

Consulting Engineer's Report

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

(2020 Operations)
(2021 Adopted Budget)

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Prepared for:

Bethlehem Authority
Bethlehem, Pennsylvania
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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 Bethlehem Authority including listing of current Board Members, Staff, and monthly meeting minutes may be found at the Authority website: www.bethlehemauthority.org. The Authority website includes a History of the Water System, which was founded in 1938 as Pennsylvania's first municipal authority; 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.

Colliers Engineering & Design, Inc. (DBA Maser Consulting) 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 year.

Through this 2020 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; and
- Other specific water system matters requested by the Authority or the City. With the assistance of the United States Department of Homeland Security (DHS), this year's report effort has a specific focus on system wide 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 2021 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 then-proposed City of Bethlehem 2021 Operating & Capital Budget with the Authority and City staff, which resulted in the issuance of the Fiscal Certification and Insurance Certification for 2021, both dated January 27, 2021. We corresponded with the City staff in March 2021 and reviewed the draft report in early May 2021. We reviewed the 2020 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 Bethlehem Authority and the City of Bethlehem Water Fund during the prior fiscal year 2020 and the current 2021 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 and the Authority's administrative expenses. The Authority's income also includes timbering revenues, sale of carbon credits, and interest on investments and other property rentals and leases. The Authority has entered into agreements with Atlantic Wind, LLC, which may result in future revenue through the development of a wind turbine energy generation project on two ridgelines within the watershed property located in Penn Forest Township, Carbon County. The Authority will also gain future revenue from the sale of carbon credits and could gain revenue through a Pipeline Right-of-Way License Agreement with PennEast Company if the pipeline is constructed.

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 2014 Authority Bond Refinancing and improved financial operations by the City have resulted in additional funds being available for capital projects. The Authority works closely with the City and bond counsels to plan for 10-year capital financing and the retirement of old debt.

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. Previously, PUC approved City rate increase was 4.7%, which went into effect on July 10, 2014. The City completed work on a year-long water consumption Demand Study in 2019 and final data is being tabulated. The City filed with PUC on July 31, 2020, for a new rate increase which was approved by the PUC on April 15, 2021. The average rate class increase approved is 8.4%.

Authority Finances

The Authority's administrative operating budget for 2021, and a small Authority Capital Budget, 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 has been revised beginning in 2019 for reporting on an all Cash basis. Previous years the revenue was reported on an accrual basis and expenditures on a cash basis. This table shows that income (revenues minus expenses) from 2019 operations ended with a net loss of (\$573,000). The estimated 2020 operations ended with a net gain of \$1,470,153.92, see footnotes. The revenues and expenditures for FY 2016 through 2021 City financial reports are summarized in Appendix 4.

Table 1
Water Fund Revenues and Expenses

2019 Operating Fund

	BUDGET	YEAR-END RECEIPTS AND DISBURSEMENTS
REVENUES	\$21,300,000	\$21,573,000
EXPENDITURES	\$23,300,000	\$22,146,000
NET (REV – EXP)	(\$2,000,000)	\$573,000
2019 YEAR-END CASH BALANCE		\$4,186,490

2020 Operating Fund

	BUDGET	YEAR-END RECEIPTS AND DISBURSEMENTS
REVENUES	\$21,075,000	\$21,201,1156
EXPENDITURES	\$21,075,000	\$19,730,962
NET (REV – EXP)	\$0	\$1,470,154
2020 YEAR-END CASH BALANCE		\$5,253,637

2020 Water Capital Fund

	2020 BUDGET	YEAR-END RECEIPTS AND DISBURSEMENTS
2020 BEGINNING OF CASH BALANCE		\$1,290,978
REVENUES	\$4,385,805	\$1,148,703
EXPENDITURES	\$4,385,805	\$1,996,489
NET (REV – EXP)	\$0	(\$-847,787)
2020 YEAR-END CASH BALANCE		\$473,192

- (a) Numbers rounded to the nearest thousand
- (b) Year-end receipts and disbursements on cash basis
- (c) 2019 Year-end capital numbers exclude \$1.7M available from BRIF which is not drawn down.

Appendix 3 includes a 2021 Water Capital Budget of \$4,999,499, which lists the capital projects approved to be funded in whole or in part during 2021 (see page titled “2021 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 2021 Water Capital Budget should be implemented in 2021 and beyond to maintain the integrity of the system, improve operating efficiencies and/or meet regulatory requirements.

The 2020 Water Capital Budget is financed in large part by approximately 2019 Year-end \$1.7 million from the Authority's Bond Redemption and Improvement Fund (BRIF) and approximately \$1.3 million from a capital appropriation from the City's operating fund.

In 2020, the City's Operating Fund revenues were more than expenditures by 7.1%, while Water Capital Fund expenditures exceeded revenues by 42.5%. However, the cash balance of each fund at year's end combines for \$5,726,829, some of which can be used for 2021 capital projects. The City maintains a minimum unassigned cash balance in each fund.

The Authority has been working with the City to plan for future financing. The goal is to better match debt periods to asset life and provide additional annual capital funds without increasing current annual debt service payment amounts. This would allow the City to better implement the 10-year Capital Plan and more aggressively replace/upgrade critical infrastructure and linear assets.

Working with the Financial Planning Advisors' of both the Authority and the City, the City and Authority worked through four iterative refinancing scenarios. The final selected strategy is presented in the 10-Year Water Capital Plan and Capital Financing Plan dated last revised October 2019 (included in Appendix 11). Due to the 1994 debt refinancing to fund the Penn Forest Dam reconstruction project the annual debt service currently dominates expenditures and limits available capital for infrastructure improvements and/or replacement projects.

The goals of the new 10-Year Capital Plan are to: emphasize pay-as-you-go funding versus additional borrowing; minimize debt financing cost; minimize increases in debt service payments; balance investment needs throughout entire system; and level annual capital budgets. Working with the respective Financial Advisors, the City and Authority created a 10-year Capital Plan with a schedule to ride out the next few years without new borrowing until approximately the 2022-2024 time period.

Physical Plant Conditions

General

The Bethlehem water system comprises many different components, including 23,000 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, 4 independent well systems and consecutive systems (East Allen Township), 14,800 valves, 3,676 hydrants, and 36,589 customer service lines and meters. A full and detailed Description of Water Facilities, dated 3/29/2016, is presented in Appendix 7 of this report.

Description of Facilities

There have been no significant new additions and/or expansions to the water system in 2020. The City commissioned a Distribution System Comprehensive Planning Study which was completed in December 2014 as part of the Long-Term Infrastructure Improvement Program (LTIIP) which was approved by the Pennsylvania Public Utilities Commission (PUC). The Comprehensive Planning Study is referenced as Appendix 10 and includes a list of twenty-two (22) system improvement projects (Appendix 10-Table E-1 is presented at the end of this chapter). Projects 1, 4, 6, 8, 11, 12, 13, 16, 20 and 21 have been completed. Projects 5, 10, 14, 15, 18 and 19 are in design or on-going.

The City commissioned the Amended Long-Term Infrastructure Improvement Plan (LTIIP), which was completed in March 2016 and updated in April 2018; this is referenced as Appendix 12. The LTIIP includes additional system description and data. Table 1-1 lists the raw water system components such as reservoirs, intakes, tunnels, and transmission lines, including size, length, and year built. Tables 1-2 through 1-10 list distribution lines, valve, hydrants exact listing by size, age range, and percent of total. Chapter 2 of this report discusses schedules for planned repair and replacement. Table 2-1 provides a main break history outside the city limits. Chapter 5 discusses the annual expenditures for the water system serving areas outside the City. The City has and continues to increase its investment in the Bethlehem Water System as depicted in Figure 5-1 (presented at the end of this chapter).

The 2014 Comprehensive Plan and the 2018 Amended LTIIP are excellent tools developed by the City for long range planning of capital investment. In 2018, the City staff reviewed these prior studies and developed a new 10-Year Capital Plan Spreadsheet; the latest, from October 2019, is provided in Appendix 11. This list of projects, forecasted implementation, and needed capital will act more 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 22, 2020 at the Water Filtration Plant. The tour proceeded that day to visit facilities specifically not scheduled to be toured later with the DHS agent. This tour included visits to East Allen Township well systems, Airport Road Booster Station, the 5 MG Northeast Standpipe at Northampton Community College, Bethlehem Township interconnection study hydrant flow testing, the 5th & Williams Booster Pump Station, the Mountaintop Booster Station & 1 MG Southeast High Tank, and the small Weil St. Booster Station.

On November 9, 2020, a second tour was scheduled with DHS and our security systems subconsultant and included key representative facilities of the entire Bethlehem Water Systems. DHS had previously toured the Water Filtration Plant with the City in 2017 and provided a confidential report at that time. This tour began at the Wild Creek Watershed facilities at Pohopoco Drive in Carbon County. We observed the Bethlehem Authority property frontage, the Wild Creek Pretreatment Building, the Watershed Office for the Authority Special Police, the maintenance garages, the Wild Creek Reservoir, Intake Building and Wild Creek Dam inspection tunnel access entrance.

The tour proceeded to the Penn Forest Reservoir, Intake Building, and Penn Forest Dam inspection tunnel access entrance. We observed the dam inspection tunnel ventilation system, emergency generator and aeration spray fountain. The tour proceeded to the East Allen Gardens Wellhouse and a representative example of the four (4) well systems. We toured the Howertown Pressure Reducing Station (similar to the Pennsylvania PRV Station). We toured the 12 MGSouthwest Low Reservoir, 5MG Southwest Tank, and Southside Booster Station in Fountain Hill Borough which is representative of the other southside facilities. We concluded the tour at the South Mountain Park 0.5 MG Tank and the City Communications Tower. Appendix 9 includes photos and brief descriptions of the various facilities toured.

Water Filtration Plant

The Water Filtration Plant was put into operation in the fall of 1994. The treatment plant was originally sized for 42 million gallons per day (MGD). The filtration beds were upgraded between 2005 and 2008, which greatly improved the treatment performance. As a result of the filter bed project, PADEP reissued the permit of the filter plant at 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 and Maintenance Supervisor on October 22, 2020. They explained that the plant is now 25 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 plant.

Recent and proposed projects include the following:

1. The carbon bldg. 30-inch raw water transmission main valve to be excavated and repaired;
2. The New Emergency Generator Project construction has begun and the existing underground fuel tank for the old generator has been removed;

3. Lagoon baffle curtain was being manufactured and will be replaced upon delivery;
4. All existing exterior plant lighting has been replaced with LED lighting, interior lighting scheduled to be replaced;
5. The freight elevator door controller has been replaced;
6. Six (6) spare chemical feed pumps has been purchased;
7. The original bulk zinc orthophosphate chemical storage tank had been replaced.

The water filtration plant supervisors have planned for the following 2021 projects:

1. Order and install second backwash lagoon curtain;
2. Replace the freight elevator hydraulic control system;
3. Replace the roof top HVAC control units;
4. Begin the pre-cast concrete panel roof testing plan as part of the leak study;
5. Complete and startup the new Emergency Generator Project;
6. Complete the Carbon Bldg. 30-inch valve repair;
7. Complete the Plant interior LED lighting replacement.
8. Begin vegetation control plan around plant property.

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.

Overall, the filtration plant is well maintained, very clean, and in good repair. The Authority and City received a positive “Commendable” review from PADEP for the Filter Plant Performance Evaluation (FPPE) in 2016.

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 Water Filtration Plant in Lehigh Township, Northampton County. We believe further improvements to the SCADA communications will be required for the implementation of improved security systems throughout the water system, particularly for the remote watershed facilities.

Watersheds

The nearly 23,000 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 has also initiated 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. In 2012, the Authority and the Nature Conservancy completed a Forest Management Plan 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. The Penn Forest Reservoir Dam was rebuilt in 1998 and is tributary to the Wild Creek Reservoir Dam, originally constructed in 1939 (refer to LTIP Table 1-1 for detail). 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 intake screens are cleaned semiannually. 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.

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 or 36-inch diameter line to the City. This project also included two (2) rock bored tunnels at Wire Ridge and Blue Mountain (refer to LTIP Table 1-1 for detail). In the 1960s, a redundant parallel 42-inch line was constructed from Blue Mountain to the site of the current filtration plant (see figures at the end of this chapter). In 1997, a parallel redundant 42-inch line was constructed to convey water from Wire Ridge south portal to Blue Mountain north portal.

The proposed high-pressure natural gas transmission line by PennEast Pipeline, LLC is currently proposed to pass in close proximity to the Wire Ridge tunnel. The recently revised PennEast Pipeline route is now aligned away from the previously proposed Blue Mountain tunnel crossing.

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.

PRV Control Stations

The water system has nineteen pressure reduction valve (PRV) stations throughout the system, of which many are no longer utilized (refer to LTIIIP Table 1-9 for detail). The Pennsylvania Avenue PRV Station has recently been renovated, is in continual service, and is in good repair. The future LTIIIP 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 (refer to LTIIIP Table 1-8 for detail).

The 5th & 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. The fenced area around the emergency generator was full of dry leaves which can be a fire hazard. In addition to clearing the leaves, we recommend that the large adjacent tree be removed to both eliminate the leaves issue 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 1919. 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.

The Mountaintop Booster Pump Station (formerly Fire Pump Station) was built in 1959 and was designed for full renovation and pump replacements renovation with the PADEP Construction Permit issued June of 2020. Although construction contracts were issued in July 2020, COVID

Pandemic manufacturing delays caused delays in the construction through year 2020. The proposed full renovation will be completed in May 2021 with two (2) new redundant 1,000 gpm pumps, flow meter, electrical service, motor control, emergency generator, and building renovations.

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 system (refer to LTIP Table 1-10 for detail). 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 1.0 MG South Side High Level (1959 steel) tank adjacent to the Fire PS was recently power-washed and cleaned. The 5.0 MG Southeast Low Service Water Tank (1965 steel) is located on William Street and has recently been modified with new control valves and put back online. The 0.5 MG South Mt. High Service (1959 steel) tank located in South Mountain Park 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 two of the tanks.

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 2.0 MG Southwest High Service Reservoir is a two-cell concrete structure which is in disrepair and currently being evaluated by the City for total replacement. The City is evaluating alternatives for the replacement of this tank, possibly as only 1.0 MG tank. We recommend that this concrete tank be replaced as soon as possible. We also recommend that the City accelerate the schedule for tank refurbishment through contracts with utility maintenance firms.

East Allen Township Well Stations

The Bethlehem 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 Square (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. 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.

These independent water systems are in a minimal state of repair. The Comprehensive Planning Study 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 has completed installing emergency generators at the Shady Lane, Country Squire Systems and Wil-Mar System (in 2021). A separate pilot program for manganese treatment has commenced at the Shady Lane System and received a PADEP operating permit in 2017. The City has begun the Mud Lane water main extension to the East Allen Gardens system. The extension will connect the finished water transmission lines north of Howertown, and will include a small booster station and allow the East Allen Gardens wells to be abandoned.

Emergency Interconnections

The Water System has seven (7) emergency interconnections with adjoining water systems. The Comprehensive Planning Study (page 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 is 12 MGD.

Based upon our prior recommendations, 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. The Authority commissioned an Emergency Interconnection Evaluation Study in 2020 as a first step.

Ongoing Initiatives

Forest Management

The Authority conducts an annual timbering program following its Forest Management Plan. This timbering program brings in generally between \$50,000 and \$150,000 a year in revenue, depending on the quality and quantity of the harvested timber. The Authority works closely with its forestry consultant, Woodland Management Services, to select areas of the watershed suitable for timbering contracts.

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

In 2019 an infestation of spotted lantern flies was discovered in a section of the watershed near the Penn Forest Reservoir in Monroe County. The U.S. and PA Departments of Agriculture declared Monroe County a quarantine area for these insects and following investigations, the USDA contracted with a firm to treat the infected trees to eliminate or minimize the spread of these harmful insects. Follow-up monitoring was scheduled for 2020, but USDA staffing and funding issues brought on by the pandemic, halted this program.

Wind Energy

In 2013, the Authority authorized Atlantic Wind, LLC to install five 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. The project now appears to be feasible and the five temporary towers have been removed. Should this project be successful, it will produce a significant annual revenue stream for the Authority in the future. Over the past two years, Atlantic Wind and the Authority have been working through the legal system to resolve the local Zoning Hearing Board's denial to develop the project.

GIS/GPS and UAV

The Authority had retained Maser Consulting to assist in the purchase, licensing, and training for an unmanned aerial vehicle (UAV). This equipment is currently being used by the Authority Special Police to aid in recognizance and enforcement of watershed property trespass. It is anticipated that the geographical information system (GIS) and global positioning system (GPS) technology will provide a means for the Authority to better manage the 23,000 acres of watershed land assets in the office and in the field.

Watershed Land Survey

In response to a property dispute with an adjacent land owner, the Authority retained Maser Consulting and sub-consulting partner, Arthur A. Swallow Associates, LLC, to research and evaluate many of the deeds and survey warrants associated with the original watershed land acquisition of the late 1920s. Some of these deeds and warrants date back to the 1790s. A program for research and physical property survey of the watershed property is being considered to support the accuracy of the GIS database system of the Authority.

Risk and Resilience Assessment

The City completed a Risk and Resilience Assessment (RRA) in accordance with America's Water Infrastructure Act (AWIA) in 2020. This will be followed by an update of the City's Emergency Response Plan which will incorporate the findings of the RRA. Both are scheduled to be 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 will make 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 Department of Homeland Security (DHS) Infrastructure Survey Security and Resilience Report will be taken into consideration.

Hydroelectricity

The Authority and City may revisit in the future a study of the feasibility of installing equipment in certain pipelines for the purpose of generating electricity.

Solar Power System

The City had evaluated the feasibility of installing solar power generating equipment at the Water Filtration Plant as part of the City's sustainability initiatives. New technology may allow for the potential use of floatable solar on the Wild Creek and Penn Forest reservoirs.

Emergency Interconnection Assessment and Improvements

In July of 2020, the Bethlehem Authority commissioned an Emergency Interconnection Evaluation Study. 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. 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 final report for this study is not yet complete.

System Wide Security Improvements

The Bethlehem 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 City had previously invited US DHS to conduct security assessments. 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. Due to time limitations, the November 9, 2020 tour included specific Bethlehem Authority facilities that would be representative of the entire system.

On November 17, 2020, The DHS Agent met at the Bethlehem 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.

Due to the sensitive nature of the security assessments, a detailed review of the DHS findings and our recommendations for improvement are provided separately in Appendix 14 which should be treated as Confidential and under separate cover.

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 and watershed security were conducted by City staff. The Bethlehem Authority continued its Patrol Officer (PO) Program. 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 2018, the Authority hired three (3) additional 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 purchased 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.

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. The Authority and City carefully evaluated the potential impact of the proposed NG pipeline throughout the multi-year negotiations with PennEast Pipeline. Ultimately, the Authority executed a Pipeline Right-of-Way License Agreement in early 2018 which includes many safeguards and monitoring throughout the NG pipeline construction phase, and also during the on-going operations of the NG pipeline when in service.

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. The PADEP January 26, 2017, letter and evaluation report praises the performance of the filter plant: "It is our conclusion that your filter plant was operating at a 'Commendable Level.'"

Storage

Maintenance of storage facilities in 2018 included routine activities. The City has been sequentially upgrading/repainting water tanks as part of their program to enter into contracts with utility maintenance firms. Two 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 is planning on adding two more tanks to the contract maintenance program by end of 2021.

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. These data are one criterion for scheduling water line replacements. However, some larger main breaks, such as the September 2016 break in the 700 block of North New Street, can be very disruptive and expensive to repair.

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>
2013	416
2014	577
2015	1,074
2016	1,416
2017	1,192
2018	1,235
2019	1,380
2020	955
Total	8,245

The 8,245 meters replaced represents 46% of the total 36,589 customer meters. The City has also implemented Advance Metering Infrastructure (AMI) for remote meter reading. Two (2) AMI towers were installed in 2018. A third AMI tower was installed in 2019 and one (1) more AMI tower is planned for 2021. Currently 5,208 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. The leak detection data spreadsheet and maintenance graph reports for previous years are provided in Appendix 13 of this report. For the 2020 calendar year we received the following scorecard data from the City:

Water Main Breaks	79
Water Service Lateral Leaks/Replacements	87
Hydrants maintained/valves exercised	2408
Main Line Valves Exercised	1788
Distribution System Flushing (Hydrants Flushed)	822
Leak Detection (Miles Surveyed)	189.1

The total miles of leak detection work executed in 2020 is more than previous years, see Appendix 13. We recommend that the leak detection, and the effort to resolve unaccounted-for-water be increased in 2021.

The 2018 Amended LTIIP Tables 1-2, 1-3, and 1-4 document 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 also are 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.

Master Planning

The City has completed a master plan for the distribution system, otherwise known as the Comprehensive Planning Study (CPS). The 2014 Distribution System Comprehensive Planning Study is part of the Long-Term Infrastructure Improvement Program (LTIP). This Study is referenced as Appendix 12 (under separate cover). The 2014 CPS and 2018 Amended LTIP are very thorough and provide priority planning for capital projects. In 2018, the City Staff first created and then revised the 2019 10-Year Capital Plan Spreadsheet to be a working document to be reviewed and updated annually.

Customers Served/Service Area

At the end of 2020, the City provided water service to 36,589 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 119,854 (includes all systems, extrapolated from Lehigh Valley Planning Commission 2020 year-end data, an increase of 0.3%).

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 2020 calendar year, 5.793 billion gallons of water, or an average of 15.830 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 0.044 billion gallons of water, or an average of 0.121 MGD, and Easton Suburban Water Authority (ESWA), which provided water service of 3,114,062 gallons of water, or an average of 0.009 MGD, through the Hecktown Road interconnection (northern Bethlehem Township). Total metered

consumption by customers and other accounted for usage totaled 3.598 billion gallons, or an average of 9.829 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 has significantly increased over the last two years to 26% in 2019 and 30% in 2020. 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 Commission to be excessive." Unaccounted Water continues to be an issue.

We recommend that the City implement a water balance audit program following American Water Works Association (AWWA) guidelines. Such a program may include a monthly spreadsheet comparing the water meters at key locations: 1. raw water leaving the Wild Creek Reservoir; 2. to raw water entering the water filtrations plant (WFP); 3. finished water leaving the WFP, less backwash water; 4. water passing through the pressure reduction stations; and 5. the distribution system total customer meters. Water loss such as hydrant flushing, fire department activity, and main breaks should also be estimated for the water budget. The City started using the PUC Method for calculation in addition to the AWWA Method. As part of the 2020 PUC rate case, the City is committed to addressing the unaccounted water issue.

Staffing

The Bureau of Water Supply and Treatment budget for 2021 will include 35 positions, not including one (1) contract Water Engineer. The Bureau of Water Maintenance will have 33 staff positions. The personnel in the two bureaus perform other duties in addition to operating/maintaining the system. Appendix 6 provides a breakdown of manpower in each division.

The Director, Departmental Business Manager, Manager of Commercial Operations, Water Quality Manager, Microbiologist, Laboratory Technician, and Customer Service Staff in the Water and Sewer Resources Department are budgeted for approximately 50% of their time to the Bethlehem water system.

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 information purposes. We recommend that the City and Authority review and update this list as needed on an annual basis to include new facilities and exclude any abandoned facilities.

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.

We recommend that the Authority and City work together to fund the full development of the GIS system map to include the finished water transmission lines, water filtration plant, the raw water transmission lines, and the full watershed land and physical assets. The Authority is considering future funding for GIS platform for the watershed properties.

The US EPA has published its Asset Management Guidelines which include the five major planning and analysis components:

- Asset Inventory/Mapping and Condition Assessment
- Level of Service Goals
- Criticality/Prioritization – Risk Assessment
- Life Cycle Costing
- Long Term Funding Strategy

As stated above, the City has already made strides toward asset mapping. We recommend that this component be developed further to include complete mapping and asset inventory in each major facility. This would include asset numbering and identification. The next step would be asset condition assessment including such attributes as type, size, material, age of asset, and more. This exercise also includes 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. Key questions of this process include:

- Which assets are most critical to the sustained function of the system?
- What is the likelihood of each of these assets failing?
- What are the consequences if each asset fails?

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 a particular 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.

Criticality (BRE) Combined Rating= Probability of Failure (PoF) x Consequence of Failure (CoF)

Multiplier		Consequence (Cost) of Failure				
Probability of Failure	X	1	2	3	4	5
	1	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25

Vulnerability is a component of risk and should also be considered. The above described analysis provides a vetting 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. We believe BRE may be more objective and strategic than the previously completed “Pair-Wise” analysis within the Comprehensive Distribution Planning Study.

The following components of Life Cycle Costing lead to improved O&M programs, repair/replacement schedules, and capital improvement plans. Finally, 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. An asset management plan would aid in the critical decision process for funding maintenance and facility replacement capital projects while providing the justification for potentially taking on more long-term debt financing.

TABLE 2

Revised 3/2021

Average Daily Water Consumption (Gallons/Day GPD)

Municipality	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
City of Bethlehem	6,754,200	6,773,000	6,234,600	6,211,300	6,097,500	6,172,900	6,441,201	6,458,623	6,432,657	6,075,211	6,012,081
Bethlehem Twp	1,000,500	973,100	916,000	936,300	935,700	952,900	961,400	939,638	937,726	898,952	888,101
Hanover Twp (Northampton)	959,500	941,300	820,000	919,200	955,600	978,400	1,003,901	996,105	1,006,332	984,353	1,023,709
Hanover Twp (Lehigh)	253,300	283,500	241,200	252,600	275,100	302,300	324,400	325,094	350,660	334,158	293,274
Fountain Hill Borough	586,800	426,200	413,900	373,900	393,200	394,200	425,400	412,851	413,219	392,009	374,007
Freemansburg Borough	164,300	190,100	148,900	161,000	130,900	157,300	137,500	187,873	154,571	121,637	153,119
Salisbury Twp	111,500	109,000	92,100	88,700	90,400	86,500	86,600	92,924	88,956	89,022	79,092
Upper Saucon Twp	191,200	172,200	123,000	116,900	109,200	115,400	121,600	102,439	107,563	109,745	136,893
East Allen Twp ¹	128,700	125,600	136,300	115,500	123,900	110,900	214,000	202,257	204,820	201,165	211,269
Lower Saucon Twp	473,900	440,400	398,600	400,600	425,400	416,000	421,800	407,722	421,624	371,463	393,931
Allen Twp	14,400	13,400	13,100	12,700	13,800	13,200	13,200	19,327	19,944	18,796	21,319
Lower Nazareth Twp	-	-	-	-	-	-	1,200	4,170	5,439	6,463	7,703
Total Consumption	10,638,200	10,447,900	9,537,800	9,588,800	9,550,800	9,700,000	10,152,400	10,149,023	10,143,511	9,602,974	9,594,498

1) Includes Well Systems and RT512 Consecutive System

TABLE 3
Revised 3/2021
HISTORICAL SUMMARY OF WATER CONSUMPTION
BY CUSTOMER CLASSIFICATION AND DEMAND
Bethlehem Water System
Average Daily Water Consumption/Demand (mgd)

Customer Classification	2010	2011	2012	2013	2014	2015	2016*	2017**	2018	2019***	2020
Domestic	6.02	5.90	5.68	5.69	5.55	5.64	5.61	5.69	5.52	5.37	5.59
Commercial	1.64	1.69	1.53	1.53	1.64	1.69	1.79	1.78	1.93	1.75	1.71
Industrial	1.00	1.13	0.85	0.92	0.99	0.99	1.32	1.29	1.30	1.22	1.14
Institutional	0.91	0.75	0.65	0.67	0.67	0.69	0.77	0.77	0.78	0.69	0.55
Public	0.36	0.33	0.28	0.26	0.17	0.14	0.13	0.13	0.09	0.13	0.11
Bulk Sales	0.70	0.65	0.54	0.51	0.53	0.54	0.53	0.50	0.52	0.45	0.50
Other	2.52	2.39	2.64	2.66	1.46	1.62	1.49	1.40	1.38	1.33	1.54
Accounted for Usage	13.15	12.84	12.17	12.24	11.01	11.31	11.64	11.54	11.53	10.93	11.14
Total Inflow to Plant	14.89	15.10	15.15	14.58	13.57	14.36					
Source of Supply							14.26	13.68	14.67	14.83	15.83
Unaccounted-for Water	1.74	2.26	2.98	2.34	2.56	3.05	2.62	2.13	3.14	3.90	4.70
Percent Unaccounted (%)	11.7%	15.0%	19.7%	16.0%	18.9%	21.2%	18.4%	15.6%	21.4%	26.3%	29.7%

*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:

1. The City of Bethlehem Approved 2020 Operating & Capital Budgets includes the Water Capital Fund Analysis Summary and 2020 Water Capital Project Detail (pages 299-303). We support the execution of these water system improvement projects in 2020. Many of these capital projects include renovation and/or replacement of key water system infrastructure, which is consistent with the responsibilities of the City and Authority to maintain the water system for the rate payers and bond indenture.
2. The Authority and the City are exploring alternative energy sources for and on its facilities including wind energy, hydro power, and solar power. We recommend that these worthwhile efforts continue to be explored to their fullest potential.
3. The Authority commissioned the Emergency Water Supply Feasibility Study completed in October 2018. The shortfall of working emergency sources is a significant concern. In July of 2020, the Bethlehem Authority **commissioned an** Emergency Interconnection Evaluation Study. We recommend that the Authority and City work together to plan additional long-term funding to further invest in improved emergency water supplies.
4. We recommend the City continue to improve/replace critical equipment at the water filtration plant. We recommend that the City continue towards the planned chlorination system replacement with safer modern disinfection systems. The Water Filtration Plant Staff are aggressively replacing critical equipment for the now 25-year old system. The Capital Plan includes increased funding for the Water Filtration Plant; the replacement chlorination system is planned for design in 2023 and construction in 2024.
5. We recommend 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, access gates are rusted and difficult to operate, and much of the posted signage needs to be replaced.
6. We recommend that the City begin work to restore and preserve the historic structures of the Watershed Campus which date back to the 1940s. Specifically, several areas of the old masonry stone walls and buildings are in need of repair and/or restoration.
7. We recommend 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. The City completed a replacement feasibility study in 2020. The Capital Plan includes funding for design in 2022 and construction in 2023.

8. 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. We recommend that this program continue to ensure proper operation of the distribution system, the detections of problems, and to avoid fire protection limitations. We recommend the City Staff continue to improve their regular maintenance and repair of all facilities in the distribution system.
9. We recommend 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. We have conducted several meetings and access investigations with specialty contracting firms who believe in-situ analysis of the water transmission piping and robotic cameral analysis of the two tunnels is possible. However, this work is expensive, and the tunnel access will require upfront capital investment. We will continue to investigate.
10. The City has begun an aggressive program of customer water meter replacement starting with the larger commercial and industrial high-water-users.. We recommend that this program continue each year for the replacement of all water customer meters throughout the system. The Capital Plan includes significant funding which increases over time toward this goal. Percent unaccounted-for-water has significantly increased above industry standards, as reported in years 2018, 2019 and 2020. We recommend that the City increase their efforts to investigate meter accuracy, ramp up leak detection efforts, and track unaccounted for water on a monthly basis.
11. 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. For the period 2014 through 2019, the city has replaced on average 4,400 linear feet of water main per year. However, this only represents 0.2% of the 500 miles of water main in the system. We recommend the City increase funding of this program over the next decade. The Capital Plan includes doubling the funding of water main replacement from \$500,000 to \$1,000,000 in year 2023.
12. We recommend 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.
13. We recommend the Authority and City work toward completion of its GIS model for the entire water system and watershed assets. This continues to be a long-term goal as funding permits investment.

14. We recommend 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. This continues to be a long-term goal as funding permits investment and may be mandated by the PA Senate Bill 597 – Water Quality Accountability Act, if it is voted into law.
15. The Authority and City have worked with their respective financial planning consultants to create the 10-Year Capital Plan and Capital Improvement Program Funding Plan. We recommend 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 when needed.
16. In March of 2020, the City completed a Risk and Resilience Assessment (RRA) in accordance with America's Water Infrastructure Act (AWIA) of 2018. We recommend that the City implement the findings of these study reports to reduce vulnerability of the Bethlehem Water System.
17. United States Department of Homeland (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 found in Appendix 14 are considered confidential and are provided under separate cover. We recommend that the City and Authority budget for and implement these security initiatives.
18. The Pohopoco Drive frontage should be secured with a 6-feet high fence across the entire frontage at the ultimate right-of-way, ideally the fence could be decorative. Low shrubbery could be added in front of the fence and "No Parking" signs posted on the fence. A mortorized slide gate should be installed at the main entrance behind the stone walls.
19. We recommend that a separate detailed security improvements feasibility study be authorized to develop a full program for implementation program of prioritization and assigned estimated costs for each particular water system facility. Based solely on the knowledge gained to date, we anticipate that the preliminary budget to implement security improvements over several years would have a budgetary range of \$1.2M to \$2.0M.
20. We recommend that the recently completed Water System Risk and Resilience Assessment Study be implemented and that a specific Cybersecurity Assessment evaluation of the City's current IT systems be commissioned. The recommendations of this third party study should then be addressed.

APPENDIX 1

2020 WATER SERVICE & USAGE RATES

MONTHLY CHARGES FOR CUSTOMERS

Meter Size	Residential	Commercial	Industrial	Public	Bulk Sales	Untreated Water
5/8"	\$8.25	\$8.25	\$8.25	\$8.25	\$8.25	\$8.25
3/4"	\$13.98	\$13.98	\$13.98	\$13.98	\$13.98	\$13.98
1"	\$27.14	\$27.14	\$27.14	\$27.14	\$27.14	\$27.14
1-1/2"	\$53.04	\$53.04	\$53.04	\$53.04	\$53.04	\$53.04
2"	\$85.28	\$85.28	\$85.28	\$85.28	\$85.28	\$85.28
3"	\$174.80	\$174.80	\$174.80	\$174.80	\$174.80	\$174.80
4"	\$273.56	\$273.56	\$273.56	\$273.56	\$273.56	\$273.56
6"	\$547.11	\$547.11	\$547.11	\$547.11	\$547.11	\$547.11
8" and Larger	\$1,098.37	\$1,098.37	\$1,098.37	\$1,098.37	\$1,098.37	\$1,098.37
Consumption Charges/1,000 Gallons	\$4.266	\$3.333	\$3.333	\$3.333	\$3.969	\$2.035

Fire Lines - (monthly)	
Less than 6"	\$37.50
6"	\$46.85
8"	\$56.09
10"	\$65.33
12"	\$84.02

Fire Hydrants - (monthly)	
Private	\$26.09
Public	\$22.00

***Effective July 10, 2014**

ARTICLE 913

Water Rates and Charges

- 913.01 Water service rates.
- 913.02 Scheduling of bills for all water service customers.
- 913.03 Penalties for late payments of bills.
- 913.04 Collection of delinquent bills.
- 913.05 Charges For Discontinuing And Restoring Of Water Service For In-City and Out-of-City Users.
- 913.06 Additional Charge For Discontinuing And Restoring Of Water Service For Out-Of-City Users.
- 913.07 Returned check charge.
- 913.08 Meter test rates.
- 913.09 Construction rates.
- 913.10 Rider DIS - Demand-Based Industrial Service.
- 913.11 Rider DRS - Demand-Based Resale Service.

CROSS REFERENCES

Water supply - See 3rd Class Sections 3501-3572 (53 P.S. Sections 38501-38572)

Water regulations - See S.U. & P.S. Art. 911

Use in air conditioning systems - See S.U. & P.S. Art. 915

Sewer rental based on water consumed - See S.U. & P.S. Art. 927

913.01 WATER SERVICE RATES.

The Council of the City of Bethlehem hereby fixes and establishes the following rates governing the furnishing of water with respect to real estate situate both inside and outside the City of Bethlehem.

(a) Meter Rates. The following schedules apply to all service other than fire protection.

Schedule A

Meter Rates - General Residential Customer Service

APPLICATION

This schedule applies to all residential customer service.

CUSTOMER CHARGES

All metered residential customers shall pay the following customer charge based on the required size of meter to render adequate service.

<u>Size of Meter Inches</u>	<u>Customer Charge</u>	
	<u>Per Month</u>	<u>Per Quarter</u>
5/8	\$ 8.25	\$ 24.75
3/4	\$ 13.98	\$ 41.94
1	\$ 27.14	\$ 81.42
1-1/2	\$ 53.04	\$ 159.12
2	\$ 85.28	\$ 255.84
3	\$ 174.80	\$ 524.40
4	\$ 273.56	\$ 820.68
6	\$ 547.11	\$ 1641.33
8 or larger	\$ 1098.37	\$ 3295.11

CONSUMPTION CHARGES

In addition to the customer charge all water consumption will be billed at the following rate:

Rate Per
1,000 Gallons

For all usage monthly or quarterly \$4.266

Schedule BMeter Rates - General Commercial Customer ServiceAPPLICATION

This schedule applies to all commercial customer service.

CUSTOMER CHARGES

All metered commercial customers shall pay the following customer charge based on the required size of meter to render adequate service.

<u>Size of Meter</u>	<u>Customer Charge</u>		<u>Size of Meter</u>	<u>Customer Charge</u>	
	<u>Per Month</u>	<u>Per Quarter</u>		<u>Per Month</u>	<u>Per Quarter</u>
5/8"	\$ 8.25	\$ 24.75	3"	\$ 174.80	\$ 524.40
3/4"	\$ 13.98	\$ 41.94	4"	\$ 273.56	\$ 820.68
1"	\$ 27.14	\$ 81.42	6"	\$ 547.11	\$ 1641.33
1-1/2"	\$ 53.04	\$ 159.12	8"	\$ 1098.37	\$ 3295.11
2"	\$ 85.28	\$ 255.84	or larger		

CONSUMPTION CHARGES

In addition to the customer charge all water consumption will be billed at the following rates:

	<u>Rate Per</u> <u>1,000 Gallons</u>
For all usage monthly or quarterly	\$3.333

Schedule C
Meter Rates - General Industrial Customer Service

APPLICATION

This schedule applies to all industrial customer service.

CUSTOMER CHARGES

All metered industrial customers shall pay the following customer charge based on the required size of meter to render adequate service.

<u>Size of</u> <u>Meter</u>	<u>Customer Charge</u>		<u>Size of</u> <u>Meter</u>	<u>Customer Charge</u>	
	<u>Per Month</u>	<u>Per Quarter</u>		<u>Per Month</u>	<u>Per Quarter</u>
5/8"	\$ 8.25	\$ 24.75	3"	\$ 174.80	\$ 524.40
3/4"	\$ 13.98	\$ 41.94	4"	\$ 273.56	\$ 820.68
1"	\$ 27.14	\$ 81.42	6"	\$ 547.11	\$ 1641.33
1-1/2"	\$ 53.04	\$ 159.12	8"	\$ 1098.37	\$ 3295.11
2"	\$ 85.28	\$ 255.84	or larger		

CONSUMPTION CHARGES

In addition to the customer charge all water consumption will be billed at the following rates:

	<u>Rate Per</u> <u>1,000 Gallons</u>
For all usage monthly or quarterly	\$3.333

Schedule D
Meter Rates - General Public Customer Service

APPLICATION

This schedule applies to all public customer service.

CUSTOMER CHARGES

All metered public customers shall pay the following customer charge based on the required size of meter to render adequate service.

Size of Meter	<u>Customer Charge</u>		Size of Meter	<u>Customer Charge</u>	
	<u>Per Month</u>	<u>Per Quarter</u>		<u>Per Month</u>	<u>Per Quarter</u>
5/8"	\$ 8.25	\$ 24.75	3"	\$ 174.80	\$ 524.40
3/4"	\$ 13.98	\$ 41.94	4"	\$ 273.56	\$ 820.68
1"	\$ 27.14	\$ 81.42	6"	\$ 547.11	\$ 1641.33
1-1/2"	\$ 53.04	\$ 159.12	8"	\$ 1098.37	\$ 3295.11
2"	\$ 85.28	\$ 255.84	or larger		

CONSUMPTION CHARGES

In addition to the customer charge all water consumption will be billed at the following rates:

	<u>Rate Per</u> <u>1,000 Gallons</u>
For all usage monthly or quarterly	\$3.333

Schedule E
Meter Rates - Sales for Resale

APPLICATION

This schedule applies to all sale of water to other water utilities or public authorities for resale.

CUSTOMER CHARGES

All metered sales for resale customers shall pay the following customer charge based on the required size of meter to render adequate service.

Size of Meter	<u>Customer Charge</u>		Size of Meter	<u>Customer Charge</u>	
	<u>Per Month</u>	<u>Per Quarter</u>		<u>Per Month</u>	<u>Per Quarter</u>
5/8"	\$ 8.25	\$ 24.75	3"	\$ 174.80	\$ 524.40
3/4"	\$ 13.98	\$ 41.94	4"	\$ 273.56	\$ 820.68
1"	\$ 27.14	\$ 81.42	6"	\$ 547.11	\$ 1641.33
1-1/2"	\$ 53.04	\$ 159.12	8"	\$ 1098.37	\$ 3295.11
2"	\$ 85.28	\$ 255.84	or larger		

Lower Saucon Honor System	\$1098.37	\$3295.11
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CONSUMPTION CHARGES

In addition to the customer charge all water consumption will be billed at the following rates:

	Rate Per <u>1,000 Gallons</u>
For all usage monthly or quarterly	\$3.969

Schedule F
Meter Rates - Untreated Water Service

APPLICATION

This schedule applies to all sale of untreated water for non-potable use only.

CUSTOMER CHARGES

All metered untreated water service customers shall pay the following customer charge based on the required size of meter to render adequate service.

<u>Size of Meter</u>	<u>Customer Charge</u>		<u>Size of Meter</u>	<u>Customer Charge</u>	
	<u>Per Month</u>	<u>Per Quarter</u>		<u>Per Month</u>	<u>Per Quarter</u>
5/8"	\$ 8.25	\$ 24.75	3"	\$ 174.80	\$ 524.40
3/4"	\$ 13.98	\$ 41.94	4"	\$ 273.56	\$ 820.68
1"	\$ 27.14	\$ 81.42	6"	\$ 547.11	\$ 1641.33
1-1/2"	\$ 53.04	\$ 159.12	8"	\$ 1098.37	\$ 3295.11
2"	\$ 85.28	\$ 255.84	or larger		

CONSUMPTION CHARGES

In addition to the customer charge all water consumption will be billed at the following rates:

	Rate Per <u>1,000 Gallons</u>
For all usage monthly or quarterly	\$2.035

(b) Private Fire Service Standby System Rates

For each private fire line that supplies water service to a standby system for fire protection, the following quarterly/monthly charge is made according to the size of the area protected and the size of the fire line servicing the facility.

<u>Fire Line</u>	<u>Per Quarter</u>	<u>Per Month</u>
Less than 6" (including Siamese connections and 2", 3", and 4" residential connections)	\$112.50	\$37.50
6"	\$140.55	\$46.85
8"	\$168.27	\$56.09
10"	\$195.99	\$65.33
12"	\$252.06	\$84.02

In addition to the above fire line charge, a quarterly/monthly charge is made at \$2.79 (\$0.93 per month) per thousand square feet of protected area.

(c) Private Fire Hydrant

For each private fire hydrant, the following quarterly/monthly charge is made:

	<u>Per Quarter</u>	<u>Per Month</u>
Each Private Fire Hydrant	\$78.27	\$26.09

(d) Public Fire Hydrants - Out-of-City

For each public fire hydrant, the following quarterly/monthly charge is made:

	<u>Per Quarter</u>	<u>Per Month</u>
Each Public Fire Hydrant	\$66.00	\$22.00

(e) The out-of-city rates contained herein shall be effective subject to the established date by and the approval of the Pennsylvania Public Utility Commission which date is July 10, 2014; and, in-city rates shall take effect on the effective date above.

(Ord. 2008-20. Passed 7/1/08; Ord. 2012-3. Passed 2/21/12; Ord. 2014-25. Passed 8/19/14.)

913.02 SCHEDULING OF BILLS FOR ALL WATER SERVICE CUSTOMERS

Billing for all properties serviced by a five-eighth (5/8") inch, three-quarter (3/4") inch or one (1") inch meter shall be on a quarterly basis, and all other bills for water service through a meter shall be on a monthly basis.

All customers will be given the option of being billed monthly.

913.03 PENALTIES FOR LATE PAYMENT OF BILLS

(a) Residential and Non-Residential Accounts

All customer water meter bills for residential and non-residential accounts shall be subject to a penalty of one and one-half (1.50%) percent interest per month on the full unpaid and overdue balance of the bill if not paid within twenty (20) calendar days from the date the bill is mailed. The interest charges are to be calculated on the overdue portions of the bill only and shall not be charged against any sum that falls due during a current billing period.

(b) Private Fire Protection Service
Residential and Non-Residential:

All customer bills for residential and non-residential accounts shall be subject to a penalty of one and one-half (1.50%) percent interest per month on the full unpaid and overdue balance of the bill if not paid within twenty (20) calendar days from the date the bill is mailed. The interest charges are to be calculated on the overdue portions of the bill only and shall not be charged against any sum that falls due during a current billing period.

(c) Private Fire Hydrants
Residential and Non-Residential:

All customer bills for residential and non-residential accounts shall be subject to a penalty of one and one-half (1.50%) percent interest per month on the full unpaid and overdue balance of the bill if not paid within twenty (20) calendar days from the date the bill is mailed. The interest charges are to be calculated on the overdue portions of the bill only and shall not be charged against any sum that falls due during a current billing period.

(d) Public Fire Hydrants - Out-of-City

All public fire hydrant bills will be subject to a penalty of one and one-half (1.50%) percent interest per month on the full unpaid and overdue balance of the bill if not paid within twenty (20) calendar days from the date the bill is mailed.

913.04 COLLECTION OF DELINQUENT BILLS

(a) In-City Customer - Delinquent accounts placed for collection shall be subject to the penalties set forth in Section 913.03 together with costs of collection and reasonable attorney's fees.

(b) Out-of-City Customers - It shall be the duty of the Bureau of Law, when requested by the Department of Water and Sewer Resources, to take such action as may be authorized by law or ordinance for the collection of delinquent bills, including any court costs deemed appropriate by a court of jurisdiction.

913.05 CHARGES FOR DISCONTINUING AND RESTORING OF WATER SERVICE FOR IN-CITY AND OUT-OF-CITY USERS

(a) The fee for shut-off and turn-on of service at the curb stop shall be \$35.00.

(b) See Article 911.

913.06 ADDITIONAL CHARGE FOR DISCONTINUING AND RESTORING OF WATER SERVICE FOR OUT-OF-CITY USERS

(a) A charge of thirty-five dollars (\$35.00) per premises shall be made whenever a municipality which is serviced by the City water system requests the City to shut off water service from any premises within the municipality for nonpayment of sewer charges.

(b) See Article 911.

913.07 RETURNED CHECK CHARGE

A charge of twenty dollars (\$20.00) will be assessed anytime where a check which has been presented to the City for payment on account has been returned by the payor bank for any reason.

913.08 METER TEST RATES

(a) The fee schedule for testing of meters shall be as follows:

One (1") inch or less	\$38.00
One and one quarter (1-1/4") inch - two (2") inch	\$40.00

Fees for testing meters over two (2") inches or for testing meters so located that testing costs are disproportionate to the stated fees shall be established by the City based upon the actual cost of the test.

(b) See Article 911.

(Ord. 3026. Passed 10/15/85; Ord. 4073. Passed 5/16/01; Ord. 4363. Passed 12/20/05.)

913.09 CONSTRUCTION RATES

(a) Building Water Charge

- (1) Out-of-City. If water is required for building purposes, a charge shall be made at the time application is made for water service. This charge will be one quarterly customer charge based on the size of the City service line servicing the facility.
- (2) In City. For in-City construction the above charge shall be levied at the time of building permit application.
- (3) Restriction. Water for building purposes will be used only for actual construction of the building and shall not be used to facilitate landscaping or other purposes.

913.10 RIDER DIS - DEMAND-BASED INDUSTRIAL SERVICE

(a) APPLICABILITY.

Throughout the water service territory served.

(b) AVAILABILITY.

This rider is available to a customer that:

- (1) purchases water from the City for industrial purposes;
- (2) enters into a Service Agreement for a term of not less than 10 years;
- (3) during the original and any renewal terms of the Service Agreement, agrees to purchase an average of 10 million gallons of water per month at a daily load factor of not less than 0.67; and
- (4) has a viable competitive alternative to service from the City and intends to select that alternative to the detriment of the City and its other customers.

The City shall require documentation to establish, to the City's satisfaction, the existence of a competitive alternative. Such documentation may include, but is not limited to, an affidavit of the customer or, if the customer is a

corporation, an affidavit of one or more of its officers.

(c) RATE.

The rate(s) to be charged qualifying customers under this rider will be as set forth in the Service Agreement, provided, however, that such rate(s): (1) shall not exceed the Maximum Rate; (2) shall not be less than the Minimum Rate; and (3) shall be subject to an Escalation Clause, as hereafter defined.

(d) MAXIMUM RATE.

The Maximum Rate shall be the charges specified in the City's Rate Schedule that would otherwise apply to the qualifying customer absent this rider.

(e) MINIMUM RATE.

The Minimum Rate shall be sufficient to recover: (1) the Production Cost of Water; (2) the fixed costs (depreciation and pre-tax return) associated with all new facilities added to serve the customer; and (3) some portion of the fixed costs of the City's other facilities. For purposes of this rider, the Production Cost of Water shall be the variable cost the City incurs to produce additional treated water, which consists of expenses for electric power, chemicals and purchased water.

(f) ESCALATION CLAUSE.

The rate set forth in the Service Agreement shall be subject to an Escalation Clause, during the original and any renewal terms of the Service Agreement, based upon changes in published price indices and/or changes in the City's cost of service, as the City and the qualifying customer shall agree.

(g) FILING WITH THE PENNSYLVANIA PUBLIC UTILITY COMMISSION/
CONFIDENTIALITY FOR OUTSIDE-CITY CUSTOMERS.

Service Agreements entered into between the City and qualifying customers under this rider shall be filed with the Commission on a confidential basis within five (5) days of their execution and shall not be subject to disclosure except by Petition made to and granted by the Commission pursuant to 52 Pa. Code §1.74. The City shall provide copies of such Service Agreements to the Pennsylvania Office of Consumer Advocate ("OCA") contemporaneously with their filing with the Commission, subject to the OCA's execution of a Confidentiality Agreement.

913.11 RIDER DRS - DEMAND-BASED RESALE SERVICE

(a) APPLICABILITY.

Throughout the water service territory served.

(b) AVAILABILITY.

This rider is available to a customer that:

- (1) purchases water from the City for resale;
- (2) enters into a Service Agreement for a term of not less than 15 years;
- (3) during the original and any renewal terms of the Service Agreement, agrees to purchase an average of 21 million gallons of water per month and maintain a daily load factor of not less than 0.67; and
- (4) has a viable competitive alternative to service from the City and intends to select that alternative to the detriment of the City and its other customers.

The City shall require documentation to establish, to the City's satisfaction, the existence of a competitive alternative. Such documentation may include, but is not limited to, an affidavit of the customer or, if the customer is a corporation, an affidavit of one or more of its officers.

(c) RATE.

The rate(s) to be charged qualifying customers under this rider will be as set forth in the Service Agreement, provided, however, that such rate(s): (1) shall not exceed the Maximum Rate; (2) shall not be less than the Minimum Rate; and (3) shall be subject to an Escalation Clause, as hereafter defined.

(d) MAXIMUM RATE.

The Maximum Rate shall be the charges specified in the City's Rate Schedule that would otherwise apply to the qualifying customer absent this rider.

(e) MINIMUM RATE.

The Minimum Rate shall be sufficient to recover: (1) the Production Cost of Water; (2) the fixed costs (depreciation

and pre-tax return) associated with all new facilities added to serve the customer; and (3) some portion of the fixed costs of the City's other facilities. For purposes of this rider, the Production Cost of Water shall be the variable cost the City incurs to produce additional treated water, which consists of expenses for electric power, chemicals and purchased water.

(f) ESCALATION CLAUSE.

The rate set forth in the Service Agreement shall be subject to an Escalation Clause, during the original and any renewal terms of the Service Agreement, based upon changes in published price indices and/or changes in the City's cost of service, as the City and the qualifying customer shall agree.

(g) FILING WITH THE PENNSYLVANIA PUBLIC UTILITY COMMISSION/
CONFIDENTIALITY FOR OUTSIDE-CITY CUSTOMERS.

Service Agreements entered into between the City and qualifying customers under this rider shall be filed with the Commission on a confidential basis within five (5) days of their execution and shall not be subject to disclosure except by Petition made to and granted by the Commission pursuant to 52 Pa. Code §1.74. The City shall provide copies of such Service Agreements to the Pennsylvania Office of Consumer Advocate ("OCA") contemporaneously with their filing with the Commission, subject to the OCA's execution of a Confidentiality Agreement.

(Ord. 3026. Passed 10/15/85; Ord. 4073. Passed 5/16/01; Ord. 4363. Passed 12/20/05; Ord. 2008-20. Passed 7/1/08.)

APPENDIX 2

**BETHLEHEM AUTHORITY
2021 OPERATING BUDGET
EXPENSES**

See EXPENSE DETAIL for explanation of line items

	ACTUAL 19 FULL YEAR	BUDGET 20 FULL YEAR	ACTUAL 20 AS OF 12/01	PROJ 20 FULL YEAR	BUDGET 21 FULL YEAR
PROFESSIONAL SERVICES:					
Audit Services	\$3,620	3,700	\$0	\$3,700	\$3,800
Consulting Engineer	13,947	25,000	17,104	22,000	27,100
Controller	6,980	7,000	5,565	7,000	7,000
Payroll Services	822	1,200	965	1,200	1,200
Financial Advisor	24,868	23,000	9,675	11,000	20,000
Forestry	13,440	12,000	6,491	6,000	7,500
Investment Fees	7,448	7,200	7,199	7,400	6,900
Legal Fees/Solicitor/Bond Counsel	19,940	20,000	15,685	22,000	25,000
Other Consulting/Right-of-Way Purchase/Expense	7,177	6,000	4,289	8,000	8,000
Trustee	4,000	4,000	5,250	5,250	5,250
Total Professional Services	\$102,242	\$109,100	\$72,223	\$93,550	\$111,750

ADMINISTRATIVE EXPENSES:					
Advertising - Legal	\$295	\$300	\$234	\$234	\$300
Conferences and Meetings	635	700	249	250	500
Contingencies	0	3,000	0	0	3,000
Contributions/Donations	100	300	200	200	300
Dues and Subscriptions	995	995	995	995	995
Insurance/Pension	39,174	11,707	11,968	12,100	41,938
Office Equipment	0	2,000	2,134	2,134	500
Office Supplies/Expense	2,106	1,500	873	1,000	1,200
Web Services	0	500	3,791	4,000	1,000
Postage	167	170	139	139	150
Rent/COB Stormwater Fee	1,834	1,950	1,874	1,986	4,000
Salaries:					
Board Chairperson	1,650	1,800	0	1,800	1,800
Board Members	660	720	0	720	720
Administrative Assistant	27,960	28,840	25,451	28,000	32,000
Executive Director	89,666	92,345	84,649	92,345	94,192
Special Police Officer/Officer In Charge	28,015	37,681	28,039	30,350	71,000
Taxes - Payroll	17,449	18,788	14,140	15,290	18,500
Telephone	673	900	897	1,121	900
Travel, Meals, Etc.	1,641	1,700	1,212	1,600	1,700
Contribution to BRIF or Water Cap Fund	0	0	0	100,000	100,000
Transfer to Capital Reserve Fund	0	207,684	0	121,748	149,150
Total Administrative Expenses	\$213,020	\$413,580	\$176,845	\$416,012	\$523,845

PROPERTY & SECURITY EXPENSES:					
Miscellaneous Property Maintenance	33,060	4,000	600	845	2,000
Office Building Utilities	1,564	1,800	1,583	1,800	2,000
Silviculture Expenses	9,802	16,000	17,723	21,723	5,000
Subtotal Property Expenses	44,426	21,800	19,906	24,368	9,000
Certifications and Training	\$175	\$0	\$54	\$54	\$200
Equipment	4,291	36,000	34,576	30,910	2,500
Equipment Maintenance/Repairs	2,653	3,000	2,270	7,029	3,500
Firearms and Ammunition	0	0	0	0	1,500
Fuel Expense	4,383	5,000	2,903	2,816	5,000
Miscellaneous Supplies	127	350	561	450	500
Security Support	58,599	63,850	29,731	31,900	24,000
Uniforms	476	1,600	756	1,300	1,900
Wireless Services	3,767	4,500	4,015	4,100	5,000
Property Services (Real Estate, Surveys, etc.)	182,240	21,500	882	438	6,000
Subtotal Security Expenses	256,711	135,800	75,748	78,997	50,100
Total Security and Property Expenses	\$301,137	\$157,600	\$95,654	\$103,365	\$59,100

TOTAL OPERATING EXPENSES	\$616,399	\$680,280	\$344,722	\$612,927	\$694,695
TOTAL OPERATING REVENUES	\$725,539	\$680,280	\$452,045	\$612,927	\$694,695
NET REVENUES/(EXPENSES)	\$109,140	\$0	\$107,323	\$0	\$0

**BETHLEHEM AUTHORITY
2021 CAPITAL BUDGET
EXPENSES AND SOURCE OF FUNDING**

CAPITAL EXPENSES	ACTUAL 19 FULL YEAR	BUDGET 20 FULL YEAR	ACTUAL 20 AS OF 12/01	PROJ 20 FULL YEAR	BUDGET 21 FULL YEAR
Transfer to Operating Fund	\$0	\$0	\$0	\$0	\$0
Wind Project Development					
Legal Fees	11,572	12,000	2,552	3,000	9,000
Consulting Forester Fees	0	0	0	0	0
Other Consulting Fees	0	0	0	0	0
Property Improvements					
Physical Security	0	0	0	0	50,000
Authority Watershed Office Improvements	0	0	0	0	0
Property Purchases	166,362	0	0	0	0
Security Equipment	0	0	0	0	0
Emergency Alternative Source Water Study (*)	0	75,000	28,370	45,000	30,000
PennEast Pipeline Expenses					
Security Equipment and Improvements	0	0	0	0	0
Engineering	0	3,000	0	0	3,000
Financial Advisor	0	0	0	0	0
Forestry	0	500	0	0	500
Legal Fees	0	1,000	0	0	1,000
Total Capital Expenses	\$177,934	\$91,500	\$30,922	\$48,000	\$93,500
SOURCE OF FUNDING					
Reserves					
Wind Project Development					
Operating Funds	\$0	\$0	\$0	\$0	\$0
Reserves	0	0	2,552	3,000	9,000
Wind Developer Reimbursements	0	3,000	0	0	0
Wind Developer License Fee	35,000	35,000	0	35,000	35,000
Property Improvements/Purchases					
Reserves	166,362	0	0	0	50,000
Security Equipment					
PLGIT Pipeline Account	0	4,500	0	0	0
Reserves		0	0	0	0
Emergency Alternative Source Water Study					
Reserves	0	75,000	28,370	45,000	30,000
PennEast Pipeline					
License Fee	0	0	0	0	0
Annual Fee	0	34,125	0	34,125	34,125
Reserves	0	0	0	0	4,500
Total Source of Funding	\$201,362	\$151,625	\$30,922	\$117,125	\$162,625

(*) Interconnection Study and Testing

CASH FLOW BUDGET

Operating Fund Balance on Jan. 1, 2020		\$ 40,479	2020	2021
<u>Revenues & Transfers</u>			Projected	Budget
City of Bethlehem - Operating Funds			\$ 325,000	\$ 350,000
Carbon Credit Revenue			150,000	190,000
Miscellaneous Income, including Interest			17,650	9,500
Silviculture (Timbering) Income			5,262	29,000
Rental/Lease Income			115,015	116,195
Total Revenues			612,927	694,695
Transfer from Capital Reserve Fund			-	-
Total Revenues & Transfers			\$ 612,927	\$ 694,695
<u>Expenses & Transfers</u>				
Professional Services			93,550	111,750
Salaries and Benefits			180,605	260,150
Misc. Administrative Expenses			10,959	17,245
Contribution to City Water Capital Fund/BRIF			100,000	100,000
Security and Property Expenses			103,365	59,100
Total Expenses			488,479	548,245
Transfer to Capital Reserve Fund			121,748	146,450
Total Expenses & Transfers			\$ 610,227	694,695
Projected Balance on Dec. 31, 2020:			\$ 43,179	
Projected Balance on Dec. 31, 2021:				\$ 43,179
Capital Fund Balance on Jan. 1, 2020		\$ 723,624	2020	2021
<u>Revenues & Transfers</u>			Projected	Budget
Transfer from Operating Fund			121,748	146,450
PennEast License Fee/Annual Fee			\$ -	\$ 34,125
Wind Developer License Fee			35,000	35,000
Wind Developer Reimbursements			3,000	-
Total Revenues & Transfers			\$ 159,748	215,575
<u>Expenses & Transfers</u>				
Wind Project Development			\$ 3,000	\$ 9,000
PennEast Pipeline			-	4,500
Property & Security Improvements			-	50,000
Alternate Source Water Study			45,000	30,000
Total Expenses			48,000	93,500
Transfer to Operating Fund			-	-
Total Expenses & Transfers			\$ 48,000	\$ 93,500
Projected Balance on Dec. 31, 2020:			\$ 835,372	
Projected Balance on Dec. 31, 2021:				\$ 957,447
Total Cash Balance Both Funds:			\$ 878,551	\$ 1,000,626

APPENDIX 3

**CITY OF BETHLEHEM
WATER CAPITAL FUND
FUND ANALYSIS SUMMARY**

	2021 Final Budget
REVENUES:	
308901 Cash	673,088
37005 Bond Redemption and Improvement	2,780,000
39805 Capital Appropriations	1,546,411
TOTAL WATER CAPITAL FUND REVENUES	4,999,499
EXPENDITURES:	
770016 5 Million Gallon Northeast Standpipe Engineering	106,000
77002 Distribution Systems Extension	50,000
77003 Service Lines New/Renewal	150,000
77004 Metering	350,000
77005 Replace, Relocate, Rehabilitate Distribution System	500,000
77006 Fire Hydrant New/Renewal	250,000
77015 0.5 MG SE Tank Engineering	32,800
77016 Emergency Repair Transmission Mains	15,000
77023 Fire Pump Station Engineering/Construction	572,000
77026 Sidewalk/Trench Restoration	150,000
77028 Rt. 512 Extension for EAT Engineering	1
77032 SCADA System Upgrade	1
77034 WTP Chlorination Alternatives Design/Construction	1
77036 Commercial & Industrial Meter Replacement	105,000
77037 Automatic Meter Reading Project	31,200
77038 Replace WTP Air Blowers	1
77039 Master Meters/Pits/Appurtenances	1
77040 Fixed Asset Repairs	120,660
77042 2 MG SE Storage Tank Modifications	9,029
77045 5 MG SW Tank Engineering	1
77049 Wild Creek Intake Screen Replacement	36,350
77051 WTP Bulk Chemical Storage Tank Replacement	49,300
77052 WTP Lagoon Baffle System Replacement	173,100
77053 Distribution System Auto Flushing Stations	24,000
77054 Drexel Heights Pressure Improvement	45,000
77055 Hecktown Road Bridge Main Replacement	550,000
77056 WTP Emergency Generator	877,100
77057 WTP Lower Roof Replacement/Engineering	90,000
77059 Well System Generators and Transfer Switches	230,000
77060 Mud Lane Water Main Extension and Well Abandonment	95,000
77062 Shady Lane Manganese Treatment	88,000
77084 Security Enhancements	1
77096 Penn Forest Dam SCADA	1
77099 Equip. Water Maint.	110,500
770991 Equip. Collection & Treatment	70,750
770992 Equip. Water Laboratory	1
770993 Equip. Meter Shop	37,100
770996 Equip. WTR. Filtration	71,600
770997 Equip. Utility Billing	1
770999 Equip. Tech. Support	10,000
TOTAL WATER CAPITAL FUND EXPENDITURES	4,999,499

2021 WATER CAPITAL PROJECT DETAIL

5 Million Gallon Northeast Standpipe Engineering

007A-770016

Project includes the painting of interior/exterior, antenna retrofit service, mixing system installation and service and inspection services. Professional engineers will be responsible for ongoing asset management and scheduling of maintenance and for future structural integrity and renovations.

Distribution System Extensions

007A-77002

The extension of the distribution system and the routine expansion of the distribution mains to serve customers.

Service Lines New/Renewal

007A-77003

Pipe, fittings and material for repair/replacement of service lines. These lines are installed from the main to the curb line and are generally ¾" in size, but can be as large as 4". Also includes tapping sleeves and valves for fire lines and other supplies.

Metering

007A-77004

This is an annual project for replacement of older residential and small commercial property meters. Meters range from 5/8" to 1" in size including washers, couplings, wire and endpoints.

Replace, Relocate, Rehabilitate Distribution System

007A-77005

This is an annual project. Replacement, relocation or rehabilitation of water distribution system based on Long Term Infrastructure Improvement Plan or emergencies.

Fire Hydrant - New/Renewal

007A-77006

This is an annual project. Additional hydrants are needed to eliminate spacing deficiencies. Damaged and worn hydrants must be replaced and new hydrants added as distribution system expands. Includes new hydrants, hydrant repair kits and hydrant locks.

0.5 MG SE Tank Engineering

007A-77015

Project includes the painting of interior/exterior, mixing system installation and service and inspection services. Professional engineers will be responsible for ongoing asset management and scheduling of maintenance and for future structural integrity and renovations.

Emergency Repair Transmission Mains

007A-77016

To repair transmission main leaks including permitting, construction administration, and construction/repair costs. To replace transmission main appurtenances.

Fire Pump Station Engineering/Replacement

007A-77023

Project for design, bid, and construction to install new pumps, motors, isolation and check valves, actuators, motor control center, piping, electrical work, flow meter and emergency generator/transfer switch. Complete construction in 2021.

Sidewalk/Trench Restoration

007A-77026

This is an annual project which includes trench, curb and sidewalk restoration following water line repairs.

Route 512 Extension for East Allen Township

007A-77028

Project to extend water distribution main on Route 512 in East Allen Township. Contingent on development along the Rt. 512 Corridor. Includes cost to acquire Rights-of-Way.

2021 WATER CAPITAL PROJECT DETAIL

SCADA System Upgrade

007A-77032

This is an annual project to perform software updates, server upgrades, replacement instrumentation, SCADA conversions. SCADA consultant services for upgrade of WDC SCADA system to new non-proprietary head end.

Chlorine Gas Alternatives Design/Construction

007A-77034

Design alternative to chlorine gas at the Water Filtration Plant based on results of alternatives study completed in 2018. Design and construction will be planned for a future year pending availability of capital funding.

Commercial and Industrial Meter Replacement

007A-77036

This is an annual project. It is to provide for replacement of old high usage meters in commercial, industrial, public and institutional buildings and pits and for meter bypasses and fire lines. Meters range from 1 ½" to 8" in size.

Automatic Meter Reading Project

007A-77037

Strategic plan to complete the installation of Advanced Metering Infrastructure. (AMI) technology will provide for automatic meter reading via central radio towers. One additional tower and base station to be installed in 2021 with a possibility of smaller tower depending on the efficiency of the entire AMI infrastructure.

Replace Air Blowers at WTP

007A-77038

To replace two (2) air blowers at WTP which are 25 years old. Slated for a future budget year.

Master Meters/Pits/Appurtenances

007A-77039

To maintain master meters in meter pits with piping and for our bulk service customers to monitor flows and for accurate billing purposes.

Fixed Asset Repair

007A-77040

Repairs or replacements (\$5,000 or more) to the utility's fixed assets which may include buildings, computer equipment, computer software, intangible assets, land, leasehold improvements, machinery, and vehicles. Equipment repairs (\$5,000 or more) including but not limited to pumps, generators and other process control equipment needed to maintain good working order and/or to restore the equipment to its previous condition.

2 MG SW Reservoir Engineering

007A-77042

To inspect and evaluate the condition of the reservoir, evaluate rehabilitation or replacement alternatives, prepare budgetary pricing for each option and submission of final report with recommendations. Payment in 2021.

5 MG SW Tank Engineering

007A-77045

Project includes the painting of interior/exterior, mixing system installation and service and inspection services. Professional engineers will be responsible for ongoing asset management and scheduling of maintenance and for future structural integrity and renovations. Slated for a future budget year.

Wild Creek Intake Screen Replacement

007A-77049

To fabricate new link elements for two sets of Wild Creek intake screens on Line #2 which are severely corroded as per PA DEP inspection report.

WTP Bulk Chemical Storage Tank Removal/Replacement

007A-77051

To remove and replace WTP bulk orthophosphate chemical storage tank which exceeded its useful life.

2021 WATER CAPITAL PROJECT DETAIL

WTP Lagoon Baffle System Replacement

007A-77052

To replace WTP Floating Lagoon Baffle System in the north lagoon in 2020 and in the south lagoon in 2021. Floats and skirts are deteriorating and must be replaced to avoid short circuiting.

Distribution System Auto Flushing Stations

007A-77053

Installation of automatic flushing stations at various locations in the distribution system to maintain water quality to meet new PA DEP regulations.

Drexel Heights Pressure Improvement

007A-77054

To design and construct new water main feed to the Drexel Heights development in Allen Township to increase water pressure to acceptable levels.

Hecktown Road Bridge Main Replacement

007A-77055

To replace water main on Hecktown Road over Route 22. Includes design, bidding and construction services.

WTP Emergency Generator Replacement

007A-77056

To replace emergency generator at WTP which is at the end of its useful life. Includes generator, enclosure, load bank, fuel tank, automatic transfer switch, mechanical/HVAC, demo of existing UST, replace electronic controller, site work, conduit, fencing and other electrical modifications, start-up, and training.

WTP Lower Roof Replacement

007A-77057

To make repairs to the existing WTP lower roof and replace vapor barrier and roofing system. In 2021 perform diagnostic scans and remove two roof sections to repair two roof drains and reinstall roofing in these two sections.

Well System Emergency Generators and Transfer Switches

007A-77059

To install emergency generators and automatic transfer switches at each of the City's well systems as per the Uninterrupted System Service Plan requirements of PA DEP Chapter 109.

Mud Lane Water Main Extension and Well Abandonment

007A-77060

Project to extend 1,500 feet of water main on Mud Lane including pump package and connection to the East Allen Gardens distribution system. Existing well system will be abandoned.

Shady Lane Manganese Treatment

007A-77062

Installation of equipment necessary to reduce high manganese at the Shady Lane well system.

Security Enhancements

007A-77084

To design and install security enhancements identified as a result of a security study assessment of the water system.

Penn Forest Dam SCADA System

007A-77096

To provide SCADA system services on an as needed basis. Needed to monitor dam measurements to ensure structural integrity of the dam.

2021 WATER CAPITAL PROJECT DETAIL

Equipment –Utility Maintenance

007A-77099

The following is the list of equipment requested by the Bureau of Utility Maintenance:

New Vehicle Leases:

One (1) GMC 3500 HD Utility Body Crew Truck (Lease year 1 of 4)
One (1) John Deere 310 SL Backhoe w/ accessories (Lease year 1 of 3)

Equipment:

One (1) Light tower with generator
One (1) Line Stop/Tapping equipment

Equipment – Collection & Treatment

007A-770991

The following is the list of equipment requested by Bureau of Collection & Treatment:

New Vehicle Leases:

One (1) 2021 GMC Sierra 3500 HD 4WD Pickup Truck (Lease year 1 of 3)

Current Vehicle Leases:

One (1) 2019 Ford F250 Regular Cab Pickup Truck (Lease year 3 of 3)
One (1) John Deere 6130M Cab Tractor 4x4 with diamond mower (Lease year 2 of 4)

Equipment – Laboratory Services

007A-770992

No capital equipment purchases planned for 2021

Equipment – Meter Shop

007A-770993

Current Vehicle Leases:

One (1) 2019 GMC Savana 4X4 Cargo Van (Lease year 3 of 3)

Equipment:

Three (3) GB Handheld FL6501
Three (3) AG6590 Reading Gun

Equipment – Water Filtration

007A-770996

Replace one (1) rooftop air handler
Rebuild one (1) water service pump

Equipment – Utility Billing

007A-770997

No capital equipment purchases planned for 2021

Equipment – Technical Support

007A-770999

SCADA system pressure, level and flow transmitters

APPENDIX 4

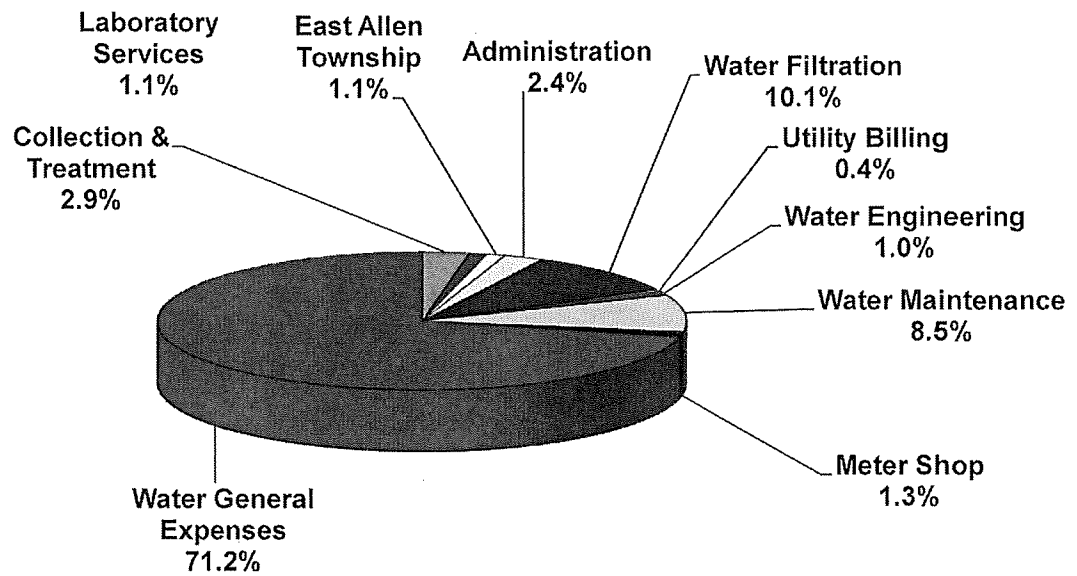
**CITY OF BETHLEHEM
WATER FUND
FUND ANALYSIS SUMMARY**

	2016 Actual	2017 Actual	2018 Actual	2019 Actual	2020 Budget w/ Transfers	2020 Actual & Estimated	2021 Final Budget
REVENUES:							
Sale of Water							
31001A Residential	12,873,616	12,696,445	12,600,162	12,651,625	12,559,748	12,550,000	12,671,649
31001B Commercial	2,943,652	2,915,254	3,115,947	3,079,827	2,999,848	2,980,000	2,960,597
31001C Industrial	1,701,782	1,696,445	1,689,330	1,664,455	1,662,408	1,595,000	1,679,032
31001D Institutional	1,306,070	1,238,690	1,289,288	1,239,735	1,273,508	1,250,000	1,268,000
31001E Public	135,479	94,309	20,040	16,453	116,143	60,000	83,000
31003 Northampton Borough	-	-	-	-	-	-	13,000
31004 Salisbury Township	4,394	3,985	4,032	4,041	3,977	3,950	4,017
31005 East Allen Township	58	-	13	-	1	-	1
31006 Utilities Inc	240,837	232,086	237,606	226,928	227,462	230,000	229,737
31007 Upper Saucon	(142,260)	40,047	53,902	46,147	46,480	46,000	46,945
31008 Lower Saucon	562,368	564,553	576,225	525,514	537,175	535,000	542,547
31009 Fire Protection	788,396	810,924	852,211	883,228	822,050	830,000	863,075
31012 Penalty on Delinquents	135,545	91,958	131,507	97,717	75,000	85,000	75,750
31014 Building Permit Water	6,332	13,747	14,965	15,532	15,000	14,000	15,150
31016 Fire Hydrant Water Use	583,555	584,672	609,888	608,972	585,000	590,000	590,850
31017 Penalty - Fire Protection	6,660	-	-	1,748	1,000	4,000	1,000
31050D Delinquent Water	151	-	595	97	-	-	-
Total Sale of Water	21,146,635	20,983,115	21,195,711	21,062,019	20,924,800	20,772,950	21,044,350
Other Operating Revenues							
308901 Cash Balance	-	-	-	-	-	-	500,000
31101 Water Main Assessment	-	-	-	-	-	-	-
31103 Permits & Materials	42,290	60,346	24,579	35,969	30,000	25,000	30,000
31105 Expense Returns	-	-	350	1,924	-	-	-
31106 Miscellaneous	33,301	79,062	150,784	54,428	45,000	40,000	45,450
31108 Backflow	-	-	-	-	100	-	100
31109 Dist System Improve Charge	-	-	-	-	100	-	100
Total Other Operating Revenues	75,591	139,408	175,713	92,321	75,200	65,000	575,650
Investment Interest							
30850 Investment Interest	8,143	22,365	70,191	117,049	75,000	60,000	35,000
Total Investment Interest	8,143	22,365	70,191	117,049	75,000	60,000	35,000
TOTAL WATER FUND REVENUES	21,230,369	21,144,888	21,441,615	21,271,389	21,075,000	20,897,950	21,655,000
EXPENDITURES BY BUREAU/DIVISION:							
Collection & Treatment	466,638	443,296	498,199	513,120	626,568	604,778	619,353
Laboratory Services	157,111	155,467	173,296	209,409	230,571	220,221	236,172
East Allen Township	193,838	184,627	188,945	225,171	237,190	223,150	239,050
Administration	322,399	340,911	357,152	422,919	509,465	498,265	519,323
Water Filtration	1,483,542	1,579,533	1,557,134	1,687,227	1,934,832	1,880,012	2,182,924
Utility Billing	79,711	73,222	75,638	75,836	83,733	81,838	81,964
Water Engineering	192,656	206,188	214,007	210,469	218,685	214,185	224,016
Water Control	446,926	350,197	371,884	375,953	-	-	-
Water Maintenance	1,331,602	1,328,329	1,411,295	1,364,140	1,803,997	1,728,987	1,844,842
Meter Shop	397,551	410,273	417,092	417,359	262,785	249,435	280,098
Water General Expenses	14,656,593	16,156,935	14,667,653	16,643,065	15,167,174	15,011,635	15,427,258
TOTAL WATER FUND EXPENDITURES	19,728,567	21,228,978	19,932,295	22,144,668	21,075,000	20,712,506	21,655,000
EXPENDITURES BY CATEGORY:							
Personnel Costs	3,850,890	3,724,199	3,907,741	4,029,926	3,984,696	3,953,486	4,092,087
Materials & Supplies	258,921	301,941	350,047	371,794	468,250	419,380	493,305
Purchased Services	15,618,756	17,144,475	15,628,848	17,707,618	16,533,404	16,271,135	16,971,808
Equipment	-	58,363	45,659	35,330	88,650	68,505	97,800
TOTAL WATER FUND EXPENDITURES	19,728,567	21,228,978	19,932,295	22,144,668	21,075,000	20,712,506	21,655,000

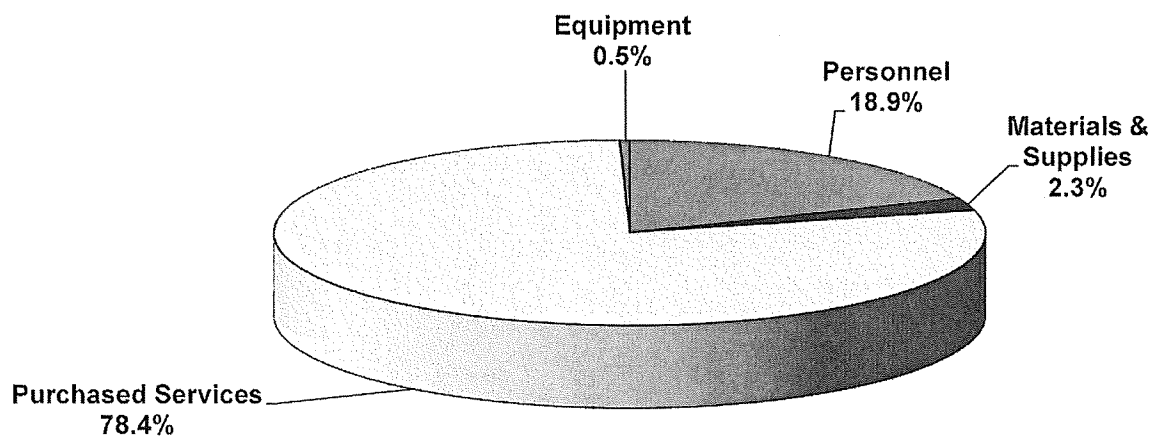
**CITY OF BETHLEHEM
WATER FUND
BUREAU/DIVISION RESOURCE SUMMARY**

Bureau/Divison		Personnel	Materials & Supplies	Purchased Services	Equipment	Total
20011	Collection & Treatment	\$ 427,153	\$ 28,600	\$ 162,600	\$ 1,000	\$ 619,353
20012	Laboratory Services	169,872	19,500	43,700	3,100	236,172
20014	East Allen Township	-	20,300	218,750	-	239,050
20015	Administration	380,093	1,530	132,700	5,000	519,323
20016	Water Filtration	1,244,324	303,400	618,000	17,200	2,182,924
20017	Utility Billing	78,964	1,000	1,000	1,000	81,964
20018	Water Engineering	152,516	-	71,500	-	224,016
Supply & Treatment		2,452,922	374,330	1,248,250	27,300	4,102,802
20022	Utility Maintenance	1,407,267	95,775	277,800	64,000	1,844,842
20023	Meter Shop	231,898	17,500	24,200	6,500	280,098
Water Maintenance		1,639,165	113,275	302,000	70,500	2,124,940
2006	Water General Expenses	-	5,700	15,421,558	-	15,427,258
Water General Expenses		-	5,700	15,421,558	-	15,427,258
TOTAL WATER FUND		\$ 4,092,087	\$ 493,305	\$ 16,971,808	\$ 97,800	\$ 21,655,000

Water Fund Expenditures by Bureau/Division



Water Fund Expenditures by Category



**CITY OF BETHLEHEM
WATER FUND
SUMMARY OF POSITIONS**

Bureau/Divison		2016 Actual	2017 Actual	2018 Actual	2019 Actual	2020 Budget w/ Transfers	2020 Actual & Estimated	2021 Final Budget
20011	Collection System	6	6	6	6	6	6	6
20012	Laboratory Services	3	3	3	3	4	4	4
20014	East Allen Township	-	-	-	-	-	-	-
20015	Administration	4	4	4	4	5	5	5
20016	Water Filtration	15	15	15	15	15	15	15
20017	Utility Billing	3	3	3	3	3	3	3
20018	Water Engineering	2	2	2	2	2	2	2
20019	Water Control	6	6	6	6	-	-	-
Supply & Treatment		39	39	39	39	35	35	35
20022	Utility Maintenance	26	26	26	26	26	26	26
20023	Meter Shop	7	7	7	7	7	7	7
Water Maintenance		33	33	33	33	33	33	33
TOTAL WATER FUND		72	72	72	72	68	68	68

Debt Service

Bureau 2006

	<u>2020</u>	<u>2021</u>
Account 42094 Lease Rental		
Series of 2014		
Principal	5,300,000	5,550,000
Interest	<u>1,753,050</u>	<u>1,488,050</u>
	7,053,050	7,038,050
5% Coverage	352,653	351,903
Credit	<u>(130,000)</u>	<u>(100,000)</u>
	<u>7,275,703</u>	<u>7,289,953</u>
1998 Capital Appreciation Bond		
Principal	437,344	419,547
Interest	<u>957,656</u>	<u>990,453</u>
	1,395,000	1,410,000
5% Coverage	<u>69,750</u>	<u>70,500</u>
	<u>1,464,750</u>	<u>1,480,500</u>
	<u>8,740,453</u>	<u>8,770,453</u>
Account 42095 2007 G.O Note		
Principal	66,000	67,000
Interest	<u>5,515</u>	<u>3,713</u>
	<u>71,515</u>	<u>70,713</u>

Schedule of Payment of Bond & Note Indebtedness

	1998 Capital Appreciation Bond		2007 GO Note		2014 Guaranteed Water Revenue Bonds		Total
	<u>Principal</u>	<u>Interest</u>	<u>Principal</u>	<u>Interest</u>	<u>Principal</u>	<u>Interest</u>	
2021	419,547	990,453	67,000	3,713	5,550,000	1,488,050	8,518,763
2022	2,038,880	5,166,120	69,000	1,884	35,000	1,210,550	8,521,434
2023	1,941,153	5,288,847			80,000	1,209,500	8,519,500
2024	1,835,213	5,414,787			65,000	1,207,100	8,522,100
2025	1,746,838	5,528,163			40,000	1,205,150	8,520,150
2026	1,662,661	5,637,339			15,000	1,203,900	8,518,900
2027	1,581,392	5,738,608			-	1,203,413	8,523,413
2028	1,240,878	4,809,122			1,270,000	1,203,413	8,523,413
2029					7,360,000	1,160,550	8,520,550
2030					7,625,000	893,750	8,518,750
2031					5,960,000	512,500	6,472,500
2032					5,720,000	214,500	5,934,500
Totals	<u>12,466,562</u>	<u>38,573,438</u>	<u>136,000</u>	<u>5,597</u>	<u>33,720,000</u>	<u>12,712,375</u>	<u>97,613,972</u>

The bonds and notes were issued to provide funds for and towards the cost and expenses related to the construction of the Penn Forest Dam.

APPENDIX 5

APPENDIX 5
Water Customer Accounts
3/2021

<i>CUSTOMER CLASSIFICATION</i>	<i>ENDING 2016</i>	<i>ENDING 2017</i>	<i>ENDING 2018</i>	<i>ENDING 2019</i>	<i>ENDING 2020</i>
<i>DOMESTIC</i>	<i>34,531</i>	<i>34,586</i>	<i>34,677</i>	<i>34,663</i>	<i>34,820</i>
<i>COMMERCIAL</i>	<i>1,240</i>	<i>1,246</i>	<i>1,257</i>	<i>1,249</i>	<i>1,253</i>
<i>INDUSTRIAL</i>	<i>119</i>	<i>120</i>	<i>120</i>	<i>122</i>	<i>122</i>
<i>INSTITUTIONAL</i>	<i>295</i>	<i>296</i>	<i>318</i>	<i>318</i>	<i>317</i>
<i>OTHER</i>	<i>97</i>	<i>98</i>	<i>106</i>	<i>84</i>	<i>77</i>
<i>TOTAL</i>	<i>36,283</i>	<i>36,346</i>	<i>36,478</i>	<i>36,436</i>	<i>36,589</i>

- Note: Prior to 2004, all accounts (both Closed and Active) were included.
- Thereafter, only Active accounts were included.
- Note: Starting in 2016 water customer accounts will include well systems and Rt 512 consecutive system.

APPENDIX 6

APPENDIX 6
WATER DEPARTMENT STAFFING & BUDGET
2021 Staffing and Budget by Division

<u>Division</u>	<u>Positions</u>	<u>Budget</u>
Collection & Treatment	6	\$ 619,353
Laboratory Services	4	\$ 236,172
Administration	5	\$ 519,323
Water Filtration	15	\$2,182,924
Utility Billing	3	\$ 81,964
Water Engineering	2	\$ 224,016
Water Control	0	\$ 0
Utility Maintenance	26	\$1,844,842
Meter Shop	7	\$ 280,098
East Allen Township	-	\$ 239,050
Total	68	\$ 6,227,742

APPENDIX 7

APPENDIX 7

DESCRIPTION OF WATER SYSTEM FACILITIES

Bethlehem Water System

General

The water system is owned by the Bethlehem Authority and operated by the City of Bethlehem under a contract and lease. The system presently serves the City of Bethlehem and the surrounding municipalities of: Fountain Hill Borough, Hanover Township, Salisbury Township, and Upper Saucon Township in Lehigh County; and Freemansburg Borough, Allen Township, Bethlehem Township, East Allen Township, Hanover Township, Lower Nazareth Township and Lower Saucon Township in Northampton County. The various sources of water supply, treatment facilities, transmission system, distribution system, and distribution storage facilities comprising the existing water system are described below.

Sources of Water Supply

Bethlehem obtains its water supply from the Wild Creek Watershed (Penn Forest Dam/Reservoir and Wild Creek Dam/Reservoir) and the Tunkhannock Creek Watershed. Water from the Tunkhannock Creek is diverted to the Wild Creek Watershed when stream flow is adequate. The Tunkhannock/Wild Creek supply has a safe yield of 26.3 million gallons per day (mgd).

- (1) Tunkhannock Creek. An on-stream intake on Tunkhannock Creek controls the diversion of water from a watershed of 8.6 square miles. Water can be

diverted from this intake to Penn Forest Reservoir through 8-1/2 miles of 42-inch and 36-inch main.

- (2) Penn Forest Reservoir. This impounding reservoir is located on Wild Creek 22 miles north of the City of Bethlehem. It has a storage capacity of 6.0 billion gallons (Bgal) at the spillway overflow elevation of 1,000.6 feet. The reservoir receives runoff water from its 16.5 square mile watershed and from the Tunkhannock Creek diversion main. Water from Penn Forest Reservoir flows in Wild Creek to the Wild Creek Reservoir.
- (3) Wild Creek Reservoir. This reservoir is located on Wild Creek, 19 miles north of the City of Bethlehem. The reservoir which is supplied by releases from Penn Forest Reservoir and the additional 5.7 square mile watershed between Penn Forest and Wild Creek Reservoirs has a storage capacity of 3.9 Bgal at the spillway overflow elevation of 820.0 feet. The outlet structure at Wild Creek Reservoir delivers water directly to transmission mains, which convey water to the water treatment plant.

Treatment

Raw water from the surface water sources is presently treated at the Bethlehem Water Treatment Plant. Plant processes include pre and post chemical treatment, flocculation and filtration. This direct filtration facility is equipped to provide chemical treatment with chlorine, alum, fluoride, orthophosphate, caustic soda, lime, carbon, potassium permanganate and polymer. The plant includes necessary appurtenances such

as control and instrumentation equipment, a 7.66 Mgal clearwell and process wastewater facilities.

Water quality monitoring of treated water at the water treatment plant consists of continuous turbidity, chlorine residual, and pH analyses. Other water quality sampling and testing is conducted as required by PADEP Safe Drinking Water Regulations.

Transmission System

Raw water flows by gravity from Wild Creek Reservoir to the Bethlehem Water Treatment Plant through 30-inch, 36-inch, and 42-inch steel and reinforced concrete transmission mains, and through two 48-inch mountain tunnels. Finished water from the treatment plant is transmitted through 30-inch reinforced concrete and 48-inch steel mains. The transmission system is “dualized” except for the two 48-inch tunnels and mains inside the portals leading to and from each tunnel.

The transmission system divides into the Howertown East and Howertown South Transmission Mains at the Howertown Control Station. The Howertown East Transmission main is 34-inch and 36-inch in diameter. It extends east from the Howertown Control Station to the 5 MG Northeast Tank, and across the Lehigh River to the 5 MG Southeast Tank. The Howertown East pressure regulating valve (PRV), located at the Howertown Control Station, reduces pressures in the Howertown East Transmission Main. The Howertown South Transmission Main extends southward from the Howertown Control Station to the Pennsylvania Avenue Control Station, where the 30-inch main branches into 20-inch and 24-inch mains. The Pennsylvania Avenue PRV reduces pressure in the 20-inch and 24-inch mains. The 20-inch main extends eastward from the Pennsylvania Avenue Control Station and helps serve the Main Service Area. The 24-inch main

extends south from the Pennsylvania Avenue Control Station, crosses the Lehigh River, and delivers water to the South Side 12 MG Reservoir.

Distribution System

The City of Bethlehem water distribution network is monitored and controlled using a Supervisory Control and Data Acquisition (SCADA) system. The SCADA system is an extensive telemetry network of sensors that collect system operating data and relay the information to the central Water Control Room at City Hall. Sensors include pressure transmitters, tank water level monitors, and flow meters that are located at key points in the water system. Water Control computers display and record SCADA system data. Control room personnel monitor SCADA information to manage the operation of distribution system pumps and tanks.

The City of Bethlehem water distribution network includes ten (10) water service levels. Service level, approximate service gradient elevations, hydraulic grade lines, and pressure ranges are summarized below:

Service Level	Approximate Elevation Range (feet)	Approximate Hydraulic Grade Line (feet)	Approximate Pressure Range (psi)
Main Service	210 - 490	530	20 - 140
Howertown South	340 - 440	650	100 - 135
LVIP #3	320 - 390	500	40 - 90
South Side Low	195 - 400	475	30 - 120
South Side High	310 - 660	743	35 - 190
South Mountain High	740 - 920	1020	45 - 120
Saucon Valley	310 - 530	640	45 - 140
Southeast Low	270 - 415	490	30 - 95
Spring Lake Village	500 - 600	720	50 - 95
Weil Street	690	-	60

The Main Service Area includes most of the Bethlehem system north of the Lehigh River, plus areas south of the river in the southeast section of the system. The Howertown South

Gradient lies along the Howertown South Transmission Main, between the Howertown Control Station and the Pennsylvania Avenue Control Station. The Lehigh Valley Industrial Park (LVIP #3) zone is served by a PRV from the Howertown South gradient. The South Side Low zone covers the area south of the Lehigh River, in the central and southwest sections of the system. The South Side High and South Mountain High gradients serve customers at higher elevations on South Mountain. The Saucon Valley service area is located south of South Mountain, and receives inflow through the Saucon Valley PRV from the South Side High gradient. The Southeast Low service area is located along William Street south of the 5 MG Southeast Tank. The Spring Lake Village service area is located in East Allen Township and is served by the Frank's Corner Pumping Station. The Weil Street service area is located in Salisbury Township around Weil Street, Ritter Street, Virginia Avenue, and Hamilton Avenue and the Weil Street Booster Station was installed to increase pressures in the area.

The system operates by gravity flow from the Bethlehem Water Treatment Plant into the Main Service Area and the 12 MG Reservoir. Pressures are regulated in major transmission mains by pressure reducing valves at the Howertown and Pennsylvania Avenue Control Stations. The Howertown East PRV maintains a downstream pressure of approximately 58 psi in the Howertown East transmission main, or a hydraulic grade line (HGL) of about 550 feet. The Pennsylvania Avenue PRV also maintains a downstream pressure of about 61 psi, which corresponds to a HGL at that location of about 500 feet.

There are numerous distribution pipeline connections to the Howertown East transmission main along its route through the Main Service Area. The Howertown South transmission main carries water to the Pennsylvania Avenue Control Station. There are only a few connections to the Howertown South main that serve customers in the Lehigh Valley Industrial Park and areas near

the Lehigh Valley Airport. The Howertown South transmission main divides at the Pennsylvania Avenue Control Station into a 20-inch main (Pennsylvania Avenue East) that extends eastward along Catasauqua Road, and a 24-inch main (Pennsylvania Avenue South) that extends southward along Pennsylvania Avenue. The 20-inch and 24-inch mains both serve the Main Service Area north of the Lehigh River. The 24-inch main also crosses the Lehigh River and provides inflow to the 12 MG Reservoir.

Distribution Pumping Stations

High elevation areas on South Mountain that cannot be served by gravity flow from the Howertown East or Pennsylvania Avenue South mains are served by three (3) booster pumping stations. The 5th & William Booster Pumping Station pumps water from the Main Service Area into the South Side High Gradient. The South Side Pumping Station also serves the South Side High Gradient. This station pumps water from the 5 MG Southwest Tank into the South Side High zone. The Fire Pumping Station draws water from the 1 MG Tank and pumps into the South Mountain High service level. These pumping station are briefly described below:

1. 5th & William Booster Pumping Station: This pumping station, located at the corner of East 5th Street and William Street, houses three pumps. Two of the pumps are electric motor driven, and the third pump is equipped with an emergency natural gas powered engine. Water is pumped by this station into the South Side High Gradient and also into the 1 MG Tank and 2 MG Reservoir.
2. South Side Pumping Station: This pumping station, located adjacent to the 5 MG Southwest Tank and 12 MG Reservoir, houses three pumps. Two are electric motor driven and the third pump is driven by a diesel powered engine. Water is pumped by this

station into the South Side High Gradient and also into the 2 MG Reservoir and 1 MG Tank.

3. Fire Pumping Station: It is also located adjacent to the 1 MG Tank and draws its suction supply from the tank. The station houses three pumps. Two have dual drives and can be driven by electric motors or gasoline powered engines. The third pump is electric motor driven only. Water is pumped by this station into the South Mountain High service area and the 1/2 MG Tank.
4. Frank's Corner Pumping Station: Serves the Spring Lake Village gradient in East Allen Township. The station is equipped with two domestic pumps, one fire pump and three hydropneumatic tanks.
5. Weil Street Booster Station: It is located at the intersection of Weil Street and Ritter Street in Salisbury Township. It serves the area around Weil Street, Ritter Street, Virginia Avenue and Hamilton Avenue to boost pressures in the Weil Street gradient by 40 psi. The station is equipped with two pumps with variable frequency drives.

Distribution Storage

Distribution storage capacity in the Bethlehem system totals 38.16 million gallons. This storage volume is provided by eight (8) storage facilities owned by the Bethlehem Authority and operated by the City as follows:

Storage Facility	Capacity (MG)	Overflow Elevation (feet)
Finished Water Reservoir	7.66	655
5 MG Northeast Tank	5.00	540
12 MG Reservoir	12.00	480
5 MG Southwest Tank	5.00	478
5 MG Southeast Tank	5.00	498
2 MG Reservoir	2.00	748
1 MG Tank	1.00	749

1/2 MG Tank	0.50	1026
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The eight storage facilities are briefly described below:

1. Finished Water Reservoir: The 7.66 MG underground clearwell, located at the Bethlehem Water Treatment Plant in Lehigh Township, functions as a distribution storage reservoir. It is rectangular in shape, 400 feet long, 132 feet wide, and has a maximum water depth of 20 feet. This reservoir receives water directly from the treatment plant and serves the entire Bethlehem water system through the Howertown Control Station.
2. 5 MG Northeast Tank: The 5 MG Northeast Tank, located off Hecktown Road in Bethlehem Township, is 155 feet tall with a diameter of 76 feet. Construction of the tank was completed in 1990 and it was placed in service in 1991. This facility receives water from the Howertown East Main and serves the Bethlehem Main Service Area.
3. 12 MG Reservoir: The 12 MG ground storage reservoir, located in Fountain Hill Borough, was originally constructed in 1886 as an earthen uncovered reservoir. Its rectangular shape is approximately 448 feet long and 258 feet wide, with a maximum depth of 20 feet. The original reservoir basin was gunite lined in 1965. A flexible, plastic-vinyl liner and cover were installed in 1979. Both liner and cover were replaced in 2012. The reservoir receives water from the Pennsylvania Avenue South main through an inlet control valve. The valve regulates inflow to the reservoir to prevent overflows. Outflow from the 12 MG Reservoir flows into the adjacent 5 MG Southwest Tank.
4. 5 MG Southwest Tank: The 5 MG Southwest Tank was constructed in 1994 at the 12 MG Reservoir and South Side Pumping Station site. It was constructed in the basin of the original 2.7 MG open reservoir as a replacement for the reservoir. The 5 MG

Southwest Tank normally receives inflow directly from the 12 MG Reservoir and provides suction supply to the South Side Pumping Station and gravity service to the South Side Low service level. If necessary, the 12 MG Reservoir can be bypassed and the 5 MG Southwest Tank can receive inflow directly from the Pennsylvania Avenue South transmission main.

5. 5 MG Southeast Tank: The 5 MG Southeast Tank, located along Lynn Avenue, is 53 feet tall with a diameter of 132 feet. This facility was retrofitted with a pressure sustaining solenoid controlled influent valve and one check valve on the effluent line for fire protection and put back into service in 2016.
6. 2 MG Reservoir: The 2 MG Reservoir is a dual chamber basin, approximately 200 feet long and 70 feet wide with a maximum depth of 20 feet. Originally constructed as a reinforced concrete open reservoir, it was roofed in 1983 with precast concrete sections and covered with a rubber membrane weighted down with river rock. Recent repairs consisted of a new roof and gutters, waterproofing applied to interior concrete walls and the floor, patching and repainting of the outside concrete and brick, and replacement of the east and west sluice gates. This reservoir receives water from the South Side and 5th & William pumping stations, and serves the South Side High service level and the Saucon Valley Gradient. The 1 MG Tank also serves the South Side High service level in conjunction with the 2 MG Reservoir.
7. 1 MG Tank: The 1 MG Tank is 38 feet tall with a diameter of 75 feet. This welded steel tank is located in the City of Bethlehem. It receives water from the 5th & William and South Side pumping stations, and serves the South Side High service level and the

Saucon Valley Gradient. The 2 MG Reservoir also serves the South Side High service level in conjunction with the 1 MG Tank.

8. 1/2 MG Tank: The 1/2 MG Tank, located in South Mountain Park, Lower Saucon Township, is a welded steel tank 41 feet tall and 52 feet in diameter. This tank receives water from the Fire Pumping Station. The 1/2 MG Tank serves the South Mountain High Gradient. Peak demands for customers north of the Lehigh River and in particular along and served by the Howertown East Transmission Main are normally supplied through the transmission main and from the 5 MG Northeast Tank. This tank, with an overflow elevation of 540 feet, stabilizes pressures in the growing area of the system and provides water to meet peak demand and emergencies, including fire flow needs. The 2 MG Reservoir and 1 MG Tank, both with overflow elevations of approximately 748 feet, provide service to high elevation areas on South Mountain and in Saucon Valley that cannot be served by the gravity system. With an overflow elevation of 1,026 feet, the 1/2 MG Tank provides storage to the highest elevations in the Bethlehem system.

APPENDIX 8



CERTIFICATE OF PROPERTY INSURANCE

DATE (MM/DD/YYYY)
01/13/2021

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

PRODUCER Weiss-Schantz Agency, Inc. 1631 Main Street PO Box L Hellertown PA 18055	CONTACT NAME: Mary McCornac PHONE (A/C, No, Ext): (610) 838-7801 FAX (A/C, No): (610) 838-2420 E-MAIL ADDRESS: mary@WeissSchantz.com PRODUCER CUSTOMER ID: 00000003
INSURED City of Bethlehem, Bethlehem Authority, Bethlehem Parking Authority Bethlehem Economic Dev Authority, Bethlehem Area Public Library 10 E. Church St. Bethlehem PA 18018	INSURER(S) AFFORDING COVERAGE INSURER A: State National Insurance Company INSURER B: INSURER C: INSURER D: INSURER E: INSURER F:
	NAIC # 12831

COVERAGES **CERTIFICATE NUMBER:** CP2111300465 **REVISION NUMBER:**

LOCATION OF PREMISES / DESCRIPTION OF PROPERTY (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YYYY)	POLICY EXPIRATION DATE (MM/DD/YYYY)	COVERED PROPERTY	LIMITS
A	<input checked="" type="checkbox"/> PROPERTY	BPF-PK-101027-08	04/01/2020	04/01/2021	<input type="checkbox"/> BUILDING	\$
	CAUSES OF LOSS DEDUCTIBLES				<input type="checkbox"/> PERSONAL PROPERTY	\$
	<input type="checkbox"/> BASIC BUILDING 10,000				<input type="checkbox"/> BUSINESS INCOME	\$
	<input type="checkbox"/> BROAD CONTENTS 10,000				<input type="checkbox"/> EXTRA EXPENSE	\$
	<input checked="" type="checkbox"/> SPECIAL				<input type="checkbox"/> RENTAL VALUE	\$
	<input type="checkbox"/> EARTHQUAKE				<input type="checkbox"/> BLANKET BUILDING	\$
	<input type="checkbox"/> WIND				<input type="checkbox"/> BLANKET PERS PROP	\$
	<input type="checkbox"/> FLOOD				<input checked="" type="checkbox"/> BLANKET BLDG & PP	\$ 269,646,561
						\$
						\$
	<input type="checkbox"/> INLAND MARINE	TYPE OF POLICY				\$
	CAUSES OF LOSS					\$
	<input type="checkbox"/> NAMED PERILS	POLICY NUMBER				\$
						\$
	<input type="checkbox"/> CRIME					\$
	TYPE OF POLICY					\$
						\$
						\$
	<input type="checkbox"/> BOILER & MACHINERY / EQUIPMENT BREAKDOWN					\$
						\$
						\$
						\$
A	Commercial Gen Liability	BPF-PK &UM-101027-08	04/01/2020	04/01/2021	<input checked="" type="checkbox"/> General Liability	\$ 1,000,000
	Commercial Umbrella				<input checked="" type="checkbox"/> Umbrella Liability	\$ 10,000,000

SPECIAL CONDITIONS / OTHER COVERAGES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

CERTIFICATE HOLDER **CANCELLATION**

Maser Consulting PA 941 Marcon Blvd Suite 801 Allentown PA 18109	SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS. AUTHORIZED REPRESENTATIVE <i>Mary McCornac</i>
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Property Schedule

BPF-PK-101027-08

CITY OF BETHLEHEM BETHLEHEM PAR

EFF. APRIL 01, 2020 TO APRIL 01, 2021

Loc	Bldg	Address Description	Zip Code	Insured's Occupancy Description	Buildings	Contents	Adj TIV
1	1	10 E Church St	18018	CITY HALL COMPLEX	\$23,758,620	\$3,211,800	\$26,970,420
2	1	10 E Church St - a	18018	LIBRARY	\$11,595,788	\$5,343,638	\$16,939,427
3	1	10 E Church St - b	18018	GARAGE	\$6,371,062	\$452,324	\$6,823,386
4	1	10 E Church St - c	18018	ORNAMENTAL BLDG.	\$51,435	\$1,053	\$52,488
5	1	540 Stefko Blvd	18018	MUN. SERV.CTR	\$7,582,404	\$1,462,770	\$9,045,174
5	2	540 Stefko Blvd	18018	"	\$288,432	\$401,299	\$689,730
5	3	540 Stefko Blvd	18018	"	\$1,538,489	\$0	\$1,538,489
6	1	4th & Webster	18018	LIBRARY	\$1,006,731	\$467,889	\$1,474,620
7	1	2307 Rogers	18018	MAINT. BLDG	\$1,658,271	\$495,392	\$2,153,663
8	1	EATON & SCHOENERSVILLE	18018	MAINT. SHED	\$912,056	\$584,335	\$1,496,392
8	2	EATON & SCHOENERSVILLE	18018	MAINT. BLDG	\$118,505	\$49,153	\$167,658
8	3	EATON & SCHOENERSVILLE	18018	EQUIP. SHED	\$54,870	\$22,703	\$77,573
9	1	E. NORTH & PENN ST.	18018	ELECTR. MAINT BLDG	\$814,442	\$248,573	\$1,063,015
10	1	SHAWNEE ST & W 3RD ST	18018	GARAGE	\$30,727	\$5,851	\$36,578
11	1	RODGERS & LEWIS ST	18018	SELL FIELD HOUSE	\$193,398	\$30,778	\$224,176
12	1	8TH AVE. & UNION BLVD	18018	DAR HOUSE	\$263,565	\$64,835	\$328,400
12	2	8TH AVE. & UNION BLVD	18018	ROSE GARDEN PARK BAND SELL	\$100,688	\$0	\$100,688
12	3	8TH AVE. & UNION BLVD	18018	ROSE GARDEN RESTROOM	\$73,336	\$0	\$73,336
12	4	8TH AVE. & UNION BLVD	18018	MAINT. SHED	\$19,262	\$3,277	\$22,539
13	1	LEHIGH ST	18018	AMPHITHEATRE	\$275,535	\$20,597	\$296,132
14	1	S. MOUNTAIN DR & E UNIVERSITY DR	18018	ELEC. BLDG.	\$9,884	\$584	\$10,468
14	2	S. MOUNTAIN DR & E UNIVERSITY DR	18018	TOWER	\$290,867	\$0	\$290,867
15	1	2412 EASTON AVE.	18018	FIRE HOUSE	\$685,185	\$62,143	\$747,328
16	1	523 W. BROAD ST	18018	FIRE HOUSE	\$1,205,046	\$108,136	\$1,313,182
17	1	201 DEWBERRY AVE	18018	FIRE STATION	\$732,460	\$65,771	\$798,231
18	1	1665 CATASAUQUA Rd	18018	FIRE HOUSE	\$702,859	\$63,664	\$766,523
19	1	419 E 4TH ST.	18018	FIRE HOUSE	\$2,227,641	\$201,995	\$2,429,635
20	1	61 W. Walnut (formerly Techno Salon	18018	Parking Garage/Storage	\$750,000	\$0	\$750,000

21	1	W. WALNUT & GEUTTER ST	18018	PARKING GARAGE	\$19,508,168	\$1,857,985	\$21,366,153
22	1	85 W NORTH ST	18018	PARKING GARAGE	\$17,279,089	\$1,647,798	\$18,926,887
23	1	400 ILLICKS MILL RD	18018	GOLF COURSE - CART BARN	\$110,705	\$15,916	\$126,620
23	2	400 ILLICKS MILL RD	18018	GOLF CLUB HOUSE	\$785,704	\$140,319	\$926,023
23	3	400 ILLICKS MILL RD	18018	CART STRG 2	\$42,780	\$6,202	\$48,982
23	4	400 ILLICKS MILL RD	18018	STORAGE BLG	\$7,762	\$2,341	\$10,103
23	5	400 ILLICKS MILL RD	18018	MAINT. BARN	\$74,277	\$71,155	\$145,432
23	6	400 ILLICKS MILL RD	18018	MAINT. BLDG	\$157,740	\$94,561	\$252,302
23	7	400 ILLICKS MILL RD	18018	LOG CABIN	\$49,169	\$8,660	\$57,829
24	1	ILLICKS MILL RD & MONOCAY CREEK RD	18018	PARK RESTR	\$97,066	\$0	\$97,066
24	2	ILLICKS MILL RD & MONOCAY CREEK RD	18018	PAVILION	\$70,347	\$0	\$70,347
24	3	ILLICKS MILL RD & MONOCAY CREEK RD	18018	PAVILION	\$90,636	\$0	\$90,636
24	4	ILLICKS MILL RD & MONOCAY CREEK RD	18018	PAVILION	\$302,042	\$0	\$302,042
24	5	ILLICKS MILL RD & MONOCAY CREEK RD	18018	GRIST MILL	\$1,163,470	\$1,399,926	\$2,563,396
24	6	ILLICKS MILL RD & MONOCAY CREEK RD	18018	WELL	\$20,250	\$24,107	\$44,357
24	7	ILLICKS MILL RD & MONOCAY CREEK RD	18018	PAVILION	\$58,210	\$0	\$58,210
24	8	ILLICKS MILL RD & MONOCAY CREEK RD	18018	HOUSE @ TENNIS COURTS	\$35,583	\$36,630	\$72,213
25	1	345 ILLICKS MILL RD	18018	ICE RINK - RENTAL BUILDING	\$628,686	\$111,062	\$739,748
25	2	345 ILLICKS MILL RD	18018	STORAGE BLG	\$32,547	\$26,567	\$59,113
25	3	345 ILLICKS MILL RD	18018	STORAGE BLG	\$10,654	\$8,777	\$19,431
25	4	345 ILLICKS MILL RD	18018	ICE RINK	\$1,634,681	\$0	\$1,634,681
26	1	SCHOENERSVILLE RD & ILLICKS MILL RD	18018	STEELERS FIELD HOUSE	\$123,833	\$65,654	\$189,487
27	1	S. MOUNTAIN DR & E UNIVERSITY AVE	18018	PAVILION	\$114,465	\$0	\$114,465
27	2	S. MOUNTAIN DR & E UNIVERSITY AVE	18018	PAVILION	\$130,523	\$5,851	\$136,374

27	3	S. MOUNTAIN DR & E UNIVERSITY AVE	18018	RESTROOM	\$115,623	\$0	\$115,623
28	1	HELLERTOWN RD & MILLSIDE DR	18018	SAUCON PARK - RESTROOM	\$55,208	\$0	\$55,208
28	2	HELLERTOWN RD & MILLSIDE DR	18018	MAINT. BLDG	\$87,150	\$51,375	\$138,526
28	3	HELLERTOWN RD & MILLSIDE DR	18018	RESTROOM	\$76,484	\$0	\$76,484
28	4	HELLERTOWN RD & MILLSIDE DR	18018	PAVILION	\$96,904	\$0	\$96,904
28	5	HELLERTOWN RD & MILLSIDE DR	18018	PAVILION	\$100,930	\$0	\$100,930
28	6	HELLERTOWN RD & MILLSIDE DR	18018	RESTROOM	\$64,732	\$0	\$64,732
29	1	River St, Approx 1/4 mile east of Main St	18018	TENNIS CT BLG	\$171,278	\$29,024	\$200,302
30	1	TOW PATH	18018	PAVILION	\$17,466	\$0	\$17,466
30	2	TOW PATH	18018	PAVILION	\$17,466	\$0	\$17,466
31	1	RIVER ST & MAIN ST	18018	ICE HOUSE	\$1,691,324	\$232,892	\$1,924,216
32	1	259 ILICKS MILL RD	18018	BATH HOUSE	\$1,110,023	\$69,048	\$1,179,071
32	2	259 ILICKS MILL RD	18018	POOL	\$402,127	\$0	\$402,127
32	3	259 ILICKS MILL RD	18018	RESTROOM	\$84,464	\$0	\$84,464
32	4	259 ILICKS MILL RD	18018	WADING POOL	\$198,351	\$0	\$198,351
32	5	259 ILICKS MILL RD	18018	FILTER BLDG	\$9,848	\$3,160	\$13,009
28	7	HELLERTOWN RD & MILLSIDE DR	18018	BATH HOUSE	\$474,863	\$39,998	\$514,861
28	8	HELLERTOWN RD & MILLSIDE DR	18018	POOL	\$314,952	\$0	\$314,952
28	9	HELLERTOWN RD & MILLSIDE DR	18018	WADING POOL	\$64,213	\$0	\$64,213
33	1	WEST LEHIGH ST & 13TH AVE	18018	BATH HOUSE	\$167,046	\$13,575	\$180,621
33	2	WEST LEHIGH ST & 13TH AVE	18018	WADING POOL	\$37,704	\$0	\$37,704
33	3	WEST LEHIGH ST & 13TH AVE	18018	FILTER BLDG	\$25,687	\$6,085	\$31,772
33	4	WEST LEHIGH ST & 13TH AVE	18018	GUARD SHACK	\$10,243	\$2,457	\$12,701
33	5	WEST LEHIGH ST & 13TH AVE	18018	POOL	\$234,852	\$0	\$234,852
34	1	PINEHURST & KENSINGTON RD	18018	BATH HOUSE	\$135,453	\$11,001	\$146,454
34	2	PINEHURST & KENSINGTON RD	18018	POOL	\$304,922	\$0	\$304,922
34	3	PINEHURST & KENSINGTON RD	18018	WADING POOL	\$19,865	\$0	\$19,865
35	1	RODGERS ST & NORTH BLVD	18018	BATH HOUSE	\$65,695	\$5,266	\$70,961
35	2	RODGERS ST & NORTH BLVD	18018	POOL	\$344,787	\$0	\$344,787
35	3	RODGERS ST & NORTH BLVD	18018	WADING POOL	\$38,645	\$0	\$38,645
36	1	ATLANTIC ST & E 6TH ST	18018	BATH HOUSE	\$239,457	\$19,661	\$259,118
36	2	ATLANTIC ST & E 6TH ST	18018	POOL	\$263,421	\$0	\$263,421

37	1	144 SHIMMERSVILLE	18018	WW CONTROL BLDG	\$4,971,635	\$2,432,958	\$7,404,593
				CONTAINER STORAGE			
37	2	144 SHIMMERSVILLE	18018	BLDG	\$36,319	\$12,288	\$48,607
37	3	144 SHIMMERSVILLE	18018	CHLORINE BLG	\$389,952	\$139,500	\$529,452
37	4	144 SHIMMERSVILLE	18018	CLARIFIER #1	\$1,969,535	\$54,564	\$2,024,099
37	5	144 SHIMMERSVILLE	18018	PUMP STATION	\$939,624	\$1,375,583	\$2,315,207
37	6	144 SHIMMERSVILLE	18018	AERATION TANK	\$6,474,097	\$1,047,545	\$7,521,641
37	7	144 SHIMMERSVILLE	18018	MCC BLDG	\$14,584	\$5,382	\$19,967
37	8	144 SHIMMERSVILLE	18018	ELUTRIATION TANK	\$137,754	\$214,323	\$352,077
37	9	144 SHIMMERSVILLE	18018	CLARIFIER #1	\$1,969,535	\$1,272,946	\$3,242,480
37	10	144 SHIMMERSVILLE	18018	CLARIFIER #2	\$1,969,535	\$1,272,946	\$3,242,480
37	11	144 SHIMMERSVILLE	18018	DIGESTOR #1	\$824,145	\$0	\$824,145
37	12	144 SHIMMERSVILLE	18018	DIGESTOR #2	\$824,145	\$0	\$824,145
37	13	144 SHIMMERSVILLE	18018	CONTROL BLG	\$227,825	\$92,221	\$320,045
37	14	144 SHIMMERSVILLE	18018	DIGESTOR #1	\$824,145	\$0	\$824,145
37	15	144 SHIMMERSVILLE	18018	DIGESTOR #2	\$824,145	\$0	\$824,145
37	16	144 SHIMMERSVILLE	18018	PUMP STATION	\$165,021	\$218,847	\$383,868
37	17	144 SHIMMERSVILLE	18018	THICKENER TANK	\$455,889	\$112,487	\$568,376
37	18	144 SHIMMERSVILLE	18018	THICKENER BLG	\$146,819	\$37,215	\$184,035
37	19	144 SHIMMERSVILLE	18018	CLARIFIER #1	\$4,048,523	\$525,702	\$4,574,225
37	20	144 SHIMMERSVILLE	18018	CLARIFIER #2	\$2,024,260	\$525,702	\$2,549,963
37	21	144 SHIMMERSVILLE	18018	FILTER #1	\$757,243	\$291,056	\$1,048,299
37	22	144 SHIMMERSVILLE	18018	FILTER #2	\$757,243	\$291,056	\$1,048,299
37	23	144 SHIMMERSVILLE	18018	FILTER #3	\$757,243	\$291,056	\$1,048,299
37	24	144 SHIMMERSVILLE	18018	FILTER #4	\$757,243	\$291,056	\$1,048,299
37	25	144 SHIMMERSVILLE	18018	TANK #1	\$245,563	\$13,692	\$259,256
37	26	144 SHIMMERSVILLE	18018	TANK #2	\$245,563	\$13,692	\$259,256
37	27	144 SHIMMERSVILLE	18018	TANK #3	\$235,057	\$13,692	\$248,750
37	28	144 SHIMMERSVILLE	18018	PUMP HOUSE	\$102,802	\$77,266	\$180,069
37	29	144 SHIMMERSVILLE	18018	STORAGE SHED	\$62,491	\$18,023	\$80,514
37	30	144 SHIMMERSVILLE	18018	STORAGE SHED	\$58,583	\$16,968	\$75,551
37	31	144 SHIMMERSVILLE	18018	SHOWER	\$33,991	\$10,416	\$44,407
37	32	144 SHIMMERSVILLE	18018	TRAILER	\$52,676	\$16,032	\$68,708
37	33	144 SHIMMERSVILLE	18018	TRAILER	\$10,245	\$3,160	\$13,406

37	34	144 SHIMMERSVILLE	18018	SCREENING	\$103,424	\$100,178	\$203,602
38	1	WEST LEHIGH ST & CONESTOGA ST	18018	PUMP STATION	\$32,667	\$35,576	\$68,244
39	1	917 N. BISHOPTHORPE ST	18018	5 MG WATER TANK(SW)	\$1,495,395	\$0	\$1,495,395
39	2	917 N. BISHOPTHORPE ST	18018	12 MG WATER RESERVOIR (SW)	\$4,422,408	\$0	\$4,422,408
39	3	917 N. BISHOPTHORPE ST	18018	VALVE HOUSE	\$15,597	\$2,692	\$18,289
39	4	917 N. BISHOPTHORPE ST	18018	STORAGE BLG - BLOCK	\$7,231	\$2,341	\$9,572
39	5	917 N. BISHOPTHORPE ST	18018	Pump Station	\$0	\$0	\$0
39	6	917 N. BISHOPTHORPE ST	18018	Storage Shed	\$3,241	\$0	\$3,241
40	1	1023 WILLIAM ST	18018	SE LOW SVC TANK - 5MG	\$1,526,062	\$0	\$1,526,062
40	2	1023 WILLIAM ST	18018	RADIO BLG	\$3,134	\$819	\$3,953
41	1	5TH & WILLIAMS	18018	BOOSTER PUMP STATION	\$250,000	\$200,000	\$450,000
42	1	LOWER SAUCON TWSP	18018	SE HIGH SVC TANK - 1MG	\$552,564	\$0	\$552,564
43	1	LOWER SAUCON TWSP	18018	FIRE PUMP STATION	\$127,050	\$140,203	\$267,253
27	4	S. MOUNTAIN DR & E UNIVERSITY AVE	18018	SUPER HIGH SVC TANK- 1/2MG	\$359,215	\$0	\$359,215
44	1	LOWER SAUCON	18018	2 MILLION GALLON TANK	\$1,116,845	\$0	\$1,116,845
45	1	HECKTOWN RD & CANTERBURY RD	18018	NE STANDPIPE - 5MG	\$2,018,319	\$0	\$2,018,319
46	1	PENNSYLVANIA RD & CATASAUQUA RD	18018	WATER PRESS CONTROL STA	\$118,974	\$131,192	\$250,166
47	1	400 ILICKS MILL RD	18018	WELL HOUSE#1 - GOLF COURSE	\$35,438	\$39,205	\$74,643
47	2	400 ILICKS MILL RD	18018	WELL HOUSE#2 - GOLF COURSE	\$39,657	\$43,769	\$83,426
24	9	ILICKS MILL RD & MONOCAY CREEK RD	18018	WELL HOUSE#3 - PARK	\$39,657	\$0	\$39,657
48	1	ROUTE 329 & SAVAGE RD	18018	WATER PRESS CONTROL STA	\$115,359	\$127,213	\$242,572
49	1	TUCKHANNOCK	18018	GARAGE BARN	\$64,213	\$20,128	\$84,341
49	2	TUCKHANNOCK	18018	KEIPER HOUSE	\$150,340	\$22,353	\$172,692
49	3	TUCKHANNOCK	18018	INTAKE BLG	\$167,553	\$179,525	\$347,078
49	4	TUCKHANNOCK	18018	BACK PRESSURE CHAMBER	\$89,562	\$92,688	\$182,250

49	5	TUCKHANNOCK	18018	ROD & GUN CLUB	\$140,155	\$19,661	\$159,816
50	1	POLK TWSP	18018	FIRE LOOKOUT TOWER	\$120,542	\$0	\$120,542
51	1	7075 POHOPOCO RD	18018	CHEMICAL CONTROL BLDG	\$931,137	\$896,809	\$1,827,946
51	2	7075 POHOPOCO RD	18018	STEEL GARAGE	\$210,502	\$44,472	\$254,974
51	3	7075 POHOPOCO RD	18018	WOOD STORAGE BLG	\$67,973	\$20,714	\$88,686
51	4	7075 POHOPOCO RD	18018	POLE GARAGE	\$102,979	\$20,480	\$123,459
51	5	7075 POHOPOCO RD	18018	RESIDENCE	\$455,551	\$45,992	\$501,543
51	6	7075 POHOPOCO RD	18018	RESTROOM	\$4,436	\$0	\$4,436
51	7	7075 POHOPOCO RD	18018	INTAKE STRUCTURE	\$0	\$0	\$0
52	1	PENN FOREST	18018	LAB BLDG	\$120,288	\$130,490	\$250,778
52	2	PENN FOREST	18018	RESTROOM	\$4,436	\$0	\$4,436
52	3	PENN FOREST	18018	INTAKE STRUCTURE	\$305,694	\$337,284	\$642,978
52	4	PENN FOREST	18018	SPRAY VALVE	\$27,602	\$28,672	\$56,274
52	5	PENN FOREST	18018	ADIT BLDG	\$148,868	\$154,129	\$302,997
53	1	355 GRANGER RD,	18018	WATER TREATMENT	\$6,627,145	\$2,092,516	\$8,719,661
53	2	355 GRANGER RD,	18018	CARBON BLG	\$365,664	\$116,563	\$482,228
53	3	355 GRANGER RD,	18018	GARAGE	\$130,191	\$20,948	\$151,139
53	4	355 GRANGER RD,	18018	ELECTRICAL SUB STATION	\$154,310	\$0	\$154,310
53	5	355 GRANGER RD,	18018	7.66 MG Clear Well	\$2,705,295	\$0	\$2,705,295
53	6	355 GRANGER RD,	18018	690,000 GALLON TANK GLASSLINED STEEL	\$0	\$0	\$0
53	7	355 GRANGER RD,	18018	steel tank ring wall	\$133,101	\$0	\$133,101
53	8	355 GRANGER RD,	18018	steel tank concrete floor	\$60,815	\$0	\$60,815
53	9	355 GRANGER RD,	18018	Steel Tank & Dome	\$365,756	\$0	\$365,756
53	10	355 GRANGER RD,	18018	Steel Tank External Parts	\$48,479	\$0	\$48,479
54	1	OLD YORK RD & OHIO RD -1	18018	TANNERY -1	\$1,940,365	\$187,366	\$2,127,731
55	1	OLD YORK RD & OHIO RD	18018	SPRING HOUSE	\$160,561	\$16,150	\$176,711
55	2	OLD YORK RD & OHIO RD	18018	WATERWORKS MILL	\$381,996	\$36,865	\$418,861
56	1	OLD YORK RD & OHIO RD - 2	18018	GRIST MILL - 2	\$3,000,000	\$238,626	\$3,238,626
55	3	OLD YORK RD & OHIO RD	18018	MILLERS HOUSE	\$453,237	\$43,769	\$497,006
57	1	LANGHORNE AVE & CENTER ST	18018	PUMP STATION	\$15,068	\$19,895	\$34,963
58	1	BRIGHTON ST & OSTRUM ST	18018	PUMP STATION	\$51,591	\$68,346	\$119,936

59	1	CITY LINE/AIRPORT RD	18018	SHELTER	\$4,581	\$1,520	\$6,101
59	2	CITY LINE/AIRPORT RD	18018	VALVE PIT	\$13,621	\$9,596	\$23,217
60	1	CONESTOGA ST	18018	PUMP STATION	\$82,451	\$0	\$82,451
61	1	425 MAIN ST	18018	SMITHY HOUSE	\$467,582	\$45,166	\$512,748
62	1	APPLEBUTTER RD	18018	PUMP STATION	\$26,880	\$35,576	\$62,456
62	2	APPLEBUTTER RD	18018	VALVE PIT	\$5,183	\$3,744	\$8,927
63	1	11 W. SECOND ST	18018	PARKING GARAGE	\$6,027,100	\$117,032	\$6,144,132
64	1	1245 EASTON RD	18018	PUMP STATION	\$111,458	\$445,833	\$557,291
65	1	E 1st St BETHLEHEM PA	18018	Bethworks	\$0	\$0	\$0
66	1	559-575 Old York Rd	18018	Parking Garage	\$1,731,389	\$0	\$1,731,389
67	1	521 E. 4th St. aka 520 Evans St.	18018	Office(tech incubator)	\$721,000	\$10,300	\$731,300
68	1	10 E. Church St	18018	Redevelopment Auth	\$0	\$52,530	\$52,530
69	1	800 E 1st St	18018	Redevelopment Auth	\$6,303,600	\$1,050,600	\$7,354,200
70	1	79-81 W broad st	18018	Redevelopment Auth	\$0	\$0	\$0
71	1	749 hayes st	18018	Redevelopment Auth	\$0	\$0	\$0
13	2	LEHIGH ST	18018	Redevelopment Auth	\$0	\$0	\$0
72	1	301 Prospect St.	18018	Redevelopment Auth	\$2,781,000	\$0	\$2,781,000
73	1	800 E 1st St (Hoover-Mason Trestle)	18018	Redevelopment Auth	\$15,000,000	\$0	\$15,000,000
74	1	800 E. 1st St (Levitt Pavillion)	18018	Redevelopment Auth	\$2,500,000	\$0	\$2,500,000
75	1	26 E. Third St.	18018	Bethlehem Econ Dev	\$0	\$1,000	\$1,000
76	1	7358 Carol Lane	18018	Beth Water Auth. - Wil-Mar	\$300,000	\$0	\$300,000
77	1	7422 Airport Rd	18018	Beth Water Auth -Airport Booster	\$300,000	\$0	\$300,000
78	1	5787 Shady Lane	18018	Beth Water Auth - Shady Lane	\$300,000	\$0	\$300,000
79	1	4792 Hillside Rd	18018	Beth Water Auth - East Allen Gardens	\$400,000	\$0	\$400,000
80	1	8063 Valley View Rd	18018	Beth Water Auth- Country Squire Estates	\$400,000	\$0	\$400,000
81	1	S. New St and Graham Place	18018	Parking Garage	\$16,000,000	\$0	\$16,000,000
82	1	2740 Fifth St.	18018	Bethlehem Library -Beth Twsp Loc	\$0	\$100,000	\$100,000
83	1	410 Hatchery Rd	18018	Bethlehem Authority	\$250,000	\$0	\$250,000

84	1	Speigel St & Stanley Ave	18018	stationary bookmobile	\$15,000	\$10,000	\$25,000
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APPENDIX 9

October 22, 2020



Water Filtration Plant (WFP) – New Emergency Generator Construction



WFP – Bulk Chemical Feed Parts

October 22, 2020



WFP – Bulk Chlorine Gas Cylinder Crane Runs



WFP – New Zinc Orthophosphate Tank

October 22, 2020



WFP – Raw Water Venturi Flow Meter



WFP – Filter Backwash Valve Gallery

October 22, 2020



WFP - Filter Bed Control Hall



WFP - Flocculation Baffle Tanks

October 22, 2020



WFP - Filter Tanks

October 22, 2020



WFP – Filter Media Models

October 22, 2020



WFP – Top of 7 MG Finished Water Clearwell



WFP – Entrance Security Gates

October 22, 2020



East Allen Township Shady Lane Well House

October 22, 2020



EAG Shady Lane Pump House and Manganese Treatment Pilot Equipment



EAG Wil-Mar Wellhouse

October 22, 2020



EAG - Airport Road Booster Pump House



Community College 5 MG Northeast Standpipe Tank

October 22, 2020



Bethlehem Township Flow Test for Interconnection Study



Stefko Pressure Reduction Valve Chamber (inactive)

October 22, 2020



5th & Williams Booster Station



Mountaintop Booster Station (Formerly Fire Pump Station)

October 22, 2020



Mountaintop Booster Station & 1 MG Southeast High Tank



Weil Street Booster Station

October 22, 2020



Weil Street Booster Station

November 9, 2020



Wild Creek Watershed Facilities Entrance Gate



Pohopoco Road Frontage East

November 9, 2020



Pohopoco Road Frontage West



Wild Creek Pretreatment Building from Watershed Office

November 9, 2020



Watershed Police Office



Wild Creek Pretreatment Building

November 9, 2020



Wild Creek Pretreatment Building and Maintenance Garage



Wild Creek Dam Intake Building

November 9, 2020



Wild Creek Dam Inspection Tunnel Entrance



Wild Creek Dam Overflow

November 9, 2020



Penn Forest Dam Intake Building



Penn Forest Dam

November 9, 2020



Penn Forest Dam Inspection Tunnel Entrance



Penn Forest Discharge Aeration Spray Fountain

November 9, 2020

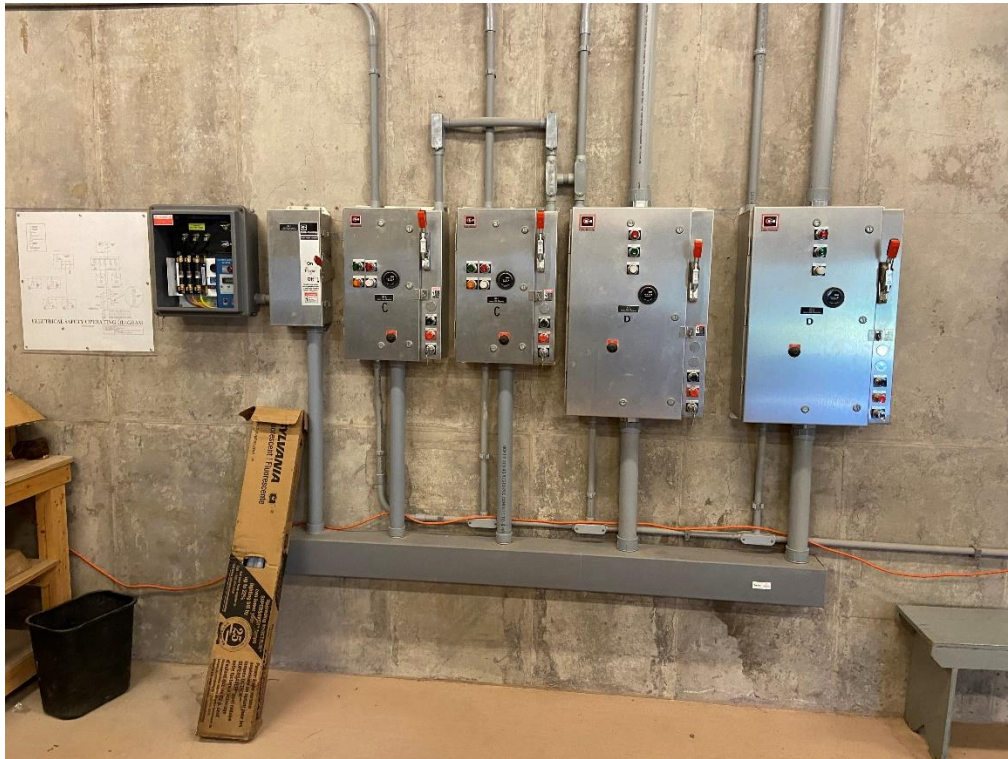


Penn Forest Dam Inspection Tunnel



Penn Forest Dam Inspection Tunnel Ventilation Panel

November 9, 2020



Penn Forest Dam Inspection Tunnel Emergency Generator



Penn Forest Dam Bald Eagles (2)

November 9, 2020



Penn Forest Dam and Reservoir Entrance Gate



East Allen Gardens Well House

November 9, 2020



EAG Finish Water Storage Tanks

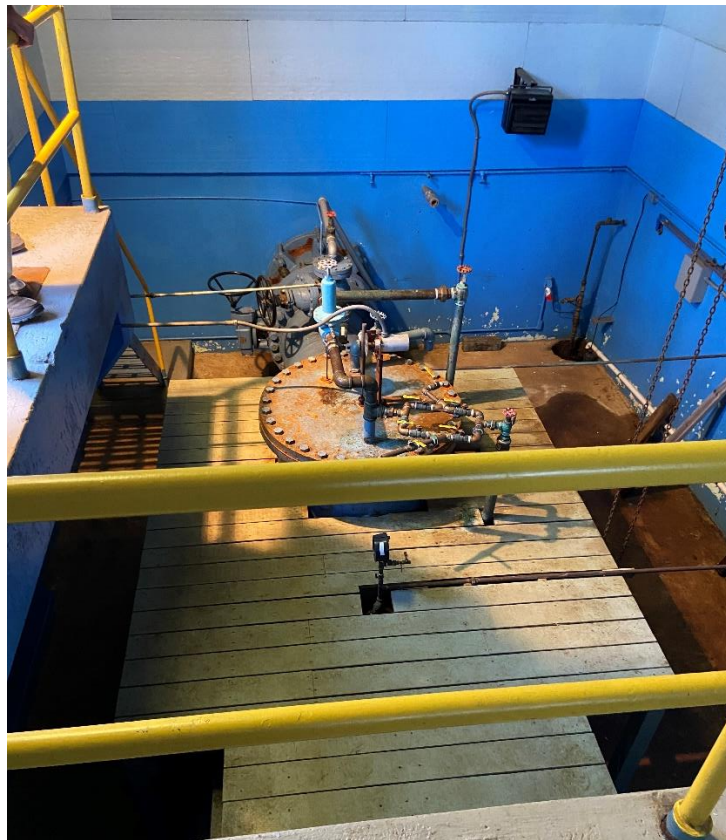


EAG Wellhouse

November 9, 2020



Howertown Pressure Reduction Valve Station



Howertown Pressure Reduction Valve Station

November 9, 2020



Howertown Pressure Reduction Valve Station



12 MG Southwest Low Reservoir

November 9, 2020



12 MG Southwest Low Reservoir



5 MG Southwest Tank

November 9, 2020



Southwest (Southside) Booster Station



South Mountain Park Communications Tower

November 9, 2020



South Mountain Park 0.5 MG Tank



South Mountain Park 0.5 MG Southeast High Tank

APPENDIX 10

**Table E-1
City of Bethlehem**

Summary of Recommended Projects

Project Number	Description	Application	Estimated Project Cost	Design and Construction Schedule
1	Groundwater Permit for Country Squire Well No. 3	Supply	\$35,000	2015 - 2020
2	Relocate and Reactivate the Airport Road PRV	Facilities	\$160,000	2015 - 2020
3	Investigate Distribution System Transmission Mains	Distribution	\$57,500	2015 - 2020
4	Install Transmission Main to Serve Prologis	Distribution	----	2015 - 2020
5	Install 9,200 feet of 16-inch Main and Construct Pumping Station (Route 512 Area Project)	System Extension	\$2.7 million	2015 - 2020
6	Install 3,300 feet of 8-inch Main - Route 412 Reverse Frontage Road	Distribution	\$410,000	2015 - 2020
7	Install 400 feet of 12-inch Main at Calpine Energy	Distribution	\$90,000	2015 - 2020
8	Install 15,600 feet of 6-inch and 8-inch Mains in the Birchwood Farms Area	Distribution	\$1.9 million	2015 - 2020
9	Replace 12-inch Main on Freemandsburg Bridge and Install 2,600 feet of 8-inch Main	Distribution	\$910,000	2020 - 2030
10	Fire Booster Pumping Station Improvements	Facilities	\$590,000	2015 - 2020
11	Emergency Water Supply Study	Supply	\$10,000	2020 - 2030
12	Replace Penn Forest SCADA System	Operations	\$130,000	2015 - 2020
13	Southside Pumping Station Improvements	Facilities	\$430,000	2015 - 2020
14	Long-Term East Allen Township Improvement Program	System Extension	\$9.98 million	2020 - 2030
15	Repair or Replace the 2 MG Reservoir	Facilities	\$400,000 to \$1.56 million	2020 - 2030
16	Improve Pressures in the Oak Lane, Maple Drive, Drexel Drive, Atlas Road Area	Distribution	\$182,000 to \$195,000	2020 - 2030
17	Replace Flow Meters and Install a 16-inch PRV at the Howertown Control Station	Facilities	\$150,000	2020 - 2030
18	Perform Water Loss Control Program	Operations	\$57,500	2015 - 2020
19	Investigate Condition of Paint Coatings at the 1 MG Tank and 5 MG Southside Tank	Facilities	\$25,000	2015 - 2020
20	Investigate Alternate SCADA Communications	Operations	\$15,000	2015 - 2020
21	Install 1,000 feet of 8-inch Main in East 5th Street	Distribution	\$175,000	2015 - 2020
22	Construct 3 MG Tank in East Allen Township	Facilities	\$3.1 million	2020 - 2030

APPENDIX 11

10 YEAR WATER CAPITAL PLAN		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Total 2020-2029	Notes
		(Actual)	(Projected)	(Budget)											
REVENUE															
Interest Income		10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	100,000	
Cash		2,016,000	211,000	1,583,000	-	-	-	-	-	-	-	-	-	1,583,000	one time cash infusion from water fund to capital fund in 2019
BRIF		-	-	2,200,000	-	-	-	-	-	-	-	-	-	2,200,000	
DSIC		-	-	-	-	-	-	-	-	-	-	-	-	-	Deferred until after next general rate case; assume no revenue
Capital Appropriation		1,288,000	3,253,000	885,000	2,000,000	2,000,000	1,500,000	1,500,000	1,500,000	2,000,000	1,500,000	1,500,000	1,500,000	15,885,000	Assumes 2021 and 2026 Rate Increases
Pa State Grant					450,000									450,000	
Additional Debt Service		-	-	-	-	-	-	-	-	-	-	-	-	-	TBD
TOTAL REVENUE		3,314,000	3,474,000	4,678,000	2,460,000	2,010,000	1,510,000	1,510,000	1,510,000	2,010,000	1,510,000	1,510,000	1,510,000	20,218,000	
EXPENDITURES															
Supply	Dams/Reservoirs		-				50,000		50,000		50,000		50,000	200,000	Pending 10 year inspection plan
	Transmission Mains	2,000	4,000	15,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	195,000	Baseline
	WC Screens		55,000	50,000					300,000				300,000	650,000	
	WC Stop Logs										250,000			250,000	
	Inspect Raw Water Mains													-	AECOM study - TBD
	Blue Mtn South Chamber										750,000			750,000	
Water Treatment Plant	Flocculators	270,000												-	
	Boiler	60,000												-	
	Misc Equipment	-	20,000	90,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	540,000	Baseline
	Generator		10,000	950,000										950,000	
	Chlorination Alternate						200,000	2,000,000						2,200,000	Per Disinfection Alternatives Study
	Filter Media Replacement								725,000	725,000	725,000			2,175,000	
	Service Pumps		15,000			50,000			50,000			50,000		150,000	
	Chemical Feed Pumps			30,000			25,000		25,000		25,000			105,000	
	Chemical Storage Tanks			60,000		150,000			150,000					360,000	
	Air Blowers												550,000	550,000	
	Turbidimeters		80,000											-	
	Filter Valve Actuators	120,000	85,000					100,000		100,000				200,000	
	Lagoon Baffles			140,000										140,000	
	Roof Repairs			40,000	400,000									440,000	
Distribution	Distribution Main Replacement	850,000	540,000	500,000	350,000	500,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	8,350,000	Baseline
	Distribution Main Extensions	-	5,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	500,000	Baseline
	Service Lines	140,000	120,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	1,500,000	Baseline
	Trench/Sidewalk Repair	110,000	105,000	105,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	1,005,000	Baseline
	Fire Hydrants	125,000	120,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	2,000,000	Baseline
	Airport Rd PRV						250,000							250,000	Pending Rt 22 Widening
	LVIP III PRV							50,000						50,000	
	Howertown PRV									300,000				300,000	
	Drexel Heights			250,000										250,000	
	Hecktown Road Bridge	10,000		420,000										420,000	Pending PaDOT HOP/Easements
	Freemansburg Bridge								700,000	700,000				1,400,000	
	Middletown Road Bridge							100,000						100,000	
	Emergency Interconnects						250,000		250,000		250,000		250,000	1,000,000	Emergency Water Study
	Rt 512 Stream Crossings		10,000											-	
	Booster Chlorine Stations													-	New Disinfection Residual Rule 2019 - TBD
Pump Stations	SS Pump Station	610,000												-	
	Fire Pump Station		35,000	760,000										760,000	
Tanks/Reservoirs	5MG NE Standpipe	95,000	100,000	110,000	115,000	120,000	125,000	130,000	140,000	145,000	155,000	160,000	160,000	1,360,000	Asset Mgmt
	0.5 MG Tank	30,000	30,000	30,000	35,000	35,000	35,000	35,000	40,000	40,000	45,000	45,000	50,000	390,000	Asset Mgmt
	2MG SS Reservoir			20,000		50,000	2,000,000							2,070,000	Replace
	1MG SE Tank							250,000	250,000	250,000	50,000	50,000	50,000	900,000	Asset Mgmt
	5MG SE Tank							360,000	360,000	360,000	360,000	360,000	100,000	1,900,000	Asset Mgmt
	5MG SW Tank						400,000	400,000	400,000	400,000	400,000	100,000	100,000	2,200,000	Asset Mgmt
	New 3MG Tank in EAT											3,000,000		3,000,000	New
Well Systems	East Allen Gardens			80,000	450,000									530,000	Pending Development/State grant
	Country Squire													-	TBD
	Wil-Mar													-	TBD
	Shady Lane			25,000										25,000	Manganese treatment
	Back-up Power			36,000										36,000	DEP mandate
Miscellaneous	Metering	425,000	490,000	385,000	300,000	300,000	500,000	750,000	750,000	750,000	750,000	750,000	750,000	5,985,000	AMI
	SCADA	35,000	65,000	5,000	50,000	50,000	100,000	100,000	100,000	150,000	150,000	100,000	150,000	955,000	Per SCADA Study
	Security	-						50,000		50,000		50,000		150,000	Baseline
	Misc Equipment	48,000	55,000	42,000	50,000	50,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	842,000	Baseline
	Vehicles	115,000	135,000	135,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	1,035,000	Baseline
TOTAL EXPENDITURES		3,045,000	2,079,000	4,678,000	2,420,000	1,975,000	5,705,000	6,095,000	6,060,000	5,740,000	5,730,000	6,435,000	4,280,000	49,118,000	

SUMMARY OF EVOLUTION OF CAPITAL IMPROVEMENT PROGRAM FUNDING

Key Metrics	Scenario 1 <i>Public Financial Management</i>	Scenario 2 <i>Public Financial Management</i>	Scenario 3 <i>Surety Substitution</i>	Scenario 4 <i>Final Plan</i>
First Bond Issue	May 2019	May 2020	November 2022	January 2023
Total Debt Incurred	\$66,730,000	\$44,900,000	\$47,790,000	\$53,885,000**
Maximum Annual Debt Service	≈\$8,500,000	≈\$9,000,000	≈\$9,000,000*	≈\$9,000,000*
Cost of Restructuring (nominal)	\$17,540,292	\$436,609	Eliminated	Eliminated
Present Value Cost of Restructuring	\$4,599,793	\$1,420,550	Eliminated	Eliminated
Negative Savings (%)	17%	16%	Eliminated	Eliminated
2014 Bonds Advance Refunded	\$9,815,000	\$2,845,000	Eliminated	Eliminated
2014 Bonds Currently Refunded				\$28,885,000
1998 Bonds Advance Refunded	\$19,235,000	\$6,715,000	Eliminated	Eliminated
	<i>January 2019</i>	<i>March 2019</i>	<i>April 2019</i>	<i>December 2019</i>

Assumptions:

PFM uses a 5% present value factor to PV the cost of restructuring and of new money which is higher than the borrowing costs.

*See Memorandum for strategies to reduce debt service in 2026-2027 to approximately \$9 million.

** Of this amount approximately \$28.885 m of current refunding bonds can be issued with assumed savings estimated by PFM of over \$2.2 m on a present value basis, but interest rates will change between now and then so this will be updated and i

*** See memo for techniques to increase amounts available for capital, and/or decrease the amount of new money bonds required by the Capital Improvement program.

SUMMARY OF CURRENT PROPOSED CAPITAL FINANCING PLAN

Following several meetings and on-going discussions with the City's Financial Advisors, PFM, and ours, Steve Goldfield from PRAG, with the help of Ed Boscola's adjustments to the City's 10-Year Capital Plan, it appears that we have a fairly sound plan for financing the capital needs of the water system into the foreseeable future.

PFM's first financing scenario was to advance refunding the 2014 Bonds using taxable bonds (\$9.815 m) and advance refunding the 1998 CABS using taxable bonds (\$19,235 m). To minimize the cost of these refinancings (nominal cost was around \$17.54 m) they set up a model with what they call a "tight wrap". That is, the refunding bonds wrap tightly around the existing debt as tightly as possible, so that the added cost is not incurred any longer than necessary. With the contemplated refinancings, and the significant costs, this approach made sense.

After several more iterations and discussions, we have now eliminated all taxable refundings and all advance refundings, and merely are looking at one tax exempt refunding for savings (several million dollars under current market conditions with some cushion) and three new money transactions. The Board was astute in pointing out that it does not make sense at this time to assume short bond issues for the new money that wrap around the existing debt service of the Authority "tightly", but to instead look at the useful life of the projects being financed. The Authority should think about spreading the new money bonds out over their useful lives, and taking advantage of the freed up cash flow to incorporate some additional pay-as-you-go capital or operating cushion.

It may not be necessary to actually size each new money transaction now, or determine the optimal term. The only thing we know for certain is that we don't know what the future will bring. What projects will become more important; less important? Where will rates be? What will the yield curve look like? etc. That being said, the Authority has arrived at the place it has been striving towards for many years; thinking about how to optimize pay-as-you go and debt financed capital spending. This is not something the Authority has had the luxury of doing because of the CABS, but we are now planning for the post-CAB era.

A more detailed Executive Summary is being prepared and should be available next week

APPENDIX 12

**CITY OF BETHLEHEM
DEPARTMENT OF WATER AND SEWER RESOURCES
BETHLEHEM, PENNSYLVANIA**

**LONG TERM
INFRASTRUCTURE
IMPROVEMENT PLAN**

**MARCH 2016
UPDATED APRIL 2018**

***STEVEN G. LOWRY & ASSOCIATES, INC.
MECHANICSBURG, PENNSYLVANIA***

CITY OF BETHLEHEM LONG TERM INFRASTRUCTURE IMPROVEMENT PLAN

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CITY OF BETHLEHEM

LONG TERM INFRASTRUCTURE IMPROVEMENT PLAN

The City of Bethlehem is submitting this Long Term Infrastructure Improvement Plan (LTIIP) in accordance with the requirements of Subchapter B, Distribution Systems, of 66 Pa. C.S. §1350–1360 and the Public Utility Commission's Final Implementation Order, Docket No. M–2012–2293611, entered August 2, 2012, for the establishment of a Distribution System Improvement Charge (DSIC).

INTRODUCTION

The Bethlehem Authority owns the Bethlehem water distribution system, which is operated and maintained by the City of Bethlehem - Department of Water and Sewer Resources. The Bethlehem water distribution system covers approximately 45 square miles in Lehigh and Northampton Counties. The sources of supply are Wild Creek Reservoir and Penn Forest Reservoir, located in Carbon and Monroe Counties, approximately 20 miles north of the City. Untreated water is conveyed through transmission mains by gravity from the reservoirs to the Bethlehem Water Treatment Plant. The Water Treatment Plant is located about 8 miles north of the City. Treated water flows through transmission mains by gravity from the Plant into the Bethlehem water system.

Major facilities in the water system include distribution mains, pumping stations, pressure reducing stations, and storage tanks.

This LTIIP describes capital improvement recommendations for the City of Bethlehem. This plan presents a strategy for infrastructure improvements to ensure that Bethlehem can continue to provide safe, high quality, and reliable service to its customers. The City of Bethlehem provides water service to over 36,000 customers in Lehigh and Northampton Counties in eastern Pennsylvania. Customers are served in the municipalities of the City of Bethlehem, portions of Allen, East Allen, Bethlehem, Hanover, Lower Saucon, Upper Saucon, Salisbury, and Lower Nazareth Townships, plus Freemansburg and Fountain Hill Boroughs. Although the Bethlehem water distribution system serves areas inside and outside Bethlehem City limits, capital improvements described in this LTIIP are allocated for projects serving areas outside the City of Bethlehem.

Water demands averaged 12.14 mgd in 2014 and maximum day demands were 16.75 mgd. The Bethlehem system experienced customer growth during the ten year period from 2005 through 2014. From 2005 through 2014 the number of customers steadily increased from 34,894 in 2005 to 35,909 in 2014. Customer growth in the Bethlehem system is forecasted to continue through the year 2022 at a rate comparable to that recorded from 2005 through 2014. The number of customers in 2022 is predicted to be 36,845, or an increase of 936 from the

35,909 customers served in the system in 2014. Average water demands are projected to increase to 12.46 mgd in 2022. Maximum day demands are forecasted to increase to 20.36 mgd in 2022.

1.0 TYPE AND AGE OF ELIGIBLE PROPERTY

The City of Bethlehem water system includes the raw water system and the treated water distribution system. The raw water system includes supply intakes and reservoirs; flow meter building; transmission mains; tunnels; associated tunnel portals, valves, and valve chambers; and a Supervisory Control and Data Acquisition (SCADA) system at Penn Forest Dam. The distribution system includes over 530 miles of transmission and distribution mains, approximately 14,800 valves, 2,700 hydrants, 37,000 customer water meters and service lines, four well stations, five pumping stations, seven storage facilities, 19 pressure reducing valve stations, and a SCADA system.

The entirety of Bethlehem raw and finished water systems are described in this Section for background purposes. LTIP eligible property however, is limited to water system facilities and mains serving areas outside of the City, as more fully described later in this report.

Raw Water System

Source Water Supply

The City of Bethlehem raw water supply system consists of source reservoirs and dams, an intake on Tunkhannock Creek, a flow meter building, and transmission mains. A SCADA system is used to monitor Penn Forest Dam. An intake tower draws water from Wild Creek Reservoir, which flows to the Flow Meter Building. Raw water then flows into dual transmission mains for the 11.6 mile long route to the Bethlehem Water Treatment Plant. There are two tunnels, Wire Ridge and Blue Mountain, between Wild Creek and the Water Treatment Plant. The tunnels are 48-inch diameter, concrete lined rock conduits.

Raw water storage is provided by Wild Creek Dam and Reservoir and Penn Forest Dam and Reservoir. Penn Forest Reservoir is upstream of Wild Creek Reservoir such that water discharged from Penn Forest flows into Wild Creek. Reservoir information is provided below:

Reservoir	Capacity (BGal)	Maximum Pool Elevation (feet)	Construction Date
Wild Creek	3.90	820.00	1940
Penn Forest	6.00	1,000.60	1998

Tunkhannock Intake diverts water from Tunkhannock Creek and transfers that water by pipeline to Penn Forest Reservoir. The intake structure diverts water from the creek through a set of

manually operated sluice gates. Diverted water is conveyed to Penn Forest Reservoir through a 30-inch and 42-inch steel transmission main. Diversions from the Tunkhannock Creek Intake continuously flow to Penn Forest Reservoir. The Tunkhannock Intake and transmission main were constructed in 1969.

Penn Forest Dam SCADA System

Groundwater levels and soil moisture content in Penn Forest Dam are continuously monitored by a series of piezometers set into the dam face. Readings from these units indicate the amount of seepage that occurs and provide a measure of the condition and stability of Penn Forest Dam. Consequently, piezometer information is critical for confirmation of dam safety and for PA DEP reporting requirements.

Data from the piezometers are collected using telemetry equipment and a cellular network system to communicate with field devices. Signals from piezometers are hard-wired to connections at four remote units. The remote units transmit data to a receiver at the Flow Meter Building. The telemetry system also includes flow meters and control of various equipment at the Adit building. The Penn Forest Dam SCADA system was installed in 1998 and upgraded in 2017.

Flow Meter Building

The Flow Meter Building was constructed in 1940 and was the original water treatment facility for the Wild Creek supply, prior to construction of the current Bethlehem Water Treatment Plant near Pennsville. Water from the Wild Creek Reservoir intake tower flows to the Flow Meter Building in parallel 38-inch steel pipelines. Flows and pressures are measured and recorded at the Flow Meter Building. Water exiting the Flow Meter Building flows through parallel 36-inch diameter venturi flow tubes and then is carried in dual 36-inch diameter transmission mains to Wire Ridge Tunnel.

Transmission Mains and Tunnels

Parallel transmission mains are installed from the Flow Meter Building to the Bethlehem Water Treatment Plant, except for the Wire Ridge and Blue Mountain tunnels. The transmission mains and tunnels extend 11.6 miles from the Flow Meter Building to the Plant. The parallel transmission mains range in size from 30-inch to 42-inch diameter. Both tunnels are 48-inch diameter, concrete lined rock conduits with sections of 32-inch to 38-inch transition pipelines at each tunnel's inlet and outlet portals.

Raw water transmission mains serving the Bethlehem system have been installed in several projects over the past 80 years. Initial construction occurred in 1939-1941 and included:

- Parallel 38-inch pipelines between Wild Creek Reservoir and the Chemical Building
- A 36-inch main between the Chemical Building and Wire Ridge Tunnel
- The 48-inch, concrete lined Wire Ridge Tunnel, including tunnel portal piping and valves
- A 36-inch main between Wire Ridge Tunnel and Blue Mountain Tunnel
- The 48-inch, concrete lined Blue Mountain Tunnel, including tunnel portal piping and valves
- A 30-inch main from Blue Mountain Tunnel into the City's distribution system

Since that initial work in 1939-1941, the Bethlehem Water Treatment Plant was constructed in 1991 near Pennsville, about 8 miles north of Bethlehem and south of Blue Mountain Tunnel. Additional transmission main construction included:

- A parallel 36-inch main installed in 1968 between the Chemical Building and Wire Ridge Tunnel
- A parallel 42-inch pipeline installed in 1969 between Blue Mountain Tunnel and the Water Treatment Plant site
- A parallel 42-inch main installed in 1994 between Wire Ridge Tunnel and Blue Mountain Tunnel
- A parallel 48-inch pipeline installed in 1994 from the Water Treatment Plant into the City's distribution system.

Raw water system information is summarized in Table 1-1.

Water Distribution System

The City of Bethlehem water distribution system serves about 36,000 customers. The distribution network includes over 530 miles of pipe, ranging in size from 1.5-inch diameter to 48-inch diameter. Pipe materials in the system include asbestos cement, cast iron, ductile iron, galvanized iron, concrete, transite, steel, PVC, and cement-lined pipe. Much of the pipe in the system is over 50 years old, and some mains are over 100 years old. There are approximately 14,800 pipeline valves, 2,700 hydrants, 37,000 customer water meters, and over 130 miles of service lines in the Bethlehem system.

Pipeline information is presented in Table 1-2, pipeline valve information is presented in Table 1-3, hydrant information is presented in Table 1-4, water meter information is presented in Table 1-5, and service line information is presented in Table 1-6.

Most of the Bethlehem service area is served as a single pressure gradient. Treated water from the Bethlehem Water Treatment Plant flows through parallel 30-inch and 48-inch transmission mains to the Howertown Control Station, where flows are divided into the Howertown East and

Howertown South transmission mains. Howertown East flows are reduced by the Howertown East pressure regulating valve at the Howertown Control Station. The Howertown South Main extends to the Pennsylvania Avenue Control Station, where pressures are reduced by the Pennsylvania Avenue pressure regulating valve.

There are four well stations that supply water to small residential neighborhoods in East Allen Township. Wells serve the East Allen Gardens, Country Squire Estates, Wil-Mar Manor, and Shady Lane areas. Well Station information is summarized in Table 1-7.

There are four high pressure zones served by five booster pumping stations. The Franks Corner Booster Station serves the Spring Lakes Village development; the Weil Street Station pumps to the Weil Street zone; the Southside Pumping Station and Fifth & William Pumping Station serve the South Side High Level gradient; and the Fire Booster Station pumps to the South Mountain zone. Pump information is presented in Table 1-8.

There are three gradients in the Bethlehem distribution system supplied by pressure regulating valves. The LVIP III zone is an industrial/commercial area located near Lehigh Valley International Airport; the Saucon Valley zone is located in the southern section of the distribution system, south of South Mountain, and the Southeast Low Gradient is supplied from the 5 MG Southeast Tank, which is filled by a back-pressure sustaining valve. Pressure control valve data is summarized in Table 1-9.

Bethlehem distribution system storage is provided by seven tanks and reservoirs. There are 30.5 million gallons of storage in the system, of which 25.5 million gallons are located south of the Lehigh River. Storage information is presented in Table 1-10.

The Distribution SCADA system consists of 33 remote telemetry sites reporting to a central control room at Bethlehem City Hall. Telemetry signals and commands in the SCADA system are transmitted and received using radio communications and one cellular modem to and from the 5 MG Southeast Tank. The Central Control Room contains redundant servers and workstations. Workstations provide operator access to the system. SCADA equipment at the 33 remote stations are Control Wave Micro remote telemetry units (RTUs), manufactured and programmed by Emerson Process Management. Servers and workstations in the Central Control Room utilize Open Enterprise human-machine-interface software. The HMI software also is provided and programmed by Emerson Process Management. The Distribution SCADA system was installed in 1998 and upgraded in 2005.

**Table 1-1
City of Bethlehem
Raw Water System**

Dams and Reservoirs		
Wild Creek:	Capacity: Maximum Pool Elev: Construction Date:	3.9 Bgal 820.0 feet 1940
Penn Forest:	Capacity: Maximum Pool Elev: Construction Date:	6.0 Bgal 1,000.6 feet 1998
Intake		
Tunhannock Intake	Source: Transmission Main: Construction Date:	Tunkannock Creek 30-inch: 35,600 feet 42-inch: 11,600 feet 1969
Meters		
Flow Meter Building	No. of Meters Meter Type: Meter Size: Construction Date:	2 Venturi 36-inch diameter 1940
Raw Water Tunnels		
Wire Ridge:	Conduit Type: Tunnel Diameter: Tunnel Length: Portal Diameter: Portal Length: Construction Date:	Concrete-lined, rock 48-inch 2,400 feet 38-inch 1,806 feet 1940
Blue Mountain:	Conduit Type: Tunnel Diameter: Tunnel Length: Portal Diameter Range: Portal Length: Construction Date:	Concrete-lined, rock 48-inch 3,400 feet 32-inch to 38-inch 2,319 feet 1940

**Table 1-1 (cont.)
City of Bethlehem
Raw Water System**

Raw Water Transmission Mains				
Location	Diameter	Length	Construction Date	Percent of Total
Wild Creek Reservoir to Flow Meter Building	38-inch	1,750 feet	1940	1.65
	38-inch	1,750 feet	1940	1.65
Flow Meter Building to Wire Ridge Tunnel	36-inch	5,605 feet	1940	5.28
	36-inch	5,605 feet	1968	5.28
Wire Ridge Tunnel to Blue Mountain Tunnel	36-inch	23,245 feet	1940	21.88
	42-inch	23,007 feet	1994	21.66
Blue Mountain Tunnel to Water Treatment Plant	30-inch	22,594 feet	1940	21.27
	42-inch	22,663 feet	1969	21.34
Totals:		106,219 feet		100

Table 1-2
City of Bethlehem
Distribution System Pipeline Information

Diameter (inches)	Pipe Length (feet)	Pipe Length (miles)	Percent of Total
1.5	275	0.05	0.01
2	14,281	2.70	0.51
3	5,678	1.08	0.20
4	79,489	15.05	2.82
6	1,043,629	197.66	36.99
8	753,016	142.62	26.69
10	79,890	15.13	2.83
12	518,885	98.27	18.39
14	2,950	0.56	0.10
16	141,446	26.79	5.01
20	40,249	7.62	1.43
24	23,716	4.49	0.84
30	47,343	8.97	1.68
34	9,816	1.86	0.35
36	41,425	7.85	1.47
48	19,661	3.72	0.70
Totals:	2,821,749	534	100

Age Range	Pipe Length (feet)	Pipe Length (miles)	Percent of Total
Pre 1920	21,690	4.11	0.77
1920 to 1929	259,089	49.07	9.18
1930 to 1939	139,989	26.51	4.96
1940 to 1949	367,761	69.65	13.03
1950 to 1959	522,167	98.90	18.51
1960 to 1969	385,253	72.96	13.65
1970 to 1979	299,553	56.73	10.62
1980 to 1989	311,589	59.01	11.04
1990 to 1999	308,906	58.50	10.95
2000 to 2017	205,752	38.97	7.29
Totals:	2,821,749	534	100

Table 1-3
City of Bethlehem
Distribution System Valve Information

Valve Diameter (inches)	Number of Valves (1)	Percent of Total
Less than 4-inch	173	1.17
4	760	5.12
6	6,247	42.09
8	4,660	31.40
10	315	2.12
12	2,151	14.49
14	2	0.01
16	373	2.51
20	76	0.51
24	18	0.12
30	31	0.21
34	4	0.03
36	24	0.16
48	7	0.05
Totals:	14,841	100

Age Range	Number of Valves (1)	Percent of Total
Pre 1920	133	0.90
1920 to 1929	1593	10.73
1930 to 1939	654	4.41
1940 to 1949	1517	10.22
1950 to 1959	2415	16.27
1960 to 1969	2058	13.87
1970 to 1979	1774	11.95
1980 to 1989	1692	11.40
1990 to 1999	1830	12.33
2000 to 2017	1175	7.92
Totals:	14,841	100

(1) Estimated

**Table 1-4
City of Bethlehem
Distribution System Hydrant Information**

Age Range	Number of Hydrants (1)	Percent of Total
Pre 1940	315	11.62
1940 to 1949	227	8.37
1950 to 1959	439	16.19
1960 to 1969	406	14.97
1970 to 1979	349	12.87
1980 to 1989	308	11.36
1990 to 1999	355	13.09
2000 to 2017	313	11.54
Totals:	2,712	100

(1) Estimated

**Table 1-5
City of Bethlehem
Customer Meter Information**

Meter Size (inches)	Number of Meters	Percent of Total
5/8	34,301	92.44
3/4	678	1.83
1	710	1.91
1.5	615	1.66
2	522	1.41
3	160	0.43
4	73	0.20
6	32	0.09
8	12	0.03
10	2	0.01
Totals:	37,105	100

Age Range	Number of Meters	Percent of Total
Pre 2001	27,008	72.79
2001 to 2005	2,232	6.02
2006 to 2010	2,019	5.44
2011 to 2017	5,846	15.76
Totals:	37,105	100

**Table 1-6
City of Bethlehem
Service Line Information**

Age Range	Service Line Length (1) (feet)	Percent of Total
Pre 1940	126,748	17.65
1940 to 1949	76,572	10.66
1950 to 1959	124,871	17.39
1960 to 1969	103,130	14.36
1970 to 1979	80,388	11.19
1980 to 1989	78,251	10.90
1990 to 1999	79,451	11.06
2000 to 2017	48,763	6.79
Totals:	718,174	100

(1) Estimated based on average service line length = 20 feet

Table 1-7
City of Bethlehem
Well Station Information

Well Station	Service Area	Well Yield (gpm)	Average Annual Usage	Year Installed
East Allen Gardens	East Allen Gardens	26	1.7 MG	1971
Country Squire	Country Squire Estates	51	1.5 MG	1970
Wil-Mar	Wil-Mar Manor	25	1.7 MG	1969
Shady Lane	Shady Lane	47	1.0 MG	1971

**Table 1-8
City of Bethlehem
Distribution System Pump Information**

Pumping Station	Construction Date	Pump No.	Rated Flow (gpm)	Rated Total Dynamic Head (feet)	Motor HP	Drive Type	Back-Up Power?
Southside	1919	1	2,100	330	250	Constant Speed - Diesel engine	Yes
		2	2,100	330	250	Constant Speed - Electric motor	No
		3	2,100	330	250	Constant Speed - Electric motor	No
Fifth and William	2016 (1)	1	1,000	210	150	Constant Speed - Electric motor	Yes
		2	1,000	210	150	Constant Speed - Electric motor	Yes
Fire Booster	1959	1	780	330	100	Constant Speed - Electric/gasoline	Yes
		2	780	330	100	Constant Speed - Electric/gasoline	Yes
		3	780	330	100	Constant Speed - Electric motor	No
Franks Corner	1997	1	100	175	7.5	Constant Speed - Electric motor	Yes
		2	100	175	7.5	Constant Speed - Electric motor	Yes
		3	500	175	30	Constant Speed - Electric motor	Yes
Weil Street	2015	1	25	100	1.5	Variable Frequency Drive - Electric	No
		2	25	100	1.5	Variable Frequency Drive - Electric	No

(1) - Station original construction date = 1959. Pumps replaced in 2016.

**Table 1-9
City of Bethlehem
Distribution System Control Valve Information**

Valve Station	Construction Date (1)	Inlet Zone	Outlet Zone	Valve Dia. - (in)	Elevation (feet)	Inlet		Outlet		Status
						Pressure - (psi)	HGL - (ft)	Pressure - (psi)	HGL - (ft)	
Howertown East	1953	WTP	Main Service	30	418	100	650	60	550	Active
Howertown East Bypass	1994			30	418	100	650	60	550	Active
Pennsylvania Avenue	1940	Howertown South	Main Service and	24	355	120	630	60	500	Active
Pennsylvania Avenue Bypass	2000		Southside Low Service	12	355	120	630	60	500	Active
LVIP	1980	Howertown South	LVIP III	2	350	128	640	90	560	Active
				6	350	128	640	85	545	Active
				16	350	128	640	60	490	Active
Saucon Valley	1952	Southside High Level	Saucon Valley	12	550	80	740	40	640	Active
				12	550	80	740	40	640	Active
Center & Macada	1952	Howertown East Trans. Main	Main Service	12	345	80	530	80	530	Inactive - Open
Main & Dewberry	1946	Howertown East Trans. Main	Main Service	24	314	90	530	75	490	Inactive - Closed
Washington & Linden	1946	Howertown East Trans. Main	Main Service	12	385	60	525	60	525	Inactive - Open
Stefko & Pembroke	1946	Howertown East Trans. Main	Main Service	12	300	100	525	100	525	Inactive - Open
Easton & Stefko	1951	Howertown East Trans. Main	Main Service	12	390	60	525	60	525	Inactive - Open
East North Street	1967	Howertown East Trans. Main	Main Service	16	250	119	524	119	524	Inactive - Open
Minsi & Daly	1946	Howertown East Trans. Main	Main Service	12	290	100	523	100	523	Inactive - Open
Third & Marshall	1946	Howertown East Trans. Main	Main Service	30	290	100	523	100	523	Inactive - Open
Third & Hobart	1946	Main Service	Southside Low Service	20	295	100	523	80	475	Inactive - Closed
Race Street	1965	Howertown South Trans. Main	Main Service	16	350	125	635	80	540	Inactive - Closed
Airport Road	1953	Howertown South Trans. Main	Main Service	12	365	115	630	70	530	Inactive - Closed
Penn & Eaton	1945	Penn Ave South Trans. Main	Main Service	12	350	60	490	60	490	Inactive - Open
15th & Market	1945	Penn Ave South Trans. Main	Main Service	12	360	55	485	55	485	Inactive - Open
12 MG Reservoir Inlet Control Valve	1992	Penn Ave South Trans. Main	Southside Low Service	24	475	2	480	-----	470	Active
5 MG Southeast Tank Inlet Control Valve	2015	Main Service	Southside Low Service	8	450	30	520	17	490	Active

Table 1-10
City of Bethlehem
Distribution System Storage Information

Storage Name	Construction Date	Gradient	Dimensions or Diameter	Overflow Elevaton (feet)	Bottom Elevation (feet)	Storage Height (feet)	Nominal Capacity	Type
0.5 MG Tank	1959	South Mountain High Service	52 feet diameter	1,026.0	992.0	34.0	0.5 MG	Steel, cylindrical ground storage
1 MG Tank	1959	Southside High Level	80 feet diameter	749.0	721.0	28.0	1.0 MG	Steel, cylindrical ground storage
2 MG Reservoir	1924	Southside High Level	70 feet x 200 feet	748.0	728.0	20.0	2.0 MG	Concrete, rectangular basin
5 MG Northeast Tank	1991	Main Service	76 feet diameter	540.0	393.0	147.0	5.0 MG	Steel, cylindrical standpipe
5 MG Southeast Tank	1965	Southeast Low Service	132 feet diameter	498.5	450.0	48.5	5.0 MG	Steel, cylindrical ground storage
5 MG Southside Tank	1993	Southside Low Service	156 feet diameter	478.06	439.8	38.26	5.0 MG	Steel, cylindrical ground storage
12 MG Reservoir	1890	Southside Low Service	250 feet x 440 feet	477.0	457.0	20.0	12.0 MG	Covered and lined basin
						Total:	30.5 MG	

2.0 SCHEDULE FOR PLANNED REPAIR AND REPLACEMENT OF ELIGIBLE PROPERTY

Bethlehem recognizes the need for ongoing, continual renewal of their distribution system to maintain safe, reliable, high-quality water service to their customers. Renewal of system infrastructure involves annual pipeline replacement programs that target small-diameter, problematic, and pipelines with capacity issues. Renewal of system infrastructure also involves specific projects identified to address issues associated with the SCADA system. Other construction projects involve installation of main extensions and pipe loops to resolve water supply concerns for existing Bethlehem customers relating to flow and pressure capacity and water quality. Infrastructure improvements described in this LTIIP apply to projects that serve areas outside Bethlehem City limits.

Over the next five years Bethlehem will continue their existing annual main replacement program. Locations for pipeline infrastructure improvements will be based on Tables 2-1, 2-2, and 2-3. Table 2-1 lists pipeline improvement projects associated with main breaks, Table 2-2 lists projects associated with fire flow improvements, and Table 2-3 lists projects associated with eliminating dead-ends.

Table 2-4 summarizes specific projects related to repair and replacement of eligible property and includes a proposed annual schedule for project implementation. Table 2-4 lists actual capital expenditures for the 5-year period of 2013 – 2017 and projected capital expenditures for the 5-year period of 2018 – 2022.

Table 2-1
City of Bethlehem
Annual Main Replacement Program
Main Break History for Areas Outside Bethlehem City Limits

Location	Number of Breaks	Breaks per 1000 feet of pipe	Length (feet)	Diameter Range (in)		Installation Year Range	
				Minimum	Maximum	Oldest Pipe	Newest Pipe
Stanbridge Court	4	10.20	392	6	6	1974	1974
Troxell Street	6	8.31	722	6	6	1960	1960
Irma Drive and Diane Blvd	4	8.16	490	6	6	1975	1975
Hampton Road and Freemansburg Avenue	2	7.41	270	8	8	1959	1959
Brook Avenue and Illingsworth Avenue	3	4.43	677	6	6	1962	1962
14th Street, 15th Street, and Allen Street	9	4.38	2,055	8	8	1971	1971
Birchwood Farms	29	3.54	8,186	6	8	1959	1974
Old Philadelphia Pike and Collons Avenue	2	3.18	629	6	6	1959	1959
Edna Terrace, from Santee Road to Hecktown Road	4	3.11	1,286	6	6	1967	1967
Brentwood Avenue, Hemlock Place, and Greenleaf Drive	8	3.08	2,599	6	8	1966	1974
Camp Meeting Road, from Valley Road to Fridens Street	3	2.96	1,013	8	8	1968	1968
Chaucer Lane, Harmor Lane, Winthrop Avenue, and Allen Way	8	2.81	2,851	6	8	1961	1964
Stafore Drive, Bonnie Avenue, Woodland Circle, Sydna Street, Cherry Lane, Jacksonville Road	31	2.63	11,776	6	12	1959	1965
Mark Twain Circle, Chippendale Circle, Walt Whitman Lane Area	13	2.58	5,032	6	8	1959	1961
Hartman Drive and Saucon Valley Road	6	2.38	2,524	6	10	1954	1968
Oswego Drive, Colony Road, Monocacy Drive, Towanda Drive Area	18	2.35	7,661	6	8	1966	1978
Manor Drive, Saucon Lane, Colesville Road, and Edward Street	15	2.30	6,522	6	12	1961	1980
Black River Road, Trotter Lane, and Wydnor Avenue	5	2.27	2,202	6	8	1966	1967
Lehigh Avenue, Rim Road, 1st Street, and 2nd Street	13	2.16	6,030	4	6	1962	1969
Honeysuckle Road - Bittersweet Road Area	4	2.05	1,951	6	10	1956	1962
Oakhurst-Colesville Road, from Old Bethlehem Pike to Kildare Court	16	1.92	8,325	10	10	1956	1956
Walter Avenue and Fiebely Avenue	3	1.87	1,601	6	12	1952	1954
Roosevelt Street	2	1.75	1,140	8	8	1967	1967
Old Bethlehem Pike, from Oakhurst Road to Saucon Drive	7	1.47	4,767	8	12	1952	1952
Saucon Valley Road and Apple Tree Lane East	7	1.43	4,903	8	10	1954	1965
10th Street, 11th Street, and 12th Street	6	1.29	4,668	6	6	1956	1967
Saucon Valley Rd, Bingen Rd, Country Rd, and Weyhill Farm Rd	10	1.14	8,779	8	10	1954	1954
8th Street	2	0.64	3,120	6	6	1949	1964

Table 2-2
City of Bethlehem
Annual Main Replacement Program
Fire Flow Projects for Areas Outside Bethlehem City Limits

No.	Location	Improvement Project
1	Tolstoy Street	Install 650 feet of 8-inch main on Roosevelt, Kanoly to Pembroke
2	Sherwood Street	Install 300 feet of 8-inch main on Hoover, Troxell to Ulster
3	Storage Area, west of Sherwood, north of Hoover	Install 200 feet of 8-inch to complete loop

**Table 2-3
City of Bethlehem
Annual Main Replacement Program
Projects to Loop Dead-Ends**

Dead-End Pipeline Street	Pipe to be Installed	Installation Street	Location of Installed Pipe	Comments
Atlas Road	500 feet of 8-inch pipe	Short Lane Road	From Atlas Road to Drexel Drive	
Weaversville Road	250 feet of 8-inch pipe	Weaversville Road	From Drexel Drive south to existing 10-inch main	
Colony Drive	300 feet of 12-inch pipe	Colony Drive	From Hanover Street east to existing 12-inch main	
Orth Street and 7th Street	120 feet of 8-inch pipe	Orth Street	From 7th Street east to existing 6-inch main	
DeWalt Street	150 feet of 8-inch pipe	DeWalt Street	Close gap in 8-inch main between 10th Street and 12th Street	
Coleman Street and Riegel St.	250 feet of 8-inch pipe	Riegel Street	From Coleman Street to Carter Road	
Coleman Street	120 feet of 8-inch pipe	Coleman Street	From 7th Street west to existing 8-inch main	
13th Street and Hamilton Street	425 feet of 8-inch pipe	13th Street and Hamilton Street	From 12th Street east to 13th Street, then north on 13th to existing 6-inch main	Replace 275 feet of 1.5-inch pipe on Hamilton Street
14th Street	150 feet of 8-inch pipe	14th Street	Connect existing 8-inch mains between Linden St and Turner St	
Ninth St and Freemansburg Ave	200 feet of 8-inch pipe	Ninth Street	From Freemansburg Avenue south to existing 6-inch main	
12th Street	500 feet of 8-inch pipe	12th Street	From Freemansburg Avenue south to existing 8-inch main	
Ulster Street and Troxell Street	350 feet of 8-inch pipe	Hoover Avenue	From Ulster Street to Troxell Street	
Tolstoy Street	100 feet of 8-inch pipe	Tolstoy Street	From Clearfield Street west to existing 6-inch main	
Karoly Street	175 feet of 8-inch pipe	Karoly Street	From Garfield Street east to existing 6-inch main	
Karoly Street and Kossuth Street	525 feet of 8-inch pipe	Cambria Street	From Karoly Street to Kossuth Street	
Weil Street and Cottage Avenue	575 feet of 8-inch pipe	Cottage Ave, Mt. Airy Ave, and Weil Street	From 16th Avenue west on Weil St, south on Mt. Airy Ave, and east on Cottage Ave to existing 6-inch main	Replace 150 feet of 2-inch pipe west of 16th Ave on Weil St
Garfield St, Somerset St, Clearfield St, and Juniata St	400 feet of 8-inch pipe	Garfield Street	From East Market Street north to existing 6-inch main	
Garfield St, Somerset St, Clearfield St, and Juniata St	450 feet of 8-inch pipe	Somerset Street	From East Market Street north to existing 6-inch main	
Garfield St, Somerset St, Clearfield St, and Juniata St	400 feet of 8-inch pipe	East Market Street	From Clearfield Street to Juniata Street	
Summit St, Graham St, and Wistar St	200 feet of 8-inch pipe	Summit Street and Graham St	From north end of existing 6-inch main in Summit St to west end of existing 6-inch main in Graham St	
Summit St, Graham St, and Wistar St	225 feet of 8-inch pipe	Wistar Street	From Graham Street south to existing 6-inch main	
Hellertown Road and Easton Rd	1700 feet of 8-inch pipe	Hellertown Road and Cherry Lane	From south end of existing 8-inch main in Hellertown Rd, south to Cherry Lane, then east on Cherry Lane to existing 8-inch main	
Brook Ave, Park Ave, and Morningside Avenue	850 feet of 8-inch pipe	Lehigh Avenue	From Brook Avenue to Park Avenue	
Brook Ave, Park Ave, and Morningside Avenue	150 feet of 8-inch pipe	Morningside Avenue	From New York Avenue south to existing 6-inch main	
Church Road and Hausman Ave	100 feet of 8-inch pipe	Church Street	From Church Road to Hausman Avenue	
Lechauweki Avenue	350 feet of 8-inch pipe	Moravia Street	From Hertzog Avenue to Lechauweki Avenue	
Forrest Street	250 feet of 8-inch pipe	Church Street	From Forrest Street to Greene Street	
Colesville Road	225 feet of 8-inch pipe	Colesville Road	From Dartford Road east to existing 8-inch main	
Viola Lane, Victor Road, and Clarence Drive	450 feet of 8-inch pipe	Viola Lane	From north end of existing 4-inch main in Viola Lane to existing 4-inch main in Clarence Drive	

Table 2-4
City of Bethlehem
Project Expenditures for Repair, Replacement, and Renovation of Eligible Property for Areas Outside Bethlehem City Limits

		Project Expenditures								Forecasted Project Expenditures						
Category	Description	2013	2014	2015	2016	2017	Totals	2013-2017	Average 2013-2017	2018	2019	2020	2021	2022	Totals 2018-2022	Average 2018-2022
Service Lines Renewal	Service Lines Renewal	\$38,082	\$52,988	\$44,359	\$35,999	\$39,172	\$210,600	\$42,120	\$73,680	\$73,680	\$73,680	\$73,680	\$73,680	\$73,680	\$368,400	\$73,680
Plant Category 323	Subtotals:	\$38,082	\$52,988	\$44,359	\$35,999	\$39,172	\$210,600	\$42,120	\$73,680	\$73,680	\$73,680	\$73,680	\$73,680	\$73,680	\$368,400	\$73,680
Distribution System Mains Rehabilitation	Replacement and Rehabilitation of Distribution System Facilities	\$29,169	\$5,799	\$158,106	\$466,239	\$430,580	\$1,089,893	\$217,979	\$448,943	\$471,360	\$471,360	\$471,360	\$471,360	\$471,360	\$2,334,383	\$466,877
Plant Category 322	Freemansburg Bridge Main Replacement	\$4,997	\$0	\$0	\$0	\$0	\$4,997	\$999	\$0	\$0	\$0	\$0	\$0	\$98,200	\$98,200	\$19,640
	Birchwood Farms Pipeline Replacements	\$123,807	\$9,000	\$187,898	\$9,889	\$0	\$330,594	\$66,119	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Distribution System Pipeline Work - Sidewalk and Trench Restoration	\$10,101	\$20,226	\$37,113	\$32,318	\$32,716	\$132,474	\$26,495	\$40,992	\$45,193	\$47,454	\$49,826	\$52,329	\$235,794	\$47,159	
	Delaware Avenue Main Replacement	\$106,159	\$250,167	\$0	\$0	\$0	\$356,326	\$71,265	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Russell Avenue Reconstruction	\$0	\$0	\$0	\$137,756	\$0	\$137,756	\$27,551	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Church Road Reconstruction (\$102,702)	\$0	\$0	\$0	\$102,702	\$0	\$102,702	\$20,540	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Troxell St - Replace 2800' 8" main and service lines	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$436,489	\$0	\$0	\$0	\$0	\$0	\$436,489	\$87,298
	Hecktown Road Main Relining	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$150,000	\$0	\$0	\$0	\$0	\$150,000	\$30,000
	Clewell Street Emergency (\$157,998)	\$0	\$0	\$63,518	\$0	\$0	\$63,518	\$12,704	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Middletown Road Bridge Main Replacement	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$200,000	\$0	\$200,000	\$40,000
	Subtotals:	\$274,232	\$285,192	\$446,635	\$748,905	\$463,296	\$2,218,259	\$443,652	\$926,424	\$666,553	\$518,814	\$721,186	\$621,889	\$3,454,866	\$690,973	
Main extensions and looping to improve service to existing customers	Route 512 Pipeline to Connect Existing Bethlehem Customers near Bath, PA	\$0	\$0	\$126,641	\$97,672	\$19,304	\$243,617	\$48,723	\$0	\$300,000	\$0	\$0	\$610,000	\$910,000	\$182,000	
Plant Category 322	Mud Lane 5,400 feet of Pipeline to Connect Existing Bethlehem Customers in East Allen Twp.	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$600,000	\$600,000	\$1,200,000	\$240,000	
	Drexel Heights Pipeline and PRV	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$350,000	\$0	\$0	\$350,000	\$70,000	
	Hoover Avenue - Tacoma to Ulster (\$140,000)	\$0	\$0	\$0	\$0	\$140,000	\$140,000	\$28,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Airport Road Pipeline and PRV	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$78,418	\$0	\$78,418	\$15,684	
	Subtotals:	\$0	\$0	\$126,641	\$97,672	\$159,304	\$383,617	\$76,723	\$0	\$300,000	\$350,000	\$678,418	\$1,210,000	\$2,538,418	\$507,684	
Meter Replacement	Residential/Commercial/Industrial Meter Replacement	\$42,184	\$45,107	\$103,154	\$69,304	\$80,311	\$340,059	\$68,012	\$81,466	\$81,466	\$81,466	\$81,466	\$81,466	\$81,466	\$407,330	\$81,466
Plant Category 324	AMR/AMI Meter Conversion Project	\$0	\$0	\$0	\$89,172	\$31,346	\$120,517	\$24,103	\$101,833	\$370,300	\$740,600	\$740,600	\$740,600	\$2,693,933	\$538,787	
	Allentown Interconnect Meter Engineering/Construction/Contract Management	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$131,250	\$0	\$131,250	\$26,250	
	Subtotals:	\$42,184	\$45,107	\$103,154	\$158,475	\$111,657	\$460,577	\$92,115	\$183,299	\$451,766	\$822,066	\$953,316	\$822,066	\$3,232,513	\$646,503	
SCADA Maintenance	SCADA System Upgrade	\$42,593	\$33,063	\$4,972	\$0	\$3,840	\$84,468	\$16,894	\$11,667	\$40,950	\$40,950	\$40,950	\$40,950	\$40,950	\$175,467	\$35,093
Plant Category 322	Equipment and Technical Support for SCADA System	\$6,793	\$4,797	\$13,050	\$7,350	\$8,449	\$40,440	\$8,088	\$3,889	\$4,667	\$5,445	\$6,222	\$7,000	\$27,223	\$5,445	
	Subtotals:	\$49,386	\$37,860	\$18,022	\$7,350	\$12,290	\$124,908	\$24,982	\$15,556	\$45,617	\$46,395	\$47,172	\$47,950	\$202,690	\$40,538	
Annual Totals:		\$403,884	\$421,147	\$738,811	\$1,048,402	\$785,718	\$3,397,962	\$679,592	\$1,198,959	\$1,537,616	\$1,810,954	\$2,473,772	\$2,775,585	\$9,796,887	\$1,959,377	

3.0 LOCATION OF ELIGIBLE PROPERTY

Eligible property in the Bethlehem system includes finished water distribution pipelines and facilities serving areas outside Bethlehem City limits:

- Distribution mains and valves
- Hydrants
- Service lines
- Water meters
- SCADA System

The Bethlehem water distribution system is located in Northampton and Lehigh Counties. The system service area includes all or parts of the City of Bethlehem; Allen, East Allen, Bethlehem, Hanover, Lower Saucon, Upper Saucon, Salisbury, and Lower Nazareth Townships; and Freemansburg and Fountain Hill Boroughs.

Locations are provided in Table 2-4 for specific projects proposed to repair and replace eligible property in the Bethlehem Distribution System. Table 2-4 is applicable to projects serving areas outside the boundaries of the City of Bethlehem.

4.0 REASONABLE ESTIMATE OF THE QUANTITY OF ELIGIBLE PROPERTY TO BE IMPROVED

The quantity of eligible property to be improved has been estimated based on projected annual revenues and budget availability, projected customer water needs, and allowances for interim repair issues. In some cases, such as pipeline replacement work, quantities are based on material units – length of pipe. In other cases, where material units cannot be accurately defined in advance, quantities are based on annual budgeted dollar amounts. Actual quantities will depend on pipeline, facility, equipment, and instrumentation operations, and on system conditions that occur each year. It should be noted that the City does not record retirements for plant in the categories listed below.

Planned capital projects for the 2018 through 2022 period for distribution system areas outside the City of Bethlehem are summarized below:

Distribution System			
1	Annual Main Replacement	4,700 feet per year	\$ 691,000 per year
2	Annual Service Line Replacement	50 service lines per year	\$ 74,000 per year
3	Annual Water Meter Replacement, including conversion to Advanced Metering Infrastructure (AMI) technology	1,600 meters per year	\$ 647,000 per year
4	Main extensions and looping to improve service to existing customers.	1,400 feet per year	\$ 394,000 per year
5	SCADA System Maintenance	1 System	\$ 41,000 per year

In addition, specific improvement projects developed from Comprehensive Planning Studies are listed in Table 2-4.

5.0 PROJECTED ANNUAL EXPENDITURES AND MEASURES TO INSURE COST-EFFECTIVE PROJECT IMPLEMENTATION

Recorded annual expenditures from 2013 to 2017 and projected annual expenditures for each year from 2018 to 2022 are presented below and are shown in Table 2-4 and on Figure 5-1. These annual expenditures are associated with infrastructure serving areas outside the City of Bethlehem. Projected annual expenditures are budget estimates and may vary depending on contractor bid prices and construction activity.

Year	Recorded Expenditures	Year	Projected Expenditures
2013	\$ 0.40 million	2018	\$ 1.20 million
2014	\$ 0.42 million	2019	\$ 1.54 million
2015	\$ 0.74 million	2020	\$ 1.81 million
2016	\$ 1.05 million	2021	\$ 2.47 million
2017	\$ 0.79 million	2022	\$ 2.78 million
Total	\$ 3.40 million	Total	\$ 9.80 million
Average	\$ 0.68 million	Average	\$ 1.96 million

The City of Bethlehem will continue their efforts through 2022 that produce cost-effective construction practices and project implementation. Measures to ensure cost-effectiveness include:

1. A Comprehensive Planning Study has been prepared that examined all aspects of the Water Distribution system. Alternative improvement projects were identified and evaluated to address service capacity and operational issues associated with these systems.
2. Individual feasibility studies are performed, where applicable, prior to project design. These studies ensure optimum and most up-to-date project designs.
3. Competitive bidding is used to obtain the best possible price for each project.
4. On-going staff training provides the skills and knowledge required for correct equipment operation, preventative maintenance procedures, and making necessary repairs.
5. Qualified and experienced inspectors are employed so that correct construction practices and procedures are used for all projects. Inspectors also require all projects are constructed and installed in accordance with AWWA, Pennsylvania DEP, City of Bethlehem, and all other applicable requirements and standards.
6. Bethlehem maintains contact with other utilities, municipalities, and agencies to coordinate water system improvement projects with other related construction activities, such as road paving/resurfacing work.

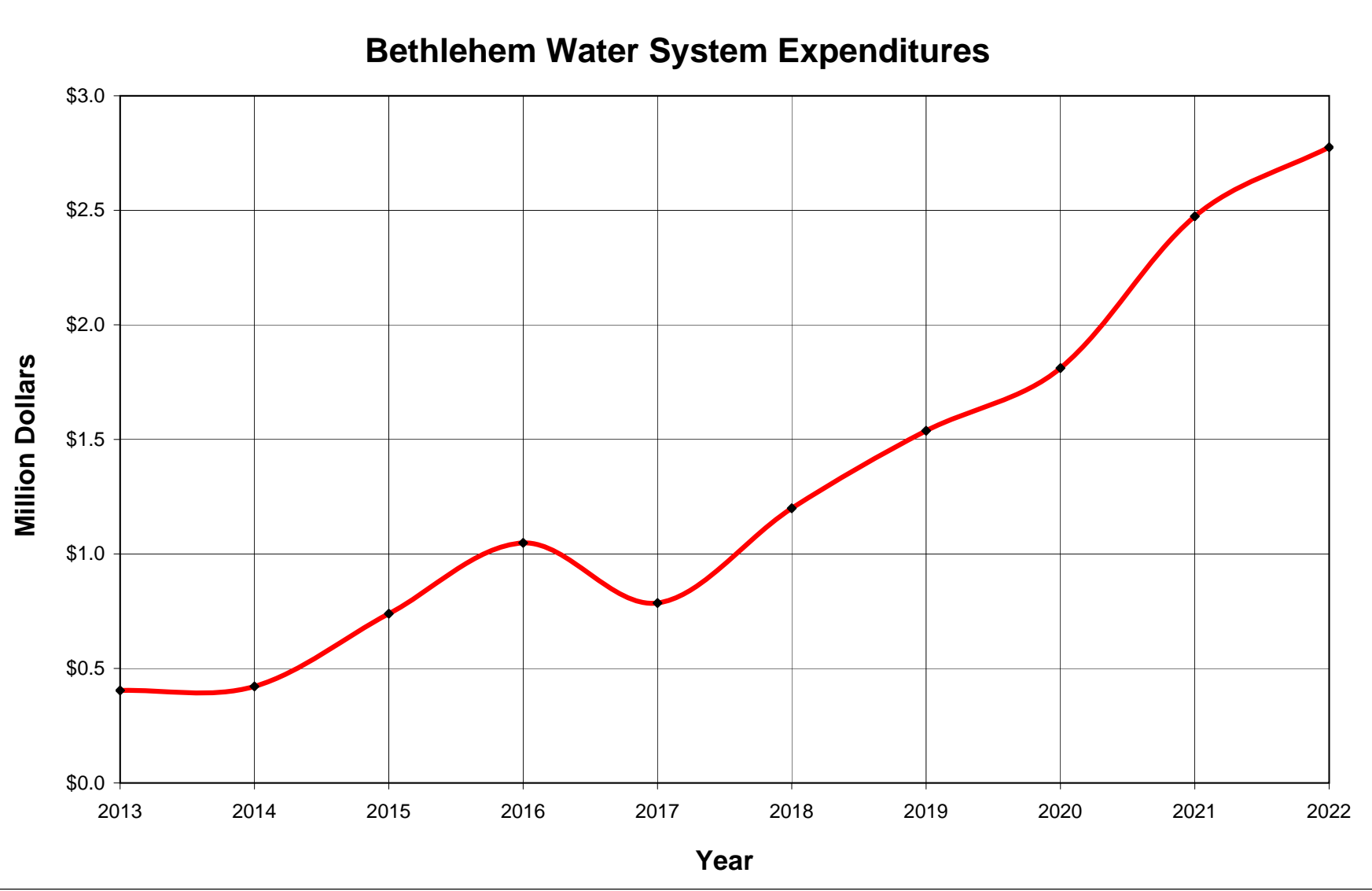


FIGURE 5-1

As a result of these practices and procedures, Bethlehem's system improvement program maximizes cost-effectiveness, while minimizing impacts on customer water service, business access, and traffic congestion.

6.0 ACCELERATION PLAN AND MAINTENANCE OF SAFE AND RELIABLE SERVICE

Bethlehem has continually invested in their Water Distribution system to maintain safe, reliable, and high quality service to their customers. As the water system ages, replacement projects are expected to expand and accelerate over the next five years. A graph of 2013 to 2017 expenditures and 2018 through 2022 budgeted expenditures is provided on Figure 5-1. These annual expenditures are associated with infrastructure serving areas outside the City of Bethlehem. Capital expenditures in 2013 through 2017 ranged from \$0.40 million to \$1.05 million, and averaged \$0.68 million. As described in Section 5.0 and shown on Figure 5-1, annual capital expenditures are forecasted to increase to \$1.20 million in 2018, \$1.77 million in 2019, and then grow to \$2.78 million in 2022. The average forecasted annual capital expenditure for 2018 through 2022 is \$1.96 million. These forecasted annual expenditures in 2018 through 2022 represent an increase of over 288% when compared to annual expenditures in 2013 through 2017.

As noted above, the City's historic annual spending level from 2013 through 2017 was \$0.68 million. The City's proposed annual accelerated spending level from 2018 through 2022 is \$1.96 million. This is a factor increase of 2.88 in spending level. As such, it would take approximately from 2018 to 2032 at the City's average historic spending levels to make its planned replacements for 2018 – 2022.

The objectives of the proposed improvement program are to maintain and enhance customer service by addressing system needs, including pressure and flow capacity, fire flow availability, water quality, and emergency capabilities, such as operations during power failures. Projects are proposed that repair or replace aging, problematic, or inadequate capacity infrastructure. As a result, unexpected infrastructure failures should be less likely and fewer emergency repairs and replacements should be required.

Unexpected infrastructure failures, such as main breaks, can have a significant impact on customer water service when compared to scheduled maintenance work. Standard Bethlehem procedures for scheduled maintenance include advance meetings with local township or borough officials to advise them regarding project activities. Customers, traffic, and other project impacts are presented and discussed at these meetings. Individual notifications to affected residences and businesses are provided in writing and by telephone.

In addition, emergency repairs usually are more costly than scheduled maintenance for replacing inadequate infrastructure. Therefore, accelerated implementation of the proposed improvement program will enhance system safety, reliability, and dependability of customer service, and provide for more cost-effective maintenance work.

7.0 WORKFORCE MANAGEMENT

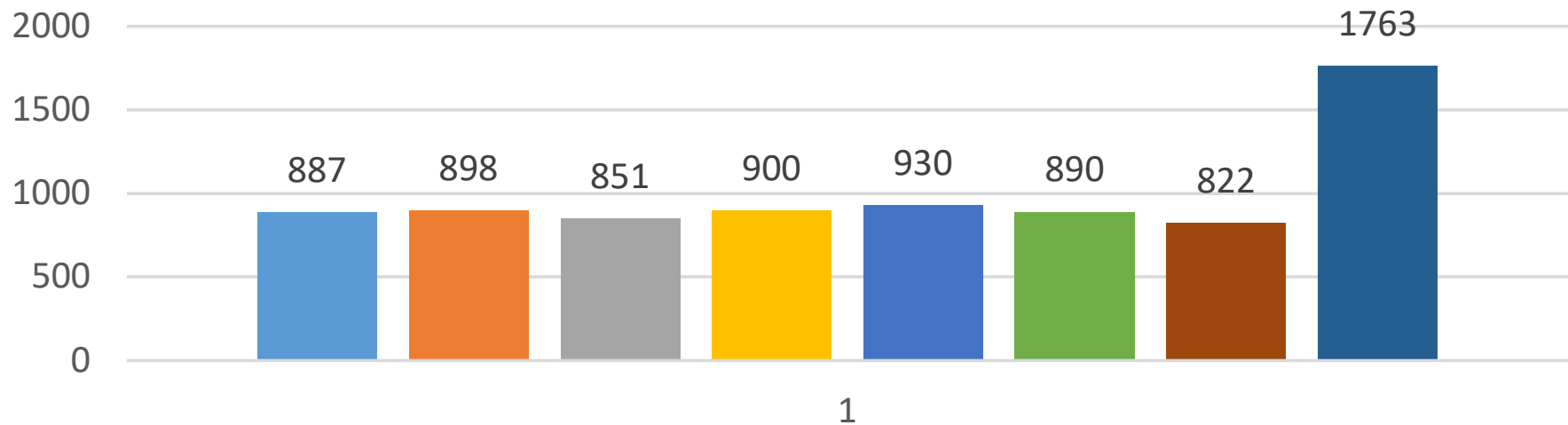
Bethlehem effectively and efficiently manages and conducts construction projects utilizing competitive bidding and an experienced and qualified engineering and inspector staff. Competitive bidding is optimized by using the online, Internet-based PennBid process. The PennBid process provides the capability to advertise Bethlehem projects to all interested and qualified bidders. PennBid also provides the ability to notify all potential bidders regarding project questions, answers, and possible project addenda.

Bethlehem's experienced engineering staff evaluates bids received for each projects. The staff is familiar with contractors in the Bethlehem area. Bids are evaluated on more than a cost basis. Other factors, evaluated along with cost to select the optimum bidder, include contractor qualifications and capabilities, contractor workload, past history on Bethlehem projects and other utility projects, safety record, and the capability to meet project schedules.

Project management involves regular engineering review meetings during project design, and inspection by highly qualified inspectors during construction. The level of experience of Bethlehem's inspectors is such that unsatisfactory work items usually are identified and prevented by inspectors before construction is completed. However, if necessary, inspectors require unacceptable work to be removed and reinstalled in accordance with project specifications.

APPENDIX 13

Distribution System Flushing - 2020



■ # Hydrants flushed - 2014

■ # Hydrants flushed - 2015

■ # Hydrants flushed - 2016

■ # Hydrants flushed - 2017

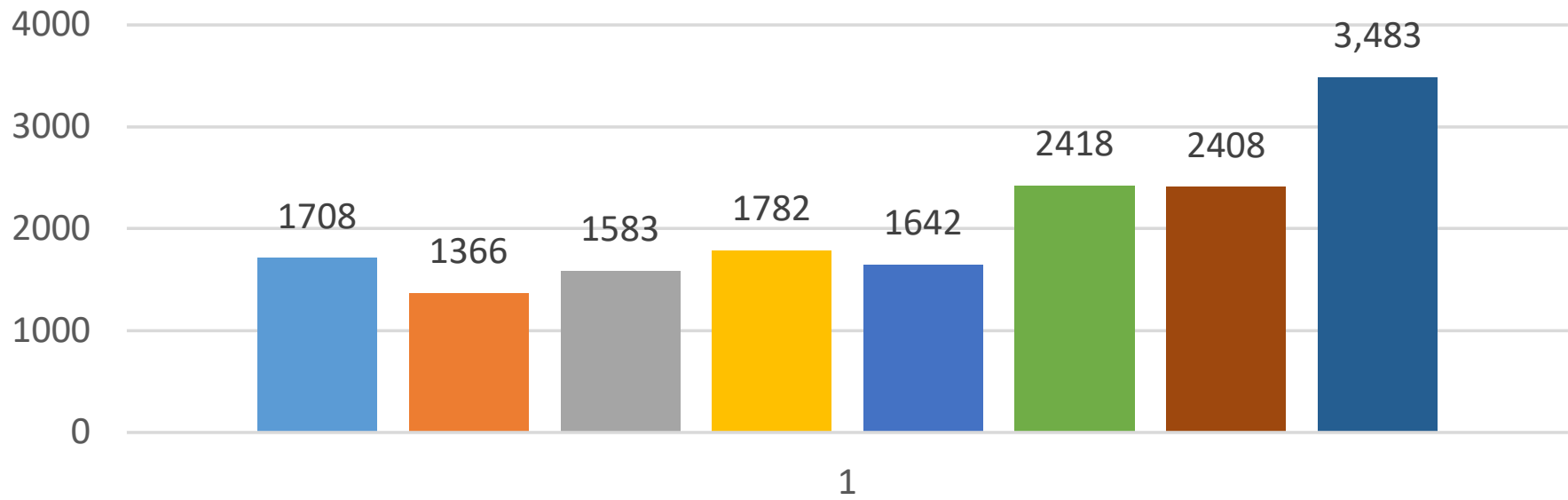
■ # Hydrants flushed - 2018

■ # Hydrants flushed - 2019

■ # Hydrants flushed - 2020

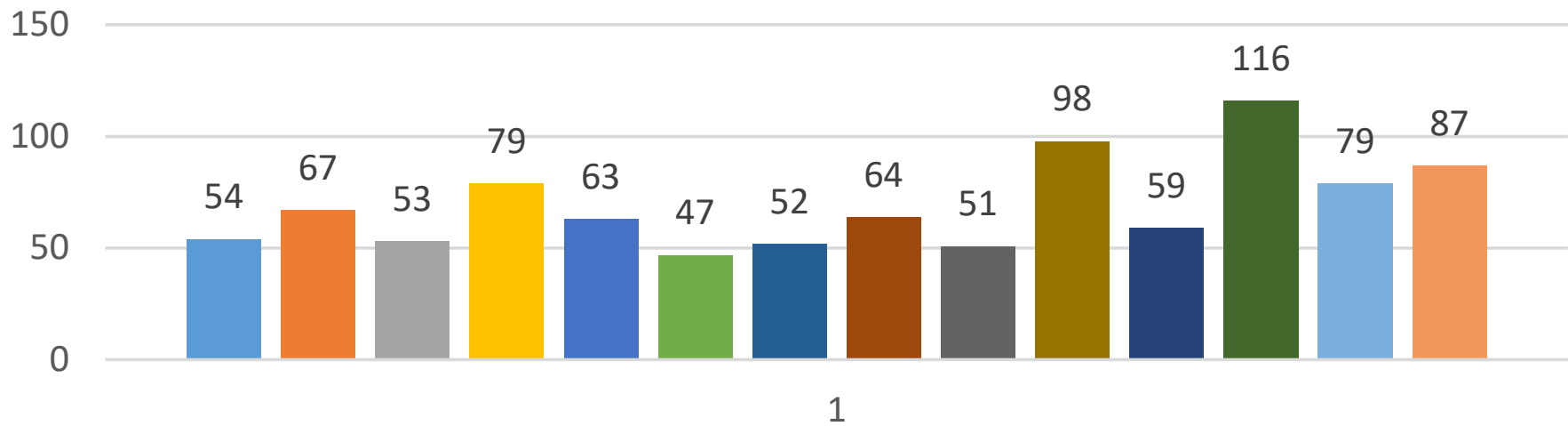
■ Total number hydrants in model

Hydrants Maintained - 2020



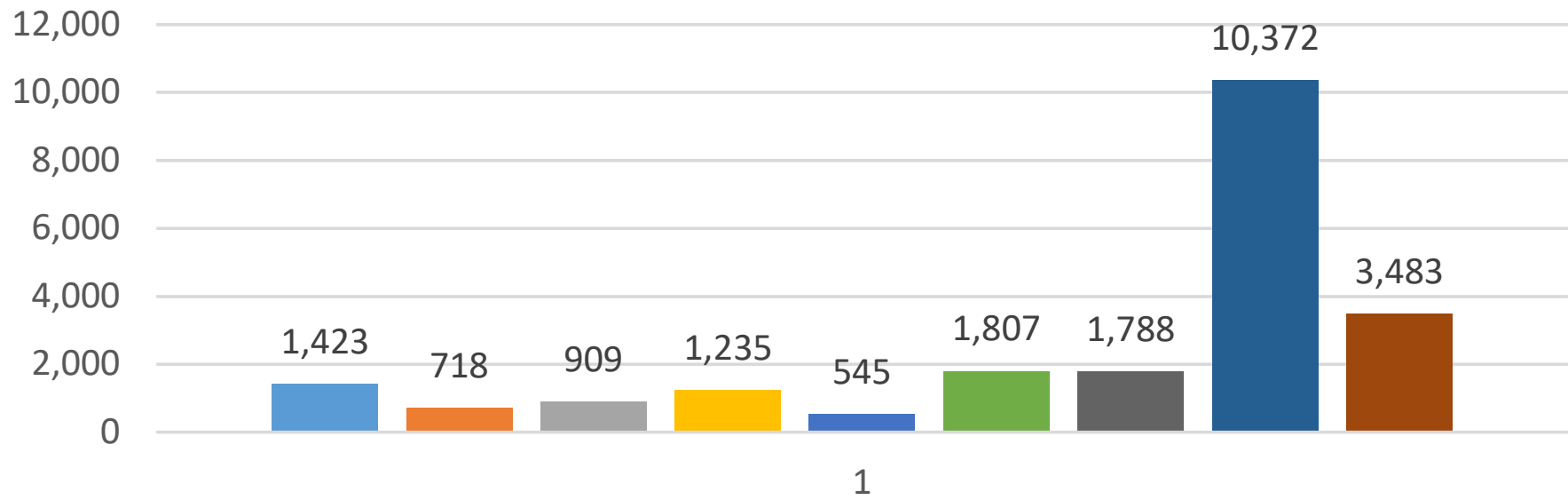
■ Hydrants maintained - 2014 ■ Hydrants maintained - 2015 ■ Hydrants maintained - 2016
■ Hydrants maintained - 2017 ■ Hydrants maintained - 2018 ■ Hydrants maintained - 2019
■ Hydrants maintained - 2020 ■ Hydrants on record

Leak Activity - 2020



■ Main breaks - 2014 ■ Service leaks - 2014 ■ Main breaks - 2015 ■ Service leaks - 2015
 ■ Main breaks - 2016 ■ Service leaks - 2016 ■ Main Breaks - 2017 ■ Service leaks - 2017
 ■ Main Breaks - 2018 ■ Service Leaks - 2018 ■ Main Breaks - 2019 ■ Service Leaks - 2019
 ■ Main Breaks - 2020 ■ Service Leaks - 2020

Valve Exercising - 2020



■ Valves Exercised - 2014 ■ Valves Exercised - 2015 ■ Valves Exercised - 2016
■ Valves Exercised - 2017 ■ Valves Exercised - 2018 ■ Valves Exercised - 2019
■ Valves Exercised - 2020 ■ Main valves on record ■ Hydrant Valves on record



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