manganese concentrations for each filter run. Figure 3.09 is an example figure (also in Appendix E as Figure D.37: Filter D – Trial 4) and is representative of the figures included and is described below:

1. X-axis is presented in units of hours of filter run time, with 0 hours set at the time the filter was placed online.
2. Field data for effluent iron concentrations are presented as hollow red triangles in units of mg/L and represent results of field analyses of grab samples. The data are plotted using the right y-axis.
3. Field data for effluent manganese concentrations are presented as hollow purple squares in units of mg/L and represent results of field analyses of grab samples.
4. The filter effluent manganese goal is presented as a purple dashed line plotted in units of mg/L using the right y-axis. The effluent manganese goal was set to the Mn SMCL (0.05 mg/L Mn).
5. All recorded filter effluent turbidity data are presented as orange "x". These are all the turbidity data logged by the PLC during the filter trial in units of NTUs. The data are plotted using the right y-axis.
6. Representative filter effluent turbidity data are presented as orange squares. These are the turbidity recorded after the filter-to-waste period, and prior to breakthrough in units of NTUs. The data are plotted using the right y-axis.
7. The filter surface loading rate (FSLR) is shown as a blue line. Loading rate was calculated from the effluent flow rate and the surface area of the filters (0.2 ft^2). The FSLR is included in the figures to show when flow rates were stable, when flow rate adjustments were made, and when the filter experienced declining rate conditions. The FLSR is presented in gpm/sf and is plotted using the left y-axis.
8. Differential pressure (DP) is shown as black dots in units of psid and is plotted using the left y-axis. DP was calculated from the differential pressure transducer connected to the inlet and outlet of the filter.
9. Periods of supernatant recycle are identified by a blue transparent square, where applicable.
10. Markers for Clean Bed Headloss are shown as yellow circles.
11. Markers for Terminal Headloss are shown as yellow triangles.
12. Markers for Contaminant Breakthrough are shown as yellow squares.
13. Inlet pH data are presented in standard units (SU) and were measured from the online pH meter. The sample stream was MPOKA. The KOH feed pump control was automated to maintain a setpoint pH level. Inlet pH is only plotted for the pretreated manganese removal filter. The iron removal filters received untreated raw water.

Figure 3.09: Example Figure – Adsorptive Filter (Figure E.37 – Trial D4) Operational Data, February 22 – 23, 2023



3.4.2.3 Adsorptive Filter Effluent Water Quality

Water quality results from field analyses are shown in Tables 3.22 to 3.25 which summarize the water quality data for Filters A through D respectively. The tables summarize water quality by trial.

A “filter run” refers to operation of a single filter in forward flow filtration mode, from startup to shutdown, followed by backwashing. A total of 44 individual filter runs were completed during the adsorptive filtration pilot study.

Laboratory data for Filters A through D are summarized in Tables 3.26 through 3.29.

Table 3.22: Adsorptive Filtration Pilot - Filtered Water Quality from Field Analyses - Filter A

Trial	**Filter Surface Loading Rate (gpm/sf)**	**Chlorine, Free (mg/L)**	**Chlorine, Total (mg/L)**	**Iron, Total (mg/L)**	**Manganese, Total (mg/L)**	**pH (s.u.)**	**TOC (mg/L)**	**Nitrate (mg/L)**	**Alkalinity (mg/L)**	**Carbon Dioxide (mg/L)**
A.1	4.70 ± 0.34 [1863]	0.89-1.16 [2]	0.94-1.29 [2]	**0.05** [1]	**0.000** [1]	6.27-6.54 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
A.2	9.72 ± 1.16 [459]	No Data [0]	No Data [0]	**0.02** [1]	**0.015** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
A.3	10.00 ± 0.05 [435]	**0.44** [1]	**0.60** [1]	**0.00** [1]	**0.000** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
A.4	10.00 ± 0.04 [469]	**0.70** [1]	**0.88** [1]	**0.04** [1]	**0.000** [1]	**6.42** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
A.5	10.00 ± 0.04 [516]	0.41-0.58 [2]	0.57-0.59 [2]	0.01-0.03 [2]	0.002-0.005 [2]	6.26-6.41 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
A.6	5.00 ± 0.08 [1473]	**0.19** [1]	**0.28** [1]	**0.01** [1]	**0.005** [1]	**6.43** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
A.7	7.50 ± 0.08 [891]	**0.26** (0.17-0.33) [3]	**0.41** (0.39-0.41) [3]	**0.01** (0.01-0.02) [3]	**0.016** (0.011-0.018) [3]	**6.32** (6.29-6.39) [3]	No Data [0]	**1.3** [1]	No Data [0]	No Data [0]
A.8	7.50 ± 0.08 [1005]	0.35-0.56 [2]	0.45-0.66 [2]	0.00-0.04 [2]	0.008-0.012 [2]	6.26-6.36 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
A.9	7.50 ± 0.06 [1464]	**0.35** [1]	**0.55** [1]	**0.02** [1]	**0.014** [1]	**6.16** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
A.10	4.99 ± 0.16 [1310]	**0.40** (0.27-0.47) [4]	0.42-0.47 [2]	**0.04** (0.00-0.10) [7]	**0.006** (0.000-0.025) [7]	**6.40** (6.25-6.41) [3]	**2.82** [1]	**0.9** [1]	**44.0** [1]	**68.6** [1]
A.11	5.01 ± 0.30 [500]	**0.27** (0.14-0.28) [3]	0.31-0.39 [2]	**0.03** (0.01-0.08) 11]	**0.005** (0.000-0.014) [11]	**6.46** (6.36-7.10) [3]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
A.11-Pre	5.30 ± 1.58 [18]	**0.28** [1]	No Data [0]	No Data [0]	No Data [0]	**7.10** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
A.11-Dur	4.99 ± 0.04 [123]	**0.27** [1]	**0.31** [1]	**0.03** (0.01-0.08) [10]	**0.004** (0.000-0.014) [10]	**6.46** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
A.11-Post	5.00 ± 0.03 [359]	**0.14** [1]	**0.39** [1]	**0.04** [1]	**0.012** [1]	**6.36** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]

Table 3.23: Adsorptive Filtration Pilot - Filtered Water Quality from Field Analyses - Filter B

Trial	Filter Surface Loading Rate (gpm/sf)	Chlorine, Free (mg/L)	Chlorine, Total (mg/L)	Iron, Total (mg/L)	Manganese, Total (mg/L)	pH (s.u.)	TOC (mg/L)	Nitrate (mg/L)	Alkalinity (mg/L)	Carbon Dioxide (mg/L)
B.1	4.25 ± 0.56 [1867]	0.83-1.30 [2]	0.88-1.00 [2]	**0.02** [1]	**0.004** [1]	6.29-6.52 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
B.2	9.00 ± 1.23 [456]	No Data [0]	No Data [0]	**0.02** [1]	**0.017** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
B.3	10.01 ± 0.24 [441]	**0.42** [1]	**0.56** [1]	**0.02** [1]	**0.000** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
B.4	10.00 ± 0.05 [462]	**0.67** [1]	**0.59** [1]	**0.04** [1]	**0.003** [1]	**6.41** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
B.5	9.77 ± 0.40 [517]	0.43-0.49 [2]	0.55-0.62 [2]	0.01-0.04 [2]	0.001-0.007 [2]	6.28-6.38 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
B.6	5.00 ± 0.09 [1473]	**0.10** [1]	**0.15** [1]	**0.03** [1]	**0.010** [1]	**6.42** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
B.7	7.51 ± 0.12 [471]	0.06-0.22 [2]	0.20-0.32 [2]	0.02-0.02 [2]	0.005-0.015 [2]	6.25-6.32 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
B.8	7.51 ± 0.11 [886]	0.29-0.30 [2]	0.34-0.38 [2]	0.02-0.02 [2]	0.019-0.028 [2]	6.35-6.38 [2]	No Data [0]	**2.5** [1]	No Data [0]	No Data [0]
B.9	7.50 ± 0.07 [2003]	0.42-0.54 [2]	0.48-0.63 [2]	0.00-0.00 [2]	0.000-0.010 [2]	6.16-6.18 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
B.10	5.00 ± 0.08 [838]	0.00-0.34 [2]	**0.41** [1]	**0.03** (0.00-0.03) [3]	**0.004** (0.000-0.005) [3]	6.21-6.43 [2]	**2.65** [1]	**1.0** [1]	**47.0** [1]	**59.0** [1]
B.11	3.72 ± 1.69 [973]	**0.17** (0.06-0.21) [4]	**0.27** (0.23-0.34) [3]	**0.03** (0.00-0.10) 16]	**0.007** (0.000-0.018) [15]	**6.38** (6.36-6.44) [4]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
B.11-Pre	4.99 ± 0.24 [491]	0.06-0.18 [2]	**0.27** [1]	**0.03** (0.03-0.05) [5]	**0.014** (0.005-0.018) [4]	6.37-6.39 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
B.11-Dur	4.88 ± 0.13 [123]	**0.21** [1]	**0.34** [1]	**0.03** (0.00-0.10) 10]	**0.006** (0.000-0.016) [10]	**6.44** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
B.11-Post	1.60 ± 0.73 [359]	**0.15** [1]	**0.23** [1]	**0.05** [1]	**0.007** [1]	**6.36** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]

Table 3.24: Adsorptive Filtration Pilot - Filtered Water Quality from Field Analyses - Filter C

Trial	**Filter Surface Loading Rate (gpm/sf)**	**Chlorine, Free (mg/L)**	**Chlorine, Total (mg/L)**	**Iron, Total (mg/L)**	**Manganese, Total (mg/L)**	**pH (s.u.)**	**TOC (mg/L)**	**Nitrate (mg/L)**	**Alkalinity (mg/L)**	**Carbon Dioxide (mg/L)**
C.1	4.90 ± 0.17 [1866]	1.00-1.31 [2]	1.06-1.55 [2]	**0.05** [1]	**0.003** [1]	7.29-7.61 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
C.2	9.79 ± 0.99 [461]	No Data [0]	No Data [0]	**0.06** [1]	**0.020** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
C.3	10.01 ± 0.07 [440]	**0.42** [1]	**0.58** [1]	**0.02** [1]	**0.000** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
C.4	10.00 ± 0.06 [456]	**0.63** [1]	**0.96** [1]	**0.05** [1]	**0.010** [1]	**7.25** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
C.5	10.00 ± 0.05 [527]	0.39-0.42 [2]	0.49-0.60 [2]	0.02-0.03 [2]	0.011-0.013 [2]	6.44-7.18 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
C.6	5.00 ± 0.15 [1459]	**0.04** [1]	**0.15** [1]	**0.03** [1]	**0.004** [1]	**8.90** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
C.7	7.50 ± 0.12 [898]	**0.17** (0.06-0.25) [3]	**0.31** (0.26-0.33) [3]	**0.01** (0.00-0.01) [3]	**0.014** (0.005-0.018) [3]	**7.36** (6.44-7.95) [3]	No Data [0]	**0.7** [1]	No Data [0]	No Data [0]
C.8	7.50 ± 0.12 [1005]	0.22-0.48 [2]	0.37-0.53 [2]	0.01-0.04 [2]	0.005-0.010 [2]	6.99-7.88 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
C.9	7.50 ± 0.12 [1474]	**0.37** [1]	**0.50** [1]	**0.00** [1]	**0.006** [1]	**6.93** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
C.10	5.00 ± 0.19 [1300]	0.32 (0.31-0.42) [3]	0.39-0.52 [2]	**0.03** (0.02-0.07) [7]	**0.008** (0.000-0.018) [7]	**7.29** (6.80-7.47) [3]	**2.74** [1]	**0.4** [1]	**81.0** [1]	**15.0** [1]
C.11	5.01 ± 0.14 [500]	0.29 (0.27-0.49) [3]	0.37-0.65 [2]	**0.02** (0.01-0.05) 12]	**0.004** (0.000-0.012) [12]	**7.56** (6.37-7.87) [3]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
C.11-Pre	5.10 ± 0.72 [18]	**0.27** [1]	No Data [0]	**0.01** [1]	**0.012** [1]	**6.37** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
C.11-Dur	5.00 ± 0.04 [123]	**0.49** [1]	**0.65** [1]	**0.03** (0.01-0.05) 10]	**0.004** (0.000-0.012) [10]	**7.87** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
C.11-Post	5.00 ± 0.03 [359]	**0.29** [1]	**0.37** [1]	**0.02** [1]	**0.000** [1]	**7.56** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]

Table 3.25: Adsorptive Filtration Pilot - Filtered Water Quality from Field Analyses - Filter D

Trial	Filter Surface Loading Rate (gpm/sf)	Chlorine, Free (mg/L)	Chlorine, Total (mg/L)	Iron, Total (mg/L)	Manganese, Total (mg/L)	pH (s.u.)	TOC (mg/L)	Nitrate (mg/L)	Alkalinity (mg/L)	Carbon Dioxide (mg/L)
D.1	5.01 ± 0.12 [1870]	1.02-1.22 [2]	1.13-1.44 [2]	**0.01** [1]	**0.000** [1]	7.30-7.63 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
D.2	9.87 ± 0.88 [457]	No Data [0]	No Data [0]	**0.08** [1]	**0.012** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
D.3	10.05 ± 0.32 [444]	**0.11** [1]	**0.56** [1]	**0.01** [1]	**0.000** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
D.4	10.03 ± 0.08 [449]	**0.70** [1]	**1.04** [1]	**0.05** [1]	**0.000** [1]	**7.28** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
D.5	10.05 ± 0.54 [529]	0.40-0.51 [2]	0.48-0.64 [2]	0.02-0.04 [2]	0.000-0.008 [2]	6.51-7.05 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
D.6	5.02 ± 0.26 [1459]	**0.09** [1]	**0.11** [1]	**0.02** [1]	**0.007** [1]	**9.38** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
D.7	7.51 ± 0.11 [478]	0.09-0.25 [2]	0.17-0.34 [2]	0.05-0.05 [2]	0.009-0.016 [2]	6.54-7.82 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
D.8	7.50 ± 0.18 [891]	0.22-0.29 [2]	0.34-0.44 [2]	0.00-0.05 [2]	0.017-0.019 [2]	7.00-7.36 [2]	No Data [0]	**1.4** [1]	No Data [0]	No Data [0]
D.9	7.51 ± 0.09 [2009]	0.37-0.59 [2]	0.45-0.60 [2]	0.00-0.03 [2]	0.016-0.026 [2]	6.99-7.84 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
D.10	5.02 ± 0.11 [828]	**0.42** (0.32-0.49) [3]	**0.55** [1]	**0.02** (0.01-0.04) [3]	**0.012** (0.011-0.012) [3]	6.76-7.28 [2]	**2.70** [1]	**2.2** [1]	**85.0** [1]	**13.2** [1]
D.11	3.71 ± 1.80 [973]	**0.28** (0.24-0.33) [4]	**0.45** (0.40-0.47) [3]	**0.05** (0.00-0.09) 16]	**0.010** (0.000-0.018) [16]	**7.55** (7.03-7.80) [4]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
D.11-Pre	5.00 ± 0.31 [491]	0.26-0.33 [2]	**0.45** [1]	**0.05** (0.03-0.07) [5]	**0.012** (0.004-0.018) [5]	7.03-7.48 [2]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
D.11-Dur	5.02 ± 0.08 [123]	**0.24** [1]	**0.47** [1]	**0.04** (0.00-0.09) 10]	**0.009** (0.000-0.016) [10]	**7.80** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]
D.11-Post	1.49 ± 0.94 [359]	**0.30** [1]	**0.40** [1]	**0.05** [1]	**0.010** [1]	**7.61** [1]	No Data [0]	No Data [0]	No Data [0]	No Data [0]

Table 3.26: Adsorptive Filtered Water Quality for Filter A by Lab Analyses

Laboratory Analyses by Alpha Analytical	Analysis	Units	Laboratory Report #			
			L2309640 CN48043	CN52089	L2311800 CN55216	CN59353
			Trial A.04	Trial A.08	Trial A.10	Trial A.11
			2/22/23	3/02/23	3/07/23	3/09/23
	Total Iron	mg/L	<0.010	<0.010	<0.010	<0.010
	Total Manganese	mg/L	<0.001	<0.001	<0.001	<0.001
	Turbidity	NTU	<0.200		<0.200	
	True Color	C.U.	<1		<1	
	Apparent Color	C.U.	5		5	
	Total Coliform	Col/100mL	Negative		Negative	
	Escherichia Coliform	Col/100mL	Negative		Negative	
	Carbon Dioxide	mg/L	19			
	Total Hardness	mg/L	109		111	
	Alkalinity	mg/L	46		48	
	pH	s.u.	6.95		6.94	
	Total Dissolved Solids	mg/L	230		250	
	Sulfate	mg/L	13.6		12.7	
	Nitrogen, Nitrate	mg/L			3.83	
	Chloride	mg/L	80.4		81.2	

Table 3.27: Adsorptive Filtered Water Quality for Filter B by Lab Analyses

	Analysis	Units	Laboratory Report #			
			L2309640 CN48043	CN52089	L2311800 CN55216	CN59353
			Trial B.04	Trial B.09	Trial B.10	Trial B.11
			2/22/23	3/02/23	3/07/23	3/09/23
Laboratory Analyses by Alpha Analytical	Total Iron	mg/L	0.011	<0.010	<0.010	<0.010
	Total Manganese	mg/L	<0.001	0.001	<0.001	<0.001
	Turbidity	NTU	<0.200		<0.200	
	True Color	C.U.	<1		<1	
	Apparent Color	C.U.	5		5	
	Total Coliform	Col/100mL	Negative		Negative	
	Escherichia Coliform	Col/100mL	Negative		Negative	
	Carbon Dioxide	mg/L	21			
	Total Hardness	mg/L	110		111	
	Alkalinity	mg/L	46		48	
	pH	s.u.	6.95		6.95	
	Total Dissolved Solids	mg/L	240		250	
	Sulfate	mg/L	13.6		13.0	
	Nitrogen, Nitrate	mg/L			3.77	
	Chloride	mg/L	78.4		79.8	

Table 3.28: Adsorptive Filtered Water Quality for Filter C by Lab Analyses

	Analysis	Units	Laboratory Report #			
			L2309640 CN48043	CN52089	L2311800 CN55216	CN59353
			Trial C.11	Trial C.04	Trial C.08	Trial C.10
			2/22/23	3/02/23	3/07/23	3/09/23
Laboratory Analyses by Alpha Analytical	Total Iron	mg/L	<0.010	<0.010	<0.010	<0.010
	Total Manganese	mg/L	<0.001	<0.001	<0.001	<0.001
	Turbidity	NTU	<0.200		<0.200	
	True Color	C.U.	<1		<1	
	Apparent Color	C.U.	5		<1	
	Total Coliform	Col/100mL	Negative		Negative	
	Escherichia Coliform	Col/100mL	Negative		Negative	
	Carbon Dioxide	mg/L	<10			
	Total Hardness	mg/L	98.2		109	
	Alkalinity	mg/L	81		77	
	pH	s.u.	8.00		7.44	
	Total Dissolved Solids	mg/L	260		260	
	Sulfate	mg/L	13.6		13.0	
	Nitrogen, Nitrate	mg/L			3.80	
	Chloride	mg/L	78.3		81.0	

Table 3.29: Adsorptive Filtered Water Quality for Filter D by Lab Analyses

	Analysis	Units	Laboratory Report #			
			L2309640 CN48043	CN52089	L2311800 CN55216	CN59353
			Trial D.04	Trial D.09	Trial D.10	Trial D.11
			2/22/23	3/02/23	3/07/23	3/09/23
Laboratory Analyses by Alpha Analytical	Total Iron	mg/L	0.012	0.014	<0.010	<0.010
	Total Manganese	mg/L	<0.001	0.001	<0.001	<0.001
	Turbidity	NTU	<0.200		<0.200	
	True Color	C.U.	<1		<1	
	Apparent Color	C.U.	<1		<1	
	Total Coliform	Col/100mL	Negative		Negative	
	Escherichia Coliform	Col/100mL	Negative		Negative	
	Carbon Dioxide	mg/L	<10			
	Total Hardness	mg/L	105		107	
	Alkalinity	mg/L	81		70	
	pH	s.u.	7.99		7.49	
	Total Dissolved Solids	mg/L	260		260	
	Sulfate	mg/L	13.6		12.8	
	Nitrogen, Nitrate	mg/L			3.80	
	Chloride	mg/L	79.8		81.1	

3.4.3 Adsorptive Filter Backwash Water Characterization

3.4.3.1 Adsorptive Filter Backwash Water Quality

Tables 3.30 and 3.31 summarize the results of laboratory analyses conducted on samples of composite backwash and settled supernatant.

Table 3.30: Combined Backwash Water Quality Data by Laboratory Analysis for Adsorptive Filters

Parameter	Lab Report #							
	CN48048				CN59351			
	Trial A.03	Trial B.03	Trial C.03	Trial D.03	Trial B.10	Trial D.10	Trial B.11	Trial D.11
	2/22/2023				3/08/2023		3/10/2023	
	Filter A	Filter B	Filter C	Filter D	Filter B	Filter D	Filter B	Filter D
Total Iron (mg/L)	92.2	71.7	83.2	72.1	74.0	80.8	133*	213*
Total Manganese (mg/L)	10.9	14.4	11.0	12.3	11.9	15.5	9.99	11.8
TSS (mg/L)	220	150	230	220	100	190	300	460

***** Atypically high results were likely due to an observed iron slug during raw flow adjustments in preparation for supernatant recycle.

Table 3.31: Suspended Supernatant Water Quality Data by Laboratory Analysis for Adsorptive Filters

Parameter	Lab Report #							
	CN48048				CN59351			
	Trial A.03	Trial B.03	Trial C.03	Trial D.03	Trial B.10	Trial D.10	Trial B.11	Trial D.11
	2/22/2023				3/08/2023		3/13/2023	
	Filter A	Filter B	Filter C	Filter D	Filter B	Filter D	Filter B	Filter D
Total Iron (mg/L)	3.02	2.20	1.94	1.43	0.877	1.16	0.250	0.437
Total Manganese (mg/L)	0.388	0.485	0.281	0.358	0.276	0.316	0.114	0.057
TSS (mg/L)					2.4	4.8	<2.0	<2.0

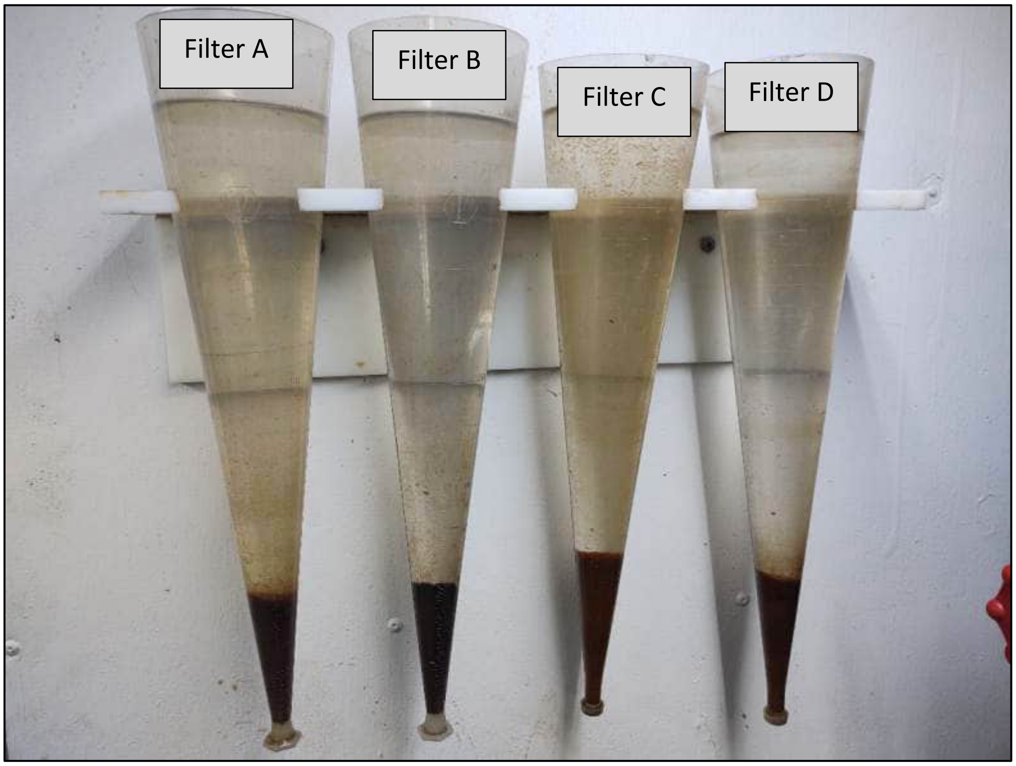
Supernatant samples collected on February 22 and March 8 were allowed to settle for 4 hours. The samples collected on March 13 settled for 72 hours over a weekend.

3.4.3.2 Adsorptive Filter Settling Time

Settling tests were conducted after most backwashes during operation of the adsorptive pilot system. The combined backwash volume (24 gal) was mixed at the completion of a backwash and a 1000 mL sample collected in an Imhoff settling cone. Each test was conducted using separate Imhoff cones for each filter backwash and was allowed to settle for a minimum of four hours.

Figure 3.10 is photos of the backwash water while settling in Imhoff cones.

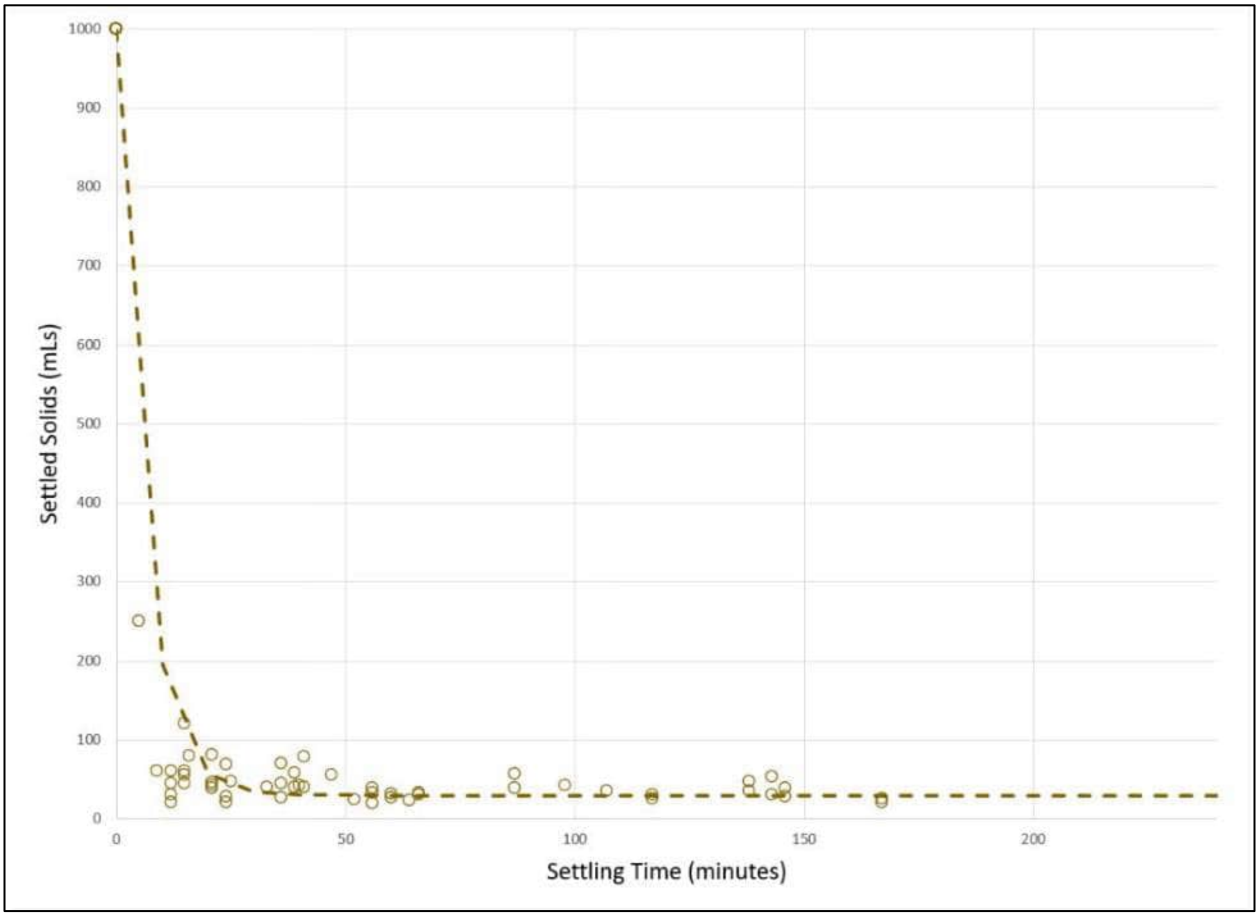
Figure 3.10: Photo of Imhoff Settling Cones



The photo was taken on March 2 after Filters A and C had settled for 24 hours and Filters B and D had settled for 48 hours. There are approximately 30 to 40 mL of solids in each cone after settling.

The results of all settling tests were combined and plotted in Figure 3.11.

Figure 3.11: Settling Tests for Adsorptive Filter Backwash



The adsorptive filter backwash solids typically settled to less than 10% of the total volume within 30 minutes and to less than 5% within one hour. The final settled volume was typically 30 to 40 mLs (3-4%) in the Imhoff cone.

4 DATA ANALYSIS

Section 4 – Data Analysis provides analysis and discussion of the data presented in Section 3. Issues and questions that are addressed in this Section were developed by the pilot operators to answer questions that are generally of interest when testing iron and manganese removal.

4.1 RAW WATER QUALITY

4.1.1 Raw Water Quality Consistency Over the Duration of the Study

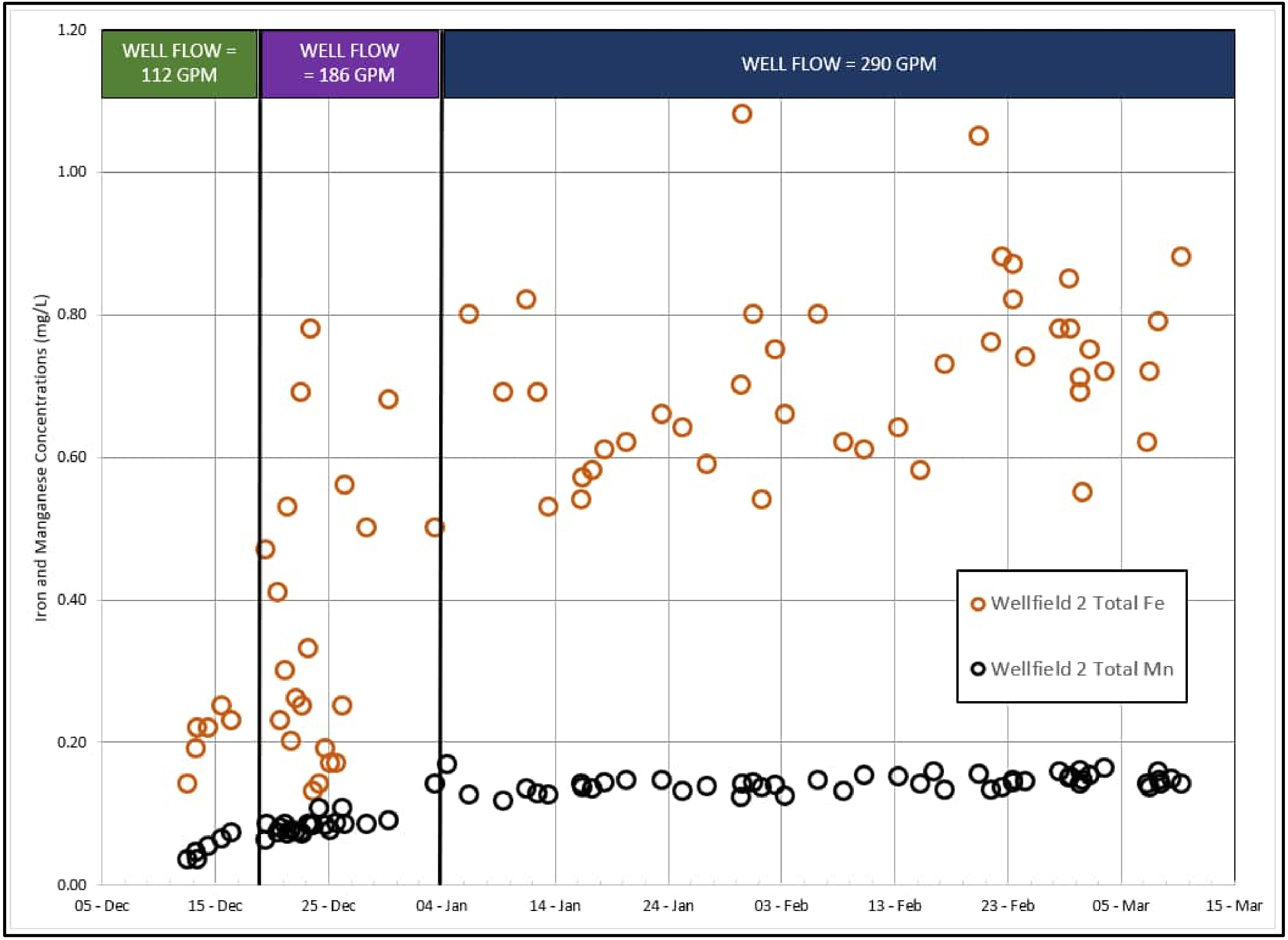
To evaluate changes in raw water quality from Wellfield 2 during the study, the raw iron and manganese concentrations were plotted in a time series. Figure 4.01 plots all data from December 12, 2022, to March 10, 2023.

Initial iron and manganese concentrations were lower than expected based on historical data and wellfield flow was increased on two occasions during the study to provide more representative concentrations.

- December 12, 2022 – Wellfield Flow @ 112 gpm at the start of pilot study
- December 19, 2022 – Wellfield Flow increased from 112 to 186 gpm
- January 4, 2023 – Wellfield Flow increased from 186 to 290 gpm

Figure 4.01 displays the flow rate for the applicable date ranges. The figure shows that the iron concentrations increased with each flow rate increase. Iron concentration increased from 0.14 to near 0.90 mg/L over the duration of the study. The raw iron concentration manganese concentration increased gradually from 0.034 to near 0.150 mg/L over the duration of the study.

Figure 4.01: Times Series of Raw Water Quality for Sharon Wellfield 2



4.1.2 Comparison of Raw Water Quality with Historical Data

Historical water quality data for 2019 to 2021 in Wellfield 2 was provided by Environmental Partners in in Figures 3 and 5 of the *Sharon Well 2 Pilot Test Proposal*, October 2022. Additional historical data from 2013 to 2020 was provided from the Town during the study when Blueleaf and Environmental Partners were researching the low iron and manganese concentrations at the startup of the pilot.

The historical iron and manganese data were compared to the raw water data collected during the pilot study. Raw water data collected during both the adsorptive filtration and biological filtration pilots were combined for the analysis. The data were compared by box plot as well as statistical Analysis of Variances (ANOVA) which are both described in the Statistical Methods Section 2.5. The confidence interval for the ANOVA was 95%, and the level of significance (α) was 0.05.

Comparisons of raw iron data are presented by box plots in Figure 4.02 and the ANOVA in Table 4.01. The pilot study data was grouped by wellfield flow rate.

Figure 4.02: Box Plot of Sharon Wellfield 2 Raw Iron Concentrations

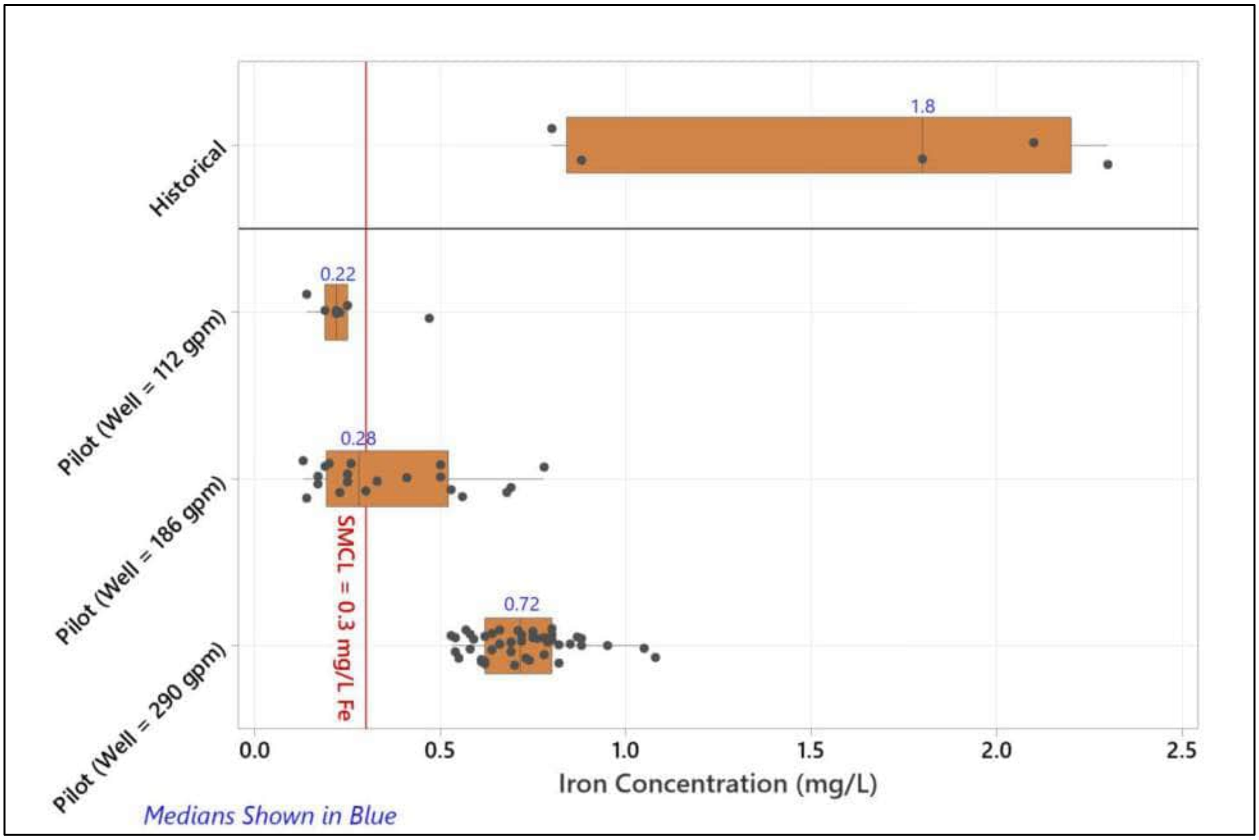
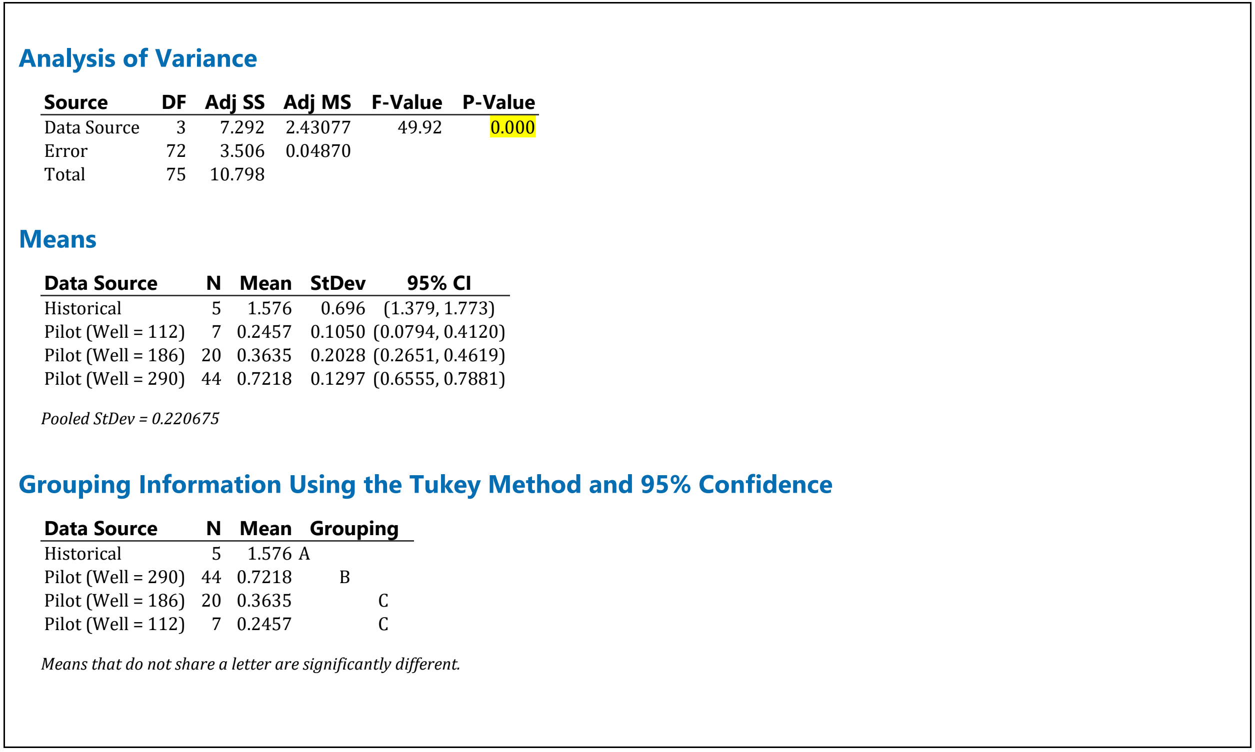


Figure 4.02 shows that all four data sets appear to be different. The median iron concentration from the wellfield when operated at the lowest two flow rates were below the SMCL of 0.3 mg/L Fe while all of the high wellfield flow rate data and the historical data exceeded the limit. An ANOVA was completed to compare the four data sets and the results are presented in Table 4.01.

Table 4.01: ANOVA of Raw Iron Concentration by Data Source



Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Data Source	3	7.292	2.43077	49.92	0.000
Error	72	3.506	0.04870		
Total	75	10.798			

Means

Data Source	N	Mean	StDev	95% CI
Historical	5	1.576	0.696	(1.379, 1.773)
Pilot (Well = 112)	7	0.2457	0.1050	(0.0794, 0.4120)
Pilot (Well = 186)	20	0.3635	0.2028	(0.2651, 0.4619)
Pilot (Well = 290)	44	0.7218	0.1297	(0.6555, 0.7881)

Pooled StDev = 0.220675

Grouping Information Using the Tukey Method and 95% Confidence

Data Source	N	Mean	Grouping
Historical	5	1.576	A
Pilot (Well = 290)	44	0.7218	B
Pilot (Well = 186)	20	0.3635	C
Pilot (Well = 112)	7	0.2457	C

Means that do not share a letter are significantly different.

The probability value of the ANOVA was 0.000 which indicated that the means are different, and the alternative hypothesis is accepted (0.000 < 0.05(α)). The statistical evaluation indicates that there are statistically significant differences between the data sets.

Table 4.01 also contains a Tukey's Comparison, which groups data sets with statistical similarities. Tukey's identified three statistically different groups. The Historical data was a distinct group, Group A, and not like the other three groups. The pilot data with the wellfield operating at 290 gpm was also a distinct group, Group B, and not like other groups. Group C included two pilot data groups, the wellfield operating at 112 and 186 gpm, which were statistically similar to each other.

The box plot and the ANOVA show that the pilot study was statistically different than the historical data. Three of the five historical data points were between 1.5 and 2.5 mg/L while the pilot study data was predominantly less than 1.0 mg/L. Two of the historical data points overlapped with the pilot study data when the wellfield was operating at 290 gpm.

The raw iron concentrations were lower than historical data during the pilot study.

Comparisons of raw manganese data are presented in Figure 4.03 and Table 4.02. The pilot study data was grouped by wellfield flow rate.

Figure 4.03: Box Plot of Sharon Wellfield 2 Raw Manganese Concentrations

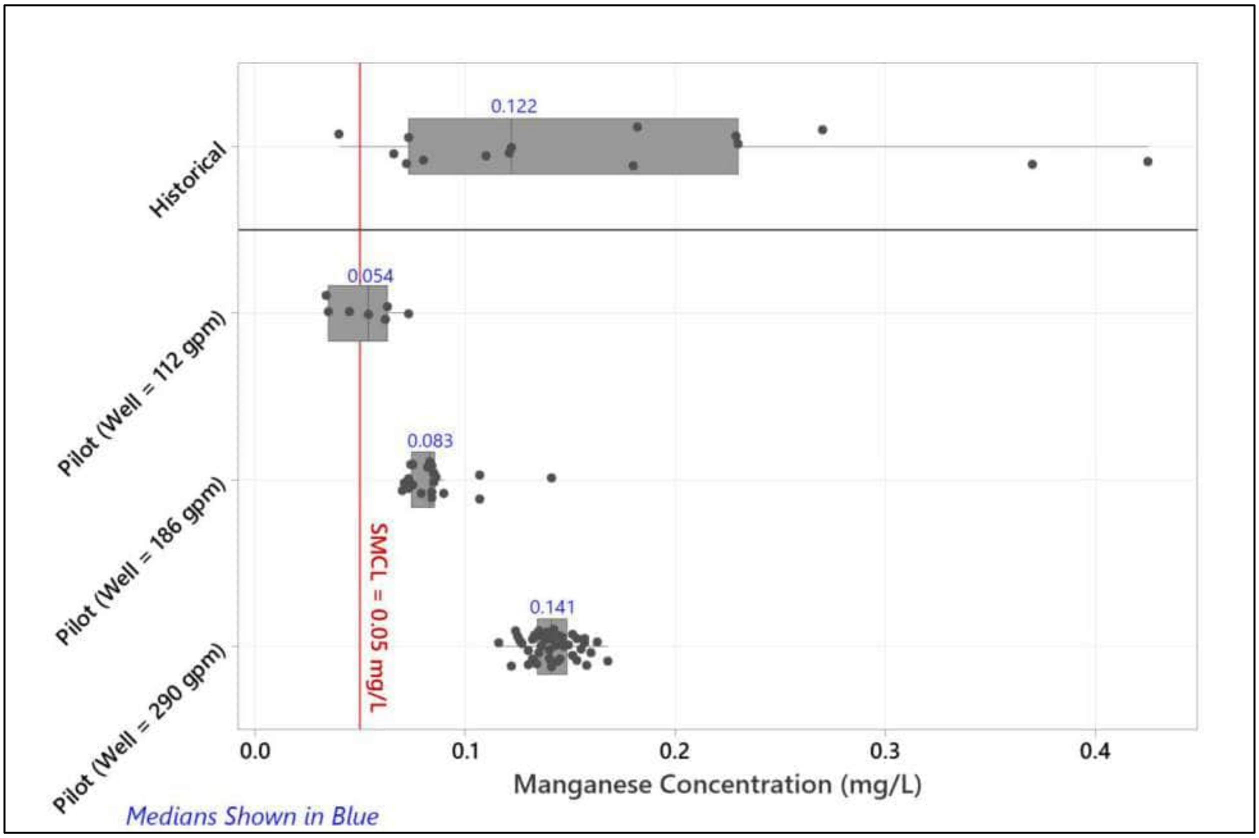


Figure 4.03 shows that the three pilot data sets appear to be different while the historical data spans the full range of pilot data. The median manganese concentration for all four data sets exceeded the SMCL of 0.05 mg/L Mn. An ANOVA was completed to compare the four data sets and the results are presented in Table 4.02.

Table 4.02: ANOVA of Raw Manganese Concentration by Data Source

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Data Source	3	0.1154	0.038471	16.92	0.000
Error	87	0.1979	0.002274		
Total	90	0.3133			

Means

Data Source	N	Mean	StDev	95% CI
Historical	15	0.1713	0.1151	(0.1469, 0.1958)
Pilot (Well = 112)	7	0.05229	0.01487	(0.01646, .08811)
Pilot (Well = 186)	21	0.08529	0.01615	(0.06460,0.10597)
Pilot (Well = 290)	48	0.14167	0.01118	(0.12798, .15535)

Pooled StDev = 0.0476905

Grouping Information Using the Tukey Method and 95% Confidence

Data Source	N	Mean	Grouping
Historical	15	0.1713	A
Pilot (Well = 290)	48	0.14167	A
Pilot (Well = 186)	21	0.08529	B
Pilot (Well = 112)	7	0.05229	B

Means that do not share a letter are significantly different.

The probability value of the ANOVA was 0.000 which indicated that the means are different, and the alternative hypothesis is accepted (0.000 < 0.05(α)). The statistical evaluation indicates that there are statistically significant differences between the data sets.

Table 4.01 also contains a Tukey's Comparison, which groups data sets with statistical similarities. Tukey's identified two statistically different groups. The historical data and the pilot data with the wellfield operating at 290 gpm were statistically similar and included in Group A. The pilot data with the wellfield operating at 112 and 186 gpm were statistically similar and included in Group B.

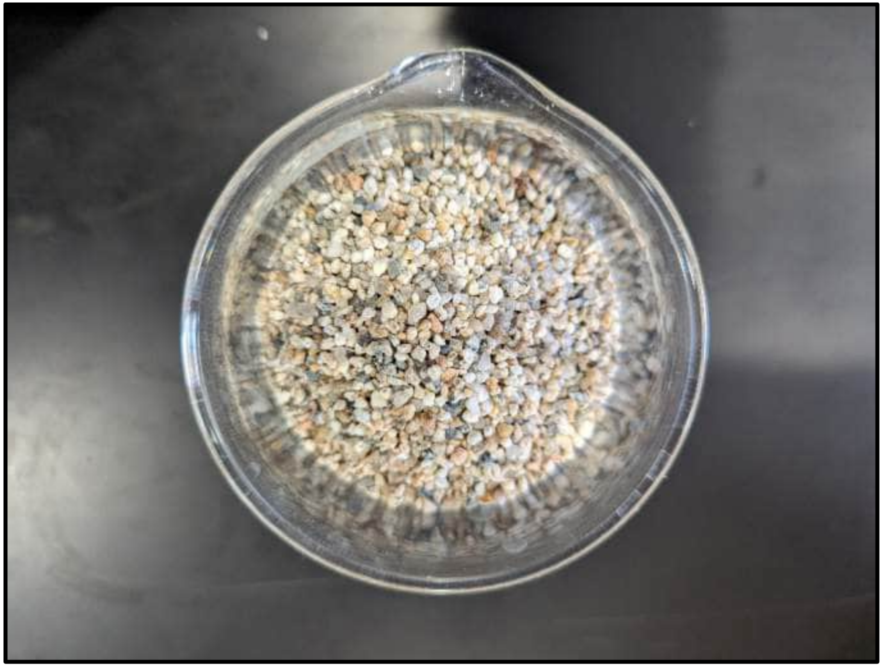
The historical manganese data had a wider range of results than the pilot data but was more similar to the pilot data than the historical iron data was. Dissolved manganese tends to stay in solution more readily than iron and is less likely to produce concentrated slugs during flow disruptions. The pilot study data collected with the wellfield operating at 290 gpm appears to be representative of historical water quality based on statistical analysis.

4.2 BIOLOGICAL FILTRATION

4.2.1 Evaluation of Acclimation Period – Iron Removal Filters

Virgin 1.3 mm sand media was installed in the two iron filters, F1 and F2, at the start of the pilot study. Figure 4.04 is a photo of the virgin media in a beaker.

Figure 4.04: Virgin 1.3 mm Sand Media For Biological Fe Filter in Beaker



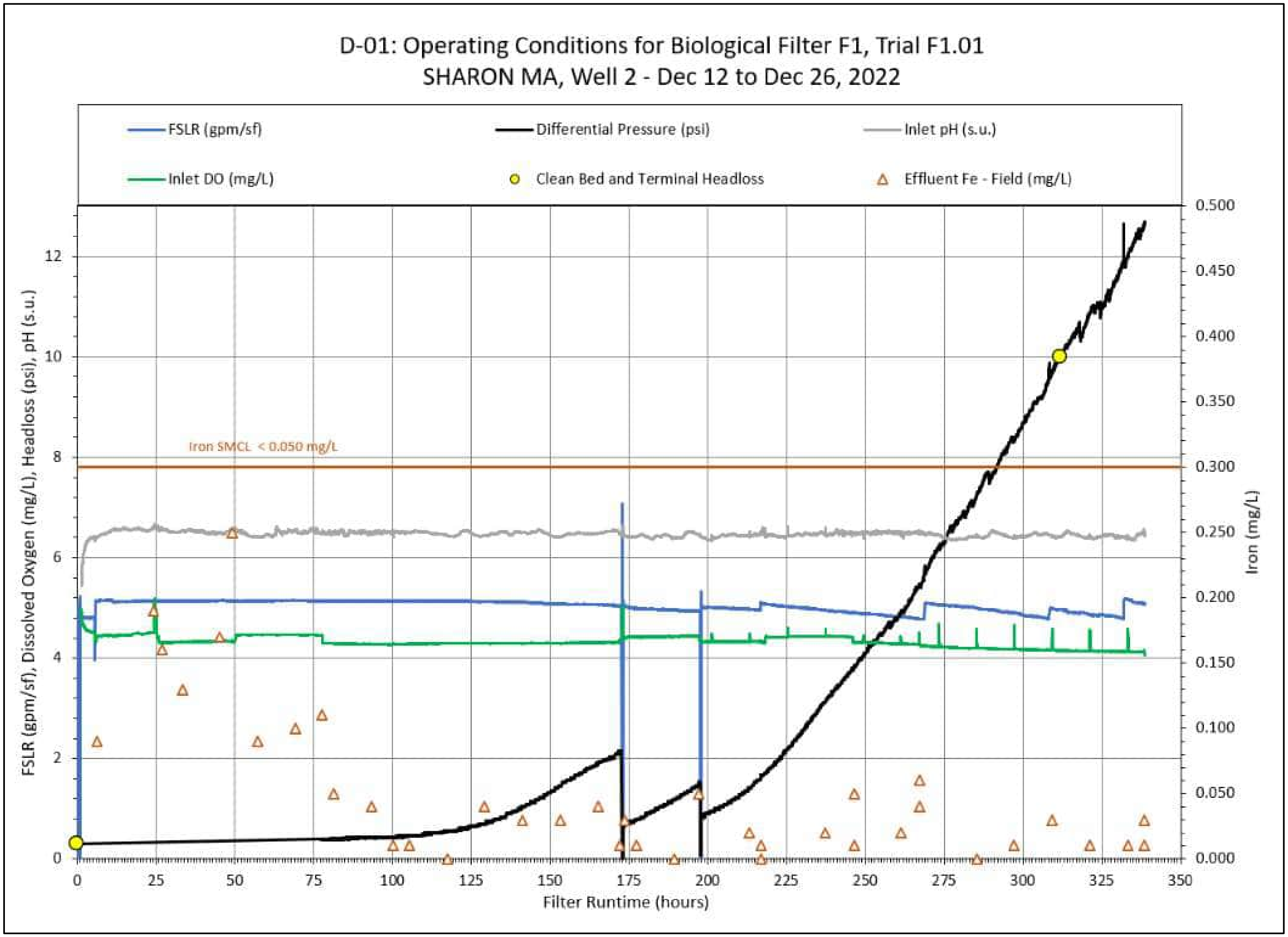
When the virgin media is exposed to the raw groundwater the native iron bacteria accumulate on the media surfaces creating an environment in which the bacteria oxidizes and removes iron.

Virgin media provides surface area for iron removal through a combination of adsorption, bio assimilation and oxidation, precipitation and filtration. The specific removal processes that occur within the biological filter are dependent on the raw water source, the pH and ORP of the water, other water quality parameters and the length of time that the biomass has matured. Iron removal may occur a few days after raw water is first introduced into a new filter, but it is likely that the biomass continues to mature and change over time.

Figure 4.05 is the hydraulic performance figure for Trial F1-1. This figure is also included in Appendix D as Figure D.01. The effluent iron concentrations are plotted as hollow rust-colored triangles. The initial raw iron concentration was near 0.20 mg/L. Figure 4.05 shows a decreasing trend over the course of the first 100 hours of operation where the effluent iron is reduced from 0.2 mg/L to 0.05 mg/L or less. Effluent iron concentrations remained at a similar concentration for the remainder of the pilot study even as the raw iron concentration increased.

The second iron removal filter operating in parallel to Filter F-1 produced a similar trend. The figure for Trial F2-1 is included in Appendix D as Figure D.23 but not shown here.

Figure 4.05: Iron Acclimation Trial – Trial F1-1



4.2.2 Operational History of the Manganese Removal Filters

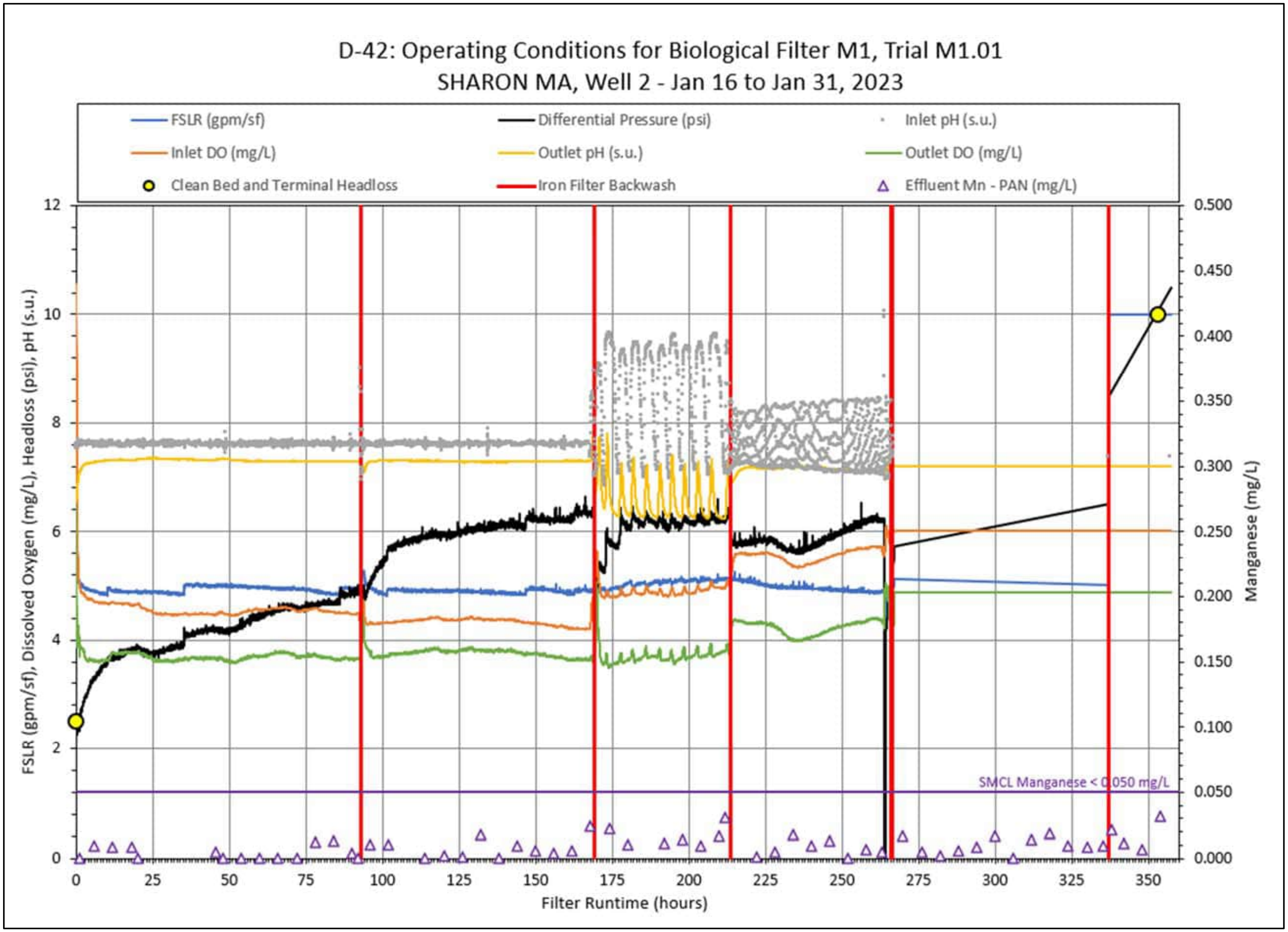
Evaluation of the acclimation period for virgin manganese removal media was not conducted as part of this pilot study. Acclimation of manganese removal filters may take multiple weeks. To decrease the time necessary to acclimate the manganese filter during the pilot study, an acclimated filter was transported and installed into the biological pilot filtration system after the raw water quality was stabilized and acclimation of the iron filters was completed. Confirming effective operation of the iron removal filters allowed the manganese removal filter to be protected from non-representative iron loading.

The manganese removal filter utilized for the Sharon pilot study was acclimated at the Home Farm WTP in Shrewsbury, MA, which is an 8 MGD biological filtration plant. A side stream of full-scale pretreated water was supplied to four 6-inch pilot filters containing 0.95 mm sand media. The pilot filters were monitored and periodically backwashed by Blueleaf personnel. On January 16, 2023, one of the four biological filters was shut down and removed from Shrewsbury and transported to the Sharon pilot site and installed downstream of the biological iron filters.

The biological manganese filter was effective for manganese removal in Sharon on the same day that it was installed. Figure 4.06 is the hydraulic performance figure for Trial M1-1. This figure is also included in Appendix D as Figure D.01. The hollow purple triangles are the effluent manganese concentrations. The raw manganese of 0.13 mg/L is reduced to concentrations well below the SMCL of 0.05 mg/L Mn from the first sample and consistently throughout the pilot study.

The manganese filter media appeared to adapt to the Sharon Wellfield 2 raw water source, to continue to develop a biomass of microorganisms, and to maintain a media coating for adsorption of manganese, but the acclimation and maturation period was not representative of initial acclimation and maturation with virgin media at this site.

Figure 4.06: Manganese Removal Filter - Initial Performance – Trial M1-1



4.2.3 Effectiveness of Biological Filtration for Fe and Mn Removal

This section evaluates iron and manganese through the biological pilot filters. Water quality data which was not representative of normal operation was excluded from the figures and statistical analysis. In particular, the following data was omitted:

- Data from F1.01 and F2.01 because the iron filters were acclimating.
- Data taken in the first 20 minutes after backwashing. This data was collected for the purpose of tracking the recovery of treatment immediately after a backwash.

4.2.3.1 Iron Removal by Biological Filtration

Figure 4.07 is a box plot of the effluent iron data organized by filter.

Figure 4.07: Boxplot of Representative Fe in Biological Filter Effluent by Filter

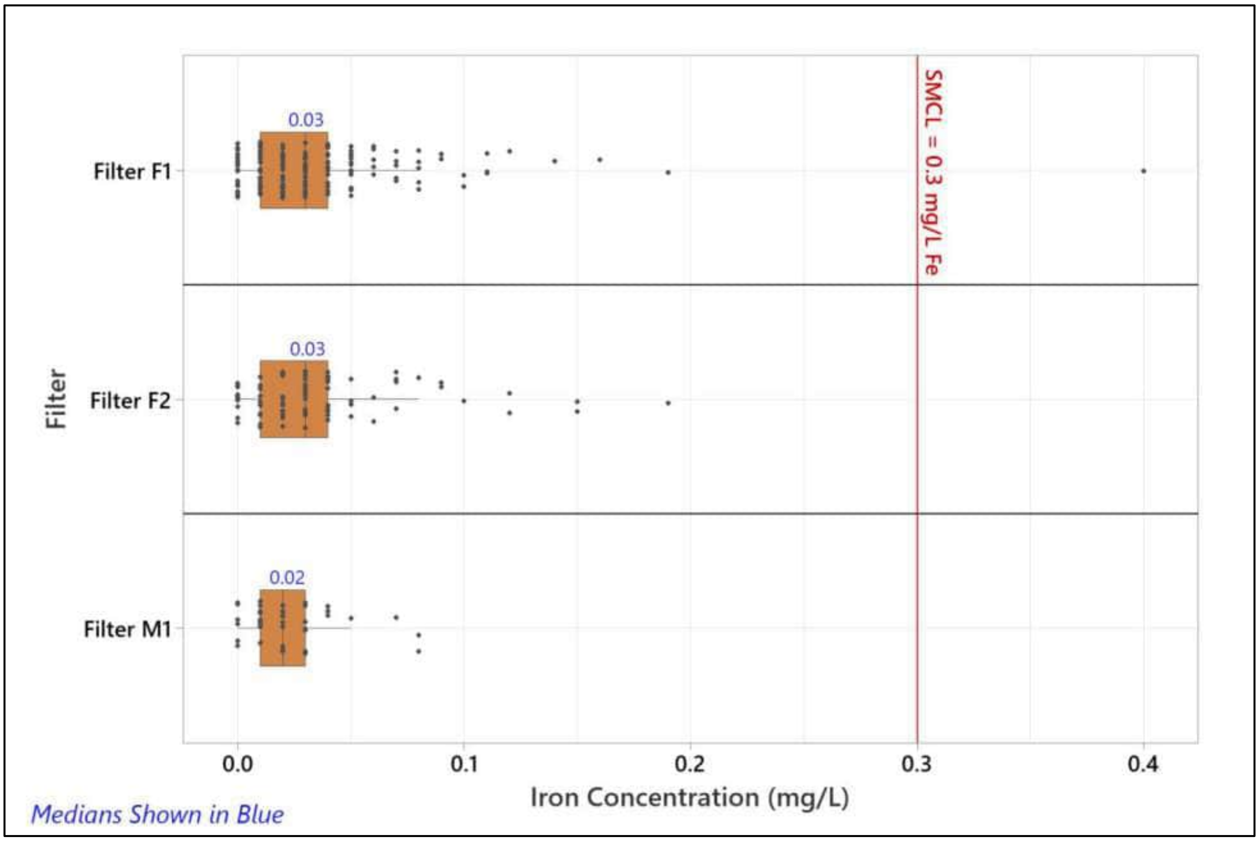


Figure 4.07 shows that the iron removal filters (F1 and F2) removed most of the raw iron. Effluent iron concentrations were predominantly less than half of the SMCL of 0.3 mg/L Fe. A single data point exceeded the limit which was from a sample collected soon after a FSLR increase. The downstream manganese removal filter (M1) further reduced the residual iron, particularly eliminating outliers greater than 0.1 mg/L.

Figures 4.08 plots the same effluent iron data but is grouped by filter surface loading rate in order to evaluate the effect of FSLR on treatment. Filters F1, F2 and M1 operated at some but not all of the same loading rates. Therefore, the figures show some loading rates without boxes where a loading rate was not tested in combination with that filter.

Figure 4.08: Boxplot of Representative Fe in Biological Filter Effluent by FSLR

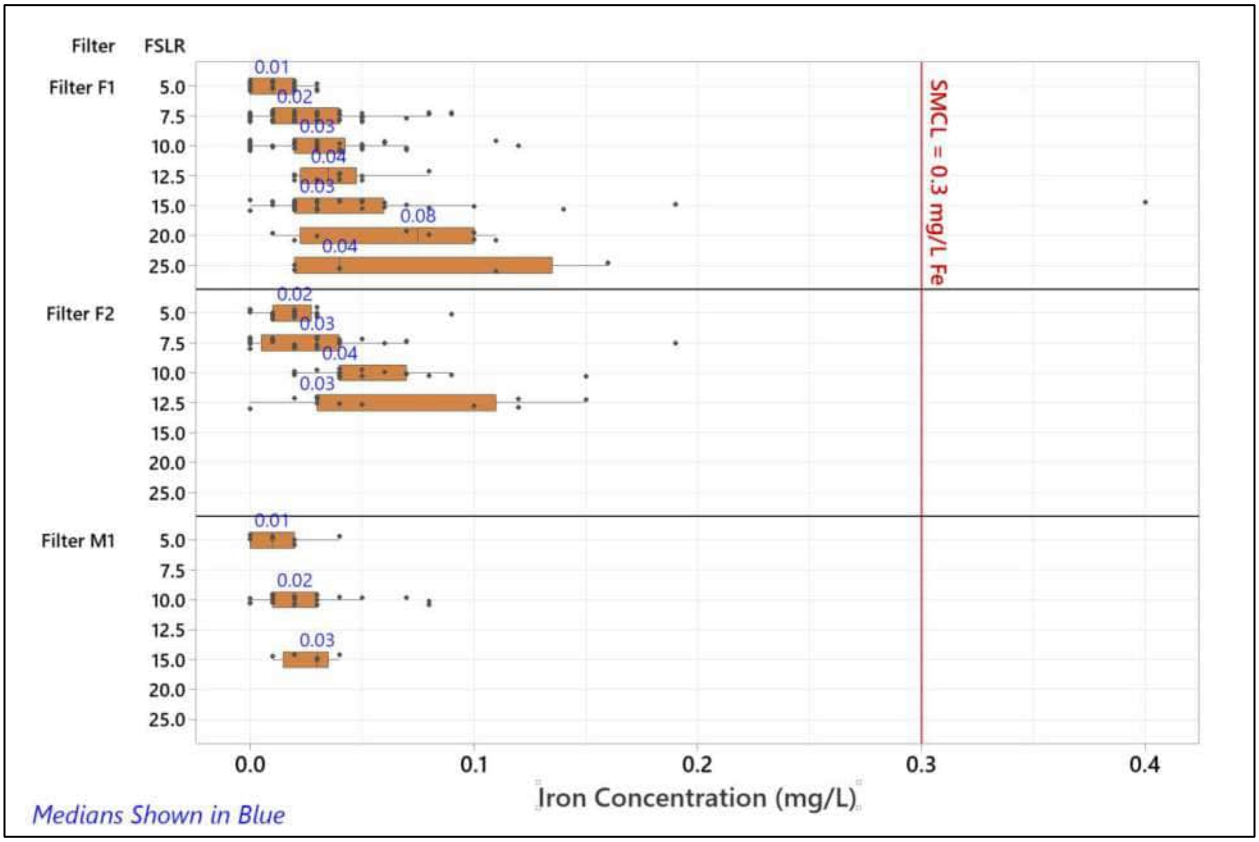


Figure 4.08 shows a general trend in that effluent iron concentrations increase slightly as the FSLR increases. Also apparent is that there is more variability in the range of effluent iron concentrations as the FSLR increases.

To determine if the biological iron removal process met the project goal for iron removal a t-test (Table 4.03) was performed to compare the effluent iron data from the two iron removal filters, F1 and F2, to the pilot study goal of one half the SMCL, or 0.15 mg/L Fe. The data was grouped by FSLR.

Table 4.03: Results of t-test for Effluent Iron by FSLR vs Pilot Study Goal

Descriptive Statistics

Sample	N	Mean	StDev	SE Mean	95% Upper Bound for μ
5	48	0.01542	0.01543	0.00223	0.01915
7.5	90	0.02722	0.02852	0.00301	0.03222
10	61	0.03885	0.02899	0.00371	0.04505
12.5	25	0.04800	0.03697	0.00739	0.06065
15	35	0.0523	0.0715	0.0121	0.0727
20	8	0.0650	0.0396	0.0140	0.0916
25	5	0.0700	0.0624	0.0279	0.1295

μ: population mean of 5, 7.5, 10, 12.5, 15, 20, 25

Test

Null hypothesis H_0: μ = 0.15
Alternative hypothesis H_1: μ < 0.15

Sample	T-Value	P-Value
5	-60.42	0.000
7.5	-40.84	0.000
10	-29.95	0.000
12.5	-13.80	0.000
15	-8.08	0.000
20	-6.06	0.000
25	-2.86	0.023

Results of the t-test (Table 4.03) show that that the iron filter effluent met the project goal with greater than 95% confidence for all seven loading rates tested from 5 to 25 gpm/sf. The 95% upper boundaries (data is highlighted in blue in Table 4.03) are all less than 0.15 mg/L and the p-values (highlighted in yellow) are less than the alpha (α) error rate of 0.05. The 95% upper bound increases with each increase in FSLR from 0.01915 mg/L at a FSLR of 5 gpm/sf to 0.1295 mg/L at a FSLR of 25 gpm/sf.

4.2.3.2 Manganese Removal by Biological Filtration

Figure 4.09 is box plot of the effluent manganese data organized by filter.

Figure 4.09: Boxplot of Representative Mn in Biological Filter Effluent by Filter

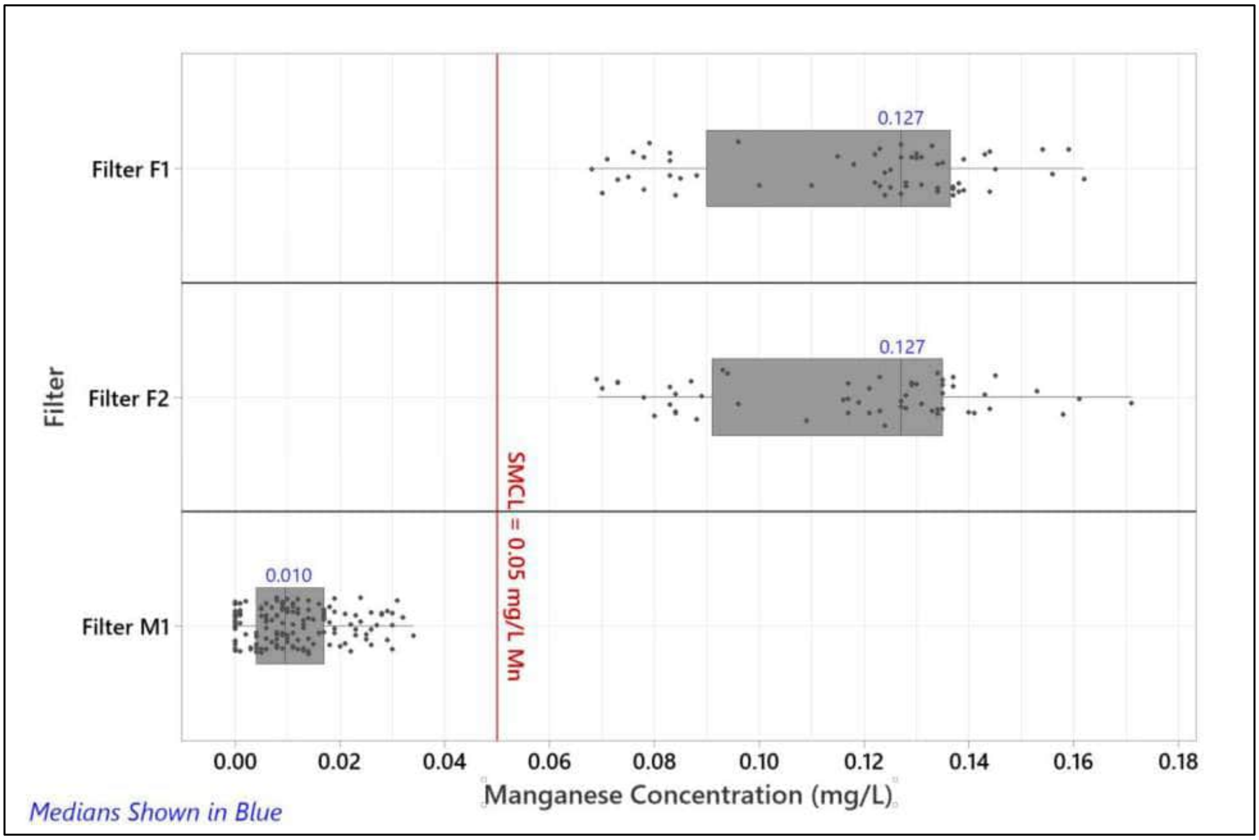
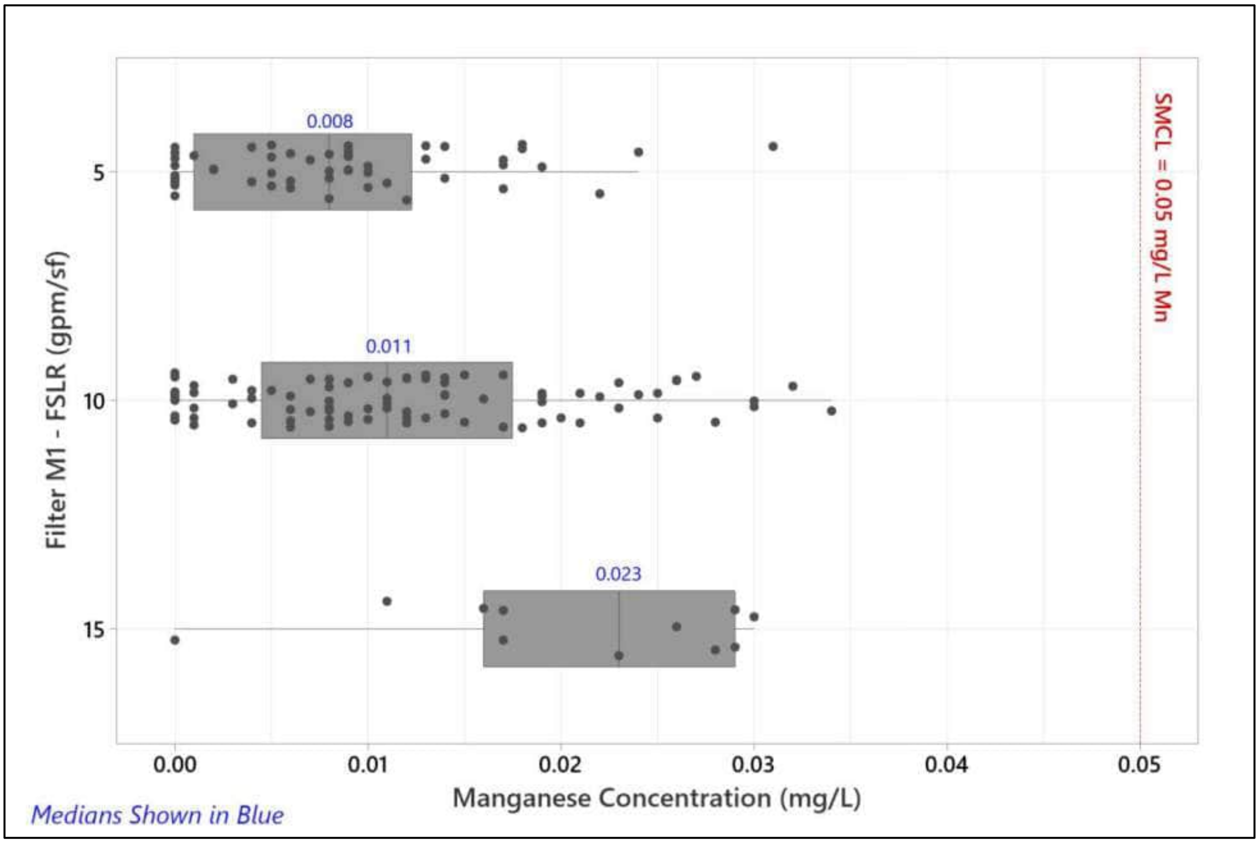


Figure 4.09 shows that most of the raw manganese passed through the biological iron removal filters, Filters F1 and F2, as expected. The figure shows that the effluent manganese data from the manganese removal filter, Filter M1, were all below the SMCL for manganese (Mn < 0.050 mg/L).

Figure 4.10 plots the effluent manganese data from only Filter M1 grouped by filter surface loading rate to evaluate the effect of FSLR on treatment.

Figure 4.10: Boxplot of Representative Mn in Biological Filter Effluent by FSLR



An increase in the median effluent manganese concentration is apparent with each increase in loading rate without exceeding the regulatory limit.

To determine if the process met the project goal for total manganese, a t-test was performed comparing effluent manganese concentrations from Filter M1 to the pilot study goal of one half the SMCL, or 0.025 mg/L Fe. The data was grouped by FSLR.

Table 4.04: Results of t-test for Effluent Manganese by FSLR vs Pilot Study Goal

Descriptive Statistics

Sample	N	Mean	StDev	SE Mean	95% Upper Bound for μ
5	54	0.008056	0.007175	0.000976	0.009690
10	89	0.011618	0.008830	0.000936	0.013174
15	11	0.02055	0.00940	0.00283	0.02568

μ: population mean of 5, 10, 15

Test

Null hypothesis	H_0: μ = 0.025
Alternative hypothesis	H_1: μ < 0.025

Sample	T-Value	P-Value
5	-17.35	0.000
10	-14.30	0.000
15	-1.57	0.073

Results of the t-test (Table 4.03) show that that the manganese filter effluent met the project goal with greater than 95% confidence when operating at 5 and 10 gpm/sf. The 95% upper boundaries (data is highlighted in blue in Table 4.03) are less than 0.025 mg/L and the p-values (highlighted in yellow) are less than the alpha (α) error rate of 0.05.

When Filter M1 was operating at 15 gpm/sf the 95% upper bound slightly exceeded the goal of 0.025 mg/L. The p-value also exceeded the error rate of 0.05.

The 95% upper bound increases with each increase in FSLR from 0.00969 mg/L at a FSLR of 5 gpm/sf to 0.02568 mg/L at a FSLR of 25 gpm/sf.

4.2.4 Effectiveness of Biological Filtration for Nitrate Removal

Due to the presence of nitrate in the Sharon Wellfield 2 raw water, nitrate removal was monitored during the pilot study. The raw nitrate measured by field and lab analyses is summarized in Table 4.05.

Table 4.05: Summary of Raw Nitrate Concentrations in Wellfield 2

Data Source	Nitrate (mg/L)
Field Data - Hach NitraVer®5 Method	**2.8** (0.5-4.2) [26]
Lab Data – Phoenix Environmental Labs	**3.59** (3.51-4.05) [5]

Figure 4.11 is a box plot of nitrate concentrations as measured by field analyses during the pilot study. The data is grouped by raw Wellfield 2, iron removal filter effluent, and manganese filter effluent.

Figure 4.11: Box Plot of Nitrate Concentrations From Field Analyses Thru Biological Filtration Process

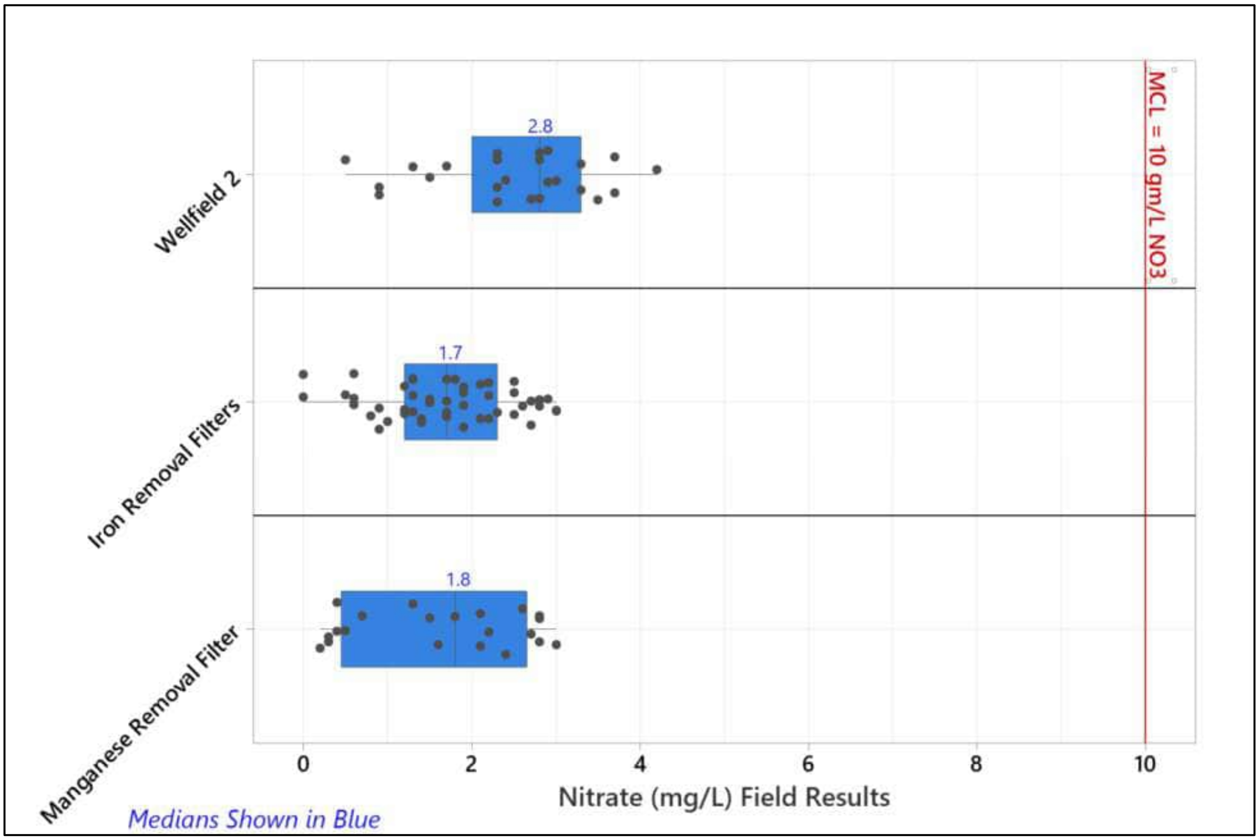
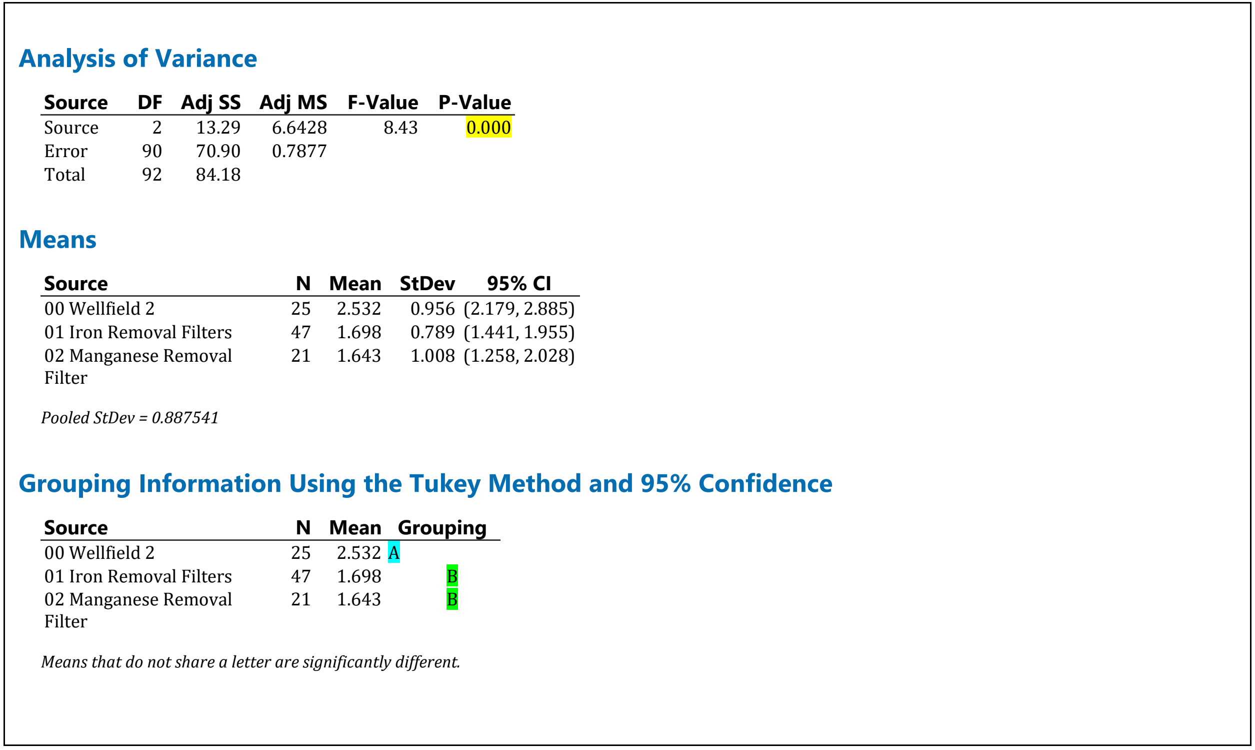


Table 4.06 is an ANOVA of the nitrate data shown in Figure 4.11.

Table 4.06: ANOVA of Field Nitrate Concentrations by Sample Source using Field Methods



Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Source	2	13.29	6.6428	8.43	0.000
Error	90	70.90	0.7877		
Total	92	84.18			

Means

Source	N	Mean	StDev	95% CI
00 Wellfield 2	25	2.532	0.956	(2.179, 2.885)
01 Iron Removal Filters	47	1.698	0.789	(1.441, 1.955)
02 Manganese Removal Filter	21	1.643	1.008	(1.258, 2.028)

Pooled StDev = 0.887541

Grouping Information Using the Tukey Method and 95% Confidence

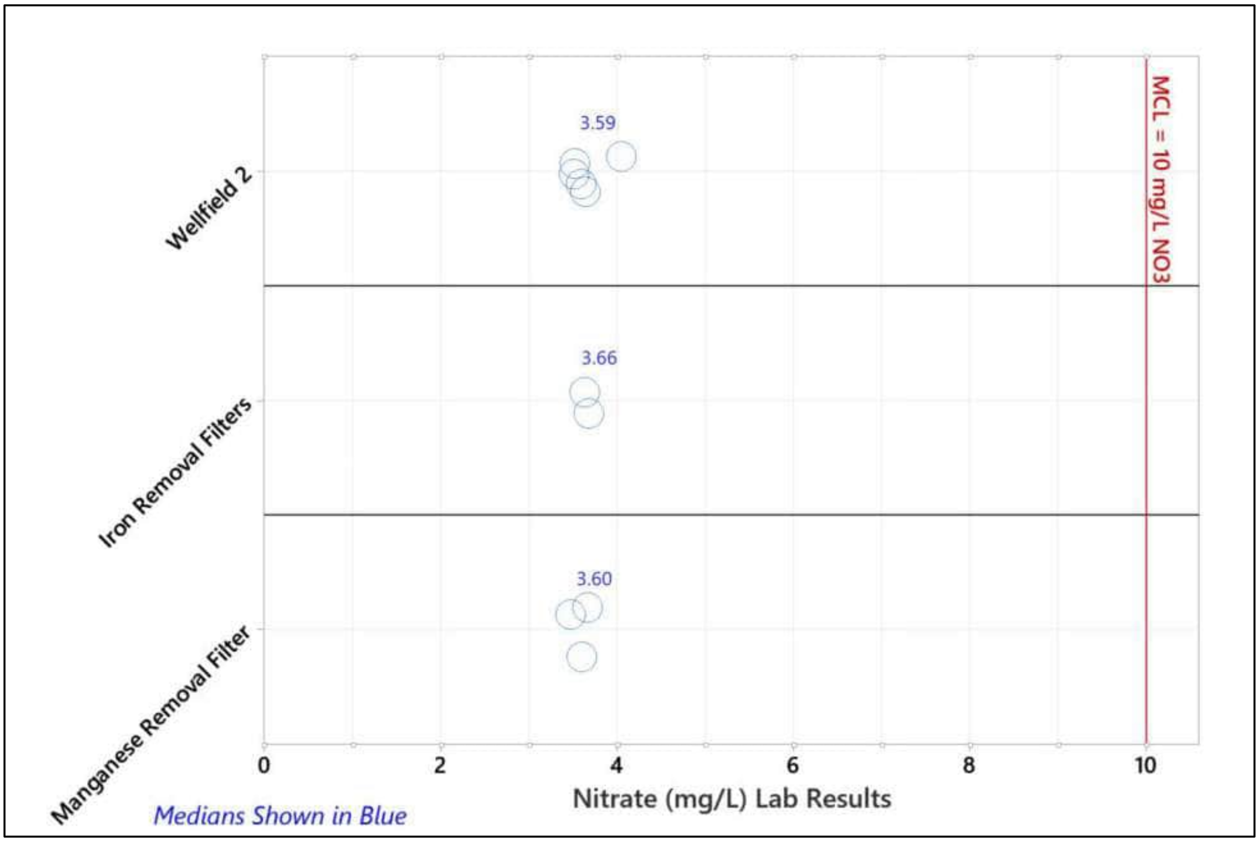
Source	N	Mean	Grouping	
00 Wellfield 2	25	2.532	A	
01 Iron Removal Filters	47	1.698		B
02 Manganese Removal Filter	21	1.643		B

Means that do not share a letter are significantly different.

Figure 4.11 shows that nitrate removal when using field methods for analyses was 0.89 mg/L or 35%. The average raw nitrate was 2.53 mg/L and the effluent nitrate was 1.64 mg/L. The low p-value (0.000) indicates that there is a statistical difference between some of the sources. The fact that the Wellfield 2 data and final manganese removal filter effluent are in different Tukey groupings (A and B) means that the data sets are statistically different (i.e. there is some reduction in nitrate).

Figure 4.12 is an individual values plot of the nitrate concentrations as measured by lab samples during the pilot study.

Figure 4.12: Individual Values Plot of Nitrate Laboratory Results Thru Biological Filtration Process



The lab data in Figure 4.12 show no removal through the biological filtration process. The lab data is much less variable than the field data. The field data ranged from 0.0 to 4.2 mg/L during the study while the lab results were consistently near 3.6 mg/L for all sample sites.

4.2.5 Filter Runtime vs Loading Rate

Filter runtimes were a function of the filter surface loading rate and the solids loading onto the media. Contaminant breakthrough was not observed in any biological iron or manganese trial. Filter run times were limited by headloss for this process, with 10 psid used as the typical terminal headloss threshold.

To estimate the relationship between Filter Surface Loading Rate and runtime, each Filter Performance Figure in Appendix D was considered. Data from trials which were not representative or did not reach terminal headloss were excluded from runtime analysis. Two trials were also not used where the data logger had failed and continuous headloss data was unavailable. Table 4.07 presents the data that was used for analysis in this section.

Table 4.07: Filter Trial Data used to Evaluate Biological Filter Runtimes

Trial	FSLR (gpm/sf)	Clean Bed Headloss (psi)	Observed Runtime to 10 psid (hours)	Rate of Headloss Development (psi/hr)	Used in Figures 4.13 and 4.14
F1.01	5.07	0.30	260	0.0373	No – Acclimation Trial
F1.02	7.42	0.70	98	0.0949	Yes
F1.03	7.45	2.00	38	0.2083	No – Fe Slug @ Flow Increase
F1.04	4.96	0.80	81	0.1141	Yes
F1.05	4.96	0.80	80	0.1150	Yes
F1.06	7.44	1.20	66	0.1333	Yes
F1.07	7.46	1.40	70	0.1229	Yes
F1.08	7.51	1.10	N/A	N/A	No – Terminated Before THL
F1.09	12.47	1.55	58	0.1470	Yes
F1.10	12.5	N/A	N/A	N/A	No - Data Logger Not Recording
F1.11	15	N/A	N/A	N/A	No - Data Logger Not Recording
F1.12	7.51	1.10	99	0.0904	Yes
F1.13	14.43	2.40	44	0.1747	Yes
F1.14	14.53	1.80	55	0.1483	Yes
F1.15	26.32	6.40	14	0.2571	Yes
F1.16	15.21	4.00	N/A	N/A	No – Terminated Before THL
F1.17	17.51	4.40	4	1.3023	No – Poor Flow Control
F1.18	15.19	3.70	35	0.1780	Yes
F1.19	20.09	3.70	28	0.2291	Yes
F1.20	20.09	3.50	33	0.1949	Yes
F1.21	15.07	2.60	47	0.1580	Yes
F1.22	10.02	1.80	64	0.1281	Yes
F1.23	10.08	1.80	71	0.1163	Yes
F1.24	10.08	2.00	68	0.1176	Yes

Table 4.07b: Filter Trial Data used to Evaluate Biological Filter Runtimes (continued)

Trial	FSLR (gpm/sf)	Clean Bed Headloss (psi)	Observed Runtime to 10 psid (hours)	Rate of Headloss Development (psi/hr)	Used in Figures 4.13 and 4.14
F2.01	5.06	0.30	267.0	0.0363	No – Acclimation Trial
F2.02	7.57	0.70	98.5	0.0944	Yes
F2.03	7.56	2.20	34.0	0.2294	No – Fe Slug @ Flow Increase
F2.04	5.03	0.65	90.0	0.1039	Yes
F2.05	5.08	0.80	108.0	0.0852	Yes
F2.06	7.62	1.05	79.5	0.1126	Yes
F2.07	7.62	1.20	73.0	0.1205	Yes
F2.08	7.64	0.90	94.0	0.0968	Yes
F2.09	7.5	N/A	N/A	N/A	No - Data Logger Not Recording
F2.10	12.5	N/A	N/A	N/A	No - Data Logger Not Recording
F2.11	7.63	0.70	93.2	0.0998	Yes
F2.12	12.72	1.60	45.5	0.1846	Yes
F2.13	12.81	1.45	55.0	0.1555	Yes
F2.14	12.93	2.00	37.0	0.2162	Yes
F2.15	12.60	1.65	36.8	0.2269	Yes
F2.16	12.85	1.50	54.3	0.1565	Yes
F2.17	12.83	1.80	52.5	0.1562	Yes
F2.18	12.80	2.00	56.1	0.1426	Yes
F2.19	10.17	1.80	66.0	0.1242	Yes
F2.20	10.20	1.70	68.1	0.1219	Yes
F2.21	10.19	2.00	64.0	0.1250	Yes
M1.01	4.93	2.50	337.0	0.0178	Yes
M1.02	9.99	1.00	365.0	0.0247	Yes
M1.03	10.03	1.60	365.0	0.0230	Yes
M1.04	14.52	2.00	N/A	N/A	No – Terminated Before THL

Figures 4.13 and 4.14 plot the observed runtimes to 10 psid against FSLR. There were 34 representative filter trials for the iron removal filters and 3 representative trials for the manganese removal filters. The manganese filter trials operated for much longer periods than the iron filters trials.

Figure 4.13: Filter Runtime versus Filter Surface Loading Rate for Biological Iron Filters at Sharon Wellfield 2

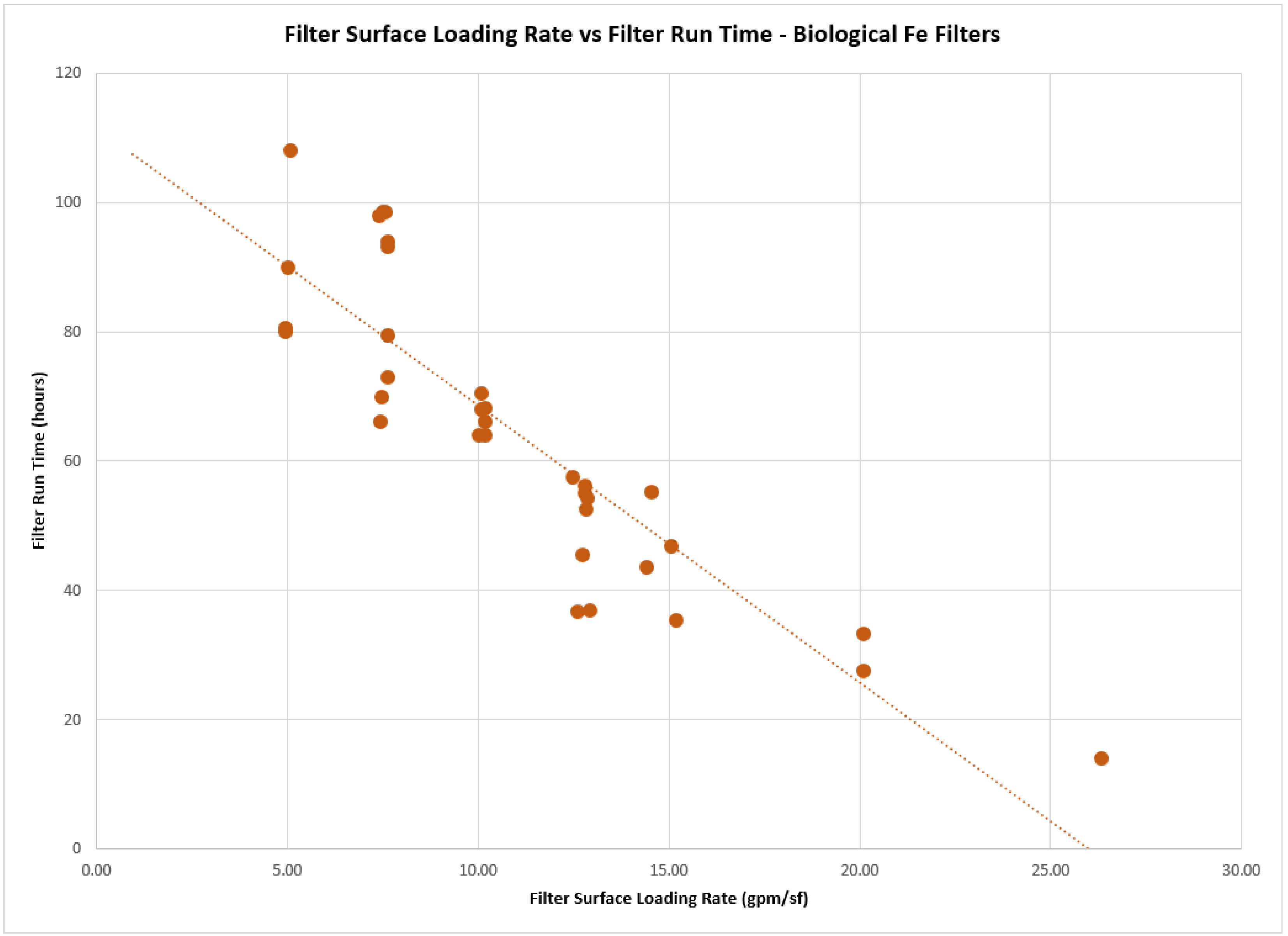
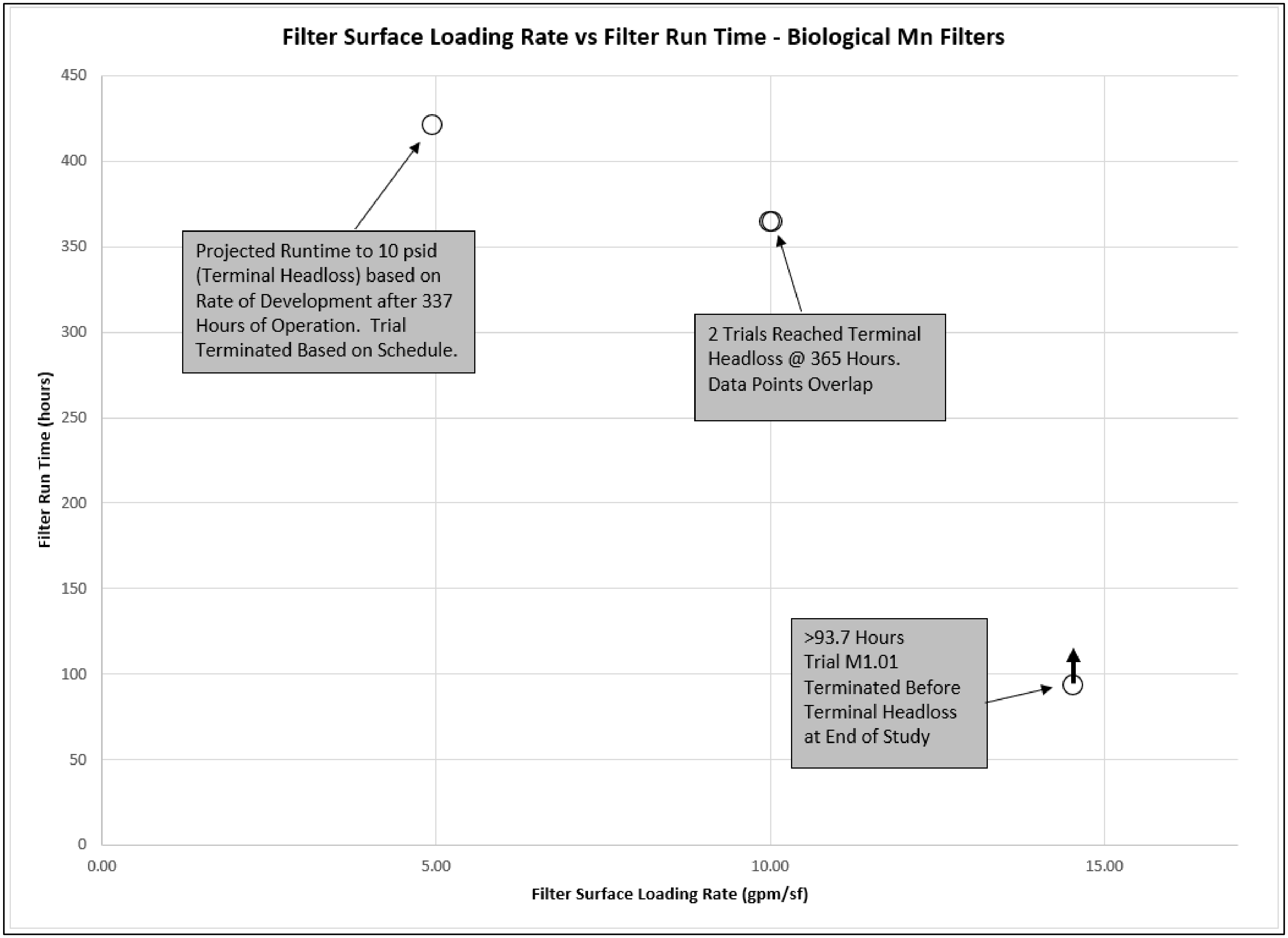


Figure 4.14: Filter Runtime versus Filter Surface Loading Rate for Biological Manganese Filters at Sharon Wellfield 2



Projected Runtime to 10 psid (Terminal Headloss) based on Rate of Development after 337 Hours of Operation. Trial Terminated Based on Schedule.

2 Trials Reached Terminal Headloss @ 365 Hours. Data Points Overlap

>93.7 Hours Trial M1.01 Terminated Before Terminal Headloss at End of Study

Figure 4.13 displays the relationship between FSLR and filter run times for the iron removal filters. Filter runtimes decrease with increased FSLR as expected. A linear line of best fit is plotted to provide a tool for predicting expected filter run times at various loading rates. Filter run times ranged from approximately 90 hours at 5 gpm/sf to near 30 hours at 20 gpm/sf.

Figure 4.14 displays the relationship between FSLR and filter run times for the manganese removal filters. The runtime for the trial operated at 5 gpm/sf was projected to 421 hours after the loading rate was increased. The loading rate increase was necessary to proceed with evaluation of other loading rates during the allotted pilot schedule. Two trials conducted at 10 gpm/sf both operated for 365 hours until reaching terminal headloss. The final trial was operated at 15 gpm/sf and was terminated after 97 hours at the end of the study. The headloss was relatively low at termination and a run time projection could not be made. Filter runtimes at 5 and 10 gpm exceeded two weeks.

The rate of headloss in the manganese removal filters typically increased gradually but some marked steps were apparent at periodic intervals when the hydraulic performance data was plotted. These steps line up with iron filter backwashes which are also plotted on the figures. This appears to indicate that there was some carryover of iron after an iron filter backwash while the filter recovered. This post backwash iron loading to the manganese filter increased headloss. This indicated that the manganese filter would benefit from a filter to waste period for upstream iron filters which would further increase run times.

4.2.6 Backwash Recovery Period (Filter-to-waste duration)

Filter effluent water quality was monitored immediately following most biological filter backwashes. This data was collected for evaluation of the backwash recovery period and was not included in the evaluation of the effectiveness of treatment.

Iron concentrations in the iron removal filter effluent after filter backwash events were tracked up to 20 minutes after restarting a filter. Similarly, manganese concentrations were tracked in the manganese filter effluent after backwashing. Figure 4.15 plots the iron and manganese concentrations after filter restart. The horizontal axis is filter run time after restarting. The left vertical axis plots iron concentrations for Filters F1 and F2 and the right vertical axis plots manganese concentrations for Filter M1.

Figure 4.15: Effluent Iron and Manganese Concentrations After Backwash

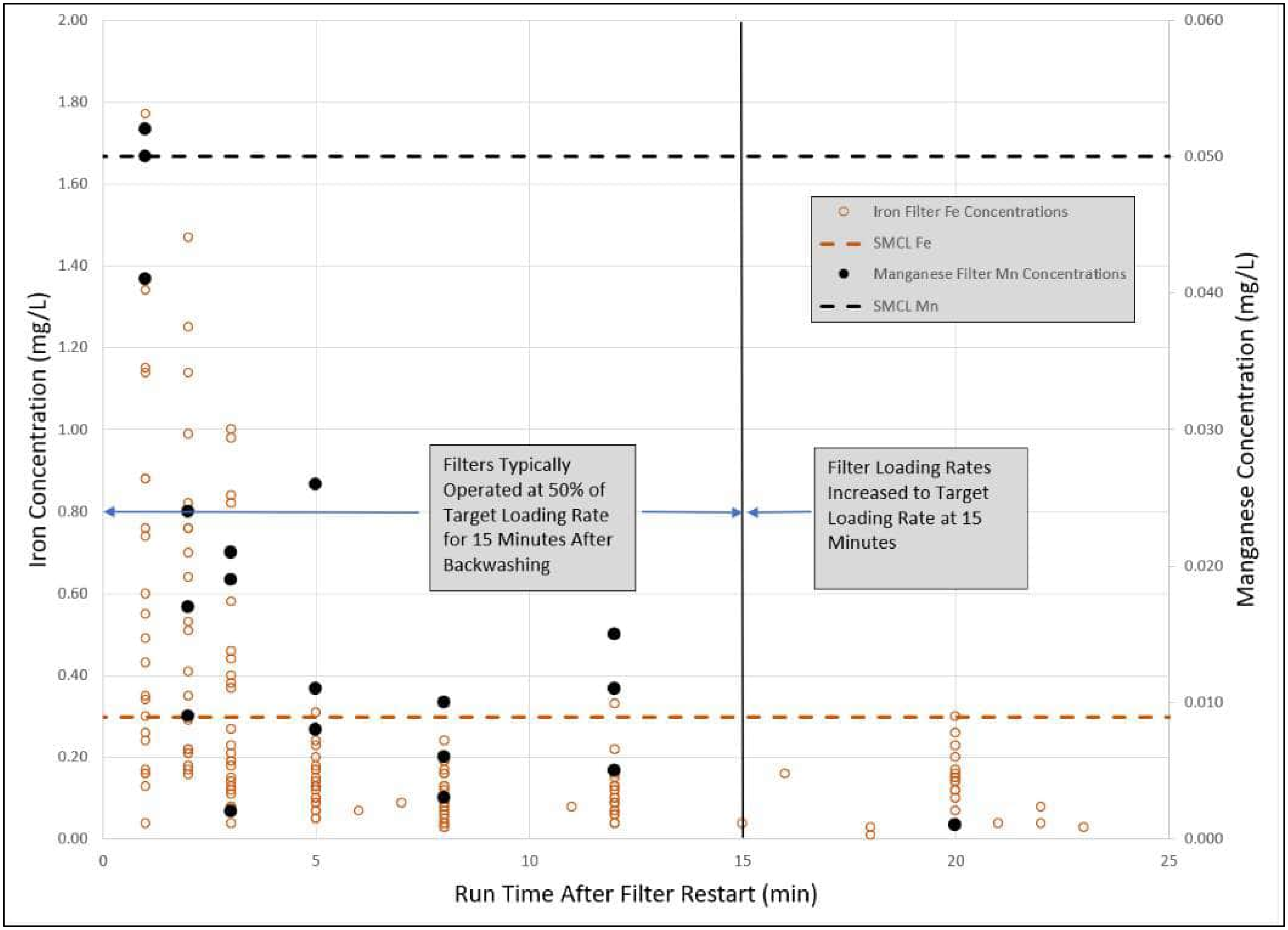


Figure 4.15 shows that the iron concentration was reduced to less than the SMCL of 0.3 mg/L Fe in the iron removal filters after 5 minutes of operation.

The manganese concentration is reduced to less than the SMCL of 0.05 mg/L Mn after one minute of operation.

4.2.7 Supernatant Recycle Performance

Biological filter backwash water was collected and stored in a 200-gallon settling tank during the pilot study. The collected backwash water was predominantly from the iron removal filter (Filters F1 and F2) because there were two iron removal filters and a single manganese removal filter. Iron removal filters were also backwashed more frequently than the manganese removal filter. The blended backwash water had a higher fraction of iron filter backwash water than would a likely full-scale composite backwash sample.

On March 1, 2023, the settled supernatant from the settling tank was pumped into the pilot influent stream at a 5% feed rate for 6.1 hours from 10:43 am until 14:48 pm. Field samples were collected at 30-minute intervals.

The influent to the pilot system and the effluent from the pilot system were both monitored to evaluate the impact of recycling supernatant into the biological process. In both cases samples were collected prior to starting the supernatant feed, samples were collected while the supernatant was added, and samples were collected after the supernatant feed was stopped. An analysis of the pilot feed is included in Section 4.2.7.1 and an analysis of the filter effluent is included in Section 4.2.7.2.

4.2.7.1 Comparison of Biological Pilot Influent with and without 5% Supernatant Recycle

The pilot influent iron and manganese concentrations were compared using data from the pre-recycle period, during the recycle period, and post-recycle period. The recycle period occurred during Trials F1.22, F2.19, and M1.03. Because each of the ongoing trials were started and terminated at different times the raw data was for the longest of the three trials, M1.03, was used for the pilot influent comparison.

Figure 4.16 is a box plot of the pilot influent iron concentrations before, during, and after the recycle period and Figure 4.17 plots the pilot influent manganese concentrations.

Figure 4.16: Influent Iron Concentrations Before, During, and After the Recycle Period

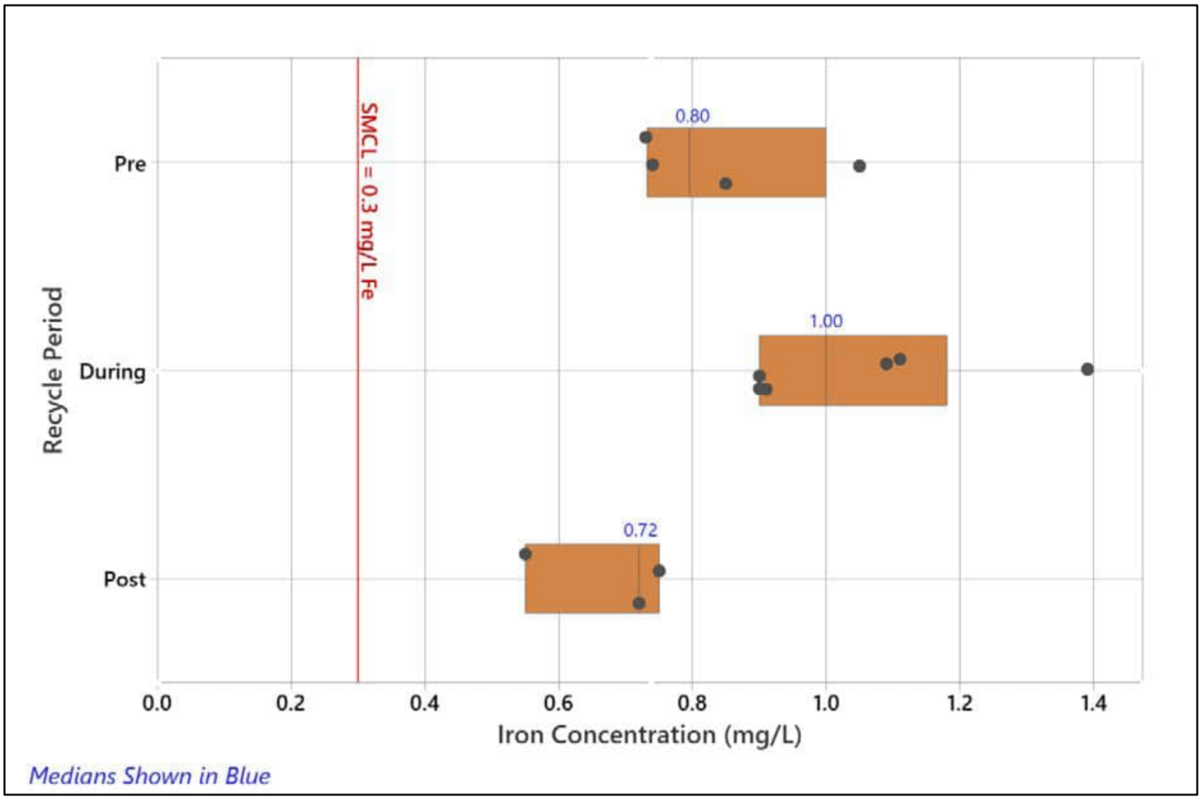


Figure 4.17: Influent Manganese Concentrations Before, During, and After the Recycle Period

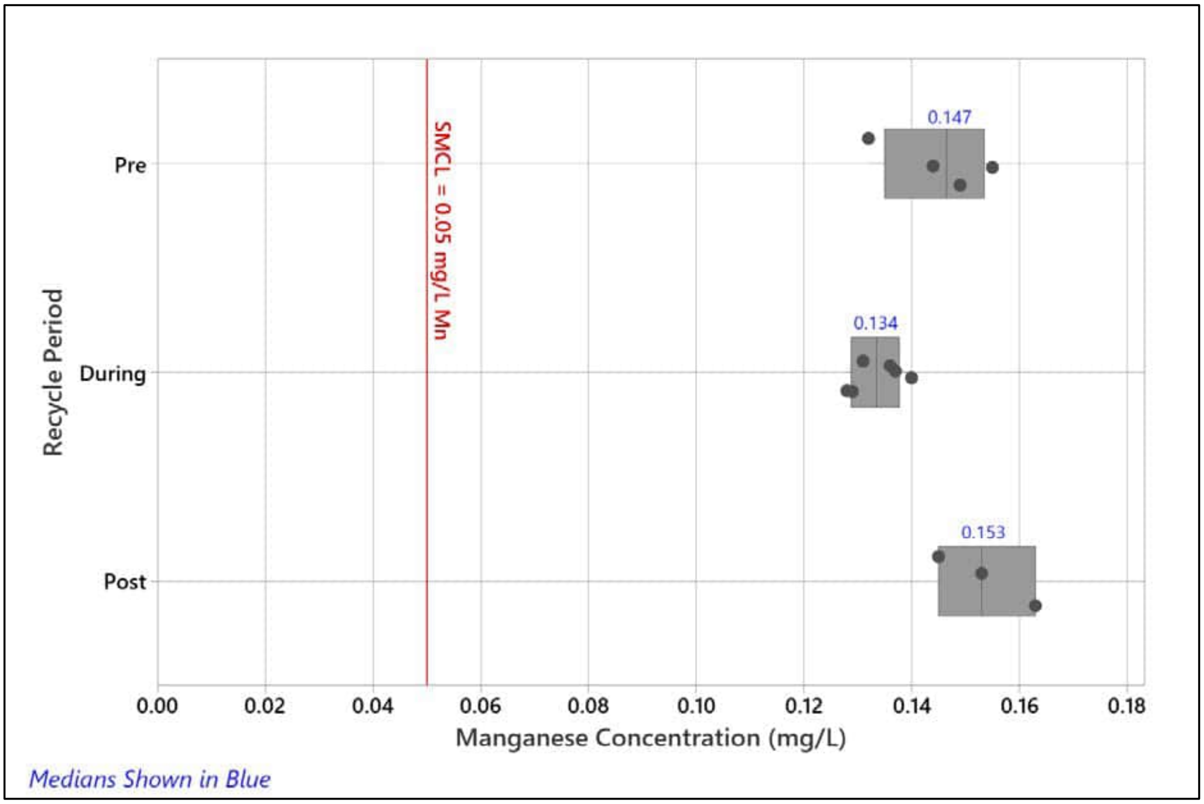


Figure 4.16 shows that the influent iron concentrations appeared to increase during the supernatant recycle period, while Figure 4.17 shows that the influent manganese concentrations appeared to decrease during the recycle period. This may be due to the fact that the stored backwash water was predominantly from iron backwashes and therefore contained more iron solids than manganese solids.

A lab sample of raw water and a sample of the pilot influent with recycle were collected during the recycle trial on March 1st.

Table 4.08: Lab Result Comparison of Fe and Mn for Raw Water with 5% Recycle

Parameter	Lab Report # CN52088	
	03/01/2023	
	Raw Water	Raw + 5% Recycle
Total Iron (mg/L)	0.802	1.44
Total Manganese (mg/L)	0.161	0.155

Table 4.08 indicates a similar result to the field analyses with an increase in iron concentration and a decrease in manganese concentration in the pilot influent with 5% supernatant recycle.

4.2.7.2 Comparison of Biological Pilot Effluent with and without 5% Supernatant Recycle

The pilot effluent iron and manganese concentrations were similarly compared using data from the pre-recycle period, during the recycle period, and post-recycle period.

Figure 4.18 is a box plot of the pilot effluent iron concentrations before, during, and after the recycle period and Figure 4.19 plots the pilot effluent manganese concentrations.

Figure 4.18: Total Fe Concentrations in Fe and Mn Filter Effluent During Supernatant Recycle Trials

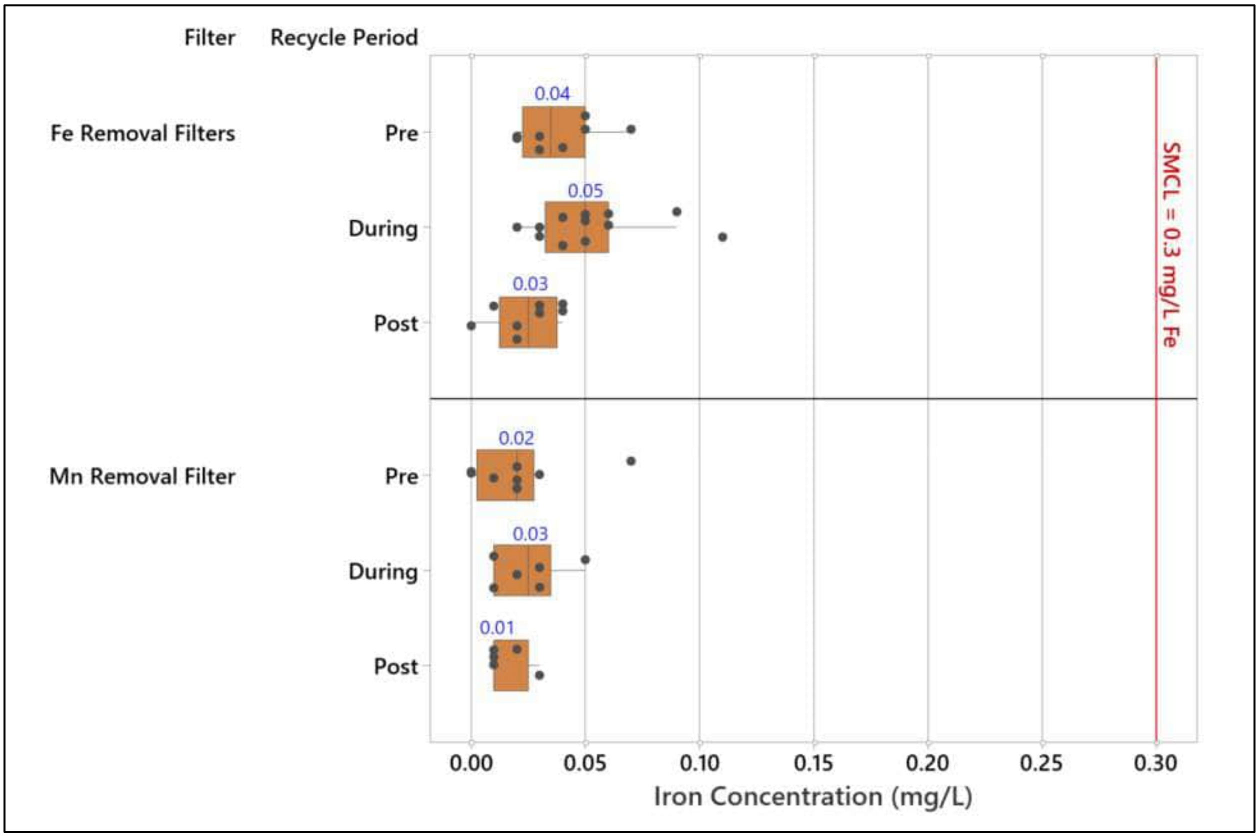


Figure 4.18 shows that the box plot and median iron effluent iron concentrations during the recycle period were slightly increased during the recycle trial compared with the data from before and after. This is shown for both the iron and manganese removal filters. The difference in the median concentrations is slight (0.01 mg/L) and not of practical significance. All data was less than the pilot study goal of 0.15 mg/L (half of the SMCL). The elevated iron concentration in the pilot influent during the recycle period was effectively removed to below the SMCL and the pilot study goal during supernatant recycle.

Figure 4.19: Box Plot of Mn Concentrations in Mn Filter Effluent During Supernatant Recycle Trials

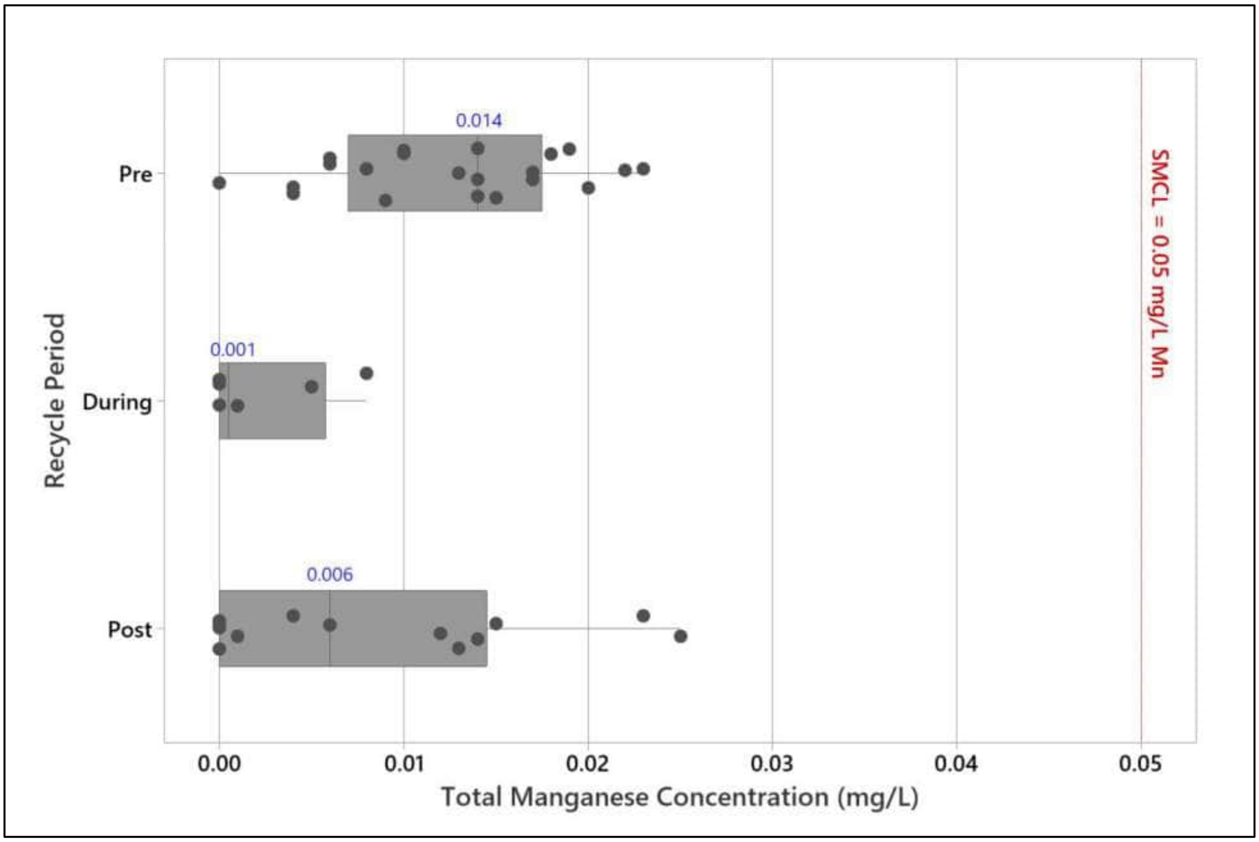
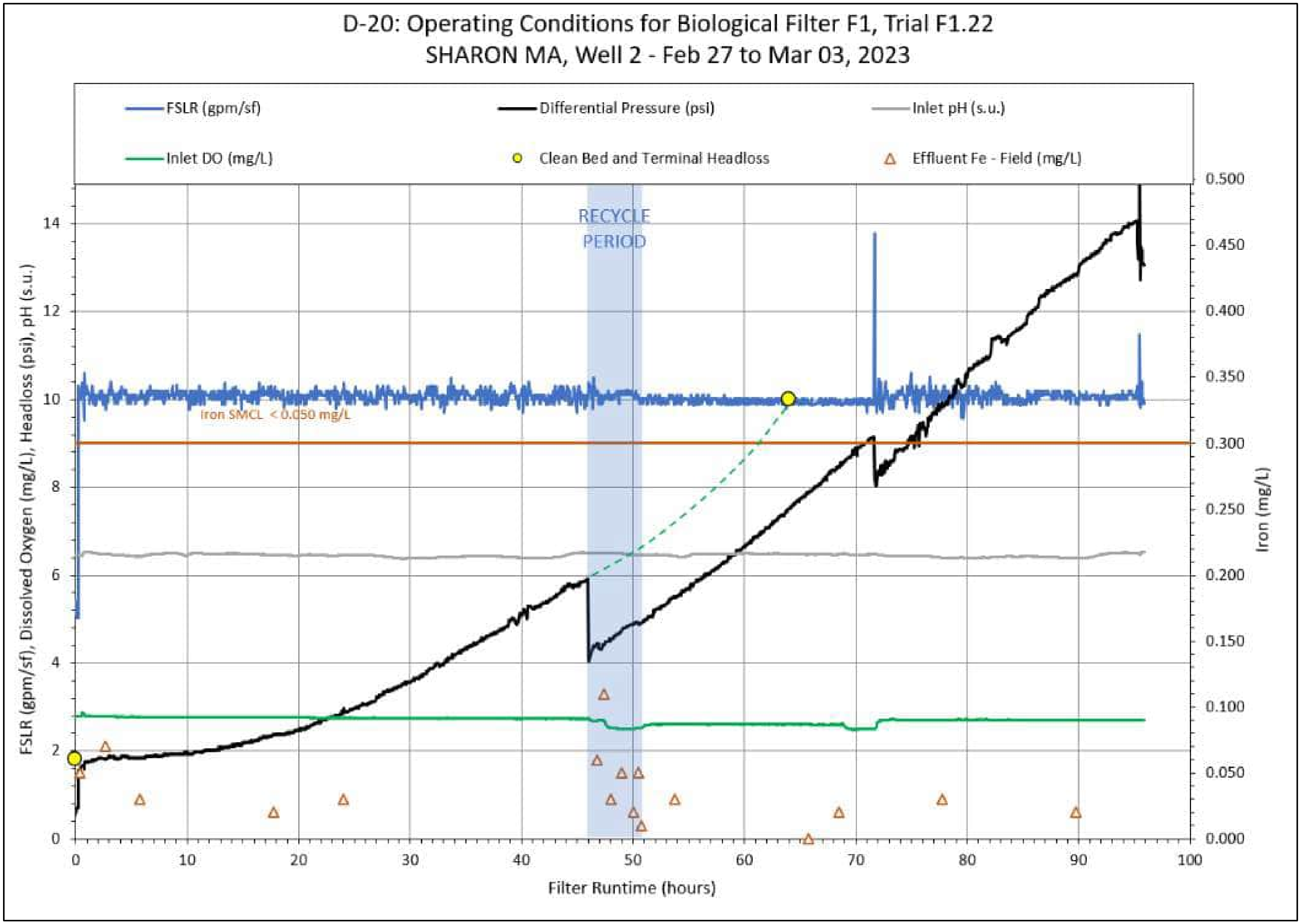


Figure 4.19 plots only the manganese removal filter effluent data as the influent manganese passes through the iron removal filters without any appreciable removal. Figure 4.19 shows that the box plot and the median effluent manganese concentrations during the recycle period were slightly decreased compared with the data from before and after. This is likely due to decrease in the pilot influent manganese concentration during the recycle period. All data was less than the pilot study goal of 0.025 mg/L (half of the SMCL).

Figure 4.20 is the filter performance figure for Trial F1.22 also included in Appendix D on page D-20. Figure 4.21 is the filter performance figure for Trial M1.03 also included in Appendix D on page D-44. The figures are included here for visual comparison of the rate of headloss accumulation during the recycle period. The recycle period is shown as the area with blue shading on the two figures.

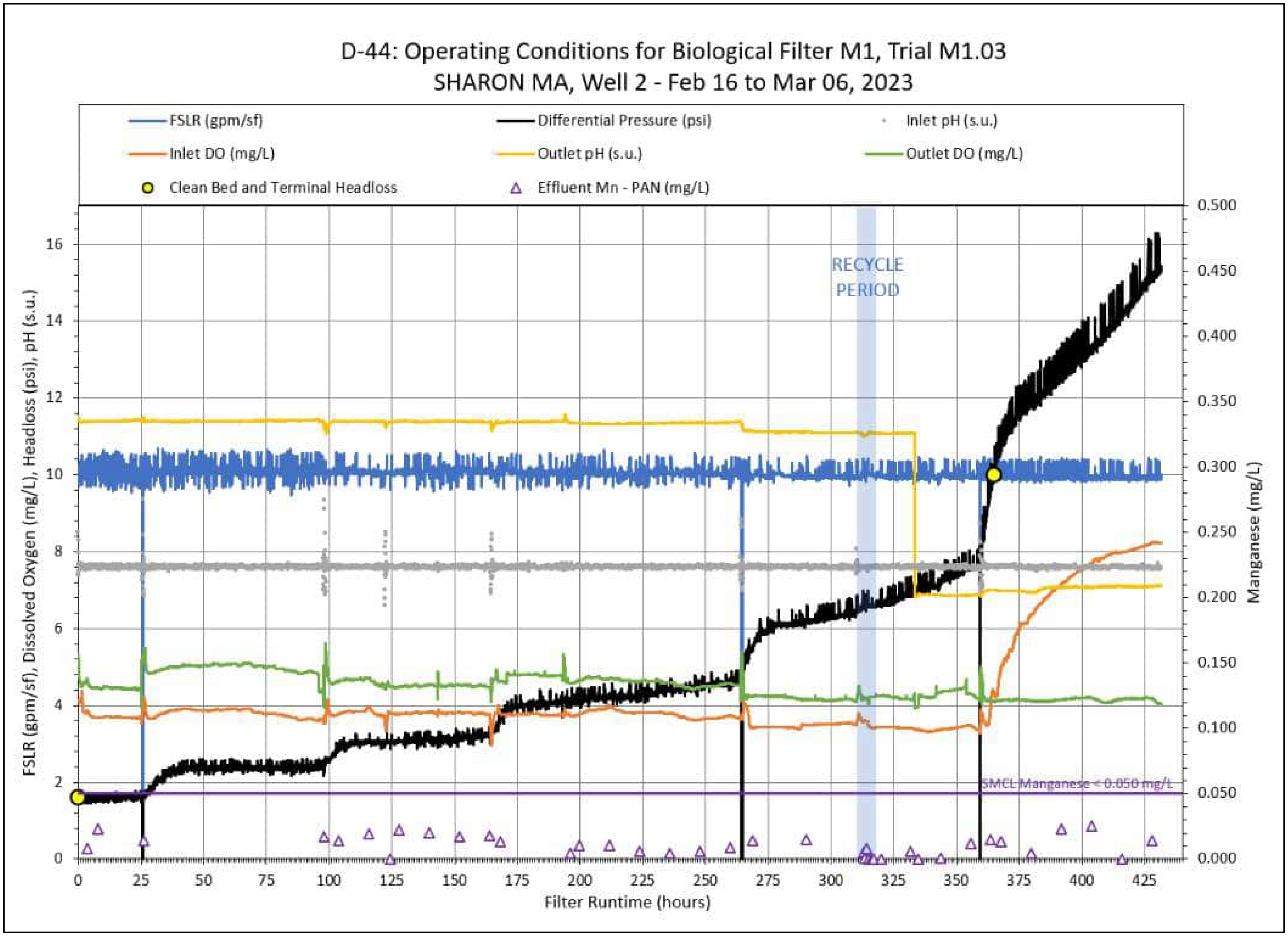
Figure 4.20: Trial F1.22 Filter Performance Figure



Visual comparison of the rate of headloss data (small black data points which appear as a trendline) in Figure 4.20 shows a drop in headloss at the start of the recycle trial. This is due to a two-minute shutdown of the feed to the pilot system to install a tee fitting for injection of the backwash supernatant during the recycle period. During a shutdown, filters experience a filter "relax" and often have a lower differential pressure upon restart as shown in the figure. After the restart the slopes appear to be consistent with those immediately before and after the recycle period. The rate of headloss accumulation appears to not be affected due to operations with 5% supernatant recycle.

Trial F2.19 (Appendix D – page D-39) is a similar figure for the second iron removal filter, Filter F2, during the recycle period but is not included here.

Figure 4.21: Trial M1.03 Filter Performance Figure



Visual comparison of the rate of headloss data (small black data points which appear as a trend line) in Figure 4.21 for the manganese removal filter, Filter M1, shows a consistent rate of headloss before, during, and after the recycle period. The rate of headloss accumulation appears to not be affected due to operations with 5% supernatant recycle.

Filter M1 did not experience the short flow shutdown at the start of the recycle period because it was supplied with water from a feed tank receiving the pH adjusted iron filter effluent. The tank was equipped with an overflow for the excess iron filter effluent and a low-level float which would shut down the filter feed pump and KOH pump if needed. The tank level did not drop substantially, and the pump continuously fed the manganese removal filter during the short shutdown.

4.3 ADSORPTIVE FILTRATION

4.3.1 Effect of pH Adjustment on the Oxidation and Precipitation of Iron and Manganese

Figure 4.22 compares soluble iron in the pretreated water at the two pH values tested during the adsorptive filtration study. Figure 4.23 compares soluble manganese in the pretreated water at the two pH values tested during the adsorptive filtration study. All four filters utilized sodium hypochlorite for oxidation. Filters A and B operated at the ambient raw pH of 6.4 while Filters C and D operated with pH adjustment to 8.0.

Figure 4.22: Box Plot of Soluble Iron in Pretreated Water vs pH

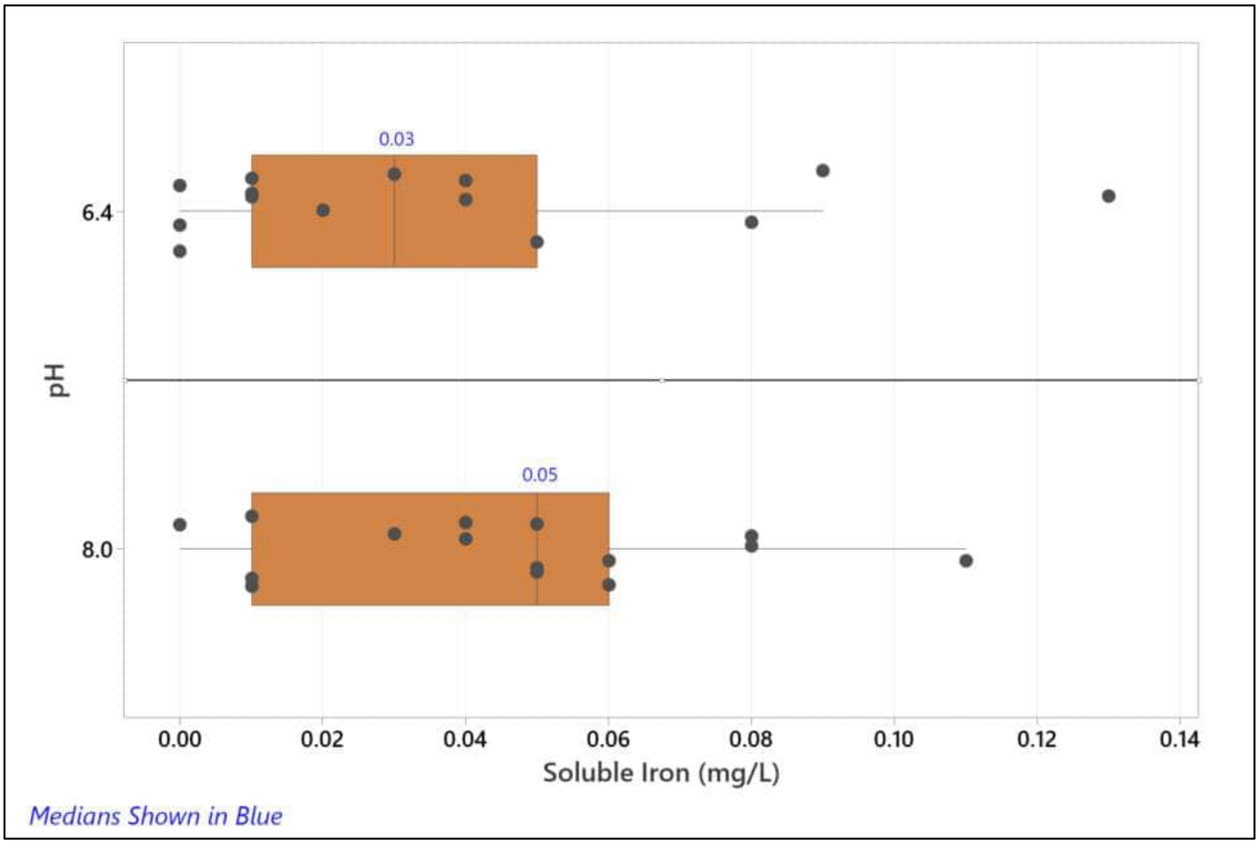


Figure 4.22 shows that the soluble iron data appears to be similar at both pH values. An ANOVA was conducted comparing the two data sets. The results of the ANOVA determined a p-value of 0.465. Where the probability value (P) is greater than alpha (0.465 > 0.05) the null hypothesis is accepted for the ANOVA. This indicates that the data sets were similar, and the soluble iron concentrations were not significantly different based on pH.

Calculating the precipitated fraction based on the median soluble iron concentrations and the median raw iron of 0.63 indicates effective precipitation of greater than 90% of the total iron for both pH values.

Figure 4.23: Box Plot of Soluble Manganese in Pretreated Water vs pH

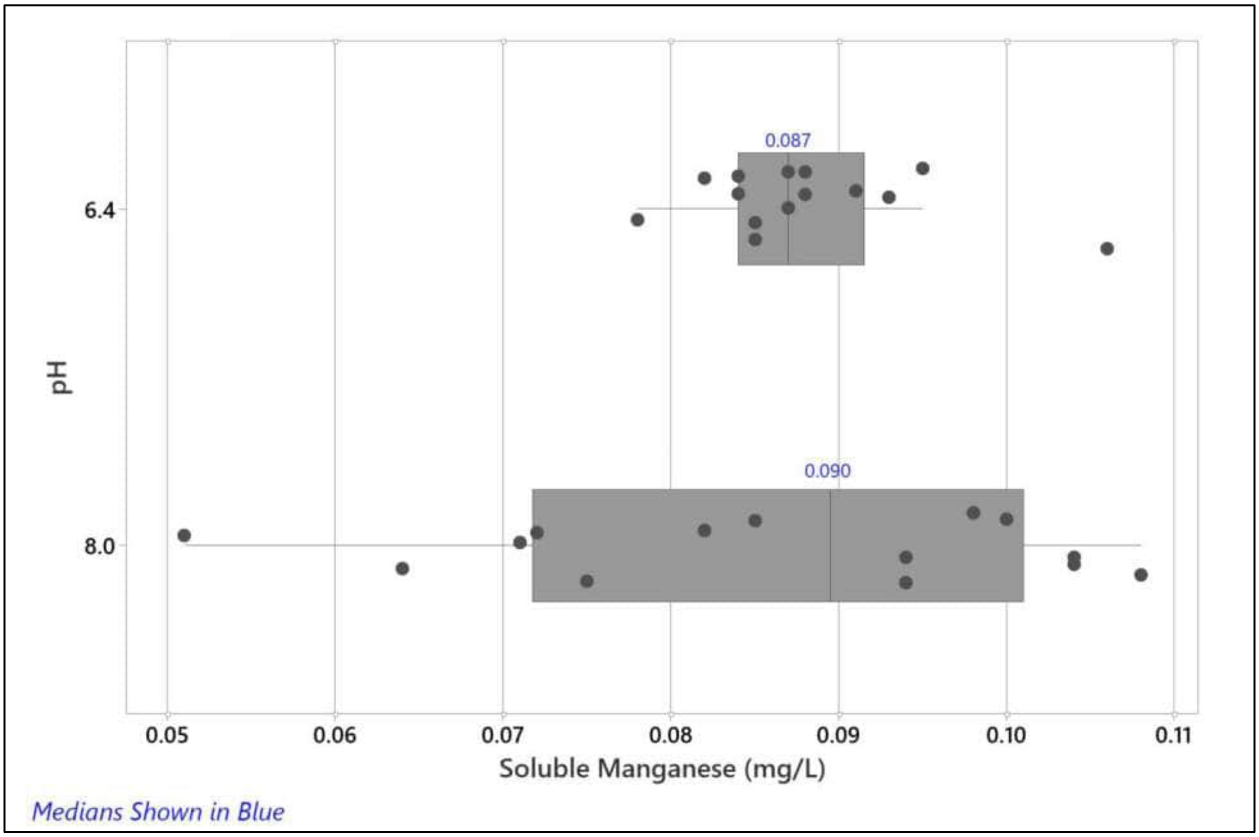


Figure 4.23 shows that the median soluble manganese concentration is similar at both pH values, while the data at the increased pH of 8.0 covers a broader range. An ANOVA was conducted comparing the two data sets. The results of the ANOVA determined a p-value of 0.658. Where the probability value (P) is greater than alpha (0.658 > 0.05) the null hypothesis is accepted for the ANOVA. This indicates that the data sets were similar, and the soluble manganese concentrations were not significantly different based on pH.

Calculating the precipitated fraction based on the median soluble manganese concentrations and the median raw manganese of 0.134 indicates effective precipitation of 34% and 33% for pH 6.4 and 8.0 respectively. Oxidation with NaOCl does not oxidize soluble manganese into a precipitated particle. The oxidized state is changed such that manganese becomes adsorptive to the oxidized surface of the media.

4.3.2 Effectiveness of Adsorptive Filtration Effective for Fe and Mn Removal

This section evaluates iron and manganese through the adsorptive pilot filters. Data from Trial 0, when filters were acclimating to the water source, and Trial 11, the recycle trial were not utilized for this evaluation.

4.3.2.1 Iron Removal by Adsorptive Filtration

There were four unique filters utilized during the adsorptive filtration study.

1. Filter A: Greensand Media operated at ambient pH of 6.4
2. Filter B: Pyrolusite Media operated at ambient pH of 6.4
3. Filter C: Greensand Media operated at an adjusted pH of 8.0
4. Filter D: Pyrolusite Media operated at an adjusted pH of 8.0

Figure 4.24 is a box plot of the effluent iron data organized by filter.

Figure 4.24: Box Plot of Fe Data for Adsorptive Filter Effluent by Filter

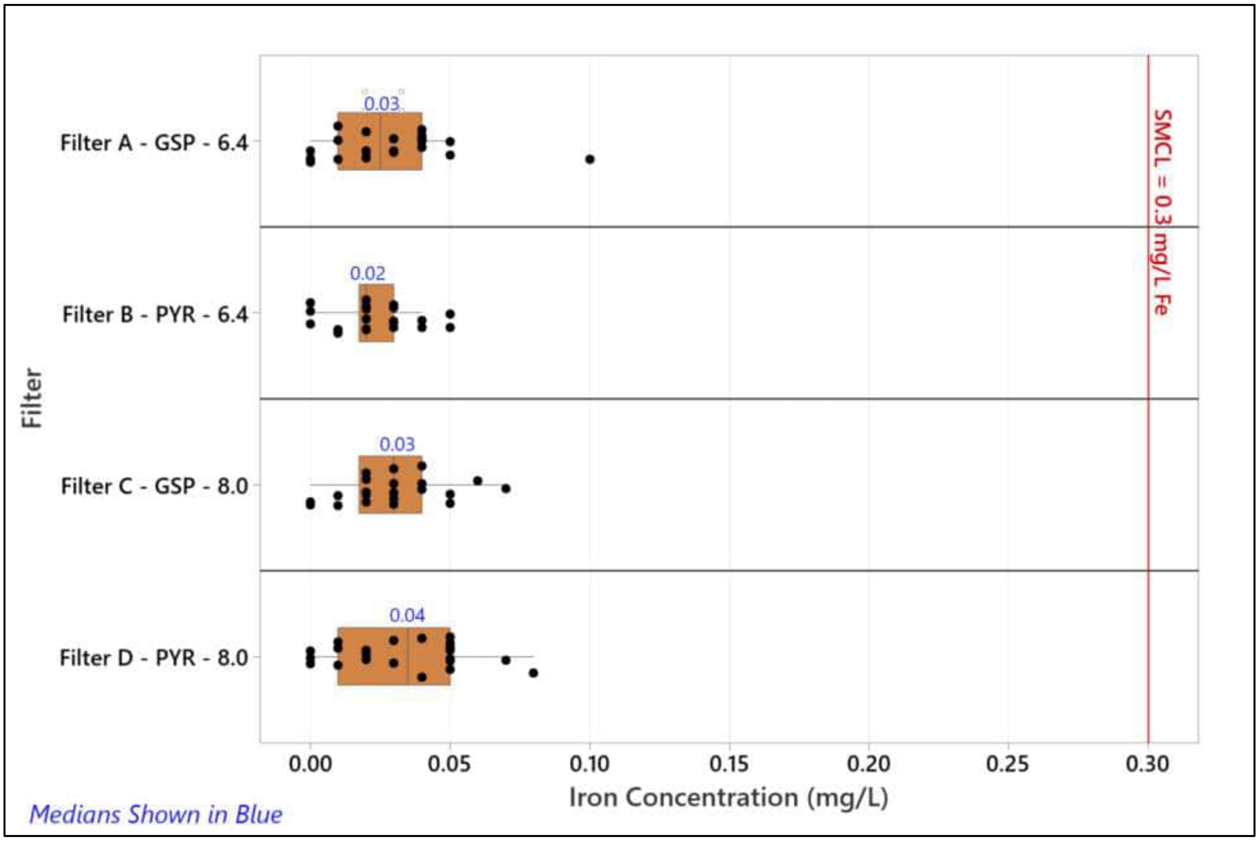


Figure 4.24 shows that all adsorptive filter effluent iron data points were less than half of the SMCL of 0.3 mg/L Fe.

An ANOVA was conducted comparing the four data sets. The results of the ANOVA determined a p-value of 0.469. Where the probability value (P) is greater than alpha (0.465 > 0.05) the null hypothesis is accepted for the ANOVA. This indicates that the data sets were similar, and the effluent iron concentrations were not significantly different based on filter. A Tukey's Comparison assigned all four data sets to a single group. Therefore, iron removal was statistically similar for the two different filter medias tested and the two different pH conditions tested.

Figures 4.25 plots the same effluent iron data but is grouped by filter surface loading rate to evaluate the effect of FSLR on treatment. Filters A, B, C and D all operated at the same filter loading rates 5, 7.5 and 10 gpm/sf.

Figure 4.25: Box Plot of Representative Fe in Adsorptive Filter Effluent by FSLR

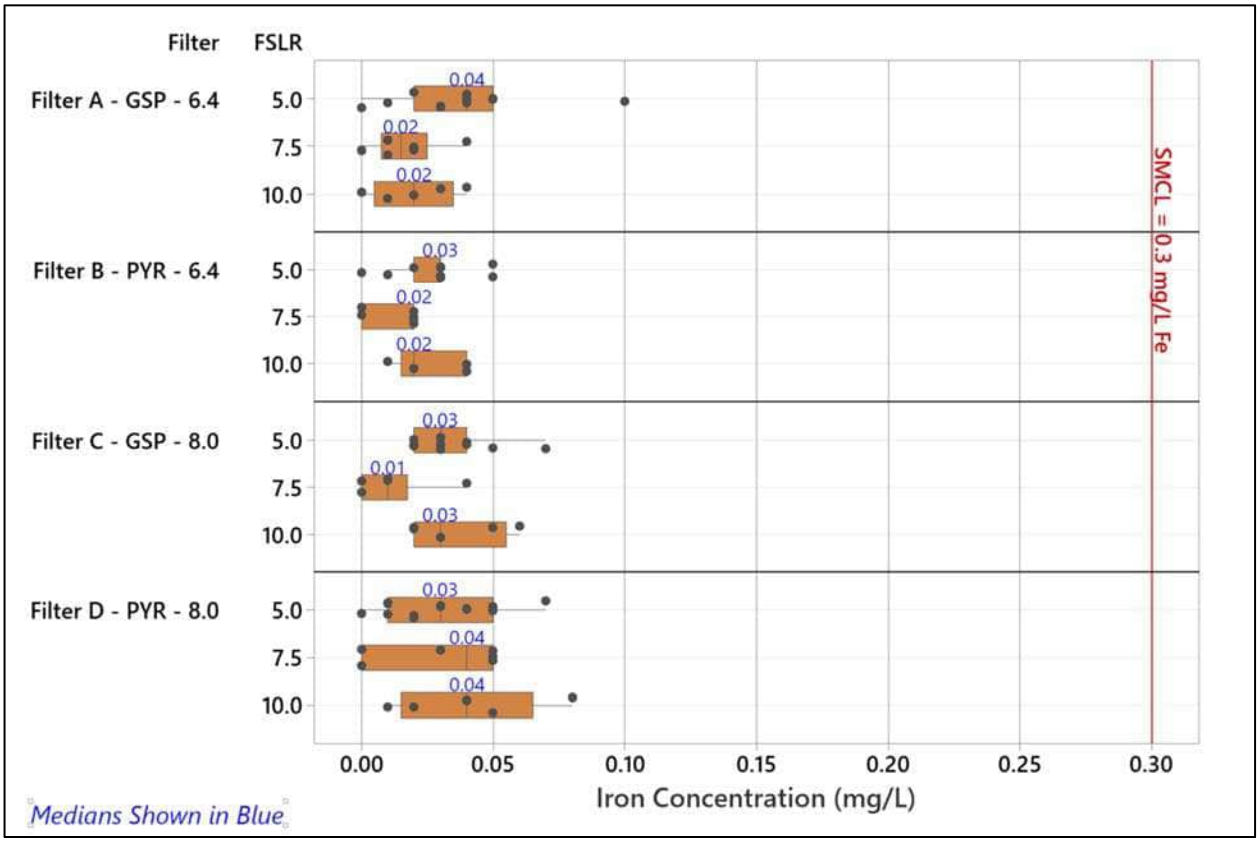


Figure 4.25 does not show an obvious relationship between iron concentrations and filter surface loading rates. Further statistical evaluation is not required as median iron concentrations for all twelve data sets are within 0.02 mg/L and less than 0.05 mg/L. When the data from all four filters were combined the mean effluent iron concentrations were 0.03 when operating at 5 gpm/sf, 0.02 mg/L when operating at 7.5 gpm/sf, and 0.03 when operating at 10 gpm/sf. FSLR did not have a practical effect on effluent iron concentrations at the loading rates tested.

4.3.2.2 Manganese Removal by Adsorptive Filtration

Figure 4.26 is box plot of the effluent manganese data organized by filter.

Figure 4.26: Box Plot of Mn Data for Adsorptive Filter Effluent by Filter

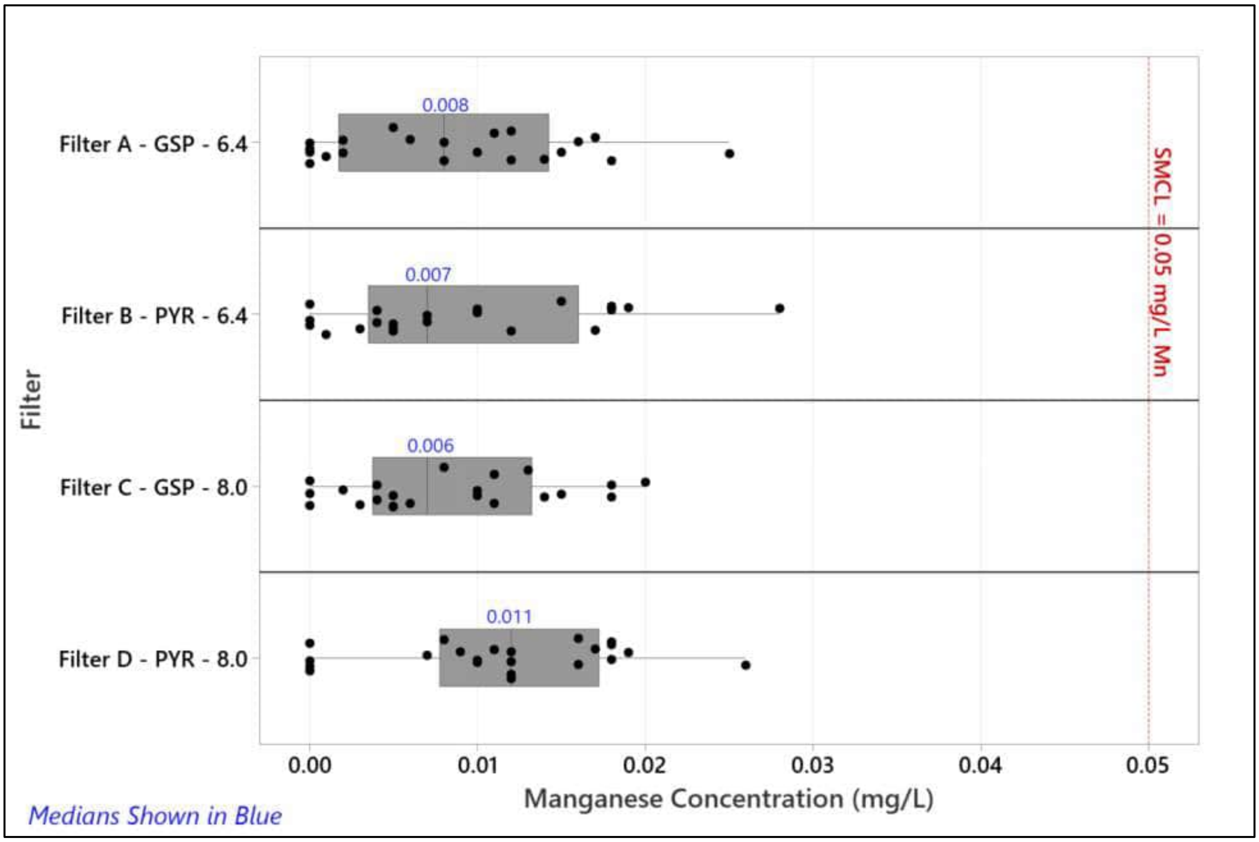


Figure 4.26 shows that adsorptive filter effluent manganese data points were predominantly less than half of the SMCL of 0.050 mg/L Mn.

An ANOVA was conducted comparing the four data sets. The results of the ANOVA determined a p-value of 0.426. Where the probability value (P) is greater than alpha (0.426 > 0.05) the null hypothesis is accepted for the ANOVA. This indicates that the data sets were similar, and the effluent iron concentrations were not significantly different based on filter. A Tukey's Comparison assigned all four data sets to a single group. Therefore, manganese removal was statistically similar for the two different filter medias tested and the two different pH conditions tested.

Figure 4.27 plots the same effluent manganese data but is grouped by filter surface loading rate in order to evaluate the effect of FSLR on treatment.

Figure 4.27: Boxplot of Mn Data for Adsorptive Filter Effluent by FSLR

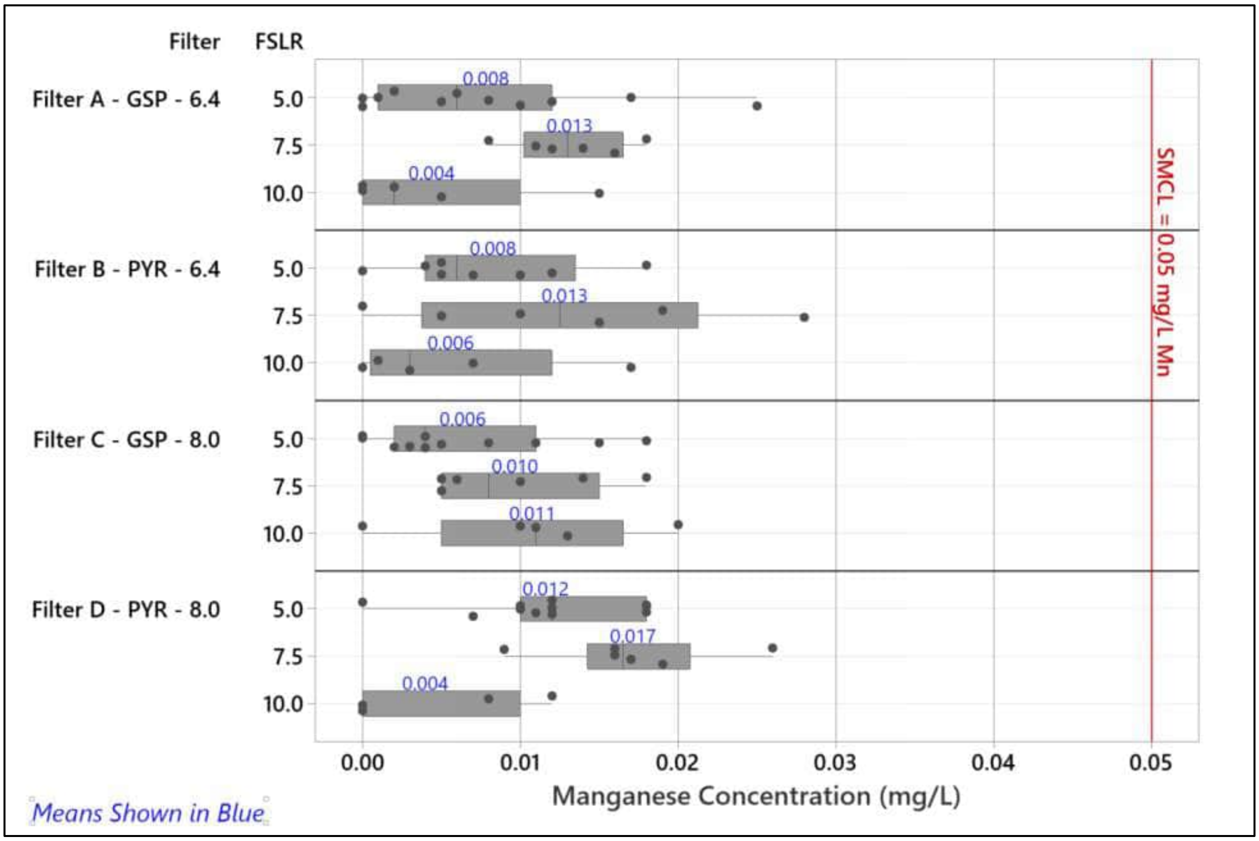


Figure 4.27 does not show an obvious relationship between manganese concentrations and Filter Surface Loading Rate. All but two effluent manganese data points were less than half of the SMCL for manganese. When the data from all four filters were combined the mean manganese concentrations were 0.008 when operating at 5 gpm/sf, 0.013 mg/L when operating at 7.5 gpm/sf, and 0.006 when operating at 10 gpm/sf. FSLR did not have a practical effect on effluent manganese concentrations at the loading rates tested.

4.3.3 Filter Runtime vs Loading Rate

Filter runtimes were a function of the filter surface loading rate and the solids loading onto the media. Most trials were terminated based on a terminal headloss of 10 psid. Contaminant breakthrough was not observed for any of the Filter A trials but the Filter A turbidimeter appeared to be underreporting which may have contributed to this result. Contaminant breakthrough was observed during the first trial only for Filters B and C (Trials B.1 and C.1). Contaminant breakthrough was observed for 5 trials for Filter D (Trials D.1, D.2, D.4, D.5 and D.9).

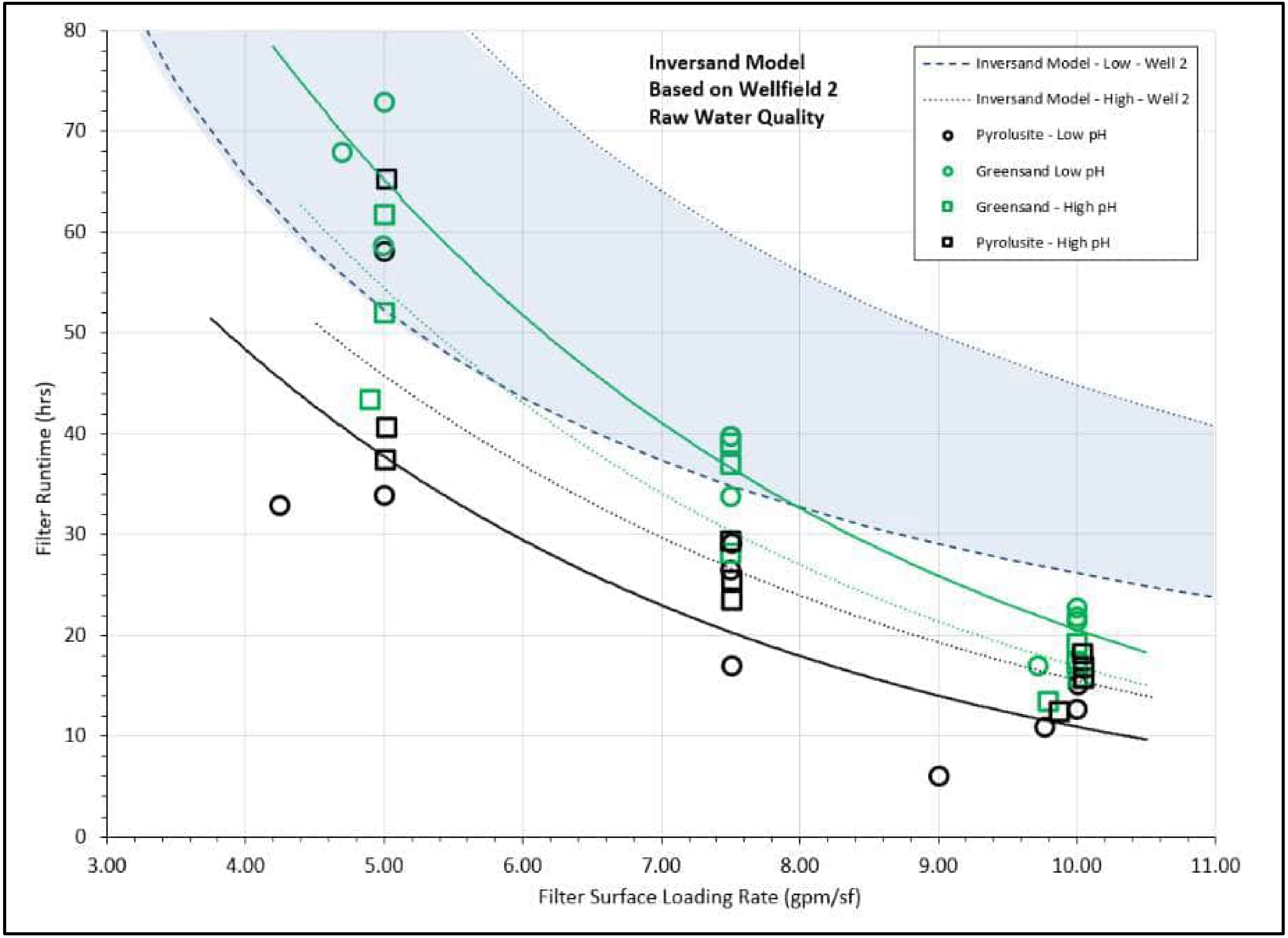
To estimate the relationship between Filter Surface Loading Rate and runtime, each Filter Performance Figure in Appendix D was considered.

Figure 4.28 plots the observed runtime to 10 psid against FSLR. There were 10 representative filter trials for each filter. Data from the four acclimation trials (Trials A0, B0, C0, D0) were excluded because the feed hose had become loose and raw water feed was lost, and the four supernatant recycle trials (Trials 11A, 11B, 11C, and 11D) were excluded from runtime analyses. The data are organized by filter.

- Filter runtimes for Filter A operating with Greensand media and at low pH are shown as hollow green circles.
- Filter runtimes for Filter B operating with Pyrolusite media and at low pH are shown as hollow black circles.
- Filter runtimes for Filter C operating with Greensand media and at high pH are shown as hollow green squares.
- Filter runtimes for Filter D operating with Pyrolusite media and at high pH are shown as hollow black squares.

Figure 4.28 includes estimated runtimes based on the Inversand's published media capacity for GreensandPlus of between 700 and 1200 grains per gallon per square foot. Blueleaf calculated the filter runtime at various Filter Surface Loading Rates by using the average raw water concentration from Table 3.01 (0.62 mg/L Fe and 0.134 mg/L Mn). The Inversand model does not include a provision for velocity, while Blueleaf believes that media capacity is higher at lower velocities than at higher velocities.

Figure 4.28: Adsorptive Filtration Runtime as a Function of FSLR



The following runtimes can be interpolated from Figure 4.28:

- Filter runtimes for Filter A operating with Greensand media and at low pH ranged from approximately 65 hours at 5 gpm/sf to 20 hours at 10 gpm/sf.
- Filter runtimes for Filter B operating with Pyrolusite media and at low pH ranged from approximately 38 hours at 5 gpm/sf to 11 hours at 10 gpm/sf.
- Filter runtimes for Filter C operating with Greensand media and at high pH ranged from approximately 54 hours at 5 gpm/sf to 17 hours at 10 gpm/sf.
- Filter runtimes for Filter D operating with Pyrolusite media and at high pH ranged from approximately 46 hours at 5 gpm/sf to 16 hours at 10 gpm/sf.

Figure 4.28 shows that the filter runtimes were generally lower than the Inversand estimates, especially at higher Filter Surface Loading Rates. It is not unusual for the sites with significant concentration of manganese to differ from the Inversand estimates, especially when the filters are terminated due to headloss. Blueleaf suspects that the Inversand capacities were developed empirically from sites that were high in iron concentration and were terminated based on contaminant breakthrough.

4.3.4 Supernatant Recycle Performance

Adsorptive filter backwash water from all four adsorptive filters was collected and stored in a 200-gallon settling tank during the pilot study. Settled supernatant was pumped into the raw water feed of the pilot filters at a 5% feed rate for 6.2 hours on March 9 during Trials A11, B11, C11 and D11. Recycle flow ended when the supernatant volume had reached a low level to avoid disturbing solids settled at the bottom of the tank. Field samples were collected at 30-minute intervals.

The performance data for the four filters are plotted in Figures E11, E22, E33 and E44 in Appendix E. All four filters were operated at nominal filter surface loading rates of 5 gpm/sf during the recycle trial. The period of supernatant recycle is highlighted in all four figures.

A comparison of pilot influent is made with and without supernatant recycle in Section 4.3.5.1 and a filter effluent comparison with and without supernatant recycle is evaluated in Section 4.3.5.2.

4.3.4.1 Comparison of Adsorptive Pilot Influent with and without 5% Supernatant Recycle

The pilot influent iron and manganese concentrations were compared using data from the pre-recycle period, during the recycle period, and post-recycle period. The recycle period occurred during Trials A11, B11, C11 and D11. Because each of the ongoing trials were started and terminated at different times the raw data was for the longest of the four trials, B.11 and D.11, were used for the pilot influent comparison.

Figure 4.29 is an individual values plot of the pilot influent iron concentrations before, during, and after the recycle period and Figure 4.30 plots the pilot influent manganese concentrations.

Figure 4.29: Individual Values Plot of Influent Iron Concentrations for Trial 11

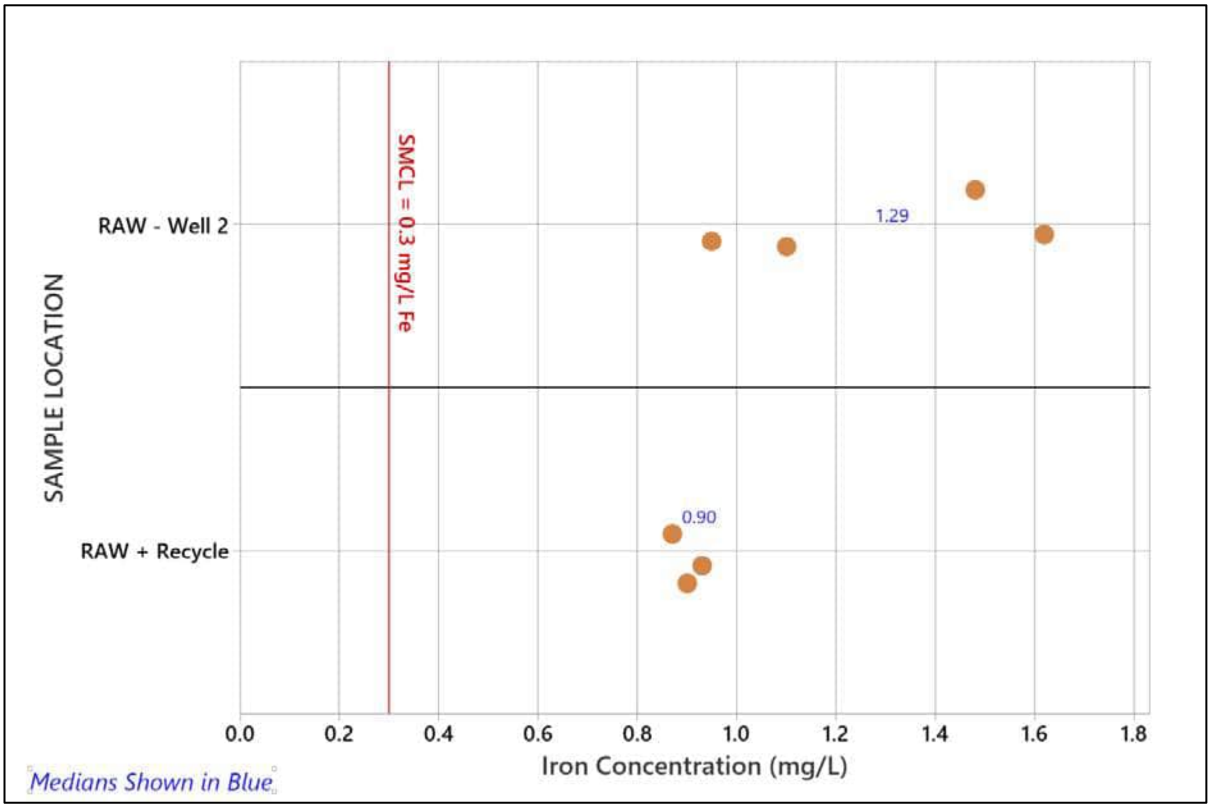
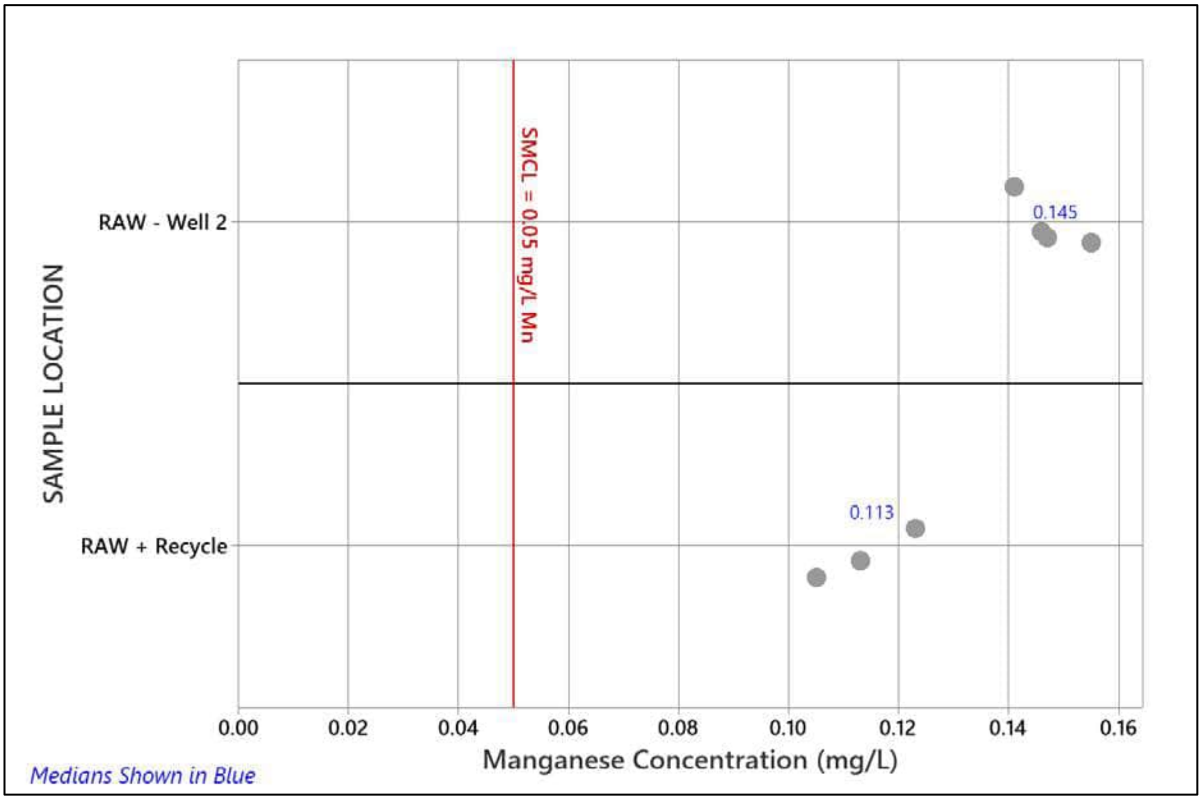


Figure 4.30: Individual Values Plot of Influent Manganese Concentrations for Trial 11



Figures 4.29 and 4.30 show that the influent iron and manganese concentrations appeared to decrease during the supernatant recycle period. A lab sample of raw water and a sample of the pilot influent with recycle were collected during the recycle trial on March 9th.

Table 4.09: Lab Result Comparison of Fe and Mn for Raw Water with 5% Recycle

Parameter	Lab Report # CN52088	
	03/01/2023	
	Raw Water	Raw + 5% Recycle
Total Iron (mg/L)	1.21	1.01
Total Manganese (mg/L)	0.161	0.155

Table 4.09 shows a similar result to the field analyses with a decrease in both iron and manganese concentrations in the pilot influent with 5% supernatant recycle. The stored backwash water had settled for days prior to the start of the recycle trial. A grab sample of supernatant collected during the recycle trial had an iron concentration of 0.14 mg/L and a manganese concentration of 0.064 mg/L. The iron and manganese concentrations in the supernatant were considerably lower than the raw water concentrations measured by field and lab analyses and therefore explain the decrease in influent iron and manganese concentrations during the recycle period.

4.3.4.2 Comparison of Adsorptive Pilot Effluent with and without 5% Supernatant Recycle

The adsorptive filter effluent iron and manganese concentrations were similarly compared using data from the pre-recycle period, during the recycle period, and post-recycle period. Before and after data was combined into the “without recycle” data set as there was only one round of data collected after the recycle period.

Figure 4.31 is a box plot of the adsorptive filter effluent iron concentrations before, during, and after the recycle period and Figure 4.32 plots the same for the effluent manganese concentrations.

Figure 4.31: Boxplot of Adsorptive Filter Effluent Fe Concentrations During Supernatant Recycle Trial

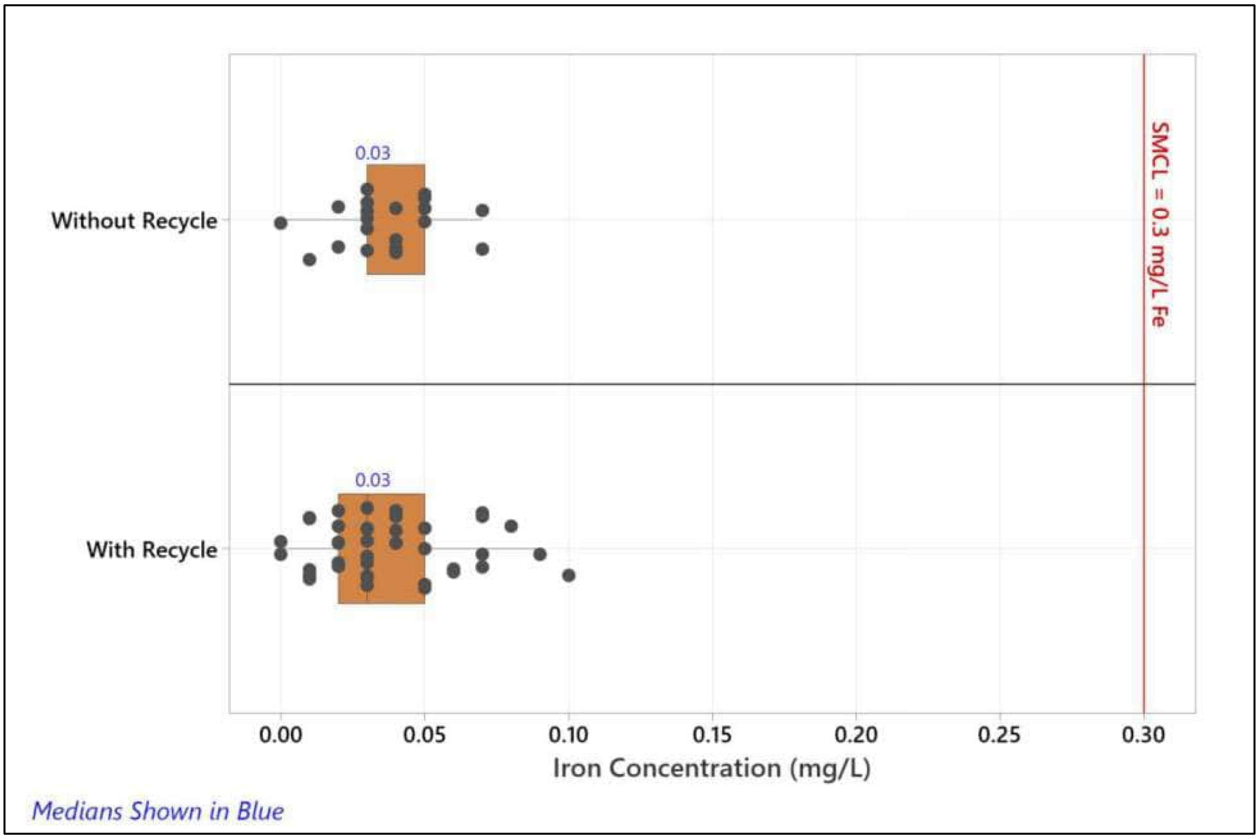


Figure 4.31 shows that the effluent iron concentrations are similar when operating with 5% recycle and without during Trial 11. The median iron concentrations for both data sets were 0.03 mg/L and all data was below the SMCL of 0.3 mg/L and the pilot study goal of 0.15 mg/L.

Figure 4.32: Boxplot of Adsorptive Filter Effluent Mn Concentrations During Supernatant Recycle Trial

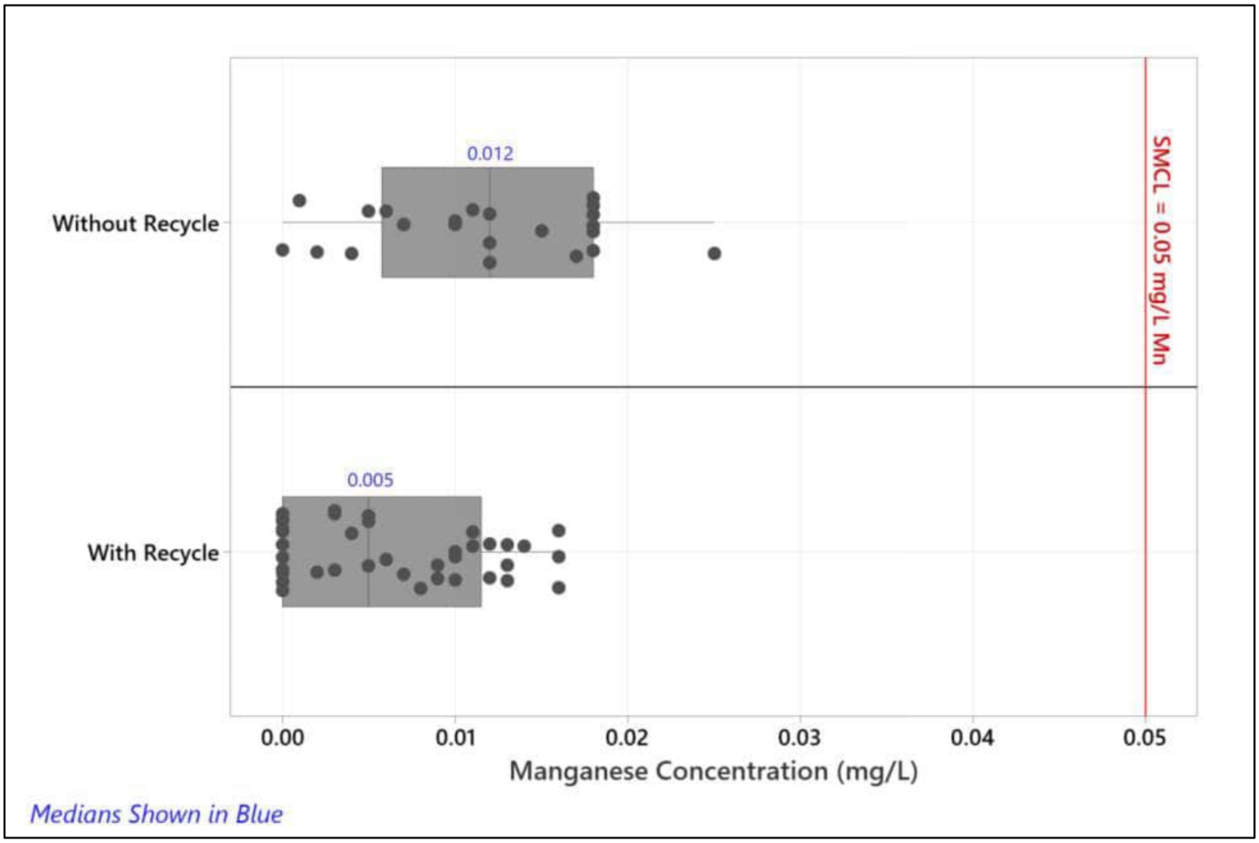
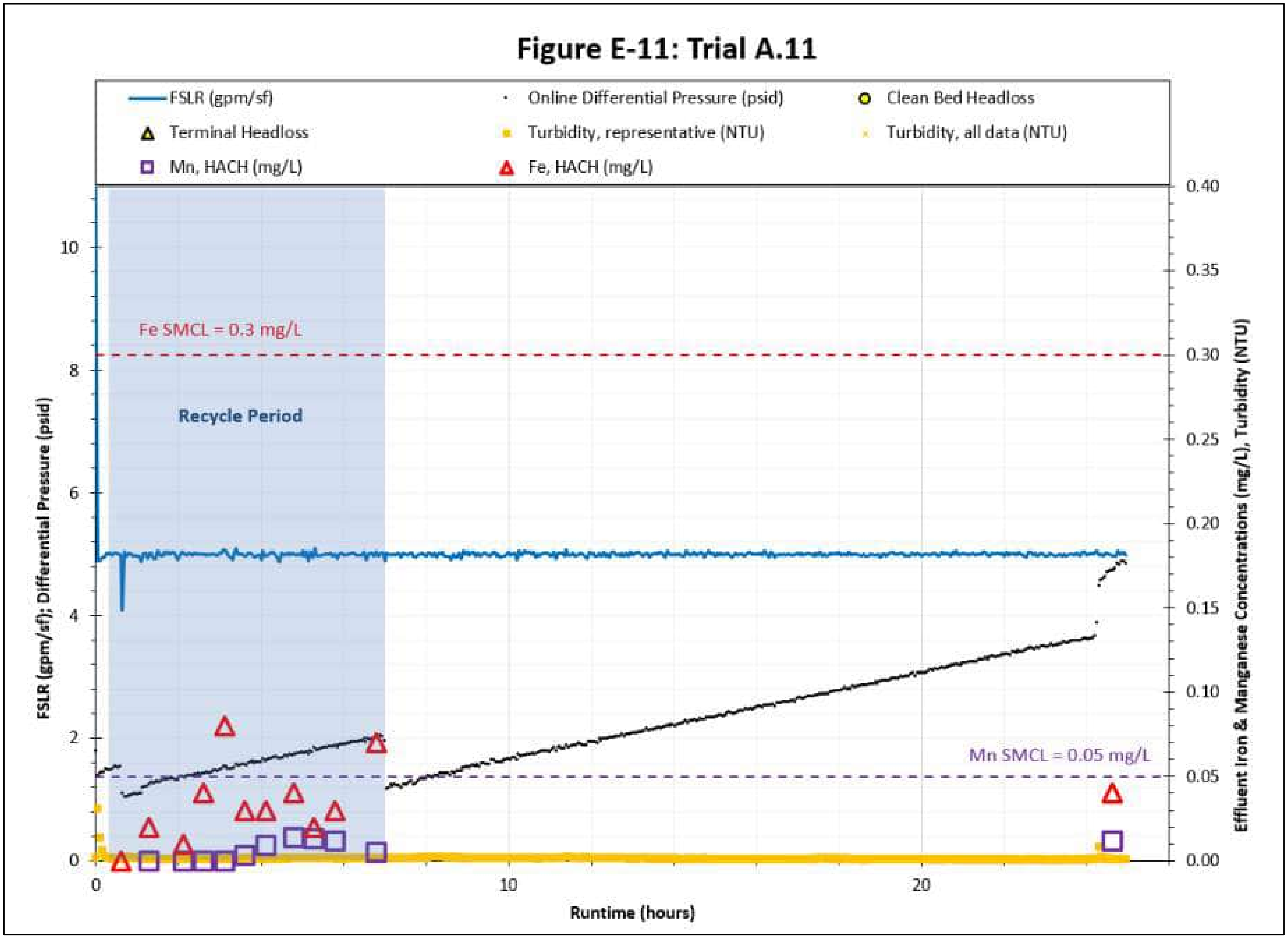


Figure 4.32 shows that the box plot and the median effluent manganese concentration during the recycle period were less than the data when operating without recycle. All data was less than the SMCL and less than the pilot study goal of 0.025 mg/L (half of the SMCL). Introduction of 5% supernatant recycle did not adversely affect manganese removal.

Figure 4.33 is the filter performance figure for Trial A.11 (also included in Appendix E on page E-11). Figure 4.34 is the filter performance figure for Trial B.11 (also included in Appendix E on page E-22). The figures are included here for visual comparison of the rate of headloss accumulation during the recycle period. The recycle period is shown as the area with blue shading on the two figures.

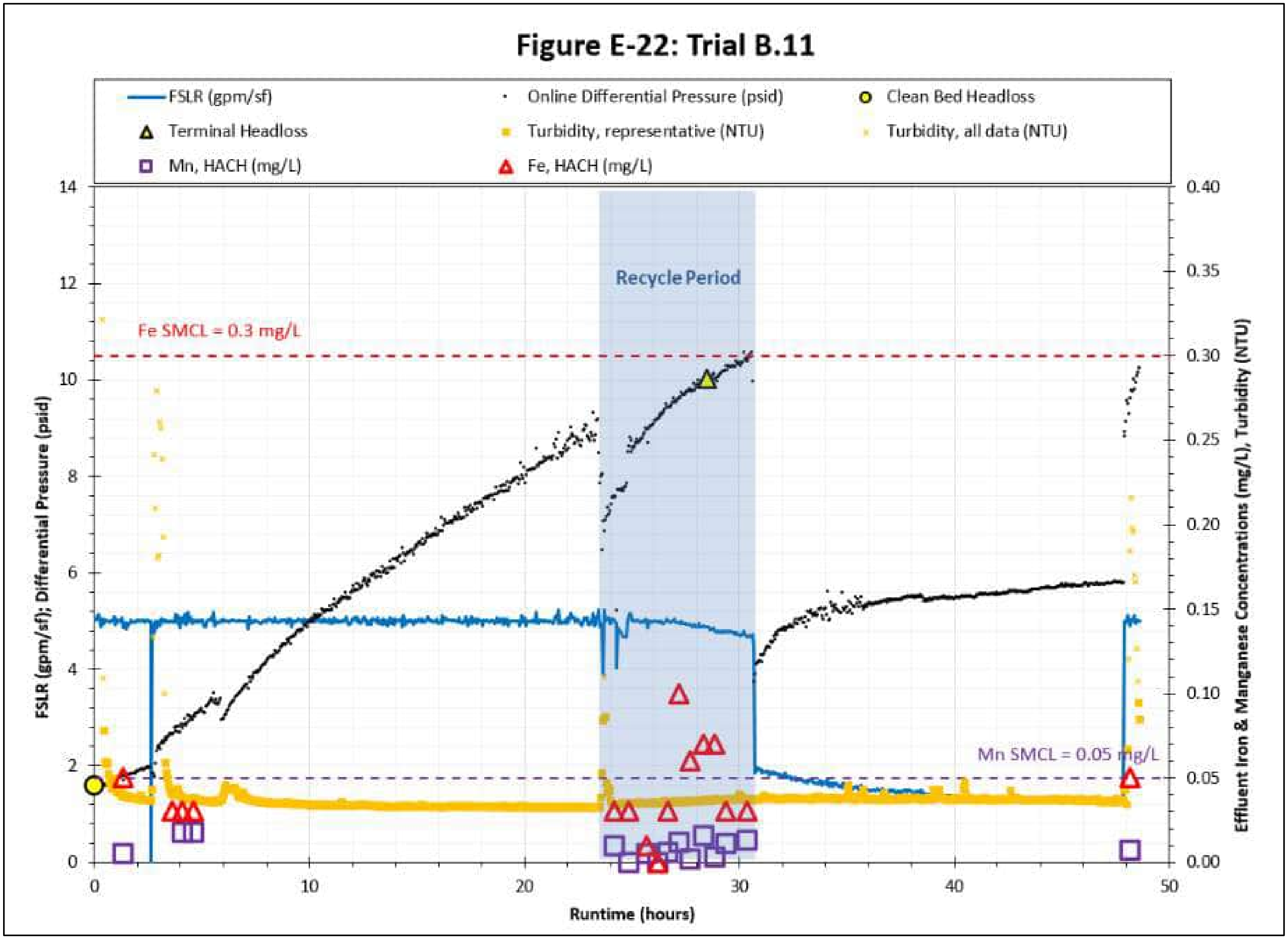
Figure 4.33: Trial A.11 Filter Performance Figure



The two greensand filters (Filters A and C) were backwashed and restarted just prior to the beginning of the supernatant recycle trial. Figure 4.33 is provided for visual comparison of the rate of headloss data (small black data points which appear as a trend line) for Filter A. Figure 4.33 shows a drop in headloss at the start of the recycle trial due to an adjustment to the feed pressure to allow for a peristaltic pump to inject the backwash supernatant. A similar disruption occurred at the end of recycle period when the peristaltic pump was shut off. The slopes for headloss development appear to be similar during and after the recycle period. The rate of headloss development during the recycle period was 0.087 psi/hr while the rate of headloss development after the recycle period was greater at 0.145 psi/hr. Filter runtimes are not expected to be adversely affected due to the introduction of 5% supernatant recycle.

Trial C.11 (Appendix E – page E-33) is a similar figure for the second Greensand media filter, Filter C, during the recycle period but is not included here.

Figure 4.34: Trial B.11 Filter Performance Figure



While the two greensand filters (Filters A and C) had been backwashed and restarted just prior to the beginning of the supernatant recycle trial, the two pyrolusite filters were near the end of their trial but were allowed to operate. Figure 4.34 is provided for visual comparison of the rate of headloss data for Filter B. Figure 4.34 shows a small drop in headloss at the start of the recycle trial similar to the drop seen in Figure 4.33. During the recycle period the rate of headloss was 0.355 psi per hour, while it had been 0.325 prior to the addition of backwash supernatant. Note that the headloss through the filter reached declining rate during the recycle trial and may have impacted the slope of the headloss curve.

Filters B and D are not optimal for comparison of headloss data due to the declining flow and loading rate. Filter B also reaches terminal headloss during the recycle period. It is expected that the adsorptive pyrolusite filters would have performed similarly to the adsorptive Greensand filter and not been adversely affected during supernatant recycle. Particularly as the influent iron and manganese concentrations decreased during the recycle period.

Trial D.11 (Appendix E – page E-44) is a similar figure for the second pyrolusite media filter, Filter D, during the recycle period but is not included here.

4.4 CONTRASTS BETWEEN BIOLOGICAL AND ADSORPTIVE FILTRATION AT SHARON WELLFIELD 2

A direct comparison or selection of processes is not the goal of this report. Environmental Partners may use the data in this report and data gathered from other sources to reject or select a process for design or for further evaluation. Blueleaf is presenting data in this section to summarize data that appears in separate sections of the report.

4.4.1 Pilot Study Variables by Process

The Sharon Wellfield 2 pilot study showed that raw iron and manganese were readily removed at a range of loading rates utilizing both biological and adsorptive filtration processes. Table 4.10 summarizes the differences between some of the process variables evaluated.

Table 4.10: Important Process Variables by Filtration Process

Process Variable	Biological Filtration		Adsorptive Filtration	
	Iron Removal Filters	Manganese Removal Filter	Greensand Filters	Pyrolusite Filters
Process Flow	Two filter system operated in series		One Filter Removes Fe and Mn	One Filter Removes Fe and Mn
Acclimation Period	4 days	Not Evaluated But Typically > 2 Weeks	Not Required	Not Required
KOH Dose to pH 8.0 (mg/L)	Not Required	33.0	33.0	33.0
NaOCl Dose to 0.5 Residual (mg/L)	Not Required	Not Required	1.5 – 2.8	1.5 – 2.8
DO (mg/L)	Ambient	>4.0	Not Required	Not Required
Effective Filter Surface Loading Rates Tested (gpm/sf)	5.0	5.0	5.0	5.0
	7.5		7.5	7.5
	10.0	10.0	10.0	10.0
	12.5			
	15.0	15.0		
	20.0			
	25.0			

Table 4.10: Important Process Variables by Filtration Process (continued)

Process Variable	Biological Filtration		Adsorptive Filtration	
	Iron Removal Filters	Manganese Removal Filter	Greensand Filters	Pyrolusite Filters
Filter Runtimes @ 5 gpm/sf (hrs)	80-110	420	55-65	36-46
Filter Runtimes @ 10 gpm/sf (hrs)	63-72	365	17-20	12-16
Median UFRV (gal/sf)	192,857	1,111,760	68,342	51,811
Combined Backwash Fe (mg/L)	92.9 - 551	53.6 – 54.4	83.2 – 93.2	71.7 – 80.8
Combined Backwash Mn (mg/L)	0.258 – 0.939	337 – 364	10.9 – 11.0	9.99 – 14.4
Supernatant Fe @ 4 Hrs Settling (mg/L)	11.1 – 33.1	1.84 – 1.86	1.94 – 3.02	0.877 – 2.20
Supernatant Mn @ 4 Hrs Settling (mg/L)	0.100 – 0.133	4.48 – 5.07	0.281 – 0.388	0.276 – 0.485
Supernatant Quality in Tank	Cloudy		Clear	
Effective Supernatant Recycle	Yes	Yes	Yes	Yes

4.4.2 Backwash Water Requirements

The volume of backwash water needed for each process is a function of the process selected, filter sizing and backwash frequency. To determine the total volume required, the following factors need to be determined:

- Backwash Requirements of Process Selected - The adsorptive filtration process often backwashes for ten minutes at 12 gpm/sf, so requires 120 gallons per sf, though some vendors have proprietary methods to reduce the overall water usage rates. Biological filtration typically backwashes with a low rate of 6 gpm/sf for 3 minutes and a high rate of 8 gpm/sf for five minutes for a total volume of 58 gallons per sf.
- Filter Sizing – the sizing of the filters is an engineering function that needs to take several factors into account that are not known at this time. For comparison purposes, a filter surface loading rate of 5 gpm/sf was chosen for the Greensand filter, the pyrolusite filter, and the biological iron filter. A filter surface loading rate of 10 gpm/sf was selected for the biological manganese filter

because filter runtimes are projected to be high. The filter runtimes are based on data presented in Sections 4.2.5 and 4.3.4. Filter surface loading rates are:

- Greensand filter: 5 gpm/sf
- Pyrolusite filter: 5 gpm/sf
- Separate biological Fe filter: 5 gpm/sf, followed by a biological Mn filter at 10 gpm/sf

Table 4.11 shows the projected backwash water production rates for each scenario.

Table 4.11: Comparison of Potential Backwash Water Requirements for Process Selection

Process	FSLR (gpm/sf)	BW Frequency (hrs)	Surface Area (sf)	BW Rate (gallon/sf)	BW Volume per MG Treated (gallons/MG)
Greensand	5	60	138.9	120	6,667
Pyrolusite	5	41	138.9	120	9,756
Biological Iron	5	95	138.9	58	2,035
Biological Manganese	10	365	69.4	58	265
Biological Total					2,300

The lowest backwash water requirement predicted by Table 4.10 is the Biological Iron and Manganese process. The greensand process had greater than twice the required backwash water volume requirement. The pyrolusite process had greater than three times the required backwash water volume requirement. Note that the loading rates and filter sizes presented in Table 4.11 are not recommendations for design but were selected solely to illustrate the unit differences in backwash water requirements for the various processes.

5 CONCLUSIONS

RAW WATER QUALITY CONCLUSIONS

Sharon Wellfield 2 is vacuum system of 8 interconnected wells. This pilot study tested the Sharon Wellfield 2 source for both adsorptive filtration and biological filtration. Raw water data from both pilot systems were combined and summarized in this section.

1. Raw water quality from field analyses during the study were summarized in Table 3.01 which is reproduced here:

Parameter	Units	Field Analysis
Total Fe	mg/L	**0.62** (0.13-1.08) [71]
Dissolved Fe	mg/L	**0.46** (0.043-0.77) [57]
Total Mn	mg/L	**0.134** (0.034-0.168) [76]
Dissolved Mn	mg/L	**0.133** (0.033-0.162) [57]
pH	s.u.	**6.40** (6.14-6.95) [58]
Temperature	°C	**12.4** (10.8-14.1) [53]
Alkalinity	mg/L as $CaCO_3$	**47** (45.5-52) [8]
Carbon Dioxide	mg/L	**39** (31-49) [7]
Nitrate	mg/L	**2.8** (0.5-4.2) [26]
Total Organic Carbon	mg/L	**0.35** (0.12-2.39) [11]

2. Raw iron and manganese concentrations were initially low compared to historical data and well flow rates were increased twice during the early stages of the pilot study, on Dec 19, 2022, and Jan 04, 2023, to provide more representative water.
3. Iron and manganese concentrations increased with increases in well flow rate.
4. Iron and manganese concentrations also increased gradually over the duration of the study.
5. Iron concentrations during the pilot study were lower than historical data.
6. Iron and manganese concentrations were most representative of historical data at the highest well flow rate tested of 290 gpm.
7. Four coliform samples analyzed by certified laboratory were all negative.
8. Five nitrate samples analyzed by certified laboratory ranged from 3.51 to 4.05 mg/L.
9. Additional raw water quality analyzed by certified laboratory are summarized in Table 3.02.

BIOLOGICAL FILTRATION PILOT CONCLUSIONS

10. Acclimation of virgin 1.3 mm sand media in the iron removal filters occurred in approximately 4 days.
11. Evaluation of the acclimation period for virgin 0.95 mm sand media in the manganese removal filters was not conducted as part of this pilot study. A mature manganese removal filter from another site was transferred to the pilot system to reduce the potential acclimation period which can take weeks. The manganese filter media appeared to adapt to the Sharon Wellfield 2 raw water source, to continue to develop a biomass of microorganisms, and to maintain a media coating for adsorption of manganese, but the acclimation and maturation period was not representative of initial acclimation and maturation with virgin media at this site.
12. Biological Iron Removal:
    i. The iron filters were operated at ambient DO and pH conditions without any pretreatment.
    ii. The iron removal filters effectively reduced raw iron to below the SMCL, and the pilot study goal of one half of the SMCL, operating at filter surface loading rates from 5 to 25 gpm/sf.
    iii. Effluent iron concentrations increased with each increase in FSLR.
    iv. The median iron concentration for all iron filter effluent data was 0.03 mg/L .
    v. The median iron concentration in the downstream manganese filter effluent was 0.02 mg/L.
13. Biological Manganese Removal:
    i. The iron removal filters were operated at conditions targeted for iron removal which allow dissolved manganese to pass through the filter for downstream removal in Filter M1. The median raw manganese concentration was 0.133 mg/L and the median manganese concentration in the iron filter effluent was 0.127 mg/L indicating no removal, as expected.
    ii. KOH was used to adjust pH from in the iron filter effluent of 6.4 to a target of 7.6 s.u. upstream of the manganese removal filter. The KOH dose response curve indicates that a dose of approximately 28 mg/L of KOH is necessary for this adjustment.
    iii. The median raw DO of 3.1 mg/L was increased to a median of 4.4 mg/L after the air contactor and prior to filtration.
    iv. The manganese removal filter effectively reduced raw manganese to below the SMCL operating at filter surface loading rates from 5 to 15 gpm/sf.
    v. The manganese removal filter effectively reduced raw manganese to below the pilot study goal of one half of the SMCL operating at filter surface loading rates of 5 and 10 gpm/sf. Statistical analysis indicated that manganese filter effluent slightly exceeded the pilot study goal when operating at 15 gpm/sf.
    vi. Effluent manganese concentrations increased with each increase in FSLR.
    vii. The median manganese concentration for all manganese filter effluent data was 0.010 mg/L.
14. Field analyses of nitrate concentrations through the biological filtration system indicated that the median concentration of 2.8 mg/L was reduced to 1.8 mg/L. Five raw and biological filter effluent laboratory analyses for nitrate resulted in concentrations of near 3.6 mg/L in all samples, indicating no reduction from filtration.

15. The relationship between filter loading rate and filter run time was established with 34 trials at seven different loading rates. Representative runtimes ranged from 14 hours at 25 gpm/sf to approximately 90 hours at 5 gpm/sf. The full range of data is provided in Section 4.2.5 (Figure 4.13).
16. Runtimes for three manganese removal filter trials completed during the study each exceeded 2 weeks.
    i. Trial M1.01 operated at 5 gpm/sf was projected to 420 hours after the loading rate was increased at 337 hours for schedule purposes.
    ii. Trials M1.02 and M1.03 were both operated at 10 gpm/sf and both reached terminal headloss at 365 hours.
    iii. Trial M1.04 operated at 15 gpm/sf and was terminated at the end of the pilot study after 93 hours before a runtime projection could be extrapolated.
    iv. Stepped increases in headloss were noted after upstream iron filter backwashes. A filter to waste period after iron filter backwashes would further increase manganese filter run times.
17. Contaminant breakthrough was not observed during any of the biological filtration trials.
18. The suspended supernatant remained cloudy even after settling, likely indicating some unsettled or dissolved iron and manganese.
19. Recycling 5% suspended supernatant did not have adverse effects on water quality or filter performance.

<u>ADSORPTIVE FILTRATION PILOT CONCLUSIONS</u>

20. Oxidation with sodium hypochlorite (NaOCl) was effective at precipitating Fe in pretreated filter influent water samples. Greater than 90% of raw iron from was precipitated when filtered with 0.45-micron cellulose acetate filters and analyzed by field methods for both pH ranges tested.
21. Oxidation with NaOCl precipitated an average of 34% of dissolved Mn at a pH of 6.4 and 33% at a pH of 8.0 in the pretreated filter influent water samples. Oxidation with NaOCl does not oxidize soluble manganese directly into a precipitated particle as iron does. The oxidized state is changed such that manganese becomes adsorptive to the oxidized surface of the media.
22. A dose of 1.5 to 2.8 mg/L of NaOCl was used to provide a free chlorine residual near 0.5 mg/L.
23. KOH was used to adjust pH from a raw pH of 6.4 to a target of 8.0 s.u. in Filters C and D. The KOH dose response curve indicates that a dose of approximately 33 mg/L of KOH is necessary for this adjustment.
24. The adsorptive filters effectively reduced raw iron and manganese to below the SMCL, and the pilot study goal of one half of the SMCL, operating at filter surface loading rates from 5 to 10 gpm/sf.
25. Iron and manganese removal was similarly effective at all three FSLR tested, 5, 7.5, and 10 gpm/sf, and both pH levels tested, 6.4 and 8.0.
26. Filter run times were limited by terminal headloss to 10 psi in 33 of 44 filter runs. Four filter runs were discontinued at the end of the study. Contaminant breakthrough was observed during 7 trials.
27. Filter runtimes were slightly lower than the Inversand model.
    i. Filter runtimes for Filter A operating with Greensand media and at pH 6.4 ranged from approximately 65 hours at 5 gpm/sf to 20 hours at 10 gpm/sf.

   ii. Filter runtimes for Filter B operating with Pyrolusite media and at pH 6.4 ranged from approximately 38 hours at 5 gpm/sf to 11 hours at 10 gpm/sf.
   iii. Filter runtimes for Filter C operating with Greensand media and at pH 8.0 ranged from approximately 54 hours at 5 gpm/sf to 17 hours at 10 gpm/sf.
   iv. Filter runtimes for Filter D operating with Pyrolusite media and at pH 8.0 ranged from approximately 46 hours at 5 gpm/sf to 16 hours at 10 gpm/sf.

28. Recycling of 5% suspended supernatant did not appear to have an adverse effect on water quality or filter performance.

CONTRASTS BETWEEN BIOLOGICAL AND ADSORPTIVE FILTRATION

29. Biological filtration requires two filter vessels, one for iron removal and one for manganese removal, operating in series, while adsorptive filtration removes both contaminants in a single vessel.
30. Biological filtration requires initial acclimation of virgin sand media while adsorptive filtration does not require acclimation time.
31. Biological filtration is capable of operating at greater loading rates than adsorptive filtration while still achieving practical filter run times.
32. Biological filtration run times are greater than those for adsorptive filtration when tested at the same FSLR.
33. Adsorptive filtration utilizes NaOCl for oxidation while biological filtration does not require a chemical oxidant but is dependent on maintaining effective dissolved oxygen levels.
34. Settled supernatant from adsorptive filter backwashes appeared clearer than settled supernatant from biological filter backwashes.
35. Biological filters require less frequent backwashes and therefore produce less backwash water.

Appendix A – Biological Field Water Quality Notes

Sample Location Reference IDs

Sample ID	Sample Location/Description
07 WELL 2	Wellfield 2 – Raw water sample collected from pilot influent tap
08 WELL 2 + REC	Wellfield 2 + 5% Settled Supernatant
11 F1 EFF	Filter F1 Effluent sampled at the point of discharge to the sample sink.
12 F2 EFF	Filter F2 Effluent sampled at the point of discharge to the sample sink.
21 MPOKA	Pretreated influent Post-Aeration, Post-KOH addition to Filter M1 collected from the filter influent sample tap.
22 M1 EFF	Filter M1 Effluent sampled at the point of discharge to the sample sink.
31 F1 CBW	CBW F1 – Combined Backwash Filter F1 collected from homogenized backwash.
32 F2 CBW	CBW F2 – Combined Backwash Filter F2 collected from homogenized backwash.
33 M1 CBW	CBW M1 – Combined Backwash Filter M1 collected from homogenized backwash.
41 F1 SSN	SSN F1 – Settled Supernatant Filter A collected from top of settled CBW F1.
42 F2 SSN	SSN F2 – Settled Supernatant Filter A collected from top of settled CBW F2.
43 M1 SSN	SSN M1 – Settled Supernatant Filter B collected from top of settled CBW M1.

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
			07 WELL 2																	
			08 WELL 2 + REC																	
			11 F1 EFF																	
			12 F2 EFF																	
			21 MPOKA																	
			22 M1 EFF																	
			31 F1 CBW																	
			32 F2 CBW																	
			33 M1 CBW																	
			41 F1 SSN																	
			42 F2 SSN																	
			43 M1 SSN																	
1	1	12/08/22 09:30	Receive Pilot Container and Mobilize																	
1	12	12/09/22 09:00	Install Raw Water Line and Compressor Line																	
1	20	12/12/22 08:40	Town Starts up Well 2. Start Pilot Filters.												F1.01	F2.01		0.00	0.00	
1	20	12/12/22 08:40	Adjust Flows and Pressure												F1.01	F2.01		0.00	0.00	
1	20	12/12/22 08:40	Well Running at 112 gpm out of typical 220 gpm												F1.01	F2.01		0.00	0.00	
2	2	12/12/22 09:00	Initial Filter DP 0.28 psid for both filters												F1.01	F2.01		0.33	0.33	
2	3	12/12/22 09:30	Backwash Filter F1 and F2												F1.01	F2.01		0.83	0.83	
2	4	12/12/22 09:50	OL Raw pH and DO Now Active												F1.01	F2.01		1.17	1.17	
2	5	12/12/22 09:55	Calibrate OL Raw pH Probe												F1.01	F2.01		1.67	1.67	
2	7	12/12/22 10:20	Leave Site to Meet W. Bridgewater Pilot Delivery												F1.01	F2.01		5.58	5.58	
2	9	12/12/22 14:15	MPOKA pH and DO Now Active in FEFF												F1.01	F2.01		5.58	5.58	
2	11	12/12/22 14:15	Calibrate OL MPOKA pH Probe												F1.01	F2.01		6.08	6.08	
2	12	12/12/22 14:45	Calibrate Benchtop pH Meter 298												F1.01	F2.01		6.13	6.13	
2	14	12/12/22 14:48	07 WELL 2	0.14	0.10	0.034	0.033	6.52							F1.01	F2.01		6.13	6.13	
2	16	12/12/22 14:48	11 F1 EFF	0.09		0.035		6.53							F1.01	F2.01		6.13	6.13	
2	17	12/12/22 14:48	12 F2 EFF	0.10		0.035		6.52							F1.01	F2.01		7.08	7.08	
2	19	12/12/22 15:45	Setup Autosamplers @ 12 hrs. 18:00 and 6:00.												F1.01	F2.01		24.17	24.17	
3	1	12/13/22 08:50	07 WELL 2	0.19	0.15	0.045	0.053	6.28	11.5						F1.01	F2.01		24.17	24.17	
3	3	12/13/22 08:50	11 F1 EFF	0.19		0.051		6.26							F1.01	F2.01		24.17	24.17	
3	4	12/13/22 08:50	12 F2 EFF	0.19		0.056		6.27							F1.01	F2.01		24.17	24.17	
3	6	12/13/22 08:50	Well 2 at Hydrant	0.19	0.16	0.072	0.079	6.59	10.3						F1.01	F2.01		26.42	26.42	
3	17	12/13/22 11:05	Startup Empty Filter M1 to Confirm Operations.												F1.01	F2.01		26.83	26.83	
3	19	12/13/22 11:30	07 WELL 2	0.22	0.15	0.035	0.041	6.4							F1.01	F2.01		26.83	26.83	
3	21	12/13/22 11:30	11 F1 EFF	0.16		0.045		6.38							F1.01	F2.01		26.83	26.83	
3	22	12/13/22 11:30	12 F2 EFF	0.19		0.048		6.37							F1.01	F2.01		26.83	26.83	
3	23	12/13/22 11:30	Well 2 at Hydrant	0.16	0.17	0.047	0.041	6.77							F1.01	F2.01		27.13	27.13	
3	25	12/13/22 11:48	Shutdown M1												F1.01	F2.01		33.33	33.33	
4	1	12/13/22 18:00	11 F1 EFF	0.13		0.068									F1.01	F2.01		33.33	33.33	
4	2	12/13/22 18:00	12 F2 EFF	0.12		0.067									F1.01	F2.01		45.33	45.33	
4	3	12/14/22 06:00	11 F1 EFF	0.17		0.068									F1.01	F2.01		45.33	45.33	
4	4	12/14/22 06:00	12 F2 EFF	0.14		0.068									F1.01	F2.01		49.23	49.23	
4	6	12/14/22 09:54	Place All DO Probes in Raw Water for Comparison												F1.01	F2.01		49.33	49.33	
4	9	12/14/22 10:00	07 WELL 2	0.22	0.22	0.054	0.046	6.31	11.5						F1.01	F2.01		49.33	49.33	

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
4	11	12/14/22 10:00	11 F1 EFF	0.25		0.055		6.31							F1.01	F2.01		49.33	49.33	
4	12	12/14/22 10:00	12 F2 EFF	0.21		0.049		6.31							F1.01	F2.01		50.00	50.00	
4	20	12/14/22 10:40	Station Raw Sample Tap: T=0.	5.16		0.119									F1.01	F2.01		50.02	50.02	
4	21	12/14/22 10:41	Station Raw Sample Tap: T=1.	0.65		0.058									F1.01	F2.01		50.03	50.03	
4	22	12/14/22 10:42	Station Raw Sample Tap: T=2.	0.39		0.054									F1.01	F2.01		50.08	50.08	
4	23	12/14/22 10:45	Station Raw Sample Tap: T=5.	0.35		0.058									F1.01	F2.01		50.12	50.12	
4	24	12/14/22 10:47	Station Raw Sample Tap: T=7.	0.30		0.053									F1.01	F2.01		50.17	50.17	
4	25	12/14/22 10:50	Station Raw Sample Tap: T=10	0.28		0.055									F1.01	F2.01		50.25	50.25	
5	6	12/14/22 10:55	Return DO Probes to Assigned Sample Cups												F1.01	F2.01		57.33	57.33	
5	12	12/14/22 18:00	11 F1 EFF	0.09		0.080									F1.01	F2.01		57.33	57.33	
5	13	12/14/22 18:00	12 F2 EFF	0.09		0.070									F1.01	F2.01		69.33	69.33	
5	14	12/15/22 06:00	11 F1 EFF	0.10		0.071									F1.01	F2.01		69.33	69.33	
5	15	12/15/22 06:00	12 F2 EFF	0.11		0.061									F1.01	F2.01		77.75	77.75	
5	17	12/15/22 14:25	07 WELL 2	0.25	0.23	0.063	0.056	6.47	13.2						F1.01	F2.01		77.75	77.75	
5	19	12/15/22 14:25	11 F1 EFF	0.11		0.051		6.51							F1.01	F2.01		77.75	77.75	
5	20	12/15/22 14:25	12 F2 EFF	0.13		0.059		6.49							F1.01	F2.01		77.83	77.83	
5	21	12/15/22 14:30	Changed DP Span from 0 to 50 to 1 to 150 for F1, F2 and M1												F1.01	F2.01		81.33	81.33	
6	1	12/15/22 18:00	11 F1 EFF	0.05		0.088									F1.01	F2.01		81.33	81.33	
6	2	12/15/22 18:00	12 F2 EFF	0.04		0.068									F1.01	F2.01		93.33	93.33	
6	3	12/16/22 06:00	11 F1 EFF	0.04		0.074									F1.01	F2.01		93.33	93.33	
6	4	12/16/22 06:00	12 F2 EFF	0.00		0.068									F1.01	F2.01		100.13	100.13	
6	7	12/16/22 12:48	07 WELL 2	0.23	0.20	0.073	0.095	6.32	13.3						F1.01	F2.01		100.13	100.13	
6	9	12/16/22 12:48	11 F1 EFF	0.01		0.066		6.37							F1.01	F2.01		100.13	100.13	
6	10	12/16/22 12:48	12 F2 EFF	0.04		0.068		6.33							F1.01	F2.01		100.38	100.38	
6	12	12/16/22 13:03	07 WELL 2							45.5					F1.01	F2.01		100.77	100.77	
6	13	12/16/22 13:26	07 WELL 2								36.08				F1.01	F2.01		105.33	105.33	
6	14	12/16/22 18:00	11 F1 EFF	0.01		0.046									F1.01	F2.01		105.33	105.33	
6	15	12/16/22 18:00	12 F2 EFF	0.01		0.043									F1.01	F2.01		117.33	117.33	
6	16	12/17/22 06:00	11 F1 EFF	0.00		0.050									F1.01	F2.01		117.33	117.33	
6	17	12/17/22 06:00	12 F2 EFF	0.01		0.035									F1.01	F2.01		129.33	129.33	
6	18	12/17/22 18:00	11 F1 EFF	0.04		0.034									F1.01	F2.01		129.33	129.33	
6	19	12/17/22 18:00	12 F2 EFF	0.03		0.051									F1.01	F2.01		141.33	141.33	
6	20	12/18/22 06:00	11 F1 EFF	0.03		0.051									F1.01	F2.01		141.33	141.33	
6	21	12/18/22 06:00	12 F2 EFF	0.01		0.047									F1.01	F2.01		153.33	153.33	
6	22	12/18/22 18:00	11 F1 EFF	0.03		0.052									F1.01	F2.01		153.33	153.33	
6	23	12/18/22 18:00	12 F2 EFF	0.04		0.051									F1.01	F2.01		165.33	165.33	
6	24	12/19/22 06:00	11 F1 EFF	0.04		0.058									F1.01	F2.01		165.33	165.33	
6	25	12/19/22 06:00	12 F2 EFF	0.01		0.057									F1.01	F2.01		172.12	172.12	
7	1	12/19/22 12:47	07 WELL 2	0.47	0.24	0.062	0.063	6.26	12.5						F1.01	F2.01		172.12	172.12	
7	3	12/19/22 12:47	11 F1 EFF	0.01		0.053		6.37							F1.01	F2.01		172.12	172.12	
7	4	12/19/22 12:47	12 F2 EFF	0.02		0.050		6.35							F1.01	F2.01		172.83	172.83	
7	8	12/19/22 13:30	Shutdown Pilot to Increase Well Flow from 112 to 186 gpm												F1.01	F2.01		173.17	173.17	
7	9	12/19/22 13:50	Restart Flow to Pilot												F1.01	F2.01		173.75	173.75	
7	11	12/19/22 14:25	07 WELL 2	1.26	0.32	0.085	0.068								F1.01	F2.01		173.75	173.75	
7	13	12/19/22 14:25	11 F1 EFF	0.03		0.068									F1.01	F2.01		173.75	173.75	
7	14	12/19/22 14:25	12 F2 EFF	0.05		0.073									F1.01	F2.01		177.33	177.33	
7	16	12/19/22 18:00	11 F1 EFF	0.01		0.067									F1.01	F2.01		177.33	177.33	

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
7	17	12/19/22 18:00	12 F2 EFF	0.00		0.063									F1.01	F2.01		189.33	189.33	
7	18	12/20/22 06:00	11 F1 EFF	0.00		0.068									F1.01	F2.01		189.33	189.33	
7	19	12/20/22 06:00	12 F2 EFF	0.00		0.063									F1.01	F2.01		197.23	197.23	
7	21	12/20/22 13:54	07 WELL 2	0.41	0.33	0.073	0.072	6.39	13.7						F1.01	F2.01		197.23	197.23	
7	23	12/20/22 13:54	11 F1 EFF	0.05		0.074		6.38							F1.01	F2.01		197.23	197.23	
7	24	12/20/22 13:54	12 F2 EFF	0.03		0.070		6.37							F1.01	F2.01		197.63	197.63	
8	1	12/20/22 14:18	Shutdown Filters to do Flow Calibrations												F1.01	F2.01		197.63	197.63	
8	3	12/20/22 14:18	Flow Calibrations												F1.01	F2.01		198.00	198.00	
8	5	12/20/22 14:40	Move Autosampler from F2 to Raw												F1.01	F2.01		201.33	201.33	
8	7	12/20/22 18:00	07 WELL 2	0.23		0.079									F1.01	F2.01		201.33	201.33	
8	8	12/20/22 18:00	11 F1 EFF	0.02		0.080									F1.01	F2.01		213.33	213.33	
8	9	12/21/22 06:00	07 WELL 2	0.30		0.084									F1.01	F2.01		213.33	213.33	
8	10	12/21/22 06:00	11 F1 EFF	0.00		0.078									F1.01	F2.01		216.90	216.90	
8	12	12/21/22 09:34	07 WELL 2	0.53	0.30	0.070	0.073	6.39							F1.01	F2.01		216.90	216.90	
8	13	12/21/22 09:34	11 F1 EFF	0.01		0.074		6.47							F1.01	F2.01		216.90	216.90	
8	14	12/21/22 09:34	12 F2 EFF	0.03		0.078		6.45							F1.01	F2.01		217.27	217.27	
8	16	12/21/22 09:56	07 WELL 2							47.5					F1.01	F2.01		217.27	217.27	
8	17	12/21/22 09:56	11 F1 EFF							42					F1.01	F2.01		217.27	217.27	
8	18	12/21/22 09:56	12 F2 EFF							42					F1.01	F2.01		217.58	217.58	
8	23	12/21/22 10:15	07 WELL 2								39.16				F1.01	F2.01		217.58	217.58	
8	24	12/21/22 10:15	11 F1 EFF								31.24				F1.01	F2.01		217.58	217.58	
8	25	12/21/22 10:15	12 F2 EFF								32.12				F1.01	F2.01		217.58	217.58	
9	1	12/21/22 10:15	pH Titrations for Raw, F1 and F2												F1.01	F2.01		225.33	225.33	
10	1	12/21/22 18:00	07 WELL 2	0.20		0.075									F1.01	F2.01		225.33	225.33	
10	2	12/21/22 18:00	11 F1 EFF	0.02		0.065									F1.01	F2.01		237.33	237.33	
10	3	12/22/22 06:00	07 WELL 2	0.26		0.074									F1.01	F2.01		237.33	237.33	
10	4	12/22/22 06:00	11 F1 EFF	0.01		0.066									F1.01	F2.01		246.67	246.67	
10	8	12/22/22 15:20	07 WELL 2	0.69	0.29	0.073	0.073	6.22	12.7						F1.01	F2.01		246.67	246.67	
10	10	12/22/22 15:20	11 F1 EFF	0.05		0.064		6.21							F1.01	F2.01		246.67	246.67	
10	11	12/22/22 15:20	12 F2 EFF	0.04		0.074		6.23							F1.01	F2.01		249.33	249.33	
10	16	12/22/22 18:00	07 WELL 2	0.25		0.071									F1.01	F2.01		249.33	249.33	
10	17	12/22/22 18:00	11 F1 EFF	0.02		0.071									F1.01	F2.01		261.33	261.33	
10	18	12/23/22 06:00	07 WELL 2	0.33		0.085									F1.01	F2.01		261.33	261.33	
10	19	12/23/22 06:00	11 F1 EFF	0.04		0.076									F1.01	F2.01		267.20	267.20	
10	22	12/23/22 11:52	07 WELL 2	0.78	0.32	0.083	0.077	6.39	13.9						F1.01	F2.01		267.20	267.20	
10	24	12/23/22 11:52	11 F1 EFF	0.06		0.072		6.17							F1.01	F2.01		267.20	267.20	
10	25	12/23/22 11:52	12 F2 EFF	0.04		0.071		6.17							F1.01	F2.01		267.23	267.23	
11	1	12/23/22 11:54	Place All DO Probes in Raw Water for Comparison												F1.01	F2.01		273.33	273.33	
11	3	12/23/22 18:00	07 WELL 2	0.13		0.083									F1.01	F2.01		273.33	273.33	
11	4	12/23/22 18:00	11 F1 EFF	0.00		0.056									F1.01	F2.01		285.33	285.33	
11	5	12/24/22 06:00	07 WELL 2	0.14		0.107									F1.01	F2.01		285.33	285.33	
11	6	12/24/22 06:00	11 F1 EFF	0.01		0.061									F1.01	F2.01		297.33	297.33	
11	7	12/24/22 18:00	07 WELL 2	0.19		0.082									F1.01	F2.01		297.33	297.33	
11	8	12/24/22 18:00	11 F1 EFF	0.03		0.061									F1.01	F2.01		309.33	309.33	
11	9	12/25/22 06:00	07 WELL 2	0.17		0.075									F1.01	F2.01		309.33	309.33	
11	10	12/25/22 06:00	11 F1 EFF	0.01		0.075									F1.01	F2.01		321.33	321.33	
11	11	12/25/22 18:00	07 WELL 2	0.17		0.086									F1.01	F2.01		321.33	321.33	

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
11	12	12/25/22 18:00	11 F1 EFF	0.01		0.071									F1.01	F2.01		333.33	333.33	
11	13	12/26/22 06:00	07 WELL 2	0.25		0.107									F1.01	F2.01		333.33	333.33	
11	14	12/26/22 06:00	11 F1 EFF	0.01		0.081									F1.01	F2.01		338.50	338.50	
11	18	12/26/22 11:10	07 WELL 2	0.56	0.25	0.084	0.083	6.2	12						F1.01	F2.01		338.50	338.50	
11	20	12/26/22 11:10	11 F1 EFF	0.03		0.084		6.46							F1.01	F2.01		338.50	338.50	
11	21	12/26/22 11:10	12 F2 EFF	0.01		0.075		6.46							F1.01	F2.01		338.50	338.50	
11	23	12/26/22 11:10	Record DO Probe Comparison - See Data Sheet												F1.01	F2.01		338.80	338.80	
11	24	12/26/22 11:28	Place All DO Probes in F2 for Comparison												F1.01	F2.01		338.92	338.92	
12	1	12/26/22 11:35	Shutdown F1 for Backwash. 30L												F1.01	F2.01		339.25	339.25	
12	2	12/26/22 11:55	Restart F1 for Trial 2												F1.02	F2.01		0.00	339.33	
12	3	12/26/22 12:00	Shutdown F2 for Backwash. 30L												F1.02	F2.01		0.08	339.47	
12	4	12/26/22 12:08	Restart F2 - For Trial 2												F1.02	F2.02		1.00	0.00	
12	5	12/26/22 12:14	Increase FSLR for both F1 and F2 from 5.0 to 7.5 gpm/sf												F1.02	F2.02		1.10	0.10	
12	8	12/26/22 18:00	07 WELL 2												F1.02	F2.02		6.87	5.87	
12	9	12/26/22 18:00	11 F1 EFF	0.01											F1.02	F2.02		6.87	5.87	
12	10	12/27/22 06:00	07 WELL 2												F1.02	F2.02		18.87	17.87	
12	11	12/27/22 06:00	11 F1 EFF	0.01											F1.02	F2.02		18.87	17.87	
12	12	12/27/22 18:00	07 WELL 2												F1.02	F2.02		30.87	29.87	
12	13	12/27/22 18:00	11 F1 EFF	0.00											F1.02	F2.02		30.87	29.87	
12	14	12/28/22 06:00	07 WELL 2												F1.02	F2.02		42.87	41.87	
12	15	12/28/22 06:00	11 F1 EFF	0.00											F1.02	F2.02		42.87	41.87	
12	16	12/28/22 10:00	Move Autosampler from Raw Back to F2												F1.02	F2.02		46.87	45.87	
12	18	12/28/22 10:20	07 WELL 2	0.50	0.33	0.084	0.081	6.53	12.1						F1.02	F2.02		47.20	46.20	
12	20	12/28/22 10:20	Well 2 at Hydrant	0.33											F1.02	F2.02		47.20	46.20	
12	21	12/28/22 10:20	11 F1 EFF	0.01		0.083		6.43							F1.02	F2.02		47.20	46.20	
12	22	12/28/22 10:20	12 F2 EFF	0.01		0.084		6.43							F1.02	F2.02		47.20	46.20	
12	23	12/28/22 10:20	Move all DO probes into FEFF + Biosulfite												F1.02	F2.02		47.20	46.20	
13	1	12/28/22 18:00	11 F1 EFF	0.00		0.071									F1.02	F2.02		54.87	53.87	
13	2	12/28/22 18:00	12 F2 EFF	0.01		0.084									F1.02	F2.02		54.87	53.87	
13	3	12/29/22 06:00	11 F1 EFF	0.00		0.078									F1.02	F2.02		66.87	65.87	
13	4	12/29/22 06:00	12 F2 EFF	0.03		0.07									F1.02	F2.02		66.87	65.87	
13	5	12/29/22 18:00	11 F1 EFF	0.02		0.079									F1.02	F2.02		78.87	77.87	
13	6	12/29/22 18:00	12 F2 EFF	0.01		0.084									F1.02	F2.02		78.87	77.87	
13	7	12/30/22 06:00	11 F1 EFF	0.00		0.076									F1.02	F2.02		90.87	89.87	
13	8	12/30/22 06:00	12 F2 EFF	0.04		0.096									F1.02	F2.02		90.87	89.87	
13	11	12/30/22 09:00	07 WELL 2	0.68	0.09	0.090	0.087	6.2	13.4						F1.02	F2.02		93.87	92.87	
13	13	12/30/22 09:00	11 F1 EFF	0.01		0.075		6.16							F1.02	F2.02		93.87	92.87	
13	14	12/30/22 09:00	12 F2 EFF	0.01		0.083		6.21							F1.02	F2.02		93.87	92.87	
13	15	12/30/22 09:06	Move DO Probes. RAW to RAW. MPOKA to F1. MEFF to F2.												F1.02	F2.02		93.97	92.97	
13	17	12/30/22 18:00	11 F1 EFF	0.00		0.068									F1.02	F2.02		102.87	101.87	
13	18	12/30/22 18:00	12 F2 EFF	0.00		0.080									F1.02	F2.02		102.87	101.87	
13	19	12/31/22 06:00	11 F1 EFF	0.03		0.083									F1.02	F2.02		114.87	113.87	
13	20	12/31/22 06:00	12 F2 EFF	0.00		0.087									F1.02	F2.02		114.87	113.87	
13	21	12/31/22 18:00	11 F1 EFF	0.00		0.083									F1.02	F2.02		126.87	125.87	
13	22	12/31/22 18:00	12 F2 EFF	0.00		0.073									F1.02	F2.02		126.87	125.87	
13	23	01/01/23 06:00	11 F1 EFF	0.01		0.088									F1.02	F2.02		138.87	137.87	
13	24	01/01/23 06:00	12 F2 EFF	0.00		0.078									F1.02	F2.02		138.87	137.87	

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
14	1	01/01/23 18:00	11 F1 EFF	0.00		0.084									F1.02	F2.02		150.87	149.87	
14	2	01/01/23 18:00	12 F2 EFF	0.00		0.073									F1.02	F2.02		150.87	149.87	
14	3	01/02/23 06:00	11 F1 EFF	0.01		0.073									F1.02	F2.02		162.87	161.87	
14	4	01/02/23 06:00	12 F2 EFF	0.00		0.089									F1.02	F2.02		162.87	161.87	
14	5	01/02/23 18:00	11 F1 EFF	0.01		0.078									F1.02	F2.02		174.87	173.87	
14	6	01/02/23 18:00	12 F2 EFF	0.04		0.069									F1.02	F2.02		174.87	173.87	
14	7	01/03/23 06:00	11 F1 EFF	0.00		0.070									F1.02	F2.02		186.87	185.87	
14	8	01/03/23 06:00	12 F2 EFF	0.00		0.083									F1.02	F2.02		186.87	185.87	
14	10	01/03/23 10:25	Shutdown Filters F1 and F2 for BW - 22L												F1.02	F2.02		191.28	190.28	
14	14	01/03/23 11:09	Restart Filters F1 and F2 for Trial 3												F1.03	F2.03		0.00	0.00	
14	15	01/03/23 11:12	F1 @ 3 min	0.04		0.170									F1.03	F2.03		0.05	0.05	
14	16	01/03/23 11:12	F2 @ 3 min	0.08		0.161									F1.03	F2.03		0.05	0.05	
14	17	01/03/23 11:17	F1 @ 8 min	0.16		0.185									F1.03	F2.03		0.13	0.13	
14	18	01/03/23 11:17	F2 @ 8 min	0.03		0.182									F1.03	F2.03		0.13	0.13	
14	19	01/03/23 11:27	F1 @ 18 min	0.03		0.169		6.27							F1.03	F2.03		0.30	0.30	
14	20	01/03/23 11:27	F2 @ 18 min	0.01		0.194		6.2							F1.03	F2.03		0.30	0.30	
14	21	01/03/23 11:27	07 WELL 2	0.50	0.41	0.141	0.126	6.38	13.6						F1.03	F2.03		0.30	0.30	
15	3	01/03/23 18:00	11 F1 EFF	0.00		0.096									F1.03	F2.03		6.85	6.85	
15	4	01/03/23 18:00	12 F2 EFF	0.07		0.093									F1.03	F2.03		6.85	6.85	
15	5	01/04/23 06:00	11 F1 EFF	0.02		0.085									F1.03	F2.03		18.85	18.85	
15	6	01/04/23 06:00	12 F2 EFF	0.06		0.088									F1.03	F2.03		18.85	18.85	
15	8	01/04/23 11:30	Town Increases Flow from 186 to 290 gpm												F1.03	F2.03		24.35	24.35	
15	9	01/04/23 12:00	Adjust Waste Valve to Provide 35 psi to pilot												F1.03	F2.03		24.85	24.85	
15	11	01/04/23 12:17	07 WELL 2	3.72	0.49	0.168	0.113	6.31	14.1						F1.03	F2.03		25.13	25.13	
15	13	01/04/23 12:17	11 F1 EFF	0.05		0.115		6.3							F1.03	F2.03		25.13	25.13	
15	14	01/04/23 12:17	12 F2 EFF	0.03		0.124		6.18							F1.03	F2.03		25.13	25.13	
15	15	01/04/23 12:40	07 WELL 2							46.5					F1.03	F2.03		25.52	25.52	
15	16	01/04/23 12:40	11 F1 EFF							41					F1.03	F2.03		25.52	25.52	
15	17	01/04/23 12:40	12 F2 EFF							42					F1.03	F2.03		25.52	25.52	
15	18	01/04/23 12:40	07 WELL 2								47.1				F1.03	F2.03		25.52	25.52	
15	19	01/04/23 12:40	11 F1 EFF								46.2				F1.03	F2.03		25.52	25.52	
15	20	01/04/23 12:40	12 F2 EFF								48.84				F1.03	F2.03		25.52	25.52	
15	22	01/04/23 18:00	11 F1 EFF	0.02											F1.03	F2.03		30.85	30.85	
15	23	01/04/23 18:00	12 F2 EFF	0.02											F1.03	F2.03		30.85	30.85	
15	24	01/05/23 06:00	11 F1 EFF	0.01											F1.03	F2.03		42.85	42.85	
15	25	01/05/23 06:00	12 F2 EFF	0.03											F1.03	F2.03		42.85	42.85	
16	1	01/05/23 18:00	11 F1 EFF	0.02											F1.03	F2.03		54.85	54.85	
16	2	01/05/23 18:00	12 F2 EFF	0.02											F1.03	F2.03		54.85	54.85	
16	3	01/06/23 06:00	11 F1 EFF	0.01											F1.03	F2.03		66.85	66.85	
16	4	01/06/23 06:00	12 F2 EFF	0.03											F1.03	F2.03		66.85	66.85	
16	6	01/06/23 13:00	07 WELL 2	0.80	0.61	0.126	0.121	6.42	12.5						F1.03	F2.03		73.85	73.85	
16	8	01/06/23 13:00	11 F1 EFF	0.03		0.100		6.4							F1.03	F2.03		73.85	73.85	
16	9	01/06/23 13:00	12 F2 EFF	0.03		0.117		6.42							F1.03	F2.03		73.85	73.85	
16	11	01/06/23 13:28	Place All DO Probes in Continually Aerated Sample												F1.03	F2.03		74.32	74.32	
16	12	01/06/23 13:32	Final Photo of 1/3 Backwash Cones												F1.03	F2.03		74.38	74.38	
16	14	01/06/23 13:40	F1 Off for BW. V= 30L												F1.04	F2.03		74.52	74.52	
16	15	01/06/23 13:48	Place F1 in Service @ Reduced FSLR 7.5 down to 5.0 gpm/sf												F1.04	F2.03		0.00	74.65	

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
16	16	01/06/23 13:54	F1 @ 6 min	0.07											F1.04	F2.03		0.10	74.75	
16	17	01/06/23 13:55	F2 Off for BW. V=30L												F1.04	F2.03		0.12	74.77	
16	18	01/06/23 14:03	Place F2 in Service @ Reduced FSLR 7.5 down to 5.0 gpm/sf												F1.04	F2.04		0.25	0.00	
16	19	01/06/23 14:04	F1 @ 16 min	0.16											F1.04	F2.04		0.27	0.02	
16	20	01/06/23 14:10	F1 @ 22 min	0.08											F1.04	F2.04		0.37	0.12	
16	21	01/06/23 14:10	F2 @ 7 min	0.09											F1.04	F2.04		0.37	0.12	
16	22	01/06/23 14:18	F2 @ 15 min	0.04											F1.04	F2.04		0.50	0.25	
16	23	01/06/23 14:25	F2 @ 22 min	0.04											F1.04	F2.04		0.62	0.37	
16	24	01/06/23 14:34	Return All DO Probes from Aerated Sample to Sample Cups. See Notes.												F1.04	F2.04		0.77	0.52	
17	1	01/06/23 14:40	Photo of Settling Cones. F1 @ 60 min with 55 mL solids. F2 @45 min with 70 mL solids.												F1.04	F2.04		0.87	0.62	
17	4	01/06/23 14:43	11 F1 EFF	0.03											F1.04	F2.04		0.92	0.67	
17	5	01/06/23 14:43	12 F2 EFF	0.02											F1.04	F2.04		0.92	0.67	
17	7	01/06/23 18:00	11 F1 EFF	0.00											F1.04	F2.04		4.20	3.95	
17	8	01/06/23 18:00	12 F2 EFF	0.01											F1.04	F2.04		4.20	3.95	
17	9	01/07/23 06:00	11 F1 EFF	0.03											F1.04	F2.04		16.20	15.95	
17	10	01/07/23 06:00	12 F2 EFF	0.00											F1.04	F2.04		16.20	15.95	
17	11	01/07/23 18:00	11 F1 EFF	0.00											F1.04	F2.04		28.20	27.95	
17	12	01/07/23 18:00	12 F2 EFF	0.00											F1.04	F2.04		28.20	27.95	
17	13	01/08/23 06:00	11 F1 EFF	0.00											F1.04	F2.04		40.20	39.95	
17	14	01/08/23 06:00	12 F2 EFF	0.09											F1.04	F2.04		40.20	39.95	
17	15	01/08/23 18:00	11 F1 EFF	0.00											F1.04	F2.04		52.20	51.95	
17	16	01/08/23 18:00	12 F2 EFF	0.00											F1.04	F2.04		52.20	51.95	
17	17	01/09/23 06:00	11 F1 EFF	0.00											F1.04	F2.04		64.20	63.95	
17	18	01/09/23 06:00	12 F2 EFF	0.02											F1.04	F2.04		64.20	63.95	
17	21	01/09/23 12:30	07 WELL 2	0.69	0.37	0.116	0.114	6.4	12.8						F1.04	F2.04		70.70	70.45	
17	22	01/09/23 12:30	11 F1 EFF	0.01		0.110		6.44							F1.04	F2.04		70.70	70.45	
17	23	01/09/23 12:30	12 F2 EFF	0.02		0.094		6.43							F1.04	F2.04		70.70	70.45	
18	1	01/09/23 12:56	Move MPOKA pH and DO probes to live MPOKA sample cup												F1.04	F2.04		71.13	70.88	
18	2	01/09/23 12:58	Start Mock MPOKA PID pH target to 7.2												F1.04	F2.04		71.17	70.92	
18	3	01/09/23 13:06	Reduce M1 FSLR from 7.5 to 5.0 gpm/sf												F1.04	F2.04		71.30	71.05	
18	5	01/09/23 13:21	07 WELL 2									4.2			F1.04	F2.04		71.55	71.30	
18	6	01/09/23 13:21	11 F1 EFF									1.8			F1.04	F2.04		71.55	71.30	
18	7	01/09/23 13:21	12 F2 EFF									2.9			F1.04	F2.04		71.55	71.30	
18	9	01/09/23 18:00	11 F1 EFF	0.00											F1.04	F2.04		76.20	75.95	
18	10	01/09/23 18:00	12 F2 EFF	0.01											F1.04	F2.04		76.20	75.95	
18	11	01/10/23 06:00	11 F1 EFF	0.02											F1.04	F2.04		88.20	87.95	
18	12	01/10/23 06:00	12 F2 EFF	0.02											F1.04	F2.04		88.20	87.95	
18	14	01/10/23 13:21	Shutdown F1 for Backwash.												F1.04	F2.04		95.55	95.30	
18	15	01/10/23 13:32	Increase MPOKA PID I-value from 30 to 60 and decrease P-value from 0.5 to 0.25													F2.04			95.48	
18	16	01/10/23 13:23	Restart Filter F1												F1.05	F2.04		0.00	95.33	
18	16	01/10/23 13:23	Shutdown Filter F2												F1.05	F2.04		0.00	95.33	
18	17	01/10/23 13:45	Restart Filter F2												F1.05	F2.05		0.37	0.00	
18	20	01/10/23 13:56	F1 @ 23 min	0.03											F1.05	F2.05		0.55	0.18	
18	21	01/10/23 13:56	F2 @ 11 min	0.08											F1.05	F2.05		0.55	0.18	
18	22	01/10/23 14:06	F1 @ 33 min	0.05											F1.05	F2.05		0.72	1.00	
18	23	01/10/23 14:06	F2 @ 21 min	0.04											F1.05	F2.05		0.72	1.00	
18	24	01/10/23 18:00	11 F1 EFF	0.00											F1.05	F2.05		4.62	4.90	

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
18	25	01/10/23 18:00	12 F2 EFF	0.01											F1.05	F2.05		4.62	4.90	
19	1	01/11/23 06:00	11 F1 EFF	0.01											F1.05	F2.05		16.62	16.90	
19	2	01/11/23 06:00	12 F2 EFF	0.00											F1.05	F2.05		16.62	16.90	
19	4	01/11/23 13:30	MPOKA pH PID not stable. Break tank level low. Decrease MPOKA, F1 and F2 sample line flows.												F1.05	F2.05		24.12	24.40	
19	7	01/11/23 13:40	Install Painters Cup at Break Tank Inflow. Install MPOKA pH probe into cup.												F1.05	F2.05		24.28	24.57	
19	9	01/11/23 14:00	07 WELL 2	0.82	0.40	0.134	0.121	6.47	11.3						F1.05	F2.05		24.62	24.90	
19	11	01/11/23 14:00	11 F1 EFF	0.01		0.123		6.47							F1.05	F2.05		24.62	24.90	
19	12	01/11/23 14:00	12 F2 EFF	0.01		0.117		6.46							F1.05	F2.05		24.62	24.90	
19	16	01/11/23 18:00	11 F1 EFF												F1.05	F2.05		28.62	28.90	
19	17	01/11/23 18:00	12 F2 EFF												F1.05	F2.05		28.62	28.90	
19	18	01/12/23 06:00	11 F1 EFF												F1.05	F2.05		40.62	40.90	
19	19	01/12/23 06:00	12 F2 EFF												F1.05	F2.05		40.62	40.90	
19	21	01/12/23 12:00	MPOKA pH Stable. PID OK. Increase pH setpoint from 7.2 to 7.6 to evaluate PID response.												F1.05	F2.05		46.62	46.90	
20	2	01/12/23 12:20	07 WELL 2	0.69	0.35	0.127	0.133	6.41	12.2			3.7			F1.05	F2.05		46.95	47.23	
20	3	01/12/23 12:20	11 F1 EFF	0.02		0.123		6.36				1.9			F1.05	F2.05		46.95	47.23	
20	4	01/12/23 12:20	12 F2 EFF	0.01		0.116						3			F1.05	F2.05		46.95	47.23	
20	7	01/12/23 12:50	Shutdown Flow to F1 to Simulate BW and evaluate PID response.												F1.05	F2.05		47.45	47.73	
20	8	01/12/23 12:50	pH drops while KOH feed rate increases. Dead zone in saturator will require future F2 and KOH connection swap.												F1.05	F2.05		47.45	47.73	
20	9	01/12/23 13:01	Restore Flow to F1.												F1.05	F2.05		47.63	47.92	
20	15	01/12/23 13:10	07 WELL 2									3.5			F1.05	F2.05		47.78	48.07	
20	16	01/12/23 13:10	11 F1 EFF									2.2			F1.05	F2.05		47.78	48.07	
20	17	01/12/23 13:10	12 F2 EFF									2.5			F1.05	F2.05		47.78	48.07	
20	21	01/12/23 18:00	11 F1 EFF	0.02											F1.05	F2.05		52.62	52.90	
20	22	01/12/23 18:00	12 F2 EFF	0.03											F1.05	F2.05		52.62	52.90	
20	23	01/13/23 06:00	11 F1 EFF	0.03											F1.05	F2.05		64.62	64.90	
20	24	01/13/23 06:00	12 F2 EFF	0.02											F1.05	F2.05		64.62	64.90	
21	2	01/13/23 11:03	MPOKA PID stable at 7.6. Shut off KOH feed and M1 booster pump.												F1.05	F2.05		69.67	69.95	
21	8	01/13/23 11:43	07 WELL 2	0.53	0.43	0.125	0.133	6.14	12.8	50	246.4				F1.05	F2.05		70.33	70.62	
21	9	01/13/23 11:43	11 F1 EFF	0.03		0.124		6.22		46	160.6				F1.05	F2.05		70.33	70.62	
21	10	01/13/23 11:43	12 F2 EFF	0.03				6.19		43	158.4				F1.05	F2.05		70.33	70.62	
21	11	01/13/23 13:10	Collect Lab Samples on Raw Water												F1.05	F2.05		71.78	72.07	
21	18	01/13/23 18:00	11 F1 EFF	0.01											F1.05	F2.05		76.62	76.90	
21	19	01/13/23 18:00	12 F2 EFF	0.03											F1.05	F2.05		76.62	76.90	
21	20	01/14/23 06:00	11 F1 EFF	0.01											F1.05	F2.05		88.62	88.90	
21	21	01/14/23 06:00	12 F2 EFF	0.03											F1.05	F2.05		88.62	88.90	
21	22	01/14/23 18:00	11 F1 EFF	0.02											F1.05	F2.05		100.62	100.90	
21	23	01/14/23 18:00	12 F2 EFF	0.01											F1.05	F2.05		100.62	100.90	
21	24	01/15/23 06:00	11 F1 EFF	0.00											F1.05	F2.05		112.62	112.90	
21	25	01/15/23 06:00	12 F2 EFF	0.03											F1.05	F2.05		112.62	112.90	
22	2	01/15/23 18:00	11 F1 EFF	0.00											F1.05	F2.05		124.62	124.90	
22	3	01/15/23 18:00	12 F2 EFF	0.01											F1.05	F2.05		124.62	124.90	
22	4	01/16/23 06:00	11 F1 EFF	0.02											F1.05	F2.05		136.62	136.90	
22	5	01/16/23 06:00	12 F2 EFF	0.02											F1.05	F2.05		136.62	136.90	
22	7	01/16/23 10:05	07 WELL 2	0.54	0.04	0.141	0.143	6.36	12.1			3.3			F1.05	F2.05		140.70	140.98	
22	8	01/16/23 10:05	11 F1 EFF	0.02		0.134		6.37				3			F1.05	F2.05		140.70	140.98	
22	9	01/16/23 10:05	12 F2 EFF	0.02		0.140		6.37				2.6			F1.05	F2.05		140.70	140.98	
22	10	01/16/23 10:08	Shutdown F1 for BW. V = 22L												F1.05	F2.05		140.75	141.03	

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
22	11	01/16/23 10:21	Restart F1													F2.05			141.25	
22	12	01/16/23 10:25	Shutdown F2 for Backwash. V = 22L													F2.05			141.32	
22	13	01/16/23 10:37	Restart F2																	
22	14	01/16/23 10:37	Shutdown F1 and F2 for Saturator Injector Modification																	
22	15	01/16/23 11:15	Replace Mock M1 Filter Vessel with mature BMARS Shrewsbury vessel.																	
22	16	01/16/23 11:23	Restart F1 and F2												F1.06	F2.06		0.00	0.00	
22	17	01/16/23 11:27	Start KOH feed on PID for MPOKA pH target 7.6												F1.06	F2.06		0.07	0.07	
22	18	01/16/23 11:31	Increase FSLR for F1 and F2 from 5.0 to 7.5 gpm/sf												F1.06	F2.06		0.13	0.13	
22	23	01/16/23 12:00	Startup M1. Move MEFF pH and DO probe to MEFF sample cup												F1.06	F2.06	M1.01	0.62	0.62	0.00
23	8	01/16/23 13:08	07 WELL 2	0.57	0.46	0.135	0.134	6.37	11.9			2.9			F1.06	F2.06	M1.01	1.75	1.75	1.13
23	9	01/16/23 13:08	11 F1 EFF	0.07		0.162		6.34				2.5			F1.06	F2.06	M1.01	1.75	1.75	1.13
23	10	01/16/23 13:08	12 F2 EFF	0.04		0.171		6.36				2.7			F1.06	F2.06	M1.01	1.75	1.75	1.13
23	11	01/16/23 13:08	21 MPOKA	0.07	0.00	0.157		7.25							F1.06	F2.06	M1.01	1.75	1.75	1.13
23	12	01/16/23 13:08	22 M1 EFF	0.00		0.000		7.22				2.8			F1.06	F2.06	M1.01	1.75	1.75	1.13
23	17	01/16/23 18:00	11 F1 EFF												F1.06	F2.06	M1.01	6.62	6.62	6.00
23	18	01/16/23 18:00	22 M1 EFF			0.009									F1.06	F2.06	M1.01	6.62	6.62	6.00
23	19	01/17/23 00:00	22 M1 EFF			0.008									F1.06	F2.06	M1.01	12.62	12.62	12.00
23	20	01/17/23 06:00	11 F1 EFF												F1.06	F2.06	M1.01	18.62	18.62	18.00
23	21	01/17/23 06:00	22 M1 EFF			0.008									F1.06	F2.06	M1.01	18.62	18.62	18.00
24	1	01/17/23 08:15	07 WELL 2	0.58	0.48	0.133	0.134	6.34	12			3.7			F1.06	F2.06	M1.01	20.87	20.87	20.25
24	3	01/17/23 08:15	11 F1 EFF	0.04		0.133		6.31				1.4			F1.06	F2.06	M1.01	20.87	20.87	20.25
24	4	01/17/23 08:15	12 F2 EFF	0.03		0.133		6.35							F1.06	F2.06	M1.01	20.87	20.87	20.25
24	5	01/17/23 08:15	21 MPOKA			0.130	0.129	7.23							F1.06	F2.06	M1.01	20.87	20.87	20.25
24	7	01/17/23 08:15	22 M1 EFF	0.01		0.000		7.28				2.8			F1.06	F2.06	M1.01	20.87	20.87	20.25
24	9	01/17/23 09:35	Clear Distributor Arm Jam on F1 Autosampler												F1.06	F2.06	M1.01	22.20	22.20	21.58
24	14	01/17/23 18:00	11 F1 EFF	0.03											F1.06	F2.06	M1.01	30.62	30.62	30.00
24	17	01/18/23 06:00	11 F1 EFF	0.01											F1.06	F2.06	M1.01	42.62	42.62	42.00
25	3	01/18/23 09:46	07 WELL 2	0.61	0.50	0.142	0.153	6.33	13.1			2.9			F1.06	F2.06	M1.01	46.38	46.38	45.77
25	4	01/18/23 09:46	11 F1 EFF	0.05		0.134		6.38				2.8			F1.06	F2.06	M1.01	46.38	46.38	45.77
25	5	01/18/23 09:46	12 F2 EFF	0.02		0.134		6.39				2.8			F1.06	F2.06	M1.01	46.38	46.38	45.77
25	6	01/18/23 09:46	21 MPOKA		0.04		0.133	7.28							F1.06	F2.06	M1.01	46.38	46.38	45.77
25	7	01/18/23 09:46	22 M1 EFF	0.01		0.005		7.29				2.7			F1.06	F2.06	M1.01	46.38	46.38	45.77
25	12	01/18/23 12:00	22 M1 EFF			0.000									F1.06	F2.06	M1.01	48.62	48.62	48.00
25	13	01/18/23 18:00	11 F1 EFF	0.01											F1.06	F2.06	M1.01	54.62	54.62	54.00
25	14	01/18/23 18:00	22 M1 EFF			0.000									F1.06	F2.06	M1.01	54.62	54.62	54.00
25	15	01/19/23 00:00	22 M1 EFF			0.000									F1.06	F2.06	M1.01	60.62	60.62	60.00
25	16	01/19/23 06:00	11 F1 EFF	0.01											F1.06	F2.06	M1.01	66.62	66.62	66.00
25	17	01/19/23 06:00	22 M1 EFF			0.000									F1.06	F2.06	M1.01	66.62	66.62	66.00
25	18	01/19/23 12:00	22 M1 EFF			0.000									F1.06	F2.06	M1.01	72.62	72.62	72.00
25	19	01/19/23 18:00	11 F1 EFF	0.02											F1.06	F2.06	M1.01	78.62	78.62	78.00
25	20	01/19/23 18:00	22 M1 EFF			0.012									F1.06	F2.06	M1.01	78.62	78.62	78.00
25	21	01/20/23 00:00	22 M1 EFF			0.013									F1.06	F2.06	M1.01	84.62	84.62	84.00
25	22	01/20/23 06:00	11 F1 EFF	0.02											F1.06	F2.06	M1.01	90.62	90.62	90.00
25	23	01/20/23 06:00	22 M1 EFF			0.004									F1.06	F2.06	M1.01	90.62	90.62	90.00
26	1	01/20/23 08:10	07 WELL 2	0.62	0.51	0.145	0.162	6.35	11.4						F1.06	F2.06	M1.01	92.78	92.78	92.17
26	3	01/20/23 08:10	11 F1 EFF	0.02		0.137		6.3							F1.06	F2.06	M1.01	92.78	92.78	92.17
26	4	01/20/23 08:10	12 F2 EFF	0.03		0.134		6.29							F1.06	F2.06	M1.01	92.78	92.78	92.17

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
26	5	01/20/23 08:10	21 MPOKA				0.129	7.2							F1.06	F2.06	M1.01	92.78	92.78	92.17
26	7	01/20/23 08:10	22 M1 EFF	0.02		0.000		7.18							F1.06	F2.06	M1.01	92.78	92.78	92.17
26	8	01/20/23 08:10	Well 2 at Blow-off	0.94		0.131									F1.06	F2.06	M1.01	92.78	92.78	92.17
26	13	01/20/23 09:04	Shutdown F1 for BW. V = 30L												F1.06	F2.06	M1.01	93.68	93.68	93.07
26	14	01/20/23 09:09	Restart F1												F1.07	F2.06	M1.01	0.00	93.77	93.15
26	15	01/20/23 09:10	F1 @ 1 min	0.43											F1.07	F2.06	M1.01	0.02	93.78	93.17
26	16	01/20/23 09:11	F1 @ 2 min	0.76											F1.07	F2.06	M1.01	0.03	93.80	93.18
26	17	01/20/23 09:12	F1 @ 3 min	0.12											F1.07	F2.06	M1.01	0.05	93.82	93.20
26	18	01/20/23 09:14	F1 @ 5 min	0.05											F1.07	F2.06	M1.01	0.08	93.85	93.23
26	19	01/20/23 09:21	Shutdown F2 for BW. V=30L												F1.07	F2.06	M1.01	0.20	93.97	93.35
26	20	01/20/23 09:23	Grace from EPG Site Visit												F1.07		M1.01	0.23		93.38
26	21	01/20/23 09:27	Restart F2												F1.07	F2.07	M1.01	0.30	0.00	93.45
26	22	01/20/23 10:15	07 WELL 2							51	30.8	2.8			F1.07	F2.07	M1.01	1.10	0.80	94.25
26	23	01/20/23 10:15	11 F1 EFF							47	45.76	2.2			F1.07	F2.07	M1.01	1.10	0.80	94.25
26	24	01/20/23 10:15	22 M1 EFF							82	10.56	2.2			F1.07	F2.07	M1.01	1.10	0.80	94.25
27	3	01/20/23 12:00	22 M1 EFF			0.010									F1.07	F2.07	M1.01	2.85	2.55	96.00
27	4	01/20/23 18:00	11 F1 EFF	0.01											F1.07	F2.07	M1.01	8.85	8.55	102.00
27	5	01/20/23 18:00	22 M1 EFF			0.010									F1.07	F2.07	M1.01	8.85	8.55	102.00
27	6	01/21/23 00:00	22 M1 EFF												F1.07	F2.07	M1.01	14.85	14.55	108.00
27	7	01/21/23 06:00	11 F1 EFF	0.04											F1.07	F2.07	M1.01	20.85	20.55	114.00
27	8	01/21/23 06:00	22 M1 EFF			0.000									F1.07	F2.07	M1.01	20.85	20.55	114.00
27	9	01/21/23 12:00	22 M1 EFF			0.002									F1.07	F2.07	M1.01	26.85	26.55	120.00
27	10	01/21/23 18:00	11 F1 EFF	0.08											F1.07	F2.07	M1.01	32.85	32.55	126.00
27	11	01/21/23 18:00	22 M1 EFF			0.001									F1.07	F2.07	M1.01	32.85	32.55	126.00
27	12	01/22/23 00:00	22 M1 EFF			0.018									F1.07	F2.07	M1.01	38.85	38.55	132.00
27	13	01/22/23 06:00	11 F1 EFF	0.03											F1.07	F2.07	M1.01	44.85	44.55	138.00
27	14	01/22/23 06:00	22 M1 EFF			0.000									F1.07	F2.07	M1.01	44.85	44.55	138.00
27	15	01/22/23 12:00	22 M1 EFF			0.009									F1.07	F2.07	M1.01	50.85	50.55	144.00
27	16	01/22/23 18:00	11 F1 EFF	0.05											F1.07	F2.07	M1.01	56.85	56.55	150.00
27	17	01/22/23 18:00	22 M1 EFF			0.006									F1.07	F2.07	M1.01	56.85	56.55	150.00
27	18	01/23/23 00:00	22 M1 EFF			0.004									F1.07	F2.07	M1.01	62.85	62.55	156.00
27	19	01/23/23 06:00	11 F1 EFF	0.05											F1.07	F2.07	M1.01	68.85	68.55	162.00
27	20	01/23/23 06:00	22 M1 EFF			0.006									F1.07	F2.07	M1.01	68.85	68.55	162.00
28	1	01/23/23 11:47	07 WELL 2	0.66	0.50	0.146	0.156	6.22	12.6						F1.07	F2.07	M1.01	74.63	74.33	167.78
28	3	01/23/23 11:47	Well 2 at Blow-off	0.92		0.149		6.49							F1.07	F2.07	M1.01	74.63	74.33	167.78
28	4	01/23/23 11:47	11 F1 EFF	0.03		0.139		6.33							F1.07	F2.07	M1.01	74.63	74.33	167.78
28	5	01/23/23 11:47	12 F2 EFF	0.00		0.135		6.31							F1.07	F2.07	M1.01	74.63	74.33	167.78
28	6	01/23/23 11:47	21 MPOKA			0.134	0.147	7.23							F1.07	F2.07	M1.01	74.63	74.33	167.78
28	7	01/23/23 11:47	22 M1 EFF	0.00		0.024		7.27							F1.07	F2.07	M1.01	74.63	74.33	167.78
28	9	01/23/23 13:00	Shutdown F1 for BW												F1.07	F2.07	M1.01	75.85	75.55	169.00
28	14	01/23/23 13:15	Restart F1 at half flow												F1.08	F2.07	M1.01	0.00	75.80	169.25
28	13	01/23/23 13:15	Shutdown F2 for BW												F1.08	F2.07	M1.01	0.00	75.80	169.25
29	2	01/23/23 13:16	F1 @ 1 min	0.24											F1.08		M1.01	0.02		169.27
29	3	01/23/23 13:17	F1 @ 2 min	0.64											F1.08		M1.01	0.03		169.28
29	4	01/23/23 13:18	F1 @ 3 min	0.98											F1.08		M1.01	0.05		169.30
29	5	01/23/23 13:20	F1 @ 5 min	0.23											F1.08		M1.01	0.08		169.33
29	6	01/23/23 13:22	Tank Level Low Tripped Float - Shutoff M1 Feed and KOH pumps												F1.08		M1.01	0.12		169.37

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
29	7	01/23/23 13:30	Increase F1 Flow to 100%												F1.08		M1.01	0.25		169.50
29	8	01/23/23 13:35	F1 @ 20 min	0.26											F1.08		M1.01	0.33		169.58
29	8	01/23/23 13:35	M1 Feed and KOH Pump Restart on Float												F1.08		M1.01	0.33		169.58
29	9	01/23/23 13:42	Restart F2 at half flow												F1.08	F2.08	M1.01	0.45	0.00	169.70
29	10	01/23/23 13:43	F2 @ 1 min	0.26											F1.08	F2.08	M1.01	0.47	0.02	169.72
29	11	01/23/23 13:44	F2 @ 2 min	0.41											F1.08	F2.08	M1.01	0.48	0.03	169.73
29	12	01/23/23 13:45	F2 @ 3 min	0.46											F1.08	F2.08	M1.01	0.50	0.05	169.75
29	13	01/23/23 13:47	F2 @ 5 min	0.20											F1.08	F2.08	M1.01	0.53	0.08	169.78
29	14	01/23/23 13:50	F2 @ 8 min	0.16											F1.08	F2.08	M1.01	0.58	0.13	169.83
29	15	01/23/23 13:54	F2 @ 12 min	0.07											F1.08	F2.08	M1.01	0.65	0.20	169.90
29	16	01/23/23 13:57	Increase F2 Flow to 100%												F1.08	F2.08	M1.01	0.70	0.25	169.95
29	17	01/23/23 13:57	F2 @ 20 min	0.10											F1.08	F2.08	M1.01	0.70	0.25	169.95
29	21	01/23/23 18:00	11 F1 EFF	0.03											F1.08	F2.08	M1.01	4.75	4.30	174.00
29	22	01/23/23 18:00	22 M1 EFF			0.022									F1.08	F2.08	M1.01	4.75	4.30	174.00
29	23	01/24/23 00:00	22 M1 EFF			0.010									F1.08	F2.08	M1.01	10.75	10.30	180.00
29	24	01/24/23 06:00	11 F1 EFF	0.04											F1.08	F2.08	M1.01	16.75	16.30	186.00
29	25	01/24/23 06:00	22 M1 EFF												F1.08	F2.08	M1.01	16.75	16.30	186.00
30	1	01/24/23 12:00	22 M1 EFF			0.011									F1.08	F2.08	M1.01	22.75	22.30	192.00
30	2	01/24/23 18:00	11 F1 EFF	0.04											F1.08	F2.08	M1.01	28.75	28.30	198.00
30	3	01/24/23 18:00	22 M1 EFF			0.014									F1.08	F2.08	M1.01	28.75	28.30	198.00
30	4	01/25/23 00:00	22 M1 EFF			0.009									F1.08	F2.08	M1.01	34.75	34.30	204.00
30	5	01/25/23 06:00	11 F1 EFF	0.00											F1.08	F2.08	M1.01	40.75	40.30	210.00
30	6	01/25/23 06:00	22 M1 EFF			0.017									F1.08	F2.08	M1.01	40.75	40.30	210.00
30	8	01/25/23 07:55	07 WELL 2	0.64	0.46	0.130	0.147	6.39	12.1			2.3			F1.08	F2.08	M1.01	42.67	42.22	211.92
30	10	01/25/23 07:55	11 F1 EFF	0.01		0.137		6.41				1.9			F1.08	F2.08	M1.01	42.67	42.22	211.92
30	11	01/25/23 07:55	12 F2 EFF	0.04		0.137		6.4				2.5			F1.08	F2.08	M1.01	42.67	42.22	211.92
30	12	01/25/23 07:55	21 MPOKA			0.142	0.137	6.71							F1.08	F2.08	M1.01	42.67	42.22	211.92
30	14	01/25/23 07:55	22 M1 EFF	0.00		0.031		6.66				2.8			F1.08	F2.08	M1.01	42.67	42.22	211.92
30	17	01/25/23 08:40	07 WELL 2							46.5					F1.08	F2.08	M1.01	43.42	42.97	212.67
30	18	01/25/23 08:40	11 F1 EFF							46					F1.08	F2.08	M1.01	43.42	42.97	212.67
30	19	01/25/23 08:40	22 M1 EFF							75					F1.08	F2.08	M1.01	43.42	42.97	212.67
30	21	01/25/23 09:04	07 WELL 2								44.88				F1.08	F2.08	M1.01	43.82	43.37	213.07
30	22	01/25/23 09:04	11 F1 EFF								38.72				F1.08	F2.08	M1.01	43.82	43.37	213.07
30	23	01/25/23 09:04	22 M1 EFF								35.2				F1.08	F2.08	M1.01	43.82	43.37	213.07
31	1	01/25/23 09:30	Shutdown F1 for BW												F1.08	F2.08	M1.01	44.25	43.80	213.50
31	2	01/25/23 09:30	Add Valve to F1 Sat Connection and Drain Whip to Sink													F2.08	M1.01		43.80	213.50
31	4	01/25/23 09:43	Restart F1 @ 12.5 gpm/sf												F1.09	F2.08	M1.01	0.00	44.02	213.72
31	7	01/25/23 10:47	Well 2 at Blow-off	1.03											F1.09	F2.08	M1.01	1.07	45.08	214.78
31	8	01/25/23 18:00	11 F1 EFF	0.04											F1.09	F2.08	M1.01	8.28	52.30	222.00
31	9	01/25/23 18:00	22 M1 EFF			0.001									F1.09	F2.08	M1.01	8.28	52.30	222.00
31	10	01/26/23 00:00	22 M1 EFF			0.005									F1.09	F2.08	M1.01	14.28	58.30	228.00
31	11	01/26/23 06:00	11 F1 EFF	0.05											F1.09	F2.08	M1.01	20.28	64.30	234.00
31	12	01/26/23 06:00	22 M1 EFF			0.018									F1.09	F2.08	M1.01	20.28	64.30	234.00
31	13	01/26/23 12:00	22 M1 EFF			0.009									F1.09	F2.08	M1.01	26.28	70.30	240.00
31	14	01/26/23 18:00	11 F1 EFF	0.02											F1.09	F2.08	M1.01	32.28	76.30	246.00
31	15	01/26/23 18:00	22 M1 EFF			0.013									F1.09	F2.08	M1.01	32.28	76.30	246.00
31	16	01/27/23 00:00	22 M1 EFF			0.000									F1.09	F2.08	M1.01	38.28	82.30	252.00

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
31	17	01/27/23 06:00	11 F1 EFF	0.02											F1.09	F2.08	M1.01	44.28	88.30	258.00
31	18	01/27/23 06:00	22 M1 EFF			0.007									F1.09	F2.08	M1.01	44.28	88.30	258.00
31	19	01/27/23 11:00	07 WELL 2	0.59	0.50	0.138	0.139	6.45	13.5			1.5	82	0.31	F1.09	F2.08	M1.01	49.28	93.30	263.00
31	21	01/27/23 11:00	11 F1 EFF	0.03		0.131		6.43				1.3	271	0.3	F1.09	F2.08	M1.01	49.28	93.30	263.00
31	22	01/27/23 11:00	12 F2 EFF	0.05		0.137		6.42				1.7	298	0.23	F1.09	F2.08	M1.01	49.28	93.30	263.00
31	23	01/27/23 11:00	21 MPOKA			0.133	0.120	7.26							F1.09	F2.08	M1.01	49.28	93.30	263.00
31	25	01/27/23 11:00	22 M1 EFF	0.02		0.005		7.12				2.1	91	0.24	F1.09	F2.08	M1.01	49.28	93.30	263.00
32	1	01/27/23 11:30	Increase I value from 30 to 60 for MPOKA pH PID												F1.09	F2.08	M1.01	49.78	93.80	263.50
32	2	01/27/23 11:40	Shutdown F2 for BW												F1.09	F2.08	M1.01	49.95	93.97	263.67
32	3	01/27/23 11:52	Restart F2 at half flow												F1.09	F2.09	M1.01	50.15	0.00	263.87
32	4	01/27/23 11:53	F2 @ 1 min	0.04											F1.09	F2.09	M1.01	50.17	0.02	263.88
32	5	01/27/23 11:54	F2 @ 2 min	0.29											F1.09	F2.09	M1.01	50.18	0.03	263.90
32	6	01/27/23 11:55	F2 @ 3 min	0.84											F1.09	F2.09	M1.01	50.20	0.05	263.92
32	7	01/27/23 11:57	F2 @ 5 min	0.31											F1.09	F2.09	M1.01	50.23	0.08	263.95
32	8	01/27/23 12:00	F2 @ 8 min	0.07											F1.09	F2.09	M1.01	50.28	0.13	264.00
32	9	01/27/23 12:04	F2 @ 12 min	0.22											F1.09	F2.09	M1.01	50.35	0.20	264.07
32	10	01/27/23 12:09	Increase F2 Flow to 100%												F1.09	F2.09	M1.01	50.43	0.28	264.15
32	11	01/27/23 12:12	F2 @ 20 min	0.12											F1.09	F2.09	M1.01	50.48	0.33	264.20
32	12	01/27/23 13:18	Caustic Titrations with and without aeration												F1.09	F2.09	M1.01	51.58	1.43	265.30
33	1	01/27/23 14:12	Shutdown F1 for BW												F1.09	F2.09	M1.01	52.48	2.33	266.20
33	2	01/27/23 14:22	Restart F1												F1.10	F2.09	M1.01	0.00	2.50	266.37
33	3	01/27/23 14:23	F1 @ 1 min	0.60											F1.10	F2.09	M1.01	0.02	2.52	266.38
33	4	01/27/23 14:24	F1 @ 2 min	0.22											F1.10	F2.09	M1.01	0.03	2.53	266.40
33	5	01/27/23 14:25	F1 @ 3 min	0.23											F1.10	F2.09	M1.01	0.05	2.55	266.42
33	6	01/27/23 14:27	F1 @ 5 min	0.17											F1.10	F2.09	M1.01	0.08	2.58	266.45
33	7	01/27/23 14:30	F1 @ 8 min	0.19											F1.10	F2.09	M1.01	0.13	2.63	266.50
33	8	01/27/23 14:34	F1 @ 12 min	0.16											F1.10	F2.09	M1.01	0.20	2.70	266.57
33	10	01/27/23 14:42	F1 @ 20 min	0.20											F1.10	F2.09	M1.01	0.33	2.83	266.70
33	12	01/27/23 18:00	11 F1 EFF	0.05											F1.10	F2.09	M1.01	3.63	6.13	270.00
33	13	01/27/23 18:00	22 M1 EFF			0.017									F1.10	F2.09	M1.01	3.63	6.13	270.00
33	14	01/28/23 00:00	22 M1 EFF			0.005									F1.10	F2.09	M1.01	9.63	12.13	276.00
33	15	01/28/23 06:00	11 F1 EFF	0.08											F1.10	F2.09	M1.01	15.63	18.13	282.00
33	16	01/28/23 06:00	22 M1 EFF			0.002									F1.10	F2.09	M1.01	15.63	18.13	282.00
33	17	01/28/23 12:00	22 M1 EFF			0.006									F1.10	F2.09	M1.01	21.63	24.13	288.00
33	18	01/28/23 18:00	11 F1 EFF	0.02											F1.10	F2.09	M1.01	27.63	30.13	294.00
33	19	01/28/23 18:00	22 M1 EFF			0.008									F1.10	F2.09	M1.01	27.63	30.13	294.00
33	20	01/29/23 00:00	22 M1 EFF			0.017									F1.10	F2.09	M1.01	33.63	36.13	300.00
33	21	01/29/23 06:00	11 F1 EFF	0.04											F1.10	F2.09	M1.01	39.63	42.13	306.00
33	22	01/29/23 06:00	22 M1 EFF			0.000									F1.10	F2.09	M1.01	39.63	42.13	306.00
33	23	01/29/23 12:00	22 M1 EFF			0.014									F1.10	F2.09	M1.01	45.63	48.13	312.00
33	24	01/29/23 18:00	11 F1 EFF	0.03											F1.10	F2.09	M1.01	51.63	54.13	318.00
33	25	01/29/23 18:00	22 M1 EFF			0.019									F1.10	F2.09	M1.01	51.63	54.13	318.00
34	1	01/30/23 00:00	22 M1 EFF			0.009									F1.10	F2.09	M1.01	57.63	60.13	324.00
34	2	01/30/23 06:00	11 F1 EFF	0.04											F1.10	F2.09	M1.01	63.63	66.13	330.00
34	3	01/30/23 06:00	22 M1 EFF			0.008									F1.10	F2.09	M1.01	63.63	66.13	330.00
34	5	01/30/23 11:26	07 WELL 2	0.70	0.44	0.122	0.137	6.36	13.7			2.4	146	0.29	F1.10	F2.09	M1.01	69.07	71.57	335.43
34	7	01/30/23 11:26	11 F1 EFF	0.03		0.118		6.38				1.7	101	0.3	F1.10	F2.09	M1.01	69.07	71.57	335.43

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
34	8	01/30/23 11:26	12 F2 EFF	0.05		0.123		6.39				1.5	148	0.32	F1.10	F2.09	M1.01	69.07	71.57	335.43
34	9	01/30/23 11:26	21 MPOKA			0.134	0.133	6.42							F1.10	F2.09	M1.01	69.07	71.57	335.43
34	11	01/30/23 11:26	22 M1 EFF	0.04		0.009		6.46				0.3	191	0.1	F1.10	F2.09	M1.01	69.07	71.57	335.43
34	13	01/30/23 11:48	Adjust/Secure MPOKA Sample Cup in Tank												F1.10	F2.09	M1.01	69.43	71.93	335.80
34	14	01/30/23 12:04	Shutdown F1 for BW												F1.10	F2.09	M1.01	69.70	72.20	336.07
34	15	01/30/23 12:12	Restart F1												F1.11	F2.09	M1.01	0.00	72.33	336.20
34	16	01/30/23 12:39	Increase F1 Flow to 3 gpm												F1.11	F2.09	M1.01	0.45	72.78	336.65
34	17	01/30/23 12:41	Shutdown F2 for BW												F1.11	F2.09	M1.01	0.48	72.82	336.68
34	18	01/30/23 12:53	Restart F2												F1.11	F2.10	M1.01	0.68	0.00	336.88
34	19	01/30/23 13:09	Increase F2 Flow to 2.5 gpm												F1.11	F2.10	M1.01	0.95	0.27	337.15
34	19	01/30/23 13:39	Increase M1 Flow to 2.0 gpm												F1.11	F2.10	M1.01	1.45	0.77	337.65
35	1	01/30/23 14:15	07 WELL 2	1.08	0.48	0.140	0.135	6.43	13.4				40	0.12	F1.11	F2.10	M1.01	2.05	1.37	338.25
35	3	01/30/23 14:15	11 F1 EFF	0.14		0.139		6.45					255	0.14	F1.11	F2.10	M1.01	2.05	1.37	338.25
35	4	01/30/23 14:15	12 F2 EFF	0.12		0.153		6.35					234	0.24	F1.11	F2.10	M1.01	2.05	1.37	338.25
35	5	01/30/23 14:15	21 MPOKA			0.136	0.138	7.02							F1.11	F2.10	M1.01	2.05	1.37	338.25
35	7	01/30/23 14:15	22 M1 EFF	0.00		0.021		7.02					335	0.36	F1.11	F2.10	M1.01	2.05	1.37	338.25
35	8	01/30/23 14:15	Well 2 at Blow-off	0.93		0.142									F1.11	F2.10	M1.01	2.05	1.37	338.25
35	10	01/30/23 18:00	11 F1 EFF	0.08											F1.11	F2.10	M1.01	5.80	5.12	342.00
35	11	01/30/23 18:00	22 M1 EFF			0.011									F1.11	F2.10	M1.01	5.80	5.12	342.00
35	12	01/31/23 00:00	22 M1 EFF			0.007									F1.11	F2.10	M1.01	11.80	11.12	348.00
35	13	01/31/23 06:00	11 F1 EFF	0.02											F1.11	F2.10	M1.01	17.80	17.12	354.00
35	14	01/31/23 06:00	22 M1 EFF			0.032									F1.11	F2.10	M1.01	17.80	17.12	354.00
35	15	01/31/23 09:26	Shutdown M1 for BW												F1.11	F2.10	M1.01	21.23	20.55	357.43
35	16	01/31/23 09:39	Restart M1 at half flow rate												F1.11	F2.10	M1.02	21.45	20.77	0.00
35	16	01/31/23 09:39	Collect CBW Labs for M1												F1.11	F2.10	M1.02	21.45	20.77	0.00
35	17	01/31/23 09:40	M1 @ 1 min			0.050									F1.11	F2.10	M1.02	21.47	20.78	0.02
35	18	01/31/23 09:41	M1 @ 2 min			0.024									F1.11	F2.10	M1.02	21.48	20.80	0.03
35	19	01/31/23 09:42	M1 @ 3 min			0.021									F1.11	F2.10	M1.02	21.50	20.82	0.05
35	20	01/31/23 09:44	M1 @ 5 min			0.011									F1.11	F2.10	M1.02	21.53	20.85	0.08
35	21	01/31/23 09:47	M1 @ 8 min			0.006									F1.11	F2.10	M1.02	21.58	20.90	0.13
35	22	01/31/23 09:39	M1 @ 12 min			0.011									F1.11	F2.10	M1.02	21.45	20.77	0.00
35	23	01/31/23 09:54	Increase M1 Flow to 2.0 gpm												F1.11	F2.10	M1.02	21.70	21.02	0.25
35	24	01/31/23 09:59	22 M1 EFF			0.010									F1.11	F2.10	M1.02	21.78	21.10	0.33
35	25	01/31/23 12:00	22 M1 EFF			0.011									F1.11	F2.10	M1.02	23.80	23.12	2.35
36	1	01/31/23 13:40	Collect SSN Labs for M1												F1.11	F2.10	M1.02	25.47	24.78	4.02
36	4	01/31/23 13:45	07 WELL 2	0.80	0.49	0.142	0.136	6.47	13			3	211	0.22	F1.11	F2.10	M1.02	25.55	24.87	4.10
36	6	01/31/23 13:45	Well 2 at Blow-off	0.73		0.136									F1.11	F2.10	M1.02	25.55	24.87	4.10
36	7	01/31/23 13:45	11 F1 EFF	0.02		0.130		6.45				1.9	321	0.36	F1.11	F2.10	M1.02	25.55	24.87	4.10
36	8	01/31/23 13:45	12 F2 EFF	0.03		0.121		6.44				2.1	331	0.33	F1.11	F2.10	M1.02	25.55	24.87	4.10
36	9	01/31/23 13:45	21 MPOKA			0.170	0.117	7.13							F1.11	F2.10	M1.02	25.55	24.87	4.10
36	11	01/31/23 13:45	22 M1 EFF	0.01		0.012		7.13				1.5	116	0.22	F1.11	F2.10	M1.02	25.55	24.87	4.10
36	12	01/31/23 18:00	11 F1 EFF	0.03											F1.11	F2.10	M1.02	29.80	29.12	8.35
36	13	01/31/23 18:00	22 M1 EFF			0.000									F1.11	F2.10	M1.02	29.80	29.12	8.35
36	14	02/01/23 00:00	22 M1 EFF			0.011									F1.11	F2.10	M1.02	35.80	35.12	14.35
36	15	02/01/23 06:00	11 F1 EFF	0.10											F1.11	F2.10	M1.02	41.80	41.12	20.35
36	16	02/01/23 06:00	22 M1 EFF			0.021									F1.11	F2.10	M1.02	41.80	41.12	20.35
36	18	02/01/23 08:57	07 WELL 2	0.54	0.53	0.135	0.129	6.49	11.6			1.7	217	0.34	F1.11	F2.10	M1.02	44.75	44.07	23.30

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
36	20	02/01/23 08:57	Well 2 at Blow-off	0.73		0.128									F1.11	F2.10	M1.02	44.75	44.07	23.30
36	21	02/01/23 08:57	11 F1 EFF	0.02		0.128		6.48				1.2	19	0.26	F1.11	F2.10	M1.02	44.75	44.07	23.30
36	22	02/01/23 08:57	12 F2 EFF	0.05		0.117		6.45				1.7	173	0.29	F1.11	F2.10	M1.02	44.75	44.07	23.30
36	23	02/01/23 08:57	21 MPOKA			0.116	0.12	7.15							F1.11	F2.10	M1.02	44.75	44.07	23.30
36	25	02/01/23 08:57	22 M1 EFF	0.08		0.003		7.22				2.6	210	0.3	F1.11	F2.10	M1.02	44.75	44.07	23.30
37	1	02/01/23 18:00	11 F1 EFF	0.05											F1.11	F2.10	M1.02	53.80	53.12	32.35
37	2	02/01/23 18:00	22 M1 EFF			0.027									F1.11	F2.10	M1.02	53.80	53.12	32.35
37	3	02/02/23 00:00	22 M1 EFF			0.025									F1.11	F2.10	M1.02	59.80	59.12	38.35
37	4	02/02/23 06:00	11 F1 EFF	0.04											F1.11	F2.10	M1.02	65.80	65.12	44.35
37	5	02/02/23 06:00	22 M1 EFF			0.028									F1.11	F2.10	M1.02	65.80	65.12	44.35
37	6	02/02/23 09:33	Shutdown F1 for BW												F1.11	F2.10	M1.02	69.35	68.67	47.90
37	7	02/02/23 08:45	Restart F1 - Compressor Frozen - Thaw Line													F2.10	M1.02		67.87	47.10
37	8	02/02/23 09:23	Shutdown F1 for BW													F2.10	M1.02		68.50	47.73
37	9	02/02/23 09:33	Restart F1 @ 0.75 gpm												F1.12	F2.10	M1.02	0.00	68.67	47.90
37	10	02/02/23 09:34	F1 @ 1 min	0.13											F1.12	F2.10	M1.02	0.02	68.68	47.92
37	11	02/02/23 09:35	F1 @ 2 min	0.21											F1.12	F2.10	M1.02	0.03	68.70	47.93
37	12	02/02/23 09:36	F1 @ 3 min	0.19											F1.12	F2.10	M1.02	0.05	68.72	47.95
37	13	02/02/23 09:38	F1 @ 5 min	0.17											F1.12	F2.10	M1.02	0.08	68.75	47.98
37	14	02/02/23 09:41	F1 @ 8 min	0.10											F1.12	F2.10	M1.02	0.13	68.80	48.03
37	15	02/02/23 09:45	F1 @ 12 min	0.10											F1.12	F2.10	M1.02	0.20	68.87	48.10
37	16	02/02/23 09:48	Increase F1 to 1.5 gpm												F1.12	F2.10	M1.02	0.25	68.92	48.15
37	17	02/02/23 09:53	F1 @ 20 min	0.15											F1.12	F2.10	M1.02	0.33	69.00	48.23
37	18	02/02/23 09:53	Shutdown F2 for BW												F1.12	F2.10	M1.02	0.33	69.00	48.23
37	19	02/02/23 10:04	Restart F2 @ 0.75 gpm												F1.12	F2.11	M1.02	0.52	69.18	48.42
37	20	02/02/23 10:05	F2 @ 1 min	0.17											F1.12	F2.11	M1.02	0.53	69.20	48.43
37	21	02/02/23 10:06	F2 @ 2 min	0.99											F1.12	F2.11	M1.02	0.55	69.22	48.45
37	22	02/02/23 10:07	F2 @ 3 min	0.08											F1.12	F2.11	M1.02	0.57	69.23	48.47
37	23	02/02/23 10:09	F2 @ 5 min	0.18											F1.12	F2.11	M1.02	0.60	69.27	48.50
37	24	02/02/23 10:12	F2 @ 8 min	0.17											F1.12	F2.11	M1.02	0.65	69.32	48.55
37	25	02/02/23 10:16	F2 @ 12 min	0.13											F1.12	F2.11	M1.02	0.72	69.38	48.62
38	1	02/02/23 10:19	Increase F2 flow to 1.5 gpm												F1.12	F2.11	M1.02	0.77	69.43	48.67
38	2	02/02/23 10:24	F2 @ 20 min	0.17											F1.12	F2.11	M1.02	0.85	69.52	48.75
38	5	02/02/23 13:15	07 WELL 2	0.75	0.51	0.139	0.124	6.45	12.8			3.3	347	0.78	F1.12	F2.11	M1.02	3.70	72.37	51.60
38	7	02/02/23 13:15	11 F1 EFF	0.08		0.125		6.38				0.8	237	0.34	F1.12	F2.11	M1.02	3.70	72.37	51.60
38	8	02/02/23 13:15	12 F2 EFF	0.07		0.127		6.38				1.3	124	0.62	F1.12	F2.11	M1.02	3.70	72.37	51.60
38	9	02/02/23 13:15	21 MPOKA			0.131	0.123	6.98							F1.12	F2.11	M1.02	3.70	72.37	51.60
38	11	02/02/23 13:15	22 M1 EFF	0.04		0.030		7.05				3	257	0.86	F1.12	F2.11	M1.02	3.70	72.37	51.60
38	12	02/02/23 14:05	Collect F1 and F2 SSN Labs												F1.12	F2.11	M1.02	4.53	73.20	52.43
38	13	02/02/23 18:00	11 F1 EFF	0.09											F1.12	F2.11	M1.02	8.45	77.12	56.35
38	14	02/02/23 18:00	22 M1 EFF			0.034									F1.12	F2.11	M1.02	8.45	77.12	56.35
38	15	02/03/23 00:00	22 M1 EFF			0.026									F1.12	F2.11	M1.02	14.45	83.12	62.35
38	16	02/03/23 06:00	11 F1 EFF	0.04											F1.12	F2.11	M1.02	20.45	89.12	68.35
38	17	02/03/23 06:00	22 M1 EFF			0.026									F1.12	F2.11	M1.02	20.45	89.12	68.35
38	19	02/03/23 08:57	07 WELL 2	0.66	0.53	0.124	0.121	6.44	11.6			2.3	196	0.35	F1.12	F2.11	M1.02	23.40	92.07	71.30
38	21	02/03/23 08:57	11 F1 EFF	0.05		0.127		6.39				1.7	163	0.83	F1.12	F2.11	M1.02	23.40	92.07	71.30
38	22	02/03/23 08:57	12 F2 EFF	0.04		0.121		6.4				1.5	38	1.7	F1.12	F2.11	M1.02	23.40	92.07	71.30
38	23	02/03/23 08:57	21 MPOKA			0.108	0.108	7.01							F1.12	F2.11	M1.02	23.40	92.07	71.30

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
38	25	02/03/23 08:57	22 M1 EFF	0.03		0.030		7.08				0.3	284	0.71	F1.12	F2.11	M1.02	23.40	92.07	71.30
39	2	02/03/23 09:43	07 WELL 2								36.96				F1.12	F2.11	M1.02	24.17	92.83	72.07
39	3	02/03/23 09:43	11 F1 EFF								37.84				F1.12	F2.11	M1.02	24.17	92.83	72.07
39	4	02/03/23 09:43	22 M1 EFF								12.32				F1.12	F2.11	M1.02	24.17	92.83	72.07
39	6	02/03/23 10:00	07 WELL 2							46					F1.12	F2.11	M1.02	24.45	93.12	72.35
39	7	02/03/23 10:00	11 F1 EFF							46					F1.12	F2.11	M1.02	24.45	93.12	72.35
39	8	02/03/23 10:00	22 M1 EFF							71					F1.12	F2.11	M1.02	24.45	93.12	72.35
39	9	02/03/23 10:00	Computer Frozen Apparently Trying to Reboot - PLC Still Running in Background												F1.12	F2.11	M1.02	24.45	93.12	72.35
39	12	02/03/23 18:00	11 F1 EFF	0.03											F1.12	F2.11	M1.02	32.45	101.12	80.35
39	13	02/03/23 18:00	22 M1 EFF			0.012									F1.12	F2.11	M1.02	32.45	101.12	80.35
39	14	02/04/23 00:00	22 M1 EFF			0.019									F1.12	F2.11	M1.02	38.45	107.12	86.35
39	15	02/04/23 06:00	11 F1 EFF												F1.12	F2.11	M1.02	44.45	113.12	92.35
39	16	02/04/23 06:00	22 M1 EFF			0.019									F1.12	F2.11	M1.02	44.45	113.12	92.35
39	18	02/03/23 10:42	IR brought out replacement laptop. Set KOH to 109 ml/Hr Manual.												F1.12	F2.11	M1.02	25.15	93.82	73.05
39	19	02/03/23 11:00	PLC now running on replacement laptop. Put KOH back in auto.												F1.12	F2.11	M1.02	25.45	94.12	73.35
39	20	02/03/23 11:11	Laptop time is 56 min fast. Download data.												F1.12	F2.11	M1.02	25.63	94.30	73.53
39	22	02/04/23 12:00	22 M1 EFF												F1.12	F2.11	M1.02	50.45	119.12	98.35
39	23	02/04/23 18:00	11 F1 EFF												F1.12	F2.11	M1.02	56.45	125.12	104.35
39	24	02/04/23 18:00	22 M1 EFF												F1.12	F2.11	M1.02	56.45	125.12	104.35
40	1	02/05/23 00:00	22 M1 EFF			0.019									F1.12	F2.11	M1.02	62.45	131.12	110.35
40	2	02/05/23 06:00	11 F1 EFF	0.05											F1.12	F2.11	M1.02	68.45	137.12	116.35
40	3	02/05/23 06:00	22 M1 EFF			0.024									F1.12	F2.11	M1.02	68.45	137.12	116.35
40	4	02/05/23 12:00	22 M1 EFF			0.013									F1.12	F2.11	M1.02	74.45	143.12	122.35
40	5	02/05/23 18:00	11 F1 EFF	0.02											F1.12	F2.11	M1.02	80.45	149.12	128.35
40	6	02/05/23 18:00	22 M1 EFF			0.008									F1.12	F2.11	M1.02	80.45	149.12	128.35
40	7	02/06/23 00:00	22 M1 EFF			0.012									F1.12	F2.11	M1.02	86.45	155.12	134.35
40	8	02/06/23 06:00	11 F1 EFF	0.03											F1.12	F2.11	M1.02	92.45	161.12	140.35
40	9	02/06/23 06:00	22 M1 EFF			0.008									F1.12	F2.11	M1.02	92.45	161.12	140.35
40	12	02/06/23 08:30	07 WELL 2	0.80	0.49	0.145	0.129	6.39	12.4			1.3	43	0.58	F1.12	F2.11	M1.02	94.95	163.62	142.85
40	14	02/06/23 08:30	11 F1 EFF	0.09		0.127		6.35				2.1	115	0.55	F1.12	F2.11	M1.02	94.95	163.62	142.85
40	15	02/06/23 08:30	12 F2 EFF	0.19		0.127		6.39				1.3	194	1.43	F1.12	F2.11	M1.02	94.95	163.62	142.85
40	16	02/06/23 08:30	21 MPOKA			0.122	0.122	7.04							F1.12	F2.11	M1.02	94.95	163.62	142.85
40	18	02/06/23 08:30	22 M1 EFF	0.02		0.012		6.99				1.3	185	0.55	F1.12	F2.11	M1.02	94.95	163.62	142.85
40	19	02/06/23 08:30	Shutdown F1 for BW												F1.12	F2.11	M1.02	94.95	163.62	142.85
40	20	02/06/23 09:40	Restart F1 @ 1.5												F1.13	F2.11	M1.02	0.00	164.78	144.02
40	21	02/06/23 09:55	Increase F1 Flow to 2.9												F1.13	F2.11	M1.02	0.25	165.03	144.27
40	22	02/06/23 09:56	Shutdown F2 for BW												F1.13	F2.11	M1.02	0.27	165.05	144.28
40	23	02/06/23 10:09	Restart F2 @ 1.5												F1.13	F2.12	M1.02	0.48	0.00	144.50
40	24	02/06/23 10:20	Increase F2 Flow to 2.9												F1.13	F2.12	M1.02	0.67	0.18	144.68
41	2	02/06/23 18:00	11 F1 EFF	0.06											F1.13	F2.12	M1.02	8.33	7.85	152.35
41	3	02/06/23 18:00	22 M1 EFF			0.008									F1.13	F2.12	M1.02	8.33	7.85	152.35
41	5	02/07/23 06:00	11 F1 EFF	0.03											F1.13	F2.12	M1.02	20.33	19.85	164.35
41	6	02/07/23 06:00	22 M1 EFF			0.011									F1.13	F2.12	M1.02	20.33	19.85	164.35
41	7	02/07/23 18:00	11 F1 EFF	0.02											F1.13	F2.12	M1.02	32.33	31.85	176.35
41	8	02/07/23 18:00	22 M1 EFF			0.008									F1.13	F2.12	M1.02	32.33	31.85	176.35
41	9	02/08/23 06:00	11 F1 EFF	0.00											F1.13	F2.12	M1.02	44.33	43.85	188.35
41	10	02/08/23 06:00	22 M1 EFF			0.008									F1.13	F2.12	M1.02	44.33	43.85	188.35

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
41	12	02/08/23 12:39	07 WELL 2	0.62	0.48	0.130	0.129	6.42	13.8			2.3	204	1.57	F1.13	F2.12	M1.02	50.98	50.50	195.00
41	14	02/08/23 12:39	11 F1 EFF	0.02		0.138		6.45				0.6	246	1.09	F1.13	F2.12	M1.02	50.98	50.50	195.00
41	15	02/08/23 12:39	12 F2 EFF	0.03		0.128		6.46				0.6	192	0.8	F1.13	F2.12	M1.02	50.98	50.50	195.00
41	16	02/08/23 12:39	21 MPOKA			0.127	0.137	7.15							F1.13	F2.12	M1.02	50.98	50.50	195.00
41	18	02/08/23 12:39	22 M1 EFF	0.08		0.009		7.06				1.6	49	0.39	F1.13	F2.12	M1.02	50.98	50.50	195.00
41	20	02/08/23 12:49	Inlet Pressure Low - Adjust Waste Valve until 30 psi to pilot												F1.13	F2.12	M1.02	51.15	50.67	195.17
42	1	02/08/23 13:27	Shutdown F1 for BW												F1.13	F2.12	M1.02	51.78	51.30	195.80
42	2	02/08/23 13:37	Restart F1 @ 1.5 gpm												F1.14	F2.12	M1.02	0.00	51.47	195.97
42	3	02/08/23 13:38	F1 @ 1 min	0.16											F1.14	F2.12	M1.02	0.02	51.48	195.98
42	4	02/08/23 13:39	F1 @ 2 min	0.18											F1.14	F2.12	M1.02	0.03	51.50	196.00
42	5	02/08/23 13:40	F1 @ 3 min	0.11											F1.14	F2.12	M1.02	0.05	51.52	196.02
42	6	02/08/23 13:42	F1 @ 5 min	0.09											F1.14	F2.12	M1.02	0.08	51.55	196.05
42	7	02/08/23 13:45	F1 @ 8 min	0.24											F1.14	F2.12	M1.02	0.13	51.60	196.10
42	8	02/08/23 13:49	F1 @ 12 min	0.13											F1.14	F2.12	M1.02	0.20	51.67	196.17
42	9	02/08/23 13:52	Increase F1 Flow to 2.9 gpm												F1.14	F2.12	M1.02	0.25	51.72	196.22
42	10	02/08/23 13:57	F1 @ 20 min	0.12											F1.14	F2.12	M1.02	0.33	51.80	196.30
42	11	02/08/23 13:57	Shutdown F2 for BW												F1.14	F2.12	M1.02	0.33	51.80	196.30
42	12	02/08/23 14:08	Restart F2 @ 1.0 gpm												F1.14	F2.13	M1.02	0.52	0.00	196.48
42	13	02/08/23 14:09	F2 @ 1 min	0.16											F1.14	F2.13	M1.02	0.53	0.02	196.50
42	14	02/08/23 14:10	F2 @ 2 min	0.21											F1.14	F2.13	M1.02	0.55	0.03	196.52
42	15	02/08/23 14:11	F2 @ 3 min	0.13											F1.14	F2.13	M1.02	0.57	0.05	196.53
42	16	02/08/23 14:13	F2 @ 5 min	0.09											F1.14	F2.13	M1.02	0.60	0.08	196.57
42	17	02/08/23 14:16	F2 @ 8 min	0.05											F1.14	F2.13	M1.02	0.65	0.13	196.62
42	18	02/08/23 14:20	F2 @ 12 min	0.04											F1.14	F2.13	M1.02	0.72	0.20	196.68
42	19	02/08/23 14:23	Increase F2 Flow to 2.5 gpm												F1.14	F2.13	M1.02	0.77	0.25	196.73
42	20	02/08/23 14:28	F2 @ 20 min	0.04											F1.14	F2.13	M1.02	0.85	0.33	196.82
42	22	02/08/23 18:00	11 F1 EFF	0.06											F1.14	F2.13	M1.02	4.38	3.87	200.35
42	23	02/08/23 18:00	22 M1 EFF			0.007									F1.14	F2.13	M1.02	4.38	3.87	200.35
42	24	02/09/23 06:00	11 F1 EFF	0.01											F1.14	F2.13	M1.02	16.38	15.87	212.35
42	25	02/09/23 06:00	22 M1 EFF			0.011									F1.14	F2.13	M1.02	16.38	15.87	212.35
43	1	02/09/23 18:00	11 F1 EFF												F1.14	F2.13	M1.02	28.38	27.87	224.35
43	2	02/09/23 18:00	22 M1 EFF												F1.14	F2.13	M1.02	28.38	27.87	224.35
43	3	02/10/23 06:00	11 F1 EFF												F1.14	F2.13	M1.02	40.38	39.87	236.35
43	4	02/10/23 06:00	22 M1 EFF												F1.14	F2.13	M1.02	40.38	39.87	236.35
43	8	02/10/23 08:30	07 WELL 2	0.61	0.47	0.153	0.139	6.48	11.3	52	49.28	2.8			F1.14	F2.13	M1.02	42.88	42.37	238.85
43	10	02/10/23 08:30	11 F1 EFF	0.00		0.134		6.44		48	51.04	2.3			F1.14	F2.13	M1.02	42.88	42.37	238.85
43	11	02/10/23 08:30	12 F2 EFF	0.02		0.143		6.43							F1.14	F2.13	M1.02	42.88	42.37	238.85
43	12	02/10/23 08:30	21 MPOKA			0.143	0.13	7.17							F1.14	F2.13	M1.02	42.88	42.37	238.85
43	14	02/10/23 08:30	22 M1 EFF	0.00		0.014		7.13		79	12.32	2.1			F1.14	F2.13	M1.02	42.88	42.37	238.85
43	15	02/10/23 08:30	Well 2 at Blow-off	0.98		0.157									F1.14	F2.13	M1.02	42.88	42.37	238.85
43	16	02/10/23 08:40	MEFF Sample Line was dripping into MPOKA sample cup												F1.14	F2.13	M1.02	43.05	42.53	239.02
43	17	02/10/23 09:09	Inlet Pressure Low - Adjust Waste Valve until 30 psi to pilot												F1.14	F2.13	M1.02	43.53	43.02	239.50
43	21	02/10/23 09:25	Collect ATP Samples on Raw, F1, F2 and M1												F1.14	F2.13	M1.02	43.80	43.28	239.77
43	22	02/10/23 09:45	Clean Raw DP and pH probes												F1.14	F2.13	M1.02	44.13	43.62	240.10
43	25	02/10/23 10:45	Grace from EPG Site Visit												F1.14	F2.13	M1.02	45.13	44.62	241.10
44	1	02/10/23 18:00	11 F1 EFF	0.03											F1.14	F2.13	M1.02	52.38	51.87	248.35
44	2	02/10/23 18:00	22 M1 EFF			0.003									F1.14	F2.13	M1.02	52.38	51.87	248.35

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
44	3	02/11/23 06:00	11 F1 EFF	0.02											F1.14	F2.13	M1.02	64.38	63.87	260.35
44	4	02/11/23 06:00	22 M1 EFF			0.001									F1.14	F2.13	M1.02	64.38	63.87	260.35
44	5	02/11/23 18:00	11 F1 EFF	0.02											F1.14	F2.13	M1.02	76.38	75.87	272.35
44	6	02/11/23 18:00	22 M1 EFF			0.001									F1.14	F2.13	M1.02	76.38	75.87	272.35
44	7	02/12/23 06:00	11 F1 EFF	0.03											F1.14	F2.13	M1.02	88.38	87.87	284.35
44	8	02/12/23 06:00	22 M1 EFF			0.001									F1.14	F2.13	M1.02	88.38	87.87	284.35
44	9	02/12/23 18:00	11 F1 EFF	0.02											F1.14	F2.13	M1.02	100.38	99.87	296.35
44	10	02/12/23 18:00	22 M1 EFF			0.000									F1.14	F2.13	M1.02	100.38	99.87	296.35
44	11	02/13/23 06:00	11 F1 EFF	0.04											F1.14	F2.13	M1.02	112.38	111.87	308.35
44	12	02/13/23 06:00	22 M1 EFF			0.001									F1.14	F2.13	M1.02	112.38	111.87	308.35
44	13	02/13/23 08:50	07 WELL 2	0.64	0.43	0.151	0.137						105	1.4	F1.14	F2.13	M1.02	115.22	114.70	311.18
44	15	02/13/23 08:50	11 F1 EFF	0.05		0.127							333	1.65	F1.14	F2.13	M1.02	115.22	114.70	311.18
44	16	02/13/23 08:50	12 F2 EFF	0.03		0.130							69	1.86	F1.14	F2.13	M1.02	115.22	114.70	311.18
44	17	02/13/23 08:50	21 MPOKA			0.125	0.124								F1.14	F2.13	M1.02	115.22	114.70	311.18
44	19	02/13/23 08:50	22 M1 EFF	0.01		0.009							57	1.55	F1.14	F2.13	M1.02	115.22	114.70	311.18
44	20	02/13/23 08:50	Well 2 at Blow-off	0.69		0.144									F1.14	F2.13	M1.02	115.22	114.70	311.18
44	22	02/13/23 10:00	Collect BART and Lab Nitrate Samples												F1.14	F2.13	M1.02	116.38	115.87	312.35
45	1	02/13/23 11:13	Shutdown F1 for BW												F1.14	F2.13	M1.02	117.60	117.08	313.57
45	2	02/13/23 11:25	Restart F1 @ 2.0 gpm												F1.15	F2.13	M1.02	0.00	117.28	313.77
45	3	02/13/23 11:26	F1 @ 1 min	0.76											F1.15	F2.13	M1.02	0.02	117.30	313.78
45	4	02/13/23 11:27	F1 @ 2 min	0.82											F1.15	F2.13	M1.02	0.03	117.32	313.80
45	5	02/13/23 11:28	F1 @ 3 min	0.82											F1.15	F2.13	M1.02	0.05	117.33	313.82
45	6	02/13/23 11:30	F1 @ 5 min	0.24											F1.15	F2.13	M1.02	0.08	117.37	313.85
45	7	02/13/23 11:33	F1 @ 8 min	0.12											F1.15	F2.13	M1.02	0.13	117.42	313.90
45	8	02/13/23 11:37	F1 @ 12 min	0.15											F1.15	F2.13	M1.02	0.20	117.48	313.97
45	9	02/13/23 11:40	Increase F1 Flow to 4.0 gpm												F1.15	F2.13	M1.02	0.25	117.53	314.02
45	10	02/13/23 11:45	F1 @ 20 min	0.30											F1.15	F2.13	M1.02	0.33	117.62	314.10
45	11	02/13/23 11:45	Shutdown F2 for BW												F1.15	F2.13	M1.02	0.33	117.62	314.10
45	12	02/13/23 11:56	Restart F2 @ 1.0 gpm												F1.15	F2.14	M1.02	0.52	0.00	314.28
45	13	02/13/23 11:57	F2 @ 1 min	0.88											F1.15	F2.14	M1.02	0.53	0.02	314.30
45	14	02/13/23 11:58	F2 @ 2 min	0.35											F1.15	F2.14	M1.02	0.55	0.03	314.32
45	15	02/13/23 11:59	F2 @ 3 min	0.21											F1.15	F2.14	M1.02	0.57	0.05	314.33
45	16	02/13/23 12:01	F2 @ 5 min	0.15											F1.15	F2.14	M1.02	0.60	0.08	314.37
45	17	02/13/23 12:04	F2 @ 8 min	0.10											F1.15	F2.14	M1.02	0.65	0.13	314.42
45	18	02/13/23 12:08	F2 @ 12 min	0.33											F1.15	F2.14	M1.02	0.72	0.20	314.48
45	19	02/13/23 12:11	Increase F2 Flow to 2.5 gpm												F1.15	F2.14	M1.02	0.77	0.25	314.53
45	20	02/13/23 12:16	F2 @ 20 min	0.23											F1.15	F2.14	M1.02	0.85	0.33	314.62
45	21	02/13/23 18:00	11 F1 EFF	0.16											F1.15	F2.14	M1.02	6.58	6.07	320.35
45	22	02/13/23 18:00	22 M1 EFF			0.000									F1.15	F2.14	M1.02	6.58	6.07	320.35
45	23	02/14/23 06:00	11 F1 EFF	0.11											F1.15	F2.14	M1.02	18.58	18.07	332.35
45	24	02/14/23 06:00	22 M1 EFF			0.006									F1.15	F2.14	M1.02	18.58	18.07	332.35
46	1	02/14/23 18:00	11 F1 EFF	0.04											F1.15	F2.14	M1.02	30.58	30.07	344.35
46	2	02/14/23 18:00	22 M1 EFF			0.016									F1.15	F2.14	M1.02	30.58	30.07	344.35
46	3	02/15/23 06:00	11 F1 EFF	0.02											F1.15	F2.14	M1.02	42.58	42.07	356.35
46	4	02/15/23 06:00	22 M1 EFF			0.008									F1.15	F2.14	M1.02	42.58	42.07	356.35
46	7	02/15/23 08:50	07 WELL 2	0.58	0.46	0.140	0.131	6.3	12.6			0.9			F1.15	F2.14	M1.02	45.42	44.90	359.18
46	9	02/15/23 08:50	11 F1 EFF	0.02		0.143		6.39				0			F1.15	F2.14	M1.02	45.42	44.90	359.18

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
46	10	02/15/23 08:50	12 F2 EFF	0.03		0.129		6.31				0			F1.15	F2.14	M1.02	45.42	44.90	359.18
46	11	02/15/23 08:50	21 MPOKA			0.129		7.05							F1.15	F2.14	M1.02	45.42	44.90	359.18
46	13	02/15/23 08:50	22 M1 EFF	0.01		0.011		7.06				0.4			F1.15	F2.14	M1.02	45.42	44.90	359.18
46	14	02/15/23 08:50	Well 2 at Blow-off	0.76		0.134		6.36							F1.15	F2.14	M1.02	45.42	44.90	359.18
46	16	02/15/23 09:39	Shutdown F1 for BW												F1.15	F2.14	M1.02	46.23	45.72	360.00
46	17	02/15/23 09:50	Restart F1 @ 2.0 gpm												F1.16	F2.14	M1.02	0.00	45.90	360.18
46	18	02/15/23 09:51	F1 @ 1 min	0.74											F1.16	F2.14	M1.02	0.02	45.92	360.20
46	19	02/15/23 09:52	F1 @ 2 min	1.47											F1.16	F2.14	M1.02	0.03	45.93	360.22
46	20	02/15/23 09:53	F1 @ 3 min	0.38											F1.16	F2.14	M1.02	0.05	45.95	360.23
46	21	02/15/23 09:55	F1 @ 5 min	0.13											F1.16	F2.14	M1.02	0.08	45.98	360.27
46	22	02/15/23 09:58	F1 @ 8 min	0.09											F1.16	F2.14	M1.02	0.13	46.03	360.32
46	23	02/15/23 10:02	F1 @ 12 min	0.10											F1.16	F2.14	M1.02	0.20	46.10	360.38
46	24	02/15/23 10:05	Increase F1 Flow to 4.0 gpm												F1.16	F2.14	M1.02	0.25	46.15	360.43
46	25	02/15/23 10:10	F1 @ 20 min	0.14											F1.16	F2.14	M1.02	0.33	46.23	360.52
47	1	02/15/23 10:10	Shutdown F2 for BW												F1.16	F2.14	M1.02	0.33	46.23	360.52
47	2	02/15/23 10:20	Restart F2 @ 1.25 gpm												F1.16	F2.15	M1.02	0.50	0.00	360.68
47	3	02/15/23 10:21	F2 @ 1 min	1.77											F1.16	F2.15	M1.02	0.52	0.02	360.70
47	4	02/15/23 10:22	F2 @ 2 min	1.14											F1.16	F2.15	M1.02	0.53	0.03	360.72
47	5	02/15/23 10:23	F2 @ 3 min	0.27											F1.16	F2.15	M1.02	0.55	0.05	360.73
47	6	02/15/23 10:25	F2 @ 5 min	0.14											F1.16	F2.15	M1.02	0.58	0.08	360.77
47	7	02/15/23 10:28	F2 @ 8 min	0.13											F1.16	F2.15	M1.02	0.63	0.13	360.82
47	8	02/15/23 10:32	F2 @ 12 min	0.07											F1.16	F2.15	M1.02	0.70	0.20	360.88
47	9	02/15/23 10:35	Increase F2 Flow to 2.5 gpm												F1.16	F2.15	M1.02	0.75	0.25	360.93
47	10	02/15/23 10:40	F2 @ 20 min	0.15											F1.16	F2.15	M1.02	0.83	0.33	361.02
47	11	02/15/23 10:55	F2 @ 35 min	0.29											F1.16	F2.15	M1.02	1.08	0.58	361.27
47	12	02/15/23 11:23	Adjusted Waste Valve for Pressure. Setting up Felma.												F1.16	F2.15	M1.02	1.55	1.05	361.73
47	14	02/15/23 18:00	11 F1 EFF												F1.16	F2.15	M1.02	8.17	7.67	368.35
47	15	02/15/23 18:00	22 M1 EFF												F1.16	F2.15	M1.02	8.17	7.67	368.35
47	16	02/16/23 06:00	11 F1 EFF												F1.16	F2.15	M1.02	20.17	19.67	380.35
47	17	02/16/23 06:00	22 M1 EFF												F1.16	F2.15	M1.02	20.17	19.67	380.35
47	18	02/16/23 09:58	Shutdown M1 for BW												F1.16	F2.15	M1.02	24.13	23.63	384.32
47	19	02/16/23 10:09	Restart M1 @ 1 gpm												F1.16	F2.15	M1.03	24.32	23.82	0.00
47	20	02/16/23 10:10	M1 @ 1 min			0.041									F1.16	F2.15	M1.03	24.33	23.83	0.02
47	21	02/16/23 10:11	M1 @ 2 min			0.009									F1.16	F2.15	M1.03	24.35	23.85	0.03
47	22	02/16/23 10:12	M1 @ 3 min			0.002									F1.16	F2.15	M1.03	24.37	23.87	0.05
47	23	02/16/23 10:17	M1 @ 5 min			0.008									F1.16	F2.15	M1.03	24.45	23.95	0.13
47	24	02/16/23 10:17	M1 @ 8 min			0.003									F1.16	F2.15	M1.03	24.45	23.95	0.13
47	25	02/16/23 10:21	M1 @ 12 min			0.005									F1.16	F2.15	M1.03	24.52	24.02	0.20
48	1	02/16/23 10:24	Increase M1 Flow to 2.0 gpm												F1.16	F2.15	M1.03	24.57	24.07	0.25
48	2	02/16/23 10:29	M1 @ 20 min			0.001									F1.16	F2.15	M1.03	24.65	24.15	0.33
48	4	02/16/23 10:29	Shutdown F1 for BW												F1.16	F2.15	M1.03	24.65	24.15	0.33
48	5	02/16/23 10:39	Restart F1 @ 2.0 gpm												F1.17	F2.15	M1.03	0.00	24.32	0.50
48	6	02/16/23 10:40	F1 @ 1 min	0.30											F1.17	F2.15	M1.03	0.02	24.33	0.52
48	7	02/16/23 10:41	F1 @ 2 min	0.22											F1.17	F2.15	M1.03	0.03	24.35	0.53
48	8	02/16/23 10:42	F1 @ 3 min	0.14											F1.17	F2.15	M1.03	0.05	24.37	0.55
48	9	02/16/23 10:44	F1 @ 5 min	0.13											F1.17	F2.15	M1.03	0.08	24.40	0.58
48	10	02/16/23 10:47	F1 @ 8 min	0.19											F1.17	F2.15	M1.03	0.13	24.45	0.63

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
48	11	02/16/23 10:51	F1 @ 12 min	0.12											F1.17	F2.15	M1.03	0.20	24.52	0.70
48	12	02/16/23 10:54	Increase F1 Flow to 4.0 gpm												F1.17	F2.15	M1.03	0.25	24.57	0.75
48	13	02/16/23 10:59	F1 @ 20 min	0.16											F1.17	F2.15	M1.03	0.33	24.65	0.83
48	15	02/16/23 13:40	07 WELL 2	2.13	0.64	0.158	0.129	6.4	13.5			2.7			F1.17	F2.15	M1.03	3.02	27.33	3.52
48	17	02/16/23 13:40	11 F1 EFF	0.40		0.145		6.35				1.9			F1.17	F2.15	M1.03	3.02	27.33	3.52
48	18	02/16/23 13:40	12 F2 EFF	0.15		0.134		6.3				1			F1.17	F2.15	M1.03	3.02	27.33	3.52
48	19	02/16/23 13:40	21 MPOKA			0.146	0.125	7.13							F1.17	F2.15	M1.03	3.02	27.33	3.52
48	21	02/16/23 13:40	22 M1 EFF	0.07		0.008		7.14				0.4			F1.17	F2.15	M1.03	3.02	27.33	3.52
48	22	02/16/23 13:40	Well 2 at Blow-off	0.16		0.164		6.44							F1.17	F2.15	M1.03	3.02	27.33	3.52
49	1	02/16/23 18:00	11 F1 EFF	0.19											F1.17	F2.15	M1.03	7.35	31.67	7.85
49	2	02/16/23 18:00	22 M1 EFF			0.023									F1.17	F2.15	M1.03	7.35	31.67	7.85
49	3	02/17/23 06:00	11 F1 EFF	0.07											F1.17	F2.15	M1.03	19.35	43.67	19.85
49	4	02/17/23 06:00	22 M1 EFF		0.00										F1.17	F2.15	M1.03	19.35	43.67	19.85
49	6	02/17/23 12:25	07 WELL 2	0.73	0.58	0.132	0.134	6.28	12.9			2.8			F1.17	F2.15	M1.03	25.77	50.08	26.27
49	8	02/17/23 12:25	11 F1 EFF	0.03		0.134		6.29	13.2			1.2			F1.17	F2.15	M1.03	25.77	50.08	26.27
49	9	02/17/23 12:25	12 F2 EFF	0.00		0.109		6.39	13.5			0.6			F1.17	F2.15	M1.03	25.77	50.08	26.27
49	10	02/17/23 12:25	21 MPOKA			0.127	0.115	7.12	15.6						F1.17	F2.15	M1.03	25.77	50.08	26.27
49	12	02/17/23 12:25	22 M1 EFF	0.03		0.014		7.12	15.6			1.8			F1.17	F2.15	M1.03	25.77	50.08	26.27
49	13	02/17/23 12:25	Well 2 at Blow-off	0.96		0.133		6.39	15.1						F1.17	F2.15	M1.03	25.77	50.08	26.27
49	14	02/17/23 13:09	Shutdown F1 for BW												F1.17	F2.15	M1.03	26.50	50.82	27.00
49	15	02/17/23 13:21	Restart F1 @ 1.5 gpm												F1.18	F2.15	M1.03	0.00	51.02	27.20
49	18	02/17/23 13:29	Increase F1 flow to 3.0 gpm												F1.18	F2.15	M1.03	0.13	51.15	27.33
49	20	02/17/23 13:47	Shutdown F2 for BW												F1.18	F2.15	M1.03	0.43	51.45	27.63
49	21	02/17/23 13:57	Restart F2 @ 1.25 gpm												F1.18	F2.16	M1.03	0.60	0.00	27.80
49	22	02/17/23 14:12	Increase F2 flow to 2.5 gpm												F1.18	F2.16	M1.03	0.85	0.25	28.05
50	1	02/17/23 18:00	11 F1 EFF	0.01											F1.18	F2.16	M1.03	4.65	4.05	31.85
50	3	02/18/23 06:00	11 F1 EFF	0.06											F1.18	F2.16	M1.03	16.65	16.05	43.85
50	5	02/18/23 18:00	11 F1 EFF	0.02											F1.18	F2.16	M1.03	28.65	28.05	55.85
50	7	02/19/23 06:00	11 F1 EFF	0.03											F1.18	F2.16	M1.03	40.65	40.05	67.85
50	9	02/19/23 18:00	11 F1 EFF	0.04											F1.18	F2.16	M1.03	52.65	52.05	79.85
50	11	02/20/23 06:00	11 F1 EFF	0.02											F1.18	F2.16	M1.03	64.65	64.05	91.85
50	13	02/20/23 11:40	Calibrate Benchtop pH Meter m=98.4												F1.18	F2.16	M1.03	70.32	69.72	97.52
50	14	02/20/23 12:07	07 WELL 2	1.05	0.46	0.155	0.138	6.42	13.6			2.3			F1.18	F2.16	M1.03	70.77	70.17	97.97
50	16	02/20/23 12:07	11 F1 EFF	0.05		0.128		6.39	13.4			0.9			F1.18	F2.16	M1.03	70.77	70.17	97.97
50	17	02/20/23 12:07	12 F2 EFF	0.12		0.123		6.43	15.8			0.5			F1.18	F2.16	M1.03	70.77	70.17	97.97
50	18	02/20/23 12:07	21 MPOKA			0.130	0.136	7.2	16.2						F1.18	F2.16	M1.03	70.77	70.17	97.97
50	20	02/20/23 12:07	22 M1 EFF	0.00		0.017		7.25	16.1			0.2			F1.18	F2.16	M1.03	70.77	70.17	97.97
50	21	02/20/23 12:07	Well 2 at Blow-off	0.71		0.128		6.47	15.2						F1.18	F2.16	M1.03	70.77	70.17	97.97
50	22	02/20/23 13:48	Shutdown F1 for BW												F1.18	F2.16	M1.03	72.45	71.85	99.65
50	23	02/20/23 13:58	Restart F1 @2.0gpm												F1.19	F2.16	M1.03	0.00	72.02	99.82
50	24	02/20/23 14:13	Increase F1 Flow to 4.0 gpm												F1.19	F2.16	M1.03	0.25	72.27	100.07
51	1	02/20/23 14:13	Shutdown F2 for BW												F1.19	F2.16	M1.03	0.25	72.27	100.07
51	2	02/20/23 14:25	Restart F2 @ 1.25 gpm												F1.19	F2.17	M1.03	0.45	0.00	100.27
51	3	02/20/23 14:40	Increase F2 flow to 2.5 gpm												F1.19	F2.17	M1.03	0.70	0.25	100.52
51	5	02/20/23 18:00	11 F1 EFF	0.10											F1.19	F2.17	M1.03	4.03	3.58	103.85
51	6	02/20/23 18:00	22 M1 EFF			0.014									F1.19	F2.17	M1.03	4.03	3.58	103.85
51	7	02/21/23 06:00	11 F1 EFF	0.08											F1.19	F2.17	M1.03	16.03	15.58	115.85

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
51	8	02/21/23 06:00	22 M1 EFF			0.019									F1.19	F2.17	M1.03	16.03	15.58	115.85
51	14	02/21/23 14:23	21 MPOKA			0.126	0.126	7.16	12.6						F1.19	F2.17	M1.03	24.42	23.97	124.23
51	16	02/21/23 14:23	22 M1 EFF	0.01		0.000		7.14	12.6			0.5			F1.19	F2.17	M1.03	24.42	23.97	124.23
51	18	02/21/23 14:30	07 WELL 2					6.49	10.8			0.9			F1.19	F2.17	M1.03	24.53	24.08	124.35
51	19	02/21/23 14:30	11 F1 EFF	0.03		0.129		6.51	11.1			0.9			F1.19	F2.17	M1.03	24.53	24.08	124.35
51	20	02/21/23 14:30	12 F2 EFF	0.03		0.135		6.46	11.9			1.3			F1.19	F2.17	M1.03	24.53	24.08	124.35
51	22	02/21/23 18:00	11 F1 EFF	0.02											F1.19	F2.17	M1.03	28.03	27.58	127.85
51	23	02/21/23 18:00	22 M1 EFF			0.022									F1.19	F2.17	M1.03	28.03	27.58	127.85
51	24	02/22/23 06:00	11 F1 EFF	0.01											F1.19	F2.17	M1.03	40.03	39.58	139.85
51	25	02/22/23 06:00	22 M1 EFF			0.020									F1.19	F2.17	M1.03	40.03	39.58	139.85
52	6	02/22/23 11:15	Shutdown F1 for BW												F1.19	F2.17	M1.03	45.28	44.83	145.10
52	8	02/22/23 11:29	Restart F1 @ 4.0 gpm												F1.20	F2.17	M1.03	0.00	45.07	145.33
52	17	02/22/23 18:00	11 F1 EFF	0.10											F1.20	F2.17	M1.03	6.52	51.58	151.85
52	18	02/22/23 18:00	22 M1 EFF			0.017									F1.20	F2.17	M1.03	6.52	51.58	151.85
52	19	02/23/23 06:00	11 F1 EFF	0.07											F1.20	F2.17	M1.03	18.52	63.58	163.85
52	20	02/23/23 06:00	22 M1 EFF			0.018									F1.20	F2.17	M1.03	18.52	63.58	163.85
52	22	02/23/23 08:30	Shutdown F2 for BW												F1.20	F2.17	M1.03	21.02	66.08	166.35
53	1	02/23/23 08:41	Restart F2 @ 1.25 gpm												F1.20	F2.18	M1.03	21.20	0.00	166.53
53	2	02/23/23 08:42	F2 @ 1 min	0.34											F1.20	F2.18	M1.03	21.22	0.02	166.55
53	3	02/23/23 08:43	F2 @ 2 min	0.53											F1.20	F2.18	M1.03	21.23	0.03	166.57
53	4	02/23/23 08:44	F2 @ 3 min	0.15											F1.20	F2.18	M1.03	21.25	0.05	166.58
53	5	02/23/23 08:46	F2 @ 5 min	0.05											F1.20	F2.18	M1.03	21.28	0.08	166.62
53	6	02/23/23 08:49	F2 @ 8 min	0.10											F1.20	F2.18	M1.03	21.33	0.13	166.67
53	7	02/23/23 08:53	F2 @ 12 min	0.04											F1.20	F2.18	M1.03	21.40	0.20	166.73
53	8	02/23/23 08:56	Increase F2 flow to 2.5 gpm												F1.20	F2.18	M1.03	21.45	0.25	166.78
53	9	02/23/23 09:01	F2 @ 20 min	0.07											F1.20	F2.18	M1.03	21.53	0.33	166.87
53	11	02/23/23 10:30	11 F1 EFF	0.11		0.144		6.38	11.5						F1.20	F2.18	M1.03	23.02	1.82	168.35
53	12	02/23/23 10:30	12 F2 EFF	0.10		0.161		6.38	11.7						F1.20	F2.18	M1.03	23.02	1.82	168.35
53	13	02/23/23 10:30	21 MPOKA			0.145	0.139	7.14	13.5						F1.20	F2.18	M1.03	23.02	1.82	168.35
53	15	02/23/23 10:30	22 M1 EFF	0.02		0.013		7.13	13.5						F1.20	F2.18	M1.03	23.02	1.82	168.35
53	16	02/23/23 10:30	Well 2 at Blow-off	0.90		0.147		6.41	12.7						F1.20	F2.18	M1.03	23.02	1.82	168.35
54	1	02/24/23 13:04	Shutdown F1 for BW												F1.20	F2.18	M1.03	49.58	28.38	194.92
54	2	02/24/23 13:14	Restart F1 @ 1.5 gpm												F1.21	F2.18	M1.03	0.00	28.55	195.08
54	3	02/24/23 13:15	F1 @ 1 min	0.35											F1.21	F2.18	M1.03	0.02	28.57	195.10
54	4	02/24/23 13:16	F1 @ 2 min	0.17											F1.21	F2.18	M1.03	0.03	28.58	195.12
54	5	02/24/23 13:17	F1 @ 3 min	0.19											F1.21	F2.18	M1.03	0.05	28.60	195.13
54	6	02/24/23 13:19	F1 @ 5 min	0.10											F1.21	F2.18	M1.03	0.08	28.63	195.17
54	7	02/24/23 13:22	F1 @ 8 min	0.08											F1.21	F2.18	M1.03	0.13	28.68	195.22
54	8	02/24/23 13:26	F1 @ 12 min	0.12											F1.21	F2.18	M1.03	0.20	28.75	195.28
54	9	02/24/23 13:29	Increase F1 flow to 3.0 gpm												F1.21	F2.18	M1.03	0.25	28.80	195.33
54	10	02/24/23 13:34	F1 @ 20 min	0.14											F1.21	F2.18	M1.03	0.33	28.88	195.42
54	14	02/24/23 14:10	07 WELL 2	0.74	0.64	0.144	0.141	6.53	12.4						F1.21	F2.18	M1.03	0.93	29.48	196.02
54	16	02/24/23 14:10	11 F1 EFF	0.12		0.154		6.59	13						F1.21	F2.18	M1.03	0.93	29.48	196.02
54	17	02/24/23 14:10	12 F2 EFF	0.04		0.135		6.41	13.7						F1.21	F2.18	M1.03	0.93	29.48	196.02
54	18	02/24/23 14:10	21 MPOKA			0.135	0.123	7.31	14.4						F1.21	F2.18	M1.03	0.93	29.48	196.02
54	20	02/24/23 14:10	22 M1 EFF	0.02		0.004									F1.21	F2.18	M1.03	0.93	29.48	196.02
54	22	02/24/23 14:48	KOH V=26.9												F1.21	F2.18	M1.03	1.57	30.12	196.65

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
55	1	02/24/23 18:00	11 F1 EFF	0.04											F1.21	F2.18	M1.03	4.77	33.32	199.85
55	2	02/24/23 18:00	22 M1 EFF			0.010									F1.21	F2.18	M1.03	4.77	33.32	199.85
55	3	02/25/23 06:00	11 F1 EFF	0.03											F1.21	F2.18	M1.03	16.77	45.32	211.85
55	4	02/25/23 06:00	22 M1 EFF			0.010									F1.21	F2.18	M1.03	16.77	45.32	211.85
55	5	02/25/23 18:00	11 F1 EFF	0.00											F1.21	F2.18	M1.03	28.77	57.32	223.85
55	6	02/25/23 18:00	22 M1 EFF			0.006									F1.21	F2.18	M1.03	28.77	57.32	223.85
55	7	02/26/23 06:00	11 F1 EFF	0.01											F1.21	F2.18	M1.03	40.77	69.32	235.85
55	8	02/26/23 06:00	22 M1 EFF			0.004									F1.21	F2.18	M1.03	40.77	69.32	235.85
55	9	02/26/23 18:00	11 F1 EFF	0.00											F1.21	F2.18	M1.03	52.77	81.32	247.85
55	10	02/26/23 18:00	22 M1 EFF			0.006									F1.21	F2.18	M1.03	52.77	81.32	247.85
55	11	02/27/23 06:00	11 F1 EFF	0.00											F1.21	F2.18	M1.03	64.77	93.32	259.85
55	12	02/27/23 06:00	22 M1 EFF			0.009									F1.21	F2.18	M1.03	64.77	93.32	259.85
55	14	02/27/23 12:03	Shutdown F1 for BW												F1.21	F2.18	M1.03	70.82	99.37	265.90
55	15	02/27/23 12:14	Restart F1 @1.0gpm												F1.22	F2.18	M1.03	0.00	99.55	266.08
55	16	02/27/23 12:15	11 F1 EFF	0.49											F1.22	F2.18	M1.03	0.02	99.57	266.10
55	17	02/27/23 12:16	11 F1 EFF	0.30											F1.22	F2.18	M1.03	0.03	99.58	266.12
55	18	02/27/23 12:17	11 F1 EFF	0.18											F1.22	F2.18	M1.03	0.05	99.60	266.13
55	19	02/27/23 12:19	11 F1 EFF	0.07											F1.22	F2.18	M1.03	0.08	99.63	266.17
55	20	02/27/23 12:22	11 F1 EFF	0.13											F1.22	F2.18	M1.03	0.13	99.68	266.22
55	21	02/27/23 12:26	11 F1 EFF	0.09											F1.22	F2.18	M1.03	0.20	99.75	266.28
55	22	02/27/23 12:29	Increase F1 flow to 2.0gpm												F1.22	F2.18	M1.03	0.25	99.80	266.33
55	23	02/27/23 12:34	11 F1 EFF	0.05											F1.22	F2.18	M1.03	0.33	99.88	266.42
55	24	02/27/23 12:35	Shutdown F2 for BW												F1.22	F2.18	M1.03	0.35	99.90	266.43
55	25	02/27/23 12:45	Restart F2 @1.0gpm												F1.22	F2.19	M1.03	0.52	0.00	266.60
56	1	02/27/23 12:46	12 F2 EFF	1.14											F1.22	F2.19	M1.03	0.53	0.02	266.62
56	2	02/27/23 12:47	12 F2 EFF	0.16											F1.22	F2.19	M1.03	0.55	0.03	266.63
56	3	02/27/23 12:48	12 F2 EFF	1.00											F1.22	F2.19	M1.03	0.57	0.05	266.65
56	4	02/27/23 12:50	12 F2 EFF	0.10											F1.22	F2.19	M1.03	0.60	0.08	266.68
56	5	02/27/23 12:53	12 F2 EFF	0.03											F1.22	F2.19	M1.03	0.65	0.13	266.73
56	6	02/27/23 12:57	12 F2 EFF	0.06											F1.22	F2.19	M1.03	0.72	0.20	266.80
56	7	02/27/23 13:00	Increase F2 Flow to 2.0gpm												F1.22	F2.19	M1.03	0.77	0.25	266.85
56	8	02/27/23 13:05	12 F2 EFF	0.04											F1.22	F2.19	M1.03	0.85	0.33	266.93
56	9	02/27/23 14:50	Fresh Batch 10L of KOH V16.5-->26.5L												F1.22	F2.19	M1.03	2.60	2.08	268.68
56	10	02/27/23 14:54	11 F1 EFF	0.07		0.159		6.37	11.9						F1.22	F2.19	M1.03	2.67	2.15	268.75
56	11	02/27/23 14:54	12 F2 EFF	0.05		0.158		6.32	11.8						F1.22	F2.19	M1.03	2.67	2.15	268.75
56	12	02/27/23 14:54	22 M1 EFF	0.02		0.014		6.91	13.2						F1.22	F2.19	M1.03	2.67	2.15	268.75
56	13	02/27/23 18:00	11 F1 EFF	0.03											F1.22	F2.19	M1.03	5.77	5.25	271.85
56	14	02/27/23 18:00	22 M1 EFF		0.02										F1.22	F2.19	M1.03	5.77	5.25	271.85
56	15	02/28/23 06:00	11 F1 EFF	0.02											F1.22	F2.19	M1.03	17.77	17.25	283.85
56	16	02/28/23 06:00	22 M1 EFF		0.00										F1.22	F2.19	M1.03	17.77	17.25	283.85
56	17	02/28/23 11:30	Cal benchtop pH Probe, m=98.8												F1.22	F2.19	M1.03	23.27	22.75	289.35
56	18	02/28/23 12:15	07 WELL 2	0.85	0.69	0.149	0.148	6.51	12.5			0.5			F1.22	F2.19	M1.03	24.02	23.50	290.10
56	20	02/28/23 12:15	11 F1 EFF	0.03		0.137		6.32	12.4			1.2			F1.22	F2.19	M1.03	24.02	23.50	290.10
56	21	02/28/23 12:15	12 F2 EFF	0.02		0.144		6.33	12.7			1.4			F1.22	F2.19	M1.03	24.02	23.50	290.10
56	22	02/28/23 12:15	21 MPOKA			0.142	0.127	6.91	13.4						F1.22	F2.19	M1.03	24.02	23.50	290.10
56	24	02/28/23 12:15	22 M1 EFF	0.00		0.015		6.95	14			0.7			F1.22	F2.19	M1.03	24.02	23.50	290.10
56	25	02/28/23 14:50	KOH V=21.9, q=134ml/h												F1.22	F2.19	M1.03	26.60	26.08	292.68

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
57	1	03/01/23 08:00	Untarp BW Storage and set up recycle												F1.22	F2.19	M1.03	43.77	43.25	309.85
57	3	03/01/23 10:15	Shutdown Feed to Bio trailor for 15 seconds to install recycle T. Reduce pressure to 12 psi												F1.22	F2.19	M1.03	46.02	45.50	312.10
57	4	03/01/23 10:15	Cal Paristatic Pump to 0.4gpm (10%) into 4gpm												F1.22	F2.19	M1.03	46.02	45.50	312.10
57	5	03/01/23 10:43	Start Recycle Trial												F1.22	F2.19	M1.03	46.48	45.97	312.57
57	6	03/01/23 11:00	08 WELL 2 + REC	1.39		0.137									F1.22	F2.19	M1.03	46.77	46.25	312.85
57	7	03/01/23 11:00	11 F1 EFF	0.06		0.124									F1.22	F2.19	M1.03	46.77	46.25	312.85
57	8	03/01/23 11:00	12 F2 EFF	0.09		0.129									F1.22	F2.19	M1.03	46.77	46.25	312.85
57	9	03/01/23 11:00	22 M1 EFF	0.05		0.005									F1.22	F2.19	M1.03	46.77	46.25	312.85
57	10	03/01/23 11:00	07 WELL 2	0.69		0.160									F1.22	F2.19	M1.03	46.77	46.25	312.85
57	12	03/01/23 11:12	Reduce Recycle rate from 10% -->5%												F1.22	F2.19	M1.03	46.97	46.45	313.05
57	13	03/01/23 11:40	08 WELL 2 + REC	0.90		0.140									F1.22	F2.19	M1.03	47.43	46.92	313.52
57	14	03/01/23 11:40	11 F1 EFF	0.11		0.125									F1.22	F2.19	M1.03	47.43	46.92	313.52
57	15	03/01/23 11:40	12 F2 EFF	0.06		0.128									F1.22	F2.19	M1.03	47.43	46.92	313.52
57	16	03/01/23 11:40	22 M1 EFF	0.03		0.001									F1.22	F2.19	M1.03	47.43	46.92	313.52
57	17	03/01/23 11:40	V/T Check=.208gpm												F1.22	F2.19	M1.03	47.43	46.92	313.52
57	19	03/01/23 12:15	08 WELL 2 + REC	1.09		0.136									F1.22	F2.19	M1.03	48.02	47.50	314.10
57	20	03/01/23 12:15	11 F1 EFF	0.03		0.122									F1.22	F2.19	M1.03	48.02	47.50	314.10
57	21	03/01/23 12:15	12 F2 EFF	0.05		0.119									F1.22	F2.19	M1.03	48.02	47.50	314.10
57	22	03/01/23 12:15	22 M1 EFF	0.02		0.008									F1.22	F2.19	M1.03	48.02	47.50	314.10
57	24	03/01/23 13:00	Cullect Full Round Lab Samples												F1.22	F2.19	M1.03	48.77	48.25	314.85
58	1	03/01/23 13:15	08 WELL 2 + REC	0.90		0.128									F1.22	F2.19	M1.03	49.02	48.50	315.10
58	2	03/01/23 13:15	11 F1 EFF	0.05											F1.22	F2.19	M1.03	49.02	48.50	315.10
58	3	03/01/23 13:15	12 F2 EFF	0.03											F1.22	F2.19	M1.03	49.02	48.50	315.10
58	4	03/01/23 13:15	22 M1 EFF	0.03		0.000									F1.22	F2.19	M1.03	49.02	48.50	315.10
58	5	03/01/23 14:15	08 WELL 2 + REC	1.11		0.131									F1.22	F2.19	M1.03	50.02	49.50	316.10
58	6	03/01/23 14:15	11 F1 EFF	0.02											F1.22	F2.19	M1.03	50.02	49.50	316.10
58	7	03/01/23 14:15	12 F2 EFF	0.04											F1.22	F2.19	M1.03	50.02	49.50	316.10
58	8	03/01/23 14:15	22 M1 EFF	0.01		0.000									F1.22	F2.19	M1.03	50.02	49.50	316.10
58	9	03/01/23 14:45	08 WELL 2 + REC	0.91		0.129									F1.22	F2.19	M1.03	50.52	50.00	316.60
58	10	03/01/23 14:45	11 F1 EFF	0.05											F1.22	F2.19	M1.03	50.52	50.00	316.60
58	11	03/01/23 14:45	12 F2 EFF	0.04											F1.22	F2.19	M1.03	50.52	50.00	316.60
58	12	03/01/23 14:45	22 M1 EFF	0.01		0.000									F1.22	F2.19	M1.03	50.52	50.00	316.60
58	13	03/01/23 14:48	End Recycle Trial												F1.22	F2.19	M1.03	50.57	50.05	316.65
58	15	03/01/23 15:00	07 WELL 2	0.55		0.145									F1.22	F2.19	M1.03	50.77	50.25	316.85
58	16	03/01/23 15:00	11 F1 EFF	0.01											F1.22	F2.19	M1.03	50.77	50.25	316.85
58	17	03/01/23 15:00	12 F2 EFF	0.04											F1.22	F2.19	M1.03	50.77	50.25	316.85
58	18	03/01/23 15:00	22 M1 EFF	0.01		0.000									F1.22	F2.19	M1.03	50.77	50.25	316.85
58	22	03/01/23 18:00	11 F1 EFF	0.03		0.122									F1.22	F2.19	M1.03	53.77	53.25	319.85
58	23	03/01/23 18:00	22 M1 EFF	0.02		0.000									F1.22	F2.19	M1.03	53.77	53.25	319.85
58	24	03/02/23 06:00	11 F1 EFF	0.00		0.130									F1.22	F2.19	M1.03	65.77	65.25	331.85
58	25	03/02/23 06:00	22 M1 EFF	0.01		0.006									F1.22	F2.19	M1.03	65.77	65.25	331.85
59	1	03/02/23 08:45	07 WELL 2	0.75	0.61	0.153	0.132	6.95							F1.22	F2.19	M1.03	68.52	68.00	334.60
59	3	03/02/23 08:45	11 F1 EFF	0.02		0.135		6.28							F1.22	F2.19	M1.03	68.52	68.00	334.60
59	4	03/02/23 08:45	12 F2 EFF	0.04		0.131		6.27							F1.22	F2.19	M1.03	68.52	68.00	334.60
59	5	03/02/23 08:45	21 MPOKA				0.13	7.09							F1.22	F2.19	M1.03	68.52	68.00	334.60
59	7	03/02/23 08:45	22 M1 EFF	0.03		0.000		6.75							F1.22	F2.19	M1.03	68.52	68.00	334.60
59	8	03/02/23 08:45	Well 2 at Blow-off	0.97		0.158									F1.22	F2.19	M1.03	68.52	68.00	334.60

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
59	10	03/02/23 09:45	Correct MEFF pH spans on SC200 and Laptop												F1.22	F2.19	M1.03	69.52	69.00	335.60
59	12	03/02/23 11:00	Add 15L 1/5 KOH to Day Tank, V=30L												F1.22	F2.19	M1.03	70.77	70.25	336.85
59	14	03/02/23 12:00	Increase influent pressure from 12 to 25 psi												F1.22	F2.19	M1.03	71.77	71.25	337.85
59	16	03/02/23 12:15	Download Data												F1.22	F2.19	M1.03	72.02	71.50	338.10
59	17	03/02/23 18:00	11 F1 EFF	0.03											F1.22	F2.19	M1.03	77.77	77.25	343.85
59	18	03/02/23 18:00	22 M1 EFF			0.001									F1.22	F2.19	M1.03	77.77	77.25	343.85
59	19	03/03/23 06:00	11 F1 EFF	0.02											F1.22	F2.19	M1.03	89.77	89.25	355.85
59	20	03/03/23 06:00	22 M1 EFF			0.012									F1.22	F2.19	M1.03	89.77	89.25	355.85
59	22	03/03/23 11:31	Shutdown F2 for BW												F1.22	F2.19	M1.03	95.28	94.77	361.37
59	23	03/03/23 11:42	Restart F2 @1gpm												F1.22	F2.20	M1.03	95.47	0.00	361.55
60	1	03/03/23 11:43	12 F2 EFF	1.15											F1.22	F2.20	M1.03	95.48	0.02	361.57
60	2	03/03/23 11:44	12 F2 EFF	1.25											F1.22	F2.20	M1.03	95.50	0.03	361.58
60	3	03/03/23 11:45	12 F2 EFF	0.58											F1.22	F2.20	M1.03	95.52	0.05	361.60
60	4	03/03/23 11:47	12 F2 EFF	0.13											F1.22	F2.20	M1.03	95.55	0.08	361.63
60	5	03/03/23 11:50	12 F2 EFF	0.06											F1.22	F2.20	M1.03	95.60	0.13	361.68
60	6	03/03/23 11:54	12 F2 EFF	0.09											F1.22	F2.20	M1.03	95.67	0.20	361.75
60	7	03/03/23 11:57	Increase F2 flow to 2.5gpm												F1.22	F2.20	M1.03	95.72	0.25	361.80
60	8	03/03/23 12:02	12 F2 EFF	0.07											F1.22	F2.20	M1.03	95.80	0.33	361.88
60	9	03/03/23 12:09	Shutdown F1 for BW												F1.22	F2.20	M1.03	95.92	0.45	362.00
60	10	03/03/23 12:20	Restart F1 @1.0gpm												F1.23	F2.20	M1.03	0.00	0.63	362.18
60	11	03/03/23 12:21	11 F1 EFF	1.34											F1.23	F2.20	M1.03	0.02	0.65	362.20
60	12	03/03/23 12:22	11 F1 EFF	0.70											F1.23	F2.20	M1.03	0.03	0.67	362.22
60	13	03/03/23 12:23	11 F1 EFF	0.37											F1.23	F2.20	M1.03	0.05	0.68	362.23
60	14	03/03/23 12:25	11 F1 EFF	0.13											F1.23	F2.20	M1.03	0.08	0.72	362.27
60	15	03/03/23 12:28	11 F1 EFF	0.04											F1.23	F2.20	M1.03	0.13	0.77	362.32
60	16	03/03/23 12:32	11 F1 EFF	0.06											F1.23	F2.20	M1.03	0.20	0.83	362.38
60	17	03/03/23 12:35	Increase F1 flow to 2.0gpm												F1.23	F2.20	M1.03	0.25	0.88	362.43
60	18	03/03/23 12:40	11 F1 EFF	0.06											F1.23	F2.20	M1.03	0.33	0.97	362.52
60	19	03/03/23 13:50	07 WELL 2	0.72	0.06	0.163	0.142	6.41	12.4						F1.23	F2.20	M1.03	1.50	2.13	363.68
60	21	03/03/23 13:50	11 F1 EFF	0.03		0.156		6.17	13.5						F1.23	F2.20	M1.03	1.50	2.13	363.68
60	22	03/03/23 13:50	12 F2 EFF	0.08		0.145		6.2	15						F1.23	F2.20	M1.03	1.50	2.13	363.68
60	23	03/03/23 13:50	21 MPOKA			0.155	0.149	7.08	15.9						F1.23	F2.20	M1.03	1.50	2.13	363.68
60	25	03/03/23 13:50	22 M1 EFF	0.01		0.015		7.04	15.7						F1.23	F2.20	M1.03	1.50	2.13	363.68
61	1	03/03/23 14:39	KOH V=25L												F1.23	F2.20	M1.03	2.32	2.95	364.50
61	4	03/03/23 18:00	11 F1 EFF	0.04											F1.23	F2.20	M1.03	5.67	6.30	367.85
61	5	03/03/23 18:00	22 M1 EFF			0.013									F1.23	F2.20	M1.03	5.67	6.30	367.85
61	6	03/04/23 06:00	11 F1 EFF	0.03											F1.23	F2.20	M1.03	17.67	18.30	379.85
61	7	03/04/23 06:00	22 M1 EFF			0.004									F1.23	F2.20	M1.03	17.67	18.30	379.85
61	8	03/04/23 18:00	11 F1 EFF	0.03											F1.23	F2.20	M1.03	29.67	30.30	391.85
61	9	03/04/23 18:00	22 M1 EFF			0.023									F1.23	F2.20	M1.03	29.67	30.30	391.85
61	10	03/05/23 06:00	11 F1 EFF	0.03											F1.23	F2.20	M1.03	41.67	42.30	403.85
61	11	03/05/23 06:00	22 M1 EFF			0.025									F1.23	F2.20	M1.03	41.67	42.30	403.85
61	12	03/05/23 18:00	11 F1 EFF	0.00											F1.23	F2.20	M1.03	53.67	54.30	415.85
61	13	03/05/23 18:00	22 M1 EFF			0.000									F1.23	F2.20	M1.03	53.67	54.30	415.85
61	14	03/06/23 06:00	11 F1 EFF	0.02											F1.23	F2.20	M1.03	65.67	66.30	427.85
61	15	03/06/23 06:00	22 M1 EFF			0.014									F1.23	F2.20	M1.03	65.67	66.30	427.85
61	16	03/06/23 11:56	Shutdown M1 for BW												F1.23	F2.20	M1.03	71.60	72.23	433.78

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
61	17	03/06/23 12:06	Restart M1 @1.5gpm, Collect Labs for CBW												F1.23	F2.20	M1.04	71.77	72.40	0.00
61	18	03/06/23 12:07	22 M1 EFF			0.052									F1.23	F2.20	M1.04	71.78	72.42	0.02
61	19	03/06/23 12:08	22 M1 EFF			0.017									F1.23	F2.20	M1.04	71.80	72.43	0.03
61	20	03/06/23 12:09	22 M1 EFF			0.019									F1.23	F2.20	M1.04	71.82	72.45	0.05
61	21	03/06/23 12:11	22 M1 EFF			0.026									F1.23	F2.20	M1.04	71.85	72.48	0.08
61	22	03/06/23 12:14	22 M1 EFF			0.010									F1.23	F2.20	M1.04	71.90	72.53	0.13
61	23	03/06/23 12:18	22 M1 EFF			0.015									F1.23	F2.20	M1.04	71.97	72.60	0.20
61	24	03/06/23 12:21	Increase M1 flow to 2.9gpm												F1.23	F2.20	M1.04	72.02	72.65	0.25
61	25	03/06/23 12:26	22 M1 EFF			0.026									F1.23	F2.20	M1.04	72.10	72.73	0.33
62	1	03/06/23 12:29	Shutdown F1 for BW												F1.23	F2.20	M1.04	72.15	72.78	0.38
62	2	03/06/23 12:40	Restart F1 @1.0gpm												F1.24	F2.20	M1.04	0.00	72.97	0.57
62	3	03/06/23 12:41	11 F1 EFF	0.55											F1.24	F2.20	M1.04	0.02	72.98	0.58
62	4	03/06/23 12:42	11 F1 EFF	0.51											F1.24	F2.20	M1.04	0.03	73.00	0.60
62	5	03/06/23 12:43	11 F1 EFF	0.40											F1.24	F2.20	M1.04	0.05	73.02	0.62
62	6	03/06/23 12:45	11 F1 EFF	0.12											F1.24	F2.20	M1.04	0.08	73.05	0.65
62	7	03/06/23 12:48	11 F1 EFF	0.08											F1.24	F2.20	M1.04	0.13	73.10	0.70
62	8	03/06/23 12:52	11 F1 EFF	0.09											F1.24	F2.20	M1.04	0.20	73.17	0.77
62	9	03/06/23 12:55	increase F1 flow to 2,0gpm												F1.24	F2.20	M1.04	0.25	73.22	0.82
62	10	03/06/23 13:00	11 F1 EFF	0.04											F1.24	F2.20	M1.04	0.33	73.30	0.90
62	11	03/06/23 13:03	Shutdown F2 for BW												F1.24	F2.20	M1.04	0.38	73.35	0.95
62	12	03/06/23 13:13	Restart F2 @1.0gpm												F1.24	F2.21	M1.04	0.55	0.00	1.12
62	13	03/06/23 13:14	12 F2 EFF	0.88											F1.24	F2.21	M1.04	0.57	0.02	1.13
62	14	03/06/23 13:15	12 F2 EFF	0.76											F1.24	F2.21	M1.04	0.58	0.03	1.15
62	15	03/06/23 13:16	12 F2 EFF	0.44											F1.24	F2.21	M1.04	0.60	0.05	1.17
62	16	03/06/23 13:18	12 F2 EFF	0.07											F1.24	F2.21	M1.04	0.63	0.08	1.20
62	17	03/06/23 13:21	12 F2 EFF	0.04											F1.24	F2.21	M1.04	0.68	0.13	1.25
62	18	03/06/23 13:25	12 F2 EFF	0.09											F1.24	F2.21	M1.04	0.75	0.20	1.32
62	19	03/06/23 13:28	Increase F2 flow to 2.0gpm												F1.24	F2.21	M1.04	0.80	0.25	1.37
62	20	03/06/23 13:33	12 F2 EFF	0.04											F1.24	F2.21	M1.04	0.88	0.33	1.45
62	21	03/06/23 13:40	KOH V=10L												F1.24	F2.21	M1.04	1.00	0.45	1.57
62	22	03/06/23 14:12	Fresh Batch KOH, V=28L												F1.24	F2.21	M1.04	1.53	0.98	2.10
62	23	03/06/23 15:35	11 F1 EFF	0.05											F1.24	F2.21	M1.04	2.92	2.37	3.48
62	24	03/06/23 15:35	12 F2 EFF	0.15											F1.24	F2.21	M1.04	2.92	2.37	3.48
62	25	03/06/23 15:35	22 M1 EFF	0.03		0.000									F1.24	F2.21	M1.04	2.92	2.37	3.48
63	1	03/06/23 16:00	Collect SSN Labs for M1												F1.24	F2.21	M1.04	3.33	2.78	3.90
63	2	03/06/23 18:00	11 F1 EFF	0.03											F1.24	F2.21	M1.04	5.33	4.78	5.90
63	3	03/06/23 18:00	22 M1 EFF			0.023									F1.24	F2.21	M1.04	5.33	4.78	5.90
63	4	03/07/23 06:00	11 F1 EFF	0.07											F1.24	F2.21	M1.04	17.33	16.78	17.90
63	5	03/07/23 06:00	22 M1 EFF			0.017									F1.24	F2.21	M1.04	17.33	16.78	17.90
63	8	03/07/23 11:00	11 F1 EFF								87.12				F1.24	F2.21	M1.04	22.33	21.78	22.90
63	9	03/07/23 11:00	12 F2 EFF								76.56				F1.24	F2.21	M1.04	22.33	21.78	22.90
63	10	03/07/23 11:00	22 M1 EFF								29.04				F1.24	F2.21	M1.04	22.33	21.78	22.90
63	12	03/07/23 11:15	11 F1 EFF							49					F1.24	F2.21	M1.04	22.58	22.03	23.15
63	13	03/07/23 11:15	12 F2 EFF							45					F1.24	F2.21	M1.04	22.58	22.03	23.15
63	14	03/07/23 11:15	22 M1 EFF							66					F1.24	F2.21	M1.04	22.58	22.03	23.15
63	16	03/07/23 11:40	11 F1 EFF	0.03		0.144							355	2.67	F1.24	F2.21	M1.04	23.00	22.45	23.57
63	17	03/07/23 11:40	12 F2 EFF	0.04		0.135							350	2.67	F1.24	F2.21	M1.04	23.00	22.45	23.57

				FIELD											Filter Trial			Filter Runtime		
Page	Row	Date and Time	Source/Notes	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp. (C)	Alk (mg/L)	CO2 (mg/L)	Nitrate (mg/L)	TOC ID No.	TOC (mg/L)	F1 Trial	F2 Trial	M1 Trial	F1 Runtime (hrs)	F2 Runtime (hrs)	M1 Runtime (hrs)
63	18	03/07/23 11:40	22 M1 EFF	0.04		0.016							7	2.65	F1.24	F2.21	M1.04	23.00	22.45	23.57
63	20	03/07/23 11:30	Collect Lab Samples												F1.24	F2.21	M1.04	22.83	22.28	23.40
63	21	03/07/23 14:10	07 WELL 2	0.72		0.136		6.47	11.6						F1.24	F2.21	M1.04	25.50	24.95	26.07
63	22	03/07/23 14:10	11 F1 EFF	0.01		0.131		6.16	11.8						F1.24	F2.21	M1.04	25.50	24.95	26.07
63	23	03/07/23 14:10	12 F2 EFF	0.07		0.137		6.18	12.2						F1.24	F2.21	M1.04	25.50	24.95	26.07
63	24	03/07/23 14:10	22 M1 EFF	0.02		0.011		7.35	13.2						F1.24	F2.21	M1.04	25.50	24.95	26.07
64	1	03/07/23 18:00	11 F1 EFF	0.02											F1.24	F2.21	M1.04	29.33	28.78	29.90
64	2	03/07/23 18:00	22 M1 EFF			0.029									F1.24	F2.21	M1.04	29.33	28.78	29.90
64	3	03/08/23 06:00	11 F1 EFF	0.00											F1.24	F2.21	M1.04	41.33	40.78	41.90
64	4	03/08/23 06:00	22 M1 EFF			0.030									F1.24	F2.21	M1.04	41.33	40.78	41.90
64	6	03/08/23 09:00	07 WELL 2	0.79	0.59	0.157	0.159	6.23	11.5			3.3			F1.24	F2.21	M1.04	44.33	43.78	44.90
64	8	03/08/23 09:00	11 F1 EFF	0.02		0.138		6.12	12.2			2.7			F1.24	F2.21	M1.04	44.33	43.78	44.90
64	9	03/08/23 09:00	12 F2 EFF	0.02		0.141		6.13	12.3			2.2			F1.24	F2.21	M1.04	44.33	43.78	44.90
64	10	03/08/23 09:00	21 MPOKA			0.140	0.134	6.17	12.4						F1.24	F2.21	M1.04	44.33	43.78	44.90
64	12	03/08/23 09:00	22 M1 EFF	0.01		0.029		6.4	13.3			2.4			F1.24	F2.21	M1.04	44.33	43.78	44.90
64	13	03/08/23 09:40	Fix MPOKA pH Cup. Needed zip-tie replaced												F1.24	F2.21	M1.04	45.00	44.45	45.57
64	14	03/08/23 14:53	22 M1 EFF			0.028									F1.24	F2.21	M1.04	50.22	49.67	50.78
64	15	03/10/23 08:30	07 WELL 2	0.88	0.77	0.141	0.134	6.21	11.3						F1.24	F2.21	M1.04	91.83	91.28	92.40
64	17	03/10/23 08:30	11 F1 EFF	0.04		0.134		6.22	12.2						F1.24	F2.21	M1.04	91.83	91.28	92.40
64	18	03/10/23 08:30	12 F2 EFF	0.02		0.127		6.2	12.5						F1.24	F2.21	M1.04	91.83	91.28	92.40
64	19	03/10/23 08:30	21 MPOKA			0.134	0.123	7.32	12.9						F1.24	F2.21	M1.04	91.83	91.28	92.40
64	21	03/10/23 08:30	22 M1 EFF	0.03		0.017		7.27	15.3						F1.24	F2.21	M1.04	91.83	91.28	92.40
64	24	03/10/23 09:46	Begin filter Backwashes and Pilot Shutdown												F1.24	F2.21	M1.04	93.10	92.55	93.67

Appendix B – Adsorptive Field Water Quality Notes

Sample Location Reference IDs

Sample ID	Sample Location/Description
01 RAW - Well 2	Wellfield 2 – Raw water sample collected from pilot influent tap
02 RAW + Recycle	Wellfield 2 + 5% Settled Supernatant
10 POX AB	Pretreated influent to Filters A and B collected from filter influent taps.
11 POX CD	Pretreated influent to Filters C and D collected from filter influent taps.
20 Filter A	Filter Effluent from Filter A collected at the point of discharge to the sample sink.
21 Filter B	Filter Effluent from Filter B collected at the point of discharge to the sample sink.
22 Filter C	Filter Effluent from Filter C collected at the point of discharge to the sample sink.
23 Filter D	Filter Effluent from Filter D collected at the point of discharge to the sample sink.
CBW A	Combined Backwash Filter A collected from homogenized backwash.
CBW B	Combined Backwash Filter B collected from homogenized backwash.
CBW C	Combined Backwash Filter C collected from homogenized backwash.
CBW D	Combined Backwash Filter D collected from homogenized backwash.
SSN A	Settled Supernatant Filter A collected from top of settled CBW A.
SSN B	Settled Supernatant Filter B collected from top of settled CBW B.
SSN C	Settled Supernatant Filter C collected from top of settled CBW C.
SSN D	Settled Supernatant Filter D collected from top of settled CBW D.

				Field Water Quality Data - Manually Entered													Filter Trial			
pg	Row	Date and Time	SAMPLE LOCATION	Cl2(f) (mg/L)	Cl2(t) (mg/L)	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp (Ce)	Alk	CO2 (mg/L)	Nitrate	TOC Vial	TOC (mg/L)	A Trial	B Trial	C Trial	D Trial
			01 RAW - Well 2																	
			02 RAW + Recycle																	
			10 POX AB																	
			11 POX CD																	
			20 Filter A																	
			21 Filter B																	
			22 Filter C																	
			23 Filter D																	
01	01	2/15/23 9:30	Arrive at site and mobilize Greensand pilot trailer																	
01	02	2/15/23 9:30	1/5 NaOCl to All 4 Filters																	
01	03	2/15/23 9:30	1/5 KOH to Filters CD - pH Setpoint 8.0																	
01	04	2/15/23 9:30	Filter A - 24" GSP + 12" Anthracite																	
01	05	2/15/23 9:30	Filter B - 24" PYR + 12" Anthracite																	
01	06	2/15/23 9:30	Filter C - 24" GSP + 12" Anthracite																	
01	07	2/15/23 9:30	Filter D - 24" PYR + 12" Anthracite																	
01	08	2/15/23 9:30	Backwash All 4 Filters w/ Raw Water																	
01	09	2/15/23 9:30	Tour w/ Rob																	
			Start Flow to Filters														A.0	B.0	C.0	D.0
01	12	2/15/23 13:20	10 POX AB	1.87	2.17												A.0	B.0	C.0	D.0
01	18	2/15/23 14:00	Setup Online pH Probes														A.0	B.0	C.0	D.0
01	22	2/15/23 14:35	Setup Online pH Control														A.0	B.0	C.0	D.0
02	03	2/15/23 15:00	20 Filter A	1.92													A.0	B.0	C.0	D.0
02	04	2/15/23 15:00	21 Filter B	1.84													A.0	B.0	C.0	D.0
02	05	2/15/23 15:00	22 Filter C	1.84													A.0	B.0	C.0	D.0
02	06	2/15/23 15:00	23 Filter D	2.10													A.0	B.0	C.0	D.0
02	16	2/16/23 14:40	20 Filter A	0.42		0.01		0.012									A.0	B.0	C.0	D.0
02	17	2/16/23 14:40	21 Filter B	0.43		0.01		0.017									A.0	B.0	C.0	D.0
02	18	2/16/23 14:40	22 Filter C	0.38		0.05		0.012									A.0	B.0	C.0	D.0
02	19	2/16/23 14:40	23 Filter D	0.50		0.02		0.006									A.0	B.0	C.0	D.0
02	22	2/16/23 15:20	Shutdown Filters A and B for BW														A.0	B.0	C.0	D.0
02	23	2/16/23 15:20	Restart Filters A and B														A.1	B.1	C.0	D.0
02	23	2/16/23 15:20	Shutdown Filters C and D for BW														A.1	B.1	C.0	D.0
02	24	2/16/23 15:20	Restart Filters C and D														A.1	B.1	C.1	D.1
03	01	2/17/23 12:10	20 Filter A	0.89	0.94	0.05		0.000		6.27	12.10						A.1	B.1	C.1	D.1
03	02	2/17/23 12:10	21 Filter B	0.83	0.88	0.02		0.004		6.29							A.1	B.1	C.1	D.1
03	03	2/17/23 12:10	22 Filter C	1.00	1.06	0.05		0.003		7.29							A.1	B.1	C.1	D.1
03	04	2/17/23 12:10	23 Filter D	1.02	1.13	0.01		0.000		7.30							A.1	B.1	C.1	D.1
03	08	2/17/23 14:34	20 Filter A														A.1	B.1	C.1	D.1
03	09	2/17/23 14:34	21 Filter B														A.1	B.1	C.1	D.1
03	10	2/17/23 14:34	22 Filter C														A.1	B.1	C.1	D.1
03	11	2/17/23 14:34	23 Filter D														A.1	B.1	C.1	D.1
03	12	2/17/23 14:49	Change Out Filter A Turb Head														A.1	B.1	C.1	D.1
03	15	2/20/23 11:50	20 Filter A	1.16	1.29					6.54	11.90						A.1	B.1	C.1	D.1
03	16	2/20/23 11:50	21 Filter B	1.30	1.00					6.52							A.1	B.1	C.1	D.1
03	17	2/20/23 11:50	22 Filter C	1.31	1.55					7.61							A.1	B.1	C.1	D.1

pg	Row	Date and Time	SAMPLE LOCATION	Cl2(f) (mg/L)	Cl2(t) (mg/L)	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp (Ce)	Alk	CO2 (mg/L)	Nitrate	TOC Vial	TOC (mg/L)	A Trial	B Trial	C Trial	D Trial
03	18	2/20/23 11:50	23 Filter D	1.22	1.44					7.63							A.1	B.1	C.1	D.1
03	19	2/20/23 12:50	Shutdown Filter A for BW														A.1	B.1	C.1	D.1
03	20	2/20/23 13:00	Restart Filter A														A.2	B.1	C.1	D.1
03	21	2/20/23 13:01	Shutdown Filter B for BW														A.2	B.1	C.1	D.1
03	22	2/20/23 13:11	Restart Filter B														A.2	B.2	C.1	D.1
03	22	2/20/23 13:11	Shutdown Filter C for BW														A.2	B.2	C.1	D.1
03	23	2/20/23 13:22	Restart Filter C														A.2	B.2	C.2	D.1
03	23	2/20/23 13:22	Shutdown Filter D for BW														A.2	B.2	C.2	D.1
03	24	2/20/23 13:33	Restart Filter D														A.2	B.2	C.2	D.2
04	05	2/20/23 14:30	20 Filter A			0.02		0.015									A.2	B.2	C.2	D.2
04	06	2/20/23 14:30	21 Filter B			0.02		0.017									A.2	B.2	C.2	D.2
04	07	2/20/23 14:30	22 Filter C			0.06		0.020									A.2	B.2	C.2	D.2
04	08	2/20/23 14:30	23 Filter D			0.08		0.012									A.2	B.2	C.2	D.2
04	11	2/21/23 8:10	Caustic Titrations - See Separate Notes														A.2	B.2	C.2	D.2
04	13	2/21/23 11:58	Shutdown Filters A and B for BW														A.2	B.2	C.2	D.2
04	14	2/21/23 12:27	Restart Filters A and B														A.3	B.3	C.2	D.2
04	14	2/21/23 12:27	Shutdown Filters C and D for BW														A.3	B.3	C.2	D.2
04	15	2/21/23 12:44	Restart Filters C and D														A.3	B.3	C.3	D.3
04	21	2/21/23 14:02	20 Filter A	0.44	0.60	0.00		0.000									A.3	B.3	C.3	D.3
04	22	2/21/23 14:02	21 Filter B	0.42	0.56	0.02		0.000									A.3	B.3	C.3	D.3
04	23	2/21/23 14:02	22 Filter C	0.42	0.58	0.02		0.000									A.3	B.3	C.3	D.3
04	24	2/21/23 14:02	23 Filter D	0.11	0.56	0.01		0.000									A.3	B.3	C.3	D.3
04	25	2/21/23 14:02	01 RAW - Well 2			0.76		0.132									A.3	B.3	C.3	D.3
05	04	2/22/23 8:00	Organize and label lab bottles for sampling event														A.3	B.3	C.3	D.3
05	05	2/22/23 10:14	Shutdown and BW Filter A														A.3	B.3	C.3	D.3
05	06	2/22/23 10:28	Restart Filter A														A.4	B.3	C.3	D.3
05	07	2/22/23 10:30	Shutdown and BW Filter B														A.4	B.3	C.3	D.3
05	08	2/22/23 10:41	Restart Filter B														A.4	B.4	C.3	D.3
05	09	2/22/23 10:43	Shutdown and BW Filter C														A.4	B.4	C.3	D.3
05	10	2/22/23 10:54	Restart Filter C														A.4	B.4	C.4	D.3
05	11	2/22/23 10:56	Shutdown and BW Filter D														A.4	B.4	C.4	D.3
05	12	2/22/23 11:08	Restart Filter D														A.4	B.4	C.4	D.4
05	13	2/22/23 11:08	Collect CBW Samples during BW														A.4	B.4	C.4	D.4
05	14	2/22/23 12:10	Disconnect and Reconnect Filter A Turb Head														A.4	B.4	C.4	D.4
05	18	2/22/23 13:05	01 RAW - Well 2			0.88	0.65	0.136	0.135	6.53	11.50						A.4	B.4	C.4	D.4
05	19	2/22/23 13:05	10 POX AB	0.70	1.64		0.08		0.078	6.46							A.4	B.4	C.4	D.4
05	20	2/22/23 13:05	11 POX CD	0.32	1.19		0.05		0.064	7.23							A.4	B.4	C.4	D.4
05	21	2/22/23 13:05	20 Filter A	0.70	0.88	0.04		0.000		6.42							A.4	B.4	C.4	D.4
05	22	2/22/23 13:05	21 Filter B	0.67	0.59	0.04		0.003		6.41							A.4	B.4	C.4	D.4
05	23	2/22/23 13:05	22 Filter C	0.63	0.96	0.05		0.010		7.25							A.4	B.4	C.4	D.4
05	24	2/22/23 13:05	23 Filter D	0.70	1.04	0.05		0.000		7.28							A.4	B.4	C.4	D.4
05	25	2/22/23 13:30	Collect Full Round of Lab Samples for Greensand Pilot														A.4	B.4	C.4	D.4
06	01	2/22/23 15:00	Reduce NaOCl Feed Rate to Target 0.25 to 0.50 mg/L Cl2 Residual														A.4	B.4	C.4	D.4
06	04	2/22/23 15:15	Collecting SSN Lab Samples														A.4	B.4	C.4	D.4
06	07	2/22/23 15:55	Download Data														A.4	B.4	C.4	D.4
06	11	2/23/23 9:36	Shutdown and BW Filter D														A.4	B.4	C.4	D.4
06	13	2/23/23 9:49	Restart Filter D														A.4	B.4	C.4	D.5
06	12	2/23/23 9:44	Shutdown and BW Filter C														A.4	B.4	C.4	D.5
06	14	2/23/23 9:54	Restart Filter C														A.4	B.4	C.5	D.5

pg	Row	Date and Time	SAMPLE LOCATION	Cl2(f) (mg/L)	Cl2(t) (mg/L)	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp (Ce)	Alk	CO2 (mg/L)	Nitrate	TOC Vial	TOC (mg/L)	A Trial	B Trial	C Trial	D Trial
06	13	2/23/23 9:49	Shutdown and BW Filter B														A.4	B.4	C.5	D.5
06	15	2/23/23 10:00	Restart Filter B														A.4	B.5	C.5	D.5
06	14	2/23/23 9:54	Shutdown Filter A for BW														A.4	B.5	C.5	D.5
06	16	2/23/23 10:05	Restart Filter A														A.5	B.5	C.5	D.5
06	16	2/23/23 10:05	Swap Turb Head for Filter A														A.5	B.5	C.5	D.5
06	18	2/23/23 12:40	01 RAW - Well 2			0.87	0.67	0.145	0.142	6.47							A.5	B.5	C.5	D.5
06	20	2/23/23 12:40	10 POX AB	0.58	0.73		0.01		0.088	6.40							A.5	B.5	C.5	D.5
06	21	2/23/23 12:40	11 POX CD	0.83	0.90		0.01		0.094	6.39							A.5	B.5	C.5	D.5
06	22	2/23/23 12:40	20 Filter A	0.58	0.59	0.01		0.005		6.41							A.5	B.5	C.5	D.5
06	23	2/23/23 12:40	21 Filter B	0.49	0.62	0.01		0.001		6.38							A.5	B.5	C.5	D.5
06	24	2/23/23 12:40	22 Filter C	0.42	0.60	0.02		0.011		6.44							A.5	B.5	C.5	D.5
06	25	2/23/23 12:40	23 Filter D	0.51	0.64	0.04		0.008		6.51							A.5	B.5	C.5	D.5
07	02	2/23/23 14:00	01 RAW - Well 2			0.82	0.64	0.143	0.145	6.26	11.10						A.5	B.5	C.5	D.5
07	04	2/23/23 14:00	10 POX AB	0.68	0.70		0.03		0.088	6.28							A.5	B.5	C.5	D.5
07	05	2/23/23 14:00	11 POX CD	0.67	0.76		0.03		0.082	7.58							A.5	B.5	C.5	D.5
07	06	2/23/23 14:00	20 Filter A	0.41	0.57	0.03		0.002		6.26							A.5	B.5	C.5	D.5
07	07	2/23/23 14:00	21 Filter B	0.43	0.55	0.04		0.007		6.28							A.5	B.5	C.5	D.5
07	08	2/23/23 14:00	22 Filter C	0.39	0.49	0.03		0.013		7.18							A.5	B.5	C.5	D.5
07	09	2/23/23 14:00	23 Filter D	0.40	0.48	0.02		0.000		7.05							A.5	B.5	C.5	D.5
07	10	2/24/23 11:51	Shutdown and BW Filter A														A.5	B.5	C.5	D.5
07	11	2/24/23 12:05	Restart Filter A														A.6	B.5	C.5	D.5
07	10	2/24/23 11:51	Shutdown and BW Filter B														A.6	B.5	C.5	D.5
07	11	2/24/23 12:05	Restart Filter B														A.6	B.6	C.5	D.5
07	12	2/24/23 12:15	Shutdown and BW Filter C														A.6	B.6	C.5	D.5
07	13	2/24/23 12:26	Restart Filter C														A.6	B.6	C.6	D.5
07	12	2/24/23 12:15	Shutdown and BW Filter D														A.6	B.6	C.6	D.5
07	13	2/24/23 12:26	Restart Filter D														A.6	B.6	C.6	D.6
07	18	2/24/23 14:10	10 POX AB	0.49	0.57		0.03		0.087	6.44	12.30						A.6	B.6	C.6	D.6
07	19	2/24/23 14:10	11 POX CD	0.23	0.33		0.04		0.100	8.41							A.6	B.6	C.6	D.6
07	20	2/24/23 14:10	20 Filter A	0.19	0.28	0.01		0.005		6.43							A.6	B.6	C.6	D.6
07	21	2/24/23 14:10	21 Filter B	0.10	0.15	0.03		0.010		6.42							A.6	B.6	C.6	D.6
07	22	2/24/23 14:10	22 Filter C	0.04	0.15	0.03		0.004		8.90							A.6	B.6	C.6	D.6
07	23	2/24/23 14:10	23 Filter D	0.09	0.11	0.02		0.007		9.38							A.6	B.6	C.6	D.6
07	24	2/24/23 14:30	Increase NaOCl feed from 115-->130ml/h														A.6	B.6	C.6	D.6
07	25	2/24/23 14:55	NaOCl V=40L, KOH V=50L q=386ml/h														A.6	B.6	C.6	D.6
08	01	2/27/23 13:21	Shutdown C & D for BW														A.6	B.6	C.6	D.6
08	02	2/27/23 13:32	Restart C&D @1.5 gpm each														A.6	B.6	C.7	D.7
08	03	2/27/23 13:41	Shutdown A&B for BW														A.6	B.6	C.7	D.7
08	04	2/27/23 13:53	Restart A&B														A.7	B.7	C.7	D.7
08	06	2/27/23 14:09	KOH V=40L, NaOCl V=31L														A.7	B.7	C.7	D.7
08	08	2/27/23 14:52	Increase NaOCl feed from 130-->200ml/h														A.7	B.7	C.7	D.7
08	09	2/27/23 15:00	01 RAW - Well 2			0.78		0.157		6.44	11.90						A.7	B.7	C.7	D.7
08	10	2/27/23 15:00	10 POX AB	0.19	0.51		0.00		0.106	6.32	12.00						A.7	B.7	C.7	D.7
08	11	2/27/23 15:00	11 POX CD	0.23	0.54		0.01		0.108	6.37	12.80						A.7	B.7	C.7	D.7
08	12	2/27/23 15:00	20 Filter A	0.17	0.39	0.01		0.016		6.32	12.20						A.7	B.7	C.7	D.7
08	13	2/27/23 15:00	21 Filter B	0.06	0.20	0.02		0.015		6.32	12.00						A.7	B.7	C.7	D.7
08	14	2/27/23 15:00	22 Filter C	0.06	0.26	0.01		0.018		6.44	12.70						A.7	B.7	C.7	D.7
08	15	2/27/23 15:00	23 Filter D	0.09	0.17	0.05		0.016		6.54	13.30						A.7	B.7	C.7	D.7
08	16	2/27/23 15:21	Increase NaOCl feed from 200-->230ml/h														A.7	B.7	C.7	D.7

pg	Row	Date and Time	SAMPLE LOCATION	Cl2(f) (mg/L)	Cl2(t) (mg/L)	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp (Ce)	Alk	CO2 (mg/L)	Nitrate	TOC Vial	TOC (mg/L)	A Trial	B Trial	C Trial	D Trial
08	18	2/28/23 12:15	10 POX AB	0.38	0.54		0.02		0.087	6.41	11.90						A.7	B.7	C.7	D.7
08	19	2/28/23 12:15	11 POX CD	0.43	0.56		0.04		0.051	9.31	11.90						A.7	B.7	C.7	D.7
08	20	2/28/23 12:15	20 Filter A	0.33	0.41	0.02		0.011		6.29	11.50						A.7	B.7	C.7	D.7
08	21	2/28/23 12:15	21 Filter B	0.22	0.32	0.02		0.005		6.25	11.50						A.7	B.7	C.7	D.7
08	22	2/28/23 12:15	22 Filter C	0.17	0.33	0.00		0.005		7.95	11.90						A.7	B.7	C.7	D.7
08	23	2/28/23 12:15	23 Filter D	0.25	0.34	0.05		0.009		7.82	12.20						A.7	B.7	C.7	D.7
09	01	2/28/23 13:25	Shutdown B&D for BW														A.7	B.7	C.7	D.7
09	02	2/28/23 13:37	Restart B&D @1.5gpm														A.7	B.8	C.7	D.8
09	04	2/28/23 14:30	01 RAW - Well 2			0.78	0.67	0.151	0.145	6.51	12.20						A.7	B.8	C.7	D.8
09	06	2/28/23 14:30	10 POX AB	0.57	0.76		0.04		0.093	6.43	12.10						A.7	B.8	C.7	D.8
09	07	2/28/23 14:30	11 POX CD	0.50	0.48		0.05		0.104	7.70	12.30						A.7	B.8	C.7	D.8
09	08	2/28/23 14:30	20 Filter A	0.26	0.41	0.01		0.018		6.39	12.60			1.3			A.7	B.8	C.7	D.8
09	09	2/28/23 14:30	21 Filter B	0.30	0.34	0.02		0.028		6.38	12.90			2.5			A.7	B.8	C.7	D.8
09	10	2/28/23 14:30	22 Filter C	0.25	0.31	0.01		0.014		7.36	11.80			0.7			A.7	B.8	C.7	D.8
09	11	2/28/23 14:30	23 Filter D	0.29	0.34	0.05		0.017		7.36	11.70			1.4			A.7	B.8	C.7	D.8
09	12	2/28/23 14:52	NaOCl V=25.5, q=230ml/h														A.7	B.8	C.7	D.8
09	13	2/28/23 14:52	KOH V=35L, q=277ml/h														A.7	B.8	C.7	D.8
09	15	3/1/23 10:26	Shutdown Filters A&C for BW														A.7	B.8	C.7	D.8
09	16	3/1/23 10:39	Restart Filters A&C														A.8	B.8	C.8	D.8
09	18	3/1/23 11:20	01 RAW - Well 2			0.71	0.59	0.141	0.138	6.37	11.70						A.8	B.8	C.8	D.8
09	20	3/1/23 11:20	10 POX AB	0.59	0.65		0.13		0.084	6.41	12.70						A.8	B.8	C.8	D.8
09	21	3/1/23 11:20	11 POX CD	0.40	0.57		0.01		0.098	6.37	13.70						A.8	B.8	C.8	D.8
09	22	3/1/23 11:20	20 Filter A	0.35	0.45	0.04		0.008		6.36	13.30						A.8	B.8	C.8	D.8
09	23	3/1/23 11:20	21 Filter B	0.29	0.38	0.02		0.019		6.35	12.90						A.8	B.8	C.8	D.8
09	24	3/1/23 11:20	22 Filter C	0.22	0.37	0.04		0.010		6.99	13.50						A.8	B.8	C.8	D.8
09	25	3/1/23 11:20	23 Filter D	0.22	0.44	0.00		0.019		7.00	13.80						A.8	B.8	C.8	D.8
10	01	3/2/23 10:05	Shutdown Filter B for BW														A.8	B.8	C.8	D.8
10	02	3/2/23 10:10	NaOCl V=15, q=230ml/h, KOH V=21L q=														A.8		C.8	D.8
10	03	3/2/23 10:18	Place Filter B in Service @7.5gpm/sqft														A.8	B.9	C.8	D.8
10	04	3/2/23 10:19	Shutdown Filter D for BW														A.8	B.9	C.8	D.8
10	05	3/2/23 10:30	Place Filter D in service @ 7.5gpm/sqft														A.8	B.9	C.8	D.9
10	06	3/2/23 10:35	Add 30L 1/5 NaOCl V=43.5L														A.8	B.9	C.8	D.9
10	07	3/2/23 10:50	Add 30L 1/5 KOH V=55L														A.8	B.9	C.8	D.9
10	09	3/2/23 11:30	10 POX AB	0.84	0.44		0.00			6.30							A.8	B.9	C.8	D.9
10	10	3/2/23 11:30	11 POX CD	0.65	0.91		0.00			8.28							A.8	B.9	C.8	D.9
10	11	3/2/23 11:30	20 Filter A	0.56	0.66	0.00		0.012		6.26							A.8	B.9	C.8	D.9
10	12	3/2/23 11:30	21 Filter B	0.54	0.63	0.00		0.000		6.18							A.8	B.9	C.8	D.9
10	13	3/2/23 11:30	22 Filter C	0.48	0.53	0.01		0.005		7.88							A.8	B.9	C.8	D.9
10	14	3/2/23 11:30	23 Filter D	0.59	0.60	0.00		0.026		7.84							A.8	B.9	C.8	D.9
10	16	3/2/23 12:15	Collect Lab Samples														A.8	B.9	C.8	D.9
10	18	3/3/23 12:54	Shutdown Filter A for BW														A.8	B.9	C.8	D.9
10	18	3/3/23 12:54	Shutdown Filter C for BW														A.8	B.9	C.8	D.9
10	19	3/3/23 13:06	Restart Filter A														A.9	B.9	C.8	D.9
10	19	3/3/23 13:06	Restart Filter C														A.9	B.9	C.9	D.9
10	20	3/3/23 13:50	10 POX AB	0.48	0.69		0.01		0.084	6.28	12.10						A.9	B.9	C.9	D.9
10	21	3/3/23 13:50	11 POX CD	0.45	0.62		0.06		0.094	6.34							A.9	B.9	C.9	D.9
10	22	3/3/23 13:50	20 Filter A	0.35	0.55	0.02		0.014		6.16							A.9	B.9	C.9	D.9
10	23	3/3/23 13:50	21 Filter B	0.42	0.48	0.00		0.010		6.16							A.9	B.9	C.9	D.9
10	24	3/3/23 13:50	22 Filter C	0.37	0.50	0.00		0.006		6.93							A.9	B.9	C.9	D.9

pg	Row	Date and Time	SAMPLE LOCATION	Cl2(f) (mg/L)	Cl2(t) (mg/L)	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp (Ce)	Alk	CO2 (mg/L)	Nitrate	TOC Vial	TOC (mg/L)	A Trial	B Trial	C Trial	D Trial
10	25	3/3/23 13:50	23 Filter D	0.37	0.45	0.03		0.016		6.99							A.9	B.9	C.9	D.9
11	03	3/6/23 14:18	Shutdown Filter A for BW														A.9	B.9	C.9	D.9
11	03	3/6/23 14:18	Shutdown Filter B for BW															B.9	C.9	D.9
11	04	3/6/23 14:29	Restart Filter A														A.10		C.9	D.9
11	04	3/6/23 14:29	Restart Filter B														A.10	B.10	C.9	D.9
11	05	3/6/23 14:30	Shutdown Filter C for BW														A.10	B.10	C.9	D.9
11	05	3/6/23 14:30	Shutdown Filter D for BW														A.10	B.10		D.9
11	06	3/6/23 15:01	Restart Filter C														A.10	B.10	C.10	
11	06	3/6/23 15:01	Restart Filter D														A.10	B.10	C.10	D.10
11	07	3/6/23 15:35	20 Filter A	0.47		0.00		0.000									A.10	B.10	C.10	D.10
11	08	3/6/23 15:35	21 Filter B			0.00		0.000									A.10	B.10	C.10	D.10
11	09	3/6/23 15:35	22 Filter C			0.03		0.000									A.10	B.10	C.10	D.10
11	10	3/6/23 15:35	23 Filter D	0.49		0.01		0.011									A.10	B.10	C.10	D.10
11	12	3/7/23 9:00	POX CD Flow Off. Restart Flow.														A.10	B.10	C.10	D.10
11	13	3/7/23 9:00	Decrease P from 4.0 to 0.4. Increase Transit Time from 0.0 to 300														A.10	B.10	C.10	D.10
11	14	3/7/23 10:07	01 RAW - Well 2			0.62	0.56	0.141	0.148	6.48	12.40			1.4	165	2.39	A.10	B.10	C.10	D.10
11	16	3/7/23 10:07	10 POX AB	0.54	0.52		0.09		0.095	6.41							A.10	B.10	C.10	D.10
11	17	3/7/23 10:07	11 POX CD	0.34	0.51		0.05		0.085	7.10							A.10	B.10	C.10	D.10
11	18	3/7/23 10:07	20 Filter A	0.44	0.47	0.10		0.008		6.41				0.9	251	2.82	A.10	B.10	C.10	D.10
11	19	3/7/23 10:07	21 Filter B	0.34	0.41	0.03		0.005		6.43				2.2	90	2.65	A.10	B.10	C.10	D.10
11	20	3/7/23 10:07	22 Filter C	0.42	0.52	0.04		0.008		6.80				0.4	353	2.74	A.10	B.10	C.10	D.10
11	21	3/7/23 10:07	23 Filter D	0.42	0.55	0.02		0.012		6.76				1.0	137	2.7	A.10	B.10	C.10	D.10
12	02	3/7/23 12:45	20 Filter A										68.64				A.10	B.10	C.10	D.10
12	03	3/7/23 12:45	21 Filter B										58.96				A.10	B.10	C.10	D.10
12	04	3/7/23 12:45	22 Filter C										14.96				A.10	B.10	C.10	D.10
12	05	3/7/23 12:45	23 Filter D										13.2				A.10	B.10	C.10	D.10
12	08	3/7/23 13:15	20 Filter A									44					A.10	B.10	C.10	D.10
12	09	3/7/23 13:15	21 Filter B									47					A.10	B.10	C.10	D.10
12	10	3/7/23 13:15	22 Filter C									81					A.10	B.10	C.10	D.10
12	11	3/7/23 13:15	23 Filter D									85					A.10	B.10	C.10	D.10
12	12	3/7/23 14:10	10 POX AB	0.34			0.05		0.085	6.23	12.40						A.10	B.10	C.10	D.10
12	13	3/7/23 14:10	11 POX CD	0.34			0.11		0.104	7.30							A.10	B.10	C.10	D.10
12	14	3/7/23 14:10	20 Filter A	0.35		0.02		0.002		6.25							A.10	B.10	C.10	D.10
12	15	3/7/23 14:10	21 Filter B	0.00		0.03		0.004		6.21							A.10	B.10	C.10	D.10
12	16	3/7/23 14:10	22 Filter C	0.31		0.02		0.005		7.29							A.10	B.10	C.10	D.10
12	17	3/7/23 14:10	23 Filter D	0.32		0.04		0.012		7.28							A.10	B.10	C.10	D.10
12	18	3/8/23 8:27	Shutdown B&D for BW														A.10	B.10	C.10	D.10
12	19	3/8/23 8:39	Restart B&D @1.5gpm														A.10	B.11	C.10	D.11
12	20	3/8/23 10:00	10 POX AB	0.51	0.66		0.00		0.085	6.43	12.40						A.10	B.11	C.10	D.11
12	21	3/8/23 10:00	11 POX CD	0.30	0.65		0.06		0.075	8.00							A.10	B.11	C.10	D.11
12	22	3/8/23 10:00	20 Filter A	0.27	0.42	0.05		0.001		6.40							A.10	B.11	C.10	D.11
12	23	3/8/23 10:00	21 Filter B	0.06	0.27	0.05		0.005		6.39							A.10	B.11	C.10	D.11
12	24	3/8/23 10:00	22 Filter C	0.32	0.39	0.02		0.011		7.47							A.10	B.11	C.10	D.11
12	25	3/8/23 10:00	23 Filter D	0.33	0.45	0.07		0.012		7.48							A.10	B.11	C.10	D.11
13	01	3/8/23 11:15	Shutdown Pilot Flow to Install Recycle Feed Connection														A.10	B.11	C.10	D.11
13	02	3/8/23 11:15	Allow Fe Slug to Pass. DPs still OK.														A.10	B.11	C.10	D.11
13	03	3/8/23 11:15	Adjust Influent P to 15 psi														A.10	B.11	C.10	D.11
13	04	3/8/23 11:15	Calibrate Peristaltic Pump to 5% Recycle														A.10	B.11	C.10	D.11
13	08	3/8/23 12:15	01 RAW - Well 2			1.62		0.146									A.10	B.11	C.10	D.11

pg	Row	Date and Time	SAMPLE LOCATION	Cl2(f) (mg/L)	Cl2(t) (mg/L)	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp (Ce)	Alk	CO2 (mg/L)	Nitrate	TOC Vial	TOC (mg/L)	A Trial	B Trial	C Trial	D Trial
13	09	3/8/23 12:15	20 Filter A			0.04		0.006									A.10	B.11	C.10	D.11
13	10	3/8/23 12:15	21 Filter B			0.03											A.10	B.11	C.10	D.11
13	11	3/8/23 12:15	22 Filter C			0.07		0.002									A.10	B.11	C.10	D.11
13	12	3/8/23 12:15	23 Filter D			0.05		0.010									A.10	B.11	C.10	D.11
13	14	3/8/23 12:45	20 Filter A			0.03		0.025									A.10	B.11	C.10	D.11
13	15	3/8/23 12:45	21 Filter B			0.03		0.018									A.10	B.11	C.10	D.11
13	16	3/8/23 12:45	22 Filter C			0.03		0.015									A.10	B.11	C.10	D.11
13	17	3/8/23 12:45	23 Filter D			0.03		0.018									A.10	B.11	C.10	D.11
13	18	3/8/23 13:15	20 Filter A			0.04		0.017									A.10	B.11	C.10	D.11
13	19	3/8/23 13:15	21 Filter B			0.03		0.018									A.10	B.11	C.10	D.11
13	20	3/8/23 13:15	22 Filter C			0.04		0.018									A.10	B.11	C.10	D.11
13	21	3/8/23 13:15	23 Filter D			0.05		0.018									A.10	B.11	C.10	D.11
13	22	3/8/23 13:15	01 RAW - Well 2			1.48		0.141									A.10	B.11	C.10	D.11
14	08	3/8/23 14:10	No Drawdown on Recycle Tank - Readjust Feed Pressure in Prep for Recycle Trial Tomorrow														A.10	B.11	C.10	D.11
14	12	3/9/23 8:01	Shutdown Filters A&C for BW														A.10	B.11	C.10	D.11
14	13	3/9/23 8:13	Restart Filters A&C														A.11	B.11	C.11	D.11
14	14	3/9/23 8:50	01 RAW - Well 2			1.10	0.87	0.155	0.139	6.37	11.70						A.11	B.11	C.11	D.11
14	16	3/9/23 8:50	10 POX AB	0.19			0.04		0.082	6.30							A.11	B.11	C.11	D.11
14	17	3/9/23 8:50	11 POX CD	0.54			0.08		0.072	7.10							A.11	B.11	C.11	D.11
14	18	3/9/23 8:50	20 Filter A	0.28		0.03		0.010		6.37							A.11	B.11	C.11	D.11
14	19	3/9/23 8:50	21 Filter B	0.18		0.01		0.012		6.37							A.11	B.11	C.11	D.11
14	20	3/9/23 8:50	22 Filter C	0.27		0.03		0.004		7.03							A.11	B.11	C.11	D.11
14	21	3/9/23 8:50	23 Filter D	0.26		0.00		0.018		7.38							A.11	B.11	C.11	D.11
14	22	3/9/23 8:52	Reduce Feed Pressure to 15 PSI in Preparation for Recycle Trial														A.11	B.11	C.11	D.11
14	23	3/9/23 9:20	Start Recycle Feed at 5%														A.11	B.11	C.11	D.11
15	01	3/9/23 9:30	02 RAW + Recycle			0.90		0.105									A.11	B.11	C.11	D.11
15	02	3/9/23 9:30	20 Filter A			0.02		0.000									A.11	B.11	C.11	D.11
15	03	3/9/23 9:30	21 Filter B			0.03		0.000									A.11	B.11	C.11	D.11
15	04	3/9/23 9:30	22 Filter C			0.02		0.000									A.11	B.11	C.11	D.11
15	05	3/9/23 9:30	23 Filter D			0.00		0.000									A.11	B.11	C.11	D.11
15	06	3/9/23 10:20	20 Filter A			0.01		0.000									A.11	B.11	C.11	D.11
15	07	3/9/23 10:20	21 Filter B			0.01		0.005									A.11	B.11	C.11	D.11
15	08	3/9/23 10:20	22 Filter C			0.01		0.000									A.11	B.11	C.11	D.11
15	09	3/9/23 10:20	23 Filter D			0.07		0.000									A.11	B.11	C.11	D.11
15	10	3/9/23 10:50	20 Filter A			0.04		0.000									A.11	B.11	C.11	D.11
15	11	3/9/23 10:50	21 Filter B			0.00		0.000									A.11	B.11	C.11	D.11
15	12	3/9/23 10:50	22 Filter C			0.02		0.000									A.11	B.11	C.11	D.11
15	13	3/9/23 10:50	23 Filter D			0.01		0.000									A.11	B.11	C.11	D.11
15	14	3/9/23 11:10	Collect Labs for Recycle Trial														A.11	B.11	C.11	D.11
15	16	3/9/23 11:20	20 Filter A			0.08		0.000									A.11	B.11	C.11	D.11
15	17	3/9/23 11:20	21 Filter B			0.03		0.006									A.11	B.11	C.11	D.11
15	18	3/9/23 11:20	22 Filter C			0.04		0.003									A.11	B.11	C.11	D.11
15	19	3/9/23 11:20	23 Filter D			0.03		0.010									A.11	B.11	C.11	D.11
15	20	3/9/23 11:50	02 RAW + Recycle			0.870		0.123									A.11	B.11	C.11	D.11
15	21	3/9/23 11:50	20 Filter A			0.03		0.003									A.11	B.11	C.11	D.11
15	22	3/9/23 11:50	21 Filter B			0.10		0.012									A.11	B.11	C.11	D.11
15	23	3/9/23 11:50	22 Filter C			0.05		0.000									A.11	B.11	C.11	D.11
15	24	3/9/23 11:50	23 Filter D			0.06		0.007									A.11	B.11	C.11	D.11
16	01	3/9/23 12:20	20 Filter A			0.03		0.009									A.11	B.11	C.11	D.11

pg	Row	Date and Time	SAMPLE LOCATION	Cl2(f) (mg/L)	Cl2(t) (mg/L)	Fe(t) (mg/L)	Fe(d) (mg/L)	Mn(t) (mg/L)	Mn(d) (mg/L)	pH (su)	Temp (Ce)	Alk	CO2 (mg/L)	Nitrate	TOC Vial	TOC (mg/L)	A Trial	B Trial	C Trial	D Trial
16	02	3/9/23 12:20	21 Filter B			0.06		0.002									A.11	B.11	C.11	D.11
16	03	3/9/23 12:20	22 Filter C			0.02		0.011									A.11	B.11	C.11	D.11
16	04	3/9/23 12:20	23 Filter D			0.05		0.016									A.11	B.11	C.11	D.11
16	05	3/9/23 13:00	01 RAW - Well 2			0.95	0.43	0.147	0.136	6.50	12.50						A.11	B.11	C.11	D.11
16	07	3/9/23 13:00	02 RAW + Recycle			0.93	0.06	0.113	0.071	6.48	12.80						A.11	B.11	C.11	D.11
16	09	3/9/23 13:00	20 Filter A	0.27	0.31	0.04		0.014		6.46							A.11	B.11	C.11	D.11
16	10	3/9/23 13:00	21 Filter B	0.21	0.34	0.07		0.016		6.44							A.11	B.11	C.11	D.11
16	11	3/9/23 13:00	22 Filter C	0.49	0.65	0.04		0.004		7.87							A.11	B.11	C.11	D.11
16	12	3/9/23 13:00	23 Filter D	0.24	0.47	0.09		0.010		7.80							A.11	B.11	C.11	D.11
16	13	3/9/23 13:30	20 Filter A			0.02		0.013									A.11	B.11	C.11	D.11
16	14	3/9/23 13:30	21 Filter B			0.07		0.003									A.11	B.11	C.11	D.11
16	15	3/9/23 13:30	22 Filter C			0.03		0.009									A.11	B.11	C.11	D.11
16	16	3/9/23 13:30	23 Filter D			0.03		0.013									A.11	B.11	C.11	D.11
16	17	3/9/23 13:30	Supernatant from BW Storage Tank			0.14		0.064									A.11	B.11	C.11	D.11
16	18	3/9/23 14:00	DEP and Town Visit Pilot														A.11	B.11	C.11	D.11
16	18	3/9/23 14:00	20 Filter A			0.03		0.012									A.11	B.11	C.11	D.11
16	19	3/9/23 14:00	21 Filter B			0.03		0.011									A.11	B.11	C.11	D.11
16	20	3/9/23 14:00	22 Filter C			0.01		0.012									A.11	B.11	C.11	D.11
16	21	3/9/23 14:00	23 Filter D			0.02		0.005									A.11	B.11	C.11	D.11
16	22	3/9/23 15:00	20 Filter A			0.07		0.005									A.11	B.11	C.11	D.11
16	23	3/9/23 15:00	21 Filter B			0.03		0.013									A.11	B.11	C.11	D.11
16	24	3/9/23 15:00	22 Filter C			0.03		0.008									A.11	B.11	C.11	D.11
16	25	3/9/23 15:00	23 Filter D			0.05		0.016									A.11	B.11	C.11	D.11
16	25	3/9/23 15:30	End Recycle Trial														A.11	B.11	C.11	D.11
17	01	3/10/23 8:25	Feed Pressure Low - Recycle Injection Was Open - Bleeding Pressure														A.11	B.11	C.11	D.11
17	05	3/10/23 8:50	10 POX AB	0.40	0.55		0.01		0.091	6.34	12.10						A.11	B.11	C.11	D.11
17	06	3/10/23 8:50	11 POX CD	0.53	0.61		0.08		0.071	8.45							A.11	B.11	C.11	D.11
17	07	3/10/23 8:50	20 Filter A	0.14	0.39	0.04		0.012		6.36							A.11	B.11	C.11	D.11
17	08	3/10/23 8:50	21 Filter B	0.15	0.23	0.05		0.007		6.36							A.11	B.11	C.11	D.11
17	09	3/10/23 8:50	22 Filter C	0.29	0.37	0.02		0.000		7.56							A.11	B.11	C.11	D.11
17	10	3/10/23 8:50	23 Filter D	0.30	0.40	0.05		0.010		7.61							A.11	B.11	C.11	D.11
17	12	3/10/23 9:20	Shutdown Chem Feed - Flush CF Pumps - BW Filters - Drain - Shutdown Pilot Flow														A.11	B.11	C.11	D.11

		Filter Runtime			
Date and Time	**SAMPLE LOCATION**	A Runtime (hrs)	B Runtime (hrs)	C Runtime (hrs)	D Runtime (hrs)
	01 RAW - Well 2				
	02 RAW + Recycle				
	10 POX AB				
	11 POX CD				
	20 Filter A				
	21 Filter B				
	22 Filter C				
	23 Filter D				
2/15/23 9:30	Arrive at site and mobilize Greensand pilot trailer				
2/15/23 9:30	1/5 NaOCl to All 4 Filters				
2/15/23 9:30	1/5 KOH to Filters CD - pH Setpoint 8.0				
2/15/23 9:30	Filter A - 24" GSP + 12" Anthracite				
2/15/23 9:30	Filter B - 24" PYR + 12" Anthracite				
2/15/23 9:30	Filter C - 24" GSP + 12" Anthracite				
2/15/23 9:30	Filter D - 24" PYR + 12" Anthracite				
2/15/23 9:30	Backwash All 4 Filters w/ Raw Water				
2/15/23 9:30	Tour w/ Rob				
	Start Flow to Filters	0.00	0.00	0.00	0.00
2/15/23 13:20	10 POX AB	0.67	0.67	0.67	0.67
2/15/23 14:00	Setup Online pH Probes	1.25	1.25	1.25	1.25
2/15/23 14:35	Setup Online pH Control	1.67	1.67	1.67	1.67
2/15/23 15:00	20 Filter A	1.67	1.67	1.67	1.67
2/15/23 15:00	21 Filter B	1.67	1.67	1.67	1.67
2/15/23 15:00	22 Filter C	1.67	1.67	1.67	1.67
2/15/23 15:00	23 Filter D	25.33	25.33	25.33	25.33
2/16/23 14:40	20 Filter A	25.33	25.33	25.33	25.33
2/16/23 14:40	21 Filter B	25.33	25.33	25.33	25.33
2/16/23 14:40	22 Filter C	25.33	25.33	25.33	25.33
2/16/23 14:40	23 Filter D	26.00	26.00	0.00	0.00
2/16/23 15:20	Shutdown Filters A and B for BW	26.00	26.00	0.67	0.67
2/16/23 15:20	Restart Filters A and B	0.00	0.00	0.67	0.67
2/16/23 15:20	Shutdown Filters C and D for BW	0.00	0.00	0.67	0.67
2/16/23 15:20	Restart Filters C and D	0.00	0.00	0.00	0.00
2/17/23 12:10	20 Filter A	20.83	20.83	20.83	20.83
2/17/23 12:10	21 Filter B	20.83	20.83	20.83	20.83
2/17/23 12:10	22 Filter C	20.83	20.83	20.83	20.83
2/17/23 12:10	23 Filter D	20.83	20.83	20.83	20.83
2/17/23 14:34	20 Filter A	23.23	23.23	23.23	23.23
2/17/23 14:34	21 Filter B	23.23	23.23	23.23	23.23
2/17/23 14:34	22 Filter C	23.23	23.23	23.23	23.23
2/17/23 14:34	23 Filter D	23.23	23.23	23.23	23.23
2/17/23 14:49	Change Out Filter A Turb Head	23.48	23.48	23.48	23.48
2/20/23 11:50	20 Filter A	92.50	92.50	92.50	92.50
2/20/23 11:50	21 Filter B	92.50	92.50	92.50	92.50
2/20/23 11:50	22 Filter C	92.50	92.50	92.50	92.50

Date and Time	SAMPLE LOCATION	A Runtime (hrs)	B Runtime (hrs)	C Runtime (hrs)	D Runtime (hrs)
2/20/23 11:50	23 Filter D	92.50	92.50	92.50	92.50
2/20/23 12:50	Shutdown Filter A for BW	93.50	93.50	93.50	93.50
2/20/23 13:00	Restart Filter A	0.00	93.67	93.67	93.67
2/20/23 13:01	Shutdown Filter B for BW	0.02	93.68	93.68	93.68
2/20/23 13:11	Restart Filter B	0.18	0.00	93.85	93.85
2/20/23 13:11	Shutdown Filter C for BW	0.18	0.00	93.85	93.85
2/20/23 13:22	Restart Filter C	0.37	0.18	0.00	94.03
2/20/23 13:22	Shutdown Filter D for BW	0.37	0.18	0.00	94.03
2/20/23 13:33	Restart Filter D	0.55	0.37	0.18	0.00
2/20/23 14:30	20 Filter A	1.50	1.32	1.13	0.95
2/20/23 14:30	21 Filter B	1.50	1.32	1.13	0.95
2/20/23 14:30	22 Filter C	1.50	1.32	1.13	0.95
2/20/23 14:30	23 Filter D	1.50	1.32	1.13	0.95
2/21/23 8:10	Caustic Titrations - See Separate Notes	19.17	18.98	18.80	18.62
2/21/23 11:58	Shutdown Filters A and B for BW	22.97	22.78	22.60	22.42
2/21/23 12:27	Restart Filters A and B	0.00	0.00	23.08	22.90
2/21/23 12:27	Shutdown Filters C and D for BW	0.00	0.00	23.08	22.90
2/21/23 12:44	Restart Filters C and D	0.28	0.28	0.00	0.00
2/21/23 14:02	20 Filter A	1.58	1.58	1.30	1.30
2/21/23 14:02	21 Filter B	1.58	1.58	1.30	1.30
2/21/23 14:02	22 Filter C	1.58	1.58	1.30	1.30
2/21/23 14:02	23 Filter D	1.58	1.58	1.30	1.30
2/21/23 14:02	01 RAW - Well 2	1.58	1.58	1.30	1.30
2/22/23 8:00	Organize and label lab bottles for sampling ever	19.55	19.55	19.27	19.27
2/22/23 10:14	Shutdown and BW Filter A	21.78	21.78	21.50	21.50
2/22/23 10:28	Restart Filter A	0.00	22.02	21.73	21.73
2/22/23 10:30	Shutdown and BW Filter B	0.03	22.05	21.77	21.77
2/22/23 10:41	Restart Filter B	0.22	0.00	21.95	21.95
2/22/23 10:43	Shutdown and BW Filter C	0.25	0.03	21.98	21.98
2/22/23 10:54	Restart Filter C	0.43	0.22	0.00	22.17
2/22/23 10:56	Shutdown and BW Filter D	0.47	0.25	0.03	22.20
2/22/23 11:08	Restart Filter D	0.67	0.45	0.23	0.00
2/22/23 11:08	Collect CBW Samples during BW	0.67	0.45	0.23	0.00
2/22/23 12:10	Disconnect and Reconnect Filter A Turb Head	1.70	1.48	1.27	1.03
2/22/23 13:05	01 RAW - Well 2	2.62	2.40	2.18	1.95
2/22/23 13:05	10 POX AB	2.62	2.40	2.18	1.95
2/22/23 13:05	11 POX CD	2.62	2.40	2.18	1.95
2/22/23 13:05	20 Filter A	2.62	2.40	2.18	1.95
2/22/23 13:05	21 Filter B	2.62	2.40	2.18	1.95
2/22/23 13:05	22 Filter C	2.62	2.40	2.18	1.95
2/22/23 13:05	23 Filter D	2.62	2.40	2.18	1.95
2/22/23 13:30	Collect Full Round of Lab Samples for Greensan	3.03	2.82	2.60	2.37
2/22/23 15:00	Reduce NaOCl Feed Rate to Target 0.25 to 0.50	4.53	4.32	4.10	3.87
2/22/23 15:15	Collecting SSN Lab Samples	4.78	4.57	4.35	4.12
2/22/23 15:55	Download Data	5.45	5.23	5.02	4.78
2/23/23 9:36	Shutdown and BW Filter D	23.13	22.92	22.70	22.47
2/23/23 9:49	Restart Filter D	23.35	23.13	22.92	0.00
2/23/23 9:44	Shutdown and BW Filter C	23.27	23.05	22.83	-0.08
2/23/23 9:54	Restart Filter C	23.43	23.22	0.00	0.08

Date and Time	SAMPLE LOCATION	A Runtime (hrs)	B Runtime (hrs)	C Runtime (hrs)	D Runtime (hrs)
2/23/23 9:49	Shutdown and BW Filter B	23.35	23.13	-0.08	0.00
2/23/23 10:00	Restart Filter B	23.53	0.00	0.10	0.18
2/23/23 9:54	Shutdown Filter A for BW	23.43	-0.10	0.00	0.08
2/23/23 10:05	Restart Filter A	0.00	0.08	0.18	0.27
2/23/23 10:05	Swap Turb Head for Filter A	0.00	0.08	0.18	0.27
2/23/23 12:40	01 RAW - Well 2	2.58	2.67	2.77	2.85
2/23/23 12:40	10 POX AB	2.58	2.67	2.77	2.85
2/23/23 12:40	11 POX CD	2.58	2.67	2.77	2.85
2/23/23 12:40	20 Filter A	2.58	2.67	2.77	2.85
2/23/23 12:40	21 Filter B	2.58	2.67	2.77	2.85
2/23/23 12:40	22 Filter C	2.58	2.67	2.77	2.85
2/23/23 12:40	23 Filter D	2.58	2.67	2.77	2.85
2/23/23 14:00	01 RAW - Well 2	3.92	4.00	4.10	4.18
2/23/23 14:00	10 POX AB	3.92	4.00	4.10	4.18
2/23/23 14:00	11 POX CD	3.92	4.00	4.10	4.18
2/23/23 14:00	20 Filter A	3.92	4.00	4.10	4.18
2/23/23 14:00	21 Filter B	3.92	4.00	4.10	4.18
2/23/23 14:00	22 Filter C	3.92	4.00	4.10	4.18
2/23/23 14:00	23 Filter D	3.92	4.00	4.10	4.18
2/24/23 11:51	Shutdown and BW Filter A	25.77	25.85	25.95	26.03
2/24/23 12:05	Restart Filter A	0.00	26.08	26.18	26.27
2/24/23 11:51	Shutdown and BW Filter B	-0.23	25.85	25.95	26.03
2/24/23 12:05	Restart Filter B	0.00	0.00	26.18	26.27
2/24/23 12:15	Shutdown and BW Filter C	0.17	0.17	26.35	26.43
2/24/23 12:26	Restart Filter C	0.35	0.35	0.00	26.62
2/24/23 12:15	Shutdown and BW Filter D	0.17	0.17	-0.18	26.43
2/24/23 12:26	Restart Filter D	0.35	0.35	0.00	0.00
2/24/23 14:10	10 POX AB	2.08	2.08	1.73	1.73
2/24/23 14:10	11 POX CD	2.08	2.08	1.73	1.73
2/24/23 14:10	20 Filter A	2.08	2.08	1.73	1.73
2/24/23 14:10	21 Filter B	2.08	2.08	1.73	1.73
2/24/23 14:10	22 Filter C	2.08	2.08	1.73	1.73
2/24/23 14:10	23 Filter D	2.08	2.08	1.73	1.73
2/24/23 14:30	Increase NaOCl feed from 115-->130ml/h	2.42	2.42	2.07	2.07
2/24/23 14:55	NaOCl V=40L, KOH V=50L q=386ml/h	2.83	2.83	2.48	2.48
2/27/23 13:21	Shutdown C & D for BW	73.27	73.27	72.92	72.92
2/27/23 13:32	Restart C&D @1.5 gpm each	73.45	73.45	0.00	0.00
2/27/23 13:41	Shutdown A&B for BW	73.60	73.60	0.15	0.15
2/27/23 13:53	Restart A&B	0.00	0.00	0.35	0.35
2/27/23 14:09	KOH V=40L, NaOCl V=31L	0.27	0.27	0.62	0.62
2/27/23 14:52	Increase NaOCl feed from 130-->200ml/h	0.98	0.98	1.33	1.33
2/27/23 15:00	01 RAW - Well 2	1.12	1.12	1.47	1.47
2/27/23 15:00	10 POX AB	1.12	1.12	1.47	1.47
2/27/23 15:00	11 POX CD	1.12	1.12	1.47	1.47
2/27/23 15:00	20 Filter A	1.12	1.12	1.47	1.47
2/27/23 15:00	21 Filter B	1.12	1.12	1.47	1.47
2/27/23 15:00	22 Filter C	1.12	1.12	1.47	1.47
2/27/23 15:00	23 Filter D	1.12	1.12	1.47	1.47
2/27/23 15:21	Increase NaoCl feed from 200-->230ml/h	1.47	1.47	1.82	1.82

Date and Time	SAMPLE LOCATION	A Runtime (hrs)	B Runtime (hrs)	C Runtime (hrs)	D Runtime (hrs)
2/28/23 12:15	10 POX AB	22.37	22.37	22.72	22.72
2/28/23 12:15	11 POX CD	22.37	22.37	22.72	22.72
2/28/23 12:15	20 Filter A	22.37	22.37	22.72	22.72
2/28/23 12:15	21 Filter B	22.37	22.37	22.72	22.72
2/28/23 12:15	22 Filter C	22.37	22.37	22.72	22.72
2/28/23 12:15	23 Filter D	22.37	22.37	22.72	22.72
2/28/23 13:25	Shutdown B&D for BW	23.53	23.53	23.88	23.88
2/28/23 13:37	Restart B&D @1.5gpm	23.73	0.00	24.08	0.00
2/28/23 14:30	01 RAW - Well 2	24.62	0.88	24.97	0.88
2/28/23 14:30	10 POX AB	24.62	0.88	24.97	0.88
2/28/23 14:30	11 POX CD	24.62	0.88	24.97	0.88
2/28/23 14:30	20 Filter A	24.62	0.88	24.97	0.88
2/28/23 14:30	21 Filter B	24.62	0.88	24.97	0.88
2/28/23 14:30	22 Filter C	24.62	0.88	24.97	0.88
2/28/23 14:30	23 Filter D	24.62	0.88	24.97	0.88
2/28/23 14:52	NaOCl V=25.5, q=230ml/h	24.98	1.25	25.33	1.25
2/28/23 14:52	KOH V=35L, q=277ml/h	24.98	1.25	25.33	1.25
3/1/23 10:26	Shutdown Filters A&C for BW	44.55	20.82	44.90	20.82
3/1/23 10:39	Restart Filters A&C	0.00	21.03	0.00	21.03
3/1/23 11:20	01 RAW - Well 2	0.68	21.72	0.68	21.72
3/1/23 11:20	10 POX AB	0.68	21.72	0.68	21.72
3/1/23 11:20	11 POX CD	0.68	21.72	0.68	21.72
3/1/23 11:20	20 Filter A	0.68	21.72	0.68	21.72
3/1/23 11:20	21 Filter B	0.68	21.72	0.68	21.72
3/1/23 11:20	22 Filter C	0.68	21.72	0.68	21.72
3/1/23 11:20	23 Filter D	0.68	21.72	0.68	21.72
3/2/23 10:05	Shutdown Filter B for BW	23.43	44.47	23.43	44.47
3/2/23 10:10	NaOCl V=15, q=230ml/h, KOH V=21L q=	23.52	44.55	23.52	44.55
3/2/23 10:18	Place Filter B in Service @7.5gpm/sqft	23.65	0.00	23.65	0.00
3/2/23 10:19	Shutdown Filter D for BW	23.67	0.02	23.67	0.02
3/2/23 10:30	Place Filter D in service @ 7.5gpm/sqft	23.85	0.20	23.85	0.20
3/2/23 10:35	Add 30L 1/5 NaOCl V=43.5L	23.93	0.28	23.93	0.28
3/2/23 10:50	Add 30L 1/5 KOH V=55L	24.18	0.53	24.18	0.53
3/2/23 11:30	10 POX AB	24.85	1.20	24.85	1.20
3/2/23 11:30	11 POX CD	24.85	1.20	24.85	1.20
3/2/23 11:30	20 Filter A	24.85	1.20	24.85	1.20
3/2/23 11:30	21 Filter B	24.85	1.20	24.85	1.20
3/2/23 11:30	22 Filter C	24.85	1.20	24.85	1.20
3/2/23 11:30	23 Filter D	24.85	1.20	24.85	1.20
3/2/23 12:15	Collect Lab Samples	25.60	1.95	25.60	1.95
3/3/23 12:54	Shutdown Filter A for BW	50.25	26.60	50.25	26.60
3/3/23 12:54	Shutdown Filter C for BW	50.25	26.60	50.25	26.60
3/3/23 13:06	Restart Filter A	0.00	26.80	50.45	26.80
3/3/23 13:06	Restart Filter C	0.00	26.80	0.00	26.80
3/3/23 13:50	10 POX AB	0.73	27.53	0.73	27.53
3/3/23 13:50	11 POX CD	0.73	27.53	0.73	27.53
3/3/23 13:50	20 Filter A	0.73	27.53	0.73	27.53
3/3/23 13:50	21 Filter B	0.73	27.53	0.73	27.53
3/3/23 13:50	22 Filter C	0.73	27.53	0.73	27.53

Date and Time	**SAMPLE LOCATION**	A Runtime (hrs)	B Runtime (hrs)	C Runtime (hrs)	D Runtime (hrs)
3/3/23 13:50	23 Filter D	0.73	27.53	0.73	27.53
3/6/23 14:18	Shutdown Filter A for BW	73.20	100.00	73.20	100.00
3/6/23 14:18	Shutdown Filter B for BW	73.20	100.00	73.20	100.00
3/6/23 14:29	Restart Filter A	0.00	100.18	73.38	100.18
3/6/23 14:29	Restart Filter B	0.00	0.00	73.38	100.18
3/6/23 14:30	Shutdown Filter C for BW	0.02	0.02	73.40	100.20
3/6/23 14:30	Shutdown Filter D for BW	0.02	0.02	73.40	100.20
3/6/23 15:01	Restart Filter C	0.53	0.53	0.00	100.72
3/6/23 15:01	Restart Filter D	0.53	0.53	0.00	0.00
3/6/23 15:35	20 Filter A	1.10	1.10	0.57	0.57
3/6/23 15:35	21 Filter B	1.10	1.10	0.57	0.57
3/6/23 15:35	22 Filter C	1.10	1.10	0.57	0.57
3/6/23 15:35	23 Filter D	1.10	1.10	0.57	0.57
3/7/23 9:00	POX CD Flow Off. Restart Flow.	18.52	18.52	17.98	17.98
3/7/23 9:00	Decrease P from 4.0 to 0.4. Increase Transit Tin	18.52	18.52	17.98	17.98
3/7/23 10:07	01 RAW - Well 2	19.63	19.63	19.10	19.10
3/7/23 10:07	10 POX AB	19.63	19.63	19.10	19.10
3/7/23 10:07	11 POX CD	19.63	19.63	19.10	19.10
3/7/23 10:07	20 Filter A	19.63	19.63	19.10	19.10
3/7/23 10:07	21 Filter B	19.63	19.63	19.10	19.10
3/7/23 10:07	22 Filter C	19.63	19.63	19.10	19.10
3/7/23 10:07	23 Filter D	19.63	19.63	19.10	19.10
3/7/23 12:45	20 Filter A	22.27	22.27	21.73	21.73
3/7/23 12:45	21 Filter B	22.27	22.27	21.73	21.73
3/7/23 12:45	22 Filter C	22.27	22.27	21.73	21.73
3/7/23 12:45	23 Filter D	22.27	22.27	21.73	21.73
3/7/23 13:15	20 Filter A	22.77	22.77	22.23	22.23
3/7/23 13:15	21 Filter B	22.77	22.77	22.23	22.23
3/7/23 13:15	22 Filter C	22.77	22.77	22.23	22.23
3/7/23 13:15	23 Filter D	22.77	22.77	22.23	22.23
3/7/23 14:10	10 POX AB	23.68	23.68	23.15	23.15
3/7/23 14:10	11 POX CD	23.68	23.68	23.15	23.15
3/7/23 14:10	20 Filter A	23.68	23.68	23.15	23.15
3/7/23 14:10	21 Filter B	23.68	23.68	23.15	23.15
3/7/23 14:10	22 Filter C	23.68	23.68	23.15	23.15
3/7/23 14:10	23 Filter D	23.68	23.68	23.15	23.15
3/8/23 8:27	Shutdown B&D for BW	41.97	41.97	41.43	41.43
3/8/23 8:39	Restart B&D @1.5gpm	42.17	0.00	41.63	0.00
3/8/23 10:00	10 POX AB	43.52	1.35	42.98	1.35
3/8/23 10:00	11 POX CD	43.52	1.35	42.98	1.35
3/8/23 10:00	20 Filter A	43.52	1.35	42.98	1.35
3/8/23 10:00	21 Filter B	43.52	1.35	42.98	1.35
3/8/23 10:00	22 Filter C	43.52	1.35	42.98	1.35
3/8/23 10:00	23 Filter D	43.52	1.35	42.98	1.35
3/8/23 11:15	Shutdown Pilot Flow to Install Recycle Feed Cor	44.77	2.60	44.23	2.60
3/8/23 11:15	Allow Fe Slug to Pass. DPs still OK.	44.77	2.60	44.23	2.60
3/8/23 11:15	Adjust Influent P to 15 psi	44.77	2.60	44.23	2.60
3/8/23 11:15	Calibrate Peristaltic Pump to 5% Recycle	44.77	2.60	44.23	2.60
3/8/23 12:15	01 RAW - Well 2	45.77	3.60	45.23	3.60

Date and Time	SAMPLE LOCATION	A Runtime (hrs)	B Runtime (hrs)	C Runtime (hrs)	D Runtime (hrs)
3/8/23 12:15	20 Filter A	45.77	3.60	45.23	3.60
3/8/23 12:15	21 Filter B	45.77	3.60	45.23	3.60
3/8/23 12:15	22 Filter C	45.77	3.60	45.23	3.60
3/8/23 12:15	23 Filter D	45.77	3.60	45.23	3.60
3/8/23 12:45	20 Filter A	46.27	4.10	45.73	4.10
3/8/23 12:45	21 Filter B	46.27	4.10	45.73	4.10
3/8/23 12:45	22 Filter C	46.27	4.10	45.73	4.10
3/8/23 12:45	23 Filter D	46.27	4.10	45.73	4.10
3/8/23 13:15	20 Filter A	46.77	4.60	46.23	4.60
3/8/23 13:15	21 Filter B	46.77	4.60	46.23	4.60
3/8/23 13:15	22 Filter C	46.77	4.60	46.23	4.60
3/8/23 13:15	23 Filter D	46.77	4.60	46.23	4.60
3/8/23 13:15	01 RAW - Well 2	46.77	4.60	46.23	4.60
3/8/23 14:10	No Drawdown on Recycle Tank - Readjust Feed	47.68	5.52	47.15	5.52
3/9/23 8:01	Shutdown Filters A&C for BW	65.53	23.37	65.00	23.37
3/9/23 8:13	Restart Filters A&C	0.00	23.57	0.00	23.57
3/9/23 8:50	01 RAW - Well 2	0.62	24.18	0.62	24.18
3/9/23 8:50	10 POX AB	0.62	24.18	0.62	24.18
3/9/23 8:50	11 POX CD	0.62	24.18	0.62	24.18
3/9/23 8:50	20 Filter A	0.62	24.18	0.62	24.18
3/9/23 8:50	21 Filter B	0.62	24.18	0.62	24.18
3/9/23 8:50	22 Filter C	0.62	24.18	0.62	24.18
3/9/23 8:50	23 Filter D	0.62	24.18	0.62	24.18
3/9/23 8:52	Reduce Feed Pressure to 15 PSI in Preparation f	0.65	24.22	0.65	24.22
3/9/23 9:20	Start Recycle Feed at 5%	1.12	24.68	1.12	24.68
3/9/23 9:30	02 RAW + Recycle	1.28	24.85	1.28	24.85
3/9/23 9:30	20 Filter A	1.28	24.85	1.28	24.85
3/9/23 9:30	21 Filter B	1.28	24.85	1.28	24.85
3/9/23 9:30	22 Filter C	1.28	24.85	1.28	24.85
3/9/23 9:30	23 Filter D	1.28	24.85	1.28	24.85
3/9/23 10:20	20 Filter A	2.12	25.68	2.12	25.68
3/9/23 10:20	21 Filter B	2.12	25.68	2.12	25.68
3/9/23 10:20	22 Filter C	2.12	25.68	2.12	25.68
3/9/23 10:20	23 Filter D	2.12	25.68	2.12	25.68
3/9/23 10:50	20 Filter A	2.62	26.18	2.62	26.18
3/9/23 10:50	21 Filter B	2.62	26.18	2.62	26.18
3/9/23 10:50	22 Filter C	2.62	26.18	2.62	26.18
3/9/23 10:50	23 Filter D	2.62	26.18	2.62	26.18
3/9/23 11:10	Collect Labs for Recycle Trial	2.95	26.52	2.95	26.52
3/9/23 11:20	20 Filter A	3.12	26.68	3.12	26.68
3/9/23 11:20	21 Filter B	3.12	26.68	3.12	26.68
3/9/23 11:20	22 Filter C	3.12	26.68	3.12	26.68
3/9/23 11:20	23 Filter D	3.12	26.68	3.12	26.68
3/9/23 11:50	02 RAW + Recycle	3.62	27.18	3.62	27.18
3/9/23 11:50	20 Filter A	3.62	27.18	3.62	27.18
3/9/23 11:50	21 Filter B	3.62	27.18	3.62	27.18
3/9/23 11:50	22 Filter C	3.62	27.18	3.62	27.18
3/9/23 11:50	23 Filter D	3.62	27.18	3.62	27.18
3/9/23 12:20	20 Filter A	4.12	27.68	4.12	27.68

Date and Time	**SAMPLE LOCATION**	A Runtime (hrs)	B Runtime (hrs)	C Runtime (hrs)	D Runtime (hrs)
3/9/23 12:20	21 Filter B	4.12	27.68	4.12	27.68
3/9/23 12:20	22 Filter C	4.12	27.68	4.12	27.68
3/9/23 12:20	23 Filter D	4.12	27.68	4.12	27.68
3/9/23 13:00	01 RAW - Well 2	4.78	28.35	4.78	28.35
3/9/23 13:00	02 RAW + Recycle	4.78	28.35	4.78	28.35
3/9/23 13:00	20 Filter A	4.78	28.35	4.78	28.35
3/9/23 13:00	21 Filter B	4.78	28.35	4.78	28.35
3/9/23 13:00	22 Filter C	4.78	28.35	4.78	28.35
3/9/23 13:00	23 Filter D	4.78	28.35	4.78	28.35
3/9/23 13:30	20 Filter A	5.28	28.85	5.28	28.85
3/9/23 13:30	21 Filter B	5.28	28.85	5.28	28.85
3/9/23 13:30	22 Filter C	5.28	28.85	5.28	28.85
3/9/23 13:30	23 Filter D	5.28	28.85	5.28	28.85
3/9/23 13:30	Supernatant from BW Storage Tank	5.28	28.85	5.28	28.85
3/9/23 14:00	DEP and Town Visit Pilot	5.78	29.35	5.78	29.35
3/9/23 14:00	20 Filter A	5.78	29.35	5.78	29.35
3/9/23 14:00	21 Filter B	5.78	29.35	5.78	29.35
3/9/23 14:00	22 Filter C	5.78	29.35	5.78	29.35
3/9/23 14:00	23 Filter D	5.78	29.35	5.78	29.35
3/9/23 15:00	20 Filter A	6.78	30.35	6.78	30.35
3/9/23 15:00	21 Filter B	6.78	30.35	6.78	30.35
3/9/23 15:00	22 Filter C	6.78	30.35	6.78	30.35
3/9/23 15:00	23 Filter D	6.78	30.35	6.78	30.35
3/9/23 15:30	End Recycle Trial	7.28	30.85	7.28	30.85
3/10/23 8:25	Feed Pressure Low - Recycle Injection Was Ope	24.20	47.77	24.20	47.77
3/10/23 8:50	10 POX AB	24.62	48.18	24.62	48.18
3/10/23 8:50	11 POX CD	24.62	48.18	24.62	48.18
3/10/23 8:50	20 Filter A	24.62	48.18	24.62	48.18
3/10/23 8:50	21 Filter B	24.62	48.18	24.62	48.18
3/10/23 8:50	22 Filter C	24.62	48.18	24.62	48.18
3/10/23 8:50	23 Filter D	24.62	48.18	24.62	48.18
3/10/23 9:20	Shutdown Chem Feed - Flush CF Pumps - BW Fil	25.12	48.68	25.12	48.68

Appendix C – Laboratory Reports

Phoenix Environmental Labs – Certified Laboratory Results

Lab Report #	Sample Date	Start Page	End Page	Analysis
CN23857	01/13/23	C1	C12	General - Raw
CN30219	01/25/23	C26	C35	General - Raw
CN33583	01/31 – 02/01	C36	C48	BW – Gen - Bio
CN35613	02/02/23	C49	C59	Backwash
CN41560	02/13/23	C60	C69	Nitrate
CN45841	02/16/23	C70	C77	Backwash
CN48043	02/22/23	C78	C95	General - Ads
CN48048	02/22/23	C113	C129	Backwash
CN48938	02/23/23	C130	C138	Backwash
CN52084	03/01/23	C139	C161	General - Bio
CN52089	03/02/23	C162	C172	Fe Mn - Ads
CN53948	03/06/23	C173	C181	Backwash
CN55216	03/07/23	C182	C205	General – Bio+Ads
CN59353	03/09/23	C226	C237	General - Ads
CN59351	03/09/23	C238	C252	Backwash

Alpha Analytical – Certified Laboratory Results

Lab Report #	Sample Date	Start Page	End Page	Analysis
L2302370	01/13/23	C13	C25	Coliform
L2309640	02/22/23	C96	C112	Coliform
L2311800	03/07/23	C206	C225	Coliform

PHOENIX
Environmental Laboratories, Inc.

Wednesday, January 25, 2023

Attn: Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Project ID: **SHARON**
SDG ID: **GCN23857**
Sample ID#s: **CN23857**

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B

NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301

SDG Comments

January 25, 2023

SDG I.D.: GCN23857

Sample CN23857 was received past hold time for Color, Apparent (SM2120B).
Sample CN23857 was received past hold time for Nitrite as Nitrogen (E300.0).
Sample CN23857 was received past hold time for Nitrate as Nitrogen (E300.0).

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Sample Id Cross Reference

January 25, 2023

SDG I.D.: GCN23857

Project ID: SHARON

Client Id	Lab Id	Matrix
RAW	CN23857	GROUND WATER

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 25, 2023

FOR: Attn: Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	GROUND WATER	Collected by:		01/13/23	13:10
Location Code:	BLUELEAF	Received by:	CP	01/16/23	11:55
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN23857
Phoenix ID: CN23857

Project ID: SHARON
Client ID: RAW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Iron (Dissolved)	< 0.011	0.011	mg/L	1	01/17/23	CPP	SW6010D	
Manganese (Dissolved)	0.144	0.001	mg/L	1	01/17/23	CPP	SW6010D	
Iron	0.644	0.010	mg/L	1	01/23/23	CPP	SW6010D	
Manganese	0.155	0.001	mg/L	1	01/23/23	CPP	SW6010D	
Zinc	< 0.004	0.004	mg/L	1	01/23/23	CPP	SW6010D	
Alkalinity-CaCO3	45	20.0	mg/L	1	01/16/23	MW/KDB	SM2320B-11	
Color, Apparent	15	1	Color Units	1	01/16/23	MW	SM2120B-11	
Conductivity	364	5.00	umhos/cm	1	01/16/23	MW/KDB	SM2510B-11	
Hydrogen Sulfide	< 0.05	0.05	mg/L	1	01/16/23	GD	SM4500SH	
Ammonia as Nitrogen	0.05	0.05	mg/L	1	01/20/23	KDB	E350.1	
Nitrite as Nitrogen	< 0.01	0.01	mg/L	1	01/16/23 23:24	BS/GD	E300.0	
Nitrate as Nitrogen	4.05	0.10	mg/L	2	01/17/23 20:22	BS/GD	E300.0	
Sulfate	13.0	5.0	mg/L	1	01/16/23	BS/GD	E300.0	
Tot. Diss. Solids	230	10	mg/L	1	01/17/23	Z/NP	SM2540C-15	
Total Organic Carbon	< 1.0	1.0	mg/L	1	01/18/23	EG	SM5310B-14	
Phosphorus, as P	0.032	0.010	mg/L	1	01/17/23	MI	SM4500PE-11	
Filtration	Completed				01/16/23	AG	0.45um Filter	
Dissolved Metals Preparation	Completed				01/16/23	AG	SW3005A	
Total Metals Digestion	Completed				01/18/23	AG		
Silica	18.9	0.500	mg/L		01/19/23	*	E200.7	7

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference

7 = This parameter is not certified by MA for this matrix.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

* Silica analysis was subcontracted to Summit Environmental Technologies Inc. MA does not certify for this analysis.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director
January 25, 2023
Reviewed and Released by: Makrina Nolan

QA/QC Report

January 25, 2023

QA/QC Data

SDG I.D.: GCN23857

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 660174 (mg/L), QC Sample No: CN24070 (CN23857)													
ICP Metals - Dissolved													
Iron	BRL	0.011	0.055	0.052	NC	91.9	90.1	2.0	87.6			80 - 120	20
Manganese	BRL	0.001	0.399	0.394	1.30	91.1	89.2	2.1	84.2			80 - 120	20
Comment:													
Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.													
QA/QC Batch 660476 (mg/L), QC Sample No: CN24477 (CN23857)													
ICP Metals - Aqueous													
Iron	BRL	0.010	0.102	0.123	18.7	110	110	0.0	109			80 - 120	20
Manganese	BRL	0.001	0.001	0.001	NC	108	108	0.0	108			80 - 120	20
Zinc	BRL	0.004	0.005	0.006	NC	106	107	0.9	106			80 - 120	20
Comment:													
Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.													

QA/QC Report

January 25, 2023

QA/QC Data

SDG I.D.: GCN23857

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 660125 (mg/L), QC Sample No: CN23573 (CN23857)													
Hydrogen Sulfide	BRL	0.05	<0.050	<0.05	NC	93.5			88.2			90 - 110	20
Comment:													
Additional: LCS acceptance range is 90-110% MS acceptance range 75-125%.													
QA/QC Batch 660216 (mg/L), QC Sample No: CN23835 (CN23857)													
Alkalinity-CaCO3	BRL	5.00	32	34	NC	89.5						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 660218 (umhos/cm), QC Sample No: CN23835 (CN23857)													
Conductivity	BRL	5.00	445	445	0	98.4						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 660279 (mg/L), QC Sample No: CN23853 (CN23857)													
Phosphorus, as P	BRL	0.01	0.106	0.100	5.80	105			97.7			85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 660239 (mg/L), QC Sample No: CN23857 (CN23857)													
Tot. Diss. Solids	BRL	10	230	220	4.40	98.0						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 660587 (mg/L), QC Sample No: CN24558 (CN23857)													
Total Organic Carbon	BRL	1.0	1.2	1.1	NC	105			108			85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 660457 (mg/L), QC Sample No: CN23429 (CN23857)													
Nitrate as Nitrogen	BRL	0.05	<0.05	<0.05	NC	101			99.2			90 - 110	20
Sulfate	BRL	5.0	<3.0	<5.0	NC	101			90.8			90 - 110	20
QA/QC Batch 660295 (mg/L), QC Sample No: CN23980 (CN23857)													
Nitrate as Nitrogen	BRL	0.05	2.33	2.34	0.40	100			108			90 - 110	20
Nitrite as Nitrogen	BRL	0.004	<0.004	<0.004	NC	100			101			90 - 110	20
Sulfate	BRL	5.0	11.1	10.8	NC	101			94.8			90 - 110	20
QA/QC Batch 660702 (mg/L), QC Sample No: CN24446 (CN23857)													
Ammonia as Nitrogen	BRL	0.05	<0.10	<0.10	NC	101			101			90 - 110	20

QA/QC Data

SDG I.D.: GCN23857

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

RPD - Relative Percent Difference
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MS Dup - Matrix Spike Duplicate
NC - No Criteria
Intf - Interference

Phyllis Shiller

Phyllis Shiller, Laboratory Director
January 25, 2023

Wednesday, January 25, 2023

Criteria: None

State: MA

Sample Criteria Exceedances Report

GCN23857 - BLUELEAF

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units

*** No Data to Display ***

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

Analysis Comments

January 25, 2023 SDG I.D.: GCN23857

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

Cooler: Yes ☑ No ☐
Coolant: IPK ☑ ICE ☐ No ☐

PHOENIX
Environmental Laboratories, Inc.

CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email Makrina Nolan: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 1.5 C Pg of

Data Delivery/Contact Options:
☐ Fax:
☐ Phone:
☐ Email:

Customer: Blueleaf, Inc.
Address: 57 Dresser Hill Rd
Charlton, MA 01507

Project: Sharon
Report to: Aaron Davis
Invoice to: Erik Grotton
QUOTE #

Project P.O:

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature Date: 1/13/23

Matrix Code:
DW=Drinking Water **GW**=Ground Water **SW**=Surface Water **WW**=Waste Water
RW=Raw Water **SE**=Sediment **SL**=Sludge **S**=Soil **SD**=Solid **W**=Wipe **OIL**=Oil
B=Bulk **L**=Liquid **X** = ____________(Other)

Analysis Request

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	Apparent Color	H2S	Total Phosphates	TOC	Silica, TDS	Conductivity, Alkalinity	SO4⁻, NO2⁻, NO3⁻, NH4+	Total Fe, Mn, Zn	Dis Fe, Mn	MS/MSD*	GL Amber 8 oz. [ ] H3PO4 [ ] NAHSO4	Soil VOA Vials [ ] methanol [ ] H2O	GL Soil container ( )oz	GL Soil container ( )oz	40 ml VOA Vial [ ] As is [ ] HCL	GL Amber 1000ml [ ] As is [ ] H2SO4	PL As is [ ]250ml [ ]500ml [ ]1000ml	PL H2SO4 [ ]250ml [ ]500ml	PL HNO3 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is
23857	RAW	GW	1/13/23	13:10	X	X	X	X	X	X	X	X	X													

Relinquished by:	Accepted by:	Date:	Time:
	Matt Saffalus	1/16/23	1045
ST		1-16-23	1155

Comments, Special Requirements or Regulations:

*MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.

Turnaround Time:
☐ 1 Day*
☐ 2 Days*
☐ 3 Days*
☐ Standard
☐ Other
* **SURCHARGE APPLIES**

RI
☐ (Residential) Direct Exposure
☐ (Comm/Industrial) Direct Exposure
☐ GA Leachability
☐ GB Leachability
☐ GA-GW Objectives
☐ GB-GW Objectives

CT
☐ RCP Cert
☐ GW Protection
☐ SW Protection
☐ GA Mobility
☐ GB Mobility
☐ Residential DEC
☐ I/C DEC
☐ Other

MA
☐ MCP Certification
☐ GW-1 ☐ MWRA eSMART
☐ GW-2 ☐ S-1 10% CALC
☐ GW-3
☐ S-1 GW-1 ☐ S-1 GW-2 ☐ S-1 GW-3
☐ S-2 GW-1 ☐ S-2 GW-2 ☐ S-2 GW-3
☐ S-3 GW-1 ☐ S-3 GW-2 ☐ S-3 GW-3
☐ SW Protection

State where samples were collected: ________

Data Format
☐ Excel
☐ PDF
☐ GIS/Key
☐ EQuIS
☐ Other

Data Package
☐ Tier II Checklist
☐ Full Data Package*
☐ Phoenix Std Report
☐ Other

* **SURCHARGE APPLIES**

PEL-126 REV. 03/22

Makrina Nolan

From:	Makrina Nolan
Sent:	Tuesday, January 17, 2023 1:50 PM
To:	adavis@blueleafwater.com
Subject:	Sharon
Attachments:	GCN23857-ChainofCustody-1.pdf

Hi Aaron,

We received your sample, with regards to the attached chain. Unfortunately, this sample was received and analyzed past hold for Color, Nitrate, and Nitrite. These results will be reported to you past hold with a comment on the report to reflect this.

Thank you,

Makrina Nolan
Client Services –Project Manager
Drinking Water Specialist
Phoenix Environmental Labs
587 Middle Turnpike East
Manchester, CT
Phone: 860-645-1102 ext 318
Website: www.phoenixlabs.com

ANALYTICAL REPORT

Lab Number:	L2302370
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Aaron Davis
Phone:	(508) 248-7094
Project Name:	SHARON WELL 2
Project Number:	05503
Report Date:	01/20/23

The original project report/data package is held by Alpha Analytical. This report/data package is paginated and should be reproduced only in its entirety. Alpha Analytical holds no responsibility for results and/or data that are not consistent with the original.

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NJ (MA935), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-17-00196).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: SHARON WELL 2
Project Number: 05503

Lab Number: L2302370
Report Date: 01/20/23

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2302370-01	RAW	WATER	SHARON, MA	01/13/23 13:10	01/13/23

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Caitlin Walukevich Caitlin Walukevich

Title: Technical Director/Representative Date: 01/20/23

INORGANICS
&
MISCELLANEOUS

SAMPLE RESULTS

Lab ID: L2302370-01
Client ID: RAW
Sample Location: SHARON, MA
Date Collected: 01/13/23 13:10
Date Received: 01/13/23
Field Prep: Not Specified

Sample Depth:
Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	01/13/23 16:44	121,9223B	TLH
Escherichia Coli	Negative		col/100ml	-	NA	1	-	01/13/23 16:44	121,9223B	TLH

Method Blank Analysis

Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Bacteria in Water - Westborough Lab for sample(s): 01 Batch: WG1733313-1										
Coliform, Total	Negative		col/100ml	-	NA	1	-	01/13/23 16:44	121,9223B	TLH
Escherichia Coli	Negative		col/100ml	-	NA	1	-	01/13/23 16:44	121,9223B	TLH

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	*Custody Seal*
A	Absent

Container Information

Container ID	*Container Type*	*Cooler*	*Initial pH*	*Final pH*	*Temp deg C*	*Pres*	*Seal*	*Frozen Date/Time*	*Analysis(*)*
L2302370-01A	Bacteria Cup unpreserved	A	NA		3.3	Y	Absent		T-COLI-C(.33)

*Values in parentheses indicate holding time in days

GLOSSARY

Acronyms

DL	- Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EMPC	- Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LOD	- Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
LOQ	- Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.) Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
NR	- No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TEF	- Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.
TEQ	- Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Report Format: Data Usability Report

Footnotes

1	- The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Chlordane: The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Gasoline Range Organics (GRO): Gasoline Range Organics (GRO) results include all chromatographic peaks eluting from Methyl tert butyl ether through Naphthalene, with the exception of GRO analysis in support of State of Ohio programs, which includes all chromatographic peaks eluting from Hexane through Dodecane.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW compliance analysis only, the 'PFAS, Total (6)' result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A	- Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.
B	- The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).
C	- Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.
D	- Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.
E	- Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.
F	- The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.
G	- The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.
H	- The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.
I	- The lower value for the two columns has been reported due to obvious interference.
J	- Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).
M	- Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

Data Qualifiers

ND	- Not detected at the reporting limit (RL) for the sample.
NJ	- Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.
P	- The RPD between the results for the two columns exceeds the method-specified criteria.
Q	- The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)
R	- Analytical results are from sample re-analysis.
RE	- Analytical results are from sample re-extraction.
S	- Analytical results are from modified screening analysis.
V	- The surrogate associated with this target analyte has a recovery outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)
Z	- The batch matrix spike and/or duplicate associated with this target analyte has a recovery/RPD outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

REFERENCES

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624/624.1: m/p-xylene, o-xylene, Naphthalene
EPA 625/625.1: alpha-Terpineol
EPA 8260C/8260D: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D/8270E: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine, alpha-Terpineol; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility
SM 2540D: TSS
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N**, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603, SM9222D.**

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522, EPA 537.1.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb**,** As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

ALPHA ANALYTICAL

8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 1/13/23

ALPHA Job #: L2302370

Client Information

Client: Blueleaf, Inc
Address: 57 Dresser Hill Rd
Charlton, MA 01507
Phone: 774 200 8029
Email: adavis@blueleafwater.com

Project Information

Project Name: Sharon Well 2
Project Location: Sharon, MA
Project #: 05503
Project Manager: Aaron Davis
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)

Date Due:

Report Information - Data Deliverables

☒ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program ____________ Criteria ____________

Additional Project Information:

SAMPLE INFO

Filtration
☐ Field
☐ Lab to do

Preservation
☐ Lab to do

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	ANALYSIS VOC: ☐ 8260 ☐ 624 ☐ 524.2	SVOC: ☐ ABN ☐ PAH	METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15	METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13	EPH: ☐ Ranges & Targets ☐ Ranges Only	VPH: ☐ Ranges & Targets ☐ Ranges Only	☐ PCB ☐ PEST	TPH: ☐ Quant Only ☐ Fingerprint	Total Coliform						Sample Comments	TOTAL # BOTTLES
02370-01	RAW	1/13	13^{10}	GW	IR									X							

Container Type													
Preservative													

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
	1/13/23 15:26		1/13/23 1526

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

PHOENIX
Environmental Laboratories, Inc.

Thursday, February 02, 2023

Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Project ID: SHARON
SDG ID: GCN30219
Sample ID#s: CN30219

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B
NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Sample Id Cross Reference

February 02, 2023

SDG I.D.: GCN30219

Project ID: SHARON

Client Id	Lab Id	Matrix
RAW	CN30219	GROUND WATER

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

February 02, 2023

FOR:
Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	GROUND WATER	Collected by:		01/25/23	9:00
Location Code:	BLUELEAF	Received by:	B	01/25/23	17:00
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN30219
Phoenix ID: CN30219

Project ID: SHARON
Client ID: RAW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Iron (Dissolved)	0.011	0.011	mg/L	1	01/28/23	TH	SW6010D	
Manganese (Dissolved)	0.153	0.001	mg/L	1	01/28/23	TH	SW6010D	
Iron	0.768	0.010	mg/L	1	01/31/23	CPP	SW6010D	
Manganese	0.159	0.001	mg/L	1	01/31/23	CPP	SW6010D	
Zinc	< 0.004	0.004	mg/L	1	01/31/23	CPP	SW6010D	
Alkalinity-CaCO3	44	20.0	mg/L	1	01/26/23	MW/EG	SM2320B-11	
Color, Apparent	< 1	1	Color Units	1	01/25/23 20:03	MEL	SM2120B-11	
Conductivity	332	5.00	umhos/cm	1	01/26/23	MW/EG	SM2510B-11	
Hydrogen Sulfide	< 0.05	0.05	mg/L	1	01/31/23	GD	SM4500SH	
Ammonia as Nitrogen	0.15	0.05	mg/L	1	01/27/23	KDB	E350.1	
Nitrite as Nitrogen	< 0.01	0.01	mg/L	1	01/26/23 00:28	BS/GD	E300.0	
Nitrate as Nitrogen	3.64	0.10	mg/L	2	01/26/23 20:08	BS/GD	E300.0	
Sulfate	12.6	5.0	mg/L	1	01/26/23	BS/GD	E300.0	
Tot. Diss. Solids	230	10	mg/L	1	01/27/23	Z	SM2540C-15	
Total Organic Carbon	< 1.0	1.0	mg/L	1	01/31/23	EG	SM5310B-14	
Total Phosphate as PO4	0.08	0.03	mg/L	0.99	01/26/23	MI	SM4500PE-11	
Filtration	Completed				01/26/23	AG	0.45um Filter	
Dissolved Metals Preparation	Completed				01/26/23	AG	SW3005A	
Total Metals Digestion	Completed				01/30/23	AG		
Silica	17.6	0.500	mg/L		01/31/23	*	E200.7	C,7

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference

7 = This parameter is not certified by MA for this matrix.
C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

* Silica analysis was subcontracted to Summit Environmental Technologies Inc. MA does not certify for this analysis.

Silica (E200.7) was analyzed by MA certified lab #M-OH923.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 02, 2023
Reviewed and Released by: Anil Makol, Project Manager

QA/QC Report

February 02, 2023

QA/QC Data

SDG I.D.: GCN30219

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 661658 (mg/L), QC Sample No: CN30219 (CN30219)													
ICP Metals - Dissolved													
Iron	BRL	0.011	0.011	0.011	NC	93.3	95.6	2.4	96.2			80 - 120	20
Manganese	BRL	0.001	0.153	0.153	0	94.5	96.7	2.3	97.3			80 - 120	20
Comment:													
Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.													
QA/QC Batch 662046 (mg/L), QC Sample No: CN31950 (CN30219)													
ICP Metals - Aqueous													
Iron	BRL	0.010	0.346	0.344	0.60	101	103	2.0	106	98.0	7.8	80 - 120	20
Manganese	BRL	0.001	0.115	0.115	0	101	103	2.0	106	100	5.8	80 - 120	20
Zinc	BRL	0.004	<0.004	<0.004	NC	99.0	101	2.0	107	102	4.8	80 - 120	20
Comment:													
Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.													

QA/QC Report

February 02, 2023

QA/QC Data

SDG I.D.: GCN30219

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 661772 (mg/L), QC Sample No: CN29915 (CN30219)													
Tot. Diss. Solids	BRL	10	200	200	0	97.0						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 661647 (mg/L), QC Sample No: CN29932 (CN30219)													
Total Phosphate as PO4	BRL	0.01	5.81	5.61	3.50	104			98.8			85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 661626 (mg/L), QC Sample No: CN29934 (CN30219)													
Alkalinity-CaCO3	BRL	5.00	139	138	0.70	92.4						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 661632 (umhos/cm), QC Sample No: CN29934 (CN30219)													
Conductivity	BRL	5.00	1080	1090	0.90	98.6						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 662143 (mg/L), QC Sample No: CN30219 (CN30219)													
Hydrogen Sulfide	BRL	0.05	<0.05	<0.05	NC	91.1			84.6			90 - 110	20
Comment:													
Additional: LCS acceptance range is 90-110% MS acceptance range 75-125%.													
QA/QC Batch 662365 (mg/L), QC Sample No: CN32025 (CN30219)													
Total Organic Carbon	BRL	1.0	2.9	3.0	NC	102			98.0			85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 661651 (mg/L), QC Sample No: CN29885 (CN30219)													
Nitrate as Nitrogen	BRL	0.05	0.33	0.33	0	91.7			98.7			90 - 110	20
Nitrite as Nitrogen	BRL	0.004	<0.004	<0.004	NC	90.8			105			90 - 110	20
Sulfate	BRL	5.0	7.7	7.5	NC	98.7			96.3			90 - 110	20
QA/QC Batch 661824 (mg/L), QC Sample No: CN30595 (CN30219)													
Sulfate	BRL	5.0	8.70	8.7	NC	100			96.6			90 - 110	20
QA/QC Batch 661824 (mg/L), QC Sample No: CN30595 (CN30219)													
Nitrate as Nitrogen	BRL	0.05	<0.05	<0.05	NC	95.8			102			90 - 110	20
QA/QC Batch 661670 (mg/L), QC Sample No: CN30093 (CN30219)													
Ammonia as Nitrogen	BRL	0.05	0.11	0.15	NC	98.4			100			90 - 110	20

QA/QC Data

SDG I.D.: GCN30219

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

RPD - Relative Percent Difference
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MS Dup - Matrix Spike Duplicate
NC - No Criteria
Intf - Interference

Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 02, 2023

Thursday, February 02, 2023

Criteria: None

State: MA

Sample Criteria Exceedances Report

GCN30219 - BLUELEAF

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units

*** No Data to Display ***

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

Analysis Comments

February 02, 2023 SDG I.D.: GCN30219

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

Cooler: Yes ☒ No ☐
Coolant: IPK ☒ ICE ☐ No ☐

PHOENIX
Environmental Laboratories, Inc.

CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email Makrina Nolan: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 1.7 °C Pg of

Data Delivery/Contact Options:
☐ Fax:
☐ Phone:
☐ Email:

Customer: Bluelect, Inc.
Address: 57 Dresser Hill Rd.
Charlton, MA 01507

Project: Sharon
Report to: Aaron Davis
Invoice to: Erik Grotton
QUOTE #

Project P.O:

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature Date:

Matrix Code:
DW=Drinking Water **GW**=Ground Water **SW**=Surface Water **WW**=Waste Water
RW=Raw Water **SE**=Sediment **SL**=Sludge **S**=Soil **SD**=Solid **W**=Wipe **OIL**=Oil
B=Bulk **L**=Liquid **X** = ____________(Other)

Analysis Request

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	Apparent Color	H_2S	Total Phosphates	TOC	Silica + TDS	Conductivity + Alkalinity	SO_4^- + NO_2^- + NO_3^- + NH_4^+	Total Fe + Mn + Zn	Dis Fe + Mn	MS/MSD*	GL Amber 8 oz. [ ] H3PO4 [ ] NAHSO4	Soil VOA Vials [ ] methanol [ ] H2O	GL Soil container ( )oz	GL Soil container ( )oz	40 ml VOA Vial [ ] As is [ ] HCL	GL Amber 1000ml [ ] As is [ ] H2SO4	PL As is [ ] 250ml [ ] 500ml [ ] 1000ml	PL H2SO4 [ ] 250ml [ ] 500ml	PL HNO3 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is	Total
30219	RAW	GW	1/25/23	9:00	X	X	X	X	X	X	X	X	X														9

Relinquished by:	**Accepted by:**	**Date:**	**Time:**
		1/25/23	15:45
	Emily	1/25/23	1700

Comments, Special Requirements or Regulations:

**MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.*

Turnaround Time:
☐ 1 Day*
☐ 2 Days*
☐ 3 Days*
☒ Standard
☐ Other
*** SURCHARGE APPLIES**

RI
☐ (Residential) Direct Exposure
☐ (Comm/Industrial) Direct Exposure
☐ GA Leachability
☐ GB Leachability
☐ GA-GW Objectives
☐ GB-GW Objectives

CT
☐ RCP Cert
☐ GW Protection
☐ SW Protection
☐ GA Mobility
☐ GB Mobility
☐ Residential DEC
☐ I/C DEC
☐ Other

MA
☐ MCP Certification
☐ GW-1
☐ GW-2
☐ GW-3
☐ MWRA eSMART
☐ S-1 10% CALC
☐ S-1 GW-1 ☐ S-1 GW-2 ☐ S-1 GW-3
☐ S-2 GW-1 ☐ S-2 GW-2 ☐ S-2 GW-3
☐ S-3 GW-1 ☐ S-3 GW-2 ☐ S-3 GW-3
☐ SW Protection

State where samples were collected: MA

Data Format
☐ Excel
☐ PDF
☐ GIS/Key
☐ EQuIS
☐ Other

Data Package
☐ Tier II Checklist
☐ Full Data Package*
☐ Phoenix Std Report
☐ Other

*** SURCHARGE APPLIES**

PHOENIX
Environmental Laboratories, Inc.

Monday, February 13, 2023

Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Project ID: SHARON
SDG ID: GCN33583
Sample ID#s: CN33583 - CN33588

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B

NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301

Sample Id Cross Reference

February 13, 2023

SDG I.D.: GCN33583

Project ID: SHARON

Client Id	Lab Id	Matrix
RAW	CN33583	GROUND WATER
F1	CN33584	WATER
F2	CN33585	WATER
M1	CN33586	WATER
M1 CBW	CN33587	GROUND WATER
M1 SSN	CN33588	GROUND WATER

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

February 13, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	GROUND WATER	Collected by:		02/01/23	10:30
Location Code:	BLUELEAF	Received by:	CP	02/01/23	13:25
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN33583
Phoenix ID: CN33583

Project ID: SHARON
Client ID: RAW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron (Dissolved)	0.058	0.011	mg/L	1	02/03/23	TH	SW6010D
Manganese (Dissolved)	0.152	0.001	mg/L	1	02/03/23	TH	SW6010D
Iron	1.34	0.010	mg/L	1	02/03/23	CPP	SW6010D
Manganese	0.154	0.001	mg/L	1	02/03/23	CPP	SW6010D
Escherichia Coli	<10	10	MPN/100 mls	10	02/01/23 15:40	KG/RM	SM9223B-16
Total Coliforms	<10	10	MPN/100 mls	10	02/01/23 15:40	KG/RM	SW9223B-16
Color, Apparent	15	1	Color Units	1	02/01/23	MW	SM2120B-11
Hydrogen Sulfide	< 0.05	0.05	mg/L	1	02/07/23	GD	SM4500SH
Filtration	Completed				02/01/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed				02/01/23	AG	SW3005A
Total Metals Digestion	Completed				02/02/23	AG	

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 13, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

February 13, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		02/01/23	9:00
Location Code:	BLUELEAF	Received by:	CP	02/01/23	13:25
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN33583
Phoenix ID: CN33584

Project ID: SHARON
Client ID: F1

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	0.017	0.010	mg/L	1	02/03/23	CPP	SW6010D/E200.7
Manganese	0.147	0.001	mg/L	1	02/03/23	CPP	SW6010D/E200.7
Total Metals Digestion	Completed				02/02/23	AG	

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 13, 2023
Reviewed and Released by: Makrina Nolan

Analysis Report

February 13, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		02/01/23	9:00
Location Code:	BLUELEAF	Received by:	CP	02/01/23	13:25
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN33583
Phoenix ID: CN33585

Project ID: SHARON
Client ID: F2

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	0.017	0.010	mg/L	1	02/03/23	CPP	SW6010D/E200.7
Manganese	0.146	0.001	mg/L	1	02/03/23	CPP	SW6010D/E200.7
Total Metals Digestion	Completed				02/02/23	AG	

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 13, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

February 13, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		02/01/23	9:00
Location Code:	BLUELEAF	Received by:	CP	02/01/23	13:25
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN33583
Phoenix ID: CN33586

Project ID: SHARON
Client ID: M1

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	< 0.010	0.010	mg/L	1	02/03/23	CPP	SW6010D/E200.7
Manganese	0.026	0.001	mg/L	1	02/03/23	CPP	SW6010D/E200.7
Total Metals Digestion	Completed				02/02/23	AG	

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 13, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

February 13, 2023

FOR:
Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	GROUND WATER	Collected by:		01/31/23	9:39
Location Code:	BLUELEAF	Received by:	CP	02/01/23	13:25
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN33583
Phoenix ID: CN33587

Project ID: SHARON
Client ID: M1 CBW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron (Dissolved)	< 0.011	0.011	mg/L	1	02/03/23	TH	SW6010D
Manganese (Dissolved)	< 0.001	0.001	mg/L	1	02/03/23	TH	SW6010D
Iron	53.6	0.010	mg/L	1	02/03/23	CPP	SW6010D
Manganese	364	1.0	mg/L	1000	02/07/23	TH	SW6010D
Settleable Solids	32.0	0.10	ml/L	1	02/02/23 05:00	KDB	SM2540F-15
Total Suspended Solids	1300	10	mg/L	2	02/02/23	Z/NP	SM2540D-15
Filtration	Completed				02/01/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed				02/01/23	AG	SW3005A
Total Metals Digestion	Completed				02/02/23	AG	

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 13, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

February 13, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	GROUND WATER	Collected by:		01/31/23	13:40
Location Code:	BLUELEAF	Received by:	CP	02/01/23	13:25
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN33583
Phoenix ID: CN33588

Project ID: SHARON
Client ID: M1 SSN

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron (Dissolved)	< 0.011	0.011	mg/L	1	02/03/23	TH	SW6010D
Manganese (Dissolved)	0.003	0.001	mg/L	1	02/10/23	TH	SW6010D
Iron	1.86	0.010	mg/L	1	02/03/23	CPP	SW6010D
Manganese	5.07	0.010	mg/L	10	02/07/23	TH	SW6010D
Total Suspended Solids	18	5.0	mg/L	1	02/02/23	Z/NP	SM2540D-15
Filtration	Completed				02/01/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed				02/01/23	AG	SW3005A
Total Metals Digestion	Completed				02/02/23	AG	

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 13, 2023
Reviewed and Released by: Makrina Nolan

QA/QC Report

February 13, 2023

QA/QC Data

SDG I.D.: GCN33583

QA/QC Batch 662466 (mg/L), QC Sample No: CN33483 (CN33583, CN33587, CN33588)

ICP Metals - Dissolved

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits	
Iron	BRL	0.011	0.421	0.398	5.60	88.4	79.0	11.2	84.8			80 - 120	20	l
Manganese	BRL	0.001	0.094	0.096	2.10	88.6	80.1	10.1	89.0			80 - 120	20	

Comment:

Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.

QA/QC Batch 662602 (mg/L), QC Sample No: CN33583 (CN33583, CN33584, CN33585, CN33586, CN33587, CN33588)

ICP Metals - Aqueous

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
Iron	BRL	0.010	1.34	1.39	3.70	104	103	1.0	116			80 - 120	20
Manganese	BRL	0.001	0.154	0.159	3.20	105	104	1.0	102			80 - 120	20

Comment:

Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.

l = This parameter is outside laboratory LCS/LCSD specified recovery limits.

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

QA/QC Report

February 13, 2023

QA/QC Data

SDG I.D.: GCN33583

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 663245 (mg/L), QC Sample No: CN33583 (CN33583)													
Hydrogen Sulfide	BRL	0.05	<0.05	<0.05	NC	91.7			92.9			90 - 110	20
Comment:													
Additional: LCS acceptance range is 90-110% MS acceptance range 75-125%.													
QA/QC Batch 662507 (mg/L), QC Sample No: CN33624 (CN33587, CN33588)													
Total Suspended Solids	BRL	2.5	<2.0	<2.0	NC	95.0						85 - 115	

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

RPD - Relative Percent Difference
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MS Dup - Matrix Spike Duplicate
NC - No Criteria
Intf - Interference

Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 13, 2023

Monday, February 13, 2023

Criteria: None

State: MA

Sample Criteria Exceedances Report

GCN33583 - BLUELEAF

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units

*** No Data to Display ***

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

Analysis Comments

February 13, 2023 SDG I.D.: GCN33583

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

Cooler: Yes ☑ No ☐
Coolant: IPK ☑ ICE ☐ No ☐

PHOENIX
Environmental Laboratories, Inc.

CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email Makrina Nolan: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 1.3 °C **Pg** of

Data Delivery/Contact Options:
☐ Fax:
☐ Phone:
☐ Email:

Customer: Bluelect, Inc
Address: 57 Dresser Hill Rd.
Charlton, MA 01507

Project: Sharon
Report to: Aaron Davis
Invoice to: Erik Grotton
QUOTE #

Project P.O:

This section MUST be completed with Bottle Quantities.

Client Sample - information - Identification

Sampler's Signature Date:

Matrix Code:
DW=Drinking Water **GW**=Ground Water **SW**=Surface Water **WW**=Waste Water
RW=Raw Water **SE**=Sediment **SL**=Sludge **S**=Soil **SD**=Solid **W**=Wipe **OIL**=Oil
B=Bulk **L**=Liquid **X** = (Other) BW = Backwash

Analysis Request

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	Total Coliform	Apparent Color	H2S	Total Fe, Mn	Dis Fe, Mn	Settleable Solids	TSS			MS/MSD *	GL Amber 8 oz. [ ] H3PO4 [ ] NAHSO4	Soil VOA Vials [ ] methanol [ ] H2O	GL Soil container ( )oz	GL Soil container ( )oz	40 ml VOA Vial [ ] As is [ ] HCL	GL Amber 1000ml [ ] As is [ ] H2SO4	PL As is [ ] 250ml [ ] 500ml [ ] 1000ml	PL H2SO4 [ ] 250ml [ ] 500ml	PL HNO3 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is	Bottles
33583	RAW	GW	2/1/23	10:30	X	X	X	X	X											2		1	1		1		5
33584	F1	DW		9:00				X														1					1
33585	F2							X														1					1
33586	M1	↓	↓	↓				X														1					1
33587	M1 CBW	BW	1/31	9:39				X	X	X	X									3		1					4
33588	M1 SSN	↓	↓	13:40				X	X		X									2		1					3

Relinquished by:	Accepted by:	Date:	Time:
		2/1/23	1240
		2/1/23	13:25

Comments, Special Requirements or Regulations:
Lab Filter Dissolved Metals

Turnaround Time:
☐ 1 Day*
☐ 2 Days*
☐ 3 Days*
☒ Standard
☐ Other
* SURCHARGE APPLIES

RI
☐ (Residential) Direct Exposure
☐ (Comm/Industrial) Direct Exposure
☐ GA Leachability
☐ GB Leachability
☐ GA-GW Objectives
☐ GB-GW Objectives

CT
☐ RCP Cert
☐ GW Protection
☐ SW Protection
☐ GA Mobility
☐ GB Mobility
☐ Residential DEC
☐ I/C DEC
☐ Other

MA
☐ MCP Certification
☐ GW-1 ☐ MWRA eSMART
☐ GW-2 ☐ S-1 10% CALC
☐ GW-3
☐ S-1 GW-1 ☐ S-1 GW-2 ☐ S-1 GW-3
☐ S-2 GW-1 ☐ S-2 GW-2 ☐ S-2 GW-3
☐ S-3 GW-1 ☐ S-3 GW-2 ☐ S-3 GW-3
☐ SW Protection

State where samples were collected: MA

Data Format
☐ Excel
☐ PDF
☐ GIS/Key
☐ EQuIS
☐ Other

Data Package
☐ Tier II Checklist
☐ Full Data Package*
☐ Phoenix Std Report
☐ Other

* SURCHARGE APPLIES

**MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.*

PHOENIX
Environmental Laboratories, Inc.

Monday, February 13, 2023

Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Project ID: SHARON
SDG ID: GCN35613
Sample ID#s: CN35613 - CN35616

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B

NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Sample Id Cross Reference

February 13, 2023

SDG I.D.: GCN35613

Project ID: SHARON

Client Id	Lab Id	Matrix
F1 CBW	CN35613	WATER
F2 CBW	CN35614	WATER
F1 SSN	CN35615	WATER
F2 SSN	CN35616	WATER

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

February 13, 2023

FOR: Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		02/02/23	9:33
Location Code:	BLUELEAF	Received by:	SR1	02/03/23	13:12
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN35613
Phoenix ID: CN35613

Project ID: SHARON
Client ID: F1 CBW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron (Dissolved)	0.056	0.011	mg/L	1	02/04/23	CPP	SW6010D/E200.7
Manganese (Dissolved)	0.047	0.001	mg/L	1	02/04/23	CPP	SW6010D/E200.7
Iron	213	0.10	mg/L	10	02/10/23	CPP	SW6010D/E200.7
Manganese	0.551	0.001	mg/L	1	02/04/23	CPP	SW6010D/E200.7
Settleable Solids	6.00	0.10	ml/L	1	02/04/23 06:10	KDB	SM2540F-15
Total Suspended Solids	360	13	mg/L	2.5	02/07/23	Z	SM2540D-15
Filtration	Completed				02/03/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed				02/03/23	AG	SW3005A
Total Metals Digestion	Completed				02/03/23	AG	SW3005/3010

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 13, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

February 13, 2023

FOR:
Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		02/02/23	10:04
Location Code:	BLUELEAF	Received by:	SR1	02/03/23	13:12
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN35613
Phoenix ID: CN35614

Project ID: SHARON
Client ID: F2 CBW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron (Dissolved)	0.055	0.011	mg/L	1	02/04/23	CPP	SW6010D/E200.7
Manganese (Dissolved)	0.060	0.001	mg/L	1	02/04/23	CPP	SW6010D/E200.7
Iron	92.9	0.010	mg/L	1	02/04/23	CPP	SW6010D/E200.7
Manganese	0.258	0.001	mg/L	1	02/04/23	CPP	SW6010D/E200.7
Settleable Solids	1.50	0.10	ml/L	1	02/04/23 06:10	KDB	SM2540F-15
Total Suspended Solids	300	13	mg/L	2.5	02/07/23	Z	SM2540D-15
Filtration	Completed				02/03/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed				02/03/23	AG	SW3005A
Total Metals Digestion	Completed				02/03/23	AG	SW3005/3010

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 13, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

February 13, 2023

FOR: Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		02/02/23	14:05
Location Code:	BLUELEAF	Received by:	SR1	02/03/23	13:12
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN35613
Phoenix ID: CN35615

Project ID: SHARON
Client ID: F1 SSN

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron (Dissolved)	0.072	0.011	mg/L	1	02/04/23	CPP	SW6010D/E200.7
Manganese (Dissolved)	0.100	0.001	mg/L	1	02/04/23	CPP	SW6010D/E200.7
Iron	13.5	0.010	mg/L	1	02/04/23	CPP	SW6010D/E200.7
Manganese	0.116	0.001	mg/L	1	02/04/23	CPP	SW6010D/E200.7
Settleable Solids	< 0.10	0.10	ml/L	1	02/04/23 06:10	KDB	SM2540F-15
Total Suspended Solids	30	6.3	mg/L	1.3	02/07/23	Z	SM2540D-15
Filtration	Completed				02/03/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed				02/03/23	AG	SW3005A
Total Metals Digestion	Completed				02/03/23	AG	SW3005/3010

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 13, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

February 13, 2023

FOR: Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		02/02/23	14:05
Location Code:	BLUELEAF	Received by:	SR1	02/03/23	13:12
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN35613
Phoenix ID: CN35616

Project ID: SHARON
Client ID: F2 SSN

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron (Dissolved)	0.059	0.011	mg/L	1	02/04/23	CPP	SW6010D/E200.7
Manganese (Dissolved)	0.084	0.001	mg/L	1	02/04/23	CPP	SW6010D/E200.7
Iron	11.1	0.010	mg/L	1	02/06/23	TH	SW6010D/E200.7
Manganese	0.100	0.001	mg/L	1	02/06/23	TH	SW6010D/E200.7
Settleable Solids	< 0.10	0.10	ml/L	1	02/04/23 06:10	KDB	SM2540F-15
Total Suspended Solids	31	5.0	mg/L	1	02/07/23	Z	SM2540D-15
Filtration	Completed				02/03/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed				02/03/23	AG	SW3005A
Total Metals Digestion	Completed				02/04/23	AG	

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 13, 2023
Reviewed and Released by: Makrina Nolan

QA/QC Report

February 13, 2023

QA/QC Data

SDG I.D.: GCN35613

QA/QC Batch 662825 (mg/L), QC Sample No: CN34667 (CN35613, CN35614, CN35615, CN35616)

ICP Metals - Dissolved

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
Iron	BRL	0.011	0.017	0.021	NC	89.2	90.8	1.8	93.2			80 - 120	20
Manganese	BRL	0.001	1.40	1.44	2.80	90.2	92.0	2.0	93.9			80 - 120	20

Comment:

Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.

QA/QC Batch 662830 (mg/L), QC Sample No: CN35413 (CN35613, CN35614, CN35615)

ICP Metals - Aqueous

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
Iron	BRL	0.010	0.216	0.214	0.90	100	101	1.0	98.7			80 - 120	20
Manganese	BRL	0.001	0.001	0.001	NC	99.7	101	1.3	99.1			80 - 120	20

Comment:

Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.

QA/QC Batch 662912 (mg/L), QC Sample No: CN35616 (CN35616)

ICP Metals - Aqueous

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
Iron	BRL	0.010	11.1	10.9	1.80	99.2	99.7	0.5	NC			80 - 120	20
Manganese	BRL	0.001	0.100	0.102	2.00	100	101	1.0	102			80 - 120	20

Comment:

Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.

QA/QC Report

February 13, 2023

QA/QC Data

SDG I.D.: GCN35613

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 663141 (mg/L), QC Sample No: CN35553 (CN35613, CN35614, CN35615, CN35616)													
Total Suspended Solids	BRL	2.5	<2.0	<2.0	NC	94.0						85 - 115	

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

RPD - Relative Percent Difference
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MS Dup - Matrix Spike Duplicate
NC - No Criteria
Intf - Interference

Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 13, 2023

Monday, February 13, 2023

Criteria: None

State: MA

Sample Criteria Exceedances Report

GCN35613 - BLUELEAF

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units

*** No Data to Display ***

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

Analysis Comments

February 13, 2023 SDG I.D.: GCN35613

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

Cooler: Yes ☑ No ☐
Coolant: IPK ☑ ICE ☐ No ☐

PHOENIX
Environmental Laboratories, Inc.

CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email Makrina Nolan: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 1.3 °C Pg of

Data Delivery/Contact Options:
☐ Fax:
☐ Phone:
☐ Email:

Customer: Bluleaf, Inc.
Address: 57 Dresser Hill Rd
Charlton, MA 01507

Project: SHARON
Report to: Aaron Davis
Invoice to: Erik Grotton
QUOTE #

Project P.O:

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature: Date:

Matrix Code:
DW=Drinking Water **GW**=Ground Water **SW**=Surface Water **WW**=Waste Water
RW=Raw Water **SE**=Sediment **SL**=Sludge **S**=Soil **SD**=Solid **W**=Wipe **OIL**=Oil
B=Bulk **L**=Liquid **X** = (Other) BW = Backwash

Analysis Request

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	Settleable Solids	TSS	Total Fe, Mn	Dis. Fe, Mn						MS/MSD *	GL Amber 8 oz. [ ] H3PO4 [ ] NAHSO4	Soil VOA Vials [ ] methanol [ ] H2O	GL Soil container ( )oz	GL Soil container ( )oz	40 ml VOA Vial [ ] As is [ ] HCL	GL Amber 1000ml [ ] As is [ ] H2SO4	PL As is [ ]250ml [ ]500ml [ ]1000ml	PL H2SO4 [ ]250ml [ ]500ml	PL HNO3 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is	
35613	F1 CBW	BW	2/2/23	9:33	X	X	X	X																			4
35614	F2 CBW	↓	↓	10:04	X	X	X	X																			4
35615	F1 SSN	↓	↓	14:05	X	X	X	X																			4
35616	F2 SSN	↓	↓	14:05	X	X	X	X																			4

16

Relinquished by:	Accepted by:	Date:	Time:
		2/3/23	1215
		2.3.23	13:12

Comments, Special Requirements or Regulations:
Lab Filter Dissolved Metals

MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.

Turnaround Time:
☐ 1 Day*
☐ 2 Days*
☐ 3 Days*
☐ Standard
☐ Other
* SURCHARGE APPLIES

RI
☐ (Residential) Direct Exposure
☐ (Comm/Industrial) Direct Exposure
☐ GA Leachability
☐ GB Leachability
☐ GA-GW Objectives
☐ GB-GW Objectives

CT
☐ RCP Cert
☐ GW Protection
☐ SW Protection
☐ GA Mobility
☐ GB Mobility
☐ Residential DEC
☐ I/C DEC
☐ Other

MA
☐ MCP Certification
☐ GW-1
☐ GW-2
☐ GW-3
☐ S-1 GW-1
☐ S-2 GW-1
☐ S-3 GW-1
☐ SW Protection
☐ MWRA eSMART
☐ S-1 10% CALC
☐ S-1 GW-2
☐ S-2 GW-2
☐ S-3 GW-2
☐ S-1 GW-3
☐ S-2 GW-3
☐ S-3 GW-3

State where samples were collected:

Data Format
☐ Excel
☐ PDF
☐ GIS/Key
☐ EQuIS
☐ Other

Data Package
☐ Tier II Checklist
☐ Full Data Package*
☐ Phoenix Std Report
☐ Other

* SURCHARGE APPLIES

PEL-126 REV. 03/22

PHOENIX
Environmental Laboratories, Inc.

Friday, February 17, 2023

Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Project ID: SHARON
SDG ID: GCN41560
Sample ID#s: CN41560 - CN41563

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

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Sincerely yours,

Phyllis Shiller

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B
NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Sample Id Cross Reference

February 17, 2023

SDG I.D.: GCN41560

Project ID: SHARON

Client Id	Lab Id	Matrix
RAW	CN41560	GROUND WATER
F1	CN41561	DRINKING WATER
F2	CN41562	DRINKING WATER
M1	CN41563	DRINKING WATER

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

February 17, 2023

FOR: Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	GROUND WATER	Collected by:		02/13/23	10:00
Location Code:	BLUELEAF	Received by:	SR1	02/13/23	15:33
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN41560
Phoenix ID: CN41560

Project ID: SHARON
Client ID: RAW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Nitrate-N	3.59	0.10	mg/L	5	02/13/23 21:16	ER	E353.2

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 17, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

February 17, 2023

FOR: Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		02/13/23	10:00
Location Code:	BLUELEAF	Received by:	SR1	02/13/23	15:33
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN41560
Phoenix ID: CN41561

Project ID: SHARON
Client ID: F1

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Nitrate as Nitrogen	3.63	0.02	2	mg/L		10		02/14/23 18:38	BS/GD	E300.0

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Maximum Contaminant Level (MCL) (Lower of): 310 CMR 22.00 MMCLs; 40 CFR Part 141 MCLs. The highest level of a contaminant that is allowed in drinking water. MCLs are enforceable standards.

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 17, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

February 17, 2023

FOR:
Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information	
Matrix:	DRINKING WATER
Location Code:	BLUELEAF
Rush Request:	Standard
P.O.#:	

Custody Information		Date	Time
Collected by:		02/13/23	10:00
Received by:	SR1	02/13/23	15:33
Analyzed by:	see "By" below		

Laboratory Data

SDG ID: GCN41560
Phoenix ID: CN41562

Project ID: SHARON
Client ID: F2

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Nitrate as Nitrogen	3.68	0.02	2	mg/L		10		02/14/23 18:42	BS/GD	E300.0

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Maximum Contaminant Level (MCL) (Lower of): 310 CMR 22.00 MMCLs; 40 CFR Part 141 MCLs. The highest level of a contaminant that is allowed in drinking water. MCLs are enforceable standards.

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 17, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

February 17, 2023

FOR: Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		02/13/23	10:00
Location Code:	BLUELEAF	Received by:	SR1	02/13/23	15:33
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN41560
Phoenix ID: CN41563

Project ID: SHARON
Client ID: M1

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Nitrate as Nitrogen	3.66	0.02	2	mg/L		10		02/14/23 18:46	BS/GD	E300.0

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Maximum Contaminant Level (MCL) (Lower of): 310 CMR 22.00 MMCLs; 40 CFR Part 141 MCLs. The highest level of a contaminant that is allowed in drinking water. MCLs are enforceable standards.

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 17, 2023
Reviewed and Released by: Makrina Nolan

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

QA/QC Report

February 17, 2023

QA/QC Data

SDG I.D.: GCN41560

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 664390 (mg/L), QC Sample No: CN42379 (CN41561, CN41562, CN41563)													
Nitrate as Nitrogen	BRL	0.05	0.20	0.21	NC	92.1			104			90 - 110	20
QA/QC Batch 664084 (mg/L), QC Sample No: CN41504 (CN41560)													
Nitrate-N	BRL	0.02	<0.02	<0.02	NC	101			100			90 - 110	20

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

RPD - Relative Percent Difference
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MS Dup - Matrix Spike Duplicate
NC - No Criteria
Intf - Interference

Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 17, 2023

Friday, February 17, 2023

Criteria: MA: DW

State: MA

Sample Criteria Exceedances Report

GCN41560 - BLUELEAF

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units

*** No Data to Display ***

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

Analysis Comments

February 17, 2023 SDG I.D.: GCN41560

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

Cooler: ~~Yes~~ ☑ No ☐
Coolant: IPK ☑ ICE ☐ No ☐

PHOENIX
Environmental Laboratories, Inc.

CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email Makrina Nolan: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 15 °C Pg of

Data Delivery/Contact Options:

☐ Fax:
☐ Phone:
☐ Email:

Customer: Blueleaf, Inc
Address: 57 Dresser Hill Rd
Charlton, MA 01507

Project: SHARON
Report to: Aaron Davis
Invoice to: Erik Gratton
QUOTE #

Project P.O:

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature Date: 2/13/23

Matrix Code:
DW=Drinking Water **GW**=Ground Water **SW**=Surface Water **WW**=Waste Water
RW=Raw Water **SE**=Sediment **SL**=Sludge **S**=Soil **SD**=Solid **W**=Wipe **OIL**=Oil
B=Bulk **L**=Liquid **X** = ____________(Other)

Analysis Request

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	Total Nitrate										MS/MSD *	GL Amber 8 oz. [ ] H3PO4 [ ] NAHSO4	Soil VOA Vials [ ] methanol [ ] H2O	GL Soil container ( ) oz	GL Soil container ( ) oz	40 ml VOA Vial [ ] As is [ ] HCL	GL Amber 1000ml [ ] As is [ ] H2SO4	PL As is [X] 250ml [ ] 500ml [ ] 1000ml	PL H2SO4 [ ] 250ml [ ] 500ml	PL HNO3 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is	
41560	RAW	GW	2/13/23	10:00	X																							1
41561	F1	DW	↓	↓	X																							1
41562	F2	↓	↓	↓	X																							1
41563	M1	↓	↓	↓	X																							1
																												4

Relinquished by:	Accepted by:	Date:	Time:
		2/13/23	1410
		2/13/23	1533

Comments, Special Requirements or Regulations:

Turnaround Time:
☐ 1 Day*
☐ 2 Days*
☐ 3 Days*
☐ Standard
☐ Other
*** SURCHARGE APPLIES**

RI
☐ (Residential) Direct Exposure
☐ (Comm/Industrial) Direct Exposure
☐ GA Leachability
☐ GB Leachability
☐ GA-GW Objectives
☐ GB-GW Objectives

CT
☐ RCP Cert
☐ GW Protection
☐ SW Protection
☐ GA Mobility
☐ GB Mobility
☐ Residential DEC
☐ I/C DEC
☐ Other

MA
☐ MCP Certification
☐ GW-1 ☐ MWRA eSMART
☐ GW-2 ☐ S-1 10% CALC
☐ GW-3
☐ S-1 GW-1 ☐ S-1 GW-2 ☐ S-1 GW-3
☐ S-2 GW-1 ☐ S-2 GW-2 ☐ S-2 GW-3
☐ S-3 GW-1 ☐ S-3 GW-2 ☐ S-3 GW-3
☐ SW Protection

Data Format
☐ Excel
☐ PDF
☐ GIS/Key
☐ EQuIS
☐ Other
Data Package
☐ Tier II Checklist
☐ Full Data Package*
☐ Phoenix Std Report
☐ Other
*** SURCHARGE APPLIES**

**MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.*

State where samples were collected: MA

PEL-126 REV. 03/22

PHOENIX
Environmental Laboratories, Inc.

Tuesday, February 21, 2023

Attn: Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Project ID: **SHARON**
SDG ID: **GCN45841**
Sample ID#s: **CN45841**

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B

NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301

SDG Comments

February 21, 2023

SDG I.D.: GCN45841

Sample CN45841 was received past hold time for Settleable Solids (SM2540F).

Sample Id Cross Reference

February 21, 2023

SDG I.D.: GCN45841

Project ID: SHARON

Client Id	Lab Id	Matrix
M1 SSN	CN45841	WASTE WATER

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

February 21, 2023

FOR: Attn: Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WASTE WATER	Collected by:		02/16/23	14:10
Location Code:	BLUELEAF	Received by:	LB	02/20/23	15:40
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN45841
Phoenix ID: CN45841

Project ID: SHARON
Client ID: M1 SSN

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Settleable Solids	1.40	0.10	ml/L	1	02/21/23 05:10	KDB	SM2540F-15

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
February 21, 2023
Reviewed and Released by: Makrina Nolan

Tuesday, February 21, 2023

Criteria: None

State: MA

Sample Criteria Exceedances Report

GCN45841 - BLUELEAF

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units

*** No Data to Display ***

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

Analysis Comments

February 21, 2023 SDG I.D.: GCN45841

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

Cooler: Yes ☑ No ☐
Coolant: IPK ☑ ICE ☐ No ☐

PHOENIX
Environmental Laboratories, Inc.

CT/MA/RI CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 1.4 °C Pg of

Data Delivery/Contact Options:
- ☐ Fax:
- ☐ Phone:
- ☐ Email:

Customer: Blueleaf, Inc
Address: 57 Dresser Hill Road
Charlton, MA 01507

Project: Sharon
Report to: Aaron Davis
Invoice to: Erik Grotton
Quote #

Project P.O:

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature DAN COBURN Date: 2/16/23

Matrix Code:
DW=Drinking Water GW=Ground Water SW=Surface Water WW=Waste Water
RW=Raw Water SE=Sediment SL=Sludge S=Soil SD=Solid W=Wipe OIL=Oil
B=Bulk L=Liquid X = ____________(Other) BW = Backwash

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	***MS/MSD** (May be billable at analysis unit rate)	Settable Solids											GL Amber 8 oz. [ ] w/H_3PO_4 [ ] NAHSO$_4$	Soil VOA Vials [ ] methanol [ ] H_2O	GL Soil container ( )oz	GL Soil container ( )oz	40 ml VOA Vial [ ] As is [ ] HCl	GL Amber 1000ml [ ] As is [ ] H_2SO_4	PL As is [ ] 250ml [ ] 500ml [ ] 1000ml	PL H_2SO_4 [ ] 250ml [ ] 500ml	PL HNO_3 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is	
45841	M1 SSN	BW	2/16/2023	14:10		X																							①

Relinquished by:	Accepted by:	Date:	Time:
		2/20/23	8 40
		2.20.23	15:40

Comments, Special Requirements or Regulations:

Turnaround Time:
- ☐ 1 Day*
- ☐ 2 Days*
- ☐ 3 Days*
- ☐ 4 Days*
- ☐ 5 Days*
- ☑ Standard
- ☐ Other ____________

RI
- ☐ RES DEC
- ☐ I/C DEC
- ☐ GA Leachability
- ☐ GB Leachability
- ☐ GA -GW Objectives
- ☐ GB -GW Objectives
- ☐ Other

CT
- ☐ RCP Cert
- ☐ GWPC
- ☐ SWPC
- ☐ GA PMC
- ☐ GB PMC
- ☐ SWPC
- ☐ RES DEC
- ☐ I/C DEC

MA
- ☐ MCP Certification
- ☐ GW-1
- ☐ GW-2
- ☐ GW-3
- ☐ S-1
- ☐ S-2
- ☐ S-3
- ☐ SW Protection
- ☐ RCS-1 / RCGW-1
- ☐ RCS-2 / RCGW-2
- ☐ ____________

Data Format
- ☐ Excel
- ☐ PDF
- ☐ GIS/Key
- ☐ EQuIS
- ☐ Other

Data Package
- ☐ Tier II Checklist*
- ☐ Full Data Package*
- ☐ Phoenix Std
- ☐ Other

MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.

*** SURCHARGES MAY APPLY**

State where samples were collected: MA

*** SURCHARGE APPLIES**

Makrina Nolan

From:	Makrina Nolan
Sent:	Tuesday, February 21, 2023 11:05 AM
To:	adavis@blueleafwater.com
Subject:	Sharon
Attachments:	GCN45841-ChainofCustody-1.pdf

Hi Aaron,

We received your sample yesterday, with regards to the attached chain. Unfortunately, this sample was received and analyzed past hold for Settable Solids. This result will be reported to you past hold with a comment on the report to reflect this.

Thank you,

Makrina Nolan
Client Services –Project Manager
Drinking Water Specialist
Phoenix Environmental Labs
587 Middle Turnpike East
Manchester, CT
Phone: 860-645-1102 ext 318
Website: www.phoenixlabs.com

PHOENIX
Environmental Laboratories, Inc.

Friday, March 03, 2023

Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Project ID: **SHARON**
SDG ID: **GCN48043**
Sample ID#s: **CN48043 - CN48047**

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B
NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Sample Id Cross Reference

March 03, 2023

SDG I.D.: GCN48043

Project ID: SHARON

Client Id	Lab Id	Matrix
RAW	CN48043	GROUND WATER
FILTER A	CN48044	DRINKING WATER
FILTER B	CN48045	DRINKING WATER
FILTER C	CN48046	DRINKING WATER
FILTER D	CN48047	DRINKING WATER

Analysis Report

March 03, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	GROUND WATER	Collected by:		02/22/23	13:30
Location Code:	BLUELEAF	Received by:	CP	02/23/23	14:22
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN48043
Phoenix ID: CN48043

Project ID: SHARON
Client ID: RAW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Iron	0.855	0.010	mg/L	1	02/27/23	CPP	SW6010D	
Hardness (CaCO3), calc.	111	0.1	mg/L	1	02/28/23		SM2340B-11	
Manganese	0.157	0.001	mg/L	1	02/27/23	CPP	SW6010D	
Alkalinity-CaCO3	45	20.0	mg/L	1	02/24/23	MW/EG	SM2320B-11	
Chloride	71.6	10.0	mg/L	2	02/25/23	BS/GD	E300.0	
Carbon Dioxide	16	10	mg/L	1	02/27/23	JR	SM4500C	7
Color, Apparent	15	1	Color Units	1	02/23/23 17:33	MEL	SM2120B-11	
Color, True	< 1	1	Color Units	1	02/23/23	MEL	SM2120B-11	
pH	6.83	1.00	pH Units	1	02/24/23 03:38	MW/EG	SM4500-H B-11	
Sulfate	13.5	5.0	mg/L	1	02/23/23	BS/GD	E300.0	
Tot. Diss. Solids	240	10	mg/L	1	02/24/23	Z	SM2540C-15	
Turbidity	1.1	0.200	NTU	1	02/24/23 03:38	MW/EG	SM2130B-11	
Total Metals Digestion	Completed				02/23/23	AG	SW3010A	

Project ID: SHARON
Client ID: RAW

Phoenix I.D.: CN48043

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference

7 = This parameter is not certified by MA for this matrix.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

The regulatory hold time for Chlorine is immediately. This Chlorine was performed in the laboratory and may be considered outside of hold-time.

The regulatory hold time for pH is immediately. This pH was performed in the laboratory and may be considered outside of hold-time.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 03, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 03, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		02/22/23	13:30
Location Code:	BLUELEAF	Received by:	CP	02/23/23	14:22
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN48043
Phoenix ID: CN48044

Project ID: SHARON
Client ID: FILTER A

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference	
Iron	< 0.010	0.010	1	mg/L			0.3	02/24/23	TH	E200.7	
Hardness (CaCO3), calc.	109	0.1	1	mg/L				03/02/23		200.7	
Manganese	< 0.001	0.001	1	mg/L			0.05	02/24/23	TH	E200.7	
Alkalinity-CaCO3	46	20.0	1	mg/L				02/24/23	MW/EG	SM2320B-11	
Chloride	80.4	10.0	2	mg/L			250	02/24/23	BS/GD	E300.0	
Carbon Dioxide	19	10	1	mg/L				02/27/23	JR	SM4500C	7
Color, Apparent	5	1	1	Color Units			15	02/23/23 17:33	MEL	SM2120B-11	
Color, True	< 1	1	1	Color Units			15	02/23/23	MEL	SM2120B-11	
pH	6.95	1.00	1	pH Units			6.5-8.5	02/24/23 03:47	MW/EG	SM4500-H B-11	
Sulfate	13.6	5.0	1	mg/L			250	02/23/23	BS/GD	E300.0-2.1	
Tot. Diss. Solids	230	10	1	mg/L			500	02/24/23	Z	SM2540C-15	
Turbidity	< 0.200	0.200	1	NTU			5	02/24/23 03:47	MW/EG	SM2130B-11	
Total Metal Digestion	Completed							02/23/23	BF	E200.5/E200.7	

Project ID: SHARON
Client ID: FILTER A

Phoenix I.D.: CN48044

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

7 = This parameter is not certified by MA for this matrix.

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 141 Monitoring; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

The regulatory hold time for pH is immediately. This pH was performed in the laboratory and may be considered outside of hold-time.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 03, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 03, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		02/22/23	13:30
Location Code:	BLUELEAF	Received by:	CP	02/23/23	14:22
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN48043
Phoenix ID: CN48045

Project ID: SHARON
Client ID: FILTER B

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference	
Iron	0.011	0.010	1	mg/L			0.3	02/24/23	TH	E200.7	
Hardness (CaCO3), calc.	110	0.1	1	mg/L				03/02/23		200.7	
Manganese	< 0.001	0.001	1	mg/L			0.05	02/24/23	TH	E200.7	
Alkalinity-CaCO3	46	20.0	1	mg/L				02/24/23	MW/EG	SM2320B-11	
Chloride	78.4	10.0	2	mg/L			250	02/25/23	BS/GD	E300.0	
Carbon Dioxide	21	10	1	mg/L				02/27/23	JR	SM4500C	7
Color, Apparent	5	1	1	Color Units			15	02/23/23 17:33	MEL	SM2120B-11	
Color, True	< 1	1	1	Color Units			15	02/23/23	MEL	SM2120B-11	
pH	6.95	1.00	1	pH Units			6.5-8.5	02/24/23 03:56	MW/EG	SM4500-H B-11	
Sulfate	13.6	5.0	1	mg/L			250	02/23/23	BS/GD	E300.0-2.1	
Tot. Diss. Solids	240	10	1	mg/L			500	02/27/23	Z/NP	SM2540C-15	
Turbidity	< 0.200	0.200	1	NTU			5	02/24/23 03:56	MW/EG	SM2130B-11	
Total Metal Digestion	Completed							02/23/23	BF	E200.5/E200.7	

Project ID: SHARON
Client ID: FILTER B

Phoenix I.D.: CN48045

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

7 = This parameter is not certified by MA for this matrix.

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 141 Monitoring; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

The regulatory hold time for pH is immediately. This pH was performed in the laboratory and may be considered outside of hold-time.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 03, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 03, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		02/22/23	13:30
Location Code:	BLUELEAF	Received by:	CP	02/23/23	14:22
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN48043
Phoenix ID: CN48046

Project ID: SHARON
Client ID: FILTER C

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron	< 0.010	0.010	1	mg/L			0.3	02/24/23	TH	E200.7
Hardness (CaCO3), calc.	98.2	0.1	1	mg/L				03/02/23		200.7
Manganese	< 0.001	0.001	1	mg/L			0.05	02/24/23	TH	E200.7
Alkalinity-CaCO3	81	20.0	1	mg/L				02/24/23	MW/EG	SM2320B-11
Chloride	78.3	10.0	2	mg/L			250	02/25/23	BS/GD	E300.0
Carbon Dioxide	< 10	10	1	mg/L				02/27/23	JR	SM4500C [7]
Color, Apparent	5	1	1	Color Units			15	02/23/23 17:33	MEL	SM2120B-11
Color, True	< 1	1	1	Color Units			15	02/23/23	MEL	SM2120B-11
pH	8.00	1.00	1	pH Units			6.5-8.5	02/24/23 04:53	MW/EG	SM4500-H B-11
Sulfate	13.6	5.0	1	mg/L			250	02/23/23	BS/GD	E300.0-2.1
Tot. Diss. Solids	260	10	1	mg/L			500	02/27/23	Z/NP	SM2540C-15
Turbidity	< 0.200	0.200	1	NTU			5	02/24/23 04:53	MW/EG	SM2130B-11
Total Metal Digestion	Completed							02/23/23	BF	E200.5/E200.7

Project ID: SHARON
Client ID: FILTER C

Phoenix I.D.: CN48046

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

7 = This parameter is not certified by MA for this matrix.

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 141 Monitoring; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

The regulatory hold time for pH is immediately. This pH was performed in the laboratory and may be considered outside of hold-time.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 03, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 03, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information

Matrix: DRINKING WATER
Location Code: BLUELEAF
Rush Request: Standard
P.O.#:

Custody Information		Date	Time
Collected by:		02/22/23	13:30
Received by:	CP	02/23/23	14:22
Analyzed by:	see "By" below		

Laboratory Data

SDG ID: GCN48043
Phoenix ID: CN48047

Project ID: SHARON
Client ID: FILTER D

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron	0.012	0.010	1	mg/L			0.3	02/24/23	TH	E200.7
Hardness (CaCO3), calc.	105	0.1	1	mg/L				03/02/23		200.7
Manganese	< 0.001	0.001	1	mg/L			0.05	02/24/23	TH	E200.7
Alkalinity-CaCO3	81	20.0	1	mg/L				02/24/23	MW/EG	SM2320B-11
Chloride	79.8	10.0	2	mg/L			250	02/25/23	BS/GD	E300.0
Carbon Dioxide	< 10	10	1	mg/L				02/27/23	JR	SM4500C [7]
Color, Apparent	< 1	1	1	Color Units			15	02/23/23 17:33	MEL	SM2120B-11
Color, True	< 1	1	1	Color Units			15	02/23/23	MEL	SM2120B-11
pH	7.99	1.00	1	pH Units			6.5-8.5	02/24/23 05:03	MW/EG	SM4500-H B-11
Sulfate	13.6	5.0	1	mg/L			250	02/23/23	BS/GD	E300.0-2.1
Tot. Diss. Solids	260	10	1	mg/L			500	02/27/23	Z/NP	SM2540C-15
Turbidity	< 0.200	0.200	1	NTU			5	02/24/23 05:03	MW/EG	SM2130B-11
Total Metal Digestion	Completed							02/23/23	BF	E200.5/E200.7

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

7 = This parameter is not certified by MA for this matrix.

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 141 Monitoring; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

The regulatory hold time for pH is immediately. This pH was performed in the laboratory and may be considered outside of hold-time.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 03, 2023
Reviewed and Released by: Makrina Nolan

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102

QA/QC Report

March 03, 2023

QA/QC Data

SDG I.D.: GCN48043

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 665564 (mg/L), QC Sample No: CN47192 (CN48043)													
ICP Metals - Aqueous													
Iron	BRL	0.010	<0.010	<0.010	NC	98.9	98.3	0.6	93.4			80 - 120	20
Manganese	BRL	0.001	0.003	<0.001	NC	99.6	99.1	0.5	93.6			80 - 120	20
Comment:													
Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.													
QA/QC Batch 665618 (mg/L), QC Sample No: CN47628 (CN48044, CN48045, CN48046, CN48047)													
ICP Metals - Aqueous													
Iron	BRL	0.010	<0.010	0.016	NC	110			111			85 - 115	20
Manganese	BRL	0.0010	0.001	0.0021	NC	102			101			85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													

QA/QC Report

March 03, 2023

QA/QC Data

SDG I.D.: GCN48043

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 665694 (mg/L), QC Sample No: CN47744 (CN48043, CN48044)													
Tot. Diss. Solids	BRL	10	60	67	11.0	97.0						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 665711 (mg/L), QC Sample No: CN47860 (CN48043, CN48044, CN48045)													
Alkalinity-CaCO3	BRL	5.00	55	58	NC	96.1						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 665715 (NTU), QC Sample No: CN47860 (CN48043, CN48044, CN48045)													
Turbidity	BRL	0.200	1.1	1.1	0	97.5						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 665707 (pH), QC Sample No: CN47980 (CN48043, CN48044, CN48045)													
pH			7.5	7.18	4.40	98.5						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 665911 (mg/L), QC Sample No: CN48043 (CN48043, CN48044, CN48045, CN48046, CN48047)													
Carbon Dioxide	BRL		16	16	NC	102						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 665862 (mg/L), QC Sample No: CN48045 (CN48045, CN48046, CN48047)													
Tot. Diss. Solids	BRL	10	240	240	0	98.0						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 665712 (mg/L), QC Sample No: CN48046 (CN48046, CN48047)													
Alkalinity-CaCO3	BRL	5.00	81	82	NC	93.1						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 665716 (NTU), QC Sample No: CN48046 (CN48046, CN48047)													
Turbidity	BRL	0.200	<0.200	<0.200	NC	97.0						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 665708 (pH), QC Sample No: CN48431 (CN48046, CN48047)													
pH			6.92	7.05	1.90	99.2						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 665679 (mg/L), QC Sample No: CN48103 (CN48043, CN48044, CN48045, CN48046, CN48047)													
Chloride	BRL	5.0	<5.0	<5.0	NC	98.2			98.4			90 - 110	20
Sulfate	BRL	5.0	5.4	5.1	NC	102			93.2			90 - 110	20

QA/QC Data

SDG I.D.: GCN48043

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits	
QA/QC Batch 665959 (mg/L), QC Sample No: CN48389 (CN48044)														
Chloride	BRL	5.0	273	285	4.30	96.5			113			90 - 110	20	m
Sulfate	BRL	5.0	100	105	4.90	99.2			100			90 - 110	20	
QA/QC Batch 665949 (mg/L), QC Sample No: CN49232 (CN48043, CN48045, CN48046, CN48047)														
Chloride	BRL	5.0	67.8	69.3	2.20	93.3			103			90 - 110	20	
Sulfate	BRL	5.0	15.7	15.7	NC	96.6			96.8			90 - 110	20	
QA/QC Batch 665595 (mg/L), QC Sample No: CN48185 (CN48043)														
Chlorine Residual	BRL	0.02	<0.02	<0.02	NC	95.7								

m = This parameter is outside laboratory MS/MSD specified recovery limits.

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

RPD - Relative Percent Difference
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MS Dup - Matrix Spike Duplicate
NC - No Criteria
Intf - Interference

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 03, 2023

Friday, March 03, 2023

Criteria: MA: DW

State: MA

Sample Criteria Exceedances Report

GCN48043 - BLUELEAF

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units

*** No Data to Display ***

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

Analysis Comments

March 03, 2023 SDG I.D.: GCN48043

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

Cooler: Yes ☒ No ☐
Coolant: IPK ☒ ICE ☐ No ☐

PHOENIX
Environmental Laboratories, Inc.

CT/MA/RI CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 2.2 °C Pg of

Data Delivery/Contact Options:
☐ Fax:
☐ Phone:
☐ Email:

Customer: Blueleaf, Inc.
Address: 57 Dresser Hill Road
Charlton, MA 01507

Project: Sharon
Report to: Aaron Davis
Invoice to: Erik Grotton
Quote #

Project P.O:

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature Date: 2/22/23

Matrix Code:
DW=Drinking Water **GW**=Ground Water **SW**=Surface Water **WW**=Weste Water
RW=Raw Water **SE**=Sediment **SL**=Sludge **S**=Soil **SD**=Solid **W**=Wipe **OIL**=Oil
B=Bulk **L**=Liquid **X** = ____________(Other)

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	***MS/MSD** (May be billable at analysis unit rate)	Turb, True & app color, pH	TDS, SO4, chloride	CO2	Total Fe, Mn, Hardness	Alkalinity							GL Amber 8 oz. [ ] w/H_3PO_4 [ ] $NAHSO_4$	Soil VOA Vials [ ] methanol [ ] H_2O	GL Soil container ( ) oz	GL Soil container ( ) oz	40 ml VOA Vial [ ] As is [ ] HCl	GL Amber 1000ml [ ] As is [ ] H_2SO_4	PL As is [ ] 250ml [ ] 500ml [x] 1000ml	PL H_2SO_4 [ ] 250ml [ ] 500ml	PL HNO_3 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is	
48043	RAW	GW	2/22/2023	13:30		X	X	X	X	X																			5
48044	FILTER A	DW	2/22/2023	13:30		X	X	X	X	X																			5
48045	FILTER B	DW	2/22/2023	13:30		X	X	X	X	X																			5
48046	FILTER C	DW	2/22/2023	13:30		X	X	X	X	X																			5
48047	FILTER D	DW	2/22/2023	13:30		X	X	X	X	X																			5
																										TOTAL			25

Relinquished by:	Accepted by:	Date:	Time:
		2/23/23	1315
		2/23/23	1422

Comments, Special Requirements or Regulations:

Turnaround Time:
☐ 1 Day*
☐ 2 Days*
☐ 3 Days*
☐ 4 Days*
☐ 5 Days*
● Standard
☐ Other ________

*** SURCHARGES MAY APPLY**

RI
☐ RES DEC
☐ I/C DEC
☐ GA Leachability
☐ GB Leachability
☐ GA -GW Objectives
☐ GB -GW Objectives
☐ Other

CT
☐ RCP Cert
☐ GWPC
☐ SWPC
☐ GA PMC
☐ GB PMC
☐ SWPC
☐ RES DEC
☐ I/C DEC

MA
☐ MCP Certification
☐ GW-1
☐ GW-2
☐ GW-3
☐ S-1
☐ S-2
☐ S-3
☐ SW Protection
☐ RCS-1 / RCGW-1
☐ RCS-2 / RCGW-2
☐ ________

Data Format
☐ Excel
☐ PDF
☐ GIS/Key
☐ EQuIS
☐ Other

Data Package
☐ Tier II Checklist*
☐ Full Data Package*
☐ Phoenix Std
☐ Other

State where samples were collected: MA

*** SURCHARGE APPLIES**

MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.

ANALYTICAL REPORT

Lab Number:	L2309640
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Aaron Davis
Phone:	(508) 248-7094
Project Name:	SHARON WELL 2
Project Number:	05503
Report Date:	03/01/23

The original project report/data package is held by Alpha Analytical. This report/data package is paginated and should be reproduced only in its entirety. Alpha Analytical holds no responsibility for results and/or data that are not consistent with the original.

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NJ (MA935), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-17-00196).

Project Name: SHARON WELL 2
Project Number: 05503

Lab Number: L2309640
Report Date: 03/01/23

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2309640-01	RAW	WATER	SHARON, MA	02/22/23 13:30	02/22/23
L2309640-02	FILTER A	DW	SHARON, MA	02/22/23 13:30	02/22/23
L2309640-03	FILTER B	DW	SHARON, MA	02/22/23 13:30	02/22/23
L2309640-04	FILTER C	DW	SHARON, MA	02/22/23 13:30	02/22/23
L2309640-05	FILTER D	DW	SHARON, MA	02/22/23 13:30	02/22/23

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Caitlin Walukevich Caitlin Walukevich

Title: Technical Director/Representative Date: 03/01/23

INORGANICS
&
MISCELLANEOUS

SAMPLE RESULTS

Lab ID: L2309640-01
Client ID: RAW
Sample Location: SHARON, MA

Date Collected: 02/22/23 13:30
Date Received: 02/22/23
Field Prep: Not Specified

Sample Depth:
Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	02/22/23 18:46	121,9223B	MTO
Escherichia Coli	Negative		col/100ml	-	NA	1	-	02/22/23 18:46	121,9223B	MTO

SAMPLE RESULTS

Lab ID: L2309640-02
Client ID: FILTER A
Sample Location: SHARON, MA

Date Collected: 02/22/23 13:30
Date Received: 02/22/23
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	02/22/23 18:46	121,9223B	MTO
Escherichia Coli	Negative		col/100ml	-	NA	1	-	02/22/23 18:46	121,9223B	MTO

SAMPLE RESULTS

Lab ID: L2309640-03
Client ID: FILTER B
Sample Location: SHARON, MA
Date Collected: 02/22/23 13:30
Date Received: 02/22/23
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	02/22/23 18:46	121,9223B	MTO
Escherichia Coli	Negative		col/100ml	-	NA	1	-	02/22/23 18:46	121,9223B	MTO

SAMPLE RESULTS

Lab ID: L2309640-04
Client ID: FILTER C
Sample Location: SHARON, MA

Date Collected: 02/22/23 13:30
Date Received: 02/22/23
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	02/22/23 18:46	121,9223B	MTO
Escherichia Coli	Negative		col/100ml	-	NA	1	-	02/22/23 18:46	121,9223B	MTO

Project Name: SHARON WELL 2
Project Number: 05503

Lab Number: L2309640
Report Date: 03/01/23

SAMPLE RESULTS

Lab ID: L2309640-05
Client ID: FILTER D
Sample Location: SHARON, MA

Date Collected: 02/22/23 13:30
Date Received: 02/22/23
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	02/22/23 18:46	121,9223B	MTO
Escherichia Coli	Negative		col/100ml	-	NA	1	-	02/22/23 18:46	121,9223B	MTO

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Bacteria in Water - Westborough Lab for sample(s): 01 Batch: WG1749725-1										
Coliform, Total	Negative		col/100ml	-	NA	1	-	02/22/23 18:46	121,9223B	MTO
Escherichia Coli	Negative		col/100ml	-	NA	1	-	02/22/23 18:46	121,9223B	MTO
Bacteria in Water - Westborough Lab for sample(s): 02-05 Batch: WG1749727-1										
Coliform, Total	Negative		col/100ml	-	NA	1	-	02/22/23 18:46	121,9223B	MTO
Escherichia Coli	Negative		col/100ml	-	NA	1	-	02/22/23 18:46	121,9223B	MTO

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	*Custody Seal*
A	Absent

Container Information

Container ID	*Container Type*	*Cooler*	*Initial pH*	*Final pH*	*Temp deg C*	*Pres*	*Seal*	*Frozen Date/Time*	*Analysis(*)*
L2309640-01A	Bacteria Cup Na2S2O3 preserved	A	NA		3.3	Y	Absent		T-COLI-C(.33)
L2309640-02A	Bacteria Cup Na2S2O3 preserved	A	NA		3.3	Y	Absent		T-COLI-C(1.25)
L2309640-03A	Bacteria Cup Na2S2O3 preserved	A	NA		3.3	Y	Absent		T-COLI-C(1.25)
L2309640-04A	Bacteria Cup Na2S2O3 preserved	A	NA		3.3	Y	Absent		T-COLI-C(1.25)
L2309640-05A	Bacteria Cup Na2S2O3 preserved	A	NA		3.3	Y	Absent		T-COLI-C(1.25)

*Values in parentheses indicate holding time in days

GLOSSARY

Acronyms

DL - Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

EDL - Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).

EMPC - Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.

EPA - Environmental Protection Agency.

LCS - Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LCSD - Laboratory Control Sample Duplicate: Refer to LCS.

LFB - Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LOD - Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

LOQ - Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

MDL - Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

MS - Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.

MSD - Matrix Spike Sample Duplicate: Refer to MS.

NA - Not Applicable.

NC - Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.

NDPA/DPA - N-Nitrosodiphenylamine/Diphenylamine.

NI - Not Ignitable.

NP - Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.

NR - No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.

RL - Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

RPD - Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.

SRM - Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.

STLP - Semi-dynamic Tank Leaching Procedure per EPA Method 1315.

TEF - Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.

TEQ - Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.

TIC - Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Chlordane: The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Gasoline Range Organics (GRO): Gasoline Range Organics (GRO) results include all chromatographic peaks eluting from Methyl tert butyl ether through Naphthalene, with the exception of GRO analysis in support of State of Ohio programs, which includes all chromatographic peaks eluting from Hexane through Dodecane.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW compliance analysis only, the 'PFAS, Total (6)' result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

Report Format: Data Usability Report

Data Qualifiers

ND - Not detected at the reporting limit (RL) for the sample.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

V - The surrogate associated with this target analyte has a recovery outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Z - The batch matrix spike and/or duplicate associated with this target analyte has a recovery/RPD outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

REFERENCES

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Alpha Analytical, Inc. ID No.:**17873**
Facility: **Company-wide** Revision 19
Department: **Quality Assurance** Published Date: 4/2/2021 1:14:23 PM
Title: **Certificate/Approval Program Summary** Page 1 of 1

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624/624.1: m/p-xylene, o-xylene, Naphthalene
EPA 625/625.1: alpha-Terpineol
EPA 8260C/8260D: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D/8270E: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine, alpha-Terpineol; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility
SM 2540D: TSS
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N**, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603, SM9222D.**

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522, EPA 537.1.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb, As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

Serial_No:03012310:47

ALPHA ANALYTICAL

8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 2/22/23

ALPHA Job #: L2309640

Project Information

Project Name: Sharon Well 2
Project Location: Sharon, MA
Project #: 05503
Project Manager: Aaron Davis
ALPHA Quote #:

Report Information - Data Deliverables

☒ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info PO #:

Client Information

Client: Bluecat, Inc.
Address: 57 Dresser Hill Rd.
Charlton, MA 01507
Phone: 774 200 8029
Email: adavis@bluecatwater.com

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program ______ Criteria ______

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)

Date Due:

Additional Project Information:

ANALYSIS

SAMPLE INFO
Filtration
☐ Field
☐ Lab to do
Preservation
☐ Lab to do

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	VOC: ☐ 8260 ☐ 624 ☐ 524.2	SVOC: ☐ ABN ☐ PAH	METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15	METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13	EPH: ☐ Ranges & Targets ☐ Ranges Only	VPH: ☐ Ranges & Targets ☐ Ranges Only	☐ PCB ☐ PEST	TPH: ☐ Quant Only ☐ Fingerprint	Total Coliform	Sample Comments	TOTAL # BOTTLES
09640-01	RAW	2/22/23	13:30	GW	AD									X		1
-02	FILTER A			DW										X		1
-03	FILTER B	↓	↓	↓	↓									X		1
-04	FILTER C													X		1
-05	FILTER D													X		1

None For Raw
Thio For Others

	Total Coliform
Container Type	P
Preservative	•

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
	2/22/23 17:00	Julie Cruz	2/22/23 17:50

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

PHOENIX
Environmental Laboratories, Inc.

Monday, March 06, 2023

Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Project ID: SHARON
SDG ID: GCN48048
Sample ID#s: CN48048 - CN48057

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B

NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Sample Id Cross Reference

March 06, 2023

SDG I.D.: GCN48048

Project ID: SHARON

Client Id	Lab Id	Matrix
FILTER A CBW	CN48048	WATER
FILTER B CBW	CN48049	WATER
FILTER C CBW	CN48050	WATER
FILTER D CBW	CN48051	WATER
FILTER A SSN	CN48052	WATER
FILTER B SSN	CN48053	WATER
FILTER C SSN	CN48054	WATER
FILTER D SSN	CN48055	WATER
F1 CBW	CN48056	WATER
F1 SSN	CN48057	WATER

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 06, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information

Matrix: WATER
Location Code: BLUELEAF
Rush Request: Standard
P.O.#:

Custody Information		Date	Time
Collected by:		02/22/23	10:30
Received by:	CP	02/23/23	14:22
Analyzed by:	see "By" below		

Laboratory Data

SDG ID: GCN48048
Phoenix ID: CN48048

Project ID: SHARON
Client ID: FILTER A CBW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	92.2	0.010	mg/L	1	02/27/23	CPP	E200.7
Manganese	10.9	0.010	mg/L	10	03/02/23	TH	E200.7
Total Suspended Solids	220	25	mg/L	5	02/24/23	Z/NP	SM2540D-15
Total Metals Digestion	Completed				02/23/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 06, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 06, 2023

FOR:
Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		02/22/23	10:45
Location Code:	BLUELEAF	Received by:	CP	02/23/23	14:22
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN48048
Phoenix ID: CN48049

Project ID: SHARON
Client ID: FILTER B CBW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	71.7	0.010	mg/L	1	02/24/23	TH	E200.7
Manganese	14.4	0.010	mg/L	10	03/03/23	TH	E200.7
Total Suspended Solids	150	25	mg/L	5	02/24/23	Z/NP	SM2540D-15
Total Metals Digestion	Completed				02/23/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 06, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 06, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		02/22/23	11:00
Location Code:	BLUELEAF	Received by:	CP	02/23/23	14:22
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN48048
Phoenix ID: CN48050

Project ID: SHARON
Client ID: FILTER C CBW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	83.2	0.010	mg/L	1	02/24/23	TH	E200.7
Manganese	11.0	0.010	mg/L	10	03/03/23	TH	E200.7
Total Suspended Solids	230	25	mg/L	5	02/24/23	Z/NP	SM2540D-15
Total Metals Digestion	Completed				02/23/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 06, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 06, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		02/22/23	11:15
Location Code:	BLUELEAF	Received by:	CP	02/23/23	14:22
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN48048
Phoenix ID: CN48051

Project ID: SHARON
Client ID: FILTER D CBW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	72.1	0.010	mg/L	1	02/24/23	TH	E200.7
Manganese	12.3	0.010	mg/L	10	03/03/23	TH	E200.7
Total Suspended Solids	220	25	mg/L	5	02/24/23	Z/NP	SM2540D-15
Total Metals Digestion	Completed				02/23/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 06, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 06, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		02/22/23	14:30
Location Code:	BLUELEAF	Received by:	CP	02/23/23	14:22
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN48048
Phoenix ID: CN48052

Project ID: SHARON
Client ID: FILTER A SSN

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	3.02	0.010	mg/L	1	02/24/23	TH	E200.7
Manganese	0.388	0.001	mg/L	1	02/24/23	TH	E200.7
Total Metals Digestion	Completed				02/23/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 06, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 06, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		02/22/23	14:45
Location Code:	BLUELEAF	Received by:	CP	02/23/23	14:22
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN48048
Phoenix ID: CN48053

Project ID: SHARON
Client ID: FILTER B SSN

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	2.20	0.010	mg/L	1	02/24/23	TH	E200.7
Manganese	0.485	0.001	mg/L	1	02/24/23	TH	E200.7
Total Metals Digestion	Completed				02/23/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 06, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 06, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		02/22/23	15:00
Location Code:	BLUELEAF	Received by:	CP	02/23/23	14:22
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN48048
Phoenix ID: CN48054

Project ID: SHARON
Client ID: FILTER C SSN

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	1.94	0.010	mg/L	1	02/24/23	TH	E200.7
Manganese	0.281	0.001	mg/L	1	02/24/23	TH	E200.7
Total Metals Digestion	Completed				02/23/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 06, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 06, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		02/22/23	15:15
Location Code:	BLUELEAF	Received by:	CP	02/23/23	14:22
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN48048
Phoenix ID: CN48055

Project ID: SHARON
Client ID: FILTER D SSN

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	1.43	0.010	mg/L	1	02/24/23	TH	E200.7
Manganese	0.358	0.001	mg/L	1	02/24/23	TH	E200.7
Total Metals Digestion	Completed				02/23/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 06, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 06, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		02/22/23	11:30
Location Code:	BLUELEAF	Received by:	CP	02/23/23	14:22
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN48048
Phoenix ID: CN48056

Project ID: SHARON
Client ID: F1 CBW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron (Dissolved)	0.082	0.011	mg/L	1	02/25/23	CPP	E200.7
Manganese (Dissolved)	0.046	0.001	mg/L	1	02/25/23	CPP	E200.7
Iron	551	0.10	mg/L	10	03/03/23	TH	E200.7
Manganese	0.939	0.001	mg/L	1	02/24/23	TH	E200.7
Settleable Solids	9.00	0.10	ml/L	1	02/24/23 05:15	KDB	SM2540F-15
Total Suspended Solids	720	50	mg/L	10	02/24/23	Z/NP	SM2540D-15
Filtration	Completed				02/23/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed				02/23/23	AG	SW3005A
Total Metals Digestion	Completed				02/23/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 06, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 06, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		02/22/23	15:30
Location Code:	BLUELEAF	Received by:	CP	02/23/23	14:22
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN48048
Phoenix ID: CN48057

Project ID: SHARON
Client ID: F1 SSN

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron (Dissolved)	0.098	0.011	mg/L	1	02/25/23	CPP	E200.7
Manganese (Dissolved)	0.054	0.001	mg/L	1	02/25/23	CPP	E200.7
Iron	33.1	0.010	mg/L	1	02/24/23	TH	E200.7
Manganese	0.121	0.001	mg/L	1	02/24/23	TH	E200.7
Settleable Solids	0.10	0.10	ml/L	1	02/24/23 05:15	KDB	SM2540F-15
Total Suspended Solids	83	17	mg/L	3.3	02/24/23	Z/NP	SM2540D-15
Filtration	Completed				02/23/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed				02/23/23	AG	SW3005A
Total Metals Digestion	Completed				02/23/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 06, 2023
Reviewed and Released by: Makrina Nolan

QA/QC Report

March 06, 2023

QA/QC Data

SDG I.D.: GCN48048

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 665576 (mg/L), QC Sample No: CN35175 (CN48056, CN48057)													
ICP Metals - Dissolved													
Iron	BRL	0.011	2.64	2.69	1.90	87.5	84.5	3.5	100			80 - 120	20
Manganese	BRL	0.001	0.462	0.465	0.60	88.1	85.1	3.5	91.3			80 - 120	20
Comment:													
Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.													
QA/QC Batch 665564 (mg/L), QC Sample No: CN47192 (CN48048)													
ICP Metals - Aqueous													
Iron	BRL	0.010	<0.010	<0.010	NC	98.9	98.3	0.6	93.4			80 - 120	20
Manganese	BRL	0.001	0.003	<0.001	NC	99.6	99.1	0.5	93.6			80 - 120	20
Comment:													
Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.													
QA/QC Batch 665565 (mg/L), QC Sample No: CN48054 (CN48049, CN48050, CN48051, CN48052, CN48053, CN48054, CN48055, CN48056, CN48057)													
ICP Metals - Aqueous													
Iron	BRL	0.010	1.94	1.98	2.00	99.3	99.1	0.2	107			80 - 120	20
Manganese	BRL	0.001	0.281	0.288	2.50	100	99.8	0.2	100			80 - 120	20
Comment:													
Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.													

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102

QA/QC Report

March 06, 2023

QA/QC Data

SDG I.D.: GCN48048

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 665659 (mg/L), QC Sample No: CN48075 (CN48048, CN48049, CN48050, CN48051, CN48056, CN48057)													
Total Suspended Solids	BRL	2.5	60	67	11.0	98.0						85 - 115	

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

RPD - Relative Percent Difference
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MS Dup - Matrix Spike Duplicate
NC - No Criteria
Intf - Interference

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 06, 2023

Monday, March 06, 2023
Criteria: None
State: MA

Sample Criteria Exceedances Report

GCN48048 - BLUELEAF

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units

*** No Data to Display ***

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

Analysis Comments

March 06, 2023 SDG I.D.: GCN48048

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

Cooler: Yes ☒ No ☐
Coolant: IPK ☑ ICE ☐ No ☐

PHOENIX
Environmental Laboratories, Inc.

CT/MA/RI CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 2.2 °C Pg of

Data Delivery/Contact Options:
☐ Fax:
☐ Phone:
☐ Email:

Customer: Blueleaf, Inc.
Address: 57 Dresser Hill Road
Charlton, MA 01507

Project: Sharon
Report to: Aaron Davis
Invoice to: Erik Grotton
Quote #

Project P.O:

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature Date: 2/22/23

Matrix Code:
DW=Drinking Water **GW**=Ground Water **SW**=Surface Water **WW**=Waste Water
RW=Raw Water **SE**=Sediment **SL**=Sludge **S**=Soil **SD**=Solid **W**=Wipe **OIL**=Oil
B=Bulk **L**=Liquid **X** = ____________(Other) BW = Backwash

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	*MS/MSD (May be billable at analysis unit rate)	Total Fe, Mn	TSS	Settlable Solids	Dissolved Fe, Mn (Lab Filter)							GL Amber 8 oz. [ ] w/H$_3$PO$_4$ [ ] NAHSO$_4$	Soil VOA Vials [ ] methanol [ ] H$_2$O	GL Soil container ( )oz	GL Soil container ( )oz	40 ml VOA Vial [ ] As is [ ] HCl	GL Amber 1000ml [ ] As is [ ] H$_2$SO$_4$	PL As is [ ] 250ml [ ] 500ml [x] 1000ml	PL H$_2$SO$_4$ ( ) 250ml [ ] 500ml	PL HNO$_3$ 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is	
48048	FILTER A CBW	BW	2/22/2023	10:30		X	X																					2
48049	FILTER B CBW	BW	2/22/2023	10:45		X	X																					2
48050	FILTER C CBW	BW	2/22/2023	11:00		X	X																					2
48051	FILTER D CBW	BW	2/22/2023	11:15		X	X																					2
48052	FILTER A SSN	BW	2/22/2023	14:30		X																						1
48053	FILTER B SSN	BW	2/22/2023	14:45		X																						1
48054	FILTER C SSN	BW	2/22/2023	15:00		X																						1
48055	FILTER D SSN	BW	2/22/2023	15:15		X																						1
48056	F1 CBW	BW	2/22/2023	11:30		X	X	X	X																			4
48057	F1 SSN	BW	2/22/2023	15:30		X	X	X	X																			4
																										TOTAL		20

Relinquished by:	Accepted by:	Date:	Time:
		2/23/23	1315
	CPheradin	2/23/23	1422

Comments, Special Requirements or Regulations:

Turnaround Time:
- ▫ 1 Day*
- ▫ 2 Days*
- ▫ 3 Days*
- ▫ 4 Days*
- ▫ 5 Days*
- [✓ Standard]
- ▫ Other ______

RI
- ▫ RES DEC
- ▫ I/C DEC
- ▫ GA Leachability
- ▫ GB Leachability
- ▫ GA -GW Objectives
- ▫ GB -GW Objectives
- ▫ Other

CT
- ▫ RCP Cert
- ▫ GWPC
- ▫ SWPC
- ▫ GA PMC
- ▫ GB PMC
- ▫ SWPC
- ▫ RES DEC
- ▫ I/C DEC

MA
- ▫ MCP Certification
- ▫ GW-1
- ▫ GW-2
- ▫ GW-3
- ▫ S-1
- ▫ S-2
- ▫ S-3
- ▫ SW Protection
- ▫ RCS-1 / RCGW-1
- ▫ RCS-2 / RCGW-2
- ▫ ______

Data Format
- ▫ Excel
- ▫ PDF
- ▫ GIS/Key
- ▫ EQuIS
- ▫ Other

Data Package
- ▫ Tier II Checklist*
- ▫ Full Data Package*
- ▫ Phoenix Std
- ▫ Other

MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.

*** SURCHARGES MAY APPLY**

State where samples were collected: MA

*** SURCHARGE APPLIES**

PHOENIX
Environmental Laboratories, Inc.

Tuesday, March 07, 2023

Attn: Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Project ID: SHARON
SDG ID: GCN48938
Sample ID#s: CN48938 - CN48939

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller

Phyllis Shiller

Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B

NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Sample Id Cross Reference

March 07, 2023

SDG I.D.: GCN48938

Project ID: SHARON

Client Id	Lab Id	Matrix
F2 CBW-SH	CN48938	WASTE WATER
F2 SSN-SH	CN48939	WASTE WATER

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 07, 2023

FOR:
Attn: Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WASTE WATER	Collected by:		02/23/23	8:30
Location Code:	BLUELEAF	Received by:	SW	02/24/23	13:05
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN48938
Phoenix ID: CN48938

Project ID: SHARON
Client ID: F2 CBW-SH

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron (Dissolved)	0.062	0.011	mg/L	1	03/01/23	CPP	E200.7
Manganese (Dissolved)	0.019	0.001	mg/L	1	03/01/23	CPP	E200.7
Iron	204	0.050	mg/L	10	03/06/23	TH	E200.7
Manganese	0.366	0.001	mg/L	1	03/01/23	TH	E200.7
Settleable Solids	5.50	0.10	ml/L	1	02/25/23 06:35	KDB	SM2540F-15
Total Suspended Solids	200	10	mg/L	2	02/27/23	Z	SM2540D-15
Filtration	Completed				02/25/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed				02/25/23	AG	SW3005A
Total Metals Digestion	Completed				02/25/23	AG	E200.7

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 07, 2023
Reviewed and Released by: Makrina Nolan

Ver 1

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 07, 2023

FOR:
Attn: Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information

Matrix: WASTE WATER
Location Code: BLUELEAF
Rush Request: Standard
P.O.#:

Custody Information		Date	Time
Collected by:		02/23/23	12:30
Received by:	SW	02/24/23	13:05
Analyzed by:	see "By" below		

Laboratory Data

SDG ID: GCN48938
Phoenix ID: CN48939

Project ID: SHARON
Client ID: F2 SSN-SH

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron (Dissolved)	0.078	0.011	mg/L	1	03/01/23	CPP	E200.7
Manganese (Dissolved)	0.111	0.001	mg/L	1	03/01/23	CPP	E200.7
Iron	20.8	0.005	mg/L	1	03/01/23	TH	E200.7
Manganese	0.133	0.001	mg/L	1	03/01/23	TH	E200.7
Settleable Solids	< 0.10	0.10	ml/L	1	02/25/23 06:35	KDB	SM2540F-15
Total Suspended Solids	18	5.0	mg/L	1	02/27/23	Z	SM2540D-15
Filtration	Completed				02/25/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed				02/25/23	AG	SW3005A
Total Metals Digestion	Completed				02/25/23	AG	E200.7

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 07, 2023
Reviewed and Released by: Makrina Nolan

QA/QC Report

March 07, 2023

QA/QC Data

SDG I.D.: GCN48938

QA/QC Batch 665828 (mg/L), QC Sample No: CN48117 (CN48938, CN48939)

ICP Metals - Aqueous

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
Iron	BRL	0.0050	0.107	0.109	1.90	108	105	2.8	106			80 - 120	20
Manganese	BRL	0.0005	0.020	0.0199	0.50	103	102	1.0	97.8			80 - 120	20

Comment:

Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.

QA/QC Batch 665829 (mg/L), QC Sample No: CN48938 (CN48938, CN48939)

ICP Metals - Dissolved

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
Iron	BRL	0.011	0.062	0.052	NC	86.4	89.4	3.4	90.8			80 - 120	20
Manganese	BRL	0.001	0.019	0.019	0	87.7	90.5	3.1	91.1			80 - 120	20

Comment:

Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102

QA/QC Report

March 07, 2023

QA/QC Data

SDG I.D.: GCN48938

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 665854 (mg/L), QC Sample No: CN48587 (CN48938, CN48939)													
Total Suspended Solids	BRL	2.5	11	11	NC	93.0						85 - 115	

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

RPD - Relative Percent Difference
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MS Dup - Matrix Spike Duplicate
NC - No Criteria
Intf - Interference

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 07, 2023

Tuesday, March 07, 2023

Criteria: None

State: MA

Sample Criteria Exceedances Report

GCN48938 - BLUELEAF

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units

*** No Data to Display ***

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

Analysis Comments

March 07, 2023

SDG I.D.: GCN48938

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

Cooler: Yes ☑ No ☐
Coolant: IPK ☑ ICE ☐ No ☐

CHAIN OF CUSTODY RECORD

PHOENIX
Environmental Laboratories, Inc.

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email Makrina Nolan: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 1.3 °C Pg of

Data Delivery/Contact Options:
- ☐ Fax:
- ☐ Phone:
- ☐ Email:

Customer: Bluelect, Inc.
Address: 57 Dresser Hill Rd.
Charlton, MA 01507

Project: Sharon
Report to: Aaron Davis
Invoice to: Erik Grotton
QUOTE #

Project P.O:

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification
Sampler's Signature Date: 2/23/23

Matrix Code:
DW=Drinking Water GW=Ground Water SW=Surface Water WW=Waste Water
RW=Raw Water SE=Sediment SL=Sludge S=Soil SD=Solid W=Wipe OIL=Oil
B=Bulk L=Liquid X = ____________(Other) BW = Backwash

Analysis Request

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	Total Fe, Mn	Dis Fe, Mn	TSS	Settleable Solids						MS/MSD *	GL Amber 8 oz. [ ] H3PO4 [ ] NAHSO4	Soil VOA Vials [ ] methanol [ ] H2O	GL Soil container ( ) oz	GL Soil container ( ) oz	40 ml VOA Vial [ ] As is [ ] HCL	GL Amber 1000ml [ ] As is [ ] H2SO4	PL As is [~~1~~] 250ml [ ] 500ml [~~1~~] 1000ml	PL H2SO4 [ ] 250ml [ ] 500ml	PL HNO3 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is
48938	F2 CBW-SH	BW	2/23/23	8:30	X	X	X	X												3		1				4
48939	F2 SSW-SH	BW	2/23/23	12:30	X	X	X	X												3		1				4
																										8

Relinquished by:	Accepted by:	Date:	Time:
		2/24/23	11:50
		2/24/23	13:05

Comments, Special Requirements or Regulations:

*MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.

Turnaround Time:
- ☐ 1 Day*
- ☐ 2 Days*
- ☐ 3 Days*
- ☒ Standard
- ☐ Other

* SURCHARGE APPLIES

RI
- ☐ (Residential) Direct Exposure
- ☐ (Comm/Industrial) Direct Exposure
- ☐ GA Leachability
- ☐ GB Leachability
- ☐ GA-GW Objectives
- ☐ GB-GW Objectives

CT
- ☐ RCP Cert
- ☐ GW Protection
- ☐ SW Protection
- ☐ GA Mobility
- ☐ GB Mobility
- ☐ Residential DEC
- ☐ I/C DEC
- ☐ Other

MA
- ☐ MCP Certification
- ☐ GW-1 ☐ MWRA eSMART
- ☐ GW-2 ☐ S-1 10% CALC
- ☐ GW-3
- ☐ S-1 GW-1 ☐ S-1 GW-2 ☐ S-1 GW-3
- ☐ S-2 GW-1 ☐ S-2 GW-2 ☐ S-2 GW-3
- ☐ S-3 GW-1 ☐ S-3 GW-2 ☐ S-3 GW-3
- ☐ SW Protection

State where samples were collected: MA

Data Format
- ☐ Excel
- ☐ PDF
- ☐ GIS/Key
- ☐ EQuIS
- ☐ Other

Data Package
- ☐ Tier II Checklist
- ☐ Full Data Package*
- ☐ Phoenix Std Report
- ☐ Other

* SURCHARGE APPLIES

PEL-126 REV. 03/22

PHOENIX
Environmental Laboratories, Inc.

Monday, March 13, 2023

Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Project ID: SHARON
SDG ID: GCN52084
Sample ID#s: CN52084 - CN52088

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B
NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Telephone (860) 645-1102

SDG Comments

March 13, 2023

SDG I.D.: GCN52084

Sample CN52084 was received past hold time for Heterotrophic Plate Count (SM9215B).
Sample CN52085 was received past hold time for Heterotrophic Plate Count (SM9215B).
Sample CN52086 was received past hold time for Heterotrophic Plate Count (SM9215B).
Sample CN52087 was received past hold time for Heterotrophic Plate Count (SM9215B).

Sample Id Cross Reference

March 13, 2023

SDG I.D.: GCN52084

Project ID: SHARON

Client Id	Lab Id	Matrix
RAW	CN52084	GROUND WATER
F1	CN52085	DRINKING WATER
F2	CN52086	DRINKING WATER
M1	CN52087	DRINKING WATER
RAW + RECYCLE	CN52088	GROUND WATER

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 13, 2023

FOR:
Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	GROUND WATER	Collected by:		03/01/23	13:00
Location Code:	BLUELEAF	Received by:	B	03/02/23	17:06
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN52084
Phoenix ID: CN52084

Project ID: SHARON
Client ID: RAW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Iron (Dissolved)	0.013	0.011	mg/L	1	03/03/23	CPP	SW6010D	
Manganese (Dissolved)	0.153	0.001	mg/L	1	03/03/23	CPP	SW6010D	
Iron	0.802	0.010	mg/L	1	03/06/23	CPP	SW6010D	
Manganese	0.161	0.001	mg/L	1	03/06/23	CPP	SW6010D	
Heterotrophic Plate Count	63	1	CFU/mL	1	03/02/23 17:55	KG/DT	SM9215B-00	
Alkalinity-CaCO3	45	20.0	mg/L	1	03/03/23	W/M/KD	SM2320B-11	
Chloride	83.1	10.0	mg/L	2	03/03/23	BS/GD	E300.0	
Carbon Dioxide	16	10	mg/L	1	03/07/23	JR	SM4500C	7
Color, Apparent	15	1	Color Units	1	03/02/23 18:50	MEL	SM2120B-11	
Color, True	< 1	1	Color Units	1	03/02/23	MEL	SM2120B-11	
Hydrogen Sulfide	< 0.05	0.05	mg/L	1	03/06/23	GD	SM4500SH	
Ammonia as Nitrogen	< 0.05	0.05	mg/L	1	03/04/23	KDB	E350.1	
Nitrite as Nitrogen	< 0.01	0.01	mg/L	1	03/02/23 21:33	BS/GD	E300.0	
Nitrate as Nitrogen	3.52	0.10	mg/L	2	03/03/23 00:19	BS/GD	E300.0	
pH	7.03	1.00	pH Units	1	03/03/23 03:47	W/M/KD	SM4500-H B-11	
Sulfate	13.8	5.0	mg/L	1	03/02/23	BS/GD	E300.0	
Tot. Diss. Solids	240	10	mg/L	1	03/03/23	Z	SM2540C-15	
Turbidity	1.1	0.200	NTU	1	03/03/23 03:47	W/M/KD	SM2130B-11	
Filtration	Completed				03/02/23	AG	0.45um Filter	
Dissolved Metals Preparation	Completed				03/02/23	AG	SW3005A	
Total Metals Digestion	Completed				03/03/23	AG	SW3005/3010	
Silica	15.4	0.500	mg/L		03/08/23	*	E200.7	7
Volatiles								
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L	1	03/03/23	MH	SW8260C	
1,1,1-Trichloroethane	ND	1.0	ug/L	1	03/03/23	MH	SW8260C	
1,1,2,2-Tetrachloroethane	ND	0.50	ug/L	1	03/03/23	MH	SW8260C	

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
1,1,2-Trichloroethane	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
1,1-Dichloroethane	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
1,1-Dichloroethene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
1,1-Dichloropropene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
1,2,3-Trichlorobenzene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
1,2,3-Trichloropropane	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
1,2,4-Trichlorobenzene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
1,2,4-Trimethylbenzene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
1,2-Dibromo-3-chloropropane	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
1,2-Dibromoethane	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
1,2-Dichlorobenzene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
1,2-Dichloroethane	ND	0.60	ug/L	1	03/03/23	MH	SW8260C
1,2-Dichloropropane	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
1,3,5-Trimethylbenzene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
1,3-Dichlorobenzene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
1,3-Dichloropropane	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
1,4-Dichlorobenzene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
2,2-Dichloropropane	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
2-Chlorotoluene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
2-Hexanone	ND	5.0	ug/L	1	03/03/23	MH	SW8260C
2-Isopropyltoluene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
4-Chlorotoluene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
4-Methyl-2-pentanone	ND	5.0	ug/L	1	03/03/23	MH	SW8260C
Acetone	ND	25	ug/L	1	03/03/23	MH	SW8260C
Acrylonitrile	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Benzene	ND	0.70	ug/L	1	03/03/23	MH	SW8260C
Bromobenzene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Bromochloromethane	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Bromodichloromethane	ND	0.50	ug/L	1	03/03/23	MH	SW8260C
Bromoform	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Bromomethane	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Carbon Disulfide	ND	5.0	ug/L	1	03/03/23	MH	SW8260C
Carbon tetrachloride	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Chlorobenzene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Chloroethane	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Chloroform	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Chloromethane	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
cis-1,2-Dichloroethene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
cis-1,3-Dichloropropene	ND	0.40	ug/L	1	03/03/23	MH	SW8260C
Dibromochloromethane	ND	0.50	ug/L	1	03/03/23	MH	SW8260C
Dibromomethane	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Dichlorodifluoromethane	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Ethylbenzene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Hexachlorobutadiene	ND	0.40	ug/L	1	03/03/23	MH	SW8260C
Isopropylbenzene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
m&p-Xylene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Methyl ethyl ketone	ND	5.0	ug/L	1	03/03/23	MH	SW8260C
Methyl t-butyl ether (MTBE)	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Methylene chloride	ND	1.0	ug/L	1	03/03/23	MH	SW8260C

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Naphthalene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
n-Butylbenzene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
n-Propylbenzene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
o-Xylene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
p-Isopropyltoluene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
sec-Butylbenzene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Styrene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
tert-Butylbenzene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Tetrachloroethene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Tetrahydrofuran (THF)	ND	2.5	ug/L	1	03/03/23	MH	SW8260C
Toluene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Total Xylenes	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
trans-1,2-Dichloroethene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
trans-1,3-Dichloropropene	ND	0.40	ug/L	1	03/03/23	MH	SW8260C
trans-1,4-dichloro-2-butene	ND	5.0	ug/L	1	03/03/23	MH	SW8260C
Trichloroethene	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Trichlorofluoromethane	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Trichlorotrifluoroethane	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
Vinyl chloride	ND	1.0	ug/L	1	03/03/23	MH	SW8260C
QA/QC Surrogates							
% 1,2-dichlorobenzene-d4	100		%	1	03/03/23	MH	70 - 130 %
% Bromofluorobenzene	98		%	1	03/03/23	MH	70 - 130 %
% Dibromofluoromethane	99		%	1	03/03/23	MH	70 - 130 %
% Toluene-d8	98		%	1	03/03/23	MH	70 - 130 %

Oxygenates & Dioxane

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
1,4-Dioxane	ND	100	ug/L	1	03/03/23	MH	SW8260C (OXY)
Diethyl ether	ND	1.0	ug/L	1	03/03/23	MH	SW8260C (OXY)
Di-isopropyl ether	ND	1.0	ug/L	1	03/03/23	MH	SW8260C (OXY)
Ethyl tert-butyl ether	ND	1.0	ug/L	1	03/03/23	MH	SW8260C (OXY)
tert-amyl methyl ether	ND	1.0	ug/L	1	03/03/23	MH	SW8260C (OXY)

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference

7 = This parameter is not certified by MA for this matrix.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected   BRL=Below Reporting Level
QA/QC Surrogates: Surrogates are compounds (preceeded with a %) added by the lab to determine analysis efficiency. Surrogate results(%) listed in the report are not "detected" compounds.

Comments:

The regulatory hold time for pH is immediately. This pH was performed in the laboratory and may be considered outside of hold-time.

* Silica analysis was subcontracted to Summit Environmental Technologies Inc. MA does not certify for this analysis.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 13, 2023
Reviewed and Released by: Greg Lawrence, Assistant Lab Director

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 13, 2023

FOR: Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		03/01/23	13:00
Location Code:	BLUELEAF	Received by:	B	03/02/23	17:06
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN52084
Phoenix ID: CN52085

Project ID: SHARON
Client ID: F1

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron (Dissolved)	< 0.011	0.011	1	mg/L			0.3	03/03/23	CPP	E200.7
Manganese (Dissolved)	0.140	0.001	1	mg/L			0.05	03/03/23	CPP	E200.7
***** Manganese (Dissolved) exceeds 310 CMR 22.00 SMCL level of 0.05***** ***** Manganese (Dissolved) exceeds 40 CFR Part 143 Secondary Goals level of 0.05*****										
Iron	0.044	0.010	1	mg/L			0.3	03/06/23	CPP	E200.7
Manganese	0.151	0.001	1	mg/L			0.05	03/06/23	CPP	E200.7
***** Manganese exceeds 310 CMR 22.00 SMCL level of 0.05***** ***** Manganese exceeds 40 CFR Part 143 Secondary Goals level of 0.05*****										
Heterotrophic Plate Count	741	1	1	CFU/mL				03/02/23 17:55	KG/DT	SM9215B-00
Alkalinity-CaCO3	46	20.0	1	mg/L				03/03/23	MW/M/KDE	SM2320B-11
Color, Apparent	5	1	1	Color Units			15	03/02/23 18:50	MEL	SM2120B-11
Color, True	< 1	1	1	Color Units			15	03/02/23	MEL	SM2120B-11
pH	6.85	1.00	1	pH Units			6.5-8.5	03/03/23 03:56	MW/M/KDE	SM4500-H B-11
Tot. Diss. Solids	240	10	1	mg/L			500	03/03/23	Z	SM2540C-15
Turbidity	0.45	0.200	1	NTU			5	03/03/23 03:56	MW/M/KDE	SM2130B-11
Filtration	Completed							03/02/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed							03/02/23	AG	SW3005A
Total Metal Digestion	Completed							03/03/23	BF	E200.5/E200.7

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level   MCL = Maximum Contaminant Level   Other = Other Goals or Guidances

Comments:

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 141 Monitoring; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

The regulatory hold time for pH is immediately. This pH was performed in the laboratory and may be considered outside of hold-time.

MCLs are established for total recoverable metals, and are not intended to be compared to the dissolved metal concentrations reported on this sample.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 13, 2023
Reviewed and Released by: Greg Lawrence, Assistant Lab Director

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 13, 2023

FOR: Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		03/01/23	13:00
Location Code:	BLUELEAF	Received by:	B	03/02/23	17:06
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN52084
Phoenix ID: CN52086

Project ID: SHARON
Client ID: F2

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron (Dissolved)	< 0.011	0.011	1	mg/L			0.3	03/07/23	TH	E200.7
Manganese (Dissolved)	0.145	0.001	1	mg/L			0.05	03/07/23	TH	E200.7

*** Manganese (Dissolved) exceeds 310 CMR 22.00 SMCL level of 0.05***
*** Manganese (Dissolved) exceeds 40 CFR Part 143 Secondary Goals level of 0.05***

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron	0.052	0.010	1	mg/L			0.3	03/06/23	TH	E200.7
Manganese	0.149	0.001	1	mg/L			0.05	03/06/23	TH	E200.7

*** Manganese exceeds 310 CMR 22.00 SMCL level of 0.05***
*** Manganese exceeds 40 CFR Part 143 Secondary Goals level of 0.05***

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Heterotrophic Plate Count	178	1	1	CFU/mL				03/02/23 17:55	KG/DT	SM9215B-00
Alkalinity-CaCO3	46	20.0	1	mg/L				03/03/23	W/M/KDE	SM2320B-11
Color, Apparent	5	1	1	Color Units			15	03/02/23 18:50	MEL	SM2120B-11
Color, True	< 1	1	1	Color Units			15	03/02/23	MEL	SM2120B-11
pH	6.87	1.00	1	pH Units			6.5-8.5	03/03/23 04:10	W/M/KDE	SM4500-H B-11
Tot. Diss. Solids	240	10	1	mg/L			500	03/03/23	Z	SM2540C-15
Turbidity	0.45	0.200	1	NTU			5	03/03/23 04:10	W/M/KDE	SM2130B-11
Filtration	Completed							03/03/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed							03/03/23	AG	SW3005A
Total Metal Digestion	Completed							03/03/23	BF	E200.5/E200.7

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 141 Monitoring; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

The regulatory hold time for pH is immediately. This pH was performed in the laboratory and may be considered outside of hold-time.

MCLs are established for total recoverable metals, and are not intended to be compared to the dissolved metal concentrations reported on this sample.

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 13, 2023
Reviewed and Released by: Greg Lawrence, Assistant Lab Director

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 13, 2023

FOR: Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		03/01/23	13:00
Location Code:	BLUELEAF	Received by:	B	03/02/23	17:06
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN52084
Phoenix ID: CN52087

Project ID: SHARON
Client ID: M1

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference	
Iron (Dissolved)	< 0.011	0.011	1	mg/L			0.3	03/07/23	TH	E200.7	
Manganese (Dissolved)	0.001	0.001	1	mg/L			0.05	03/07/23	TH	E200.7	
Iron	0.020	0.010	1	mg/L			0.3	03/06/23	TH	E200.7	
Manganese	0.003	0.001	1	mg/L			0.05	03/06/23	TH	E200.7	
Heterotrophic Plate Count	770	1	1	CFU/mL				03/02/23 17:55	KG/DT	SM9215B-00	
Alkalinity-CaCO3	67	20.0	1	mg/L				03/03/23	MW/M/KDE	SM2320B-11	
Chloride	81.5	10.0	2	mg/L			250	03/03/23	BS/GD	E300.0	
Carbon Dioxide	12	10	1	mg/L				03/07/23	JR	SM4500C	7
Color, Apparent	5	1	1	Color Units			15	03/02/23 18:50	MEL	SM2120B-11	
Color, True	< 1	1	1	Color Units			15	03/02/23	MEL	SM2120B-11	
Hydrogen Sulfide	< 0.05	0.05	1	mg/L				03/06/23	GD	SM4500SH	
Ammonia as Nitrogen	< 0.05	0.05	1	mg/L				03/04/23	KDB	E350.1	
Nitrite as Nitrogen	< 0.004	0.004	1	mg/L		1		03/02/23 21:49	BS/GD	E300.0	
Nitrate as Nitrogen	3.47	0.02	2	mg/L		10		03/03/23 00:29	BS/GD	E300.0	
pH	7.35	1.00	1	pH Units			6.5-8.5	03/03/23 04:19	MW/M/KDE	SM4500-H B-11	
Sulfate	13.9	5.0	1	mg/L			250	03/02/23	BS/GD	E300.0-2.1	
Tot. Diss. Solids	240	10	1	mg/L			500	03/03/23	Z	SM2540C-15	
Turbidity	0.25	0.200	1	NTU			5	03/03/23 04:19	MW/M/KDE	SM2130B-11	
Filtration	Completed							03/03/23	AG	0.45um Filter	
Dissolved Metals Preparation	Completed							03/03/23	AG	SW3005A	
Total Metal Digestion	Completed							03/03/23	BF	E200.5/E200.7	
Silica	15.6	0.500		mg/L				03/08/23	*	E200.7	7

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

7 = This parameter is not certified by MA for this matrix.

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level   MCL = Maximum Contaminant Level   Other = Other Goals or Guidances

Comments:

Maximum Contaminant Level (MCL) (Lower of): 310 CMR 22.00 MMCLs; 40 CFR Part 141 MCLs. The highest level of a contaminant that is allowed in drinking water. MCLs are enforceable standards.

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 141 Monitoring; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

The regulatory hold time for pH is immediately. This pH was performed in the laboratory and may be considered outside of hold-time.

MCLs are established for total recoverable metals, and are not intended to be compared to the dissolved metal concentrations reported on this sample.

* Silica analysis was subcontracted to Summit Environmental Technologies Inc. MA does not certify for this analysis.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 13, 2023
Reviewed and Released by: Greg Lawrence, Assistant Lab Director

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 13, 2023

FOR: Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	GROUND WATER	Collected by:		03/01/23	13:00
Location Code:	BLUELEAF	Received by:	B	03/02/23	17:06
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN52084
Phoenix ID: CN52088

Project ID: SHARON
Client ID: RAW + RECYCLE

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	1.44	0.010	mg/L	1	03/06/23	CPP	SW6010D
Manganese	0.155	0.001	mg/L	1	03/06/23	CPP	SW6010D
Total Metals Digestion	Completed				03/03/23	AG	SW3005/3010

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 13, 2023
Reviewed and Released by: Greg Lawrence, Assistant Lab Director

QA/QC Report

March 13, 2023

QA/QC Data

SDG I.D.: GCN52084

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 666427 (mg/L), QC Sample No: CN51503 (CN52084, CN52085)													
ICP Metals - Dissolved													
Iron	BRL	0.011	0.218	0.220	0.90	88.8	88.3	0.6	87.7			80 - 120	20
Manganese	BRL	0.001	4.52	4.35	3.80	89.8	89.2	0.7	77.8			80 - 120	20
Comment:													
Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.													
QA/QC Batch 666582 (mg/L), QC Sample No: CN51739 (CN52084, CN52088)													
ICP Metals - Aqueous													
Iron	BRL	0.010	0.040	0.041	NC	102	103	1.0	103			80 - 120	20
Manganese	BRL	0.001	0.007	0.007	0	102	104	1.9	105			80 - 120	20
Comment:													
Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.													
QA/QC Batch 666586 (mg/L), QC Sample No: CN52558 (CN52086, CN52087)													
ICP Metals - Dissolved													
Iron	BRL	0.011	76.2	76.3	0.10	95.2	93.6	1.7	NC	NC	NC	80 - 120	20
Manganese	BRL	0.001				95.9	94.3	1.7	NC	NC	NC	80 - 120	20
Comment:													
Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.													
QA/QC Batch 666643A (mg/L), QC Sample No: CN52085 (CN52085, CN52086, CN52087)													
ICP Metals - Aqueous													
Iron	BRL	0.010				107			108			85 - 115	20
Manganese	BRL	0.0010				108			99.8			85 - 115	20
Comment:													
This batch does not include a duplicate.													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													

QA/QC Report

March 13, 2023

QA/QC Data

SDG I.D.: GCN52084

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 666788 (mg/L), QC Sample No: CN51503 (CN52084, CN52087)													
Hydrogen Sulfide	BRL	0.05	<0.05	<0.05	NC	96.2			90.6			90 - 110	20
Comment:													
Additional: LCS acceptance range is 90-110% MS acceptance range 75-125%.													
QA/QC Batch 666544 (pH), QC Sample No: CN51599 (CN52084, CN52085, CN52086, CN52087)													
pH			7.17	7.12	0.70	98.9						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 666547 (mg/L), QC Sample No: CN51676 (CN52084, CN52085, CN52086, CN52087)													
Alkalinity-CaCO3	BRL	5.00	44	44	NC	93.6						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 666551 (NTU), QC Sample No: CN51676 (CN52084, CN52085, CN52086, CN52087)													
Turbidity	BRL	0.200	<0.200	<0.200	NC	98.3						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 666936 (mg/L), QC Sample No: CN52084 (CN52084, CN52087)													
Carbon Dioxide	BRL		16	16	NC	104						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 666534 (mg/L), QC Sample No: CN52084 (CN52084, CN52085, CN52086, CN52087)													
Tot. Diss. Solids	BRL	10	240	250	4.10	100						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 666585 (mg/L), QC Sample No: CN51520 (CN52084, CN52087)													
Chloride	BRL	5.0	54.9	54.9	0	104			104			90 - 110	20
Nitrate as Nitrogen	BRL	0.05	0.02	<0.05	NC	94.1			93.1			90 - 110	20
Nitrite as Nitrogen	BRL	0.004	<0.004	<0.004	NC	104			101			90 - 110	20
Sulfate	BRL	5.0	26.7	26.4	1.10	104			104			90 - 110	20
QA/QC Batch 666584 (mg/L), QC Sample No: CN51790 (CN52084, CN52087)													
Ammonia as Nitrogen	BRL	0.05	<0.10	<0.10	NC	103			99.0			90 - 110	20

QA/QC Report

March 13, 2023

QA/QC Data

SDG I.D.: GCN52084

QA/QC Batch 666629 (ug/L), QC Sample No: CN51821 (CN52084)

Volatiles - Ground Water

Parameter	Blank	Blk RL	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
1,1,1,2-Tetrachloroethane	ND	1.0	108	104	3.8				70 - 130	20
1,1,1-Trichloroethane	ND	1.0	102	96	6.1				70 - 130	20
1,1,2,2-Tetrachloroethane	ND	0.50	102	100	2.0				70 - 130	20
1,1,2-Trichloroethane	ND	1.0	104	102	1.9				70 - 130	20
1,1-Dichloroethane	ND	1.0	99	97	2.0				70 - 130	20
1,1-Dichloroethene	ND	1.0	99	94	5.2				70 - 130	20
1,1-Dichloropropene	ND	1.0	100	95	5.1				70 - 130	20
1,2,3-Trichlorobenzene	ND	1.0	110	105	4.7				70 - 130	20
1,2,3-Trichloropropane	ND	1.0	100	99	1.0				70 - 130	20
1,2,4-Trichlorobenzene	ND	1.0	112	109	2.7				70 - 130	20
1,2,4-Trimethylbenzene	ND	1.0	110	105	4.7				70 - 130	20
1,2-Dibromo-3-chloropropane	ND	1.0	108	110	1.8				70 - 130	20
1,2-Dibromoethane	ND	1.0	104	103	1.0				70 - 130	20
1,2-Dichlorobenzene	ND	1.0	105	102	2.9				70 - 130	20
1,2-Dichloroethane	ND	1.0	104	101	2.9				70 - 130	20
1,2-Dichloropropane	ND	1.0	105	103	1.9				70 - 130	20
1,3,5-Trimethylbenzene	ND	1.0	108	103	4.7				70 - 130	20
1,3-Dichlorobenzene	ND	1.0	106	102	3.8				70 - 130	20
1,3-Dichloropropane	ND	1.0	104	102	1.9				70 - 130	20
1,4-Dichlorobenzene	ND	1.0	105	101	3.9				70 - 130	20
1,4-dioxane	ND	100	112	100	11.3				40 - 160	20
2,2-Dichloropropane	ND	1.0	107	102	4.8				70 - 130	20
2-Chlorotoluene	ND	1.0	107	102	4.8				70 - 130	20
2-Hexanone	ND	5.0	105	102	2.9				40 - 160	20
2-Isopropyltoluene	ND	1.0	108	104	3.8				70 - 130	20
4-Chlorotoluene	ND	1.0	106	101	4.8				70 - 130	20
4-Methyl-2-pentanone	ND	5.0	108	108	0.0				40 - 160	20
Acetone	ND	5.0	94	94	0.0				40 - 160	20
Acrylonitrile	ND	5.0	103	103	0.0				70 - 130	20
Benzene	ND	0.70	104	99	4.9				70 - 130	20
Bromobenzene	ND	1.0	105	101	3.9				70 - 130	20
Bromochloromethane	ND	1.0	103	99	4.0				70 - 130	20
Bromodichloromethane	ND	0.50	106	102	3.8				70 - 130	20
Bromoform	ND	1.0	111	107	3.7				70 - 130	20
Bromomethane	ND	1.0	111	111	0.0				40 - 160	20
Carbon Disulfide	ND	1.0	102	98	4.0				70 - 130	20
Carbon tetrachloride	ND	1.0	99	95	4.1				70 - 130	20
Chlorobenzene	ND	1.0	103	99	4.0				70 - 130	20
Chloroethane	ND	1.0	96	95	1.0				70 - 130	20
Chloroform	ND	1.0	101	98	3.0				70 - 130	20
Chloromethane	ND	1.0	97	91	6.4				40 - 160	20

QA/QC Data

SDG I.D.: GCN52084

Parameter	Blank	Blk RL	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
cis-1,2-Dichloroethene	ND	1.0	103	99	4.0				70 - 130	20
cis-1,3-Dichloropropene	ND	0.40	114	110	3.6				70 - 130	20
Dibromochloromethane	ND	0.50	110	105	4.7				70 - 130	20
Dibromomethane	ND	1.0	102	100	2.0				70 - 130	20
Dichlorodifluoromethane	ND	1.0	75	71	5.5				40 - 160	20
Di-isopropyl ether	ND	1.0	104	101	2.9				70 - 130	20
Ethyl ether	ND	1.0	110	109	0.9				70 - 130	20
Ethyl tert-butyl ether	ND	1.0	104	103	1.0				70 - 130	20
Ethylbenzene	ND	1.0	103	99	4.0				70 - 130	20
Hexachlorobutadiene	ND	0.40	107	100	6.8				70 - 130	20
Isopropylbenzene	ND	1.0	109	105	3.7				70 - 130	20
m&p-Xylene	ND	1.0	107	101	5.8				70 - 130	20
Methyl ethyl ketone	ND	5.0	99	100	1.0				40 - 160	20
Methyl t-butyl ether (MTBE)	ND	1.0	102	101	1.0				70 - 130	20
Methylene chloride	ND	1.0	98	93	5.2				70 - 130	20
Naphthalene	ND	1.0	118	115	2.6				70 - 130	20
n-Butylbenzene	ND	1.0	107	102	4.8				70 - 130	20
n-Propylbenzene	ND	1.0	104	100	3.9				70 - 130	20
o-Xylene	ND	1.0	112	107	4.6				70 - 130	20
p-Isopropyltoluene	ND	1.0	108	103	4.7				70 - 130	20
sec-Butylbenzene	ND	1.0	104	100	3.9				70 - 130	20
Styrene	ND	1.0	108	104	3.8				70 - 130	20
tert-amyl methyl ether	ND	1.0	108	104	3.8				70 - 130	20
tert-Butylbenzene	ND	1.0	107	103	3.8				70 - 130	20
Tetrachloroethene	ND	1.0	103	98	5.0				70 - 130	20
Tetrahydrofuran (THF)	ND	2.5	108	106	1.9				70 - 130	20
Toluene	ND	1.0	102	98	4.0				70 - 130	20
trans-1,2-Dichloroethene	ND	1.0	101	96	5.1				70 - 130	20
trans-1,3-Dichloropropene	ND	0.40	113	109	3.6				70 - 130	20
trans-1,4-dichloro-2-butene	ND	5.0	108	106	1.9				70 - 130	20
Trichloroethene	ND	1.0	103	100	3.0				70 - 130	20
Trichlorofluoromethane	ND	1.0	88	87	1.1				70 - 130	20
Trichlorotrifluoroethane	ND	1.0	100	95	5.1				70 - 130	20
Vinyl chloride	ND	1.0	99	93	6.3				70 - 130	20
% 1,2-dichlorobenzene-d4	100	%	98	100	2.0				70 - 130	20
% Bromofluorobenzene	97	%	100	100	0.0				70 - 130	20
% Dibromofluoromethane	100	%	98	101	3.0				70 - 130	20
% Toluene-d8	99	%	100	100	0.0				70 - 130	20

Comment:

A LCS and LCS Duplicate were performed instead of a matrix spike and matrix spike duplicate.

Additional 8260 criteria: 10% of compounds can be outside of acceptance criteria as long as recovery is 10%.
The RPD criteria for the LCS/LCSD is 20%,
The MS/MSD RPD criteria is listed above.

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

RPD - Relative Percent Difference
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MS Dup - Matrix Spike Duplicate
NC - No Criteria
Intf - Interference

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 13, 2023

Monday, March 13, 2023

Criteria: MA: DW

State: MA

Sample Criteria Exceedances Report

GCN52084 - BLUELEAF

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units
CN52085	D-MN	Manganese (Dissolved)	EPA / 40 CFR 141 DW / 143.3 Secondary Goals	0.140	0.001	0.05	0.01	mg/L
CN52085	D-MN	Manganese (Dissolved)	MA / 310 CMR 22.00 / SMCL	0.140	0.001	0.05	0.05	mg/L
CN52085	MN-DW	Manganese	EPA / 40 CFR 141 DW / 143.3 Secondary Goals	0.151	0.001	0.05	0.01	mg/L
CN52085	MN-DW	Manganese	MA / 310 CMR 22.00 / SMCL	0.151	0.001	0.05	0.05	mg/L
CN52086	D-MN	Manganese (Dissolved)	EPA / 40 CFR 141 DW / 143.3 Secondary Goals	0.145	0.001	0.05	0.01	mg/L
CN52086	D-MN	Manganese (Dissolved)	MA / 310 CMR 22.00 / SMCL	0.145	0.001	0.05	0.05	mg/L
CN52086	MN-DW	Manganese	EPA / 40 CFR 141 DW / 143.3 Secondary Goals	0.149	0.001	0.05	0.01	mg/L
CN52086	MN-DW	Manganese	MA / 310 CMR 22.00 / SMCL	0.149	0.001	0.05	0.05	mg/L

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

ACCREDITED IN ACCORDANCE WITH nelac NY # 11301

Analysis Comments

March 13, 2023 SDG I.D.: GCN52084

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report:

VOA Narration

CHEM02 03/02/23-4: CN52084

Chem02 is a 25ml purge instrument. The laboratory minimum response factor is set at 0.01 instead of 0.05 for the 25ml purge instruments. EPA method 8260D Table 4 supports this approach.

The following Initial Calibration compounds did not meet RSD% criteria: Bromomethane 25% (20%), Naphthalene 25% (20%)
The following Initial Calibration compounds did not meet maximum RSD% criteria: None.
The following Initial Calibration compounds did not meet recommended response factors: 1,2-Dibromo-3-chloropropane 0.023 (0.05), 2-Hexanone 0.034 (0.1), 4-Methyl-2-pentanone 0.044 (0.1), Acetone 0.023 (0.1), Acrylonitrile 0.023 (0.05), Bromoform 0.053 (0.1), Methyl ethyl ketone 0.037 (0.1), Tetrachloroethene 0.164 (0.2), Tetrahydrofuran (THF) 0.023 (0.05)
The following Initial Calibration compounds did not meet minimum response factors: 1,2-Dibromo-3-chloropropane 0.023 (0.05), 2-Hexanone 0.034 (0.05), 4-Methyl-2-pentanone 0.044 (0.05), Acetone 0.023 (0.05), Acrylonitrile 0.023 (0.05), Methyl ethyl ketone 0.037 (0.05), Tetrahydrofuran (THF) 0.023 (0.05)

The following Continuing Calibration compounds did not meet recommended response factors: 1,2-Dibromo-3-chloropropane 0.022 (0.05), 2-Hexanone 0.032 (0.05), 4-Methyl-2-pentanone 0.042 (0.05), Acetone 0.020 (0.05), Acrylonitrile 0.022 (0.05), Methyl ethyl ketone 0.033 (0.05), Tetrahydrofuran (THF) 0.022 (0.05)
The following Continuing Calibration compounds did not meet minimum response factors: 1,2-Dibromo-3-chloropropane 0.023 (0.05), 2-Hexanone 0.034 (0.05), 4-Methyl-2-pentanone 0.044 (0.05), Acetone 0.023 (0.05), Acrylonitrile 0.023 (0.05), Methyl ethyl ketone 0.037 (0.05), Tetrahydrofuran (THF) 0.023 (0.05)

Up to eight compounds can be outside of ICAL %RSD criteria and up to sixteen compounds can be outside of CCAL %Dev criteria if less than 40%.

Cooler: Yes ☒ No ☐
Coolant: IPK ☒ ICE ☐ No ☐

PHOENIX
Environmental Laboratories, Inc.

CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email Makrina Nolan: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 1.8 °C Pg of

Data Delivery/Contact Options:
☐ Fax:
☐ Phone:
☐ Email:

Customer: Bluelect, Inc.
Address: 57 Dresser Hill Rd.
Charlton, MA 01507

Project: Sharon
Report to: Aaron Davis
Invoice to: Erik Grotton
QUOTE #

Project P.O:

This section MUST be completed with Bottle Quantities. 20

Client Sample - Information - Identification

Sampler's Signature Date: 3/1/23

Matrix Code:
DW=Drinking Water GW=Ground Water SW=Surface Water WW=Waste Water
RW=Raw Water SE=Sediment SL=Sludge S=Soil SD=Solid W=Wipe OIL=Oil
B=Bulk L=Liquid X = ____________(Other)

Analysis Request

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	TURB, COLOR T+A	pH, TDS, Alkalinity	SO4, Chloride, NO2, NO3, NH4	Total Fe, Mn	Dis Fe, Mn	HPC	H2S, Silica, CO2		Total VOCs	MS/MSD *	GL Amber 8 oz. [ ] H3PO4 [ ] NAHSO4	Soil VOA Vials [ ] methanol [ ] H2O	GL Soil container ( ) oz	~~GL Soil container ( ) oz~~ 20 ml VOA	40 ml VOA Vial [ ] As is [X] HCL	GL Amber 1000ml [ ] As is [ ] H2SO4	PL As is [X] 250ml [ ] 500ml [X] 1000ml	PL H2SO4 [ ] 250ml [ ] 500ml	PL HNO3 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is	
52084	RAW	GW	3/1/23	13:00	X	X	X	X	X	X	X		X					2	3		4	1	2	1		1	14
52085	F1	DW	↓	↓	X	X		X	X	X											3		1				5
52086	F2	DW	↓	↓	X	X		X	X	X											3		1				5
52087	M1	DW	↓	↓	X	X	X	X	X	X	X							2			4	1	2	1		1	11
52088	RAW + RECYCLE	GW	↓	↓			*	X															1				1

(36)

Relinquished by:	Accepted by:	Date:	Time:
		3/2/23	4:00
		3/2/23	17:06

Comments, Special Requirements or Regulations:

**MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.*

Turnaround Time:
☐ 1 Day*
☐ 2 Days*
☐ 3 Days*
☒ Standard
☐ Other
* SURCHARGE APPLIES

RI
☐ (Residential) Direct Exposure
☐ (Comm/Industrial) Direct Exposure
☐ GA Leachability
☐ GB Leachability
☐ GA-GW Objectives
☐ GB-GW Objectives

CT
☐ RCP Cert
☐ GW Protection
☐ SW Protection
☐ GA Mobility
☐ GB Mobility
☐ Residential DEC
☐ I/C DEC
☐ Other

MA
☐ MCP Certification
☐ GW-1 ☐ MWRA eSMART
☐ GW-2 ☐ S-1 10% CALC
☐ GW-3
☐ S-1 GW-1 ☐ S-1 GW-2 ☐ S-1 GW-3
☐ S-2 GW-1 ☐ S-2 GW-2 ☐ S-2 GW-3
☐ S-3 GW-1 ☐ S-3 GW-2 ☐ S-3 GW-3
☐ SW Protection

State where samples were collected: MA

Data Format
☐ Excel
☐ PDF
☐ GIS/Key
☐ EQuIS
☐ Other

Data Package
☐ Tier II Checklist
☐ Full Data Package*
☐ Phoenix Std Report
☐ Other

* SURCHARGE APPLIES

PEL-126 REV. 03/22

Bobbi Aloisa

From: Bobbi Aloisa
Sent: Friday, March 03, 2023 6:22 PM
To: adavis@blueleafwater.com
Cc: Bobbi Aloisa
Subject: hold time SPC
Attachments: GCN52084-ChainofCustody-1.pdf

HI Aaron
Hope you are doing well. Reaching out tonight on the attached chain, specifically the SPC which arrived to the lab past the 8 hour hold time. We will be processing the SPC testing past hold time

If you have any questions please feel free to reach out

Bobbi

Bobbi Aloisa
Vice President | Director of Client Services
Phoenix Environmental Laboratories, Inc.
587 East Middle Turnpike | Manchester, CT 06040
Direct Line: (860)-645-8728
www.phoenixlabs.com

Cooler: Yes ☒ No ☐
Coolant: IPK ☒ ICE ☐ No ☐

PHOENIX
Environmental Laboratories, Inc.

CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email Makrina Nolan: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 1.8 °C Pg of

Data Delivery/Contact Options:
☐ Fax:
☐ Phone:
☐ Email:

Customer: Bluelect, Inc.
Address: 57 Dresser Hill Rd.
Charlton, MA 01507

Project: Sharon
Report to: Aaron Davis
Invoice to: Erik Grotton
QUOTE #

Project P.O:

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification
Sampler's Signature Date: 3/1/23

Matrix Code:
DW=Drinking Water GW=Ground Water SW=Surface Water WW=Waste Water
RW=Raw Water SE=Sediment SL=Sludge S=Soil SD=Solid W=Wipe OIL=Oil
B=Bulk L=Liquid X = ____________(Other)

Analysis Request

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	TURB, COLOR T+A	pH, TDS, Alkalinity	SO4, Chloride, NO2, NO3, NH4	Total Fe, Mn	Dis Fe, Mn	HPC	H2S, Silica, CO2		Total VOCs	MS/MSD *	GL Amber 8 oz. [ ] H3PO4 [ ] NAHSO4	Soil VOA Vials [ ] methanol [ ] H2O	GL Soil container ( )oz	~~GL Soil container~~ ( )oz 20 ml VOA	40 ml VOA Vial [ ] As is [X] HCL	GL Amber 1000ml [ ] As is [ ] H2SO4	PL As is [X] 250ml [ ] 500ml [X] 1000ml	PL H2SO4 [ ] 250ml [ ] 500ml	PL HNO3 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is	120
52084	RAW	GW	3/1/23	13:00	X	X	X	X	X	X	X		X					2	3		4	1	2	1		1	14
52085	F1	DW			X	X		X	X	X											3		1				5
52086	F2	DW			X	X		X	X	X											3		1				5
52087	M1	DW			X	X	X	X	X	X	X							2			4	1	2	1		1	11
52088	RAW + RECYCLE	GW	↓	↓			~~X~~	X															1				1

36

Relinquished by:	Accepted by:	Date:	Time:
		3/2/23	4:00
		3/2/23	17:06

Comments, Special Requirements or Regulations:

Turnaround Time:
☐ 1 Day*
☐ 2 Days*
☐ 3 Days*
☒ Standard
☐ Other
* SURCHARGE APPLIES

*MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.

RI
☐ (Residential) Direct Exposure
☐ (Comm/Industrial) Direct Exposure
☐ GA Leachability
☐ GB Leachability
☐ GA-GW Objectives
☐ GB-GW Objectives

CT
☐ RCP Cert
☐ GW Protection
☐ SW Protection
☐ GA Mobility
☐ GB Mobility
☐ Residential DEC
☐ I/C DEC
☐ Other

MA
☐ MCP Certification
☐ GW-1 ☐ MWRA eSMART
☐ GW-2 ☐ S-1 10% CALC
☐ GW-3
☐ S-1 GW-1 ☐ S-1 GW-2 ☐ S-1 GW-3
☐ S-2 GW-1 ☐ S-2 GW-2 ☐ S-2 GW-3
☐ S-3 GW-1 ☐ S-3 GW-2 ☐ S-3 GW-3
☐ SW Protection

State where samples were collected: MA

Data Format
☐ Excel
☐ PDF
☐ GIS/Key
☐ EQuIS
☐ Other

Data Package
☐ Tier II Checklist
☐ Full Data Package*
☐ Phoenix Std Report
☐ Other

* SURCHARGE APPLIES

PEL-126 REV. 03/22

PHOENIX
Environmental Laboratories, Inc.

Thursday, March 09, 2023

**Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507**

**Project ID: SHARON
SDG ID: GCN52089
Sample ID#s: CN52089 - CN52093**

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller

**Phyllis Shiller
Laboratory Director**

**NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B**

**NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301**

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Sample Id Cross Reference

March 09, 2023

SDG I.D.: GCN52089

Project ID: SHARON

Client Id	Lab Id	Matrix
RAW	CN52089	GROUND WATER
FILTER A	CN52090	DRINKING WATER
FILTER B	CN52091	DRINKING WATER
FILTER C	CN52092	DRINKING WATER
FILTER D	CN52093	DRINKING WATER

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 09, 2023

FOR: Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	GROUND WATER	Collected by:		03/02/23	12:15
Location Code:	BLUELEAF	Received by:	B	03/02/23	17:06
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN52089
Phoenix ID: CN52089

Project ID: SHARON
Client ID: RAW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	0.993	0.010	mg/L	1	03/06/23	CPP	SW6010D
Manganese	0.161	0.001	mg/L	1	03/06/23	CPP	SW6010D
Total Metals Digestion	Completed				03/03/23	AG	SW3005/3010

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 09, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 09, 2023

FOR: Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		03/02/23	12:15
Location Code:	BLUELEAF	Received by:	B	03/02/23	17:06
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN52089
Phoenix ID: CN52090

Project ID: SHARON
Client ID: FILTER A

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron	< 0.010	0.010	1	mg/L			0.3	03/06/23	TH	E200.7
Manganese	< 0.001	0.001	1	mg/L			0.05	03/06/23	TH	E200.7
Total Metal Digestion	Completed							03/03/23	BF	E200.5/E200.7

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 09, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 09, 2023

FOR: Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		03/02/23	12:15
Location Code:	BLUELEAF	Received by:	B	03/02/23	17:06
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN52089
Phoenix ID: CN52091

Project ID: SHARON
Client ID: FILTER B

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron	< 0.010	0.010	1	mg/L			0.3	03/07/23	TH	E200.7
Manganese	0.001	0.001	1	mg/L			0.05	03/07/23	TH	E200.7
Total Metal Digestion	Completed							03/06/23	AG	E200.5/E200.7

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 09, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 09, 2023

FOR: Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		03/02/23	12:15
Location Code:	BLUELEAF	Received by:	B	03/02/23	17:06
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN52089
Phoenix ID: CN52092

Project ID: SHARON
Client ID: FILTER C

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron	< 0.010	0.010	1	mg/L			0.3	03/07/23	TH	E200.7
Manganese	< 0.001	0.001	1	mg/L			0.05	03/07/23	TH	E200.7
Total Metal Digestion	Completed							03/06/23	AG	E200.5/E200.7

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 09, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 09, 2023

FOR: Attn: Mr Erik Grotton
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		03/02/23	12:15
Location Code:	BLUELEAF	Received by:	B	03/02/23	17:06
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN52089
Phoenix ID: CN52093

Project ID: SHARON
Client ID: FILTER D

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron	0.014	0.010	1	mg/L			0.3	03/07/23	TH	E200.7
Manganese	0.001	0.001	1	mg/L			0.05	03/07/23	TH	E200.7
Total Metal Digestion	Completed							03/06/23	AG	E200.5/E200.7

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 09, 2023
Reviewed and Released by: Makrina Nolan

QA/QC Report

March 09, 2023

QA/QC Data

SDG I.D.: GCN52089

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 666582 (mg/L), QC Sample No: CN51739 (CN52089)													
<u>ICP Metals - Aqueous</u>													
Iron	BRL	0.010	0.040	0.041	NC	102	103	1.0	103			80 - 120	20
Manganese	BRL	0.001	0.007	0.007	0	102	104	1.9	105			80 - 120	20
Comment:													
Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.													
QA/QC Batch 666643A (mg/L), QC Sample No: CN52085 (CN52090)													
<u>ICP Metals - Aqueous</u>													
Iron	BRL	0.010				107			108			85 - 115	20
Manganese	BRL	0.0010				108			99.8			85 - 115	20
Comment:													
This batch does not include a duplicate.													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 666805 (mg/L), QC Sample No: CN52091 (CN52091, CN52092, CN52093)													
<u>ICP Metals - Aqueous</u>													
Iron	BRL	0.010	<0.010	0.011	NC	98.4			106			85 - 115	20
Manganese	BRL	0.0010	0.001	<0.0010	NC	99.1			102			85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

RPD - Relative Percent Difference
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MS Dup - Matrix Spike Duplicate
NC - No Criteria
Intf - Interference

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 09, 2023

Thursday, March 09, 2023

Criteria: MA: DW

State: MA

Sample Criteria Exceedances Report

GCN52089 - BLUELEAF

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units

*** No Data to Display ***

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

Analysis Comments

March 09, 2023 SDG I.D.: GCN52089

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

Cooler: Yes ☑ No ☐
Coolant: IPK ☒ ICE ☐ No ☐

PHOENIX
Environmental Laboratories, Inc.

CT/MA/RI CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 1.8 °C Pg of

Data Delivery/Contact Options:
☐ Fax:
☐ Phone:
☐ Email:

Customer: Blueleaf, Inc.
Address: 57 Dresser Hill Road
Charlton, MA 01507

Project: Sharon
Report to: Aaron Davis
Invoice to: Erik Grotton
Quote #

Project P.O:

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature Date: 3/2/23

Matrix Code:
DW=Drinking Water GW=Ground Water SW=Surface Water WW=Waste Water
RW=Raw Water SE=Sediment SL=Sludge S=Soil SD=Solid W=Wipe OIL=Oil
B=Bulk L=Liquid X = ____________(Other)

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	*MS/MSD (May be billable at analysis unit rate)	TOTAL Fe, Mn	GL Amber 8 oz. [ ] w/H$_3$PO$_4$ [ ] NAHSO$_4$	Soil VOA Vials [ ] methanol [ ] H$_2$O	GL Soil container ( ) oz	GL Soil container ( ) oz	40 ml VOA Vial [ ] As is [ ] HCl	GL Amber 1000ml [ ] As is [ ] H$_2$SO$_4$	PL As is [ ] 250ml [ ] 500ml [ ] 1000ml	PL H$_2$SO$_4$ [ ] 250ml [ ] 500ml	PL HNO$_3$ 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is
52089	RAW	GW	3/2/2023	12:15		X												/
52090	FILTER A	DW	3/2/2023	12:15		X												/
52091	FILTER B	DW	3/2/2023	12:15		X												/
52092	FILTER C	DW	3/2/2023	12:15		X												/
52093	FILTER D	DW	3/2/2023	12:15		X												/

⑤

Relinquished by:	Accepted by:	Date:	Time:
		3/2/23	4:00
		3/2/23	17:06

Comments, Special Requirements or Regulations:

Turnaround Time:
☐ 1 Day*
☐ 2 Days*
☐ 3 Days*
☐ 4 Days*
☐ 5 Days*
☒ Standard
☐ Other ________

RI
☐ RES DEC
☐ I/C DEC
☐ GA Leachability
☐ GB Leachability
☐ GA -GW Objectives
☐ GB -GW Objectives
☐ Other

CT
☐ RCP Cert
☐ GWPC
☐ SWPC
☐ GA PMC
☐ GB PMC
☐ SWPC
☐ RES DEC
☐ I/C DEC

MA
☐ MCP Certification
☐ GW-1
☐ GW-2
☐ GW-3
☐ S-1
☐ S-2
☐ S-3
☐ SW Protection
☐ RCS-1 / RCGW-1
☐ RCS-2 / RCGW-2
☐ ________

Data Format
☐ Excel
☐ PDF
☐ GIS/Key
☐ EQuIS
☐ Other

Data Package
☐ Tier II Checklist*
☐ Full Data Package*
☐ Phoenix Std
☐ Other

State where samples were collected: MA

**MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.*

* SURCHARGES MAY APPLY

* SURCHARGE APPLIES

PHOENIX
Environmental Laboratories, Inc.

Friday, March 17, 2023

Attn: Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Project ID: SHARON
SDG ID: GCN53947
Sample ID#s: CN53947 - CN53948

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B

NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Sample Id Cross Reference

March 17, 2023

SDG I.D.: GCN53947

Project ID: SHARON

Client Id	Lab Id	Matrix
M1 CBW	CN53947	WATER
M1 SSN	CN53948	WATER

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 17, 2023

FOR: Attn: Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information

Matrix: WATER
Location Code: BLUELEAF
Rush Request: Standard
P.O.#:

Custody Information		Date	Time
Collected by:		03/06/23	12:06
Received by:	SR1	03/07/23	14:34
Analyzed by:	see "By" below		

Laboratory Data

SDG ID: GCN53947
Phoenix ID: CN53947

Project ID: SHARON
Client ID: M1 CBW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron (Dissolved)	< 0.011	0.011	mg/L	1	03/08/23	TH	E200.7
Manganese (Dissolved)	0.001	0.001	mg/L	1	03/08/23	CPP	E200.7
Iron	54.4	0.10	mg/L	1	03/11/23	CPP	E200.7
Manganese	337	1.0	mg/L	100	03/15/23	TH	E200.7
Settleable Solids	30.2	0.10	ml/L	1	03/08/23 05:15	KDB	SM2540F-15
Total Suspended Solids	1400	17	mg/L	3.3	03/08/23	Z	SM2540D-15
Filtration	Completed				03/07/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed				03/07/23	AG	SW3005A
Total Metals Digestion	Completed				03/08/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 17, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

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587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 17, 2023

FOR: Attn: Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		03/06/23	16:00
Location Code:	BLUELEAF	Received by:	SR1	03/07/23	14:34
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN53947
Phoenix ID: CN53948

Project ID: SHARON
Client ID: M1 SSN

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron (Dissolved)	0.016	0.011	mg/L	1	03/08/23	TH	E200.7
Manganese (Dissolved)	0.002	0.001	mg/L	1	03/08/23	CPP	E200.7
Iron	1.84	0.010	mg/L	1	03/11/23	CPP	E200.7
Manganese	4.48	0.010	mg/L	10	03/15/23	TH	E200.7
Settleable Solids	< 0.10	0.10	ml/L	1	03/08/23 05:15	KDB	SM2540F-15
Total Suspended Solids	16	3.0	mg/L	0.6	03/08/23	Z	SM2540D-15
Filtration	Completed				03/07/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed				03/07/23	AG	SW3005A
Total Metals Digestion	Completed				03/08/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 17, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

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587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102

QA/QC Report

March 17, 2023

QA/QC Data

SDG I.D.: GCN53947

QA/QC Batch 666962 (mg/L), QC Sample No: CN53714 (CN53947, CN53948)

ICP Metals - Dissolved

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
Iron	BRL	0.015	<0.011	<0.011	NC	89.7	91.7	2.2	92.0			80 - 120	20
Manganese	BRL	0.001	0.018	0.017	5.70	90.3	91.9	1.8	92.7			80 - 120	20

Comment:

Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.

QA/QC Batch 667167 (mg/L), QC Sample No: CN54103 (CN53947, CN53948)

ICP Metals - Aqueous

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
Iron	BRL	0.010	8.92	9.10	2.00	97.6	97.3	0.3	NC			80 - 120	20
Manganese	BRL	0.001	0.013	0.013	0	98.5	98.4	0.1	100			80 - 120	20

Comment:

Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.

QA/QC Report

March 17, 2023

QA/QC Data

SDG I.D.: GCN53947

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 667069 (mg/L), QC Sample No: CN54256 (CN53947, CN53948)													
Total Suspended Solids	BRL	2.5	<2.0	<2.0	NC	103						85 - 115	

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

RPD - Relative Percent Difference
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MS Dup - Matrix Spike Duplicate
NC - No Criteria
Intf - Interference

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 17, 2023

Friday, March 17, 2023

Criteria: None

State: MA

Sample Criteria Exceedances Report

GCN53947 - BLUELEAF

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units

*** No Data to Display ***

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

Analysis Comments

March 17, 2023 SDG I.D.: GCN53947

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

Cooler: Yes ☑ No ☐
Coolant: IPK [✓] ICE ☐ No ☐

PHOENIX
Environmental Laboratories, Inc.

CT/MA/RI CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 1.1 °C Pg of

Data Delivery/Contact Options:
☐ Fax:
☐ Phone:
☐ Email:

Customer: Blueleaf, Inc.
Address: 57 Dresser Hill Road
Charlton, MA 01507

Project: Sharon
Report to: Aaron Davis
Invoice to: Erik Grotton
Quote #

Project P.O:

This section MUST be completed with Bottle Quantities. ↓ ↓ ↓ ↓ ↓

Client Sample - Information - Identification

Sampler's Signature DAN COBURN Date: 3/6/23

Matrix Code:
DW=Drinking Water GW=Ground Water SW=Surface Water WW=Waste Water
RW=Raw Water SE=Sediment SL=Sludge S=Soil SD=Solid W=Wipe OIL=Oil
B=Bulk L=Liquid X = ____________(Other)

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	*MS/MSD (May be billable at analysis unit rate)	Total Fe, Mn	TSS	Settlable Solids	Dissolved Fe, Mn (Lab Filter)								GL Amber 8 oz. [ ] w/H$_3$PO$_4$ [ ] NAHSO$_4$	Soil VOA Vials [ ] methanol [ ] H$_2$O	GL Soil container ( )oz	GL Soil container ( )oz	40 ml VOA Vial [ ] As is [ ] HCl	GL Amber 1000ml [ ] As is [ ] H$_2$SO$_4$	PL As is [2] 250ml [ ] 500ml [1] 1000ml	PL H$_2$SO$_4$ [ ] 250ml [ ] 500ml	PL HNO$_3$ 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is	
53947	M1 CBW	BW	3/6/2023	12:06		X	X	X	X														3		1				4
53948	M1 SSN	BW	3/6/2023	16:00		X	X	X	X														3		1				4
																												TOTAL	8

Relinquished by:	Accepted by:	Date:	Time:
		3/7/23	9:00
		3/7/23	14:34

Comments, Special Requirements or Regulations:

Turnaround Time:
☐ 1 Day*
☐ 2 Days*
☐ 3 Days*
☐ 4 Days*
☐ 5 Days*
☑ Standard
☐ Other ________

MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.

* SURCHARGES MAY APPLY

RI
☐ RES DEC
☐ I/C DEC
☐ GA Leachability
☐ GB Leachability
☐ GA -GW Objectives
☐ GB -GW Objectives
☐ Other

CT
☐ RCP Cert
☐ GWPC
☐ SWPC
☐ GA PMC
☐ GB PMC
☐ SWPC
☐ RES DEC
☐ I/C DEC

MA
☐ MCP Certification
☐ GW-1
☐ GW-2
☐ GW-3
☐ S-1
☐ S-2
☐ S-3
☐ SW Protection
☐ RCS-1 / RCGW-1
☐ RCS-2 / RCGW-2
☐ ____________

State where samples were collected: MA

Data Format
☐ Excel
☐ PDF
☐ GIS/Key
☐ EQuIS
☐ Other

Data Package
☐ Tier II Checklist*
☐ Full Data Package*
☐ Phoenix Std
☐ Other

* SURCHARGE APPLIES

PHOENIX
Environmental Laboratories, Inc.

Monday, March 13, 2023

Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Project ID: SHARON
SDG ID: GCN55216
Sample ID#s: CN55216 - CN55223

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B
NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301

PHOENIX

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587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Sample Id Cross Reference

March 13, 2023

SDG I.D.: GCN55216

Project ID: SHARON

Client Id	Lab Id	Matrix
RAW	CN55216	GROUND WATER
FILTER A	CN55217	DRINKING WATER
FILTER B	CN55218	DRINKING WATER
FILTER C	CN55219	DRINKING WATER
FILTER D	CN55220	DRINKING WATER
F1	CN55221	DRINKING WATER
F2	CN55222	DRINKING WATER
M1	CN55223	DRINKING WATER

PHOENIX

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Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 13, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	GROUND WATER	Collected by:		03/07/23	10:00
Location Code:	BLUELEAF	Received by:	CP	03/08/23	15:11
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN55216
Phoenix ID: CN55216

Project ID: SHARON
Client ID: RAW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron (Dissolved)	0.016	0.011	mg/L	1	03/10/23	CPP	SW6010D
Manganese (Dissolved)	0.154	0.001	mg/L	1	03/10/23	CPP	SW6010D
Iron	0.732	0.010	mg/L	1	03/10/23	TH	SW6010D
Hardness (CaCO3), calc.	107	0.1	mg/L	1	03/11/23		SM2340B-11
Manganese	0.159	0.001	mg/L	1	03/10/23	TH	SW6010D
Alkalinity-CaCO3	49	20.0	mg/L	1	03/09/23	MEL/KDB	SM2320B-11
Chloride	79.8	5.0	mg/L	1	03/08/23	BS/GD	E300.0
Color, Apparent	15	1	Color Units	1	03/08/23 17:31	MEL	SM2120B-11
Color, True	< 1	1	Color Units	1	03/08/23	MEL	SM2120B-11
Ammonia as Nitrogen	< 0.05	0.05	mg/L	1	03/10/23	KDB	E350.1
Nitrite-N	< 0.010	0.010	mg/L	1	03/08/23 22:01	ER	E353.2
Nitrate-N	3.51	0.10	mg/L	5	03/08/23 22:03	ER	E353.2
pH	7.45	1.00	pH Units	1	03/09/23 05:08	MEL/KDB	SM4500-H B-11
Sulfate	14.1	5.0	mg/L	1	03/08/23	BS/GD	E300.0
Tot. Diss. Solids	250	10	mg/L	1	03/09/23	NP	SM2540C-15
Turbidity	1.2	0.200	NTU	1	03/09/23 05:08	MEL/KDB	SM2130B-11
Filtration	Completed				03/08/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed				03/08/23	AG	SW3005A
Total Metals Digestion	Completed				03/09/23	AG	SW3010A

Project ID: SHARON
Client ID: RAW

Phoenix I.D.: CN55216

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

The regulatory hold time for pH is immediately. This pH was performed in the laboratory and may be considered outside of hold-time.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director

March 13, 2023

Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 13, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		03/07/23	10:00
Location Code:	BLUELEAF	Received by:	CP	03/08/23	15:11
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN55216
Phoenix ID: CN55217

Project ID: SHARON
Client ID: FILTER A

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron	< 0.010	0.010	1	mg/L			0.3	03/10/23	TH	E200.7
Hardness (CaCO3), calc.	111	0.1	1	mg/L				03/10/23		200.7
Manganese	< 0.001	0.001	1	mg/L			0.05	03/10/23	TH	E200.7
Alkalinity-CaCO3	48	20.0	1	mg/L				03/09/23	MEL/KDB	SM2320B-11
Chloride	81.2	10.0	2	mg/L			250	03/08/23	BS/GD	E300.0
Color, Apparent	5	1	1	Color Units			15	03/08/23 17:31	MEL	SM2120B-11
Color, True	< 1	1	1	Color Units			15	03/08/23	MEL	SM2120B-11
Nitrate as Nitrogen	3.83	0.02	2	mg/L		10		03/08/23 21:34	BS/GD	E300.0
pH	6.94	1.00	1	pH Units			6.5-8.5	03/09/23 05:17	MEL/KDB	SM4500-H B-11
Sulfate	12.7	5.0	1	mg/L			250	03/08/23	BS/GD	E300.0-2.1
Tot. Diss. Solids	250	10	1	mg/L			500	03/09/23	NP	SM2540C-15
Turbidity	< 0.200	0.200	1	NTU			5	03/09/23 05:17	MEL/KDB	SM2130B-11
Total Metal Digestion	Completed							03/09/23	BF	E200.5/E200.7

Project ID: SHARON
Client ID: FILTER A

Phoenix I.D.: CN55217

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Maximum Contaminant Level (MCL) (Lower of): 310 CMR 22.00 MMCLs; 40 CFR Part 141 MCLs. The highest level of a contaminant that is allowed in drinking water. MCLs are enforceable standards.

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 141 Monitoring; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

The regulatory hold time for pH is immediately. This pH was performed in the laboratory and may be considered outside of hold-time.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 13, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
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Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 13, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		03/07/23	10:00
Location Code:	BLUELEAF	Received by:	CP	03/08/23	15:11
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN55216
Phoenix ID: CN55218

Project ID: SHARON
Client ID: FILTER B

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron	< 0.010	0.010	1	mg/L			0.3	03/10/23	CPP	E200.7
Hardness (CaCO3), calc.	111	0.1	1	mg/L				03/11/23		200.7
Manganese	< 0.001	0.001	1	mg/L			0.05	03/10/23	CPP	E200.7
Alkalinity-CaCO3	48	20.0	1	mg/L				03/09/23	MEL/KDB	SM2320B-11
Chloride	79.8	10.0	2	mg/L			250	03/08/23	BS/GD	E300.0
Color, Apparent	5	1	1	Color Units			15	03/08/23 17:31	MEL	SM2120B-11
Color, True	< 1	1	1	Color Units			15	03/08/23	MEL	SM2120B-11
Nitrate as Nitrogen	3.77	0.02	2	mg/L		10		03/08/23 21:43	BS/GD	E300.0
pH	6.95	1.00	1	pH Units			6.5-8.5	03/09/23 05:30	MEL/KDB	SM4500-H B-11
Sulfate	13.0	5.0	1	mg/L			250	03/08/23	BS/GD	E300.0-2.1
Tot. Diss. Solids	250	10	1	mg/L			500	03/09/23	NP	SM2540C-15
Turbidity	< 0.200	0.200	1	NTU			5	03/09/23 05:30	MEL/KDB	SM2130B-11
Total Metal Digestion	Completed							03/09/23	BF	E200.5/E200.7

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Maximum Contaminant Level (MCL) (Lower of): 310 CMR 22.00 MMCLs; 40 CFR Part 141 MCLs. The highest level of a contaminant that is allowed in drinking water. MCLs are enforceable standards.

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 141 Monitoring; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

The regulatory hold time for pH is immediately. This pH was performed in the laboratory and may be considered outside of hold-time.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 13, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 13, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		03/07/23	10:00
Location Code:	BLUELEAF	Received by:	CP	03/08/23	15:11
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN55216
Phoenix ID: CN55219

Project ID: SHARON
Client ID: FILTER C

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron	< 0.010	0.010	1	mg/L			0.3	03/10/23	CPP	E200.7
Hardness (CaCO3), calc.	109	0.1	1	mg/L				03/11/23		200.7
Manganese	< 0.001	0.001	1	mg/L			0.05	03/10/23	CPP	E200.7
Alkalinity-CaCO3	77	20.0	1	mg/L				03/09/23	MEL/KDB	SM2320B-11
Chloride	81.0	10.0	2	mg/L			250	03/08/23	BS/GD	E300.0
Color, Apparent	< 1	1	1	Color Units			15	03/08/23 17:31	MEL	SM2120B-11
Color, True	< 1	1	1	Color Units			15	03/08/23	MEL	SM2120B-11
Nitrate as Nitrogen	3.80	0.02	2	mg/L		10		03/08/23 21:52	BS/GD	E300.0
pH	7.44	1.00	1	pH Units			6.5-8.5	03/09/23 05:51	MEL/KDB	SM4500-H B-11
Sulfate	13.0	5.0	1	mg/L			250	03/08/23	BS/GD	E300.0-2.1
Tot. Diss. Solids	260	10	1	mg/L			500	03/09/23	NP	SM2540C-15
Turbidity	< 0.200	0.200	1	NTU			5	03/09/23 05:51	MEL/KDB	SM2130B-11
Total Metal Digestion	Completed							03/09/23	BF	E200.5/E200.7

Project ID: SHARON
Client ID: FILTER C

Phoenix I.D.: CN55219

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Maximum Contaminant Level (MCL) (Lower of): 310 CMR 22.00 MMCLs; 40 CFR Part 141 MCLs. The highest level of a contaminant that is allowed in drinking water. MCLs are enforceable standards.

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 141 Monitoring; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

The regulatory hold time for pH is immediately. This pH was performed in the laboratory and may be considered outside of hold-time.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 13, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 13, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		03/07/23	10:00
Location Code:	BLUELEAF	Received by:	CP	03/08/23	15:11
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN55216
Phoenix ID: CN55220

Project ID: SHARON
Client ID: FILTER D

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron	< 0.010	0.010	1	mg/L			0.3	03/10/23	CPP	E200.7
Hardness (CaCO3), calc.	107	0.1	1	mg/L				03/11/23		200.7
Manganese	< 0.001	0.001	1	mg/L			0.05	03/10/23	CPP	E200.7
Alkalinity-CaCO3	70	20.0	1	mg/L				03/09/23	MEL/KDB	SM2320B-11
Chloride	81.1	10.0	2	mg/L			250	03/08/23	BS/GD	E300.0
Color, Apparent	< 1	1	1	Color Units			15	03/08/23 17:32	MEL	SM2120B-11
Color, True	< 1	1	1	Color Units			15	03/08/23	MEL	SM2120B-11
Nitrate as Nitrogen	3.80	0.02	2	mg/L		10		03/08/23 22:00	BS/GD	E300.0
pH	7.49	1.00	1	pH Units			6.5-8.5	03/09/23 06:03	MEL/KDB	SM4500-H B-11
Sulfate	12.8	5.0	1	mg/L			250	03/08/23	BS/GD	E300.0-2.1
Tot. Diss. Solids	260	10	1	mg/L			500	03/09/23	NP	SM2540C-15
Turbidity	< 0.200	0.200	1	NTU			5	03/09/23 06:03	MEL/KDB	SM2130B-11
Total Metal Digestion	Completed							03/09/23	BF	E200.5/E200.7

Project ID: SHARON
Client ID: FILTER D

Phoenix I.D.: CN55220

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Maximum Contaminant Level (MCL) (Lower of): 310 CMR 22.00 MMCLs; 40 CFR Part 141 MCLs. The highest level of a contaminant that is allowed in drinking water. MCLs are enforceable standards.

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 141 Monitoring; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

The regulatory hold time for pH is immediately. This pH was performed in the laboratory and may be considered outside of hold-time.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 13, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 13, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		03/07/23	11:30
Location Code:	BLUELEAF	Received by:	CP	03/08/23	15:11
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN55216
Phoenix ID: CN55221

Project ID: SHARON
Client ID: F1

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron (Dissolved)	< 0.011	0.011	1	mg/L			0.3	03/10/23	CPP	E200.7
Manganese (Dissolved)	0.149	0.001	1	mg/L			0.05	03/10/23	CPP	E200.7
***** Manganese (Dissolved) exceeds 310 CMR 22.00 SMCL level of 0.05***** ***** Manganese (Dissolved) exceeds 40 CFR Part 143 Secondary Goals level of 0.05*****										
Iron	0.041	0.010	1	mg/L			0.3	03/10/23	TH	E200.7
Manganese	0.151	0.001	1	mg/L			0.05	03/10/23	TH	E200.7
***** Manganese exceeds 310 CMR 22.00 SMCL level of 0.05***** ***** Manganese exceeds 40 CFR Part 143 Secondary Goals level of 0.05*****										
Alkalinity-CaCO3	46	20.0	1	mg/L				03/09/23	MEL/KDB	SM2320B-11
Tot. Diss. Solids	230	10	1	mg/L			500	03/09/23	NP	SM2540C-15
Filtration	Completed							03/08/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed							03/08/23	AG	SW3005A
Total Metal Digestion	Completed							03/09/23	BF	E200.5/E200.7

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

MCLs are established for total recoverable metals, and are not intended to be compared to the dissolved metal concentrations reported on this sample.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 13, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 13, 2023

FOR:
Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		03/07/23	11:30
Location Code:	BLUELEAF	Received by:	CP	03/08/23	15:11
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN55216
Phoenix ID: CN55222

Project ID: SHARON
Client ID: F2

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron (Dissolved)	< 0.011	0.011	1	mg/L			0.3	03/10/23	CPP	E200.7
Manganese (Dissolved)	0.148	0.001	1	mg/L			0.05	03/10/23	CPP	E200.7
***** Manganese (Dissolved) exceeds 310 CMR 22.00 SMCL level of 0.05*****										
***** Manganese (Dissolved) exceeds 40 CFR Part 143 Secondary Goals level of 0.05*****										
Iron	0.015	0.010	1	mg/L			0.3	03/10/23	CPP	E200.7
Manganese	0.154	0.001	1	mg/L			0.05	03/10/23	CPP	E200.7
***** Manganese exceeds 310 CMR 22.00 SMCL level of 0.05*****										
***** Manganese exceeds 40 CFR Part 143 Secondary Goals level of 0.05*****										
Alkalinity-CaCO3	46	20.0	1	mg/L				03/09/23	MEL/KDB	SM2320B-11
Tot. Diss. Solids	240	10	1	mg/L			500	03/09/23	NP	SM2540C-15
Filtration	Completed							03/08/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed							03/08/23	AG	SW3005A
Total Metal Digestion	Completed							03/09/23	BF	E200.5/E200.7

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

MCLs are established for total recoverable metals, and are not intended to be compared to the dissolved metal concentrations reported on this sample.

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 13, 2023
Reviewed and Released by: Makrina Nolan

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 13, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		03/07/23	11:30
Location Code:	BLUELEAF	Received by:	CP	03/08/23	15:11
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN55216
Phoenix ID: CN55223

Project ID: SHARON
Client ID: M1

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron (Dissolved)	< 0.011	0.011	1	mg/L			0.3	03/10/23	CPP	E200.7
Manganese (Dissolved)	0.003	0.001	1	mg/L			0.05	03/10/23	CPP	E200.7
Iron	0.015	0.010	1	mg/L			0.3	03/10/23	CPP	E200.7
Hardness (CaCO3), calc.	104	0.1	1	mg/L				03/11/23		200.7
Manganese	0.006	0.001	1	mg/L			0.05	03/10/23	CPP	E200.7
Alkalinity-CaCO3	83	20.0	1	mg/L				03/09/23	MEL/KDB	SM2320B-11
Chloride	78.6	10.0	2	mg/L			250	03/08/23	BS/GD	E300.0
Ammonia as Nitrogen	< 0.05	0.05	1	mg/L				03/10/23	KDB	E350.1
Nitrite as Nitrogen	< 0.004	0.004	1	mg/L		1		03/08/23 19:08	BS/GD	E300.0
Nitrate as Nitrogen	3.60	0.02	2	mg/L		10		03/08/23 22:20	BS/GD	E300.0
Sulfate	13.2	5.0	1	mg/L			250	03/08/23	BS/GD	E300.0-2.1
Tot. Diss. Solids	270	10	1	mg/L			500	03/09/23	NP	SM2540C-15
Filtration	Completed							03/08/23	AG	0.45um Filter
Dissolved Metals Preparation	Completed							03/08/23	AG	SW3005A
Total Metal Digestion	Completed							03/09/23	BF	E200.5/E200.7

Project ID: SHARON
Client ID: M1

Phoenix I.D.: CN55223

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Maximum Contaminant Level (MCL) (Lower of): 310 CMR 22.00 MMCLs; 40 CFR Part 141 MCLs. The highest level of a contaminant that is allowed in drinking water. MCLs are enforceable standards.

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

MCLs are established for total recoverable metals, and are not intended to be compared to the dissolved metal concentrations reported on this sample.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 13, 2023
Reviewed and Released by: Makrina Nolan

QA/QC Report

March 13, 2023

QA/QC Data

SDG I.D.: GCN55216

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits	
QA/QC Batch 667245 (mg/L), QC Sample No: CN54811 (CN55216, CN55221, CN55222, CN55223)														
<u>ICP Metals - Dissolved</u>														
Iron	BRL	0.011	0.189	0.154	20.4	88.8	88.5	0.3	84.4			80 - 120	20	
Manganese	BRL	0.001	0.021	0.020	4.90	90.6	90.4	0.2	89.8			80 - 120	20	
Comment:														
Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.														
QA/QC Batch 667375 (mg/L), QC Sample No: CN55642 (CN55216)														
<u>ICP Metals - Aqueous</u>														
Iron	BRL	0.010	0.130	0.084	43.0	89.9	96.1	6.7	96.6			80 - 120	20	r
Manganese	BRL	0.001	0.029	0.029	0	91.0	97.2	6.6	97.4			80 - 120	20	
Comment:														
Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.														
QA/QC Batch 667430A (mg/L), QC Sample No: CN55221 (CN55217, CN55218, CN55219, CN55220, CN55221, CN55222, CN55223)														
<u>ICP Metals - Aqueous</u>														
Iron	BRL	0.010				99.9			105			85 - 115	20	
Manganese	BRL	0.0010				102			101			85 - 115	20	
Comment:														
This batch does not include a duplicate.														
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.														

r = This parameter is outside laboratory RPD specified recovery limits.

QA/QC Report

March 13, 2023

QA/QC Data

SDG I.D.: GCN55216

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 667341 (mg/L), QC Sample No: CN54926 (CN55216, CN55217, CN55218, CN55219, CN55220)													
Alkalinity-CaCO3	BRL	5.00	59	57	NC	95.3						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 667346 (NTU), QC Sample No: CN54926 (CN55216, CN55217, CN55218, CN55219, CN55220)													
Turbidity	BRL	0.200	<0.200	<0.200	NC	99.5						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 667337 (pH), QC Sample No: CN54937 (CN55216, CN55217, CN55218, CN55219, CN55220)													
pH			7.68	7.68	0	99.3						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 667302 (mg/L), QC Sample No: CN55085 (CN55216, CN55217, CN55218, CN55219, CN55220, CN55221, CN55222, CN55223)													
Tot. Diss. Solids	BRL	10	84	84	0	102						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 667342 (mg/L), QC Sample No: CN55272 (CN55221, CN55222, CN55223)													
Alkalinity-CaCO3	BRL	5.00	21	21	NC	94.0						85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													
QA/QC Batch 667353 (mg/L), QC Sample No: CN55127 (CN55217, CN55218, CN55219, CN55220)													
Chloride	BRL	5.0	6.0	5.9	NC	95.1			95.7			90 - 110	20
Sulfate	BRL	5.0	<3.0	<5.0	NC	96.9			95.8			90 - 110	20
QA/QC Batch 667331 (mg/L), QC Sample No: CN55690 (CN55223)													
Chloride	BRL	5.0	15.1	13.7	NC	95.3			96.9			90 - 110	20
Nitrate as Nitrogen	BRL	0.05	0.15	0.14	NC	95.1			94.0			90 - 110	20
Nitrite as Nitrogen	BRL	0.004	<0.004	<0.004	NC	96.2			96.4			90 - 110	20
Sulfate	BRL	5.0	5.2	<5.0	NC	98.5			94.5			90 - 110	20
QA/QC Batch 667354 (mg/L), QC Sample No: CN55929 (CN55216, CN55217, CN55218, CN55219, CN55220)													
Chloride	BRL	5.0	<5.0	<5.0	NC	94.8			110			90 - 110	20
Nitrate as Nitrogen	BRL	0.05	0.73	0.69	5.60	96.4			98.1			90 - 110	20
Sulfate	BRL	5.0	9.2	9.0	NC	96.2			97.6			90 - 110	20
QA/QC Batch 667262 (mg/L), QC Sample No: CN55045 (CN55216)													
Nitrate-N	BRL	0.02	<0.02	<0.02	NC	102			100			90 - 110	20
Nitrite-N	BRL	0.01	<0.010	<0.01	NC	99.2			101			90 - 110	20
QA/QC Batch 667353 (mg/L), QC Sample No: CN55127 (CN55217, CN55218, CN55219, CN55220)													
Nitrate as Nitrogen	BRL	0.05	<0.05	<0.05	NC	97.5			102			90 - 110	20
QA/QC Batch 667391 (mg/L), QC Sample No: CN54512 (CN55216, CN55223)													
Ammonia as Nitrogen	BRL	0.05	<0.10	<0.10	NC	104			105			90 - 110	20

QA/QC Data

SDG I.D.: GCN55216

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

RPD - Relative Percent Difference
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MS Dup - Matrix Spike Duplicate
NC - No Criteria
Intf - Interference

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 13, 2023

Monday, March 13, 2023
Criteria: MA: DW
State: MA

Sample Criteria Exceedances Report

GCN55216 - BLUELEAF

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units
CN55221	D-MN	Manganese (Dissolved)	EPA / 40 CFR 141 DW / 143.3 Secondary Goals	0.149	0.001	0.05	0.01	mg/L
CN55221	D-MN	Manganese (Dissolved)	MA / 310 CMR 22.00 / SMCL	0.149	0.001	0.05	0.05	mg/L
CN55221	MN-DW	Manganese	EPA / 40 CFR 141 DW / 143.3 Secondary Goals	0.151	0.001	0.05	0.01	mg/L
CN55221	MN-DW	Manganese	MA / 310 CMR 22.00 / SMCL	0.151	0.001	0.05	0.05	mg/L
CN55222	D-MN	Manganese (Dissolved)	EPA / 40 CFR 141 DW / 143.3 Secondary Goals	0.148	0.001	0.05	0.01	mg/L
CN55222	D-MN	Manganese (Dissolved)	MA / 310 CMR 22.00 / SMCL	0.148	0.001	0.05	0.05	mg/L
CN55222	MN-DW	Manganese	EPA / 40 CFR 141 DW / 143.3 Secondary Goals	0.154	0.001	0.05	0.01	mg/L
CN55222	MN-DW	Manganese	MA / 310 CMR 22.00 / SMCL	0.154	0.001	0.05	0.05	mg/L

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

Analysis Comments

March 13, 2023 SDG I.D.: GCN55216

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

Cooler: Yes ☑ No ☐
Coolant: IPK ☑ ICE ☐ No ☐

PHOENIX
Environmental Laboratories, Inc.

CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email Makrina Nolan: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 2.9 °C Pg of

Data Delivery/Contact Options:
☐ Fax:
☐ Phone:
☐ Email:

Customer: Bluelcaf, Inc.
Address: 57 Dresser Hill Rd.
Dudley, MA 01571

Project: SHARON
Report to: Aaron Davis
Invoice to: Erik Grafton
QUOTE #

Project P.O:

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature Date: 3/7/23

Matrix Code:
DW=Drinking Water **GW**=Ground Water **SW**=Surface Water **WW**=Waste Water
RW=Raw Water **SE**=Sediment **SL**=Sludge **S**=Soil **SD**=Solid **W**=Wipe **OIL**=Oil
B=Bulk **L**=Liquid **X** = ____________(Other)

Analysis Request

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	Total Fe, Mn	Hardness	Dissolved Fe, Mn	Alkalinity, TDS	TURB, Color, I+A, pH	SO4, NO3, CLD	NH4, NO2		
55216	RAW	GW	3/7/23	10:00	X	X	X	X	X	X	X		
55217	FILTER A	DW	↓	↓	X	X		X	X	X			
55218	FILTER B	↓	↓	↓	X	X		X	X	X			
55219	FILTER C	↓	↓	↓	X	X		X	X	X			
55220	FILTER D	↓	↓	↓	X	X		X	X	X			
55221	F1	↓	↓	11:30	X		X	X					
55222	F2	↓	↓	↓	X		X	X					
55223	M1	↓	↓	↓	X	X	X	X		X	X		

PHOENIX USE ONLY SAMPLE #	MS/MSD *	GL Amber 8 oz. [ ] H3PO4 [ ] NAHSO4	Soil VOA Vials [ ] methanol [ ] H2O	GL Soil container ( )oz	GL Soil container ( )oz	40 ml VOA Vial [ ] As is [ ] HCL	GL Amber 1000ml [ ] As is [ ] H2SO4	PL As is [ ] 250ml [ ] 500ml [ ] 1000ml	PL H2SO4 [ ] 250ml [ ] 500ml	PL HNO3 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is
55216													5
55217													3
55218													3
55219													3
55220													3
55221													3
55222													3
55223													5
													28

Relinquished by:	Accepted by:	Date:	Time:
		3/8/23	1330
		3/8	1511

Comments, Special Requirements or Regulations:

**MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.*

Turnaround Time:
☐ 1 Day*
☐ 2 Days*
☐ 3 Days*
☒ Standard
☐ Other
*** SURCHARGE APPLIES**

RI
☐ (Residential) Direct Exposure
☐ (Comm/Industrial) Direct Exposure
☐ GA Leachability
☐ GB Leachability
☐ GA-GW Objectives
☐ GB-GW Objectives

CT
☐ RCP Cert
☐ GW Protection
☐ SW Protection
☐ GA Mobility
☐ GB Mobility
☐ Residential DEC
☐ I/C DEC
☐ Other

MA
☐ MCP Certification
☐ GW-1 ☐ MWRA eSMART
☐ GW-2 ☐ S-1 10% CALC
☐ GW-3
☐ S-1 GW-1 ☐ S-1 GW-2 ☐ S-1 GW-3
☐ S-2 GW-1 ☐ S-2 GW-2 ☐ S-2 GW-3
☐ S-3 GW-1 ☐ S-3 GW-2 ☐ S-3 GW-3
☐ SW Protection

State where samples were collected: MA

Data Format
☐ Excel
☐ PDF
☐ GIS/Key
☐ EQuIS
☐ Other

Data Package
☐ Tier II Checklist
☐ Full Data Package*
☐ Phoenix Std Report
☐ Other

*** SURCHARGE APPLIES**

PEL-126 REV. 03/22

ANALYTICAL REPORT

Lab Number:	L2311800
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Aaron Davis
Phone:	(508) 248-7094
Project Name:	SHARON WELL 2
Project Number:	05503
Report Date:	03/14/23

The original project report/data package is held by Alpha Analytical. This report/data package is paginated and should be reproduced only in its entirety. Alpha Analytical holds no responsibility for results and/or data that are not consistent with the original.

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NJ (MA935), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-17-00196).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: SHARON WELL 2
Project Number: 05503

Lab Number: L2311800
Report Date: 03/14/23

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2311800-01	RAW	WATER	SHARON, MA	03/07/23 10:00	03/07/23
L2311800-02	FILTER A	DW	SHARON, MA	03/07/23 10:00	03/07/23
L2311800-03	FILTER B	DW	SHARON, MA	03/07/23 10:00	03/07/23
L2311800-04	FILTER C	DW	SHARON, MA	03/07/23 10:00	03/07/23
L2311800-05	FILTER D	DW	SHARON, MA	03/07/23 10:00	03/07/23
L2311800-06	F1	DW	SHARON, MA	03/07/23 11:30	03/07/23
L2311800-07	F2	DW	SHARON, MA	03/07/23 11:30	03/07/23
L2311800-08	M1	DW	SHARON, MA	03/07/23 11:30	03/07/23

Project Name: SHARON WELL 2 **Lab Number:** L2311800
Project Number: 05503 **Report Date:** 03/14/23

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Cristin Walker Cristin Walker

Title: Technical Director/Representative Date: 03/14/23

INORGANICS
&
MISCELLANEOUS

Project Name:	SHARON WELL 2	**Lab Number:**	L2311800
Project Number:	05503	**Report Date:**	03/14/23

SAMPLE RESULTS

Lab ID:	L2311800-01	Date Collected:	03/07/23 10:00
Client ID:	RAW	Date Received:	03/07/23
Sample Location:	SHARON, MA	Field Prep:	Not Specified

Sample Depth:
Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
Heterotrophic Plate Count	140		CFU/ml	1.0	NA	1	-	03/07/23 15:43	121,9215B	DRV
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	03/07/23 16:20	121,9223B	MTO
Escherichia Coli	Negative		col/100ml	-	NA	1	-	03/07/23 16:20	121,9223B	MTO

SAMPLE RESULTS

Lab ID: L2311800-02
Client ID: FILTER A
Sample Location: SHARON, MA
Date Collected: 03/07/23 10:00
Date Received: 03/07/23
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	03/07/23 16:20	121,9223B	MTO
Escherichia Coli	Negative		col/100ml	-	NA	1	-	03/07/23 16:20	121,9223B	MTO

SAMPLE RESULTS

Lab ID: L2311800-03
Client ID: FILTER B
Sample Location: SHARON, MA

Date Collected: 03/07/23 10:00
Date Received: 03/07/23
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	03/07/23 16:20	121,9223B	MTO
Escherichia Coli	Negative		col/100ml	-	NA	1	-	03/07/23 16:20	121,9223B	MTO

SAMPLE RESULTS

Lab ID: L2311800-04
Client ID: FILTER C
Sample Location: SHARON, MA
Date Collected: 03/07/23 10:00
Date Received: 03/07/23
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	03/07/23 16:20	121,9223B	MTO
Escherichia Coli	Negative		col/100ml	-	NA	1	-	03/07/23 16:20	121,9223B	MTO

SAMPLE RESULTS

Lab ID: L2311800-05
Client ID: FILTER D
Sample Location: SHARON, MA
Date Collected: 03/07/23 10:00
Date Received: 03/07/23
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	03/07/23 16:20	121,9223B	MTO
Escherichia Coli	Negative		col/100ml	-	NA	1	-	03/07/23 16:20	121,9223B	MTO

Project Name: SHARON WELL 2

Lab Number: L2311800

Project Number: 05503

Report Date: 03/14/23

SAMPLE RESULTS

Lab ID:	L2311800-06	Date Collected:	03/07/23 11:30
Client ID:	F1	Date Received:	03/07/23
Sample Location:	SHARON, MA	Field Prep:	Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
Heterotrophic Plate Count	27		CFU/ml	1.0	NA	1	-	03/07/23 15:43	121,9215B	DRV

SAMPLE RESULTS

Lab ID: L2311800-07
Client ID: F2
Sample Location: SHARON, MA

Date Collected: 03/07/23 11:30
Date Received: 03/07/23
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
Heterotrophic Plate Count	23		CFU/ml	1.0	NA	1	-	03/07/23 15:43	121,9215B	DRV

SAMPLE RESULTS

Lab ID: L2311800-08
Client ID: M1
Sample Location: SHARON, MA
Date Collected: 03/07/23 11:30
Date Received: 03/07/23
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
Heterotrophic Plate Count	19		CFU/ml	1.0	NA	1	-	03/07/23 15:43	121,9215B	DRV

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab for sample(s): 06-08 Batch: WG1752010-1										
Heterotrophic Plate Count	ND		CFU/ml	1.0	NA	1	-	03/07/23 15:43	121,9215B	DRV
Microbiological Analysis - Westborough Lab for sample(s): 01 Batch: WG1752011-1										
Heterotrophic Plate Count	ND		CFU/ml	1.0	NA	1	-	03/07/23 15:43	121,9215B	DRV
Bacteria in Water - Westborough Lab for sample(s): 01-05 Batch: WG1752053-1										
Coliform, Total	Negative		col/100ml	-	NA	1	-	03/07/23 16:20	121,9223B	MTO
Escherichia Coli	Negative		col/100ml	-	NA	1	-	03/07/23 16:20	121,9223B	MTO

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2311800-01A	Bacteria Cup unpreserved	A	NA		2.5	Y	Absent		PLATECT(.33)
L2311800-01B	Bacteria Cup unpreserved	A	NA		2.5	Y	Absent		T-COLI-C(.33)
L2311800-02B	Bacteria Cup unpreserved	A	NA		2.5	Y	Absent		T-COLI-C(1.25)
L2311800-03B	Bacteria Cup unpreserved	A	NA		2.5	Y	Absent		T-COLI-C(1.25)
L2311800-04B	Bacteria Cup unpreserved	A	NA		2.5	Y	Absent		T-COLI-C(1.25)
L2311800-05B	Bacteria Cup unpreserved	A	NA		2.5	Y	Absent		T-COLI-C(1.25)
L2311800-06A	Bacteria Cup unpreserved	A	NA		2.5	Y	Absent		PLATECT(.33)
L2311800-07A	Bacteria Cup unpreserved	A	NA		2.5	Y	Absent		PLATECT(.33)
L2311800-08A	Bacteria Cup unpreserved	A	NA		2.5	Y	Absent		PLATECT(.33)

*Values in parentheses indicate holding time in days

GLOSSARY

Acronyms

DL	- Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EMPC	- Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LOD	- Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
LOQ	- Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.) Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
NR	- No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TEF	- Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.
TEQ	- Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Chlordane: The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Gasoline Range Organics (GRO): Gasoline Range Organics (GRO) results include all chromatographic peaks eluting from Methyl tert butyl ether through Naphthalene, with the exception of GRO analysis in support of State of Ohio programs, which includes all chromatographic peaks eluting from Hexane through Dodecane.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW compliance analysis only, the 'PFAS, Total (6)' result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

Report Format: Data Usability Report

Data Qualifiers

ND	- Not detected at the reporting limit (RL) for the sample.
NJ	- Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.
P	- The RPD between the results for the two columns exceeds the method-specified criteria.
Q	- The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)
R	- Analytical results are from sample re-analysis.
RE	- Analytical results are from sample re-extraction.
S	- Analytical results are from modified screening analysis.
V	- The surrogate associated with this target analyte has a recovery outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)
Z	- The batch matrix spike and/or duplicate associated with this target analyte has a recovery/RPD outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

REFERENCES

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Alpha Analytical, Inc. ID No.:**17873**
Facility: **Company-wide** Revision 19
Department: **Quality Assurance** Published Date: 4/2/2021 1:14:23 PM
Title: **Certificate/Approval Program Summary** Page 1 of 1

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624/624.1: m/p-xylene, o-xylene, Naphthalene
EPA 625/625.1: alpha-Terpineol
EPA 8260C/8260D: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D/8270E: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine, alpha-Terpineol; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility
SM 2540D: TSS
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N**, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603, SM9222D.**

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522, EPA 537.1.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb**,** As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

ALPHA ANALYTICAL

8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 3/7/23

ALPHA Job #: L2311800

Client Information

Client: Blueleaf Inc.
Address: 57 Dresser Hill Rd.
Charlton, MA 01507
Phone: 774 200 8029
Email: adavis@blueleafwater.com

Additional Project Information:

Project Information

Project Name: Sharon
Project Location: Sharon, MA
Project #: 05503
Project Manager: Aaron Davis
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)
Date Due:

Report Information - Data Deliverables

☐ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info
PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods
☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program ____________ Criteria ____________

ANALYSIS

- VOC: ☐ 8260 ☐ 624 ☐ 524.2
- SVOC: ☐ ABN ☐ PAH
- METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15
- METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13
- EPH: ☐ Ranges & Targets ☐ Ranges Only
- VPH: ☐ Ranges & Targets ☐ Ranges Only
- ☐ PCB ☐ PEST
- TPH: ☐ Quant Only ☐ Fingerprint
- Total Coliform
- HPC

SAMPLE INFO
Filtration
☐ Field
☐ Lab to do
Preservation
☐ Lab to do

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	Total Coliform	HPC	Sample Comments	TOTAL # BOTTLES
11800-01	RAW	3/7/23	10:00	GW	AD	X	X		2
02	FILTER A	↓	↓	DW	↓	X			1
03	FILTER B	↓	↓	↓	↓	X			1
04	FILTER C	↓	↓	↓	↓	X			1
05	FILTER D	↓	↓	↓	↓	X			1
06	F1	↓	11:30	↓	↓		X		1
07	F2	↓	↓	↓	↓		X		1
08	M1	↓	↓	↓	↓		X		1
									9

	Total Coliform	HPC
Container Type	B	B
Preservative		

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
	3/7/23 14:17	AAL	3/7/23 14:17

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

PHOENIX
Environmental Laboratories, Inc.

Friday, March 17, 2023

Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Project ID: SHARON
SDG ID: GCN59353
Sample ID#s: CN59353 - CN59358

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B
NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Sample Id Cross Reference

March 17, 2023

SDG I.D.: GCN59353

Project ID: SHARON

Client Id	Lab Id	Matrix
RAW	CN59353	GROUND WATER
RAW + RECYCLE	CN59354	GROUND WATER
FILTER A	CN59355	DRINKING WATER
FILTER B	CN59356	DRINKING WATER
FILTER C	CN59357	DRINKING WATER
FILTER D	CN59358	DRINKING WATER

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 17, 2023

FOR:
Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	GROUND WATER	Collected by:		03/09/23	11:10
Location Code:	BLUELEAF	Received by:	CP	03/14/23	12:28
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN59353
Phoenix ID: CN59353

Project ID: SHARON
Client ID: RAW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	1.21	0.010	mg/L	1	03/16/23	CPP	SW6010D
Manganese	0.161	0.001	mg/L	1	03/16/23	CPP	SW6010D
Total Metals Digestion	Completed				03/15/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 17, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 17, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	GROUND WATER	Collected by:		03/09/23	11:10
Location Code:	BLUELEAF	Received by:	CP	03/14/23	12:28
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN59353
Phoenix ID: CN59354

Project ID: SHARON
Client ID: RAW + RECYCLE

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	1.01	0.010	mg/L	1	03/16/23	CPP	SW6010D
Manganese	0.155	0.001	mg/L	1	03/16/23	CPP	SW6010D
Total Metals Digestion	Completed				03/15/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller, Laboratory Director
March 17, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 17, 2023

FOR:
Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		03/09/23	11:10
Location Code:	BLUELEAF	Received by:	CP	03/14/23	12:28
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN59353
Phoenix ID: CN59355

Project ID: SHARON
Client ID: FILTER A

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron	< 0.010	0.010	1	mg/L			0.3	03/16/23	TH	E200.7
Manganese	< 0.001	0.001	1	mg/L			0.05	03/16/23	TH	E200.7
Total Metal Digestion	Completed							03/15/23	BF	E200.5/E200.7

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 17, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 17, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		03/09/23	11:10
Location Code:	BLUELEAF	Received by:	CP	03/14/23	12:28
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN59353
Phoenix ID: CN59356

Project ID: SHARON
Client ID: FILTER B

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron	< 0.010	0.010	1	mg/L			0.3	03/16/23	TH	E200.7
Manganese	< 0.001	0.001	1	mg/L			0.05	03/16/23	TH	E200.7
Total Metal Digestion	Completed							03/15/23	BF	E200.5/E200.7

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 17, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 17, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		03/09/23	11:10
Location Code:	BLUELEAF	Received by:	CP	03/14/23	12:28
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN59353
Phoenix ID: CN59357

Project ID: SHARON
Client ID: FILTER C

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron	< 0.010	0.010	1	mg/L			0.3	03/16/23	TH	E200.7
Manganese	< 0.001	0.001	1	mg/L			0.05	03/16/23	TH	E200.7
Total Metal Digestion	Completed							03/15/23	BF	E200.5/E200.7

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 17, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 17, 2023

FOR:
Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		03/09/23	11:10
Location Code:	BLUELEAF	Received by:	CP	03/14/23	12:28
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN59353
Phoenix ID: CN59358

Project ID: SHARON
Client ID: FILTER D

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference
Iron	< 0.010	0.010	1	mg/L			0.3	03/16/23	TH	E200.7
Manganese	< 0.001	0.001	1	mg/L			0.05	03/16/23	TH	E200.7
Total Metal Digestion	Completed							03/15/23	BF	E200.5/E200.7

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances

Comments:

Other Levels (OTHER): (Lower of): 310 CMR 22.00 ORSG; 310 CMR 22.00 SMCL; 40 CFR Part 143 Secondary Goals. Other are non-enforceable goals or guidances.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 17, 2023
Reviewed and Released by: Makrina Nolan

QA/QC Report

March 17, 2023

QA/QC Data

SDG I.D.: GCN59353

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 668150 (mg/L), QC Sample No: CN59974 (CN59353, CN59354)													
ICP Metals - Aqueous													
Iron	BRL	0.010	0.481	0.473	1.70	99.9	99.0	0.9	102			80 - 120	20
Manganese	BRL	0.001	0.006	0.006	0	101	100	1.0	101			80 - 120	20
Comment:													
Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.													
QA/QC Batch 668220 (mg/L), QC Sample No: CN59530 (CN59355, CN59356, CN59357, CN59358)													
ICP Metals - Aqueous													
Iron	BRL	0.010	<0.010	<0.010	NC	105			108			85 - 115	20
Manganese	BRL	0.0010	0.001	0.0015	NC	106			103			85 - 115	20
Comment:													
Additional: LCS acceptance range is 85-115% MS acceptance range 75-125%.													

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

RPD - Relative Percent Difference
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MS Dup - Matrix Spike Duplicate
NC - No Criteria
Intf - Interference

Phyllis Shiller, Laboratory Director
March 17, 2023

Friday, March 17, 2023

Criteria: MA: DW

State: MA

Sample Criteria Exceedances Report

GCN59353 - BLUELEAF

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units

*** No Data to Display ***

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

Analysis Comments

March 17, 2023 SDG I.D.: GCN59353

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

Cooler: Yes ☒ No ☐
Coolant: IPK ☒ ICE ☐ No ☐

PHOENIX
Environmental Laboratories, Inc.

CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email Makrina Nolan: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 1.2 °C Pg of

Data Delivery/Contact Options:
☐ Fax:
☐ Phone:
☐ Email:

Customer: Bluleaf, Inc
Address: 57 Dresser Hill Rd.
Charlton, MA 01507

Project: Sharon
Report to: Aaron Davis
Invoice to: Erik Grotton
QUOTE #

Project P.O:

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature DAN COBURN Date: 3/9/23

Matrix Code:
DW=Drinking Water GW=Ground Water SW=Surface Water WW=Waste Water
RW=Raw Water SE=Sediment SL=Sludge S=Soil SD=Solid W=Wipe OIL=Oil
B=Bulk L=Liquid X = ____________(Other)

Analysis Request

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	Total Fe, Mn									MS/MSD *	GL Amber 8 oz. [ ] H3PO4 [ ] NAHSO4	Soil VOA Vials [ ] methanol [ ] H2O	GL Soil container ( )oz	GL Soil container ( )oz	40 ml VOA Vial [ ] As is [ ] HCL	GL Amber 1000ml [ ] As is [ ] H2SO4	PL As is [ ] 250ml [ ] 500ml [ ] 1000ml	PL H2SO4 [ ] 250ml [ ] 500ml	PL HNO3 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is
59353	RAW	GW	3/9/23	11:10	X																		1			
59354	RAW + RECYCLE	↓	↓	↓	X																		1			
59355	FILTER A	DW			X																		1			
59356	FILTER B	↓			X																		1			
59357	FILTER C				X																		1			
59358	FILTER D				X																		1			

6

Relinquished by:	Accepted by:	Date:	Time:
	Dyh Bk	3/14/23	2:45
	Emily	3/14/23	1828

Comments, Special Requirements or Regulations:

*MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.

Turnaround Time:
☐ 1 Day*
☐ 2 Days*
☐ 3 Days*
☒ Standard
☐ Other
* SURCHARGE APPLIES

RI
☐ (Residential) Direct Exposure
☐ (Comm/Industrial) Direct Exposure
☐ GA Leachability
☐ GB Leachability
☐ GA-GW Objectives
☐ GB-GW Objectives

CT
☐ RCP Cert
☐ GW Protection
☐ SW Protection
☐ GA Mobility
☐ GB Mobility
☐ Residential DEC
☐ I/C DEC
☐ Other

MA
☐ MCP Certification
☐ GW-1 ☐ MWRA eSMART
☐ GW-2 ☐ S-1 10% CALC
☐ GW-3
☐ S-1 GW-1 ☐ S-1 GW-2 ☐ S-1 GW-3
☐ S-2 GW-1 ☐ S-2 GW-2 ☐ S-2 GW-3
☐ S-3 GW-1 ☐ S-3 GW-2 ☐ S-3 GW-3
☐ SW Protection

State where samples were collected: MA

Data Format
☐ Excel
☐ PDF
☐ GIS/Key
☐ EQuIS
☐ Other

Data Package
☐ Tier II Checklist
☐ Full Data Package*
☐ Phoenix Std Report
☐ Other

* SURCHARGE APPLIES

PEL-126 REV. 03/22

PHOENIX
Environmental Laboratories, Inc.

Wednesday, March 22, 2023

Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Project ID: SHARON
SDG ID: GCN59345
Sample ID#s: CN59345 - CN59352

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B

NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Sample Id Cross Reference

March 22, 2023

SDG I.D.: GCN59345

Project ID: SHARON

Client Id	Lab Id	Matrix
FILTER B CBW	CN59345	WATER
FILTER D CBW	CN59346	WATER
FILTER B SSN	CN59347	WATER
FILTER D SSN	CN59348	WATER
FILTER B CBW	CN59349	WATER
FILTER D CBW	CN59350	WATER
FILTER B SSN	CN59351	WATER
FILTER D SSN	CN59352	WATER

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 22, 2023

FOR:
Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		03/09/23	8:40
Location Code:	BLUELEAF	Received by:	CP	03/14/23	12:28
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN59345
Phoenix ID: CN59345

Project ID: SHARON
Client ID: FILTER B CBW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	74.0	0.010	mg/L	1	03/15/23	TH	E200.7
Manganese	11.9	0.010	mg/L	10	03/21/23	TH	E200.7
Total Suspended Solids	100	17	mg/L	3.3	03/15/23	Z/NP	SM2540D-15
Total Metals Digestion	Completed				03/14/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 22, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 22, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		03/09/23	8:40
Location Code:	BLUELEAF	Received by:	CP	03/14/23	12:28
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN59345
Phoenix ID: CN59346

Project ID: SHARON
Client ID: FILTER D CBW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	80.8	0.010	mg/L	1	03/15/23	TH	E200.7
Manganese	15.5	0.010	mg/L	10	03/21/23	TH	E200.7
Total Suspended Solids	190	17	mg/L	3.3	03/15/23	Z/NP	SM2540D-15
Total Metals Digestion	Completed				03/14/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 22, 2023
Reviewed and Released by: Makrina Nolan

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587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 22, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		03/09/23	12:40
Location Code:	BLUELEAF	Received by:	CP	03/14/23	12:28
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN59345
Phoenix ID: CN59347

Project ID: SHARON
Client ID: FILTER B SSN

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	0.877	0.010	mg/L	1	03/16/23	CPP	E200.7
Manganese	0.276	0.001	mg/L	1	03/21/23	TH	E200.7
Total Suspended Solids	2.4	2.0	mg/L	0.4	03/15/23	Z/NP	SM2540D-15
Total Metals Digestion	Completed				03/15/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller, Laboratory Director
March 22, 2023
Reviewed and Released by: Makrina Nolan

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587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 22, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		03/09/23	12:40
Location Code:	BLUELEAF	Received by:	CP	03/14/23	12:28
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN59345
Phoenix ID: CN59348

Project ID: SHARON
Client ID: FILTER D SSN

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	1.16	0.010	mg/L	1	03/16/23	CPP	E200.7
Manganese	0.316	0.001	mg/L	1	03/16/23	TH	E200.7
Total Suspended Solids	4.8	2.0	mg/L	0.4	03/15/23	Z/NP	SM2540D-15
Total Metals Digestion	Completed				03/15/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 22, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 22, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		03/10/23	10:10
Location Code:	BLUELEAF	Received by:	CP	03/14/23	12:28
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN59345
Phoenix ID: CN59349

Project ID: SHARON
Client ID: FILTER B CBW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	133	0.010	mg/L	1	03/16/23	CPP	E200.7
Manganese	9.99	0.010	mg/L	10	03/21/23	TH	E200.7
Total Suspended Solids	300	17	mg/L	3.3	03/15/23	Z/NP	SM2540D-15
Total Metals Digestion	Completed				03/15/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 22, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 22, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		03/10/23	10:30
Location Code:	BLUELEAF	Received by:	CP	03/14/23	12:28
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN59345
Phoenix ID: CN59350

Project ID: SHARON
Client ID: FILTER D CBW

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	213	0.10	mg/L	10	03/21/23	TH	E200.7
Manganese	11.8	0.010	mg/L	10	03/21/23	TH	E200.7
Total Suspended Solids	460	17	mg/L	3.3	03/15/23	Z/NP	SM2540D-15
Total Metals Digestion	Completed				03/15/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 22, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 22, 2023

FOR:
Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		03/13/23	11:30
Location Code:	BLUELEAF	Received by:	CP	03/14/23	12:28
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN59345
Phoenix ID: CN59351

Project ID: SHARON
Client ID: FILTER B SSN

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	0.250	0.010	mg/L	1	03/16/23	CPP	E200.7
Manganese	0.114	0.001	mg/L	1	03/16/23	TH	E200.7
Total Suspended Solids	< 2.0	2.0	mg/L	0.4	03/15/23	Z/NP	SM2540D-15
Total Metals Digestion	Completed				03/15/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 22, 2023
Reviewed and Released by: Makrina Nolan

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

March 22, 2023

FOR: Attn: Mr Aaron Davis
Blue Leaf Inc.
57 Dresser Hill Road
Charlton MA 01507

Sample Information		Custody Information		Date	Time
Matrix:	WATER	Collected by:		03/13/23	11:30
Location Code:	BLUELEAF	Received by:	CP	03/14/23	12:28
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN59345
Phoenix ID: CN59352

Project ID: SHARON
Client ID: FILTER D SSN

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Iron	0.437	0.010	mg/L	1	03/16/23	CPP	E200.7
Manganese	0.057	0.001	mg/L	1	03/16/23	CPP	E200.7
Total Suspended Solids	< 2.0	2.0	mg/L	0.4	03/15/23	Z/NP	SM2540D-15
Total Metals Digestion	Completed				03/15/23	AG	SW3010A

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 22, 2023
Reviewed and Released by: Makrina Nolan

QA/QC Report

March 22, 2023

QA/QC Data

SDG I.D.: GCN59345

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits	
QA/QC Batch 668008 (mg/L), QC Sample No: CN57964 (CN59345, CN59346)														
ICP Metals - Aqueous														
Iron	BRL	0.010	20.9	21.2	1.40	102	103	1.0	NC			80 - 120	20	
Manganese	BRL	0.001	0.340	0.341	0.30	104	103	1.0	107			80 - 120	20	
Comment:														
Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.														
QA/QC Batch 668148 (mg/L), QC Sample No: CN59347 (CN59347, CN59348, CN59349, CN59350, CN59351)														
ICP Metals - Aqueous														
Iron	BRL	0.010	0.877	0.874	0.30	98.8	99.9	1.1	116			80 - 120	20	
Manganese	BRL	0.001	0.276	0.274	0.70	100	101	1.0	132			80 - 120	20	m
Comment:														
Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.														
QA/QC Batch 668150 (mg/L), QC Sample No: CN59974 (CN59352)														
ICP Metals - Aqueous														
Iron	BRL	0.010	0.481	0.473	1.70	99.9	99.0	0.9	102			80 - 120	20	
Manganese	BRL	0.001	0.006	0.006	0	101	100	1.0	101			80 - 120	20	
Comment:														
Additional: LCS acceptance range is 80-120% MS acceptance range 75-125%.														

m = This parameter is outside laboratory MS/MSD specified recovery limits.

QA/QC Report

March 22, 2023

QA/QC Data

SDG I.D.: GCN59345

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 668066 (mg/L), QC Sample No: CN59150 (CN59345, CN59346, CN59347, CN59348, CN59349, CN59350, CN59351, CN59352)													
Total Suspended Solids	BRL	2.5	<2.0	<2.0	NC	100						85 - 115	

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

RPD - Relative Percent Difference
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MS Dup - Matrix Spike Duplicate
NC - No Criteria
Intf - Interference

Phyllis Shiller

Phyllis Shiller, Laboratory Director
March 22, 2023

Wednesday, March 22, 2023

Criteria: None

State: MA

Sample Criteria Exceedances Report

GCN59345 - BLUELEAF

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units

*** No Data to Display ***

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

Analysis Comments

March 22, 2023 SDG I.D.: GCN59345

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

Cooler: Yes ☒ No ☐
Coolant: IPK ☒ ICE ☐ No ☐

PHOENIX
Environmental Laboratories, Inc.

CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email Makrina Nolan: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 1.2 °C Pg of

Data Delivery/Contact Options:
☐ Fax:
☐ Phone:
☐ Email:

Customer: Blueleaf, Inc.
Address: 57 Dresser Hill Rd.
Charlton, MA

Project: Sharon
Report to: Aaron Davis
Invoice to: Erik Grotton
QUOTE #

Project P.O:

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification
Sampler's Signature Date:

Matrix Code:
DW=Drinking Water **GW**=Ground Water **SW**=Surface Water **WW**=Waste Water
RW=Raw Water **SE**=Sediment **SL**=Sludge **S**=Soil **SD**=Solid **W**=Wipe **OIL**=Oil
B=Bulk **L**=Liquid **X** = ____________(Other) BW = Backwash

Analysis Request

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	Total Fe, Mn	TSS	MS/MSD *	GL Amber 8 oz. [ ] H3PO4 [ ] NAHSO4	Soil VOA Vials [ ] methanol [ ] H2O	GL Soil container ( ) oz	GL Soil container ( ) oz	40 ml VOA Vial [ ] As is [ ] HCL	GL Amber 1000ml [ ] As is [ ] H2SO4	PL As is [X] 250ml [ ] 500ml [ ] 1000ml	PL H2SO4 [ ] 250ml [ ] 500ml	PL HNO3 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is	
59345	Filter B CBW	BW	3/9/23	8:40	X	X								1		1				2
59346	Filter D CBW	|	↓	↓	X	X								1		1				2
59347	Filter B SSN	|	|	12:40	X	X								1		1				2
59348	Filter D SSN	|	↓	↓	X	X								1		1				2
59349	Filter B CBW	|	3/10/23	10:10	X	X								1		1				2
59350	Filter D CBW	|	↓	10:30	X	X								1		1				2
59351	Filter B SSN	|	3/13/23	11:30	X	X								1		1				2
59352	Filter D SSN	↓	↓	↓	X	X								1		1				2
																				16

Relinquished by:	Accepted by:	Date:	Time:
		3/14/23	7:45
		3/14/23	12:28

Comments, Special Requirements or Regulations:

*MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.

Turnaround Time:
☐ 1 Day*
☐ 2 Days*
☐ 3 Days*
☒ Standard
☐ Other
* SURCHARGE APPLIES

RI
☐ (Residential) Direct Exposure
☐ (Comm/Industrial) Direct Exposure
☐ GA Leachability
☐ GB Leachability
☐ GA-GW Objectives
☐ GB-GW Objectives

CT
☐ RCP Cert
☐ GW Protection
☐ SW Protection
☐ GA Mobility
☐ GB Mobility
☐ Residential DEC
☐ I/C DEC
☐ Other

MA
☐ MCP Certification
☐ GW-1
☐ GW-2
☐ GW-3
☐ MWRA eSMART
☐ S-1 10% CALC
☐ S-1 GW-1 ☐ S-1 GW-2 ☐ S-1 GW-3
☐ S-2 GW-1 ☐ S-2 GW-2 ☐ S-2 GW-3
☐ S-3 GW-1 ☐ S-3 GW-2 ☐ S-3 GW-3
☐ SW Protection

State where samples were collected: MA

Data Format
☐ Excel
☐ PDF
☐ GIS/Key
☐ EQuIS
☐ Other

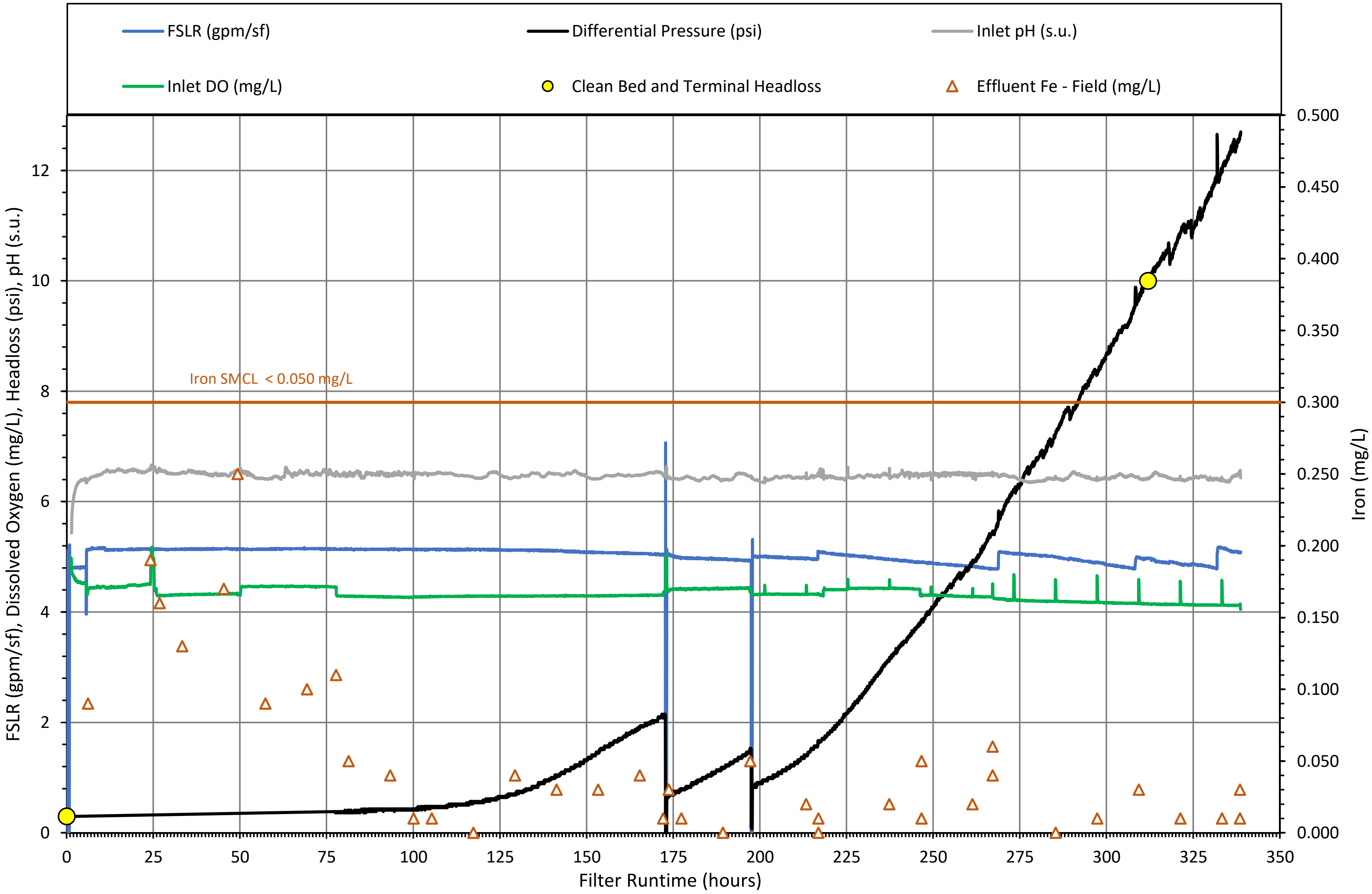
Data Package
☐ Tier II Checklist
☐ Full Data Package*
☐ Phoenix Std Report
☐ Other

* SURCHARGE APPLIES

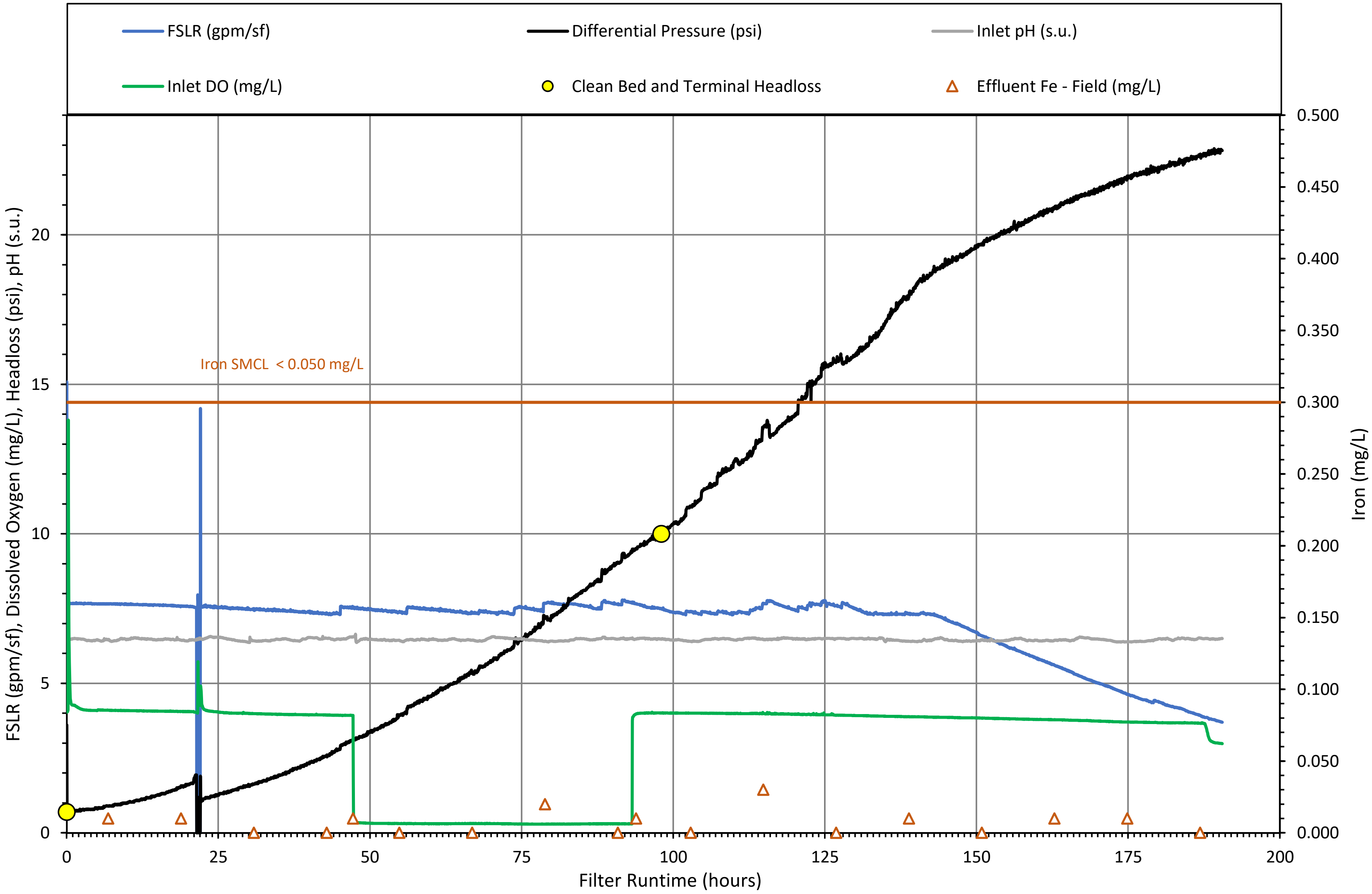
PEL-126 REV. 03/22

Appendix D – Biological Filter Performance Figures

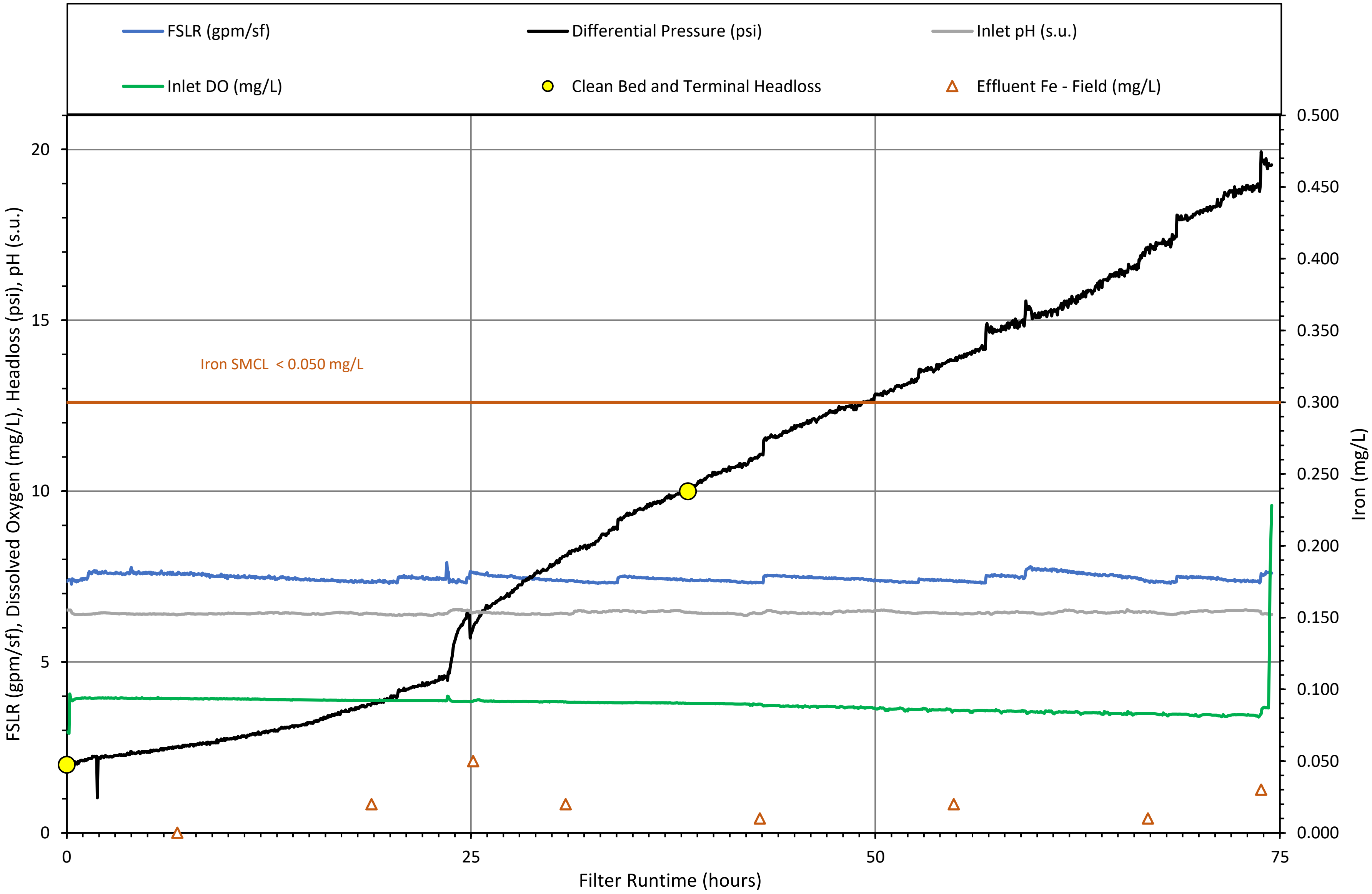
D-01: Operating Conditions for Biological Filter F1, Trial F1.01
SHARON MA, Well 2 - Dec 12 to Dec 26, 2022



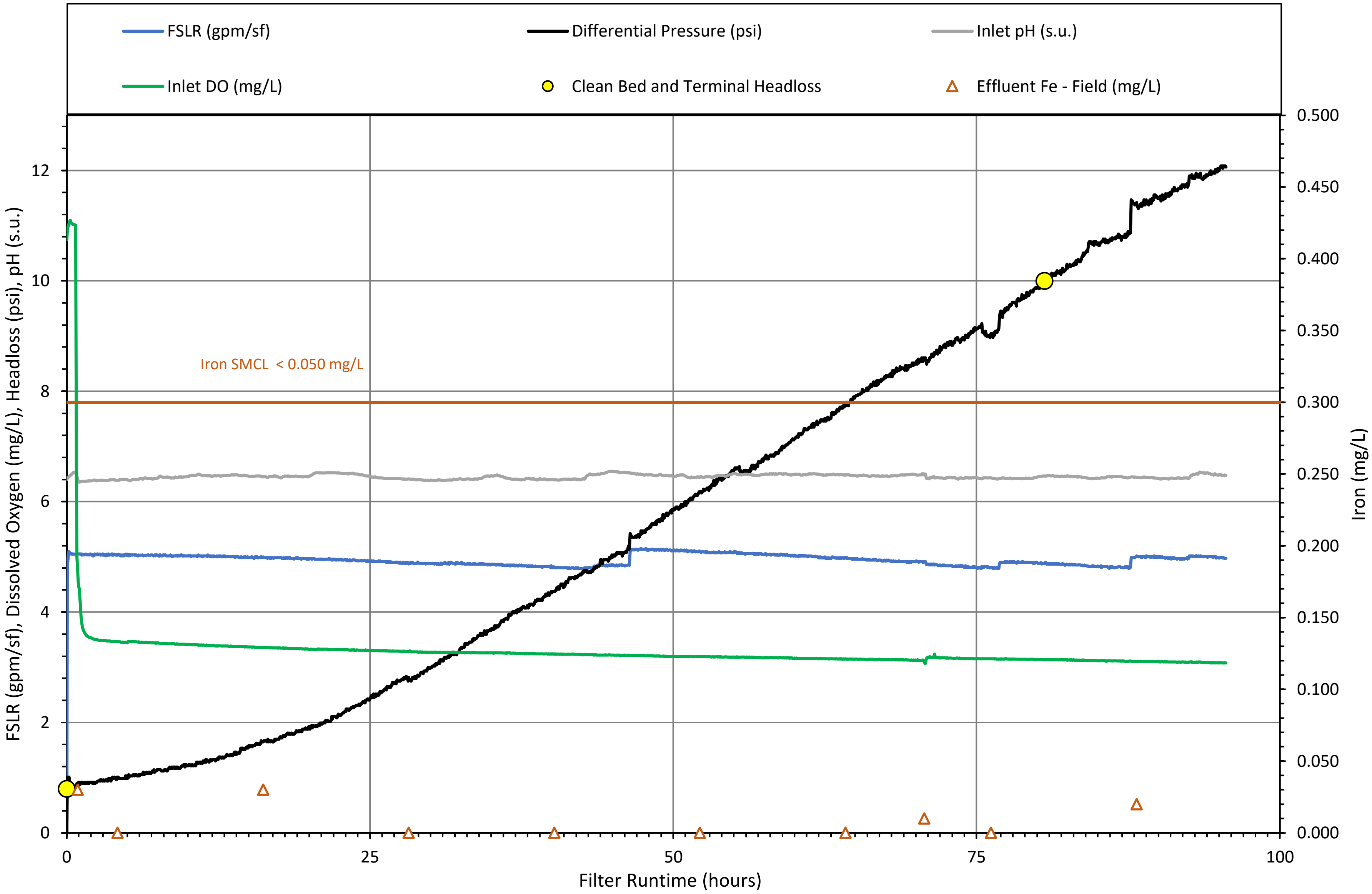
D-02: Operating Conditions for Biological Filter F1, Trial F1.02
SHARON MA, Well 2 - Dec 26, 2022 to Jan 03, 2022



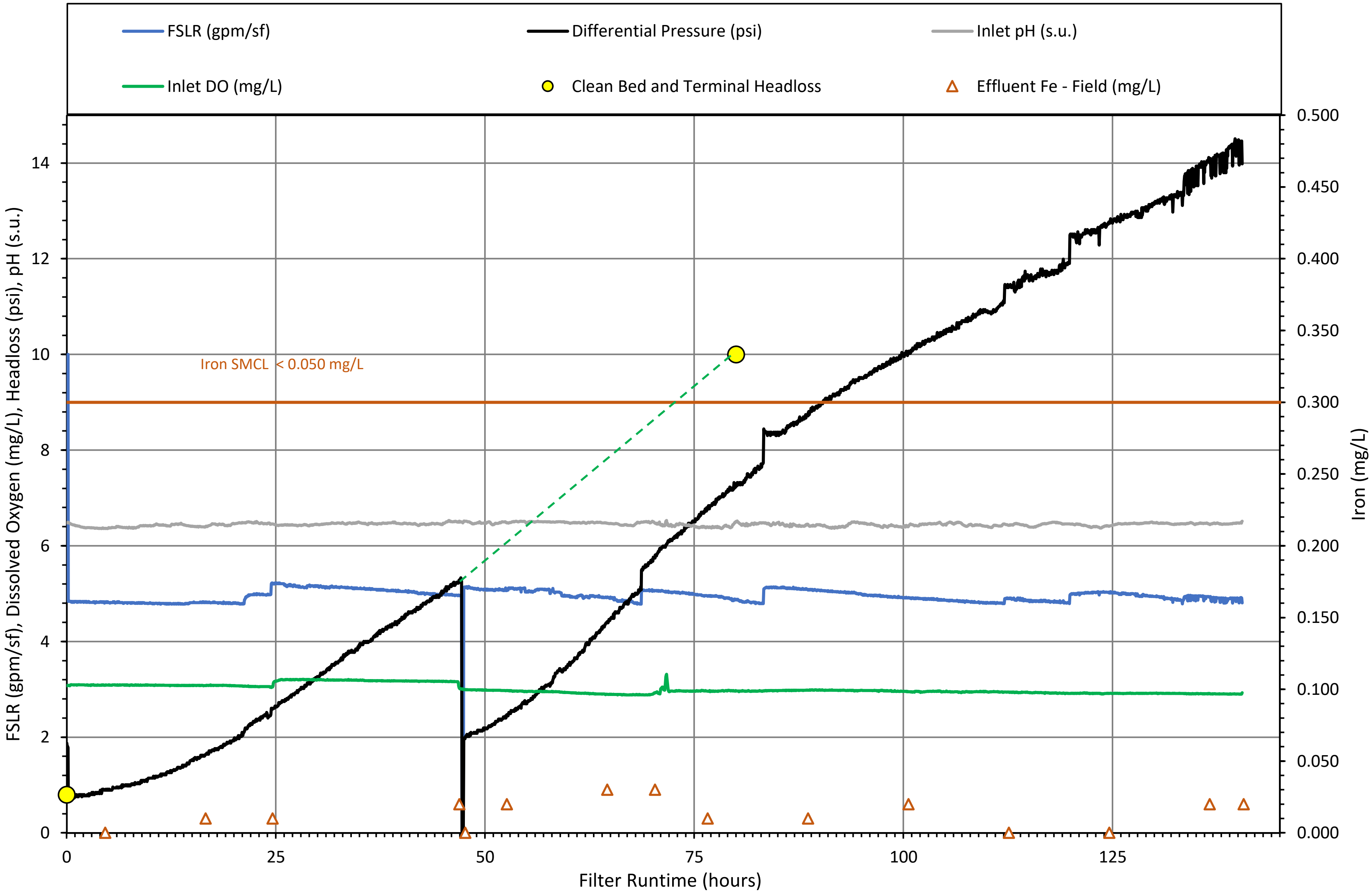
D-03: Operating Conditions for Biological Filter F1, Trial F1.03
SHARON MA, Well 2 - Jan 03 to Jan 06, 2023



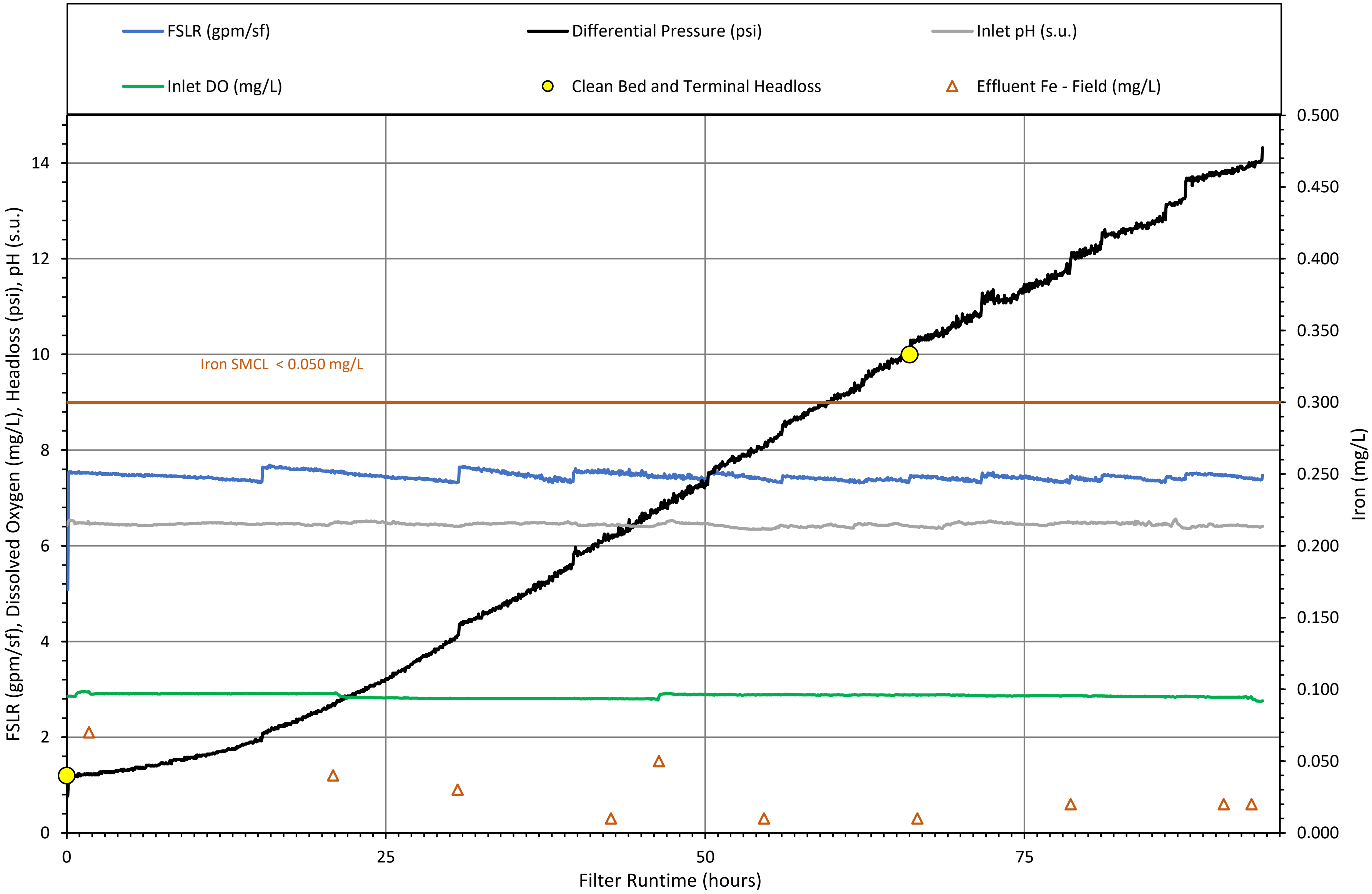
D-04: Operating Conditions for Biological Filter F1, Trial F1.04
SHARON MA, Well 2 - Jan 06 to Jan 10, 2023



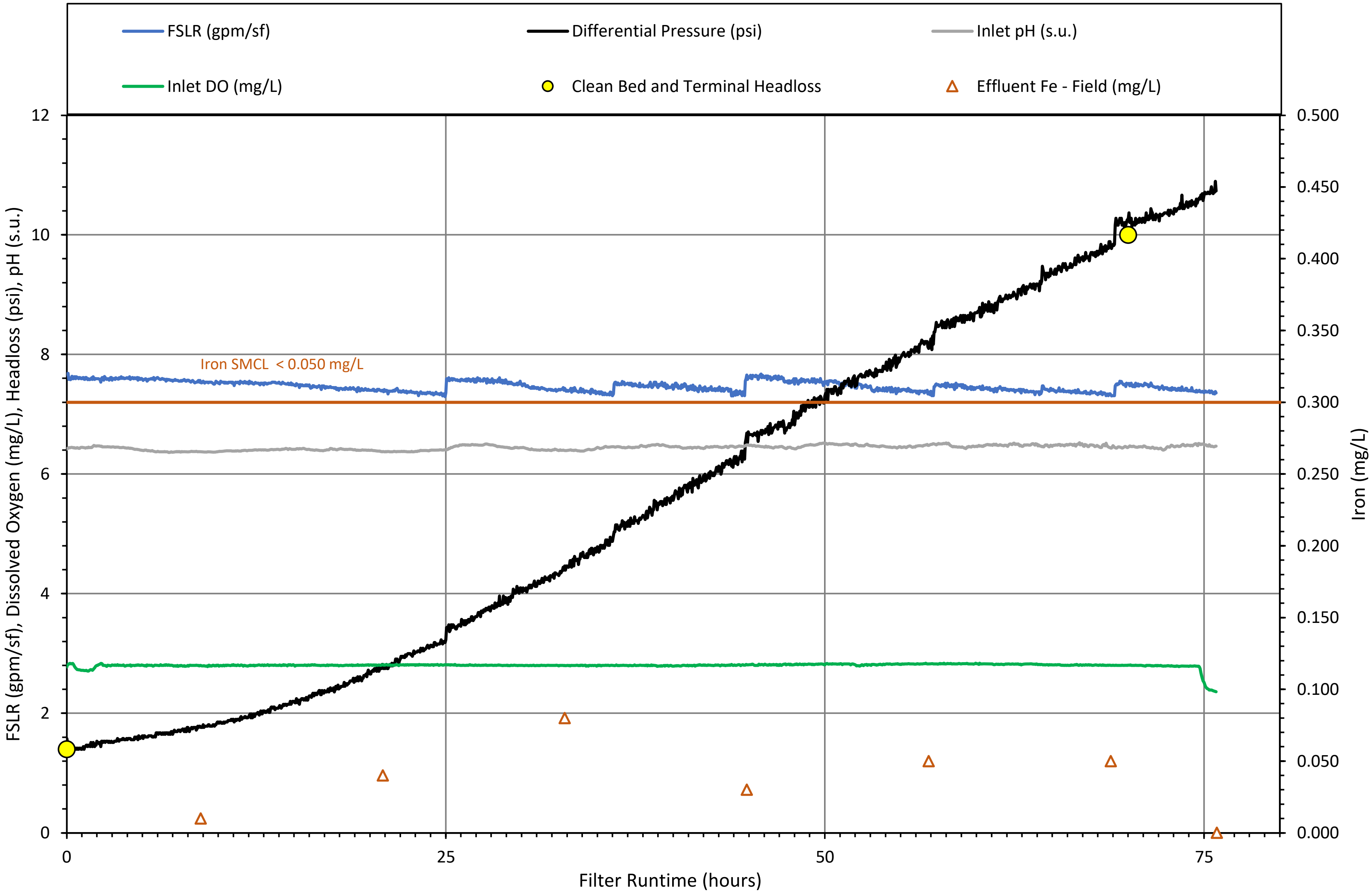
D-05: Operating Conditions for Biological Filter F1, Trial F1.05
SHARON MA, Well 2 - Jan 10 to Jan 16, 2023



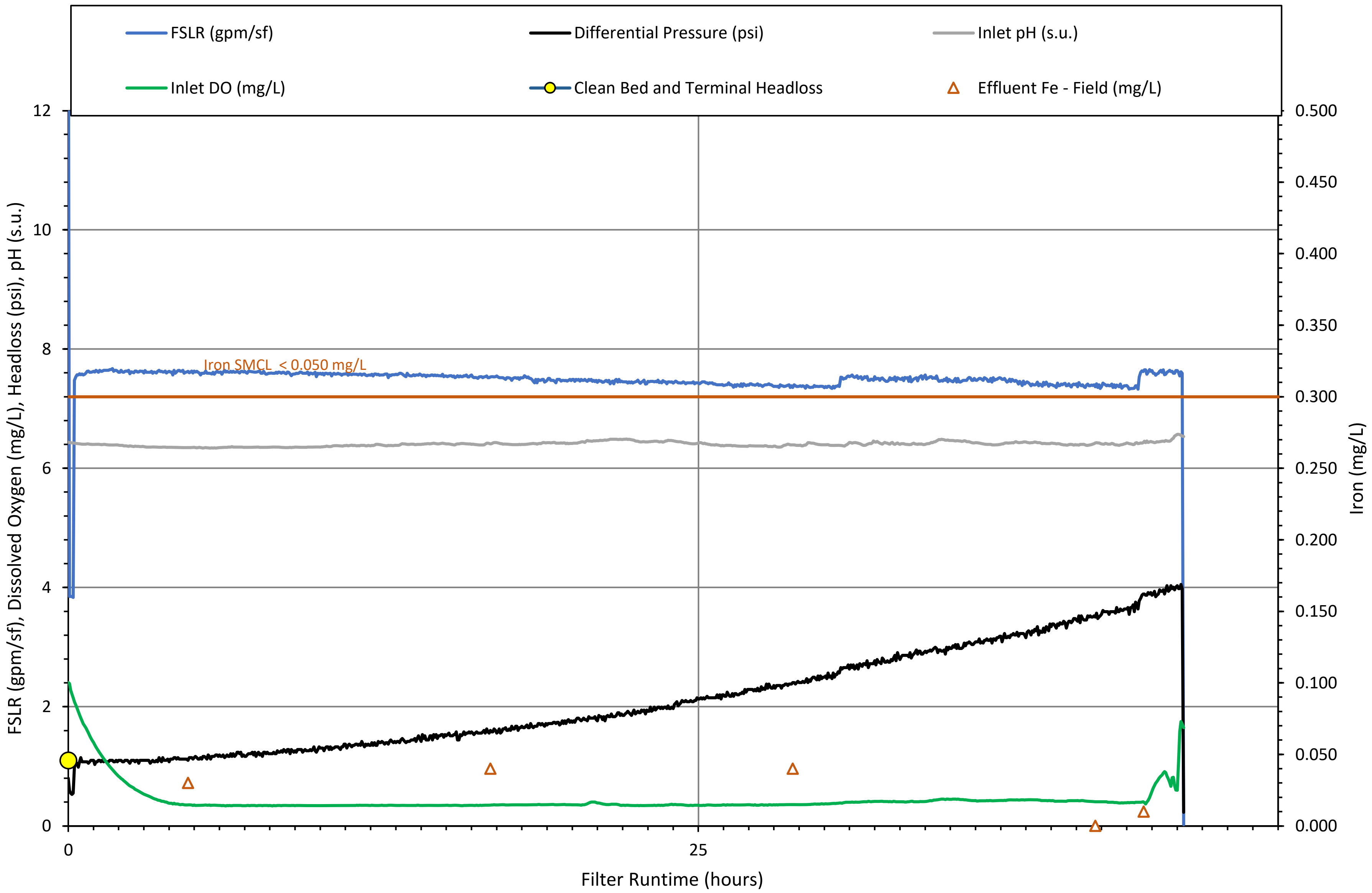
D-06: Operating Conditions for Biological Filter F1, Trial F1.06
SHARON MA, Well 2 - Jan 16 to Jan 20, 2023



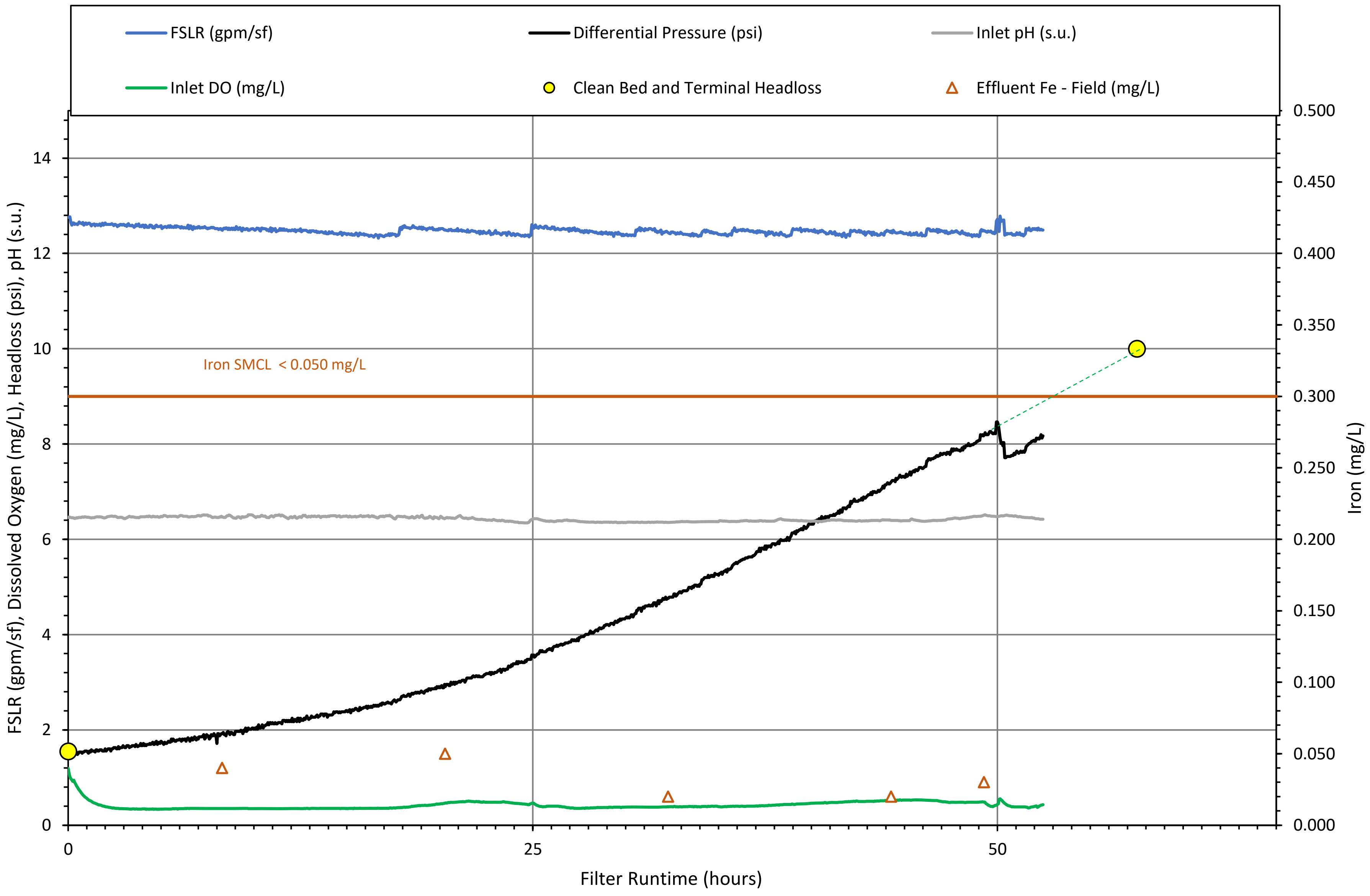
D-07: Operating Conditions for Biological Filter F1, Trial F1.07
SHARON MA, Well 2 - Jan 20 to Jan 23, 2023



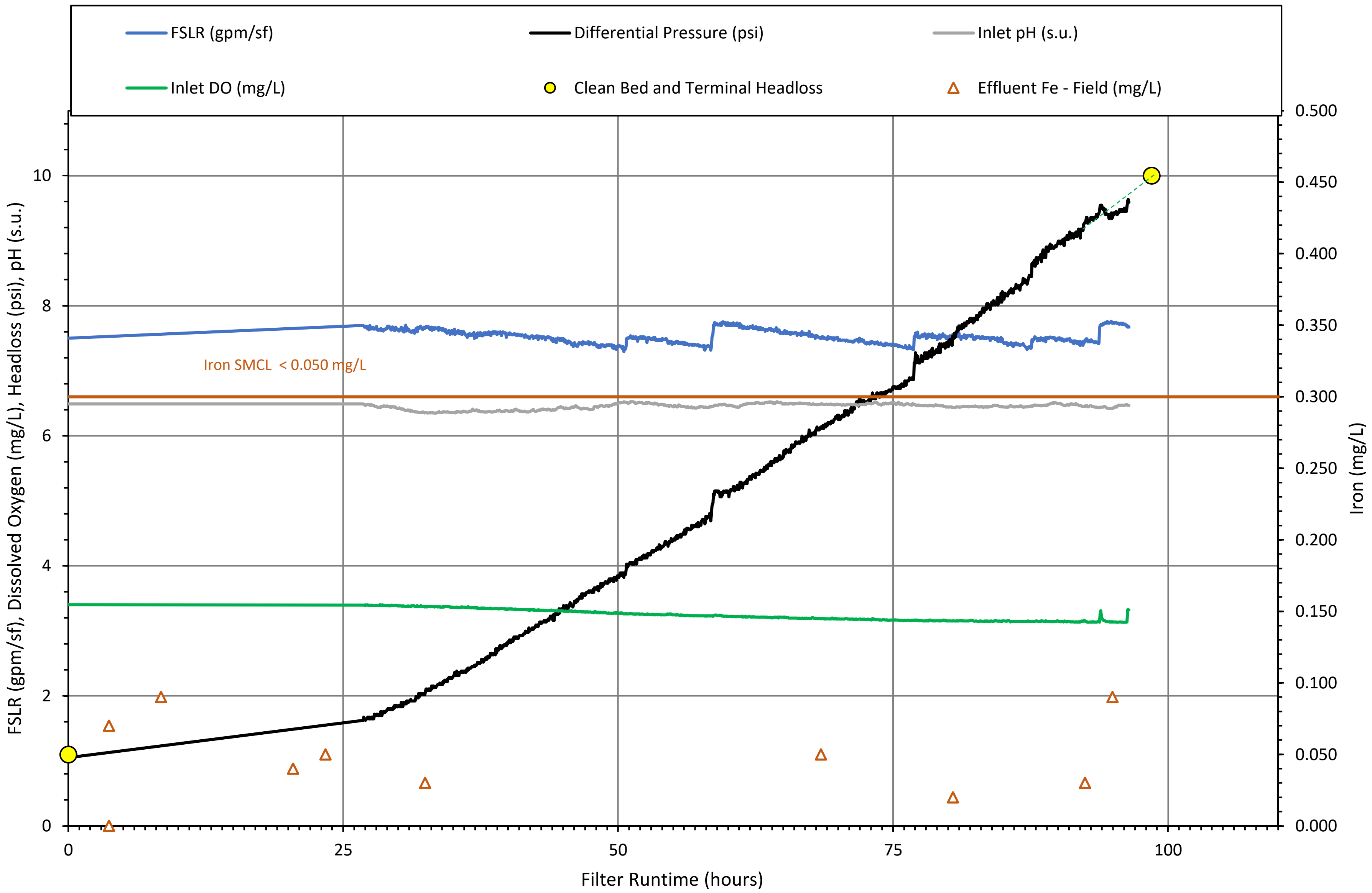
D-08: Operating Conditions for Biological Filter F1, Trial F1.08
SHARON MA, Well 2 - Jan 23 to Jan 25, 2023



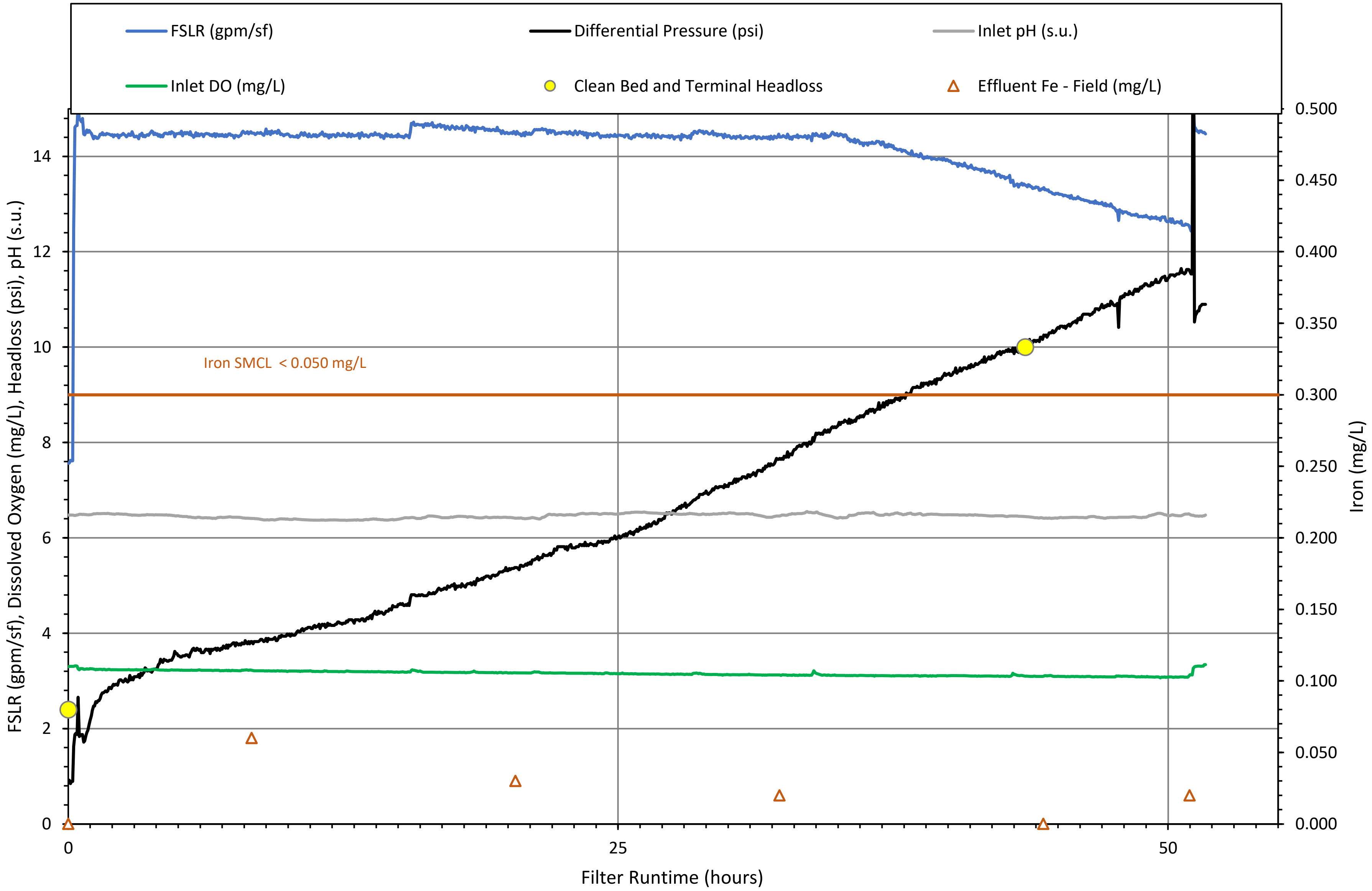
D-09: Operating Conditions for Biological Filter F1, Trial F1.09
SHARON MA, Well 2 - Jan 25 to Jan 27, 2023



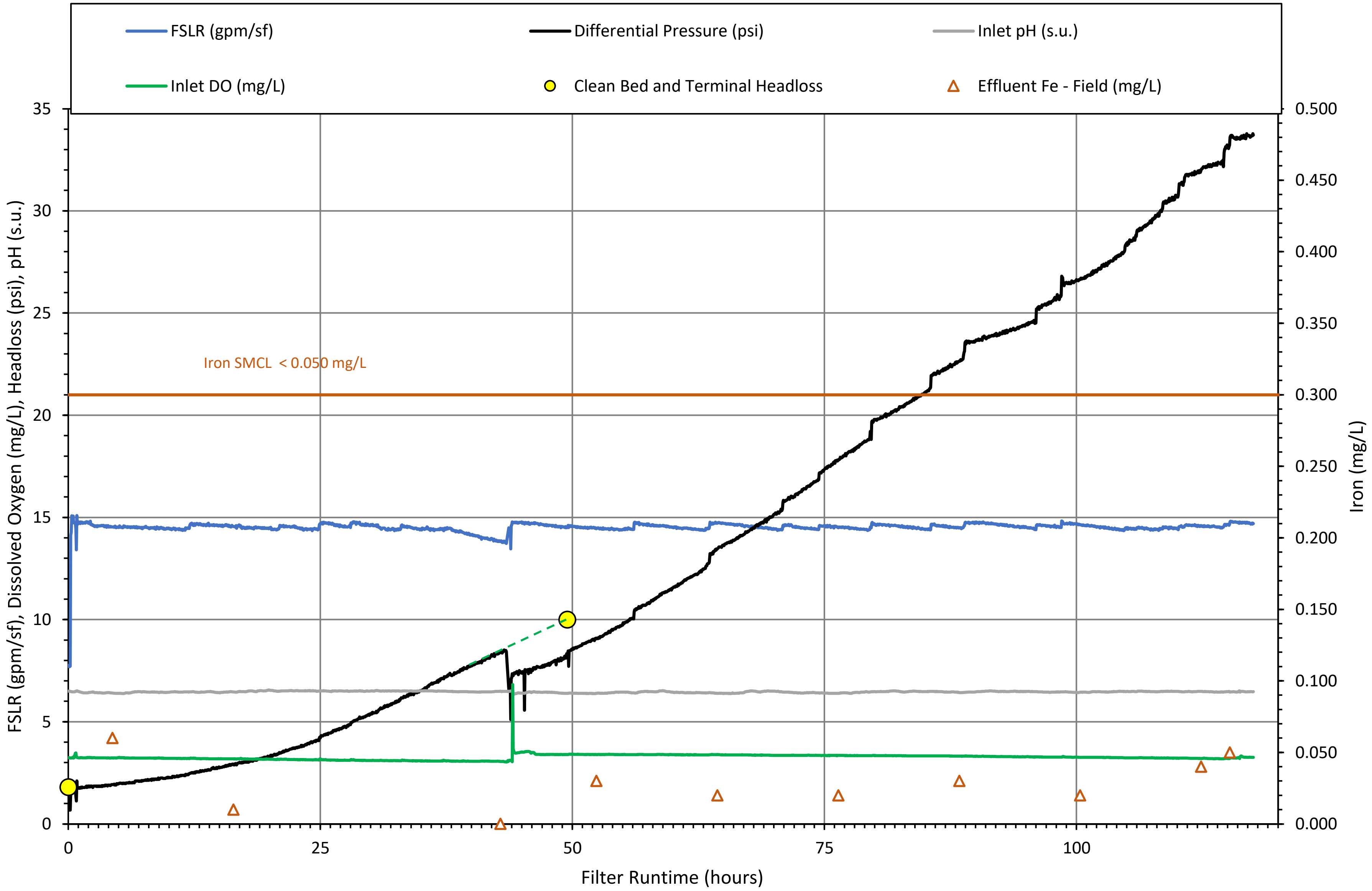
D-10: Operating Conditions for Biological Filter F1, Trial F1.12
SHARON MA, Well 2 - Feb 02 to Feb 06, 2023



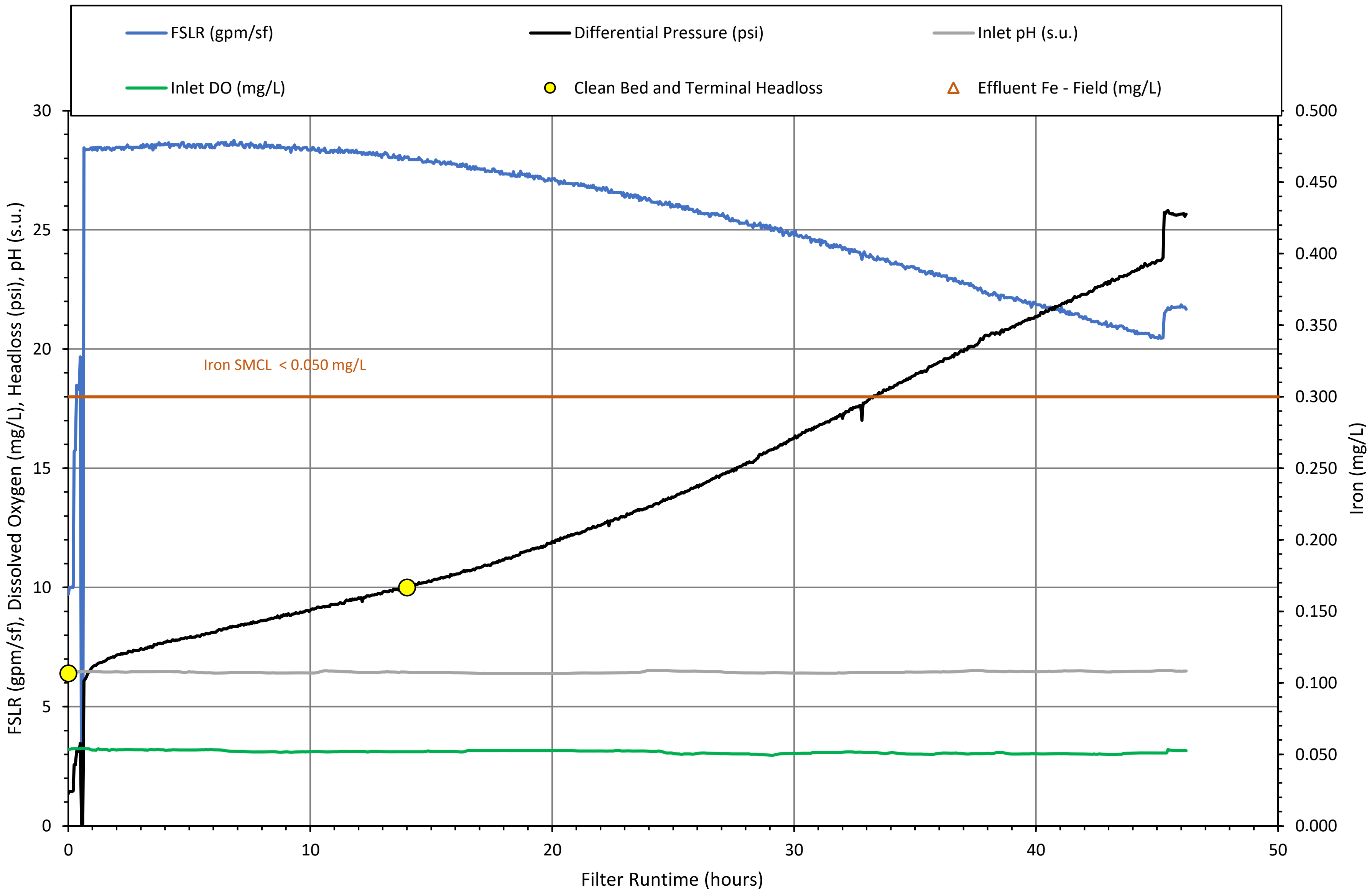
D-11: Operating Conditions for Biological Filter F1, Trial F1.13
SHARON MA, Well 2 - Feb 06 to Feb 08, 2023



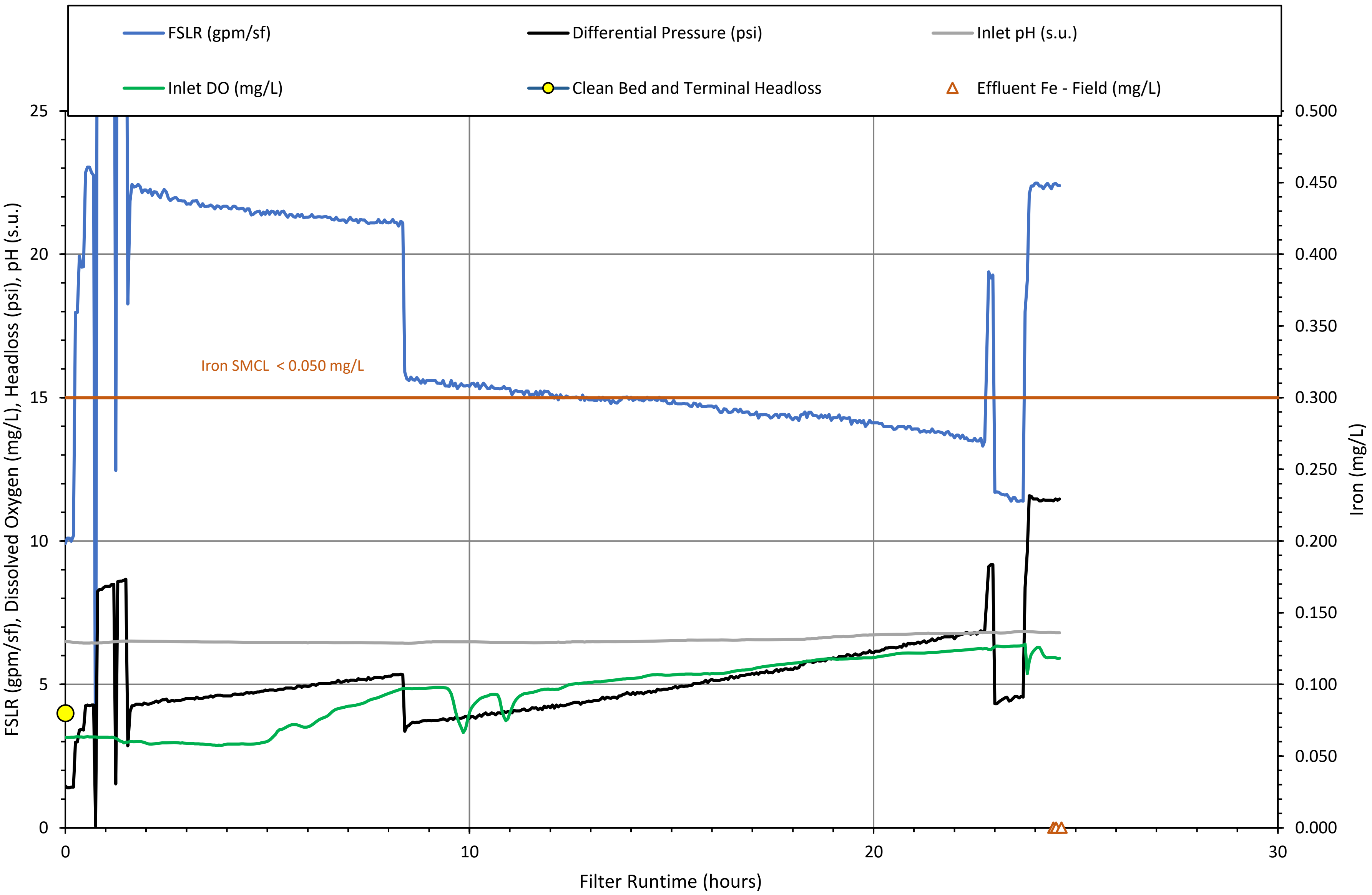
D-12: Operating Conditions for Biological Filter F1, Trial F1.14
SHARON MA, Well 2 - Feb 08 to Feb 13, 2023



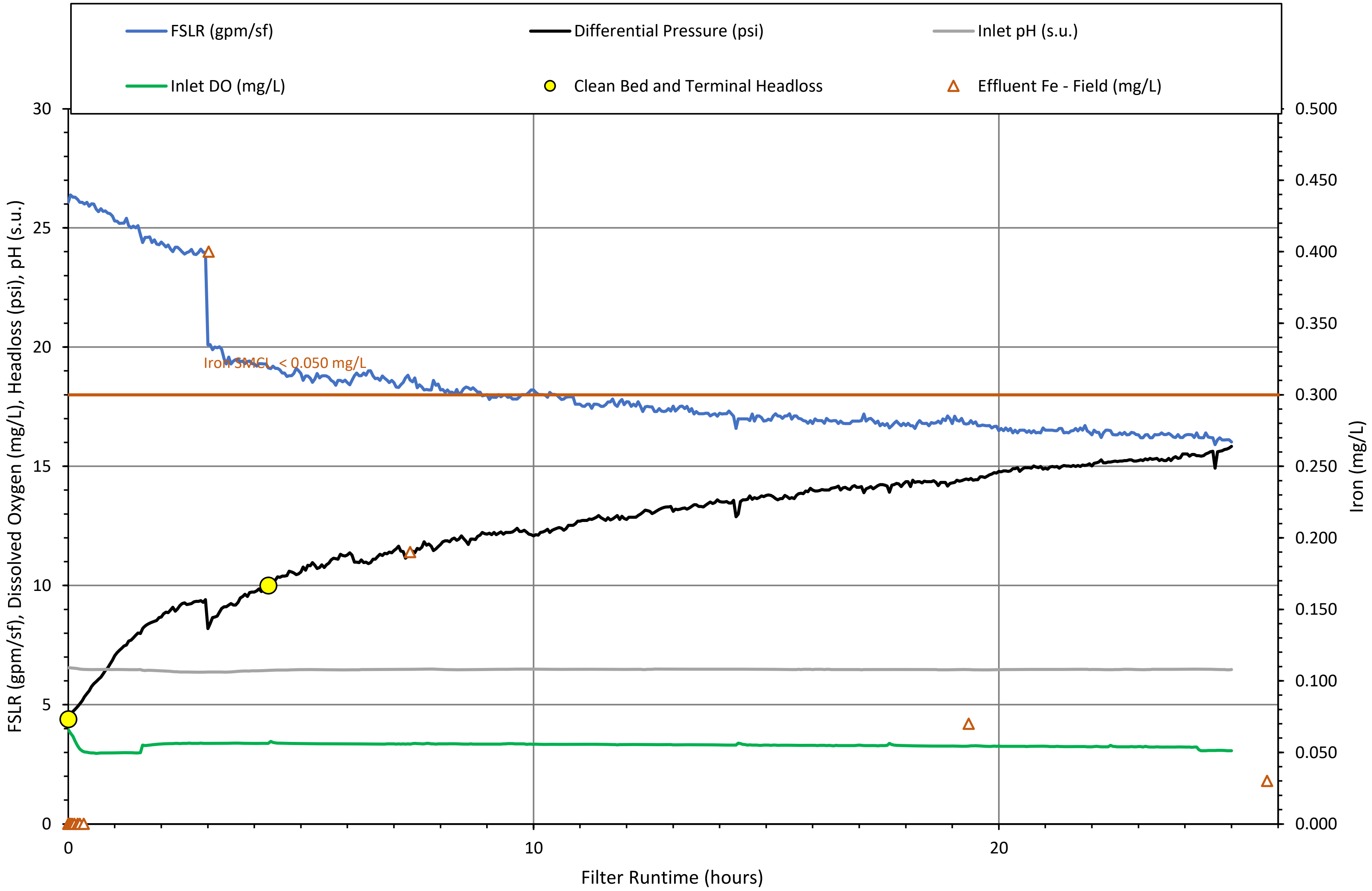
D-13: Operating Conditions for Biological Filter F1, Trial F1.15
SHARON MA, Well 2 - Feb 13 to Feb 15, 2023



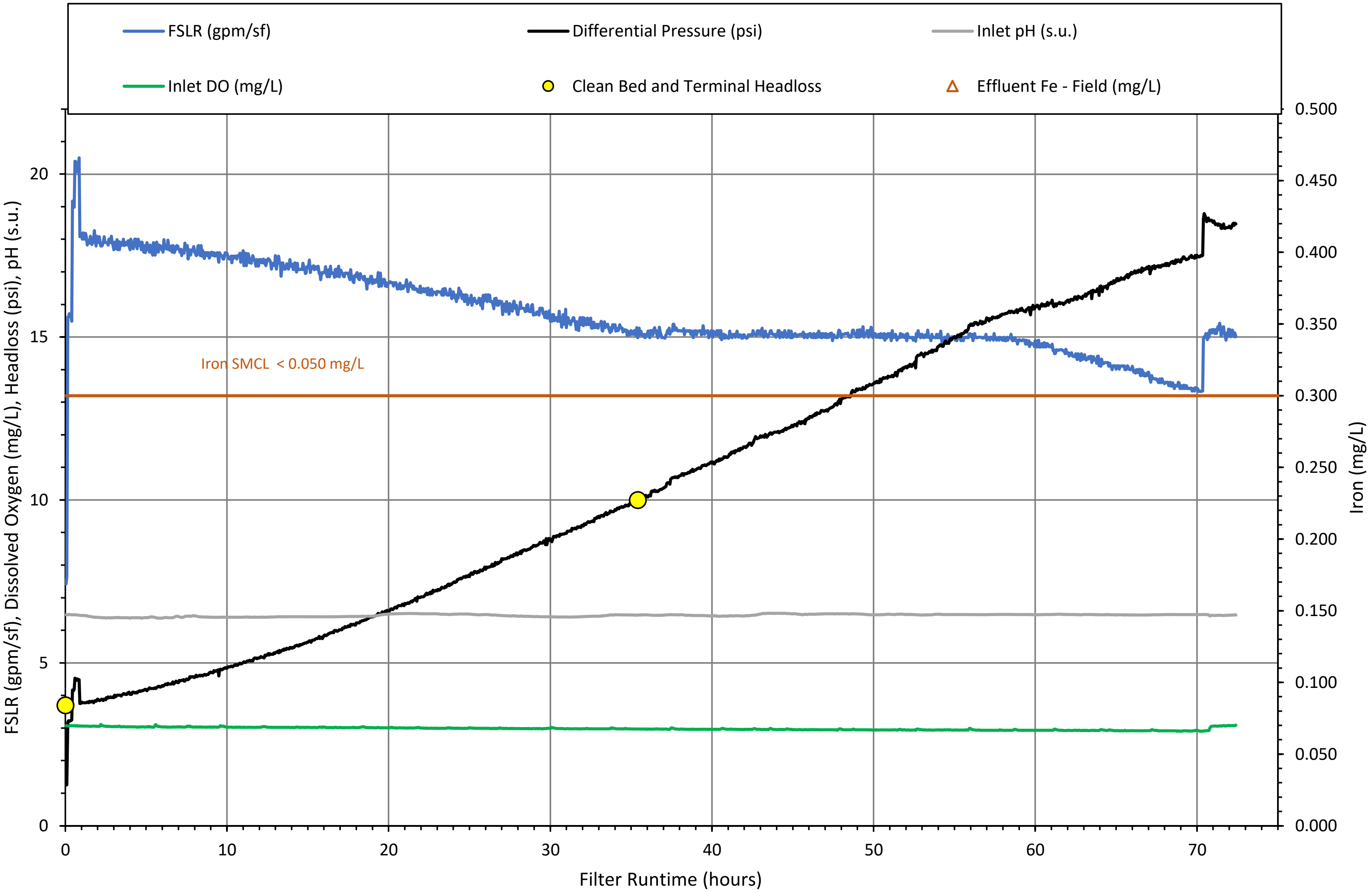
D-14: Operating Conditions for Biological Filter F1, Trial F1.16
SHARON MA, Well 2 - Feb 15 to Feb 16, 2023



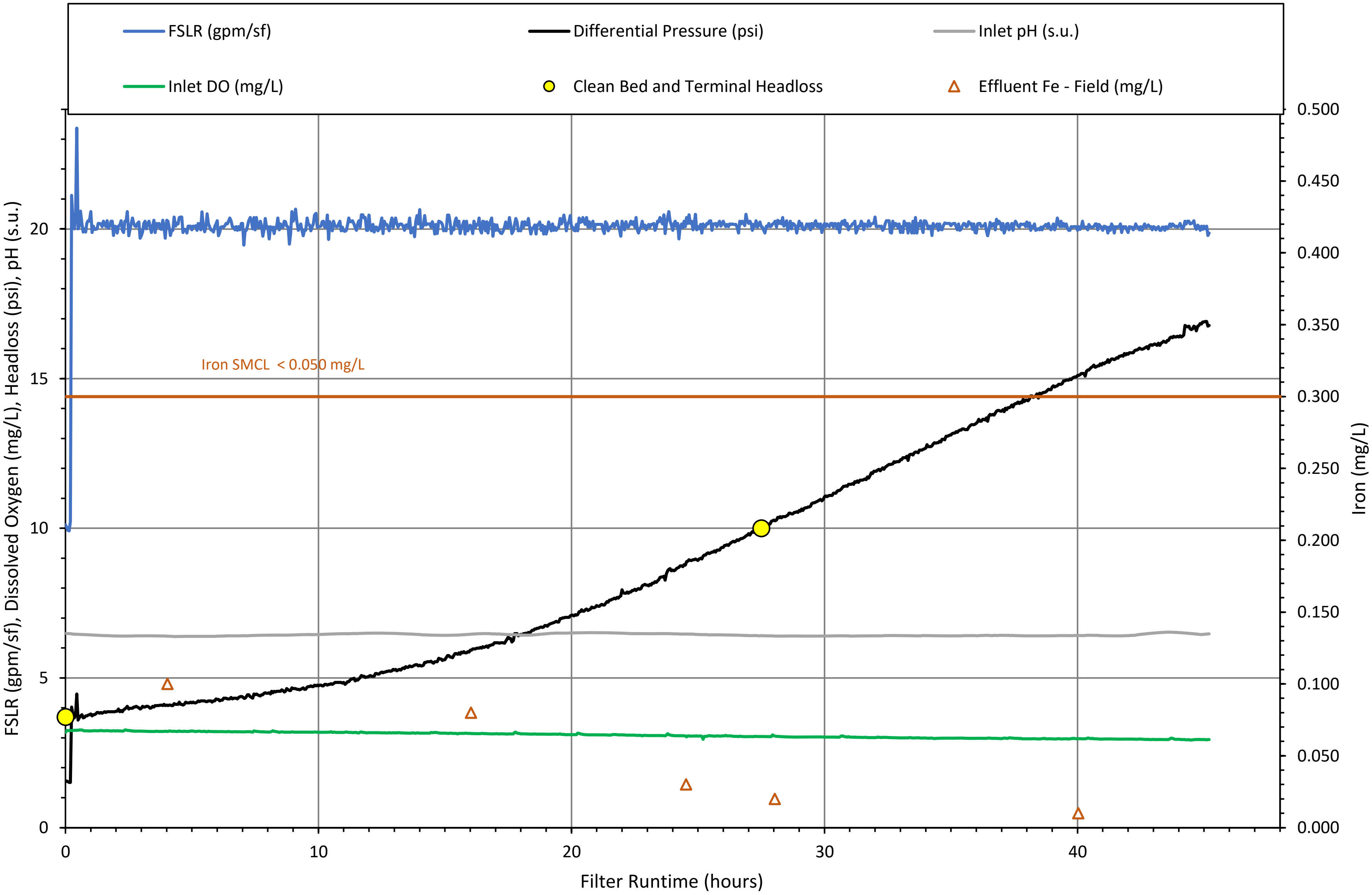
D-15: Operating Conditions for Biological Filter F1, Trial F1.17
SHARON MA, Well 2 - Feb 16 to Feb 17, 2023



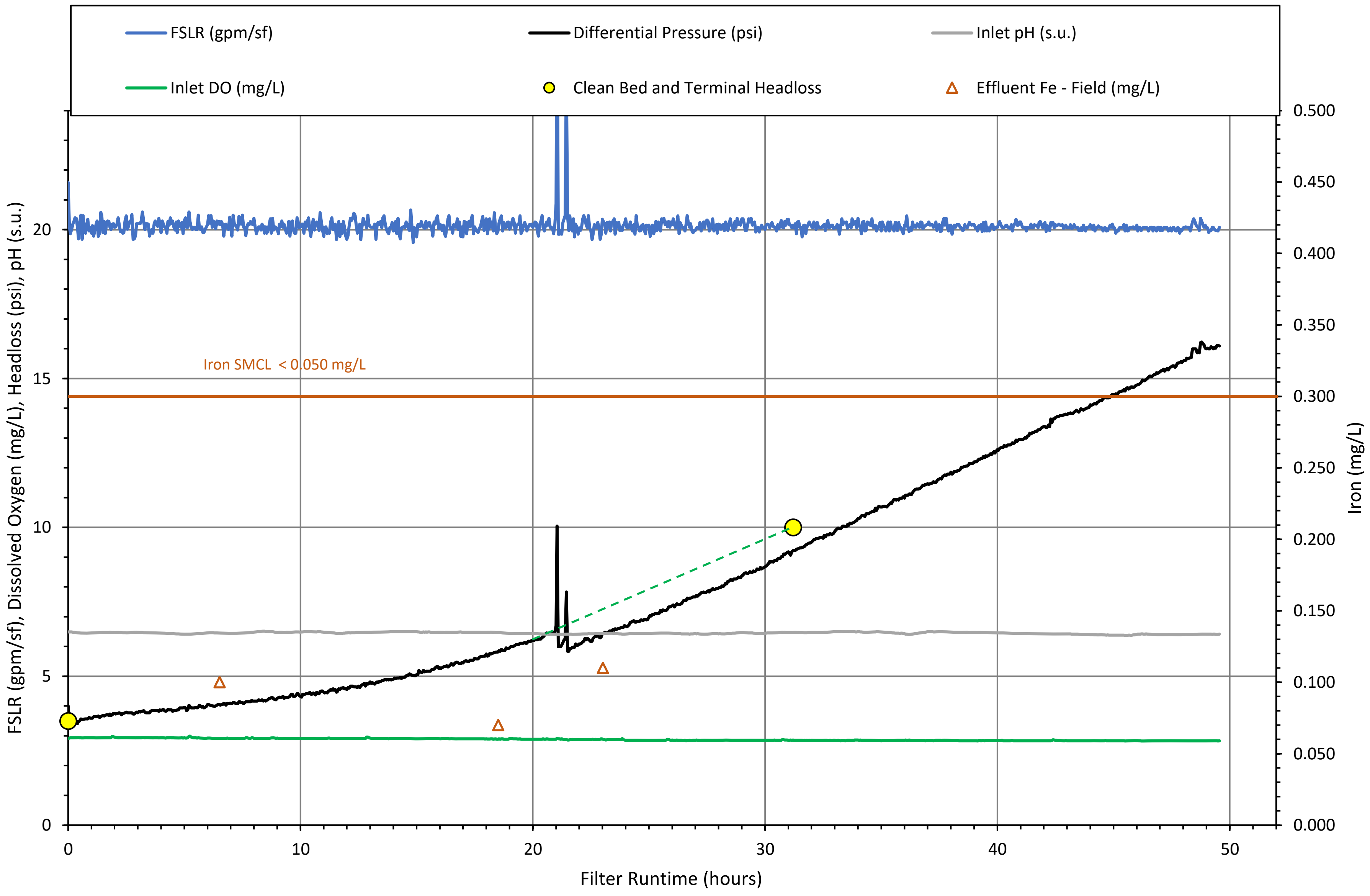
D-16: Operating Conditions for Biological Filter F1, Trial F1.18
SHARON MA, Well 2 - Feb 17 to Feb 20, 2023



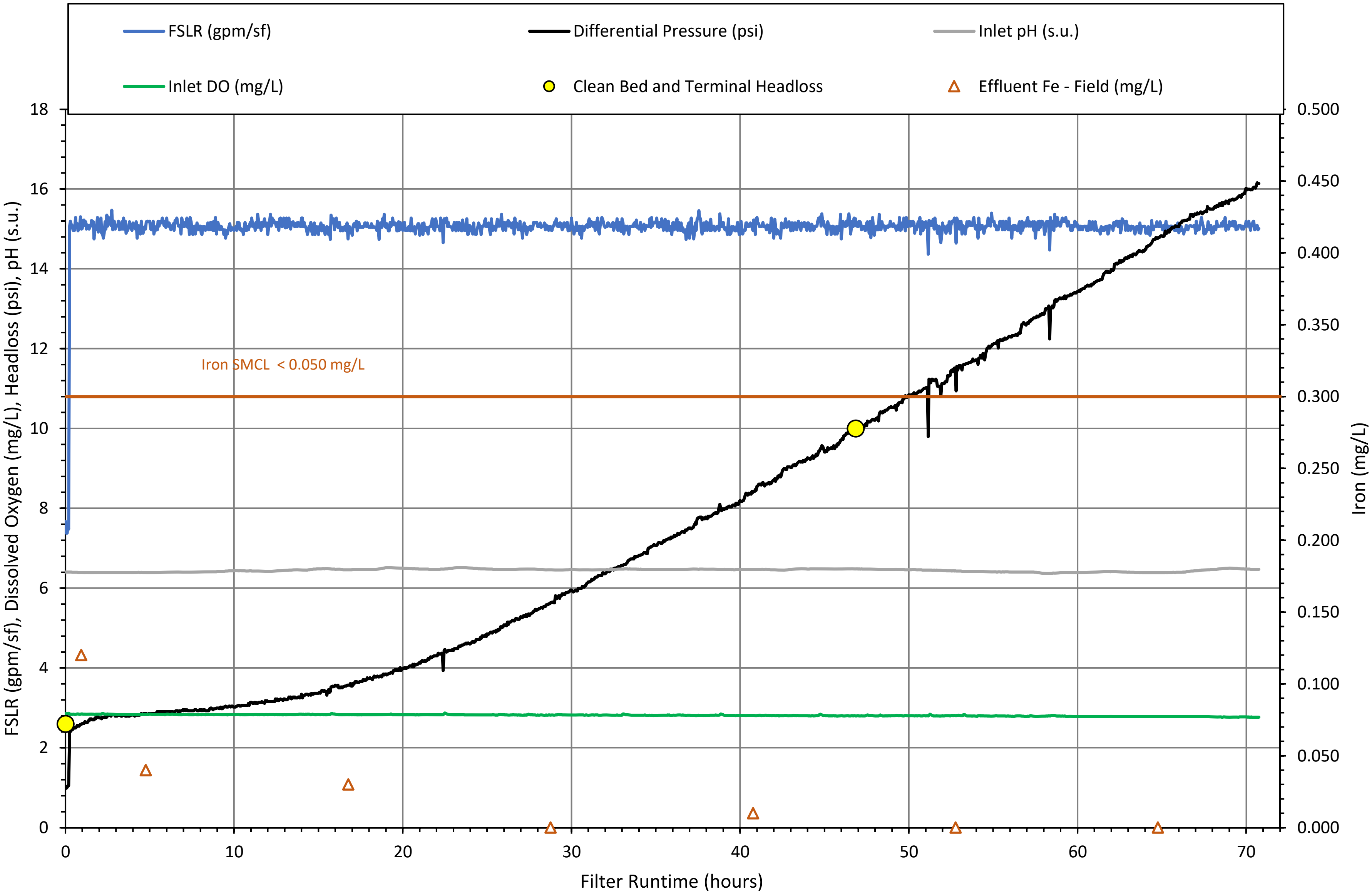
D-17: Operating Conditions for Biological Filter F1, Trial F1.19
SHARON MA, Well 2 - Feb 20 to Feb 22, 2023



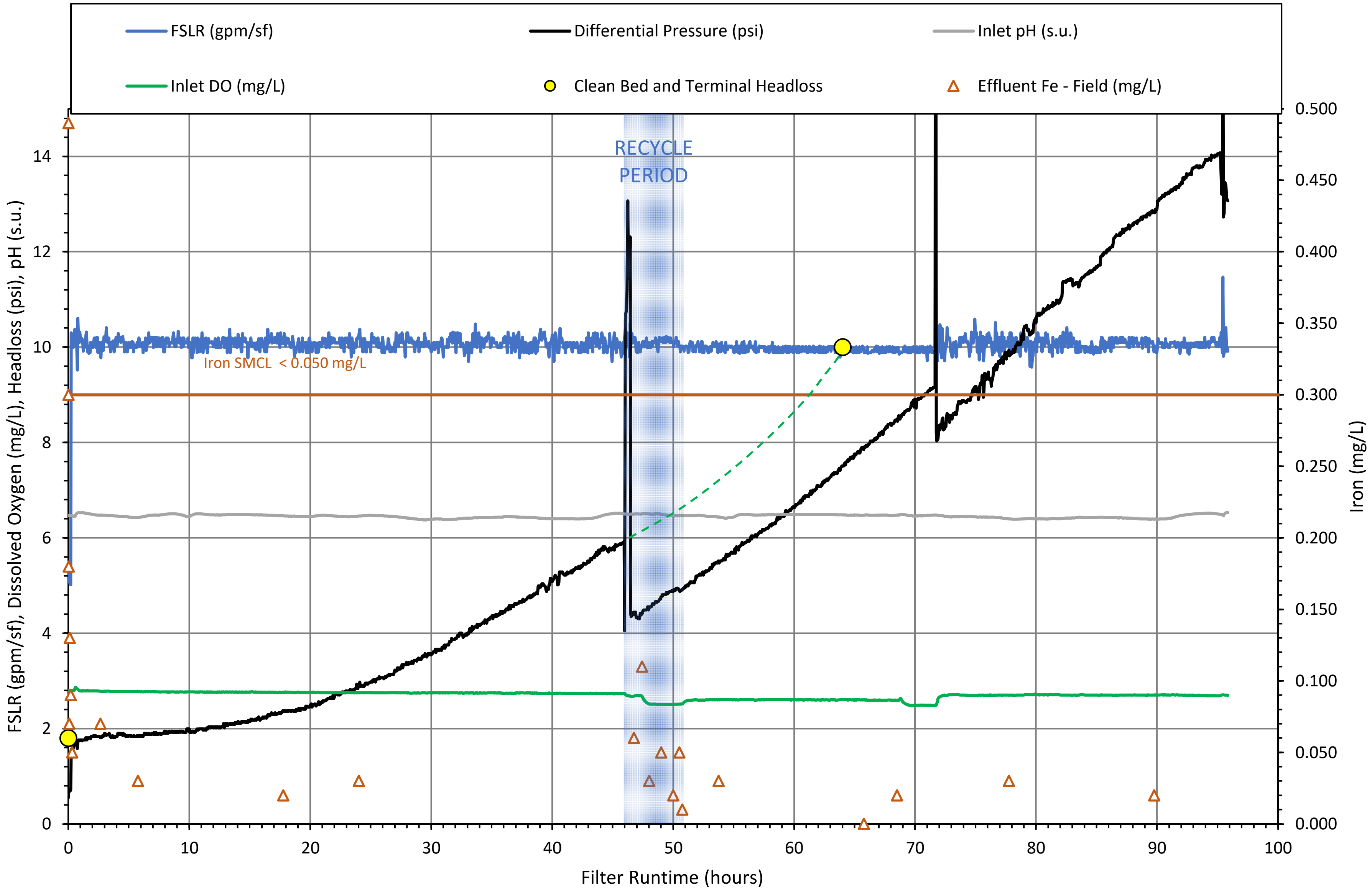
D-18: Operating Conditions for Biological Filter F1, Trial F1.20
SHARON MA, Well 2 - Feb 22 to Feb 24, 2023



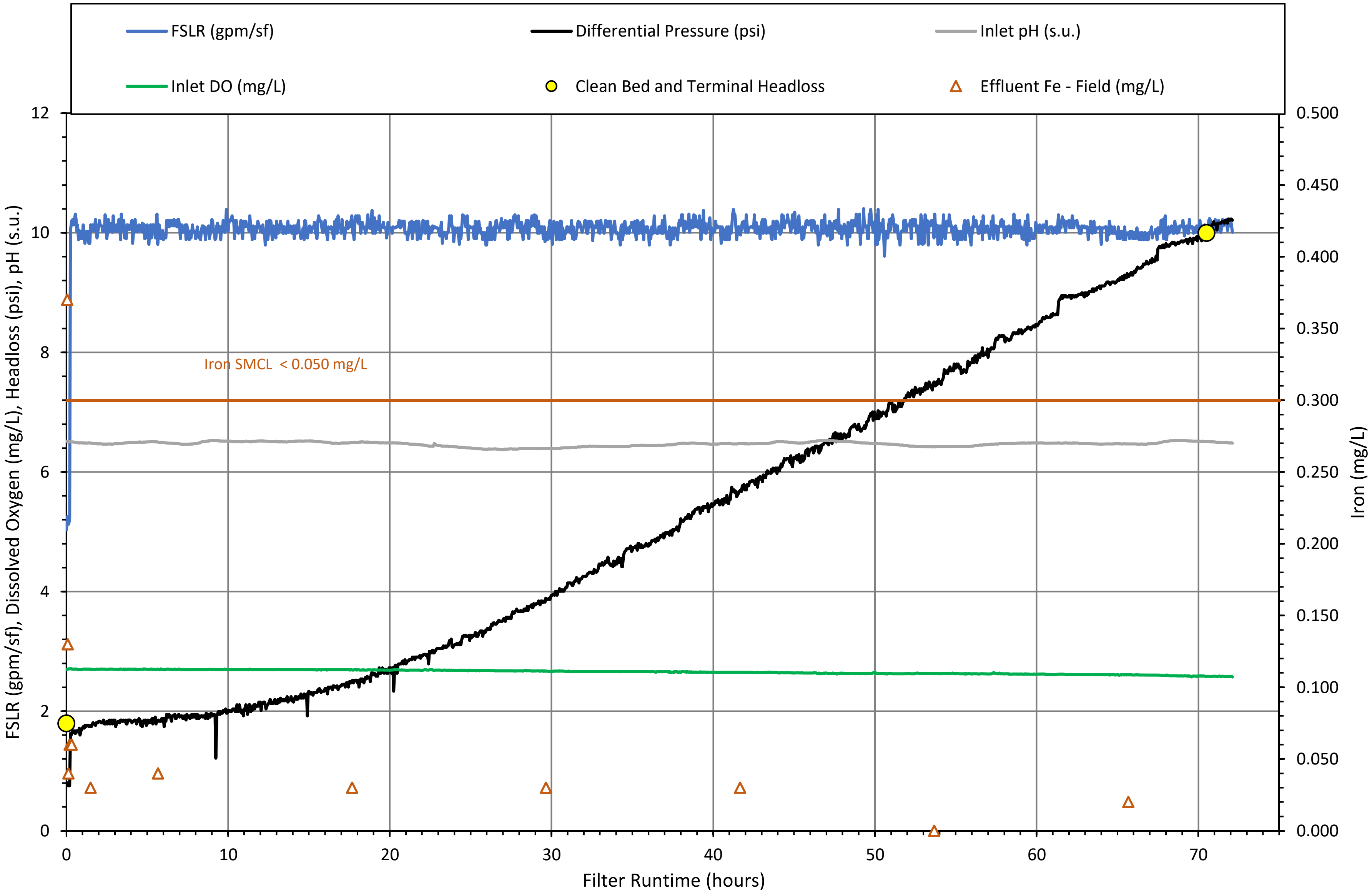
D-19: Operating Conditions for Biological Filter F1, Trial F1.21
SHARON MA, Well 2 - Feb 24 to Feb 27, 2023



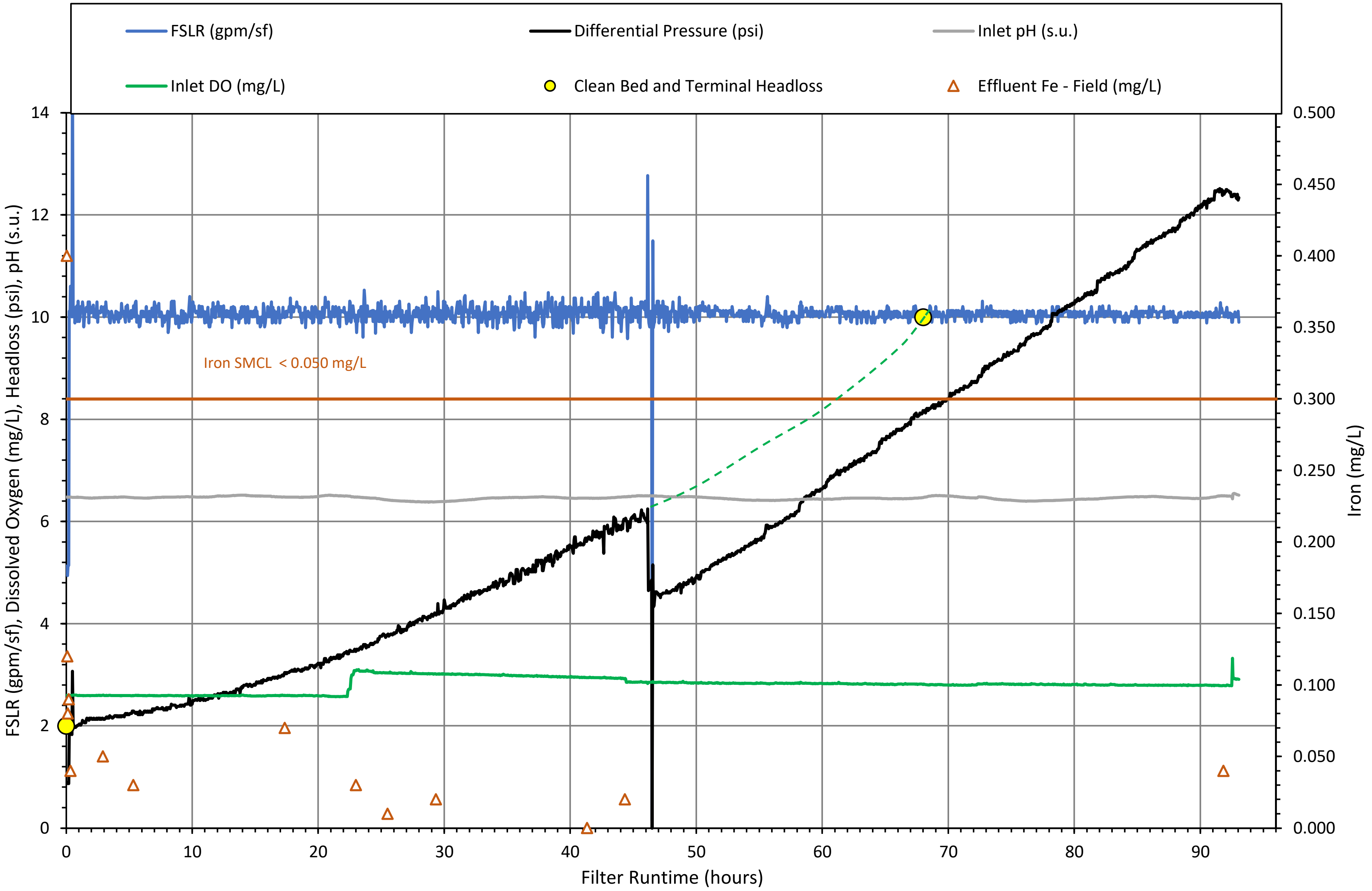
D-20: Operating Conditions for Biological Filter F1, Trial F1.22
SHARON MA, Well 2 - Feb 27 to Mar 03, 2023



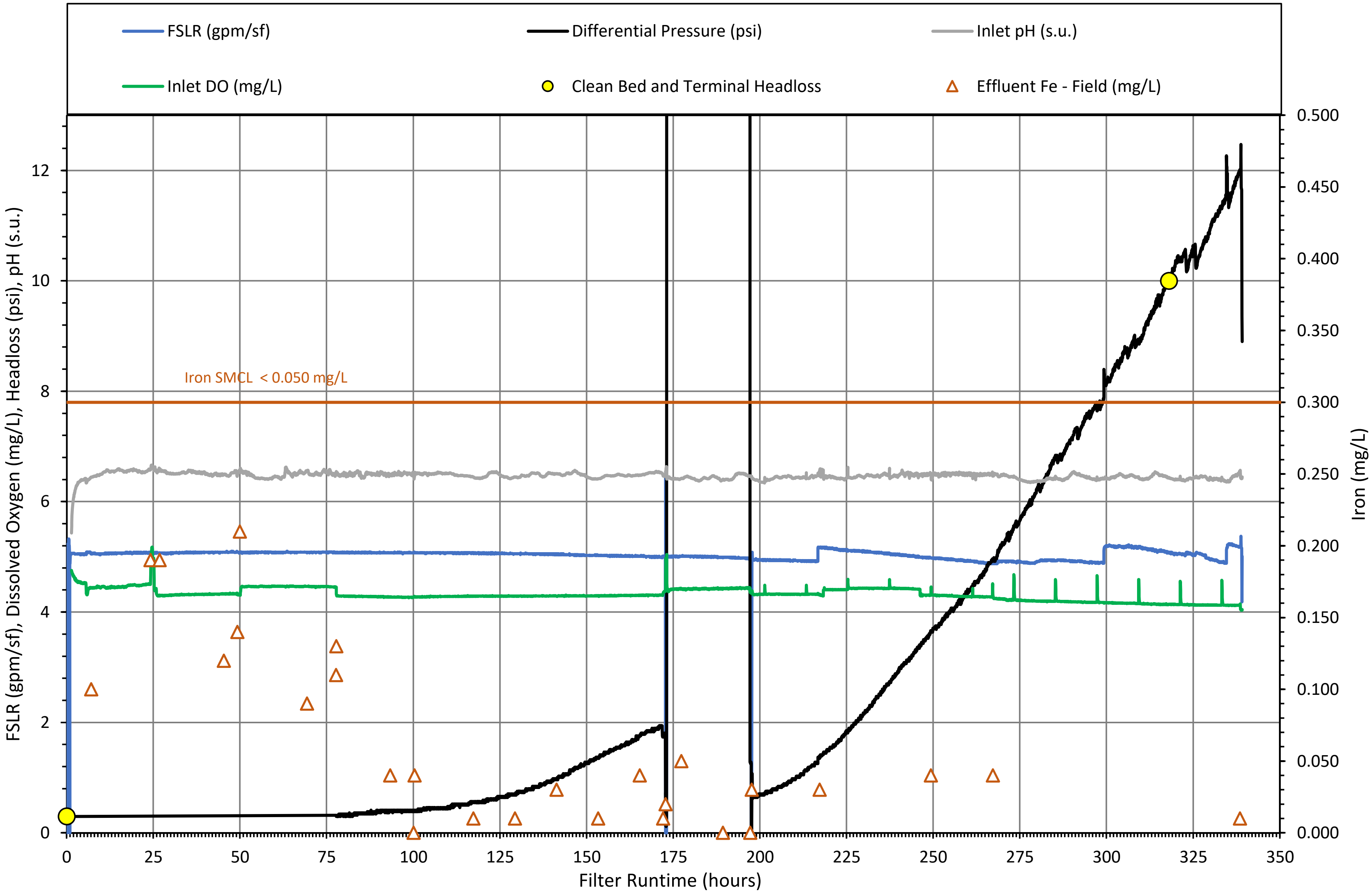
D-21: Operating Conditions for Biological Filter F1, Trial F1.23
SHARON MA, Well 2 - Mar 03 to Mar 06, 2023



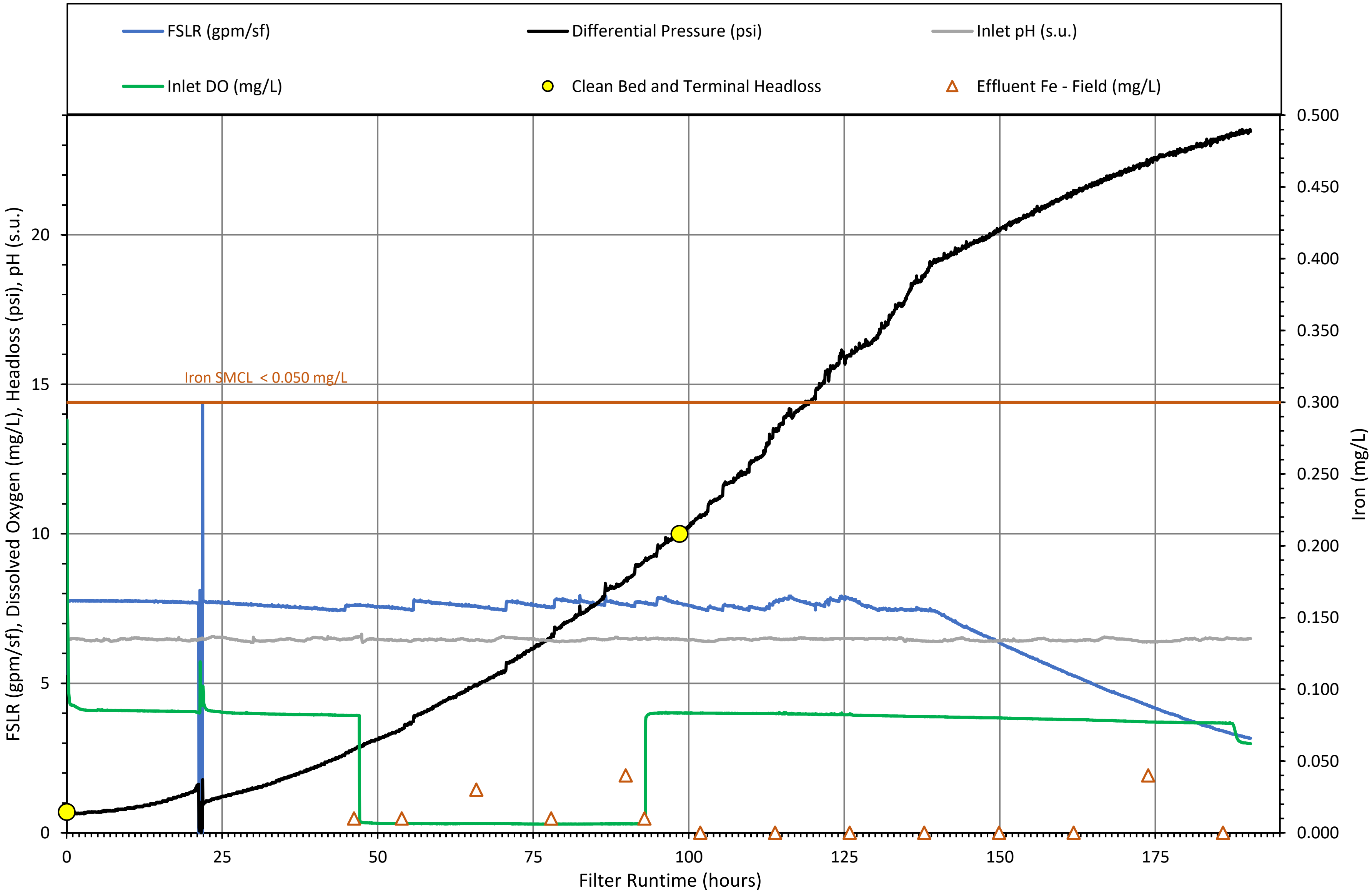
D-22: Operating Conditions for Biological Filter F1, Trial F1.24
SHARON MA, Well 2 - Mar 06 to Mar 10, 2023



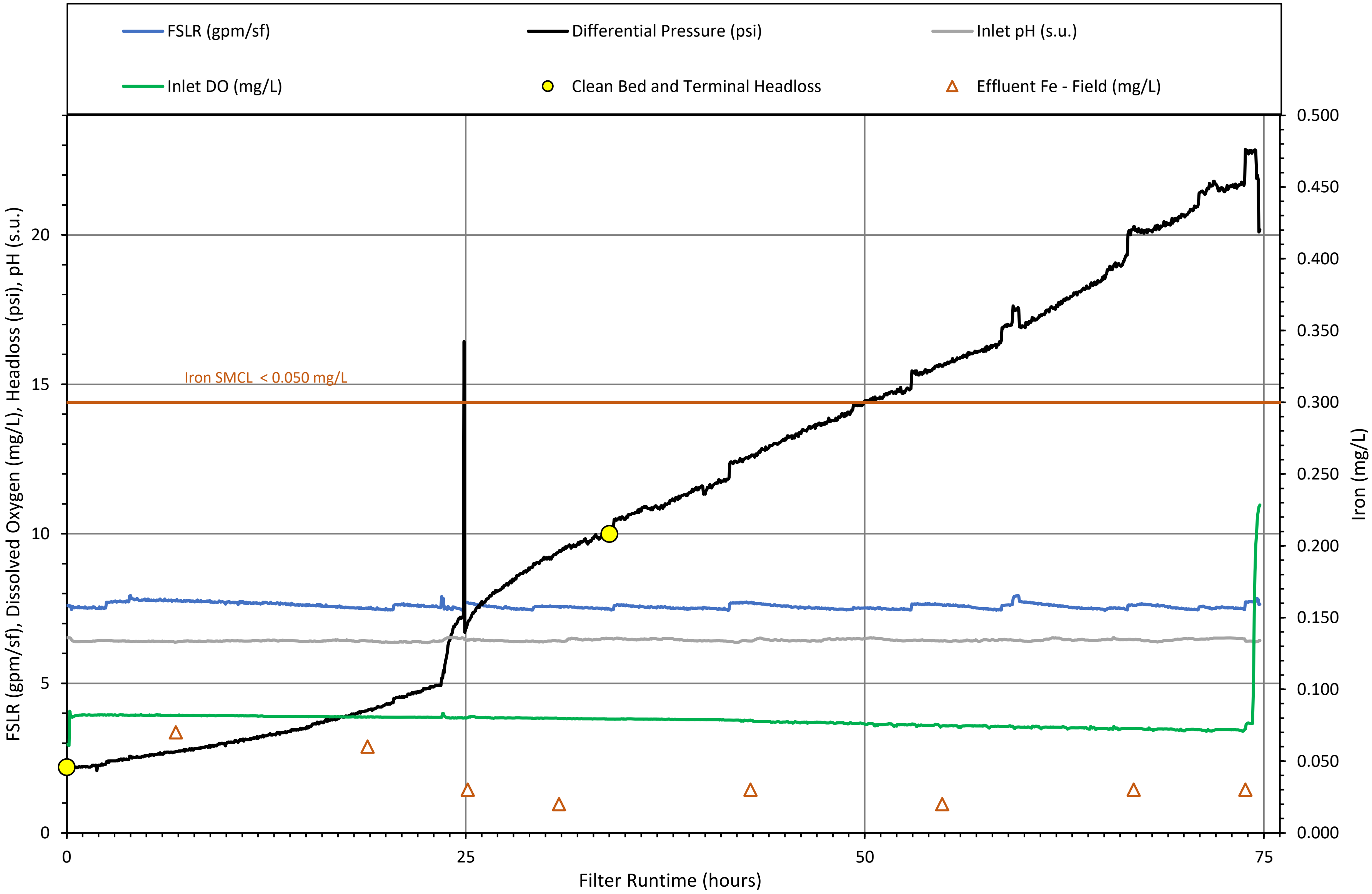
D-23: Operating Conditions for Biological Filter F2, Trial F2.01
SHARON MA, Well 2 - Dec 12 to Dec 26, 2022



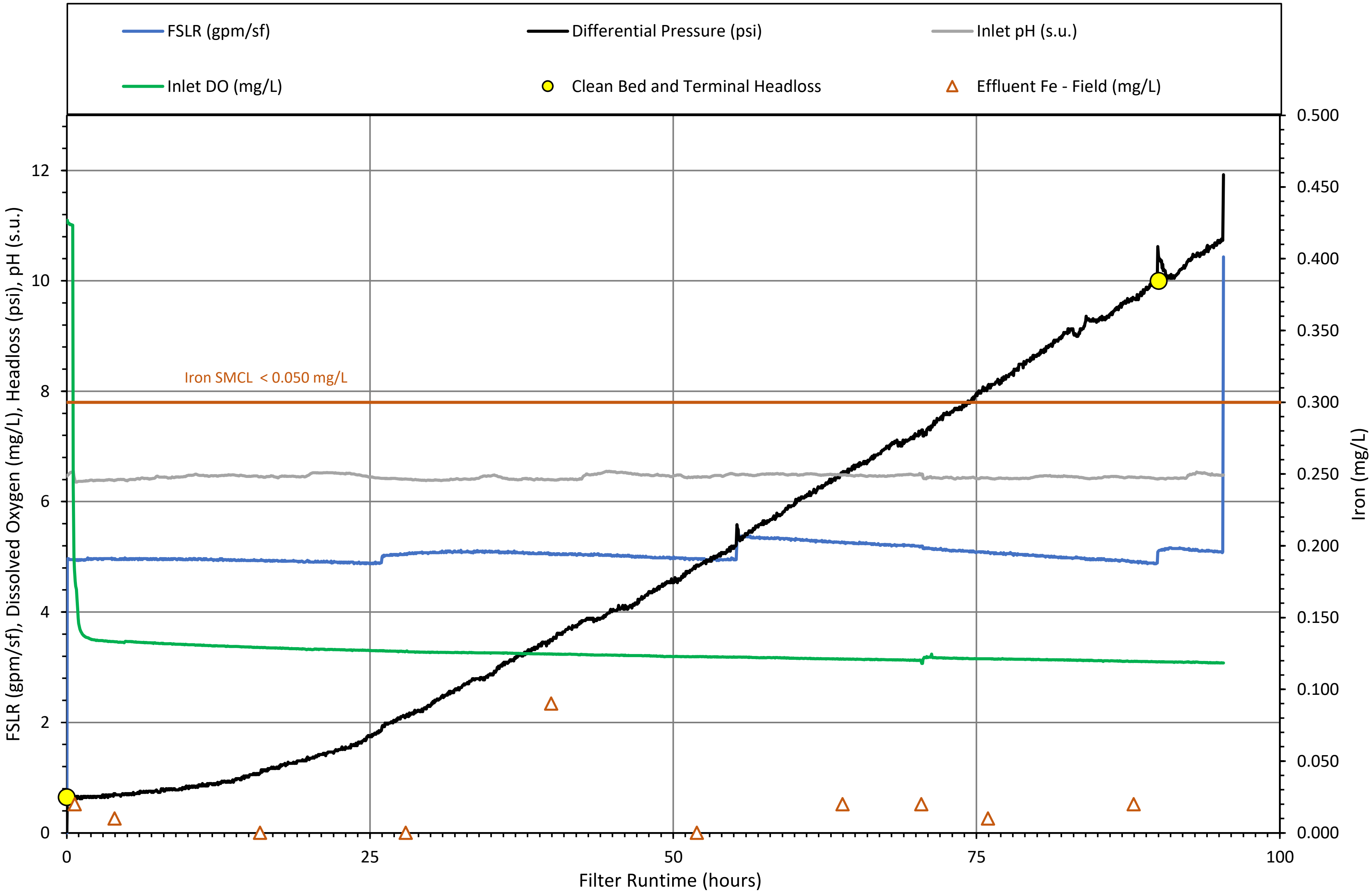
D-24: Operating Conditions for Biological Filter F2, Trial F2.02
SHARON MA, Well 2 - Dec 26, 2022 to Jan 03, 2023



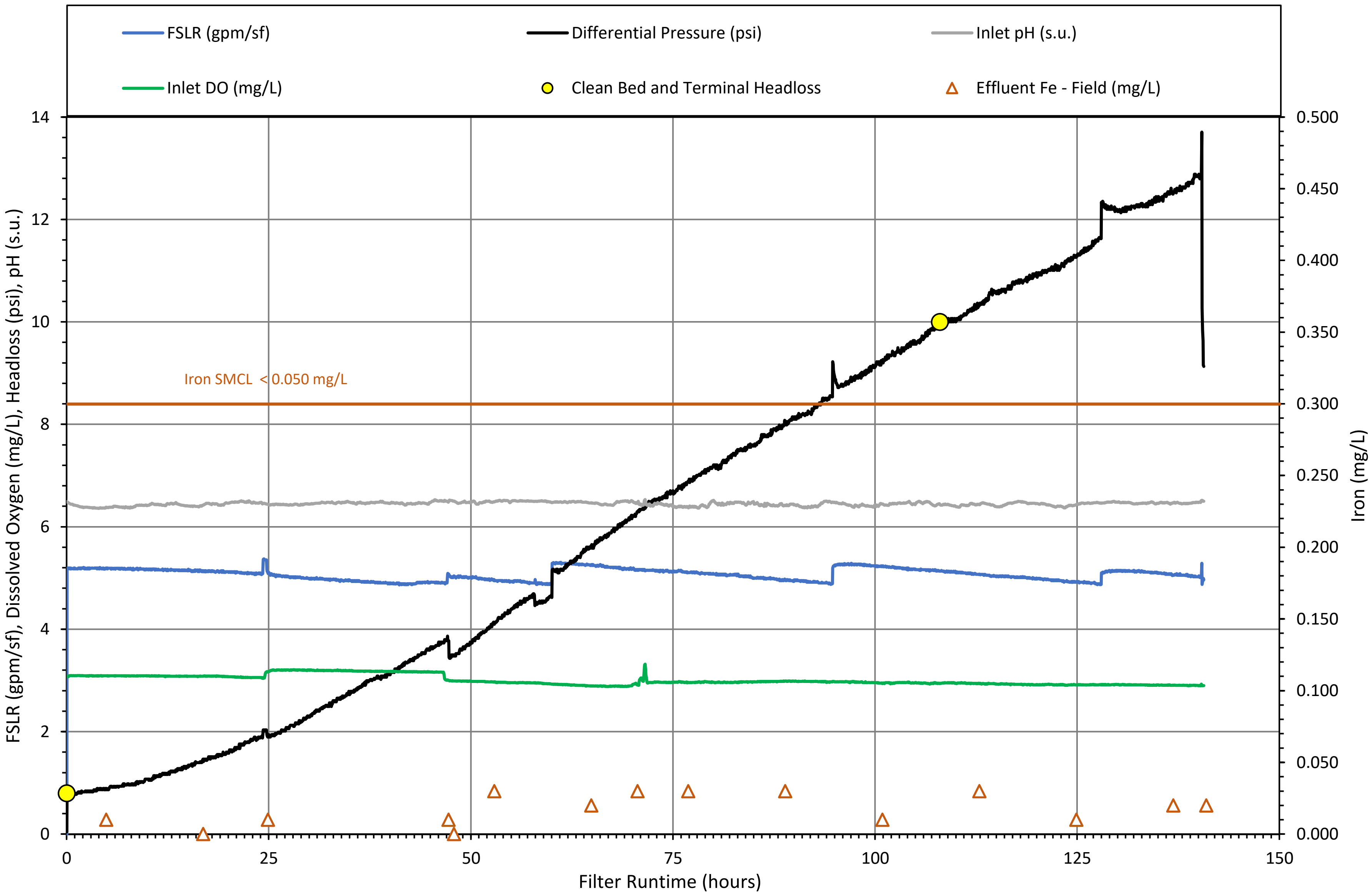
D-25: Operating Conditions for Biological Filter F2, Trial F2.03
SHARON MA, Well 2 - Jan 03 to Jan 06, 2023



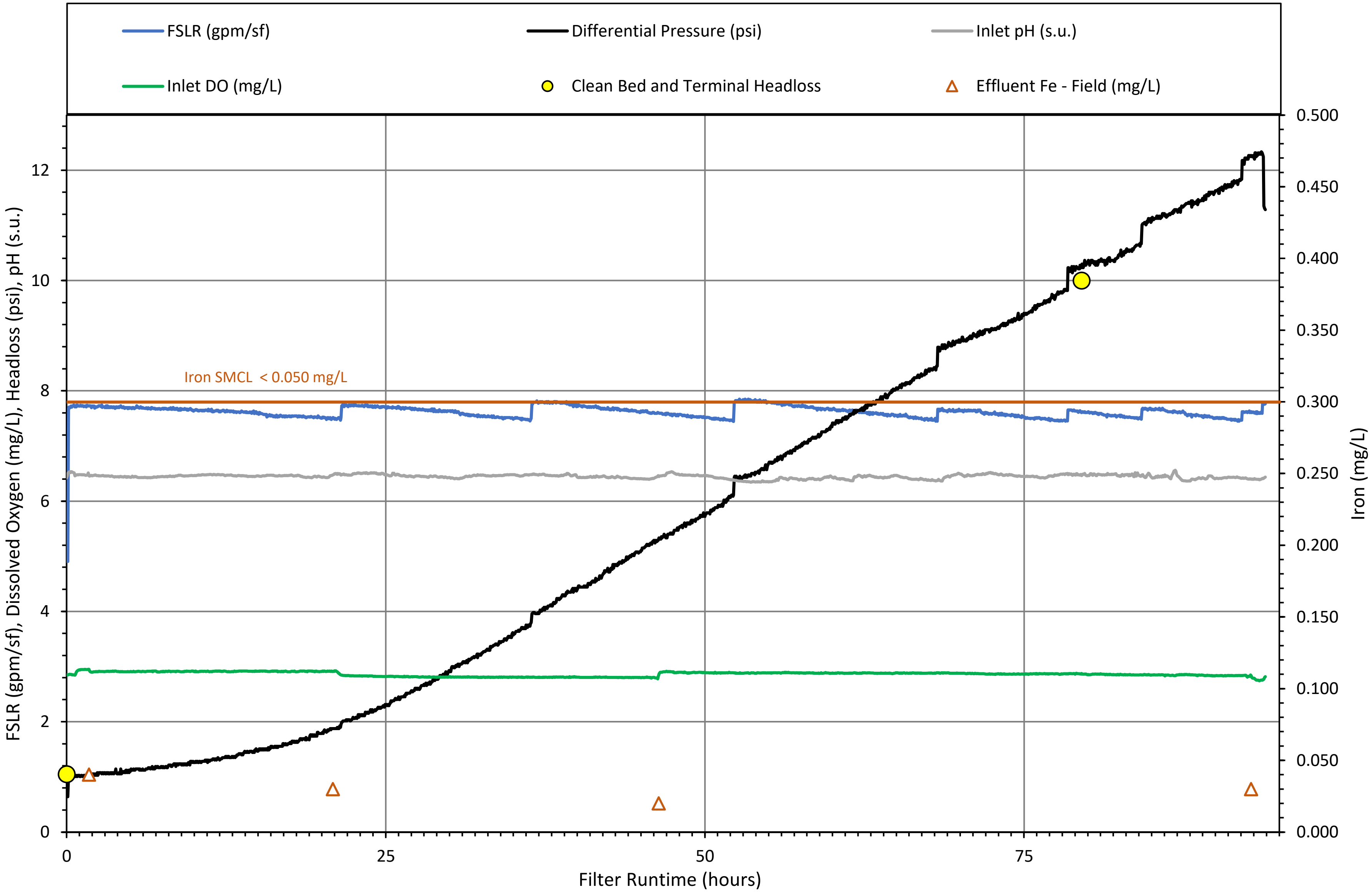
D-26: Operating Conditions for Biological Filter F2, Trial F2.04
SHARON MA, Well 2 - Jan 06 to Jan 10, 2023



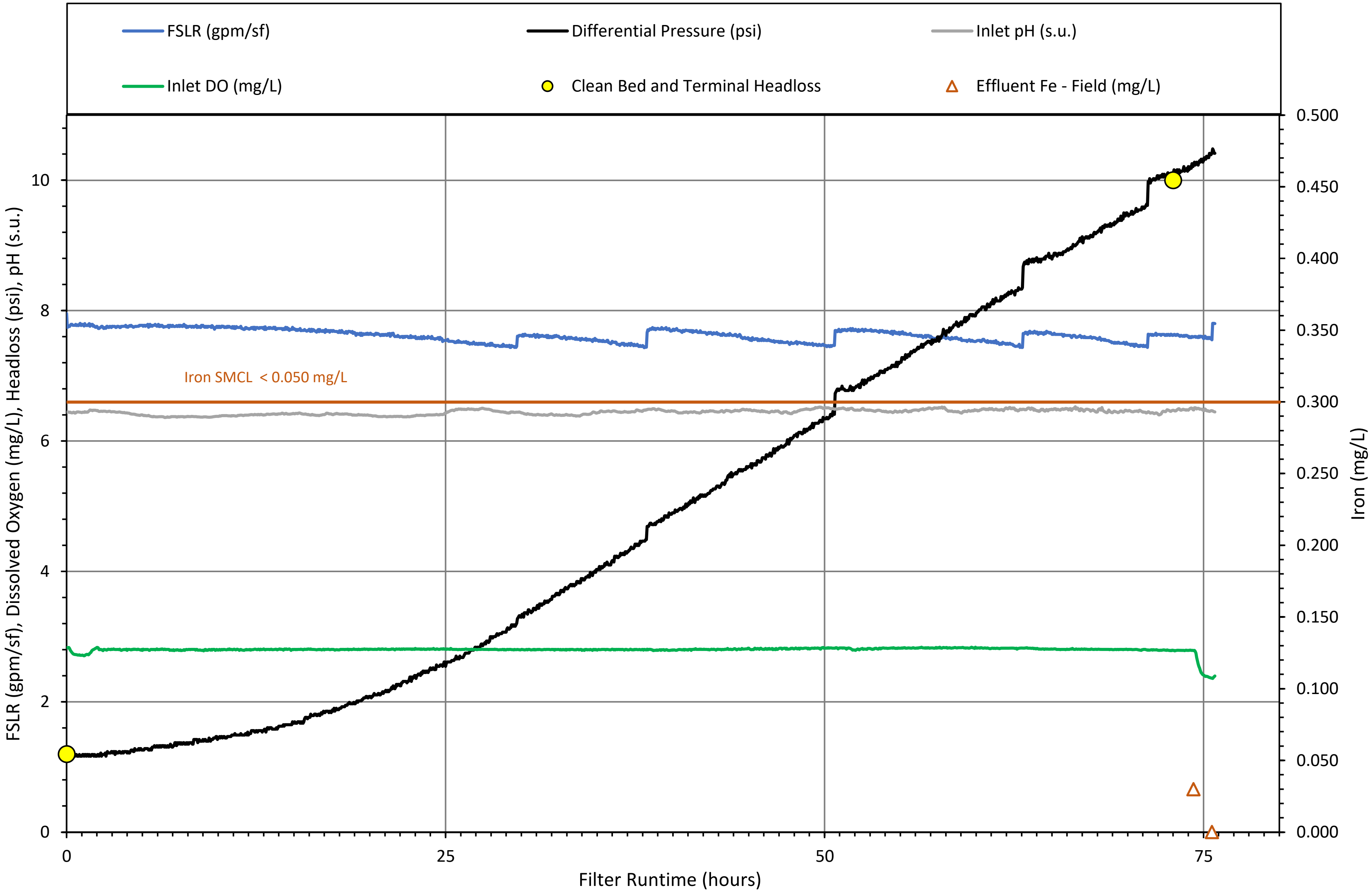
D-27: Operating Conditions for Biological Filter F2, Trial F2.05
SHARON MA, Well 2 - Jan 10 to Jan 16, 2023



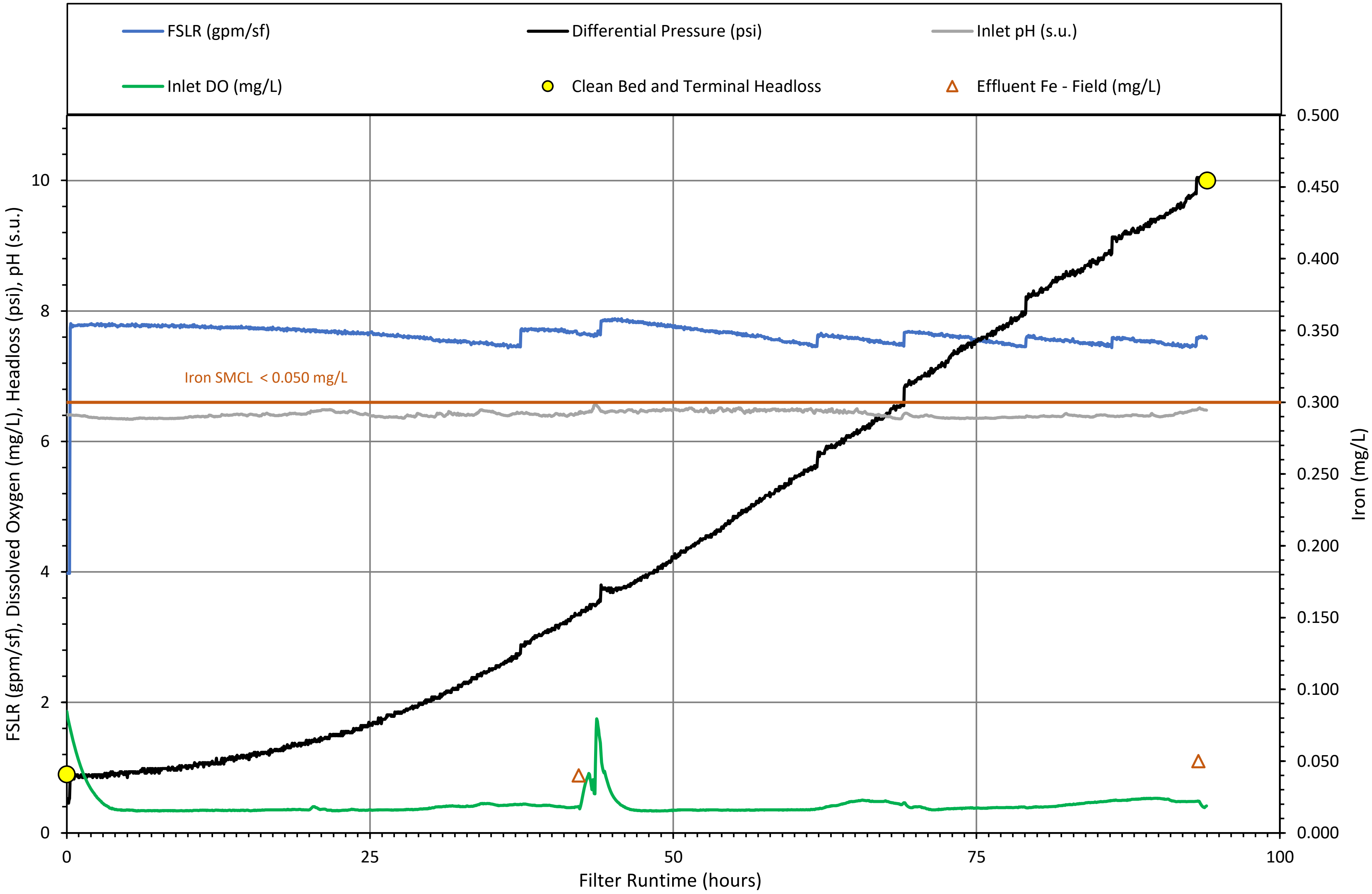
D-28: Operating Conditions for Biological Filter F2, Trial F2.06
SHARON MA, Well 2 - Jan 16 to Jan 20, 2023



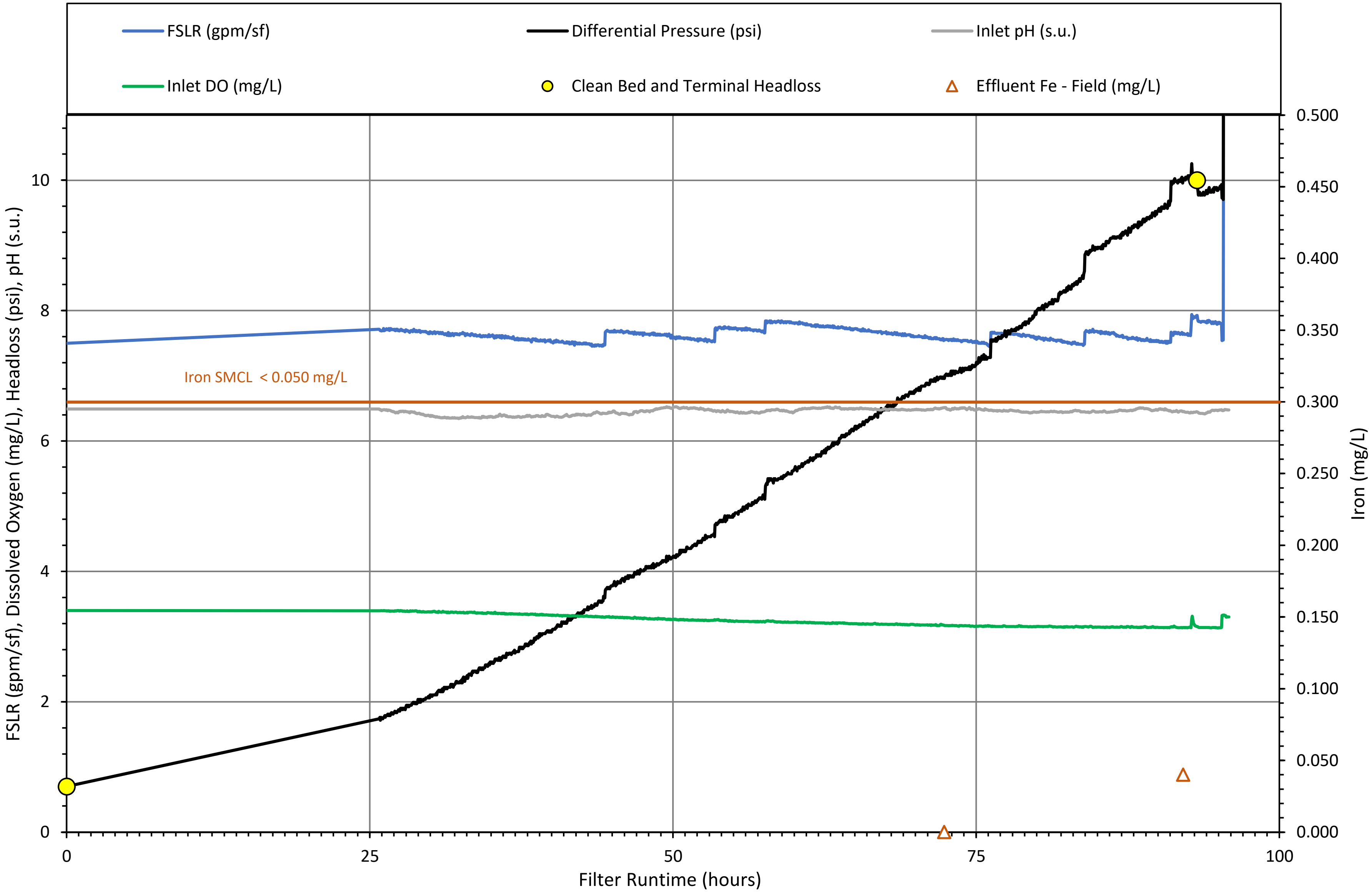
D-29: Operating Conditions for Biological Filter F2, Trial F2.07
SHARON MA, Well 2 - Jan 20 to Jan 23, 2023



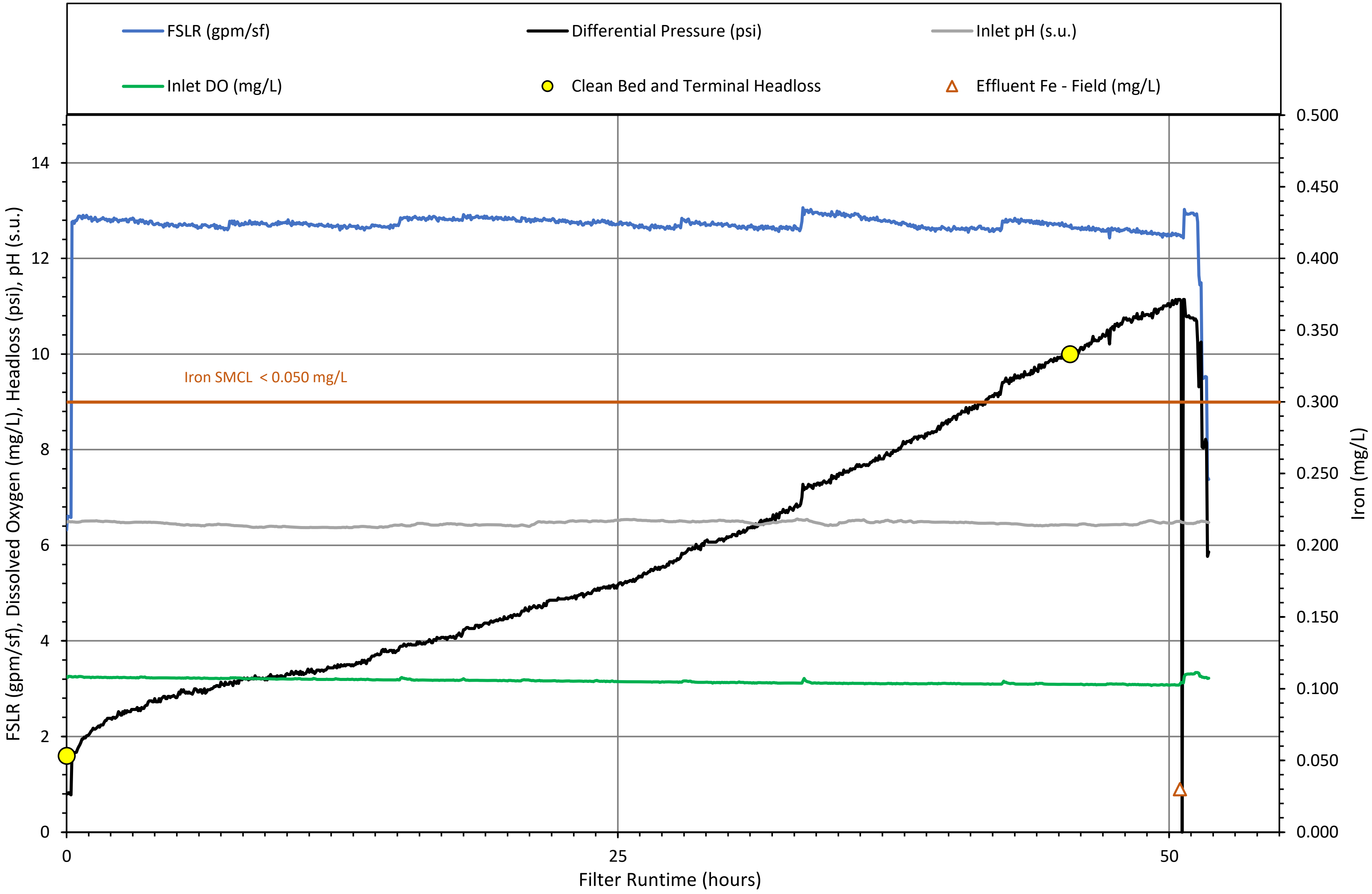
D-30: Operating Conditions for Biological Filter F2, Trial F2.08
SHARON MA, Well 2 - Jan 23 to Jan 27, 2023



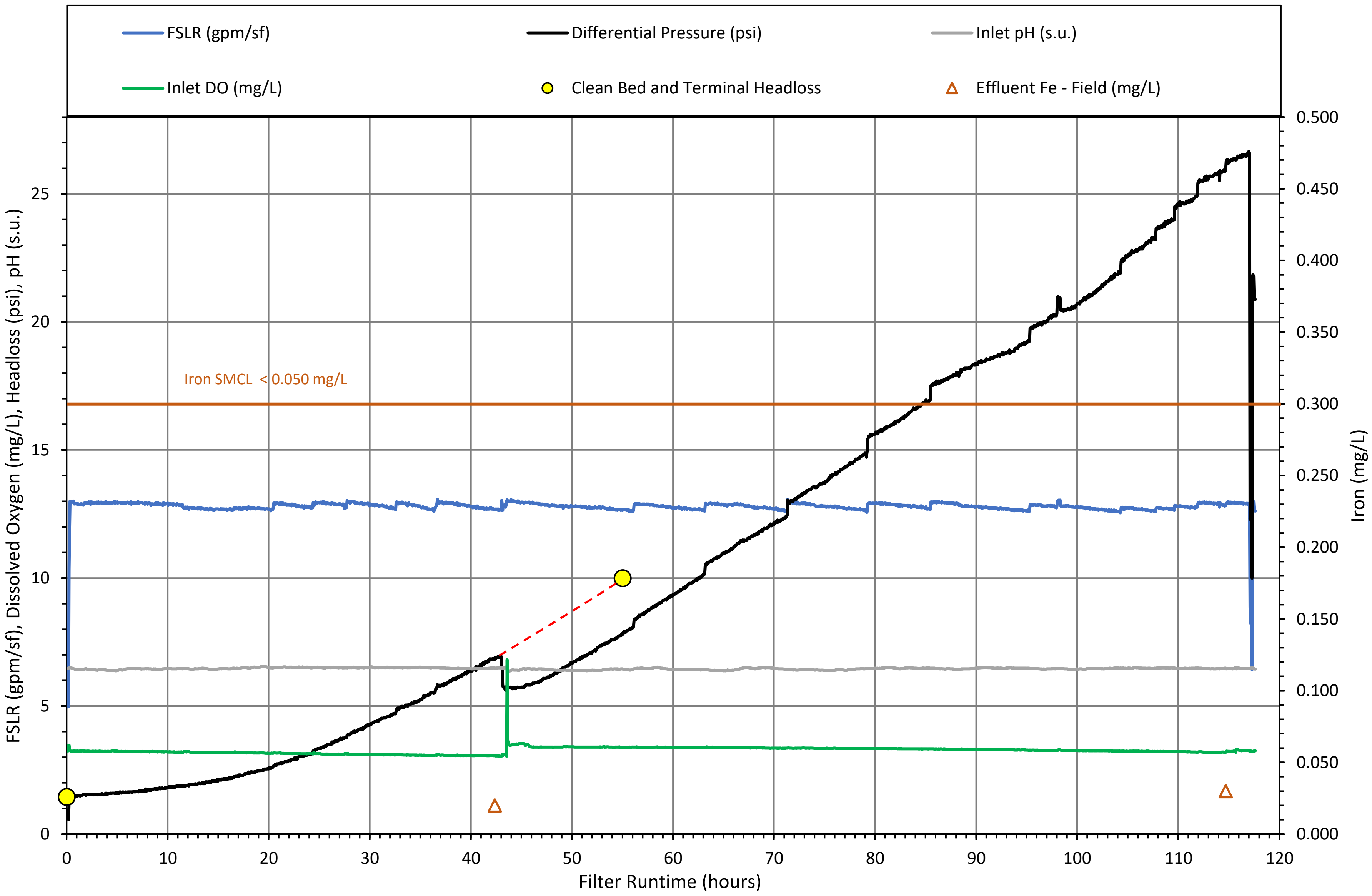
D-31: Operating Conditions for Biological Filter F2, Trial F2.11
SHARON MA, Well 2 - Feb 02 to Feb 06, 2023



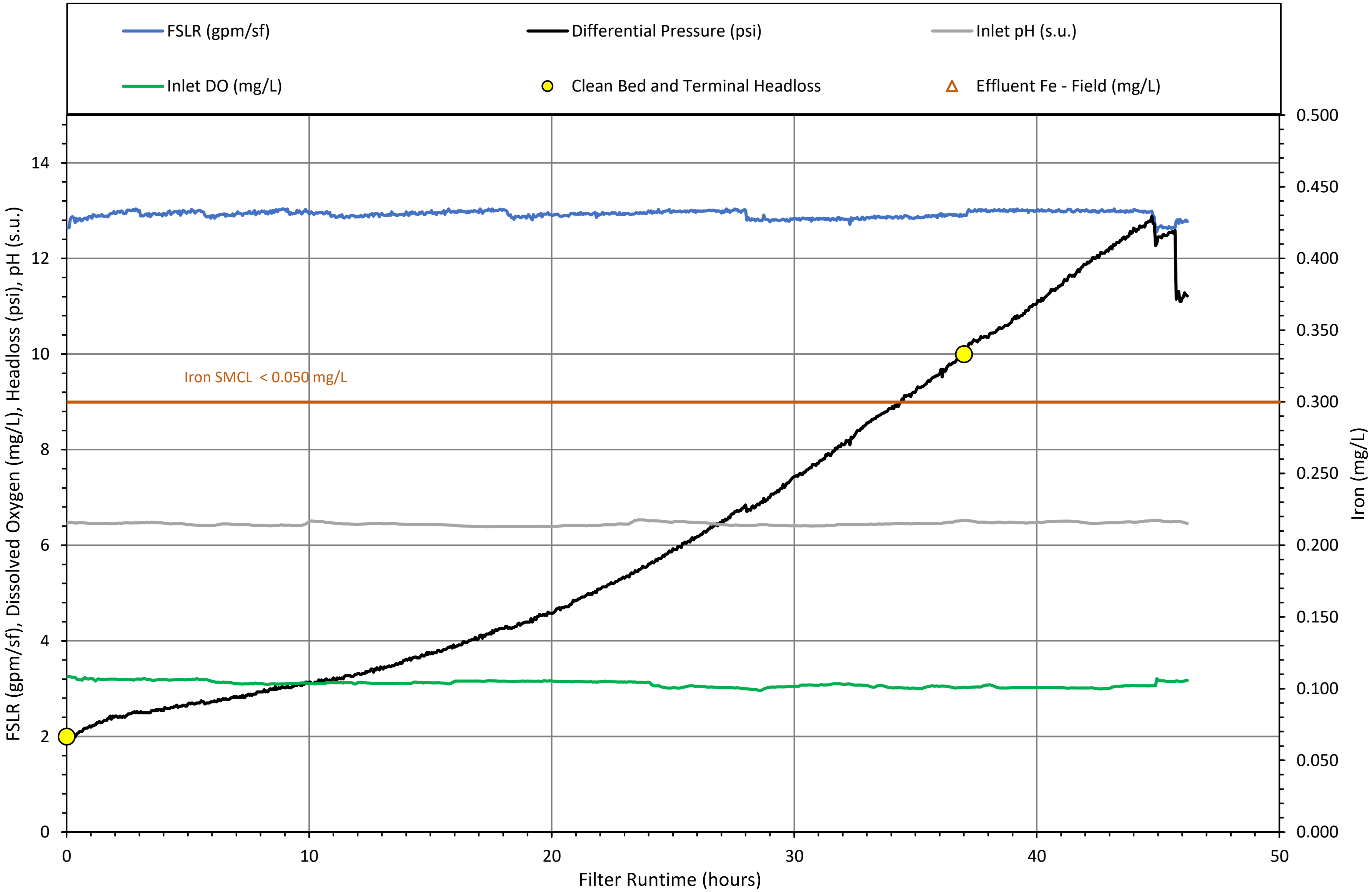
D-32: Operating Conditions for Biological Filter F2, Trial F2.12
SHARON MA, Well 2 - Feb 06 to Feb 08, 2023



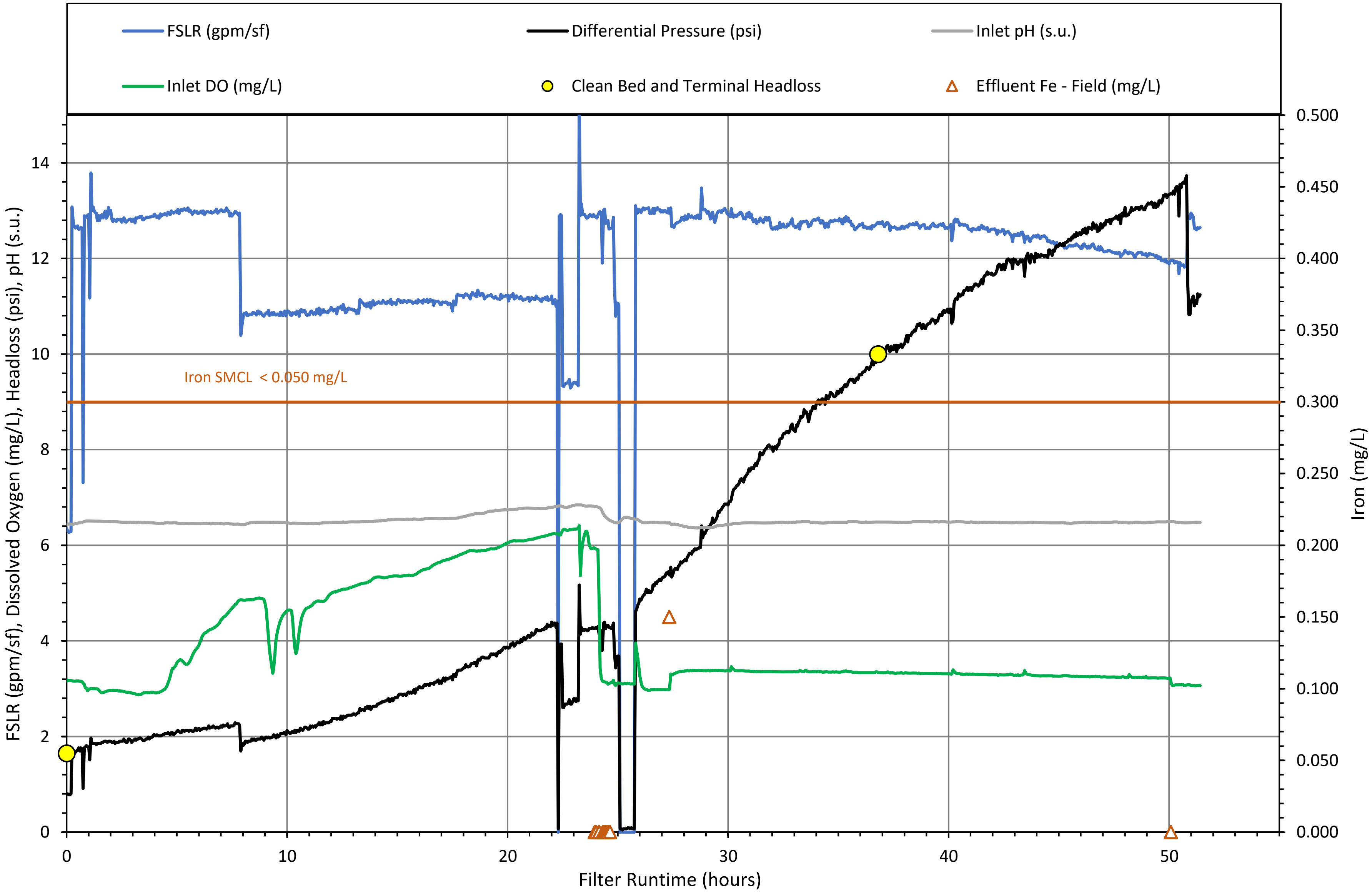
D-33: Operating Conditions for Biological Filter F2, Trial F2.13
SHARON MA, Well 2 - Feb 08 to Feb 13, 2023



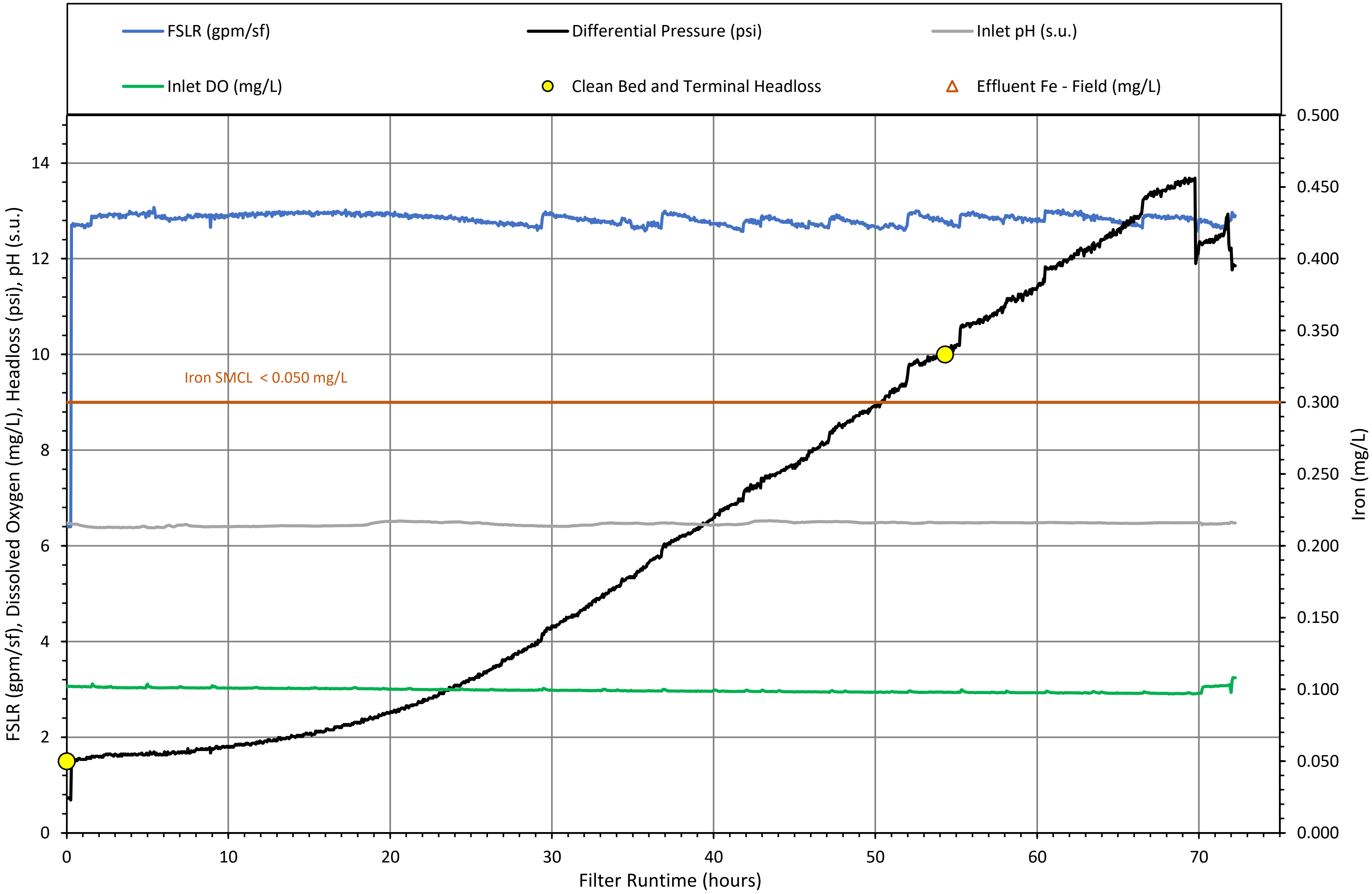
D-34: Operating Conditions for Biological Filter F2, Trial F2.14
SHARON MA, Well 2 - Feb 13 to Feb 15, 2023



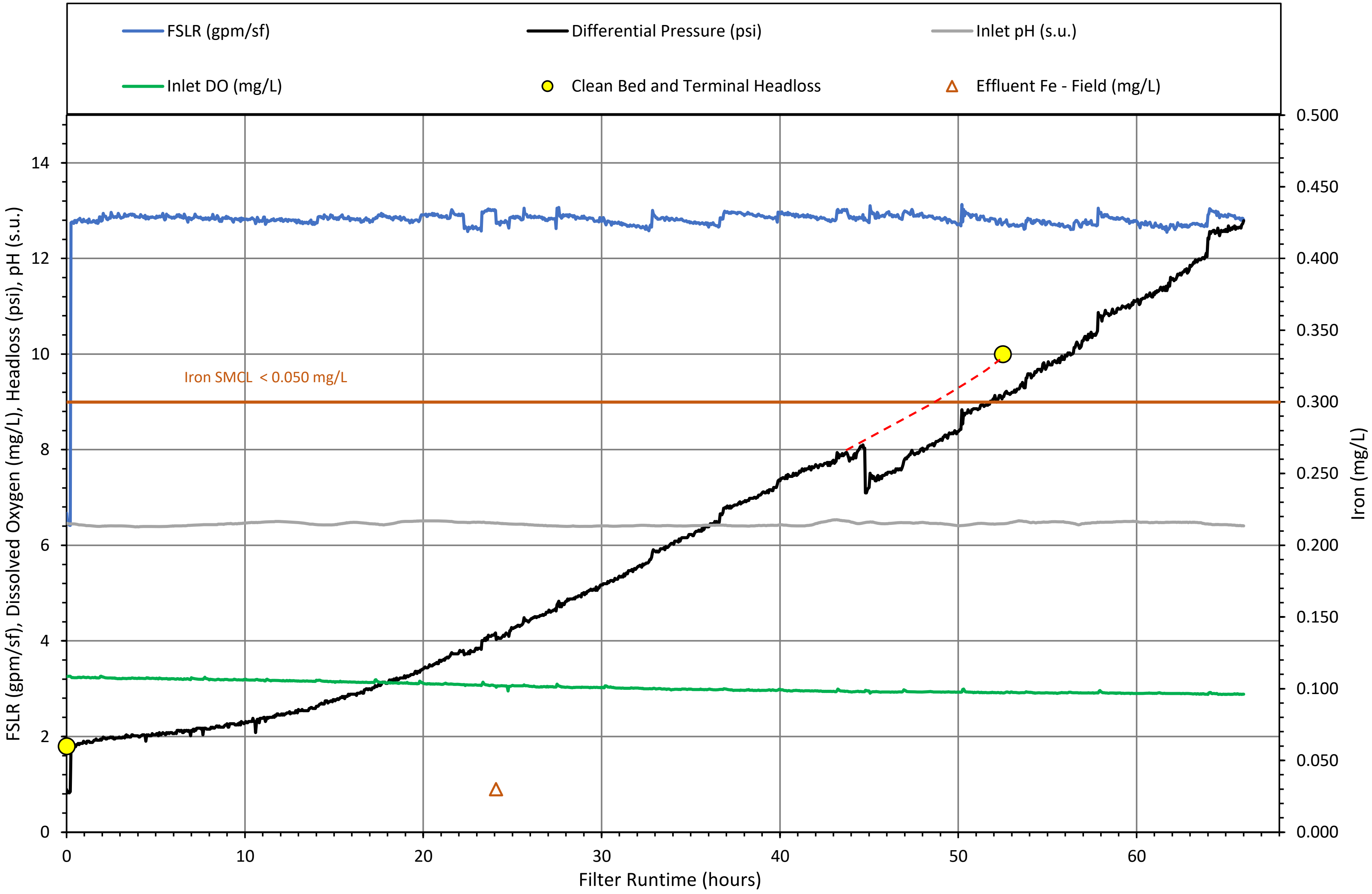
D-35: Operating Conditions for Biological Filter F2, Trial F2.15
SHARON MA, Well 2 - Feb 15 to Feb 17, 2023



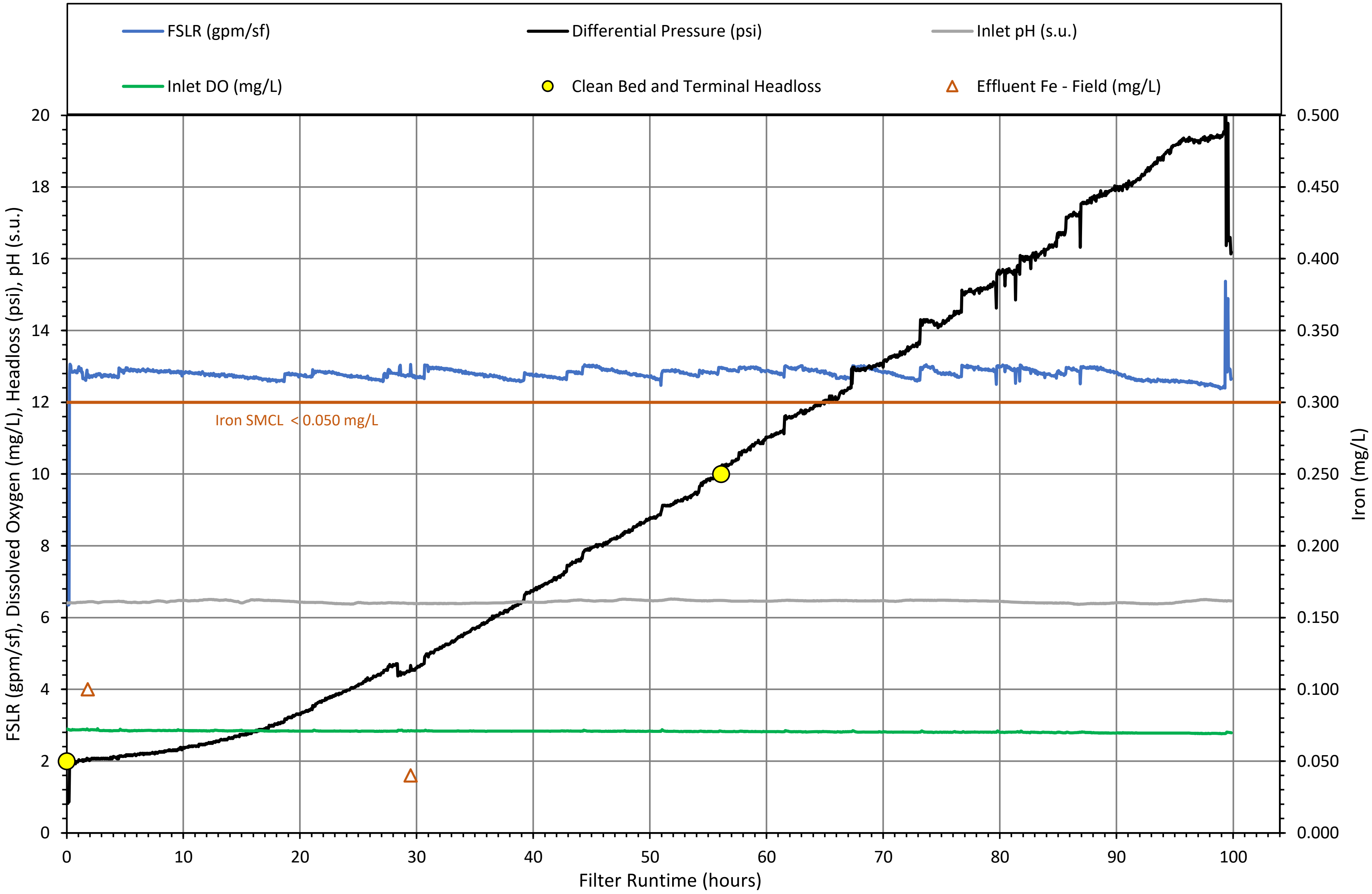
D-36: Operating Conditions for Biological Filter F2, Trial F2.16
SHARON MA, Well 2 - Feb 17 to Feb 20, 2023



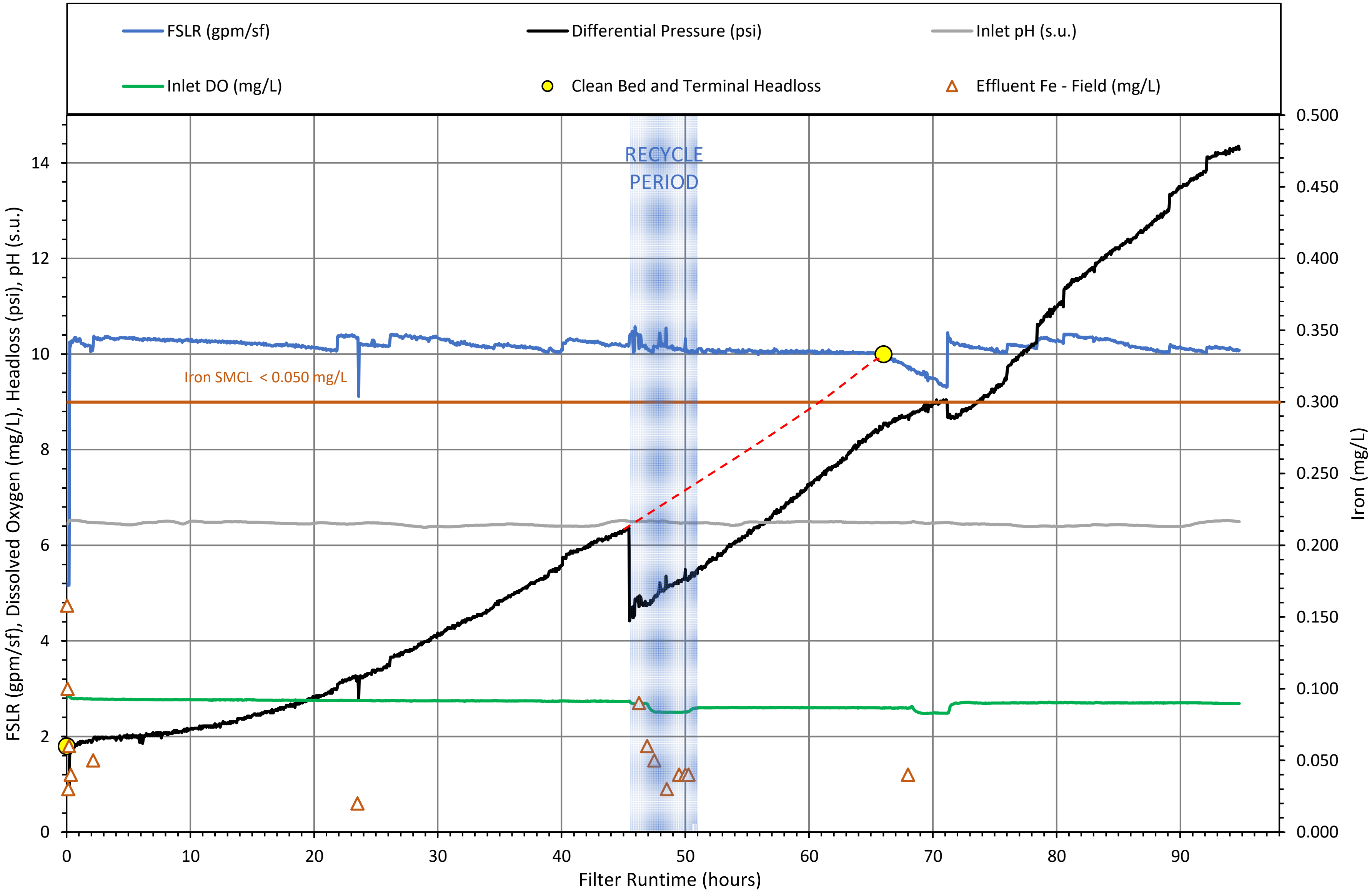
D-37: Operating Conditions for Biological Filter F2, Trial F2.17
SHARON MA, Well 2 - Feb 20 to Feb 23, 2023



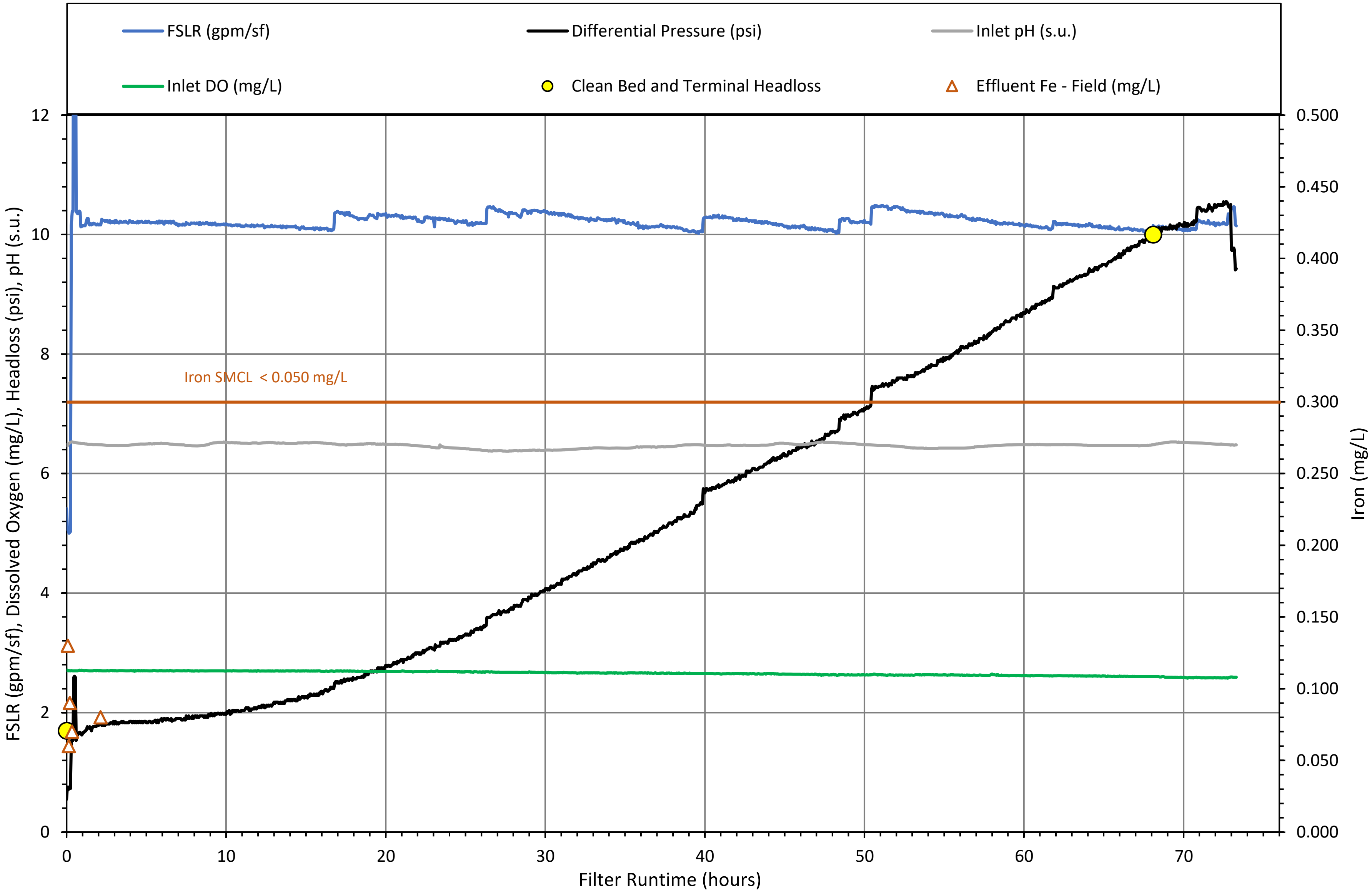
D-38: Operating Conditions for Biological Filter F2, Trial F2.18
SHARON MA, Well 2 - Feb 23 to Feb 27, 2023



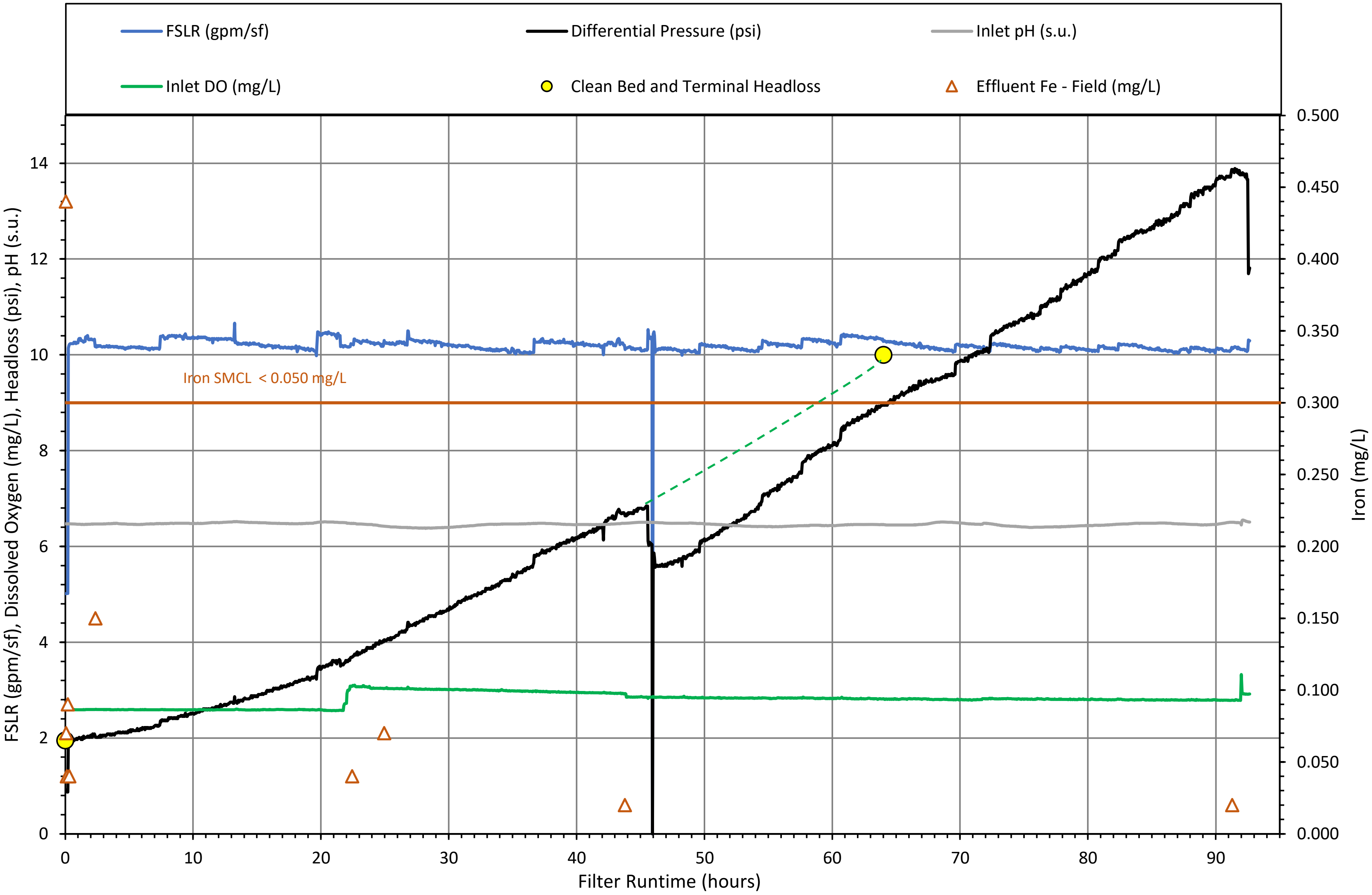
D-39: Operating Conditions for Biological Filter F2, Trial F2.19
SHARON MA, Well 2 - Feb 27 to Mar 03, 2023



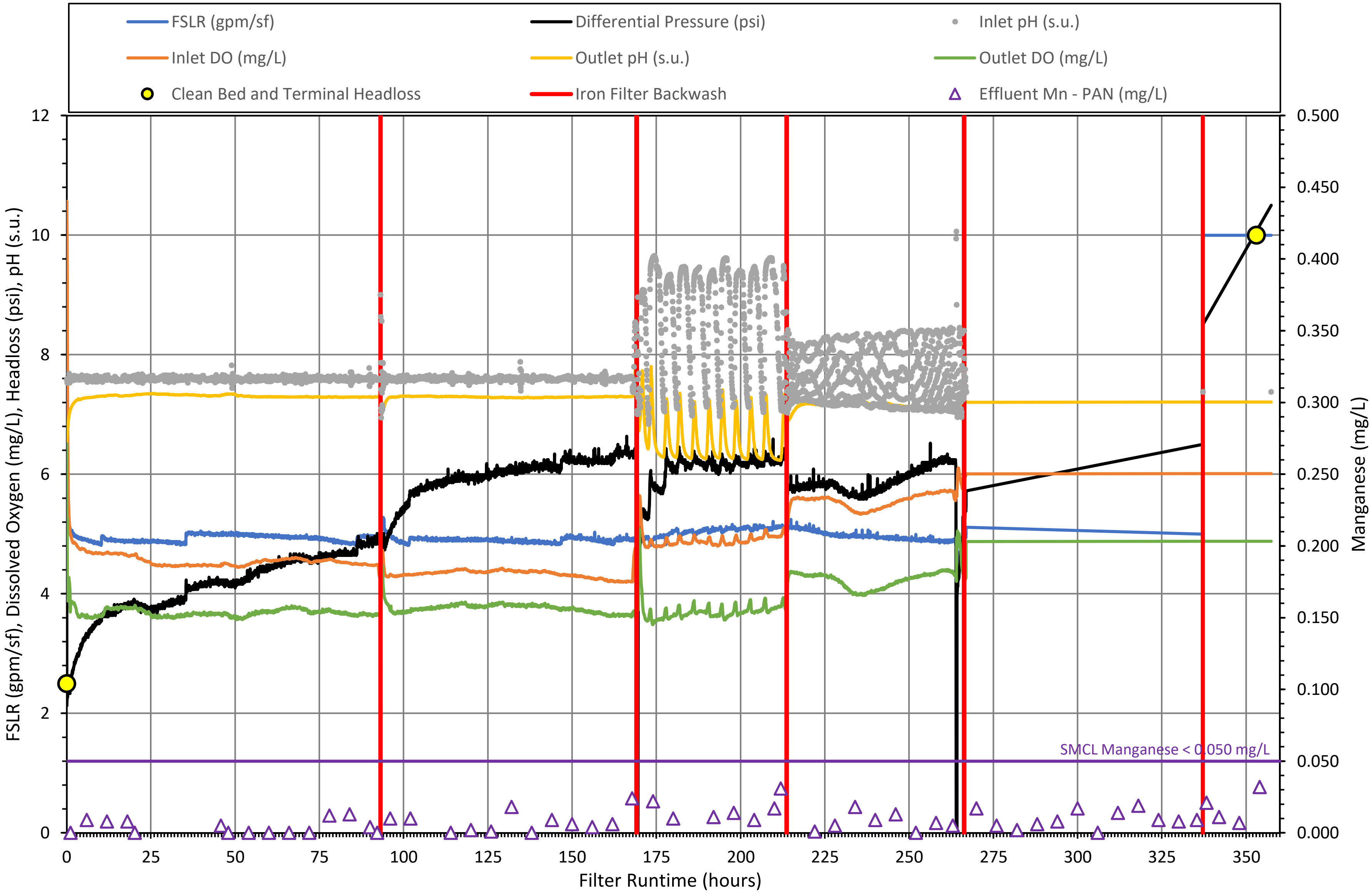
D-40: Operating Conditions for Biological Filter F2, Trial F2.20
SHARON MA, Well 2 - Mar 03 to Mar 06, 2023



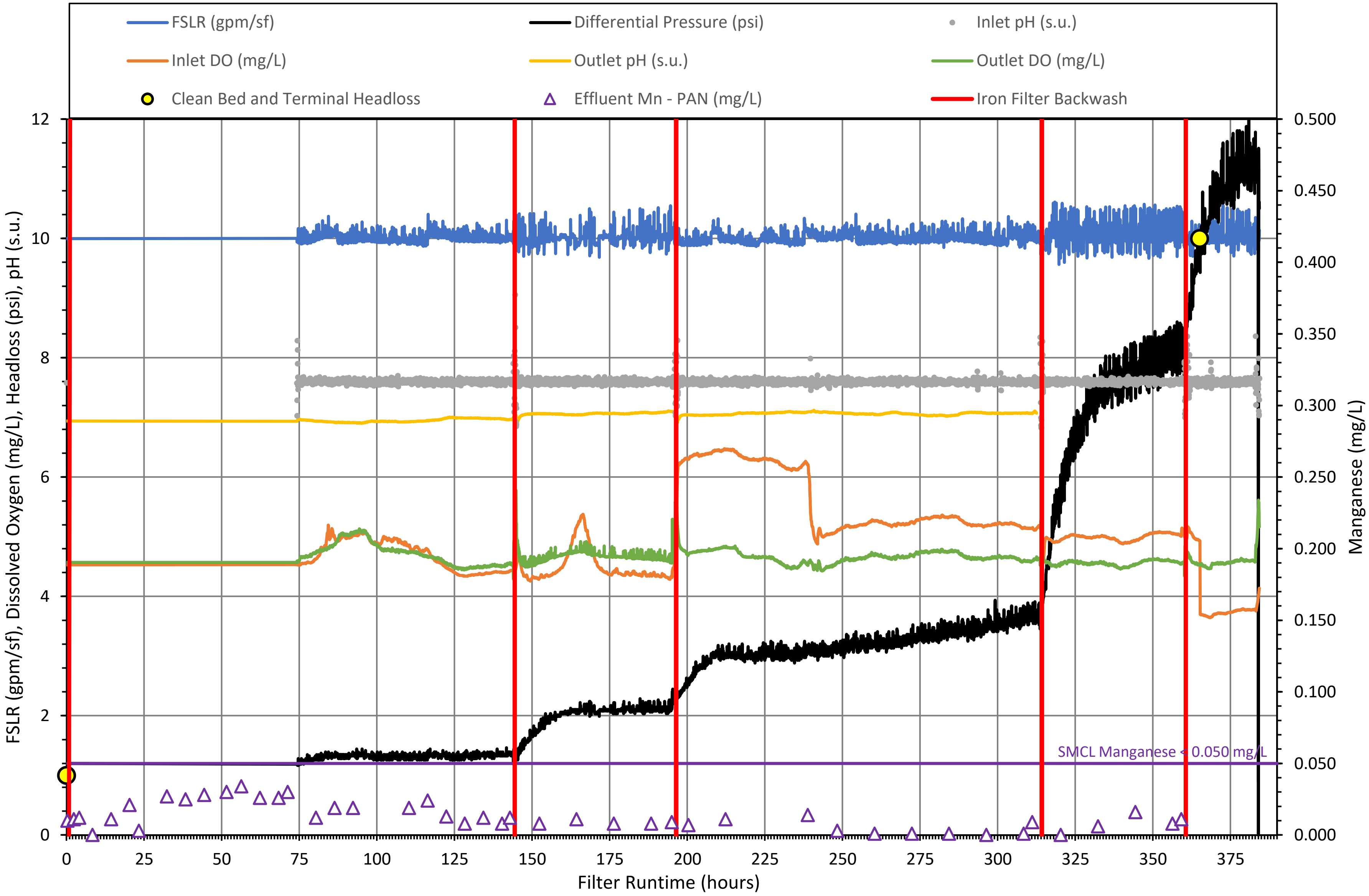
D-41: Operating Conditions for Biological Filter F2, Trial F2.21
SHARON MA, Well 2 - Mar 06 to Mar 10, 2023



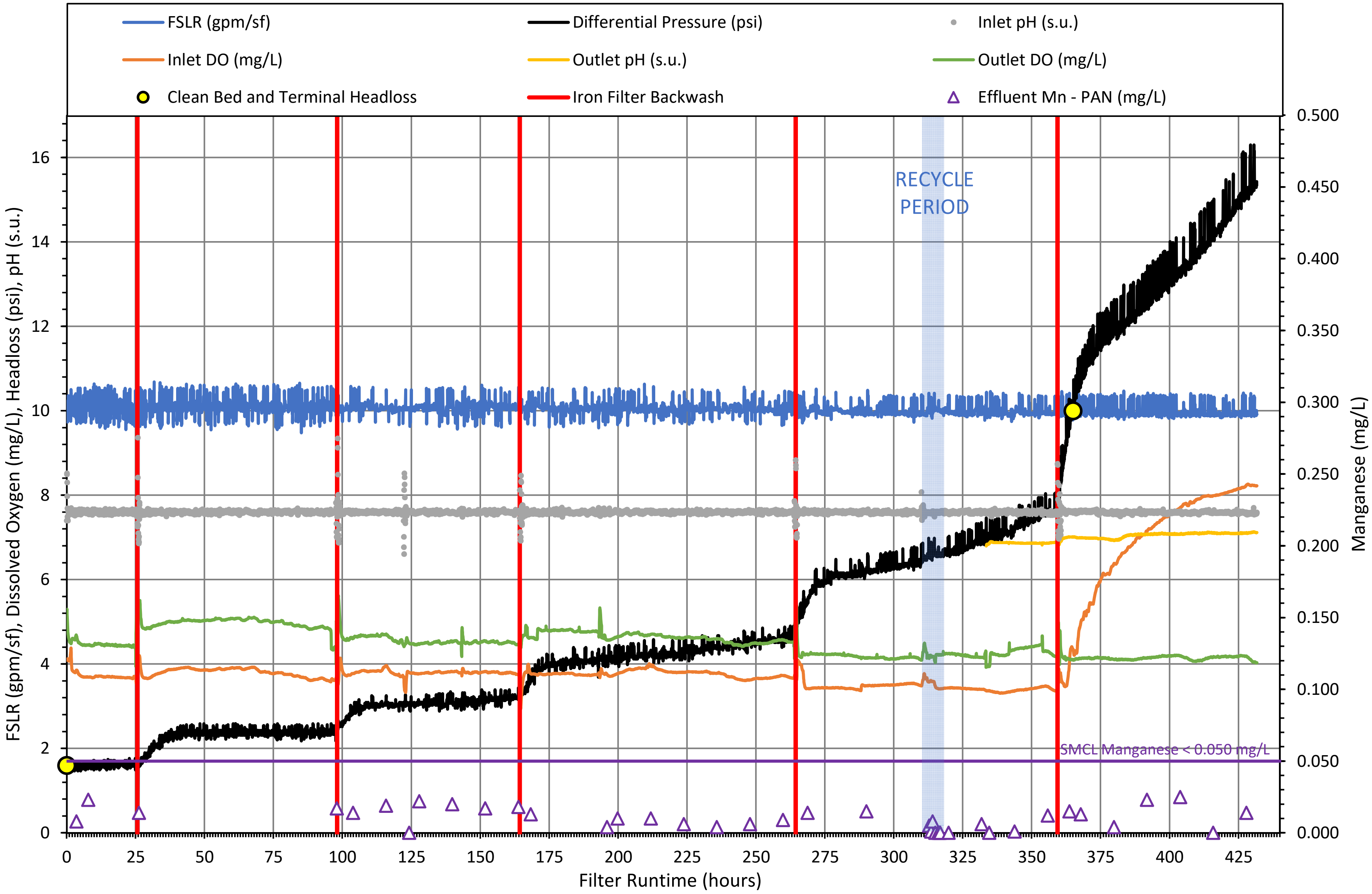
D-42: Operating Conditions for Biological Filter M1, Trial M1.01
SHARON MA, Well 2 - Jan 16 to Jan 31, 2023



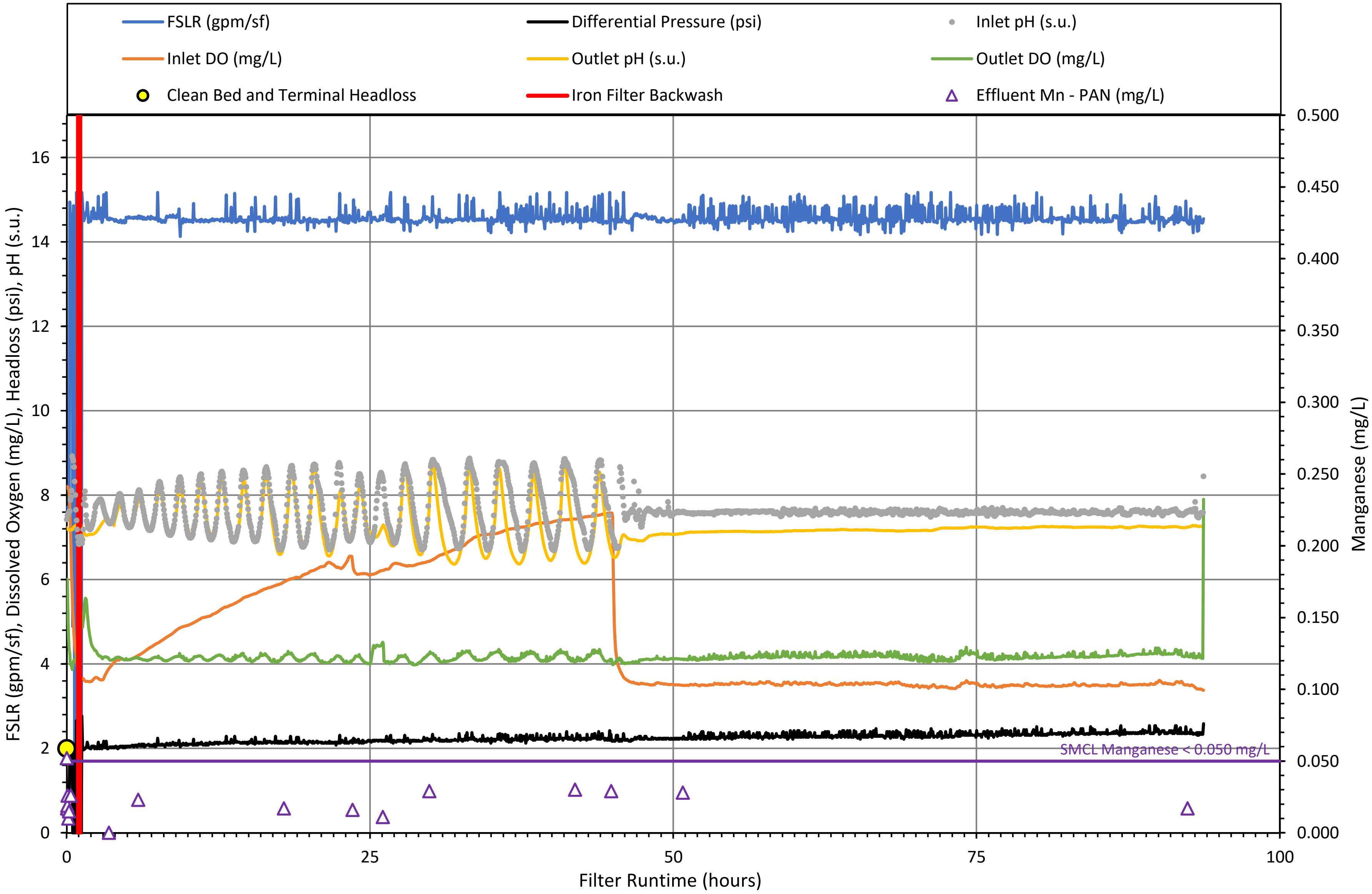
D-43: Operating Conditions for Biological Filter M1, Trial M1.02
SHARON MA, Well 2 - Jan 31 to Feb 16, 2023



D-44: Operating Conditions for Biological Filter M1, Trial M1.03
SHARON MA, Well 2 - Feb 16 to Mar 06, 2023



D-45: Operating Conditions for Biological Filter M1, Trial M1.04
SHARON MA, Well 2 - Mar 06 to Mar 10, 2023



Appendix E – Adsorptive Filter Performance Figures

Figure E-1: Operating Conditions for Adsorptive Filter A (Greensand-Low pH) Trial A.1
SHARON MA, Well 2 - Feb 16 to Feb 20, 2023

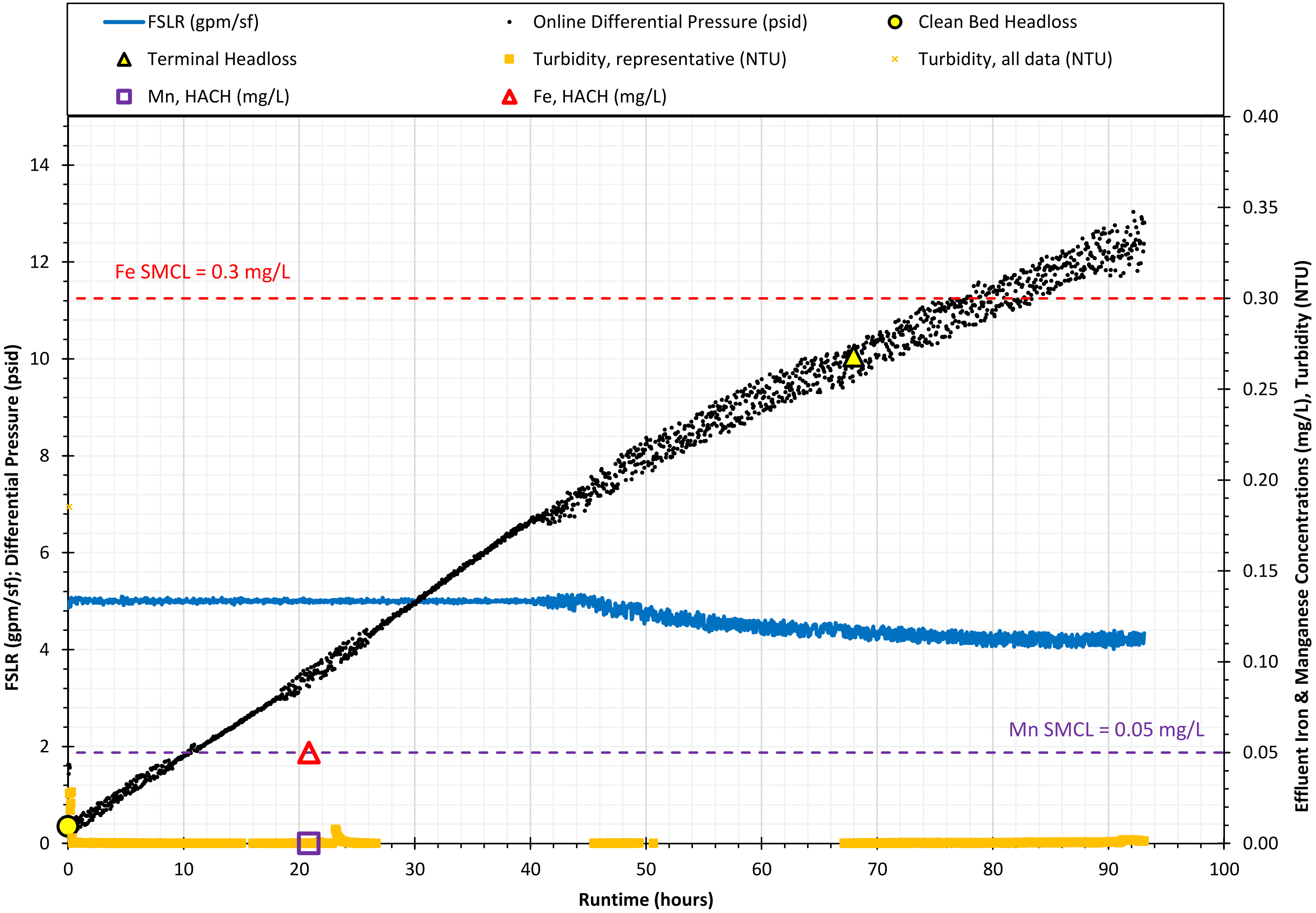


Figure E-2: Operating Conditions for Adsorptive Filter A (Greensand-Low pH) Trial A.2
SHARON MA, Well 2 - Feb 20 to Feb 21, 2023

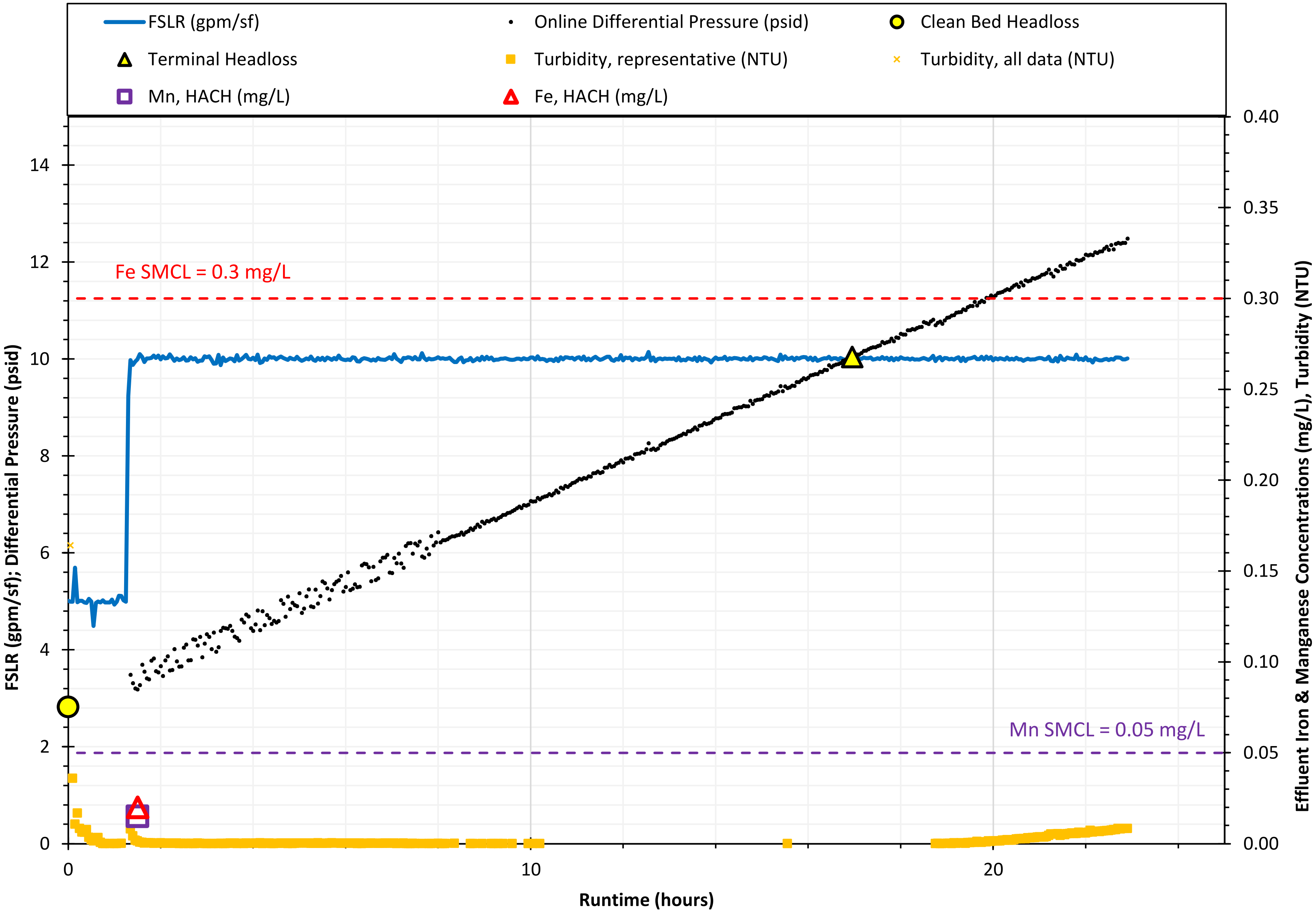


Figure E-3: Operating Conditions for Adsorptive Filter A (Greensand-Low pH) Trial A.3
SHARON MA, Well 2 - Feb 21 to Feb 22, 2023

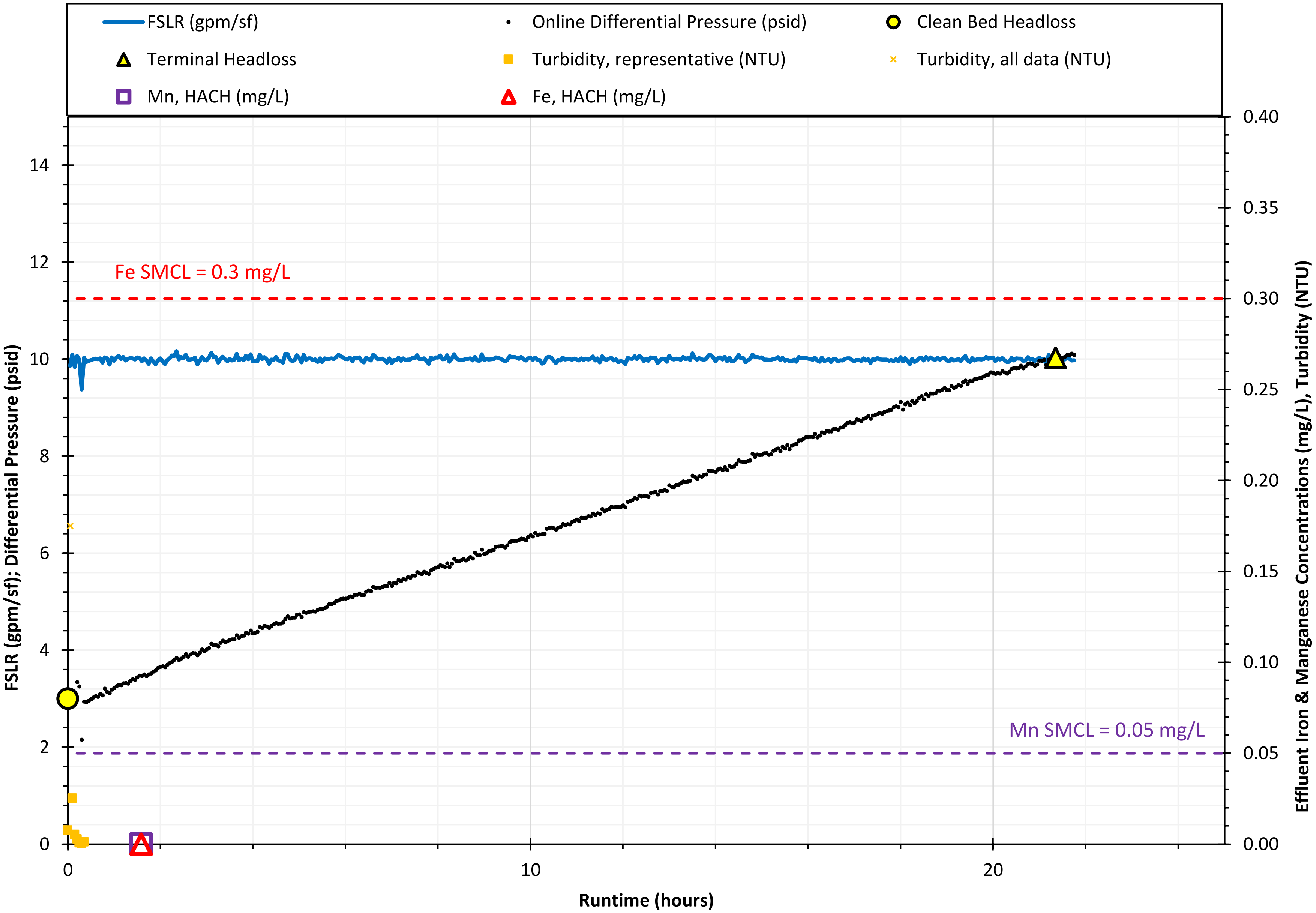


Figure E-4: Operating Conditions for Adsorptive Filter A (Greensand-Low pH) Trial A.4
SHARON MA, Well 2 - Feb 22 to Feb 23, 2023

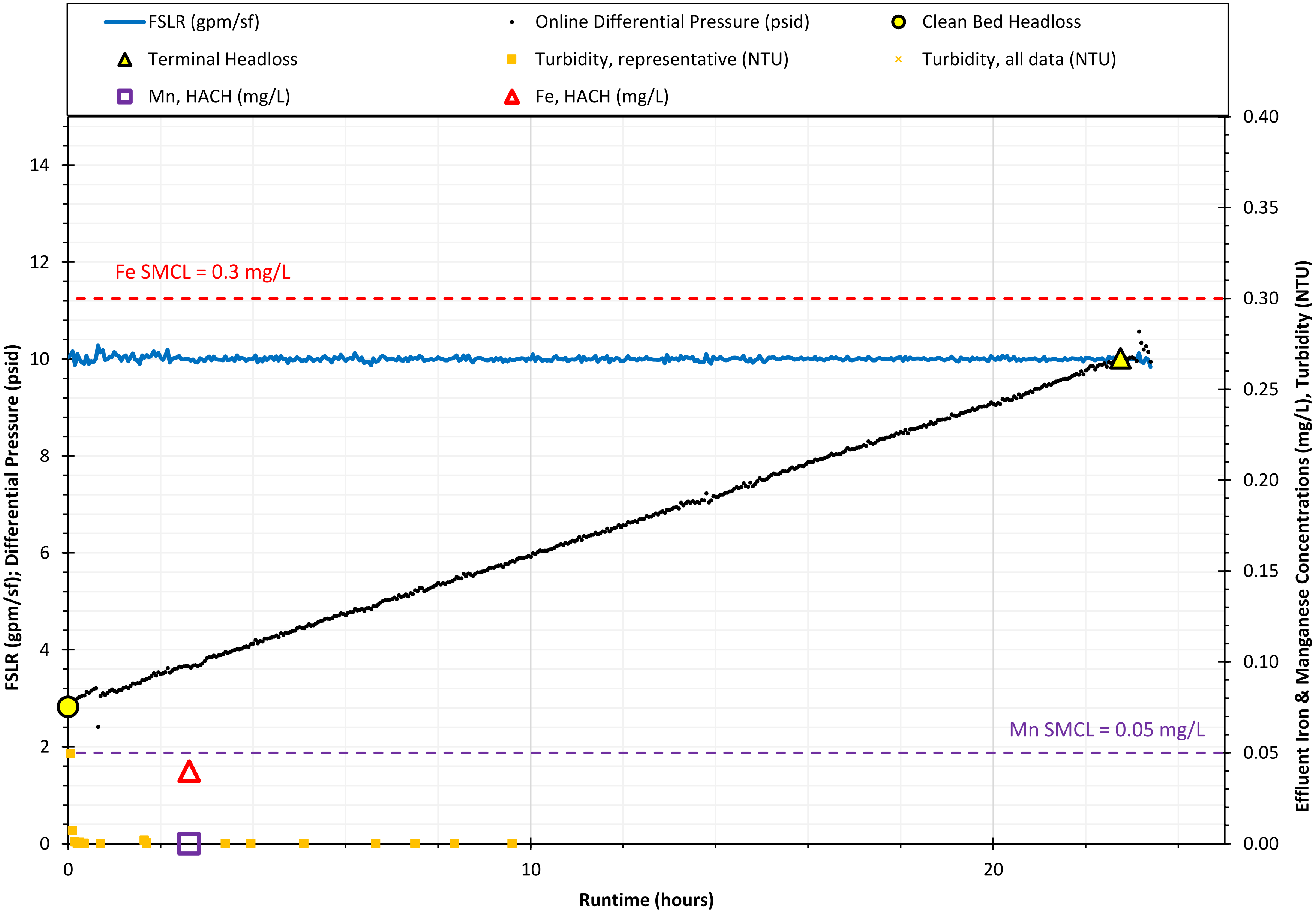


Figure E-5: Operating Conditions for Adsorptive Filter A (Greensand-Low pH) Trial A.5
SHARON MA, Well 2 - Feb 23 to Feb 24, 2023

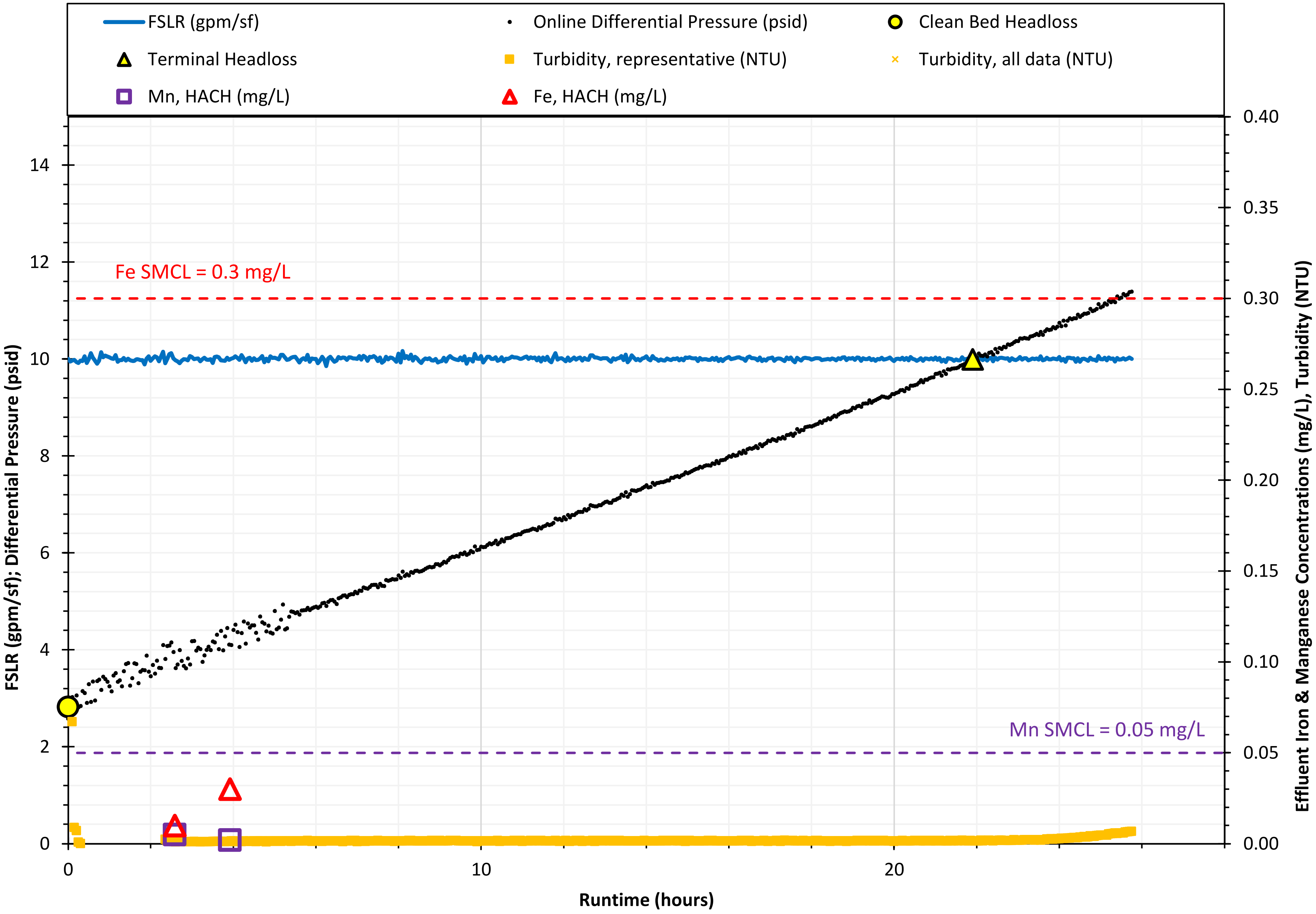


Figure E-6: Operating Conditions for Adsorptive Filter A (Greensand-Low pH) Trial A.6
SHARON MA, Well 2 - Feb 24 to Feb 27, 2023

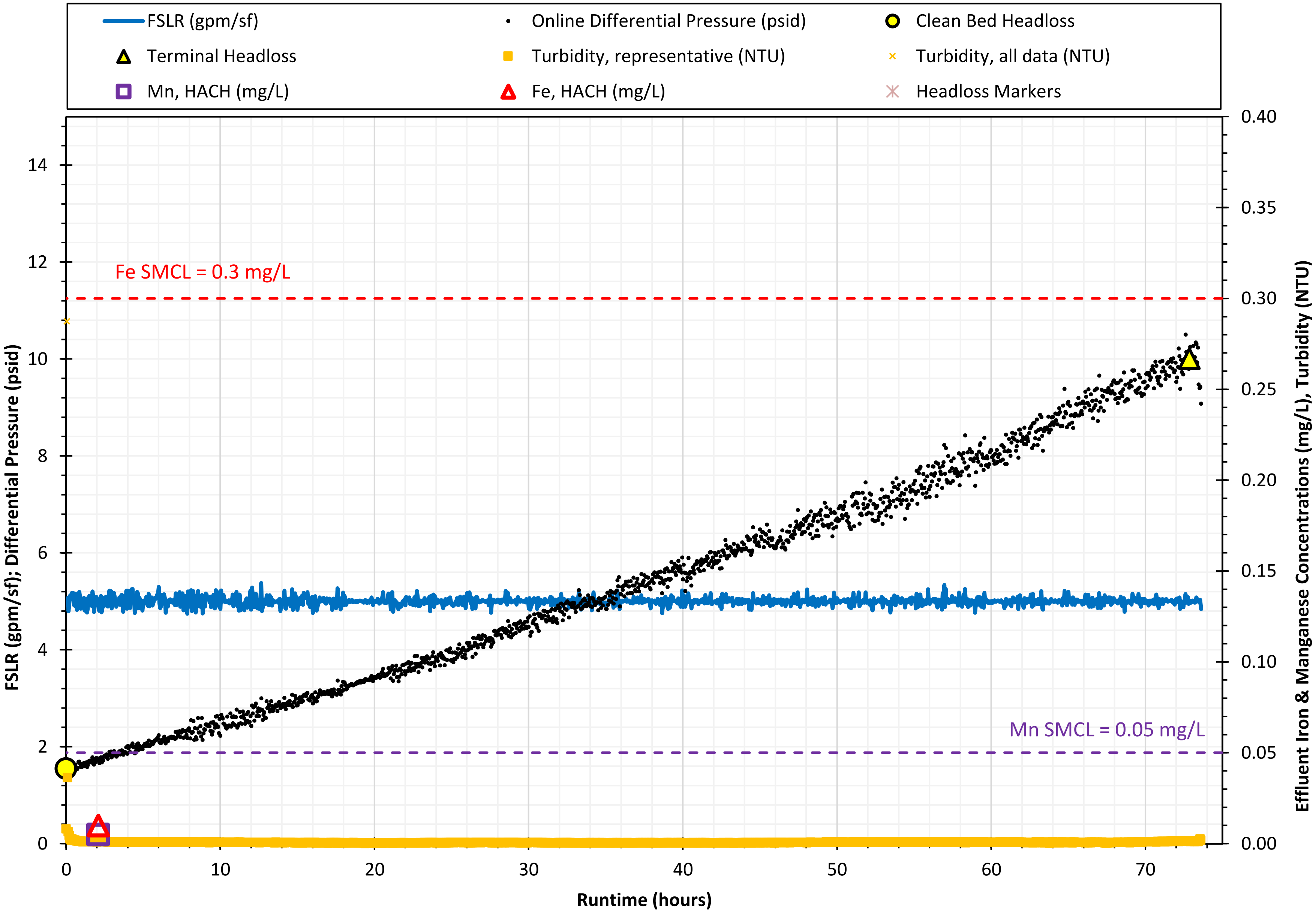


Figure E-7: Operating Conditions for Adsorptive Filter A (Greensand-Low pH) Trial A.7
SHARON MA, Well 2 - Feb 27 to Mar 01, 2023

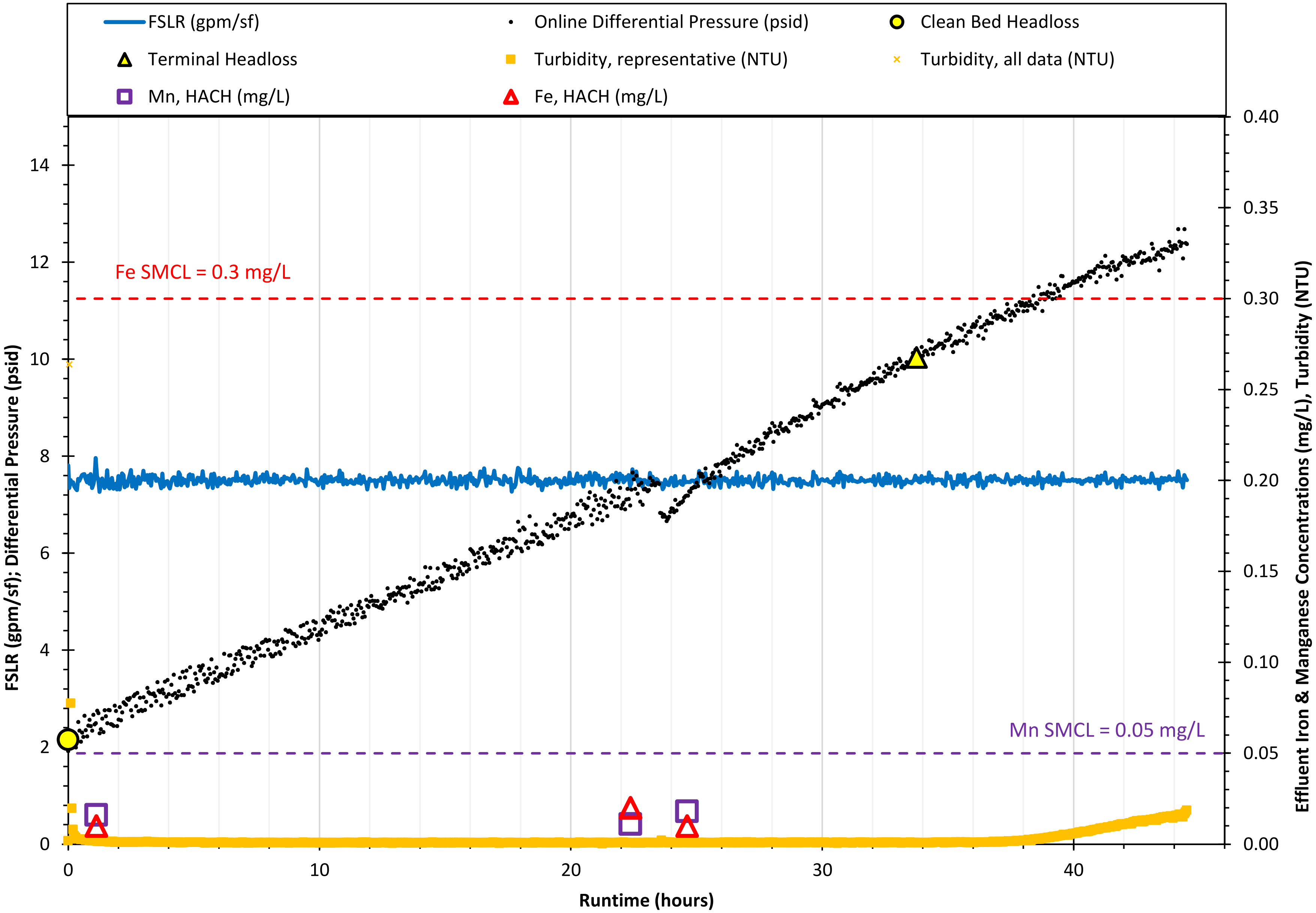


Figure E-8: Operating Conditions for Adsorptive Filter A (Greensand-Low pH) Trial A.8
SHARON MA, Well 2 - Mar 01 to Mar 03, 2023

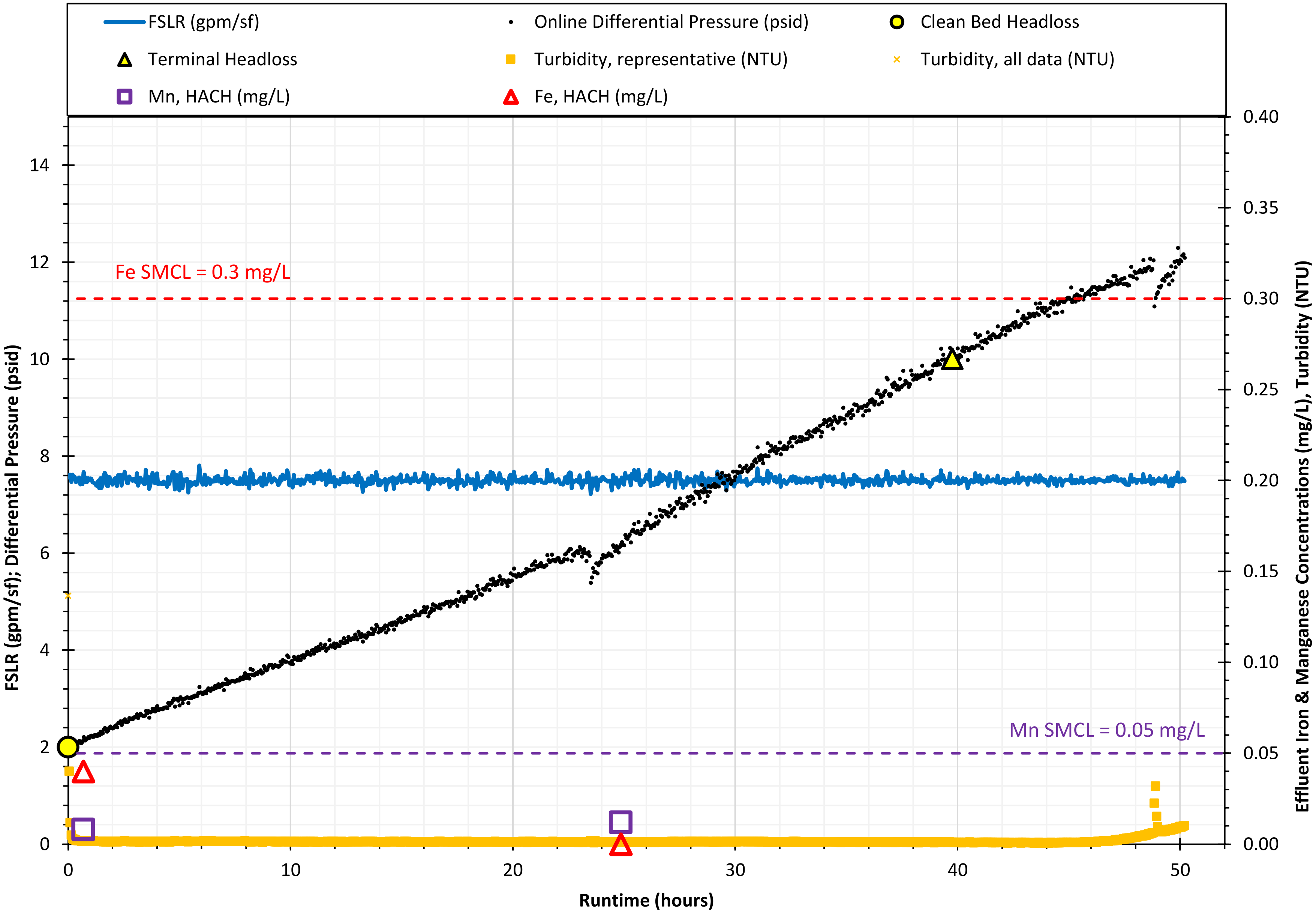


Figure E-9: Operating Conditions for Adsorptive Filter A (Greensand-Low pH) Trial A.9
SHARON MA, Well 2 - Mar 03 to Mar 06, 2023

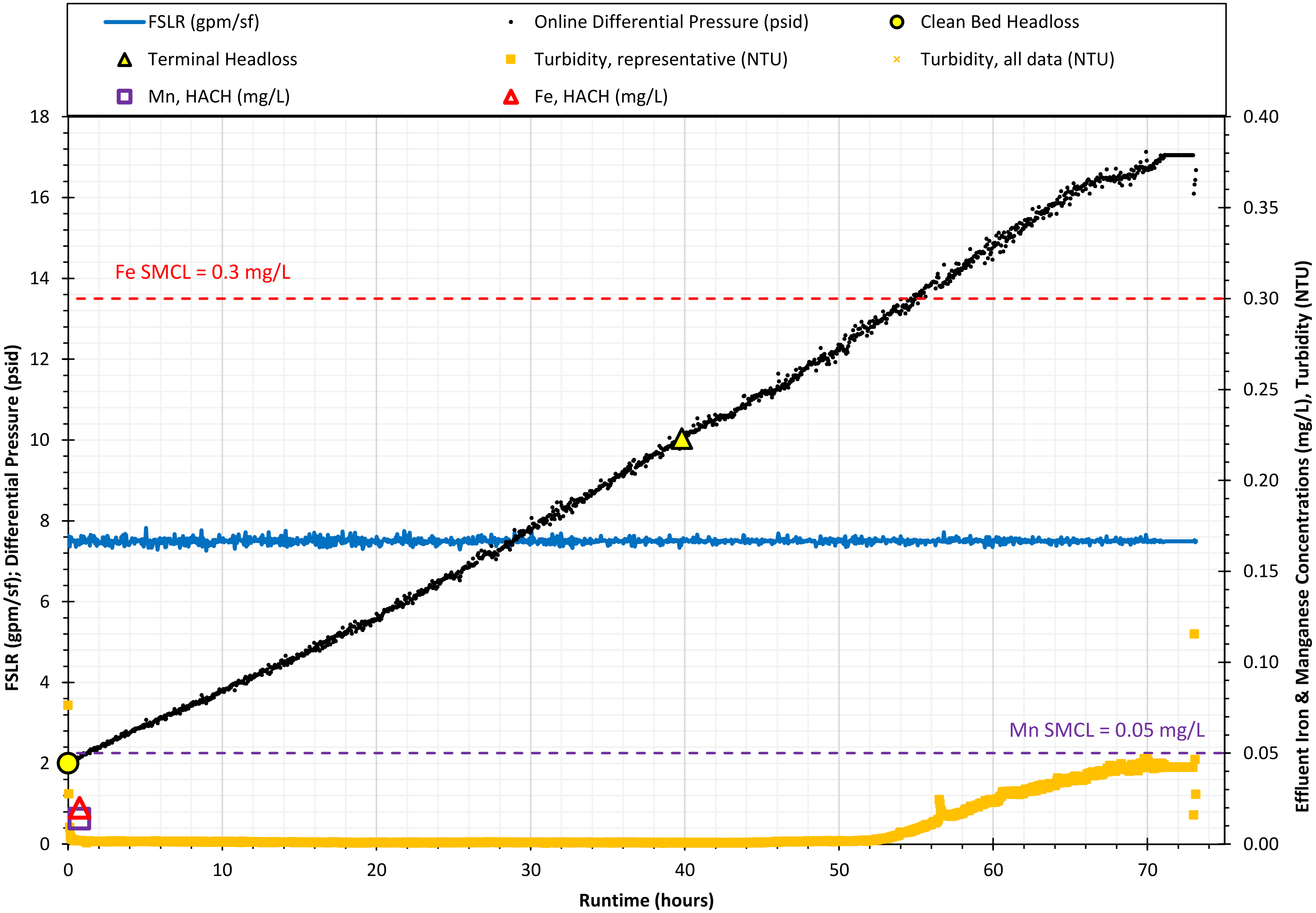


Figure E-10: Operating Conditions for Adsorptive Filter A (Greensand-Low pH) Trial A.10
SHARON MA, Well 2 - Mar 06 to Mar 09, 2023

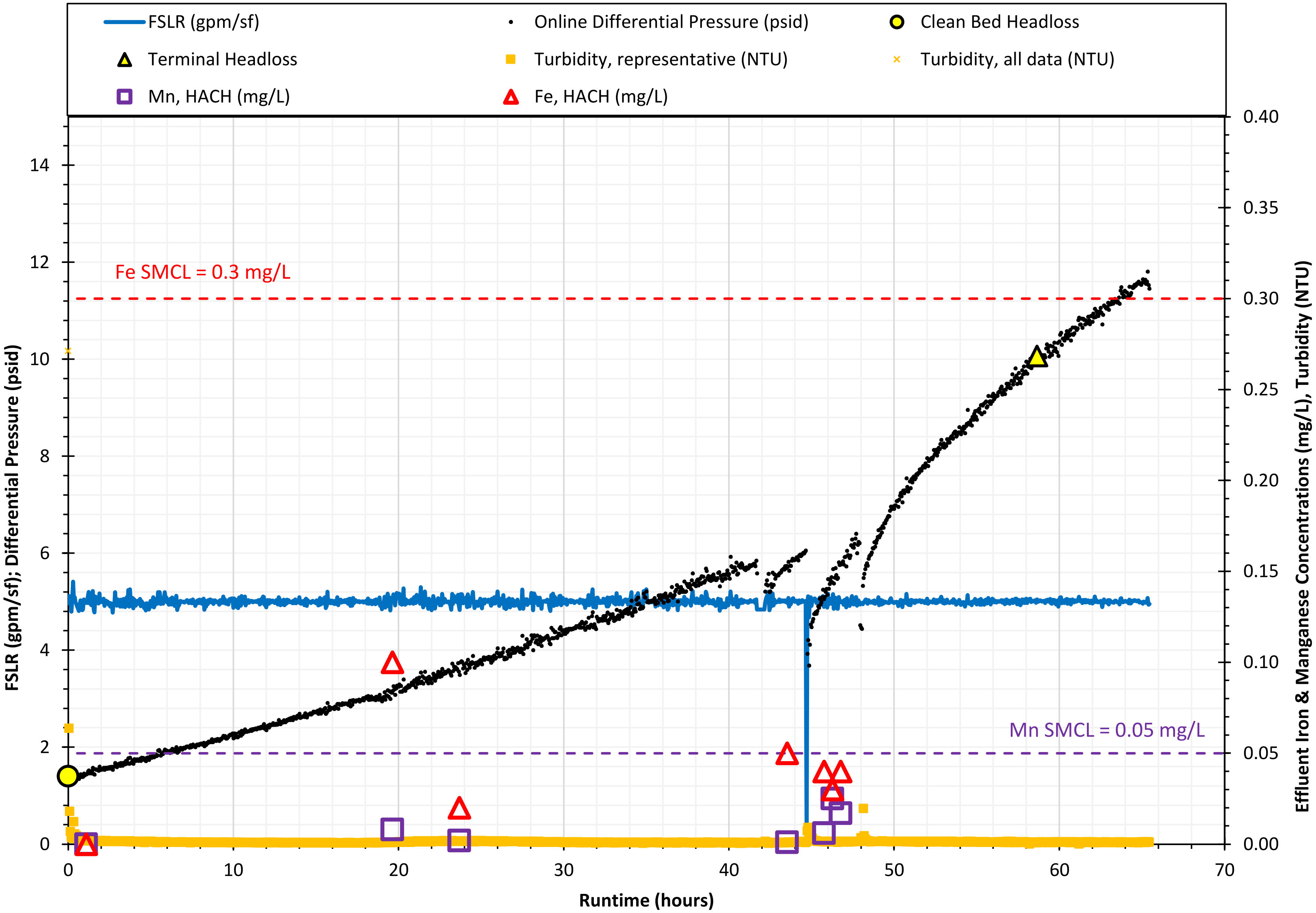


Figure E-11: Operating Conditions for Adsorptive Filter A (Greensand-Low pH) Trial A.11
SHARON MA, Well 2 - Mar 09 to Mar 10, 2023

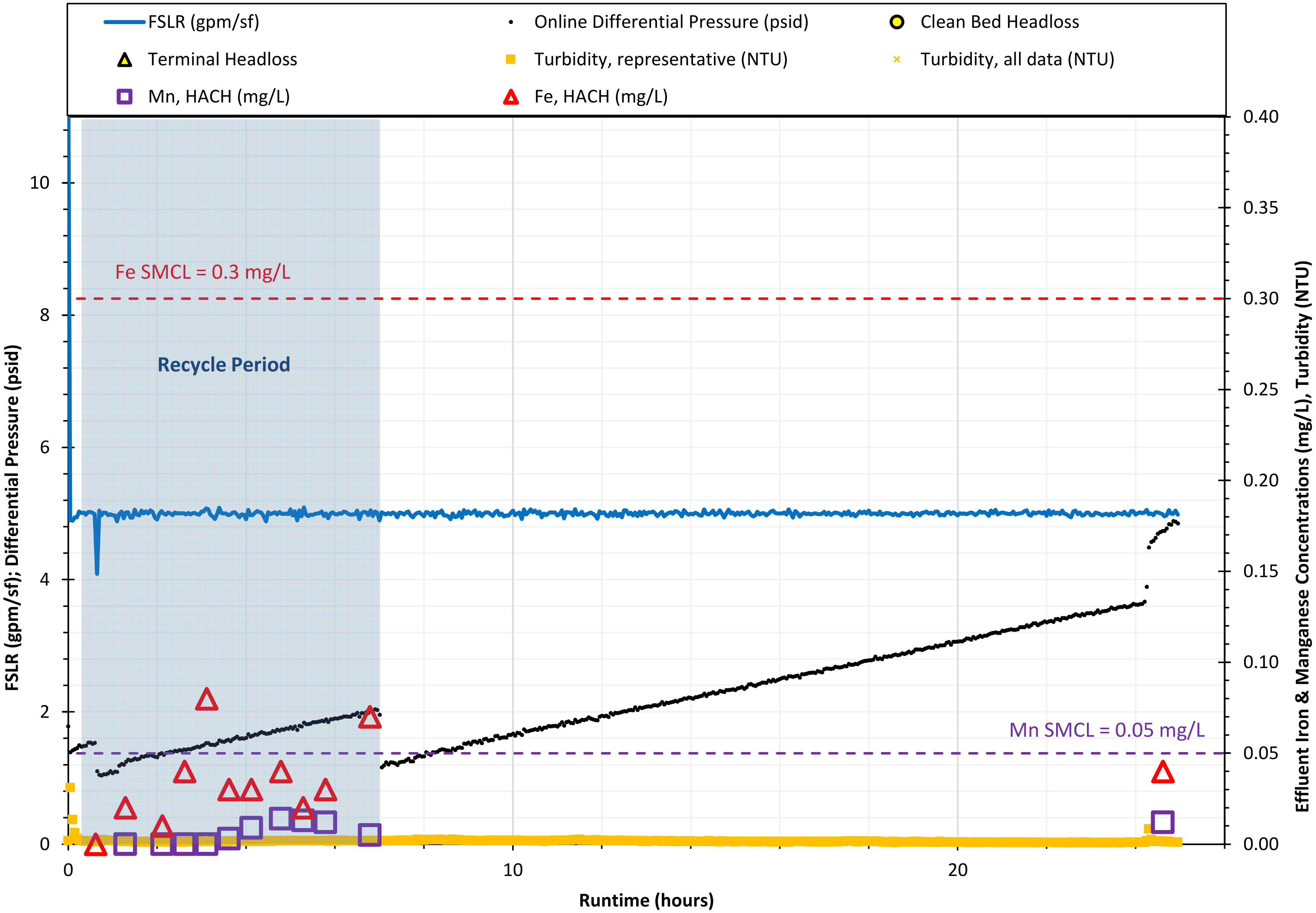


Figure E-12: Operating Conditions for Adsorptive Filter B (Pyrolusite-Low pH) Trial B.1
SHARON MA, Well 2 - Feb 16 to Feb 20, 2023

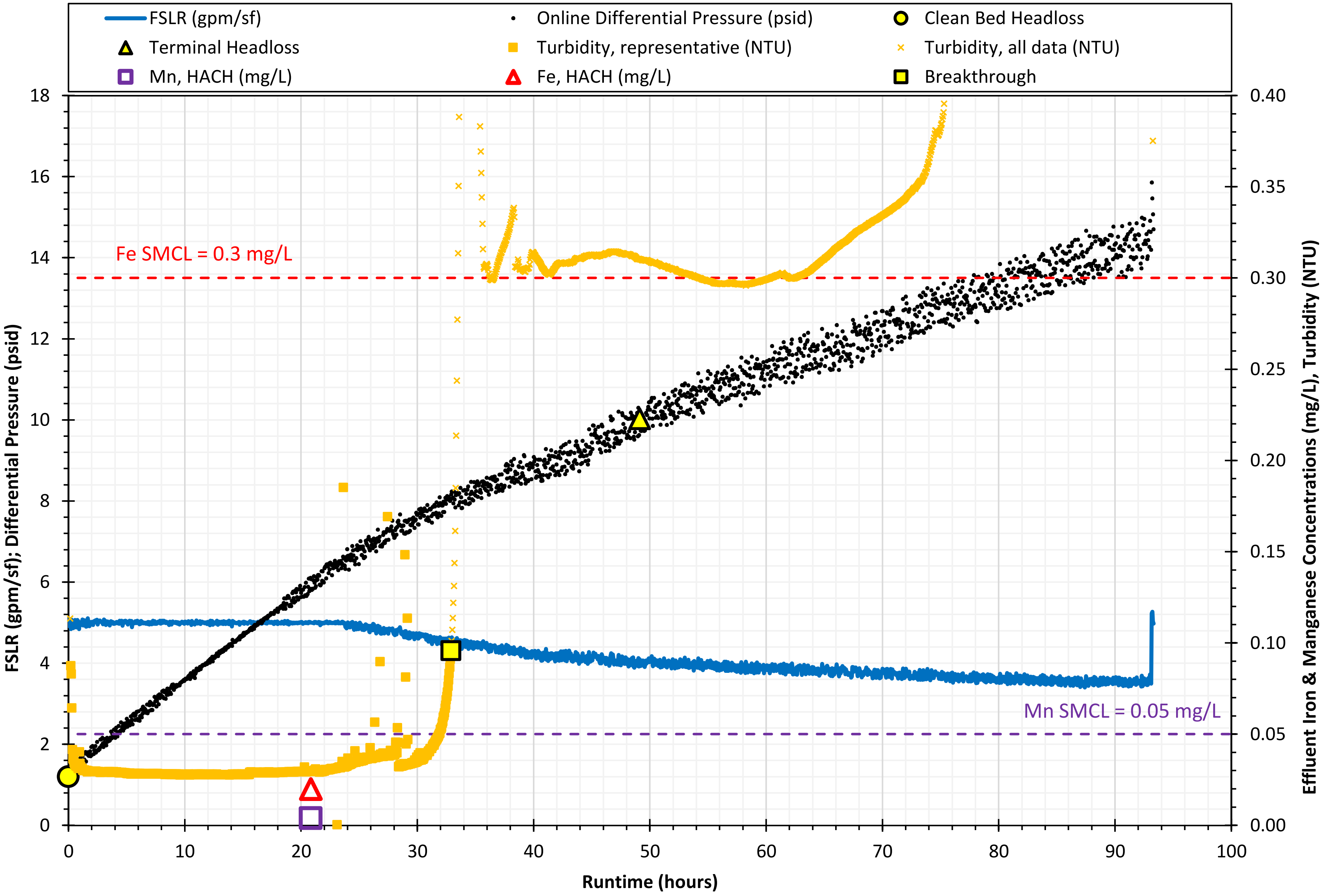


Figure E-13: Operating Conditions for Adsorptive Filter B (Pyrolusite-Low pH) Trial B.2
SHARON MA, Well 2 - Feb 20 to Feb 21, 2023

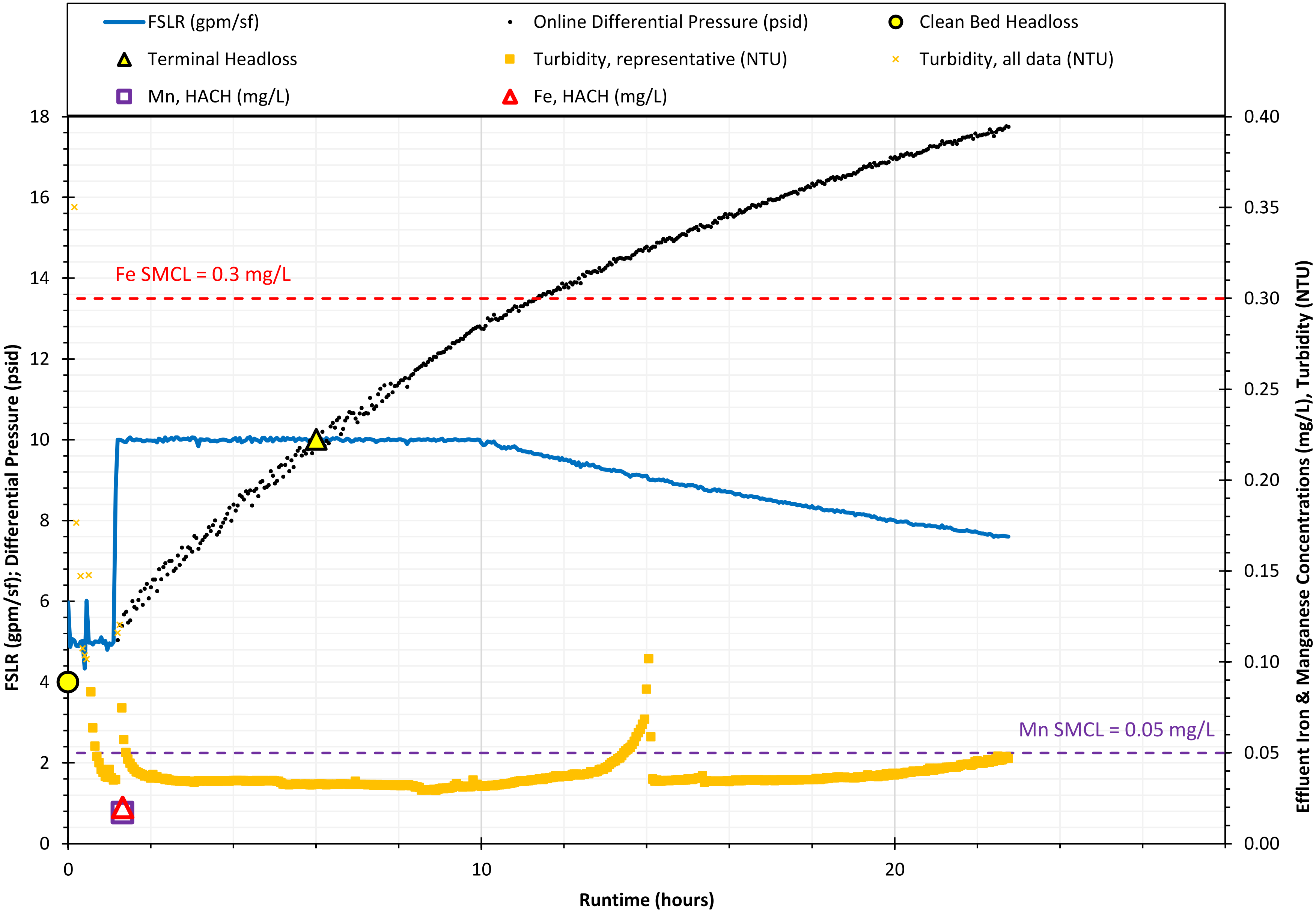


Figure E-14: Operating Conditions for Adsorptive Filter B (Pyrolusite-Low pH) Trial B.3
SHARON MA, Well 2 - Feb 21 to Feb 22, 2023

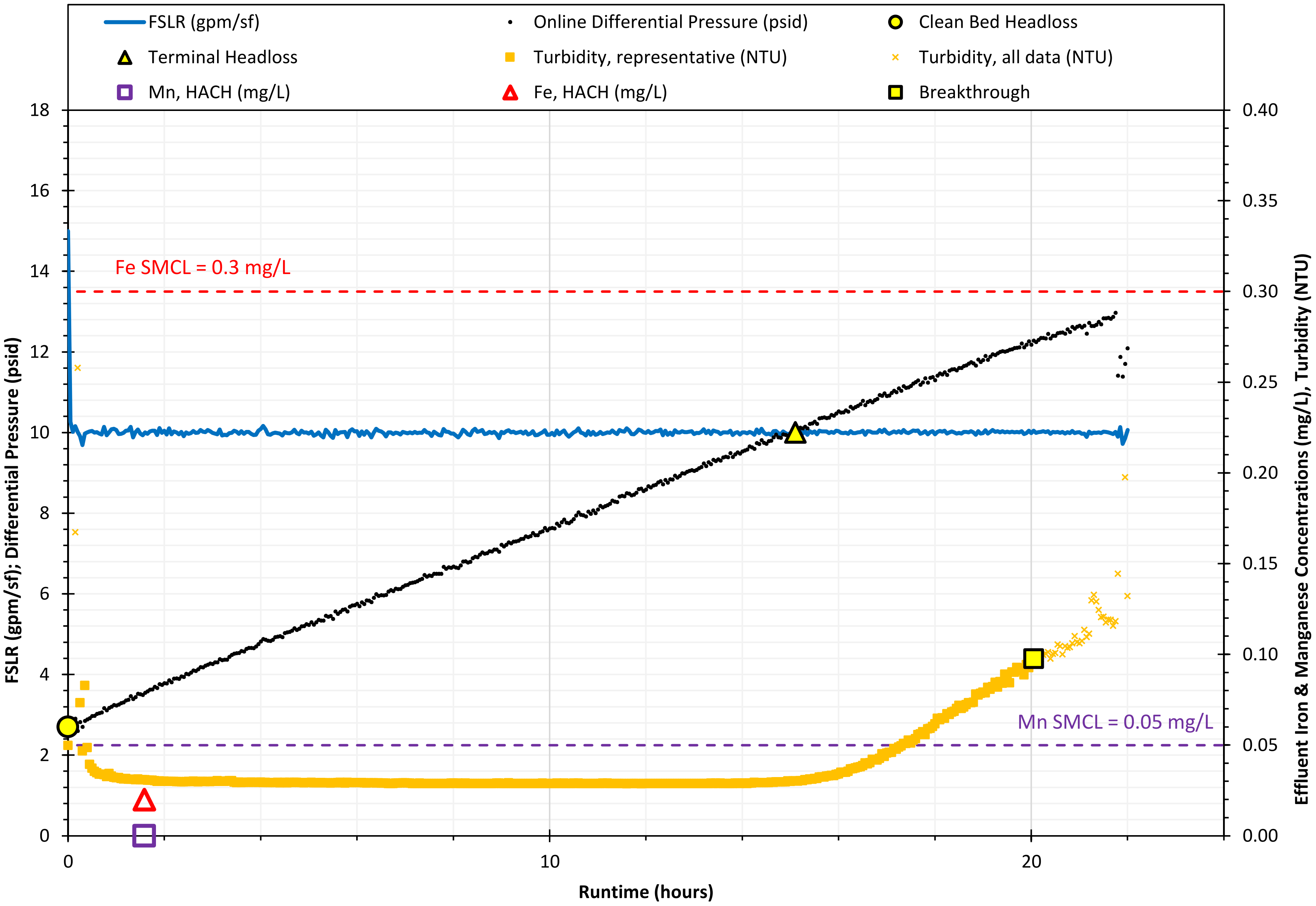


Figure E-15: Operating Conditions for Adsorptive Filter B (Pyrolusite-Low pH) Trial B.4
SHARON MA, Well 2 - Feb 22 to Feb 23, 2023

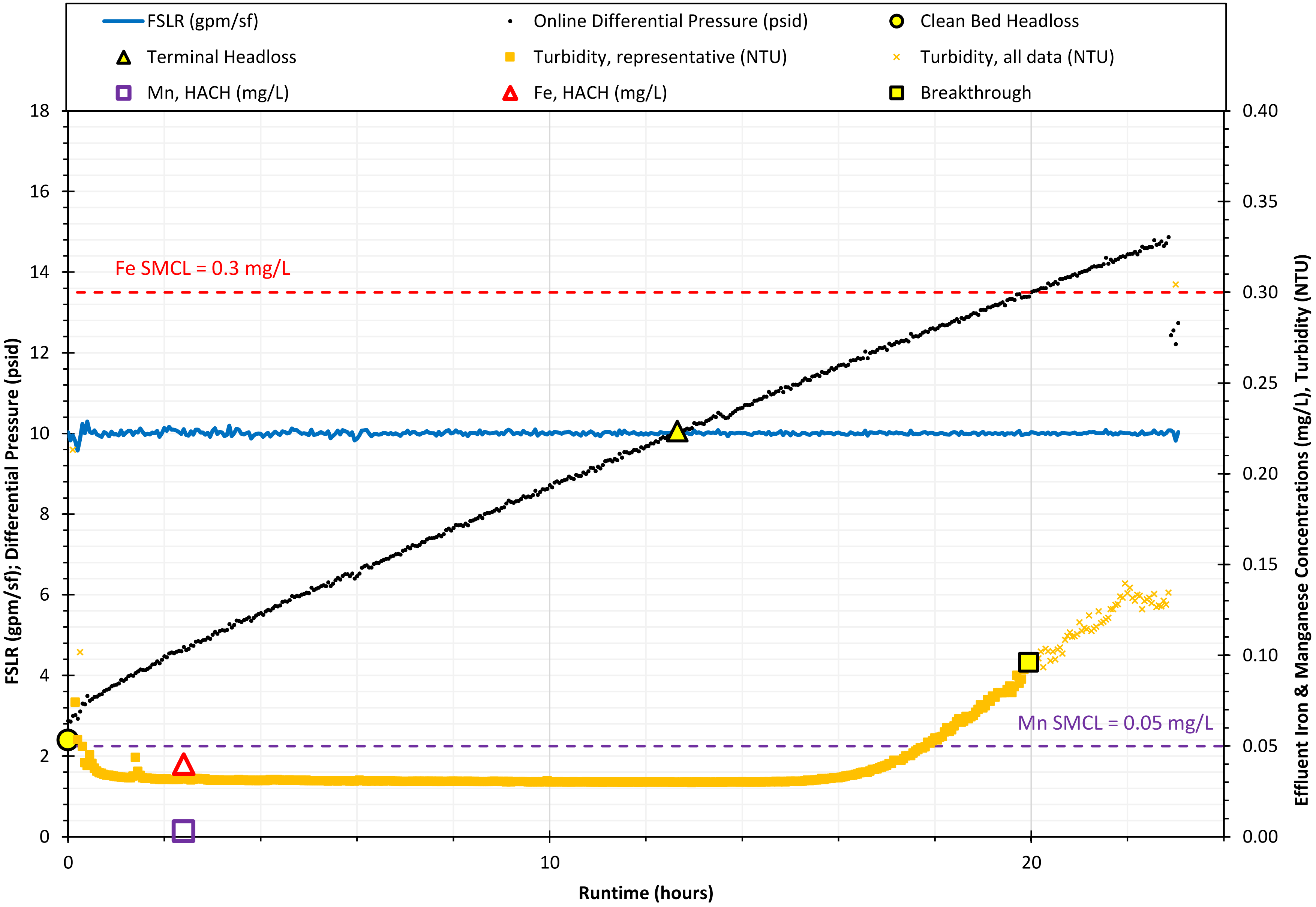


Figure E-16: Operating Conditions for Adsorptive Filter B (Pyrolusite-Low pH) Trial B.5
SHARON MA, Well 2 - Feb 23 to Feb 24, 2023

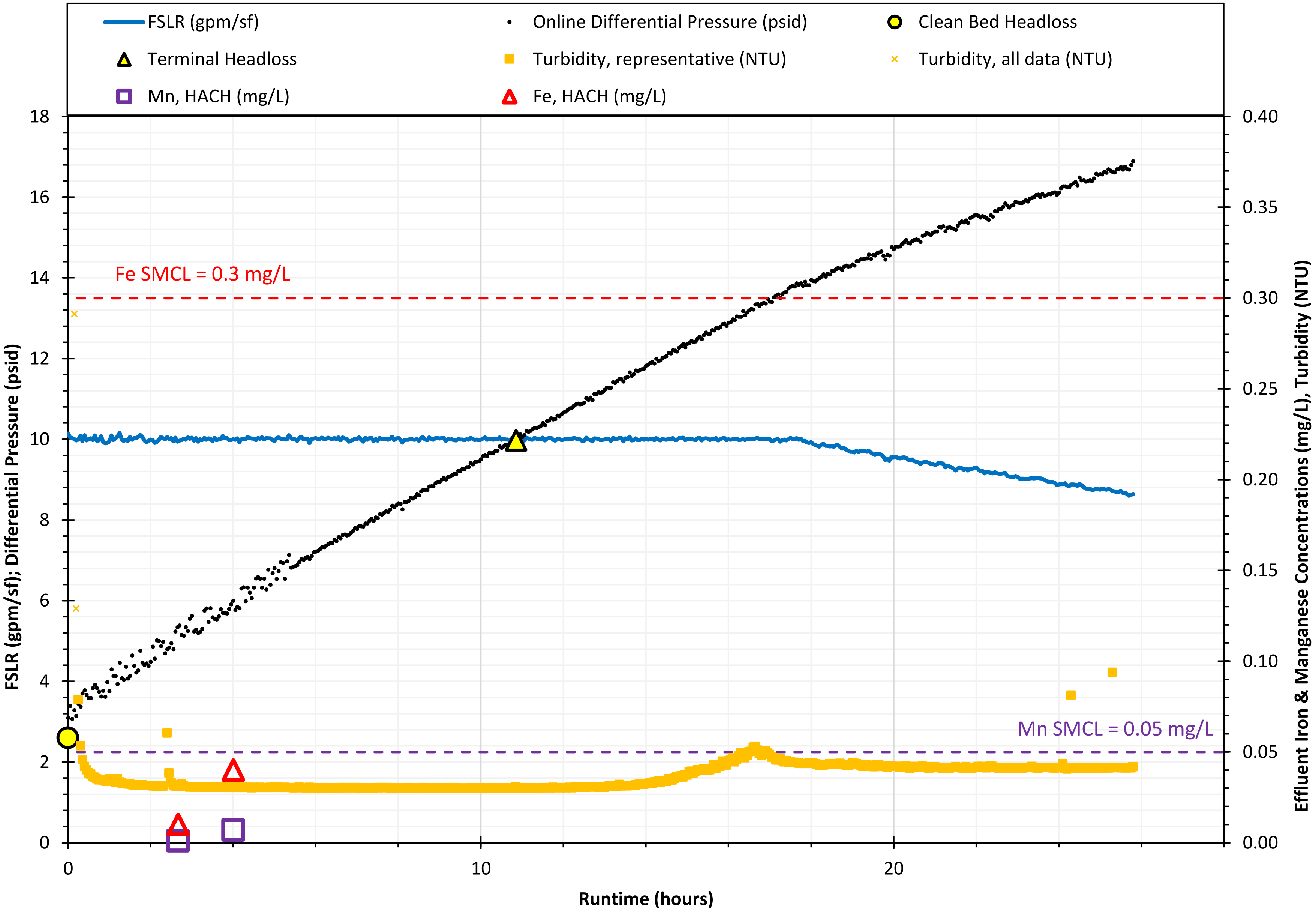


Figure E-17: Operating Conditions for Adsorptive Filter B (Pyrolusite-Low pH) Trial B.6
SHARON MA, Well 2 - Feb 24 to Feb 27, 2023

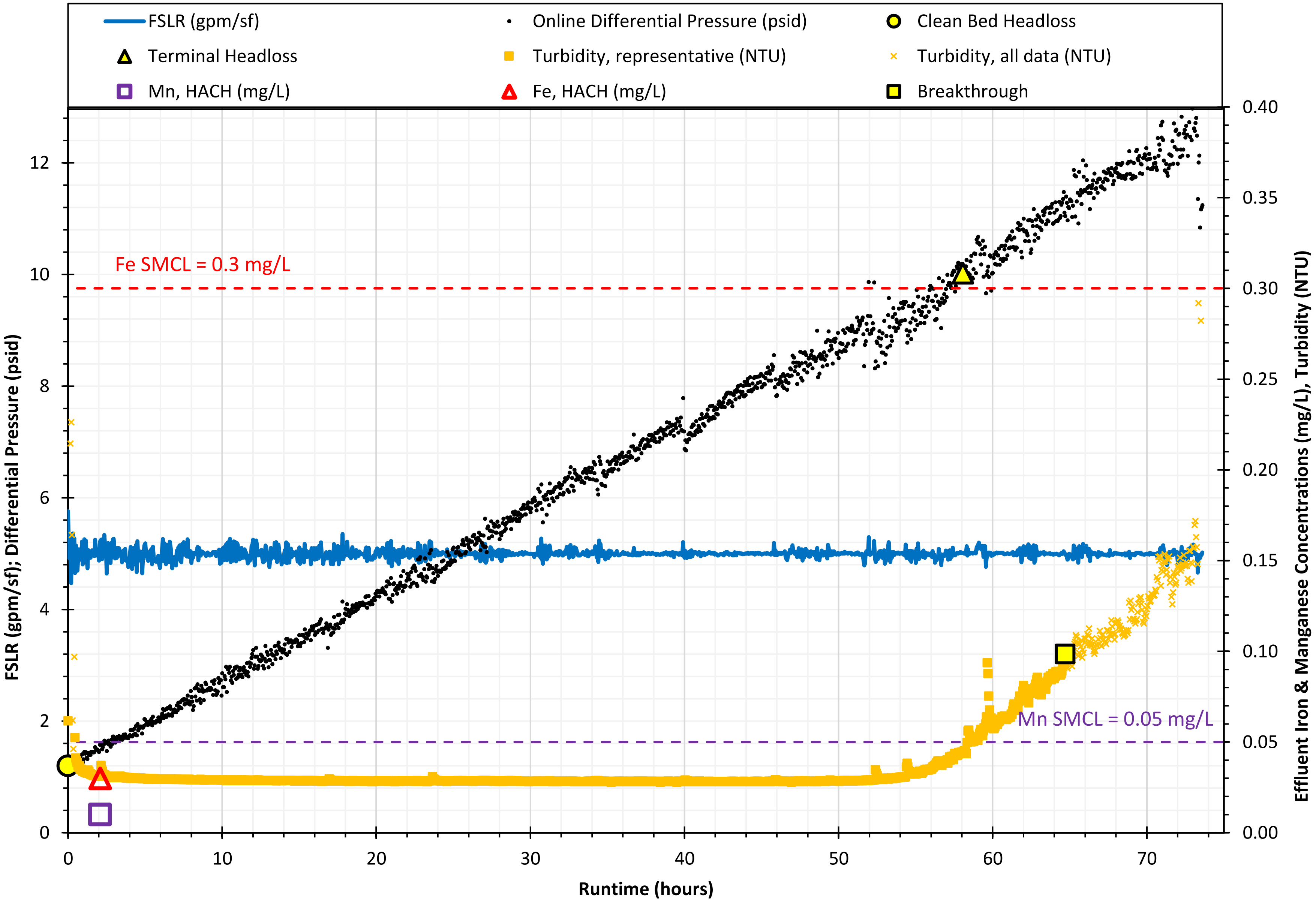


Figure E-18: Operating Conditions for Adsorptive Filter B (Pyrolusite-Low pH) Trial B.7
SHARON MA, Well 2 - Feb 27 to Feb 28, 2023

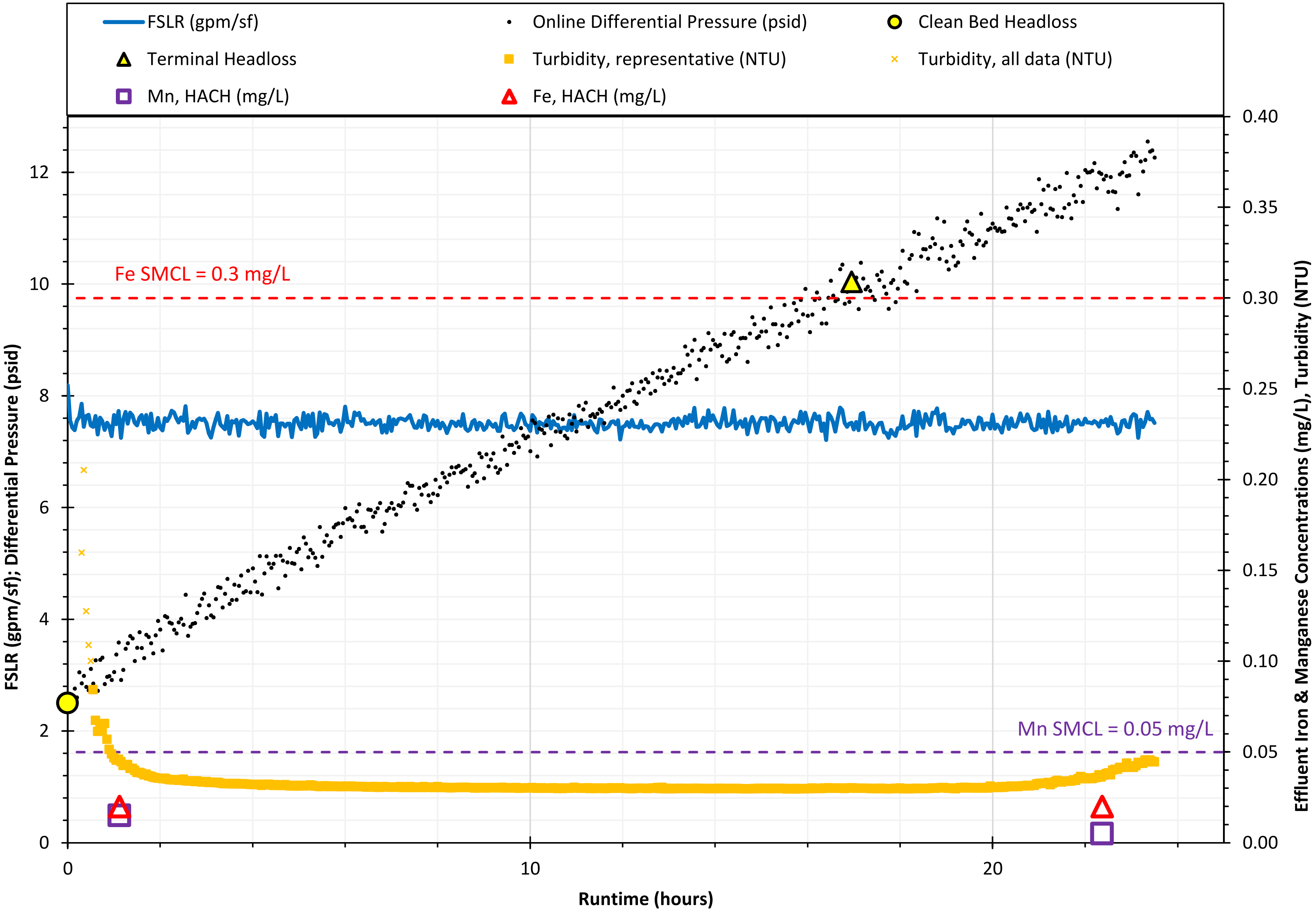


Figure E-19: Operating Conditions for Adsorptive Filter B (Pyrolusite-Low pH) Trial B.8
SHARON MA, Well 2 - Feb 28 to Mar 02, 2023

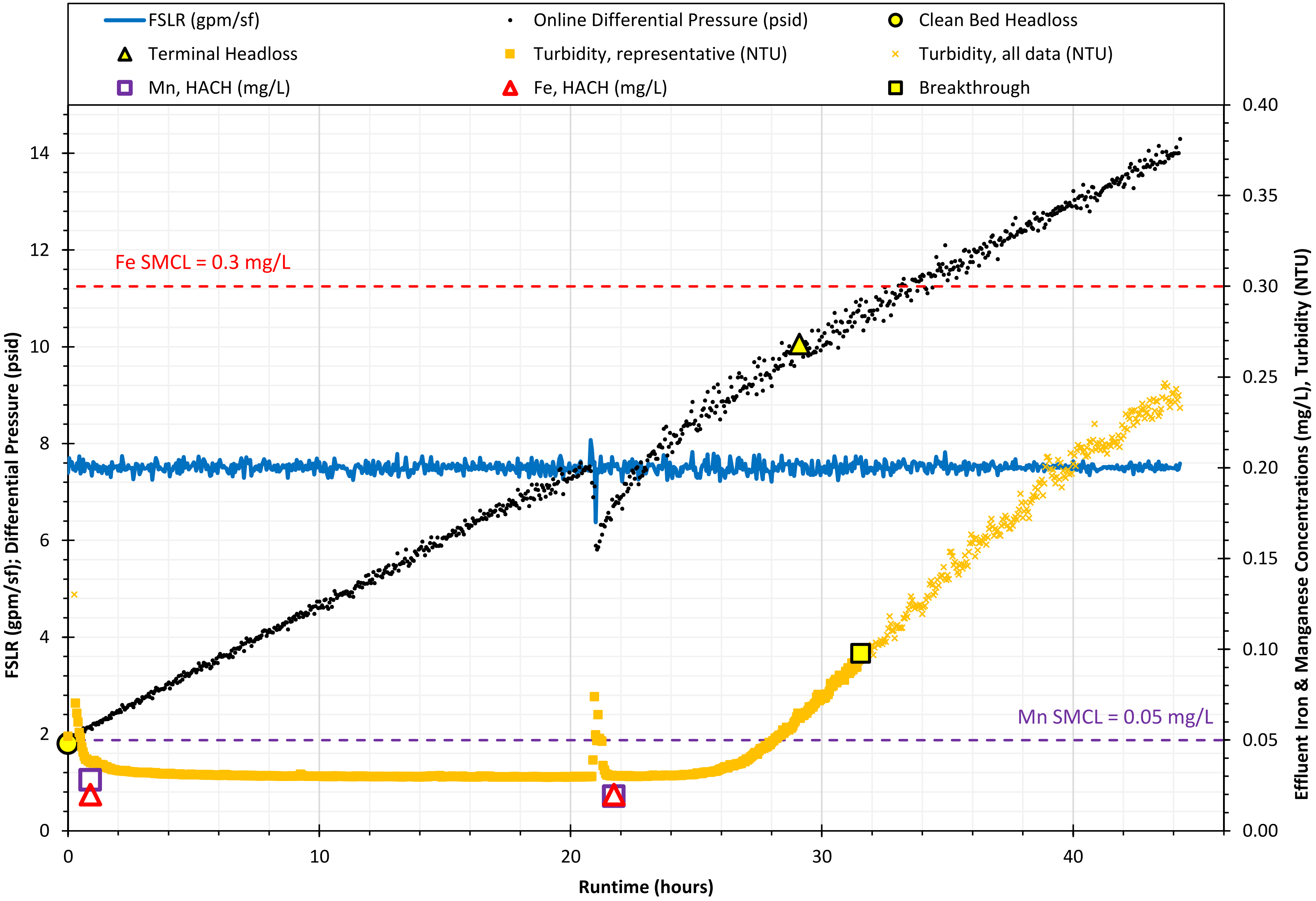


Figure E-20: Operating Conditions for Adsorptive Filter B (Pyrolusite-Low pH) Trial B.9
SHARON MA, Well 2 - Mar 02 to Mar 06, 2023

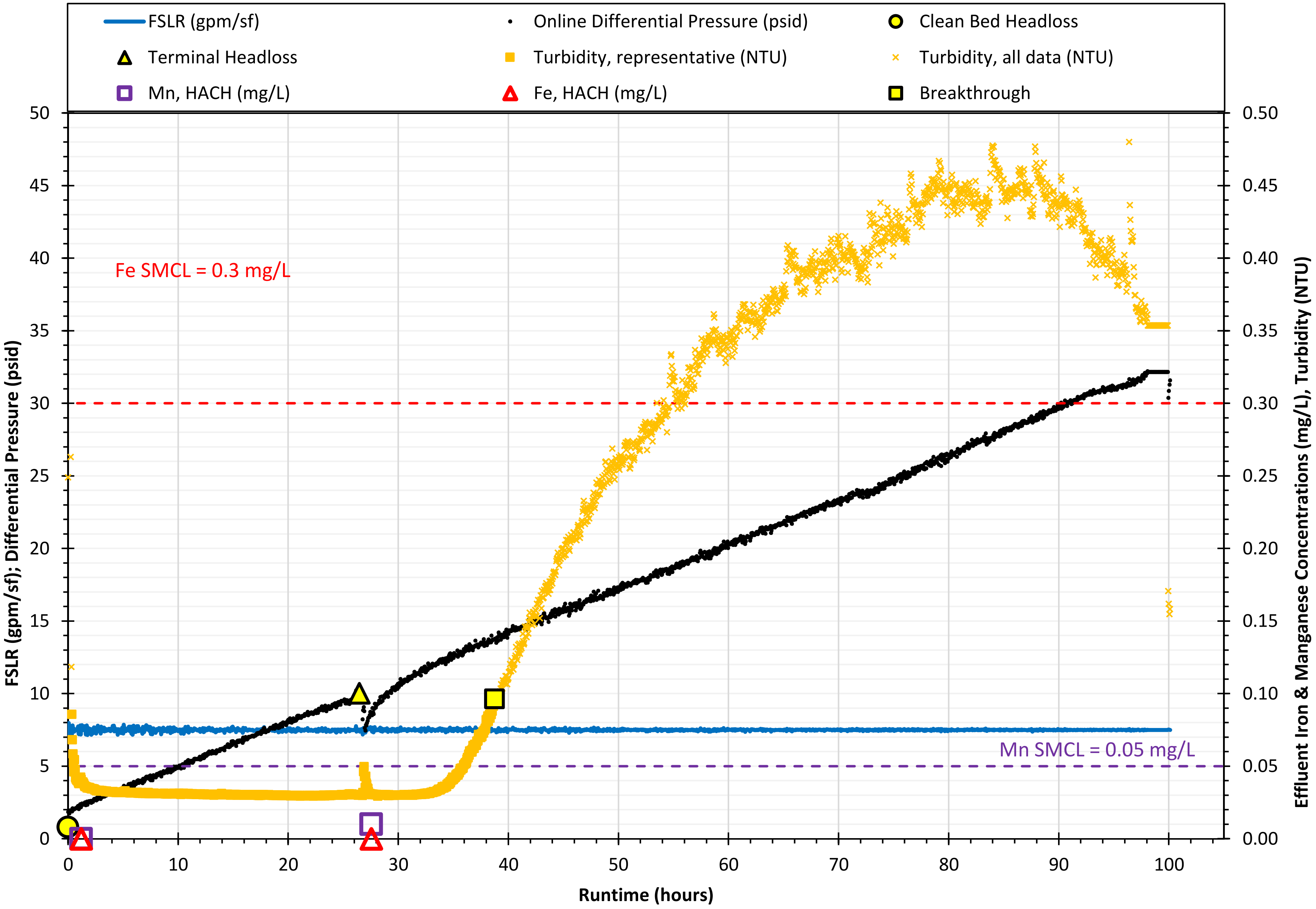


Figure E-21: Operating Conditions for Adsorptive Filter B (Pyrolusite-Low pH) Trial B.10
SHARON MA, Well 2 - Mar 06 to Mar 08, 2023

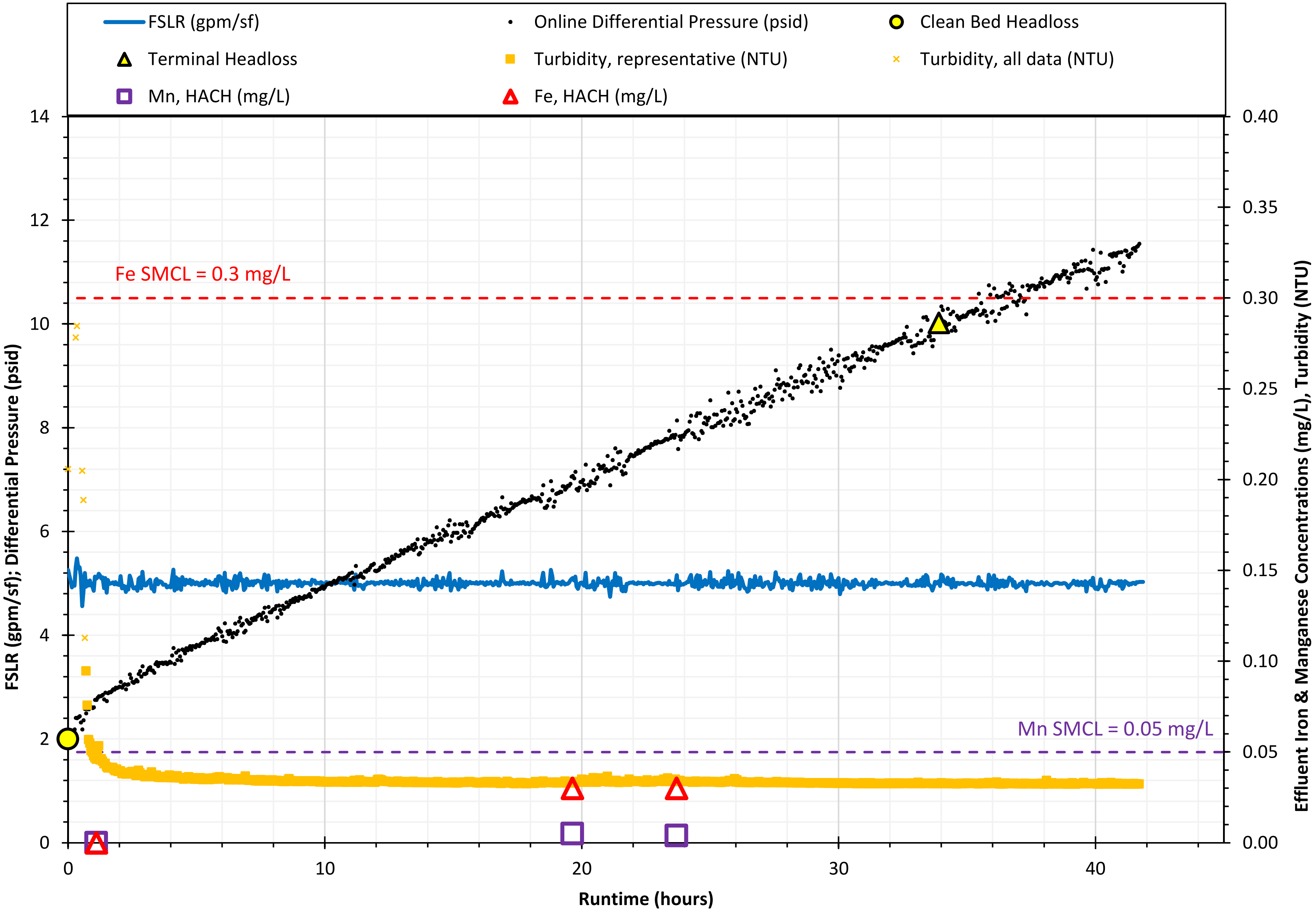


Figure E-22: Operating Conditions for Adsorptive Filter B (Pyrolusite-Low pH) Trial B.11
SHARON MA, Well 2 - Mar 08 to Mar 10, 2023

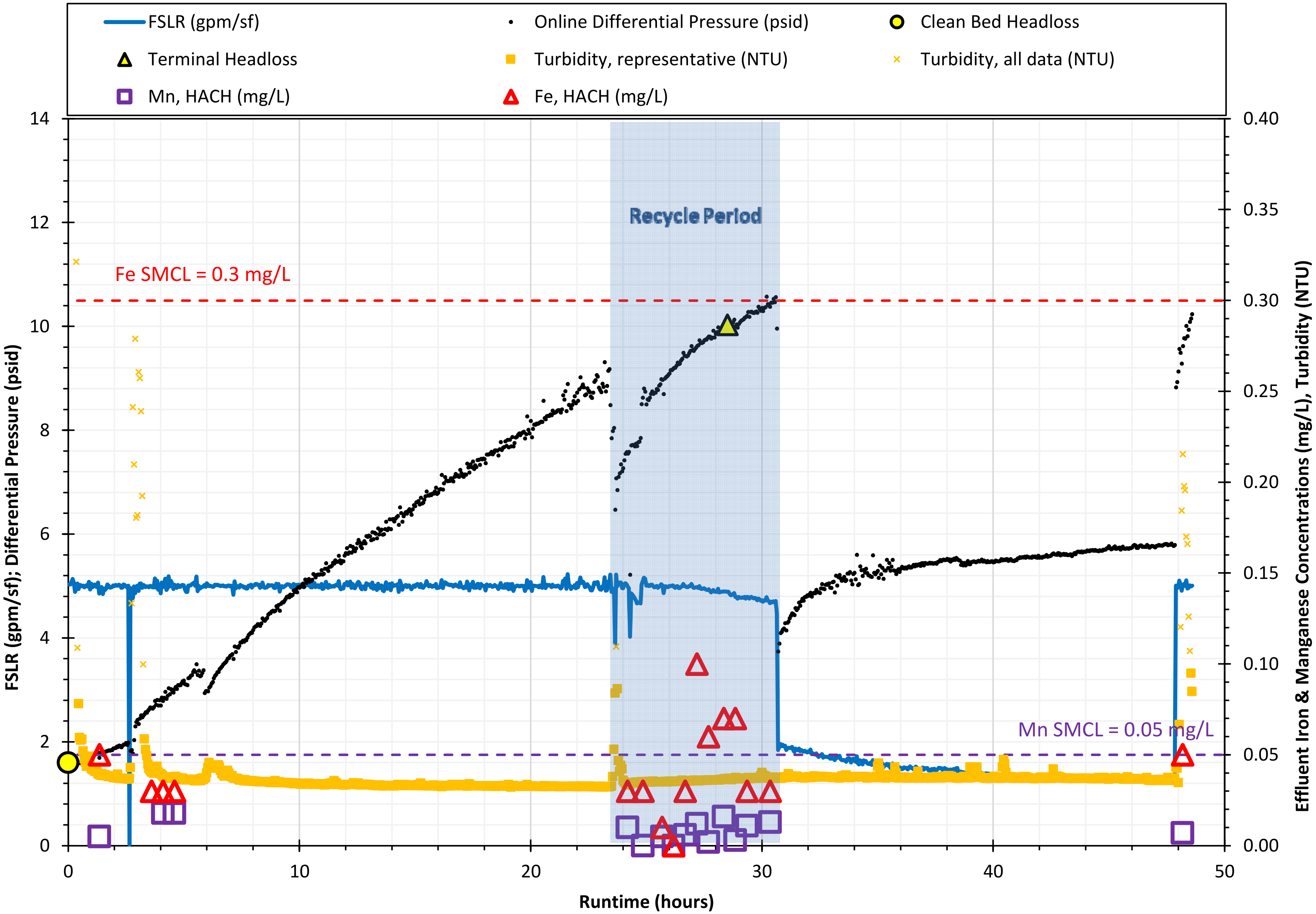


Figure E-23: Operating Conditions for Adsorptive Filter C (Greensand-High pH) Trial C.1
SHARON MA, Well 2 - Feb 16 to Feb 20, 2023

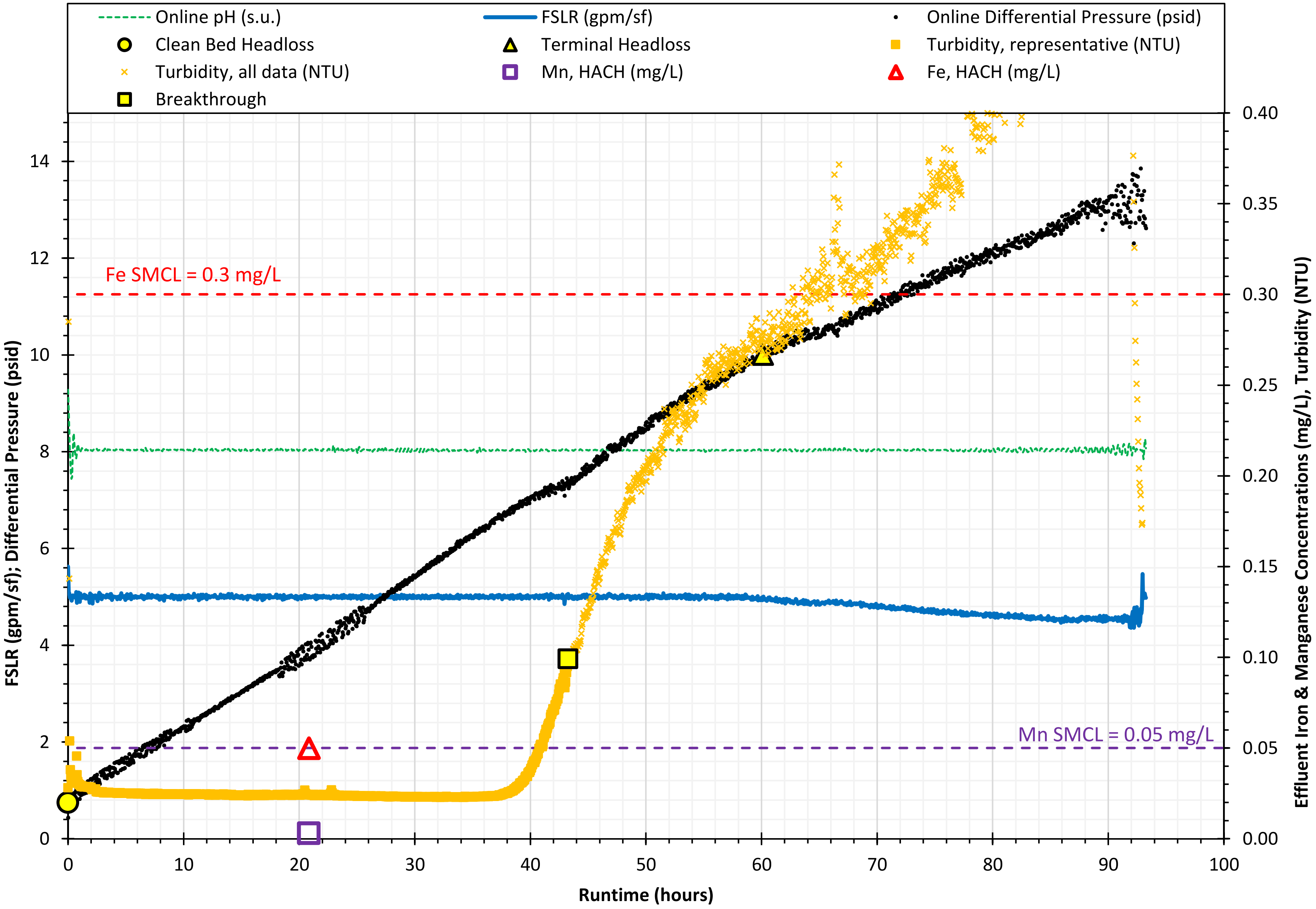


Figure E-24: Operating Conditions for Adsorptive Filter C (Greensand-High pH) Trial C.2
SHARON MA, Well 2 - Feb 20 to Feb 21, 2023

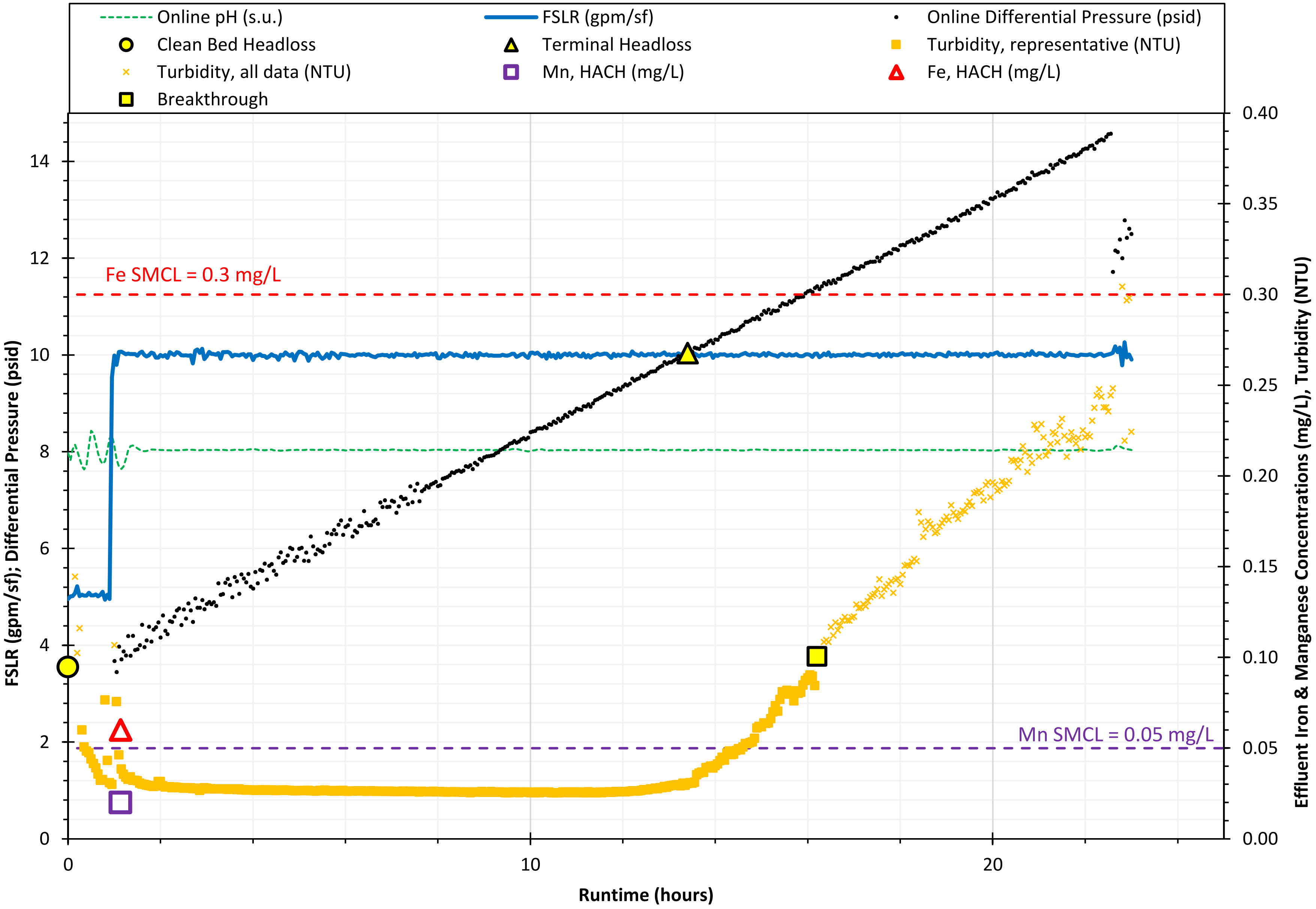


Figure E-25: Operating Conditions for Adsorptive Filter C (Greensand-High pH) Trial C.3
SHARON MA, Well 2 - Feb 21 to Feb 22, 2023

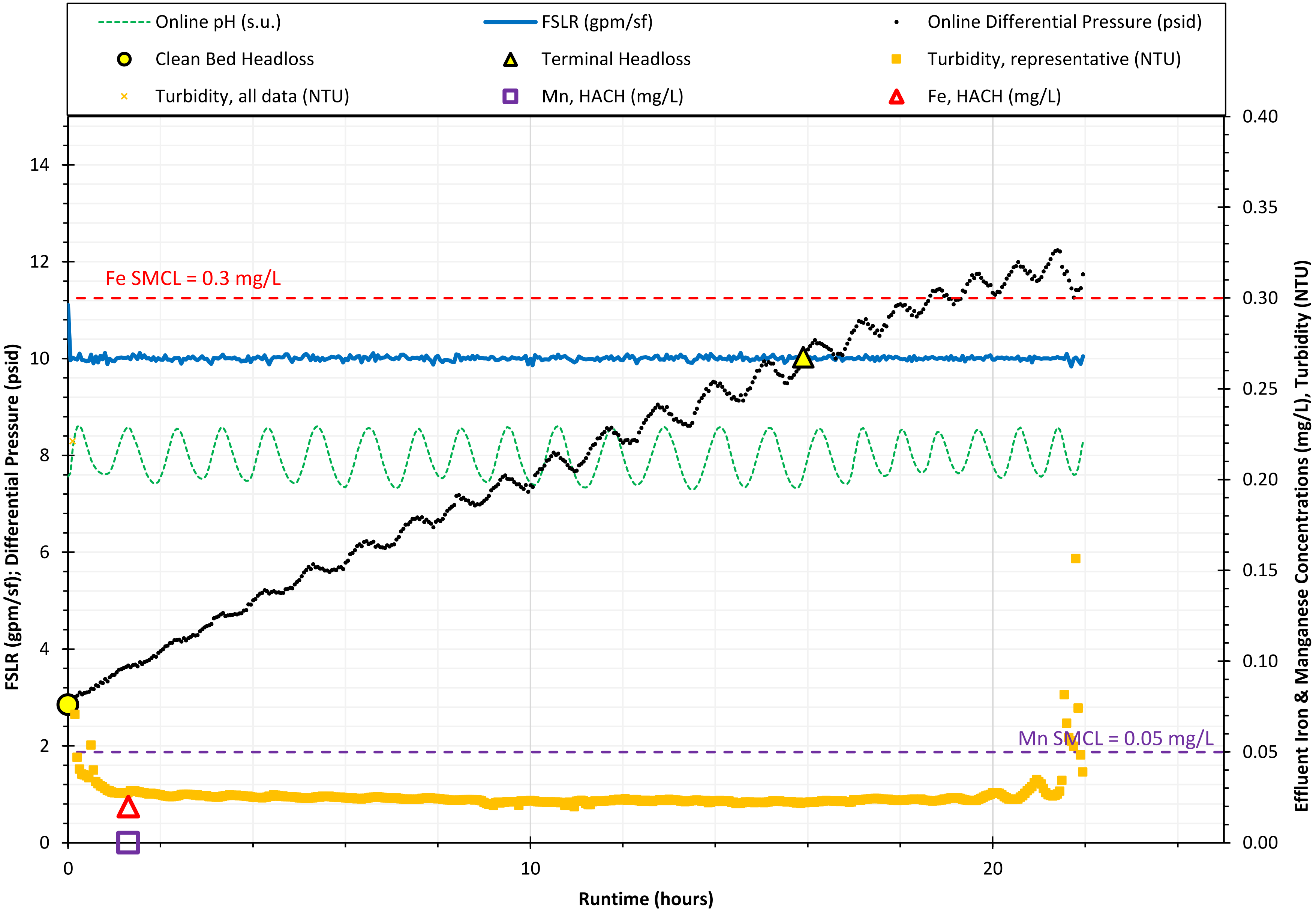


Figure E-26: Operating Conditions for Adsorptive Filter C (Greensand-High pH) Trial C.4
SHARON MA, Well 2 - Feb 22 to Feb 23, 2023

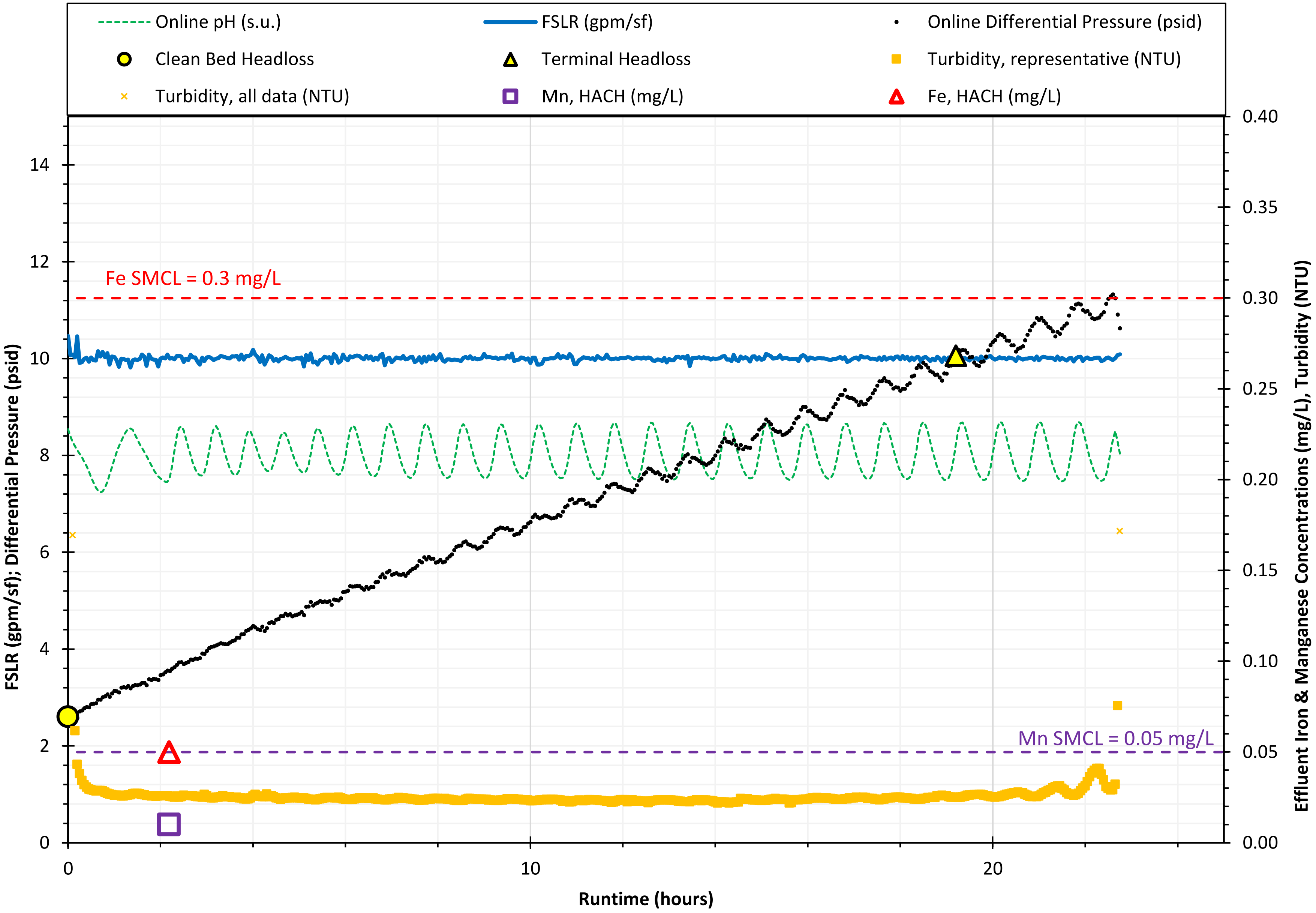


Figure E-27: Operating Conditions for Adsorptive Filter C (Greensand-High pH) Trial C.5
SHARON MA, Well 2 - Feb 23 to Feb 24, 2023

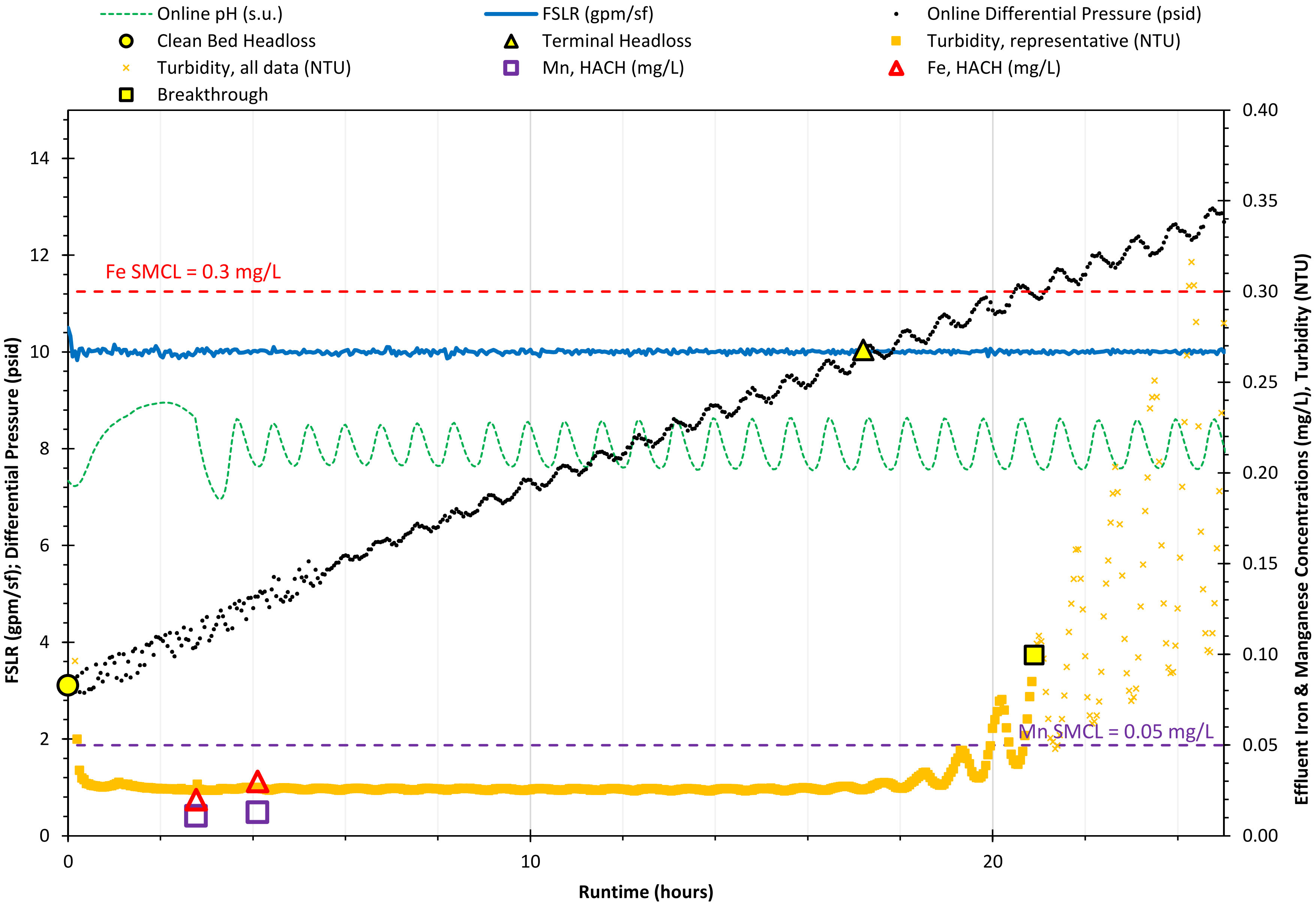


Figure E-28: Operating Conditions for Adsorptive Filter C (Greensand-High pH) Trial C.6
SHARON MA, Well 2 - Feb 24 to Feb 27, 2023

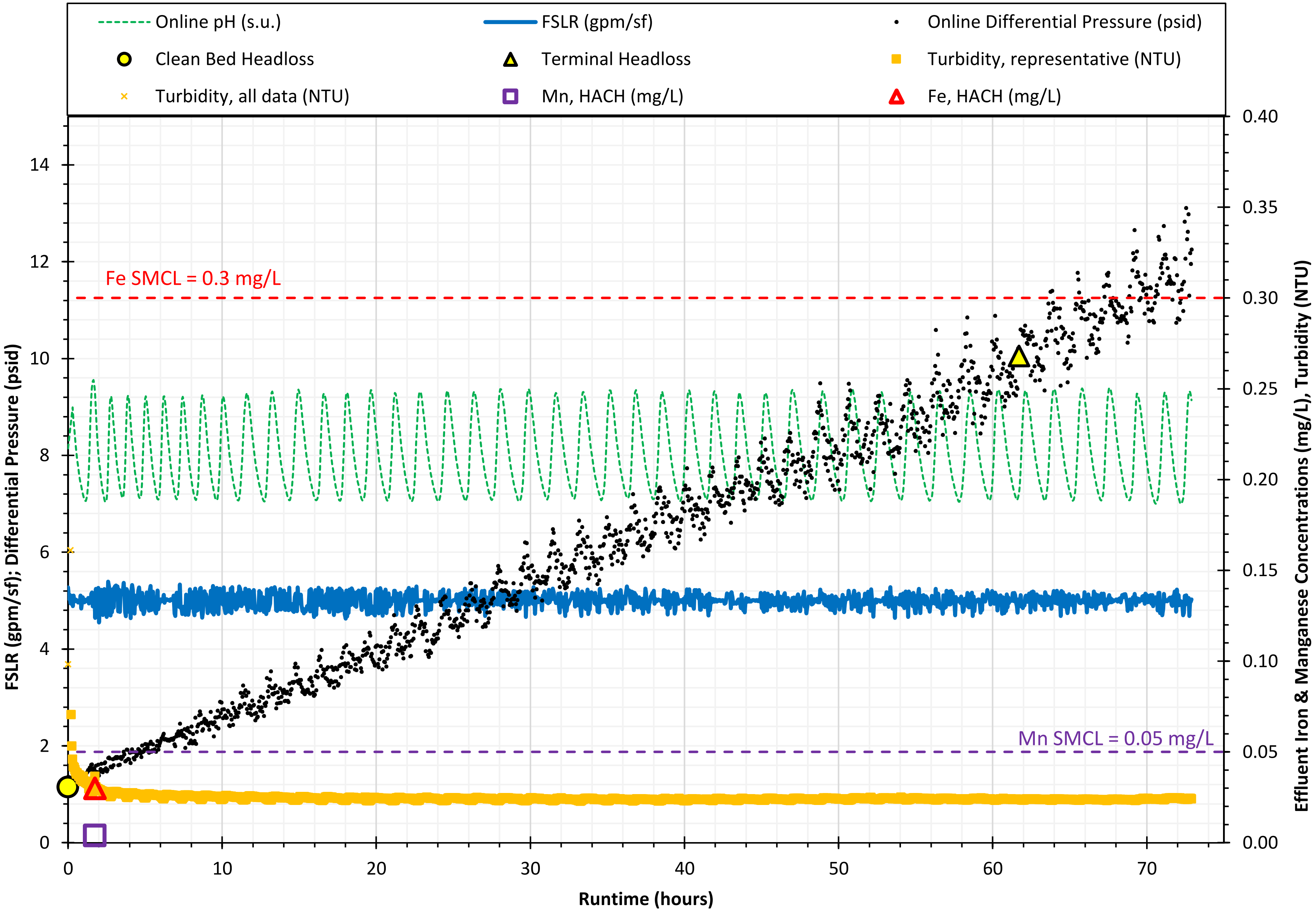


Figure E-29: Operating Conditions for Adsorptive Filter C (Greensand-High pH) Trial C.7
SHARON MA, Well 2 - Feb 27 to Mar 01, 2023

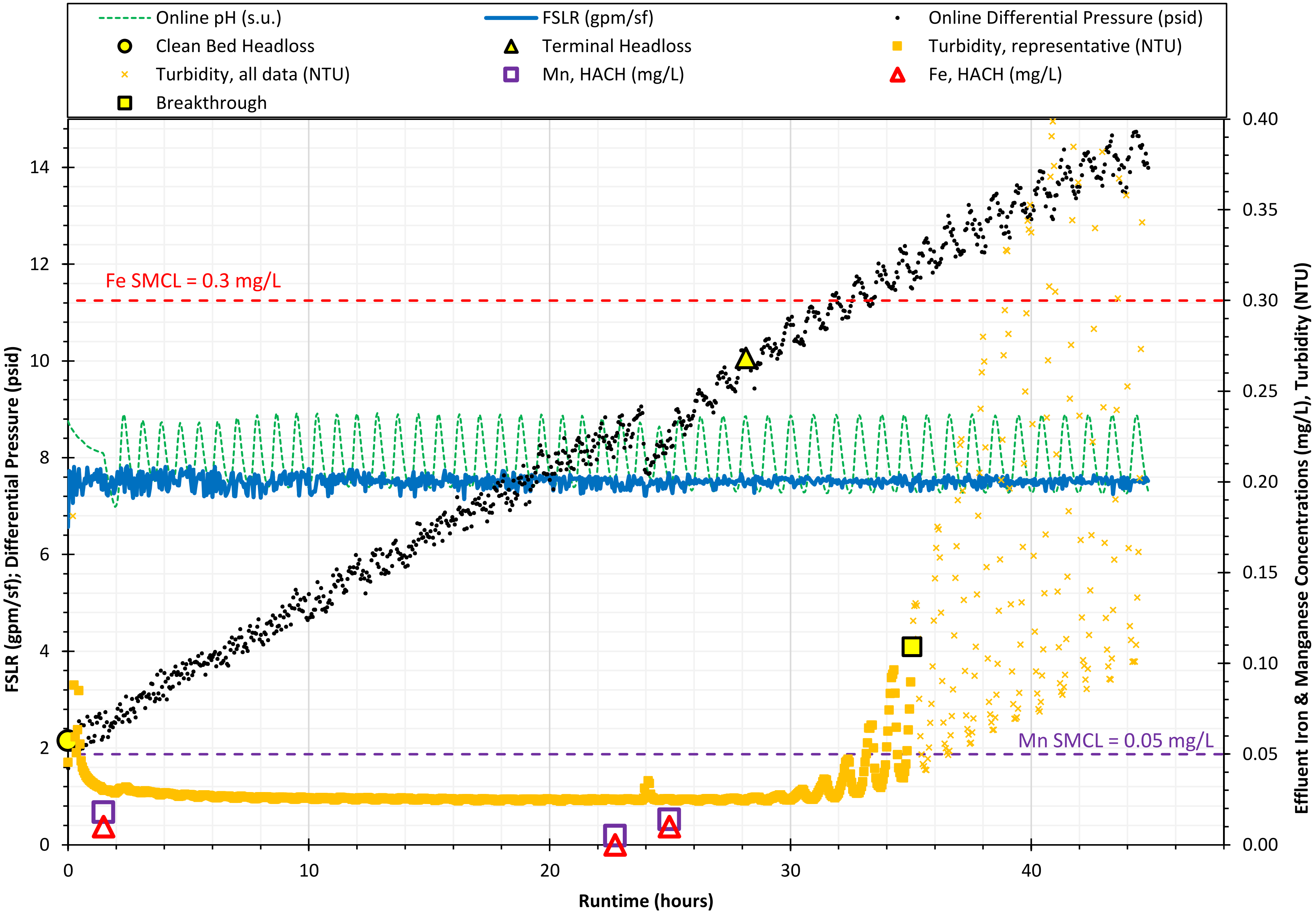


Figure E-30: Operating Conditions for Adsorptive Filter C (Greensand-High pH) Trial C.8
SHARON MA, Well 2 - Mar 01 to Mar 03, 2023

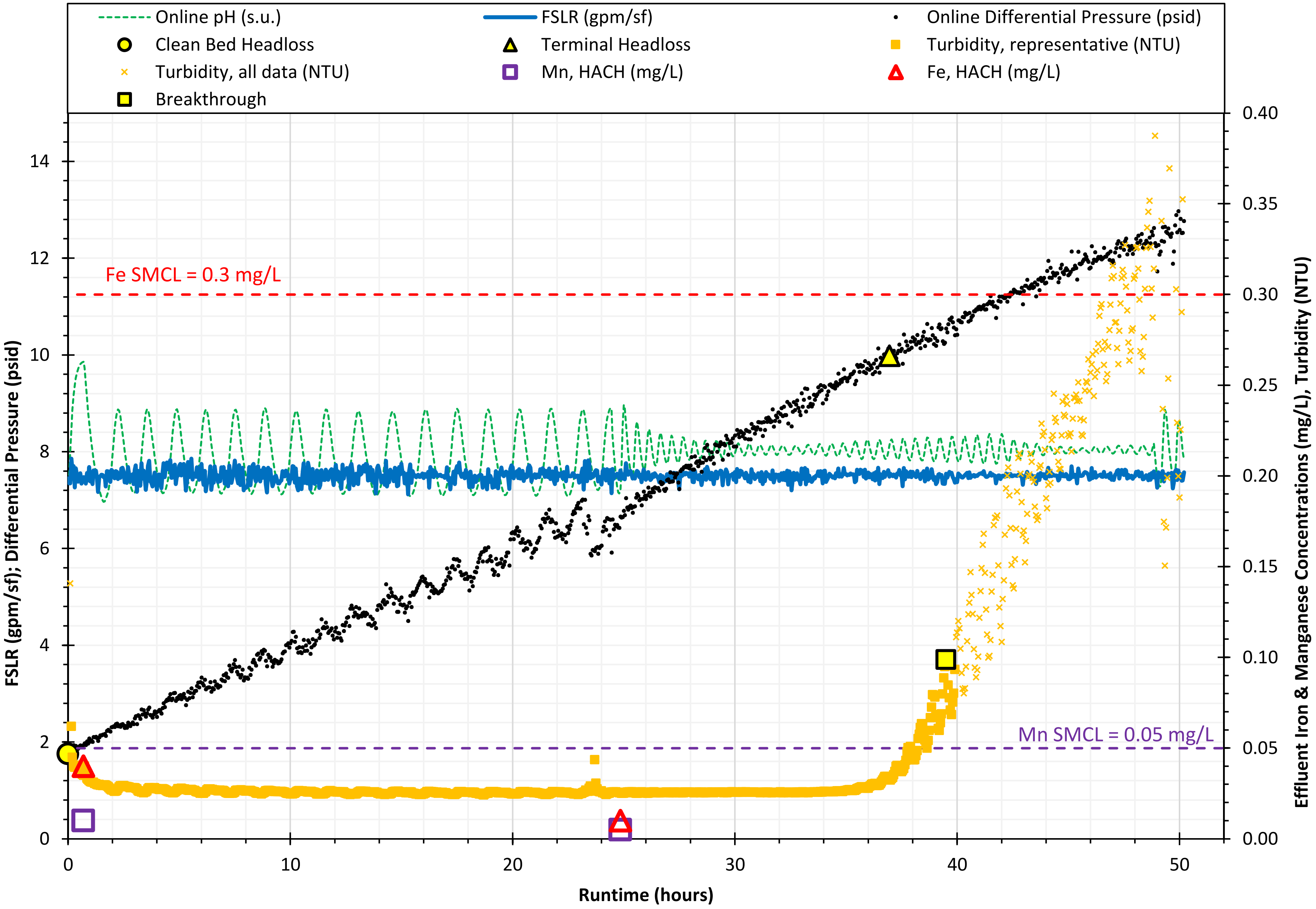


Figure E-31: Operating Conditions for Adsorptive Filter C (Greensand-High pH) Trial C.9
SHARON MA, Well 2 - Mar 03 to Mar 06, 2023

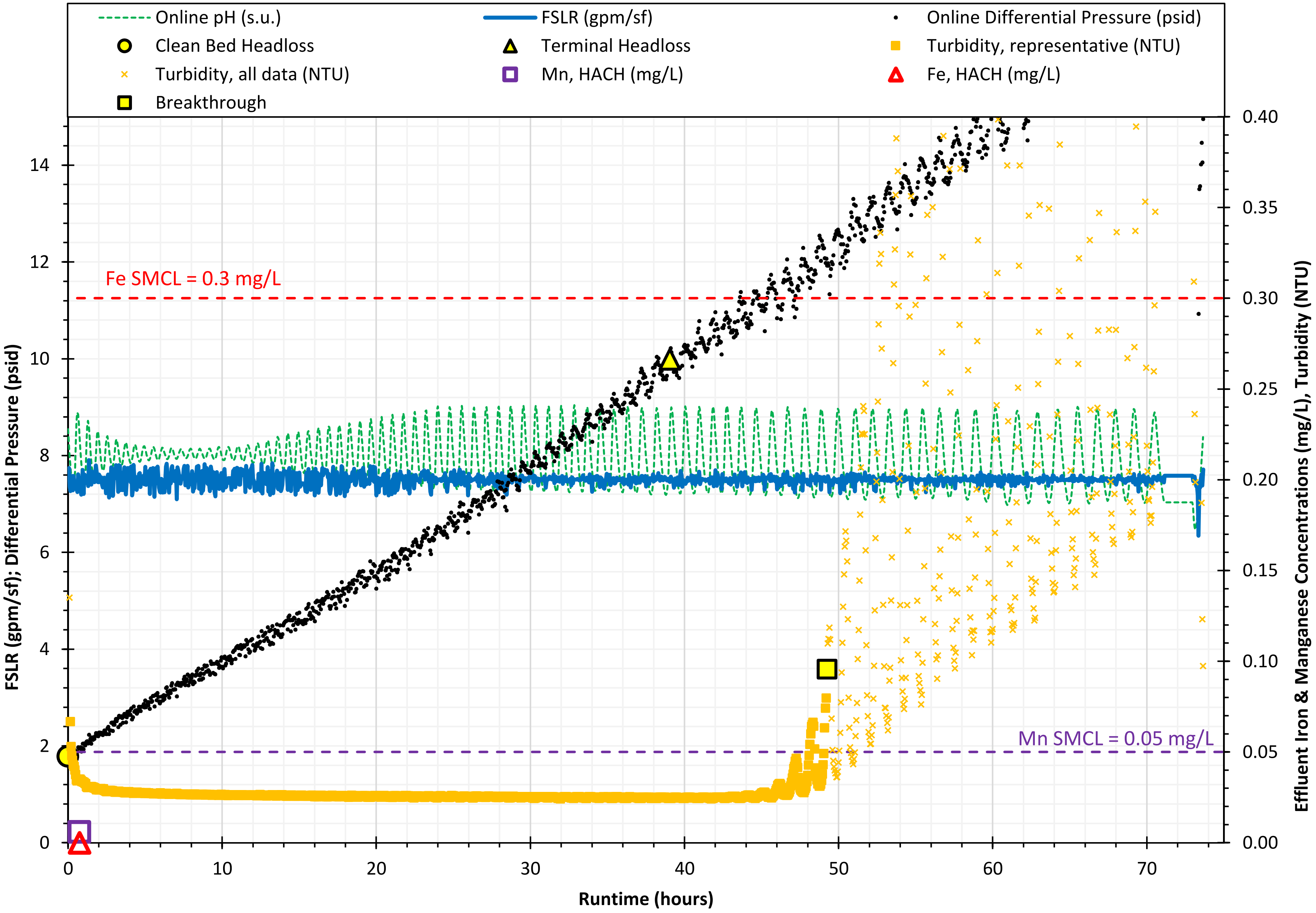


Figure E-32: Operating Conditions for Adsorptive Filter C (Greensand-High pH) Trial C.10
SHARON MA, Well 2 - Mar 06 to Mar 09, 2023

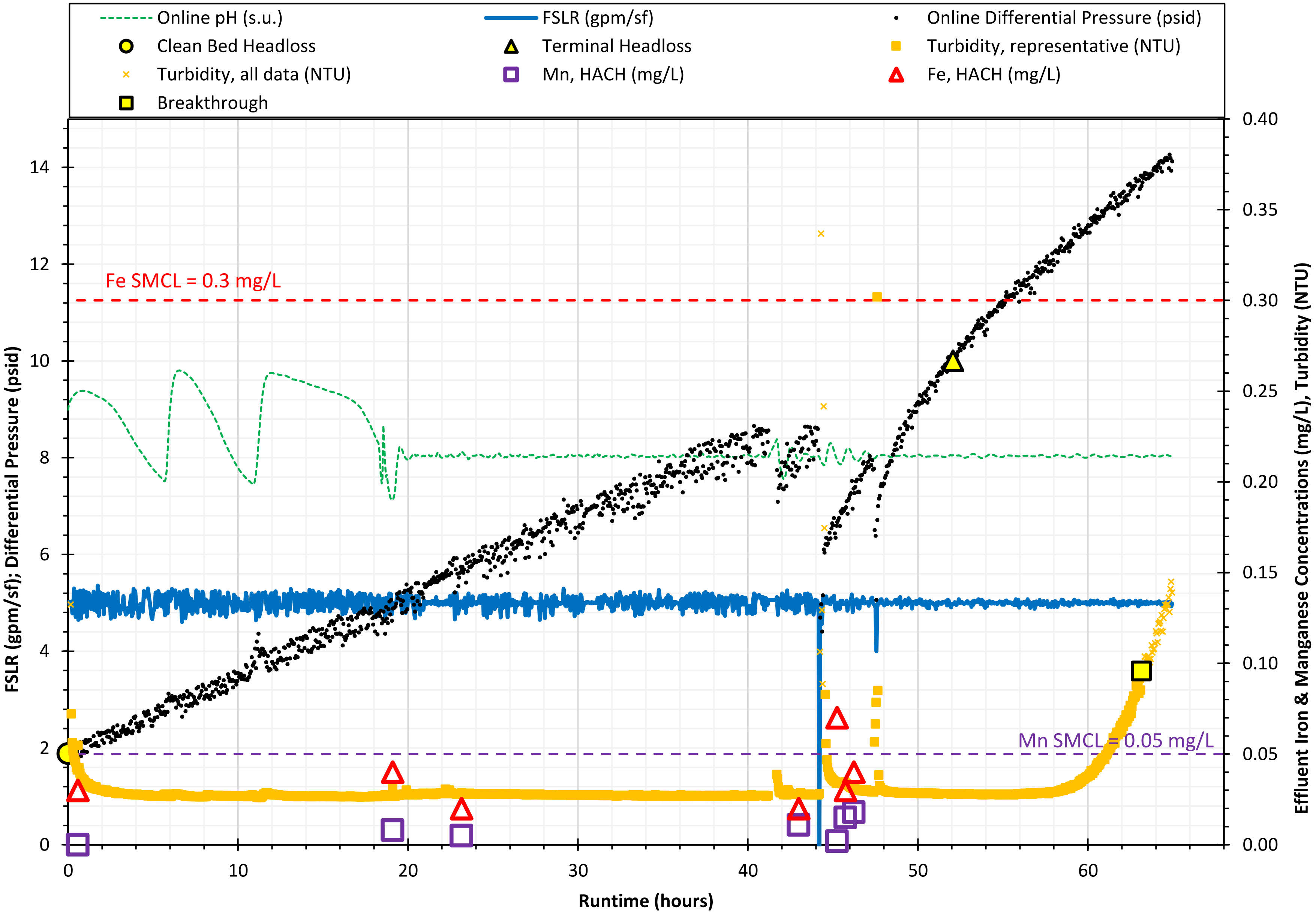


Figure E-33: Operating Conditions for Adsorptive Filter C (Greensand-High pH) Trial C.11
SHARON MA, Well 2 - Mar 09 to Mar 10, 2023

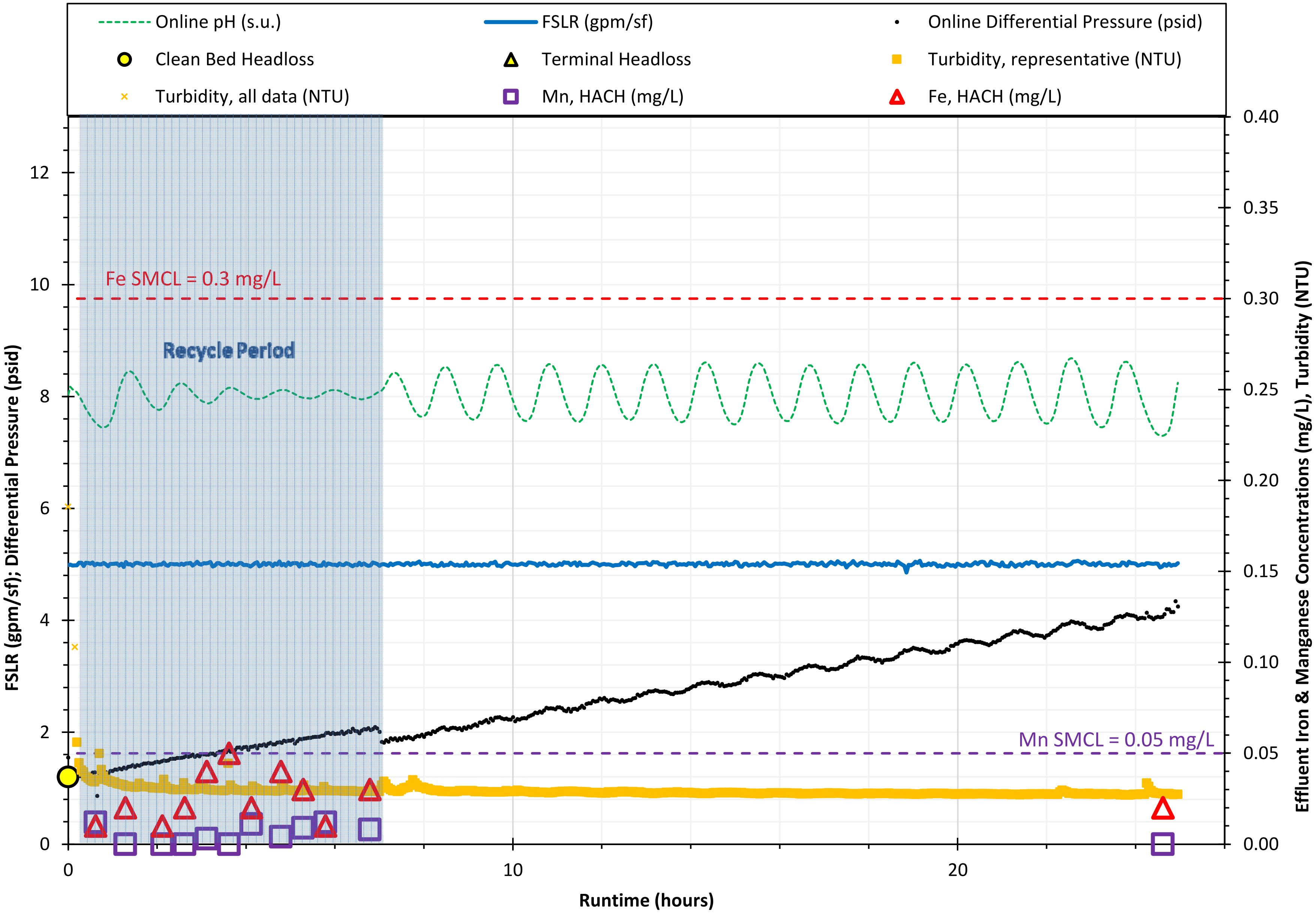


Figure E-34: Operating Conditions for Adsorptive Filter D (Pyrolusite-High pH) Trial D.1
SHARON MA, Well 2 - Feb 16 to Feb 20, 2023

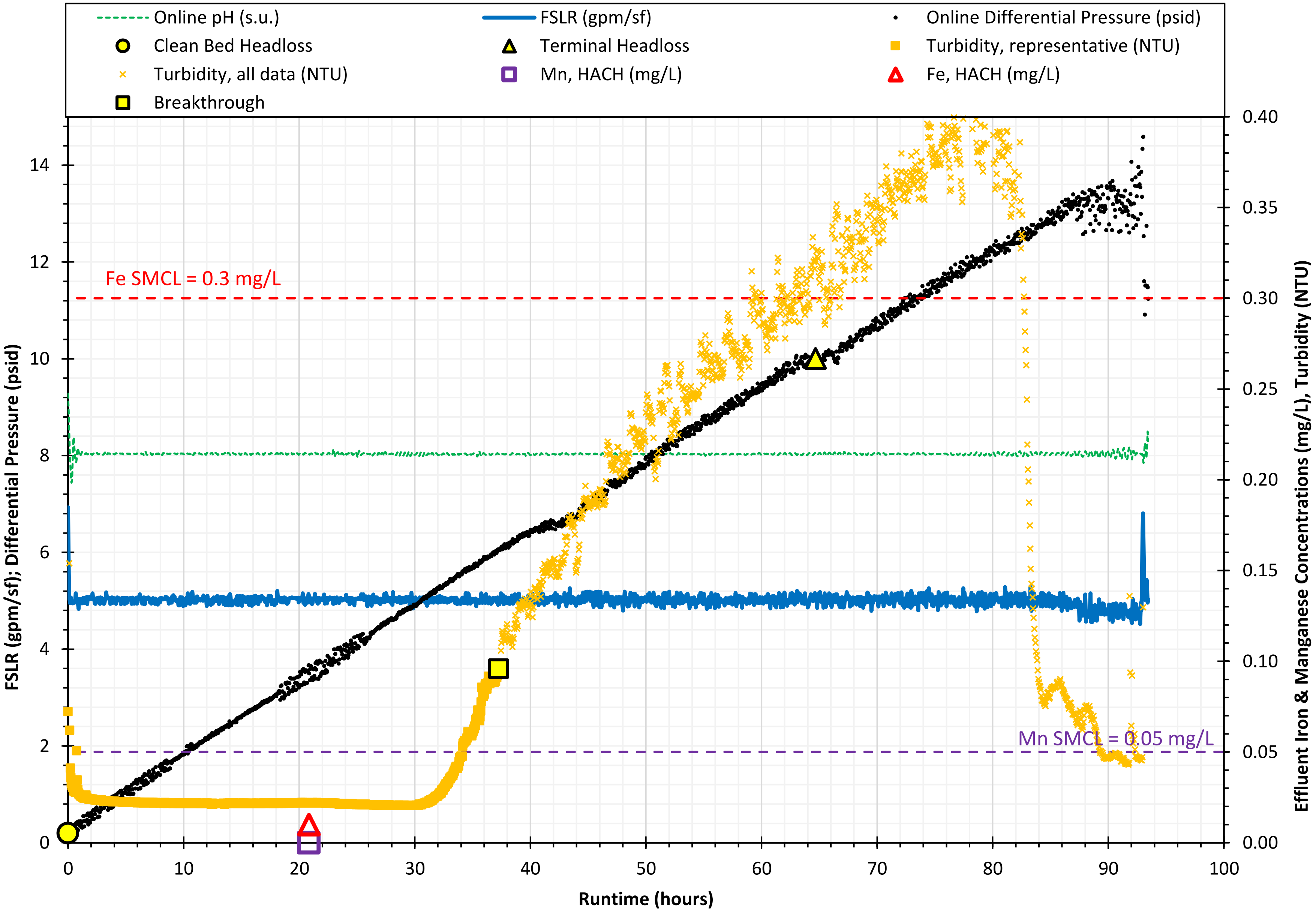


Figure E-35: Operating Conditions for Adsorptive Filter D (Pyrolusite-High pH) Trial D.2
SHARON MA, Well 2 - Feb 20 to Feb 21, 2023

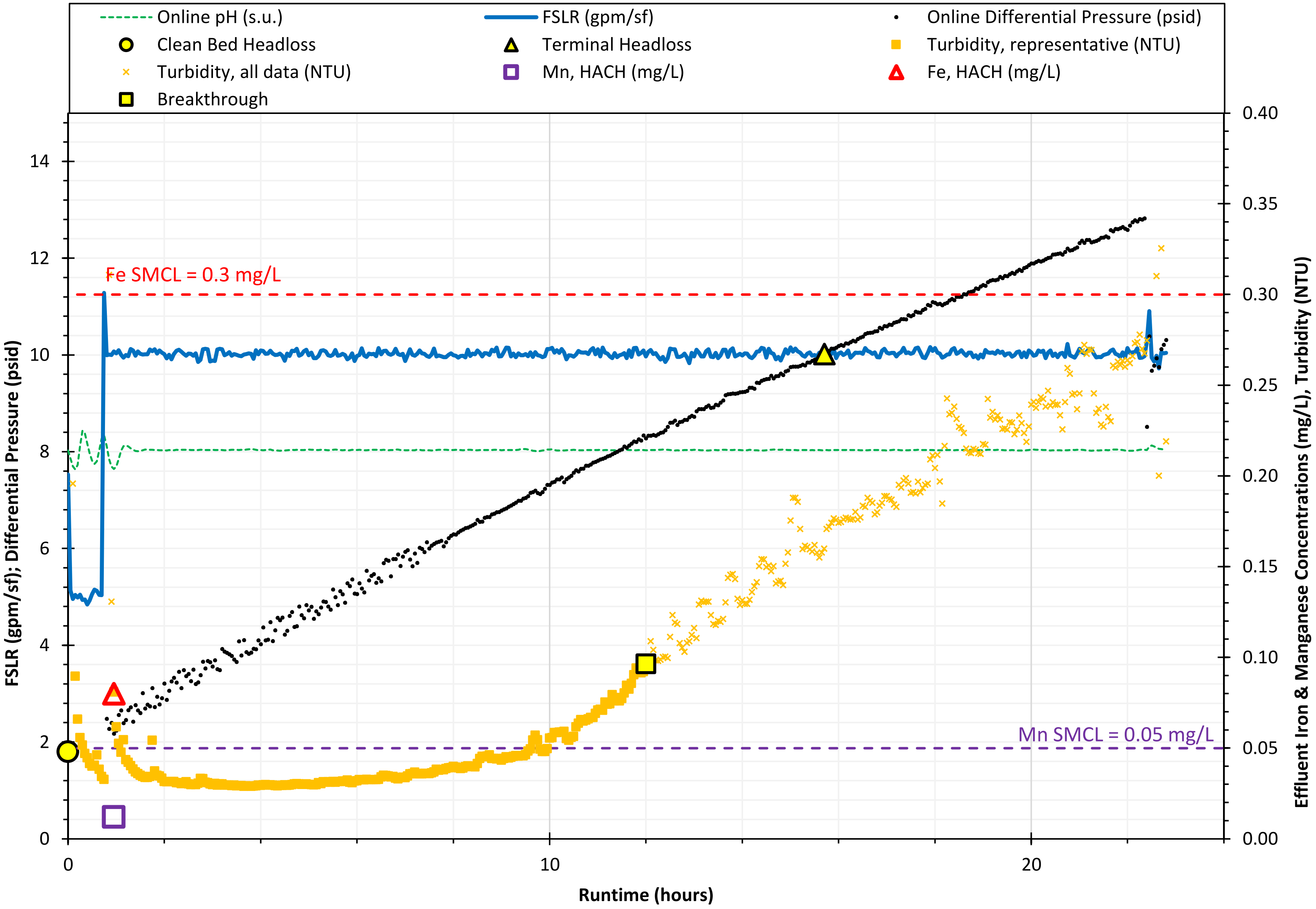


Figure E-36: Operating Conditions for Adsorptive Filter D (Pyrolusite-High pH) Trial D.3
SHARON MA, Well 2 - Feb 21 to Feb 22, 2023

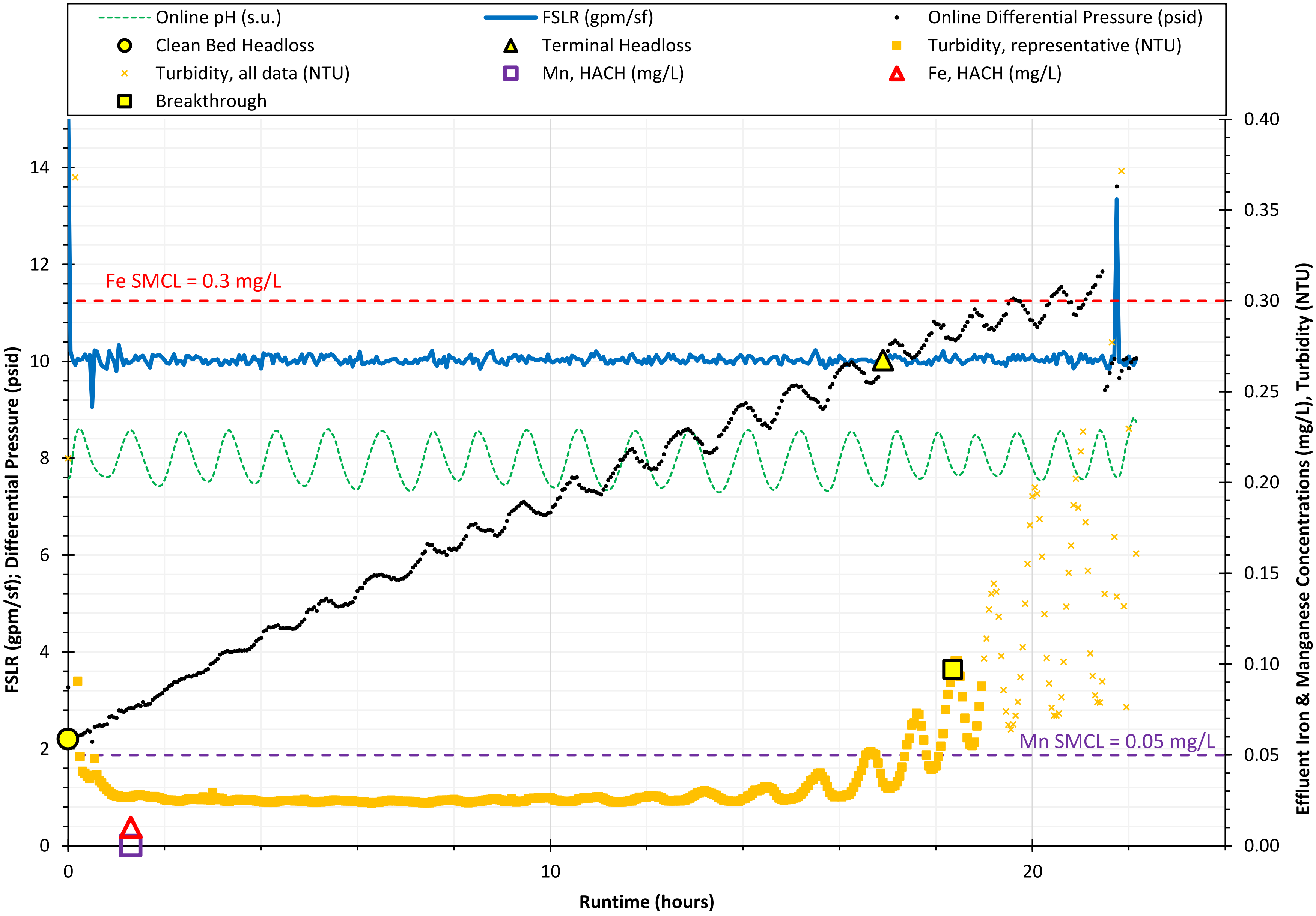


Figure E-37: Operating Conditions for Adsorptive Filter D (Pyrolusite-High pH) Trial D.4
SHARON MA, Well 2 - Feb 22 to Feb 23, 2023

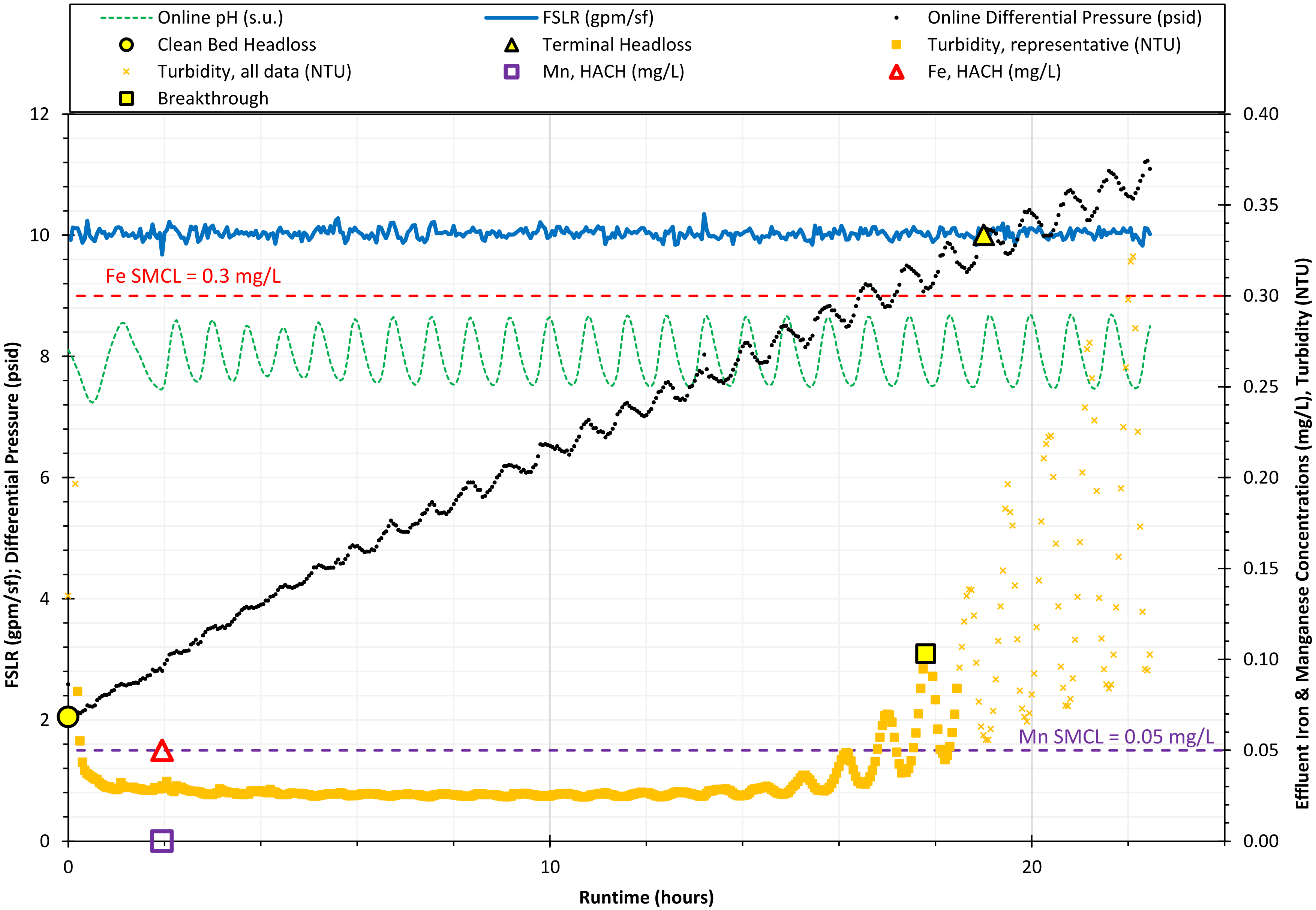


Figure E-38: Operating Conditions for Adsorptive Filter D (Pyrolusite-High pH) Trial D.5
SHARON MA, Well 2 - Feb 23 to Feb 24, 2023

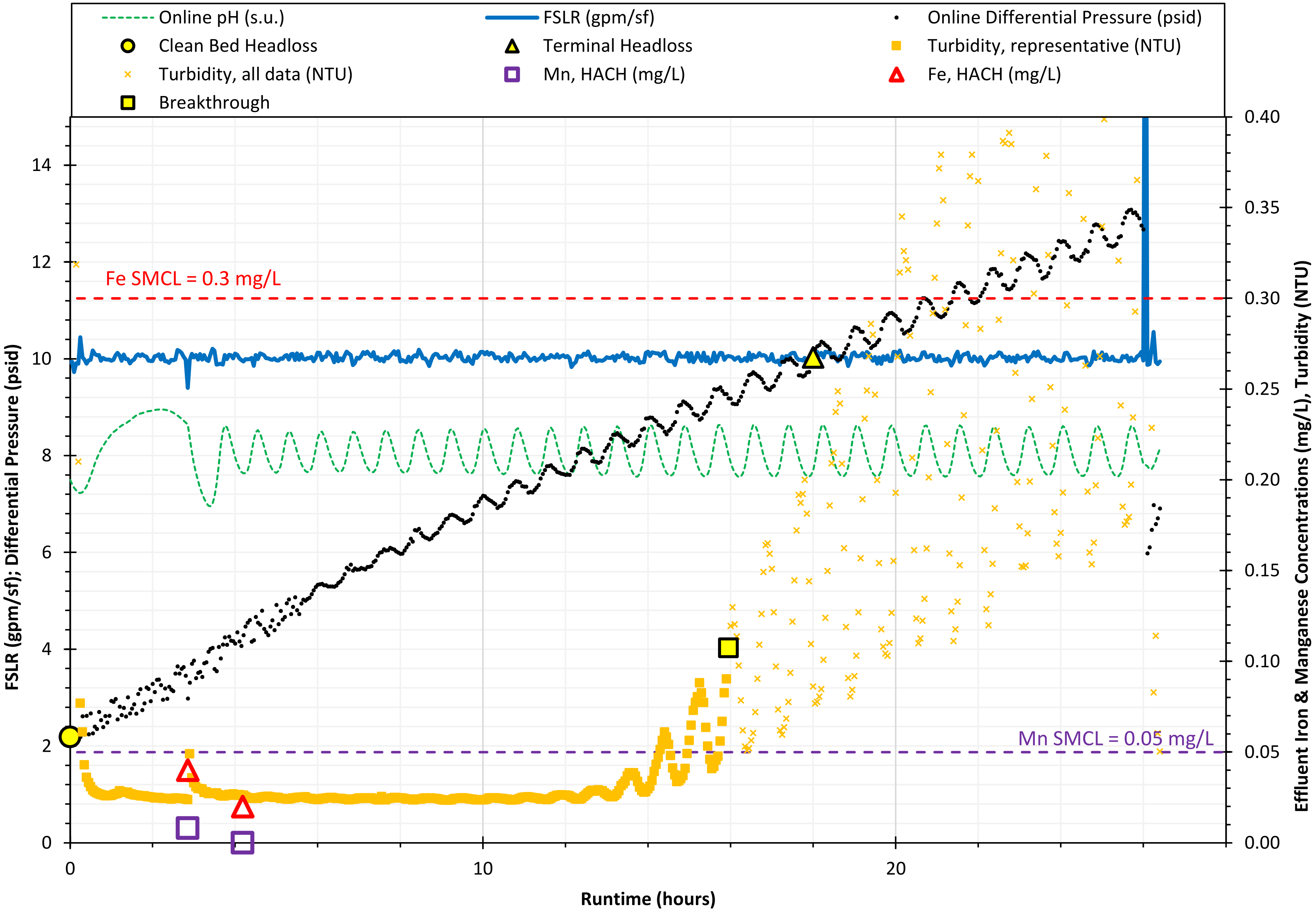


Figure E-39: Operating Conditions for Adsorptive Filter D (Pyrolusite-High pH) Trial D.6
SHARON MA, Well 2 - Feb 24 to Feb 27, 2023

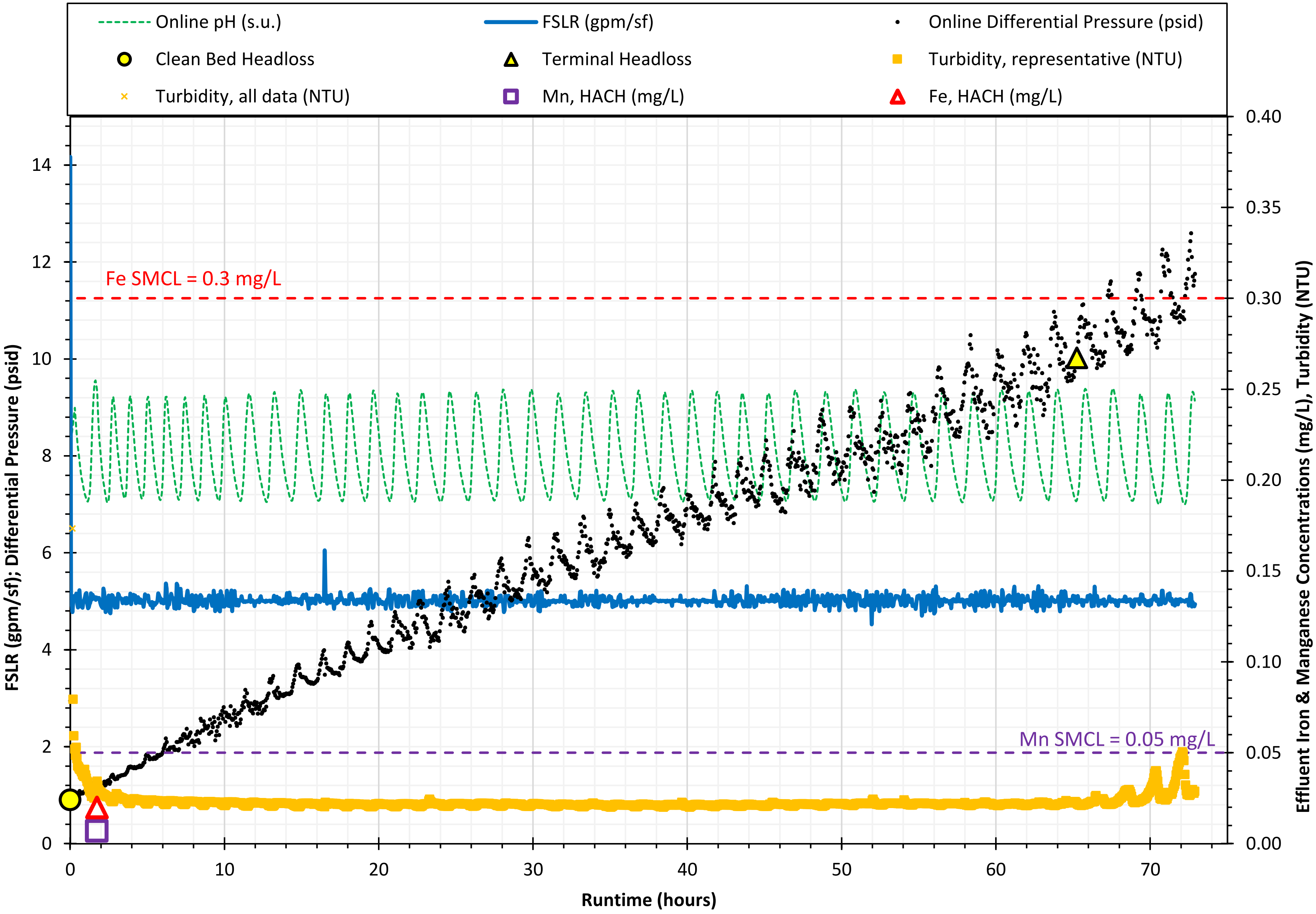


Figure E-40: Operating Conditions for Adsorptive Filter D (Pyrolusite-High pH) Trial D.7
SHARON MA, Well 2 - Feb 27 to Feb 28, 2023

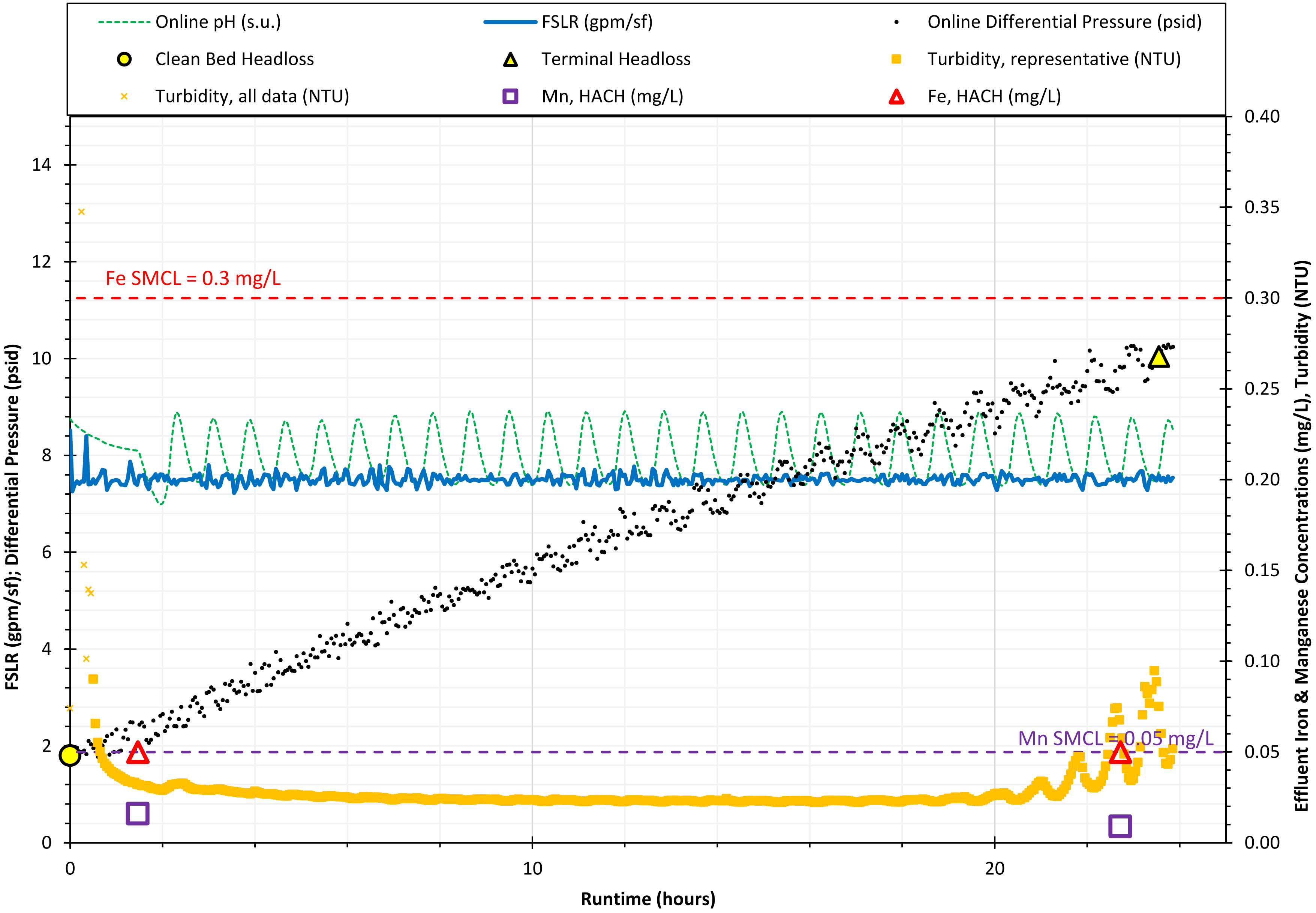


Figure E-41: Operating Conditions for Adsorptive Filter D (Pyrolusite-High pH) Trial D.8
SHARON MA, Well 2 - Feb 28 to Mar 02, 2023

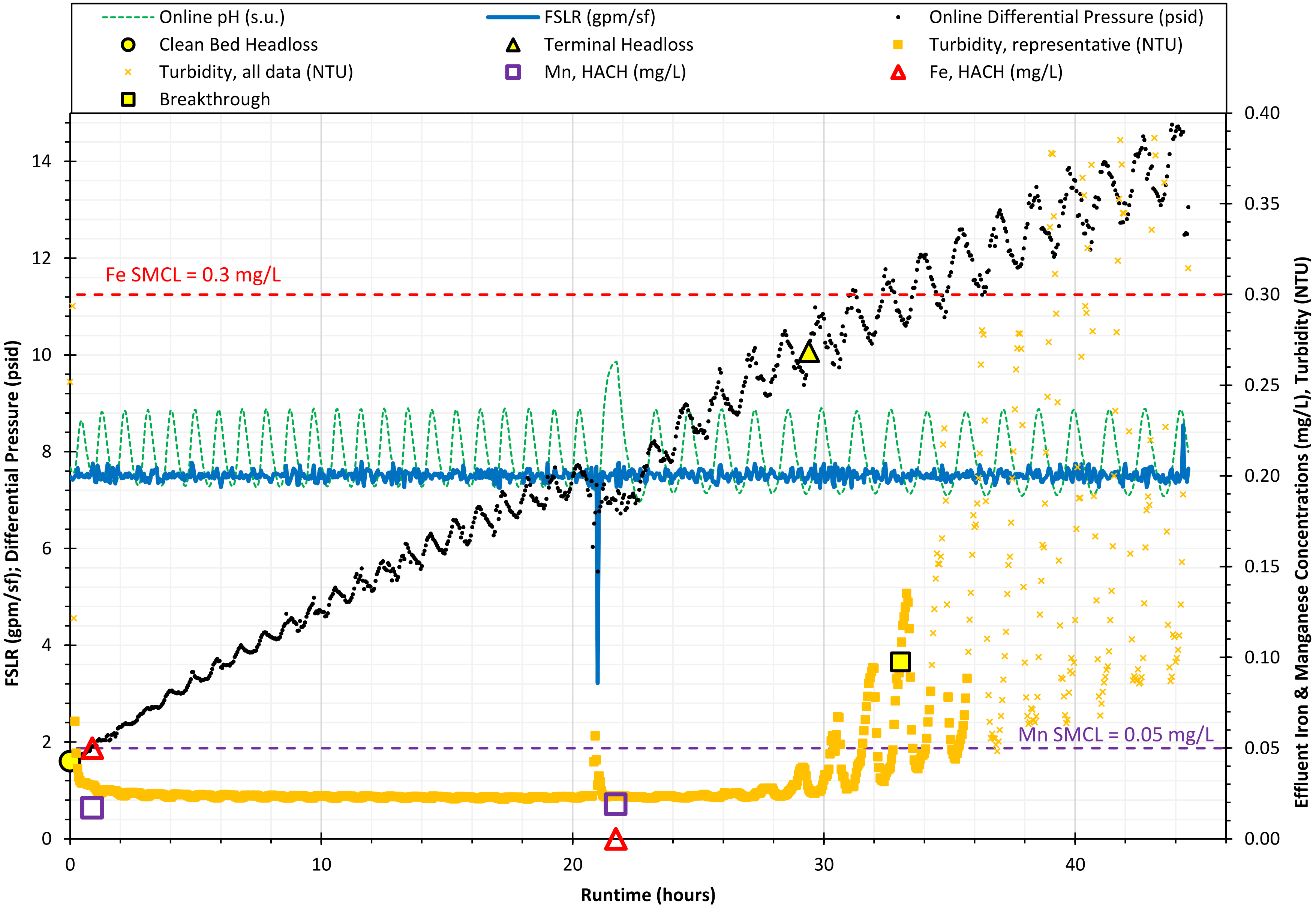


Figure E-42: Operating Conditions for Adsorptive Filter D (Pyrolusite-High pH) Trial D.9
SHARON MA, Well 2 - Mar 02 to Mar 06, 2023

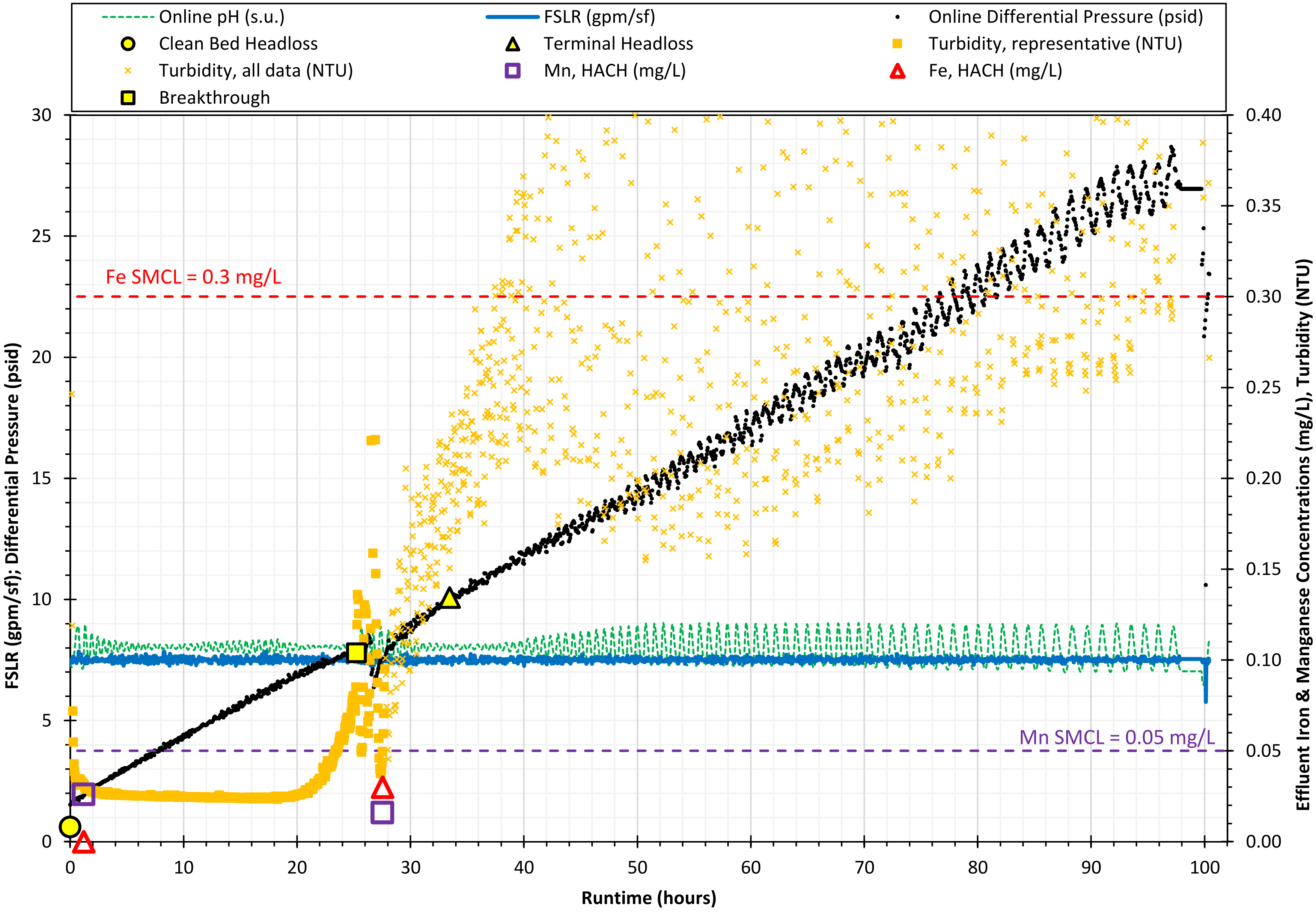


Figure E-43: Operating Conditions for Adsorptive Filter D (Pyrolusite-High pH) Trial D.10
SHARON MA, Well 2 - Mar 06 to Mar 08, 2023

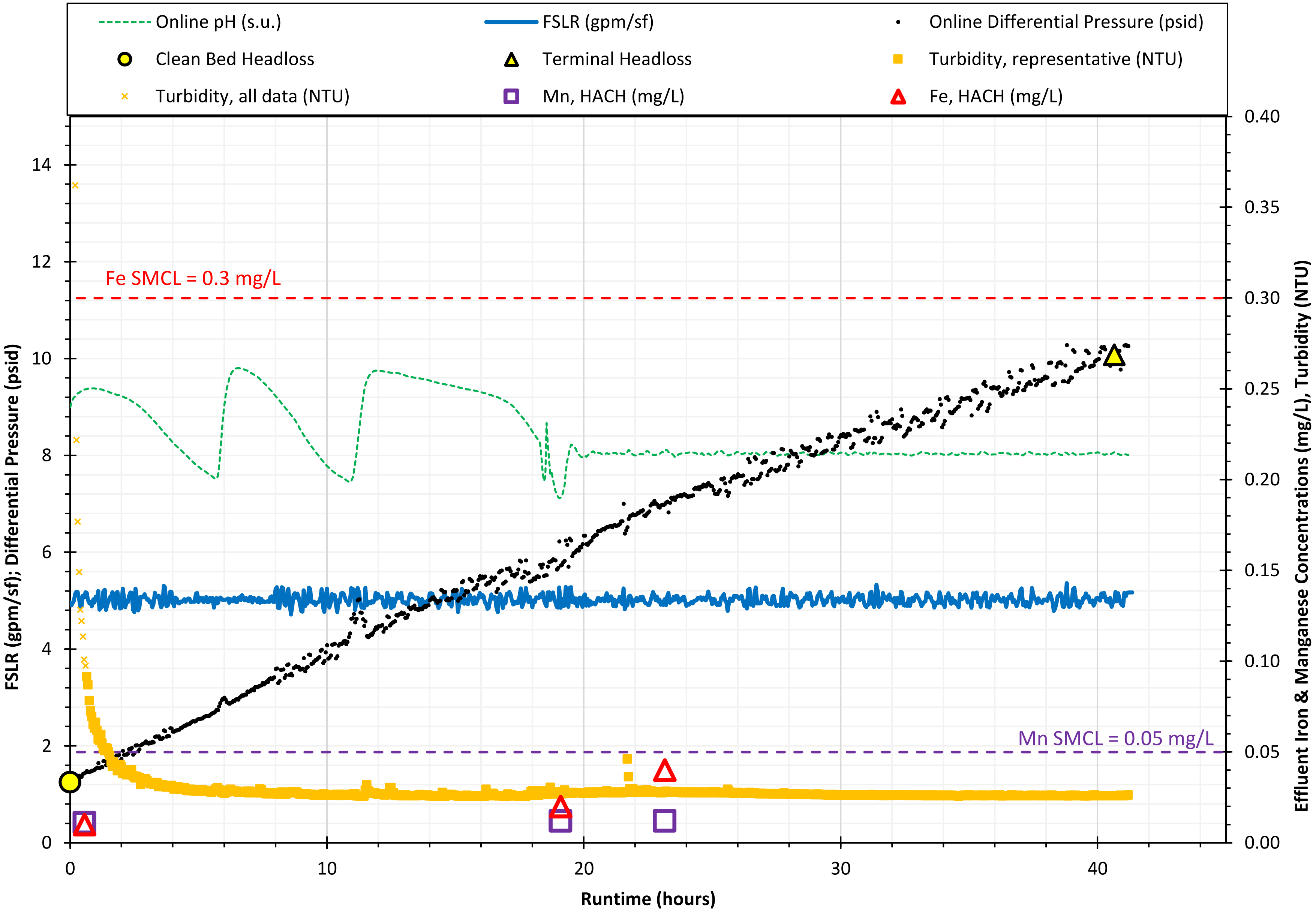
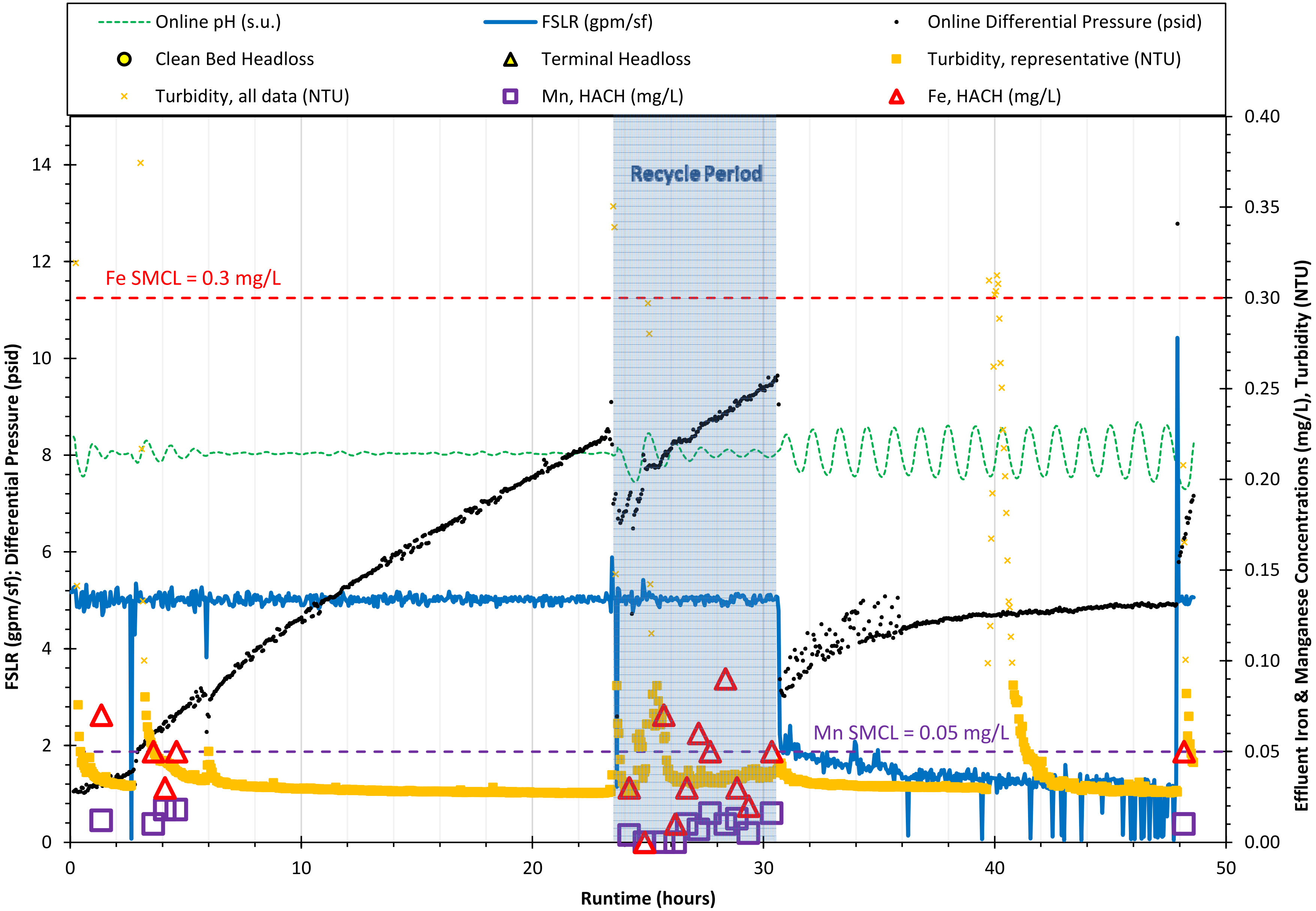


Figure E-44: Operating Conditions for Adsorptive Filter D (Pyrolusite-High pH) Trial D.11
SHARON MA, Well 2 - Mar 08 to Mar 10, 2023



ATTACHMENT B

WS Certification Form

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Drinking Water Program

WS Certification Form

For Drinking Water Program (Water Supply) Permits or Approvals

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Certification

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

tab ✓

return ✗

"I certify, under penalty of law, that this application and all attachments were prepared under my supervision, in accordance with a system designed to ensure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information submitted in this application, the information submitted is, to the best of my knowledge and belief, true, accurate and complete."

Authorized Signature	August 25, 2023 Date
Alston W.C. Potts, PE Print Name	Project Manager Position/Title
Alston W.C. Potts, PE Professional Engineer (if applicable)	56074 P.E. License Number

COMMONWEALTH OF MASSACHUSETTS
ALSTON W.C. POTTS
CIVIL
NO. 56074
REGISTERED PROFESSIONAL ENGINEER

08/25/2023

ATTACHMENT C

Wells 2, 3, and 4 Water Treatment Plant Preliminary Design Drawings

WELLS 2, 3, AND 4
WATER TREATMENT PLANT

TOWN OF SHARON, MA

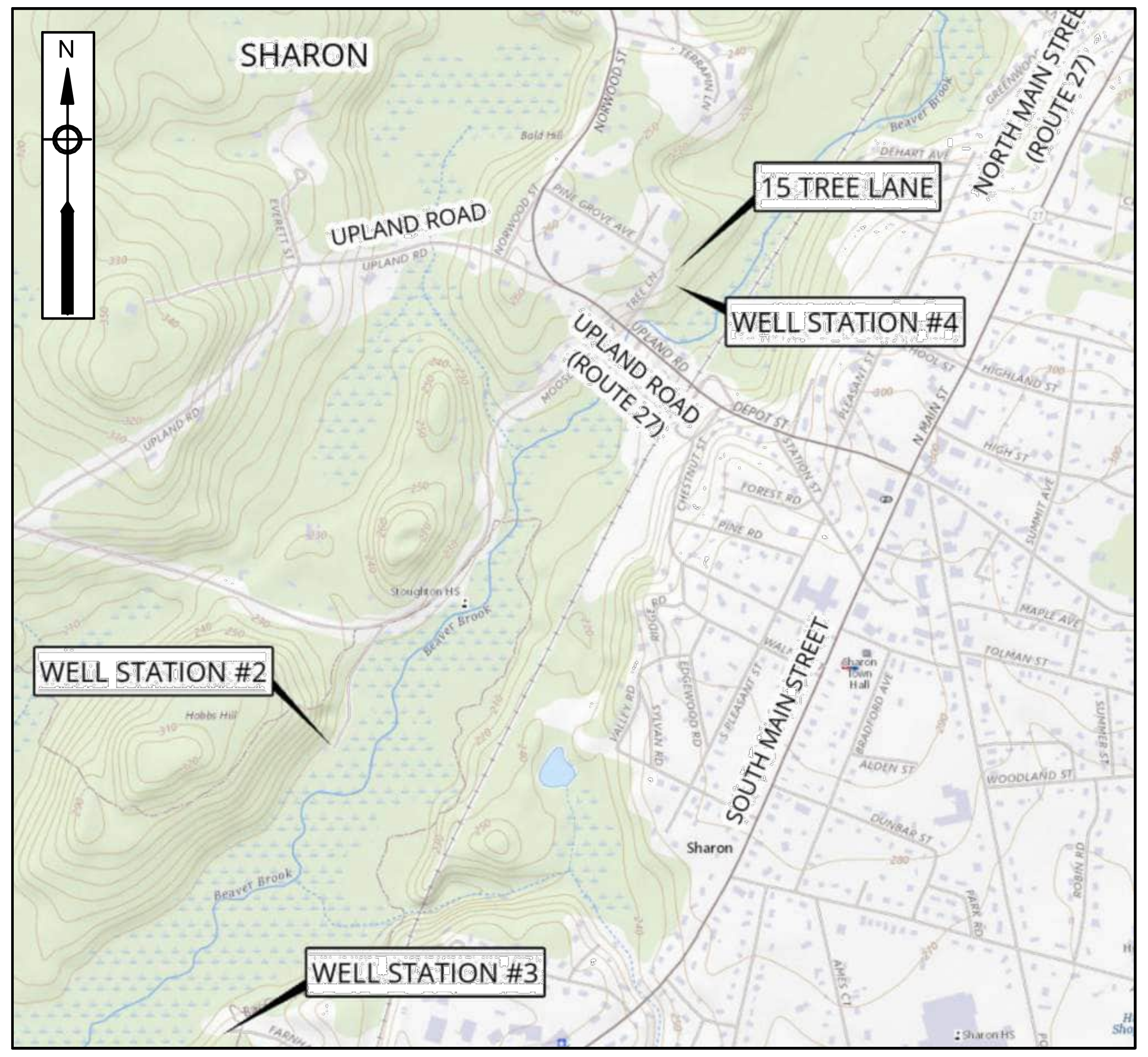
PUBLIC WORKS SUPERINTENDENT
ERIC HOOPER, P.E.

TOWN ENGINEER
PETER O'CAIN, P.E.

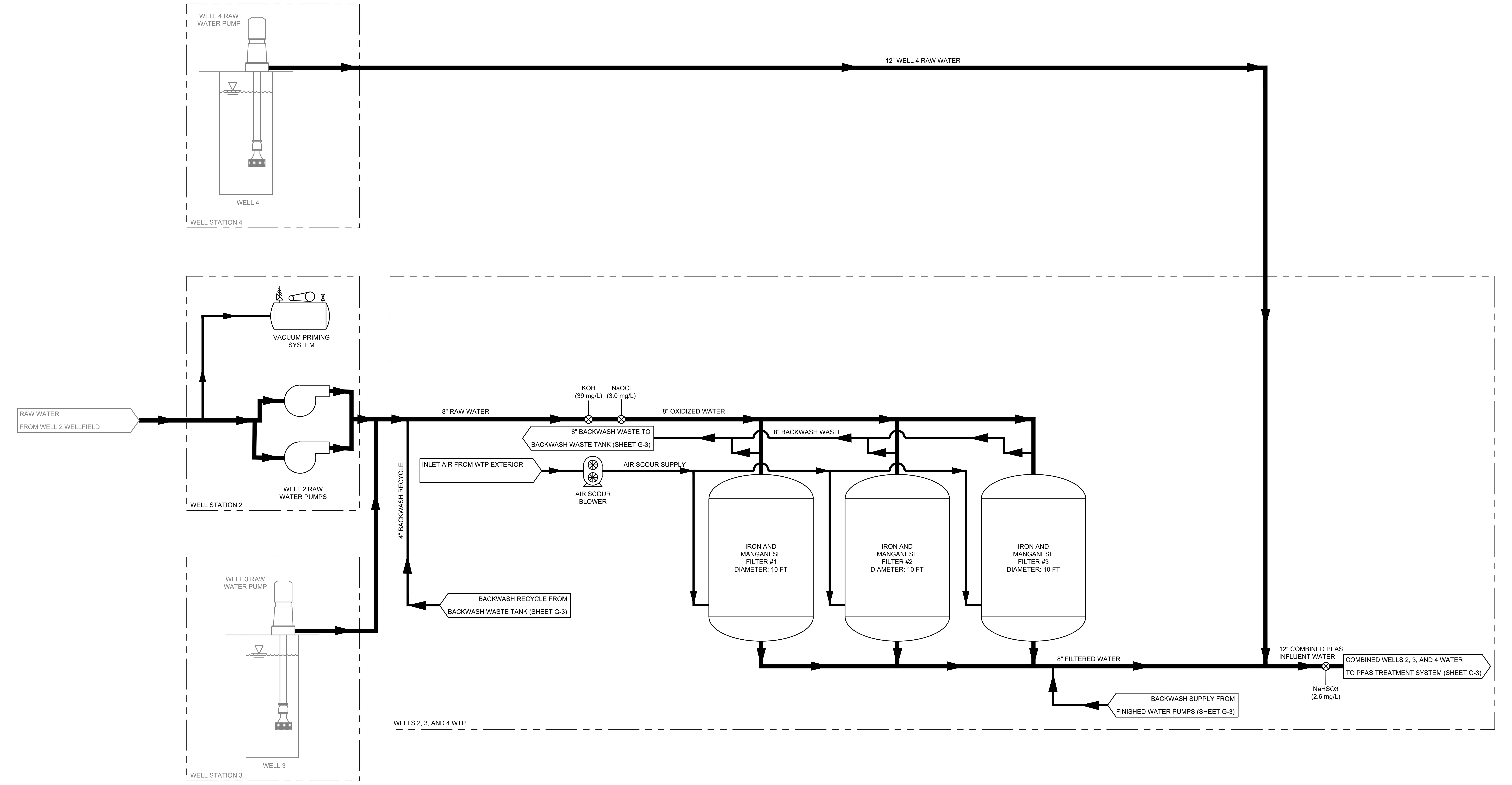
WATER DIVISION SUPERVISOR
ROBERT TERPSTRA

JOB NO. 245-2103
MAY 2023
PRELIMINARY DESIGN

ENVIRONMENTAL PARTNERS
— An Apex Company —



VICINITY MAP
1"= 1,000'



NOTES:
1. ALL CHEMICAL DOSES AS DRY PRODUCT.

ENVIRONMENTAL
PARTNERS
— An Apex Company —

MARK	DATE	DESCRIPTION

Scale	N.T.S.
Date	MAY 2023
Job No.	245-2103
Designed by	GAR/AWCP
Drawn by	GAR
Checked by	AWCP
Approved by	ASK

THIS LINE IS ONE INCH LONG WHEN PLOTTED AT FULL SCALE ON A 22" X 34" DRAWING

WELLS 2, 3, AND 4 WATER TREATMENT PLANT
TOWN OF SHARON, MA

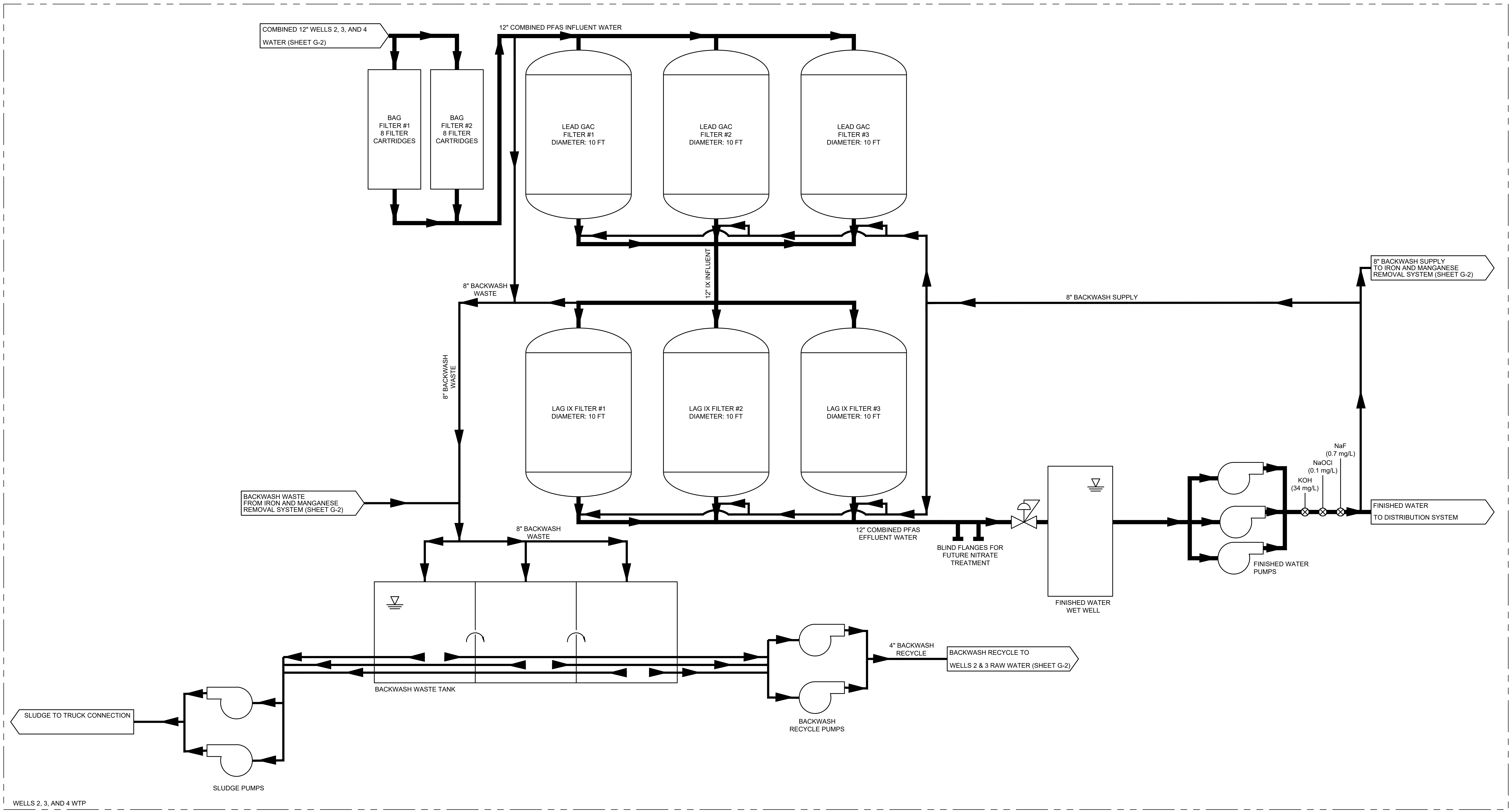
PROCESS FLOW DIAGRAM I

PRELIMINARY DESIGN

Sheet No.

G-2

Drawing file: I:\Sharon, MA.245\245-2103 Well 4 PFAS Treatment System\04 Preliminary Design\Drawings\CAD\01 General Sheets.dwg Plot Date: May 15,2023-8:00am



NOTES:
1. ALL CHEMICAL DOSES AS DRY PRODUCT.

ENVIRONMENTAL PARTNERS
— An Apex Company —

MARK	DATE	DESCRIPTION		
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			Date	MAY 2023
			Job No.	245-2103
			Designed by	GAR/AWCP
			Drawn by	GAR
			Checked by	AWCP
			Approved by	ASK

THIS LINE IS ONE INCH LONG WHEN PLOTTED AT FULL SCALE ON A 22" X 34" DRAWING

WELLS 2, 3, AND 4 WATER TREATMENT PLANT
TOWN OF SHARON, MA

PROCESS FLOW DIAGRAM II

PRELIMINARY DESIGN

Sheet No.
G-3

Drawing file: I:\Sharon, MA.245\245-2103 Well 4 PFAS Treatment System\04 Preliminary Design\Drawings\CAD\01 General Sheets.dwg Plot Date: May 23,2023-11:48am

PLAN

SCALE: 3/16" = 1'-0"

ENVIRONMENTAL PARTNERS
— An Apex Company —

MARK	DATE	DESCRIPTION

Scale	AS SHOWN
Date	MAY 2023
Job No.	245-2103
Designed by	GAR/AWCP
Drawn by	GAR
Checked by	AWCP
Approved by	ASK

THIS LINE IS ONE INCH LONG WHEN PLOTTED AT FULL SCALE ON A 22" X 34" DRAWING

WELLS 2, 3, AND 4 WATER TREATMENT PLANT
TOWN OF SHARON, MA

PROCESS MECHANICAL FIRST FLOOR PLAN

PRELIMINARY DESIGN

Sheet No.

M-1

Drawing file: I:\Sharon, MA.245\245-2103 Well 4 PFAS Treatment System\04 Preliminary Design\Drawings\CAD\07 Mechanical Sheets.dwg Plot Date: May 23,2023-8:22am

PLAN

SCALE: 3/16" = 1'-0"

ENVIRONMENTAL PARTNERS
— An Apex Company —

MARK	DATE	DESCRIPTION

Scale	AS SHOWN
Date	MAY 2023
Job No.	245-2103
Designed by	GAR/AWCP
Drawn by	GAR
Checked by	AWCP
Approved by	ASK

THIS LINE IS ONE INCH LONG WHEN PLOTTED AT FULL SCALE ON A 22" X 34" DRAWING

WELLS 2, 3, AND 4 WATER TREATMENT PLANT
TOWN OF SHARON, MA

PROCESS MECHANICAL LOWER LEVEL PLAN

PRELIMINARY DESIGN

Sheet No.

M-2

Drawing file: I:\Sharon, MA.245\245-2103 Well 4 PFAS Treatment System\04 Preliminary Design\Drawings\CAD\07 Mechanical Sheets.dwg Plot Date: May 23,2023-12:39pm

ENVIRONMENTAL PARTNERS

— An Apex Company —

1900 Crown Colony Drive, Suite 402
Quincy, MA 02169
P: 617.657.0200 F: 617.657.0201

envpartners.com