UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO ATTENTION OF
ECW-15J

Region 5 Enforcement and Compliance Assurance Division
SDWA DRINKING WATER INSPECTION REPORT

City of Benton Harbor

Berrien County Michigan

Inspection Date(s):	September 20 to September 27, 2021		
Owner/Company Name:	City of Benton Harbor		
System Name	Benton Harbor PWS		
System Location	601 North Ridgeway Drive		
City, State, Zip Code	St. Joseph, Michigan 49085		
County	Berrien		
Mailing Address:	601 North Ridgeway Drive		
City, State, Zip Code	St. Joseph, Michigan 49085		
System Contact	Abul Ahmed		
	(269) 927-8471		
PWS ID No:	MI0000600		
Personnel Participating in Inspection:			
Jonathan Moody	Environmental Engineer, Lead	Moody.Jonathan@epa.gov	312-886-7570
Naomi Huff	Life Scientist	huff.naomi@epa.gov	312-353-4934
Joan Rogers	Environmental Scientist	rogers.joan@epa.gov	312-886-2785
Jenny Wilson	Environmental Engineer	wilson.jennifera@epa.gov	312-353-3115
Abul Ahmed	Operator in Charge Treatment System	aahmed@fv-operations.com	616-588-2900
Ernest Sarkipato	Distribution Engineering Specialist	SARKIPATO@michigan.gov	616-307-0261
Ellis Mitchell	City Manager	emitchell@bhcity.us	269-927-8457
EPA Lead Inspector Signature/Date	JONATHAN MOODY Digitally signed by JONATHAN MOODY Date: 2021.10.27 13:30:15 -05'00'		
Reviewed by: Team Leader Signature/Date	MARK CONTI Digitally signed by MARK CONTI Date: 2021.10.27 14:50:42 -04'00'		
Approved by: Section Chief Signature/Date	BROOKE FURIO Digitally signed by BROOKE FURIO Date: 2021.10.27 16:12:27 -04'00'		

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1 INTRODUCTION

1.1 Purpose of the Inspection

On September 20 to September 27, EPA Region 5 conducted an inspection at the City of Benton Harbor public drinking water system (System) in Berrien County, Michigan. The scope of the inspection was an onsite review of the water source, facilities, equipment, operation, maintenance, and monitoring and reporting of a public water system (PWS) to evaluate the adequacy of the PWS, its sources and operations, and the distribution of safe drinking water. At the time of the inspection, the System had no unresolved violations of the National Primary Drinking Water Regulations (NPDWRs) but had recent Action Level Exceedances (ALEs) of the Lead and Copper Rule (LCR) and several Treatment Technique (TT) and monitoring (MR) violations.

1.2 System Description

The System is a community water system (CWS) serving approximately 9,800 full time residents in southwest Michigan. The System is owned by the City of Benton Harbor and operated by a contractor, F&V Operations and Resource Management, Inc. (F&V). The source water is Lake Michigan, and raw water is provided through a single intake location. The treatment system is a conventional filtration treatment process including coagulation, flocculation, sedimentation, and filtration. Chemical additions include alum, aqueous chlorine mixture for free chlorine disinfection, fluoride, and a blended phosphate for corrosion control.

At the time of the inspection, the treatment system was being run for approximately 6 hours a day. A 2-million-gallon (MG) reservoir and a 600,000-gallon high service suction well with a variable speed pump provided pressure and storage capacity in place of an elevated tank. The average daily demand was between 1.1 and 1.3 MGD for a service population of approximately 9,800.

1.3 Compliance History

Below is a summary of the violations since January 2020 in EPA Enforcement Response Plan Tool at the time of the inspection.

Code	Type	Rule	Compliance Start	Compliance End	Violation Confirmed in July 2021 ERP Tool
52	MR	Lead and Copper Rule	1/1/2020		Yes
03	MR	Synthetic Organic Chemicals	1/1/2020	3/31/2020	Yes
65	TT	Lead and Copper Rule	3/2/2020		Yes
03	MR	Synthetic Organic Chemicals	4/1/2020	6/30/2020	Yes
65	TT	Lead and Copper Rule	8/30/2020		Yes

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27	MR	Stage 1 Disinfectants and Disinfection Byproducts Rule	1/1/2021	3/31/2021	Yes
46	TT	Stage 1 Disinfectants and Disinfection Byproducts Rule	1/1/2021	3/31/2021	Yes

Michigan Department of Environment, Great Lakes, and Energy (EGLE) completed a sanitary survey on September 14, 2018. The survey identified significant deficiencies in four of the eight required categories and additional significant deficiencies in the financial and other categories. There were also deficiencies in five of the required categories.

Source:
- Deficiency: Need to inspect intake and restart mussel control

Treatment:
- Significant Deficiency: Coagulant feed needs ample mixing energy to be effective
- Deficiency: Finished water meters not functioning, can't determine Contact Time (CT).

Distribution System:
- Significant Deficiency: Formalize program to turn valves & flush hydrants.
- Significant Deficiency: Cross Connection Program needs complete overhaul
- Significant Deficiency: Many areas of low flow/no flow
- Deficiency: Aging water main replace is lacking

Finished Water Storage:
- Deficiency: Reinspection of the elevated storage tank is overdue

Monitoring and Reporting:
- Significant Deficiency: Fix continuous chlorine analyzer
- Deficiency: Monthly Operating Report, Inaccurate information on treated water

System Management & Operations:
- Significant Deficiency: Must commit to timeline for compliance
- Significant Deficiency: Financial & Managerial Capacity is not met
- Significant Deficiency: Hydraulic model calibration indicated areas of low flow

Financial
- Significant Deficiency: Collection of rates is inefficient and ineffective
- Significant Deficiency: Rates insufficient to cover capital improvements

Other
- Significant Deficiency: Supervisory Control and Data Acquisition (SCADA) system needs additional functionality

The City of Benton Harbor entered into an Administrative Consent Order (ACO) with the State of Michigan signed March 5, 2019. The Order required:

1. Submit to the EGLE a completed rate study from a qualified professional consultant, along with a plan to implement rate increases as recommended by the study;

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2. Upgrade the water plant SCADA system to allow for storage and easy access to required regulatory data including turbidity and chlorine, alarming for regulatory minimum levels, and potential automation of some water plant operations;
3. Install metering capabilities on the finished water no later than April 1, 2019;
4. Make necessary improvements to the water treatment facility in order to have a functioning and reliable continuous chlorine analyzer on the finished water tap;
5. Obtain an adequately licensed operator in charge, solely dedicated to the water distribution system;
6. Submit a proposal for optimal corrosion control treatment or a corrosion control study to the EGLE;
7. Submit to EGLE an implementation plan for a consistent and equitable rate collection program to minimize the number of unpaid bills and streamline the collections process;
8. Submit an updated cross connection program for EGLE approval, incorporating the City's plan for implementing control of residential accounts, and for obtaining adequate personnel to implement the City's cross connection control program;
9. Install necessary modifications at the water treatment plant to inject coagulant chemical at an EGLE-approved rapid mix location, and develop a standard operating procedure for feeding coagulant;
10. Submit a plan to EGLE for inventorying and ongoing maintenance of distribution valves and hydrants, no later than June 1, 2019;
11. Conduct professional inspection of the elevated tank interior and exterior;
12. Install working mussel control system at the intake; and
13. Repair filter to waste valves.

The ACO was amended on August 5, 2020. The Amended ACO (AACO) changed due dates in the original ACO and added the following requirements:

1. Complete a technical, managerial, and financial capacity study (Capacity Study);
2. Complete a Staffing Plan to address findings from the Capacity Study;
3. Comply with the monitoring and reporting requirements; and
4. Have a qualified third-party consultant submit a corrosion control optimization study.

2 INSPECTION SUMMARY

2.1 Virtual Opening Conference

Written notice of the inspection was provided to Ellis Mitchell, City Manager for Benton Harbor, on September 13, 2021.

The inspection opening conference began at 1200 Eastern on Monday, September 20, 2021. Jonathan Moody, EPA Region 5, used a virtual conference line to start the opening conference. The EPA field inspection team members Naomi Huff, Joan Rogers, and Jennifer Wilson participated in the opening conference as well as other EPA staff, Victoria Anderson, Valerie Bosscher, Taylor Girouard, and Jeff Lippert and staff from EGLE, Michael Bolf, Ernest Sarkipato, Brian Thurston, and Ryan VanDerWoude. The City of Benton Harbor was represented by Mr. Mitchell, and individuals from F&V, Abul Ahmed, Darold L Harlan, Matt Hoiser, Robert Jones, Blair Selover, and Catherine Winn, as well as Jason Marquardt with Abonmarche, which provide engineering services to the City of Benton Harbor.

The current operator in charge of the treatment works is an employee of F&V named Abul Ahmed. Mr. Ahmed began serving as the operator in charge in May 2021. Prior to Mr. Ahmed, H. George Regan and Catherine Winn, employees of F&V, were the operators in charge beginning November 2020. Prior to F&V, the water treatment plant was under the operation of a City of Benton Harbor employee, Michael O'Malley. Mr. O'Malley was the operator in charge of the plant from sometime in 2008 until 2010, when he was terminated, and then again from July 2016 until November 2020, when he was placed on administrative leave. At the time of the inspection, Benton Harbor had two operators and one operator in training. The operators were Doug Vanderploeg, who has been with Benton Harbor since 1992, and Denny Edwards, who has been with the Benton Harbor since 1994. Mr. Edwards was not present for the duration of the onsite inspection.

Lead and Copper Rule:

EPA requested a copy of the Lead and Copper Rule sampling plan. A plan was not available at the time of the inspection. EPA also requested copies of the LCR monitoring results, Public Education materials and distribution lists for those materials. Partial copies of these documents were provided as discussed later in this report.

2.2 Physical Areas Inspected

The field portion of the inspection began on Tuesday September 21, 2021, at the Benton Harbor Water Treatment Plant located in St. Joseph, Michigan. The inspection started at the low service pumps. There are setups for five low service pumps. At the time of the inspection, it was unknown if all five were still functional. The raw water enters the plant at the small room shown in Photos 11 and 12 in Appendix A. The lighting in that room was not functioning, and the paint on the ceiling appeared to be flaking. Water could be seen below the grating and it was unclear if this water was connected to the lower raw water wet well. The yellow pipes in this room were historically used to deliver chlorine to the intake, but at the time of the inspection, this system was not functioning. The first treatment component is an inlet screen. The control panel for the inlet screen is shown Photos 14 and 15 in Appendix A. Mr. Ahmed said that they do not remove waste from the screen. At the time of the inspection, there were no maintenance records available.

Mr. Moody asked Mr. Ahmed to show him the location where chlorine is first injected into the raw water. Mr. Ahmed was not sure where that injection was located. There were several possible injection locations shown in Photos 44 through 47 in Appendix A. The yellow pipes are chlorine, the orange pipes are polymer feeds and the blue pipes are fluoride. All valves were open. The large diameter green pipes are for raw water and the large diameter white pipes are settled water. The mechanical equipment shown in Photos 29 and 30 in Appendix A is associated with the out of service accelator clarifiers located north of the existing water treatment plant. It was ultimately determined that the injection point shown in Photo 44 in Appendix A was the location where chlorine is first added to the raw water.

Photos 56 through 59 and 61 in Appendix A show a backflow prevention device installed on a water softener in the basement of the treatment building. The inspection tag indicated that this

unit was installed in 2017 and was tested in March and December 2017, but it had not been tested since December 2017.

There was a turbidimeter and continuous chlorine analyzer on the raw water line. Both pieces of equipment are shown in Photo 64 in Appendix A. At the time of the inspection, the continuous chlorine analyzer was out of service and the turbidimeter was reading approximately 1.192 Nephelometric Turbidity Unit (NTU). Two other pieces of monitoring equipment were visible at this location; one is shown in Photo 66 in Appendix A. Mr. Ahmed did not know what these pieces were intended to monitor or if they were connected to the SCADA system.

The inspection team proceeded to the plate settler building. There are two treatment trains each equipped with rapid mixers, flocculators and plate settlers. At the time of the inspection, the north treatment train was active, and the south treatment train was not active and could not be returned to service until mechanical repairs were completed. Per Mr. Ahmed, chlorine addition to the raw water is adjusted based on a grab sample from the end of the plate settlers. The set point was 3 parts per million (ppm) and samples were collected every 2 hours, with 3 samples per day. The alum addition occurs directly into the mixing chamber upstream of the flocculator. The dose of the alum is not adjusted, and Mr. Ahmed did not know the alum dose setpoint.

Sample cups for collecting grab samples were present along the railing of the flocculator tank. Mr. Ahmed said samples of the turbidity are occasionally taken as needed, but no routine monitoring is done in that tank. A sludge judge was also present at the railing for the plate settler. Mr. Ahmed said that monitoring of the sludge levels is not part of the routine monitoring. The sludge level is checked once every two weeks or once a month, but there is not a fixed schedule, and the results are not recorded. The sludge removal system was not fully operational at the time of the inspection.

Mr. Moody asked Mr. Ahmed to demonstrate the use of the sludge judge. Photos 73 through 75 in Appendix A document the process.

The inspection team proceeded to the basement below the plate settlers. There was a continuous turbidimeter and continuous chlorine analyzer at the downstream end of the plate settlers. At the time of the inspection, the continuous chlorine analyzer was not functioning and the turbidimeter was reading 0.041 NTU. Each plate settler treatment train had its own turbidimeter, but there was only one continuous chlorine analyzer.

At the west end, or upstream side of the plate settlers, of the north treatment train, there was effervescence or deposits observed, which are consistent with a leak. A trough was poured along the perimeter at the base of the tanks which appeared to drain to a sump at the west end of the tanks. The trough surrounding the north tank was being utilized for draining the condensate from portable dehumidifiers. The trough surrounding the south tank was filled with water even though it did not have any condensate lines draining to it, and the tank was empty and out of service.

There were readouts for the flow meters at both the north and south plate settlers. The system representatives were unsure where the flow meters were located for these devices. The meter on

the north tank, which was in service, was reading approximately 2,100 gallons per minute (gpm) at the time of the inspection, and it had been last calibrated on February 3, 2017. The readout on the south tank was showing 2,200 gpm, though the tank was not in service and was empty.

There was a small machine shop between the plate settlers and the alum storage room. This room is shown in Photo 103 in Appendix A. There was water covering the floor of this room. A floor drain could be seen below the surface of the water, but it was not draining the water out of the room. It was unclear where the water came from or where the blockage was located.

At the far west end of the plate settler building was a room with day tanks for the alum feed. There were two tanks in the room, but only one was in use at the time of the inspection. The tank recently overflowed, which resulted in a buildup of material on the top of the tank and in the containment surrounding the tank. This condition is shown in Photos 109 and 117 in Appendix A. Mr. Ahmed said the day tank is filled from the bulk tank by pressing and holding a button on a control panel next to the containment for the day tank. There is no overflow protection because the operator must hold the button while the pump which fills the tank is running. The day tank was also not plumbed for an overflow. It appeared that alum had come out of the joints and seals at the top of the tank. It was speculated by Mr. Ahmed that the overflow occurred when an operator had improvised a way to hold the button without being present at the tank. The overflowed alum had been pumped into a series of plastic drums. Some of the drums were reused corrosion control chemical drums. Mr. Ahmed said there was a plan to return the material to the day tank so that it could be used in the alum feed.

The inspection team proceeded to the filters. There are 12 filters in total, and they are operated in pairs. At the time of the inspection, filters 1, 2, 3, and 4 had been offline since at least 2018 and could not be put back into service without repairs. The condition of filters 1 and 2 is shown in Photos 136 and 137 in Appendix A. The overflow troughs were severely corroded and pieces had begun to fall into the filter media.

Filters 9 and 10 were also out of service during the inspection. The electric control for the waste valve was inoperable and had to be manually controlled if the filters were to be backwashed, so this set of filters was not being used. Filters 5, 6, 7, 8, 11 and 12 were in use during the inspection. Backwashes of the active filters occur every 110-130 hours of operation. The readouts for one of the continuous turbidity meters was shown in Photo 143 in Appendix A. The logging intervals for the continuous meters varied. Filters 5, 6, 8, and 12 had a 120-second logging interval and filters 7 and 11 had a 60-second logging interval. A filter backwash was observed during the second day of the inspection.

The inspection team proceeded to the pipe gallery beneath the filters. A large backflow prevention device was located in the pipe gallery. The line coming from the device was labeled for the filter wash. The device had no installation or inspection tag on it. This backflow prevention device is shown in Photo 164 in Appendix A. Combined filter effluent (CFE) samples are taken as grab samples from taps located in the pipe gallery. There is no location in the plant where a sample can be collected which represents the combination of all filters. The filters on the north side of the filter building are sampled from one tap and the filters on the south

side of the building are sampled at a second tap. The samples are analyzed and reported separately on the monthly operating reports. Photos 168 through 171 in Appendix A show the running taps where the CFE turbidity samples are collected. A second chlorine injection is done at the east end of the pipe gallery.

The inspection continued into the lowest level basement of the plant, which is below the filter pipe gallery and the low service pumps. This was the location where the readouts from the continuous individual filter effluent (IFE) were located. Mr. Ahmed said that he cleans the turbidimeters approximately once a month by opening the unit and swabbing sensor components. This was also the location where high service pumps pull water from the high service suction well. The phosphate corrosion control chemical is added to the line as it leaves the high service suction well. There is also a flow meter on this pipe. At the time of the inspection, the meter readout was showing 764 gallons per minute. The readout and the meter are shown in Photos 149 and 150 in Appendix A respectively.

When Mr. Moody first went into this room, the feed line to the phosphate injection had slipped and was kinked as shown in Photo 146 in Appendix A. Mr. Ahmed reattached the exterior tube to remove the kink. This corrected condition is shown in Photo 147 in Appendix A.

An example of one of the 12 Hach 1720E Turbidimeters is shown in Photo 153 in Appendix A. The active displays for the turbidimeters were for filters 3, 5, 6, 8, 11, and 12. It was assumed that the ID for number 3 was actually the meter for filter 7, since filter 3 had not been in service for several years, however this could not be confirmed during the inspection. Mr. Ahmed said that the turbidimeters are cleaned approximately once a month but he did not do the calibrations and did not know the schedule for calibrations.

Water was ponding on the floor of the lowest level basement and the source appeared to be a leaking pipe coming from a sump pump in the bottom of the stairwell to this level. This condition is shown in Photos 151 and 152 in Appendix A.

The inspection continued outside to the roof of the 2-million-gallon reservoir located north of the treatment buildings. There were 8 vents on the reservoir, and 3 of them had torn or missing screens. Photos 175 through 177 and 180 through 186 in Appendix A show these conditions. Several other locations had screens which may have been coarser than a No. 24 mesh. The hatches throughout were rusted and had vegetation covering them. They did appear to be the type of hatch which would have an overlap and a sanitary seal. The operators were unable to open the hatches without causing cross contamination, so the configuration of the hatch and the internal conditions of the overflows and tank could not be assessed.

The inspection team proceeded to the room containing the chlorine dosing equipment. A backflow prevention device in this room had a tag stating it had last been tested in June 2008.

The inspection continued to the point-of-entry (POE) chlorine monitoring location, which is in the laboratory at the water treatment building. At the time of the inspection, the continuous chlorine analyzer was offline. According to the operations staff, the unit had been offline for at least 2 weeks. No calibration or maintenance records were available for this unit.

The inspection team proceeded to the parking lot where there was a vent for the high service suction well. The screen on the vent was missing as shown in Photo 199 in Appendix A. The inspection team proceeded into the building where the roof of the high service suction well could be accessed. There was a flow meter installed on one of the lines and an aluminum hatch shown in Photo 209 in Appendix A. The operational status of the flow meter was unknown. The hatch did not appear to be of the sort which has an overlap and a sanitary seal. The hatch could not be opened, the operator was concerned this would result in contamination of the treated water in the high service well. A sheet of plywood appeared to be stuck to the roof of the high service suction well with tar as shown in Photo 207 in Appendix A. The concrete surrounding the plywood appeared to have been patched at some point in time, and it was unclear if the plywood was covering a deficiency in the roof structure.

The inspection team proceeded to the high service pumps. At the time of the inspection, the elevated storage tower was offline while it was being repaired. In order to maintain proper system pressure, a temporary variable frequency drive (VFD) was brought into the plant and connected to a high service pump. That pump is shown in Photo 217 in Appendix A. The status of the plant-wide emergency backup power system was unknown. To provide redundant electrical and mechanical systems while the tank was being repaired, the system had a second portable VFD and pump connected to a separate backup generator. The two pumps were controlled by a set of pressure gages shown in Photo 219 in Appendix A. To the left of those pressure gages was another continuous chlorine analyzer which was out of service during the inspection.

The second day of the inspection began with an observation of filters 5 and 6. The wash arms on filter 5 were not functioning at the time of the inspection. Photos 254 and 259 in Appendix A show filter 5 at the end of its wash cycle, which took approximately 12 minutes. The water above the filter media was noticeably cloudier than the water above filter 6 at the end of its wash cycle which is shown in Photo 277 in Appendix A. While the two filters were being backwashed, Mr. Moody observed filters 7, 8, 11, and 12. The flow meters on filters 11 and 12 were showing 338 and 290 gpm respectively. The flow meters on filters 7 and 8 were showing 734 and 735 gpm. The surface of the water above the filter media in filters 7 and 8 was turbulent, as shown in Photo 236 in Appendix A when compared to the surface of the water in filters 11 and 12 which is shown in Photo 238 in Appendix A. According to the sanitary survey completed in 2018, each filter has 349 square feet of surface area, a maximum loading rate of 4 gpm/sf and an average approved loading of 2 to 2.5 gpm/sf. This is a maximum flow of 1,396 gpm, and an average of 785 gpm.

Photo 231 in Appendix A shows the control panel for filters 5 and 6 during the backwash cycle. During the backwash for filter 5 the control panel's indicator lights were both illuminated indicating the filter to waste valve was open and closed. On the portion of the panel for filter 6, the indicator lights for the backwash valve and the filter to waste valve were both out, which gives no indication of the status of either of these valves. The operator did not use these lights and had no affirmative indicators that valve operation was successful.

The filter to waste valve actuator on filters 5 and 6 was not working at the time of the inspection, so the filter to waste step was skipped. Per the operator, this was the typical operation for these filters.

Mr. Moody inspected the fluoride and chlorine day tank room, while Ms. Rogers did a side-by-side chlorine analysis in the lab. Fluoride is made using powdered sodium fluoride. The powder is added to a small tank saturator. The solid sodium fluoride levels in the saturator are monitored daily to ensure that there is always solid sodium fluoride in the saturator. Photo 285 in Appendix A shows the yellow saturator tank with a yellow metering pump on top of it. The yellow metering pump seemed to be connected to two peristaltic pumps, which were used for controlling the dose. The daily fluoride loading is measured by reading the gallons of makeup water added to the saturator from a totalizer shown in Photo 286 in Appendix A. The saturator was located outside of spill containment. Behind the saturator was a brown day tank as shown in Photo 287 in Appendix A. This day tank seemed to be connected to the piping manifold with the yellow metering pump and the peristaltic pumps, but it was unclear what function the brown day tank provided and how water was entering or leaving that tank. Mr. Ahmed was unsure how that particular component functioned.

This same room held the day tanks for the chlorine feeds. There was one large tank for the pre-settled water feed and a smaller tank for the post filter feed. A control panel shown in Photo 288 in Appendix A was used to transfer aqueous chlorine from the bulk tanks to the day tank. The day tanks did not have plumbed overflows. The system could overflow from the vents, but the lowest vent was shared with a vent in the chlorine dosing room, so an overflow of these tanks could flood the dosing system in the chlorine dosing room.

Ms. Rogers used a Hach SL1000 to conduct the side-by-side free chlorine analysis. This was done in the lab from a tap which represents the finished water entering the distribution system. The operator uses a titration method to perform a free chlorine analysis and at the time of the inspection the reading was 1.59 mg/L. The free chlorine reading from the SL1000 was 1.43 mg/L.

The inspection team proceeded to the bulk storage building. The building contained three rooms: one for the chlorine bulk tanks, one for the alum bulk tanks, and one for the electrical switch gear. One of the bulk tanks in the alum room was offline and had been disconnected, and the tank had been partially pushed off the base as shown in Photo 292 in Appendix A.

There were three bulk chlorine tanks. Tank 3 was empty, and the valving for the other two tanks was set up to run them in tandem. Photo 296 in Appendix A shows the depth sensor readout for the three tanks. The top readout is for tank 1, the middle readout is for tank 2 and the bottom readout is for tank 3. The readout for tank 3 should be empty and tanks 1 and 2 should be the same. Mr. Ahmed said he did not think the depth sensors were working properly.

The inspection ended with a review of monthly operating reports and the lab methods. A summary of those activities is provided in the records review section below.

2.3 Closing Conference

The closing conference was held at 1200 on September 27, 2021. The conference was virtual and included representatives from EPA, Victoria Anderson, Taylor Girouard, Naomi Huff, Jeff Lippert, Jonathan Moody, Joan Rogers, Jenny Wilson, representatives from EGLE, Ernie Sarkipato, Ryan VanDerWoude, representatives from City of Benton Harbor, Ellis Mitchell and Lesia Osler, representatives from F&V, Abul Ahmed, Blair Selover, Darold Harlan, Matt Hosier and Jason Marquardt from Abonmarche. The first portion of the closing conference followed up on items that could not be covered during the opening conference due to time constraints.

Lead and Copper Rule

EPA reviewed the 2019 Preliminary Distribution Systems Materials Inventory, which had two separate numbers for the total number of service connections: 3,400 and 5,877. The City said 3,400 service connections was probably correct, and that the materials inventory would not be corrected or updated until 2024 or 2025. A request was made for the known inventory of lead service lines, a copy of the scope of work for the lead service line identification project, and a list of the lead service lines replaced since 2017.

Benton Harbor provided a list of 67 addresses with confirmed lead service lines. They also provided a summary document with a total of 219 full water service line replacements since January 2017. Of the total full water service lines replaced, 50 locations had specific residential addresses. Benton Harbor was unable to verify which of those line replacements were lead service lines.

EPA requested a list of the dates for Public Education distribution from January 2017 to present and a copy of the distribution lists. Copies of the "*Summary of Public Education (PE) Requirements and Certificate of Distribution*" documents were provided for February and August 2021. No other public education records or distribution lists were provided for the time period January 2017 through December 2019.

ACO Compliance Monitoring and General Items

EPA asked about the SCADA monitoring and alarm systems. The SCADA system has the capability of calling out to cell phones when alarms are activated. At the time of the inspection and during the closing conference call, the operator and the City of Benton Harbor did not know what alarms were set to call out.

Mr. Moody asked what the long-term plan was for maintaining adequate operator supervision of the water treatment plant and/or distribution system. Mr. Mitchell said the long-term plan was to hire a new city employee to provide adequate supervision. Mr. Moody asked for a copy of the contract outlining F&V's operational services. A copy was not provided.

EPA asked for copies of the agreements for interconnects and emergency water. The City did not provide copies of the interconnect agreements. Mr. Moody asked if the valves controlling the interconnects had been maintained and exercised to ensure that they were functional. The operators did not know if the valves had been exercised.

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A copy of the cross-connection control program plan or procedures was requested but was not available. The cross-connection control program progress was reported in a document dated March 24, 2021. The report states "*No records have been located from the previous Operator in Charge for the period January 1, 2020 thru November 3, 2020. Due to Covid restrictions no on-site inspections were completed from November 4, 2020 thru December 31, 2020.*" During the closing conference, Benton Harbor confirmed that no cross-connection control activities were being conducted and none were planned until after the technical, managerial and financial (TMF) capacity study was completed.

Mr. Moody asked for a copy of the current and prior budget for the water treatment operations, but he was not provided with one. Mr. Moody also asked when the most recent rate study was completed. Mr. Mitchell did not know, but he thought there was a rate increase as a result of the 2020 Drinking Water State Revolving Fund projects. Benton Harbor said that these activities are handled by Plante Moran, a contractor to the City of Benton Harbor.

The mussel control system was offline during the inspection. There are plans to fix the chemical feed system next year, and this project was a priority. The filter to waste valves on some of the filters were not functioning during the inspection. Benton Harbor stated that the schedule was delayed for fixing those valves and making other repairs to the filters, and this project was not a priority.

DBP Monitoring

Mr. Moody asked for copies of the Total Organic Carbon (TOC) precursor monitoring and DBP distribution system sampling for January 2017 to present. An incomplete set of records was provided; the data from February 2018 to October 2020 and January and February 2021 was unavailable. At the time of the inspection, there was an unaddressed violation for TOC precursor removal, which occurred during the first quarter of 2021. Benton Harbor said they were not aware that there had been a violation. At time this report was written, EGLE had confirmed that the violation for the TOC precursor removal had been an error, However, the missing data makes it difficult to verify compliance with the DBP requirements of the NPDWRs.

At the conclusion of the closing conference EPA provided a summary of the initial areas of concern which were identified at the time of the closing conference. These areas of concern were initial observations prior to completing the records review.

3 Records Review

During the inspection, Mr. Ahmed provided the following explanation of the monthly operating report (MOR) calculations:

From the August 2021 MOR:

Page 1: Monthly Operating Report Cover Page	
Field Title	***Description/Calculation Method***
Maximum Treatment Rate	Maximum Low Service Pump based on runtime
Was Minimum C*T credit achieved for the entire month?	Default 'YES', assumed that previous year set points were made based on an acceptable C*T calculation. Calculation is no longer available.

	Flow rate is not measured, and residence time is unknown.
Page 2: Coagulation Parameters	
Field Title	***Description/ Calculation Method***
Al2(SO4) (pounds)	Read manually from a scale
Alum as AL3+ (mg/L)	Calculated by dividing the pounds per day by 11.11
Turbidity Units Raw Avg.	Average of the grab samples from the raw tap in the lab
Turbidity Units Raw Max.	Max from the grab samples from the raw tap in the lab
Turbidity Units Applied Ave.	Applied means the settled water, though it is unclear where this sample or measurement is taken.
Filtered North and South, Avg. and Max	Grab samples from the CFE locations
Page 3: Chemical Analysis	
Field Title	***Description/Calculation Method***
pH raw	Raw tap in lab, lab pH probe
pH tap	Tap in lab, lab pH probe
Total Hardness, raw	by titration, no method
Total Hardness, tap	by titration, no method
Alkalinity, raw	by titration, no method
Alkalinity, tap	by titration, no method
Non-Carb Hardness, raw	by calculation
Non-Carb Hardness, raw	by calculation
Calcium, raw	by calculation
Calcium, tap	by calculation
Magnesium, raw	by calculation
Magnesium, tap	by calculation
Chloride, raw	Hach Powder Packets and titration with silver nitrate
Chloride, tap	Hach Powder Packets and titration with silver nitrate
WQP Conductivity, tap	Oakton Cond 6+
Sulfate, tap	Hach pocket colorimeter II Sulfate.
Page 4: Fluoridation and Chlorination	
Field Title	***Description/Calculation Method***
Fluoride Analysis, Applied as mg/L	Calculation based on flow meter for makeup water to saturator and assumed LS flow.
Fluoride Analysis, raw, mg/L	Grab sampled at lab, unknown test method.
Fluoride Analysis, tap, mg/L	Grab sampled at lab, unknown test method.
Fluoride Analysis, Distribution, mg/L	Sample from B&Z Construction location
Chlorine Application and Chlorine Residual, Intake, PPD	Not measured, dosing system inactive

Chlorine Application and Chlorine Residual, Intake, Free	Not analyzed
Chlorine Application and Chlorine Residual, Raw Treatment Line, PPD	Scale on large chlorine day take
Chlorine Application and Chlorine Residual, Raw Treatment Line, Free	Concentration from calculation based on LS Flow and pounds of chlorine
Chlorine Application and Chlorine Residual, Filtered, PPD	Scale on small chlorine day take
Chlorine Application and Chlorine Residual, Filtered, free	Concentration from calculation based on LS Flow and pounds of chlorine
Chlorine Application and Chlorine Residual, Total NaOCl Use, PPD	Total of large and small day tank scale readings.
Chlorine Application and Chlorine Residual, Total NaOCl Use, free	Concentration from calculation based on LS Flow and pounds of chlorine.
Demand, mg/L	Calculation, Total NaOCl use concentration minus measured total from the Tap.
Tap, Free, mg/L	Lab analysis using titration from grab at the lab tap. No method.
Tap, Total, mg/L	Lab analysis using titration from grab at the lab tap. No method.
Page 5: Bacteriological and Physical Parameters	
Field Title	***Description/Calculation Method***
Plant Tap, No. of Samples	All these measurements, are taken at the Benton Harbor lab.
Plant Tap, Colilert P/A	
Standard Plate Count, Raw	
Standard Plate Count, Tap	
Raw Temp	
Tap Temp	
Page 6: Distribution Flow and Corrosion Treatment	
Field Title	***Description/Calculation Method***
City Hall Ortho P Residual, mg/L	Distribution system ortho phosphate sample
Wolfs Ortho P Residual, mg/L	Distribution system ortho phosphate sample
Bait Shed Ortho P Residual, mg/L	Distribution system ortho phosphate sample
Sunny Spot Ortho P Residual, mg/L	Distribution system ortho phosphate sample
B&Z Ortho P Residual, mg/L	Distribution system ortho phosphate sample
High Lift to Distribution	Sum of daily flow based on change in elevation of the high service suction well and assumed constant flow rate from the high service pumps. Since the high service pump is currently running off a VFD, this number is not accurate.
Lbs PO4	Scale on phosphate day tank
PO4, Treatment, mg/L	Calculated based on the flow and the pounds of phosphate applied

Ortho P Residual, mg/L	Test in the laboratory from the tap using Hach Phosphate 3, DR300 device. No method referenced, equipment probably not verified

For the purposes of this chart, Raw and Tap refer to two faucets at the laboratory for water representative of raw and finished water to the distribution system. At the time of the inspection, the plumbing for lines could not be verified.
PPD – Pounds Per Day
LS – Lower Service Pump, flow is in MGD and is calculated based on pump runtime.

Lab Methods and Calibration/Verifications
At the time of the inspection there were no written lab manuals, standard operating procedures (SOPs) or quality assurance documents. Below is a summary of each piece of equipment or major analysis. Unless otherwise stated, no calibration or verifications were being performed. Mr. Ahmed provided copies of draft SOPs, but those were not in use by the other operators at the time of the inspection.

- Hach Chloride kit with silver nitrate titration.
- Oakton Cond 6+, No SOP or method reference. Calibrated with conductivity each use. This device is only one month old. A Hach device was used prior to the current conductivity meter. No SOP in use.
- Hach pocket colorimeter II Sulfate
- Hach DR300 Orthophosphate – using PhosVer 3 powder pillows. Method has a range of 0.02 -3.00 mg/L. System operators need to dilute the sample in order to take the measurement using this method.
- Ferrous Ammonium Sulfate (FAS) Titration for chlorine (free and total)
- Titration for alkalinity and hardness

Turbidity Records summary
A set of hardcopy emails were provided with a description of previous turbidimeter calibration and maintenance activities. Below is a summary of the dates of those activities:

1. 11/12-13/2020 – All plumbing to the 8 turbidity meters was replaced and meters were calibrated with StablCal.
2. 12/21-22/2020 – Cleaned and calibrated all 8 turbidity meters.
3. 4/29/2021 – Hach 1720E turbidity meters were reprogramed and calibrated.
4. 6/1-2/2021 – Serviced the lines to the Hach 1720E turbidity meters on the raw line.

The Hach 1720E Low Range Turbidimeter User Manual states: "*...recalibration is recommended after any significant maintenance or repair and at least once every three months during normal operation.*" No records were available for the calibration activities between December 22, 2020 and April 29, 2021. Monthly cleanings could be considered significant maintenance per the manufacturer, but no records of calibration activities were available after the cleanings.

Photos 297 through Photos 303 in Appendix A are photos of the daily logbook kept by the operator in charge of the treatment facility. Notable entries from that logbook include the following:

Flow is monitored by level measurement in the high service suction well, but that sensor seems unreliable based on notes in the operator logbook in Photos 297 and 298. These observations occurred on September 12, 2021 and August 14, 2021.

The chlorine feed pumps were left on when the plant was not pumping water through the treatment. This occurred on July 19, 2021 and July 9, 2021.

SCADA Screens

Photo 601 in Appendix A shows the filter flow and continuous turbidity monitoring on the SCADA screens. At the time the photo was taken, the screen showed the following results for flow:

Filter	1	2	3	4	5	6	7	8	9	10	11	12
Flow (gpm)	0	0	0	0	12	0	700	4	700	0	87	108

At the time the photo was taken, filter #9 may have been out-of-service and the remaining filters may not have been in use, since the plant typically ends filtering earlier in the day.

This screen also included a reading for "Tap Water Chlorine Residual" which was showing 0.14 mg/L. The equipment used to monitor chlorine residual was out-of-service during the inspection. Photo 305 in Appendix A shows the aqueous chlorine feed tanks (or day tanks). The large tank has a capacity of 200 gallons (about 2,000 pounds), and the screen indicated that the tank's maximum fill line occurs at 1,400 pounds. The scale reading reporting to the SCADA was showing 1,739 pounds. The values on the computer screen indicated the tank was filled above its maximum fill line, but no alarms were shown on this screen.

At the time of the inspection, the system was showing a high-level alarm on the high service suction well.

America's Water Infrastructure Act Records

Benton Harbor submitted certifications on June 29, 2021 that the Risk and Resilience Assessment and Emergency Response Plan developed under America's Water Infrastructure Act of 2018 had been completed. EPA requested to review these documents. Benton Harbor stated that they had not completed the Emergency Response Plan.

Revised Total Coliform Rule

Benton Harbor provided a copy of the revised total coliform rule site sampling plan dated June 2016. The addresses listed in the sampling siting plan differ from the locations where the system is currently sampling.

Address	2016 Sample Site Plan	Current Monitoring Location
City Hall, 200 East Wall Street	Yes	No
Cornerstone Building, 38 West Wall Street	Yes	No
Wolf's Marine, 250 West Main Street	Yes	Yes
Citgo Gas Station, 470 West Main Street.	Yes	Yes
Sunny Spot, 895 Pipestone	Yes	Yes
Blu Water (S. Fair and Valley Drive)	No	Yes
B&Z Construction Milton Street	No	Yes

Summary of Previous Sanitary Survey

	2018 Sanitary Survey Finding	2021 Inspection	Corrected
Source	Deficiency: need to inspect intake and restart mussel control	The intake was inspected July 2021. Repairs to the intake structure were made, but the mussel control system was not functional at the time of the inspection.	No
Treatment	Significant Deficiency: Coagulant feed needs ample mixing energy to be effective	Coagulate feed location was relocated to a mixing chamber at the plate settler basins.	Yes
Treatment	Deficiency: Finished water meters not functioning, can't determine CT.	Finish water meter is installed but is not being maintained Finish water meter is not being used for compliance monitoring	No
Distribution System	Significant Deficiency: Formalize program to turn valves & flush hydrants.	Not Evaluated	Unknown
Distribution System	Significant Deficiency: Cross Connection Program needs complete overhaul	A new cross connection program was developed in 2020, but at the time of the inspection no actions had been taken to implement the 2020 plan.	No

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Distribution System	Significant Deficiency: Many areas of low flow/no flow	Not Evaluated	Unknown
Distribution System	Deficiency: Aging water main replace is lacking	Not Evaluated	Unknown
Finished Water Storage	Deficiency: Reinspection of the elevated storage tank is overdue	At the time of the inspection, the tank was nearing completion of a substantial rehabilitation. The underground storage at the water treatment plant had several missing screens on vent pipes, and could not be accessed to evaluate sanitary conditions.	Partial
Monitoring and Reporting	Significant Deficiency: Fix continuous chlorine analyzer	The continuous chlorine analyzer was offline at the time of the inspection.	No
Monitoring and Reporting	Deficiency: MOR inaccurate information on treated water	The flow measurement method was inaccurate and based on a combination of uncalibrated depth sensors.	No
System Management & Operations	Significant Deficiency: Must commit to timeline for compliance	Benton Harbor is in the process of developing plans under an EGLE administrative order. Aspects of that order were addressed during the inspection	Ongoing
System Management & Operations	Significant Deficiency: Financial & Managerial Capacity is not met	System was unable to provide financial information at the time of the inspection.	Ongoing
System Management & Operations	Significant Deficiency: Hydraulic model calibration indicated areas of low flow	Not Evaluated	Unknown
Operator Compliance	Recommendation: Distribution & Treatment need more certified operators	Benton Harbor must determine the appropriate staffing level as a requirement of the EGLE administrative order. This item cannot be addressed until the staffing analysis is completed.	Ongoing

Financial	Significant Deficiency: Collection of rates is inefficient and ineffective	No records could be provided at the time of the inspection to evaluate this item. Bill collection is handled by a third-party contractor.	Unknown
Financial	Significant Deficiency: Rates insufficient to cover capital improvements	No records could be provided at the time of the inspection to evaluate this item. Benton Harbor was unable to provide a budget for water treatment activities.	Unknown
Other	Significant Deficiency: SCADA system needs additional functionality	Many continuous monitoring components and system automation functions were not working at the time of the inspection. The SCADA system was collecting inaccurate data. Alarm functions were unknown.	No

4 Areas of Concern and Observations

4.1 Areas of Concern

The following areas of concern were noted based on the inspection and review of documents received:

1. **Records Maintenance (40 C.F.R. 141.33)**
    a. Missing TOC Precursor Monitoring
        i. No records from February 2018 through September 2020.
        ii. Also missing January and February 2021 results
    b. DBP Distribution monitoring
        i. Missing Q1 2019 through Q3 2020
        ii. Operational Evaluation Level Calculations
    c. LS flow measurement for MOR reporting is not accurate, affects system operation and also CT calculation

2. **Requirements when making a significant change in disinfection practice. (40 C.F.R. 141.708)**
    When the mussel control system was taken offline, the point of disinfection changed. This would require the development of a disinfection profiles and calculation of disinfection benchmarks.

3. **Disinfection (40 C.F.R. 141.72)**
    During the inspection, the operator confirmed that the chlorine dosing is not being properly calculated, but the operator is assuming that the existing set points are providing adequate disinfection.

4. **Emergency Response Plan (SDWA Section 1433)**
   The Emergency Response Plan is due 6 months after the Risk and Resilience Assessment. Benton Harbor has submitted certification that the Emergency Response Plan is completed. During the inspection, the Emergency Response Plan was not available since it had not yet been completed.

5. **Revised Total Coliform Rule - General monitoring requirements for all public water systems. Plan is outdated (40 C.F.R. 141.853)**
   The current copy of the revised total coliform site sampling plan was dated June 2016. The locations in the approved site sampling plan do not match the locations being sampled.

6. **Monitoring and Analytical Requirements (40 C.F.R. 141 Subpart C)**
   At the time of the inspection, the system did not have written procedures for conducting laboratory analyses. Laboratory staff did not know the analytical methods used, and no quality control procedures were available.

7. **Enhanced Filtration and Disinfection - Systems Serving Fewer Than 10,000 People (40 C.F.R. 141 Subpart T)**
   The combined filter effluent monitoring location was not representative of the filtered water from all filters in use at the time of the inspection. The system was using two locations for combined filter effluent.

8. **Treatment**
   a. Broken washer arms on filters
   b. Broken filter to waste valve
   c. Broken control panels. E.g., panels at the filters not functioning
   d. Lack of procedures and records for the sludge monitoring and removal activities from the plate settlers
   e. Unbalanced filter flows during backwash

9. **Potential Deficiencies**
   Mussel control system is still offline. There is no chlorine addition at the intake.

10. **A number of potential cross connections were identified throughout the treatment system**
    a. Open and unused polymer line on the raw water feed.
    b. Out of date test for backflow device on softener near the low service pumps.
    c. Untested backflow prevention device in the filter pipe gallery on the wash line for filters.
    d. Out of date backflow device in chlorine dose room.
    e. Hatch on the high service suction well does not appear to have an overlap. The sanitary seal could not be evaluated since the hatch could not be opened without causing contamination to the finished water.
    f. Plywood on roof of high service suction well hatches on reservoir did not have sanitary seals.

g. The hatches on the 2-million-gallon reservoir did not appear to have overlaps or sanitary seals, and it could not be evaluated since the hatch could not be opened without causing contamination to the finished water.
h. No plumbed overflows were found on the chlorine day tanks. Overflows can damage dosing equipment. No auto control to prevent overfill.
i. Unidentified day tank was connected to fluoride saturator.

11. Monitoring Equipment Issues

a. Raw water chlorine analyzer was not functioning.
b. There were two unidentified sensors at the raw water monitoring location.
c. The settled water chlorine analyzer was not functioning.
d. Settled water flow meters were not calibrated, and one appeared to be malfunctioning with erroneous readings.
e. Status of the flow meter at roof of high service suction well was unknown.
f. The flow meter on header to high service pumps had no calibration records available, and it was unknown if it was connected to the SCADA. It is not being used for compliance reporting on monthly operating reports.
g. Continuous chlorine meter at the pressure gages for finished water to the distribution system was not functioning but was still sending values to the SCADA system.
h. Depth sensors on the chlorine bulk tanks and chlorine day tanks are inaccurate.
i. The status of the flow meters on the individual filters was unknown.
j. The depth sensor on the high service suction well appears to be unreliable based on notes in logbook. This depth sensor is being used for compliance reporting.
k. Individual filter effluent turbidimeters are not being calibrated as recommended by the manufacturer. No maintenance schedule or operating procedure is available for that equipment.
l. Unknown if the turbidimeters on the raw water and settled water lines have been calibrated and maintained.

4.2 Additional Observations

1. The room above the raw water wet well had severe paint flaking on the ceiling.

2. The fluoride saturator was located outside of the of containment for the day tanks.

3. A lack of automation has led to overflowing chemical tanks and operating chemical injections to the treated water when the treatment system was not in operation.

4. At the time of the inspection, the system was unable to identify which alarms had call out capability for the SCADA system.

5. Operation of the treatment plant is being conducted with both contract staff and employees of the City of Benton Harbor. It is unclear how the treatment plant operations staff is organized or supervised. A copy of the operations contract was not made available.

6. There are no formal written agreements for the supply of emergency water through the system interconnects. The status of the valves to control those interconnects is also unknown.

7. Benton Harbor was unable to provide a copy of the budget for the water treatment plant operations.

8. Benton Harbor did not have records of customer complaints.

DOCUMENTS RECEIVED AND REFERENCED

Document Number	Document Name	Requested	Provided	Claimed CBI
1	Treatment plant schematics	X	X	
2	Most recent elevated tank inspection/evaluation	X	X	
3	Risk and Resiliency Plan under AWIA	X	X	X
4	Lagoon Details, 9/30/09	X	X	
5	Site Grading Plan for Lagoon, 9/30/09	X	X	
6	Site Piping Plan for Lagoon, 9/30/09	X	X	
7	City of Benton Harbor Organization Chart	X	X	
8	2017 Water Asset Management Plan	X	X	
9	2020 Cross Connection Report	X	X	
10	2021 Water Distribution System Map	X	X	
11	2017 Water Reliability Study	X	X	
12	2021 DWSRF Project Plan Draft	X	X	
13	2021 Risk and Resiliency Assessment	X	X	X
14	DWSRF Final Project Plan, June 22, 2021	X	X	
15	Intake Project Records, 7/27/2021 Inspection Report, 3 Videos	X	X	
16	2012 Renovations Construction Set	X	X	
17	2012 Renovations Records Set	X	X	
18	2020 Elevated Water Tank General and Technical Specifications	X	X	
19	Water Tank Daily Inspection Reports through 9/14/2021	X	X	
20	2019 Preliminary Distribution System Inventory	X	X	
21	Operator Certification Records	X	X	
22	Map of Hydrant Locations	X	X	
23	Appendix with Hydrant Repair and Replacement	X	X	
24	Summary of Public Education Requirements and Certificate of Distribution, February 2021	X	X	
25	Summary of Public Advisory Requirements and Distribution Checklist, August 2021	X	X	
25	Summary of Public Education Requirements and Certificate of Distribution, August 2021	X	X	
26	Distribution list for PE materials submitted in response to LCR Action Level Exceedances	X		
27	Dates when PE materials have been provided in response to LCR Action Level Exceedances	X		
28	Copies of customer complaint log from January 2017 to present	X		
29	2020 Cross Connection Control Plan	X	X	
30	2016 RTCR Sample Siting Plan	X	X	

Document Number	Document Name	Requested	Provided	Claimed CBI
31	2013 DBP Sample Site Plan	X	X	
32	Lead and Copper Sample Sites	X	X	
33	Water Quality Parameter Monitoring December 2020	X	X	
34	DBP Distribution System Monitoring Q4 2020	X	X	
35	DBP Distribution System Monitoring Q2 2021	X	X	
36	DBP Distribution System Monitoring Q3 2021	X	X	
37	August 2021 LCR Sampling and B&Z 8/31/21 TTHM Sample	X	X	
38	DBP and TOC results from Nov 2013 to Nov 2018 (excel)	X	X	
39	DBP Distribution System Monitoring Q1 2021	X	X	
40	DBP Distribution System Monitoring Q3 2017	X	X	
41	August 2017 LCR Sampling	X	X	X
42	August 13, 2021 LCR Sampling	X	X	X
43	August 26, 2021 LCR Sampling	X	X	X
44	September 2, 2021 Sampling	X	X	X
45	LCR Sampling Summary Second Half of 2020	X	X	X
46	LCR Sampling Summary First Half of 2021	X	X	X
47	TMF Capacity Study Grant Application	X	X	
48	Records of turbidity meter maintenance and calibrations, and system automation maintenance	X	X	
49	Dates and locations of lead service lines replaced January 2017 to present.	X	X	X
50	Contract with F&V for operator services	X		
51	Agreements for emergency water through system interconnects	X		
52	Past 6 months of RTCR sampling and reporting records (with MORs)	X	X	
53	Monthly Operating Reports, January 2017 - August 2021	X	X	
54	Memo Proposed Replacements for Next 5 years, September 29, 2021	X	X	
55	TOC Precursor Monitoring January 2017-present	X	X	
56	Current LSL Inventory	X	X	X
57	Scope of the upcoming Blue Conduit potholing project	X		

Appendix A: Photolog

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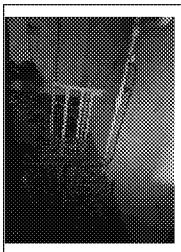
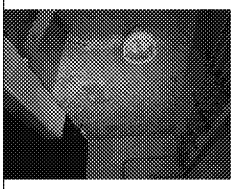
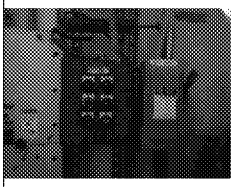


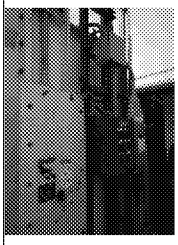
1: DSCN0307JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 9:11 AM
Camera Direction: Indoor facing forward
Description: Room above the raw water cone valve adjacent to the raw water wet well. This yellow pipe carries chlorine for the mussel control system.



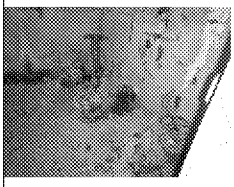
2: DSCN0308JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 9:11 AM
Camera Direction: Indoor facing forward
Description: Corroded ceiling and flaking paint above the raw water wet well.



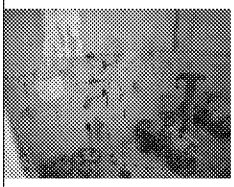
3: DSCN0310JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 9:16 AM
Camera Direction: Indoor facing forward
Description: Screen control panel. Screen appeared to be energized, but no lights were illuminated on the control panel.



4: DSCN0311JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 9:16 AM
Camera Direction: Indoor facing forward
Description: Screen control panel

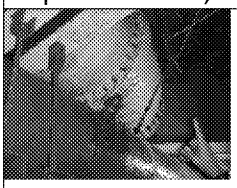


5: DSCN0325JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 9:23 AM
Camera Direction: Indoor facing forward
Description: Unused pumps under the old clarifiers or accelators

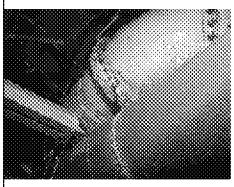


6: DSCN0326JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 9:23 AM
Camera Direction: Indoor facing forward
Description: Unused pumps under the old clarifiers or accelators

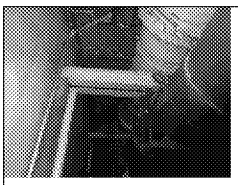
7: DSCN0340JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 9:33 AM
Camera Direction: Indoor facing forward
Description: Green pipe is raw water and white pipe is settled water. The orange pipe is an alum feed line. At the time of the inspection, the valve on the alum line was open. Per the system representatives, this alum feed line was no longer used.



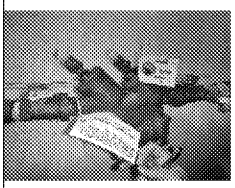
8: DSCN0341JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 9:34 AM
Camera Direction: Indoor facing forward
Description: Green pipe are raw water and white pipes are settled water. The orange pipe is an alum feed line. At the time of the inspection, the valve on the alum line was open. Per the system representatives, this alum feed line was no longer used.



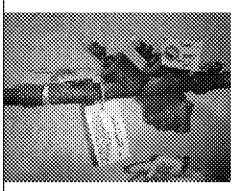
9: DSCN0342JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 9:34 AM
Camera Direction: Indoor facing forward
Description: Green pipe are raw water and white pipes are settled water. The orange pipe is an alum feed line. At the time of the inspection, the valve on the alum line was open. Per the system representatives, this alum feed line was no longer used. The yellow and blue lines are the chlorine feed and flouride feed respectively to the line from the plate settler basins. All feed line valves were open.



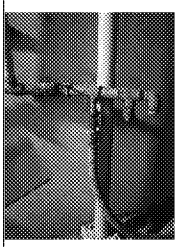
10: DSCN0343JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 9:34 AM
Camera Direction: Indoor facing forward
Description: Green pipe are raw water and white pipes are settled water. The orange pipe is an alum feed line. At the time of the inspection, the valve on the alum line was open. Per the system representatives, this alum feed line was no longer used. The yellow and blue lines are the chlorine feed and flouride feed respectively to the line from the plate settler basins. All feed line valves were open.



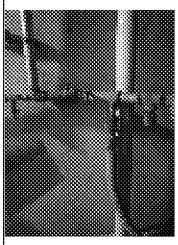
11: DSCN0352JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 9:38 AM
Camera Direction: Indoor facing forward
Description: Backflow appurtenance



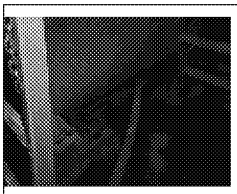
12: DSCN0353JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 9:38 AM
Camera Direction: Indoor facing forward
Description: Backflow appurtenance



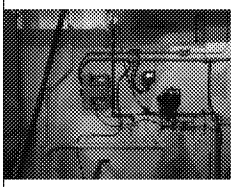
13: DSCN0354JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 9:38 AM
Camera Direction: Indoor facing forward
Description:Rigid hose connected to a potable water line. Pipe connection made with a wire, appears to form an air gap.



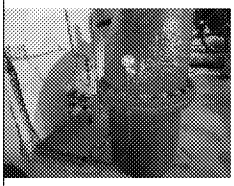
14: DSCN0355JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 9:38 AM
Camera Direction: Indoor facing forward
Description: Rigid hose connected to a potable water line. Pipe connection made with a wire, appears to form an air gap.



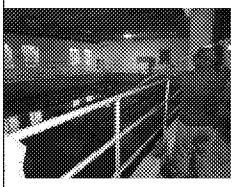
15: DSCN0357JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 9:39 AM
Camera Direction: Indoor facing forward
Description: Rigid hose connected to a potable water line appears to drain to the floor. Wet floor by old sedimentation basins



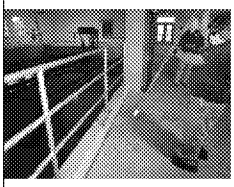
16: DSCN0360JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 9:47 AM
Camera Direction: Indoor facing forward
Description: Non-functioning continuous chlorine analyzer and turbidimeter on the raw water line.



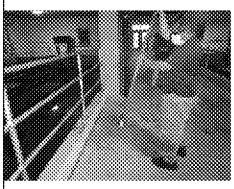
17: DSCN0362JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 9:48 AM
Camera Direction: Indoor facing forward
Description: Raw water pipe



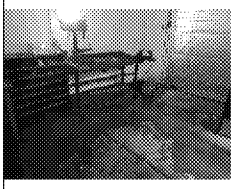
18: DSCN0369JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 10:21 AM
Camera Direction: Indoor facing forward
Description: Operator taking sludge height samples using a sludge judge



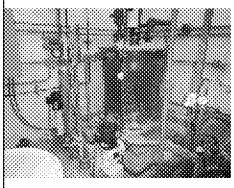
19: DSCN0370JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 10:21 AM
Camera Direction: Indoor facing forward
Description: Operator taking sludge height samples using a sludge judge.



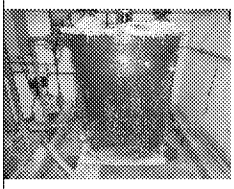
20: DSCN0371JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 10:21 AM
Camera Direction: Indoor facing forward
Description: Operator taking sludge height samples using a sludge judge



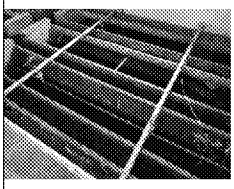
21: DSCN0399JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 10:59 AM
Camera Direction: Indoor facing forward
Description: Water leak on floor, blocked floor drain



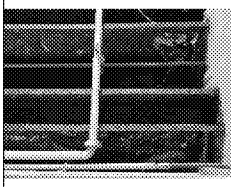
22: DSCN0405JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 11:00 AM
Camera Direction: Indoor facing forward
Description: Alum day tank.



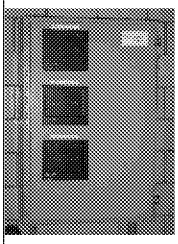
23: DSCN0413JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 11:09 AM
Camera Direction: Indoor facing forward
Description: Alum day tank. At the time of the inspection this tank was in use and had previously overflowed leaving residual material on the tank.



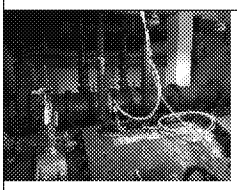
24: DSCN0432JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 1:05 PM
Camera Direction: Indoor facing forward
Description: Empty filter cell



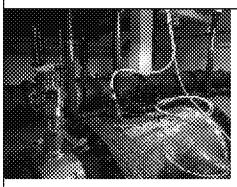
25: DSCN0433JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 1:05 PM
Camera Direction: Indoor facing forward
Description: Empty filter cell



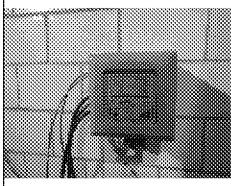
26: DSCN0439JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 1:28 PM
Camera Direction: Indoor facing forward
Description: Filter turbidity control panel for the south filters. At the time of the inspection, filters 3 & 4 were offline.



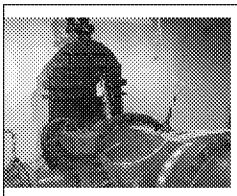
27: DSCN0442JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 1:43 PM
Camera Direction: Indoor facing forward
Description: Finished water from the high service suction well to the high service pumps. The flow meter measures the total flow out to the distribution system. The white tubes are the corrosion control chemical feed. At the time of the photo, the feed line had become kinked.



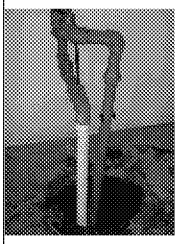
28: DSCN0443JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 1:45 PM
Camera Direction: Indoor facing forward
Description: Finished water from the high service suction well to the high service pumps. The flow meter measures the total flow out to the distribution system. The white tubes are the corrosion control chemical feed. At the time of the photo, the feed line kink shown in Photo 146 was corrected.



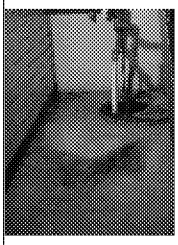
29: DSCN0445JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 1:45 PM
Camera Direction: Indoor facing forward
Description: Readout for the flow meter to the distribution system. At the time of the inspection the read out was displaying 764 gallons per minute.



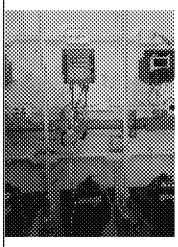
30: DSCN0446JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 1:48 PM
Camera Direction: Indoor facing forward
Description: Finished water from the high service suction well to the high service pumps. The flow meter measures the total flow out to the distribution system. The white tubes are the corrosion control chemical feed. At the time of the photo, the feed line kink shown in Photo 146 was corrected.



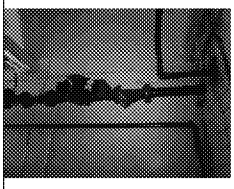
31: DSCN0447JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 1:49 PM
Camera Direction: Indoor facing forward
Description: Sump pit in the basement of the main water treatment plant building. At the time of the inspection, these pipes seemed to be leaking causing water to pool on the floor.



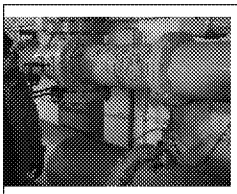
32: DSCN0448JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 1:49 PM
Camera Direction: Indoor facing forward
Description: Sump pit in the basement of the main water treatment plant building. At the time of the inspection, these pipes seemed to be leaking causing water to pool on the floor.



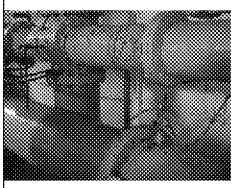
33: DSCN0449JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 1:49 PM
Camera Direction: Indoor facing forward
Description: Readout for the turbidimeters.



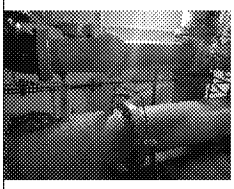
34: DSCN0460JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 2:10 PM
Camera Direction: Indoor facing forward
Description: Prevention device on the water for the surface wash lines on the filters. No tags were present at the time of the inspection.



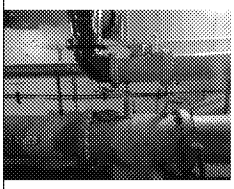
35: DSCN0464JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 2:12 PM
Camera Direction: Indoor facing forward
Description: One location of the combined filter effluent monitoring. The thin metal line in the foreground is the location of the grab samples for combined filter effluent turbidity monitoring.



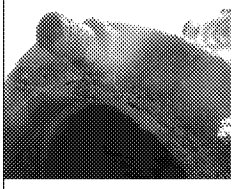
36: DSCN0465JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 2:12 PM
Camera Direction: Indoor facing forward
Description: One location of the combined filter effluent monitoring. The thin metal line in the foreground is the location of the grab samples for combined filter effluent turbidity monitoring.



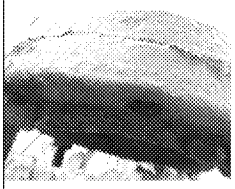
37: DSCN0466JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 2:13 PM
Camera Direction: Indoor facing forward
Description: Second location of the combined filter effluent monitoring. The thin metal line in the foreground is the location of the grab samples for combined filter effluent turbidity monitoring.



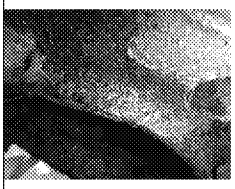
38: DSCN0467JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 2:13 PM
Camera Direction: Indoor facing forward
Description: Drain pipe



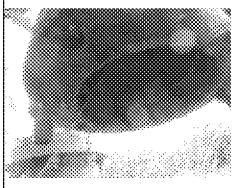
39: DSCN0471JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 2:22 PM
Camera Direction: Outdoor facing forward
Description: Vent, missing screen



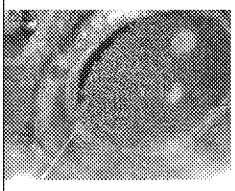
40: DSCN0472JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 2:22 PM
Camera Direction: Outdoor facing forward
Description: Vent missing screen



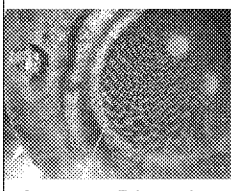
41: DSCN0473JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 2:22 PM
Camera Direction: Outdoor facing forward
Description: Vent missing screen



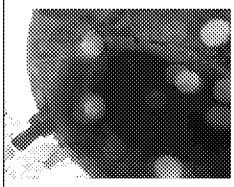
42: DSCN0476JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 2:23 PM
Camera Direction: Outdoor facing forward
Description: Vent, missing screen



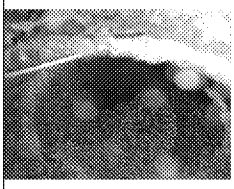
43: DSCN0477JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 2:23 PM
Camera Direction: Outdoor facing forward
Description: Vent, torn screen



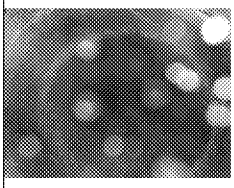
44: DSCN0478JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 2:23 PM
Camera Direction: Outdoor facing forward
Description: Vent, torn screen



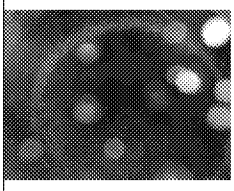
45: DSCN0479JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 2:24 PM
Camera Direction: Outdoor facing forward
Description: Vent, torn screen



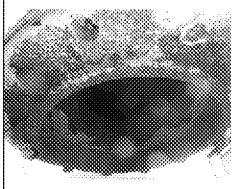
46: DSCN0480JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 2:24 PM
Camera Direction: Outdoor facing forward
Description: Vent, torn screen



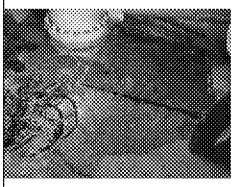
47: DSCN0481JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 2:24 PM
Camera Direction: Outdoor facing forward
Description: Vent, torn screen



48: DSCN0482JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 2:24 PM
Camera Direction: Outdoor facing forward
Description: Vent, missing screen

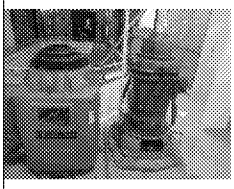


49: DSCN0495JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 3:29 PM
Camera Direction: Indoor facing forward
Description: Overflow pipe for the high service suction well, screen was missing.

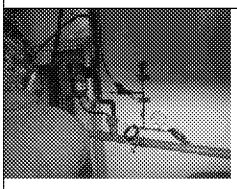


50: DSCN0503JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 3:34 PM
Camera Direction: Indoor facing forward
Description: Wooden board covering potential hole in the high service suction well.

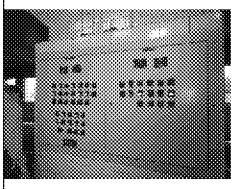
51: DSCN0505JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 3:36 PM
Camera Direction: Indoor facing forward
Description: Unidentified flow meter on unknown pipes. The hatch in the background goes to the high service suction well.



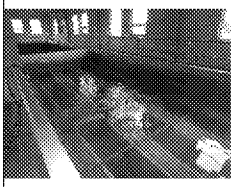
52: DSCN0513JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 3:48 PM
Camera Direction: Indoor facing forward
Description: On the left is an unused motor, on the right is the VFD enabled high service pump providing service at the time of the inspection.



53: DSCN0516JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/21/2021 3:53 PM
Camera Direction: Indoor facing forward
Description: Pressure gage for the water to the distribution system. The two pressure transducers control the two VFD enabled pumps in Photos 217 and 218. The chlorine analyzer shown in this photo was not functioning at the time of the inspection.

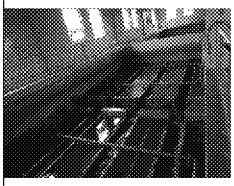


54: DSCN0528JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 9:15 AM
Camera Direction: Indoor facing forward
Description: Filter cells system control panel

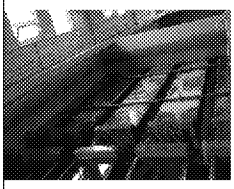


55: DSCN0533JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 9:16 AM
Camera Direction: Indoor facing forward
Description: Filter cells being backwashed

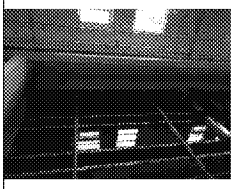
56: DSCN0535JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 9:17 AM
Camera Direction: Indoor facing forward
Description: Filter cells being backwashed



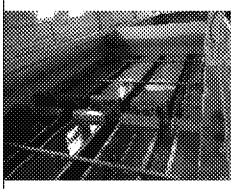
57: DSCN0551JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 9:26 AM
Camera Direction: Indoor facing forward
Description: Filter cells being backwashed



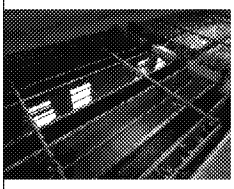
58: DSCN0552JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 9:27 AM
Camera Direction: Indoor facing forward
Description: Filter cells being backwashed



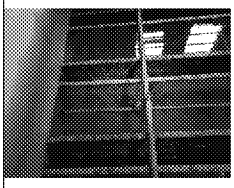
59: DSCN0553JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 9:27 AM
Camera Direction: Indoor facing forward
Description: Filter cells being backwashed



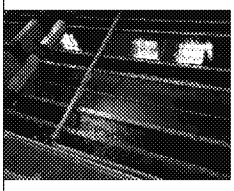
60: DSCN0554JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 9:27 AM
Camera Direction: Indoor facing forward
Description: Filter cells being backwashed



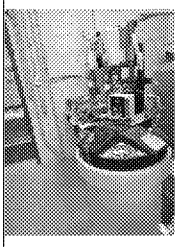
61: DSCN0555JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 9:28 AM
Camera Direction: Indoor facing forward
Description: Filter cells being backwashed



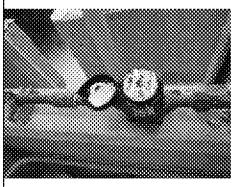
62: DSCN0556JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 9:28 AM
Camera Direction: Indoor facing forward
Description: Filter cells being backwashed



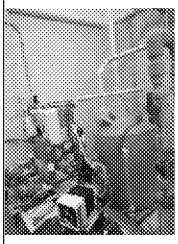
63: DSCN0574JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 9:38 AM
Camera Direction: Indoor facing forward
Description: Filter cells being backwashed



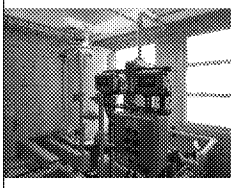
64: DSCN0582JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 10:38 AM
Camera Direction: Indoor facing forward
Description: Saturator and meter pumps for the flouride feed system.



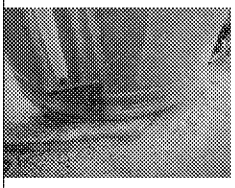
65: DSCN0583JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 10:38 AM
Camera Direction: Indoor facing forward
Description: Meter for the makeup water to the flouride saturator.



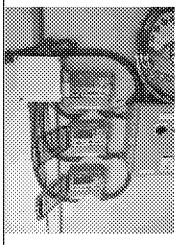
66: DSCN0584JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 10:48 AM
Camera Direction: Indoor facing forward
Description: Flouride feed system. The brown tank in the background is connected to the flouride system.



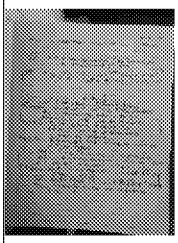
67: DSCN0585JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 11:08 AM
Camera Direction: Indoor facing forward
Description: Chlorine day tanks and readouts for the scales.



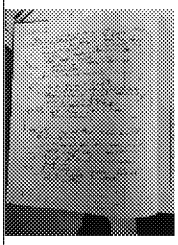
68: DSCN0589JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 11:22 AM
Camera Direction: Indoor facing forward
Description: Unused tank in the alum bulk tank storage. This tank was no longer sitting on the concrete base.



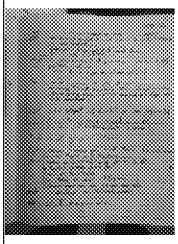
69: DSCN0593JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 11:33 AM
Camera Direction: Indoor facing forward
Description: Aqueous chlorine tank depth sensors



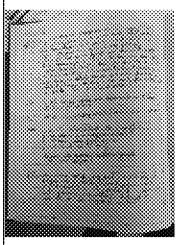
70: DSCN0594JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 4:11 PM
Camera Direction: Indoor facing forward
Description: System operator notes



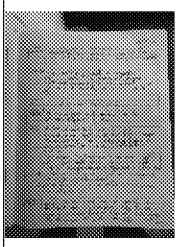
71: DSCN0595JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 4:11 PM
Camera Direction: Indoor facing forward
Description: System operator notes



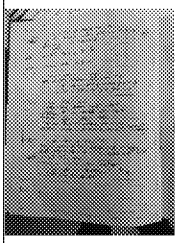
72: DSCN0596JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 4:11 PM
Camera Direction: Indoor facing forward
Description: System operator notes



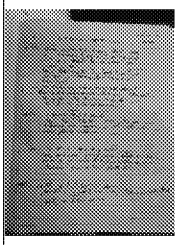
73: DSCN0597JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 4:11 PM
Camera Direction: Indoor facing forward
Description: System operator notes



74: DSCN0598JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 4:11 PM
Camera Direction: Indoor facing forward
Description: System operator notes



75: DSCN0599JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 4:11 PM
Camera Direction: Indoor facing forward
Description: System operator notes



76: DSCN0600JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 4:11 PM
Camera Direction: Indoor facing forward
Description: System operator notes

77: DSCN0602JPG
Location: Benton Harbor PWS
Photographer: Naomi Huff
Date/Time: 9/22/2021 4:12 PM
Camera Direction: Indoor facing forward
Description: Facility SCADA system, CONFIDENTIAL