

# Consulting Engineer's Report

Operation of the Authority's Water  
System by the City of Bethlehem

(2025 Operations)  
(2026 Adopted Budget)

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Prepared for:

Bethlehem Authority  
Bethlehem, Pennsylvania  
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Prepared by:

**Ronald B. Madison, PE**  
PA Professional Engineer  
License No. PE47925R

**Colliers Engineering & Design**  
1110 American Parkway  
Building 10, Suite F-200B  
Allentown, Pennsylvania 18109  
Main: 610-868-4201  
[Colliersengineering.com](http://Colliersengineering.com)

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# Introduction

## Purpose and Scope

The Bethlehem Authority (the Authority) owns source water properties and the water treatment and distribution system facilities that serve the City of Bethlehem, Pennsylvania (the City) and portions of eleven (11) surrounding municipalities. The City leases (from the Authority), operates, and maintains these water system facilities.

A full description of the Authority including listing of current Board Members, Staff, and monthly meeting minutes, may be found at the Authority website: [www.bethlehemauthority.org](http://www.bethlehemauthority.org). The Authority was founded in 1938 as Pennsylvania's first municipal authority. The Authority website includes a History of the Water System, a description of the Wild Creek and Penn Forest Reservoirs located in the Pocono Mountains, and a description of the Authority's award-winning Watershed Forest Management of the nearly 23,000 acres of property. The City of Bethlehem Water & Sewer Resources website also provides a brief history and potable water quality reports which may be found at [www.bethlehem-pa.gov/water-sewer-resources](http://www.bethlehem-pa.gov/water-sewer-resources).

Colliers Engineering & Design, Inc. is the appointed consulting engineer for the Authority. As consulting engineer, Colliers Engineering & Design's responsibilities include reviewing the City's budget for operation of the water system facilities, reviewing insurance coverage, preparing a written report on the condition and operation of the water system by the City during the preceding year, and setting forth recommendations for the ensuing years.

Through this 2025 Annual Report, Colliers Engineering & Design provides an account of:

- The financial condition of the Authority and City Water Fund during the last fiscal year as reflected by information supplied by the Authority and the City;
- The budget for the current fiscal year for the Authority and the City Water Fund along with pertinent observations and recommendations;
- The physical condition of the water system;
- The general operation and maintenance of the water system during the past year;
- List of recommendations with respect to operations, maintenance, improvements and finances for the ensuing fiscal year;
- List of recommendations as to any renewal and replacement or change in operating policies that may be advisable;
- In late 2021, the Authority authorized a Confidential Water Systems Security Improvements Feasibility Study. The Authority and City continue to work toward the implementation of recommended security improvements.

The information used for this report was obtained from Authority and City records, from discussions with personnel, and through visual inspection of many of the system facilities. Investigations for this report do not include an independent check of records, audits, and regulatory compliance or operational testing.

## Executive Summary

Colliers Engineering & Design has been working closely with the Authority and the City to assess the physical condition and current operation of the water system facilities. This effort originally began in September 2016 and has followed each year through 2025 with a tour of the water filtration plant, the Wild Creek & Penn Forest reservoirs, and nearly all of the significant water infrastructure facilities.

Colliers Engineering & Design reviewed the City of Bethlehem 2026 Operating & Capital Budget, which resulted in the issuance of the Fiscal Certification for 2026 dated February 6, 2026 and the Insurance Certification for 2026 dated January 8, 2026. We corresponded with the City staff in April 2026 and reviewed the draft report on April 16, 2026. We reviewed the 2025 year-end financial data and the capital projects and initiatives completed by the City. During our discussions with the City staff and tour of the facilities, we did not find any major deficiencies which require immediate attention. Based upon the above described efforts, we offer the following statements:

Colliers Engineering & Design has reviewed the financial condition of the Authority and the City of Bethlehem Water Fund during the prior fiscal year 2025 and the current 2026 Budgets of the Authority and City. We have observed the physical condition and current operation of the water system to which we provide observations and recommendations.

*In general, Bethlehem Water System is in a "State of Good Repair"; the Authority and City have the financial resources to continue the proper operation and maintenance of the Water System.*

# Financial Operations

## Overview

The finances of the Authority and the City Water Fund are discussed in this section. The Authority has legal title to the water system's assets, including the watershed lands. It leases the assets to the City pursuant to a Contract and Lease dated January 1, 1992, which has been updated periodically pursuant to various borrowings. The relationship between the City and the Authority is further governed by a trust indenture which, among other things, establishes reserve funds for repairs and maintenance and provides for the orderly payment of the system's debt obligations. The Authority, in cooperation with the Trustee, is responsible for management of all reserve funds/trust indenture funds, payment of all debt service costs, and management of the watershed lands and certain other properties related to the water system.

The Authority's income includes the lease rental payments from the City's water fund pursuant to the Contract and Lease. The lease rental payments are fixed so as to be sufficient for payment of the Authority's debt service requirements related to the water system's various borrowings. The Authority's income also includes timbering revenues, sale of carbon credits, and interest on investments and other property rentals and leases. The Authority will continue to evaluate options for renewable energy generation projects as they may arise. The Authority will also gain future revenue from the sale of carbon credits.

The City is responsible for managing the water system, operating and maintaining all water system facilities, and complying with regulatory requirements. Financially, the City is responsible for setting water rates and charges (with the approval of the Pennsylvania Public Utilities Commission) to meet all financial requirements including operating and maintenance expenses, and the lease rental payments due under the Contract and Lease.

As additional security for the Authority's borrowings, the City has guaranteed payment of debt service. As guarantor, the City has ultimate responsibility for the repayment of the water system's debt obligations.

Monies for capital additions and long-term maintenance to the system can be provided from Authority reserves, if they are available, or from the City, or from borrowings which are proposed and administered by the Authority and approved by City Council. The Authority works closely with the City and financial advisors to plan for 10-year capital financing and the retirement of old debt.

In 2022, the Authority refinanced the long-term debt. The savings in debt service resulting from refinancing of the Authority long term debt was applied to support additional debt to help fund the 10-Year Capital Plan. A copy of the Final Transaction Statistics and Aggregate Debt Service dated August 17, 2022 may be found in Appendix 11.

## Water Rates

The City serves retail customers inside and outside of the City. The rates charged to the customers outside of the City and the service they receive are regulated by the Pennsylvania Public Utility Commission (PUC). It has been the practice of the City to charge inside-City customers the same rates approved by the PUC for outside-City customers. The current Schedule of Rates is summarized in Appendix 1. The City completed work on a year-long water consumption Demand Study in 2019. The City filed with PUC on July 31, 2020 for a rate increase which was approved by the PUC on April 15, 2021. The average rate class increase approved was 8.4%, which went into effect on June 1, 2021.

## Authority Finances

The Authority's administrative operating budget for 2026, and a small Authority Capital Budget, as approved in December 2025 are set forth in Appendix 2. As noted above, the Authority is partly reliant upon the City to fund its operating budget. The Authority's capital budget has been funded from other sources, including past grants, carbon credit revenues, and Authority reserves.

## City Water Fund Budget Finances

A summary of the City Water Fund revenues and expenses are shown in Table 1 which is reported on an all cash basis. This table shows that income (revenues minus expenses) from 2024 operations ended with a net gain of \$2,343,453.05. The estimated 2025 operations ended with a net gain of \$1,544,410.75 (see footnotes). The revenues and expenditures for FY 2022 through 2025 City financial reports are summarized in Appendix 4.

**Table 1**  
**Water Fund Revenues and Expenses**  
**2024 Operating Fund**

	BUDGET	YEAR-END RECEIPTS AND DISBURSEMENTS
REVENUES	\$23,516,000	\$24,604,000
EXPENDITURES	\$23,516,000	\$22,300,000
NET (REV – EXP)	\$0	\$2,343,000
2024 YEAR-END CASH BALANCE		\$13,893,000

### 2025 Operating Fund

	BUDGET	YEAR-END RECEIPTS AND DISBURSEMENTS
REVENUES	\$25,106,000	\$25,386,000
EXPENDITURES	\$25,106,000	\$23,841,000
NET (REV – EXP)	\$0	\$1,544,000
2025 YEAR-END CASH BALANCE		\$15,437,000

### 2025 Water Capital Fund

	2025 BUDGET	YEAR-END RECEIPTS AND DISBURSEMENTS
2025 BEGINNING OF CASH BALANCE		\$2,361,000
REVENUES	\$12,159,000	\$7,610,000
EXPENDITURES	\$12,159,000	\$5,858,000
NET (REV – EXP)	\$0	\$1,752,000
2025 YEAR-END CASH BALANCE		\$4,113,000

- (a) Numbers rounded to the nearest thousand
- (b) Year-end receipts and disbursements on cash basis

Appendix 3 includes a 2026 Water Capital Budget of \$12,824,040, which lists the capital projects approved to be funded in whole or in part during 2026 (see page titled “2026 Water Capital Fund – Fund Analysis Summary”). Other water capital items noted in Appendix 3 address normal replacements and renewals required to maintain the water distribution system itself and numerous items to improve, protect, and maintain water supply, treatment, transmission, pumping, and storage facilities. The items in the 2026 Water Capital Budget should be implemented in 2026 and beyond to maintain the integrity of the system, improve operating efficiencies and/or meet regulatory requirements.

The 2025 Water Capital Budget was financed by the 2022 Bond Construction Fund and capital appropriation from the City’s operating fund.

In 2025, the City’s Operating Fund revenues were more than expenditures by 6.5%, while Water Capital Fund revenues exceeded expenditures by 29.9%. However, the cash balance of each fund at



year's end combines for \$18,524,652.99, some of which can be used for 2026 capital projects. The City maintains a minimum unassigned cash balance in each fund.

The City and Authority worked with their Financial Planning Advisors in 2022, and considered four refinancing scenarios. The final selected strategy is presented in the 10-Year Water Capital Plan and Capital Financing Plan dated last revised April 2026 (included in Appendix 10). The 10-Year Water Capital Plan is a working document which is to be updated in the fall of each year as part of the City budgeting process. Due to the 1994 debt refinancing to fund the Penn Forest Dam reconstruction project the annual debt service is currently a major portion of operating expenditures. The goals of the new 10-Year Capital Plan are to: emphasize pay-as-you-go funding together with grant funding and additional borrowing; minimize debt financing cost; minimize increases in debt service payments; balance investment needs throughout entire system; and level annual capital budgets.

In 2022, the Authority refinanced the long-term debt with the intent to maintain a level annual debt payment and free up capital reinvestment to provide additional capital funds over the coming years. The goal is to better match debt terms to asset life and provide additional annual capital funds without increasing current annual debt service payment amounts. This will allow the City to better implement the 10-year Capital Plan and more aggressively replace/upgrade critical infrastructure and linear assets (distribution piping).

# Physical Plant Conditions

## General

The Bethlehem water system comprises many different components, including approximately 22,500 acres of watersheds, 9.9 billion gallons of reservoir impoundments, 20.6 miles of dual raw water transmission mains, a water filtration plant (WFP) with permitted capacity of 28.6 million gallons per day, 530 miles of potable water transmission and distribution mains, 30.5 million gallons of potable water storage facilities, 5 booster pump stations, 4 major pressure control valve stations, 3 independent well systems and consecutive systems (East Allen Township), 14,800 valves, 3,705 hydrants, and 37,104 customer service lines and meters. A full and detailed Description of Water Facilities, dated March 29, 2016, is presented in Appendix 7 of this report.

## Description of Facilities

Appendix 7 includes a brief description of the water system facilities which was written in 2016 and revised in April 2026. The City commissioned a Distribution System Comprehensive Planning Study (CPS) which was completed in December 2014 as part of the Long-Term Infrastructure Improvement Program (LTIIIP). The LTIIIP was approved by the Pennsylvania Public Utilities Commission (PUC) and was last amended in 2022. The LTIIIP was retired at the end of 2022. The City's CPS is complementary to the 10-Year Capital Plan and was last revised in February 2025.

In 2018, the City staff reviewed these prior long term infrastructure studies for the water system and developed a new 10-Year Capital Plan Spreadsheet; the latest, from April 2026, is provided in Appendix 10 and includes a list of the system improvement projects planned through 2034. This list of projects, forecasted implementation, and needed capital will act as a working document to be reviewed and updated annually.

## Water System Tour & Observations

The consulting engineer takes a tour of selected water system facilities each year for the purpose of providing general observations of the system and recommendations to the City for its capital and operating budget process. Colliers Engineering & Design toured the water system with the Authority and City Staff. This effort began October 28, 2025 at the Water Filtration Plant, Wild Creek Dam, Wild Creek Dam Intake Building, Penn Forest Dam, and Penn Forest Dam Intake Building.

On October 31, 2025 the tour proceeded to the 5th & William St Booster Station, the Mountaintop Booster Station, Southwest 2 MG High Service Reservoir, and the South Side Pump Station. The tour proceeded to the Pennsylvania Avenue Pressure Reducing Valve Station, Howertown Pressure Reducing Valve Station, East Allen Gardens Pump House, Wil-Mar Wellhouse, Country Squire Estates Well System, Shady Lane Well House, and the Airport Road Booster Pump House.

Appendix 9 includes photos and brief descriptions of the various facilities toured.

### **Water Filtration Plant**

The Water Filtration Plant (WFP) was put into operation in the fall of 1994. The treatment plant was originally sized for 42 million gallons per day (MGD). The current PADEP permit for the filter plant allows a maximum flow of 28.6 MGD. The water filtration plant currently treats an average maximum day of 20 MGD, and average daily of 15 MGD, and an average night-time rate of just less than 8 MGD.

We met with the water filtration plant Operations Supervisor on October 28, 2025. They reiterated that the plant is over 30 years old and is starting to show its age in some areas such as the roof and filter basement concrete beam spalling. Based upon mechanical equipment wear, they have recommended a program of sequential renovation throughout the WFP. CED corresponded via email on March 19, 2026 regarding the projects which have been completed on the WFP in 2025 and what projects are planned for 2026.

Projects recently completed in 2025 include the following:

1. Rehabilitation of the Electric Substation to address hotspots from IR report
2. Re-build of Entryway Arm Gates – new gate with ID card entry
3. Entry-gate for Barbed Wire Fence Automated with Cameras.

The water filtration plant supervisors have planned for the following 2026 projects:

1. Addition of Exterior Security Cameras (6)
2. Upgrade Lime Tanks from Fiber-glass tanks to Stainless Steel tanks
3. Replacement of Lower Roof on building

The City completed a Disinfection Alternatives Study to evaluate renovating the chlorine gas system and/or developing an alternative disinfection system. The City will be appropriating funds for the implementation of a sodium hypochlorite generation facility to provide safe, cost effective water disinfection. There has also been evidence of leaking (mineral deposits) from the sand filter beds into the rooms below which will need to be addressed. The caustic soda storage tank and room was renovated in 2023.

Overall, the filtration plant is well maintained, very clean, and in good repair. PADEP now requires the system operator (City) to hire a specialty independent firm to test all filter beds on three (3) year cycle (ten beds over three years). Three of the filter beds were inspected in 2025 and were found to be in good condition.

### **Water System Control Center**

The City operates a Water System Control Center in which the SCADA (supervisory control and data acquisition) data from throughout the water system is reported back to the control center. The water control system operator can monitor the levels in all storage tanks, conditions at PRV stations, et cetera. The operator can remotely turn on booster pumps to fill the water storage tanks as well. The City continues to implement improvements to the SCADA system as facilities are upgraded.

In 2018, the City completed an investigative study to improve SCADA communications. In 2019 as part of the conversion of 911 Service from the City to Northampton County, the City moved the Water System Control Center operations to a Water Filtration Plant in Lehigh Township, Northampton County. We believe further improvements to upgrade portions of the SCADA communications from radio frequency to cellular systems will be required for the implementation of improved security systems throughout the water system, particularly for the remote watershed facilities.

### **Watersheds**

The approximate 22,500 acres of land owned by the Authority in both Carbon and Monroe Counties are maintained by the City's staff at Wild Creek. The Authority and the City are actively working with local governments, conservation organizations, and the State to manage the watersheds in a sustainable manner with the primary goal of maintaining and possibly improving the high quality of the pristine drinking water supply. The City also has a Source Water Protection Plan through the auspices of the PADEP, as designed by the PA Rural Water Association, and has been approved by the DEP. An annual meeting is held to review and update this plan.

The Authority continues to actively manage the forest through a timbering plan meant to improve the quality of the timber in the watershed, thus improving the watershed and ultimately the quality of the water, while gaining modest revenues to support the program. The Authority and the Nature Conservancy completed a Forest Management Plan (FMP) in 2012 which was last updated in 2025 which allowed its watershed properties to be certified as sustainable by the Forest Stewardship Council, the preeminent certification standard in the world. This allows the carbon stored in the forests to be sold on the carbon exchange market.

The Wild Creek Dam and the Penn Forest Dam facilities are well-maintained and receive annual inspections by an outside consulting firm. These reports are submitted to PADEP. In 2021 the City completed and submitted a 10 Year Dam report to the Pennsylvania Division of Dam Safety under the guidance of a consulting engineer. This was a multi-year effort demonstrating the integrity of the Dams and their key features. All submitted objectives were accepted; however, the Wild Creek downstream outlet inspection was not completed due to low visibility at the base of the reservoir.

The Penn Forest Reservoir Dam was rebuilt in 1998 and is tributary to the Wild Creek Reservoir Dam, originally constructed in 1939. The Penn Forest Reservoir is released to maintain the Wild Creek Reservoir full. As such, both reservoir levels are monitored and used to predict drought conditions and are included as part of the City's monthly reports to the Authority. The Wild Creek Reservoir raw water intake screens are alternately cleaned annually. The Wild Creek Flow Meter Building includes two (2) 36-inch diameter venturi flow meters, and the building has the ability to be used for chemical pre-treatment if necessary. These facilities are clean and in good repair.

The Tunkhannock Creek diversion facility is utilized to supplement raw water to the Penn Forest Reservoir. The intake building is clean and in good repair. The stop-logs which protect the intake bar screens were replaced in 2025 but need to be repaired. The intake screens are cleaned semi-annually. The stream weir structure can become clogged with grasses and must be cleared as needed during the growing season and after storms.

The Tunkhannock Creek raw water transmission main includes 47,000 feet of 30-inch and 42-inch lines and a pressure reducing valve station. This station is located in a remote area. The PRVs appear to be operating properly, but they are dirty and in need of maintenance, specifically the Tunkhannock PRV station off of SR 115.

### **Raw Water Transmission**

The raw water transmission lines were initially installed in 1939 as part of the original Wild Creek Dam project and included a 30-inch and 36-inch diameter line to the City. This project also included two (2) rock bored tunnels at Wire Ridge and Blue Mountain. In the 1960s, a redundant parallel 42-inch line was constructed from Blue Mountain to the site of the current filtration plant. In 1997, a parallel redundant 42-inch line was constructed to convey water from Wire Ridge south portal to Blue Mountain north portal.

No parallel raw water transmission facilities exist should these tunnels become compromised by a natural or man-made event. In addition, these tunnels cannot be taken out of service for full inspection and/or maintenance.

We scheduled specific tours of the raw water transmission lines and the tunnel access points in April 2019 and January 2020 to inspect the interior of the tunnel upstream portal chambers, and a few valve chambers along the route to the water filtration plant. New technology may allow for the in-situ evaluation of the tunnels and raw water transmission lines without interruption of service. These technologies have been evaluated in terms of cost benefit verses focused improvements to the emergency interconnection facilities with adjacent water supply systems. The raw water transmission line tunnel portals and H-valve concrete chamber vaults have surface concrete degradation and have undergone repairs over the last year.

### **PRV Control Stations**

The water system has nineteen pressure reduction valve (PRV) stations throughout the system, of which many are no longer utilized. The Pennsylvania Avenue PRV Station was renovated in 2011, is in continual service, and is in good repair. The Howertown primary PRV was rebuilt in 2023 and the bypass PRV was rebuilt in 2024. The future projects include replacement of the Howertown flow meters and installation of an additional 16-inch PRV. The Race Street PRV station was relocated as part of road improvements. The Stefko & Pembroke PRV station is currently inactive; however, the below-grade large station was very dirty and in disrepair. We recommend that minor repairs and regular cleaning be implemented by the City for all PRV stations.

### **Booster Pumping Stations**

The Water System includes three large booster pumping stations to lift the gravity-fed finished water in the distribution system up South Mountain, and to balance pressures of the system in South Bethlehem and the Saucon Valley service area.

The 5<sup>th</sup> & William Street Booster Station renovation was completed in 2016, with two (2) new redundant 900 gpm pumps, flow meter, electrical service, motor control, emergency generator, and building renovations. This booster station is in good repair; however, the meter pit had standing water in it. We recommend that a permanent vault drain be installed to keep the meter pit dry. In 2025, the large adjacent tree was removed to avoid the leaves becoming caught in the emergency

generator enclosure and avoid possible damage to the pump station from the tree or limbs falling in a storm event.

The South Side Booster Pump Station was originally built in the 1950s. Full renovation and pump replacements were completed in 2018 with two (2) new redundant 1,000 gpm pumps, flow meter, electrical service, motor control, emergency generator, and building renovations. In 2023, new Cla-Val equipment was installed with hydraulic & electrical closure controls to dampen water hammer effects.

The Mountaintop Booster Pump Station (formerly Fire Pump Station) was built in 1959. A full renovation of the pump station was completed in August 2021 with two (2) new redundant 1,000 gpm pumps, flow meter, electrical service, motor control, emergency generator, and building renovations. This renovation also included discharge control valves with hydraulic & electrical closure controls to reduce water hammer pressure wave.

Two minor booster pump stations include the Frank's Corner PS (East Allen Township) and the Weil Street PS (Salisbury Township). Frank's Corner PS was built in 1997 and includes domestic pumps, fire pump, and emergency generator in a metal building. The Weil Street PS is a package steel below grade pump station with 25 gpm pumps built in 2015. Both stations are in good repair.

### **Finished Water Storage**

The Water System includes seven (7) finished water storage tanks throughout the distribution system. All tanks, but one, are located on South Mountain (see figures at end of this chapter). The 5.0 million gallon (MG) Northeast Standpipe (1991 steel) is located on the Northampton Community College campus in Bethlehem Township and has been recently refurbished. The City has been sequentially upgrading/repainting water tanks as part of their program to enter into contracts with a utility maintenance firm for three of the seven water storage tanks. The 5 MG Southeast Tank was added to this program in 2021 and was refurbished in 2022.

The 12 MG South Side Low Service Reservoir located behind St. Luke's Hospital was originally constructed in 1890 but has been refurbished over the years with a synthetic liner and cover. The adjacent 5.0 MG steel Southwest Low Service steel tank was built in 1993 and needs roof structure repairs/replacement and recoating of the entire tank as confirmed by inspection in 2018. The 100-year old 2.0 MG Southwest High Service Reservoir is a two-cell concrete structure is currently scheduled to be replaced in 2026/2027 with a 1 MG cylindrical concrete tank reservoir. The 5 MGD Southwest Low Service tank was taken out of service in 2023. We also recommend that the City accelerate the schedule for tank refurbishment through contracts with utility maintenance firms. The City intends to place the 5 MG Southwest Tank and the 1 MG Mountaintop Tank into the Long Term Maintenance Contract.

### **East Allen Township Well Stations**

The Authority acquired the assets of the former East Allen Township Municipal Authority in 2013, including four (4) separate well systems serving residential subdivisions: East Allen Gardens (1971), County Squire (1970), Wil-Mar (1969) and Shady Lane (1971). The systems include groundwater wells and well pumps for source water, chemical treatment and disinfection, below grade finished water storage, and booster pumps for distribution pressure. Each system can be supplied with trucked-in

potable water should the wells be temporarily affected by drought or mechanical failure. The City completed the Shady Lane replacement Well & Booster Station in 2018. The City received the Country Squire Well No. 3 Operating Permit from PADEP in October 2019. The East Allen Gardens Well House was converted to be a Booster Pump House in 2023, and the well was disconnected.

These independent water systems are in a minimal state of repair. The CPS recommends several long-range plans to expand the water distribution system northward in East Allen Township to integrate these water systems and eliminate the well sources. However, the pace of such progress will be driven by future development in East Allen Township.

The City completed installation of emergency generators at the Shady Lane, Country Squire Systems and Wil-Mar System in 2021. The pilot program for manganese treatment has been completed at the Shady Lane System and received a PADEP operating permit in 2017, and is currently in service. The City constructed the Mud Lane water main extension to the East Allen Gardens system in 2022 and the wells have been grouted and abandoned. The wells have not been in use since January 2023.

#### **Emergency Interconnections**

The Water System has seven (7) emergency interconnections with adjoining water systems. The CPS (pages 4-23) estimated the total theoretical capacity of all emergency interconnections as 5+ MGD. Many of these interconnections have never been utilized and/or tested. This issue is a significant concern since the average daily demand of all customers may be as great as 15 MGD.

### **Ongoing Initiatives**

#### **Forest Management**

The Authority conducts an annual timbering program following its Forest Management Plan (FMP). This timbering program generally brings between \$10,000 and \$100,000 a year in revenue, depending on the quality and quantity of the harvested timber. The Authority uses Highland Forestry Management as its forestry consultant (forester). The forester selects areas of the watershed that are suitable for sustainable timber harvesting and the Authority contracts with reputable timber contractors to harvest the selected timber stands.

In addition, the forester monitors spongy moth infestations and other invasive plants and insect species. The forester periodically recommends strategic spraying efforts to limit the negative impact of insect and invasive species to the forest health and future forest management activities.

#### **Wind Energy**

In 2013, the Authority authorized Atlantic Wind, LLC (AW) to install six temporary and one permanent wind measuring towers on its property in Penn Forest Township as part of a feasibility study to determine if a wind turbine farm could be developed for the purpose of producing electricity. All MET towers have been removed and the project appeared to be feasible. In 2022, AW terminated the License and Lease Agreement with the Authority due to on-going litigation involving Township Zoning denials. The Authority has assumed the rights to the project and continues to pursue the negative zoning decision appeals through the courts.



## GIS

The CED GIS services team recently completed the mapping of Bethlehem Authority owned Parcels. The Property Management Tracking Application can now be used to view and track the use of those parcels. The team plans to continue adding property information to the application in 2026.

The CED GIS services team is also working to train the City Public Works Department on GPS field data collection tools, equipment, and methods to correct the locations of previously mapped utility assets (including the water system assets).

The City is currently Testing VueWorks Asset Management Software and will consider whether to purchase the software for Utility GIS asset management.

## Risk and Resilience Assessment

The City completed a Risk and Resilience Assessment (RRA) in accordance with America's Water Infrastructure Act (AWIA) in 2020 and was last updated in May 2025 (will be completed every 5 years). This was followed by an update of the City's Emergency Response Plan incorporating the findings of the RRA. Both were completed in 2021. The purpose of the RRA is to evaluate vulnerabilities, risks, and consequence of failure of water system assets with respect to man-made, malevolent, and natural hazards. The RRA makes recommendations on security enhancements and actions to improve resilience of the system. Prior risk and vulnerability analyses, such as the 2003 US-EPA Vulnerability Assessment and a 2017 and 2020 Department of Homeland Security (DHS) Infrastructure Survey Security and Resilience Reports have been taken into consideration. A desktop emergency response exercise was held by the City water staff in September 2023. The Emergency Response Plan (ERP) is updated annually, and the emergency response desktop exercise is scheduled to be executed again in 2027.

A US EPA audit was conducted of the water system and the City's operations in February of 2025. The written report of the EPA audit has not yet been received by the City.

## Solar Power System

The Authority and the City continue to evaluate the feasibility of installing solar power generating equipment at the Water Filtration Plant as part of the City's sustainability initiatives. New technology may also allow for the potential use of floatable solar on the Wild Creek and Penn Forest reservoirs. The City and their Sustainability Consultant are currently negotiating a potential solar energy project adjacent to the WFP which is consistent with the City's Sustainability Initiative and Climate Action Plan.

## Emergency Interconnection Assessment and Improvements

The Authority commissioned an Emergency Water Supply Feasibility Study which was completed in October 2018. The hired consultant evaluated the interconnections and other alternatives to supplement emergency water. The executive summary recommended a condition assessment of the raw water transmission tunnels and further evaluation of improvements/replacements of the emergency interconnections with adjacent water systems. The preliminary capital requirements for these projects are significant.

In July of 2020, the Authority commissioned an Emergency Interconnection Evaluation Study which was completed on December 9, 2021 and accepted by the Authority in March 2022. The goal of the



study is to determine if the Authority's maximum day demand of up to 15 MGD could be reliably provided through existing and/or improved interconnections with the neighboring utilities of Lehigh County Authority (LCA), Easton Suburban Water Authority (ESWA), Northampton Borough Municipal Authority (NBMA), Upper Saucon Water & Sewer, Hellertown Borough Authority, Bath Borough Authority, and Salisbury Township. The latest design report estimates that all three proposed LCA interconnections could yield approximately 5.3 MGD of emergency water supply. This Study included flow and pressure testing of the Bethlehem Water System and the neighboring utilities systems. This information was used to calibrate Bethlehem's WaterGEMS water distribution system model. The Authority and City are meeting with the adjacent water systems to jointly implement the interconnection study recommendations and have agreed with LCA to budget for the design of interconnection upgrades in 2025. The design for three LCA interconnections have been completed and permits are currently being sought. Construction of the three LCA interconnections is expected to begin in 2027. ESWA has recently reached out to the City to resume discussions regarding their two proposed interconnections.

#### **Reduce Unaccounted-For Water**

The percent unaccounted-for water (water loss) in the water system has been significantly above industry standards since 2018. In 2023, the unaccounted-for-water decreased slightly. The City commissioned an Unaccounted-For Water Study by AECOM to evaluate previous efforts to address unaccounted-for-water and recommend program(s) to implement additional leak detection efforts to reduce the percentage of unaccounted-for throughout the water in the distribution system. A final draft of the report was issued April 28, 2023. The City has begun implementation of the recommendations provided in the Unaccounted-For Water Study. The 2025 unaccounted for water increased from previous years (see Table 3).

#### **System Wide Security Improvements**

The Authority requested a specific focus and assessment of the existing security measures in place throughout the water system. The Authority requested that we make specific recommendations for security improvements. Colliers Engineering & Design (CED) was aware that the Authority had previously invited US DHS to conduct security assessments. In 2020, CED invited DHS to conduct additional assessments as part of the Annual Tour. CED also retained our teaming partner, Instrumentation Controls & Energy Engineering, LLC (IC&EE) to take part in the Annual Tour and provide their security recommendations based on our joint experience with other water system clients.

On November 17, 2020, the DHS Agent met at the Authority's office to review the preliminary findings. The DHS Cybersecurity and Infrastructure Security Agency (CISA) utilizes a standardized model, the Security Assessment at First Entry (SAFE). *SAFE is designated to assess the current security posture and identify options for facility owners and operators to mitigate against relevant threats. It is not intended to be an in-depth security assessment.* The DHS model includes many questions which are used to score the facility's current commendable actions and practices, as well as vulnerabilities and options for consideration of improvement. A significant positive score item listed is the Bethlehem Authority Police and their patrol of the Watershed and the professional relationship to the City Police Department and other first responders throughout the distribution system.

As a follow-up to this security assessment, the Authority approved the Colliers Engineering & Design Confidential Water Systems Security Feasibility Study in September 2021. This Feasibility study was completed and presented to the Authority in Executive session and Accepted in March 2022. The City is working to implement the improvements recommended in the security assessment and feasibility study. In 2023, a fence and gate was installed at the Water Filtration Plant and at the entrance to the Watershed Campus on Pohopoco Drive. A motorized gate with key card access for the Water Filtration Plant was completed in January 2025. A motorized gate with key card access at Pohopoco Drive was installed in early 2026. The City plans for the installation of cameras at the WFP and additional fencing along the side boundaries of the property at Pohopoco Drive in 2026 and 2027. Card access at other water system facilities will be planned and budgeted for 2027 to 2029 completion.

# System Maintenance and Operations

## Maintenance

Maintenance of the water system is an ongoing activity of the City. Each facility has particular maintenance requirements unique to the type of facility. The following paragraphs discuss the maintenance activities conducted on the various types of water system facilities.

### Watersheds

Routine monitoring and maintenance activities associated with fire roads, dams, and other water system facilities were conducted by City staff. The Authority continued its Patrol Officer (PO) Program for the security of the watershed properties. The special police patrolling is done from an enforcement perspective. The PO continues to develop relationships with many local area residents, municipal officials, and conservation and sporting organizations, as well as other law enforcement agencies, to further the "eyes and ears" philosophy and learn what is occurring on the property. In addition to a full-time officer in charge, the Authority has four (4) part-time watershed police officers for weekends and evening hours. We recommend that the City and Authority watershed staff continue to work together to improve their communication regarding matters of watershed security. The Authority has also installed a number of cameras which have helped increase security in the watershed properties.

Security has been increased by the visible patrols around Authority lands at unpredictable times, not just during normal work hours. The Authority uses an unmanned aerial vehicle (UAV) with a high-resolution camera at the beginning of 2017, to assist in security patrolling and supplement efforts of implementing graphical information system (GIS) technology for watershed mapping and monitoring forestry issues such as spongy moth infestation.

### Dams and Intakes

The Wild Creek and Penn Forest reservoir dams are routinely monitored including the Penn Forest interior dam access tunnel. Each dam receives an annual inspection by a geotechnical engineer as part of the PADEP requirements. The Wild Creek Reservoir raw water intake structure has two (2) complete sets of intake screens which are alternately cleaned, one set each year, with the change-over of each raw water transmission lines to the water treatment plant.

### Transmission

Routine maintenance of the transmission system mains, appurtenances, and rights-of-way is ongoing. Pressure monitoring has been completed, and the past studies indicated that there does not appear to be any significant capacity deficiencies in the lines.

New technology may allow in situ inspection of the rock bore tunnels and large diameter water transmission lines without taking them out of service. We recommend the City explore this type of investigation for these critical assets of the water system. The large transmission valves on the north side of Blue Mountain are exercised regularly to alternate the raw water flow in the redundant lines. The valves south of Blue Mountain are exercised yearly between 50% & 75% of fully closed. Only the two valves at the Blue Mountain southern portal are not exercised because the deep portal is flooded.

### **Treatment**

The City maintains the Water Filtration Plant in accordance with documented procedures appropriate for the processes, equipment, and structures involved. The Maintenance Supervisor provided a description of the ongoing maintenance at the plant. A third party, Water Service Professionals, is on-site annually to do thorough testing on filter media. Each filter must be tested every three years. As such, three or four filters are tested each year. The City received a 2025 Area Wide Optimization Program (AWOP) Award at the 2026 Water Works Operators' Association of Pennsylvania (WWOAP) Conference. The Water Filtration Plant also received "an overall Commendable performance rating for its ability to remove and inactivate waterborne pathogens through optimized filter plant performance" from PADEP in its November 2023 Filter Plan Performance Evaluation.

### **Storage**

The City has been sequentially upgrading/repainting water tanks as part of their program to enter into contracts with utility maintenance firms. Three of the seven tanks have been completed. During our tour, the maintenance and operations of the storage facilities appear to be satisfactory (except for the 2 MG Concrete Tank and the roof of the 5 MG Southwest Tank). The City added the 5 MG Southeast Tank (William Street) to the program in 2021 and full refurbishing was completed in 2022. Design/Replacement of the 2 MG with a 1 MG tank is scheduled for 2026/2027.

### **Distribution**

Maintenance of the distribution system included hydrant flushing, painting/repair, valve exercising, and the ongoing meter replacement program. The City has initiated an improved hydrant maintenance program and tracking system through the use of state-of-the-art software and field equipment and has assigned an individual to oversee this activity. The target maintenance schedule is as follows: one fifth (1/5) of the distribution system valves are exercised each year; fire hydrants receive maintenance in a three (3) year cycle; fire hydrants are flushed in a two (2) year cycle. The City also maintains the various pressure regulating and water pumping facilities in accordance with established procedures and waterworks practices.

The City purchased equipment to do in-house leak detection and has an active leak detection program that is performed year-round. This program has helped to reduce the City's unaccounted-for water. The City purchased a twin turner valve maintenance trailer, including computer and mapping software that is synchronized with the City's GIS software, to be utilized in a system-wide valve maintenance and exercising program. Distribution pipe breaks are tracked based on location and frequency. This data is one criterion for scheduling water line replacements.

The Accelerated Meter Replacement program has provided more accurate billing for customers and has increased revenues for the City. The strategy targets the largest water consuming customers and largest sized metered customers first. The program has increased the investment in the numbers of meters replaced each year working from the larger to smaller meters:

<u>Year</u>	<u>Meters Replaced</u>
2015	1,074
2016	1,416
2017	1,192
2018	1,235
2019	1,380
2020	955
2021	1,077
2022	1,559
2023	4,145
2024	4,408
2025	4,092
Total	22,533

The 22,533 meters replaced in the past decade represents 60.50% of the total 37,243 customer meters. The City has also implemented Advance Metering Infrastructure (AMI) for remote meter reading. There are now a total of four (4) AMI towers in service. Currently 22,698 water meters can be read remotely through the tower signal reception. The AMI implementation allows for real-time data for more accurate data and faster response to abnormal water use or loss.

The Maintenance Score Card is used to track and report the efforts of the City's distribution system maintenance department. For the 2025 calendar year we received the following scorecard data from the City which represents some decrease in maintenance (hydrant flushing) due to staffing issues:

Water Main Breaks	62
Water Service Lateral Leaks/Replacements	79
Hydrants maintained/valves exercised	4,193
Main Line Valves Exercised	1,025
Distribution System Flushing (Hydrants Flushed)	420
Leak Detection (Miles Surveyed)	430

Because reducing the unaccounted-for water is a priority, the City commissioned an Unaccounted-For Water Study by AECOM to review of the City's past efforts to address unaccounted-for-water and recommend program(s) to further evaluate, implement additional leak detection efforts, and reduce the percentage of unaccounted-for throughout the water in the distribution system. A final draft of the report was issued in April 2023. We recommend that the leak detection and the effort to resolve unaccounted-for water be continued in 2026.

The 2018 Amended Long-Term Infrastructure Improvement Program (LTIP) documented that 40% of the 534 miles of waterlines, 43% of the valves, and 38% of the fire hydrants were installed before 1960. Some water lines and valves were installed before 1920. We are also aware that the largest water transmission lines from the Wild Creek Reservoir and the two single bore rock tunnels were installed between 1939 and 1940. As such, we recommend that the Authority and City work towards increasing capital investment in replacement of the oldest and most critical assets of the water system.

The City received a \$2.875 Million PennVest Grant for lead service line replacements. Since 2022, approximately 413 lead service lines to residential properties were replaced. The City plans to apply for more lead service line replacement funding in the future. EPA/PADEP Lead and Copper Rule currently requires the creation of a baseline lead service line inventory by November 2027. This DEP submission will include a 10-year plan submission to PADEP for further lead service line mitigation.

### Master Planning

In 2018, the City Staff first created the 10-Year Capital Plan. The 10-Year Capital Plan is to be a working document to be reviewed and updated annually. The 10-Year Capital Plan which was last updated in April 2026 is included in Appendix 10.

## Customers Served/Service Area

At the end of 2025, the City provided water service to 37,243 domestic, commercial, industrial, institutional, and other customers in the following municipalities:

City of Bethlehem	Hanover Township (Lehigh County)
Bethlehem Township	Hanover Township (Northampton County)
Freemansburg Borough	Salisbury Township
Fountain Hill Borough	Lower Nazareth Township
East Allen Township	Lower Saucon Township
Allen Township	Upper Saucon Township

The number of customers in each customer class and the changes over the last six years are shown in Appendix 5. The total population served is approximately 121,114 (includes all systems, extrapolated from Lehigh Valley Planning Commission 2020 year-end data, an increase of 0.4%).

The City staff is very quick to respond to any interruption of service. We are not aware of above average customer complaints and/or PUC action notices in terms of customer service. Bethlehem water is generally regarded as the best-tasting water regionally.

## Water Production/Consumption

In the 2025 calendar year, 5.346 billion gallons of water, or an average of 14.65 MGD, was delivered to the Water Treatment Plant from Wild Creek. Other minor water sources include: East Allen Well Systems, including Bath Borough Authority through the Route 512 interconnections, which delivered 0.080610 billion gallons of water, or an average of 0.221 MGD. Total metered consumption by customers and other accounted for usage totaled 3.570 billion gallons, or an average of 9.781 MGD. A summary of Water Consumption by Municipality and Customer Category is shown in Tables 2 and 3, respectively.

The Percent Unaccounted Water listed in Table 3 below decreased from 30% in 2020 to 23% in 2024 but has increased in 2025 to about 28%. The Delaware River Basin Commission (DRBC) and the PA Public Utilities Commission (PUC) have issued a policy statement that: "Levels of unaccounted-for-water should be kept to within reasonable amounts. Levels above 20% have been considered by the PUC to be excessive." Unaccounted Water continues to be an issue.

The City started using the PUC Method for calculation in addition to the AWWA Method. DEP/DRBC and PUC methods use different data inputs to calculate the water balance, so there are two different calculated unaccounted-for-water values generated each year. As part of the 2020 PUC rate case, the City is committed to addressing the unaccounted water issue. A system-wide unaccounted-for water study was conducted in 2022. The final study report was last revised April 28, 2023. The City has reviewed the recommendations provided in the Unaccounted-For Water Study and is implementing the recommended leak detection efforts. The prior decreasing trend of percent unaccounted water from 2020 to 2024 has reversed, the 28% for 2025 is an increase from the prior three years.

## Staffing

The Water Fund budget for 2026 includes 69 full-time positions, not including one (1) contract Water Engineer. Salaries for 44 positions are split 50/50 with the sewer fund; salaries for the remaining 25 positions are paid 100% by the water fund. Positions for which salaries are split 50/50 with the sewer fund include those in the following bureaus: Administration, Quality, Utility Billing, Utility Maintenance, and Meter Shop; staff in these bureaus perform duties related to both water and sewer system operations. The water fund also pays partial salaries for three (3) IT positions and twelve (12) service center positions in the General Fund. Appendix 6 provides a breakdown of manpower in each division.

## Insurance

The City maintains an insurance policy to protect the water system against loss or damage by fire or other casualty, and against public liability. A list of the facilities insured by the City is shown in Appendix 8 for informational purposes. The City has reviewed and updated this list to include new facilities and exclude any abandoned facilities. The revised list of assets was included in the January 8, 2026 Authority Engineer Certification of Insurance.

## Asset Management

The City developed and refined over many decades its Hardy-Cross hydraulic pipe network model for analyzing the existing water distribution system, future expansions, and efficiency improvements to the system. The City has also implemented graphic information system (GIS) mapping for much of the water distribution system. The Authority has implemented GIS mapping for much of the watershed lands. The City and the Authority are working to expand the GIS system to connect the distribution system with the transmission system and with the watershed lands.

True asset management is an exercise in determining the remaining life and value of an asset and/or the energy use of an asset. The Business Risk Exposure (BRE) is a method of calculating (scoring) the nature and level of exposure that a utility is likely to confront through the potential failure of a specific asset. Probability of Failure (PoF) involves assessments of mortality, financial inefficiency, and deficient capacity. Ratings of 5 to 1 are scored for each asset as: imminent to improbable. Consequence of Failure (CoF) involves assessment of severity of loss a system would incur as a result of failure of an asset (public health, safety, environmental impacts, cost of repair, litigation exposure, etc.). Ratings of 5 to 1 are scored for each asset as: catastrophic to insignificant disruption.

This asset management analysis provides a process to determine which assets are critical in terms of both probability and consequence of failure. It is these assets which need the most attention for maintenance and capital funding. After the needs are clearly identified, the Long-Term Funding Strategy can be implemented. We recommend that the Authority and City pursue implementing a full asset management strategy over the next several years to better maintain a sustainable water system.



**TABLE 2**  
**Revised 3/2026**  
**Average Daily Water Consumption (Gallons/Day GPD)**

Municipality	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
City of Bethlehem	6,172,900	6,441,201	6,458,623	6,432,657	6,075,211	6,012,081	6,019,856	6,264,504	6,076,294	6,000,639	6,039,973
Bethlehem Twp	952,900	961,400	939,638	937,726	898,952	888,101	893,852	901,749	896,434	903,996	903,391
Hanover Twp (Northampton)	978,400	1,003,901	996,105	1,006,332	984,353	1,023,709	1,012,394	1,062,780	1,077,915	1,098,908	976,221
Hanover Twp (Lehigh)	302,300	324,400	325,094	350,660	334,158	293,274	341,016	393,665	377,743	354,843	348,653
Fountain Hill Borough	394,200	425,400	412,851	413,219	392,009	374,007	370,236	364,523	369,668	377,002	395,205
Freemansburg Borough	157,300	137,500	187,873	154,571	121,637	153,119	121,292	150,340	150,166	148,007	152,269
Salisbury Twp (& Alex Court)	86,500	86,600	92,924	88,956	89,022	79,092	74,613	72,083	72,209	71,980	71,090
Upper Saucon Twp	115,400	121,600	102,439	107,563	109,745	136,893	107,977	107,513	105,047	117,190	128,129
East Allen Twp <sup>1</sup>	110,900	214,000	202,257	204,820	201,165	211,269	223,552	249,188	137,254	262,843	236,913
Lower Saucon Twp	416,000	421,800	407,722	421,624	371,463	393,931	409,078	399,175	383,806	368,646	360,114
Allen Twp	13,200	13,200	19,327	19,944	18,796	21,319	21,965	23,691	26,344	34,417	26,973
Lower Nazareth Twp	-	1,200	4,170	5,439	6,463	7,703	8,400	7,706	6,318	5,688	6,323
<b>Total Consumption</b>	<b>9,700,000</b>	<b>10,152,400</b>	<b>10,149,023</b>	<b>10,143,511</b>	<b>9,602,974</b>	<b>9,594,498</b>	<b>9,604,231</b>	<b>9,996,917</b>	<b>9,679,198</b>	<b>9,804,159</b>	<b>9,645,254</b>

1) Includes Well Systems and RT512 Consecutive System

**TABLE 3**  
**Revised 3/2026**  
**HISTORICAL SUMMARY OF WATER CONSUMPTION**  
**BY CUSTOMER CLASSIFICATION AND DEMAND**  
**Bethlehem Water System**  
**Average Daily Water Consumption/Demand (mgd)**

Customer Classification	2015	2016*	2017**	2018	2019***	2020	2021	2022	2023	2024	2025
Domestic	5.64	5.61	5.69	5.52	5.37	5.59	5.443	5.662	5.289	5.454	5.42
Commercial	1.69	1.79	1.78	1.93	1.75	1.71	1.834	1.993	2.096	2.107	2.03
Industrial	0.99	1.32	1.29	1.30	1.22	1.14	1.2257	1.278	1.201	1.150	1.087
Institutional	0.69	0.77	0.77	0.78	0.69	0.55	0.553	0.588	0.609	0.621	0.652
Public	0.14	0.13	0.13	0.09	0.13	0.11	0.215	0.146	0.134	0.104	0.146
Bulk Sales	0.54	0.53	0.50	0.52	0.45	0.50	0.479	0.469	0.457	0.442	0.449
Other	1.62	1.49	1.40	1.38	1.33	1.54	0.933	0.961	0.962	0.789	0.915
Accounted for Usage	11.31	11.64	11.54	11.53	10.93	11.14	10.681	11.097	10.748	10.667	10.702
Total Inflow to Plant	14.36										
Source of Supply		14.26	13.68	14.67	14.83	15.83	15.124	15.081	14.1	13.825	14.88
Unaccounted-for Water	3.05	2.62	2.13	3.14	3.90	4.70	4.443	3.984	3.352	3.158	4.18
Percent Unaccounted (%)	21.2%	18.4%	15.6%	21.4%	26.3%	29.7%	29.40%	26.4%	23.8%	22.8%	28.1%

\*Starting in 2016 "Total Inflow to Plant" will be "Sources of Supply" from Main Bethlehem System, well systems and Rt. 512 Consecutive System.

\*\*Starting in 2017 "Total Inflow to Plant" will be "Sources of Supply from Main Bethlehem System, well systems, Rt. 512 Consecutive System and water purchased from ESWA through Hecktown Rd Interconnection.

\*\*Starting in 2017 "Unaccounted for Water" is now termed "Water Loss" and "Percent Unaccounted for Water" is now termed "% Water Loss."

\*\*\*The City's bulk meters have been calibrated. The City began investigating the increase of unaccounted water in 2019.

# Recommendations

As a result of the reviews made during preparation of this Annual Report, we offer the following recommendations for consideration by the Authority and the City:

## High Priority Recommendations (Security & Regulatory Compliance)

1. **Security Improvements:** The United States Department of Homeland Security (DHS) assisted Colliers Engineering & Design and our subconsultant in touring specific and strategic water system facilities to assess the current security systems and make recommendations for security system improvements throughout the Bethlehem Water System. The DHS documents and our security recommendations are considered confidential and have been previously provided under separate cover. As a follow-up to this security assessment, the Authority approved the Colliers Engineering & Design (CED) Confidential Water Systems Security Feasibility Study in 2021. This Feasibility study was completed, presented to the Authority in Executive session, and accepted in 2022. Several of the initial security improvements projects have been completed through 2025, such as the fencing around the Water Filtration Plant with motorized gate, and fencing across the frontage of the watershed campus along Pohopoco Drive. 2026 security improvements include motorized entrance gate at the watershed (completed January 2026), additional fencing along the sides of the watershed property from Pohopoco Drive. Future improvements include planning in 2026 and implementation beginning in 2027 for security cameras and key card employee access for all water system facilities. We also recommend that a specific Cybersecurity Assessment evaluation of the City's current IT systems be commissioned, but this requires funding in the City Administrative Budget. CED recommends that the security improvements recommendations be implemented by the City as part of 10-year Capital Planning. The April 2026 10-Year Capital Plan includes funding for security enhancement design and implementation through 2029.
2. **Reduce Unaccounted for Water & Meter Replacement:** The percent unaccounted-for-water had increased above industry standards, as reported in years 2018-2021. Between 2022 and 2024 the unaccounted-for-water decreased, however it has increased in 2025 to 28%. CED recommends that the City increase their efforts to investigate meter accuracy, ramp up leak detection efforts, and track unaccounted for water on a quarterly basis. The City has been implementing the recommendations provided in the Unaccounted-For Water Study which was completed in April 2023. The City has deployed active leak detection monitoring devices throughout the system. Better accounting and monitoring, as well as improved metering has reversed the trend of the annual unaccounted for water data. The City has begun an aggressive program of customer water meter replacement starting with the larger commercial and industrial high-water users as mandated by the Public Utility Commission. In 2023, the City also began a 6-year program to replace 4,000 meters per year at \$2M annually. By 2028 approximately 26,000 of the 37,000 customer meters will be replaced. The meter replacement program improves accuracy, reduces unaccounted for

water, and improves water revenue. CED recommends that this program continue each year for the replacement of all water customer meters throughout the system. The 10-Year Water Capital Plan includes significant funding toward this goal through 2028. Future funding will be required beyond 2028. The City is looking to investigate large meter accuracy and flow calibration at Wild Creek and WFP.

3. **2 MG Southwest Reservoir Replacement:** CED has previously recommended that the City replace the 2 MG concrete Southwest High Service Reservoir as soon as possible and accelerate the refurbishment and maintenance contract for the remaining finished water storage tanks. In 2025, the City has completed the design and permitting for the replacement of the 2 MG SW Reservoir with a 1 MG cylindrical concrete tank. Bidding and construction of this project is planned for 2026/2027. CED recommends that the remaining water storage tanks be added to the asset management maintenance contract.
4. **Service Line & Lead Service Line Replacement:** Due to the issuance of the USEPA Copper Rule Revision (LCRR) and Improvements (LCRI) and supporting PADEP and PUC regulations, the City must update the service line inventory, develop a lead service line identification and replacement plan. The Service Line Inventory must be submitted to PADEP by November 2027, validate the accuracy of methods used to identify non-lead service lines by 2034, and develop a plan to replace all lead service lines and galvanized steel service lines by 2037. The City has completed a \$2.875M PennVest Grant project to replace lead service lines, which replaced 413 lead service lines between 2022 and 2025. CED recommends that the City and Authority work to revise the 10-year Capital Plan to provide the additional funding required to meet these regulated deadlines. The City has hired a consultant to assist with Service Line Inventory and Lead Service Line Replacement program.

### Intermediate Priority Recommendations (Water Asset Resiliency)

5. **GIS Water System Model & Asset Management:** CED recommends the Authority and City work toward completion of their combined GIS model for the entire water system and watershed assets. The City has retained a GIS consultant to upgrade the GIS platform for all underground utilities. We recommend that the Authority expand on this effort to connect the City's GIS water distribution model to the transmission lines up to and including the watershed. CED recommends the City implement full Asset Management based upon the EPA guidelines. This process will vet the most critical assets for a targeted long-range capital improvement plan.
6. **Emergency Water Supply & Interconnections:** The Authority commissioned the Emergency Water Supply Feasibility Study which was completed in October 2018. The shortfall of working emergency sources is a significant concern. In 2020, the Authority commissioned an Emergency Interconnection Evaluation Study which was accepted by the Bethlehem Authority Board in 2022. The Authority and City have been meeting with the adjacent water systems to jointly implement the interconnection study recommendations.

The City has engaged a consultant to design the first phases of the inter-connection plan. The April 2026 10 Year Water Capital Plan includes funding for design improvements to emergency interconnections are planned for 2026-2031. CED recommends that the Authority and City work together on a plan to increase the funding to implement the emergency interconnection program.

7. **Water Distribution Line Replacement:** The City continues its replacement program of water distribution lines throughout the system. In a system with facilities well over 100 years old, it is important that a systematic, annual replacement program be implemented. The City has improved its extensive leak survey and system analysis to determine areas of water mains that are most susceptible to leaks. There were 2,000 feet of water main replaced in 2025 and 1,000 feet of HDPE insert installed to renew sections under Route 378 and under the Freemansburg Bridge in 2025. The City's 2026 Water Capital Budget includes \$1.5 million for distribution system upgrades and repairs. Within the American Society of Civil Engineer (ASCE) *2021 Report Card for America's Infrastructure*, "water utilities, on average, were replacing waterlines at a rate of 0.5 percent per year". The American Water Works Association (AWWA) Policy Statement on Asset Management dated June 2013, last revised April 2019 recommends that an Asset Management Program be implemented by water utilities for the decision process of water system annual maintenance and replacement. The PA-AWWA staff confirmed that prior AWWA guidance documents recommended a target water system replacement goal of 1.0 percent per year. CED recommends the City increase funding for water main replacement each year to work towards 1.0 percent goal. In 2026, it is estimated that 1.0 percent replacement of the City's 500 mile water system (5 miles per year) would require an investment of approximately \$7.5M to \$10M in the annual capital budget. CED recommends future funding to accelerate water main replacement.

## Long Term Annual Recommendations (Recurring Indefinitely)

8. **Water Filtration Plant Improvements:** CED recommends the City continue to improve/replace critical equipment at the water filtration plant. The Water Filtration Plant Staff are aggressively replacing critical equipment for the now 32-year old system. Water Filtration Plant capital upgrades are budgeted on an annual basis. CED recommends that the City continue towards the planned chlorination system replacement with safer modern disinfection systems. The replacement chlorination system is currently planned for design in 2031 and construction in 2032.
9. **Long Term Capital Funding:** The Authority and City have worked with their respective financial planning consultants to create the 10-Year Water Capital Plan and Capital Improvement Program Funding Plan. CED recommends that the Authority and City continue their efforts to monitor the current Funding Plan and its implementation to best balance capital project funding and debt management; and to allow additional new capital funding of City water system improvement projects. Future refinancing is targeted for 2028, prior to the 1998 Bond debt service retiring in 2028.

10. **Risk & Resilience:** In March of 2020, the City completed a Risk and Resilience Assessment (RRA) in accordance with America's Water Infrastructure Act (AWIA) of 2018. This desktop assessment is required to be updated every 5 years and was updated in May 2025. CED recommends that the City continue efforts to reduce vulnerability of the Bethlehem Water System.
11. **Water Transmission Tunnels:** CED recommends that the Authority and City continue to explore the new technologies for in-situ inspection of the water transmission lines and rock bore tunnels constructed as early as 1939. In-situ inspection of the water transmission piping and robotic camera analysis of the two tunnels is possible. However, this work is expensive, and the tunnel access will require upfront capital investment.
12. **Watershed Maintenance:** CED recommends the City Staff improve their regular maintenance and repair of all facilities in the watershed system, specifically: access roads and fire lanes need to be better maintained for use by the Authority Special Police, and other authorized personnel. The raw water transmission line tunnel portals and H-valve concrete chamber vaults need repair and maintenance.
13. **Distribution System Maintenance:** The City has implemented a program to systematically exercise valves throughout the entire water system every five years and annually exercise fire hydrants through flushing as part of the maintenance program. CED recommends that this program continue to ensure proper operation of the distribution system, the detections of problems, and to avoid fire protection limitations.
14. **Watershed Management & Alternative Energy Opportunities:** CED recommends that the Authority continue its efforts to maximize the potential of all of its assets through the Watershed Management Program. The Authority continues its annual sale of green energy credits, strategic sale of timber program and the development of alternative energy. CED recommends that the Authority and the City consider opportunities related to alternative energy sources for and on its facilities including wind energy, hydro power, and solar power.



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