City of Benton Harbor
Water System Alternatives Analysis

October 17, 2022

ACKNOWLEDGEMENTS

The project team would like to acknowledge the following individuals for their assistance in providing information and guidance for development of this Alternatives Analysis for the Benton Harbor water system.

Ellis Mitchell, Darrell Rice, Sarah Murray-Williams, and Lesia Osler, City of Benton Harbor

Benton Harbor Mayor and City Commission

Jason Marquardt, Abonmarche Consultants, Inc.

Blair Selover, Darold Harlan, and Rob Jones, F&V Operations

Elaine Venema, Matt Johnson, Fleis & VandenBrink Engineering

Greg Alimenti, Greg Grothous, John Hodgson, and Tim Zebell, City of St. Joseph

Kyle Tryan, Mike Baldwin and Debbie Boothby, Benton Charter Township

Ernie Sarkipato, Michigan Department of Environment, Great Lakes and Energy (EGLE)

Erin Russell, Michael Bolf, EGLE

John Young

EXECUTIVE SUMMARY

The City of Benton Harbor provides water to its customers by treating water from Lake Michigan and pumping the treated water through a series of distribution pipes. As a regulated public water supply, the City is required to sample for a number of contaminants. From 2018-2021 some of the point of service samples showed lead levels exceeding the regulated action level for drinking water. To address lead in the drinking water, the City feeds a corrosion inhibitor to reduce the potential for lead to leach from pipes and is replacing lead service lines. At the time of this writing, approximately 95% of the lead service lines in the City have been replaced.

The City has other challenges with the water system and received an Administrative Consent Order from Michigan Department of Environment, Great Lakes, and Energy (EGLE) in March 2019 to address water system deficiencies identified during a 2018 water system sanitary survey. EGLE later amended the Administrative Consent Order in August 2020 to acknowledge resolved issues and extend deadlines on remaining issues. These system deficiencies resulted from many investment and operating issues over the years. Additionally, in response to the City's financial challenges, Benton Harbor was placed under the control of a State-appointed emergency manager in 2010. In this role, the emergency manager was empowered to govern the Benton Harbor budget. Attempts by the emergency manager to reduce the City's operating costs resulted in substantial staffing reduction in the Benton Harbor Water Department, which severely impacted Benton Harbor's ability to provide adequate and safe water service to its residents. Benton Township and St. Joseph Charter Township then discontinued service from Benton Harbor in 2011 and 2013, respectively, and some local water supply contracts were cancelled by the emergency manager resulting in additional financial and operating challenges for the Benton Harbor water system.

In September 2021, EGLE and the Environmental Protection Agency (EPA) conducted a joint inspection of the Benton Harbor water system. EPA issued a Unilateral Administrative Order (Order) post-inspection with findings and required follow-up actions. One of the follow-up actions in the Order directs Benton Harbor to conduct an alternatives analysis for exploring other water system operational and managerial options. Per the Order, the alternatives analysis must consider the following:

- Staffing and administrative changes to enable Benton Harbor to be the direct majority provider of long-term technical, managerial, and financial capacity.
- Consolidation, restructuring, or regionalization, including:
    - Physical consolidation of the Benton Harbor water system with one (1) or more other systems;
    - Consolidation of significant management and administrative functions of the Benton Harbor water system with one (1) or more other systems; and
    - Transfer of ownership of the system that may reasonably be expected to improve drinking water quality.

- Entering into contractual agreements with third-party entities to provide significant management or administrative functions.
- A combination or hybrid of these alternatives.

This report addresses the requirement in the Order to complete an alternatives analysis of the City of Benton Harbor's public water supply. The alternatives considered in this report include:

1. **Alternative 1-Benton Harbor Retains Full Ownership of System, Surface Water Source and Treatment Plant:** Benton Harbor maintains all current assets and retains full ownership. Benton Harbor makes required short-term improvements to the treatment plant and distribution system along with all improvements required by EGLE and in the Order. Within this alternative, three different staffing plans are evaluated:

   Alternative 1A: Benton Harbor hires required staff to operate and maintain the water treatment plant and distribution system.

   Alternative 1B: Benton Harbor contracts for all staff positions to operate and maintain the water treatment plant and distribution system, with the exception of the administrative assistant and groundskeeper.

   Alternative 1C: Hybrid of Alternatives 1A and 1B where lead operator positions are filled under contract and other positions remain Benton Harbor employees.

2. **Alternative 2-Benton Harbor Retains Full Ownership of System and Purchases Water from St. Joseph:** Benton Harbor purchases water wholesale (2.2 million gallons per day maximum) from St. Joseph, maintains ownership of all current assets, abandons all or most of the existing water treatment plant, and makes required short-term improvements to the distribution system along with all improvements required by EGLE and in the Order. Benton Harbor hires the required staff for operation of the water system. With this alternative, two options are considered:

   Alternative 2A: All purchased water from St. Joseph discharges to the existing storage reservoirs at the Benton Harbor water treatment plant and then pumped to distribution.

   Alternative 2B: A portion of the water from St. Joseph goes directly to Benton Harbor's distribution system and a portion goes into the existing storage reservoirs at the Benton Harbor water treatment plant.

3. **Alternative 3-Benton Harbor Retains Full Ownership of System and Purchases Water from Benton Charter Township:** Benton Harbor purchases water wholesale from Benton Charter Township, maintains ownership of all current assets, abandons the existing water treatment plant, and makes required short-term improvements to the water treatment plant and distribution system along with all improvements required by EGLE and in the Order. Benton Harbor hires the required staff for operation of the water system.

4. **Alternative 4-Regionalization with Neighboring Systems:** Benton Harbor enters into a formal agreement with St. Joseph and Southwest Michigan Regional Sanitary Sewer and Water Authority (SMRSS&WA) for shared services of the water system.

Benton Harbor maintains ownership of all current assets and makes required short-term improvements to the water treatment plant and distribution system along with all improvements required by EGLE and in the Order.

5. **Alternative 5-Consolidation with Neighboring System:** Benton Harbor's water system is owned, operated, and maintained by either Benton Charter Township, St. Joseph, or SMRSS&WA. With this alternative, Benton Harbor relinquishes ownership of all water system assets to either Benton Charter Township, St. Joseph, or SMRSS&WA.
6. **Alternative 6-Private Ownership of the Benton Harbor Water System:** Benton Harbor relinquishes ownership of the water system to a private company who provides the capital to purchase all assets and makes required system upgrades identified in Alternative 1. The new owner also assumes any outstanding debt for previous system improvements. The new owner operates the system, provides all water system staff, and performs all maintenance. The new owner addresses all unresolved compliance issues and operates the system to maintain compliance.
7. **Alternative 7-Alternative Water Source:** Benton Harbor drills new wells to replace its existing Lake Michigan water source. This alternative requires Benton Harbor to hire the required additional staff to operate and maintain the distribution system, abandons the existing treatment plant, constructs a new smaller treatment plant for treatment of groundwater by disinfection and possibly iron and arsenic removal, and hires staff to operate the new treatment plant.

   Alternative 7A: Benton Harbor hires required staff to operate and maintain the groundwater water treatment plant and distribution system.

   Alternative 7B: Benton Harbor contracts for all staff positions to operate and maintain the water treatment plant and distribution system, with the exception of the administrative assistant.

Estimated costs and monthly residential customer cost increases for Alternatives 1, 2, 3, and 7 are shown in Table ES-1. Costs for other alternatives are not estimated due to insufficient information to accurately develop costs or the alternative is not deemed viable at this time.

Table ES-1. Summary of Alternatives – Incremental Costs

Alternative Description	Estimated Incremental Monthly Increase to Residential Customers[a]
1A – Benton Harbor retains full ownership of the water system, all water system staff are Benton Harbor employees	$12.95
1B – Benton Harbor retains full ownership of the water system, all water system staff (except two positions) are contracted	$7.45
1C – Benton Harbor retains full ownership of the water system, hybrid of 1A and 1B where lead operator positions are contracted and other staff are Benton Harbor employees	$13.05
2A – Purchase water from St. Joseph, all water goes through existing storage reservoirs at water treatment plant	$40.14
2B – Purchase water from St. Joseph, a portion of the water goes through existing storage reservoirs at water treatment plant and a portion goes directly to distribution system	$42.17
3 – Purchase water from Benton Charter Township	$77.08
7A – Abandon existing surface water intake and treatment plant, drill wells and groundwater treatment plant, all water system staff are Benton Harbor employees	$12.50
7B – Abandon existing surface water intake and treatment plant, drill wells and groundwater treatment plant, all water staff (except two positions) are contracted	$8.00

[a] Monthly increase is in addition to the current water rate plus the rate increase needed to cover the current deficit, which is currently estimated as $36.00 - $37.00 per month for a typical residential customer, unless O&M funding for certain costs (e.g. unfunded pensions, general fund costs) can be obtained through other source(s) (e.g. additional State and federal grants, etc.)

The estimated monthly residential customer rate increases are in addition to the current water rate (nominally $50/residence/month) plus the proposed rate increase being evaluated in the City's Capacity Study (report in-progress) to address the current water system budget deficit. The financial analysis in the Draft Capacity Study estimated a need to increase current water rates 13.75% each year for the next 10 years to ensure revenues are sufficient to cover the water system operational costs and repay all existing loans (Plante Moran, 2022) (Fleis and Vandenbrink, 2022). The actual amount of the required rate increase will be very dependent on collection rates. Benton Harbor will need to significantly improve residential collection rates to avoid additional rate shock.

The alternatives identified in this report provide options for Benton Harbor and its customers to consider for providing safe and reliable drinking water. Each alternative has benefits and concerns for the long-term sustainability of the Benton Harbor water system, as noted in the Table ES-2.

Table ES-2. Benefits and Concerns with each Alternative

	Alt 1A	Alt 1B	Alt 1C	Alt 2A	Alt 2B	Alt 3	Alt 4[a]	Alt 5[a]	Alt 6[a]	Alt 7A	Alt 7B
Benefits											
Benton Harbor retains ownership of the water system	✓	✓	✓	✓	✓	✓	✓			✓	✓
Increases Benton Harbor's technical, managerial, and/or financial capacity		✓	✓				✓	✓	✓		✓
Benton Harbor more likely to fill all required certified operator positions through contracted services or reduced number of operators needed		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Improves working relationship and promotes partnership with neighboring systems				✓	✓	✓	✓	✓			
Potential to result in cost savings through shared resources or reduced capital improvements							✓	✓	✓	✓	✓
Access to additional resources, improving customer service and system reliability		✓	✓				✓	✓	✓		✓
Concerns											
Benton Harbor may struggle to fill all required certified operator and water system staff positions	✓			✓	✓	✓	✓			✓	
All or key certified operator positions provided by contracted services, creating operational vulnerability if contract is terminated for any reason		✓	✓								
Benton Harbor lacks adequate technical, managerial, and/or financial capacity to oversee all needed improvements	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Significant financial impacts to rate payers in addition to rate increase needed to address current water system budget deficit and legacy costs (e.g. pensions)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Local autonomy and policy control may become challenging							✓	✓	✓		
Challenges with distributing costs equitably among participating jurisdictions							✓				
Benton Harbor relinquishes ownership of the water system								✓	✓		

[a] Alternative not considered viable at this time and costs were not developed.

TABLE OF CONTENTS

Page

TABLES OF CONTENTS (Continued)

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

LIST OF ACRONYMS

CIP	Capital Improvement Plan
CCF	100 cubic feet
EGLE	Michigan Department of Environment, Great Lakes and Energy
FVOP	F&V Operations and Resource Management
GIS	Geographic Information System
MCL	Maximum Contaminant Level
MDEQ	Michigan Department of Environmental Quality
MG	million gallons
MGD	Million gallons per day
NPDES	National Pollutant Discharge Elimination System
NPDWR	National Primary Drinking Water Regulations
PM	Preventative Maintenance
ppb	Parts per billion
PWS	Public Water System
SCADA	Supervisory Control and Data Acquisition
SDWA	Safe Drinking Water Act
TMF	Technical, Managerial and Financial
TTHM	Total trihalomethanes
VFD	Variable Frequency Drive

1.0 INTRODUCTION

The City of Benton Harbor, Michigan, currently owns and operates a Type 1 Community Public Water Supply system that provides drinking water to the residents, businesses, and public organizations located within the City of Benton Harbor. Michigan Department of Environment, Great Lakes, and Energy (EGLE) has oversight authority of the Benton Harbor water system for compliance with the Safe Drinking Water Act (SDWA). The water system includes both a treatment plant located near the shores of Lake Michigan and 66 miles of water distribution pipe that serves a population of approximately 9,970 people through 3,335 service connections (United Stated Environmental Protection Agency (USEPA) Region 5 Unilateral Administrative Order, 2021).

The current water treatment plant was constructed in the mid-1950's but smaller distribution piping to individual buildings has been in place for nearly 100 years and the 6-inch diameter water mains date back to the 1930s (Abonmarche, 2021). Because the water system piping was installed at different times, the piping materials varied and include cast iron, ductile iron, copper, galvanized steel, and lead. Nearly 84% of the water service connections within the City of Benton Harbor were of unknown material and likely contained a portion of lead or galvanized piping requiring replacement (Abonmarche, 2021). At this writing, nearly all (95 percent) of known lead service leads have been removed and replaced (Abonmarche, 2022).

Beginning in June 2018, routine lead and copper compliance monitoring samples[1] collected from single family homes within the City of Benton Harbor (Benton Harbor or City) found some lead levels well above the SDWA action level (AL) of 15 ppb. Compliance monitoring samples collected again for lead and copper in 2019, 2020 and through June 2021 also had lead results levels above the AL (Benton Harbor Community Water Council, et. al., 2021). Benton Harbor began adding a phosphate-based corrosion inhibitor in March 2019 to finished water entering the distribution system to reduce leaching of lead. The City has also contracted with Cornwell Engineering to conduct a Corrosion Control Optimization Study to further study corrosion control improvements. At this writing, the City has maintained compliance with SDWA AL for the last 18 months and continued compliance is expected.

To provide safe drinking water to the citizens of Benton Harbor, Michigan Governor Gretchen Whitmer issued Executive Directive No. 2021-6 ("Executive Directive") on October 14, 2021 that directed Michigan departments and agencies ensure residents of Benton Harbor have immediate access to free bottled water for consumption through distribution sites and drop-off delivery until further notice.[2] The Executive Directive also directed Michigan departments and agencies to leverage state resources to support the City of Benton Harbor with replacing lead service lines. On October 14, 2021, the Governor announced that all lead service lines should be replaced in the City of Benton Harbor within18 months. Subsequently, Benton Harbor has

[1] Sampling conducted for compliance with EPA's Lead and Copper Rule and Michigan Administrative Rule R 325.10710

[2] Executive Order 20216 Available at: https://content.govdelivery.com/attachments/MIEOG/2021/10/14/file_attachments/1965527/ED%202021-06%20Benton%20Harbor%20%28final%20signed%29.pdf

received approximately $28 million in grant funding for replacement of lead service lines. Removal and replacement of lead service lines is nearly complete.

In November 2018, Michigan Department of Environmental Quality (now known as EGLE) conducted a sanitary survey of the Benton Harbor water treatment plant and water distribution system. EGLE found numerous problems ranging from a lack of appropriate staffing to treatment equipment either out of service or not being properly maintained. These system deficiencies resulted from many investment and operating issues over the years. Additionally, in response to the City's financial challenges, Benton Harbor was placed under the control of a State-appointed emergency manager in 2010. In this role, the emergency manager was empowered to govern the Benton Harbor budget. Attempts by the emergency manager to reduce the City's operating costs resulted in substantial staffing reduction in the Benton Harbor Water Department, which severely impacted Benton Harbor's ability to provide adequate and safe water service to its residents. Benton Township and St. Joseph Charter Township then discontinued service from Benton Harbor in 2011 and 2013, respectively, and some local water supply contracts were cancelled by the emergency manager resulting in additional financial and operating challenges for the Benton Harbor water system.

As a result, EGLE entered into an Administrative Consent Order (ACO)[3] with the City of Benton Harbor in March 2019. The ACO was amended in August 2020 to acknowledge completed items in the order and extend deadlines for other items not completed. The ACO requires Benton Harbor to perform a Capacity Study to address technical, managerial, and financial capacity issues that limit Benton Harbor's ability to provide safe and reliable drinking water. The City of Benton Harbor subsequently hired Fleis & Vandenbrink (F&V) along with their financial services subcontractor, Plante Moran, PLLC, to prepare the Draft Capacity Study report (Fleis & Vandenbrink, 2022). An Affordability and Planning Grant from EGLE funded the study and the City submitted the draft report to EGLE in February 2022. The final Capacity Study report is scheduled for completion in March 2023.

In late September 2021, EGLE and USEPA Region 5 conducted a joint inspection of the Benton Harbor water system to assess compliance with the SDWA. USEPA Region 5 issued a Unilateral Administrative Order (Order) to Benton Harbor in November 2021 subsequent to the joint inspection (Appendix A). Per the Order, Benton Harbor is required to address several findings and complete an alternatives analysis. The alternatives analysis must consider the following:

- Staffing and administrative changes to enable Benton Harbor to be the direct majority provider of long-term technical, managerial, and financial capacity.
- Consolidation, restructuring, or regionalization, including:
  - Physical consolidation of the Benton Harbor water system with one (1) or more other systems;
  - Consolidation of significant management and administrative functions of the Benton Harbor water system with one (1) or more other systems; and

[3] Administrative Consent Order-399-07-2019 between the City of Benton Harbor and the Michigan Department of Environment, Great Lakes and Energy, dated March 5, 2019. Available at: https://www.michigan.gov/egle/

- Transfer of ownership of the system may reasonably be expected to improve drinking water quality.

- Entering into contractual agreements with third-party entities to provide significant management or administrative functions.
- A combination or hybrid of these alternatives

This report addresses the requirement in the Order to complete an alternatives analysis of the City of Benton Harbor's public water supply.

2.0 BENTON HARBOR WATER SYSTEM

This section describes the current status of the Benton Harbor water system including the physical assets at the water treatment plant and distribution system, the current management structure, and the financial status of the water system.

2.1 Current Water Treatment Plant

The Benton Harbor water treatment plant was constructed in the 1950's and was upgraded in 2011 with funding from the State of Michigan's Drinking Water State Revolving Fund (DWSRF) and a grant from the Federal Government's American Resources and Recovery Act. After the 2011 upgrades, the water treatment plant has a designed treatment capacity of up to 12 million gallons per day (MGD) of water and an anticipated life span of 50 years (City of Benton Harbor, 2014). A process flow diagram of the water treatment plant showing each of the treatment steps is provided as Figure 2-1. EGLE requires Benton Harbor have an operator with F-1 certification to fill the operator-in-charge position at the water treatment plant.

The water treatment plant draws water from an intake structure (crib) located approximately 3,400 feet into Lake Michigan at a depth of 42 feet (MDEQ, 2018a). Water from the intake structure is conveyed through a 36-inch diameter pipe to a wet well located adjacent to the low service pump room in the treatment plant. A chlorine feed line is provided from the water treatment plant to the submerged intake structure to control zebra and quagga mussels. The chlorine feed line is not used due to plugging issues and the potential to form disinfection byproducts in the raw water prior to removal of organics through the water treatment plant.

At the water treatment plant, water first passes through traveling screens to remove large solids before entering the wet well. Four low-lift pumps pull water from the wet well (one pump is currently out of service) and into the treatment plant piping where it is dosed with sodium hypochlorite for disinfection and liquid aluminum sulfate (alum) to coagulate and flocculate suspended solids. The water then passes into a rapid mixing tank and then into three successively slower flocculation mixers followed by sedimentation with plate settlers. After the plate settlers, the water flows to dual media filters that remove any residual solids not removed by the plate settlers before flowing into two underground clearwells, each having the capacity to hold one million gallons of treated water. Prior to entering the distribution system, water is treated with chlorine to meet disinfection requirements, fluoride for dental health, and a polyphosphate corrosion inhibitor. Solids collected from the bottom of the plate settling tanks and spent filter backwash are pumped to a 0.8-acre lagoon east of the treatment plant. Water either infiltrates into the soil or is discharged through a National Pollution Discharge Elimination System (NPDES) permitted outfall and the solids are periodically excavated and hauled to a landfill.

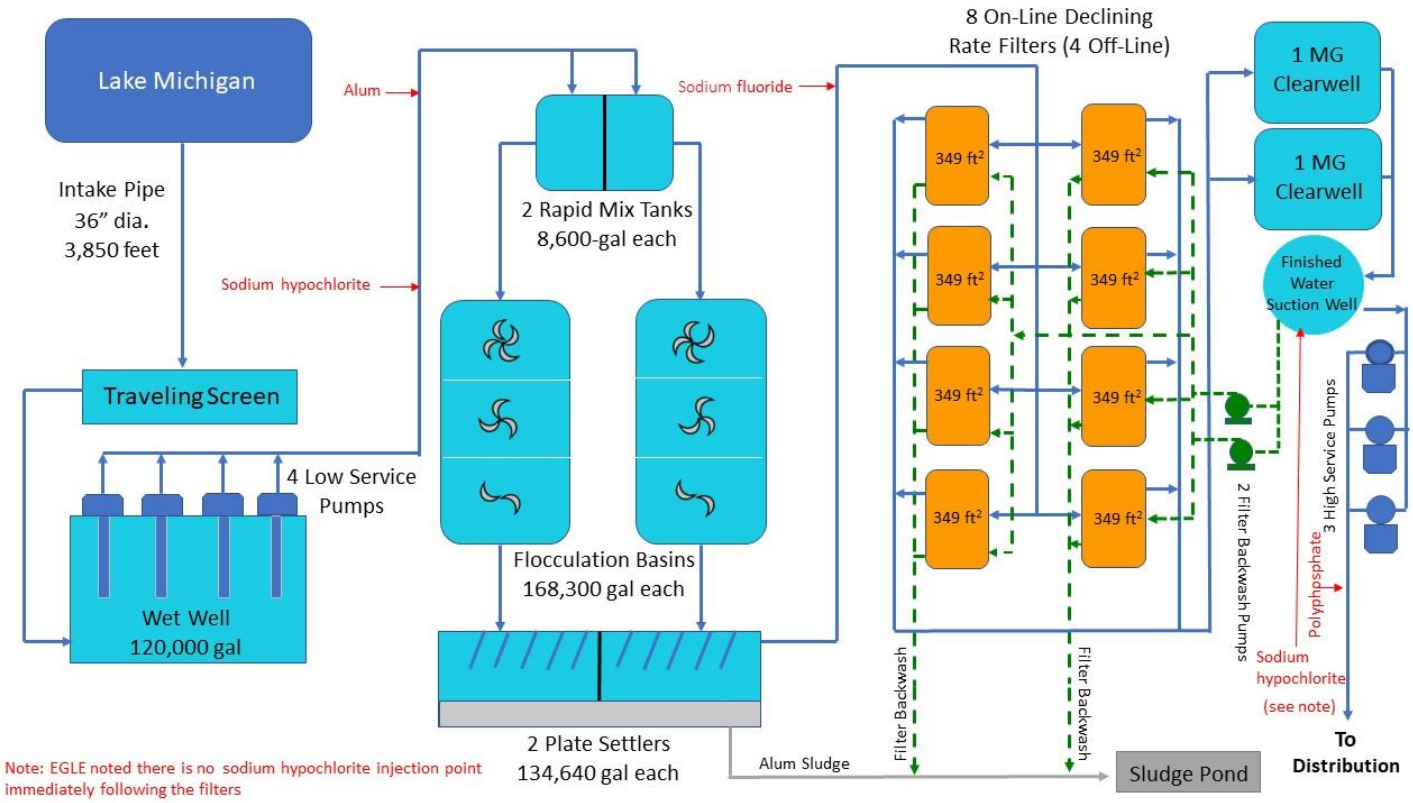


Figure 2-1. Process Flow Diagram of the Benton Harbor Water Treatment Plant

The original water treatment plant was designed to provide 12 MGD with 12 dual media filters. The current treatment plant rating is less than 8 MGD due to four filters being decommissioned and other needed improvements at the treatment plant:

- Upgrading piping and electrical
- Replacing chemical feed pumps
- Updating the laboratory and SCADA system
- Replacing all filter valves and actuators
- Fixing or replacing monitoring equipment such as chlorine analyzers and flow meters

The existing water treatment plant can meet current system demands, with an estimated maximum day demand of 2 MGD.

Filter backwash, filter-to-waste, and alum sludge from the settling basins inside the treatment plant are discharged to a lagoon adjacent to the water treatment plant. The lagoon includes two sections in series; the first section is designed to remove most of the solids while the second section is intended to provide polishing before overflowing through an elevated discharge pipe to a wetland in Jean Klock Park. The overflow from the lagoon is permitted under NPDES General Permit No. MIG640000 and Certificate of Coverage (COC) No. MIG640258 (Permit). The General Permit requires water treatment plants like Benton Harbor practicing coagulation and

filtration to measure the daily volume of flow from the lagoon and to collect weekly grab samples of the effluent for total suspended solids.

In November 2021, EGLE staff conducted an NPDES inspection of the Benton Harbor water treatment plant lagoon and noted numerous violations related to the sludge lagoon relative to the NPDES General Permit (EGLE, 2021b). Based on their inspection, EGLE required Benton Harbor to:

- Designate a certified individual responsible for the sludge lagoons at the water treatment plant.
- Develop and submit a sludge removal plan for review and approval.
- Provide a plan and a timely schedule for the removal of sludge currently stored on the water treatment plant property.
- Provide the elevations of the overflow structure and the low point of the south berm in the road constructed through the lagoons.
- Remove the road constructed through the lagoons and rebuild the berms according to approved design.
- Develop and submit an Operations and Maintenance (O&M) Manual for the sludge lagoons, including routine monitoring and a sampling plan in the event of a surface water discharge.
- Provide a plan and schedule to reduce vegetation in and around the lagoons.

EGLE is currently working with Benton Harbor to correct these issues (EGLE, 2022a and EGLE 2022b).

The water treatment plant is currently operated daily from approximately 7 am to 3 pm. During this period, enough water is treated and placed into storage to supply the City of Benton Harbor for an entire 24-hour period. Treated water from the treatment process is held in the two clearwell tanks and pumped into the City's distribution system by up to five high lift service pumps.

2.2 Current Distribution System

Water distribution system piping includes the primary transmission mains ranging from 8-inches to 20-inches in diameter near the treatment plant and distribution mains ranging from 2-inches to 8-inches in diameter, with approximately one quarter of the City's water distribution mains 4-inches or less in diameter (Figure 2-2) (Abonmarche, 2021). Approximately 80 percent of the City's water distribution piping is cast iron and the remaining 20 percent is ductile iron (MDEQ, 2018). EGLE requires Benton Harbor have an operator with S-2 certification to fill the operator-in-charge position for the distribution system.

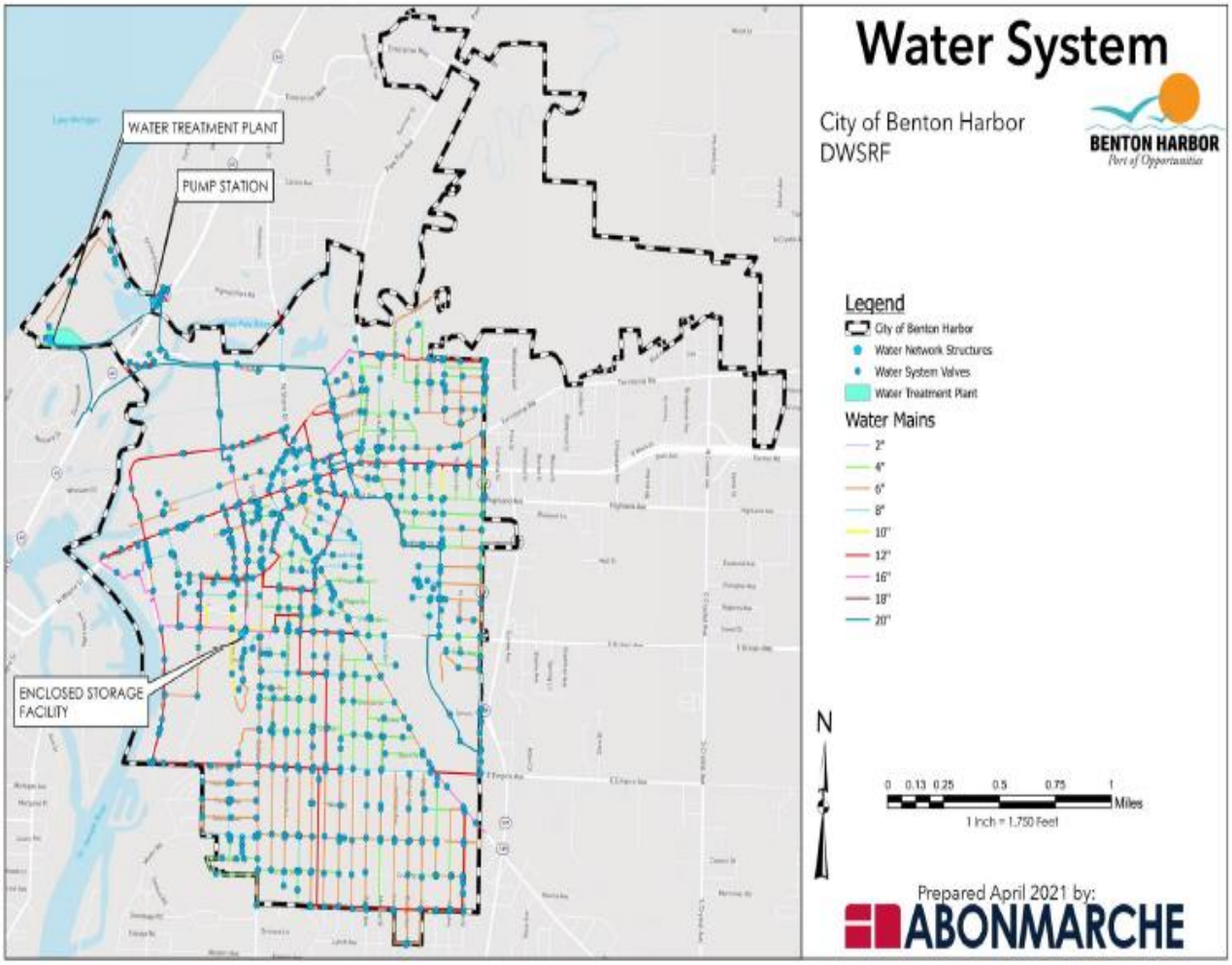


Figure 2-2. Map of the Benton Harbor Water System Showing Various Sizes of Water Mains (Abonmarche, 2021)

The City of Benton Harbor had approximately 3,011 known or likely lead service lines and another 2,733 service lines having unknown material (Benton Harbor Water Quality Report, 2019). The City, along with their engineering contractor Abonmarche, are nearly complete with identification and removal of lead service lines. Work associated with lead service line removal and replacement is funded with grants, as previously described.

Benton Harbor currently feeds a poly/orthophosphate blend for corrosion control at the water treatment plant which has been used effectively in recent years. The City has been directed by EGLE to conduct a Corrosion Control Optimization Study (currently in progress).

Benton Harbor has existing interconnections with the City of St. Joseph and Benton Charter Township that are large enough to supply water to the Benton Harbor distribution system. Currently two interconnections exist with St. Joseph, with the main and largest interconnection located on Highway M-63 between Momany Drive and Klock Road. This interconnection includes a concrete vault, 20-inch diameter ductile iron pipe installed in the late 1950's, water meter, valves, electrical and lighting. The 20-inch ductile iron pipe provides a direct connection

between the City of St. Joseph water system and the City of Benton Harbor water system. According to the September 2014 Interconnection Agreement between the City of St. Joseph and the City of Benton Harbor (see Appendix B), St. Joseph is currently responsible for maintenance of the interconnection and periodic exercising of the two gate valves, and St. Joseph and Benton Harbor share equally in all costs of maintenance including all replacement parts and utilities to the interconnection.

There are currently ten interconnections between Benton Harbor and Benton Charter Township, with the largest (20-inch) metered interconnection located at the intersection of Fair Avenue and East Valley Drive. There is no formal agreement for use of the interconnections between Benton Harbor and Benton Charter Township.

EGLE is reluctant to allow water from neighboring systems to enter Benton Harbor's distribution system because the two neighboring systems currently do not feed a polyphosphate corrosion inhibitor.

2.3 Current Benton Harbor Water Demand

A water reliability study conducted by Abonmarche in 2017 found the average water consumption in the city was 1.307 MGD and the recorded maximum day demand in 2017 was 2.28 MGD. Per capita demand averages approximately 131 gallons per day (gpd), with a maximum per capita demand of 233 gpd (Abonmarche, 2021).

Future water use projections by Abonmarche (2021) and provided in Table 2-1 show the maximum day demand in the City of Benton Harbor as 2.2 MGD in 2026 and 2.5 MGD in 2037, due in part to increases in population and possibly new industry locating to Benton Harbor. The While there is the potential for growth in Benton Harbor in the near future, both residential and commercial, anticipated demands associated with these uses have not been confirmed or quantified; therefore, these increased demands are not considered in this report.

Table 2-1. Predicted Water System Demands Based on Population Growth

Year	Estimated Population	Average Per Capita Demand (GPD)	Average Daily Demand (MGD)	Maximum Per Capita Demand (GPD)	Maximum Daily Demand (MGD)
2017	9,976	131	1.307	233	2.3
2026	9,590	131	1.256	233	2.2
2037	10,570	131	1.385	233	2.5

Source: Abonmarche, 2021

2.4 Current Water System Staffing, Operations, and Management Structure

The water treatment plant and distribution system are currently operated by a combination of City of Benton Harbor employees and contracted employees provided through an agreement with F&V Operations and Resource Management (FVOP).

The City of Benton Harbor water system is operated by:

- One utility service maintenance technician.

- Two certified treatment plant operators having F-3/S-3 and F-4/S-4 certifications, respectively, responsible for daily oversight of the water treatment plant.
- One meter reader.
- One utility technician.
- An allocation of six Public Works staff supporting the distribution system.

FVOP currently provides a F-1 certified drinking water treatment plant operator-in-charge position and the S-2 certified water distribution operator-in-charge through a month-to-month agreement with the City. FVOP was hired to provide these specific operators after the City's previous F-1/S-2 water plant superintendent was terminated in November 2020. FVOP also provides additional operation consulting assistance on an as-needed basis as well as reviewing monthly operations reports. FVOP is not contracted to provide management or training and does not have authority over the City operations staff who are responsible for the day-to-day operation of the water system. FVOP staff report directly to the city manager.

Employees in the Finance Department provide water system customer support including meter reading, water payments, and customer service. The Finance Department is supported by Plante Moran, a private accounting and consulting firm.

Benton Harbor does not have a city engineer but instead relies on contracted engineering services provided by Abonmarche. Abonmarche works directly with the city manager to:

- Develop both the asset management plan and capital improvement plans (CIP) with associated costs.
- Provide mapping of the water system infrastructure and construction documents (plans and specifications) for infrastructure improvements.
- Assist the city manager with funding applications.
- Oversee the current effort to replace all lead service lines within the distribution system.

Until recently, the water system lacked many formal written standard operating procedures (SOPs). The City developed SOPs (using contracted services) in early 2021 for major and critical operations within the water treatment plant, the on-site laboratory, and the distribution system (Fleis and Vandenbrink, 2022). Development of SOPs for non-critical operations continues. Operating records for the treatment plant and distribution system are currently maintained in a hardcopy format at the treatment plant. Historical operating records have been unorganized, misplaced, or damaged (Fleis and Vandenbrink, 2022) over the years. The 2021 sanitary survey by EGLE noted multiple deficiencies associated with lack of maintenance, SOPs, and record keeping.

Maintenance of the water system infrastructure has been conducted by a combination of City staff and FVOP on an as-needed basis without the benefit of a formal preventative maintenance (PM) program. According to the Draft Capacity Study (Fleis & Vandenbrink, 2022), the following deficiencies need to be addressed to develop a formal PM program:

- Develop a comprehensive O&M manual for the water treatment plant.

- Make equipment O&M manuals readily available.
- Train operators on equipment maintenance per the manufacture's recommendations.

Benton Harbor uses Cityworks, a computerized maintenance management software system (CMMS), to track assets and Abonmarche populated the software with distribution system information. Water treatment plant assets still need to be entered in Cityworks. In mid-January 2022, Benton Harbor hired an administrative assistant tasked with gathering and maintaining information in Cityworks to schedule maintenance, generate work orders, and track assets. Until the administrative assistant is familiar with Cityworks and the software is fully operational, City and FVOP employees are limited in their ability to perform preventative maintenance and will instead continue performing maintenance on an as-needed or emergency basis. This mode of operation has resulted in a reduction in asset performance and life, along with significant deficiencies noted in the 2021 EGLE sanitary survey.[4] According to the Draft Capacity Study, there is currently insufficient managerial capacity in the water system, the water system is understaffed, and City personnel have not received adequate training, professional development, continuing education, or proper certification for their respective duties (Fleis & Vandenbrink, 2022).

2.5 Current Financial Status of the Water System

Per the Draft Capacity Study, revenue generated from annual water sales was $1.45 million in 2021 and budgeted at approximately $1.75 million for fiscal year (FY) 2022. Without raising water rates, having new industrial/commercial development within the City that requires a large water demand, or supplementing revenues from other non-water revenue sources, the forecasted annual revenue will likely remain at $1.75 million (Fleis & Vandenbrink, 2022). The Draft Capacity Study estimates fiscal year 2022 operation and maintenance costs (including legacy costs and labor) to oversee the water treatment plant and distribution system at approximately $3.03 million (Fleis & Vandenbrink, 2022). Based on current revenues and operation and maintenance costs, the water system budget is operating with a net loss of approximately $1.3 million per year.

The City's proposed annual operating budgets for the water treatment plant and the distribution system under its current configuration are provided in Table 2-2 and Table 2-3. The Draft Capacity Study estimated annual operating costs (including legacy costs and labor), without any staff increases above the existing staff, to be between $2.9 and $3.2 million (Fleis & Vandenbrink, 2022). This O&M cost does not account for potential changes in costs associated with future capital improvements, increased staffing levels above existing staff, or debt service associated with existing capital projects. The short-term capital costs are presumed to be adequately provided for by available grant monies.

Current Benton Harbor water rates for a residential single-family dwelling are:

- Base rate of $10.92 per month (includes a 9.95% increase effective July 1, 2022)

[4] Michigan Department of Environment, Great Lakes and Energy (EGLE) Significant Deficiency Violation Notice; City of Benton Harbor 2021 Water System Sanitary Survey available at: https://www.michigan.gov/egle/-/media/Project/Websites/egle/Documents/Multi-Division/Benton-Harbor/2021/Violation-Notice-2021-11-02-Sanitary-Survey-Enclosures.pdf?rev=ef68e590b7b24926b4b1ce248317c985&hash=0E8965FB01B2513AD68C76AD57ACB728

- Usage fee of $4.60 per 100 cubic feet used (includes a 9.95% increase effective July 1, 2022). Assuming 800 cubic feet per month on average, the usage fee is $36.80 per month.
- Capital improvement charge of approximately $2.40 per month for repaying existing loans associated with drinking water improvements.

Using the above current rates, the average monthly residential water rate is around $50 per month. The financial analysis in the Draft Capacity Study estimates a need to increase rates 13.75% each year for the next 10 years to ensure revenues are sufficient to cover the legacy costs (e.g. pensions), water system operational costs and repay all existing loans. The actual amount of the required rate increase will be very dependent on collection rates. Benton Harbor will need to significantly improve residential collection rates to avoid additional rate shock.

Water rates for the City of Benton Harbor are provided in Appendix B.

Grant monies (through an allocation of the State of Michigan ARPA monies in Public Act 053 of 2022 (PA 53 of 2022) are available for short term capital improvements (e.g. rehabilitation or replacement of the Benton Harbor water treatment plant and certain distribution system assets). Short term capital improvements are not incorporated in operational budgets.

Table 2-2. Benton Harbor Proposed Annual Water Treatment Plant Budget for 2021 - 2022

Item	Description	2021-2022 Request
Salaries and wages	Includes wages for 2 water plant operators and 1 utility service maintenance position.	$101,293
Fringe benefits	Includes employer cost for health insurance, FICA, Medicare, unemployment insurance and workers compensation.	$37,902
Supplies and materials	Water treatment chemicals and supplies	$48,364
Professional services	FVOP expenses for normal monthly charges and additional support services performed. *Note: 2021 expended costs indicate $262,000 spent on FVOP providing water treatment plant operational support.*	$175,483
Other expenditures	Internet services, cell phones, postage, utilities, miscellaneous building repairs, water filtration cleaning, leased vehicles, Midstate Engineering expenses.	$192,549
Total capital outlay	Treatment plant capital improvements	$0
City's proposed total treatment plant budget		**$555,592**

Source: Benton Harbor 2021 – 2022 Budget for Dept. 570

Table 2-3. Benton Harbor Proposed Annual Water Distribution System Budget for 2021 - 2022

Item	Description	2021- 2022 Request
Salaries and wages	Includes 1 meter reader, 1 utility tech and allocation of 6 public works staff time as they work on resident's water/sewer issues.	$201,392
Fringe benefits	Includes employer cost for health insurance, FICA, Medicare, unemployment insurance and workers compensation.	$45,479
Supplies and materials	Non project purchases for octave meter, copper tube, curb stop, etc	$57,306
Professional services	Engineering charges from Abonmarche, RW Lapine repairs, miscellaneous other contracted services. *Note: 2021 expended costs indicate $159,000 spent on FVOP providing distribution system operational support*	$368,751
Other expenditures	Liability insurance, electrical and miscellaneous repair work.	$444,550
City's proposed total distribution system budget		**$1,117,477**

Source: Benton Harbor 2021 – 2022 Budget for Dept. 571

The Water System budget also pays for a portion of the City's Utility Administration (Dept 558), Customer Service (Dept 559), and Storm Drain (Dept 573) costs, with the remaining portion covered through the Sewer Utility and the General Fund. These expenses are summarized in the following tables.

Table 2-4. Benton Harbor Proposed Utility Administration Budgets for 2021 - 2022

Dept	Item	2021- 2022 Request
Salaries & Wages	A portion of the City's Utility Administration staff salaries and wages.	$72,928
Fringe Benefits	A portion of the City's Utility Administration staff employer cost for health insurance, FICA, Medicare, unemployment insurance, workers compensation, and pension costs for past employees.	$368,434
Supplies and materials	General office supplies	$2,000
Professional services	Includes annual audit and other professional services	$26,000
Other expenditures	Includes postage, communication costs, and software subscription/maintenance costs	$16,823
Allocations	Includes payments to the General Fund for indirect costs and administration	$687,500
Other expenses	Bad debt expense for non-payment of water bills *(Note that in 2021 the actual bad debt expense was $389,438)*	$500

Dept	Item	2021- 2022 Request
City's proposed total utilities administration (water system portion) budget		**$1,174,185**

Source: Benton Harbor 2021 – 2022 Budget for Dept. 558

Table 2-5. Benton Harbor Proposed Customer Service Budgets for 2021 - 2022

Dept	Item	2021- 2022 Request
Salaries & Wages	A portion of the City's Customer Service staff salaries and wages.	$49,208
Fringe Benefits	A portion of the City's Customer Service staff employer cost for health insurance, FICA, Medicare, unemployment insurance, and workers compensation	$8,976
Supplies and materials	General office supplies, gasoline	$1,203
Professional services	Professional services	$66,298
Other expenditures	Includes postage, utilities and misc. expenses	$4,950
Capital Outlay	Capital costs related to customer service	$5,000
City's proposed total customer service (water system) budget		**$135,635**

Source: Benton Harbor 2021 – 2022 Budget for Dept. 559

Table 2-6. Benton Harbor Proposed Storm Drain Budgets for 2021 - 2022

Dept	Item	2021- 2022 Request
Supplies and materials	Operating supplies for storm drains	$2,000
Professional services	Professional services related to storm drains	$43,828
Other expenditures	Includes repairs/maintenance and permit fee	$5,737
City's proposed total storm drain budget		**$51,565**

Source: Benton Harbor 2021 – 2022 Budget for Dept. 573

3.0 BASE ASSUMPTIONS

Following are base assumptions that are used throughout this report and for cost development associated with alternatives. The costs used are based on staffing, capital, and O&M for the next five years. Cost estimates are limited to needs within the next five years since costs beyond the

near term are not well defined. All costs developed for this Alternatives Analysis are provided in Appendix C.

3.1 Staffing

As described in Section 2.3 and Benton Harbor's proposed budget information in Table 2-2 and Table 2-3, current staffing consists of:

- Treatment plant operator-in-charge (F-1) and distribution system operator-in-charge (S-2) positions covered under contract with FVOP, with a budgeted annual cost of $175,500 (Professional Services shown in Table 2-2). 2021 Benton Harbor water system operational costs indicate the expenditures for FVOP contracted services are $262,000 for water treatment plant operations and $159,000 for distribution system operations, for a total of $421,000. The 2021 costs are used in this document as opposed to the budgeted costs to more accurately reflect costs of operating the water system.
- Two treatment plant shift operators and one utility service maintenance position, with a total budget (salary plus benefits) of $139,200.
- Distribution system staff consisting of one meter reader, one utility technician, and allocation of six Public Works staff time, with a total budget (salary plus benefits) of $246,900.

Using the above costs and salary information, it is estimated that Benton Harbor currently spends approximately $401,000 for general operations and staff at the water treatment plant and $377,000 for distribution system, totaling $778,000 on staff to operate and maintain the water system.

3.2 Capital Improvements

Benton Harbor has short-term capital improvements needed within the next five years (Fleis and Vandenbrink, 2022):

- $9 million of water treatment plant upgrades, with $1.7 million of these improvements needed for replacement of the high service pumps.
- Lagoon and sludge handling improvements to address the recent NPDES violations. Lagoon and sludge handling costs are not included in the $9 million estimate.
- $8.3 million of distribution improvements to replace old valves, hydrants, and water mains. Removal and replacement of lead service lines are not included in this cost as grant funding has been provided for these efforts.

The short-term capital projects are detailed in Table 3-1. All capital costs (except for the lagoon and sludge handling improvements) are financed with recently received American Rescue Plan Act (ARPA) funds from the Michigan legislature and is all grant funding. After completion of their lead service line replacement program, it appears that Benton Harbor will have approximately $27 million of grant funds remaining. After the $17.3 million of short-term capital improvements referenced in Table 3-1 are completed, approximately $10 million of grant funds will remain. These funds could be entirely used for needed distribution improvements or used to implement the selected alternative after the Capacity Study is completed and approved. Using

this assumption, the City will not assume loans for the projects identified in Table 3-1 and customers will not be burdened with a rate increase associated with repaying loans.

Table 3-1. Estimated 5-Year Short Term Capital Improvements

Capital Improvement	Capital Cost
Water treatment plant[a]	
Water treatment plant rehabilitation	$5,000,000
Raw water intake improvements	$1,800,000
High service pump improvements	$1,700,000
Plate settler building improvements	$110,000
Monitoring and HVAC improvements	$430,000
Water treatment plant total	**$9,040,000**
Distribution system[a,b]	
Water valve replacements (165 valves)	$1,250,000
Hydrant replacements (25 hydrants)	$250,000
Main replacements (16,100 LF)	$6,807,000
Distribution system total	**$8,307,000**
Total	**$17,347,000**

[a] Draft Capacity Study

[b] 2021 DWSRF Plan, lead service lines not included because those are covered with grant money

Additional one-time technical and managerial improvements identified in the Draft Capacity Study are also needed to maintain compliance with SDWA requirements at both the water treatment plant and within the distribution system. These include items such as:

- Developing a training program for treatment plant and distribution system operators.
- Updating the Cityworks computerized maintenance management system.
- Developing standard operating procedures for non-critical operations.
- Developing a records management system for the water treatment plant.
- Developing a water treatment plant O&M manual.

It is unknown how these improvements will be funded but these items could add tens of thousands of dollars in additional one-time capital costs.

Benton Harbor has existing loans and according to recent information provided by Benton Harbor, current annual debt service is approximately $98,000 per year over the next five years. Also, at least $35 million of additional distribution capital improvements are needed over the next 20 years (Abonmarche, 2017).

3.3 Operation and Maintenance

The Draft Capacity Study estimates current operation and maintenance costs of the water system to be approximately $3.03 million for fiscal year 2022 (Fleis and Vandenbrink, 2022). Included in these costs are wages, benefits, pensions, utilities, supplies, insurance, and professional services for other activities and staff supporting the water system, as detailed in Table 2-2 through2-6.

4.0 WATER SYSTEM ALTERNATIVES

This Alternatives Analysis uses information presented in the Draft Capacity Study (Fleis & Vandenbrink, 2022)[5] plus other information provided by Benton Harbor's consultants, the City of St. Joseph, and Benton Charter Township. Based on information provided from these sources, the following alternatives for the Benton Harbor water system were identified:

1. **Alternative 1-Benton Harbor Retains Full Ownership and Operation:** Benton Harbor maintains all current assets and retains full ownership. Benton Harbor makes required short-term improvements to the treatment plant and distribution system along with all improvements required by EGLE and in the Order. Within this alternative, three different staffing plans are evaluated:

   Alternative 1A: Benton Harbor hires required staff to operate and maintain the water treatment plant and distribution system.

   Alternative 1B: Benton Harbor contracts for all staff positions to operate and maintain the water treatment plant and distribution system, with the exception of the administrative assistant and groundskeeper.

   Alternative 1C: Hybrid of Alternatives 1A and 1B where lead operator positions are filled under contract and other positions remain Benton Harbor employees.

2. **Alternative 2- Benton Harbor Retains Full Ownership of System and Purchases Water from St. Joseph:** Benton Harbor purchases water wholesale (2.2 million gallons per day maximum) from St. Joseph, maintains ownership of all current assets, abandons all or most of the existing water treatment plant, and makes required short-term improvements to the distribution system along with all improvements required by EGLE and in the Order. Benton Harbor hires the required staff for operation of the water system. With this alternative, two options are considered:

   Alternative 2A: All purchased water from St. Joseph discharges to the existing storage reservoirs at the Benton Harbor water treatment plant and then pumped to distribution.

   Alternative 2B: A portion of the water from St. Joseph goes directly to Benton Harbor's distribution system and a portion goes into the existing storage reservoirs at the Benton Harbor water treatment plant.

[5] Benton Harbor Draft Technical, Managerial and Financial (TMF) Capacity Study available at: https://michiganegle.govqa.us/WEBAPP/_rs/(S(wqmqiksd1nnp33jiypibb5cb))/OpenRecordsSummary_.aspx?sSessionID=&view=1; Reference #E209731-031122

3. **Alternative 3- Benton Harbor Retains Full Ownership of System and Purchases Water from Benton Charter Township:** Benton Harbor purchases water wholesale from Benton Charter Township, maintains ownership of all current assets, abandons the existing water treatment plant, and makes required short-term improvements to the distribution system along with all improvements required by EGLE and in the Order. Benton Harbor hires the required staff for operation of the water system.
4. **Alternative 4-Regionalization with Neighboring Systems:** Benton Harbor enters into a formal agreement with St. Joseph and Southwest Michigan Regional Sanitary Sewer and Water Authority (SMRSS&WA) for shared services of the water system. Benton Harbor maintains ownership of all current assets and makes required short-term improvements to the water treatment plant and distribution system along with all improvements required by EGLE and in the Order.
5. **Alternative 5-Consolidation with Neighboring System:** Benton Harbor's water system is owned, operated, and maintained by either Benton Charter Township, St. Joseph, or SMRSS&WA. With this alternative, Benton Harbor relinquishes ownership of all water system assets to either Benton Charter Township, St. Joseph, or SMRSS&WA.
6. **Alternative 6-Private Ownership of the Benton Harbor Water System:** Benton Harbor relinquishes ownership of the water system to a private company who provides the capital to purchase all assets and makes required system upgrades identified in Alternative 1. The new owner also assumes any outstanding debt for previous system improvements. The new owner operates the system, provides all water system staff, and performs all maintenance. The new owner addresses all unresolved compliance issues and operates the system to maintain compliance.
7. **Alternative 7-Alternative Water Source:** Benton Harbor drills new wells to replace its existing Lake Michigan water source. This alternative requires Benton Harbor to hire the required additional staff to operate and maintain the distribution system, abandons the existing treatment plant, constructs a new smaller treatment plant for treatment of groundwater by disinfection and possibly iron and arsenic removal, and

   Alternative 7A hires staff to operate the new treatment plant, or **Alternative 7B** retains qualified contract operations company (as described in Alternative 1B) to operate the new treatment plant.

Each of these alternatives, including the cost implications, are discussed below. Costs impacts are shown for residential customers; however, commercial, and industrial customers will realize rate increases associated with each alternative on a proportional scale. Section 5.0 of this report addresses the financial implications of these alternatives and a comparison between the alternatives based on criteria that ensures safe drinking water is provided to the citizens of Benton Harbor.

4.1 Alternative 1: Benton Harbor Retains Full Ownership and Operation

Scenario: Benton Harbor maintains all current assets and retains full ownership. Benton Harbor makes required short-term improvements to the treatment plant and distribution system along

with all improvements required by EGLE and in the Order. Within this alternative, three different staffing plans are evaluated:

> ***Alternative 1A:*** *Benton Harbor hires required staff to operate and maintain the water treatment plant and distribution system.*
>
> ***Alternative 1B:*** *Benton Harbor contracts for all staff positions to operate and maintain the water treatment plant and distribution system, with the exception of the administrative assistant and groundskeeper.*
>
> ***Alternative 1C:*** *Hybrid of Alternatives 1A and 1B where lead operator positions are filled under contract and other positions remain Benton Harbor employees.*

For Benton Harbor to retain full ownership of the water system, they must:

- Hire or contract appropriately trained staff with the required certifications for multiple positions.
- Upgrade the water treatment plant and distribution system with the short-term capital improvements identified in the Draft Capacity Study (Fleis & Vandenbrink, 2022).
- Make significant changes to their O&M programs.
- Without these changes, the City will continue to lack the technical, financial, and managerial capacity to comply with all SDWA requirements (EGLE, 2021).

4.1.1 Alternative 1A: Benton Harbor Hires all Staff

For this alternative, Benton Harbor hires all staff required to operate and maintain the water treatment plant and distribution system.

4.1.1.1 Alternative 1A Staffing

To address the overall operations and management gaps in the Benton Harbor water system to meet SDWA requirements and provide safe and reliable drinking water, the updated Capacity Study (not yet publicly available) recommends the water system needs 13 full-time employees (FTEs) having various levels of certifications and training:

- One water system director, preferably having F-1 and S-2 certification.
- One administrative assistant experienced with computerized maintenance management software, such as Cityworks.
- One water treatment plant operator with an F-1 certification.
- Four water treatment plant operators with at least F-4 certifications.
- One water distribution operator with an S-2 certification.
- Three water system operators with at least an S-4 certification.
- One water meter/maintenance technician.
- One groundskeeper.

Figure 4-1 provides an organizational chart showing the required positions listed above and the reporting structure. A description of the duties and requirements for each of these positions is available in Appendix E (Fleis and Vandenbrink, 2022). This scenario assumes Benton Harbor hires all 13 operator and staff positions to oversee the water treatment plant and distribution

system. The Finance Department, with customer service and meter reading personnel supporting the Water Department, and the Department of Public Works will continue to operate under its current structure.

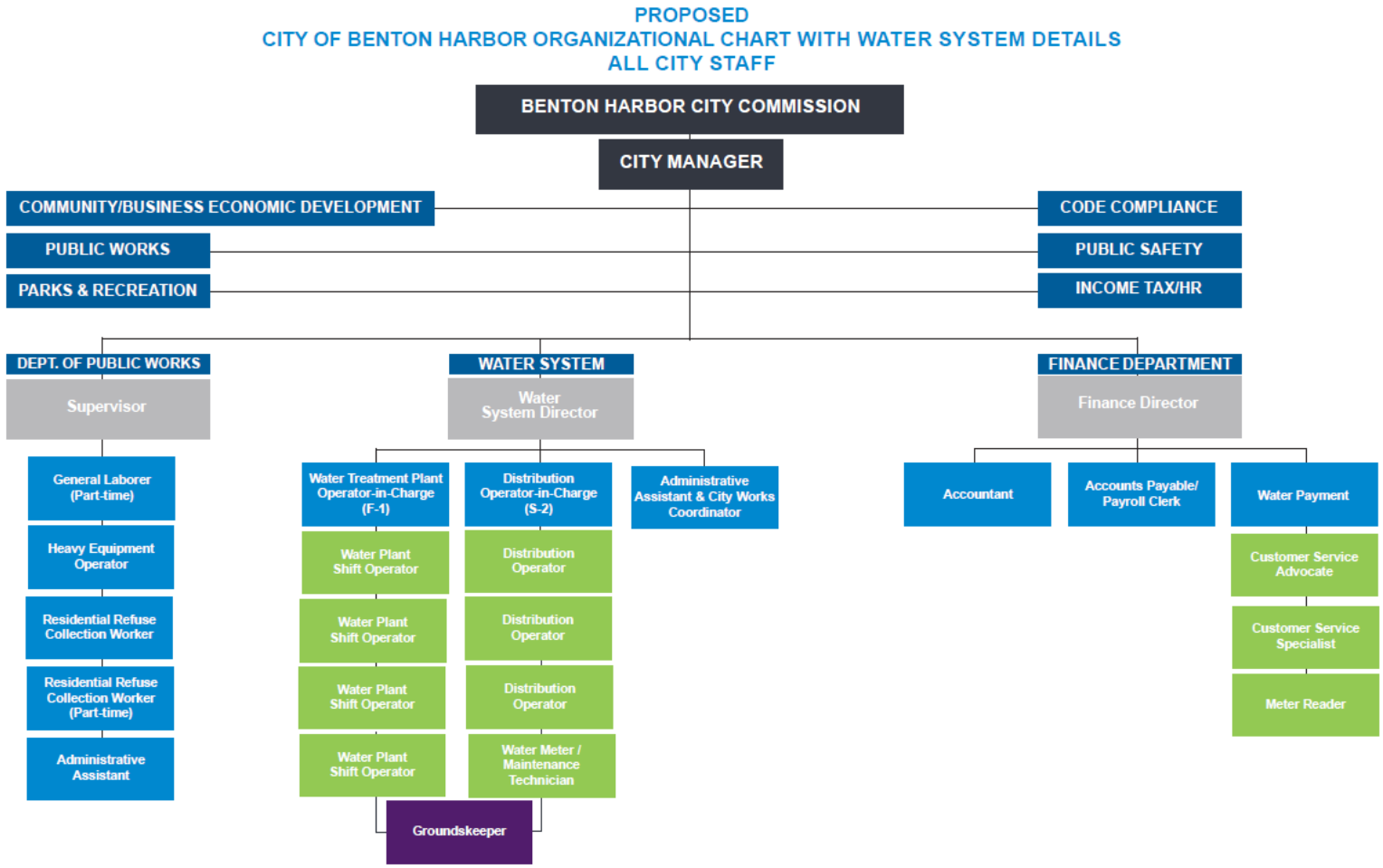


Figure 4-1. Alternative 1A Staffing Requirements for the Benton Harbor Water System

Table 4-1 shows the annual estimated labor cost (salary plus fringe benefits) to operate the treatment plant and distribution system according to the organizational chart shown above. The estimated total is $1,180,000 per year, resulting in an approximate $402,000 annual increase over current labor costs (estimated to be $778,000).

Table 4-1. Alternative 1A Estimated Annual Labor Costs for the Water Treatment Plant and Distribution System Based on 13 FTEs.

Position	FTEs	Total Annual Salary	Annual Fringe Benefits	Total Annual Salary & Fringe Benefits
General operations and water treatment plant staff				
Water director, administrative assistant, water treatment plant operator-in-charge with F-1 certification, and 4 water treatment plant operators with at least F-4 certifications	7	$490,000	$210,000	$700,000
Distribution System Staff				
Water distribution operator-in-charge with S-2 certification, 3 water system distribution operators with at least S-4 certification, distribution water meter technician, and groundskeeper	6	$300,000	$180,000	$480,000
Total	**13 staff**	**$790,000**	**$390,000**	**$1,180,000**

Hiring a new water system director, a water treatment plant operator with F-1 certification, a distribution system operator with S-2 certification and up to four water treatment plant shift operators and three distribution system shift operators may be challenging for the City. The current labor market is very limited for certified water system operators in Michigan and nationally. The City would need to offer very competitive salaries and benefits to attract and retain these individuals who will be joining a water system experiencing significant technical, managerial, and financial challenges. Given today's current labor market, the City may have to offer salaries that are as much as 15% to 20% higher than those shown in Table 4-1. These challenges may limit the feasibility of this alternative in the short-term.

4.1.1.2 Alternative 1A Capital Improvements

As indicated previously in Section 3.2, numerous short-term capital projects (within the next 5 years) are needed at both the treatment plant and within the distribution system to continuously provide safe drinking water to City of Benton Harbor customers. Estimated short-term capital improvement needs at the treatment plant and in the distribution system are $9 million and $8.3 million, respectively (Fleis and Vandenbrink, 2022).

During EGLE and EPA's NPDES inspection of the water treatment plant's alum sludge lagoon in November 2021 (Appendix F), numerous violations were noted. These violations include removal of the sludge lagoon's berm to create a roadway through the pond, excessive vegetation

in and around the pond limiting its treatment capacity, and elevation issues with the spillway. To prevent further NPDES violations associated with the sludge lagoon and to alleviate water treatment plant operations related to sludge wasting and filter backwash, capital costs for a new sludge handling facility to be located near the water treatment plant were estimated. The sludge handling facility will allow sludge to be removed from the lagoon, dewatered, and disposed off-site on a continuous basis.

The sludge handling facility includes a sludge handling building housing a belt filter press sludge conveyor system. Equipment sizes are based on:

- Filter backwash and filter-to-waste volumes comprise five percent of the average daily water treatment plant water flow (1.26 MGD) (AWWA, 1998).
- Approximately 235 pounds of alum sludge per million gallons of treated water are discharged from the plate settlers to the lagoons (AWWA, 1998).
- Settled sludge transferred from the lagoon to the belt filter press is 2% solids.

Table 4-2 summarizes the sludge handling facility costs; Appendix C presents detailed costs.

Table 4-2. Estimated Capital Costs for a New Sludge Handling Facility

Item	Estimated Capital Cost ($2022)[a]
Belt filter press	$376,000
Sludge conveyor	$75,000
Filter press building	$358,000
Other direct costs	$231,000
Other indirect costs	$580,000
Lagoon improvements[b]	$81,000
Total cost	**$1,701,000**

[a] Costs for the belt press, conveyor, buildings, direct costs and indirect costs estimated by CapdetWorks.

[b] Costs for lagoon improvements assumed 10% of equipment capital costs.

Another option for management of filter backwash and filter-to-waste water includes discharge to the sanitary sewer system. This option requires Benton Harbor to discuss permitting requirements with the SMRSS&WA and St. Joseph to verify the discharge could be accepted. This would be followed by an engineering assessment to determine the infrastructure needs to transfer the discharge from the water treatment plant into the sanitary sewer system.

Table 4-3 summarizes the capital improvements at the water treatment plant, new sludge handling facility, and distribution system. It is assumed that capital costs for the proposed sludge handling facility is to be financed with a generous funding package through the Michigan Drinking Water State Revolving Fund program. Assuming Benton Harbor qualifies for this funding and using the lending terms of recent infrastructure funding being made available, the project is awarded 49% principal forgiveness and the remaining loan amount is issued at 2% annual interest rate for a term of 20 years. All other capital improvements are assumed to be funded with recently received State ARPA grant funds (through PA 53 of 2022) and the City will not assume any additional debt service for the capital improvements identified in Table 4-3.

Table 4-3. Estimated 5-Year Short Term Capital Improvements for Alternative 1

Capital Improvement	Capital Cost	Annual Debt Service
Water treatment plant improvements	$9,040,000	$0
Sludge handling improvements	$1,701,000	$53,100
Distribution system improvements	$8,307,000	$0
Total cost	**$19,048,000**	**$53,100**

Benton Harbor may realize additional capital costs needed to implement any improvements recommended in the forthcoming Corrosion Control Optimization Study. These costs are unknown at this time and cannot be estimated until the study is completed. Other one-time short-term costs will also be incurred as Benton Harbor continues to address items in the EPA Order and EGLE's 2021 sanitary survey, such as repairs to the clearwell hatches or installation of a new on-line chlorine analyzer. This alternatives analysis assumes most of these costs are covered in the system's annual budget (either in the operation and maintenance budget or as part of an additional capital improvement project) or existing grant funds and does not assign an additional cost to these activities.

4.1.1.3 Alternative 1A Operation and Maintenance

As described in Section 3.3, the current annual O&M costs for the treatment plant are $555,292and $1,117,477 for the distribution system, respectively. The costs for operating and maintaining the lagoon and resulting sludge handling facilities need to be added to these costs. Annual O&M costs for Benton Harbor to properly operate the sludge lagoon by periodically removing and disposing of sludge is estimated at $63,000 per year (see Appendix C for details). The Draft Capacity Study and 2021 Sanitary Survey also included other annual activities for Benton Harbor to maintain water system compliance, such as ensuring SOPs are being updated and providing training for operators to maintain State of Michigan required certifications. This alternatives analysis assumes most of these costs are covered in the O&M budget or as part of capital improvement project and does not assign an additional cost to these activities.

4.1.1.4 Alternative 1A Summary

For Benton Harbor to retain ownership of the entire water system, bring the system into compliance, and operate the water system to provide safe and reliable drinking water to all customers, additional costs will be incurred beyond the existing water rates. The additional costs estimated over the next 5 years consist of:

- Labor costs associated with hiring and retaining 13 FTEs to fill all positions, with an estimated increased cost of $402,000 per year.
- Water treatment plant and distribution system capital improvements as shown in Table 3-1 are assumed to be funded with State ARPA grant dollars (PA 53 of 2022), resulting in zero increases to rates to repay loans.

- The sludge lagoon improvements and sludge handling facilities are assumed to be funded with low interest loans, as described in 4.1.1.2, with annual debt service cost of $53,100.
- Increased O&M costs at the treatment plant for sludge handling, resulting in an increased cost of $63,000 per year.

The total increase to rate payers each year is approximately $518,100 (see Table 4-4, resulting in an increase per connection (assuming 3,335 connections) of $12.95 per month in residential customer water rates).

Table 4-4. Alternative 1A Cost Implications

Item	Annual Existing Cost	Annual Proposed Cost	Annual Increase/ Decrease to Customers
Labor (salary plus benefits)			
General operations and water treatment plant staff	$401,000	$700,000	$299,000
Distribution staff	$377,000	$480,000	$103,000
Labor total	**$778,000**	**$1,180,000**	**$402,000**
Capital costs (debt service)			
Water treatment plant		$0	$0
Sludge handling facility		$48,000	$53,100
Distribution system		$0	$0
Capital costs (debt service) total		**$48,000**	**$53,100**
Operation and maintenance (excluding labor)			
Water treatment plant	$251,000	$251,000	$0
Sludge handling facility	$0	$63,000	$63,000
Distribution system	$502,000	$502,000	$0
Utility Admin/Customer Service	$1,361,400	$1,361,400	$0
Operation and maintenance total	**$2,114,400**	**$2,177,400**	**$63,000**
Net increase cost to system			**$518,100**

This alternative results in Benton Harbor retaining full ownership of the water treatment plant and distribution system, which is a high priority for current management. Conversely, this alternative presents concerns:

Benton Harbor may not be able to hire and retain all required certified operators.

- Benton Harbor may not have the technical, managerial, and financial capacity to oversee all needed improvements.

- The estimated monthly increase per residential customer for this alternative is $12.95. This increase is in addition to the rate increase needed to address the current annual operating deficit of $1.3 million; the total rate increase amount is being determined in the Capacity Study, pending evaluation of a financial gap closure plan.

4.1.2 Alternative 1B: Benton Harbor Contracts for Most Operator Positions

For this alternative, the majority of water system operator and maintenance positions are filled through a contract with a private company, such as FVOP. The contractor is required to have staff available on a daily basis and be available on-call for emergencies or alarm call-outs. The contractor is responsible for all operations, maintenance, and management of the Benton Harbor water treatment plant and water distribution system. Contracted staff are required to obtain all the required certifications. The water system director is also assumed to be filled under contract and reports directly to the city manager.

The operations contractor and City of Benton Harbor would enter into a contractual agreement to provide services to the water system for a minimum of 5 years.

4.1.2.1 Alternative 1B Staffing

For this alternative, all staff to operate and maintain the water system are contracted, except for the administrative assistant and part-time groundskeeper positions. The full-time staff requirements are less than the 13 FTEs presented in Alternative 1A since the contracted operator can deploy operators from other locations to cover vacations, illness and other labor staffing issues associated with holidays and shift changes. Under this alternative, 10.5 FTEs are proposed to operate and maintain the system (see Table 4-2), with nine positions filled with contract operators. Using contractor rates, the annual cost for 10.5 staff (nine of which are contracted) to operate the water system is approximately $960,000 per year as shown in Table 4-5. This amount results in an approximate annual increase of $182,000 above current labor costs (estimated to be $778,000).

Table 4-5. Alternative 1B Estimated Annual Labor Cost for Contracted Staff to Operate the Water Treatment Plant and Distribution System Based on 10.5 FTEs

Position	FTEs	Total Annual Salary	Annual Fringe Benefits	Total Annual Salary & Fringe Benefits
General operations and water treatment plant staff				
City employed: administrative assistant and part-time groundskeeper	1.5	$75,000	$30,000	$105,000
Contracted: Water director, water treatment plant operator-in-charge with F-1 certification, and 3 water treatment plant operators with at least F-4 certifications	4.5	$495,000	N/A	$495,000

Position	FTEs	Total Annual Salary	Annual Fringe Benefits	Total Annual Salary & Fringe Benefits
Distribution system staff				
Contracted: Water distribution operator-in-charge with S-2 certification, 2 water system distribution operators with at least S-4 certification, distribution water meter technician	4.5	$360,000	N/A	$360,000
Total	**10.5 staff**	**$930,000**	**$30,000**	**$960,000**

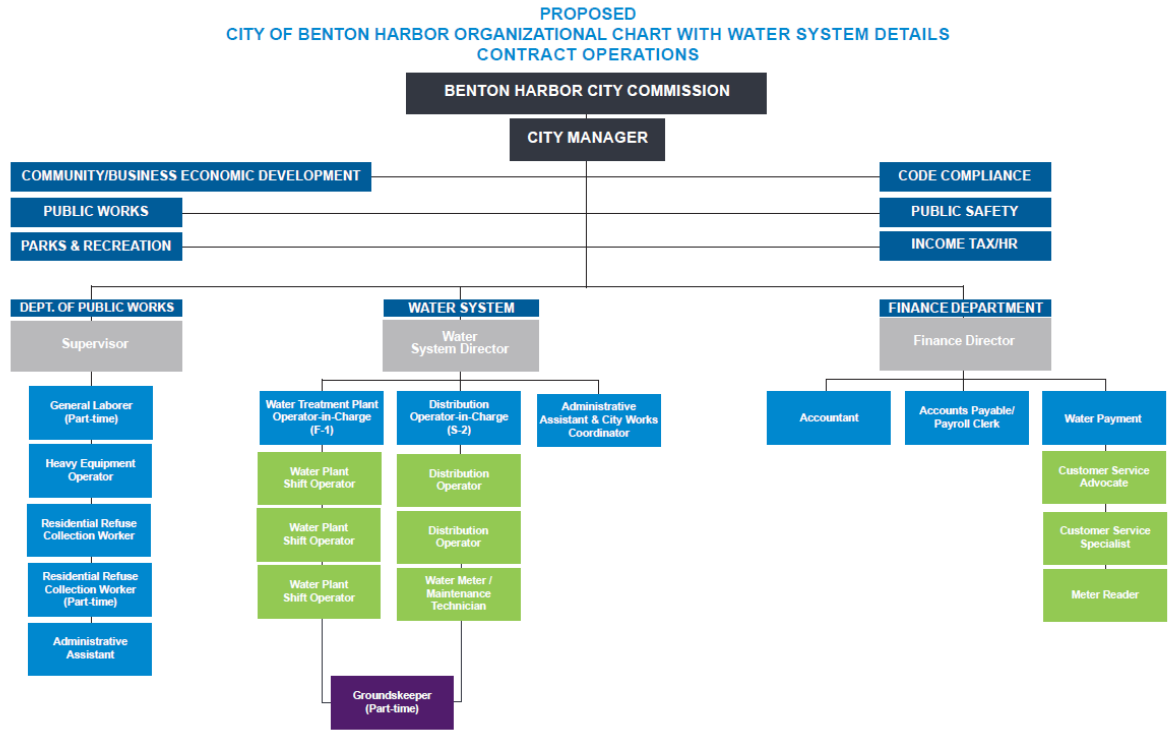


Figure 4-2. Alternative 1B Staffing Requirements for the Benton Harbor Water System

4.1.2.2 Alternative 1B Capital Improvements

Capital improvements remain the same as identified for Alternative 1A in Section 4.1.1.2 and Benton Harbor will realize a debt service cost of $53,100 for the sludge lagoon upgrades and sludge handling facilities.

4.1.2.3 Alternative 1B Operation and Maintenance

Operations of the water system by a contractor will still require Benton Harbor to provide utilities, chemicals, equipment maintenance, and sludge disposal. Operation and maintenance

costs are the same as identified in Section 4.1.1.3, with an increase of $63,000 above current operating costs for sludge handling.

4.1.2.4 Alternative 1B Summary

This alternative would eliminate City staff operating the water system by using contracted staff for most positions. The additional costs estimated over the next 5 years consist of:

- Labor costs associated with contracting nine of the 10.5 FTEs to fill all positions, with an estimated increased cost of $182,000 per year.
- Water treatment plant and distribution system capital improvements as shown in Table 3-1 are assumed to be funded with ARPA grant dollars, resulting in zero increases to rates to repay loans.
- The sludge lagoon improvements and sludge handling facilities are assumed to be funded with low interest loans, as described in 4.1.1.2, with annual debt service cost of $53,100.
- Increased operation and maintenance costs at the treatment plant for sludge handling, resulting in an increased cost of $63,000 per year.
- The total increase to rate payers each year is approximately $298,100 (See Table 4-6), resulting in an incremental increase per connection (assuming 3,335 connections) of $7.45per month in residential customer water rates.

Table 4-6. Alternative 1B Cost Implications

Item	Annual Existing Cost	Annual Proposed Cost	Annual Increase/ Decrease to Customers
Labor (salary plus benefits)			
General operations and water treatment plant staff	$401,000	$600,000	$199,000
Distribution staff	$377,000	$360,000	($17,000)
Labor total	**$778,000**	**$960,000**	**$182,000**
Capital costs (debt service)			
Water treatment plant		$0	$0
Sludge handling facility		$48,000	$53,100
Distribution system		$0	$0
Capital costs (debt service) total		**$48,000**	**$53,100**
Operation and maintenance (excluding labor)			
Water treatment plant	$251,000	$251,000	$0
Sludge handling facility	$0	$63,000	$63,000
Distribution system	$502,000	$502,000	$0
Utility Admin/Customer Service	$1,361,400	$1,361,400	$0
Operation and maintenance total	**$2,114,400**	**$2,186,400**	**$63,000**

Item	Annual Existing Cost	Annual Proposed Cost	Annual Increase/ Decrease to Customers
Net increase cost to system			**$298,100**

This alternative results in the following benefits:

- Benton Harbor retains full ownership of the water treatment plant and distribution system.
- Benton Harbor can fill all required water system operator and staff positions with properly certified operators, greatly increasing the technical capacity of the system. It also provides city employees with the opportunity to develop skills while working under contracted certified operators.
- Benton Harbor has access to additional resources, such as equipment or technical expertise through the contractor providing operators, potentially improving customer service and system reliability.

Conversely, this alternative presents concerns:

- Benton Harbor may not have the managerial and financial capacity to oversee all needed improvements.
- The estimated monthly increase per residential customer for this alternative is $7.45. This increase is in addition to the rate increase needed to address the current annual operating deficit of $1.3 million; the rate increase amount is being determined in the Capacity Study , pending evaluation of a financial gap closure plan.
- Benton Harbor is vulnerable to losing all operations staff in the event the contractor terminates services or financial hardships limit the city's ability to pay for contracted services.

4.1.3 Alternative 1C: Hybrid of Alternatives 1A and 1B where lead operator positions are filled under contract and other positions remain Benton Harbor employees.

Given the challenges associated with hiring qualified staff in Benton Harbor, another option is current Benton Harbor operating staff is supplemented with qualified and licensed contract operation employees. This alternative is similar to the operational approach currently being employed by Benton Harbor. Under this alternative, staffing level would remain similar to Alternative 1A. This alternative could be immediately implemented but reporting relationships between Benton Harbor staff and the contract operation employees would need to be better defined. This alternative allows Benton Harbor water department to be more resilient in the event contracted operations are reduced or terminated. Maintaining a certain level of in-house talent will reduce this operational risk.

4.1.3.1 Alternative 1C Staffing

For this alternative, a combination of city staff and contracted staff are used to fill all required positions to operate and maintain the water system. A total of 13 FTEs are needed for this alternative (see Figure 4-5):

- **City-employed:** An administrative assistant, three water treatment plant shift operators, and part-time groundskeeper (total of 4.5 FTEs) are assumed for general and water treatment plant operations. Two distribution shift operators and water meter technician (total of 3 FTEs) are assumed for water distribution operations.
- **Contracted:** The water system director, water treatment plant operator-in-charge with F-1 certification, and one water treatment plant shift operation (total of 3 FTEs) are assumed for general and water treatment plant operations. The distribution system operator-in-charge with S-2 certification along with one full-time and part-time shift operator (total of 2.5 FTEs) are assumed for the distribution system. The part-time shift operator is assumed to provide coverage of other shifts in the event a city employee is unavailable.

Table 4-7 provides a summary of staff positions and costs, with a total estimated cost of $1,184,000 per year. This amount results in an approximate annual increase of $406,000 above current labor costs (estimated to be $778,000).

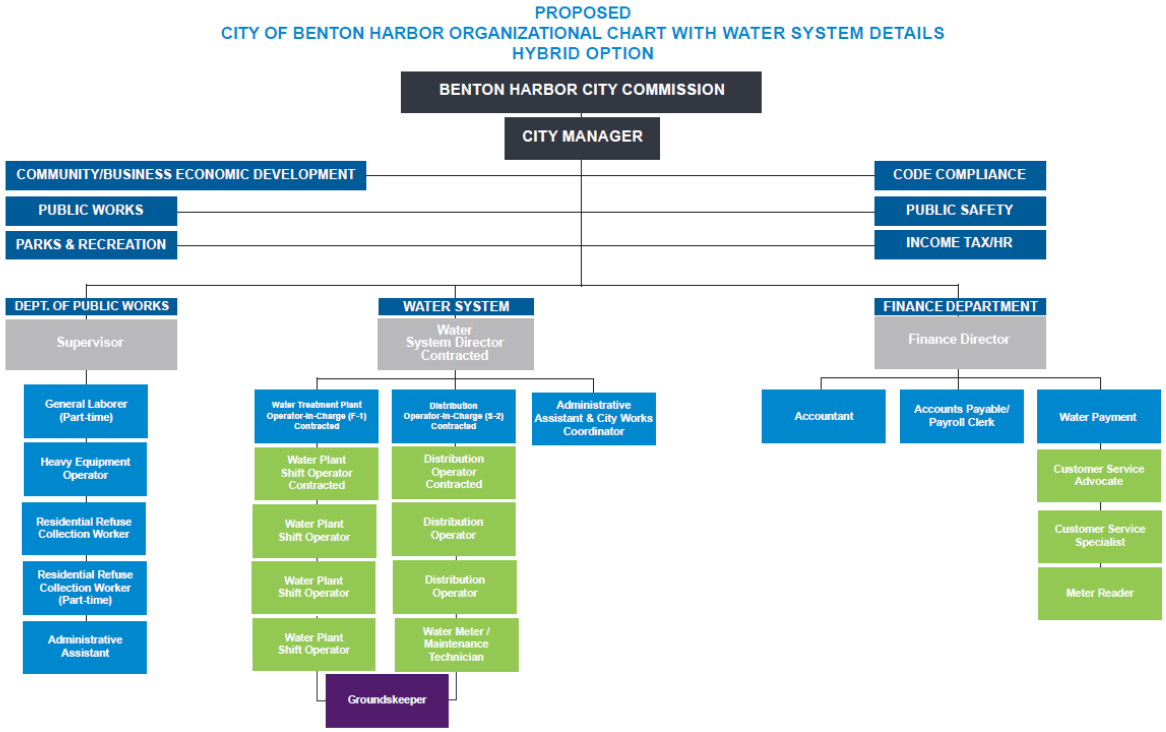


Figure 4-3. Alternative 1C Staffing Requirements for the Benton Harbor Water System

Table 4-7. Alternative 1C Estimated Annual Labor Cost for City and Contracted Staff to Operate the Water Treatment Plant and Distribution System

Position	FTEs	Total Annual Salary	Annual Fringe Benefits	Total Annual Salary & Fringe Benefits
General operations and water treatment plant staff				
City employed: Administrative assistant, 3 water treatment plant operators, and part-time groundskeeper	4.5	$279,000	$135,000	$414,000
Contracted: Water director, water treatment plant operator-in-charge with F-1 certification, and 1 water treatment plant operator	3	$330,000	N/A	$330,000
Distribution system staff				
City employed: 2 water system distribution operators and water meter technician	3	$150,000	$90,000	$240,000
Contracted: Water distribution operator-in-charge with S-2 certification and 1.5 water system distribution operators	2.5	$200,000	N/A	$200,000
Total	**13 staff**	**$959,000**	**$225,000**	**$1,184,000**

4.1.3.2 Alternative 1C Capital Improvements

Capital improvements remain the same as identified for Alternative 1A in Section 4.1.1.2 and Benton Harbor will realize a debt service cost of $53,100 for the sludge lagoon upgrades and sludge handling facilities.

4.1.3.3 Alternative 1C Operation and Maintenance Cost

Operations of the water system by a contractor will still require Benton Harbor to provide utilities, chemicals, equipment maintenance, and sludge disposal. Operation and maintenance costs are the same as identified in Section 4.1.1.3, with an increase of $63,000 above current operating costs for sludge handling.

4.1.3.4 Alternative 1C Summary

This alternative provides Benton Harbor some resiliency by using both city employees and contracted employees along with opportunities for Benton Harbor staff to develop skills to eventually assume lead positions. With all water department staff being employed by a contract operator, any change in the status or availability of the contract operator could have a significant impact on the Benton Harbor operation. Maintaining a certain level of in-house talent will reduce this operational risk.

The additional costs estimated over the next 5 years consist of:

- Labor costs associated with employing or contracting 13 FTEs to fill all positions, with an estimated increased cost of $406,000 per year.
- Water treatment plant and distribution system capital improvements as shown in Table 3-1 are assumed to be funded with ARPA grant dollars, resulting in zero increases to rates to repay loans.
- The sludge lagoon improvements and sludge handling facilities are assumed to be funded with low interest loans, as described in 4.1.1.2, with annual debt service cost of $53,100.
- Increased operation and maintenance costs at the treatment plant for sludge handling, resulting in an increased cost of $63,000 per year.

The total increase to rate payers each year is approximately $522,100 (See Table 4-8), resulting in an incremental increase per connection (assuming 3,335 connections) of $13.05 per month in residential customer water rates.

Table 4-8. Alternative 1C Cost Implications

Item	Annual Existing Cost	Annual Proposed Cost	Annual Increase/ Decrease to Customers
Labor (salary plus benefits)			
General operations and water treatment plant staff	$401,000	$744,000	$343,000
Distribution staff	$377,000	$440,000	$63,000
Labor total	**$778,000**	**$960,000**	**$406,000**
Capital costs (debt service)			
Water treatment plant		$0	$0
Sludge handling facility		$48,000	$53,100
Distribution system		$0	$0
Capital costs (debt service) total		**$48,000**	**$53,100**
Operation and maintenance (excluding labor)			
Water treatment plant	$251,000	$251,000	$0
Sludge handling facility	$0	$63,000	$63,000
Distribution system	$502,000	$502,000	$0
Utility Admin/Customer Service	$1,361,400	$1,361,400	$0
Operation and maintenance Total	**$2,114,400**	**$2,177,400**	**$63,000**
Net increase cost to system			**$522,100**

This alternative results in the following benefits:

- Benton Harbor retains full ownership of the water treatment plant and distribution system.

- Benton Harbor can fill all required water system operator and staff positions with properly certified operators, greatly increasing the technical capacity of the system. It also provides city employees with the opportunity to develop skills while working under contracted certified operators and may lead to city employees assuming lead roles. In addition, in the event the city is unable to financially support contracted positions, it is able to maintain a reduced level of operations.
- Benton Harbor has access to additional resources, such as equipment or technical expertise through the contractor providing operators, potentially improving customer service and system reliability.

Conversely, this alternative presents concerns:

- Benton Harbor may not have the managerial and financial capacity to oversee all needed improvements.
- The estimated monthly increase per residential customer for this alternative is $13.05. This increase is in addition to the rate increase needed to address the current annual operating deficit of $1.3 million; the rate increase amount is being determined in the Capacity Study, pending financial gap closure plan.
- Benton Harbor is vulnerable to losing key staff in the event the contractor terminates services or financial hardships limit the city's ability to pay for contracted services.

4.2 Alternative 2: Benton Harbor Retains Full Ownership of System and Purchases Water from St. Joseph

***Scenario**: Benton Harbor purchases water wholesale (2.2 million gallons per day maximum) from St. Joseph, maintains ownership of all current assets, abandons all or most of existing water treatment plant, and makes required short-term improvements to the distribution system along with all improvements required by EGLE and in the Order. Benton Harbor hires the required staff for operation of the water system. With this alternative, two options are considered:*

> ***Alternative 2A:** All purchased water from St. Joseph discharges to the existing storage reservoirs at the Benton Harbor water treatment plant and then pumped to distribution.*
>
> ***Alternative 2B:** A portion of the water from St. Joseph goes directly to Benton Harbor's distribution system and a portion goes into the existing storage reservoirs at the Benton Harbor water treatment plant.*

This alternative discusses the capacity of the St. Joseph water system to provide water to the City of Benton Harbor, how water would be transferred into the Benton Harbor distribution system from St. Joseph, and upgrades needed to ensure water supplied by St. Joseph does not exacerbate corrosion in the Benton Harbor distribution system. This alternative assumes Benton Harbor retains ownership of all water system infrastructure, performs all needed short-term improvements, and hires all water system employees and operators to maintain the water system.

The City of St. Joseph is located adjacent to the City of Benton Harbor and owns and operates a public water supply that includes a treatment plant and distribution system. St. Joseph provides potable water to the City of St. Joseph and to neighboring communities including Lincoln

Charter Township, Royalton Township and St. Joseph Charter Township. The water system is governed by the Water Services Joint Operating Board. For this alternative to be further considered, the Water Services Joint Operating Board needs to be consulted. The City of St. Joseph extracts water from Lake Michigan and treats the water by alum coagulation, up-flow solids contact clarification and filtration. Chlorine is added for disinfection and fluoride is added for dental health. Currently no corrosion inhibitor is added to the water from the St. Joseph water treatment plant.

The City of St. Joseph water treatment plant has a design capacity of 16 MGD (CH2MHill, 2014). Average daily demand data provided by St. Joseph from 1992 through 2021 shows the maximum daily demand of 14.6 MGD occurred in 2005. Due to a substantial reduction in industrial water demand and reduced per customer residential demand, the maximum daily demand has been below 10 MGD since 2013. The latest data available shows the maximum daily demand in 2021 was 9.33 MGD and the average daily demand was 3.52 MGD (City of St. Joseph, 2021). The 2014 Strategic Capital Improvement Plan for the City of St. Joseph forecasted the 75-percentile maximum daily water demand within the system to be approximately 11.5 MGD by 2027 and 13 MGD (80% capacity threshold) by 2034 when considering the probability of additional residential and commercial customers (CH2MHill, 2014). Based on the forecasted demand, St. Joseph likely has enough additional capacity to provide the maximum daily demand of 2.2 MGD (Abonmarche, 2021) to the City of Benton Harbor for a minimum of five years without expanding their current treatment plant capacity. Updated population and water demand projections may result in extending the duration of supplying Benton Harbor with the current St. Joseph plant capacity.

The City of St. Joseph is currently identifying and replacing lead service lines within its distribution system (City of St. Joseph, 2021) and conducting a corrosion control study to determine if the water treatment plant needs to add a corrosion inhibitor. According to the St. Joseph Water Plant Superintendent, equipment is in-place at the water treatment plant to inject a corrosion inhibitor, so no additional capital costs would be incurred if this becomes necessary.

Currently, treated water leaving the St. Joseph treatment plant contains total trihalomethanes (TTHMs) ranging in concentrations from 35 to 45 ppb. Although these levels are currently below the MCL of 80 ppb, Benton Harbor should further assess TTHM formation potential within the distribution system and evaluate the need for treatment to maintain compliance.

It should be noted that St. Joseph is currently considering replacing its existing sedimentation system at the treatment plant, which will reduce the treatment plant capacity to 10 MGD during the construction period. Although the project is currently in the planning stages, St. Joseph expects construction to begin in 2023 and be completed mid-2025. During this period, St. Joseph would not have sufficient treatment capacity to sell water to Benton Harbor, so this alternative may not be available for implementation until mid-2025.

Treated water from St. Joseph entering the Benton Harbor system would likely be delivered at the existing interconnection located along M-63 (see Figure 4-4). An existing 20-inch line runs from the interconnection to the Benton Harbor water treatment plant. This scenario assumes the existing 20-inch line from the interconnection to Benton Harbor water treatment plant is in good working condition, there are no services on this line, and the valves are routinely exercised.

Under both scenarios, a secondary interconnection point with the St. Joseph system is required to provide the proper reliability of the St. Joseph supply. A cost estimate for this second interconnection is presented but is very preliminary and more details are needed to further evaluate the costs. Given St. Joseph's adequate water production and distribution system capacity to supply Benton Harbor, the current Benton Harbor supply requirement would have minimal impact on St Joseph staffing, operating costs, or capital requirement. However, providing a "special" wholesale rate for Benton Harbor would require a significant analytical and political effort.

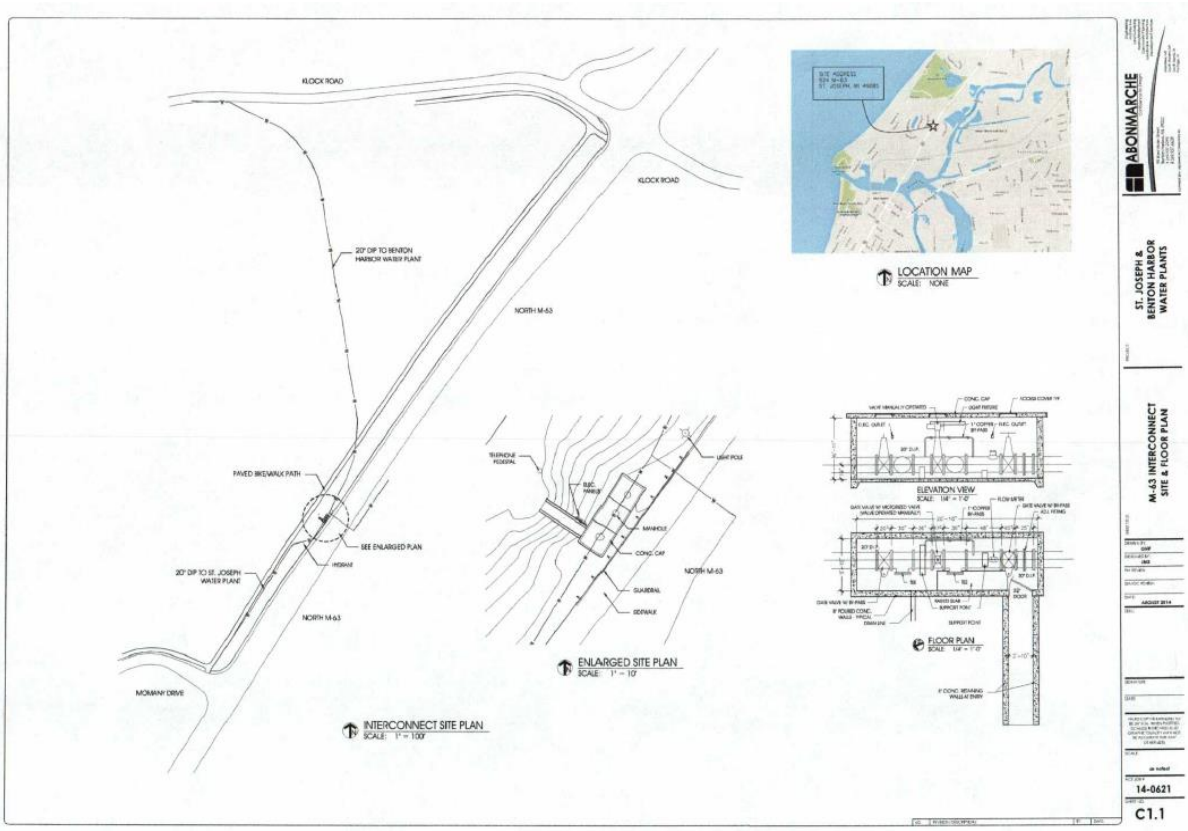


Figure 4-4. Location and Sectional Drawing of the St. Joseph and Benton Harbor Water Distribution System Interconnection (City of St. Joseph, 2014)

4.2.1 Alternative 2A: Purchase Water from St. Joseph and Discharge to Benton Harbor Water Treatment Plant Storage Reservoirs

This alternative assumes the following:

- Water from St. Joseph discharges into the two existing 1 million-gallon (MG) storage reservoirs, also known as clearwells, at the Benton Harbor water treatment plant. Some piping improvements and modifications are needed to allow water from St. Joseph to discharge into the existing clearwells at the water treatment plant; the type and extent of piping work needs to be verified.

- Water pumped from the clearwells is dosed with polyphosphate or other corrosion inhibitor after careful evaluation of water quality characteristics to address corrosion control within Benton Harbor's distribution system.
- Chlorine is injected to maintain distribution chlorine residuals using the existing chlorine feed system at the treatment plant before entering the Benton Harbor distribution system.
- Existing high service pumps at the Benton Harbor water treatment plant are used to convey water from the clearwells to the distribution system. Keeping the high service pumps as part of this project does require the capital project for replacing the high service pumps to occur, with an estimated cost of $1.7 million (see Table 3-1).

Purchasing water from St. Joseph and sending the water into the existing clearwells allows Benton Harbor to abandon most of the water treatment plant and only operate the existing clearwells, polyphosphate and chlorine chemical feed system, and high service pumps.

4.2.1.1 Alternative 2A Staffing Needs

Shutting down most of the Benton Harbor water treatment plant and only operating the clearwells, chlorine and corrosion inhibitor chemical feed systems, and high service pumps will eliminate the need for the F-1 operator-in-charge position along with the shift operators. Instead, a D-1 certified operator is needed at the water treatment plant to oversee equipment and chemical feed systems. For this option, Benton Harbor hires all 9.5 (FTE) water system staff and labor costs are assumed to be:

- Three and a half FTEs for general operations and water treatment plant oversight: One water system director having a D-1/S-2 certification, one treatment plant operator with a D-1 certification to oversee chemical feed systems and pumps at the Benton Harbor treatment plant, one half-time treatment plant shift operator, and one administrative assistant experienced with computerized maintenance management software. The operators are assumed to be paid slightly less than the salaries presented in Alternative 1A and shown in Table 4-1 since a lower certification level is needed. The average annual salary is assumed to be $65,000 and fringe benefits are assumed to be $20,000 each. The total cost for Benton Harbor management and treatment plant staff for this alternative is approximately $300,000.
- Distribution staff remain the same as identified in Alternative 1A: One water distribution operator-in-charge with S-2 certification, three water system distribution operators with at least S-4 certification, distribution water meter technician, and one groundskeeper. The total cost for Benton Harbor distribution staff is $480,000.

The labor cost for this option is estimated to be $780,000, approximately $2,000 more than the current (FY2021) labor costs of $778,000.

4.2.1.2 Alternative 2A Capital Improvements

Alternative 2A assumes all water purchased from St. Joseph flows directly into the existing clearwells at the Benton Harbor water treatment plant and is then pumped to the distribution system. Alternative 2A will take time to fully develop, including a second interconnection with St. Joseph to provide system redundancy. In addition, St. Joseph is performing upgrades at its

water treatment plant with an anticipated completion date of mid-2025. During this interim period, Benton Harbor will need to conduct some portion of the water treatment plant improvements identified in Table 3-1 for reliability and compliance purposes until a second interconnection is fully developed. The one capital project identified in Table 3-1 that must occur as part of Alternative 2A is the high service pump replacement project, with an estimated cost of $1.7 million. Benton Harbor will also conduct some (or all) sludge lagoon and sludge handling improvements to address this violation, resulting in an additional capital cost. For this alternative, it is assumed the majority of the $9,040,000 identified for Benton Harbor water treatment plant capital improvements are expended for both water treatment plant capital improvements. All distribution system improvements identified in Table 3-1 (total of $8.3 million) are needed. The Benton Harbor water treatment plant, sludge lagoon and handling facilities, and distribution system capital projects are assumed to be funded with recent ARPA grant dollars and will not result in a rate increase to customers.

For this alternative, the following new capital projects are needed:

- $500,000 estimated for improvements at the existing Benton Harbor/St. Joseph interconnection. The extent of modifications and upgrades needs to be verified.
- $500,000 for piping modifications as needed to discharge into the existing clearwells. The extent of modifications and upgrades needs to be verified.
- Develop second interconnection for redundancy purposes, estimated at $3.2 million (see Appendix C for detailed information)

These costs are assumed to be financed with a generous funding package through the Michigan Drinking Water State Revolving Fund program. Assuming Benton Harbor qualifies for this funding and using the lending terms of recent infrastructure funding being made available, the project is awarded 49% principal forgiveness and the remaining loan amount is issued at 2% annual interest rate for a term of 20 years. Costs are summarized in Table 4-9 and in Appendix C.

Table 4-9. Alternative 2A Estimated Capital Costs to Purchase Water from St. Joseph

Capital Improvement	Capital Cost	Annual Debt Service
High service pumps plus interim water treatment plant and sludge handling improvements[a]	$9,040,000	$0
Distribution system improvements[a]	$8,307,000	$0
Improvements at Benton Harbor/St. Joseph interconnection[b]	$500,000	$15,300
Piping improvements at Benton Harbor clearwells[b]	$500,000	$15,300
Develop 2nd interconnection for redundancy[b]	$3,200,000	$99,800
Total cost	**$21,547,000**	**$130,400**

[a] Funded with ARPA funds and no debt service incurred

[b] Funded with 2% loan, 20-year term, 49% principal forgiveness

Other capital improvements may be needed with this project. Service connections on the transmission mains connecting the interconnection to the plant clearwell will need to be relocated to other pipelines. A TTHM formation potential should be conducted to assess the need for treatment. In the event TTHM treatment is needed, one option is the addition of a spray aeration unit fixed inside each of the Benton Harbor clearwells to remove TTHMs in the St. Joseph water (USEPA, 2015). Other options to reduce TTHM levels in the St. Joseph water could also include installation of an aeration tower.

4.2.1.3 Alternative 2A Operation and Maintenance Costs

A significant portion of the treatment plant O&M costs are eliminated with this option, such as inspection and cleaning of the submerged intake piping, purchase of alum, and maintenance of intake pumps, rapid mix tanks, flocculators, plate settlers, and dual media filters. The sludge lagoon and associated NPDES permit are also no longer needed with this alternative.

For this alternative, the clearwells, chlorine feed and corrosion inhibitor chemical feed systems, and high service pumps remain in operation. The O&M costs associated with these components are (see 4-9):

- Clearwell maintenance, such as routine inspections and repair of vents and hatches, estimated at $5,000 per year.
- Chlorine feed system, with an estimated annual cost of $20,000 for purchase of chlorine and maintenance of chemical feed and monitoring equipment.
- Corrosion inhibitor feed system, with an estimated annual cost of $38,000 for purchase of corrosion inhibitor and maintenance of chemical feed equipment.
- Energy use and maintenance of high service pumps, with an estimated annual cost of $18,000.
- Under this alternative, annual O&M costs at the Benton Harbor water treatment plant decrease from $251,000 to $81,000.
- The O&M costs at the interconnection are assumed to be similar to the O&M costs as described above, with an estimated cost of $81,000.
- O&M costs for the Benton Harbor distribution system remain the same, with an estimated cost of $502,000 (see Section 3.3).

The total annual O&M costs for this alternative is estimated to be $689,000 per year.

Per information provided by St. Joseph, the current retail rate at the Benton Harbor interconnection is $2.55 per 100 cubic feet. Assuming an average daily flow of 1.256 MGD (see Table 2-1) and a purchase price at $2.55 per 100 cubic feet, the annual cost to purchase water from St. Joseph is $1,563,000 per year. As previously stated, this purchased water cost could be reduced through the development of a “special” wholesale tariff for Benton Harbor. However, development of this tariff would require additional analysis and formal engagement and agreement between the two cities. Cost information is in Table 4-10 and details are provided in Appendix C.

Table 4-10. Alternative 2A Estimated Annual Operation and Maintenance Costs to Purchase Water from St. Joseph

Item	Estimated Annual Cost ($/year)
Benton Harbor Water Treatment Plant	
Clearwells[a]	$5,000
Chlorine feed system	$20,000
Corrosion inhibitor feed system	$38,000
High service pumps energy and maintenance	$18,000
Total operation and maintenance costs at Benton Harbor Water Treatment Plant	**$81,000**
O&M for second interconnection	**$81,000**
Benton Harbor Distribution System	
Distribution system	$502,000
Utility Admin/Customer Service	$1,361,400
Total annual O&M cost	**$2,025,400**

[a] Includes inspection and maintenance of the two in-ground clearwells at the Benton Harbor treatment plant.

This option results in a drastic decrease in the Benton Harbor water treatment plant O&M costs from $251,000 to $81,000 per year, plus a new O&M cost for the second interconnection ($81,000 estimate). This option does not result in any changes in the O&M costs of the Benton Harbor distribution system, which remain at $502,000 per year, or any changes to the existing Utilities Administration and Customer Services costs, budgeted at $1,361,400 per year.. This option does result in a new annual cost to purchase water, estimated to be $2,025,000 per year.

4.2.1.4 Alternative 2A Summary

Alternative 2A consists of Benton Harbor purchasing water from St. Joseph and discharging the purchased water directly to the existing two 1-MG clearwells at the Benton Harbor water treatment plant. In this alternative, the following costs will be incurred over the next 5 years:

- Labor costs associated with hiring and retaining 9.5 FTEs to fill general, water treatment plant, and distribution system operations positions, with an estimated increased cost of $2,000 per year compared to existing labor costs
- All water treatment plant, sludge handling, and distribution system capital improvements are assumed to be funded with ARPA grant dollars, resulting in zero increases to rates to repay loans.
- Additional capital improvements for the existing interconnection ($500,000), clearwells ($500,000), and second interconnection ($3,200,000) are financed with a low interest loan and result in a combined annual debt service cost of $118,000.
- Decreased operation and maintenance costs at the treatment plant with a large part of the treatment plant being abandoned, resulting in a decreased cost from $251,000 to $81,000 per year

- New O&M cost of $81,000 for the second interconnection
- No change in distribution system O&M costs
- No change in Utilities Administration and Customer Service Costs.
- New annual cost to purchase water from St. Joseph, estimated to be $1,563,000 per year. It is important to emphasize that current St. Joseph wholesale water costs will increase in the future to reflect increasing operating cost and infrastructure improvements to their system.

The total net increase to rate payers each year is approximately $1,606,400(see Table 4-11), resulting in an increase per connection (assuming 3,335 connections) of $40.14 per month in residential customer water rates. As previously noted, additional capital costs may be associated with this option for TTHM treatment.

Table 4-11. Alternative 2A Cost Implications

Item	Annual Existing Cost	Annual Proposed Cost	Annual Increase/ Decrease to Customers
Labor (salary plus benefits)			
Water treatment plant staff	$401,000	$300,000	($101,000)
Distribution staff	$377,000	$480,000	$103,000
Labor total	**$778,000**	**$780,000**	**$2,000**
Capital costs (debt service)[a]			
Capital costs (debt service) total		**$130,400**	**$130,400**
Operation and maintenance			
Benton Harbor Water Treatment Plant	$251,000	$81,000	($170,000)
Distribution system	$502,000	$502,000	$0
O&M for second interconnection	$0	$81,000	$81,000
Utility Admin/Customer Service	$1,361,400	$1,361,400	$0
Operation and maintenance total	**$2,114,400**	**$2,025,400**	**($89,000)**
Purchase of Saint Joseph water	**$0**	**$1,563,000**	**$1,563,000**
Net increase cost to system			**$1,606,400**

[a] See Table 4-9 for capital cost details

This alternative results in the following benefits:

- Benton Harbor retains full ownership of the distribution system.
- Benton Harbor can abandon most of the water treatment plant infrastructure and reduce the number of needed staff and operators.

- Potential to improve working relationship and promote partnership between St. Joseph and Benton Harbor, perhaps leading to other regionalization options.

Conversely, this alternative presents concerns:

- Benton Harbor may not be able to hire and retain all required certified operators.
- Benton Harbor may not have the technical, managerial, and financial capacity to oversee all needed improvements.
- The estimated monthly increase per residential customer for this alternative is $40.14. This increase is in addition to the rate increase needed to address the current annual operating deficit of $1.3 million; the rate increase amount is being determined in the Capacity Study.

4.2.2 Alternative 2B: Purchase Water from St. Joseph and Discharge to Benton Harbor Water Treatment Plant Clearwells and Distribution System

This alternative assumes the following:

- Water from the St. Joseph interconnection is conveyed to both Benton Harbor water treatment plant clearwells and directly into the distribution system.
- The existing hydraulic gradient at the interconnection is sufficient to allow water to continue flowing throughout the Benton Harbor water system.
- All treatment at the existing water treatment plant is abandoned. Instead, a new building is constructed to feed chlorine and a corrosion inhibitor at the interconnection.
- The clearwells and high service pumps at the Benton Harbor water treatment plant remain in service to provide adequate storage throughout Benton Harbor's water system.

4.2.2.1 Alternative 2B Staffing

Staffing for this alternative is the same as presented for Alternative 2A in Section 4.1.2.1. The labor cost for this option is estimated to be $780,000, approximately $2,000 more than the current (FY2021) labor costs of $778,000.

4.2.2.2 Alternative 2B Capital Improvements

Alternative 2B assumes all water purchased from St. Joseph flows directly into the distribution system or the existing clearwells at the Benton Harbor water treatment plant, where it is then pumped to the distribution system. The same assumptions made in Section 4.2.1.2 for Alternative 2A with regard to short-term capital improvements are also applied to Alternative 2B. It is assumed the majority of the $9,040,000 identified for Benton Harbor water treatment plant capital improvements are expended for both water treatment plant capital improvements. Alternative 2B will take time to fully develop, including a second interconnection with St. Joseph to provide system redundancy. During this interim period, Benton Harbor will need to conduct some portion of the water treatment plant improvements identified in Table 3-1 for reliability and compliance purposes until a second interconnection is fully developed. All distribution system improvements identified in Table 3-1 (total of $8.3 million) are needed. The Benton Harbor water treatment plant, sludge lagoon and handling facilities, and distribution

system capital projects are assumed to be funded with recent ARPA grant dollars and will not result in a rate increase to customers.

For this alternative, the following new capital projects are needed:

- $500,000 for piping modifications as needed to discharge into the existing clearwells. The extent of modifications and upgrades needs to be verified.
- Construction of a new treatment building at the interconnection to allow chlorine and a corrosion inhibitor to be fed. It is assumed the city owns land nearby the interconnection to construct a new treatment building, so land purchase is not included. The cost of the new building, piping, corrosion inhibitor feed, and chlorine feed are estimated to be $3.1 million (see Appendix C for detailed costs).
    - Develop second interconnection for redundancy purposes, estimated at $3.2 million

These costs are assumed to be financed with a generous funding package through the Michigan Drinking Water State Revolving Fund program. Assuming Benton Harbor qualifies for this funding and using the lending terms of recent infrastructure funding being made available, the project is awarded 49% principal forgiveness and the remaining loan amount is issued at 2% annual interest rate for a term of 20 years.

As with Alternative 2A, capital improvements may be needed with this project for TTHM treatment and further evaluation is needed to confirm the need to TTHM treatment.

Costs are summarized in Table 4-12 and detailed in Appendix C. Capital costs from this alternative will be substantially reduced in the future if St. Joseph optimizes its corrosion control and adequate chlorine residuals are maintained at the interconnection points.

Table 4-12. Alternative 2B Estimated Capital Costs to Purchase Water from St. Joseph

Item	Estimated Installed Capital Cost	Annual Debt Service
Benton Harbor Water Treatment Plant upgrades		
High Service Pumps Plus Interim Water Treatment Plant and Sludge Handling Improvements[a]	$9,040,000	$0
Piping improvements at Benton Harbor clearwells[b]	$500,000	$15,300
New treatment building at Benton Harbor/St. Joseph interconnection[b]		
Construct a new treatment building at the Benton Harbor/St. Joseph interconnection	$3,100,000	$96,700
Develop 2nd interconnection for redundancy	$3,200,000	$99,800
Total debt service costs for new treatment building at interconnection and redundant interconnection	**$6,300,000**	**$196,500**
Benton Harbor Distribution System upgrades[a]		

Benton Harbor Distribution System upgrades	$8,307,000	$0
Total cost	**$24,147,000**	**$211,800**

[a] Funded with ARPA funds and no debt service incurred

[b] Funded with 2% loan, 20-year term, 49% principal forgiveness

4.2.2.3 Alternative 2B Operation and Maintenance Cost

The O&M costs for Alternative 2B are assumed to be the same as for Alternative 2A, as presented in Section 4.2.1.3. Given a portion of the purchased water is going directly into the distribution system, this alternative results in reduced run times of the high service pumps and energy costs. However, these costs savings are offset by maintenance for a new building. The O&M costs for the new treatment building are estimated at $81,000 per year and this same cost is estimated for the second interconnection. Therefore, total annual O&M costs at the two interconnections is $162,000 for this alternative. The existing O&M cost for Benton Harbor water treatment plant are assumed to be zero as the treatment plant would be abandoned. The distribution costs remain the same ($502,000). The City's Utility Administration and Customer Service Costs would also remain the same, $1,361,000. The O&M costs for this alternative is estimated to be $689,000 per year. The purchase cost of water from St. Joseph remains the same as presented in Alternative 2A, with an annual cost of $2,025,000 per year. Cost information details are provided in Appendix C.

4.2.2.4 Alternative 2B Summary

Alternative 2B assumes Benton Harbor purchases water from St. Joseph and discharges the purchased water directly to the existing two 1-MG clearwells and the distribution system. In this alternative, the following costs will be incurred over the next 5 years:

- Labor costs associated with hiring and retaining 9.5 FTEs to fill general, water treatment plant, and distribution system operations positions, with an estimated increased cost of $2,000 per year compared to existing labor costs.
- All water treatment plant, sludge handling, and distribution system capital improvements are assumed to be funded with ARPA grant dollars, resulting in zero increases to rates to repay loans.
- Capital improvements for the existing clearwells ($500,000), new treatment building ($3,100,000), and developing a second interconnection ($3,200,000) are financed with a low interest loan and result in a combined annual debt service cost of $211,800.
- Decreased operation and maintenance costs at the treatment plant with the treatment plant being abandoned, resulting in a decreased cost from $251,000 to zero per year.
- O&M cost for new treatment buildings at two interconnections, estimated at $81,000 each for a total of $162,000.
- No change in distribution system O&M costs.
- No change in City Utilities Administration and Customer Service Costs.

- New annual cost to purchase water from St. Joseph, estimated to be $1,563,000 per year. It is important to emphasize that current St. Joseph wholesale water costs will increase in the future to reflect increasing operating cost and infrastructure improvements to their system.

The total net increase to rate payers each year is approximately $1,687,800(see Table 4-13), resulting in an increase per connection (assuming 3,335 connections) of $42.17 per month in residential customer water rates. As previously noted, additional capital costs may be associated with this option for TTHM treatment.

Table 4-13. Alternative 2B Cost Implications

Item	Annual Existing Cost	Annual Proposed Cost	Annual Increase/ Decrease to Customers
Labor (salary plus benefits)			
Water treatment plant staff	$401,000	$300,000	($101,000)
Distribution staff	$377,000	$480,000	$103,000
Labor total	**$778,000**	**$780,000**	**$2,000**
Capital costs			
Total debt service costs for new treatment building at interconnection and redundant interconnection [a]		**$211,800**	**$211,800**
Operation and maintenance			
Benton Harbor Water Treatment Plant	$251,000	$0	($251,000)
Distribution system	$502,000	$502,000	$0
O&M for new treatment building at existing interconnection	$0	$81,000	$81,000
O&M for second interconnection	$0	$81,000	$81,000
Utility Admin/Customer Service	$1,361,400	$1,361,400	$0
Operation and maintenance total	**$2,114,400**	**$2,025,400**	**($89,000)**
Purchase of Saint Joseph water	**$0**	**$1,563,000**	**$1,563,000**
Net increase cost to system			**$1,687,800**

[a] See Table 4-12 for detailed line-item costs

This alternative results in the following benefits:

- Benton Harbor retains full ownership of the distribution system.

- Benton Harbor can abandon most of the water treatment plant infrastructure and reduce the number of needed staff.
    - Potential to improve working relationship and promote partnership between St. Joseph and Benton Harbor, perhaps leading to other regionalization options.

Conversely, this alternative presents concerns:

- Benton Harbor may not be able to hire and retain all required certified operators.
- Benton Harbor may not have the technical, managerial, and financial capacity to oversee all needed improvements.
    - The estimated monthly increase per residential customer for this alternative is $42.17. This increase is in addition to the rate increase needed to address the current annual operating deficit of $1.3 million; the rate increase amount is being determined in the Capacity Study, pending financial gap closure plan.

4.3 Alternative 3: Purchase Water from Benton Charter Township

Scenario: *Benton Harbor purchases water wholesale (2.2 million gallons per day max) from Benton Charter Township. Benton Harbor maintains ownership of all current assets, abandons the existing water treatment plant, and makes required short-term improvements to the distribution system along with all improvements required by EGLE and in the Order. Benton Harbor hires the required staff for operation of the water system.*

Benton Charter Township operates a water treatment plant and a distribution system, with 10 existing interconnections to the Benton Harbor water distribution system. The Benton Charter Township treatment plant pulls water from Lake Michigan and pumps the water through screens and then a microfiltration system to remove particulates, bacteria, and other microorganisms. Sodium hypochlorite is added for disinfection and fluoride for dental protection before the water enters a 1 MG finished water storage reservoir. Benton Charter Township does not feed a corrosion inhibitor into the finished water. Benton Charter Township's treated water quality data for 2020 indicates TTHMs currently approaching the 80 ppb MCL (Benton Charter Township, 2021) and future treatment may be required.

The Benton Charter Township water system serves over 2,300 residential households and more than 500 commercial customers (Benton Charter Township, 2021). Benton Charter Township also sells water directly to customers in Hagar and Sodus Townships and is contracted to provide operations and maintenance of these two distribution systems.

The Benton Charter Township water treatment plant has a 3 MGD rated firm capacity. Firm capacity of the treatment plant is dictated by the maximum capacity of the three ultrafiltration membrane filter skids. Other equipment including the low service pumps has a firm capacity of 4 MGD and the combined storage capacity at the water treatment plant and within the distribution system is 5.8 MG. The five-year maximum daily flow demand on the water system was 2.65 MGD (88% of treatment plant capacity) from 2011 through 2017 (MDEQ, 2018b). Maximum daily demand for 2017 through 2021 is 2.28 MGD, which is 76% of treatment plant capacity.

The Benton Charter Township distribution system includes 77 miles of water mains ranging in size from 4-inch to 20-inch. The distribution system also includes a 0.8 MG reservoir in the northern part of the system and a 4 MG standpipe. A map of the Benton Charter Township

distribution system showing 10 interconnections to the Benton Harbor distribution system is provided as Figure 4-5. The largest interconnection is located at Fair Avenue and East Valley Drive and includes a 20-inch diameter water main, valves and a water meter all located in an underground concrete vault. There is no formal agreement between Benton Charter Township and the City of Benton Harbor to provide an emergency supply of water to the City of Benton Harbor. Benton Charter Township proposed an agreement following construction of their treatment plant but did not receive a response from the City of Benton Harbor (MDEQ, 2018b).

To supply a maximum daily demand of 2.2 MGD (Abonmache, 2021) of treated water to the City of Benton Harbor, Benton Charter Township would likely need to increase the capacity of their treatment plant by at least 2.5 MGD. According to Benton Charter Township, increasing the treatment plant capacity would require a minimum of two additional microfiltration skids, one additional microstrainer, and three additional pumps (one low service pump, one process pump, and one high service pump).

To receive water from Benton Charter Township, the following is assumed:

- The existing interconnection at Fair Avenue and East Valley Drive will be used (see Figure 4-5).
- Land needs to be purchased to allow construction of a new treatment building near the Benton Charter Township/Benton Harbor interconnection to house treatment equipment and pumps.
- A polyphosphate or other corrosion inhibitor needs to be added. A study is needed to carefully evaluate Benton Charter Township water quality characteristics and resulting corrosion control within Benton Harbor's distribution system.
- Chlorine injection is needed to maintain chlorine residuals throughout the distribution system.
- Booster pumps and additional new storage are not included, but further hydraulic analysis is needed to verify pressures and storage requirements are satisfied.
- Piping and other improvements are needed to convey water to/from the interconnection, treatment building, and Benton Harbor distribution system.
- A second interconnection is needed for redundancy and reliability purpose.
- TTHM concentrations near the interconnection are estimated to be between 30 and 60 ppb. Although this level is currently below the MCL of 80 ppb, Benton Harbor should further assess TTHM formation potential within the distribution system and evaluate the need for treatment to maintain compliance. In the event TTHM treatment is needed, granular activated carbon filters or aeration towers are considerations to address TTHM reduction.

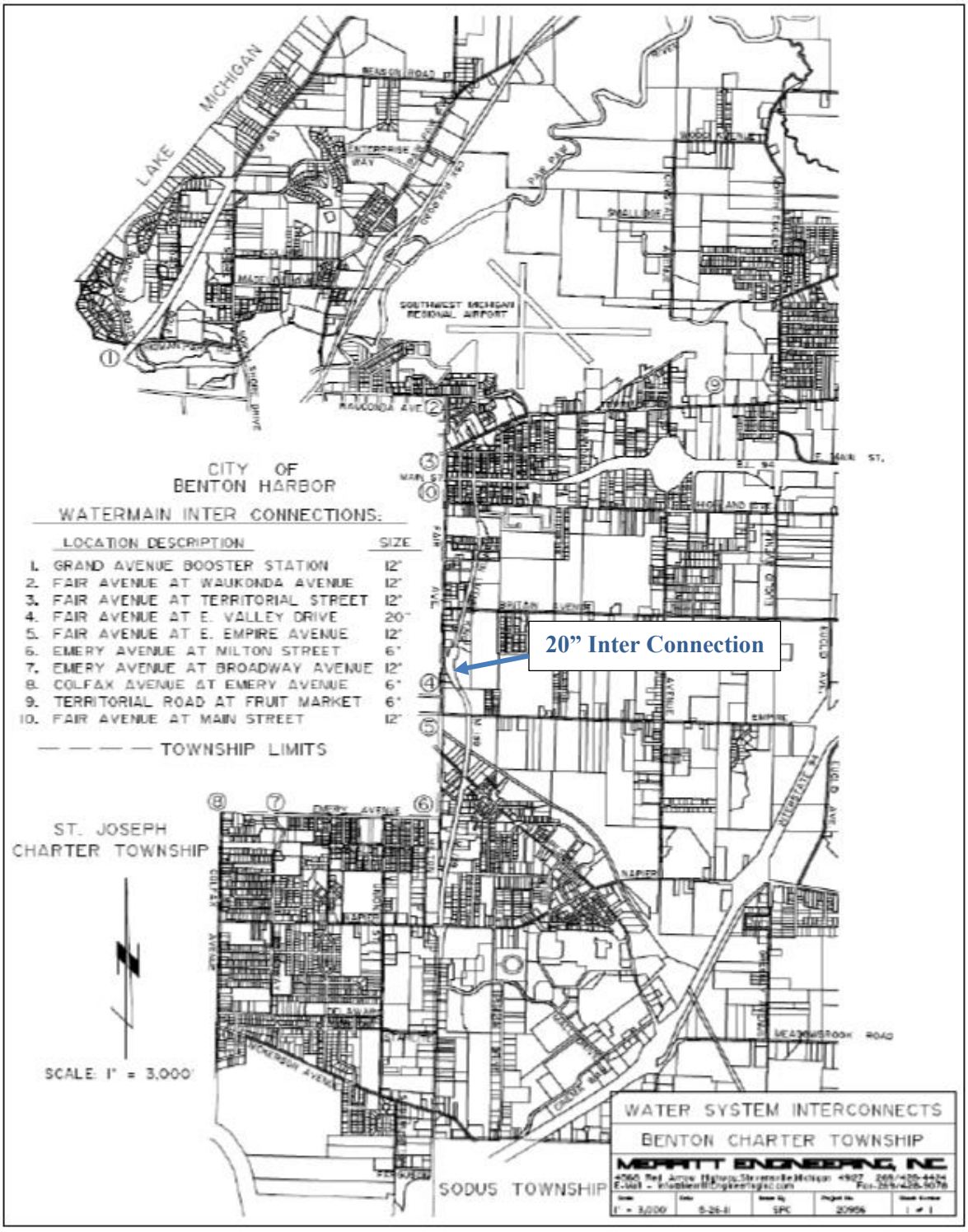


Figure 4-5. Benton Charter Township Distribution System and Interconnections to the City of Benton Harbor Distribution System (MDEQ, 2018b)

4.3.1.1 Alternative 3 Staffing

With this alternative, the entire Benton Harbor water treatment plant is abandoned, eliminating the need for all water treatment plant operators. However, a D-1 certified operator is required at the new treatment building near the Benton Charter Township/Benton Harbor interconnection to feed a corrosion inhibitor (polyphosphate or other chemical) and inject chlorine (assumes no TTHM treatment needed). For this option, Benton Harbor hires all water system staff and labor costs are assumed to be the same as in Alternative 2A:

- Three and a half FTEs for general operations and water treatment plant oversight: One water system director having a D-1/S-2 certification, one treatment plant operator with a D-1 certification to oversee chemical feed systems and pumps, one half-time treatment plant shift operator, and one administrative assistant experienced with computerized maintenance management software. The operators are assumed to be paid slightly less than the salaries presented in Alternative 1A and shown in Table 4-1 since a lower certification level is needed. The average annual salary is assumed to be $65,000 and fringe benefits are assumed to be $20,000 each. The total cost for Benton Harbor management and treatment plant staff for this alternative is approximately $300,000.
- Distribution staff remain the same as identified in Alternative 1A: One water distribution operator-in-charge with S-2 certification, three water system distribution operators with at least S-4 certification, distribution water meter technician, and one groundskeeper. The total cost for Benton Harbor distribution staff is $480,000.

The labor cost for this option is estimated to be $780,000, approximately $2,000 more than the current (FY2021) labor costs of $778,000.

4.3.1.2 Alternative 3 Capital Cost

This alternative will take time to fully develop, including a second interconnection with Benton Charter Township to provide system redundancy and expansion of the Benton Charter Township water treatment plant. During this interim period, Benton Harbor will need to conduct some portion of the water treatment plant improvements identified in Table 3-1 or reliability and compliance purposes. Benton Harbor will also conduct some (or all) sludge lagoon and sludge handling improvements to address this violation, resulting in an additional capital cost. For this alternative, it is assumed the majority of the $9,040,000 identified for Benton Harbor water treatment plant capital improvements are expended for both water treatment plant capital improvements. All distribution system improvements identified in Table 3-1 (total of $8.3 million) are needed. The Benton Harbor water treatment plant, sludge lagoon and handling facilities, and distribution system capital projects are assumed to be funded with recent ARPA grant dollars and will not result in a rate increase to customers.

This alternative includes additional capital costs for the following improvements:

- Upgrades to the Benton Charter Township water treatment plant to increase capacity to serve Benton Harbor a maximum day demand of 2.2 MGD. Improvements include two additional membrane treatment skids, three additional pumps, and a new microstrainer. The details on financing these improvements and how Benton Charter

Township would allocate these costs across the systems it serves are undecided at this time. This alternative assumes these capital costs are not borne by City of Benton Harbor and the associated debt service is not incorporated for these costs.

- A new treatment building located near the existing interconnection at Fair Avenue and E. Valley Drive to provide corrosion inhibitor and chlorine chemical feed and booster pumps. One-acre of land required to construct the new treatment building near the interconnection is included in the costs. New 16-inch piping needed to and from the new treatment building is also included in the costs. The cost is estimated to be $3,200,000.
- Develop a second interconnection for redundancy purposes, estimated at $3,200,000

These additional capital improvements (except for the Benton Charter Township treatment plant expansion costs) are assumed to be financed with a generous funding package through the Michigan Drinking Water State Revolving Fund program. Assuming Benton Harbor qualifies for this funding and using the lending terms of recent infrastructure funding being made available, the project is awarded 49% principal forgiveness and the remaining loan amount is issued at 2% annual interest rate for a term of 20 years.

Costs are summarized in Table 4-14 and detailed costs are provided in Appendix C.

Table 4-14. Alternative 3 Estimated Capital Cost to Purchase Water from Benton Charter Township

Item	Estimated Installed Capital Cost	Annual Debt Service
Improvements at Benton Charter Township Water Treatment Plant[a]		
Install two additional ultrafiltration skids at the water treatment plant.	$3,000,000	
Install three additional pumps: one low service pump, one process, and one high service pump at the treatment plant.	$360,000	
Install one additional microstrainer	$120,000	
Total for Benton Charter Township Water Treatment Plant improvements	$3,480,000	*To be determined*
New treatment building at Benton Harbor/Benton Charter Township interconnection[b]		
Construct a new treatment building at the Benton Charter Township/Benton Harbor interconnection (includes land purchase)	$3,200,000	$99,800
Develop 2nd interconnection for redundancy	$3,200,000	$99,800

Item	Estimated Installed Capital Cost	Annual Debt Service
Total for new treatment building and redundant interconnection	**$6,400,000**	**$199,600**
Benton Harbor Water Treatment Plant and Distribution System upgrades[c]		
High service pumps plus interim water treatment plant and sludge handling improvements	$9,040,000	$0
Benton Harbor Distribution System upgrades	$8,307,000	$0
Total cost	**$23,747,000 [d]**	**$199,600**

[a] Costs provided by Benton Charter Township. Financing of these improvements is unknown and no debt service is shown at this time.

[b] Funded with 2% loan, 20-year term, 49% principal forgiveness

[c] Funded with ARPA funds and no debt service incurred

[d] Excludes capital costs associated with Benton Charter Township treatment plant upgrades

Other capital improvements may be needed with this project; these need further evaluation:

- **Treatment for TTHMs.** A TTHM formation potential study should be conducted to assess the need for treatment. If further studies determine a treatment unit such as carbon adsorption is needed, capital costs will likely increase by another $1 million.
- **Benton Charter Township water main improvements.** Water main improvements are possibly needed within Benton Charter Township's distribution system to support this alternative. A detailed study is required to evaluate all water main upgrades if this alternative is given further consideration. These costs could conceivably add another $1 million to the capital costs shown in Table 4-15.
- **Hydraulic and storage evaluation.** The storage needs within Benton Harbor's distribution system should be evaluated to ensure all demands and pressure requirements are met under all operating conditions, including fire flow conditions.

4.3.1.3 Alternative 3 Operation and Maintenance and Water Purchase Costs

The O&M costs for Alternative 3 are assumed to be the same as for Alternative 2B, as presented in Section 4.2.2.3. The O&M costs for the new treatment building at the interconnections are estimated at $81,000 per year and this same cost is estimated for the second interconnection. Therefore, total annual O&M costs at the two interconnections is $162,000 for this alternative. The existing O&M cost for Benton Harbor water treatment plant are assumed to be zero as the treatment plant would be abandoned. The distribution costs remain the same ($502,000). Utilities Administration and Customer Service remain the same ($1,361,400). The total O&M cost for this alternative is estimated to be $2,025,400 per year.

Table 4-15. Alternative 3 Estimated Annual O&M Cost to Purchase Water from Benton Charter Township

Item	Estimated Annual O&M Cost ($/year)
O&M for new treatment building at existing interconnection	$81,000
O&M for second interconnection	$81,000
Operation and maintenance of the Benton Harbor Distribution System	$527,000
Utilities Administration and Customer Service	$1,361,400
Total Annual O&M Cost	**$2,025,400**

Benton Charter Township stated the cost to serve water to Benton Harbor at the interconnection is $4.85 per 100 cubic feet. The estimated annual cost for the City of Benton Harbor to purchase an average daily demand of 1.256 MGD (Abonmarche, 2021) of water from Benton Charter Township is approximately $2,972,000. Detailed costs are provided in Appendix C.

4.3.1.4 Alternative 3 Summary

Alternative 3 assumes Benton Harbor purchases water from Benton Charter Township and discharges the purchased water directly to the distribution system at a new treatment building. In this alternative, the following costs will be incurred over the next 5 years:

- Labor costs associated with hiring and retaining 9.5 FTEs to fill general, water treatment plant, and distribution system operations positions, with an estimated increased cost of $2,000 per year compared to existing labor costs.
- All capital improvements at Benton Harbor's water treatment plant and distribution system are assumed to be funded with ARPA grant dollars, resulting in zero increases to rates to repay loans.
- All capital improvements for the new treatment plant at the Benton Harbor/Benton Charter Township interconnection and redundant interconnection are funded with low interest loans, resulting in an annual debt service of $199,600.
- All O&M costs at Benton Harbor's water treatment plant are no longer needed, resulting in a decreased cost of $251,000 per year.
- New O&M costs are realized with the new treatment building at both interconnections, resulting in an increase cost of $162,000 per year
- No change in distribution system O&M costs, which remain at $502,000
- New annual cost to purchase water from Benton Charter Township, estimated to be $2,972,000 per year.

The total net increase to rate payers each year is approximately $3,084,600(see Table 4-16) resulting in an increase per connection (assuming 3,335 connections) of $77.08 per month in residential water rates. As previously noted, additional capital costs may be associated with this

option for TTHM treatment, anticipated improvements to Benton Charter Township's water mains, and additional storage needs within Benton Harbor's distribution system.

Table 4-16. Alternative 3 Cost Implications

Item	Annual Existing Cost	Annual Proposed Cost	Annual Increase/ Decrease to Customers
Labor (salary plus benefits)			
Water treatment plant staff	$401,000	$300,000	($101,000)
Distribution staff	$377,000	$480,000	$103,000
Labor total	**$778,000**	**$780,000**	**$2,000**
Capital costs			
Total debt service costs for new treatment building at interconnection and redundant interconnection [a]		**$199,600**	**$199,600**
Operation and maintenance			
Benton Harbor Water Treatment Plant	$251,000	$0	($251,000)
Distribution system	$502,000	$502,000	$0
O&M for new treatment building at existing interconnection	$0	$81,000	$81,000
O&M for second interconnection	$0	$81,000	$81,000
Utility Admin/Customer Service	$1,361,400	$1,361,400	$0
Operation and maintenance total	**$2,114,400**	**$2,025,400**	**($89,000)**
Purchase of Benton Charter Township water	**$0**	**$2,972,000**	**$2,972,000**
Net Increase Cost to System			**$3,084,600**

[a] See Table 4-14 for detailed line-item costs

This alternative results in the following benefits:

- Benton Harbor retains full ownership of the distribution system.
- Benton Harbor can abandon the water treatment plant infrastructure and reduce the number of needed staff.
- Potential to improve working relationship and promote partnership between Benton Charter Township and Benton Harbor, perhaps leading to other regionalization options.

Conversely, this alternative presents concerns:

- Benton Harbor may not be able to hire and retain all required certified operators.

- Benton Harbor may not have the technical, managerial, and financial capacity to oversee all needed improvements.
- The estimated monthly increase per residential customer for this alternative is $77.08 and the citizens of Benton Harbor are not able to sustain this large increase to support system operations and needed infrastructure improvements. This increase is in addition to the rate increase needed to address the current annual operating deficit of $1.3 million; the rate increase amount is being determined in the Capacity Study, pending the financial gap closure plan.

4.4 Alternative 4: Regionalization with Neighboring Water Systems

Scenario: *Benton Harbor enters into a formal agreement with St. Joseph and SMRSS&WA for shared services of the water system. Benton Harbor maintains ownership of all current assets and makes required short-term improvements to the water treatment plant and distribution system along with all improvements required by EGLE and in the Order.*

Drinking water system partnerships involve a full range of options where jurisdictions work together to reduce operating costs, improve access to safe drinking water, and leverage limited resources that encompass regional considerations (Beecher, 1996). Partnerships can result in economies of scale agreements that range from a chemical bulk purchasing or equipment agreement to a formal contract between jurisdictions for the purposes of sharing operators or billing services (USEPA, 2017). Regionalization provides an opportunity for improved services while reducing costs by working on the economies of scale principle. For instance, buying chemicals in bulk or coordinating storage tank inspections could result in cost savings for each participating jurisdiction.

Benton Harbor currently has an agreement with SMRSS&WA for wastewater services. For this alternative, the possibility of Benton Harbor receiving technical, managerial, and financial support for its water system through an expanded agreement with SMRSS&WA or St. Joseph is theoretically explored. Some potential examples for services under a regionalization agreement include:

- SMRSS&WA provides billing services for Benton Harbor for both water and wastewater, building on the existing agreement for wastewater services.
- St. Joseph provides operators on a part-time or full-time basis to fill key positions, such as the F-1 and S-2 operator positions, that have proven difficult for Benton Harbor to permanently fill.
- Shared equipment or bulk purchase agreements for common chemicals are developed.
- Benton Harbor could also explore similar regionalization opportunities with Benton Charter Township. Historically, all three entities did operate cooperatively but parted ways under unfavorable terms in 2011 (Fleis and Vandenbrink, 2022). Based on recent conversations with St. Joseph, Benton Charter Township, and Benton Harbor, none of these entities appear willing to enter into an agreement for shared water system services at this time. Developing formal agreements to share services and expertise would require extensive negotiations and cooperation among the political leaders. However, St. Joseph and Benton Charter Township are willing to assist Benton Harbor, as needed, in an emergency.

Future opportunities for regionalization conversations exist as St. Joseph experiences increased water demands and the potential capacity available at the Benton Harbor water treatment plant can help meet area demands. A future regionalization consideration is for the Benton Harbor water treatment plant to serve other nearby jurisdictions, as formerly planned when it expanded in 2010. Several options exist for this alternative that include Benton Harbor retaining ownership of the water treatment plant or the Benton Harbor water treatment plant becoming a shared asset as part of any regionalization agreement.

Regionalization and shared services agreements on any level include the following advantages:

- Benton Harbor retains full ownership of the water system.
- Potential to increase technical, managerial, and financial capacity and reduce costs through several resource sharing arrangements:
  - Centralized planning and coordination between systems for scheduled maintenance activities, such as routine inspections of finished water reservoirs.
  - Formalizing interconnection agreements to assist each other in an emergency.
  - A pool of trained and certified water treatment plant and distribution system operations staff that can provide coverage to all three systems, especially during weekends, holidays, and vacation periods.
  - Shared maintenance equipment (such as, backhoes, trucks, and tools) can have greater utilization.
  - Bulk purchasing of chemicals.
  - Can consolidate meter reading, billing, collection, and service requests under one entity.
  - Shared assets, such as the potential for the Benton Harbor water treatment plant to serve beyond its current service area as a shared asset to meet increased regional demands. This alternative should be further evaluated as an option to St. Joseph installing additional filters to meet anticipated future demands within its service area. This arrangement could also result in a cost savings to the Benton Harbor customers as all water treatment plant costs (labor, operation and maintenance, and capital improvements) identified in Alternative 1 are distributed over a larger customer base.
- Benton Harbor has access to additional resources, such as operators or equipment from neighboring systems, improving customer service and system reliability.
- Potential to improve working relationship and promote partnership between Benton Harbor and neighboring systems.
- Potential to result in cost savings through shared resources or reduced capital improvements.

The disadvantages of developing a shared services agreement between Benton Harbor, St. Joseph, Benton Charter Township, and/or SMRSS&WA include:

- Benton Harbor may not be able to hire and retain all required certified operators.

- Benton Harbor may not have the technical, managerial, and financial capacity to oversee all needed improvements.
- Local autonomy and policy control may become challenging. Benton Harbor, Benton Charter Township, and St. Joseph are not willing to consider regionalization options at this time.
- Difficulty with distributing maintenance costs equally, especially when older distribution systems combine with newer distribution systems.

4.5 Alternative 5: Consolidation with Neighboring Water Systems

Scenario: *Benton Harbor's water system is owned, operated, and maintained by either Benton Charter Township, St. Joseph, or SMRSS&WA. With this alternative, Benton Harbor relinquishes ownership of all water system assets to either Benton Charter Township, St. Joseph, or SMRSS&WA.*

This alternative includes the following considerations:

- Benton Harbor relinquishes ownership of all water system assets to Benton Charter Township, St. Joseph, or SMRSS&WA and is operated and maintained by the entity assuming ownership.
- All water system operators and staff are provided by the entity assuming ownership.
- The entity assuming ownership provides financial and billing services for the water system.
- Benton Harbor is provided water by Benton Charter Township or St. Joseph through existing interconnections or the Benton Harbor water treatment plant is maintained to meet area demands.

This alternative was not further vetted as none of these jurisdiction's desire to pursue this arrangement. However, this alternative has similar benefits as mentioned with regionalization along with the potential to fill all operator positions. Consolidation will result in enhanced technical, managerial, and financial capacity for Benton Harbor and have the added benefit of improving access to capital for future improvements if operating under a different ownership structure.

Some of the concerns with this alternative include:

- Benton Harbor relinquishes ownership of the water system, which is not a desire or priority per the city manager.
- Local autonomy and policy control may become challenging. Benton Harbor, Benton Charter Township, and St. Joseph are not willing to consider regionalization options at this time.

4.6 Alternative 6: Private Ownership of the Benton Harbor Water System

Scenario: *Benton Harbor relinquishes ownership of the water system to a private company who provides the capital to purchase all assets and makes required system upgrades identified in Alternative 1. The new owner also assumes any outstanding debt for previous system improvements. The new owner operates the system, provides all water system staff, and performs*

all maintenance. The new owner addresses all unresolved compliance issues and operates the system to maintain compliance.

With this alternative, a private company purchases and assumes ownership of the Benton Harbor water system. American Water, the largest investor-owned water utility in North America, was contacted to judge their interest in privatization of the Benton Harbor water system through acquisition of all the physical assets of the treatment plant and distribution system. American Water currently operates water systems in northern Indiana. Based on the initial conversation, American Water indicated interest to further explore ownership of the Benton Harbor water system.

This alternative results in the following benefits:

- Benton Harbor can have all required water system operator and staff positions filled with properly certified operators, greatly increasing the technical capacity of the system.
- American Water provides managerial and financial services for the water system, increasing the managerial and financial capacity of the system.
- American Water has access to other staff, experts, and resources to assist with operation and maintenance of the water system. Access to these additional resources could result in reduced operational costs while improving customer service and system reliability.

Some of the concerns with this alternative include:

- Benton Harbor relinquishes ownership of the water system, which is not a desire or priority per the city manager.
- Local autonomy and policy control may become challenging.

However, subsequent conversations with American Water resulted in their expressing no interest in the acquisition of the Benton Harbor system. American Water had recently divested themselves of their only owned utility in Michigan (Calumet) and was not looking to reestablish a presence in Michigan. Additionally, other challenges make Benton Harbor a difficult system for any investor-owned utility to acquire:

- The significant revenue deficit which requires a substantial customer rate increase to achieve the system revenue requirement
- The substantial capital investment requirements of the system
- Limited synergies due to the proximity to other investor-owned systems
- System size (larger systems preferred)
- Current collection rate challenges
- Michigan does not regulate investor-owned water utilities

Therefore, this private ownership is not a feasible option at this time.

4.7 Alternative 7A: Change Water Source, Benton Harbor Staffing

Scenario: *Benton Harbor drills new wells to replace its existing Lake Michigan water source. This alternative requires Benton Harbor to hire the required additional staff to operate and maintain the distribution system, abandons the existing treatment plant, constructs a new smaller treatment plant for treatment of groundwater by disinfection and possibly iron and arsenic removal, and hires staff to operate the new treatment plant. (Note that Alternative 7B, below, will include identical analyses for all features except staffing).*

This alternative examines abandoning the existing surface water source and treatment plant and replaces it with a groundwater source and treatment plant to serve City of Benton Harbor. Switching to a groundwater source would result in a more predictable source water quality and a simpler treatment scheme. The projected groundwater source would require disinfection, possibly injection of a corrosion inhibitor, and potentially iron and other contaminant removal depending on the groundwater quality (EGLE, 2019).

The cost of drilling and equipping multiple new high-capacity municipal wells with the required treatment will be significant. In addition, finding a location for the wells in a city with multiple potential groundwater contaminant sources could also be challenging. Likewise, as the City of Benton Harbor expands, additional wells would need to be constructed to meet the new water demands and finding locations for wells with the needed capacity and source water protection could be difficult.

Another consideration is storage needs within the Benton Harbor distribution system if the clearwells at the existing Benton Harbor water treatment plant are abandoned. The storage needs within Benton Harbor's distribution system should be evaluated to ensure all demands and pressure requirements are met under all operating conditions, including fire flow conditions.

4.7.1 Alternative 7A Staffing

This alternative allows for the eventual shut-down of the Benton Harbor intake and water treatment plant, which will eliminate the need for the F-1 operator-in-charge position along with the shift operators. Instead, a D-1 certified operator is needed at the water treatment plant to oversee equipment and chemical feed systems. In addition, a groundwater treatment plant can be automated and allow for reduced number of operators at the treatment plant. For this option, Benton Harbor hires all 9.5 FTEs water system staff and labor costs are assumed to be:

- Three and one half FTEs for general operations and water treatment plant oversight: One water system director having a D-1/S-2 certification, one treatment plant operator with a D-1 certification to oversee chemical feed systems and pumps at the new groundwater treatment plant, one half-time treatment plant shift operator, and one administrative assistant experienced with computerized maintenance management software. The operators are assumed to be paid slightly less than the salaries presented in Alternative 1A and shown in Table 4-1 since a lower certification level is needed. The average annual salary is assumed to be $65,000 and fringe benefits are assumed to be $20,000 each. The total cost for Benton Harbor management and treatment plant staff for this alternative is approximately $300,000.

- Distribution staff 6 FTEs remain the same as identified in Alternative 1A: One water distribution operator-in-charge with S-2 certification, three water system distribution operators with at least S-4 certification, distribution water meter technician, and one groundskeeper. The total cost for Benton Harbor distribution staff is $480,000.

The labor cost for this option is estimated to be $780,000, approximately $2,000 more than the current (FY2021) labor costs of $778,000.

4.7.2 Alternative 7A Capital Costs

This alternative will take years to fully develop. During this interim period, Benton Harbor will need to conduct some portion of the water treatment plant improvements identified in Table 3-1 for reliability and compliance purposes. Benton Harbor will also conduct some (or all) sludge lagoon and sludge handling improvements to address this violation, resulting in an additional capital cost. For this alternative, it is assumed the majority of the $9,040,000 identified for Benton Harbor water treatment plant capital improvements are expended for both water treatment plant capital improvements plus sludge lagoon and sludge handling facilities. All distribution system improvements identified in Table 3-1 (total of $8.3 million) are needed. The Benton Harbor water treatment plant, sludge lagoon and handling facilities, and distribution system capital projects are assumed to be funded with recent ARPA grant dollars and will not result in a rate increase to customers.

This alternative includes additional capital costs for the following improvements:

- Six new wells are drilled and equipped
- A new treatment plant with iron removal and chlorine feed
- New transmission main

The total cost is estimated to be $20 million, but more information, including property acquisition/easement or usage agreement, hydrogeological/aquifer testing, and water quality is needed to further analyze this option and associated costs. These costs are assumed to be financed with a generous funding package through the Michigan Drinking Water State Revolving Fund program. Assuming Benton Harbor qualifies for this funding and using the lending terms of recent infrastructure funding being made available, the project is awarded 49% principal forgiveness and the remaining loan amount is issued at 2% annual interest rate for a term of 20 years. Costs are summarized in Table 4-17 and in Appendix C. As previously noted, the storage needs with Benton Harbor's distribution system should be evaluated to better assess the need for additional storage.

Table 4-17. Alternative 7A Estimated Capital Costs for new Groundwater Source

Capital Improvement	Capital Cost	Annual Debt Service
High service pumps plus interim water treatment plant and sludge handling improvements[a]	$9,040,000	$0
Distribution system improvements[a]	$8,307,000	$0
New groundwater sources, treatment plant, and transmission main[a,b]	$20,000,000	$623,800

Total cost	**$37,347,000**	**$623,800**

[a] Funded with ARPA funds and no debt service incurred

[b] Funded with 2% loan, 20-year term, 49% principal forgiveness

4.7.3 Alternative 7A Operation and Maintenance Costs

This alternative provides the following opportunities to reduce O&M costs in comparison to the existing surface water treatment plant:

- Less chemicals are needed, with the elimination of a coagulant currently used at the water treatment plant
- Solids processing costs would be significantly reduced due to the limited solids in the groundwater source.
- Power costs may marginally increase based on the pumping level of the wells.

In-depth O&M costs are not available for this alternative, but overall operating costs may be reduced by approximately 50% per year as compared to the existing annual O&M costs of $251,000.

4.7.4 Alternative 7A Summary

Alternative 7 assumes Benton Harbor abandons the existing surface water intake and treatment plant and develops groundwater sources. In this alternative, the following costs will be incurred over the next 5 years:

- Labor costs associated with hiring and retaining 9.5 FTEs to fill general, water treatment plant, and distribution system operations positions, with an estimated increased cost of $2,000 per year compared to existing labor costs
- All capital improvements at Benton Harbor's water treatment plant, sludge lagoon and handlings facilities, and distribution system are assumed to be funded with ARPA grant dollars, resulting in zero increases to rates to repay loans
- All capital improvements for six wells, iron removal treatment plant, and transmission main are funded with low interest loans, resulting in an annual debt service of $623,800
- O&M costs are reduced by at least 50% in comparison to existing O&M costs to operate Benton Harbor's surface water treatment plant, resulting in a decreased cost of $125,500 per year
- No change in distribution system O&M costs, which remain at $502,000
- No change in City Utilities Administration and Customer Service Costs

The total net increase to rate payers each year is approximately $500,300(see Table 4-18) resulting in an increase per connection (assuming 3,335 connections) of $12.50 per month in residential water rates. This alternative requires more detailed analysis to properly identify well locations and if additional treatment is needed based on further hydrogeologic investigations.

Table 4-18. Alternative 7A Cost Implications

Item	Annual Existing Cost	Annual Proposed Cost	Annual Increase/ Decrease to Customers
Labor (salary plus benefits)			
Water treatment plant staff	$401,000	$300,000	($101,000)
Distribution staff	$377,000	$480,000	$103,000
Labor total	**$778,000**	**$780,000**	**$2,000**
Capital costs			
Total debt service costs for new groundwater sources, treatment building, and transmission main improvements [a]		**$623,800**	**$623,800**
Operation and maintenance			
Benton Harbor Water Treatment Plant	$251,000	$0	($251,000)
Distribution system	$502,000	$502,000	$0
New groundwater treatment plant	$0	$125,500	$125,500
Utility Admin/Customer Service	$1,361,400	$1,361,400	$0
Operation and maintenance total	**$2,114,400**	**$1,988,900**	**($125,300)**
Net Increase Cost to System			**$500,300**

[a] See Table 4-17 for detailed line-item costs

This alternative results in the following benefits:

- Benton Harbor retains full ownership of the distribution system.
- Benton Harbor can abandon the surface water treatment plant infrastructure and reduce the number of needed staff, which results in fewer operators needed and reduced costs.

Conversely, this alternative presents concerns:

- The estimated monthly increase per residential customer for this alternative is $12.50. This increase is in addition to the rate increase needed to address the current annual operating deficit of $1.3 million; the rate increase amount is being determined in the Capacity Study, pending financial gap closure plan.
- Benton Harbor may not be able to hire and retain all required certified operators.
- Benton Harbor may not have the technical, managerial, and financial capacity to oversee all needed improvements.

4.8 Alternative 7B: Change Water Source, Contract Operations

Scenario: *Benton Harbor drills new wells to replace its existing Lake Michigan water source. This alternative has Benton Harbor retaining a contract operations company for all but two staff to operate and maintain the distribution system and a new smaller treatment plant. The City would abandon the existing treatment plant, construct a new smaller treatment plant for treatment of groundwater by disinfection and possibly iron and arsenic removal. Analyses are identical to Alternative 7A with the exception of staffing.*

4.8.1 Alternative 7B Staffing

This alternative allows for the eventual shut-down of the Benton Harbor intake and water treatment plant, which will eliminate the need for the F-1 operator-in-charge position along with the shift operators. Instead, a D-1 certified operator is needed at the water treatment plant to oversee equipment and chemical feed systems. In addition, a groundwater treatment plant can be automated and allow for reduced number of operators at the treatment plant.

For this alternative, all 7.5 FTEs staff to operate and maintain the water system are contracted, except for the administrative assistant and part-time groundskeeper positions. The full-time staff requirements are less than the 9.5 FTEs presented in Alternative 7A since the contracted operator can deploy operators from other locations to cover vacations, illness and other labor staffing issues associated with holidays and shift changes. Labor costs are assumed to be:

- **Three and one half FTEs** for general operations and water treatment plant oversight: Contracted staff include one water system director having a D-1/S-2 certification who is the treatment plant operator-in-charge and one treatment plant operator with a D-1 certification to oversee chemical feed systems and pumps at the new groundwater treatment plant. City staff include one administrative assistant experienced with computerized maintenance management software and one part time groundskeeper. The operators are assumed to be paid slightly less than the salaries presented in Alternative 1B and shown in Table 4-1 since a lower certification level is needed. The average annual salary is assumed to be $65,000 and fringe benefits are assumed to be $20,000 each. The total cost for Benton Harbor management and treatment plant staff for this alternative is approximately $275,000.
- **Four FTEs** for Distribution staff remains the same as identified in Alternative 1B: One water distribution operator-in-charge with S-2 certification, two water system distribution operators with at least S-4 certification, distribution water meter technician. The total cost for distribution staff is $380,000.
-
- Table 4-19. Alternative 7B Labor Costs

Position	FTEs	Total Annual Salary	Annual Fringe Benefits	Total Annual Salary & Fringe Benefits
General operations and water treatment plant staff				
City employed: administrative assistant and part-time groundskeeper	1.5	$75,000	$45,000	$120,000

Position	FTEs	Total Annual Salary	Annual Fringe Benefits	Total Annual Salary & Fringe Benefits
Contracted: Water director who is water treatment plant operator-in-charge with D1/S2 certification, and 1 water treatment plant operators with at D1 certification	1.5	$120,000	N/A	$120,000
Distribution system staff				
Contracted: Water distribution operator-in-charge with S-2 certification, 2 water system distribution operators with at least S-4 certification, distribution water meter technician	4.5	$360,000	N/A	$360,000
Total	7.5 staff	$555,000	$45,000	$600,000

Using contractor rates, the annual cost for 7.5 staff (6 of whom are contracted) to operate the water system is approximately $655,000 per year as shown in Table 4-5. The labor cost for this option is estimated to be $600,000 approximately $161,000 less annually than the FY2021 labor costs of $778,000.

4.8.2 Alternative 7B Capital Costs

See Alternative 7A.

4.8.3 Alternative 7B Operation and Maintenance Costs

See Alternative 7A.

4.8.4 Alternative 7B Summary

Alternative 7B assumes Benton Harbor abandons the existing surface water intake and treatment plant and develops groundwater sources. In this alternative, the following costs will be incurred over the next 5 years:

- Labor costs associated with retaining a contract operations company for 6 FTEs plus 1.5 FTE city staff to fill general, water treatment plant, and distribution system operations positions, with an estimated reduction of labor cost of $120,000 per year compared to FY 2021 labor costs
- All capital improvements at Benton Harbor's water treatment plant, sludge lagoon and handlings facilities, and distribution system are assumed to be funded with ARPA grant dollars, resulting in zero increases to rates to repay loans
- A portion of the capital improvements for six wells, iron removal treatment plant, and transmission main are funded with low interest loans, resulting in an annual debt service of $623,800
- O&M costs are reduced by at least 50% in comparison to existing O&M costs to operate Benton Harbor's surface water treatment plant, resulting in decreased cost of $125,500 per year

- No change in distribution system O&M costs, which remain at $502,000
- No change in City Utilities Administration and Customer Service Costs

The total net increase to rate payers each year is approximately **$320,300** (see **Table 4-18**) resulting in an increase per connection (assuming 3,335 connections) of **$8.00** per month in residential water rates. This alternative requires more detailed analysis to properly identify well locations and if additional treatment is needed based on further hydrogeologic investigations.

Table 4-20 Alternative 7B Cost Implications

Item	Annual Existing Cost	Annual Proposed Cost	Annual Increase/ Decrease to Customers
Labor (salary plus benefits)			
Water treatment plant staff	$401,000	$240,000	($161,000)
Distribution staff	$377,000	$360,000	$(17,000)
Labor total	**$778,000**	**$600,000**	**$(178,000)**
Capital costs			
Total debt service costs for new groundwater sources, treatment building, and transmission main improvements [a]		**$623,800**	**$623,800**
Operation and maintenance			
Benton Harbor Water Treatment Plant	$251,000	$0	($251,000)
Distribution system	$502,000	$502,000	$0
New groundwater treatment plant	$0	$125,500	$125,500
Utility Admin/Customer Service	$1,361,400	$1,361,400	$0
Operation and maintenance total	**$2,114,400**	**$1,988,900**	**($125,300)**
Net Increase Cost to System			**$320,300**

[a] See Table 4-17 for detailed line-item costs

This alternative results in the following benefits:

- Benton Harbor retains full ownership of the distribution system.
- Benton Harbor can abandon the surface water treatment plant infrastructure and reduce the number of needed staff, which results in fewer operators needed and reduced costs.

Conversely, this alternative presents concerns:

- The estimated monthly increase per residential customer for this alternative is $8.00. This increase is in addition to the rate increase needed to address the current annual operating deficit of $1.3 million; the rate increase amount is being determined in the Capacity Study, pending financial gap closure plan.
- Benton Harbor may not be able to hire and retain all required certified operators.
- Benton Harbor may not have the technical, managerial, and financial capacity to oversee all needed improvements.
- Additional hydrogeological, aquifer, and water quality studies are needed to confirm obtaining a sufficient groundwater supply is a viable technical option.

5.0 COMPARISON OF ALTERNATIVES

This section compares the financial impacts of each alternative outlined in Section 4.0 where costs are available along with other considerations associated with all alternatives.

As mentioned previously in Section 2.0, the Benton Harbor water system currently has an annual shortfall of approximately $1.3 million and current revenues are insufficient to cover costs. The Draft Capacity Study determined Benton Harbor needs to raise rates 13.75% each year for the next 10 years to address this deficit and ensure revenues cover expenditures (Fleis and Vandenbrink, 2022). This increase is without Benton Harbor hiring more staff beyond existing staff or performing any of the short-term capital improvements as identified in Section 3.2. Benton Harbor needs to hire additional staff and construct much needed improvements to the water system to ensure safe and reliable drinking water is provided to all customers.

Table 5-1 provides estimated increase of annual costs for each alternative in Section 4.0 (where costs are provided) beyond current rates. The estimated rate increases in Table 5-1 are in addition to the rate increase needed to address the current deficit (to be determined in the Capacity Study).

Table 5-2 provides benefits and concerns with each alternative considered.

Table 5-1. Summary of Costs for Alternatives

Alternative – Description	Estimated Change in Annual Labor Costs	Estimated Change in Annual O&M Costs	Estimated Change in Annual Debt Service Costs for Capital Improvements	Estimated Annual Water Purchase Cost	Estimated Net Annual Increase	Estimated Incremental Monthly Increase to Residential Customer[a]
1A – Retain full ownership of the water system and hire all operations staff	$402,000	$63,000	$0	N/A	$518,100	$12.95
1B – Retain full ownership of the water system but contract operations	$182,000	$63,000	$0	N/A	$298,100	$7.45
1C – Retain full ownership of the water system and contract lead operations staff, but hire others	$406,000	$63,000	$0	N/A	$522,100	$13.05
2A – Purchase water from St. Joseph and discharge to existing storage reservoirs	$2,000	($89,000)	$0	$1,563,000	$1,606,400	$40.14
2B – Purchase water from St. Joseph and discharge to distribution system with a portion to existing reservoirs	$2,000	($89,000)	$0	$1,563,000	$1,687,800	$42.17
3 – Purchase water from Benton Charter Township	$2,000	($89,000)	$0[b]	$2,972,000	$3,084,600	$77.08
4 – Regionalization with neighboring system	N/A	N/A	N/A	N/A	N/A	N/A
5 – Consolidation with neighboring system	N/A	N/A	N/A	N/A	N/A	N/A
6 – Private ownership of the Benton Harbor Water System	N/A	N/A	N/A	N/A	N/A	N/A
7A – Alternative water source – City staffing	$2,000	($125,500)	$322,800	N/A	$500,300	$12.50
7A – Alternative water source – Contract Operations	($178,000)	($125,500)	$322,800	N/A	$320,300	$8.00

[a.] Monthly increase is in addition to the current water rate plus the rate increase needed to cover the current deficit, to be determined in the Capacity Study.

[b.] Financing of approximately $3.48 million in needed improvements at the Benton Charter Township WTP is unknown and no debt service is shown at this time.

Table 5-2. Benefits and Concerns for Each Alternative

	Alt 1A	Alt 1B	Alt 1C	Alt 2A	Alt 2B	Alt 3	Alt 4[a]	Alt 5[a]	Alt 6[a]	Alt 7A	Alt 7B
Benefits											
Benton Harbor retains ownership of the water system	✓	✓	✓	✓	✓	✓	✓			✓	✓
Increases Benton Harbor's technical, managerial, and/or financial capacity		✓	✓				✓	✓	✓		✓
Benton Harbor more likely to fill all required certified operator positions through contracted services or reduced number of operators needed		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Improves working relationship and promotes partnership with neighboring systems				✓	✓	✓	✓	✓			
Potential to result in cost savings through shared resources or reduced capital improvements							✓	✓	✓	✓	✓
Access to additional resources, improving customer service and system reliability		✓	✓				✓	✓	✓		✓
Concerns											
Benton Harbor may struggle to fill all required certified operator and water system staff positions	✓			✓	✓	✓	✓			✓	
All or key certified operator positions provided by contracted services, creating operational vulnerability if contract is terminated for any reason		✓	✓								
Benton Harbor lacks adequate technical, managerial, and/or financial capacity to oversee all needed improvements	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Significant financial impacts to rate payers in addition to rate increase needed to address current water system budget deficit and legacy costs (e.g. pensions)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Local autonomy and policy control may become challenging							✓	✓	✓		

	Alt 1A	Alt 1B	Alt 1C	Alt 2A	Alt 2B	Alt 3	Alt 4[a]	Alt 5[a]	Alt 6[a]	Alt 7A	Alt 7B
Challenges with distributing costs equitably among participating jurisdictions							✓				
Benton Harbor relinquishes ownership of the water system								✓	✓		

6.0 SUMMARY

The alternatives identified in this report provide options for Benton Harbor and its customers to consider for providing safe and reliable drinking water. These alternatives were identified and evaluated based on available information. All alternatives should be further analyzed and refined to ensure all costs, benefits, and concerns are properly identified. Regardless of which alternative is selected, Benton Harbor faces challenges with conducting needed improvements and the ability of existing customers to afford the rate increase needed to address the current deficit plus costs associated with needed improvements.

7.0 REFERENCES

1. Abonmarche 2021. City of Benton Harbor Drinking Water State Revolving Fund Project Plan.

2. American Water Works Association (AWWA) and American Society of Civil Engineers, 1998. Water Treatment Plant Design, Third Edition. McGraw-Hill.

3. Beecher, J., 1996. The Regionalization of Water Utilities: Perspectives, Literature Review, and Annotated Bibliography. National Regulatory Research Institute available at: https://pubs.naruc.org/pub/48860212-155D-0A36-3115-26BCFC16B761

4. Benton Harbor Community Water Council, 2021. Petition for Emergency Action under the Safe Drinking Water Act, 42 U.S.C. § 300i and 42 U.S.C. § 300j-1(b), to Abate the Imminent and Substantial Endangerment to Benton Harbor, Michigan Residents from Lead Contamination in Drinking Water. Submitted to the U.S. Environmental Protection Agency, September 9, 2021.

5. Benton Charter Township, 2021. Annual Water Quality Report for 2020. Available at: https://bentonchartertwp.org/assets/content/Water-Quaility-Report-2020.pdf

6. Benton Harbor, 2019. Annual Water Quality Report for 2019. Available at https://bhcity.us/wp-content/uploads/2020/06/Benton-Harbor-Water-2019-CCR-Water-Quality-Report.pdf

7. CH2MHILL, 2014. Drinking Water System Strategic Capital Improvement Plan Prepared for the City of St. Joseph, MI.

8. City of St. Joseph, 2014. City of St. Joseph and City of Benton Harbor Public Water System Interconnection Agreement.

9. City of St. Joseph, 2021. Annual Water Quality Report for 2020.

10. City of St. Joseph, 2022. Personnel communication between Greg Alimenti, City of St. Joseph and Mark Briggs, Eastern Research Group.

11. Fleis & Vendenbrink, 2022. Draft Technical, Managerial Financial Capacity Study, City of Benton Harbor, Project No. 851350

12. Michigan Department of Environmental Quality (MDEQ), 2018a. Benton Harbor Water System 2018 Water System Sanitary Survey.

13. Michigan Department of Environmental Quality (MDEQ), 2018b. Benton Charter Township 2018 Water System Sanitary Survey.

14. Michigan Department of Environment, Great Lakes and Energy (EGLE), 2019. Water Quality Maps for Michigan by County. Available at: https://www.michigan.gov/egle/0,9429,7-135-3313_3675_3690-76500--,00.html

15. Michigan Department of Environment, Great Lakes and Energy (EGLE), 2021a. Significant Deficiency Violation Notice; City of Benton Harbor; 2021 Water System Sanitary Survey. Letter to Mayor Muhammad and Mr. Mitchell dated November 2, 2021.

16. Michigan Department of Environment, Great Lakes and Energy (EGLE), 2021b. Benton Harbor Water Treatment Plant NPDES Discharge From Potable Water Supply Inspection Form dated November 10, 2021.

17. Michigan Department of Environment, Great Lakes and Energy (EGLE), 2022a. NPDES Violation Notice letter from Kip Mitchell to Ellis Mitchell dated January 27, 2022, VN No. VN-012645.

18. Michigan Department of Environment, Great Lakes and Energy (EGLE), 2022b. Follow Up to Violation Notice No. VN-012645 Dated January 27, 2021. Designated Name: Benton Harbor. Letter from Kip Mitchell to Ellis Mitchell dated March 21, 2022.

19. Rodriguez, G., Nagy, M., Bye, J., Meixner, K., and Wax, M., 2018. Public Perception of Michigan Water Quality and Affordability: A Case Study of Benton Harbor. Michigan Journal of Sustainability, Volume 6, Issue 1, Available at: http://dx.doi.org/10.3998/mjs.12333712.0006.105

20. United States Environmental Protection Agency (USEPA), 2015. Reducing Volatile Disinfection By-Products in Treated Drinking Water Using Aeration Technologies. Water Research Foundation, Web Report #4441.

21. United States Environmental Protection Agency (USEPA), 2017. Water System Partnerships: State Programs and Policies Supporting Cooperative Approaches for Drinking Water Systems. Office of Water, EPA 816-S-17-002.

Appendix A–
U.S. EPA Administrative Order

Appendix B–
St. Joseph and Benton Harbor Interconnection Agreement

Appendix C–
Detailed Cost Analysis

Appendix D–
City of Benton Harbor Water Rates

Appendix E–
Duties and Responsibilities for Proposed Water System Personnel
(Fleis and Vandenbrink, 2022)

Appendix F–
EGLE NPDES Violation Notice Letter

Appendix A–
U.S. EPA Administrative Order

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5

In the Matter of:	)	**UNILATERAL ADMINISTRATIVE ORDER**
City of Benton Harbor Public Water Supply, PWS ID MI0000600	)	**Proceeding under Section 1414(g) of the Safe Drinking Water Act, 42 U.S.C. § 300g-3(g)**
Benton Harbor, Michigan	)	

WHEREAS, the Michigan Department of Environment, Great Lakes, and Energy ("EGLE") has primary responsibility for the implementation and enforcement of the public water supply program in Michigan, and on March 5, 2019, EGLE and the City of Benton Harbor ("Benton Harbor" or "City") entered into an Administrative Consent Order, ACO-399-07-2019 ("2019 ACO"), to address violations and significant deficiencies of Michigan Safe Drinking Water Rules ("MSDWRs"). On August 7, 2020, EGLE and Benton Harbor agreed to amend the 2019 ACO ("2020 Amended ACO") to acknowledge completion of several activities required by the 2019 ACO and to require Benton Harbor to take additional actions to correct MSDWR violations and significant deficiencies, including developing a Capacity Study to address significant technical, managerial, and financial deficiencies.

WHEREAS, on August 19, 2021, EGLE requested that the United States Environmental Protection Agency ("EPA") participate in a joint Safe Drinking Water Act ("SDWA") inspection of the Benton Harbor Public Water System ("System") that the agencies scheduled for the week of September 20, 2021.

WHEREAS, between September 20-27, 2021, EPA and EGLE conducted the scheduled joint compliance inspection of the System to assess the SDWA compliance status of the System ("September 2021 Inspection").

WHEREAS, on October 14, 2021, Michigan Governor Gretchen Whitmer issued Executive Directive No. 2021-6 ("Executive Directive") that requires, among other actions, a whole-of-government response that directs Michigan departments and agencies to expeditiously take all appropriate action to ensure residents of Benton Harbor have immediate access to free bottled water for consumption through distribution sites and drop-off delivery until further notice.[1]

WHEREAS, the Executive Directive also requires, among other actions, that Michigan departments and agencies expeditiously take all appropriate action to leverage available state resources to support the City in replacing lead service lines.

1 For additional information on Michigan's Benton Harbor drinking water response visit: https://www.michigan.gov/cleanwater/0,9779,7-411-98113_99988_109059---,00.html.

WHEREAS, on October 14, 2021, Michigan Governor Gretchen Whitmer announced an expedited timeline to replace 100 percent of lead service lines in Benton Harbor in the next 18 months.

WHEREAS, based on EPA's commitment to follow the best science to address lead in drinking water, EPA is conducting a confirmatory filter study, in coordination with community, local and state partners, to provide reassurance of filter effectiveness in relation to Benton Harbor's specific water chemistry.

WHEREAS, on October 19, 2021, the EPA Acting Regional Administrator, Region 5, issued a letter to EGLE Director Liesl Eichler Clark ("October 19, 2021 letter") indicating that EPA was considering its enforcement options to address any violations or deficiencies identified as a result of the September 2021 Inspection, and indicating that EPA expected to work with EGLE and the System to address such violations or deficiencies under a joint enforcement approach to maintain consistency of obligations and a better result.

WHEREAS, in the October 19, 2021 letter, EPA committed to continuing to exercise its independent oversight of Michigan's primary enforcement authority for the SDWA in the State, including continuing to provide technical assistance, pursue joint enforcement of the SDWA against the System, oversee EGLE's continuing enforcement against the System, "and if problems arise, [EPA] will . . . exercise [its] independent authorities to ensure that the residents of Benton Harbor are provided safe drinking water."

WHEREAS, in the October 19, 2021 letter, EPA further committed to continuing to be involved in Benton Harbor to support and monitor the effectiveness of the immediate interventions initiated by Michigan and the development of long-term solutions in Benton Harbor.

WHEREAS, the System's technical, managerial, and financial capacity is essential to the provision of drinking water that is compliant with the SDWA and is a critical component of ensuring corrosion control treatment is effective at reducing lead levels in the System's distribution system during and after lead service line replacement.

NOW THEREFORE, EPA FINDS and ORDERS:

I. STATUTORY AUTHORITY

1. The Director of the Enforcement and Compliance Assurance Division, EPA Region 5, is issuing this Order ("Order") to the System, PWS Identification Number MI0000600, under Section 1414(g) of the SDWA, 42 U.S.C. § 300g-3(g).

2. Section 1414 of the SDWA, 42 U.S.C. § 300g-3(g), authorizes EPA to order persons subject to SDWA to comply with all applicable requirements under the SDWA. Applicable

requirements include, among other things, the National Primary Drinking Water Regulations ("NPDWRs") promulgated at 40 C.F.R. Part 141 pursuant to Section 1412 of the SDWA, 42 U.S.C. §§ 300g-1, 300g-3(i).

3. The Administrator of EPA has delegated the authority to take these actions to the Regional Administrator of EPA Region 5, pursuant to Delegation 9-32, who has, in turn, delegated the authority to the Director of the Enforcement and Compliance Assurance Division.

II. FINDINGS OF FACT AND CONCLUSIONS OF LAW

General Findings

4. The City ("Respondent") is the owner and/or operator of the System located at 200 East Wall Street, Benton Harbor, Michigan 49022.

5. Respondent is a "person," as defined by Section 1401(12) of the SDWA, 42 U.S.C. § 300f(12), and 40 C.F.R. § 141.2.

6. The System is a "public water system" ("PWS") within the meaning of Section 1401(4) of the SDWA, 42 U.S.C. § 300f(4); and 40 C.F.R. § 141.2 that provides water from a surface water source.

7. The System regularly serves at least twenty-five (25) year-round residents and is therefore a "community water system" ("CWS") within the meaning of Section 1401(15) of the SDWA, 42 U.S.C. § 300f(15), and 40 C.F.R. § 141.2.

8. The System serves approximately 9,970 persons and has 3,335 active service connections.

9. The System has an intake in Lake Michigan as its source of drinking water.

10. Respondent's ownership and/or operation of the System makes it a "supplier of water" within the meaning of Section 1401(5) of the SDWA, 42 U.S.C. § 300f(5), and 40 C.F.R. § 141.2, and subject to the requirements of Part B of the SDWA, 42 U.S.C. § 300g, and the NPDWRs at 40 C.F.R. Part 141.

11. Pursuant to SDWA Section 1413, 42 U.S.C. § 300g-2, EGLE has primary responsibility for the implementation and enforcement of the public water supply program in Michigan.

12. Between September 20–27, 2021, EPA and EGLE conducted a joint compliance inspection of the System pursuant to Section 1445(b) of the SDWA, 42 U.S.C. § 300j-4(b), and identified numerous violations of the NPDWRs identified in Paragraphs 15–104 below, including NPDWR violations related to the System's technical, managerial, and financial capacity.

13. On October 29, 2021, EGLE referred the identified violations to EPA to require the System to comply with the associated applicable requirements under the SDWA.

14. On October 26, 2021, EPA met with EGLE to confer on this Order, in conformance with Section 1414(g)(2) of the SDWA, 42 U.S.C. § 303g-3(g)(2).

Lead and Copper Public Education

15. The System is classified as a medium-sized PWS (3,301 to 50,000 people served) under the Lead and Copper Rule ("LCR"), as defined at 40 C.F.R. §§ 141.2 and 141.81(a)(2), and as such, was required to conduct sampling, beginning with two (2) consecutive six-month monitoring periods during July 1 to December 31, 1992 and January 1 to June 30, 1993 to determine compliance with the LCR at 40 C.F.R. § 141.86(d).

16. After meeting lead and copper action levels during the two (2) consecutive six-month monitoring periods, a medium-sized water system may reduce monitoring frequency to once per year. 40 C.F.R. §§ 141.86(d)(1)(ii)(B); 141.86(d)(4).

17. After three (3) consecutive years of monitoring, a medium-sized water system in compliance may further reduce the frequency of monitoring from annually to once every three (3) years. 40 C.F.R. §§ 141.86(d)(4)(iii).

18. An LCR compliance sample is a sample that has been collected and analyzed for lead and copper according to the requirements of the LCR at 40 C.F.R. § 141.86. The lead action level is exceeded if the concentration of lead in more than ten (10) percent of tap water samples collected during any monitoring period conducted in accordance with 40 C.F.R. § 141.86 is greater than 0.015 mg/L (i.e., if the "90th percentile" lead level is greater than 0.015 mg/L or 15 parts per billion ("ppb")).

19. Between January 2016 and December 2018, the 90th percentile of the samples collected during this period was 22 ppb, which is a lead action level exceedance ("ALE") pursuant to the LCR at 40 C.F.R. § 141.80(c).

20. Between January 2019 and June 2019, the 90th percentile of the samples collected during this sampling period was 27 ppb, which is a lead ALE pursuant to the LCR at 40 C.F.R. § 141.80(c).

21. Between July 2019 and December 2019, the 90th percentile of the samples collected during this sampling period was 32 ppb, which is a lead ALE pursuant to the LCR at 40 C.F.R. § 141.80(c).

22. Between January 2020 and June 2020, the 90th percentile of the samples collected during this sampling period was 23 ppb, which is a lead ALE pursuant to the LCR at 40 C.F.R. § 141.80(c).

23. Between July 2020 and December 2020, the 90th percentile of the samples collected during this sampling period was 24 ppb, which is a lead ALE pursuant to the LCR at 40 C.F.R. § 141.80(c).

24. Between January 2021 and June 2021, the 90th percentile of the samples collected during this sampling period was 24 ppb, which is a lead ALE pursuant to the LCR at 40 C.F.R. § 141.80(c).

25. A PWS that exceeds the lead action level based on tap water samples collected in accordance with 40 C.F.R. § 141.86 must comply with certain public education requirements at 40 C.F.R. § 141.85.

26. 40 C.F.R. § 141.85(a) regulates the content of written public education materials (e.g., brochures and pamphlets), while 40 C.F.R. § 141.85(b) regulates the delivery of such public education materials.

27. Pursuant to 40 C.F.R. § 141.85(b)(2)(ii)(A), a CWS that exceeds the lead action level must contact the local health department and deliver education materials that meet the content requirements of 40 C.F.R. § 141.85(a) to local public health agencies even if they are not located within the water system's service area, along with an informational notice that encourages distribution to all the organization's potentially affected customers or CWS's users.

28. 40 C.F.R. § 141.85(b)(3) requires contact with the local health department at least every twelve (12) months as long as the CWS exceeds the lead action level.

29. According to the System's February 2021 and August 2021 public education certifications, the System did not contact the local health department in the 12-month period between August 2020 and August 2021.

30. Respondent's failure to contact the local health department in the 12-month period between August 2020 and August 2021 is a violation of 40 C.F.R. §§ 141.85(b)(2)(ii)(A) and 141.85(b)(3).

31. Pursuant to 40 C.F.R. § 141.85(b)(2)(ii)(B), a CWS that exceeds the lead action level must contact customers who are most at risk by delivering materials that meet the content requirements of 40 C.F.R. § 141.85(a) to the following organizations within the water system's service area, along with an informational notice that encourages distribution to all the organization's potentially affected customers or CWS's users: public and private schools or school boards, Women, Infants and Children (WIC) and Head Start programs, public and private hospitals and medical clinics, pediatricians, family planning clinics, and local welfare agencies.

32. 40 C.F.R. § 141.85(b)(3) requires contact with the organizations identified in 40 C.F.R. § 141.85(b)(2)(ii)(B) at least every twelve (12) months as long as the CWS exceeds the lead action level.

33. According to the System's February and August 2021 public education certifications, the System did not contact public and private hospitals, pediatricians, family planning clinics, community centers, or adult foster care facilities in the 12-month period between August 2020 and August 2021.

34. During the September 2021 Inspection, the inspectors asked the System to produce a distribution list confirming that organizations identified in 40 C.F.R. § 141.85(b)(2)(ii)(B) within the System's service area were contacted and delivered materials.

35. During and after the September 2021 Inspection, the System did not produce the requested distribution list.

36. Respondent's failure to contact certain organizations identified in 40 C.F.R. § 141.85(b)(2)(ii)(B) in the 12-month period between August 2020 and August 2021 is a violation of 40 C.F.R. §§ 141.85(b)(2)(ii)(B) and 141.85(b)(3).

37. Pursuant to 40 C.F.R. § 141.85(b)(2)(ii)(C), a CWS that exceeds the lead action level must make a good faith effort to locate the following organizations within the service area and deliver materials that meet the content requirements of 40 C.F.R. § 141.85(a) to them, along with an informational notice that encourages distribution to all potentially affected customers or users: licensed childcare centers, public and private preschools, and obstetricians-gynecologists and midwives.

38. 40 C.F.R. § 141.85(b)(3) requires good faith effort to locate such organizations identified in 40 C.F.R. § 141.85(b)(2)(ii)(C) at least every twelve (12) months as long as the CWS exceeds the lead action level.

39. According to the System's February and August 2021 public education certifications, the System did not make a good faith effort to locate and contact obstetricians-gynecologists in the 12-month period between August 2020 and August 2021.

40. Respondent's failure to make a good faith effort to locate organizations identified in 40 C.F.R. § 141.85(b)(2)(ii)(C) in the 12-month period between August 2020 and August 2021 is a violation of 40 C.F.R. §§ 141.85(b)(2)(ii)(C) and 141.85(b)(3).

41. Pursuant to 40 C.F.R. § 141.85(b)(2)(iii), a CWS that exceeds the lead action level must provide, no less often than quarterly, information on or in each water bill, including verbatim text, notifying customers that the system has found high levels of lead, as long as the system exceeds the lead action level.

42. 40 C.F.R. § 141.85(b)(3) requires provision of the information required under 40 C.F.R. § 141.85(b)(2)(iii) in each billing cycle.

43. According to the System's February and August 2021 public education certifications, the System did not provide information notifying customers that the System has found high levels of lead in each water bill during the 12-month period between August 2020 and August 2021.

44. During the September 2021 Inspection, the System stated to the inspectors that no public education materials are sent with water bills delivered through the mail.

45. Respondent's failure to provide information notifying customers that the System has found high levels of lead in each water bill during the 12-month period between August 2020 and August 2021 is a violation of 40 C.F.R. §§ 141.85(b)(2)(iii) and 141.85(b)(3).

Performing Turbidity Measurements

46. Pursuant to 40 C.F.R. § 141.550, systems which serve populations fewer than 10,000, are required to filter, and utilize filtration other than slow sand filtration or diatomaceous earth filtration must meet the combined filter effluent turbidity requirements of 40 C.F.R. §§ 141.551 through 141.553.

47. Pursuant to 40 C.F.R. § 141.551, the first combined filter effluent turbidity limit is a "95th percentile" turbidity limit that your system must meet in at least 95 percent of the turbidity measurements taken each month. Measurements must continue to be taken as described in 40 C.F.R. § 141.74(a) and (c). For systems using conventional filtration or direct filtration the 95th percentile turbidity value is 0.3 NTU. For systems using conventional filtration or direct filtration the maximum turbidity value is 1 NTU.

48. Pursuant to 40 C.F.R. § 141.74(c)(1), turbidity measurements must be performed on representative samples of the system's filtered water every four (4) hours (or more frequently) that the system serves water to the public. A PWS may substitute continuous turbidity monitoring for grab sample monitoring if it validates the continuous measurement for accuracy on a regular basis using a protocol approved by the State.

49. The System uses fifteen (15) Hach 1720E Turbidimeters to conduct continuous turbidity monitoring throughout the PWS. Twelve (12) of the fifteen (15) Hach 1720E Turbidimeters used to collect continuous turbidity measurements are on the System's filters.

50. The manufacturer's recommendation for the Hach 1720E Turbidimeters is that meters should be recalibrated quarterly for accurate measurements. The manufacturer also recommends recalibration after any significant maintenance or repair and at least once every three (3) months during normal operation.

51. During and after the September 2021 Inspection, the System did not demonstrate that it calibrates the twelve (12) turbidimeters on the filters every three (3) months and after significant maintenance activities, consistent with the manufacturer's recommendations.

52. Respondent's failure to calibrate the turbidimeters consistent with the manufacturer's recommendation is a failure to accurately measure turbidity, in violation of 40 C.F.R. § 141.74(c)(1).

Monitoring of Residual Disinfectant Concentration

53. Pursuant to 40 C.F.R. § 141.72(b), each PWS that provides filtration treatment must provide disinfection treatment consistent with requirements at 40 C.F.R. §§ 141.72(b)(1)–(3).

54. The System provides filtration treatment and is subject to the requirements at 40 C.F.R. §§ 141.72(b)(1)–(3).

55. Pursuant to 40 C.F.R. § 141.72(b)(2), the residual disinfectant concentration in the water entering the distribution system, measured as specified in 40 C.F.R. §§ 141.74(a)(2) and (c)(2), cannot be less than 0.2 mg/l for more than four (4) hours. The residual disinfectant concentration in the distribution system, measured as total chlorine, combined chlorine, or chlorine dioxide, as specified in 40 C.F.R. § 141.74(a)(2) and (c)(2), cannot be undetectable in more than five (5) percent of the samples each month, for any two (2) consecutive months that the system serves water to the public.

56. Pursuant to 40 C.F.R. § 141.74(a)(2), PWSs must measure residual disinfectant concentrations with specified analytical methods. If approved by the State, residual disinfectant concentrations for free chlorine and combined chlorine also may be measured by using DPD colorimetric test kits. Free and total chlorine residuals may be measured continuously by adapting a specified chlorine residual method for use with a continuous monitoring instrument provided the chemistry, accuracy, and precision remain the same. Instruments used for continuous monitoring must be calibrated with a grab sample measurement at least every five (5) days, or with a protocol approved by the State.

57. The System has numerous continuous chlorine analyzer devices installed throughout the PWS to perform continuous monitoring of chlorine residuals.

58. During the September 2021 Inspection, the System did not demonstrate that the continuous chlorine analyzers were calibrated every five (5) days with a grab sample when the chlorine analyzers were operating.

59. Respondent's failure to calibrate the chlorine analyzers every five (5) days with a grab sample when in operation is a violation of 40 C.F.R. § 141.74(a)(2).

60. Pursuant to 40 C.F.R. § 141.74(c)(2), the residual disinfectant concentration of the water entering the distribution system must be monitored continuously, and the lowest value must be recorded each day. Grab sampling every four (4) hours may be conducted in lieu of continuous monitoring if the continuous monitoring equipment fails, but for no more than five (5) working days following the failure of the equipment.

61. During the September 2021 Inspection, the inspectors observed that multiple continuous chlorine analyzer devices located on the raw water line, downstream of the plate settlers, at the point of entry station inside the PWS laboratory, and at the high service pump were offline and had been offline for more than two (2) weeks. The point of entry station inside the PWS laboratory monitored the residual disinfectant concentration of the water entering the distribution system.

62. Respondent's failure to repair the continuous chlorine analyzers monitoring the residual disinfectant concentration of the water entering the distribution system no more than five (5) working days following the failure of the equipment is a violation of 40 C.F.R. § 141.74(c)(2).

63. During the September 2021 Inspection, the inspectors observed that the System was taking manual grab samples every two (2) hours during the six (6) to eight (8) hours daily that the treatment plant filters are in operation. At the time of the September 2021 Inspection, the water treatment plant was continuously pumping water to the distribution system. System personnel stated they were not taking residual disinfectant concentration grab samples during after hours outside of the six (6) to eight (8) hours a day when the water plant filters were in operation.

64. Respondent's failure to maintain continuous monitoring of the residual disinfectant concentration is a violation of 40 C.F.R. § 141.74(c)(2).

SCADA System

65. 40 C.F.R. § 141.63(e) identifies the best technology, treatment techniques, or other means available for achieving compliance with the maximum contaminant level for total coliforms and for achieving compliance with the maximum contaminant level for *E. coli*, including: maintenance of a disinfectant residual throughout the distribution system; proper maintenance of the distribution system including appropriate pipe replacement and repair procedures, main flushing programs, proper operation and maintenance of storage tanks and reservoirs, cross connection control, and continual maintenance of positive water pressure in all parts of the distribution system; and filtration and/or disinfection of surface water, as described in 40 C.F.R. §§ 141.70 through 141.76 and 40 C.F.R. §§ 141.500 through 141.571.

66. During the September 2021 Inspection, the inspectors observed that the System has a Supervisory Control and Data Acquisition (SCADA) system in place for monitoring and

operating the plant to, among other things, achieve proper disinfection. The SCADA system has the capability to set alarms and send out calls or alerts to operators 24/7 in the event a monitoring parameter falls out of a preset range or if there is an emergency at the PWS. At the time of the September 2021 Inspection, the System did not know what alarms had been set in place, and the SCADA system was in an unknown and inadequate working condition to continuously monitor residual disinfectant concentration of the water entering the distribution system. The inspectors observed that the depth sensor values being collected through the SCADA system were not consistent with the physical observations of the chlorine tanks. During the September 2021 Inspection, the System could not verify that the SCADA system is configured to issue alarms or call outs when water levels in the reservoir are low and/or there is a loss of positive pressure in the distribution system.

67. Respondent's failure to maintain alarms and/or alerts through the SCADA system is a violation of 40 C.F.R. § 141.63(e).

Filter and Disinfection Profiling and Benchmarking

68. Pursuant to 40 C.F.R. § 141.530, if a system is a Subpart H CWS which serves fewer than 10,000 persons, the system must develop a disinfection profile unless the State determines that the system's profile is unnecessary. Pursuant to 40 C.F.R. § 141.500, the requirements of Subpart T (40 C.F.R. §§ 141.500 through 141.571), including the requirements regarding disinfection, constitute NPDWRs.

69. Pursuant to 40 C.F.R. § 141.533, to calculate a disinfection profile, a system must monitor the following parameters to determine the total log inactivation using the analytical methods in 40 C.F.R. § 141.74(a), once per week on the same calendar day, over twelve (12) consecutive months:

    (a) The temperature of the disinfected water at each residual disinfectant concentration sampling point during peak hourly flow;

    (b) If the system uses chlorine, the pH of the disinfected water at each residual disinfectant concentration sampling point during peak hourly flow;

    (c) The disinfectant contact time(s) ("T") during peak hourly flow; and

    (d) The residual disinfectant concentration(s) ("C") of the water before or at the first customer and prior to each additional point of disinfection during peak hourly flow.

70. Pursuant to 40 C.F.R. § 141.534, systems must use the tables in 40 C.F.R. § 141.74(b)(3)(v) to determine the appropriate CT99.9 value.

71. During and after the September 2021 Inspection, the System did not demonstrate it calculates CT, which is needed to calculate a disinfection profile as described in 40 C.F.R. § 141.533.

72. During the September 2021 Inspection, the inspectors observed that the flow meters for treated water were not functioning properly, as is needed to calculate a disinfection profile as described in 40 C.F.R. § 141.533.

73. During the September 2021 Inspection, the inspectors observed that the continuous chlorine analyzers were not working, as is needed to calculate a disinfection profile as described in 40 C.F.R. § 141.533.

74. Respondent's failure to calculate CT, failure to maintain a properly functioning flow meter, failure to maintain working continuous chlorine analyzers, all of which are needed to calculate disinfection profiles pursuant to the NPDWRs, is a violation of 40 C.F.R. § 141.533.

75. Pursuant to 40 C.F.R. § 141.540, a system subject to Subpart H (40 C.F.R. §§ 141.70 through 141.76) that is required to develop a disinfection profile under 40 C.F.R. §§ 141.530 through 141.536, must develop a disinfection benchmark if it decides to make a significant change to its disinfection practice. A system must consult with the State for approval before it can implement a significant disinfection practice change.

76. Pursuant to 40 C.F.R. § 141.541, significant changes to the point of disinfection include: changes to the point of disinfection, changes to the disinfectant(s) used in the treatment plant, changes to the disinfection process; or any other modification(s) identified by the State.

77. On or about February 2017, the System ceased chlorine addition to the intake crib for the purposes of zebra mussel control. Later in 2017, the System altered chlorine addition from the raw line to the settled water feed. Such changes to the point of disinfection are considered a significant change to disinfection practice, as defined in 40 C.F.R. § 141.541. Therefore, according to 40 C.F.R. § 141.540, the System was required to develop disinfection benchmarks and notify the State prior to making the change.

78. During and after the September 2021 Inspection, the System did not demonstrate that it develops disinfection profiles and disinfection benchmarks after changing the point of disinfection.

79. Respondent's failure to develop disinfection profiles and disinfection benchmarks prior to making changes to the point of disinfection, in 2017, pursuant to the NPDWRs, is a violation of 40 C.F.R. § 141.540.

Requirements for Disinfection

80. Pursuant to 40 C.F.R. § 141.72, each PWS that provides filtration treatment must provide disinfection treatment.

81. Pursuant to 40 C.F.R. § 141.500, the requirements of Subpart T (40 C.F.R. §§ 141.500 through 141.571) constitute NPDWRs. These regulations establish requirements for filtration and disinfection that are in addition to criteria under which filtration and disinfection are required under Subpart H. The regulations establish or extend treatment technique requirements in lieu of maximum contaminant levels for the following contaminants: *Giardia lamblia,* viruses, heterotrophic plate count bacteria, *Legionella, Cryptosporidium,* and turbidity. The treatment technique requirements consist of installing and properly operating water treatment processes which reliably achieve:

    (a) At least 99 percent (2-log) removal of *Cryptosporidium* between a point where the raw water is not subject to recontamination by surface water runoff and a point downstream before or at the first customer for filtered systems, or *Cryptosporidium* control under the watershed control plan for unfiltered systems; and

    (b) Compliance with the profiling and benchmark requirements in 40 C.F.R. §§ 141.530 through 141.544.

82. Respondent's failures identified in Paragraphs 59, 62, 64, 67, 74, and 79, above, constitute Respondent's failure to demonstrate that the System provides adequate disinfection pursuant to the NPDWRs, in violation of 40 C.F.R. §§ 141.72 and 141.500.

Operational Evaluation Level Calculations for Disinfectant Byproduct Monitoring

83. A CWS that uses a primary or residual disinfectant other than ultraviolet light or delivers water that has been treated with a primary or residual disinfectant other than ultraviolet light is subject to monitoring and other requirements at Subpart V (40 C.F.R. §§ 141.620 through 141.629) of the NPDWRs for achieving compliance with maximum contaminant levels based on locational running annual averages ("LRAA") for total trihalomethanes ("TTHM") and haloacetic acids five ("HAA5").

84. 40 C.F.R. § 141.621(a) establishes routine monitoring requirements, including the frequency of and locations for routine monitoring.

85. Pursuant to 40 C.F.R. § 141.626(a), a CWS has exceeded the Operational Evaluation Level ("OEL") at any monitoring location where the sum of the two (2) previous quarters' TTHM results plus twice the current quarter's TTHM result, divided by four (4) to determine an average, exceeds 0.080 mg/L, or where the sum of the two (2) previous quarters' HAA5 results plus twice the current quarter's HAA5 result, divided by four (4) to determine an average, exceeds 0.060 mg/L.

86. During the September 2021 Inspection, the System did not demonstrate that it performs OEL calculations.

87. Respondent's failure to perform OEL calculations pursuant to the NPDWRs is a violation of 40 C.F.R. § 141.626.

America's Water Infrastructure Act

88. On October 23, 2018, the America's Water Infrastructure Act ("AWIA") of 2018 (Public Law 115-270) amended the SDWA.

89. Section 1433(a)(1) of the SDWA, 42 U.S.C. § 300i-2(a)(1), requires each CWS serving a population of greater than 3,300 persons to conduct a Risk and Resilience Assessment (RRA) of its system, including an assessment of:

(a) The risk to the system from malevolent acts and natural hazards;

(b) The resilience of the pipes and constructed conveyances, physical barriers, source water, water collection and intake, pretreatment, treatment, storage and distribution facilities, electronic, computer, or other automated systems (including the security of such systems) which are utilized by the system;

(c) The monitoring practices of the system;

(d) The financial infrastructure of the system;

(e) The use, storage, or handling of various chemicals by the system; and

(f) The operation and maintenance of the system.

90. Section 1433(a)(3)(A)(iii) of the SDWA, 42 U.S.C. § 300i-2(a)(3)(A)(iii), requires each CWS serving a population greater than 3,300 but less than 50,000 to submit a certification to the EPA Administrator that it has conducted an RRA prior to June 30, 2021.

91. Section 1433(b) of the SDWA, 42 U.S.C. § 300i-2(b), requires each CWS serving a population greater than 3,300 to prepare or revise, where necessary, an Emergency Response Plan (ERP) that incorporates the findings of the RRA and to certify to the EPA Administrator no later than six (6) months after completion of the RRA that the system has completed an ERP. The ERP shall include:

(a) Strategies and resources to improve the resilience of the system, including the physical security and cybersecurity of the system;

(b) Plans and procedures that can be implemented, and identification of equipment that can be utilized, in the event of a malevolent act or natural hazard that threatens the ability of the community water system to deliver safe drinking water;

(c) Actions, procedures, and equipment which can obviate or significantly lessen the impact of a malevolent act or natural hazard on the public health and the safety and supply of drinking water provided to communities and individuals, including the development of alternative source water options, relocation of water intakes, and construction of flood protection barriers; and

(d) Strategies that can be used to aid in the detection of malevolent acts or natural hazards that threaten the security or resilience of the system.

92. Section 1433(d) of the SDWA, 42 U.S.C. § 300i-2(d), requires that each CWS shall maintain a copy of the RRA and the ERP (including any revised RRA or ERP) for five (5) years after the date on which a certification of such assessment or plan is submitted.

93. According to EPA's AWIA database, the System certified on June 29, 2021 that it had completed both an RRA and an ERP.

94. During the September 2021 Inspection, the System stated that it could not produce the ERP because it had not yet prepared the ERP.

95. Respondent's failure to retain a copy of the ERP pursuant to Section 1433(b) of the SDWA, 42 U.S.C. § 300i-2(b), is a violation of Section 1433(d) of the SDWA, 42 U.S.C. § 300i-2(d).

Record Maintenance

96. Any owner or operator of a PWS subject to the NPDWRs must comply with record maintenance requirements at 40 C.F.R. § 141.33.

97. Pursuant to 40 C.F.R. § 141.33(a), any owner or operator of a PWS subject to the NPDWRs shall retain, on its premises or at a convenient location near its premises, records of microbiological analyses and turbidity analyses made pursuant to the NPDWRs for not less than five (5) years and records of chemical analyses made pursuant to the NPDWRs for not less than ten (10) years.

98. During and after the September 2021 Inspection, the System did not produce analysis records for disinfectant byproducts ("DBP"), Total Organic Carbon precursor, turbidity, or residual chlorine that the inspectors asked Respondent to produce during and after the September 2021 Inspection.

99. Respondent's failure to retain records of microbiological, turbidity, and chemical analyses made pursuant to the NPDWRs is a violation of 40 C.F.R. § 141.33(a).

100. During the September 2021 Inspection, the inspectors requested the Total Organic Carbon precursor monitoring and DBP distribution system sampling. The System provided an incomplete set of records and did not provide the data from February 2018 to October 2020, and January and February 2021.

101. Respondent's failure to retain complete records of Total Organic Carbon precursor monitoring and DBP distribution system sampling made pursuant to the NPDWRs is a violation of 40 C.F.R. § 141.33(a).

102. Pursuant to 40 C.F.R. § 141.91, any system subject to the requirements of Subpart I (40 C.F.R. §§ 141.80 through 141.93) shall retain on its premises original records of all sampling data and analyses, reports, surveys, letters, evaluations, schedules, State determinations, and any other information required by 40 C.F.R. §§ 141.81 through 141.88. Each water system shall retain the records required by this section for no fewer than twelve (12) years.

103. During and after the September 2021 Inspection, the inspectors asked the System to provide a distribution list with dates of public education materials provided to organizations and customers following each lead ALE, as required by 40 C.F.R. § 141.85. The System did not provide these records for the June 2018 through June 2020 time period.

104. Respondent's failure to retain complete lead and copper public education materials required by 40 C.F.R. § 141.85 is a violation of 40 C.F.R. § 141.91.

Conclusions of Law

105. Based on the findings above, EPA has determined that the System has numerous SDWA violations, including violations of the NPDWRs.

106. The NPDWR violations identified in the findings above represent significant technical, managerial, and financial deficiencies, as contemplated by 40 C.F.R. § 141.723.

III. ORDER

Based on the foregoing FINDINGS, and pursuant to the authority of Section 1414(g) of the SDWA, 42 U.S.C. § 300g-3(g), EPA is issuing this Order to comply with the SDWA and the NPDWRs, 40 C.F.R. Part 141. **EPA hereby ORDERS:**

107. Lead and Copper Public Education Requirements. Beginning no later than the Effective Date of this Order, Respondent shall comply with the following requirements:

(a) The System must provide, no less often than quarterly, the following information on or in each water bill when the System exceeds the action level for lead:

> "The Benton Harbor Public Water System found high levels of lead in drinking water in some homes. Lead can cause serious health problems. For more information, please call the Benton Harbor Public Water System."

The message on the water bill must include the above statement exactly as written except that the message or delivery mechanism can be modified in consultation with the State; specifically, the State may allow a separate mailing of public education materials to customers if the water system cannot place the information on water bills. The System must repeat this task every time the System exceeds the action level for lead.

(b) The System must contact the local health department and deliver education materials that meet the content requirements of 40 C.F.R. § 141.85(a) along with an informational notice that encourages distribution to all the organization's potentially affected customers. The System must repeat this task every twelve (12) months as long as the System exceeds the action level for lead.

(c) The System must contact customers who are most at risk by delivering materials that meet the content requirements of 40 C.F.R. § 141.85(a) to the following organizations that are located within the water system's service area, along with an informational notice that encourages distribution to each of the organization's potentially affected customers or CWS's users: (1) Public and private schools or school boards, (2) Women, Infants and Children (WIC) and Head Start programs, (3) Public and private hospitals and medical clinics, (4) Pediatricians, (5) Family planning clinics, and (6) Local welfare agencies. The System must repeat this task every twelve (12) months as long as the System exceeds the action level for lead.

(d) The System must make a good faith effort to locate the following organizations within the service area and deliver materials that meet the content requirements of 40 C.F.R. § 141.85(a) to them, along with an informational notice that encourages distribution to all potentially affected customers or users: (1) licensed childcare centers, (2) public and private preschools, and (3) obstetricians-gynecologists and midwives. The System must repeat this task every twelve (12) months as long as the System exceeds the action level for lead.

(e) The System must provide documentation to EPA that the requirements in Paragraph 107(a)–(d) have been met within seven (7) days of the System completing each Public Education requirement.

108. Address the Non-Operable Continuous Monitoring Devices Throughout the System.

(a) The System must repair and/or bring online the continuous flow meters the System currently utilizes in the drinking water treatment process to meet the monitoring standards of 40 C.F.R. § 141.533 within seven (7) days of the Effective Date of this Order.

(b) The System must create a plan and schedule to repair and/or bring online all non-operable continuous monitoring devices which the System currently utilizes in the drinking water treatment process. The plan must include specific deadlines for repairing and/or bringing online the continuous chlorine analyzers to meet the monitoring standards of 40 C.F.R. § 141.74(c)(2), continuous flow meters to meet the monitoring standards of 40 C.F.R. § 40 C.F.R. § 141.533, and depth sensors in the chlorine tanks. The plan must also include a detailed description of how the System will connect and ensure all active continuous monitoring devices remain connected to the SCADA system as well as a specific deadline to complete this action. The System must submit the plan to EPA and EGLE for review and approval within thirty (30) days of the Effective Date of this Order.

(c) Following EPA and EGLE's approval of the plan, the System must implement the plan according to the approved schedule. Any request for an extension to the approved schedule must be submitted in writing to both EPA and EGLE for review and approval.

(d) The System must also develop a separate calibration schedule for all continuous monitoring devices, including, but not limited to, the chlorine analyzers, flow meters, turbidimeters, and depth sensors. The System must submit the calibration schedule to EPA and EGLE for review and approval within forty-five (45) days of the Effective Date of this Order.

(e) Following EPA and EGLE's approval of the calibration schedule, the System must immediately implement the calibration schedule.

109. SCADA Alarms.

(a) The System must determine for which components of the PWS is the SCADA system currently configured to issue alarms and/or initiate calls to the operator when alarms are activated.

(b) The System must configure the SCADA system to issue alarms for all appropriate situations including, but not limited to:

i. When chlorine levels are outside the regulatory limits of 40 C.F.R. § 141.72(b)(2);

ii. When turbidity levels are outside the regulatory limits of 40 C.F.R. § 141.73(a)(2); and
iii. When water levels in the reservoir are low such that the System's ability to maintain adequate disinfection and/or positive pressure in the distribution system, per 40 C.F.R. §§ 141.72(b) and 141.63(e) respectively, is adversely affected.

(c) The System must configure the SCADA system to initiate calls to the operator of record for all appropriate situations including, but not limited to:

i. When chlorine levels are outside the regulatory limits of 40 C.F.R. § 141.72(b)(2);
ii. When turbidity levels are outside the regulatory limits of 40 C.F.R. § 141.73(a)(2); and
iii. When water levels in the reservoir are low such that the System's ability to maintain adequate disinfection and/or positive pressure in the distribution system, per 40 C.F.R. §§ 141.72(b) and 141.63(e) respectively, is adversely affected.

(d) The System must demonstrate to EPA that the SCADA system has been configured to meet the requirements of Paragraph 109(a)–(c) within sixty (60) days of the Effective Date of this Order.

110. Adequate Disinfection of Finished Water and Reducing Exposure to Disinfection Byproducts.

(a) The System must develop a Disinfection Profile and Benchmarking Report by following the steps in the EPA guidance document, "*Disinfection Profiling and Benchmarking Technical Guidance Manual*", June 2020, or an EPA-approved equivalent. The Disinfection Profile and Benchmarking Report must:

i. Identify disinfection segments;
ii. Collect relevant disinfection data, including, but not limited to:
    1. Peak Hourly Flow;
    2. Residual Disinfection Concentration;
    3. Temperature; and
    4. pH;
iii. Calculate CT;
iv. Calculate inactivation and required CT;
v. Develop the disinfection profile and benchmark; and
vi. Report and evaluate the disinfection profile and benchmark.

(b) The System must begin monitoring, at a frequency of at least once weekly, the necessary parameters to complete the Disinfection Profile and Benchmarking Report within thirty (30) days of the Effective Date of this Order.

(c) The System must deliver to EPA a preliminary report of the requirements in Paragraph 110(a)(i)–(iv) for the first four (4) weeks of monitoring within sixty (60) days of the Effective Date of this Order.

(d) If the System chooses to bring online the chlorine injection point at the intake as a zebra mussel control measure, this action would be considered a significant change to the point of disinfection. If the System brings online the zebra mussel chlorine injection point at the intake, the System must notify EPA of when this occurred and restart the monitoring and actions describe in Paragraph 110(a), (b), and (c).

(e) The System must deliver to EPA a completed Disinfection Profile and Benchmarking Report within four hundred and twenty-five (425) days of the Effective Date of this Order.

111. Alternatives Analysis.

(a) The System shall complete an Alternatives Analysis of the PWS.

(b) The Alternatives Analysis must be completed with the assistance of an independent third-party approved by the Director of the Enforcement and Compliance Assurance Division, EPA Region 5. For purposes of this Order, the term "independent" shall mean a third party that has not been employed or contracted by Respondent within the last five (5) years, as well as any affiliates, subsidiaries, officers, shareholders, employees, or assigns of such entity. Respondent shall select an independent third-party and submit to EPA for approval within thirty (30) days of the Effective Date of this Order. The independent third-party selected by Respondent should consist of at least one licensed Professional Engineer.

(c) The Alternatives Analysis should use the information gathered to support development of the System's Capacity Study required under the 2020 Amended ACO to identify, at a minimum, the following potential alternatives in an Alternatives Analysis Report ("Report"):

i. Staffing and administrative changes to enable Respondent to be the direct majority provider of long-term technical, managerial, and financial capacity;
ii. Consolidation, restructuring, or regionalization, including:
    1. Physical consolidation of the System with one (1) or more other systems;
    2. Consolidation of significant management and administrative functions of the System with one (1) or more other systems; and
    3. Transfer of ownership of the system that may reasonably be expected to improve drinking water quality;
iii. Entering into contractual agreements with third-party entities to provide significant management or administrative functions; and
iv. A combination or hybrid of alternatives in Paragraph 111(d)(i)–(iii), above.

(d) The System shall complete the Report within one hundred and eighty (180) days of approval of the independent third-party by EPA.

(e) After the Report is complete, the System must post the Report for public comment for at least thirty (30) days. The System must post the Report online and make hard copies available at the local public library, City Hall, the Berrien County Health Department, the Armory Community Center, and other locations that are accessible on weekends and outside working hours on weekdays, such as local schools, churches, and welfare agencies. The System must notify customers at least through local radio and local newspapers that the Report is available and provide clear instructions for how customers can review and comment on the Report.

(f) After the public comment period closes, the System must consolidate all public comments received by the System within seven (7) days of the end of the public comment period.

(g) The System shall submit the Report and the consolidated public comments to EPA immediately following the completion of the requirement in Paragraph 111(f) as well as post these documents online and make hard copies available at the local public library.

112. Water Treatment Plant Filter Repair

(a) The System must immediately identify the number of filters necessary to produce the daily demand during the hours of plant operation along with adequate redundancy and prioritize repair of those filters. The approved filtration rate is 2 gpm/ft^2 over the entire filter run.

(b) Within fifteen (15) days of the Effective Date of this Order, the System must initiate repairs to return the full backwash functionality to the water treatment plant filters identified pursuant to Paragraph 113(a), above. Full backwash functionality includes, but is not limited to:

i. Functioning mechanical surface washers, such as the existing sprayer arms;
ii. Utilizing the filter to waste valves to enable a filter to waste step with each backwash cycle;
iii. Monitoring for combined filter effluent using an appropriate location;
iv. Adequate sludge monitoring and removal activities from the plate settlers;
v. Regularly and properly testing backflow prevention devices;
vi. Ability to accurately monitor flow through each filter;
vii. Continuous turbidity monitoring;

viii. Fully functioning control panels with working indicator lights and accurate readouts. Repairs to Programmed Logic Controllers (PLCs) as necessary;
ix. Finalized Standard Operating Procedures for filters including the backwash procedures; and
x. All operations staff trained on the filter operation procedures.

(c) The System must ensure that volume through the filters over the course of each filter run cycle is evenly balanced between all combinations of filters used to comply with Paragraph 112(a).

(d) The System must notify EPA and EGLE once all repairs are complete, and the filters identified pursuant to Paragraph 112(a) have been returned to full functionality.

113. AWIA: By December 31, 2021, Respondent shall provide written confirmation to EPA, that Respondent has met the requirements of Section 1433(b) of the SDWA, 42 U.S.C. § 300i-2(b), and that Respondent is in compliance with Sections 1433(b) and (d) of the SDWA, 42 U.S.C. § 300i-2(b) and (d). Respondent should not submit an ERP to the below addresses; the above referenced confirmation shall be submitted electronically via email to the staff identified in Paragraph 114.

114. Reporting: Respondent must submit all submissions, including progress reports, required by this Order by electronic mail to EPA at r5weca@epa.gov, and the address identified in below. All electronically submitted materials must be in final and searchable format, such as Portable Document Format (PDF) with Optical Character Recognition (OCR) applied. Do not use the email address r5weca@epa.gov for submission of any information for which you intend to assert a claim of business confidentiality under 40 C.F.R. Part 2, Subpart B. If Respondent is unable to send a report or notification to these addresses due to email size restrictions, the confidential nature of the information, or another problem, contact the EPA case manager and send an email to r5weca@epa.gov to make alternative arrangements for the transmission of the report or notification.

EPA points of contact:

Taylor Girouard
Water Enforcement and Compliance Assurance Branch
U.S. EPA Region 5
77 West Jackson Boulevard (ECW-15J)
Chicago, IL 60604
Email: girouard.taylor@epa.gov

Victoria Anderson
Water Enforcement and Compliance Assurance Branch
U.S. EPA Region 5
77 West Jackson Boulevard (ECW-15J)

Chicago, IL 60604
Email: anderson.victoria@epa.gov

Matthew Russo
Office of Regional Counsel
U.S. EPA Region 5
77 West Jackson Boulevard (C-14J)
Chicago, IL 60604
Email: russo.matthew@epa.gov

EGLE point of contact:

Ernest Sarkipato
Drinking Water and Environmental Health Division
Michigan Department of Environment, Great Lakes, and Energy
Email: sarkipatoe@michigan.gov

IV. PARTIES BOUND

115. The provisions of this Order shall apply to and be binding upon Respondent, its officers, employees, agents, successors, and assigns.

V. GENERAL PROVISIONS

116. This Order constitutes final agency action. Under Section 1448(a) of the SDWA, 42 U.S.C. § 300j-7(a), Respondent may seek federal judicial review.

117. EPA may modify this Order. EPA will consider information provided by Respondent to modify this Order. EPA will communicate any modification(s) to Respondent in writing and the modification(s) shall be incorporated into this Order.

118. Compliance with the terms and conditions of this Order does not constitute compliance with the SDWA or the NPDWRs nor any permits or orders issued thereunder. This Order shall not in any way be construed to relieve Respondent from its obligations to comply with all provisions of federal, state, or local law, nor shall it be construed to be a determination of any issue related to any federal, state, or local permit. Compliance with this Order shall not be a defense to any actions subsequently commenced for any violation of federal laws and regulations administered by EPA, and it is the responsibility of Respondent to comply with such laws and regulations.

119. EPA reserves all rights against Respondent and all other persons to take any further civil, criminal, or administrative enforcement action pursuant to any available legal authority, and to exercise its information gathering and inspection authorities. Nothing in this Order shall preclude EPA from taking any additional enforcement actions, including modification

of this Order or issuance of additional Orders, and/or additional actions as EPA may deem necessary, and/or from requiring Respondent in the future to perform additional activities pursuant to the SDWA or any other applicable law. EPA further expressly reserves the right to disapprove work performed by Respondent.

120. Failure to comply with this Order may subject Respondent to a penalty up to $59,017 per day per violation for each day in which a violation occurs, as assessed by the United States District Court, under Section 1414(g)(3)(A) of the SDWA, 42 U.S.C. § 300g-3(g)(3)(A), (C), or up to $41,120 per violation, as assessed by the Administrator, under Section 1414(g)(3)(B) of the SDWA, 42 U.S.C. § 300g-3(g)(3)(B).

VI. EFFECTIVE DATE

121. This Order is effective on the date of signature by the Director of the Enforcement and Compliance Assurance Division, EPA Region 5, and will remain in effect until EPA has notified Respondent of termination of the Order pursuant to Section VII, below. If modifications are made by EPA to this Order, such modifications will be effective on the date on which the modification is signed by EPA.

VII. TERMINATION

122. The provisions of this Order shall be deemed satisfied when Respondent receives written notice from EPA that Respondent has demonstrated, to the satisfaction of EPA, that the terms of this Order, including any additional tasks determined by EPA to be required under this Order or any continuing obligation or promises, have been satisfactorily completed, and the written notice from EPA will state that this Order is terminated.

United States Environmental Protection Agency

_____

Michael D. Harris
Director
Enforcement and Compliance Assurance Division
U.S. Environmental Protection Agency, Region 5

Appendix B–
St. Joseph and Benton Harbor Interconnection Agreement

CITY OF ST. JOSEPH AND CITY OF BENTON HARBOR
PUBLIC WATER SYSTEM
INTERCONNECTION AGREEMENT

THIS PUBLIC WATER INTERCONNECTION AGREEMENT made and executed September ____, 2014 (hereinafter referred to as the "Agreement"), by and between the **CITY OF ST. JOSEPH**, a Michigan municipal corporation located at 700 Broad Street, St. Joseph, MI 49022, ("The City of St. Joseph") and the **CITY OF BENTON HARBOR**, a Michigan municipal corporation located at 200 E. Wall Street, Benton Harbor, MI 49022, ("The City of Benton Harbor"), collectively the "Parties".

RECITALS

WHEREAS, The City of St. Joseph owns and operates a public water treatment plant and distribution system (the "City of St. Joseph Water System"); **WHEREAS,** The City of Benton Harbor owns and operates a public water treatment plant and distribution system (the City of Benton Harbor Water System);

WHEREAS, The City of St. Joseph and the City of Benton Harbor each desire to obtain an alternate source of water to provide its users with an emergency water source;

WHEREAS, An interconnection owned by the City of St. Joseph located on M-63 between Momany Drive and Klock Road presently connects the two systems and includes a concrete vault, pipe, water meter, valves and related appurtenances ("Interconnection"), as exhibited in the drawing attached and incorporated as Exhibit A.

NOW, THEREFORE, the Parties, for and in consideration of the terms and conditions herein, and for such other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, do hereby covenant and agree as follows:

TERMS

Section 1. Ownership of the Meter and Related Appurtenances.

All right, title and interest in the Interconnection shall remain with the City of St. Joseph.

Section 2. Maintenance and Replacement of the Meter and Related Appurtenances

The City of St. Joseph shall be responsible for appropriate periodic maintenance and exercise of the Interconnection in a reasonable and workmanlike manner.

The City of St. Joseph and the City of Benton Harbor shall share equally in all costs of maintenance, including all part replacement and utilities to the Interconnection.

Beginning April 1, 2015, and quarterly thereafter, the City of St. Joseph will invoice the City of Benton Harbor for its share of the Interconnection costs. Payment is due on each invoice within thirty (30) days of the billing date.

Section 3. Meter Reading and Failure.

The City of St. Joseph and the City of Benton Harbor shall each regularly read the meter at least monthly and before and after each use at the Interconnection and shall keep records of each reading. Such

records shall be made available to each Party upon request and shall be public records as defined by Public Act 422 of 1976, as amended, being the Freedom of Information Act, MCL 15. 231 et. seq.. The Party who provides emergency water service shall bill the Party using emergency water service within thirty (30) days of such usage; payment is due within thirty (30) days of the billing date.

In the event the meter fails or malfunctions, the Parties shall collectively estimate the amount of water supplied through the Interconnection, and charged in accordance with the provisions contained in Section 4 of this Agreement.

Section 4. Rates and Charges.

In the event of an emergency or the Interconnection is otherwise utilized to supply water from one Party to the other, the Party receiving the water shall be responsible for paying the Party supplying the water an amount metered, or calculated, at the highest consumption rate customarily charged by either Party. For example, the City of Benton Harbor currently charges a consumption rate of $3.80 per ccf; the City of St. Joseph currently charges a consumption rate of $1.80 per ccf. In the event water was currently supplied to either Party through the Interconnection, the rate charged today for such water would be charged at the higher rate of $3.80 per ccf. Each Party's current water rates are attached and incorporated as Exhibit B. Each Party shall provide the other Party with a written notice showing any changes in its water rates within fourteen (14) days of such change.

Section 5. Water Quality.

The Parties agree that the water delivered through the Interconnection shall be potable water, provided, however, the Party supplying the water is responsible to provide potable water only to the point of connection.

The City of St. Joseph and the City of Benton Harbor water plant operators shall communicate and discuss with each other any proposed changes in water treatment practices at their respective plants that could result in incompatibility, prior to making such changes. In the event that a water plant changes its practices in such a way that the water supplied to the Interconnection cannot or should not be mixed with the other, the operator of the plant implementing new water treatment practices shall communicate to the operator of the other plant in advance of such change. Each Party shall make all reasonable efforts to maintain compatibility with the other Party's water system.

Section 6. Request for Use of the Connection

All requests to utilize the Interconnection to supply water shall be made only by and to the City Manager or appropriate personnel in lawful charge of the operations of each Party's water plant. The Interconnection shall not be opened by any Party without the concurrence of such personnel at each plant and such personnel shall agree as to who will be responsible for opening the Interconnection each time it is used based on as the individual circumstances present at that time .

A Party which has requested an emergency water supply will use its best efforts to minimize nonessential water usage in its system for the period in which water is supplied. This includes but is not limited to activities such as lawn sprinkling, washing vehicles, ornamental fountains, and nonessential hydrant flushing.

Section 7. Restriction and Discontinuance of Water Service.

If either the City of St. Joseph or the City of Benton Harbor is requested to supply water to the other Party through the Interconnection during a time of scarcity or emergency, the Party requested to supply

water may do so to the extent it deems possible, if at all, using its sole and absolute discretion. Nothing in this Agreement shall be construed as a guaranty, warranty by or obligation of the City of St. Joseph or the City of Benton Harbor to provide water at any time, other than with its express approval of same. Accordingly, this Agreement shall not be construed so as to create liability for either Party for the failure to provide water through the Connection except as provided in Sections 5 and 6 of this Agreement.

Section 8. Rights of Way.

The City of Benton Harbor shall be allowed to access the City of St. Joseph's rights of way in and around the Interconnection as is consistent to carry out the terms of this Agreement.

Section 9. Indemnification.

The City of St. Joseph shall, to the extent permitted by any applicable constitutional or statutory limitation, save and hold harmless, defend, and indemnify the City of Benton Harbor, including its respective officers, agents, and employees, against any and all liability, claims, losses, demands, damages or actions brought against them that arise out of the acts or omissions of negligence, gross negligence, or willful misconduct in the maintenance or operation of the St. Joseph Water Plant, except to the extent that such claims or actions arise out of acts or omissions of negligence, gross negligence, or willful misconduct by the City of Benton Harbor, its respective officers, agents, or employees.

The City of Benton Harbor shall, to the extent permitted by any applicable constitutional or statutory limitation, save and hold harmless, defend, and indemnify the City of St. Joseph, including its respective officers, agents, and employees, against any and all liability, claims, losses, demands, damages or actions brought against them that arise out of acts or omissions of negligence, gross negligence, or willful misconduct in the maintenance or operation of the Benton Harbor Water Plant, except to the extent that such claims or actions arise out of any acts or omissions of negligence, gross negligence, or willful misconduct by the City of St. Joseph, its respective officers, agents, or employees.

Section 10. Permits and Licenses.

Each Party shall be fully responsible for obtaining and maintaining all licenses, permits, certificates, and governmental authorizations for its employees and/or agents necessary to maintain and operate its respective water plant and to perform all of its obligations under this Agreement. Upon request, a Party shall furnish a copy of any permit, license, certificate or governmental authorization to the requesting party.

Section 11. Fines, Penalties, or Sanctions.

Unless otherwise provided in this Agreement, each Party shall be fully responsible for any fines, penalties, expenses, sanctions, or financial loss for any activities, action, inaction or other matter related to its respective water plant in any way.

Section 12. Duration.

The term of this Agreement shall be for a period of ten (10) years from the date of its execution by the parties. However, either party may terminate this agreement upon six (6) months' written notice from the date of notice of termination or nonrenewal to allow sufficient time for the other party to obtain an alternate emergency water supply. This Agreement shall automatically extend for two (2) consecutive periods of five (5) years each unless terminated as provided in this Section.

This Agreement may be terminated earlier if either party has been formally notified by the State of Michigan, federal government, or an agency, branch or division thereof, that the terms of this Agreement have placed either party in jeopardy of losing state or federal funding, incurring fines or penalties, or in violation of state or federal laws, rules or regulations, and modification of the terms will not satisfactorily address the noted issue.

Section 13. Governmental Immunity.

Nothing in this Agreement shall be deemed a waiver by any party of any governmental immunity as provided by law.

Section 14. Third Parties.

Nothing in this Agreement shall be deemed to create any rights in third parties.

Section 15. Laws of Michigan/Jurisdiction/Venue.

This Agreement shall be construed and interpreted in accordance with the laws of the state of Michigan. The parties irrevocably consent to the jurisdiction of, and venue in, a court in Berrien County, Michigan, or the federal district court in Kalamazoo, Michigan.

Section 16. Compliance with Law.

Each party agrees that it shall fully comply with all federal, State and local laws, rules and regulations.

Section 17. Counterparts/Copies.

This Agreement may be executed in counterparts and each executed counterpart when taken together with the other executed counterparts shall constitute one Agreement. Photographic or other facsimile reproductions of this Agreement may be made and delivered and may be relied upon by any person to the same extent as though the copy were an original.

Section 18. Waiver.

The failure to enforce any provision in this Agreement shall not constitute a waiver or serve as a bar to the enforcement of that provision or of any other provision in this Agreement. The waiver of a breach of any provision in this agreement must be in writing.

Section 19. Notice.

All notices any other communications required under this Agreement shall be deemed given when sent by regular, registered or certified mail, postage prepaid, or by personal delivery to the City Manager or Water Plant Superintendent of the respective entity at the addresses noted above.

Section 20. Severability.

If any provision of this Agreement is held invalid or unenforceable by a court of competent jurisdiction, that provision shall be severed from this Agreement and the remainder of the Agreement shall remain in full force and effect.

Section 21. Entire Agreement.

Unless otherwise provided in this Agreement, this Agreement constitutes the entire agreement between the Parties and there are no other representations, warranties, promises, guarantees or agreements, oral or written, express or implied, between the Parties with respect to the subject matter of this Agreement.

Section 22. Amendments.

This Agreement may only be amended upon written consent of the Parties.

Section 23. No Assignment.

This Agreement shall not be assignable by either party without the written agreement of all Parties.

In WITNESS WHEREOF, the Parties hereto have each caused these presents to be signed by their respective duly authorized officers all as of the day and year first written above.

CITY OF ST. JOSEPH

Michael Garey

Michael Garey, Mayor

Deborah S. Koroch

Deborah S. Koroch, City Clerk

CITY OF BENTON HARBOR

James Hightower

James Hightower, Mayor

Kimberly Thompson

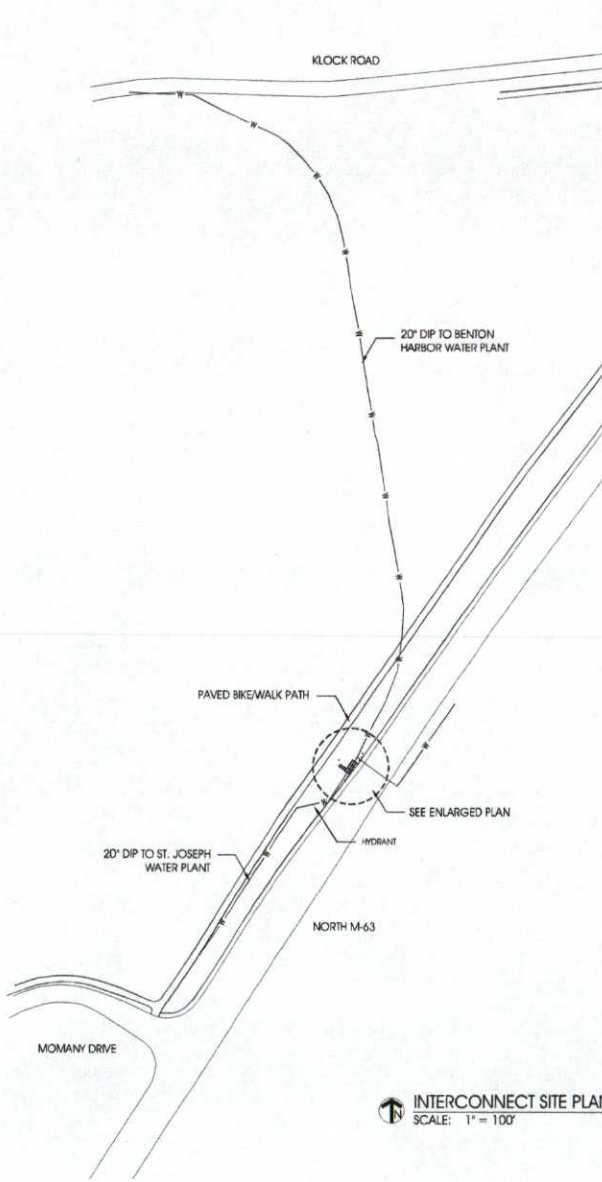
Kimberly Thompson, City Clerk

EXHIBITS

A. Interconnection Site and Floor Plan

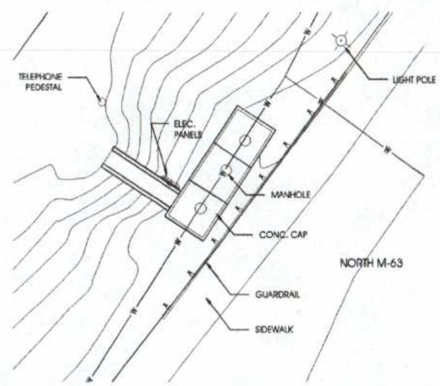
B. Water Rate Schedules

EXHIBIT A

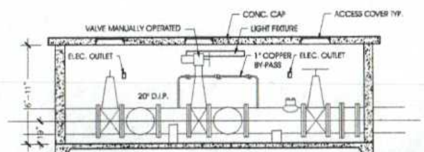


INTERCONNECT SITE PLAN
SCALE: 1" = 100'

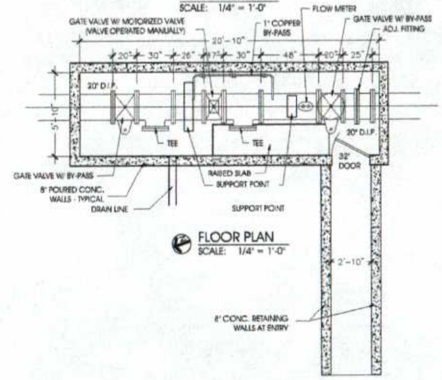
LOCATION MAP
SCALE: NONE



ENLARGED SITE PLAN
SCALE: 1" = 10'



ELEVATION VIEW
SCALE: 1/4" = 1'-0"



FLOOR PLAN
SCALE: 1/4" = 1'-0"

NO.	REVISION DESCRIPTION	BY	DATE

ABONMARCHE
Confidence by Design.

PROJECT:
ST. JOSEPH & BENTON HARBOR WATER PLANTS

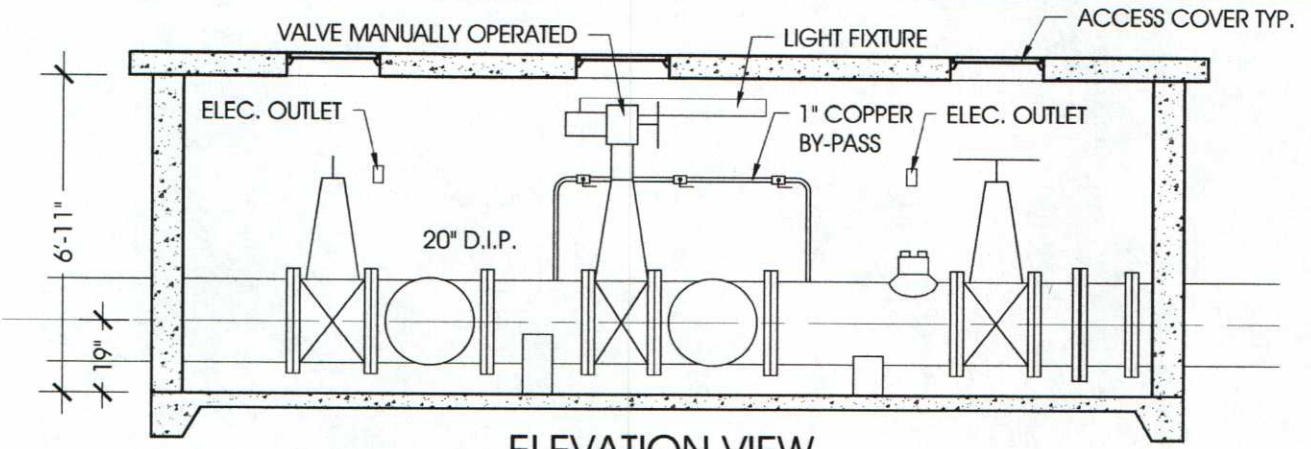
SHEET TITLE:
M-63 INTERCONNECT SITE & FLOOR PLAN

DRAWN BY: GNF
DESIGNED BY: JMS
PM REVIEW:
QA/QC REVIEW:
DATE: AUGUST 2014
SEAL:

SIGNATURE:
DATE:

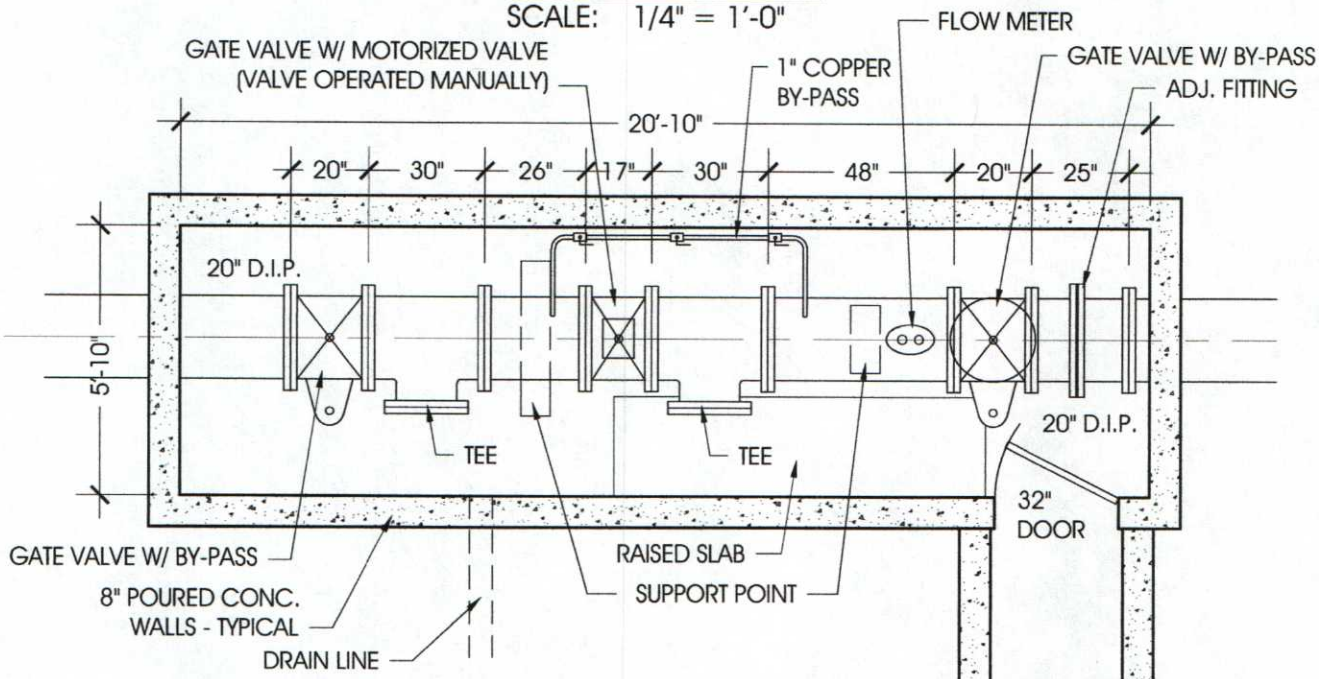
HARD COPY IS INTENDED TO BE 24"X36" WHEN PLOTTED. SCALE(S) INDICATED AND GRAPHIC QUALITY MAY NOT BE ACCURATE FOR ANY OTHER SIZES.

SCALE: as noted
ACS JOB #: 14-0621
SHEET NO. C1.1



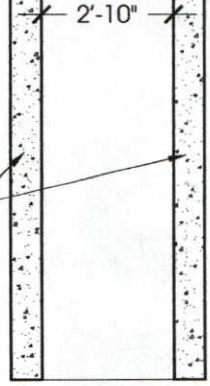
ELEVATION VIEW

SCALE: 1/4" = 1'-0"



FLOOR PLAN

SCALE: 1/4" = 1'-0"



ABONMARCHE
Confidence By Design

95 West Main Street
Benton Harbor, MI 49022
T 269.927.2295
F 269.927.4639

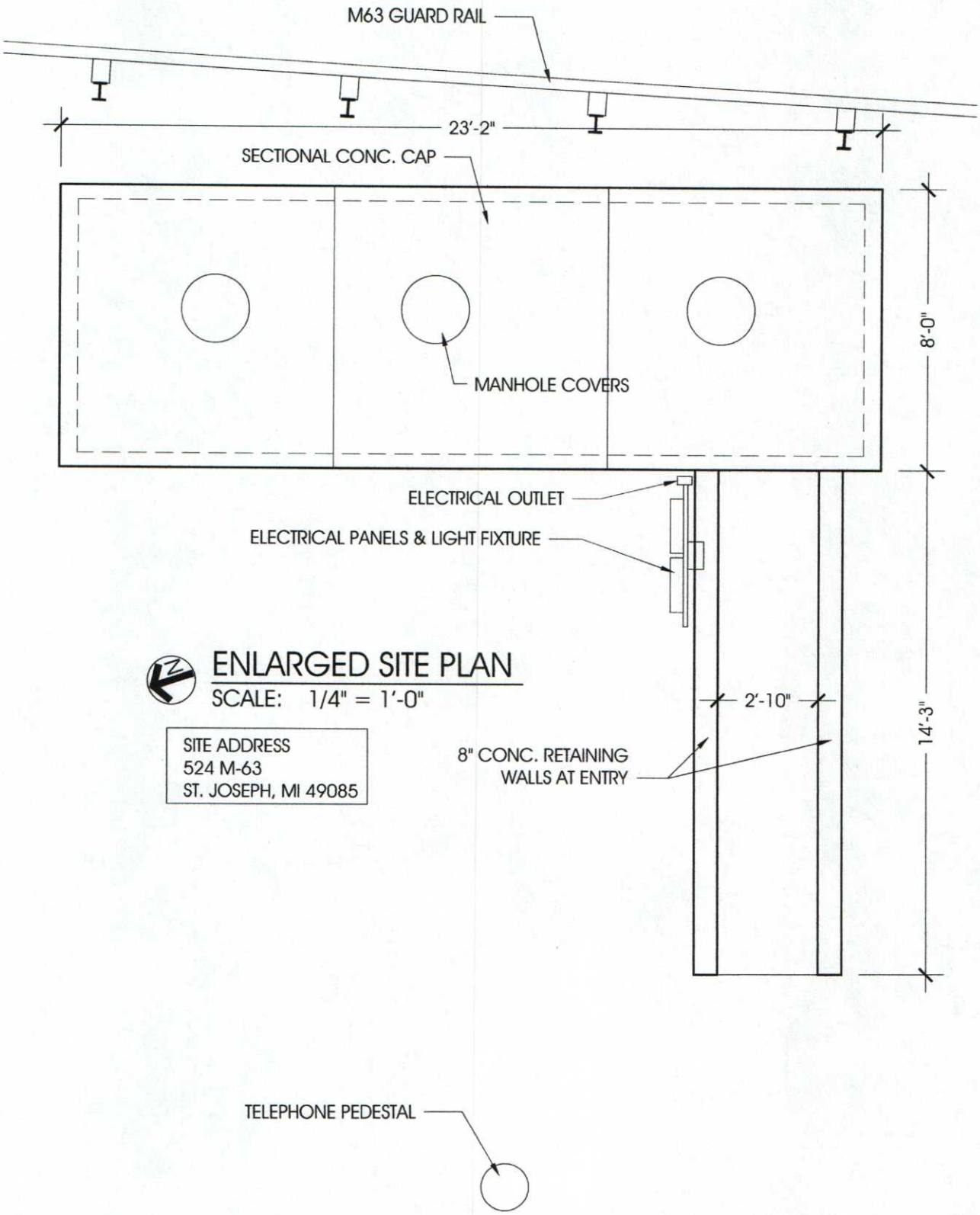
Manistee, MI
South Haven, MI
South Bend,IN
Portage, IN

Engineering
Architecture
Land Surveying
Marina/Waterfront
Community Planning
Landscape Architecture
Development Services

PREPARED FOR:
M63 INTERCONNECT BETWEEN BENTON HARBOR & ST. JOSEPH MICHIGAN

COPYRIGHT 2014-ABONMARCHE CONSULTANTS, INC.

DATE	**AUGUST 2014**
JOB #	**14-0621**
SHEET	**A1.1**



ENLARGED SITE PLAN

SCALE: 1/4" = 1'-0"

SITE ADDRESS
524 M-63
ST. JOSEPH, MI 49085

ABONMARCHE
Confidence By Design

95 West Main Street
Benton Harbor, MI 49022
T 269.927.2295
F 269.927.4639

Manistee, MI
South Haven, MI
South Bend,IN
Portage, IN

Engineering
Architecture
Land Surveying
Marina/Waterfront
Community Planning
Landscape Architecture
Development Services

PREPARED FOR:
M63 INTERCONNECT
BETWEEN BENTON HARBOR
& ST. JOSEPH MICHIGAN

COPYRIGHT 2014-ABONMARCHE CONSULTANTS, INC.

DATE **AUGUST 2014**
JOB # **14-0621**
SHEET **A1.2**

EXHIBIT B

City of St. Joseph Rates

Water rates set by Joint Water Services Board. Sewer rates increased to offset DEQ mandated storage projects.

Total Charges = A + B	City Water Rate +	City Sewer Rate +	City System Development Rate
A) Ready to Serve (Base Rate)		(Flat sewer (SF) = $50.31)	
5/8 inch meter	(W1) $15.70	(S1) $13.40	(CSD1) $27.89
3/4 inch meter	$17.27	$14.74	$39.05
1 inch meter	$21.98	$18.76	$69.73
1 1/2 inch meter	$28.26	$24.12	$158.97
2 inch meter	$45.53	$38.86	$278.90
3 inch meter	$172.70	$147.40	$641.47
4 inch meter	$219.80	$187.60	$1,143.49
6 inch meter	$329.80	$281.40	$2,565.88
B) PLUS Per Unit Amount	**$1.80/unit**	**$2.20/unit**	**NA**

C

St. Joseph Township (SJCT) Utility Rates

Total Charges = A + B	City Water Rate +	SJCT Sewer Rate +	HC (west)	or	FP (east)	+SJCT Surcharge Rate
A) Ready to Serve (Base Rate)		(Sewer Flat (TSF) =$85.17)	(HC)		(FP)	(eff. 8-1-14)
5/8 inch meter	(OW1) $15.70	(TS1) $25.69	$13.69	or	$23.92	(DX1) $7.85
3/4 inch meter	$17.27	$25.69	$13.69	or	$23.92	$8.64
1 inch meter	$21.98	$25.69	$13.69	or	$23.92	$10.99
1 1/2 inch meter	$28.26	$25.69	$13.69	or	$23.92	$14.13
2 inch meter	$45.53	$25.69	$13.69	or	$23.92	$22.77
3 inch meter	$172.70	$25.69	$13.69	or	$23.92	$86.35
4 inch meter	$219.80	$25.69	$13.69	or	$23.92	$109.90
6 inch meter	$329.70	$25.69	$13.69	or	$23.92	$164.85
B) PLUS Per Unit Amount	**$1.80/unit**	**$2.17/unit**	**N/A**		**N/A**	**$0.90/unit**

D

Total Charges = A + B	City Water Rate +	RTWP Sewer Rate (Flat sewer (RSF) = $133.00)	+Royalton Twp. Water Rate
A) Ready to Serve (Base Rate)			
5/8 inch meter	(OW1) $15.70	(RSW) $76.00	(FX1)
3/4 inch meter	$17.27	$76.00	-
1 inch meter	$21.98	$76.00	-
1 1/2 inch meter	$28.26	$76.00	-
2 inch meter	$45.53	$76.00	-
3 inch meter	$172.70	$76.00	-
4 inch meter	$219.80	$76.00	-
6 inch meter	$329.70	$76.00	-
B) PLUS Per Unit Amount	**$1.80/unit**	**$2.11/unit** After first 9 units	**$1.05/unit**

F

Total Charges = A + B	City Water Rate +	LCT Sewer Rate (Flat sewer (LF) = $97.03)	+ Lincoln Twp. Water Rate
A) Ready to Serve (Base Rate)			
5/8 inch meter	(OW1) $15.70	(LS1) $43.00	(GX1) $1.93
3/4 inch meter	$17.27	$45.00	$2.20
1 inch meter	$21.98	$48.75	$3.30
1 1/2 inch meter	$28.26	$53.50	$5.50
2 inch meter	$45.53	$58.00	$6.60
3 inch meter	$172.70	$63.00	$13.20
4 inch meter	$219.80	$69.00	$22.00
6 inch meter	$329.70	$74.50	$44.00
B) PLUS Per Unit Amount	**$1.80/unit**	**$2.09/unit** After first 6 units	**$0.29/unit**

(1/3 off sewer 3rd quarter)

G

WATER RATES - Effective JULY 2014

(LCT rev. 3-1-14, ALL rev. 7-1-14, SJCT rev. 8-1-14)

WATER RATE SHEET

MONTHLY BILLING RATES AS OF 10/7/2013

CITY OF BENTON HARBOR

BILL CODE	MTR SZ	BASE WTR	BASE SWR	CAPITAL IMP
1--11	5/8 IN	$ 9.03	$ 15.59	$ 4.60
2--12	3/4 IN	$ 13.54	$ 17.78	$ 6.90
3--13	1 IN	$ 23.47	$ 24.76	$ 11.96
5--15	1 1/2 IN	$ 54.16	$ 34.34	$ 27.60
6--16	2 IN	$ 90.26	$ 43.95	$ 46.00
8--18	3 IN	$ 207.60	$ 63.16	$ 105.80
9--19	4 IN	$ 370.06	$ 111.87	$ 188.60
0A/1A	6 IN	$ 830.40	$ 184.84	$ 423.20
0B/1B	8 IN	$ 1,489.30	$ 257.54	$ 759.00
CONSUMP CHRG PER CCF		**$ 3.80**	**$2.96 after 3**	

SPECIAL SEWER/BT

BILL CODE	MTR SZ	BS SWR
21/31	5/8 IN	$ 15.59
22/32	3/4 IN	$ 17.78
23/33	1 IN	$ 24.76
25/35	1 1/2 IN	$ 34.34
26/36	2 IN	$ 43.95
28/38	3 IN	$ 63.16
29/39	4 IN	$ 111.87
2A/3A	6 IN	$ 184.84
2B/3B	8 IN	$ 257.54
CUSUMP CHRG PER CCF		**$2.96 after 3**

TRASH

SINGLE UNIT		$15.46
DOUBLE UNIT		$30.92
TRIPLE UNIT		$46.38

CITY	S.S/BT
8--8	S-S
4--10	
2--12	
1--14	
7--16	

NOTE***

21.79% RATE INCREASE TO CITY SWR ONLY EFFECTIVE 7/1/11
45.1% WATER RATE INCREASE TO CITY & ST JOE EFF 1/1/2012
READY TO SERVE WATER, CONSUMPTION & CAPITAL IMPROVEMENT FEE EFFECTIVE 3/8/12
READY TO SERVE, WATER, CONSUMPTION 5% REDUCTION EFFECTIVE 10/7/2013
READY TO SERVE, SEWER, CONSUMPTION INCREASE EFFECTIVE 11/1/2013

Appendix C–
Detailed Cost Analysis

Benton Harbor Water System Alternatives Analysis Cost Information

Contents

Benton Harbor Water System Alternatives Analysis Cost Information

Overview

Cost Development

This appendix includes data sources, cost calculations and critical assumptions that were used to generate the estimated costs provided for the alternatives in the report. The Draft Capacity Study (Fleis and Vandenbrink (F&V), 2022), Benton Harbor DWSRF Capital Plan (Abonmarche, 2021), CapdetWorks Cost Software[1], and labor costs from Benton Harbor's contractors were used to generate costs. The basis for costs of existing labor and O&M costs are provided in Sections 3.1 and 3.3 of the report, respectively. Additional costs provided by St. Joseph, Benton Charter Township, WBS Cost Model[2] and CapdetWorks were used to generate additional costs for certain alternatives. Costs for each alternative are categorized into labor, capital improvement, and operation and maintenance (O&M) costs for both the distribution system and treatment plant.

Cost Summary

The costs developed for each alternative are summarized in Table C-1. O&M costs were developed based on information from F&V projected 2023 variable costs (supplies, materials, chemicals, energy, insurance, and repairs):

- Annual O&M of the water treatment plant (excluding labor costs and other fixed costs): $251,000
- Annual O&M of the distribution system (excluding labor costs and other fixed costs): $502,000

Total annual O&M costs for variable costs are estimated to be $753,000.

Total annual fixed O&M costs, including Utilities Administration and Customer Service expenses are estimated to remain at $1,361,400 per year for all alternatives.

Table C-1. Cost Summary

Alternatives	Labor Costs	Capital Costs	Variable O&M Costs
Current Operation	$778,000	$17,347,000	$753,000
Alternative 1A	$1,180,000	$19,048,000	$816,000
Alternative 1B	$960,000	$19,048,000	$816,000
Alternative 1C	$1,184,000	$19,048,000	$816,000
Alternative 2A	$780,000	$21,547,000	$2,227,000[a]
Alternative 2B	$780,000	$24,147,000	$2,227,000[a]
Alternative 3	$780,000	$23,747,000	$3,636,000[a]
Alternative 4	Not Provided	Not Provided	Not Provided
Alternative 5	Not Provided	Not Provided	Not Provided
Alternative 6	Not Provided	Not Provided	Not Provided
Alternative 7	$780,000	$37,347,000	$627,500

[a] Includes cost of purchased water from neighboring system.

[1] Hydromanits HESS, Inc. (2022, May). *CapdetWorks Cost Model Software for Wastewater Treatment*. https://www.hydromantis.com/CapdetWorks.html

[2] US EPA, (2021, September). *EPA Work Breakdown Structure-Based Cost Model for Nontreatment Options for Drinking Water Compliance*. https://www.epa.gov/sdwa/drinking-water-treatment-technology-unit-cost-models

Alternative 1 - Benton Harbor Retains Full Ownership and Operation

Alternatives 1A, 1B, and 1C Labor Costs

For Alternative 1A, it is assumed all positions are City of Benton Harbor employees and 13 full-time employees (FTEs) are needed for the water system:

- 1 water system director (F-1 certification / S-2 certification preferred)
- 1 administrative assistant, experienced with computerized maintenance management system (CMMS) program, e.g., Cityworks
- 1 water treatment plant operator-in-charge (F-1 certification)
- 4 water treatment plant shift operators (F-4 certification or higher)
- 1 water distribution operator-in-charge (S-2 certification)
- 3 water distribution system shift operators (S-4 certification preferred)
- 1 water meter/maintenance technician
- 1 groundskeeper

For Alternative 1B, 10.5 FTEs are required and all positions are contracted except for the administrative assistant position and a part-time groundskeeper. The nine FTEs assumed to be contracted positions are:

- 1 water system director (F-1 certification / S-2 certification preferred)
- 1 water treatment plant operator-in-charge (F-1 certification)
- 2.5 water treatment plant shift operators (F-4 certification or higher)
- 1 water distribution operator-in-charge (S-2 certification)
- 2.5 water distribution shift operators (S-4 certification preferred)
- 1 water meter/maintenance technician

For Alternative 1C, a combination of city staff and contracted staff are used to fill all required positions to operate and maintain the water system. A total of 13 FTEs are needed for this alternative:

- **City-employed:** An administrative assistant, three water treatment plant shift operators, and part-time groundskeeper (total of 4.5 FTEs) are assumed for general and water treatment plant operations. Two distribution shift operators and water meter technician (total of 3 FTEs) are assumed for water distribution operations.

- **Contracted:** The water system director, water treatment plant operator-in-charge with F-1 certification, and one water treatment plant shift operation (total of 3 FTEs) are assumed for general and water treatment plant operations. The distribution system operator-in-charge with S-2 certification along with one full-time and part-time distribution shift operator (total of 2.5 FTEs) are assumed for the distribution system. The part-time shift operator is assumed to provide coverage of other shifts in the event a city employee is unavailable.

Table C-2 summarizes labor costs for Alternatives 1A, 1B, and 1C.

Table C-2. Labor Costs for Alternatives 1A, 1B, and 1C (provided by John Young and F&V)

	Alternative					
	Alternative 1A		Alternative 1B		Alternative 1C	
	Estimated Cost	FTE	Estimated Cost	FTE	Estimated Cost	FTE
Water Treatment						
Salary- City	$490,000	7	$75,000	1.5	$279,000	4.5
Fringe Benefits- City	$210,000		$30,000		$135,000	
Contracted			$495,000	4.5	$330,000	3
Treatment Subtotal	$700,000		$600,000		$744,000	
Distribution						
Salary- City	$300,000	6			$150,000	3
Fringe Benefits- City	$180,000				$90,000	
Contracted			$360,000	4.5	$200,000	2.5
Distribution Subtotal	$480,000		$360,000		$440,000	
TOTAL	**$1,180,000**	**13**	**$960,000**	**10.5**	**$1,184,000**	**13**

Alternatives 1A, 1B, and 1C Capital Costs

Capital costs were estimated by using previously estimated capital costs for recommended treatment plant and distribution system improvements. Estimated 5-year distribution improvements are in Table 8 and 10 of the May 18, 2021 DWSRF Project Plan completed by Abonmarche (Table C-3). Estimated 5-year treatment plant improvements obtained from Table 3 of the Draft Benton Harbor TMF Capacity Study completed by F&V are shown in Table C-4. Lead service line replacement costs are not included because these costs are being financed with separate grant money provided by the State of Michigan and other funding sources. All costs are in 2021 dollars.

Table C-3. Short Term Capital Costs for the Benton Harbor Distribution System (Abonmarche, 2021)

Water Valve Replacements (165 Valves)	$1,250,000
Hydrant Replacements (25 Hydrants)	$250,000
Main Replacements (16,100 LF)	$6,807,000
Total Short-Term Distribution System Capital Cost	**$8,307,000**

Table C-4. Short Term Capital Costs for the Benton Harbor Water Treatment Plant (F&V, 2022)

Water Treatment Plant Rehabilitation	$5,000,000
Raw Water Intake Improvements	$1,800,000
High Service Pump Improvements	$1,700,000
Plate Settler Building Improvements	$110,000
Monitoring and HVAC Improvements	$430,000
Total Short Term Treatment Plant Capital Cost	**$9,040,000**

EGLE and EPA conducted a NPDES inspection of the sludge lagoon and outfall in November 2021 and noted numerous violations. Based on these violations and the on-going need to process and dispose of alum sludge from the lagoon, capital costs for a new sludge handling facility to be located near the water treatment plant were estimated. The sludge handling facility includes a sludge handling building with belt filter press. Equipment sizes are based on:

- Daily filter backwash flow is estimated to be 5% of the annual average demand (1.256 MGD)
- Filter backwash solids content is estimated to be 0.04% solids (400 mg/L TSS)
- Wet alum sludge production is estimated to be 235 lb/MG equaling 295 lb/day based on 1.256 MGD
- Wet alum sludge solids content is estimated to be 2% solids (20,000 mg/L TSS)

This design information was entered into the software cost model CapdetWorks (Hdyromantis, Inc.) to generate estimated capital costs for a belt filter press system. Design information generated by CapdetWorks for the alum sludge belt filter press system is shown in Table C-5.

Table C-5. CapdetWorks Belt Press Design Information

BELT FILTER PRESS		
Belt filter width	2	Meters
Number of units	1	
Hydraulic loading per unit per meter of belt width	70	gpm (US)
Building size requirement	3250	Sq ft
Final solids content of sludge	19	%
Solids capture fraction	0.757	
Dry solids produced	196	lbs/day

Using the design output information CapdetWorks provided a rough estimated capital cost (+/- 50%) for the sludge handling system shown in Table C-6. Equipment includes the sludge handling system, building to house the belt press, a conveyor system to move dewatered sludge from the belt press to a storage hopper located inside the building, and the installed belt press. Other direct costs generated by CapdetWorks include mobilization, site prep, electrical, piping, and instrumentation and controls. All costs are in 2021 dollars.

Table C-6. Estimated Sludge Handling System Capital Cost

EQUIPMENT COST	
Building Cost	$358,000
Conveyor System Cost	$75,300
Installed Belt Filter Cost	$376,000
Total Equipment cost	**$809,300**
OTHER DIRECT COSTS	
Mobilization	$27,200
Site preparation	$66,400
Site electrical	$64,200

Yard piping	$46,700
Instrumentation and control	$26,000
Total direct construction costs	**$230,500**
OTHER INDIRECT COSTS	
Cost of land	$180,000
Legal cost	$50,000
Engineering design fee	$200,000
Inspection cost	$50,000
Contingency	$100,000
Total indirect construction costs	**$580,000**
Sludge lagoon improvements	**$81,000**
TOTAL CAPITAL COST	**$1,701,000[a]**

[a] Rounded to nearest $1,000

EGLE and EPA's November 2021 inspection of the alum sludge lagoon identified numerous concerns that must be addressed including removal of the roadway through the lagoon, reestablishing the berm to allow for adequate sludge settling, and removal of vegetation in and around lagoon cells 1 and 2. This one-time capital cost for the alum sludge lagoon improvements was estimated to be 10% of the equipment cost for the sludge handing system ($809,300) totaling $81,000. Combining the sludge handling system total capital cost with the alum sludge lagoon improvements results in a total capital cost of $1,701,000. Combining the total sludge handling costs with the distribution and treatment plant capital costs results in a total of $19,048,000.

Alternatives 1A, 1B, and 1C O&M Costs

The estimated annual total O&M costs for these alternatives are explained in detail in Sections 4.1.1.3, 4.1.2.3, and 4.1.3.3 in the report. In summary, the existing treatment plant and distribution system O&M are $251,000 and $502,000, respectively. For each alternative, a new annual O&M cost is incurred for sludge handling.

Annual O&M costs for extraction of sludge from the lagoon, dewatering the sludge by belt pressing, and disposal of sludge in a local Subtitle D landfill was estimated using CapdetWorks. Table C-7 shows the estimated electrical cost for the belt press dewatering system including the sludge pumps, the amount of dewatered sludge generated and disposed per year and the associated cost, and the estimated cost for biannually dredging sludge from the ponds. The total annual O&M for the lagoon and sludge management costs is $63,000.

Table C-7. Estimated Annual Lagoon Sludge Management Cost

Solids Handling O&M		
Annual Dewatering Energy Requirement including Sludge Pumps	28,000	kWh/yr
Energy Unit Cost	$0.10	$/kWh
Energy Cost	$2,800	

Mass of dewatered solids Hauled	0.45	ton/d
Mass of dewatered solids Hauled	164	ton/yr
Transport and Disposal Unit Cost	$150	ton
Transport and Disposal Total Cost	$24,638	
Biannual Dredging of Existing Sludge Ponds	$35,000	
Total Solids Handling O&M	**$63,000**	

The grand total of distribution, treatment plant and solids handling O&M costs is $841,000.

Alternatives 2A and 2B– Benton Harbor Purchases Water from St. Joseph

Alternative 2A and 2B Labor Costs

- Alternatives 2A and 2B assume that the treatment plant staff will be reduced since water is purchased from St. Joseph and the Michigan Lake intake and majority of the existing water treatment plant can be abandoned. All other administrative and distribution staff will still be required for this alternative. The following staff are assumed:
- Three and a half FTEs for general operations and water treatment plant oversight: One water system director having a D-1/S-2 certification, one treatment plant operator with a D-1 certification to oversee chemical feed systems and pumps at the Benton Harbor treatment plant, one half-time treatment plant shift operator, and one administrative assistant experienced with computerized maintenance management software. The operators are assumed to be paid slightly less than the salaries presented in Alternative 1A and shown in Table C-2 since a lower certification level is needed. The average annual salary is assumed to be $65,000 and fringe benefits are assumed to be $20,000 each. The total cost for Benton Harbor management and treatment plant staff for this alternative is approximately $300,000.
- Distribution staff remain the same as identified in Alternative 1A: One water distribution operator-in-charge with S-2 certification, three water system distribution operators with at least S-4 certification, distribution water meter technician, and one groundskeeper. The total cost for Benton Harbor distribution staff is $480,000.

The labor cost for this option is estimated to be $780,000, approximately $2,000 more than the current labor costs of $778,000. The revised labor costs can be seen in Table C-8. All water system staff are assumed to be City of Benton Harbor employees.

Table C-8. Labor Costs for Alternatives 2A and 2B

	Alternatives 2A and 2B	
	Estimated Cost	**FTE**
Water Treatment		
Salary- City	$227,500	3.5
Fringe Benefits- City	$70,000	
Treatment Subtotal	$300,000[a]	
Distribution		

Salary- City	$300,000	6
Fringe Benefits- City	$180,000	
Distribution Subtotal	$480,000	
TOTAL	**$780,000**	**9.5**

[a] Rounded to $300,000 given estimates used for this alternative.

Alternative 2A Capital Cost

All water treatment plant (including replacement of the high service pumps) and distribution system upgrades are needed with this alternative. To purchase water from St. Joseph, Benton Harbor will need to upgrade piping systems at the treatment plant to route water from the 20-inch transmission main into the clearwells. Piping system upgrades at the clearwells are a rough estimate ($500,000) and will require further investigation and preliminary design to refine this cost. Improvements are also needed at the existing interconnection, estimated to be $500,000.

In addition, a second redundant interconnection with chlorine and corrosion inhibitor feed capabilities is needed for redundancy purposes. The cost for this second interconnection is estimated to be at least $3.2 million and costs are summarized in Table C-9.

Table C-9. Capital Costs for a New Interconnection and Treatment Building

Item	Quantity/Size	Units	Unit Price	Total
Land Acquisition	1	Acre	$ 65,000	$ 65,000
Building	2,500	sq ft	$ 220.00	$ 550,000
Chlorine Feed	Lump Sum			$ 96,000
Corrosion Inhibitor Feed	Lump Sum			$ 177,000
Interconnection Rehab, Piping	Lump Sum			$ 500,000
Mechanical	Lump Sum			$ 249,800
Electrical	Lump Sum			$ 222,100
Plumbing	Lump Sum			$ 97,200
Instrumentation	Lump Sum			$ 236,000
Mobilization	Lump Sum			$ 55,500
Site Work	Lump Sum			$ 194,300
Subtotal				$ 2,442,900
Engineering, Legal, Other Indirects (20%)				$ 488,600
Contingency (10%)				$ 244,300
TOTAL				**$ 3,200,000[a]**

[a] Rounded to nearest $100,000

Alternative 2A O&M Cost

Annual O&M costs to purchase water from St. Joseph include the estimated cost to purchase water based on the water rates and meter charge that St. Joseph provided. O&M costs include: operation of the distribution system and a portion of the treatment plant; the inspection and maintenance of the clearwells; O&M of the high service pumps, chlorine feed system and polyphosphate feed systems; and O&M of the new interconnection. Costs for purchasing water from St. Joseph is provided in Table C-10.

Costs were estimated based on Benton Harbor's average daily demand and the water rates provided by St. Joseph.

Table C-10. Annual Purchased Water Cost from St. Joseph

Average Demand	1.256	MGD	
Water Rate (Provided by SJ)	$2.55	per 100/cuft	
Conversion to Gallons	7.48052	gal/cuft	
Annual Cost for Water	$1,563,000	**per year**	

Other annual O&M costs associated with purchasing water from St. Joseph are shown in Tables C-11 through C-13. Costs for electrical, chemicals, and maintenance materials were estimated using CapdetWorks.

Table C-11. Operation and Maintenance Costs for the Clearwell and High Service Pumps

Clearwell inspections every 3 years	$5,000	per yr
High service pump energy	108,000	kWh/yr
Energy cost	$10,800	per yr
High service pumps maintenance materials	$6,800	per yr
Annual O&M Cost	**$22,600**	**per yr**

Table C-12. Operation and Maintenance Costs for the Chlorine Feed System

Treatment Chemical	Sodium Hypochlorite	
Dosage	4	mg/L
Average chlorine required	42	lb/d
Energy required	118,000	kWh/yr
Chemical cost	$8,000	per yr
Energy cost	$11,800	per yr
Annual O&M Cost	**$19,800**	**per yr**

Table C-13. Operation and Maintenance Costs for the Corrosion Inhibitor Feed System

Treatment Chemical	Blended Phosphate (70/30)	
Dosage	1.5	mg/L as Total PO4
Average Chemical Required	38	lb/MGD
Unit Cost of Corrosion Inhibitor	$1.50	/pound
Electrical energy required	118,000	kWh/yr
Chemical cost	$26,131	per year
Energy cost	$11,800	per year
Annual O&M Cost	**$37,900**	**per year**

- Combined O&M costs for the clearwell and high service pumps, hypochlorite feed system and the corrosion inhibitor feed system are $81,000 per year. This same O&M cost was assumed for the second interconnection. Table C-14 provides a summary of all Alternative 2A O&M and purchase water costs, with an annual estimated total of $2,252,000.

Table C-14. Alternative 2A Operation and Maintenance and Purchase Water Costs

Item	Annual Cost
Clearwells[a]	$5,000
Chlorine feed system	$20,000
Corrosion inhibitor feed system	$38,000
High service pumps energy and maintenance	$18,000
Total operation and maintenance costs at Benton Harbor Water Treatment Plant	**$81,000**
O&M for second interconnection	**$81,000**
Distribution system O&M	**$527,000**
Purchase of St. Joseph Water	**$1,563,000**
TOTAL	**$2,252,000**

[a] Includes inspection and maintenance of the two in-ground clearwells at the Benton Harbor treatment plant.

Alternative 2B Capital Cost

All water treatment plant (including replacement of the high service pumps) and distribution system upgrades are needed with this alternative. This alternative is very similar to Alternative 2A but also assumes:

- A portion of the St. Joseph water is discharged directly to the distribution system and a portion is discharged into the existing clearwells at the existing Benton Harbor treatment plant.
- A new treatment building is constructed near the existing interconnection where both chlorine and a corrosion inhibitor are fed at this location, allowing the chlorine and corrosion inhibitor feed at the existing Benton Harbor water treatment plant to be abandoned.
- Land is available near the existing interconnection and the cost for land purchase is not included.

Costs for a new treatment building near the Benton Harbor/St. Joseph interconnection are summarized in Table C-15.

Table C-15. Alternative 2B Capital Costs for a New Treatment Building at Interconnection

Item	Quantity/Size	Units	Unit Price	Total
Building	2,500	sq ft	$ 220.00	$ 550,000
Chlorine Feed	Lump Sum			$ 96,000
Corrosion Inhibitor Feed	Lump Sum			$ 177,000
Piping and Interconnection Improvements	Lump Sum			$ 500,000
Mechanical	Lump Sum			$ 249,800
Electrical	Lump Sum			$ 222,100

Plumbing	Lump Sum			$	97,200
Instrumentation	Lump Sum			$	236,000
Mobilization	Lump Sum			$	55,500
Site Work	Lump Sum			$	194,300
Subtotal				$	2,377,900
Engineering, Legal, Other Indirects (20%)				$	488,600
Contingency (10%)				$	244,300
TOTAL				**$**	**3,100,000[a]**

[a] Rounded to nearest $100,000

Similar to Alternative 2A, a second redundant interconnection with chlorine and corrosion inhibitor feed capabilities is needed for redundancy purposes. The cost for this second interconnection is estimated to be at least $3.2 million (see Table C-9). The improvements at the existing clearwells are also required for this alternative.

Alternative 2B O&M Cost

The O&M costs for Alternative 2B are assumed to be the same as for Alternative 2A, as presented in Section 4.2.1.3 of the report. Given a portion of the purchased water is going directly into the distribution system, this alternative results in reduced run times of the high service pumps and energy costs. However, these costs savings are offset by maintenance for a new building. The O&M costs for the new treatment building are estimated at $81,000 per year and this same cost is estimated for the second interconnection. Therefore, total annual O&M costs at the two interconnections is $162,000 for this alternative.

Alternative 3 – Benton Harbor Purchases Water from Benton Charter Township

Alternative 3 Labor Costs

Alternative 3 assumes that the treatment plant staff will be reduced and are the same as in Alternatives 2A and 2B.

Alternative 3 Capital Cost

All water treatment plant (including replacement of the high service pumps) and distribution system upgrades are needed with this alternative. To purchase water from Benton Charter Township (BCT), improvements to the BCT treatment plant are required, a new treatment building located near the interconnection with chlorine and corrosion inhibitor feed systems, and improvements to the piping systems in and around the interconnection. BCT provided costs for the improvements at the BCT treatment plant (Table C-16). The new treatment building needed at the interconnections assumes the same costs as presented for Alternative 2A (Table C-9). To provide redundancy, two interconnections are assumed to be needed with a total cost of $6.4 million ($3.2 million per interconnection).

Table C-16. Capital Costs Provided by BCT to Increase Capacity of the BCT Treatment Plant

Install two additional ultrafiltration skids at the water treatment plant.	$3,000,000
Install three additional pumps (1 low service pump, 1 process pump, and 1 highs service pump at the treatment plant	$360,000
Install 1 additional Microstrainer	$120,000
Total BCT Treatment Plant Capital Cost	**$3,480,000**

Alternative 3 O&M Cost

O&M costs for the two interconnections are assumed to be the same as described for Alternative 2B, with a cost of $81,000 per year per interconnection ($162,000 per year total). Costs for purchasing water from BCT is provided in Table C-17. Costs were estimated based on Benton Harbor's average daily demand and the water rate provided by BCT.

Table C-17. Estimated Water Purchase Cost from BCT

Average Demand	1.256	MGD	
Water Rate (Provided by BCT)	$4.85	per 100/cuft	
Conversion to Gallons	7.48052	gal/cuft	
Annual O&M Cost	**$2,972,000[a]**	**per year**	

[a] Rounded to nearest $1,000

Alternative 4 – Regionalization with Neighboring System

There was not sufficient information to estimate costs for Alternative 4.

Alternative 5 – Consolidation with Neighboring System

There was not sufficient information to estimate costs for Alternative 5.

Alternative 6 – Private Ownership of the Benton Harbor System

There was not sufficient information to estimate costs for Alternative 6.

Alternative 7 – Alternative Water Source

Alternative 7A Labor Costs

This alternative allows for the eventual shut-down of the Benton Harbor intake and water treatment plant, which will eliminate the need for the F-1 operator-in-charge position along with the water treatment plant shift operators. Instead, a D-1 certified operator is needed at the water treatment plant to oversee equipment and chemical feed systems. In addition, a groundwater treatment plant can be automated and allow for reduced number of operators at the treatment plant. For this option, Benton Harbor hires all water system staff and labor costs are assumed to be:

- Three and a half FTEs for general operations and water treatment plant oversight: One water system director having a D-1/S-2 certification, one treatment plant operator with a D-1 certification to oversee chemical feed systems and pumps at the new groundwater treatment plant, one half-time treatment plant shift operator, and one administrative assistant experienced with computerized maintenance management software. The operators are assumed to be paid slightly less than the salaries presented in Alternative 1A and shown in Table C-2 since a lower certification level is needed. The average annual salary is assumed to be $65,000 and fringe benefits are assumed to be $20,000 each. The total cost for Benton Harbor management and treatment plant staff for this alternative is approximately $300,000.
- Distribution staff remain the same as identified in Alternative 1A: One water distribution operator-in-charge with S-2 certification, three water system distribution operators with at least S-4 certification, distribution water meter technician, and one groundskeeper. The total cost for Benton Harbor distribution staff is $480,000.

The labor cost for this option is estimated to be $780,000, approximately $2,000 more than the current labor costs of $778,000.

Alternative 7B Labor Costs

As with alternative 7A, this alternative allows for the eventual shut-down of the Benton Harbor intake and water treatment plant, which will eliminate the need for the F-1 operator-in-charge position along with the water treatment plant shift operators. Instead, a D-1 certified operator is needed at the water treatment plant to oversee equipment and chemical feed systems. In addition, a groundwater treatment plant can be automated and allow for reduced number of operators at the treatment plant. For this option, Benton Harbor hires a qualified contract operations firm to provide all operations and maintenance for the groundwater treatment plant and the distribution system.

- One and a half FTEs for general operations and water treatment plant oversight: One water system director having a D-1/S-2 certification, one treatment plant operator with a D-1 certification to oversee chemical feed systems and pumps at the new groundwater treatment plant who can also split time in the distribution system, and one administrative assistant (City employee) experienced with computerized maintenance management software. Total treatment contract operations is estimated at $120,000. The City administrative assistant would add $75,000 salary plus $45,000 in fringe benefits.
- Distribution staff remain the same as identified in Alternative 1B, estimated at $360,000.

Alternative 7 Capital Costs

This alternative estimates costs for installation of new groundwater wells to replace Lake Michigan as the water source for Benton Harbor. Preliminary capital costs were developed for purchase of land to locate the wells, developing and equipping six new wells, piping, electrical, iron removal treatment, and other direct costs, as shown in Table C-18.

Table C-18. Alternative 7 Estimated Capital Costs for Groundwater Source Development (from F&V)

Item	Description	Unit	Qty.	Unit Price	Amount
Water Treatment Plant					
1	**Site Work (To be finalized based on building location)**				
2	Construction Staking	LS	1	$10,000	$10,000
3	Excavation/Site Grading	LS	1	$50,000	$50,000
4	6" Raw WM to Treatment Building (from wells to loop)	LF	480	$100	$48,000
5	8" RAW WM to Treatment Building (loop around site)	LF	16,000	$150	$2,400,000
6	16" to Distribution System	LF	7,000	$300	$2,100,000
7	Sanitary Sewer - PVC	LF	800	$150	$120,000
8	HMA Drive/Parking	SY	2,500	$25	$63,000
9	Backwash EQ Pond	LS	1	$100,000	$100,000
10	Site Restoration (Top Soil, Seed, Fertilizer, Mulch)	LS	1	$50,000	$50,000
11	Concrete Sidewalk - 4" thick	SF	400	$12	$5,000
12	Site Fencing	LF	2,500	$25	$63,000
13	Main Gate	LS	1	$25,000	$25,000
14	2" Water	LF	120	$30	$4,000
				Total Site Work:	**$5,040,000**
16	**Production Wells**				
17	Site Investigation	LS	1	$15,000	$15,000
18	Preliminary Testing	LS	1	$150,000	$150,000
19	Well drilling, testing, reporting	Ea	6	$120,000	$720,000
20	Well Pump, Pitless Adapter, Drop Pipe	Ea	6	$95,000	$570,000
				Production Wells:	**$1.460.000**
16	**Treatment System Building**				
17	Treatment Building	SF	8,000	$250	$2,000,000
18	Exhaust Fan & Intake Louver Set	EA	6	$5,500	$33,000
19	Unit Heaters (Gas Fired)	EA	6	$2,800	$16,800
20	Gas Service Allowance	LS	1	$10,000	$10,000
21	General Plumbing (water, floor drains, gas lines)	SF	8,000	$8	$64,000
22	Dehumidifier	LS	4	$3,500	$14,000
23	HVAC Controls	LS	1	$10,000	$10,000
				Total Treatment System Building	**$2,150,000**
24	**Process Equipment**				
25	Vertical Pressure Filters, Face Piping, Blower, Valves	LS	1	$1,749,000	$1,749,000
26	Process Piping, Valves, Flow Meters	LS	1	$110,000	$110,000
27	Steel Air Piping	LS	1	$20,000	$20,000
28	Disinfection Equip	LS	1	$35,000	$35,000
29	Phosphate Feed Equipment	LS	1	$35,000	$35,000
30	Safety Equipment	LS	1	$10,000	$10,000
31	Mechanical Contractor Installation, 25%	LS	1	$489,800	$489,800
32	Process Equipment and Pipe Painting	LS	1	$100,000	$100,000
				Total Process Equipment:	**$2,550,000**
33	**Electrical, SCADA & Controls**				
34	Electrical Service Allowance	LS	1	$60,000	$60,000
35	Electrical Distribution to Wells	LS	1	$1,260,000	$1,260,000
36	Well Control Panels and VFDs	EA	6	$37,000	$222,000
37	SCADA Computer Hardware	LS	1	$10,000	$10,000
38	PLC & SCADA Software	LS	1	$12,500	$12,500
39	SCADA Programming & Testing	LS	1	$45,000	$45,000
40	SCADA Network Wiring (Fiber + CAT 6)	LS	1	$160,000	$160,000
41	Main SCADA Control Panel	EA	1	$40,000	$40,000
				Total Electrical, SCADA, & Controls:	**$1,810,000**
33	**General Conditions and OH&P**		15%		**$1,950,000**
				Construction Cost:	**$15,000,000**
34	Contingency/Undeveloped Details		20%		$3,000,000
35	Engineering Services				$2,300,000
36	Property Purchase	Acre	5	$15,000	$75,000
				Total Project Cost:	**$20,400,000**

Notes:

(1) The Design Professional has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. Bid prices may vary significantly based on these factors and market conditions at time of bid.

Alternative 7 O&M Costs

O&M for the new groundwater sources and treatment facility is assumed to be 50% of the estimated O&M costs for the Benton Harbor water treatment plant, resulting in an annual O&M cost of $125,500.

Appendix D–
City of Benton Harbor Water Rates

WATER RATE SHEET

MONTHLY BILLING RATES AS OF 7/1/2020

CITY OF BENTON HARBOR

BILL CODE	MTR SZ	BASE WTR	BASE SWR	CAPITAL IMP
1--11	5/8 IN	$ 9.93	$ 16.69	$ 4.60
2--12	3/4 IN	$ 14.89	$ 19.03	$ 6.90
3--13	1 IN	$ 25.81	$ 26.50	$ 11.96
5--15	1 1/2 IN	$ 59.55	$ 36.75	$ 27.60
6--16	2 IN	$ 99.24	$ 47.03	$ 46.00
8--18	3 IN	$ 228.26	$ 67.59	$ 105.80
9--19	4 IN	$ 406.88	$ 119.70	$ 188.60
0A/1A	6 IN	$ 913.03	$ 197.78	$ 423.20
0B/1B	8 IN	$ 1,637.49	$ 275.57	$ 759.00
CONSUMP CHRG PER CCF		$ 4.18	$3.17after 3	

SPECIAL SEWER/BT

BILL CODE	MTR SZ	BS SWR
21/31	5/8 IN	$ 16.69
22/32	3/4 IN	$ 19.03
23/33	1 IN	$ 26.50
25/35	1 1/2 IN	$ 36.75
26/36	2 IN	$ 47.03
28/38	3 IN	$ 67.59
29/39	4 IN	$ 119.70
2A/3A	6 IN	$ 197.78
2B/3B	8 IN	$ 275.57
CUSUMP CHRG PER CCF		$3.17 after 3

TRASH

SINGLE UNIT		$17.65
DOUBLE UNIT		$35.30
TRIPLE UNIT		$52.95

CITY	S.S/BT
8--8	S-S
4--10	
2--12	
1--14	
7--16	

NOTE***

REFUSE RATE INCREASE EFFECTIVE 10/2/16
REFUSE RATE DECREASE EFFECTIVE 10/1/17
WATER AND CUMSUPTION CHARGE INCREASE 9.95% EFFECTIVE 7/1/20
SEWER RATE INCREASE 7% EFFECTIVE 7/1/20

Appendix E–
Duties and Responsibilities for Proposed Water System Personnel
(Fleis and Vandenbrink, 2022)

DUTIES & RESPONSIBILITIES FOR PROPOSED WATER SYSTEM PERSONNEL

The following duties and responsibilities correspond to the proposed Baseline Water System positions in Figure 6 of the TMF Report. It should be noted that the following is intended to present a descriptive list of the range of duties performed by employees, they are **not** intended to reflect all duties performed within each job.

WATER SYSTEM DIRECTOR

The Water System Director is responsible for operation and management of the City's Water System and reports back to the City Manager. The Water System Director supervises the Water Treatment Plant Operator-in-Charge and the Distribution Operator-in-Charge. Specific duties and responsibilities of the Water System Director includes:

- Provide supervision and training to Water System personnel; assign tasks and projects to the WTP OIC and Distribution OIC.
- Establishing schedules and methods for capital improvement planning and staffing plans; identify resource needs; review needs with the City Manager and City Commission, and allocate resources accordingly.
- Respond to (or assign Water System personnel to respond to) customer complaints.
- Coordinate communications with the City Manager, City Commission, public, and is responsible for ensuring regulatory compliance with public notification requirements.
- Maintain and assist in developing Water System Budgets.
- Schedule and manage required water system monitoring and reporting.

WTP OPERATOR-IN-CHARGE

The Water Treatment Plant Operator-in-Charge (WTP OIC) is responsible for the operation of the Water Treatment Plant. The WTP OIC supervises the Water Treatment Plant Operators and manages all aspects of the WTP. Specific duties and responsibilities of the WTP OIC include:

- Perform daily WTP operations and/or supervise operators who provide daily WTP operations, including operation of low and high service pumps, chemical feed equipment, filters, and other treatment process equipment.
- Monitor treatment rates, chemical feed rates, filtration rates, and filtration performance. Adjust treatment rates, chemical feed dosage, filtration rates, and backwash cycles as needed for proper plant performance and compliance.
- Complete regulatory reports and maintain required operating records.
- Complete repairs to, or coordinate/supervise contracted repair services for process equipment, including chemical feed systems, service pumps, standby power equipment, valves, filters, basins and piping, controls, and instrumentation.
- Provide supervision and training to WTP personnel; assign tasks and projects to plant operations staff; train staff in appropriate treatment methods and techniques; schedule staff to ensure proper plant coverage; audit and enter timesheet information into the City's computer system for assigned employees.
- Establish schedules and methods for providing maintenance and repair services; identify resource needs; review needs with the Water System Director and/or City Manager and allocate resources accordingly.
- Purchase treatment chemicals, equipment, and supplies for the WTP utilizing the City's automated purchasing program and review deliveries.
- Prepare and maintain emergency response plans.
- Perform WTP laboratory duties and/or provide supervision to operators assigned to conduct WTP laboratory duties, including collecting drinking water samples, performing bacteriological tests, performing daily chemical/turbidity testing and other laboratory analyses completed in house, and preparing reagents and calibration standards.
- Responsible for online instrumentation calibration.

- Responsible for establishing and maintaining Laboratory QC program and certification.
- Assigns and reviews water treatment plant corrective, routine, and preventive maintenance activities.
- Develop SOPs (Standard Operating Procedures) for water treatment activities.

Distribution Operator-in-Charge

The Distribution Operator-in-Charge (OIC) is responsible for the operation of the Water Distribution System. The Distribution OIC supervises the Distribution Operators and manages all aspects of the water Distribution System. Specific duties and responsibilities of the Distribution OIC include:

- Perform daily distribution system operations and/or provide supervision to distribution operators who provide daily distribution system operations, including operation and control of water storage, routine flushing and valve turning, service turn on and turn offs.
- Provide supervision and training to Distribution personnel; assign tasks and projects to distribution staff; train staff in appropriate distribution maintenance and operations methods and techniques; schedule staff to ensure proper distribution operations coverage; audit and enter timesheet information into the City's computer system for assigned employees.
- Establish schedules and methods for providing maintenance and repair services; identify resource needs; review needs with the Water System Director and/or City Manager and allocate resources accordingly.
- Purchase equipment and supplies for the Water Distribution System utilizing the City's automated purchasing program and review deliveries.
- Prepare and maintain regulatory reports and distribution system plans.
- Establish, maintain, and enforce formal Cross Connection Program, maintain Cross Connection Program records, review device test reports, and prepare annual EGLE Cross Connection Report.
- Manage distribution system sampling requirements and activities.
- Assigns and reviews water distribution system corrective, routine, and preventive maintenance activities.
- Develop SOPs (Standard Operating Procedures) for water distribution activities.

Administrative Assistant

Under the supervision of the Water System Director, the Administrative Assistant performs a variety of duties related to the administration of the City's water treatment plant, water distribution system, and computerized maintenance and management, i.e. Cityworks program, as well as other duties as assigned.

- Provide Water System staff with daily administrative support.
- Perform general office and administrative duties: answer phones and take messages, greet visitors, sort and distribute mail, schedule appointments, maintain department calendar, scan documents, etc.
- Point of contact for customers, vendors, contractors, and water system field staff.
- Create and maintain filing systems, both electronic and physical.
- Maintain water system contact list.
- Order office supplies and other materials as directed, maintain supplies inventory.
- Write, proofread, and format emails, memos, letters, reports, and other documents.
- Assist with service agreements, contractor coordination, invoice processing, etc.
- Manage deadlines and track important dates.
- Generate workorders, track status, and file completed forms.
- Schedule and coordinate staff and other meetings.

WATER PLANT OPERATOR

Water Plant Operators are responsible for the day-to-day operation of the Water Treatment Plant. They report directly to the Water Treatment Plant Operator-In-Charge. Under general supervision, Water Plant Operators perform a variety of skilled technical duties and semiskilled labor in the operation and maintenance of the City's water treatment plant; perform adjustments and repairs to plant equipment; collects and documents samples for laboratory testing; perform supervision and training to assigned staff; and perform a variety of related duties as assigned, including:

- Perform assigned treatment plant rounds; inspect, monitor, troubleshoot, performance test and document plant processes by reading plant equipment gauges, dials, graphs, online analyzers, computer screens, meters, SCADA systems and other instrumentation.
- Operate and adjust treatment plant pumps, motors, chemical feed, and other equipment to maintain appropriate plant operations.
- Maintain, compile and update plant operations logs and reports; perform and record mathematical calculations related to plant operational activities.
- Mix and add treatment chemicals; ensure adequate chemical application according to regulations and guidelines.
- Install, maintain, repair, and troubleshoot plant operations machinery and equipment including pumps, valves, motors, meters, and tanks; change lubricants.
- Collect and document samples and perform a variety of routine water quality laboratory tests; monitor laboratory results; collect water samples as required by the Michigan Department of Environment, Great Lakes, and Energy (EGLE).
- Perform general plant facility maintenance such as cleaning, painting, and repairing plant facilities; perform various grounds maintenance duties as required.
- Assist in unloading chemicals as necessary.
- Coordinate maintenance and repair activities with contractors, vendors, and other City staff.
- As assigned, participate in a variety of special projects such as construction of piping, electrical, and structural systems.
- Conduct tours for the general public, school groups, and City staff as necessary.
- Work with a variety of vendors and outside contractors on water treatment activities.
- Perform other related duties as required.

DISTRIBUTION OPERATOR

Distribution Operators are responsible for the day-to-day operation of the distribution system. They report directly to the Distribution System Operator-In-Charge. Under general supervision, Distribution Operators perform a variety of skilled technical duties and semiskilled labor in the operation and maintenance of the City's distribution system; perform adjustments and repairs to distribution piping, hydrants, and appurtenances; perform supervision and training to assigned staff; and perform a variety of related duties as assigned, including:

- Operate and/or control water storage.
- Perform routine flushing, hydrant maintenance, and valve turning.
- Perform water service turns on and shut offs.
- Repair or supervise repair/installation of services, taps, valves, hydrants, and curb stops.
- Coordinate, supervise, or complete installation or replacement of water mains, fire hydrants, and system valves, including disinfection and sampling of new mains, and required pressure tests and leakage calculations.
- Participates in cross connection inspections and documentation.
- Performs routine and non-routine distribution system sampling.
- Perform Miss Dig location services.
- Perform other related duties as required.

Water Meter / Maintenance Technician

The water meter and maintenance technician is responsible for periodic meter reads and maintenance and operation of water meters. Specific duties and responsibilities include:

- Read, test, install, and repair water meters/remotes.

Groundskeeper (Part-Time)

The groundskeeper is responsible for general grounds maintenance and custodial duties, including:

- Lawn mowing and landscaping at the WTP and water storage facilities.
- Snow plowing, snow removal, and salting/de-icing of parking lots and sidewalks at the WTP and water storage facilities.

Contracted Services

The following list outlines Contracted Services which are specifically *excluded* from Duties and Responsibilities of Water System personnel:

- Chemical suppliers and consultants.
- Perform troubleshooting, maintenance (including annual infrared camera inspections of major equipment and motor control systems) and repairs of electrical systems and electrical equipment that requires a qualified/licensed electrician.
- Maintenance, troubleshooting, calibration, or programming of SCADA, instrumentation or controls systems that requires a qualified SCADA or instrumentation technician.
- Heavy maintenance (not routine preventative maintenance), repair/replacement/installation of pumps, process equipment or piping that requires a qualified mechanical contractor.
- Maintain and repair of HVAC equipment that requires a qualified HVAC contractor.
- Vehicle maintenance.
- Contract laboratory analysis for analyses not performed onsite.
- Perform annual calibration and certification of analytical balance, thermometers, and other laboratory equipment that requires a qualified laboratory maintenance contractor.
- Perform annual inspection and cleaning of water plant intake and perform repairs as needed, completed by commercial diving contractor.
- Engineering.
- Other specialized, non-routine services, as needed

Appendix F–
EGLE NPDES Violation Notice Letter

STATE OF MICHIGAN
DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY
KALAMAZOO DISTRICT OFFICE

GRETCHEN WHITMER
GOVERNOR

LIESL EICHLER CLARK
DIRECTOR

January 27, 2022

VN No. VN-012645

VIA EMAIL

Mr. Ellis Mitchell, City Manager
City of Benton Harbor
200 East Wall Street
Benton Harbor, Michigan 49022

Dear Mr. Mitchell:

SUBJECT: Violation Notice

On November 10, 2021, staff of the Department of Environment, Great Lakes, and Energy (EGLE), Water Resources Division (WRD), conducted a National Pollutant Discharge Elimination System (NPDES) Compliance Evaluation Inspection (CEI) at the Benton Harbor Water Treatment Plant (Benton Harbor WTP), located at 601 North Ridgeway Drive, Saint Joseph, Berrien County, Michigan 49085. The purpose of the inspection was to evaluate the facility's compliance with Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA), MCL 324.3101 *et seq*., and the Administrative Rules promulgated thereunder being 2006 AACS R 323.2101 *et seq*., as amended and NPDES General Permit No. MIG640000 and Certificate of Coverage (COC) No. MIG640258 (Permit). The effective date of the COC was May 19, 2015, and the Sections of the general permit applicable to this facility include: the cover page, Part I.A.3., Part I.A.6., and Part I.A.9., through Part II.E.6., inclusively. The effective date for the effluent limitation in Part I.A.6., and Part I.A.9. is the effective date of the COC. The NPDES Permit does not authorize a discharge to groundwater.

The facility was also evaluated to determine compliance with the Part 5, Spillage of Oil and Polluting Materials, (Part 5 Rules) R 324.2001 through R 324.2009 of the Michigan Administrative Code, the Part 22, Groundwater Quality (Part 22 Rules), promulgated pursuant to Part 31 of the NREPA.

Inspection Participants

Mr. Abul Ahmed and Mr. Rob Jones, Fleis and Vandenbrink Operations (F&V) operators representing the City of Benton Harbor; Mr. Matthew Schulte and Mr. Jonathan Moody, representing the United States Environmental Protection Agency (EPA); and Mr. Kip Mitchell and Ms. Jennifer Klang, representing EGLE, participated in the inspection. A follow up email was sent to F&V on December 28, 2021, requesting the date F&V began operating the Benton Harbor WTP. In their response F&V clarified their duties, stating, “To clarify F&V Operations does not operate the City of Benton Harbor Water plant. F&V provides consulting technical support services to the City of Benton Harbor. Benton Harbor staff have operated the water Plant for as long as I can remember." A second follow up email was sent to F&V on December 29, 2021, requesting the date F&V began providing technical support services to Benton Harbor WTP. There has not been a reply. Though City of Benton Harbor (City) personnel were given advance notice of and invited to the inspection, no City employees participated in the inspection. The inspection included an opening and closing conference, an

interview, a records review, sampling and lab review, a site inspection of the facility, and a pre-inspection off-site file review.

Facility Description

The Benton Harbor WTP discharges their potable water filter backwash treatment water into a lagoon system on-site. The waste disposal lagoons were designed and constructed during the 2010 Drinking Water Revolving Loan Fund (DWRF) water plant upgrades project. The waste disposal system consists of two cells and an overflow discharge to wetlands in Jean Klock Park. The two cells were to function in series: the smaller would remove solids first, then water would flow over an adjustable weir for further settling. A discharge to surface water is currently authorized under the Permit.

A discharge to surface waters would occur through an emergency overflow structure located at the high point in the lagoons. According to F&V staff, a discharge from the emergency overflow structure has never occurred during their time as operators; although F&V staff also stated they do not observe the discharges of filter backwash water into the lagoons. It was stated that a visual inspection of the lagoons is done three times per week.

The discharge to groundwater from the lagoons has historically been considered exempt from permitting requirements of Part 22, Groundwater Quality, promulgated pursuant to Part 31of the NREPA by the Exemption for Public Water Treatment Plants, approved on April 25, 1991.

Interview

During the initial interview at the facility, F&V staff stated they are only contracted to handle the drinking water operations at the Benton Harbor WTP. As such, F&V is not involved in the discharge of wastewater to surface waters of the state. The limited information associated with the sludge lagoons obtained during the inspection was provided by Mr. Abul Ahmed who has a F-1 Drinking Water operator certification. The failure to have the waste treatment system under the direct supervision or control of a properly certified operator is a violation of the NPDES Permit.

During the inspection, EGLE staff requested to review the facility's self-monitoring records associated with the discharge of wastewater to waters of the state. No records were provided. The Permit requires specific parameters to be monitored during a discharge event to waters of the state, and also requires monitoring and sampling results to be retained in accordance with Part II.C.3. - *Retained Self-Monitoring Requirements.* The failure to maintain self-monitoring records is a violation of the Permit.

At the time of inspection, sludge was observed on the ground to the south of the plant and on the berms of the lagoons. Proper sludge removal is required by the Permit in Part II.D.7.-*Waste Treatment Residues* which states:

> "Residuals (i.e. solids, sludges, biosolids, filter backwash, scrubber water, ash, grit, or other pollutants or wastes) removed from or resulting from treatment or control of wastewaters, including those that are generated during treatment or left over after treatment or control has ceased, shall be disposed of in an environmentally compatible manner and according to applicable laws and rules. These laws may include, but are not limited to, the NREPA, Part 31 for protection of water resources, Part 55 for air pollution control, Part 111 for hazardous waste management, Part 115 for solid waste

> management, Part 121 for liquid industrial wastes, Part 301 for protection of inland lakes and streams, and Part 303 for wetlands protection. Such disposal shall not result in any unlawful pollution of the air, surface waters or groundwaters of the state."

A compliance communication issued on October 8, 2020, addressed sludge removal plan concerns. The City of Benton Harbor was notified that to return to compliance, and to remain covered under the Part 22 Rules groundwater exemption, the removal and disposal of sludge on the ground and on the berms of the lagoons would be required in accordance with Part 115, Solid Waste Management, of the NREPA. An option for an alternative means of sludge disposal was provided in this communication, but no submittal for a revised sludge handling plan was received. Failure to properly manage the waste treatment residuals is a violation of the Permit.

The sludge currently on the grounds of the facility must be removed and properly disposed of in accordance with Part 115 of the NREPA. This includes all sludge that is located on the facility property, including any sludge that is in place around and/or on the berms of the lagoons.

Site Inspection

Prior to the construction of the lagoons, backwash water (wastewater) was conveyed directly to the Paw Paw River marshland in Jean Klock Park. There are two manholes to the north of the lagoons within the Jean Klock Park parking lot that appear on construction plans to connect the backwash water from the facility to the lagoons and the piping that conveys emergency overflows to the wetland. At the time of inspection, a pole camera was used to observe this potential connection. It was determined that the connection between the two manholes has been bulkheaded. Therefore, any discharge to surface waters of the state would only occur via the overflow structure in the lagoon. Part II.D.3.-*Facilities Operation* of the Permit requires all treatment or control facilities, or systems be maintained in good operating condition to achieve compliance with the Permit. EGLE recommends that the bulkheaded connection be inspected annually. A failure of this bulkhead would result in an unmonitored discharge to surface waters of the state.

It appears that part of the lagoon berm was removed to create a road, damaging the structural integrity of the lagoon and losing important treatment capacity. The October 8, 2020, compliance communication required removal of the road constructed through the lagoons. At the time of the November 10, 2021, inspection, the road was still in place. The road must be removed, and the lagoons must be returned to their designed treatment area. This will require removal of excess sludge. The lagoons also had significant vegetation in and around both lagoon cells 1 and 2. It is recommended that vegetation around the lagoons be cut down, and vegetation within the lagoons be removed entirely. The failure to properly operate and maintain the treatment or control facilities is a violation of the Permit.

The overflow structure is located adjacent to the influent structure, but at an increased elevation. WRD is concerned that the high-water elevation of the overflow structure may result in an unpermitted overflow/discharge onto the street to the south of the lagoons. The exact elevations of the overflow structure and the low point of the south berm in the driveway should be determined and recorded for review to ensure an unpermitted overflow/discharge does not occur.

Off-Site File Review

The City is required in Part II.C.3.-*Retained Self-Monitoring Requirements* to submit Retained Self-Monitoring Certifications by January 10th of each year certifying that 1) all retained self-monitoring requirements have been complied with and a year-to-date log has been maintained; and 2) the application on which this Permit is based still accurately describes the discharge. The City failed to submit Certifications for 2016 and 2020 and the Certifications for 2017 and 2018 were not submitted by their due dates. The Certification submitted for 2015 incorrectly contains the Certification for 2016 and should therefore be resubmitted under the appropriate schedule. The failure to submit these Certifications and/or by their due dates is a violation of the Permit.

Part 5 – Spillage of Oil and Polluting Materials

The containment of chemicals on site was evaluated during the inspection. It was determined there are significant volumes of chemicals, both liquid and dry, stored on site.

Part II.D.6 – *Containment Facilities* of the Permit states:

> "The permittee shall provide facilities for containment of any accidental losses of polluting materials in accordance with the requirements of the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code). For a Publicly Owned Treatment Work (POTW), these facilities shall be approved under Part 41 of the NREPA."

Sodium fluoride was being stored without containment within approximately two (2) feet of a floor drain. White barrels storing Aquadene SK-7661 were also stored without containment in close proximity to a floor drain. The location of the discharge point of both floor drains was unknown. In the response to this Violation Notice, drain maps confirming the ultimate drainage discharge location shall be provided.

On-site there are three tanks for the storage of chlorine and four tanks for the storage of aluminum sulfate. During the inspection it was stated that the chlorine tanks are 20,000 gallons each. There are two 3,500-gallon tanks for aluminum sulfate, and two additional tanks between 800-to-1,200 gallons. It was noted during the inspection that only one of the 800-to-1,200-gallon aluminum sulfate tanks is in use.

There are day tanks used in the polymer room that do not appear to have adequate containment for the size of the tank in use. Additionally, one of the day tanks had recently spilled or overflowed and not been properly cleaned up. During the inspection it was stated that there are no spill kits on-site except for those used in the laboratory.

Based on the information gathered during the inspection and summarized in the attachment "Part 5 Checklist", Benton Harbor WTP is subject to the Part 5 Rules and must develop a Pollution Incident Prevention Plan (PIPP). EGLE will provide Benton Harbor WTP guidance documents to assist in the development of the PIPP. The failure to comply with the containment requirements and the development of a PIPP is a violation of the Part 5 Rules and the Permit.

Groundwater Exemption

As stated previously, the discharge to groundwater from the lagoons has historically been considered exempt from permitting requirements of the Part 22 Rules. However, to be covered by the exemption, specific requirements must be met, and the facility must be maintained and operated in accordance with the exemption.

Rule 323.2210(o)-*Items permitted to be discharged without permit* states:

> "Water treatment filter backwash water if disposal is in accordance with plans and specifications approved by the department under Act No. 399 of the Public Acts of 1976, as amended, being §325.1001 et seq. of the Michigan Compiled Laws, and known as the safe drinking water act."

The specific requirements that must be met for the exemption are detailed in the document entitled Exemption for Public Water Treatment Plants and issued on April 25, 1991, by the Water Resources Commission. The document states:

"It shall be the policy of the Commission that discharges of liquid water treatment process wastes including filter backwash water, from public water treatment plants to the ground or groundwater of the State, will not be required to have a groundwater discharge permit pursuant to 1929, P.A. 245, as amended (Act 245). This exemption is developed pursuant to rule 2209(2) of Act 245 and is limited by the following conditions:

1. *The treatment plant discharge shall only consist of liquid water treatment process wastes, including filter backwash water, from water treatment plants.*
2. *Contaminants present in the discharge to the groundwater shall not exceed state or federal primary drinking water standards prior to discharge.*
3. *The discharge of liquid water treatment process wastes shall be done in accordance with a plan approved by the MDPH. The plan shall contain the requirements deemed necessary by the MDPH and shall include appropriate treatment plant discharge and groundwater monitoring requirements.*
4. *All sludges removed from lagoons shall be disposed in accordance with all applicable environmental laws.*
5. *All sanitary sewage, laboratory wastes, floor drain wastes and other wastes shall only be discharged to the ground or groundwaters if the discharge has been authorized through a permit issued by the Commission. The wastes may be disposed in accordance with other applicable environmental laws.*
6. *Any discharge of liquid water treatment process wastes contrary to the provisions of this exemption if a violations of 1929 PA 245, as amended unless the discharge has been authorized through a permit issued by the Commission."*

Due to the violations and concerns identified in this letter, coverage under the exemption for Benton Harbor WTP is being reevaluated.

The first step in this reevaluation is sampling of the wastewater in the lagoons to determine the wastewater characteristics. This sampling will be conducted by EGLE staff and will provide a preliminary indicator if the wastewater in the lagoons is, or is likely to become, injurious to the groundwater. If it is determined that coverage under the exemption no longer applies, Benton Harbor WTP will be notified promptly and provided with additional information. At that point, the continued discharge of water treatment backwash water to groundwaters of the state will be considered a violation of the Part 22 Rules.

The sludge removal and handling deficiencies must be corrected regardless of the coverage of the exemption.

Required Response

Please submit a response to this office **via MiWaters by February 28, 2022**. At a minimum, the response shall include.

1. Provide the name(s), certifications (drinking water and/or wastewater), the certificate number(s) and certification expiration dates of the operator(s) designated to be responsible for the waste treatment system at the Benton Harbor Water Treatment Plant.

2. Develop and submit a sludge removal plan for review and approval.

3. Provide a plan and a timely schedule for the removal of sludge currently stored on the Benton Harbor WTP property.

4. If the City of Benton Harbor plans to inspect the bulkheaded connection described in the letter, please provide a tentative schedule for this inspection.

5. Provide the elevations of the overflow structure and the low point of the south berm in the road constructed through the lagoons.

6. Remove the road constructed through the lagoons and rebuild the berms according to approved design.

7. Develop and submit an Operations and Maintenance (O&M) Manual for the filter backwash water lagoons. This should include a plan for routine monitoring of the wastewater system and a sampling plan in the event of a surface water discharge.

8. If the City of Benton Harbor plans to reduce vegetation in and around the lagoons, please provide a plan and a timely schedule to do so. This plan should include a schedule for regular inspections and maintenance and should be included in the overall O & M Manual. If the City of Benton Harbor does not plan to reduce vegetation in and around the lagoons, then please provide an explanation which includes how the excessive vegetation observed during the inspection will not interfere with lagoon design function, capacity, and emergency access.

9. Submit self-retained monitoring for FY2016 (due January 10,2017) and FY2020 (due January 10,2021), and also correct the submission for FY2015 (due January 10,2016).

10. Identify and submit floor drain maps identifying where they flow to.

11. Develop and implement a PIPP for the storage of on-site chemicals. Submit that PIPP as part of the response to this Violation Notice **by February 28, 2022**.

If you have any factual information, you would like us to consider regarding the violations identified in this Violation Notice, please provide them with your written response.

We anticipate and appreciate your cooperation in resolving this matter. Should you require further information regarding this Violation Notice or if you would like to arrange a meeting to

discuss it, please contact me at 269-569-2886; MitchellK16@michigan.gob; or Department of Environment, Great Lakes, and Energy, WRD, 7953 Adobe Road, Kalamazoo, Michigan 49009-5025.

Sincerely,

Kip W Mitchell

Kip Mitchell
Environmental Engineer
Kalamazoo District Office
Water Resources Division

cc: Mr. Abul Ahmed, F&V
Mr. Matthew Schulte, EPA
Mr. Jonathan Moody, EPA
Mr. Fred Sellers, EGLE
Mr. James Zellinger, EGLE
Ms. Jen Klang, EGLE
Ms. Terri Shattuck, EGLE