2019 Consulting Engineer's Annual Report

December 2019

The Pittsburgh Water and Sewer Authority
507393845

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Executive Summary

The Pittsburgh Water and Sewer Authority (PWSA) retained Mott MacDonald, LLC, as its Consulting Engineer in August of 2019. One of the tasks of the Consulting Engineer is to prepare an Annual Report for the PWSA as required by the current Bond Indenture Amended and Restated as of November 1, 2017, and effective December 28, 2017. The Bond Indenture requires the Consulting Engineer, in addition to other duties identified in the Bond Indenture, to:

a. Provide advice and recommendations as to the proper maintenance, repair, and operation of the water and sewer systems during the next Fiscal Year and estimate the amounts of money that should be expended for such purposes.
b. Provide advice and recommendations as to the Capital Additions that should be made during the next Fiscal Year and estimate the amount of money that is recommended for such purposes.
c. Indicate whether the properties of the water and sewer systems have been maintained in good repair and sound operating condition and the Consulting Engineer's estimate of the amount, if any, required to place such properties in such condition and the details of such expenditures and the approximate time required to do this.

In this Annual Report, the 2019 Consulting Engineer's Annual Report, the Consulting Engineer describes a system that is functional but subject to Amended Consent Orders from the Pennsylvania Department of Environmental Protection to address numerous regulatory standards and other compliance requirements.

The water and sewer systems require upgrades to address end of useful life conditions and updates to current operational and safety standards. The PWSA's water and sewer systems also include critical facilities which expose customers to the risk of loss of water if taken off line for repairs due to a lack of redundant facilities.

Additionally, to sustain cost-effective operations while optimizing asset performance and life expectancy, significant structural, operational, and maintenance improvements are required and must be undertaken in the near-term to address long-standing deficiencies in both the water and sewer systems.

During 2018, the PWSA gave notice that they intend to accept responsibility for the separate storm water system compliance within the City of Pittsburgh, as requested by the United States Environmental Protection Agency (USEPA). Currently, management of separate storm sewer systems is the responsibility of the City of Pittsburgh; however, because of the PWSA's combined sewer collection system (sewage and storm water conveyed in the same pipe), the PWSA has the operational and management capacity to take some measure of responsibility for the compliance activities related to flow into these separate stormwater conveyances. This report does not address complete city-wide storm water management as the PWSA does not currently have this responsibility. We understand a Memorandum of Agreement between the City of Pittsburgh and the PWSA has been drafted to assign responsibilities to both parties, but is not yet approved.

Water System

The PWSA's water treatment plant has the permitted capacity to provide 100 million gallons per day (MGD). Approximately 70 MGD is currently being used by its existing customers, providing routine operational and maintenance deficiencies are addressed. The water system is sized to deliver adequate water supply to meet the demands in the foreseeable future, assuming the PWSA continues the rehabilitation and replacement program provided for in its ongoing Capital Improvement Program (CIP). The PWSA monitors water quality on a continuous basis for contaminants that may be present in source water prior to treatment, during treatment, and in finished water from the water treatment plant. This monitoring is necessary to verify that water quality meets or exceeds regulatory standards.

A major focus of the PWSA during 2019 was to reduce the amount of public and private lead service lines within the water system, which would reduce the amount of lead that may leach into the water supply. This program is one of the PWSA's success stories for 2019, as it was in 2018. Pursuant to a Consent Order and Agreement (COA) issued by the Pennsylvania Department of Environmental Protection (PADEP) on November 17, 2017, the PWSA was required to replace at least 2,196 public lead service lines by December 31, 2018. The PWSA succeeded in replacing 2,713 lead service lines by December 13, 2018. The 2019 Lead Service Line Program has continued the progress that was made in 2018 by exceeding the COA-mandated number of lead service lines replaced nine months early. This was achieved by replacing approximately 100 service lines per week using four contractors. The 2019 Lead Service Line Replacement Program will continue through April 2020 even though it met the annual lead service line replacement requirements early. The regulator's fiscal year begins on July 1st and ends June 30th. Starting in 2020, the lead service line replacement program will be included with the Small Diameter Water Main Replacement Program.

In addition to the success of the lead line replacement program, the PWSA obtained the necessary Operating Permit from the PADEP on March 29, 2019 to begin adding orthophosphate to the water supply to improve corrosion control. Chemical testing of the orthophosphate application to the PWSA's finished water demonstrated mitigation of lead and copper corrosion to levels below current federal drinking water standards.

Sewer System

The sewer collection system mostly consists of combined sewers where sewage and storm water are conveyed in the same pipe. The collection system is designed so that during wet weather, a portion of the collected storm water and diluted wastewater is discharged to natural water courses through diversion chambers located throughout the sewer system and at connections to the Allegheny County Sanitary Authority (ALCOSAN) interceptors.

The sewer system is in satisfactory operating condition and has adequate capacity for the dry weather sewer flows. During any wet weather event, the sewer system is often taxed beyond its capacity resulting in overflows, bypassing, and flooding. The PWSA's sewer system is the basis for a prior 2004 Consent Order issued by the Pennsylvania Department of Environmental Protection. Numerous projects have been identified and some started to address the terms of the 2004 Consent Order, which has expired. A new Consent Order and Agreement is expected to be negotiated with the USEPA in the coming months to address these issues.

Several combined sewer overflow (CSO) abatement projects, basement flooding reduction projects and water quality impact mitigation plans are in various stages of design, construction, or regulatory review and are expected to require significant operational and capital investments. The sewer system requires ongoing attention and funds from the Capital Improvement Program

to correct existing deficiencies and maintain and upgrade the system to meet regulatory requirements and reduce localized backups. If the Capital Improvement Program continues to include the identified sewer system improvements, it is anticipated that foreseeable future demands on the system can be met and the CSO compliance requirements achieved.

In summary, it is the Consulting Engineer's opinion, based upon our review of the PWSA 2020 – 2024 Capital Improvement Plan, that implementation of the 2020 initiatives will move the PWSA forward in their efforts to provide functional and efficient water and sewer systems for their customers.

1 History and Background

1.1 General

In February 1984, the leadership of the City of Pittsburgh (City) formed The Pittsburgh Water and Sewer Authority (PWSA) under the provisions of the Pennsylvania Municipality Authorities Act, 53 Pa. C.S.A. §5601 et. seq. The PWSA's Articles of Incorporation were originally approved on February 17, 1984, by the Commonwealth of Pennsylvania. In 2008, the Commonwealth approved an Amendment to the Articles of Incorporation as adopted by the City and the PWSA to extend its term of existence to 2045 to ensure that its term covers the duration of certain bond obligations.

1.2 Initial Operation

Pursuant to a Lease and Management Agreement dated March 29, 1984, between the PWSA and the City (the "Lease and Management Agreement"), the water and sewer systems were leased to the PWSA and the PWSA took over operations of these systems on May 1, 1984.

Under the Lease and Management Agreement, the PWSA was authorized to operate and maintain the water and sewer systems, construct all necessary improvements, establish and collect rates and charges for its service, and finance its operations and improvements through revenue collections and sale of bonds and notes payable solely from the PWSA's revenues. The PWSA appointed and designated the City as the PWSA's agent to manage, operate, and maintain the water and sewer systems for the term of the lease, subject to the general supervision, direction, and the control of the PWSA. The City provided the services necessary to operate the water and sewer systems to the PWSA with the PWSA reimbursing the City for all expenses incurred and expended by the City.

The Capital Lease Agreement and Cooperation Agreement, each between the PWSA and the City, as authorized in Resolution No. 47 of 1995, terminated the Lease and Management Agreement. The Cooperation Agreement provided that the City render certain services to the PWSA as set forth in the agreement and provided the basis of payment for such services to be rendered by the City. As of January 1, 1995, all positions in the City Water Department and certain positions in the Water and Sewer Division of the Department of Engineering and Construction were eliminated from the City's budget, and similar positions were created and filled by the PWSA. Under the terms of the Capital Lease Agreement, the PWSA will own the water and sewer systems on September 1, 2025 upon payment of $1.00.

1.3 Capital Improvement Program (CIP) Funding Source History

1.3.1 First Bond Issue

On April 19, 1984, the PWSA Board adopted a major Capital Improvements Program (CIP) by Resolution No. 19 of 1984. The Program was designed to maintain a satisfactory level of service to the water and sewer systems current users, to improve operating efficiency, and to address future user requirements. In July 1984, the PWSA issued $93,600,000 Daily Adjustable Demand Water and Sewer Systems Revenue Bonds, Series of 1984, to implement the initial phase of the program. From proceeds of this bond issue, $78,777,000 was deposited into the

Construction Fund for the initial phase of the CIP. In June 1986, the PWSA issued an additional $134,700,000 Adjustable Rate Tender Revenue Bonds, Series of 1986. From the 1986 Bond Issue, $115,000,000 was available to continue the program.

Additionally, the initial bond issue of the PWSA created the "Renewal and Replacement Fund" to be held in trust by the Trustee to be used by the PWSA for extraordinary maintenance and repair of the water and sewer systems or to pay the cost of capital additions. The Trust Indenture provides, so long as the aggregate amount of funds on deposit in the Construction Funds(s) is not less than $7,000,000, the PWSA is not required to make any deposits into the Renewal and Replacement Fund. It is further required that if this aggregate amount is less than $7,000,000, the PWSA shall transfer, on or before the first day of each month, a sum of $100,000 from the Revenue Fund to the Renewal and Replacement Fund until the aggregate amount equals $7,000,000. In addition, if the aggregate amount on deposit in these two funds is less than $5,000,000, the PWSA shall, on each September 1st, transfer to the Renewal and Replacement Fund all surplus moneys remaining in the Revenue Fund after all payments required to be made on such September 1st have been made until such time as the aggregate amount on deposit in these funds are equal to not less than $5,000,000.

1.3.2 1993 Bond Issue and Refunding

In November 1993, the PWSA issued two series of Water and Sewer System Bonds to advance refund all the outstanding previously issued bonds, provide additional funds for capital improvements to the water and sewer systems, and pay all fees and expenses incurred in connection with issuance of the 1993 Bonds. Series A of the 1993 Bonds, in the aggregate principal amount of $278,970,000, was for the advanced refunding of outstanding bonds. Series B of the 1993 Bonds, in the aggregate principal amount of $10,785,000, was to finance additional capital improvements.

The new Trust Indenture, dated October 15, 1993 and applicable to the Series A and B of the 1993 Bond Issues, eliminated the requirements for a fund balance, as described in the previous Section, to be maintained in the "Renewal and Replacement Fund" unless determined necessary annually by the Consulting Engineer. Therefore, the $2,009,523 which was being maintained in the Fund under the previous Trust Indenture was transferred to the "Prior Bonds Construction Fund" for use for capital improvements. From the Series B of the 1993 Bond Issue, $9,990,477 was deposited into the 1993 Bond Construction Fund for additional capital improvements.

1.3.3 1995 Bond Issue

In 1995, the PWSA recognized that the funding for the CIP implemented in 1984 was almost depleted. To ensure a continued supply of safe drinking water and proper sewer service to the PWSA's current and future users and to address future demands on the water and sewer systems, a new CIP was developed and adopted.

The PWSA also negotiated a Capital Lease Agreement with the City, which terminated the Lease and Management Agreement and provided for the PWSA to acquire the water and sewer systems from the City.

The PWSA issued additional bonds in 1995 to fund the 1995 CIP and to pay certain obligations of the PWSA to the City under the Capital Lease Agreement. On July 15, 1995, the PWSA issued Water and Sewer System First Lien Revenue Bonds, Series A of 1995, to pay for the capital improvements identified in the new CIP and Water and Sewer System Subordinate Revenue Bonds, Series B of 1995, to pay the obligation of the PWSA to the City under the Capital Lease Agreement in the aggregate principal amounts of $89,850,000 and $103,020,000,

respectively. From the Series A of 1995 Bonds, $80,000,000 was deposited into the Series A of 1995 Capital Project Fund to fund the new CIP of the PWSA.

1.3.4 1998 Bond Issue and Refunding

Early in 1998, additions to the CIP were proposed that addressed future needs of the PWSA, which included covering Highland Reservoir No. 1, City and Urban Redevelopment Authority Projects, and improvements to the water distribution and sewerage systems.

On March 2, 1998, the PWSA issued Water and Sewer System First Lien Revenue Bonds, Series A of 1998, to provide for the refunding of the PWSA's outstanding Series A of 1995 Bonds; Water and Sewer System First Lien Revenue Bonds, Series B of 1998, to fund additions to the CIP; and Water and Sewer System Subordinate Revenue Bonds, Series C of 1998, and to refund the PWSA's outstanding Series B of 1995 Bonds. The Series B of 1998 Bonds enabled $36,001,908 to be deposited into the 1998 Capital Projects Fund, funding the CIP into the year 2000.

1.3.5 2002 Bond Issue

At the end of 2000, the Capital Project Funds of the PWSA were largely spent with approximately $345,000 in reserve for construction and capital projects. The PWSA had anticipated this drawdown of funds and had begun work to issue additional bonds in early 2002. The Capital Projects Fund, through this issue, provided $90,494,400 for the construction of capital projects and to meet the needs of emergencies that may require the use of capital funds.

1.3.6 2003 Bond Refunding

On September 23, 2003, the PWSA issued $167,390,000 of Water and Sewer System Revenue Refunding Bonds, 2003 Bonds, to partially refund the 1993 Bond Series. The 2003 Bonds, with an average yield of 3.8 percent, generated a reduction in annual debt service payments of approximately $4,000,000 for 2004. The 2003 Bonds were refunded by a portion of the 2013 Series A Bonds.

1.3.7 2005 Bond Issue

In June of 2005, the PWSA issued First Lien Revenue Bonds, 2005 Bonds, in the amount of $50,385,000 to provide for continuation of the CIP and to meet the needs of emergencies that may require the use of capital funds. The 2005 Bonds, with an average yield of 4.23 percent, created an increase in annual debt service payments of approximately $32 million for the first 12 years. The Capital Projects Fund, through this issue, provided $49,799,037 for capital projects.

1.3.8 2007 Bond Advance Refunding

In March of 2007 and pursuant to Resolution No. 23 of 2007, adopted on February 9, 2007, the PWSA issued $158,895,000 of First Lien Water and Sewer System Revenue Refunding Bonds: $43,720,000 Series A of 2007 (fixed rate), $57,585,000 Series B-1 of 2007 (variable rate demand), and $57,590,000 Series B-2 of 2007 (variable rate demand). The 2007 Bond Issue refunded the 2002 and 2005 Bonds. The 2007 Bond Advance Refunding also resulted in the deposit of $6,319,014 into the 2007 Depository Agreement Fund. These funds were available for capital projects and were exhausted in 2009. The final amount deposited was $7,503,881. Series B of 2007 Bonds are being refunded by the Series A of 2013 Bonds.

Pursuant to Resolution No. 23 of 2007, adopted on February 9, 2007, an additional $7,000,000 was made available for capital improvements. These additional funds were provided through a transfer from the Debt Service Reserve Fund in accordance with Section 6.04 of the Trust

Indenture, which provided for the required funds for Debt Service Reserve Fund to be in the form of cash, a letter of credit or other credit instrument, a surety bond, or a combination thereof. The PWSA Board elected to replace the monies in the fund with a surety bond. As a result, $7,000,000 was transferred to the Construction Fund for capital improvements, and the balance of the monies were transferred to the Debt Service Fund.

1.3.9 2008 Bond Advance Refunded

In June 2008 and pursuant to Resolution No. 54 of 2008, adopted on April 11, 2008, the PWSA issued the following bonds:

- $145,495,000 (variable rate demand) Water and Sewer System First Lien Revenue Bonds, Series B of 2008
- $71,225,0000 (variable rate demand) Water and Sewer System First Lien Revenue Bonds, Series D-2 of 2008
- $51,910,000 (variable rate demand) Water and Sewer System Subordinate Revenue Refunding Bonds, Series C-1 of 2008
- $51,885,000 (variable rate demand) Water and Sewer System Subordinate Revenue Refunding Bonds, Series C-2 of 2008
- $68,970,000 (fixed rate) Water and Sewer System First Lien Revenue Refunding Bonds, Series A of 2008 Taxable
- $24,665,000 (fixed rate) Water and Sewer System First Lien Revenue Refunding Bonds, Series D-1 of 2008 Taxable

Proceeds of the 2008 Bonds refunded the PWSA's Series A of 1998 Bonds, Series C of 1998 Bonds, certain maturities of the Series B-1 and B-2 of 2007 Bonds, advance refunded certain maturities of the Series B of 1998 Bonds, and provided $98,442,194 for the continuation of the CIP and to meet the needs of emergencies that may require the use of capital funds.

The issuance of the 2008 Bonds resulted in no rate increase and initially levelled the PWSA's debt service requirements at approximately $42,000,000 until 2040. Due to the crisis that hit the financial sector in the last quarter of 2008, the debt service for 2009 increased to $51,716,888. The debt service was $49,803,245 in 2010 and $46,507,900 in 2011.

In 2011, Resolution No. 59 of 2011 extended liquidity facilities for $71,225,000 (variable rate demand) Water and Sewer System First Lien Revenue Bonds, Series D-2 of 2008. Also, Resolution No. 77 of 2011 and Resolution No. 78 of 2011 extended credit facilities for $72,750,000 (variable rate demand) Water and Sewer System First Lien Revenue Bonds, Series B-2 of 2008 and $72,745,000 (variable rate demand) Water and Sewer System First Lien Revenue Bonds, Series B-2 of 2008, respectively.

In 2012, Resolution No. 64 of 2012 and Resolution No. 65 of 2012 extended liquidity facilities for the 2008 Series C-1-A, B, and C Bonds and the 2008 Series C-1D Bonds, respectively.

1.3.10 2013 Bond Issue

In December of 2013 and pursuant to Resolution No. 101 of 2013, the PWSA issued $86,695,000 (fixed rate) of Water and Sewer System First Lien Revenue Bonds, Series B of 2013, to provide for continuation of the CIP and to meet the needs of emergencies that may require the use of capital funds. Additionally, $8,941,131 of the Series B of 2013 Bonds was utilized to reimburse the PWSA's Operations Fund for funds that were used by the PWSA to construct CIP projects in 2013. The Capital Projects Fund, through this issue, provided $75,000,000 for capital projects. These bonds are expected to carry interest at approximately

5.16 percent maturing in 2043. The PWSA also issued $130,215 (fixed rate) of Water and Sewer System First Lien Revenue Refunding Bonds, Series A of 2013, to refund the Series 2003 and Series 2007 B-1 and B-2 Bonds.

1.3.11 Revolving Line of Credit

In July 2016 and pursuant to Resolution No. 36 of 2016, the PWSA entered a drawdown, revolving line of credit financing with JPMorgan Chase Bank NA. The maximum amount that can be drawn and outstanding at any one time is $80,000,000 and has an initial term of four years. The PWSA is using funds borrowed under this vehicle to finance capital projects. The intention of the PWSA is to draw down this balance to near the facility's capacity and then to issue bonds to replenish the facility before using it again.

In June 2018 and pursuant to Resolution No. 63 of 2018, the PWSA amended the revolving line of credit financing agreement with JP Morgan Chase Bank NA to increase the maximum line of credit limit from $80,000,000 to $150,000,000.

1.3.12 2017 Bond Refunding

In December 2017 and pursuant to Resolution No. 190 of 2017, the PWSA issued $165,390,000 Water and Sewer First Lien Revenue Refunding Bonds composed of Series A ($159,795,000) and Series B (taxable) ($5,595,000). The proceeds of the bonds were used to fund the costs of the refunding of all or a portion of the PWSA's outstanding Series 1998B, 2008A, 2008D-1, and 2013B Water and Sewer System Revenue Bonds. The refunding was completed to reduce the PWSA's debt service payments over the next 15 years by approximately $6,275,000 and to obtain an economic gain (difference between present values of old debt and new debt service payments) of $5,311,111.

The 2017 A and B Bonds were issued at a bond premium of $23,374,000, which is being amortized as an adjustment to interest expense over the life of the bonds.

The 2017 A and B Bonds at December 31, 2017 have carrying amounts of approximately $160 million and $5 million, respectively. The maturity value of defeased 2008-D1 bonds outstanding at December 31, 2017 was $24,665,000.

In addition, the PWSA issued $218,805,000 Series C First Lien Revenue Refunding Bonds, the proceeds of which were used to fund the costs of refunding the PWSA's outstanding Series 2008 B-1, B-2, and D-2 Water and Sewer System Revenue Bonds. The refunding was completed to reduce the PWSA's debt service payments over the next 23 years by approximately $9,782,000 and to obtain an economic gain (difference between present values of old and new debt service payments) of $7,852,000.

The 2017 C Bonds at December 31, 2017 have a carrying amount of approximately $219 million.

1.3.13 2019 Bond Issuance and Refunding

In July 2019 and pursuant to Resolution No. 62 of 2019, the PWSA issued $109,900,000 (fixed-rate) Series A First Lien Water and Sewer Revenue Bonds and $104,290,000 (fixed-rate) Series B Subordinate Water and Sewer Refunding Bonds. The proceeds from the Series A of 2019 Bonds were used to pay down the balance of the revolving line of credit. This increased the capacity on the revolving line of credit to allow the PWSA to continue funding capital projects. The proceeds from the Series B of 2019 were used to refund the PWSA's outstanding Series C-1 and C-2 of 2008 Water and Sewer System Revenue Bonds and terminating the associated swaps. The cost to terminate the swaps was $27,605,000, of which $5,700,000 was funded with

a cash contribution. The refunding was completed to reduce the PWSA's exposure from the risks associated with swaps.

1.3.14 PENNVEST Funding

Act 16 of 1988 established the Pennsylvania Infrastructure Investment Authority (PENNVEST) to assist local governments in financing water and sewer projects. The PENNVEST Program provides loans and grants for acquisition, construction, improvement, expansion, extension, repair and/or rehabilitation of all or part of any water or sewer system. Funding under the PENNVEST Program is primarily in the form of low interest, 20-year loans.

Prior to 2018, the PWSA applied for and obtained 16 PENNVEST loans for seven water, seven wastewater and two storm water projects at various locations in the City of Pittsburgh.

In 2018, the PWSA applied for and received a significant funding package from PENNVEST for the ongoing Lead Service Line Replacement program. The funding offered to the PWSA by PENNVEST consists of $13,687,173 in grants and $35,441,231 in low interest loans with a total funded amount of $49,128,404. These moneys were used for continuing the Lead Service Line Replacement Program in 2019 as detailed in Section 2.2.2.

The table below summarizes the active and complete PENNVEST loans secured by the PWSA.

Table 1: PENNVEST loans

Project name	Project type	Loan approval date	Status	Loan amount[1]
Railside Street Sanitary Sewer Ext.	Wastewater	11/15/00	Complete	$158,399.23
Ollie Street & Overbrook Blvd. Storm Sewer	Storm	11/15/00	Complete	$800,963.48
Water System Improvements No. 1	Water	3/21/01	Complete	$3,940,113.91
Streets Run Interceptor	Wastewater	7/18/01	Complete	$1,928,470.44
Water System Improvements No. 2	Water	3/20/02	Complete	$5,112,263.50
Water System Improvements No. 3	Water	7/17/02	Complete	$4,821,500.00
Sewer System Improvements – Phase I	Wastewater	10/27/08	Active	$4,672,410.00
Sewer System Improvements – Phase II	Wastewater	4/20/09	Complete	$10,264,250.00
Sewer System Improvements – Phase III	Wastewater	7/21/09	Active	$4,865,613.00
Water System Improvements – Phase V	Water	4/20/09	Complete	$8,613,546.00
Water System Improvements – Phase VI	Water	7/21/09	Complete	$8,393,478.00
Sewer System Improvements – Phase IV	Wastewater	1/22/13	Complete	$3,275,316.00
Water System Improvements – Phase VII	Water	1/22/13	Complete	$2,713,065.00
Water System Improvements – Phase VIII	Water	4/24/13	Complete	$3,813,561.00
Lower Hill Sewer Infrastructure Project Phase 1A	Wastewater	10/23/13	Complete	$1,712,506.00
COA Storm Sewer Separation Project 2013	Storm	10/23/13	Active	$2,361,405.00
Lead Service Line Replacements	Water	10/17/18	Active	$35,441,231.00
			Total PENNVEST Funding	**$102,888,091.56**

[1] Loan amount shown is final loan amount for completed project or original approved loan amount for active projects. Does not include grants.

1.4 Water System Background

The Allegheny River provides the sole source of water for the system. The Pennsylvania Department of Environmental Resources, now the PADEP, issued a Water Allocation Permit to the PWSA in March 1989, which allows for water withdrawal of up to 100 MGD from the river. The PADEP has advised the PWSA that the permitted allocation would be re-evaluated in the

future if the PWSA's demand increases because of growth within the City or through the sale of water to surrounding municipalities.

The PWSA, through its water supply and distribution system, provides water service to more than 300,000 people and over 80,000 service line connections from residential, commercial, industrial and public customers with potable water and water for fire protection within the geographic boundaries of the City and surrounding areas. The system consists of:

- 117 million gallons per day (MGD) rapid sand-type water treatment plant
- 26 MGD microfiltration water treatment plant – currently optimized to run at approximately 9 MGD and offline for improvements
- Approximately 960 miles of mains
- 18,754 valves
- 7,450 fire hydrants
- Raw water pump station located along the Allegheny River
- 10 finished water pump stations
- Three finished water reservoirs
- Source water reservoir
- 13 distribution storage tanks

The total storage capacity of the reservoirs and the tanks is approximately 455 million gallons. The useable storage capacity within the reservoir and tank system provides adequate volume and pressure for the equivalent of about two days of normal water usage.

The PWSA employs 301 people (as of September 2019) and projects a total workforce of 524 employees by the year 2023. Staffing levels have been a concern for the PWSA historically. In 2019, PWSA hired 77 new employees including a Director of Engineering and Construction, Deputy Director of Engineering, Senior Project Manager, Senior Contract Specialist, Senior Water Program Manager, Senior Field Operations Manager, Senior Construction Manager, Senior Project Controls Manager, and a Deputy Chief of Program Management.

The Pennsylvania-American Water Company (PAAW) supplies water to approximately 26,000 customers in the southern and western sections of the City. The PWSA provides sewer conveyance to these customers. The PWSA has an agreement with PAAW to subsidize the water purchased for these PWSA customers because PAAW has a higher rate for water than the PWSA. The amount of the subsidy has been greatly reduced in recent years due to rate increases implemented by the PWSA. The PWSA budgeted $1,700,000 million for subsidy payments in fiscal year 2019 as compared to the $4,800,000 that was budgeted in fiscal year 2018. As part of the PWSA compliance filing with the PA Public Utility Commission (PUC) at Docket No. M-2018-2640802, effective January 1, 2020, the PAAW subsidy will be eliminated. This filing was supported by the PUC to ensure an appropriate cost of service model was implemented across the service area.

Two additional small areas, one in the eastern part and the other in the western end of the City, are served by the Wilkinsburg-Penn Joint Water Authority and the West View Water Authority, respectively. In each of these areas, the respective independent water purveyor owns and maintains the distribution system elements such as the waterlines, valves, hydrants and other equipment. In addition, the PWSA, through interconnections with other systems, provides water for supply and/or emergency use to several adjacent municipalities: Blawnox, Fox Chapel, Millvale, Reserve Township, portions of the Pennsylvania-American Water Company system and intermittent provisions to several other neighboring communities.

1.4.1 PADEP Administrative Order, April 2016

In April 2016, the PWSA received an Administrative Order from PADEP for violations under the Pennsylvania Safe Drinking Water Act and regulations related to a modification of corrosion control treatment chemical in 2014. The PWSA reinstituted the original corrosion control chemical in early 2016 and is fully cooperating with PADEP and the components of the Order. The PWSA completed a corrosion control study in 2017 as part of this effort and implementation of the recommendations began in 2019. These included the introduction of orthophosphate into the system to reduce corrosion and help control lead levels. On April 29, 2019, the first of the orthophosphate systems was placed into service at the Bruecken Pump Station. In May of 2019, the second and third orthophosphate systems were placed into service at the Aspinwall Pump Station. These corrosion control systems along with the Lead Service Line Replacement Program have lowered the lead concentration in the water supply over the past few months. Modifications and improvements to those systems continue. A Lead and Copper Rule (LCR) compliance sampling round is due to be complete by December 31, 2019, with the results publicly reported in mid-January 2020.

1.4.2 September 6, 2019 Consent Order and Agreement

On September 6, 2019, the PWSA entered into a Consent Order and Agreement (COA) in the matter of "violations of the Pennsylvania Safe Drinking Water Act and the Rules and Regulations Promulgated Pursuant Thereto." The COA mandates the PWSA take action to implement a previously recommended clearwell improvement plan, and eliminate "washout" cross-connections (washouts are used to drain or flush the water system).

The issues surrounding the clearwell have been studied by technical experts from four different consultants since 1998. Marion Hill Associates found that the clearwell was structurally stable but identified areas of concern including, but not limited to: build-up of sediment in the bottom of the tank prohibiting inspection; infiltrating tree roots; erosion evidence, deterioration and cracks in the concrete walls; clearwell equalization chamber leaks and rusted gates on the clearwell and gatehouse. The other three consultants provided reports in 2008 and 2017 that focused on available alternatives to address "PWSA's desires to have a clearwell system with the operational flexibility of being able to remove approximately one half of the clearwell from service for cleaning and maintenance while the other half remains in service; and to have the ability to bypass the clearwell and send filtered water directly to the Bruecken Pump Station in emergency situations."

The September 2019 COA establishes the requirements to bring the PWSA clearwell and cross-connection systems into compliance along with a timeline for the improvements.

Table 2 provides an overview of the requirements and due dates from the September 6, 2019 Consent Order and Agreement.

Table 2: Subject and Location in COA of Requirement

	Requirement	Design/permit date construction complete	Reference COA
Aspinwall WTP Clearwell bypass	Design, permit and construct bypass system that will enable the PWSA to remove the clearwell from service and replace it.	January 1, 2023 Construction permit issue date plus 2 years	#3a & #3b
Rehabilitate or replace Rising Main #3 to Highland 2 Reservoir	Design, permit and construct rehabilitation or replacement of Rising Main #3.	September 1, 2020 March 1, 2021 Construction permit issue date plus 1 year	#3c(i) and (ii) & #3d

	Requirement	Design/permit date construction complete	Reference COA
Rehabilitate or replace Rising Main #4 to Highland 2 Reservoir	Design, permit and construct rehabilitation or replacement of Rising Main #4 to Highland 2 Reservoir to facilitate the clearwell bypass system.	June 1, 2021 Construction permit issue date plus 2 years	#3e & #3f
Replace the cover and liner of the Highland 2 Reservoir to facilitate the clearwell bypass system	Design, permit and construct replacement of the cover and liner of the Highland 2 Reservoir to facilitate the clearwell bypass system.	June 30, 2020 Construction permit issue date plus 18 months	#3i & #3j
Replace or rehabilitate the Aspinwall and Bruecken Pump Stations	Design, permit and construct a combined pump station to replace the existing Aspinwall and Bruecken Pump Stations OR Design, permit and construct the rehabilitation of the existing Aspinwall and Bruecken Pump Stations.	January 1, 2021 Construction permit issue date plus 2 years	#3k (i) and (ii) & #3l
Replace the clearwell and begin clearwell operations	Design, permit and construct the replacement of the clearwell.	January 1, 2024 Construction permit issue date plus 2 years Within 30 days of operation permit issuing from PADEP	#3m & #3n
Cross Connections Investigation and Report	Complete an investigation of the locations where valves, blow-offs, meters or other such appurtenances to the distribution system are found within chambers, pits or manholes connected directly or indirectly to any storm drain or sanitary sewer and submit a report detailing the findings, including the number and locations or all such cross-connections within the PWSA system	June 1, 2020	#3q
Cross Connection Elimination Action Plan and Schedule	Submit to the Department a plan and proposed schedule to eliminate all the identified cross-connections including whether the requested modification to eliminate each cross-connection identified in the report constitutes a major or minor change.	Within 90 days of Cross Connection Investigation Report submittal	#3r
Cross Connections Permits	For any modification the Department determines to require a permit, submit a complete and technically sufficient application to the Department for a construction permit.	Within 60 days of the issue date of the written determination.	#3s
Cross Connection Elimination	Design, permit and eliminate all identified cross connections.	Consistent with the cross connection elimination plan and as approved or as modified and approved by the Department	#3t
Cross Connection Elimination Report	Submit a report confirming the elimination of all previously existing cross-connections. Report includes: confirmatory photographs, dates and details of the corrective work performed.	Within 90 days of completion of cross-connection elimination	#3t

In order to meet the requirements of the COA, the PWSA will need to complete three additional support projects including the Aspinwall Water Treatment Plant Electrical and Backup Power Improvements, the Highland Reservoir Pump Station and Rising Main and the Aspinwall Pump Station to Lanpher Reservoir Secondary Rising Main. The PWSA developed a timeline in order to accomplish these requirements as shown in Table 3: PADEP Consent Order Related Capital Projects Schedule.

Table 3: PADEP Consent Order Related Capital Projects Schedule

Description	Design Start Date	Design Complete	Submit Construction Permit	Construction Permit Issued (Projected)	Construction Complete	Design (days)	Construct (days)
Projects specifically stated in COA							
Rising Main 3 – Rehabilitation	11/1/2019	10/30/2020	9/1/2020	11/30/2020	11/30/2021	364	365
Rising Main 3 – Replacement	11/1/2019	4/30/2021	3/1/2021	5/30/2021	5/30/2022	546	365
Highland No. 2 Reservoir Improvements (Liner and Cover Replacement)	9/30/2019	8/28/2020	6/30/2020	9/28/2020	3/29/2022	333	547
Rising Main 4 – Rehabilitation	6/1/2020	7/30/2021	6/1/2021	8/30/2021	8/30/2023	424	730
Rising Main 4 – Replacement	1/31/2020	7/30/2021	6/1/2021	8/30/2021	8/30/2023	546	730
Aspinwall WTP High Service Pumping	1/2/2020	2/26/2021	1/1/2021	4/1/2021	4/1/2023	421	730
Aspinwall Pump Station Improvements	1/2/2020	2/26/2021	1/1/2021	4/1/2021	4/1/2023	421	730
Bruecken Pump Station Improvements	1/2/2020	2/26/2021	1/1/2021	4/1/2021	4/1/2023	421	730
Aspinwall WTP Clearwell Bypass (Emergency Response)	1/3/2022	3/3/2023	12/30/2022	3/30/2023	3/29/2025	424	730
Aspinwall WTP Clearwell Improvements (Replacement)	1/2/2023	3/1/2024	1/1/2024	3/31/2024	3/31/2026	424	730
Project necessary to support COA projects							
Aspinwall Water Treatment Plant Electrical and Backup Power Improvements	1/1/2020	12/31/2020		6/29/2021	6/29/2023	365	730
Highland Reservoir Pump Station and Rising Main	10/1/2018	4/15/2020		10/12/2020	10/12/2022	562	730
Aspinwall Pump Station to Lanpher Reservoir Rising Main	1/1/2019	12/1/2020	9/30/2020	12/29/2020	12/29/2022	700	730

1.5 Sewer System Background

The sewer system conveys wastewater collected from 24 neighboring suburban municipalities and generated within the City boundaries to the Allegheny County Sanitary Authority's (ALCOSAN) interceptors located along the rivers and tributaries for conveyance to ALCOSAN's Wastewater Treatment Facility (WWTF) for treatment prior to discharge into the Ohio River. The ALCOSAN WWTF is operating in compliance with the National Pollutant Discharge Elimination System (NPDES) under Permit No. 0025984. In total, the ALCOSAN WWTF receives wastewater flows from 83 municipalities and authorities. ALCOSAN also manages enforcement of industrial pretreatment in the PWSA's service area.

The PWSA's sewer collection system includes:

- An extensive network of approximately 1,227 miles of sanitary, storm, and combined sewers
- 29,000 manholes (which includes flow dividers and diversion chambers)
- 30,000 inlets (which includes catch basins and storm inlets)
- 98 combined sewer overflow (CSO) diversion chambers
- 185 storm sewer outfalls
- Four wastewater pump stations and ancillary facilities

Approximately 74 percent of the sewer system has combined sewers designed so during wet weather events, a portion of the collected storm water and diluted wastewater is discharged into natural watercourses through 98 CSO diversion chambers. Approximately 26 percent of the sewer system consists of separate sewers that are dedicated sanitary and storm sewer pipelines; however, as redevelopment occurs in the City and portions of the combined sewer system are replaced by separate sewer systems, the percentage of separate sanitary and storm sewers is gradually increasing.

The 24 neighboring municipalities' sewer system connections to the PWSA collection system were established pursuant to agreements with the City to convey their wastewater to the ALCOSAN WWTF. While some Agreements specify cost sharing, most of these municipal agreements do not address sharing of the costs associated with construction and maintenance of the trunk sewers carrying sewage flows from these 24 municipalities through the PWSA's system to ALCOSAN's system.

The sewer system has adequate capacity to convey dry weather wastewater flows; however, during wet weather events, the system often exceeds its capacity, which results in overflows, bypassing, and flooding.

The US Environmental Protection Agency (USEPA) had adopted regulations regarding overflows from combined sewer outfalls during events that result in the discharge of untreated sanitary sewage into receiving waters. These CSOs contain pollutants that are present in domestic and industrial wastewater, as well as those in the urban storm water runoff that enter the combined sewer system. The USEPA regulations require owners of any sewer system having CSOs to acquire NPDES discharge permits for each overflow site. In January 1997, the owners of these systems implemented the USEPA's "Nine Minimum Control Measures" (NMCs). The NMCs define the basic steps for maintaining the combined sewer system in proper operational order and identifying potential areas requiring updates and repairs.

During dry weather conditions, the ALCOSAN interceptor system is designed to intercept wastewater flows from the City and surrounding municipalities and convey the flows to the ALCOSAN WWTF. ALCOSAN's interceptor system includes shallow-cut pipes, deep tunnels,

and diversion structures. During wet weather conditions, the flow diversion structures (which are maintained by ALCOSAN, the PWSA, and other municipalities) limit or "regulate" the amount of combined sewage that enters trunk sewers and ALCOSAN's Interceptor System. In addition, there are regulator points in the sanitary sewer system that relieve or overflow untreated sewage (sanitary sewer overflows or SSOs) to the nearest water body when the systems are overtaxed. ALCOSAN's WWTF has a NPDES permitted dry weather capacity of 190 MGD and wet weather capacity of 250 MGD. Currently, the ALCOSAN WWTF is operating at capacity. The flow regulation at the plant limits peak wet weather flow to the permitted capacity. The combined sewage which exceeds the capacity of the flow regulators at the trunk sewers, interceptors, and treatment plant is discharged as CSOs to the receiving waters of the State. ALCOSAN maintains 53 diversion structures and an additional 153 diversion structures are maintained by the PWSA and other municipalities and authorities.

1.5.1 Administrative Consent Orders and Consent Order and Agreements

Administrative Consent Orders (ACOs) and Consent Order and Agreements (COA) were issued in early 2004 to the City of Pittsburgh and the other 82 communities tributary to ALCOSAN. The Orders directed compliance with the Pennsylvania Clean Streams Law of 1937 and the Federal Clean Water Act, to eliminate SSOs, and fulfil the Pennsylvania and USEPA CSO Policy obligations. The ACOs were issued to separate sewer communities by the Allegheny County Health Department (ACHD) and the COAs were issued to combined sewer communities by the PADEP. The initial COA among the PWSA, the City of Pittsburgh, PADEP, and ACHD was entered on January 29, 2004, and later amended in July 2007. The original Orders required communities to complete the following activities:

- Assess and map the sewer collection system
- Clean and televise the sewer collection system
- Make critical repairs
- Conduct flow monitoring
- Develop a long-term wet weather control plan in conjunction with ALCOSAN

The PWSA has completed the Consent Order's compliance requirements, including the preparation and submission of a Wet Weather Feasibility Study on July 31, 2013. The submitted Feasibility Study proposes the use of green infrastructure and integrated watershed management (IWM) to assist in the control of combined sewer overflows. The integrated approach, which utilizes a combination of 'green' and 'gray' solutions to address combined sewer overflows, considers all types of pollutant sources in the watershed to holistically address water quality challenges.

On March 27, 2015, PADEP sent a letter to all ALCOSAN customer municipalities and authorities setting forth a procedure to provide additional time to explore flow reduction. The obligations of the COAs and ACOs, as amended, terminated on March 30, 2015. In mid-2015, the City of Pittsburgh and the PWSA requested to work with USEPA rather than PADEP on future orders and agreements relating to wet weather overflows. In late 2015, 82 municipalities in the ALCOSAN service area (all municipalities except Pittsburgh) received new Consent Order and Agreement (COAs) outlining Corrective Actions that must be completed by December 1, 2017. The Corrective Actions include development of a Source Reduction Study that identifies the types of projects that will most effectively reduce flows in the sewer system and at least one flow reduction demonstration project.

In January 2016, the PWSA and the City received an Information Request from the USEPA under Section 308 of the Clean Water Act. This work was completed and submitted to the

USEPA and PADEP on December 1, 2017. The PWSA is advancing stream removal and source reduction projects consistent with this submittal. USEPA representatives have indicated that ACO negotiations with the PWSA and the City related to CSO compliance will begin in the near future.

2 Maintenance, Repair and Operation of the Water and Sewer Systems

Three primary sources of information were used to construct the findings and recommendations of Section 2 for the maintenance, repair and operation of the water and sewer systems:

1. A questionnaire was used as a tool to facilitate data and dialogue exchange with the PWSA
2. *Draft Consulting Engineer's 2015 Facility Conditions Assessment Report* submitted to the PWSA in May 2015
3. *Consulting Engineer's 2016 Facility Conditions Assessment Report* submitted to the PWSA in October 2016. (Many of the recommendations from 2016 remain valid today.)

The 2020-2024 Capital Improvement Plan is discussed primarily in Section 3 of this report. However, the allocation of funds to future projects is relevant to the information in Section 2.

2.1 Findings on Current Maintenance, Repair and Operation of the Water and Sewer Systems

In April 2015, Mott MacDonald conducted a Facility Physical Condition Assessment of some of the PWSA's "vertical" facilities to evaluate the condition of each of the facilities. The facilities that were evaluated, and the type of evaluation conducted, whether it was the general physical condition, operations, maintenance, or health and safety, are listed in Table 4. These evaluations are generally defined as follows:

- General Physical Condition: Condition of the physical building such as (but not limited to): walls, foundation, floors, ceiling, roof, doors, windows, access road, grounds, lighting, signage, parking and overall condition of the interior and exterior of the facility.
- Operations: Condition of operational components such as (but not limited to): equipment, pumps, electrical controls, wiring, gauges, valves, controls, supports, piping, platforms, tanks, containers, lifts, cranes, special equipment, and overall operation of the facility.
- Maintenance: Condition of the facility in respect to (but not limited to): general cleanliness; condition and location of stored materials; leaks; drips; puddles; accessibility; temperature; humidity; condition and operability of fans; heaters; lighting and overall maintenance of the building and grounds.
- Health and Safety: Condition of safety considerations such as (but not limited to) railing, ramps, lights, alarms, detectors, signage, clear pathways, clearances, warning signs and labels, training, and posted procedures.

This investigation included site visits, review of previous inspection reports, and limited personnel interviews. The site visits provided an opportunity to visually inspect the equipment, interview staff on the condition of the assets, and determine a condition score for each component of the facility. Confined spaces were not entered, and equipment was not operated.

Table 4: Limited Facility Physical Condition Assessment Locations and Types from 2015

Facility	Assessment type		Status
	General physical condition assessment conducted	Operations, Maintenance Health and Safety	
Water facilities			
Aspinwall Pump Station (subject of COA)	X	H&S	
Brashear Chlorine Booster	X	H&S	Design Contract Awarded
Bedford Chlorine Booster	X	H&S	Design Contract Awarded
Bruecken Pump Station (subject of COA)	X	O	
Herron Hill Pump Station	X		
Highland, Howard, and Lincoln Pump Station		O	
Highland Reservoir No. 1	X		
Highland Reservoir No. 1 Membrane Filtration Plant	X	O	Construction
Highland Reservoir No. 2 Chlorine Booster Station	X		Design Contract Awarded
Lanpher Reservoir	X		Construction of liner and cover complete; design underway for ancillary items
McNaugher Tank		M	
Mission Pump Station	X	M	
Saline Pump Station	X		
Various Reservoirs (Herron Hill, Highland No. 2, Lanpher (subject of COA)		O	Herron Hill in construction, Highland 2 design awarded
WTP – West Raw Water Intake Structure	X	O	
WTP – East Raw Water Intake		O	
WTP – Walkway from Ross to clarifiers	X		
WTP – Clarifier No. 2	X		
WTP – Clarifier Flumes	X		
WTP – Gas Building	X		
WTP – Clearwell (subject of COA)	X	O	
WTP – Emergency Access Tunnel		O	
WTP – Chemical Feed - Carbon		O	Construction
WTP – Mechanical Room		H&S	
WTP – Sedimentation Basins		O	
WTP – Site and Grounds		H&S	
Browns Hill Pump Station	X	O, H&S	
Lincoln Place (Mifflin Road) Pump Station		O, H&S	
Other			
Central Warehouse	X	H&S	
Various Facilities – Pump Component Deficiencies		M	
Various Facilities – Electrical Deficiencies		M	
Various Facilities – Vegetation		M	
Various Facilities – Defective Downspouts		M	
Various Facilities – Roof Deficiencies		M	

Facility	Assessment type		Status
	General physical condition assessment conducted	Operations, Maintenance Health and Safety	
Various Facilities – Emergency Light Fixtures		H&S	
Various Facilities – Spill Containment		H&S	

Detailed investigation findings, which can be found in the *Draft Consulting Engineer's Facility Physical Condition Assessment Report* dated May 20, 2015, and the *Consulting Engineer's 2016 Facility Conditions Assessment Report* dated October 7, 2016 are presented by facility and identify the various components of the facility, suggested corrective actions to address observed deficiencies and condition scores.

A full facility physical condition assessment on each of PWSA's facilities has not been conducted since the findings of the 2015 Assessment were reported. To date, significant improvements have been made to address the deficiencies outlined in the 2015 Assessment. However, these improvements have not been documented in a comprehensive document. Detailed finished water pump station assessments were started in late 2016. We suggest that the PWSA conduct a comprehensive assessment on all of their facilities, including a review for compliance with the American with Disabilities Act, the presence of lead paint, and the presence of asbestos building materials.

2.1.1 Water System Findings

Condition Assessments should be updated, and the critical need of the facility identified, and the repairs required to the facility determined in order to maintain the facility in good operating condition. Recommended repairs and/or replacements are identified and prioritized in the 2020-2024 Capital Improvement Plan (CIP).

Water Treatment Plant improvements will be required to meet current and upcoming water quality regulations. There are several facilities that are in use beyond their useful lives and have not had a detailed condition assessment to check for major or moderate structural defects. Detailed analyses are required to determine actual conditions and appropriate maintenance and/or rehabilitation. During 2018, the PWSA began development of a Master Plan for the water treatment plant. This plan will include an assessment of each system within the plant and a plan to address noted deficiencies or required improvements. In the interim, needed maintenance and near-term capital improvements are moving forward.

The floating covers and liners on the remaining water reservoirs had reached their normal life expectancy. Replacement of the cover and liner at the Lanpher Reservoir was completed in 2019. The other covers are scheduled for replacement in the CIP however we recommend continued frequent visual inspections of the remaining covers until they are finally replaced.

Water storage tank inspections are overdue for many of the 13 tanks in the PWSA system. Water storage tanks should be inspected every five years. Table 5 provides storage tank inspection and renovation information. The schedule to inspect and repair water storage tanks is identified in the CIP.

There are several facilities that have potential major to moderate structural defects. Detailed structural analyses are required to determine actual conditions.

Heating, ventilation, electrical, security, and auxiliary equipment have experienced significant deterioration and near-term maintenance and/or replacement is strongly advised. The schedule to replace this equipment is included in the CIP.

Preventative maintenance and housekeeping are not typically performed on a routine basis. For example, excessive vegetation and vine growth is present on the buildings and/or perimeter fencing and is damaging or collapsing fencing, clogging roof drains, and damaging roofs.

Emergency backup power is not available at most facilities and should be installed as soon as possible to ensure uninterrupted water supply.

Table 5: Water Storage Tank Inspections and Renovations

Name	Type	Construction material	Year constructed	Last major renovation	Last known inspection date	Year inspection required*
Allentown Tanks (2)	Standpipe	Riveted steel	1939	2015	2019	2024
Bedford Tank	Standpipe	Welded steel	1993	N/A	2006	2011
Brashear Tanks (2)	Standpipe	Welded steel	Undetermined	2010	2006	2015
Garfield Tank	Elevated	Welded steel	1959	1992	2018	2023
Herron Hill Tank	Elevated	Welded steel	1967	2012	2008	2017
Lincoln Tank	Standpipe	Welded steel	1939	1982	2018	2023
McNaugher Tanks (2)	Standpipe	Concrete	1998	N/A	Undetermined	2017
Spring Hill Tanks (2)	Standpipe	Riveted steel	1928	1982	2006	2011
Squirrel Hill Tank	Standpipe	Welded steel	1939	2012	2008	2017

*Based on AWWA standard five-year inspection cycle.

In 2016, the PWSA water sampling results exceeded the PADEP action levels from compliance tests for lead. In May 2016, the PWSA outlined a water quality program initiative involving programmatic, testing, and customer education efforts. This has triggered other requirements that include additional distribution system water quality monitoring, optimization of corrosion control treatment, source water monitoring and treatment, public education, and replacement of the PWSA-owned lead service lines.

The existing water distribution system has significant portions of the system operating beyond their useful lives. Preventative maintenance and/or replacement is strongly recommended in the near-term to ensure reliable water supply and public safety. A robust water distribution system replacement program is included in the CIP.

Inspection and condition assessment of below-ground infrastructure, pipelines, and storage facilities need to be conducted on a more frequent and routine basis.

Significant portions of the PWSA facilities and infrastructure are located outside of the public right-of-way, and easements have not been obtained. The PWSA should establish easements in ownership of all property where the PWSA facilities or infrastructure are located.

To prevent premature failure and undue deterioration of valves and hydrants, routine maintenance, testing, operation, and inspection should be increased in breadth and frequency.

Known changes in future water quality standards require a plan for implementing changed operating treatment materials and procedures. The PWSA has restored its pilot plant within the laboratory at the Water Treatment Plant as well as joined Partnership For Safe Water in order to prepare for these changes.

2.1.2 Sewer and Stormwater System Findings

Condition assessments should continue to prioritize repairs.

The existing sewer system has significant portions of the system operating beyond their useful lives. Preventative maintenance and/or replacement is strongly recommended in the near-term to ensure reliable water supply and public safety.

Inspection and condition assessment of below-ground infrastructure, pipelines, and storage facilities must be conducted at a more rapid pace to complete an assessment of the entire system every five years as recommended by the AWWA. This work has moved forward; however, it is behind schedule.

The sewer system contains a significant number of "junctions" serving as sewer connections in place of manholes. These sewer connections are inaccessible for maintenance and repair purposes and should be avoided wherever possible. It is recommended that manholes are constructed instead of junctions. The maximum distance between manholes should be 400 feet, as per "Recommended Standards for Wastewater Facilities," also known as "10 State Standards."

Paragraph 7 of the 2004 Consent Order and Agreement requires all municipal catch basins within 100 feet of a sanitary sewer to be tested to verify that they are not connected to the sanitary sewer. The PWSA completed testing of the catch basins in 2011 and continues to disconnect catch basins which failed inspection.

Flooding has continued to be an issue in several parts of the service area during heavy rain events. The PWSA should continue to collaborate with the City and Pennsylvania Department of Transportation to mitigate flooding.

A CSO Long Term Control Plan (LTCP) has not been accepted by the USEPA for the City of Pittsburgh and the PWSA. This plan, once finalized and accepted, will create a significant draw on the PWSA resources.

2.1.3 Information Management System Findings

Condition assessments should be updated on a priority basis to determine any changes in condition and to prioritize work on all facilities.

Continued reliance on existing information and lack of coordination between various information systems will result in incomplete communication of critical system information, slower responses to system deficiencies, and overall increased management and capital costs. Implementation of a Computerized Maintenance Management System (CMMS) would provide the ability for operations and engineering to make effective operating decisions, rank capital investments, improve customer service, and lower operation, maintenance, and capital costs. Also, this system would provide transparent access by all management at the PWSA to monitor project work, costs, and budgets.

The PWSA is in the final stages of implementing a mobile work order application called SpryMobile. This application will enable real time reporting on work orders, metering deployment and equipment testing. In addition, the PWSA is in the beginning phases of implementing a series of other information management system upgrades that include, Enterprise Resource Planning (ERP), Document Management Services, and Geographic Information System (GIS).

The PWSA is currently building and calibrating a hydraulic water model using WaterGems by Bentley. The model work was completed in November 2019.

The PWSA's hydrologic and hydraulic sewer system model are valuable tools for assessing the evaluating these respective systems and should be upgraded as necessary and maintained and updated on a regular basis. The existing sewer model is incomplete and must be updated to provide a calibrated tool for developing efficient CSO reduction projects compliant with the CSO LTCP. This effort will be completed in conjunction with the completion of development of the system master plan.

2.2 Recommendations for Maintenance, Repair and Operation of the Water and Sewer Systems during the 2020 Fiscal Year

As Consulting Engineer for the PWSA, Mott MacDonald recommends the PWSA advance the Capital Improvement Program forward in accordance with current planning. The majority of the maintenance and operational issues previously identified are being addressed in the current CIP or being undertaken as separate tasks as part of the PWSA's Facility Improvement Plan. In addition, we recommend that the following actions are undertaken (or continued) during 2020 to improve PWSA's ability to provide a reliable source of potable water to its customers, provide reliable sewer system operations, and achieve compliance with the anticipated Consent Order requirements. Most of these recommendations are included in the Capital Improvement Program 2020-2024.

Capital costs associated with these actions were estimated and used to assess the budget for the PWSA's CIP 2020. Operational cost increases are mostly attributable to increased labor costs. An increased number of employees is needed to effectively address the additional monitoring, maintenance, and project management required to implement the CIP and the maintenance and operational improvements identified herein. The costs associated with the increased staff should be closely monitored during 2020 as the many programs are put into place.

2.2.1 Water System Recommendations

2.2.1.1 New and Priority Recommendations for 2020

Designate a leader and team from the operations staff to focus on system flushing, testing, monitoring and tracking trends to optimize this work.

2.2.1.2 On-going Recommendations

Continue the Water Quality Initiative Program and adjust the program as necessary, depending on regulatory requirements and testing results. These types of requirements include: lead and copper testing program for residential customers, continued optimization at the water treatment plant, continuing the lead service line replacement assistance, replacing the PWSA-owned lead service lines, and continuing the public education program.

Continue to track and control "lost and unaccounted for" water through increased leak detection efforts, large meter calibration and/or replacement, and installation of meters on unmetered uses. Additionally, continue to review tank level information provided by the SCADA system to detect overflows.

Exercise distribution system valves and hydrants on a routine basis and implement a plan to exercise valves and sluice gates at the water treatment plant on a routine basis. Repair or

replace non-operable valves and sluice gates at the water treatment plant and non-operable valves and hydrants in the system.

Perform inspections on the water storage tanks that are overdue or due as shown in Table 5.

Continue the routine maintenance program (in-house or through a third-party) to remove and prevent vine and vegetation growth from the vertical facilities and perform detailed inspections of roofs and rain conductor systems.

Continue planning and design of facilities to replace the Clearwell. Monitor the condition of the existing Clearwell related to cleaning, structural, and mechanical performance, and implement the Emergency Contingency Plan as necessary.

The PWSA is conducting a comprehensive condition assessment at the Aspinwall Water Treatment Plant to identify the condition of the buildings, site, process equipment, electrical system, river intake, raw water pump station, high service pump station, clearwell, and support systems. The comprehensive condition assessment will be used to prioritize the capital improvements project list which identifies improvements required to meet upcoming federal regulations and future system expansion goals.

2.2.2 Lead Service Line Replacement (LSLR) Program

Pursuant to Paragraph 3.e.i of the November 17, 2017 Consent Order and Agreement (COA) issued by the PADEP, the PWSA was required to replace at least 1,341 public lead service lines in place within the system on or before June 30, 2018. To address the requirements of the COA and in support of full-service line replacements, the PWSA Board of Directors approved allocation of approximately $44 million of the 2018 CIP budget to fund both the public and private side replacement for lead service lines in the PWSA's water service area. The public and private line replacements were performed by several contractors selected by an open public bid process.

The PWSA met the requirements of Paragraph 3.e.i of PADEP's November 17, 2017 Consent Order and Agreement (COA). By June 26, 2018, the PWSA had replaced 1,347 public lead service lines to meet the COA requirements. Of the 1,347 lead service line replacements, 634 replacements were conducted under the 2017 and 2018 Lead Service Line Replacement Program. All other replacements were conducted either by the PWSA's Field Operations crews or as part of water main relay projects.

Pursuant to Paragraph 3.e.i of the November 17, 2017 COA and as subsequently amended by the PADEP, the PWSA was required to replace an additional 855 public lead service lines by December 31, 2018. The PWSA exceeded that goal and replaced 1,366 lead service lines between June 27, 2018 and December 19, 2018.

The 2019 Lead Service Line Replacement program can be categorized into two projects based on the funding source. As of early November, the PENNVEST funds in 2019 have been used for 2,226 public service line replacements and 1,560 private side replacements, completed by PWSA and their chosen contractors.

A second component of the 2019 LSLR efforts are those counted in the Individual Lead Service Line Replacement (ILSLR) project. ILSLR includes any replacements not funded using PENNVEST money and include the following categories:

- Urgent – Emergency replacement, usually due to a leak.
- CEP – Community Environmental Program. This is $1.8 M of the fine imposed on the PWSA that the PADEP is permitting PWSA to use to replace service lines for locations that

are not in a current work order and that meet low to middle income guidelines. This program is administered by the Dollar Energy Fund for PWSA. The lead team at PWSA coordinates the contractors to do the replacements.

- Backlog – PWSA may need to return and replace the private side of the lead lines if a partial replacement was done by the PWSA between February 1, 2016 and December 31, 2018.

As of early November 2019, the PWSA has replaced 129 public service lines and 415 private service lines as part of the ILSLR program.

In all, the 2019 LSLR PENNVEST and ILSLR projects have touched over 4,000 sites in the service area. The teams are doing approximately 100 replacements per week using four contractors. We recommend that the PWSA continue this very important and well received program.

2.2.3 Sewer and Stormwater System Recommendations

2.2.3.1 New and Priority Recommendations for 2020

Review the Intermunicipal Agreements to assess opportunities to charge fees to upstream municipalities, where appropriate.

2.2.3.2 On-going Recommendations

Increase the cleaning and inspection frequency cycle for the system to improve on O&M knowledge to allow the PWSA to be proactive in responding to potential failures before they occur.

Perform a desktop risk-based assessment of the sewer mains and sewage pump stations using industry standards and best practices to prioritize inspection and rehabilitation.

Replace junctions throughout the wastewater and stormwater systems with traditional manholes wherever possible.

Evaluate the need for additional metering in the wastewater system.

Continue Adaptive Management Approach for stormwater and CSO reduction and/or pollutant reduction in programs such as Saw Mill Run watershed and the 14 connected sewersheds for which it was found that the PWSA's existing collection system could not convey the typical year flows.

Continue to maintain the stormwater system for optimal operation and in compliance with the Municipal Separate Storm Sewer System (MS4) requirements, including the six Minimum Control Measures. When PADEP issues the renewed MS4 permit, we expect it will include additional regulatory obligations for the PWSA and the City in the five-year permit term, including reduction of pollutants such as sediment and nutrients. In 2020, the PWSA and the City should plan and design the stormwater best management practices to address the pollutant reduction regulatory requirements.

Continue to evaluate and address the basement sewage backup issues that occur during intense wet weather events.

2.2.4 Information Management System Recommendations

2.2.4.1 New and Priority Recommendations for 2020

The PWSA is in the early phases of implementing a series of information management system upgrades that include, Enterprise Resource Planning (ERP), Document Management Services, Computerized Maintenance Management System (CMMS), Geographic Information System (GIS), and Human Capital Management (HCM). It is anticipated that these new information management systems will be fully implemented in the coming years.

2.2.4.2 On-going Recommendations

Acquire, install, develop, and implement a Computerized Maintenance Management System (CMMS), including training staff to assist with capital investment prioritization. CMMS is a software system that can be used to house, manage, and track all the various field inspection, relays, repairs, materials, equipment and labor costs, and other associated work for the PWSA's asset management program. The CMMS can be used by field and engineering staff to record, house, track, and identify short-term and long-term asset investment needs. A properly-developed CMMS can identify efficiency improvements, increase levels of asset renewal, and reduce operation, maintenance, and capital costs. The CMMS should communicate with the GIS system and be able to coordinate with eBuilder software as well as the PWSA's finance system. Successful implementation of a system-wide CMMS will require significant organizational, operational, management, and capital changes to the PWSA's status.

Add pipe material and installation date with hyperlinks to historical records and photographs to the existing GIS information. Continuous GIS improvements will reduce the costs of data management, increase the flow of technical information, decrease the costs of engineering activities, and allow more comprehensive coordination with agencies, utilities, and the PWSA operations. In addition, it will allow the PWSA to securely share and/or publish certain portions of the data for public consumption.

The water distribution modelling software, WaterGEMS, has been developed for the PWSA's system. WaterGEMS is the only hydraulic model that has a separate input for hydrant data. Hydrant results from field investigations can easily be compared to modelled data to pinpoint possible problems in the system. It also can perform a criticality analysis, which can be integrated into the CMMS to develop a comprehensive main replacement program and help turn engineering decisions from a reactive process to a proactive process. The model which has been developed can be made more accurate as more accurate input data is obtained. It is our understanding that these activities are scheduled to be undertaken as part of the water system master planning effort during 2019. We recommend this effort continue and that this model is used to help plan each project.

Update and expand the hydrologic and hydraulic sewer system model as new and updated data is generated and use the model for various assessments, such as to inform development and maintenance needs of the PWSA's collection system and to evaluate wet weather impacts in the PWSA's collection system and its tributary areas.

3 Capital Addition and Planning Projects

Sections 3.1 and 3.2 are based on information in the PWSA 2020-2024 Capital Improvement Plan

3.1 General

The following factors and conditions were considered in the development and project prioritization of the 2020-2024 Capital Improvement Plan:

- Safety – Potential health and safety risks to personnel and the public if action is not taken
- Regulatory Compliance – Regulatory compliance schedule and potential fines for non-compliance
- Reliability/Operational Flexibility – Location, age, and condition of infrastructure and risk if action is not taken
- Capacity – Meets community health needs and growth, as needed
- Operations and Maintenance Efficiency – Potential for operating cost savings
- Regional Cooperation/Stewardship – Coordination with external stakeholders or meeting the communities needs
- Level of Service – Improvements to customer service
- Sustainability – Energy efficiency and "green" approach to improving water quality

3.2 Current Capital Improvement Plan

Table 6 presents the CIP approved by the PWSA Board in 2019. The plan is further defined in Tables 7 through 12. This list comprises the best estimation of projects at the time of this report.

Table 6: PWSA 2020-2024 Capital Improvement Plan

PWSA Capital Improvement Program	Total Commitment (Budget)	FY 2020	FY 2021	FY2022+
Total Water Treatment Plant	$102,818,518	$16,884,025	$31,260,131	$54,674,361
Total Water Pumping and Storage	$306,804,594	$31,065,447	$71,377,720	$204,361,427
Total Water Distribution System	$521,297,717	$77,597,135	$63,277,796	$380,422,786
Total Wastewater System	$189,007,936	$35,140,573	$46,010,731	$107,856,631
Total Stormwater System	$131,862,619	$26,927,774	$46,008,174	$58,926,671
Total Other	$38,684,500	$16,650,000	$7,634,500	$14,400,000
Total Systemwide CIP	**$1,290,475,883**	**$204,264,954**	**$265,569,052**	**$820,641,876**

Table 7: Water Treatment Plant Improvements

PWSA 2020-2024 Capital Improvement Program	Total commitment (budget)	FY 2020	FY 2021	FY 2022+
Aspinwall and Membrane Filtration Plant Fiberglass Reinforced Plastic Chemical Tank Inspections and Repairs/Replacement	$4,691	$4,691	---	---
Aspinwall Treatment Plant Pretreatment Chemical System and Clarification Improvements	$18,983,725	$4,596,583	$5,623,596	$8,763,546
Corrosion Control Chemical Storage & Feed Systems	$390,748	$390,748	---	---
Highland Park Membrane Filtration Plant UV System	$2,100,000	$2,100,000	---	---
Highland Park Membrane Filtration Module Replacement Program	$1,132,731	$1,132,731	---	---
Membrane Filtration Plant Assessment and Critical Process Improvements	$171,848	$171,848	---	---
Aspinwall Water Treatment Plant Electrical and Backup Power Improvements	$23,867,114	$1,082,568	$8,270,961	$14,513,584
Aspinwall Water Treatment Plant Security Fence, Lighting, and Surveillance	$530,000	$300,000	$230,000	---
Aspinwall Water Treatment Plant Raw Water Intakes	$41,137,661	$2,304,856	$7,435,574	$31,397,231
Clearwell Emergency Response Project	$14,500,000	$4,800,000	$9,700,000	---
Total Water Treatment Plant	**$102,818,518**	**$16,884,025**	**$31,260,131**	**$54,674,361**

Table 8: Water Pumping and Storage Improvements

PWSA 2020-2024 Capital Improvement Program	Total commitment (budget)	FY 2020	FY 2021	FY 2022+
Bruecken Pump Station Valve Vault	$31,485	$31,485	---	---
Lanpher Reservoir Improvements	$10,181,328	$3,716,026	$6,465,302	---
Ross Pump Station	$39,347,848	$2,184,432	$5,653,015	$31,510,401
Aspinwall Pump Station to Lanpher Reservoir Rising Main	$32,699,381	$4,468,239	$11,463,520	$16,767,622
Highland Reservoir Pump Station and Rising Main	$27,230,000	$1,563,260	$3,614,929	$22,051,811
Herron Hill Reservoir Improvements	$5,520,000	$3,864,000	$1,656,000	---
Clearwell Improvements	$67,062,343	$3,159,375	$4,134,375	$59,768,593
Aspinwall Water Treatment Plant High Service Pumping	$53,620,000	$2,794,262	$10,653,269	$40,172,469
Inline Pump Station (Coral and Pacific) Improvements	$600,000	$53,000	$487,833	$59,167
Garfield Tank Improvements	$4,017,647	---	---	$4,017,647
Lincoln Tank Improvements	$3,875,980	---	---	$3,875,980
Spring Hill Tank Improvements	$2,040,241	---	---	$2,040,241

PWSA 2020-2024 Capital Improvement Program	Total commitment (budget)	FY 2020	FY 2021	FY 2022+
Mission Pump Station Improvements	$4,252,270	---	---	$4,252,270
Herron Hill Tank Pump Station Improvements	$481,340	---	---	$481,340
Herron Hill Pump Station Improvements	$2,465,961	---	---	$2,465,961
Howard Pump Station Improvements	$1,683,810	---	---	$1,683,810
Lincoln Pump Station Improvements	$1,374,898	$331,061	$1,043,838	---
Saline Pump Station Improvements	$1,491,995	$359,848	$1,132,147	---
Chlorine Booster Station Improvements	$9,764,414	$1,090,090	$6,117,915	$2,556,409
Highland No. 2 Reservoir Improvements	$16,708,962	$4,965,756	$11,743,206	---
2019 Large Diameter Water Main Improvements - Rising Mains 3 & 4	$22,354,689	$2,484,612	$7,212,370	$12,657,707
Total Water Pumping and Storage	**$306,804,594**	**$31,065,446**	**$71,377,719**	**$204,361,428**

Table 9: Water Distribution System Improvements

PWSA 2020-2024 Capital Improvement Program	Total commitment (budget)	FY 2020	FY 2021	FY 2022+
2018-2019 Lead Service Line Replacement Program	$36,780,128	$36,780,128	---	---
2018-2024 Small Diameter Water Main Replacement Program	$326,133,714	$13,459,161	$32,788,975	$279,885,577
2018-2024 Water Relay	$9,551,316	$2,317,816	$1,727,500	$5,506,000
2017-2024 Valve Replacement Program	$18,316,824	$3,888,977	$3,230,652	$11,197,195
2017-2024 Hydrant Replacement Program	$7,988,931	$1,899,892	$1,539,725	$4,549,314
2019-2024 Surface Restoration	$20,315,569	$3,564,474	$4,158,926	$12,592,170
Fort Duquesne Bridge Water Air Release Valve Repair	$1,498,479	$1,495,563	$2,916	---
2019-2021 Unmetered and Flat Rate Properties	$8,617,151	$3,078,419	$3,266,087	$2,272,645
2018 Curb Box Inspections	$278,081	$278,081	---	---
2019-2021 Lead Service Line Identification Program	$13,434,667	$3,000,000	$3,138,667	$7,296,000
2020-2024 Private Lead Service Line Reimbursement Program	$5,000,000	$1,000,000	$1,000,000	$3,000,000
2020-2024 Large Diameter Water Main Replacement Program	$46,493,809	$1,292,197	$3,790,379	$41,411,233
2019-2024 Small Meter Replacement Program	$4,273,775	$785,775	$857,000	$2,631,000
2019-2024 Large Meter Replacement Program	$4,335,000	$847,000	$857,000	$2,631,000
Low Pressure Area Remediation	$2,393,358	$1,029,259	$1,193,445	$170,654

PWSA 2020-2024 Capital Improvement Program	Total commitment (budget)	FY 2020	FY 2021	FY 2022+
Bus Rapid Transit (BRT) Water Distribution	$11,730,000	$700,000	$3,750,000	$7,280,000
Bates Street Waterline Relay	$1,151,000	$160,000	$991,000	---
West Ohio Street Bridge Replacement	$289,250	$289,250	$0	---
District Water and Pressure Meters	$2,716,667	$1,731,143	$985,524	---
Total Water Distribution System	**$521,297,717**	**$77,597,135**	**$63,277,796**	**$380,422,786**

Table 10: Wastewater System Improvements

PWSA 2020-2024 Capital Improvement Program	Total commitment (budget)	FY 2020	FY 2021	FY 2022+
2018-2024 Small Diameter Sewer Rehabilitation	$95,728,939	$13,469,310	$21,359,629	$60,900,000
2018-2023 Sewers Under Structures	$41,259,993	$7,251,959	$10,394,090	$23,613,945
2018-2024 Sewer Reconstruction	$9,420,190	$1,700,668	$2,274,105	$5,445,417
31st Ward Sewer System	$13,630,000	$4,000,000	$1,300,000	$8,330,000
Maytide Storm and Sanitary Sewer System Improvements	$6,027,814	$3,013,907	$3,013,907	---
M-29 Outfall Improvements	$2,384,329	$934,329	$1,450,000	---
2020-2024 Large Diameter Sewer Rehabilitation	$17,147,270	$3,847,000	$4,529,000	$8,771,270
Browns Hill Road Sewer Pump Station Replacement	$796,000	---	---	$796,000
Mellon Terrace Sewer System Improvements	$2,030,000	$340,000	$1,690,000	---
Larimer Avenue Sewer and 28th Street Slope Stabilization	$583,400	$583,400	---	---
Total Wastewater System	**$189,007,936**	**$35,140,573**	**$46,010,731**	**$107,856,632**

Table 11: Stormwater Improvements

PWSA 2020-2024 Capital Improvement Program	Total commitment (budget)	FY 2020	FY 2021	FY 2022+
Catch Basin and Inlet Replacement	$45,701,180	$5,689,061	$11,651,535	$28,360,585
Lawn and Ophelia	$275,375	$275,375	---	---
Wightman Park Stormwater Infrastructure Improvements	$3,562,740	$2,515,715	$1,047,025	---
Woods Run Stream Removal Stormwater Infrastructure Improvements	$9,652,000	$2,570,000	$525,641	$6,556,359
Maryland Avenue Stormwater Infrastructure Improvements - Phase 1	$2,401,200	$2,401,200	---	---
Four Mile Run Stormwater Infrastructure Improvements	$30,000,000	$3,000,000	$13,500,000	$13,500,000
Woodland Drive Stormwater Infrastructure Improvements	$1,695,395	---	$1,695,395	---

PWSA 2020-2024 Capital Improvement Program	Total commitment (budget)	FY 2020	FY 2021	FY 2022+
Thomas and McPherson Stormwater Infrastructure Improvements - Phase 1	$4,901,000	$250,000	$4,651,000	---
Southside Stormwater Infrastructure Improvements	$5,461,680	$590,180	$1,994,000	$2,877,500
St. Johns Stormwater Infrastructure Improvements	$4,776,895	$2,973,230	$1,803,665	---
Spring Garden Stream Stormwater Infrastructure Improvements	$1,479,000	---	$1,000,000	$479,000
Martin Luther King Field Stormwater Infrastructure Improvements	$3,348,276	$1,200,000	$2,148,276	---
AMG Capital Funds - As-Needed Sewer Flow Monitoring	$102,500	$102,500	---	---
Saw Mill Run MS4 Compliance Projects	$3,500,000	---	---	$3,500,000
Tide Gate Installations	$1,000,000	---	---	$1,000,000
Overbrook Middle School Pollution and Flood Reduction	$6,500,000	$2,625,058	$3,874,942	---
Queenston Stormwater Infrastructure Improvements	$1,500,000	$750,000	$750,000	---
Bus Rapid Transit (BRT) Stormwater Infrastructure Improvements	$4,274,988	$255,065	$1,366,695	$2,653,228
Volunteer's Field Stormwater Infrastructure Improvements	$854,185	$854,185	---	---
Saw Mill Run Stream Bank Restoration Stormwater Infrastructure Improvements	$876,204	$876,204	---	---
Total Stormwater	**$131,862,619**	**$26,927,773**	**$46,008,174**	**$58,926,672**

Table 12: Other Improvements

PWSA 2020-2024 Capital Improvement Program	Total commitment (budget)	FY 2020	FY 2021	FY 2022+
Computerized Maintenance Management System	$2,500,000	$1,250,000	$1,250,000	---
Enterprise Resource Planning	$2,500,000	$1,250,000	$1,250,000	---
Property Acquisition/Facility Upgrades	$13,000,000	$9,000,000	$1,000,000	$3,000,000
Park Maintenance/Upgrades	$5,000,000	$1,000,000	$1,000,000	$3,000,000
Facility Standby Power	$750,000	$750,000	---	---
Utility Cost Shares	$4,300,000	$500,000	$800,000	$3,000,000
Vehicle and Major Equipment	$9,234,500	$2,100,000	$1,734,500	$5,400,000
GIS System Upgrades: Water	$1,400,000	$800,000	$600,000	---
Total Other Improvements	**$38,684,500**	**$16,650,000**	**$7,634,500**	**$14,400,000**

4 Public Utilities Commission

4.1 Regulatory Background

4.1.1 Overview

On December 21, 2017, Pennsylvania Governor Wolf signed Act 65 of 2017 (Act) into law amending the Pennsylvania Public Utility Code which, among other things, added a new Chapter 32 (Sections 3201 – 3209) addressing the Public Utility Commission's (Commission) jurisdiction over the provision of utility water, wastewater, and stormwater service by entities created by Pennsylvania cities of the second class under the Municipality Authorities Act. As the City of Pittsburgh is the only city of the second class in the Commonwealth, the Commission now has jurisdiction over the PWSA. The PWSA is the first municipal authority to be regulated by the Commission.

Effective April 1, 2018, pursuant to 66 Pa.C.S. §§ 3201-3209, Act 65 of 2017, the PUC was granted jurisdiction over the PWSA. The Commission approved the initial water and wastewater tariffs of the PWSA effective March 1, 2019 as part of the PWSA's first base rate filing at Docket Numbers R-2018-3002645 and R-2018-3002647.

4.1.2 Long-Term Infrastructure Improvement Plan

Under the new Act, the PWSA was requested to file a Long-Term Infrastructure Improvement Plan (LTIIP) (66 Pa C.S. §3202 (6)) on or before September 28, 2018. The Commission normally requires that a LTIIP be submitted to support a Distribution System Improvement Charge (DSIC). A DSIC is a separate charge from the tariff and supports the accelerated replacement of aging infrastructure. At the time the LTIIP was submitted, the PWSA elected not to request a separate DSIC and proposed to fund the short- term water distribution system and sanitary sewer collection system capital improvements through its current tariffs. However, the PWSA was reconsidering the need for a DSIC in the future and prepared the LTIIP to outline its proposed program of renewal and rehabilitation as its initial steps to comply with the Commission's requirements.

The requirements for the development and submission of an LTIIP are outlined in PA code Chapter 121 §121.3 as follows:

- Identification of the types and age of eligible property owned and operated by the utility
- An initial schedule for planned repair and replacement of eligible property
- A general description of the location of eligible property
- A reasonable estimate of the quantity of eligible property to be improved or repaired
- Projected annual expenditures and means to finance the expenditures
- A description of the way infrastructure replacements will be accelerated and how repair, improvement or replacement will ensure and maintain adequate, efficient, safe, reliable and reasonable service to customers
- A workforce management and training program designed to ensure that the utility will have access to a qualified workforce to perform work in a cost-effective, safe and reliable manner

- A description of the utility's outreach and coordination activities with other utilities, Department of Transportation and local governments regarding the planned maintenance/construction projects and roadways that may be impacted by the LTIIP

Financing was not specifically addressed in the LTIIP since a DSIC was not part of the submission. It should be noted that current planned improvements will be funded through both current rates and future rate increases, as well as through revenue bonds, a capital line of credit, pay-as-you-go (PAYGO) funding and PENNVEST low interest loans.

The PWSA submitted their LTIIP to the Commission on September 28, 2018. An update to the LTIIP was finalized in August and September 2019 after consideration of input from interested parties and stakeholders. The LTIIP submitted by the PWSA was approved with revisions. This plan continues to be updated as milestones are achieved and further information becomes available.

4.1.3 Compliance Plan

The PWSA was created under the Pennsylvania Municipal Authorities Act. Because of the passage of Act 2017-65, which included Chapter 32 to the Public Utility Code, as of April 1, 2018, the PWSA is now being regulated as a public utility by the Commission. Under Chapter 32, the Commission has jurisdiction over the provision of water and wastewater service by the PWSA. Section 3204(b) of the Public Code directed the PWSA to file a "Compliance Plan" with the Commission that proposes a plan to achieve full regulatory compliance with the Commission's legal and regulatory requirements. The Commission is required to review the PWSA's Compliance Plan and may order the PWSA to file a new or revised Compliance Plan if the Compliance Plan fails to adequately ensure and maintain the provision of adequate, efficient, safe, reliable and reasonable service. As noted previously, this plan has been submitted to the Commission in accordance with the mandated schedule. The PWSA and Commission are currently working together to review the Compliance Plan and LTIIP to achieve consensus on the plan and implementation schedule.

The Compliance Plan sets forth steps that the PWSA proposes to achieve full regulatory compliance in areas in which the PWSA is not yet fully in compliance and plans that when completed over time will ensure and maintain the provision of adequate, efficient, safe, reliable and reasonable service and to reach an ultimate end-state of full compliance with the Public Utility Code and the Commission's orders and regulations.

The PWSA filed a Compliance Plan on September 28, 2018 to comply with the commitments made as part of the approved settlement of its initial rate case. A Compliance Plan Supplement was filed on February 1, 2019. A Joint Petition for Partial Settlement of the PWSA's Compliance Plan is currently pending but, as part of that settlement, the PWSA agreed to complete and report on critical activities to the PUC and interested parties on a quarterly basis.

As part of its reporting requirements, the PWSA has prepared an update on each of the areas where it is required to provide information and compiled them in a standard format. These areas include Operations, Billing and Customer Service, Lead, Infrastructure/Engineering, Finance and Accounting, and Contractual/Other Issues.

The PWSA believes that it is in compliance with the scheduled requirements presented in the Compliance Plan.

5 Conclusion

During 2019, the PWSA made significant progress on their quest to improve the water, sewer, storm water and operational systems for which they are responsible. They improved their project controls, financial controls, operational abilities, added key staff and worked to engage key customers and stakeholders on the work at hand.

In summary, it is the opinion of the Consulting Engineer, based on our understanding of the many infrastructure needs of the PWSA and the progress made during 2019, that the 2020-2024 Capital Improvement Plan coupled with the oversight of the Commission, there will be sufficient funding to advance the goals and obligations of the PWSA.

6 Acknowledgement

Mott MacDonald would like to take this opportunity to express its sincere thanks to the staff of the Pittsburgh Water and Sewer Authority for their valuable contributions to this report.

Appendices

A. Duties of the Consulting Engineer

The duties of the Consulting Engineer are many and vary depending on the needs of the Authority and the provisions of the Trust Indenture. Those duties beyond the provisions of the Trust Indenture are addressed elsewhere. Per the Amended and Restated Trust Indenture between the Pittsburgh Water and Sewer Authority and the Bank of New York Mellon Trust Company, NA originally dated October 15, 1993 and amended and restated on November 1, 2017 and effective December 28, 2017, the Pittsburgh Water and Sewer Authority must engage a Consulting Engineer to perform such duties as are imposed by the provisions of the Trust Indenture. Those provisions from the Trust Indenture pertinent to the activities of the Consulting Engineer are provided below for reference.

Per ARTICLE I – DEFINITIONS AND GENERAL INDENTURE MATTERS

Section 1.01 – Definitions: Qualified Independent Consultant

"The term "Qualified Independent Consultant" shall mean an independent professional consultant having the skill and experience necessary to provide the particular certificate, report, or approval required by the provision of this Indenture or any Supplemental Indenture in which such requirement appears, including without limitation a Consulting Engineer and an Independent Auditor."

Per ARTICLE V – CONSTRUCTION FUND

Section 5.01 Construction Fund

"There is hereby created a special fund known as the "Construction Fund," which shall be held in trust by the Trustee. Money shall be deposited to the Construction Fund pursuant to the provisions of Article II and from any other sources identified by the Authority. To the extent Costs of a Construction Project are paid for from Bonds, the Authority must deposit the construction proceeds of the Bonds in the Construction Fund and must follow the provisions of this Article V. To the extent the Authority is self-funding Costs from other than proceeds of Bonds, the Authority may use moneys in the Revenue Fund and the Operating Fund to pay such costs, and the Authority need not use the Construction Fund or follow the provisions of the Article V..."

"(b) Except to the extent to which a requisition relates to financing costs, a certificate signed by the Consulting Engineer approving such requisition and certifying that each item to be paid as set forth in such requisition constitutes an obligation which has been properly incurred as part of the Cost of the Construction Project and is then due and unpaid.

Upon receipt of each such requisition and the accompanying certificate, the Trustee shall pay to the persons named in such requisition, the respective amounts stated therein to be due to such persons ..."

Section 5.02 Amendment of Construction Project

"The Authority may from time to time amend or revise a construction project with the approval of the Consulting Engineer, but only if the Authority shall have first delivered to the Trustee:

(i) a written statement describing the proposed amendments and revisions.

(ii) a Resolution of the Board approving the proposed amendments and revisions.

(iii) a certificate signed by the Consulting Engineer setting forth the general effect of such proposed amendments and revisions and certifying in his opinion that such proposed amendments and revisions are in the best interests of the Authority.

(iv) an opinion of Bond Counsel that such amendment or revision in and of itself will not adversely affect the exclusion from gross incoming of interest on the Series of Bonds issued to fund such construction project."

Section 5.03 Contract Security

"All contracts which provide for the furnishing of material or the doing of work with regard to a Construction Project shall be in compliance with all federal and state statutes, rules, and regulations and shall be subject to the approval of the Consulting Engineer. The Authority will require each person with whom it may contract for construction to furnish a performance security and a labor and materialmen's security each for not less than 100% of the full amount of the contract entered into with such person or such greater or lesser amount as may be required by applicable law, and to carry such insurance as may be required by law and as may be recommended by the Consulting Engineer. The proceeds of any such performance security shall forthwith, upon the receipt thereof by the Authority, be deposited to the credit of the applicable Construction Fund or account therein and applied toward the completion of the construction covered by the contract in connection with which such performance security shall have been furnished except that any such proceeds as shall constitute liquidated damages for delay shall be deposited to the credit of the Revenue Fund."

Per ARTICLE VII – RATE COVENANT AND PARTICULAR COVENANTS

Section 7.07 Liens; Sale of Assets

"So long as any of the Bonds secured hereby are Outstanding, none of the Revenues shall be used for any purpose other than as provided in this Indenture, and no contract or contracts will be entered into or any action taken by which the rights of the Trustee or of the Bondholders might be impaired or diminished."

"The Authority will not voluntarily create or permit to be created any debit, lien, or charge on a parity with (except pursuant to Section 3.03 hereof) or having priority over the lien of this Indenture upon any of the Revenues pledged hereby or any other revenues or other amounts at any time pledged for the payment of the Bonds. The Authority will not sell or otherwise dispose of or encumber the System or any part thereof except as herein otherwise having provided. No sale or other disposition of fixed properties having a fair market value in excess of One Million Dollars ($1,000,000)shall be made unless the Consulting Engineer shall first have filed his certificate with the Authority and the trustee recommending such sale or other disposition of said fixed properties and shall have stated in such certificate that the sale or other disposition of said properties is in the best interests of the Authority and will not

impair the security of the Bonds and the retention of said properties is not necessary for the efficient operation of the system. If, after receiving the certificate of the Consulting Engineer, the Authority determines to sell or otherwise dispose of said fixed properties, it shall by Resolution of the Authority adopted by a majority vote of a quorum of the Board, authorize such sale or other disposition and shall file a certified copy of such Resolution of the Authority with the Trustee..."

Section 7.10 Damage, Destruction or Condemnation of System: Application of Proceeds

"In the event of any damage to the System covered by insurance or condemnation or taking by eminent domain of any part of the System for which the cost of repair or replacement shall exceed $5,000,000, the proceed shall be deposited in the Revenue Fund and the Authority shall promptly notify the Trustee and file with the Trustee a Consulting Engineer's certificate stating whether, in the signer's opinion, it is practicable and advantageous to repair the damaged or condemned property, If the certificate states that the repair or replacement is practicable and advantageous, the Consulting Engineer shall, if appropriate, prepare and file with the Trustee plans and specifications therefor with an estimate of the cost thereof, and the insurance of condemnation proceeds, if any, shall be transferred to the Operating Fund and allied thereto. If the certificate states that the repair or replacement is not practical and advantageous, the proceeds shall be remain deposited in the Revenue Fund or, at the option of the Authority be transferred to the Redemption Fund for the extraordinary redemption of Bonds as hereinafter provided."

"The Bonds are subject to redemption without premium at any time, in whole or in part, within a maturity by lot, by the Authority upon the occurrence of any condemnation of taking or damage or injury of the nature set forth in the Article, from the proceeds collected as the result of such damage, injury or taking. In all cases of redemption of equipment, the Authority shall cause to be filed with the Trustee the certificate of the Consulting Engineer referred to above, determining that repair, reconstruction or replacement is not practicable, desirable or financially feasible. In the event that less than all of the Bonds outstanding are to be redeemed, the Authority shall furnish to the Trustee a Consulting Engineer's Certificate stating (i) that the property forming a part of the System that was damaged or injured or taken by such condemnation proceedings is not essential to the operation of the System and that the continued operation of the remaining System will not, in the signer's opinion, adversely affect the security of the Bonds remaining outstanding after such redemption, or (ii) that the System has been restored to a condition substantially equivalent to its condition prior to the occurrence of such damage, injury, or condemnation, and that continued operation of the System will not, in the signer's opinion, adversely affect the security of the Bonds remaining outstanding after such redemption. For purposes of this Section 7.10, the term Consulting Engineer shall also include an employee of the City or the Authority who is otherwise qualified to act as Consulting Engineer under this Indenture."

Section 7.11 Employment of Consulting Engineer; Reports

"The Authority will employ a Consulting Engineer to perform such duties as are imposed on the Consulting Engineer by the provisions of the Indentures.

It shall be the duty of the Consulting Engineer, in addition to the other duties prescribed elsewhere in this in this Indenture, to prepare and file with the PWSA and with the Trustee on or before 30 days prior to the beginning of each fiscal year thereafter, a report setting forth the following:

(a) Advice and recommendations as to the proper maintenance, repair, and operation of the system during the next fiscal year and an estimate of the amounts of money that should be expended for such purposes.

(b) Advice and recommendations as to the Capital Additions that should be made during the next fiscal year, and an estimate of the amount of money that is recommended for such purposes.

(c) Whether the properties of the System have been maintained in good repair and sound operating condition of the Consulting Engineer's estimate of the amount, if any, required to place such properties in such condition and the details of such expenditures and the approximate time required therefor."