MOTT MACDONALD

PGH2O
Pittsburgh
Water & Sewer
Authority

2017 Consulting Engineer's Annual Report

November 2017

Pittsburgh Water and Sewer Authority
368533

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Executive Summary

The Authority has retained Mott MacDonald of Pittsburgh, Pennsylvania as its Consulting Engineer. The Consulting Engineer undertakes an Annual Report for the Authority as required by the Current Indenture. The Consulting Engineer is to advise as to maintenance and repair of the System, advise on capital additions, repairs, replacements and estimated Revenues and Current Expenses of the Authority. In the 2017 Consulting Engineer's Annual Report, the Consulting Engineer describes a System that is functional, but in violation of critical regulatory requirements. There are components of the systems that require significant upgrades to meet current operational and safety standards. Systems also include critical facilities which cannot be taken off line for repairs due to a lack of backup to the facilities. Additionally, to sustain cost-effective operations while optimizing asset performance and life expectancy, significant structural, operational, and maintenance improvements are required to be undertaken in the near term to address deficiencies in both the water and sewer systems noted during the site visits. The 2017 Engineer's Report discusses multiple deficiencies in both the water and sewer system which will require significant resources to meet current operational and safety standards.

Water System

The Authority's water treatment plant is capable of providing more water than is currently being used by its existing customers provided 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, provided that the Authority continues the rehabilitation and replacement program provided for in its ongoing Capital Improvement Program. The Authority 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. The Authority is working to improve the quality of its delivered product and is actively engaging regulatory agencies in this effort.

Sewer System

The Sewer System is designed so that during wet weather, a portion of the collected storm water and diluted wastewater is discharged to natural water courses by diversion chambers located throughout the Sewer System and at connections to the ALCOSAN interceptors. The Sewer System is in satisfactory operating condition and has adequate capacity for the dry weather wastewater flows; however, during wet weather, the Sewer System has often been taxed beyond its capacity resulting in overflows, bypassing, and flooding. The Authority's Sewer System has been the basis for a prior 2004 Consent Order. Numerous projects have addressed the required CSO issues, in collaboration and cooperation with the entire ALCOSAN 83 municipality service area. PWSA has addressed the Order requirements, and continues to perform biannual performance progress reports. Several additional CSO abatement and water quality impact mitigation plans are under Regulatory review, and are expected to require additional operational and capital investments. The Sewer System is in adequate operating condition but is in need of the ongoing Capital Improvement Program in order to correct existing deficiencies and maintain and upgrade the system to meet regulatory requirements and reduce localized backups. With the continuation of the Capital Improvement Program, it is anticipated that the Sewer System will be sufficient to meet foreseeable future demands, and be able to address its CSO compliance requirements.

In summary, it is the Consulting Engineer's opinion, based upon estimated 2018 Revenues, Operating Expenses, and Operating Cash Reserves, the planned rate increases, and the *PWSA 10 Year CIP Model* provided to Mott MacDonald on August 30, 2017, that the proposed 2018 rate and fee schedule will provide sufficient funds in 2018 to cover the proposed budgeted operating expenses and satisfy the Rate Covenant Test as provided in the Authority's Trust Indenture.

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 (Authority) under the provisions of the Pennsylvania Municipality Authorities Act, 53 Pa. C.S.A. §5601 et. seq. The Authority'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 Authority, to extend its term of existence to 2045 in order to ensure that its term covers the duration of certain bond obligations.

1.2 Initial authority operation

Pursuant to a Lease and Management Agreement dated March 29, 1984, between the Authority and the City (the "Lease and Management Agreement), the water and sewer systems were leased to the Authority and the Authority took over operations of these systems on May 1, 1984. Under the Lease and Management Agreement, the Authority 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 Authority's revenues. The Authority appointed and designated the City as the Authority'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 Authority. The City provided the services necessary to operate the water and sewer systems to the Authority with the Authority reimbursing the City for all expenses actually incurred and expended by the City.

The Capital Lease Agreement and Cooperation Agreement, each between the Authority and City, as authorized in Resolution No. 47 of 1995, terminated the aforementioned Lease and Management Agreement. The Cooperation Agreement provided that the City render certain services to the Authority 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 Authority. Under the terms of the Capital Lease Agreement, the Authority will own the water and sewer systems on September 1, 2025 upon payment of $1.00.

1.3 CIP funding source history

1.3.1 First bond issue

On April 19, 1984 the Authority 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 Authority issued $93,600,000 Daily Adjustable Demand Water and Sewer Systems Revenue Bonds, Series of 1984, in order 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 Authority

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 Authority, created the “Renewal and Replacement Fund” to be held in trust by the Trustee to be used by the Authority for extraordinary maintenance and repair of the water and sewer systems or to pay the cost of capital additions. The Trust Indenture provided so long as the aggregate amount of funds on deposit in the Construction Funds(s) were not less than $7,000,000, the Authority was not required to make any deposits into the Renewal and Replacement Fund. It was further required that if this aggregate amount was less than $7,000,000, the Authority would 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 were less than $5,000,000, the Authority 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 refinancing

In November 1993, the Authority issued two series of Water and Sewer System Bonds to: (i) advance refund all of the outstanding previously issued bonds, (ii) provide additional funds for capital improvements to the water and sewer systems, and (iii) 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 Authority recognized that the funding for the CIP implemented in 1984 was almost depleted. In order to ensure a continued supply of safe drinking water and proper sewer service to the Authority’s current and future users and to address future demands on the water and sewer systems, a new CIP was developed and adopted.

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

The Authority issued additional bonds in 1995 to fund the 1995 CIP and to pay certain obligations of the Authority to the City under the Capital Lease Agreement. On July 15, 1995, the Authority 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 Authority 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 Authority.

1.3.4 1998 bond issue and refinancing

Early in 1998, additions to the CIP were proposed that addressed future needs of the Authority, 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 Authority issued: (i) Water and Sewer System First Lien Revenue Bonds, Series A of 1998, to provide for the refunding of the Authority's outstanding Series A of 1995 Bonds, (ii) Water and Sewer System First Lien Revenue Bonds, Series B of 1998, to fund additions to the CIP, and (iii) Water and Sewer System Subordinate Revenue Bonds, Series C of 1998, to refund the Authority'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 Authority were largely spent with approximately $345,000 in reserve for construction and capital projects. The Authority 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 refinancing

On September 23, 2003, the Authority 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 Authority 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 Authority 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 Authority 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 refunding

In June 2008 and pursuant to Resolution No. 54 of 2008, adopted on April 11, 2008, the Authority 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; and
- $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 Authority'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 leveled the Authority'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, the Authority 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 Authority's Operations Fund for funds that were used by the Authority 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% maturing in 2043. The Authority 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 2016 revolving line of credit

In July 2016, the Authority entered into a drawdown, revolving line of credit financing with JPMorgan Chase Bank N.A. 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 Authority is using funds borrowed under this vehicle to finance capital projects. To date, the Authority has used $27.9 million of this line, which leaves $52.1 million of remaining available liquidity under this facility. The intention of the Authority 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.

1.3.12 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, twenty-year loans.

To date, the Authority has applied for and obtained 16 PENNVEST loans for seven water, seven wastewater, and two stormwater projects at various locations in the City of Pittsburgh. PENNVEST funding in the amount of $67,446,860.56 has been obtained to fund these projects. Table 1 summarizes the PENNVEST loans secured by the Authority. The PENNVEST loans currently have a remaining balance of approximately $33 million. (Note: Funding amount is the actual loan amount on completed projects and the original loan amount on active projects.)

Table 1: PENNVEST loans

Loan no.	Project name	Project type	Loan approval date	Status	Loan amount[1]
71191	Railside Street Sanitary Sewer Ext.	Wastewater	11/15/00	Complete	$158,399.23
58066	Ollie Street & Overbrook Blvd. Storm Sewer	Storm	11/15/00	Complete	$800,963.48
25074	Water System Improvements No. 1	Water	3/21/01	Complete	$3,940,113.91
71217	Streets Run Interceptor	Wastewater	7/18/01	Complete	$1,928,470.44
12587	Water System Improvements No. 2	Water	3/20/02	Complete	$5,112,263.50
12608	Water System Improvements No. 3	Water	7/17/02	Complete	$4,821,500.00
71362	Sewer System Improvements – Phase I	Wastewater	10/27/08	Active	$4,672,410.00
27772	Sewer System Improvements – Phase II	Wastewater	4/20/09	Active	$10,264,250.00
27784	Sewer System Improvements – Phase III	Wastewater	7/21/09	Active	$4,865,613.00
12696	Water System Improvements – Phase V	Water	4/20/09	Active	$8,613,546.00
83126	Water System Improvements – Phase VI	Water	7/21/09	Active	$8,393,478.00
71396	Sewer System Improvements – Phase IV	Wastewater	1/22/13	Active	$3,275,316.00
81026	Water System Improvements – Phase VII	Water	1/22/13	Active	$2,713,065.00
81027	Water System Improvements – Phase VIII	Water	4/24/13	Active	$3,813,561.00
71404	Lower Hill Sewer Infrastructure Project Phase 1A	Wastewater	10/23/13	Active	$1,712,506.00
58113	COA Storm Sewer Separation Project 2013	Storm	10/23/13	Active	$2,361,405.00
				Total PENNVEST funding	$67,446,860.56

[1] Loan amount shown is final loan amount for completed project or original approved loan amount for active projects.

1.3.13 Historical summary of CIP funding sources

As described in the previous subsections of this Report, a total of $797,465,281 has been made available for capital improvements since the establishment of the Authority in 1984. Table 2 summarizes the sources of these funds.

Table 2: Historical capital improvement fund sources

Source	Amount
1984 Bond Issue	$78,777,000.00
1986 Bond Issue	$115,000,000.00
Transfer from Debt Service Fund (1993)	$7,000,000.00
Transfer from Renewal and Replacement Fund (1993)	$2,009,523.00
Series B of the 1993 Bond Issue	$9,990,477.00
Series A of the 1995 Bond Issue	$80,000,000.00
Series B of the 1998 Bond Issue	$36,001,908.00
2002 Bond Issue	$90,494,400.00
2005 Bond Issue	$49,799,037.00
2007 Depository Agreement Fund	$7,503,881.00
2008 Construction Fund	$98,442,194.00
2013 Construction Bond Fund	$75,000,000.00
2016 Revolving Line of Credit	$80,000,000.00
Subtotal (bond and loan funds)	$730,018,420.00
PENNVEST funds	$67,446,860.56
TOTAL (TOTAL FUNDS)	$797,465,280.56

1.4 Outstanding bonds

According to the latest available Audit Report dated April 18, 2017, the Authority had a revenue bond balance of $683,313,000, which represents the bonds payable balance as of December 31, 2016. The following revenue bonds were listed in the Single Audit Report for 2016:

Table 3: Bonds payable, balance at December 31, 2016

Bond	Balance
1998 Series B	$85,513,000
2007 Series A	$5,480,000
2008 Series A	$68,970,000
2008 Series B-1	$72,750,000
2008 Series B-2	$72,745,000
2008 Series C-1A	$10,000,000
2008 Series C-1B	$10,000,000
2008 Series C-1C	$5,000,000
2008 Series C-1D	$26,840,000
2008 Series C-2	$51,820,000
2008 Series D-1	$24,665,000
2008 Series D-2	$71,225,000
2013 Series A	$95,285,000
2013 Series B	$83,020,000

1.5 Water system background

The Authority, through its water supply and distribution system, provides water service to more than 300,000 people and over 80,000 customers throughout the City of Pittsburgh and surrounding areas. The system consists of a 117 million gallons per day (MGD) rapid sand type water treatment plant, one 26 MGD (currently optimized to run at approximately 9 MGD) microfiltration water treatment plant, approximately 930 miles of mains, 18,754 valves, 7,450 fire hydrants, 1 raw water pump station located along the Allegheny River, 11 finished water pump stations, three finished water reservoirs, one source water reservoir, and 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 providing adequate volume and pressure, is sufficient to provide storage equivalent to approximately two days of normal water usage. The average daily filtered water processed in 2017 through July 31 was 70.97 MGD, with a peak day of 93.55 MGD.

The sole source of water for the water system is the Allegheny River. The Pennsylvania Department of Environmental Resources, now the Department of Environmental Protection (PADEP), issued a Water Allocation Permit to the Authority in March 1989, which allows for water withdrawal of up to 100 MGD from the river. The PADEP has advised PWSA that the permitted allocation would be re-evaluated in the future if the Authority's demand increases as a result of growth within the City or through the sale of water to surrounding municipalities. The average water withdrawal and the maximum single day water withdrawal from the Allegheny River in 2017 through July 31 were 71.41 MGD and 99.39 MGD, respectively.

The Authority's water system currently has 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. Approximately 11,000 of the connections are fire hydrants and private fire line accounts.

The Pennsylvania-American Water Company supplies water to approximately 26,000 customers in the southern and western sections of the City. PWSA provides sewer conveyance to these customers. 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 distribution system elements (waterlines, valves, hydrants, etc.) are owned and maintained by the respective independent water purveyor. In addition, the Authority, 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 a number of other neighboring communities.

In April 2016, 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. PWSA reinstituted the original corrosion control chemical in early 2016 and is fully cooperating with PADEP and the components of the Order. PWSA began a corrosion control study in 2017 as part of this effort.

1.6 Sewer system background

The Authority's sewer collection system is comprised of 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), 38 combined sewer overflow (CSO) outfalls, 185 storm sewer outfalls, four wastewater pump stations, and ancillary facilities. A majority of the sewer system, approximately 77 percent, is

combined sewers, designed so that during wet weather events, a portion of the collected stormwater and diluted wastewater is discharged into natural watercourses through 98 CSO diversion chambers. Approximately 23 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 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 Authority's service area.

The 24 neighboring municipalities' sewer system connections were established pursuant to agreements with the City to convey their wastewater to the ALCOSAN WWTF. Many of these agreements with these municipalities do not provide for cost sharing of sewer system maintenance and reconstruction.

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 U.S. 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 stormwater 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 wastewater treatment facility. 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 Authority, 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. 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 in excess 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 other municipalities and authorities.

1.6.1 ALCOSAN federal consent decree

During the approximately 75 wet weather events that occur in the region over a typical year, the discharge structures allow an estimated 9 billion gallons of combined flow (untreated sewage and stormwater), and an estimated 670 million gallons of sanitary sewer overflow to flow into the region's rivers. In 1997, the USEPA and the PADEP began negotiations with ALCOSAN and its 83 tributary communities to mitigate these discharges. The process culminated with a Federal Consent Decree (CD) issued to ALCOSAN by the USEPA that required preparation of a Wet Weather Plan (WWP) by 2012 and implementation of controls to minimize the frequency and duration of CSOs and SSOs until planned improvements to eliminate CSOs and SSOs can be implemented.

On January 23, 2008, a binding CD was approved in federal court in which ALCOSAN, under the mandate of the USEPA, PADEP, and Allegheny County Health Department (ACHD), agreed to produce a comprehensive plan to greatly reduce the annual discharge of untreated sewage into area waterways by 2026. The CD required ALCOSAN to handle all flows that their 83 "customer municipalities", one of which is the Authority, can deliver to their connection points. Flows delivered to these connection points would then be handled by ALCOSAN per their WWP.

ALCOSAN's CD required them to complete its WWP in conjunction with the Authority and other municipalities and authorities. In accordance with the CD, ALCOSAN submitted the WWP to regulators on January 30, 2013. In late January 2014, the USEPA informed ALCOSAN that the submitted WWP was deficient and did not comply with the water quality goals set in the 2008 CD and offered to meet with ALCOSAN about the deficiencies. On February 7, 2014, ALCOSAN issued a press release that stated a settlement communication was received from the United States Department of Justice (USDOJ), which indicated it was willing to modify the CD to consider a wet weather plan that consisted of a phased approach involving flow reduction and green infrastructure. Discussions among ALCOSAN, USEPA, and USDOJ have continued throughout 2017 about modifying the CD to allow for submittal of a revised WWP, for evaluation of source reduction and green infrastructure, and for ALCOSAN to develop flow targets for all of its contributing municipalities and authorities.

1.6.2 Administrative consent orders and consent order and agreements

Administrative Consent Orders (ACOs) and Consent Order and Agreements (COAs) 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 fulfill the Pennsylvania and USEPA CSO Policy obligations. The ACOs were issued to separate sewer communities by the ACHD and the COAs were issued to combined sewer communities by the PADEP. The initial COA among PWSA, the City of Pittsburgh, PADEP, and ACHD was entered into 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.

Since 2004, the Authority worked to complete 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 Authority 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. The study results are to be supported by demonstration projects that are closely monitored for pre- and post-construction performance. The GI and source control study was completed in June 2016 and one project has been completed, three projects are under construction with completion expected by the end of 2017, and the final two projects are in design for construction in 2018. The GI study proposes $46 million for stream removal projects and $490 million in distributed green infrastructure and source control projects over the next 20 years to achieve the required level of CSO control.

In January 2016, PWSA and the City received an Information Requirement from the USEPA under Section 308 of the Clean Water Act. This request includes requirements for a flow reduction demonstration project and a Source Reduction Study (for both the combined sewer system and the sanitary sewer system), with due dates of August 1, 2017 and December 1, 2017, respectively. In October 2016, PWSA and the City received an additional information request from the USEPA under Section 308 of the Clean Water Act.

1.6.3 Green Infrastructure

The Authority has reported that its 2013 Facilities Plan as submitted to the PADEP proposes Enhanced Green Best Management Practices (EGBMP) as a significant part of its program to address its Combined Sewer Overflow (CSO) reduction compliance. Implementation of EGBMPs has been shown nationally as an innovative way to reduce CSO, but also address: flooding resultant from stormwater runoff, improving surface water quality, wildlife habitat restoration, improving regional air quality, as well as stimulate economic opportunities. The Authority’s approach to the Wet Weather Plan will involve cost-effective and sustainable projects combining EGBMPs and traditional conveyance and storage infrastructure to manage stormwater discharge to the CSO system. PWSA has invested more than $5 million in projects to develop the overall “City-Wide” plan, and install capacity to potentially manage 3.7 million gallons annually.

2 Maintenance, repair, and operation of the water and sewer systems

Section 2 contains materials from the *Draft Consulting Engineer's 2015 Facility Conditions Assessment Report* submitted to PWSA in May 2015*, and the Consulting Engineer's 2016 Facility Conditions Assessment Report* submitted to PWSA in October 2016.

2.1 Findings on current maintenance, repair, and operation of the water and sewer systems.

In April 2015, Mott MacDonald (formerly known as Hatch Mott MacDonald) conducted a Facility Physical Condition Assessment of some of 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. 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.

The condition score, which ranks the potential for failure, was assigned through visual inspections using a scale from 1 to 5, with 5 being in the worst condition. A general description of these categories is listed in Table 5. Additionally, facilities' characterizations of not applicable, no longer in service, and unknown were utilized as appropriate.

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

Facility	Assessment Type			
	General Physical Condition	Operations	Maintenance	Health & Safety
	Water Facilities			
Aspinwall Pump Station	X			X
Brashear Chlorine Booster				X
Bedford Chlorine Booster				X
Bruecken Pump Station		X		
Herron Hill Pump Station	X			
Highland, Howard, and Lincoln Pump Station		X		
Highland Reservoir No. 1	X			
Highland Reservoir No. 1 Membrane Filtration Plant	X	X		
Highland Reservoir No. 2 Chlorine Booster Station	X			
Lanpher Reservoir	X			
McNaugher Reservoir			X	

Facility	Assessment Type			
	General Physical Condition	Operations	Maintenance	Health & Safety
Mission Pump Station	X		X	
Saline Pump Station	X			
Various Reservoirs (Herron Hill, Highland No. 2, Lanpher)		X		
WTP - West Raw Water Intake Structure	X	X		
WTP - East Raw Water Intake		X		
WTP - Walkway from Ross to clarifiers	X			
WTP - Clarifier No. 2	X			
WTP - Clarifier Flumes	X			
WTP - Gas Building	X			
WTP - Clearwell		X		
WTP - Emergency Access Tunnel		X		
WTP - Chemical Feed - Carbon		X		
WTP - Mechanical Room				X
WTP - Sedimentation Basins		X		
WTP - Site and Grounds				X
Sewage Facilities				
Browns Hill Pump Station	X	X		X
Lincoln Place (Mifflin Road) Pump Station		X		X
Other				
Central Warehouse	X			X
Various Facilities - Pump Component Deficiencies			X	
Various Facilities - Electrical Deficiencies			X	
Various Facilities - Vegetation			X	
Various Facilities - Defective Downspouts			X	
Various Facilities - Roof Deficiencies			X	
Various Facilities - Emergency Light Fixtures				X
Various Facilities - Spill Containment				X

Table 5: Description of asset scoring for visual assessment

Score	Description
1 – Excellent	Sound physical condition. Meets current needs. Operable and maintained. No obvious repairs required. Asset expected to perform adequately with routine maintenance for ten (10) years or more.
2 – Good	Sound and maintained but shows slight signs of early wear. Delivering full efficiency with little to no performance deterioration. Minor repairs required. Potential for deterioration or impaired performance over next five (5) to ten (10) years.
3 – Fair	Functionally sound but showing signs of normal wear and diminished performance. Minor failures and increased maintenance costs to operate. Minor work required but asset is serviceable. Renewal of major component replacement expected within next five (5) years.
4 – Poor	Functional but requires a high level of maintenance to remain operational. There is a risk of short-term failure. Likely to have significant deterioration in performance within the near term. Renewal or replacement expected in the near term.
5 – Very Poor	Effective life exceeded and/or is a significant health and safety hazard. High risk of breakdown or imminent failure. Requires immediate replacement or major repair.

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.

Both the water and sewer systems are functional but are in violation of critical regulatory requirements. There are components of the systems that require significant upgrades to meet current operational and safety standards. Systems also include critical facilities which cannot be taken off line for repairs due to a lack of backup to the facilities. Additionally, to sustain cost-effective operations while optimizing asset performance and life expectancy, significant structural, operational, and maintenance improvements are required to be undertaken in the near term to address deficiencies in both the water and sewer systems noted during the site visits.

A full facility physical condition assessment has not been conducted since the findings of the 2015 Assessment were reported. To date, only minor improvements have been made to address the deficiencies outlined in the 2015 Assessment. However, detailed finished water pump station assessments started in late 2016 and PWSA is awaiting the deliverables. Additional planned improvements for 2017 and beyond are outlined in Section 2.

In addition to the Facility Physical Condition Assessment, the Consulting Engineer has evaluated the current operational procedures at the PWSA to determine where improvements can be made to maximize the effectiveness of the PWSA while minimizing risk. The evaluation revealed the findings as follows.

2.1.1 Water system findings

1. Condition Assessments should be updated on a priority basis to determine any changes in condition and to prioritize work on all facilities.
2. Water Treatment Plant improvements will be required to meet 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.
3. From available information, the water reservoirs with covers and liners have likely reached their normal life and should be scheduled for replacement.

4. Water storage tank inspections are due for many of the 13 tanks in the PWSA system. Water storage tanks should be inspected every five years. Table 6 provides storage tank inspection and renovation information.
5. There are several facilities that have potential major to moderate structural defects. Detailed structural analyses are required to determine actual conditions.
6. Heating, ventilation, electrical, security, and auxiliary equipment have experienced significant deterioration and near-term maintenance and/or replacement is strongly advised.
7. 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.
8. Emergency backup power is not available at most facilities, and should be installed as soon as possible to ensure uninterrupted water supply.

Table 6: 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	2006	2020
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	N/A	1997
Herron Hill Tank	Elevated	Welded steel	1967	2012	2008	2017
Lincoln Tank	Standpipe	Welded steel	1939	1982	2008	2013
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 AWAA standard five-year inspection cycle.

9. In 2016, PWSA water sampling results exceeded the PADEP action levels from compliance tests for lead and copper. 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.
10. 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.
11. Inspection and condition assessment of below-ground infrastructure, pipelines, and storage facilities need to be conducted on a more frequent and routine basis.
12. Significant portions of the PWSA facilities and infrastructure are located outside of the public right-of-way, and easements have not been obtained. PWSA should establish easements in ownership of all property when PWSA facilities or infrastructure are located.
13. To prevent premature failure and undue deterioration of valves and hydrants, routine maintenance, testing, operation, and inspection should be increased in breadth and frequency.
14. Known changes in future water quality standards require a plan for implementing changed operating treatment materials and procedures. PWSA needs to develop a plan to meet those quality requirements as they come into effect.

2.1.2 Sewer and stormwater system findings

1. Condition Assessments should be updated on a priority basis to determine any changes in condition and to prioritize work on all facilities.
2. 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.
3. Inspection and condition assessment of below-ground infrastructure, pipelines, and storage facilities must be conducted at a more rapid pace in order to complete an assessment of the entire system every five years.
4. Significant portions of the system are located outside of the public right-of-way and easements have not been obtained.
5. 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”.
6. Paragraph 7 of the Consent Order 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. To date, 80 catch basins/inlets require testing.
7. Flooding has continued to be an issue in the Washington Boulevard area during heavy rain events. PWSA should continue to collaborate with the City and Pennsylvania Department of Transportation to mitigate the flooding.
8. 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 PWSA resources.
9. PWSA has received some complaints of basement sewage backups during wet weather. PWSA should continue to evaluate and address this problem.

2.1.3 Information management system findings

1. Condition Assessments should be updated on a priority basis to determine any changes in condition and to prioritize work on all facilities.
2. 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 PWSA to monitor project work, costs, and budgets.
3. Successful implementation of a CMMS may be delayed or compromised due to existing deficiencies in the GIS system. The existing GIS platform may eventually limit the GIS system’s performance. An enhanced GIS system will reduce the time necessary to access data during system operation and maintenance activities and planning, design, and construction activities.
4. PWSA is currently building and calibrating a hydraulic water model using WaterGems by Bentley.

5. 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.
6. Customer billing errors have been a recurring issue, and PWSA should continue to make this a priority.

2.2 Recommendations for maintenance, repair, and operation of the water and sewer systems during the 2018 fiscal year

It is the engineer's opinion that sufficient funds were projected in PWSA's 2017 Operating Budget to continue the programs to improve operation, maintenance, and routine repair of the water, sewer, and stormwater infrastructure. Property development did not occur at the pace of previous years and accounting adjustments due to the billing process improvements had to be taken, resulting in lower than anticipated revenue. Therefore, the coverage will most likely be at the minimum level for 2017 if current forecasts hold. The 2018 proposed budget incorporates the new rates for 2018, based on a rate increase the PWSA Board approved on November 8, 2017 and a rate increase projected to become effective during 2018. A review of the projected rates for 2018 indicates that the revenue and receipts appear to be sufficient for the 2018 approved budget should these rate increases occur.

As Consulting Engineer for the PWSA, Mott MacDonald recommends the following actions be undertaken during 2018, to maintain the PWSA's ability to provide a reliable source of potable water to its customers and provide reliable sewer system operations and compliance with the anticipated consent order requirements. Capital costs associated with these actions were estimated and used to assess PWSA's proposed CIP budget. Operational costs are mostly attributable to increased labor costs. An increased number of staff was assumed to address the additional monitoring, maintenance, and program management. The costs associated with the increased staff base should be closely monitored during 2018 as the many programs are put into place.

2.2.1 Water system recommendations

1. Continue Water Quality Initiative Program and adjust program as necessary, depending on regulatory requirements and testing results. These types of requirements include: lead and copper testing program for residential customers, corrosion control study (pipe loop study is currently underway), corrosion control pilot testing, and continuation of optimization at the Water Treatment Plant, continuing lead service line replacement assistance, replacing PWSA-owned lead service lines, and public education program.
2. 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.
3. Evaluate the overall system to determine where excess capacity exists or where not enough capacity exists. Evaluate system to determine whether pressure gradient boundaries should be moved.
4. Perform a desktop risk-based assessment of the water mains using industry standards and best practices to prioritize replacement areas and develop a program and schedule for small diameter water main replacement and large water main inspection, rehabilitation, and replacement.

5. Determine whether small diameter water main rehabilitation is feasible in the system.
6. Develop program for air/vacuum and dividing pressure valve inspection, testing, and replacement.
7. 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.
8. Develop a schedule to perform detailed inspections of the interior and exterior of water storage tanks. Perform inspections on the water storage tanks that are overdue or due in 2018, shown in Table 6. This includes Bedford Tank, Brashear Tanks, Garfield Tank, Herron Hill Tank, Lincoln Tank, McNaugher Tanks, Spring Hill Tanks, and Squirrel Hill Tank.
9. Institute a routine maintenance program (in-house or through a third-party) to remove and prevent debris from accumulating on the finished water reservoir covers and develop a schedule to perform detailed inspections of the covers monthly.
10. Institute a 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.
11. 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.
12. Develop a schedule to evaluate, design, and implement the upgrade or replacement of existing heating, ventilation, and air conditioning systems (as applicable) at all facilities where the systems are non-operational or operating with a significant deterioration in performance.
13. Address any excessive water leakage from pumps, piping, and valves noted in the *Draft Consulting Engineer's Facility Physical Condition Assessment Report*, dated May 20, 2015.
14. Perform or obtain from a current PWSA provider, a comprehensive condition assessment at the Aspinwall Water Treatment Plant to identify the condition of the buildings, site, process equipment, and support systems. (ARCADIS is currently tasked with the assessment of the pretreatment and chemical feed systems.) Develop a prioritized capital improvements project list. Identify required improvements to meet upcoming federal regulations and future system expansion goals.
15. Replace aged pump and valve equipment, electrical equipment, HVAC, and auxiliary systems and rehabilitate the building architectural and energy management systems of pump stations.
16. Overhaul HVAC and electrical system at the New Highland Pump Station.
17. Perform routine maintenance on pump station equipment as outlined in the *Draft Consulting Engineer's Facility Physical Condition Assessment Report*, dated May 20, 2015.
18. Obtain easements for facilities and infrastructure outside of the public right-of-way.
19. Develop a plan to replace corroded water mains and implement corrosion protection measures through the use cathodic protection.

2.2.2 Sewer and stormwater system recommendations

1. 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.

2. 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.
3. Clean, dye-test, and CCTV inspect inlets and catch basins that were not previously dye tested due to structural or operation and maintenance issues.
4. Replace junctions throughout the wastewater and stormwater systems with traditional manholes wherever possible.
5. Obtain easements for infrastructure outside of the public right-of-way.
6. Evaluate alternatives to manage stormwater and reduce combined sewer flows in the Washington Boulevard area.
7. Evaluate the need for additional metering in the wastewater system.
8. Continue Adaptive Management Approach for stormwater and CSO reduction and/or pollutant reduction in programs such as Saw Mill Run watershed and the 14 point of connection sewersheds for which it was found that the PWSA's existing collection system could not convey all typical year flows.
9. 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 in 2018, it will include additional regulatory obligations for the Authority and the City in the five-year permit term, including reduction of pollutants such as sediment and nutrients. In 2018, the Authority and the City should plan and design the stormwater best management practices to address the pollutant reduction regulatory requirements.
10. Continue to evaluate and address the basement sewage backup issues that occur during intense wet weather events.

2.2.3 Information management system recommendations

1. Acquire, install, develop, and implement a Computerized Maintenance Management System (CMSS), 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 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 PWSA's current status. These efforts are not reflected in the current budget.
2. 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 PWSA operations. In addition, it will allow PWSA to securely share and/or publish certain portions of the data for public consumption.
3. The water distribution modelling software, WaterGEMS, is currently being developed. WaterGEMS is the only hydraulic model that has a separate input for hydrant data. Hydrant results from field investigations can easily be compared to modeled data to pinpoint possible problems in the system. It also has the ability to 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.

4. 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.
5. Monitor and improve the customer billing system in order to minimize errors, improve performance, create redundancy in systems, and ensure that all customers are billed regularly. Develop improved billing and metering processes to streamline data processing, minimize data errors, and improve cost efficiency.

3 Capital addition and planning projects

Sections 3.1 and 3.2 are based on information in the *PWSA 10 Year CIP Model* provided to Mott MacDonald in an email by PWSA on August 30, 2017.

3.1 General

The following factors and conditions were considered in the preparation of the PWSA 10 Year CIP Model:

- Sustaining the continuous operation of PWSA's water supply and distribution system, including the primary functions of pumping, treatment, conveyance, and storage facilities for the benefit of existing customers.
- Building personnel and related Integrated Management System (IMS) to support a program that will significant capital over the next five years.
- Ensuring compliance with the anticipated consent order with USEPA and USDOJ, including implementing an Integrated Watershed Management approach with Adaptive Management to mitigate CSOs and sanitary sewer overflows (SSOs) and address water quality challenges.
- Developing Green Infrastructure strategies, design standards, demonstration projects, and effective Best Management Practices to optimize PWSA investment values and benefits.
- Developing energy and general utility improvements to optimize investment benefits and lower operations costs.

3.2 Current capital improvement plan

The following tables provide key projects that were included in the PWSA 10 Year CIP Model. This list comprises the best estimation of projects at the time of this report. The total estimated CIP expenditure for 2018 is $73,079,599.

Table 7: Water treatment plant improvements

Project Description	Projected Fiscal 2018 CIP Expenditures
Filter Rehab	$1,228,471
MFP Assessment and Critical Process Improvements	Future
Highland Park Membrane Filtration Module Replacement Program	$17,333
MFP Transformer Repair and UPS Replacement	$79,012
Aspinwall Water Treatment Plant Electrical and Backup Power Improvements	$1,253,935
Aspinwall Treatment Plant Pretreatment Chemical System and Clarification Imprv.	$2,216,300
Clearwell Emergency Response Project	$1,269,386
Corrosion Control Chemical Storage & Feed Systems	$1,499,637
Aspinwall Water Treatment Plant Calcium Hypochlorite Storage	$123,000
Chlorine Booster Station Improvements	$366,667
Aspinwall Water Treatment Plant Improvements (Placeholder)	Future
Clearwell Improvements	Future
Highland Park Membrane Filtration Floor Drainage Modifications	Future

Table 8: Water pumping and storage improvements

Project Description	Projected Fiscal 2018 CIP Expenditures
Bruecken Pump Station Valve Vault	$579,510
Aspinwall and MFP Fiberglass Reinforced Plastic Chemical Tank Inspect. and Repairs/Replacement	$138,356
Highland Reservoir Pump Station and Rising Main	$1,731,578
New Highland Pump Station Improvements	$674,704
Aspinwall Pump Station Improvements	$1,822,117
Aspinwall Pump Station to Lanpher Reservoir Rising Main	$1,614,684
Bruecken Pump Station Improvements	$1,436,433
Inline Pump Station (Coral and Pacific) Improvements	$74,917
Lanpher Reservoir Liner and Cover Replacement	$640,000
Herron Hill Reservoir Liner and Cover Replacement	$96,000
Mission Pump Station Improvements	Future
Herron Hill Tank Pump Station Improvements	Future
Herron Hill Pump Station Improvements	Future
Howard Pump Station Improvements	Future
Lincoln Pump Station Improvements	Future
Saline Pump Station Improvements	Future

Table 9: Water distribution system improvements

Project Description	Projected Fiscal 2018 CIP Expenditures
2016 Valve and Hydrant	$91,287
2016 Lead Service Line Replacement Demonstration Project	$19,205
Lead Service Line Replacement	$5,682,137
2016 Curb Box Inspections	$65,642
Ft. Duquesne Bridge Water Air Release Valve Repair	$419,175
Small Water Main Replacement	$3,539,910
Lead Line Identification (Curb Box/Expl. Excavation)	$6,670,393
District Water and Pressure Meters	$323,043
Large Water Meters	$576,087
Large Diameter Water Main Improvements	$2,090,000
Water Relay	$1,448,043
Valve Replacement	$2,617,849
Hydrant Replacement	$1,138,728

Table 10: Wastewater system improvements

Project Description	Projected Fiscal 2018 CIP Expenditures
Baum and Bigelow	$15,500
2016 Sewer Relay	$72,432
2016 Sewer Lining	$497,014
Larimer Avenue Sewer and 28th Street Slope Stabilization	$35,829
31st Ward Sewer System	$1,461,939
Lawn and Ophelia	$321,208
Small Diameter Sewer Rehabilitation	$4,836,528
Sewers Under Structures	$767,806
Maytide Storm and Sanitary Sewer System Improvements	$267,789
Sewer Reconstruction	$1,229,110
Wastewater System Improvements	$885,000
Large Diameter Sewer Rehabilitation	$387,456
Mellon Terrace Sewer System Improvements	Future

Table 11: Stormwater system improvements

Project Description	Projected Fiscal 2018 CIP Expenditures
2017 Catch Basin and Inlet Replacement	$2,364,130
Wightman Park	$234,378
Woods Run Stream Removal-Phase 1	$331,233
2018 Catch Basin Replacement	$879,526
Washout Disconnection	$218,889
Stormwater system Improvements	$55,714
Catch Basin Replacement	Future
CSO Flow Monitoring Equipment	Future

Table 12: Green infrastructure improvements

Project Description	Projected Fiscal 2018 CIP Expenditures
Hillcrest Green Infrastructure Project	$555,292
Centre and Herron Green Infrastructure	$758,272
Melwood/Finland Green Infrastructure Project	$761,035
Maryland Avenue Green Infrastructure	$1,742,048
Shamrock Way Green Infrastructure	$504,692
Thomas and McPherson Green Infrastructure	$776,808
Heth's Run Green Infrastructure	$1,127,486
East Street Green Infrastructure	$533,538
Highland Drive Green Infrastructure	$336,341
Southside Complete Street Green Infrastructure	$188,484
MLK Field Green Infrastructure	$552,036
Sampsonia Way Street Green Infrastructure	$228,868
Bausman & Bend Green Infrastructure	$21,429
S 21st Street Green Infrastructure	$407,198
Panther Hollow/Four Mile Green Infrastructure	$1,930,055
2018 GI Cost Share Projects	$750,000
Future Green Infrastructure Projects	Future

Table 13: Information management systems improvements

Project Description	Projected Fiscal 2018 CIP Expenditures
Computerized Maintenance Management System (CMMS)	$250,000
Geographic Information System (GIS) Needs Assessment	$125,000
Water Distribution and Water Quality Model Enhancements	Future
Sewer Hydrologic and Hydraulic Model Extensions	Future
Cogsdale Rehabilitation	$500,000
New Accounting System	$350,000
New Billing System	Future

Table 14: Miscellaneous improvements

Project Description	Projected Fiscal 2018 CIP Expenditures
Vehicles and Equipment	$1,826,000
Radon Treatment	$200,000
Utility Coordination Cost Share Projects	$2,250,000

3.3 Capital projects and funding

3.3.1 Funding and payments for capital projects

Table 15 shows the drawdown of capital funds during Fiscal Year 2017.

On approximately July 1, 2016, a revolving line of credit in the amount of $80,000,000 was put in place for PWSA to use to fund capital projects. The first draw from the line of credit for capital expenditures took place in July 2016. The first requisition was in October 2016. Capital expenditures applied to this line of credit in 2017 (through August, 2017) are shown in Table 15.

Table 15: 2017 monthly capital expenditures (as of 8/21/17)

Month	Revolving line of credit[1]
January	$1,674,653.15
February	$2,829,447.41
March	$599,717.48
April	$1,870,834.57
May	$2,632,296.93
June	$1,640,118.90
July	$2,509,710.71
August	$2,358,390.22
September	---
October	---
November	---
December	---
TOTAL as of 8/21/17	$16,115,169.37

[1] A revolving line of credit of $80 million, for PWSA to use to fund capital projects, was put in place on approximately 7/1/16.

3.3.2 Contract awards

From January 1 through August 2, 2017, the Authority awarded $24,792,571.94 in construction contracts for water treatment, water distribution, sewage collection facilities, and stormwater projects. A summary of these contract awards is shown in Table 16.

3.3.3 PENNVEST financing

Table 17 presents the annual debt service payments on loans for which PENNVEST funding has been obtained, listed by project, with payments paid in 2017 through July 31, 2017, and the anticipated payment for August – December 2017.

3.3.4 Renewal and replacement fund

Section 6.06 of the Trust Indenture, dated October 15, 1993, eliminated the requirements of the Renewal and Replacement Fund unless determined necessary annually by the Consulting Engineer. The 2013 Construction Bond Fund was exhausted as of approximately September 30, 2016. PWSA has secured a revolving line of credit bank loan in an amount up to $80 million to use to fund capital projects. Because the funds available with the line of credit exceeds $7 million, Mott MacDonald recommends that the Authority does not deposit any funds into the Renewal and Replacement Fund during the 2017 fiscal year.

Table 16: 2017 construction contract awards

Resolution no.	Contract award date	Project No.	Description	Original Contract Value[1]
8	1/27/2017	2016-325-105-0	Lead Service Line Replacement Contract-Zottola	$1,594,850.00
8	1/27/2017	2016-325-105-0	Lead Service Line Replacement Contract-Independent	$1,943,148.00
11	1/27/2017	2016-OPS-119-0	2017 Manhole and Point Repair	$856,814.50
32	2/24/2017	2017-OPS-105-0	2017 Surface Restoration	$5,284,846.00
40	2/24/2017	2017-323-103-0	Lanpher Rising Main Repair	$1,122,000.00
69	4/28/2017	2017-325-101-0	2017 Water Relay Contract	$971,885.00
77	4/28/2017	2017-OPS-102-0	2017 Urgent Water Replacement Contract - Zottola	$966,235.00
77	4/28/2017	2017-OPS-102-0	2017 Urgent Water Replacement Contract - Independent	$1,078,348.00
78	4/28/2017	2017-OPS-101-0	2017 Urgent Sewer Replacement Contract - Independent	$1,154,665.00
78	4/28/2017	2017-OPS-101-0	2017 Urgent Sewer Replacement Contract - A. Merante	$1,177,760.00
84	4/28/2017	2016-325-105-2	2017 Lead Service Line Replacement Exceedances	$939,208.00
110	4/28/2017	2016-GI-103-0	Hillcrest, North Atlantic, and Donna Streets - Green Infrastructure	$728,464.00
127	6/23/2017	2017-322-103-0	Highland Park Membrane Filtration Plant Transformer Repair	$74,425.00
131	6/23/2017	2017-424-102-0	2017 Catch Basin and Inlet Replacement Contract - Facchiano	$1,195,051.00
131	6/23/2017	2017-424-102-1	2017 Catch Basin and Inlet Replacement Contract - Independent	$1,196,294.00
134	6/23/2017	2017-325-102-0	2017 Hydrant Replacement Contract	$1,059,938.00
135	6/23/2017	2017-325-104-0	2017 Valve Replacement Contract	$2,128,380.00
141	6/23/2017	2016-GI-104-0	Centre and Herron - Green Infrastructure	$748,689.44
148	8/2/2017	2016-GI-105-0	Finland Street, Bethoven Street, and Melwood Avenue- Green Infrastructure	$571,571.00
			TOTAL	$24,792,571.94

[1] Excludes engineering and construction management fees.

Table 17: PENNVEST loans annual debt payments in 2017

Legacy loan no.	Loan number	Project name	Debt service payment start date	Type	Status	Annual debt service[1] paid in 2017 (through 7/31/17)	Anticipated debt service[1] to be paid 8/17 - 12/17
71191	P33000648-102	Railside Street	2/02	Sewer	Complete	$6,052.20	$4,323.00
58066	P33000482-101	Ollie Street & Overbrook Blvd. Storm Sewer	5/02	Sewer	Complete	$30,366.63	$21,690.45
25074	P33000188-101	Water system improvements no. 1	1/03	Water	Complete	$126,127.05	$90,090.75
71217	P33000669-102	Streets Run interceptor	5/03	Sewer	Complete	$66,650.64	$47,607.60
12587	P33000019-101	Water system improvements no. 2	1/04	Water	Complete	$172,951.52	$123,536.80
12608	P33000036-101	Water system improvements no. 3	7/04	Water	Complete	$155,039.99	$110,742.85
71362	P33000777-102	Sewer system improvements – phase I	5/11	Sewer	Active	$169,215.76	$120,868.40
27772	P33000304-101	Sewer system improvements – phase II	4/11	Sewer	Active	$383,209.33	$273,720.95
27784	P33000315-101	Sewer system improvements – phase III	9/11	Sewer	Active	$156,636.76	$111,883.40
12696	P33000098-101	Water system improvements – phase V	5/11	Water	Active	$321,581.33	$229,700.95
83126	P33001336-100	Water system improvements – phase VI	10/11	Water	Active	$273,388.99	$195,277.85
71396	P33000807-102	Sewer system improvements – phase IV	5/15	Sewer	Active	$105,440.93	$75,314.95
81026	P33001313-100	Water system improvements – phase VII	3/15	Water	Active	$87,340.61	$62,386.15
81027	P33001467-100	Water system improvements – phase VIII	5/15	Water	Active	$122,768.45	$87,691.75
71404	P33001499-102	Lower Hill Sewer Infrastructure Project Phase 1A	5/15	Sewer	Active	$55,130.04	$39,378.60
58113	P33001496-101	COA Storm Sewer Separation Project 2013	1/16	Sewer	Active	$76,019.79	$54,299.85
					TOTAL	$2,307,920.02	$1,648,514.30

[1] Includes principal and interest.

4 Revenues and expenditures

4.1 General

In accordance with Section 7.11 of the Trust Indenture, dated October 15, 1993, the Consulting Engineer shall include in the annual report:

"His estimate of Receipts and Revenues and Current Expense for the next Fiscal Year and his recommendation as to any necessary revision of water and sewer rates, rents, or other charges."

The 2018 Draft Operating Budget (not yet approved by the Board) was provided to Mott MacDonald on August 23, 2017 and most recently updated on October 25 and November 7, 2017 (see Appendix A). The information provided in the Budget form the basis for the Tables and Figure in this section.

The Consulting Engineer generally agrees with the 2018 Draft Operating Budget as presented.

4.2 2018 total estimated receipts and revenues and total available funds

The projected receipts and revenues for Fiscal Year 2018 are $257.2 million, which is based on the following:

- Water supply and sewage conveyance receipts ($177.3 million);
- Sewage treatment receipts ($75.9 million);
- Fees ($2.9 million);
- Miscellaneous revenue ($1.1 million).

The estimated Total Available Funds for Fiscal Year 2018 are projected to be $276.1 million, which is based on the following:

- Operating revenues from water sales, sewer conveyance charges, tap fee collections, and other miscellaneous collections ($257.2 million);
- Interest earnings on the capital projects funds, debt service funds, revenue funds, and Other Funds ($0 million);
- Unrestricted cash balance ($18.9 million).

Table 18 presents the historic and budgeted receipts and revenues for 2013 through 2016, forecasted 2017, and the 2018 budget, and estimated total available funds.

Table 18: Historical and budgeted receipts and revenue and total available funds[1]

Category	Unaudited 2013	Unaduited 2014	Unaudited 2015	Unaudited 2016	Forecast 2017	Draft budget 2018 (as of 11/7/17)
WATER COLLECTIONS	$ 87,492,878	$ 98,427,248	$ 101,043,192	$ 104,662,048	$ 131,294,306	$ 177,289,499
DISC	$ 5,930,799	$ 6,619,757	$ 6,769,976	$ 6,939,920	$ 549,229	$ -
Customer Refunds	$ (354,122)	$ -	$ -	$ -	$ -	$ -
SEWAGE COLLECTIONS	$ 47,159,390	$ 53,168,777	$ 57,077,760	$ 62,731,097	$ 67,510,745	$ 75,869,702
Less Collection Agency Commission	$ -	$ -	$ -	$ -	$ -	$ -
FEE COLLECTIONS	$ 807,181	$ 2,143,092	$ 1,573,643	$ 4,050,478	$ 3,033,208	$ 2,910,369
OTHER COLLECTIONS	$ 1,755,395	$ 1,946,296	$ 2,166,321	$ -	$ -	$ -
GRANT REVENUE	$ -	$ 88,550	$ -	$ -	$ -	$ -
MISCELLANEOUS REVENUE	$ -	$ -	$ -	$ 3,135,542	$ 5,557,978	$ 1,151,229
OPERATING DEBT SERVICE RESERVE	$ -		$ -	$ -	$ -	$ -
INTEREST EARNINGS						
Capitalized Interest Funds	$ -	$ -	$ -	$ -	$ -	$ -
Capital Project Funds	$ 1,888	$ 241,797	$ -	$ -	$ -	$ -
Debt Service Funds	$ 398,197		$ 156,499	$ -	$ -	$ -
Debt Service Reserve Funds	$ -	$ -	$ -	$ -	$ -	$ -
Revenue Funds	$ 5,538	$ -	$ 5,241	$ -	$ -	$ -
Other Funds	$ -	$ 4,536	$ -	$ -	$ -	$ -
Interest in Trusteed Funds	$ -	$ -	$ -	$ -	$ -	$ -
PENNVEST PROJECTS	$ 1,726,065	$ 4,963,243	$ 3,458,528	$ -	$ -	$ -
TRANSFER FROM CONSTRUCTION FUND						
Engineering Department Reimbursement	$ -	$ -	$ -	$ -	$ -	$ -
Reimbursement for Capital Projects	$ -	$ 4,579,474	$ 3,331,287	$ -	$ -	$ -
TOTAL SOURCES OF FUNDS	**$ 144,923,209**	**$ 172,182,770**	**$ 175,582,447**	**$ 181,519,085**	**$ 207,945,466**	**$ 257,220,799**
REVENUE FUND	$ 33,756,000	$ 31,518,041	$ 28,378,488	$ 21,714,289	$ 18,874,052	$ 18,874,052
TOTAL AVAILABLE FUNDS	**$ 178,679,209**	**$ 203,700,811**	**$ 203,960,935**	**$ 203,233,374**	**$ 226,819,518**	**$ 276,094,851**

[1] Prepared with data available on October 25, 2017 and November 7, 2017. Values are cash basis, and are considered unaudited.

4.3 2018 Total Projected Expenditures

The anticipated total operating and debt service expenditures for Fiscal Year 2018 are projected to be $239.0 million, which is based on the following:

- Total operating expenses ($186.7 million);
- Debt service expenses ($52.3 million).

Table 19 presents the historical and budgeted expenses for 2013 through 2016, forecasted 2017, and the 2018 budget. The Direct Operating Expenses include the following:

- Administration
  - Executive Director
  - Customer Service
  - MIS
  - Finance
  - Procurement
  - Human Resources
  - Legal
  - External Affairs
  - Ops Executive
  - Admin General
- Operations
  - Warehouse
  - Water Quality (Lab)
  - Water Treatment Plant
  - Water Distribution
  - Sewer Operations
- Engineering & Construction
- Employee Benefits

Table 19: Historical and budgeted expenses[1]

Category	Unaudited 2013	Unaudited 2014	Unaudited 2015	Unaudited 2016	Forecast 2017	Draft budget 2018 (as of 11/7/17)
DIRECT OPERATING						
Administration	$ 13,664,845	$ 12,847,834	$ 14,185,979	$ 14,755,973	$ 16,175,699	$ 21,242,194
Operations	$ 21,384,407	$ 26,206,802	$ 30,158,227	$ 30,907,882	$ 37,398,137	$ 54,651,286
Engineering & Construction	$ 2,863,280	$ 5,909,573	$ 5,630,329	$ 10,146,881	$ 11,195,423	$ 14,296,501
Employee Benefits[2]	$ 3,288,774	$ 3,628,876	$ 4,946,657	$ 5,091,276	$ 5,437,294	$ 7,281,447
TOTAL DIRECT OPERATING	**$ 41,201,306**	**$ 48,593,085**	**$ 54,921,193**	**$ 60,902,012**	**$ 70,206,553**	**$ 97,471,428**
COOPERATION AGREEMENT						
Water - Indirect	$ 1,850,000	$ 1,850,000	$ 1,850,000	$ 1,850,000	$ 1,850,000	$ 1,850,000
Sewer - Direct	$ 2,300,000	$ 2,300,000	$ 2,300,000	$ 2,300,000	$ 2,300,000	$ 2,300,000
Sewer - Indirect	$ 3,000,000	$ 3,000,000	$ 3,000,000	$ 3,000,000	$ 3,000,000	$ 3,000,000
TOTAL COOPERATION AGREEMENT	**$ 7,150,000**	**$ 7,150,000**	**$ 7,150,000**	**$ 7,150,000**	**$ 7,150,000**	**$ 7,150,000**
OTHER OPERATING						
Non-City Water Subsidy (PAWC)	$ 2,370,633	$ 2,583,319	$ 1,791,062	$ 2,169,429	$ 4,255,579	$ 4,800,000
ALCOSAN	$ 46,761,134	$ 51,572,036	$ 58,322,674	$ 62,849,859	$ 72,652,554	$ 77,290,985
TOTAL OTHER OPERATING	**$ 49,131,767**	**$ 54,155,355**	**$ 60,113,736**	**$ 65,019,288**	**$ 76,908,133**	**$ 82,090,985**
TRANSFER COSTS TO DISC FUNDING	$ -		$ -	$ -		
TOTAL OPERATING EXPENSES	**$ 97,483,073**	**$ 109,898,440**	**$ 122,184,929**	**$ 133,071,300**	**$ 154,264,686**	**$ 186,712,413**
CAPITAL EXPENDITURES						
Reimbursements	$ -	$ -	$ -	$ -	$ -	
Self Insured Escrow	$ -	$ -	$ -	$ -	$ -	
DISC	$ 2,431,751	$ 7,370,367	$ 5,324,630	$ -	$ -	
PENNVEST	$ 2,854,043	$ 5,401,038	$ 3,141,249	$ 809,206	$ (816,622)	
TOTAL CAPITAL EXPENDITURES	**$ 5,285,794**	**$ 12,771,405**	**$ 8,465,879**	**$ 809,206**	**$ (816,622)**	**$ -**
DEBT SERVICE EXPENSES						
Principal on Bonds	$ 14,155,000	$ 19,774,999	$ 18,330,000	$ 18,855,000	$ 17,346,740	$ 20,070,000
Interest on Bonds	$ 25,861,376	$ 26,451,740	$ 29,861,647	$ 29,062,173	$ 30,624,509	$ 26,382,293
Remarketing and Liquidity	$ 4,501,127	$ 2,445,362	$ 1,384,559	$ 1,483,083	$ 1,536,157	$ 1,406,559
Transfer to Operating DSRF	$ -	$ -	$ -	$ -	$ -	
Reduction of Fees/Interest on Debt	$ -	$ -	$ -	$ -	$ -	
Trustee Fees	$ 156,746	$ -	$ -	$ -	$ -	
PENNVEST Loan Payments	$ 3,135,616	$ 3,145,390	$ 3,585,115	$ 3,857,178	$ 3,899,627	$ 3,906,434
Revolver Interest	$ -	$ -	$ -	$ 94,890	$ 691,807	$ 560,000
Reimbursements from Municipalities	$ (50,523)	$ (66,610)	$ (58,315)	$ -	$ -	
TOTAL DEBT SERVICE EXPENSES	**$ 47,759,342**	**$ 51,750,881**	**$ 53,103,006**	**$ 53,352,324**	**$ 54,098,840**	**$ 52,325,286**
TOTAL EXPENSES	**$ 150,528,209**	**$ 174,420,726**	**$ 183,753,814**	**$ 187,232,830**	**$ 207,546,904**	**$ 239,037,699**

[1] Prepared with data available on October 25, 2017 and November 7, 2017. Values are cash basis, and are considered unaudited.

[2] Starting with the 2015 Budget, benefits are included in the individual department budget and rolled up.

4.4 Conclusions and recommendations on water and sewer rates

4.4.1 General

Raftelis Financial Advisors, Inc. prepared the 2017-2021 rate study for Pittsburgh Water and Sewer Authority, which evaluated the need for user rate adjustments. This study determined rates on a cost of service basis for all rate components for all customer rate classes. The cost of service was determined with an intention to improve the financial standing of PWSA, increase service levels to its customers, and invest more in the water and sewer systems to begin to address historical underinvestment in the system.

On December 2, 2016, the PWSA Board approved the rate increase schedule recommended in the rate study through Resolution 134 of 2016, authorizing a change in water and sewer rates and tapping fees for PWSA customers. These rates were subsequently approved by the Board in a special meeting on November 8, 2017. User rates were approved for years 2018 through 2019.

4.4.2 Rate Covenant Calculations

The Authority's Trust Indenture provides for the fixing and charging by the Authority of rates, rents, and charges for water and sewer service in accordance with the following Rate Covenant. Under the Indenture, the Authority has covenanted with the owners of all the bonds to adopt rates complying with either of the following methods in each Fiscal Year:

> Method 1

The Authority will maintain, charge, and collect, so long as any of the Bonds shall remain outstanding, reasonable rates, rentals, and other charges for the use of the facilities of the water and sewer system which (after making due and reasonable allowances for contingencies and a margin of error in the estimates), together with other receipts and revenues, including any unrestricted cash and investments accumulated in the Revenue Fund at the beginning of each Fiscal Year, shall be at all times at least sufficient to provide annually:

- Funds to pay all of the current expenses of the Authority; and
- An amount equal to 120 percent of the Debt Service Requirements with respect to the bonds authenticated and delivered under the Indenture or other long-term indebtedness of the Authority during the then current Fiscal Year of the Authority.

> Method 2

The Authority will maintain, charge, and collect, so long as any of the Bonds shall remain outstanding, reasonable rates, rentals, and other charges for the use of the facilities of the water and sewer system which (after making due and reasonable allowances for contingencies and a margin of error in the estimates), together with other receipts and revenues, for the then current Fiscal Year (exclusive of interest income earned by the Authority on funds other than the Debt Service Reserve Fund; provided, however, that earnings on the Construction Fund may also be included during any construction period, but only to the extent such earnings are expressly required to be either retained in the Construction Fund and may be used to pay debt service on the Bonds or applied directly to payment of debt service of Bonds) shall be at all times at least sufficient to provide annually:

- Funds to pay all of the current expenses of the Authority; and
- An amount equal to 100 percent of the Debt Service Requirements with respect to the bonds authenticated and delivered under the Indenture or other long-term indebtedness of the Authority during the then current Fiscal Year of the Authority.

Based on the methodology prescribed above, the Authority is projected to meet the requirement for coverages for Fiscal Year 2018 and is projected to satisfy the Rate Covenant Test as provided in the Authority's Trust Indenture. The details of this analysis are shown in Table 20. Table 20 was prepared using cash-basis data available through September 30, 2017, so the data is considered preliminary and unaudited. (Cash-basis computations do not align with the calculations called for by the Trust Indenture as calculated by PWSA's financial auditors.) Historically, the Authority has been able to maintain the required coverage factor in most years and satisfy financial obligations.

Table 20: Debt service coverage factor (cash-basis)[1]

Category	Unaudited 2013	Unaudited 2014	Unaudited 2015	Unaudited 2016	Forecast 2017	Draft budget 2018 (as of 11/7/17)
TOTAL AVAILABLE FUNDS						
Cash	$ 33,756,000	$ 31,518,041	$ 28,378,488	$ 21,714,289	$ 18,874,052	$ 18,874,052
Water Collections	$ 87,138,756	$ 98,427,248	$ 101,043,192	$ 104,662,048	$ 131,294,306	$ 177,289,499
DISC	$ 5,930,799	$ 6,619,757	$ 6,769,976	$ 6,939,920	$ 549,229	
Interest Earnings	$ 405,623	$ 246,333	$ 161,740	$ -	$ -	
Transfer - Engineering from CIP	$ -	$ -	$ -	$ -	$ -	
Transfer - Reimbursement from CIP	$ -	$ 4,579,474	$ 3,331,287	$ -	$ -	
PENNVEST Projects [2]	$ 1,726,065	$ 4,963,243	$ 3,458,528	$ -	$ -	
Fee Collections	$ 807,181	$ 2,143,092	$ 1,573,643	$ 4,050,478	$ 3,033,208	$ 2,910,369
Sewage Collections	$ 47,159,390	$ 53,168,777	$ 57,077,760	$ 62,731,097	$ 67,510,745	$ 75,869,702
Other Collections	$ 1,755,395	$ 1,946,296	$ 2,166,321	$ 3,135,542	$ 5,591,840	$ 1,151,229
OPERATING DEBT SERVICE RESERVE	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
DEBT SERVICE COVERGE FACTOR - METHOD 1						
Total Available Funds	$ 178,679,209	$ 203,612,261	$ 203,960,935	$ 203,233,374	$ 226,853,380	$ 276,094,851
Operating Expenses	$ 97,483,073	$ 109,898,440	$ 122,184,929	$ 133,071,300	$ 154,264,686	$ 186,712,413
Capital Projects	$ 5,285,794	$ 12,771,405	$ 8,465,879	$ 809,206	$ (816,622)	$ -
NET AVAILABLE FOR DEBT SERVICE	$ 75,910,342	$ 80,942,416	$ 73,310,127	$ 69,352,868	$ 73,405,316	$ 89,382,438
DEBT SERVICE REQUIREMENTS	$ 47,759,342	$ 51,750,881	$ 53,103,006	$ 53,352,324	$ 53,282,218	$ 52,325,286
COVERAGE FACTOR	1.59	1.56	1.38	1.30	1.38	1.71
REQUIRED COVERAGE	1.20	1.20	1.20	1.20	1.20	1.20
DEBT SERVICE COVERAGE FACTOR - METHOD 2						
Total Operating Revenues	$ 144,923,209	$ 172,094,220	$ 175,582,447	$ 181,519,085	$ 207,979,328	$ 257,220,799
Total Operating Expenses	$ 97,483,073	$ 109,898,440	$ 122,184,929	$ 133,071,300	$ 154,264,686	$ 186,712,413
AMOUNT REMAINING FOR DEBT SERVICE	$ 47,440,136	$ 62,195,780	$ 53,397,518	$ 48,447,785	$ 53,714,642	$ 70,508,386
DEBT SERVICE REQUIREMENTS	$ 47,759,342	$ 51,750,881	$ 53,103,006	$ 53,352,324	$ 53,282,218	$ 52,325,286
DEBT SERVICE COVERAGE FACTOR	99%	120%	101%	91%	101%	135%
REQUIRED COVERAGE	100%	100%	100%	100%	100%	100%

[1] Prepared with data available on October 25, 2017 and November 7, 2017. Values are cash basis, and are considered unaudited.

[2] PennVest loan proceeds and expenditures are a net zero.

4.4.3 Conclusion

In summary, it is the Consulting Engineer's opinion, based upon estimated 2018 Revenues, Operating Expenses, and Operating Cash Reserves, the planned rate increases, and the *PWSA 10 Year CIP Model* provided to Mott MacDonald on August 30, 2017, that the proposed 2018 rate and fee schedule will provide sufficient funds in 2018 to cover the proposed budgeted operating expenses and satisfy the Rate Covenant Test as provided in the Authority's Trust Indenture.

5 ACKNOWLEDGEMENT

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

APPENDICES

A. Draft 2018 operating budget

2018 Operating Budget Proposed
Summary

	2018 Budget	2017 Forecast	Difference	%	2018 Budget	2016 Actuals	Difference	%
Receipts								
Water	109,674,239	85,341,299	24,332,940	29%	109,674,239	68,030,331	41,643,907	61%
Sewage Conveyance	67,615,260	45,953,007	21,662,253	47%	67,615,260	36,631,717	30,983,544	85%
DISC	-	549,229	(549,229)	-100%	-	6,939,920	(6,939,920)	-100%
ALCOSAN	75,869,702	67,510,745	8,358,957	12%	75,869,702	62,731,097	13,138,605	21%
Fees	2,910,369	3,033,208	(122,839)	-4%	2,910,369	4,050,478	(1,140,109)	-28%
Miscellaneous Revenue	1,151,229	5,557,978	(4,406,749)	-79%	1,151,229	3,135,542	(1,984,313)	-63%
Total Receipts	257,220,799	207,945,467	49,275,332	24%	257,220,799	181,519,085	75,701,714	42%
Operating Expenses								
Salaries	(21,386,377)	(16,801,156)	4,585,220	-27%	(21,386,377)	(15,556,521)	5,829,856	-37%
Benefits	(7,281,447)	(5,437,294)	1,844,152	-34%	(7,281,447)	(5,091,276)	2,190,171	-43%
Direct Operating	(34,642,650)	(22,895,521)	11,747,129	-51%	(34,642,650)	(20,153,582)	14,489,068	-72%
Inventory	(2,815,278)	(1,749,624)	1,065,654	-61%	(2,815,278)	(908,616)	1,906,662	-210%
General & Administrative	(28,745,676)	(23,322,958)	5,422,718	-23%	(28,745,676)	(19,192,018)	9,553,658	-50%
ALCOSAN	(77,290,985)	(72,652,554)	4,638,431	-6%	(77,290,985)	(62,849,859)	14,441,126	-23%
Co-Op Payment	(7,150,000)	(7,150,000)	-	0%	(7,150,000)	(7,150,000)	-	0%
Non-City Subsidy	(4,800,000)	(4,255,579)	544,421	-13%	(4,800,000)	(2,169,429)	2,630,571	-121%
Customer Assistance Program	(2,600,000)	-	2,600,000	0%	-	-	-	0%
Total Operating Expenses	(186,712,412)	(154,264,687)	32,447,726	-21%	(184,112,412)	(133,071,300)	51,041,112	-38%
Net Operating Income	**70,508,387**	**53,680,780**	**16,827,607**	31%	**73,108,387**	**48,447,785**	**24,660,602**	51%
Debt Service								
Debt Service - Principal	(20,070,000)	(17,346,740)	2,723,260	-16%	(20,070,000)	(18,855,000)	1,215,000	-6%
Debt Service - Interest	(26,382,293)	(30,624,509)	(4,242,216)	14%	(26,382,293)	(29,062,173)	(2,679,880)	9%
Debt Service - Liquidity & Remarketing	(1,406,559)	(1,536,157)	(129,598)	8%	(1,406,559)	(1,483,083)	(76,524)	5%
Debt Service - Pennvest	(3,906,434)	(3,899,627)	6,807	0%	(3,906,434)	(3,857,178)	49,256	-1%
Revolver Interest	(560,000)	(691,807)	(131,807)	19%	(560,000)	(94,890)	465,110	
Pennvest Cash Flows	-	816,622	816,622	0%	-	(809,206)	(809,206)	100%
Total Debt Service	(52,325,286)	(53,282,218)	(956,932)	2%	(52,325,286)	(54,161,530)	(1,836,244)	3%
Total Costs	(239,037,698)	(207,546,904)	31,490,794	-15%	(236,437,698)	(187,232,830)	49,204,868	-26%
Net Cash Flow	**18,183,101**	**398,562**	**15,870,675**	3982%	**20,783,101**	**(5,713,745)**	**22,824,358**	-399%
Cash Balance - Beginning	18,874,052	21,620,000	(2,745,948)	-13%	18,874,052	28,269,000	(9,394,948)	-33%
Net Cash Flow	18,183,101	398,562	17,784,539	4462%	20,783,101	(5,713,745)	26,496,846	-464%
Transfer to Reserve	(2,933,110)	(3,144,510)	211,400	-7%	(2,933,110)	(840,966)	(2,092,144)	249%
Capital Spending	(15,249,991)	-	(15,249,991)	0%	(17,849,991)	-	(17,849,991)	0%
Cash Balance - Ending	**18,874,052**	**18,874,052**	**-**	0%	**18,874,052**	**21,714,289**	**(2,840,237)**	-13%

2018 Operating Budget Proposed
Budget Comparison

	2018 Budget	2017 Budget	Difference	%	2017 Budget	2017 Forecast	Difference	%
Receipts								
Water	109,674,239	87,952,137	21,722,102	25%	87,952,137	85,341,299	2,610,838	3%
Sewage Conveyance	67,615,260	45,665,816	21,949,444	48%	45,665,816	45,953,007	(287,191)	-1%
DISC	-	-	-	0%	-	549,229	(549,229)	-100%
ALCOSAN	75,869,702	70,780,469	5,089,233	7%	70,780,469	67,510,745	3,269,724	5%
Fees	2,910,369	8,718,474	(5,808,105)	-67%	8,718,474	3,033,208	5,685,266	187%
Miscellaneous Revenue	1,151,229	5,669,431	(4,518,202)	-80%	5,669,431	5,557,978	111,453	2%
Total Receipts	257,220,799	218,786,327	38,434,472	18%	218,786,327	207,945,467	10,840,860	5%
Operating Expenses								
Salaries	(21,386,377)	(18,831,047)	2,555,330	-14%	(18,831,047)	(16,801,156)	2,029,891	-12%
Benefits	(7,281,447)	(6,211,309)	1,070,138	-17%	(6,211,309)	(5,437,294)	774,015	-14%
Direct Operating	(34,642,650)	(24,796,526)	9,846,124	-40%	(24,796,526)	(22,895,521)	1,901,005	-8%
Inventory	(2,815,278)	(2,429,421)	385,857	-16%	(2,429,421)	(1,749,624)	679,797	-39%
General & Administrative	(28,745,676)	(19,303,069)	9,442,607	-49%	(19,303,069)	(23,322,958)	(4,019,889)	17%
ALCOSAN	(77,290,985)	(70,780,469)	6,510,516	-9%	(70,780,469)	(72,652,554)	(1,872,085)	3%
Co-Op Payment	(7,150,000)	(7,150,000)	-	0%	(7,150,000)	(7,150,000)	-	0%
Non-City Subsidy	(4,800,000)	(1,920,716)	2,879,284	-150%	(1,920,716)	(4,255,579)	(2,334,863)	55%
Customer Assistance Program	(2,600,000)	-	2,600,000	0%	-	-	-	0%
Total Operating Expenses	(186,712,412)	(151,422,557)	35,289,855	-23%	(151,422,557)	(154,264,687)	(2,842,130)	2%
Net Operating Income	**70,508,387**	**67,363,770**	**3,144,617**	5%	**67,363,770**	**53,680,780**	**7,998,731**	15%
Debt Service								
Debt Service - Principal	(20,070,000)	(17,385,490)	2,684,510	-15%	(17,385,490)	(17,346,740)	38,750	0%
Debt Service - Interest	(26,382,293)	(30,426,690)	(4,044,397)	13%	(30,426,690)	(30,624,509)	(197,819)	1%
Debt Service - Liquidity & Remarketing	(1,406,559)	(1,403,338)	3,221	0%	(1,403,338)	(1,536,157)	(132,819)	9%
Debt Service - Pennvest	(3,906,434)	-	3,906,434	0%	-	(3,899,627)	(3,899,627)	100%
Revolver Interest	(560,000)	(780,000)	(220,000)	28%	(780,000)	(691,807)	88,193	-13%
Pennvest Cash Flows	-	-	-	0%	-	816,622	816,622	100%
Total Debt Service	(52,325,286)	(49,995,518)	2,329,768	-5%	(49,995,518)	(53,282,218)	(3,286,700)	6%
Total Costs	(239,037,698)	(201,418,075)	37,619,623	-19%	(201,418,075)	(207,546,904)	(6,128,829)	3%
Net Cash Flow	**18,183,101**	**17,368,252**	**814,849**	5%	**17,368,252**	**398,562**	**16,969,690**	4258%
Cash Balance - Beginning	18,874,052	22,491,922	(3,617,870)	-16%	22,491,922	21,620,000	871,922	4%
Net Cash Flow	18,183,101	17,368,252	814,849	5%	17,368,252	398,562	16,969,690	4258%
Transfer to Reserve	(2,933,110)	(3,144,510)	211,400	-7%	(3,144,510)	(3,144,510)	-	0%
Capital Spending	(15,249,991)	(14,223,742)	(1,026,249)	7%	(14,223,742)	-	(14,223,742)	0%
Cash Balance - Ending	**18,874,052**	**22,491,922**	**(3,617,870)**	-16%	**22,491,922**	**18,874,052**	**3,617,870**	19%