

# Consulting Engineer's Annual Report – Wastewater System

**Capital Region Water**

September 30, 2021



# Consulting Engineer's Annual Report

## Wastewater System

FINAL

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## Acronyms and Abbreviations

<b>AWTF</b>	<b>Advanced Wastewater Treatment Facility</b>
<b>BOD</b>	<b>Biochemical Oxygen Demand</b>
<b>CAMP</b>	<b>CSO Activation Monitoring Pilot</b>
<b>CEAR</b>	<b>Consulting Engineer's Annual Report</b>
<b>CIP</b>	<b>Capital Improvement Plan</b>
<b>CRW</b>	<b>Capital Region Water</b>
<b>CSO</b>	<b>Combined Sewer Overflow</b>
<b>FY</b>	<b>Fiscal Year</b>
<b>MGD</b>	<b>Million Gallons per Day</b>
<b>Mg/L</b>	<b>Milligrams per Liter</b>
<b>NMC</b>	<b>Nine Minimum Controls</b>
<b>NPDES</b>	<b>National Pollutant Discharge Elimination System</b>
<b>O&amp;M</b>	<b>Operation and Maintenance</b>
<b>OMM</b>	<b>Operation &amp; Maintenance Manual</b>
<b>PADEP</b>	<b>Pennsylvania Department of Environmental Protection</b>
<b>PPC</b>	<b>Preparedness, Prevention, and Contingency</b>
<b>PRP</b>	<b>Pollution Reduction Plan</b>
<b>SSO</b>	<b>Sanitary Sewer Overflow</b>
<b>TMDL</b>	<b>Total Maximum Daily Load</b>
<b>VFD</b>	<b>Variable Frequency Drive</b>

# 1 Introduction

Arcadis U.S., Inc. (Arcadis) prepared this Wastewater System Consulting Engineer's Annual Report (CEAR) for Capital Region Water (CRW) as required by Section 7.11 of the Trust Indenture between CRW and The Bank of New York Mellon Trust Company, N.A. originally dated May 1, 2017. This CEAR is being submitted to comply with the following requirements for Fiscal Year (FY) 2020, as outlined in the Indenture:

Section 7.11:

*"It shall be the duty of the Consulting Engineers, in addition to the other duties prescribed elsewhere in this Indenture, to prepare and file with the Authority and with the Trustee on or before 90 days prior to the beginning of each Fiscal Year hereafter, a report setting forth the following:*

- a. Their advice and recommendations as to the proper maintenance and repair of the operating and wastewater delivery infrastructure of the Sewer System during the next Fiscal Year;*
- b. Their advice and recommendations as to the Capital Additions that should be made during the next Fiscal Year and their estimate of the amounts of money necessary for such purpose; and*
- c. Their finding whether the operating and wastewater delivery infrastructure of the Sewer System have been maintained in good repair and sound operating condition and their estimate of the amount, if any, required to place such operating and wastewater delivery infrastructure in such condition and the details of such expenditures and the approximate time required therefor."*

CRW's fiscal year runs from January 1 through December 31. The wastewater system is owned and operated by CRW and includes an Advanced Wastewater Treatment Facility (AWTF), a conveyance system, and wastewater and stormwater collection systems located within the City of Harrisburg (City) limits. Overall, the wastewater system includes approximately 36 miles of sanitary sewers, 40 miles of stormwater sewers, and 101 miles of combined sanitary and stormwater sewers.

The wastewater collection system services customers located within the City. The conveyance and treatment systems provide wastewater conveyance and treatment services to the City and Suburban wholesale customers. Suburban wholesale customers are located in Susquehanna Township, Lower Paxton Township, Swatara Township, Paxtang Borough, Penbrook Borough, and Steelton Borough.

## 1.1 Report Methodology and Limitations

In preparing this CEAR, Arcadis reviewed existing records and documents prepared by or on behalf of CRW to understand, assess, and report on the technical information contained therein as it relates to the CEAR. The major relevant documents provided by CRW and reviewed as part of the CEAR include, but are not necessarily limited to the following:

- Chapter 94 Municipal Wasteload Management Report and Semi-Annual Report on Consent Decree Implementation, March 2021.
- Design and Operational Parameters Associated with the Wastewater System
- Monthly Treatment Plant Operating Data (2020, and January 2021 through June 2021).

## Consulting Engineer's Annual Report – Wastewater System

- Historic Wastewater System Expenses (FY 2020)
- Budgeted FY 2021 Wastewater System Expenses.
- Correspondence to/from the Pennsylvania Department of Environmental Protection (PADEP), as related to inspection reports, bypass events, unauthorized discharges (UD), and sanitary sewer overflow (SSO) events.
- Memorandum from AECOM to CRW entitled “CRW Front Street Interceptor Rehabilitation – Preliminary Design”, dated December 16, 2020.
- Technical Memorandums provided by KCI, Phase 4 CCTV, January 2021.

In addition, on August 9, 2021, Arcadis conducted limited visual site inspections of the following components of the Wastewater System:

- Advanced Wastewater Treatment Facility
- Front Street Pump Station
- Spring Creek Pump Station
- City Island North Pump Station
- City Island South Pump Station
- Market Street Pump Station

The review also included discussions with representatives of CRW and performance comparisons to other comparable wastewater systems and related industries.

This CEAR summarizes the findings of the visual inspections at the time they were conducted, and the findings of the data reviewed and discussions with CRW up to the date of the issuance of the CEAR. Changed conditions occurring or becoming known after such date could affect the material presented and the conclusions reached herein to the extent of such changes.

Arcadis has not independently verified the accuracy of the information provided by CRW and others. However, it is believed such sources are reliable and the information obtained to be appropriate for the analysis undertaken and the conclusions reached herein. In addition, the scope did not include review of any pending or threatened litigation against CRW, however CRW has stated that there is pending litigation (one claim related to termination of sewer construction contracts totaling \$2.4M) which at this time it is not anticipated to have a material impact on its wastewater operations.

In completing this CEAR for CRW, Arcadis is not serving in the role of a “municipal advisor” under the regulations of the Securities and Exchange Commission. As such, Arcadis is not recommending any action regarding municipal financial products or the issuance of municipal securities; and is not acting as a registered municipal advisor to CRW and does not owe a fiduciary duty to CRW pursuant to Section 15B of the Securities Exchange Act of 1934, as amended by the Dodd-Frank Wall Street Reform and Consumer Protection Act, with respect to the information and material prepared in connection with this CEAR. CRW should discuss any information and material prepared in connection with this CEAR with any and all internal and external financial and other advisors that they may deem appropriate before acting on this information and material.



## 2 Wastewater system Management

### 2.1 Overview of the Wastewater System

CRW is a municipal authority that owns and operates an Advanced Wastewater Treatment Facility (AWTF), a conveyance system, and wastewater and stormwater collection system within City limits. The AWTF employs biological nutrient removal technology in an activated sludge plant to achieve nitrogen and ammonia requirements. Overall, the wastewater system includes approximately separate sanitary sewers and stormwater sewers, as well as combined sanitary and stormwater sewers. A summary of the major wastewater system facilities is provided in **Table 2-1**. The wastewater collection system provides service to customers located within the City. The conveyance and treatment systems provide wastewater conveyance and treatment services to City and Suburban wholesale customers. Suburban wholesale customers are located in Susquehanna Township, Lower Paxton Township, Swatara Township, Paxtang Borough, Penbrook Borough, and Steelton Borough. The Suburban wholesale customers account for approximately 50% of the revenues of the wastewater system.

**Table 2-1: Summary of Major Wastewater and Stormwater System Facilities**

Facility	Description	Design Peak Capacity	2020 Average Flow	2020 Peak Flow
Advanced Wastewater Treatment Facility	High Purity Oxygen Activated Sludge Plant	45.0 MGD	19.5 MGD	24.4MGD <sup>1</sup>
Front Street Pump Station	Pump Station	43.2 MGD	12.9 MGD	62.8 MGD <sup>2</sup>
Spring Creek Pump Station	Pump Station	28.9 MGD	5.12 MGD	15.3 MGD
City Island North Pump Station	Pump Station	0.432 MGD	0.006 MGD	0.014 MGD <sup>3</sup>
City Island South Pump Station	Pump Station	0.432 MGD		Total
Market Street Pump Station	Pump Station	Unavailable	Unavailable	Unavailable

<sup>1</sup>Maximum monthly flow, which occurred in December 2020.

<sup>2</sup>The 2020 Front St. Pump Station peak flow was pumped by a temporary bypass pumping system while the pump station is out of service for improvements. This was not pumped by the station pumps.

<sup>3</sup>2020 City Island flows based on 2007 reported flows. Actual flows are not available.

Sources: Chapter 94 Municipal Wasteload Management Report for Calendar Year 2020, and Semi-Annual Report on Consent Decree Implementation for July 1, 2020 to December 31, 2020, dated March 2021.

Wastewater Division Monthly Report, dated December 2020

A map of the wastewater system's infrastructure, including stormwater pipe, interceptor sewers, force mains, gravity sewer mains, and pump stations, is shown in **Figure 2-1**.

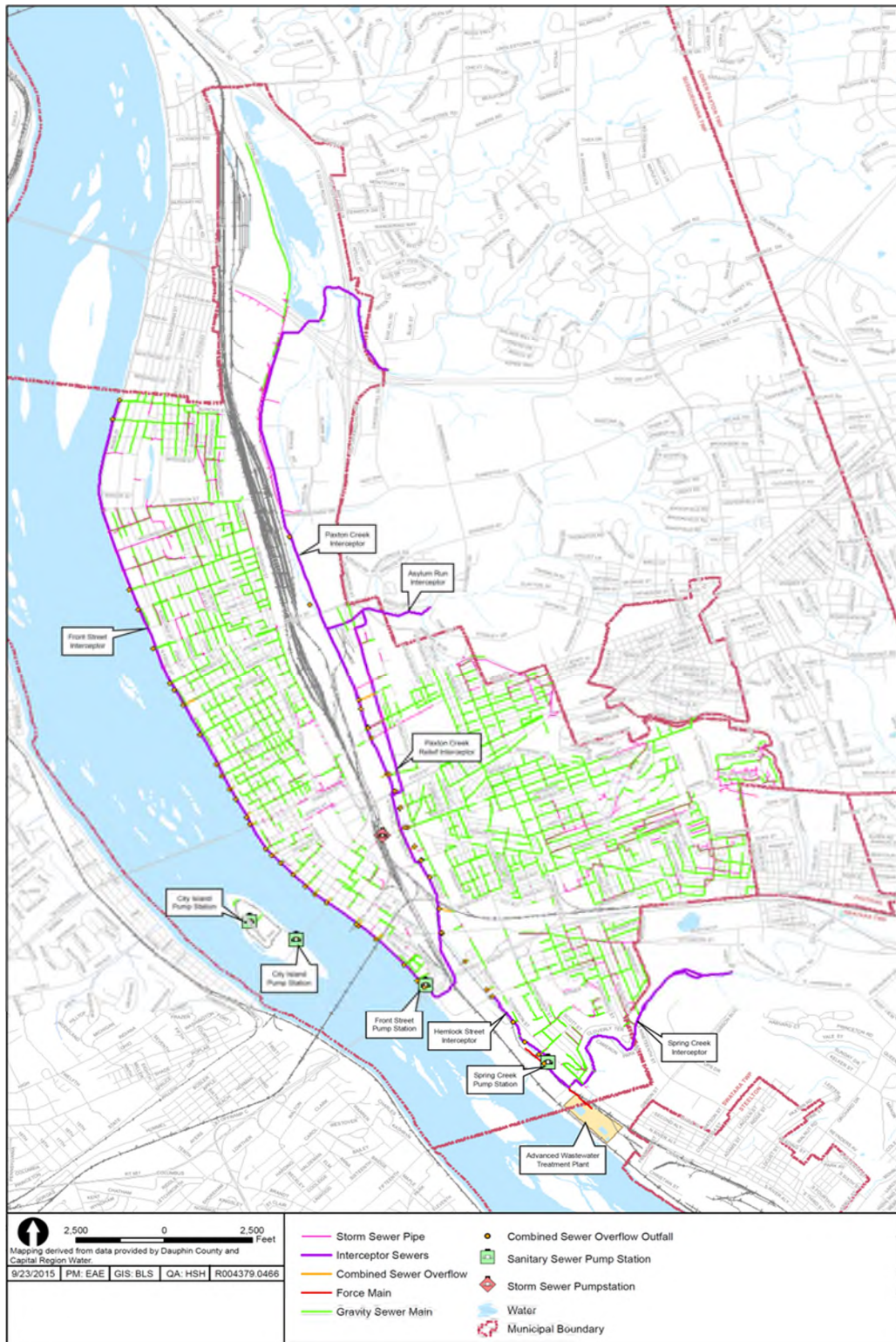


Figure 2-1: Wastewater System Infrastructure Map

## 2.2 Wastewater System Description

### 2.2.1 Wastewater Treatment

The AWTF is a 45 million gallon per day (MGD) capacity, high purity, oxygen activated sludge plant. The plant consists of preliminary treatment, including vortex grit removal, followed by primary clarifiers, high purity oxygen secondary treatment, secondary clarifiers, and chlorine disinfection. In 2016 the plant was upgraded to implement biological nutrient removal. This upgrade consisted of new side-stream treatment, 4.5-million-gallon biological reactor tankage and numerous associated appurtenances to upgrade treatment capabilities for nitrogen removal.

### 2.2.2 Wastewater Pump Stations

The Front Street Sewage Pump Station, located at 830 South Front Street, receives combined sewage flows from the 42-inch by 42-inch Front Street interceptor and 60-inch diameter Paxton Creek interceptor. The Pump Station was constructed in the late 1950s. Annual average daily flow ranges between 12 and 20 MGD with peak daily flows exceeding the station design capacity of 43.2 MGD in 2020 with a peak daily flow of 62.8 MGD being recorded. The Pump Station conveys flow approximately 6,100-feet to the AWTF through a 48-inch diameter cast iron force main joined by the contribution of Spring Creek Pump Station into the force main approximately 2,000-feet upstream of the AWTF. The Front Street Pump Station underwent a rehabilitation project to replace the aging infrastructure at the station and increase peak capacity to 60 MGD. The rehabilitation project was awarded in September 2018 with a total cost of \$12.5M. The majority of the construction activities for the project have been completed and the contractor is currently addressing punch list work in order to achieve to substantial completion.

The Spring Creek Pump Station was originally constructed in 1959, and it currently conveys average daily flows of 5.12 MGD to the AWTF with a peak design capacity of 28.9 MGD. The pump station is located just southwest of the intersection of South Cameron Street and Magnolia Street and serves the southern portions of the wastewater collection system. Wastewater enters the station through a 24-inch diameter cast iron interceptor on the east side of the station and a 27-inch diameter reinforced concrete pipe interceptor on the south side. The station is equipped with three sewage pumps that discharge through a 24-inch diameter cast iron line, which ultimately connects to the 48-inch diameter force main from the Front Street Pump Station. The Spring Creek Pump Station also has a permitted combined sewer overflow (CSO) chamber that relieves the system during high flow events. The Spring Creek Pump Station is nearing the end of its useful life, and CRW has begun evaluating potential improvement options for how to implements improvements to the station. CRW is waiting to determine capacity and screening requirements for upgrading or replacement/relocation of the Spring Creek Pump Station once they have a better idea of how the Front Street PS upgrade affects flow management of the system. A tentative CIP project has been scheduled for FY2026 for a future Spring Creek PS project for approximately \$14.1M through FY2028.

There are also two small pump stations (City Island North Pump Station and City Island South Pump Station) that convey wastewater flow from City Island to the Front Street Interceptor and eventually to the Front Street Pump Station. CRW also operates the Market Street Pump Station, which conveys stormwater from a railroad underpass to Paxton Creek.

### 2.2.3 Wastewater Conveyance

CRW operates and maintains 59 CSO regulator structures located along the Front Street, Paxton Creek, and Hemlock Street interceptor sewers, which ultimately direct combined wastewater (sanitary wastewater and stormwater) to the AWTF. During dry weather conditions, the CSO regulator structures divert all of the combined wastewater from the trunk sewer lines to the interceptor sewers. During wet weather, the rate and volume of the sanitary and stormwater flow from the system of collector sewers increases significantly and can exceed the capacity of the downstream interceptor sewers and the AWTF. When this occurs, the CSO regulator structures (oftentimes called diversion structures) divert a controlled volume of flow to the interceptor, while untreated excess combined wastewater is discharged to receiving waters. The receiving waters are the Susquehanna River for regulator structures along the Front Street interceptor and Paxton Creek (a tributary of the Susquehanna) for regulators along the Paxton Creek and Hemlock Street interceptors.

There are also CSO outfalls at the Front Street Pump Station and the Spring Creek Pump Station. These are permitted emergency outfalls (CSO-002 and CSO-003) that only activate during a mechanical failure of the pump stations or if the station capacities are exceeded during large storms. Each regulator has a dedicated outfall, except in one case where two regulators serve a common outfall. Therefore, there are a total of 61 outfalls (including those from the pump stations) in the system.

In addition, the wastewater conveyance system also includes approximately 36 miles of sanitary sewers, 40 miles of stormwater sewers, and 101 miles of combined sanitary and stormwater sewers.

## 2.3 Management and Staffing

CRW is governed by a five-member Board of Directors. A management team headed by the Chief Executive Officer is responsible for technical and administrative operations of CRW, as well as the implementation of programs, policies, and procedures, and the execution of contracts upon approval by the Board. In addition to providing drinking water services, CRW also provides wastewater services. CRW operates as one entity; however, CRW separately tracks and records the provision of services associated with each of the utilities that it manages and operates.

CRW's organizational chart is made up of five departments as well as an Executive Team and Human Resources. Both Drinking Water and Wastewater Operations were combined in 2020 with a Director of Operations managing both departments. CRW did not previously have a Director of Operations for Drinking Water and had a vacancy in the Superintendent of Water Operations position, so this new position assists with managing reporting requirements and other higher level management tasks. The five departments are as follows: Finance, Engineering, Operations, Shared Services, and Strategic Initiatives. An overview of the current organization structure of CRW is shown in **Figure 2-2**.



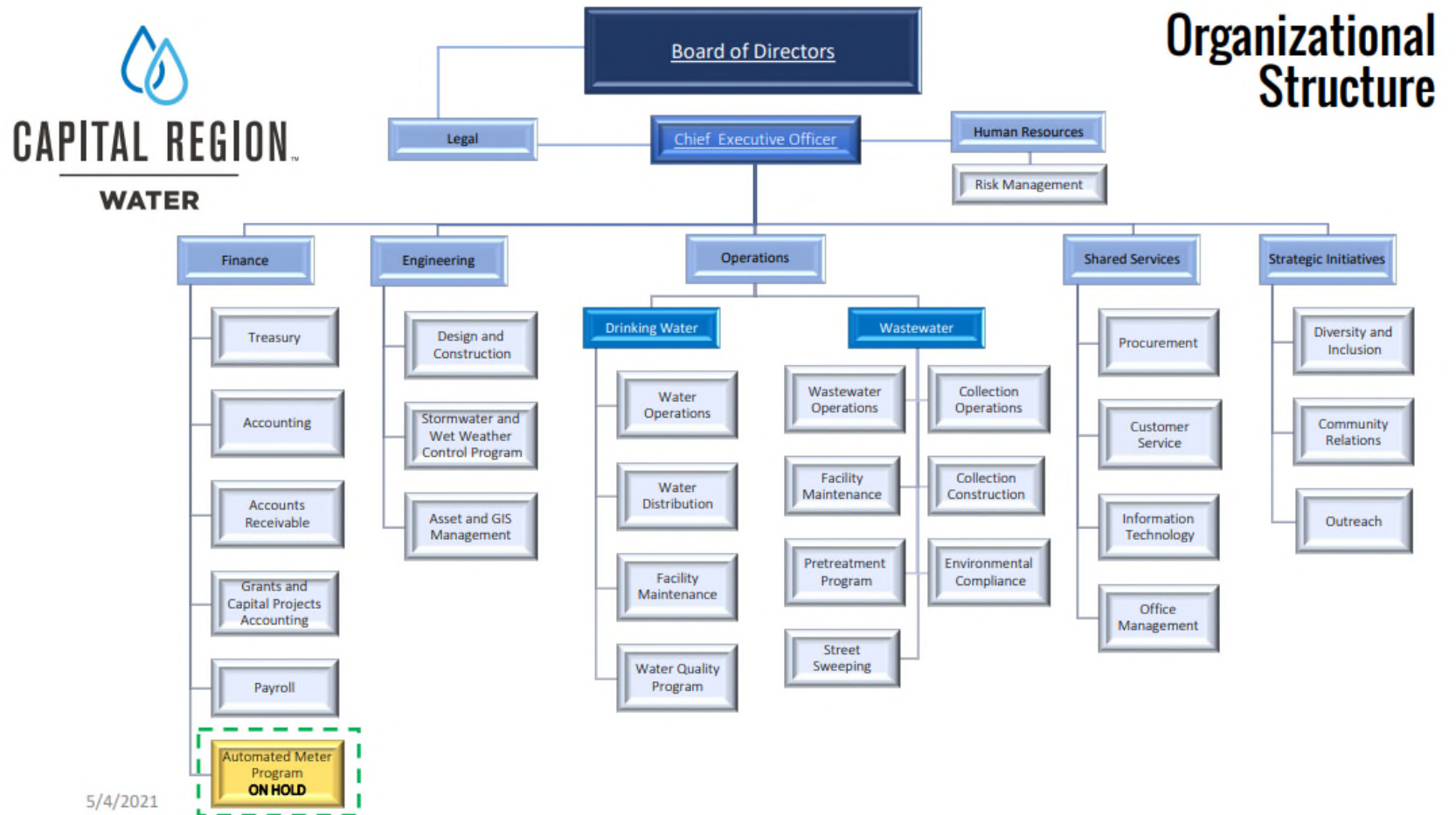


Figure 2-2: CRW Management Level Organizational Chart

### **2.3.1 Administration, Strategic Initiatives, Engineering, Finance, and Water/Wastewater Departments**

The Drinking Water and Wastewater Departments are responsible for operation and maintenance (O&M) of facilities, permit compliance, tracking and reporting, energy management, monitoring, long-term planning, repair and construction, and assistance in budget preparation and tracking. The Wastewater Department includes plans for 55 positions, with 53 positions filled as of July 2021. The Wastewater Operations organizational chart is provided in **Figure 2-3**.

The Administrative Department provides office management, information technology, customer service, and procurement services. The Engineering Department provides engineering support, project coordination, GIS coordination, wet weather coordination, and asset management services. The services currently provided by the Finance Department include accounting, billing and collections, customer service, and payroll. The Executive Team provides legal and human resources services. A Strategic Initiatives Department provides diversity and inclusion as well as community outreach and communications.

It is understood that CRW plans to staff the Administrative Department, Engineering Department, Finance Department, Strategic Initiatives, and Executive Team with a total of 53 positions (17 for Administration, 9 for Engineering, 14 for Finance, 5 for Strategic Initiatives, and 8 for Executive), and as of May 2021, 47 of the 53 positions have been filled. Personnel expenses associated with these departments are allocated to each of the utilities based on budgeted time allocated to each of the services.

In summary, CRW's FY 2021 Wastewater System budget includes estimated costs associated with the current and planned employees dedicated to the Wastewater System and the Wastewater System's share of costs associated with the planned positions under the Administrative, Engineering, Strategic Initiatives, and Finance Departments as well as the Executive Team, which all provide support to CRW's water and wastewater utilities. These employees are all employees of CRW, with the majority belonging to a collective bargaining unit.

The organizational structure of CRW provides strong opportunities for economies of scale through the sharing of administrative, engineering, finance, and executive services between the water and wastewater utilities. The structure is generally consistent with similar-sized, combined utilities and it appears that all required Wastewater System functions of CRW are adequately staffed.

Due to COVID-19, CRW has maintained adjusted staffing. The Maintenance and Field crews have each split into two teams and are isolated from each other to prevent cross-exposure. Teams continue to be split to limit contact with each other and start times were adjusted. The operations staff continue to working normally except 8-hour employees were changed to 12-hour shifts to limit contact between operations teams. The teams adjusted their end of shift updates to limit contact. The in-house lab staff is back into one group. If an exposure occurs, CRW plans to outsource regulatory required testing. There was a reduction in extra process control testing but all required testing and significant process control testing is being completed. As case rates change, management is adjusting required protocols as necessary to keep safety as the main priority. Despite smaller crews, the maintenance department was able to continue making repairs as needed and was able to keep up with preventative maintenance work orders. Field Maintenance numbers such as feet televised and cleaned is down from normal due to the



smaller crews. Hauled-in waste program changes were made and include haulers collecting their own samples for analysis and paperwork is left in a drop box to limit contact between drivers and CRW operations staff.

CRW began street sweeping responsibilities on August 3, 2020. The program was initially delayed due to equipment arrivals and training on the new equipment. CRW had purchased three street sweepers and will operate two sweepers daily. Sweepings are disposed in the grit lagoon at the plant for dewatering. Once dry, the sweepings will then be handled at the Harrisburg Incinerator. In 2021, citizen complaints have decreased dramatically due to the program. During heavy rain events, street sweeping is cancelled, and staff perform checks of storm inlets around the city to make sure they are not blinded by trash or debris.



# Wastewater

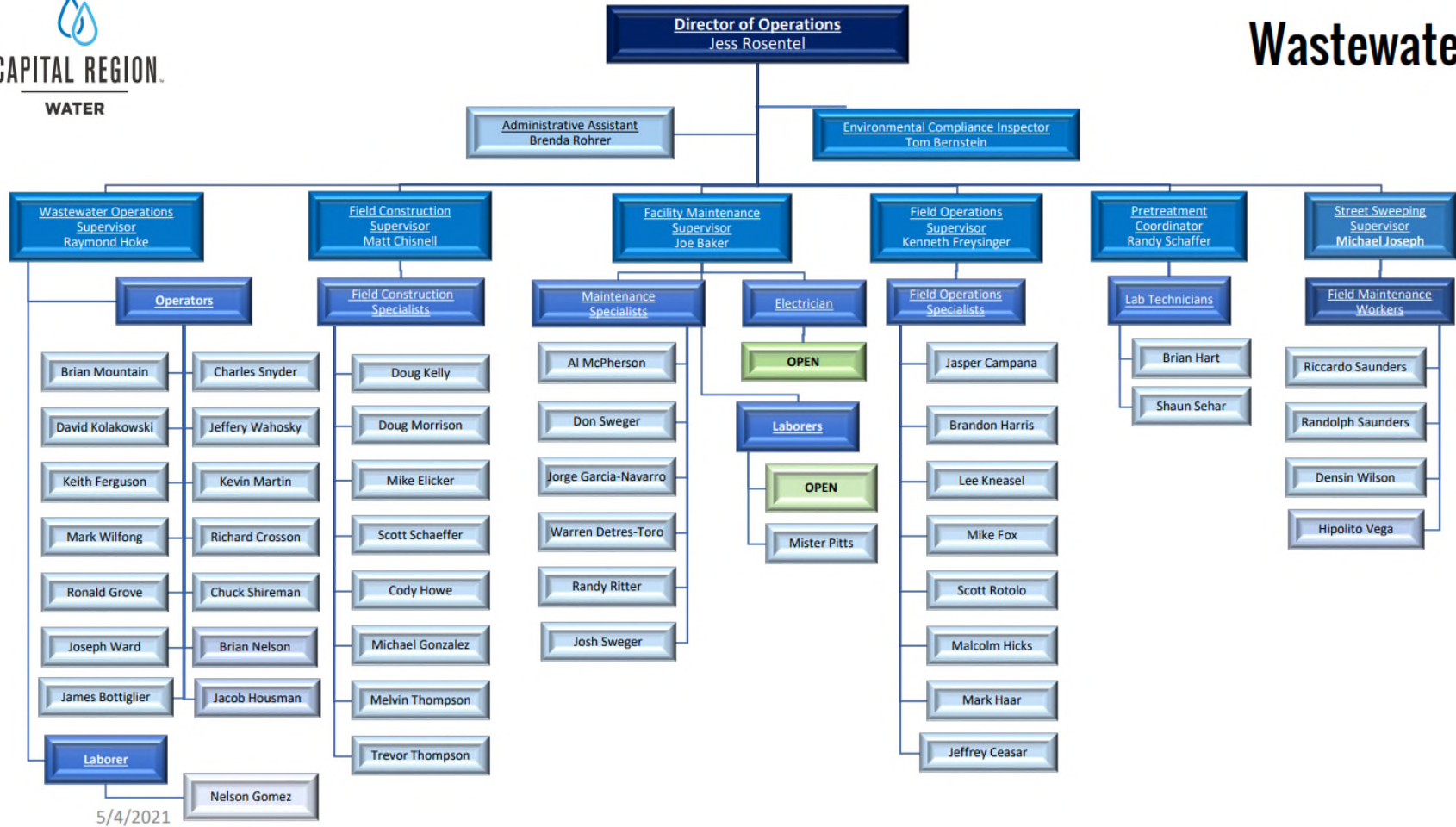


Figure 2-3: Wastewater Operations Division Organizational Chart

## 3 Wastewater System Performance

### 3.1 Service Area

The wastewater system provides service to City retail customers and suburban community wholesale customers. The suburban communities account for approximately half of the revenues of the conveyance and treatment systems and include Susquehanna Township, Lower Paxton Township, Swatara Township, Paxtang Borough, Penbrook Borough, and Steelton Borough, all of which are located in Dauphin County. A map of the wastewater system's service area is included in Appendix A.

### 3.2 Customer Base

CRW maintains approximately 17,000 active connections within the City. Suburban communities are billed on a wholesale basis with their allocation based on an estimate of individual account data for customers located in these communities. Some suburban customers are billed based on metered water consumption, while others are billed based on the estimated number of equivalent dwelling units within their customer base. For 2020 billing purposes, one equivalent dwelling unit has been assumed to equal 45,000 gallons of annual water consumption. During FY 2020, suburban communities were billed for approximately 2.1 billion gallons of wastewater flow.

The number of customers and billed wastewater flow by class for customers located within the City are shown in **Table 3-1**. The total billed wastewater flow for Suburban communities is also shown in the table.

Table 3-1: Customer Information

Description	Accounts	Billed Wastewater Flow (1,000 gal.)
City of Harrisburg:		
Residential	14,786	753,646
Commercial	1,695	432,165
Industrial	22	53,959
Public / Institutional	71	75,407
Total	16,574	1,315,177
Suburban Communities <sup>1</sup> :		
Penbrook Borough	n/a	68,585
Paxtang Borough	n/a	35,471
Swatara Township	n/a	429,239
Lower Paxton Township	n/a	791,512
Susquehanna Township	n/a	626,616
Steelton Borough	n/a	120,733
Total	n/a	2,072,156
<b>Combined Total</b>	<b>n/a</b>	<b>3,387,333</b>

Source: FY 2020 customer and billing data provided by CRW.

<sup>1</sup>EDU basis for residential portion of Suburban Communities reduced from 65,000 gallons/yr to 45,000 gallons/yr in 2018

### 3.3 Regulation and Compliance

CRW's AWTF is permitted to discharge to the Susquehanna River under National Pollutant Discharge Elimination System (NPDES) Permit No. PA0027197. CRW's permit renewal application was submitted in July 2014 and is currently under review. The information in section 3.3.1 and 3.3.2 was obtained from the Chapter 94 Municipal Wasteload Management Report for Calendar Year 2020, and Semi-Annual Report on Consent Decree Implementation for July 1, 2020 to December 31, 2020, dated March 2021.

#### 3.3.1 Operation and Performance

In FY 2020, the average annual wastewater flow received at the AWTF was 19.5 MGD, with the highest month being December with an average flow of 24.4 MGD, and the maximum 3-month average of 23.4 MGD during March to May 2020. The permitted design hydraulic capacity flow for the AWTF is 45.0 MGD. No hydraulic overloads were recorded in 2020, as the monthly average flow at the AWTF did not exceed the design capacity of 45.0 MGD in any month during the year. In addition, the average flow at the AWTF in FY 2021 (through June), was approximately 20.4 MGD and the highest average flow on a per month basis occurred in March and was 23.8 MGD. Based on flow projections for the City, and contributing municipalities, no hydraulic overload conditions are projected through FY 2025, as the annual average flow in that year is projected to be 23.3 MGD.

In FY 2020, annual average biochemical oxygen demand (BOD) loading was 25,663 pounds per day with a maximum one month loading of 30,076 pounds per day. The permitted average daily organic loading for the AWTF is 68,257 pounds BOD per day. No organic overloads were recorded in 2020 and no overload conditions are expected through 2025, as the annual average organic loading is projected to be 24,651 pounds per day over the period from 2020 to 2025. Over the past five years, the average organic waste strength of the sewerage received at the AWTF has averaged at 139 milligrams per liter (mg/L). The organic waste strength of the sewerage is not expected to increase significantly over the next five years.

With the completion of the AWTF Nutrient Removal Upgrade (BNR) project in 2016, CRW has realized a significant decrease in the concentration of nitrogen in the effluent from the AWTF. For example, in 2015, the average concentration of nitrogen as sampled from effluent was 22.4 mg/L; in FY 2018 the average concentration of nitrogen in the effluent was 7.0 mg/L, in FY 2019 the average concentration of nitrogen in the effluent was 8.0 mg/L, in FY 2020 the average concentration of nitrogen in the effluent was 7.0 mg/L, and in FY 2021 (January -June) the average concentration of nitrogen in the effluent was 8.0 mg/L.

### 3.3.2 Permit Exceedances

CRW did not exceed any of its NPDES permit requirements in 2020.

### 3.3.3 Sewer Overflow and Bypass Events

There were 18 secondary bypass events during 2020. A secondary bypass event is where there is excess wastewater flow received at the secondary treatment train above 45.0 MGD, causing the wastewater flow to bypass secondary treatment. Three of the bypass events exceeded 12 hours in duration, with the longest bypass event lasting longer than 108 hours.

CRW has a combined sanitary and stormwater system, which conveys wastewater and stormwater runoff during wet weather periods. Regulators and diversion chambers divert excess flow to Paxton Creek or Susquehanna River during wet weather events. Wet weather events occur when the combined flow exceeds the dry weather peak flow capacity. CRW's discharge permit authorizes discharges from regulators and diversion chambers; however, it does not authorize overflows from sanitary sewers or discharges from other than identified combined sewer regulators and diversion chambers. A summary of the SSO events and combined sewer unauthorized discharges during the 2020 reporting period are listed in Table 3-2.

Table 3-2: Sanitary Sewer Overflows and Unauthorized Discharges (2020)

Date	Location	SSO or UD	Issue	Duration (Hrs.)
1/17/20	1336 N 15th St	SSO	Backup in building; broken pipe/blockage at manhole	14
1/27/20	SSMH-000690 Spring Creek Interceptor	SSO	Surcharged manhole; wet weather	-

Date	Location	SSO or UD	Issue	Duration (Hrs.)
6/17/20	385 Hale Ave	SSO	Backup in building; debris/blockage removed	2
7/2/20	321 N Front St	UD	Unknown small diameter lines	4
10/1/20	1001 S 17th St	SSO	Backup in basement; stones/rags/grease removed from main	3
10/6/20	Christian St & Sylvan Terrace	UD	Collapsed pipe	2
10/22/20	104 N 2nd St	UD	Collapsed pipe	3
12/3/20	1519 S 12th St	SSO	Backup in basement; root balls removed from main	2
12/3/20	427 Hale Ave	SSO	Grease accumulation	1

Source: Chapter 94 Municipal Wasteload Management Report for Calendar Year 2020, and Semi-Annual Report on Consent Decree Implementation for July 1, 2020 to December 31, 2020, March 2021.

### 3.3.4 Partial Consent Decree

In August 2015, CRW entered into a partial Consent Decree with the Department of Justice, the U.S. Environmental Protection Agency, and PADEP concerning the operation of its collection system, pump stations, and AWTF. The Consent Decree requires CRW to complete a Long-Term Control Plan for its combined sewer system, update the Combined Sewer System Operations and Maintenance Manual and Nine Minimum controls, obtain a MS4 permit and establish a Stormwater Management Program, and implement early action projects. In 2020, CRW fulfilled its partial Consent Decree requirements for deadlines due during this reporting period, including the following:

- Completion of its Annual Update of the Nine Minimum Controls plan
- Completion of its Semi-Annual Report on Consent Decree Implementation
- Completion of a Chapter 94 Annual Wasteload Management Report
- Preparation of its updated Long-Term Control Plan (City Beautiful H<sub>2</sub>O Program Plan) in March 2018. The following have been completed in support of the LTCP:
  - Completion of five green stormwater infrastructure projects.
  - Completed the CSO/wet weather alternatives evaluation.
  - Performed a Financial Capabilities Analysis (FCA) according to U.S. EPA protocol. CRW is currently working on a revised FCA in response to EPA comments.
  - Conducted community stakeholder workshops.



- Met with USDOJ/USEPA/PADEP on 12/8/2020 to continue discussion on the legal strategy to modify the Consent Decree. CRW is waiting for USDOJ to provide a proposed amended partial Consent Decree to review.
- LTCP has yet to be approved by EPA and DEP.
- Front Street Ph. I Interceptor Priority Remedial Work

CRW has met compliance dates for the reporting period January 1, 2021 to June 30, 2021 corresponding to Semi-Annual Report on Consent Decree Implementation and Chapter 94 Annual Wasteload Management Report.

CRW completed upgrades to its AWTF in 2016 with biological nutrient removal in order to comply with the Chesapeake Bay Tributary Strategy and meet new NPDES permit discharge requirements. This \$50 million project at the AWTF consisted of adding biological nutrient removal technology to the existing processes to achieve nitrogen and ammonia removal requirements associated with the new NPDES discharge permit. With the project now complete, CRW has the ability to generate nutrient credits. However, as reported by CRW, based upon the current market value of the credits, it is not cost-effective to generate credits at this time.

### **3.3.5 Wet Weather Program Accomplishments**

CRW's progress during FY 2020 and FY 2021 under its Wet Weather Program included the following accomplishments:

- Submitted the Nine Minimum Controls Plan Update on August 10, 2020.
- Continued to provide updates and review to the OMM to implement improvements in the 2020 Annual Update.
- Continued to expand the development of the sewer maintenance management system, including the GIS and Cityworks systems, including development of training protocol for all Cityworks users and is incorporating additional reporting related to maintenance and regulatory activities within the sewer system from the Cityworks data. CRW continues to update their GIS database, and recent additions include incorporating capital projects.
- CRW continued to implement their CSO hotline with the status of CSO events and continued to conduct public outreach, education, and notification programs.
- CRW received a new MS4 permit in 2020. CRW partnered with Lower Paxton Township and Susquehanna Township to prepare a Joint Pollutant Reduction Plan which was approved by PADEP in 2020.
- Continues to monitor 8 precipitation gauging sites as well as gauge adjusted radar rainfall, 4 flow meters monitoring flow from the satellite communities, and 8 combined sewer interceptor flow meters.
- Continued maintenance of Green Stormwater Infrastructure Projects at the following sites: Cloverly Heights, Penn & Sayford, Royal Terrace, Summit Terrace, and 3rd Street in Harrisburg.
- Revised the Green Stormwater Infrastructure Operation and Maintenance Manual to include a Landscape Maintenance Program for the completion of monthly surface maintenance on constructed SCMs, implemented training to educate CRW employees and contractors on the function and

maintenance of both surface and subsurface components of GSI systems, and developed an asset management system for GSI and integrate into Cityworks.

### 3.3.6 Nine Minimum Controls Plan

CRW developed a detailed approach to achieve future compliance with each of the Nine Minimum Controls (NMCs), which was submitted in the August 2015 NMC Plan and has been updated annually. In many cases, the compliance measures have already been implemented, such as daily CSO regulator inspections. In other areas, additional information is required to implement some of the NMCs, and CRW has undertaken efforts necessary to collect the data. Efforts related to the NMC Plan that have been completed include the following:

- Prepared the 2020 NMC Plan Update to address EPA comments
- Identified critical trunk sewers and completed manhole inspection data review
- Refined the sewershed and catchment delineations using the manhole investigation data
- Updated the GIS system with collection system manhole investigation and rapid assessment data
- Advanced CRW's risk-based asset condition/criticality rating system to be used to establish priorities for CCTV inspections and subsequent cleaning and repair projects.
- Completed an internal force main inspection and found no critical deficiencies. Routine force main monitoring continues.
- Continued to implement and optimize Cityworks for the management of complaints and service requests and operations and maintenance of AWTF and pumping stations
- Continued to perform daily regulator inspections at each regulator

The following efforts are ongoing by CRW related to its NMC Plan:

*Conduct proper operation and regulator maintenance of the conveyance and collection system:*

- Initiation of a comprehensive systemwide CCTV inspection and assessment of the collection system
- Identification of key equipment purchases
- Allocating funds to address Priority 1 projects within the next five years
- Continued to provide training to staff
- Continued to perform daily regulator inspections
- Address potential river intrusion during design of future regulator improvement projects under baseline City Beautiful H<sub>2</sub>O Program Plan (CBH2OPP) implementation
- Continued to implement practices outlined in the Operations and Maintenance Manual (OMM)
- Continued with an ongoing inlet cleaning and inspection program
- Continued to inspect and maintain pump stations as outlined in the OMM
- Continued to optimize Cityworks for data management and maintenance problems
- Continued to investigate and repair sinkholes in accordance with the OMM

*Maximize use of storage in the collection systems:*

- Continuing to prioritize areas of the collection system for remedial repair based on an overall schedule for cleaning, rehabilitation, and replacement as part of the core risk analysis in the asset management program and LTCP plan implementation.
- Continuing to clean interceptors every 5 years following rehabilitation of each interceptor.
- Intention to use a decentralized green grey local control strategy during the implementation of the LTCP to provide storage to reduce CSOs and unauthorized releases (e.g., basement backups) within the collection system

*Maximize flow to the AWTF:*

- Continued to operate the system in accordance with the OMM
- Developed H&H Model to assess system capacity; calibrated H&H model; characterized existing system performance
- Implement CSO regulator/outfall enhancements recommended as a baseline control under the LTCP
- Conducted flow monitoring to characterize wet weather inflows from suburban communities
- Prepared Capacity Assessment Report; no significant I/I reductions recommended
- Evaluated the AWTF flows for the preparation of the Chapter 94 Report
- Completion of upgrades to the Front Street Pumping Station

*Eliminate dry weather overflows:*

- Reported dry weather overflows in accordance with regulatory guidelines
- Implement weir height adjustments for the Baseline Level of Control
- Removed blockages and modified hydrant flushing operations to correct dry weather overflows.
- Conducted daily inspections as detailed in the OMM
- Removed waste material that accumulated on the stream banks.

*Operate and maintain the combined sewer system to control solid and floatable materials:*

- Removed waste material that accumulated on the stream banks

*Implement public notification procedures set forth in the NMC plan:*

- Installed temporary signs at each CSO outfall and public stream access point that notify and alert the public.
- Continued to develop a public outreach and notification program as described in the NMC Plan
- Continued to increase public involvement activities, including monthly trash clean-ups, and presentations at community events.

*Utilize a phased approach to characterize CSO impacts and control efficacy:*

- Employed visual inspections of regulator and outfalls daily

- Continue to monitor rainfall at rain gauges
- Use calibrated H&H model to quantify and characterize CSOs in semi-annual reports

*Evaluate the efficacy of the NMC Plan:*

- Updated the NMC Plan

*Submit MS4 Individual Permit Application with a Stormwater Management Plan:*

- Continued implementing a TMDL Strategy in collaboration with two neighboring municipalities
- Continued with field investigations to identify outfalls and a map of the MS4 system
- Continued to conduct stormwater management plan reviews through coordination with the City of Harrisburg
- Implemented rules and regulations for stormwater management
- Pursuing an MOU with Dauphin County Conservation District (currently functioning under an existing MOU with City of Harrisburg)

### **3.3.7 Operations and Maintenance Manual**

CRW reviewed ongoing maintenance and operation efforts and developed improved practices for compilation in the new Operations and Maintenance Manual (OMM). The OMM defines the critical equipment and facilities for the AWTF and collection/conveyance systems. The OMM also includes detailed procedures, complete with checklists, for the following system components: CSO regulators, outfalls and backflow prevention gates, pump stations, interceptors, force mains, collection system and manholes, and inlets and catch basins. The OMM also outlines emergency procedures, citizen complaint tracking, sinkhole remediation, and education programs. The OMM document was originally submitted on August 10, 2015, and the latest version (V5.0) was released in March 2021.

### **3.3.8 Data Management Systems**

CRW has developed a Cityworks™ data management system for their sewer system. Cityworks was implemented on October 20, 2015. This software is the recordkeeping tool for maintenance activities and will assist in reporting requirements of the partial Consent Decree. From January to December 2020 the following items have been documented in Cityworks for sewer system maintenance and inspection activities and reported in the Semi-annual Report on Consent Decree Implementation (September 2020 and March 2021):

- 348 inlets were cleaned and 191 were repaired
- 27 sinkholes were investigated or repaired, 7 were due to wastewater infrastructure (according to Wastewater Division Monthly Report, December 2019)
- 4,040 work orders completed, including pipe flushing, cleaning out manholes and repairing manholes
- 125,664 linear feet of collection system sewer were cleaned and televised
- 1,664 hotspot inspections

- 21,286 daily CSO inspections

### **3.3.9 Industrial Pre-Treatment**

CRW maintains an Industrial Pre-Treatment Program to ensure that industrial users comply with federal state, and local pre-treatment program effluent discharge limitations and regulations. Industrial user compliance eliminates interference or possible damage to the conveyance and treatment system, untreated waste from passing through the AWTF to the receiving stream, the contamination of sludge which limits disposal and reuse options, and the exposure of personnel to chemical, explosion or fire hazards.

One new industrial user was permitted in 2020, which brings the total number of permitted industrial users to nine. Of the nine permitted industrial users, one is classified as categorical and eight as non-categorical industrial users. Inspection and sampling activities performed during the year included facility inspections, self-monitoring inspections, and compliance sampling. During 2020, no permitted industrial users were on a formal compliance schedule for non-compliance. However, during the 2020 calendar year, one violation notice was issued for a sampling and reporting violation due to a retirement and transition to a new pretreatment oversight signatory.

## 4 Wastewater System Condition

### 4.1 Overview

CRW staff aim to ensure the entire Wastewater System is properly operated and maintained. The cost to provide routine and preventative maintenance is included in CRW's annual operating budget. CRW uses a proactive preventative maintenance program and a systematic replacement policy for inventory parts to minimize downtime.

Additionally, CRW has developed a comprehensive asset management program for the wastewater system which will further enhance preventative maintenance and increase system reliability. Asset registries have been developed for all CRW treatment plants, pumping stations, storage facilities, and the DeHart Dam facility. CRW has developed a risk register for CRW's buried assets and established high-level replacement, rehabilitation, and condition assessment cost estimates.

Development of the Wastewater Collection System Asset Management Plan was completed in January 2020. The plan provided CRW with strategies for operations, maintenance, capital investments, and funding.

### 4.2 Condition Assessment

Arcadis conducted a limited condition assessment of the key components of CRW Wastewater System, which included a review of existing information provided by CRW, discussions with CRW staff, and visual observations during field visits held on August 9, 2021. Based on the type of facilities, available documents related to the facilities, and previous experience with similar facilities, a representative sample of facilities was inspected on a limited basis to visually confirm the information provided, identify any apparent capital improvement needs, and discuss reliability and O&M performance with the operation and maintenance staff. No field investigations were conducted for buried infrastructure.

The condition assessment of the facilities in the Wastewater System was based on numerical ratings for the following criteria:

- Appearance of mechanical, structural, and electrical components
- Reliability
- O&M performance
- Capacity
- Regulatory compliance

Based on the evaluations using the above categories, an overall risk rating was assigned to each of the major assets. The risk ratings for each of the five categories above are outlined in **Table 4-1**.



**Table 4-1: Summary of the Rating System**

Numerical Rating	Interpretation of Rating	Description
1	Little to no risk	Relatively new and in good physical and operating condition.
2	Some risk	Good condition, no known capital requirements.
3	Moderate risk	Aged or worn but generally in good operating condition may require capital investment within 5 years.
4	Significant risk	Operational but nearing end of life and / or requires investment to bring to full operating condition.
5	High risk	Should be on high priority for renewal and/or replacement.

The following **Table 4-2** presents a summary of the risk ranking for each of the major facilities based on a review of the available information and limited visual inspections.

**Table 4-2: Major Assets Risk Rating**

Major Asset	Risk Rating	Change from Prior Year
AWTF	2.2	-0.5
Pump Stations and CSO Regulators		
<ul style="list-style-type: none"> <li>• Front Street Pump Station (1.0)</li> <li>• Spring Creek Pump Station (3.3)</li> <li>• City Island North Pump Station (2.0)</li> <li>• City Island South Pump Station (2.0)</li> <li>• Market Street Stormwater Pump Station (2.1)</li> <li>• Combined Sewer Overflow Regulators (2.0)</li> </ul>	2.1	-0.3
Interceptor Sewers		
<ul style="list-style-type: none"> <li>• Front Street Interceptor (4.1)</li> <li>• Paxton Creek Interceptor (4.8)</li> <li>• Hemlock Street Interceptor (3.0)</li> <li>• Spring Creek Interceptor (3.0)</li> <li>• Paxton Creek Relief Interceptor (3.0)</li> <li>• Asylum Run Interceptor (3.0)</li> </ul>	3.5	No change
Collection System	3.0	No change
Separate Stormwater Collection System	3.0	No change
<b>Overall System Rating</b>	<b>2.8</b>	<b>-0.1</b>

Overall, the Wastewater System is in fair condition; however, some components are aged and will require investigation and capital investment to preserve the asset and maintain appropriate system performance and delivery of services.

The risk rating of the AWTF has been lowered from the prior year due to recent improvements such as the in-house rehabilitation progressing with the primary clarifiers, rebuilt pump and drive at the settled sewage pump station, and minor improvements to the gravity thickener piping. The risk rating of the Spring Creek Pump Station has been raised from the prior year due to further deterioration. The risk ratings have not changed for the Market Street Pump Station and the City Island Pump Stations. The risk rating has been lowered for the Front Street Pump Station due to the recent rehabilitation and upgrade of the pump station.

An arc flash study is recommended for the wastewater system in order to be in compliance with current NFPA 70E and OSHA 1910 (Subpart S) regulations. CRW intends to perform the arc flash studies in 2022.

The following provides a summary of the current condition of the major components, the rationale for the risk scores assigned, and the improvements needed to address moderate, significant, and high risks.

#### **4.2.1 AWTF**

The AWTF, located on Elliot Street off South Cameron Street on the City of Harrisburg's border with the Borough of Steelton, treats wastewater conveyed from the Front Street Pump Station, the Spring Creek Pump Station, and the Trewick Street Pump Station (Borough of Steelton). It also treats trucked in wastewater. The site also contains the CRW collection system maintenance garage. The AWTF utilizes grit removal, primary clarification, oxic/anoxic biological treatment, chemical addition, final clarification, and disinfection to treat wastewater prior to discharge to the Susquehanna River. Additionally, AWTF thickens, anaerobically digests, and dewater residuals from the wastewater treatment processes prior to farmland application as Class B residuals. CRW completed major improvements to the biological treatment and final clarification processes at the AWTF in 2016 which were intended to achieve the effluent limits for nutrient removal contained in its discharge permit.

The AWTF appears to be in fair overall physical condition based on the available documents and an Arcadis inspection on August 9, 2021. However, some capital investments and minor additional O&M expenditures should be made within the next five years to ensure continued compliance with effluent limits and reduce operating costs.

CRW has completed construction on primary digester number 2 in late 2020 and is in process with the rehabilitation of primary digester number 1 which should be completed in late 2021 or early 2022.

An energy audit was performed for the AWTF in July 2017. The purpose of the audit was to provide a comprehensive list of energy efficiency improvements that CRW could perform to reduce overall energy consumption. Based on the results of the audit, CRW plans to implement various energy efficiency improvements at the AWTF. Already completed by CRW was the installation of a dissolved oxygen (DO) probe in the final effluent channel that measures the oxygen in the effluent and reduced the number of blowers in operation to maintain adequate DO without over aerating. CRW is currently evaluating

alternatives for the implementation of solids handling improvements that would modify existing piping in the waste activated sludge (WAS) and return activated sludge (RAS) pump stations to allow for RAS to be wasted instead of mixed liquor suspended solids (MLSS). By wasting RAS instead of MLSS, the pumping requirements are significantly reduced due to the increased solids concentration of the RAS compared to the MLSS.

Additionally, CRW is in the process of implementing improvements to the existing primary clarifiers. The improvements to be made include the following:

- Structural repairs and rehabilitation of all clarifier tanks
- Primary clarifier mechanism replacement of all tanks (inclusive of main and cross collector drive units, chain and flight scrapers, influent gates, effluent weirs).
- Replacement of miscellaneous piping, valves, and actuators.
- Primary sludge pump replacement (2 units).
- Replacement of decant pump in the decant pump vault.

Currently, in-house crews have begun replacement of drives, gears, electrical, and other components in the primary clarifiers. The number 1 tank was completed, and the number 2 tank has been dewatered and work is progressing and will be completed in 2021. The remaining 2 tanks should be completed in 2022. The grease collection system and weirs are scheduled to be replaced within the next 5 years.

#### **4.2.1.1 Biosolids Facility Review**

In March 2017, a Biosolids Facilities Existing Conditions Report was completed by Whitman, Requardt & Associates (WRA). The purpose of this report was to provide an assessment of the current conditions of the solids treatment and handling systems at the AWTF. Based on the Biosolids Facilities Existing Conditions Report, WRA submitted in June 2017, a Preliminary Biosolids Facilities Improvement Plan for CRW, which included several recommendations as part of the improvement plan, including:

- Process modifications to separately thicken waste activated sludge and primary sludge
- Upgrade of the primary digesters
- Replacement of gravity thickener facilities
- Upgrade of the dewatering facilities
- Construction of a hauled waste facility
- Replacement of the boiler building
- Replacement of the combined heat and power (cogeneration) system equipment
- Replacement of the gas collection, storage and pretreatment systems

The opinion of probable construction costs for the biosolids facility improvements total \$52.3 million, with a low estimate of \$42.4 million and a high estimate of \$75.5 million. The report provides phased schedule for construction beginning in 2017 for the primary digester improvements and extending to 2024 for the dewatering facility improvements. CRW has proceeded with the primary digester improvements which is currently under construction. The Primary Digester Improvements project is based upon the May 2017

Basis of Design Report prepared by WRA for the Rehabilitation of the Primary Digester Facilities. The improvements include the rehabilitation of the primary digester facilities equipment to replace old components with new and upgrade the digester mixing system. In addition, the project includes an electrical building to help facilitate the replacement of old electrical gear and provide a central power distribution facility to serve the southern part of the AWTF. The engineer's opinion of probable construction cost was \$10.1M, however the awarded construction contract value is \$8.8M. Currently construction is underway, having started in the summer of 2018 with the first digester online in 2020 and the second digester to be online late 2021 or early 2022. Delays during leak testing of the primary digester led to lining the digester and delayed the start of the second primary digester. CRW also noted that there were leaks along the gravity thickener piping from the primary clarifiers and to the digesters and these were replaced in early 2020. In 2021, CRW installed flow meters on each of the gravity thickener pipes to the digesters and installed a density meter on one of the pipes.

CRW is moving forward with replacement of the combined heat and power (CHP) system; the design stands at 90% complete for comprehensive replacement of their biogas utilization and will be purifying the methane into renewable natural gas. CRW intends to prioritize work on the secondary digesters following completion of the primary digester improvements. Remaining biosolids facility projects will be evaluated for priority as the above projects are completed.

Additionally, from 2013 to present, nearly all of the biosolids generated by CRW have been land applied for beneficial use by agriculture. Biosolids hauling to the farms is provided by a contracted hauler. The 13,250 wet tons of biosolids produced by CRW requires approximately 623 acres of beneficial use. CRW has approximately 1,131 qualified acres (including 110 acres acquired in 2021), which provides a buffer of 508 acres. WRA recommended that an additional 30 acres of qualified acreage be added to the current land base over the next 1 to 5 years for beneficial biosolids disposal.

Recommendations from WRA's regulatory biosolids review include a recommendation that CRW should periodically have a phosphorous source coefficient test performed as part of routine monitoring, which can be used in the future in site index calculations of phosphorous management is implemented by PADEP. Further, WRA notes that there are several regulatory and non-regulatory drivers that could potentially affect biosolids land application programs, including limiting phosphorous application, odor considerations, and farmland availability. While there are no federal biosolids regulatory changes planned, PADEP indicated that the new General Permit would include new phosphorous management and hauled waste requirements. CRW's qualified acreage has been approved by PADEP.

## **4.2.2 Pump Stations**

CRW maintains five wastewater or stormwater pump stations: Front Street, Spring Creek, City Island North, City Island South, and Market Street.

### **4.2.2.1 Front Street Pump Station**

The Front Street Pump Station is located at 830 South Front Street in the City of Harrisburg and receives combined sewage flows from the 42-inch by 42-inch Front Street interceptor and 60-inch diameter Paxton Creek interceptor. The pump station is currently being upgraded, including replacement of pumps, bar screens, screenings conveyance equipment, controls, and associated improvements to electrical, HVAC,

and building systems to meet current code requirements. Construction of the facility was completed in 2021 with only minor punch list work continuing at the time of the site visit.

#### **4.2.2.2 Spring Creek Pump Station**

The Spring Creek Pump Station is located southwest of the intersection of South Cameron Street and Magnolia Street in the City. It conveys combined sewage from the Spring Creek Interceptor and the Hemlock Street Interceptor to the AWTF. Hazen and Sawyer prepared an engineering report dated April 21, 2015 that assessed the condition of the station as part of an investigation into improving wastewater screen performance at all CRW's major wastewater facilities. The station appears to be in fair overall physical condition based on the available documents and an inspection by Arcadis on August 9, 2021. Many of the pump station components are near the end of their useful life, including the pumps, HVAC system, and electrical and control systems. Capital investments should be made within the next five years to ensure continued operation and to reduce operating costs.

Miscellaneous improvements were made since the previous site inspection. The drives were rebuilt and the roof was repaired to address leaks. The bar screen continues to have minor repairs made to keep it in service.

Spring Creek Pump Station will be evaluated to determine if additional improvements will be made to the existing Spring Creek Pump Station or if a new Pump Station will be constructed along with CSO storage.

#### **4.2.2.3 City Island Pump Stations**

The City Island North Pump Station is located at the north end of City Island in the City of Harrisburg. Sewage is conveyed from the City Island South Pump Station and elsewhere on City Island to the CRW collection system in Harrisburg proper. The station appears to be in good overall physical condition based on the available documents and an inspection by Arcadis on August 9, 2021. During the inspection, there were no noted defects. Currently CRW operates the pump station but has not accepted ownership of the pump station.

The City Island South Pump Station is located near the center of City Island in the City. It conveys sewage from elsewhere on City Island to the CRW collection system in Harrisburg proper. The station appears to be in good overall physical condition based on the available documents and an inspection by Arcadis on August 9, 2021. It was noted during the inspection that the pump station continues to be bypassed and flow is being directed to the City Island North Pump Station. This is due to the lack of pumping requirements out of both facilities as pumping is not required at both stations to accommodate service flow requirements. During the inspection, there were no noted defects. Currently CRW operates the pump station but has not accepted ownership of the pump station.

#### **4.2.2.4 Market Street Pump Station**

The Market Street Pump Station conveys stormwater from a railroad underpass to Paxton Creek. The station appears to be in good to fair overall physical condition based on the available documents and an inspection by Arcadis on August 9, 2021. However, some additional O&M expenditures should be made within the next five years to ensure continued operation and to reduce operating costs. For example,

concrete cracks were observed at the following locations: floor surfaces in the generator building, along the east side of the exterior of the building, and at the stairs leading to the entrance to the Pump Station. Additionally, the 4<sup>th</sup> pump is to be replaced by the end of 2021.

### **4.2.3 Collection System**

CRW wastewater system includes approximately 33 miles of sanitary sewers, 40 miles of stormwater sewers, and 87 miles of combined sanitary and stormwater sewers. Approximately 80% of the collection system was installed prior to 1940. Regulators and diversion chambers serve to divert excess flows to the Paxton Creek or the Susquehanna River during wet weather events.

While the collection system was not inspected by Arcadis during its August 2021 field visit, CRW has completed several inspection efforts associated with its collection system. In April 2017, CRW issued a Collection System Rapid Assessment Findings and Recommendations Report, where the findings of the assessments performed in 2012, 2015, and 2016 were summarized and recommendations were provided. The Report recommended that CRW complete the immediate sewer repairs that were identified and to continue to televise the collection system over the next 4 to 6 years. The remedies range from light to heavy cleaning to point repairs and pipe replacement. Remedial program costs were developed, which estimated the cost to address immediate priority issues at \$2.3 million, high priority issues at \$16 million, medium priority issues at \$32.2 million, and low priority issues at \$35.6 million. The report also provided a schedule for remedial repairs, cleaning and inspection on an annual basis, which consisted of an annual cost of between \$4.0 million and \$4.9 million in years 1-5, and \$4.0 million per year thereafter through 2026.

In October 2019, Herbert, Rowland & Grubic, Inc. (HRG) prepared “Sewer Replacement Project Study Phase – Report of Findings” for CRW following the review of CCTV inspections of the sewer pipe sections completed by CRW. HRG recommends the repair/replacement of the identified sewer sections in their report. The construction cost estimate for the recommended improvements is \$2,070,000 and CRW has recently begun the design phase for these improvements.

In 2020, CRW engaged KCI Technologies to provide CCTV inspection of approximately 50,200 feet of collection and conveyance pipe. KCI provided a memo on January 22, 2021 summarizing the methodology and findings of the CCTV inspections, as well as the associated data management work using Cityworks and GIS. The goal of this work was to obtain quality CCTV to aid CRW in the development of future capital improvement projects.

#### **4.2.3.1 Sewer Interceptors**

CRW operates and maintains a total of six (6) interceptor sewers. Four of these interceptors convey combined wastewater, including the Front Street Interceptor, Paxton Creek Interceptor, Paxton Creek Relief Interceptor, and the Hemlock Street Interceptor. Each of these interceptor sewers receive combined wastewater from trunk lines, and each trunk line has an associated CSO regulator structure and outfall. Two of the interceptors convey sanitary wastewater, including the Spring Creek Relief Interceptor and the Asylum Run Interceptor.



A May 3, 2017 memorandum prepared by CDM Smith provided CRW with an update of the interceptor cleaning and rehabilitation improvements.<sup>1</sup> As the interceptor cleaning was completed, additional inspections of the interceptors were conducted providing better detail and evaluation of the existing conditions than the initial inspections. In some cases, this resulted in expanding the scope of proposed improvements for sewer and manhole rehabilitation. Additional areas were recommended for rehabilitation within the Paxton Creek Interceptor and the Front Street Interceptor. The opinion of probable construction cost for the Paxton Creek Interceptor was estimated to be \$7.3 million, \$1.6 million for the Asylum Run Interceptor, \$9.4 million for the Front Street Interceptor, and \$2.5 million for the Spring Creek Interceptor. CRW completed rehabilitation and replacement of the Asylum Run Interceptor in 2018 (substantial completion was issued in January 2019). However, until the upgrades of the Spring Creek Pump Station are confirmed, the schedule and design of the Spring Creek Interceptor improvements that feeds the pump station cannot be determined.

The Paxton Creek Interceptor rehabilitation project was initiated in 2017 utilizing spin-cast applied geopolymer due to the irregular shape of the pipe. Construction was halted when the condition of the pipe worsened and efforts to control active leakage was beyond the scope of the project. In November 2019, JMT issued a memo which reviewed alternate rehabilitation technologies and recommended sliplining due to potential cost savings of above ground feature restoration. Project is currently on hold pending further engineering evaluations in 2021. Construction is anticipated in 2022.

In March 2019 CDM Smith performed a two-phase evaluation of the rehabilitation/lining alternatives under consideration for the Front Street Interceptor. In August 2020, CRW engaged AECOM to develop contract documents to rehabilitate the remaining non-circular portion of the Front Street Interceptor (14,400-LF) by either Cured-In-Place-Pipe or Segmented-Slip-Lining (competitively). AECOM provided a memorandum in December 2020 recommending the Front Street Interceptor be rehabilitated with Cured-In-Place Pipe. Current schedule anticipates advertisement for public construction bids January 2022 with construction to immediately follow through 2023.

#### **4.2.3.2 CSO Outfalls and Regulators**

CRW operates and maintains 59 CSO regulator structures located along Front Street, Paxton Creek, and Hemlock Street Interceptors, which ultimately direct combined flows of wastewater and stormwater to the AWTF. During dry weather, the CSO regulators divert all of the combined flows from the trunk sewer lines to the interceptor sewers. During wet weather, the CSO regulator structures divert a controlled volume of flow to the interceptors, while untreated excess combined flow is discharged to receiving waters. In addition to the 59 CSO regulator structures and outfalls, there are two additional CSO outfalls at the Front Street pumping station and the Spring Creek pumping station that activate only during mechanical failure of the pump stations or if the pump station capacities are exceeded.

The regulators and diversion chambers are inspected by CRW on a daily basis to ensure proper operation. Furthermore, each of the 59 regulator structures are inspected once per day by CRW.

During the manhole inspections in the fall of 2015, zoom cameras were used to inspect each of the flood chambers, gates, and the outfall pipes. This information was analysed by CRW for structural integrity and

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<sup>1</sup> Memorandum from CDM Smith to CRW entitled "Capital Region Water Interceptor Cleaning and Rehab Improvements Update", dated May 3, 2017.

operation and maintenance issues. CRW continues to develop recommendations for early action projects to address critical structural deterioration and river intrusion. Two CSO outfalls were addressed in 2020 for critical structural deterioration.

## 5 Capital Improvement Plan

### 5.1 Overview

CRW prepares a capital improvement plan (CIP) that identifies the major planned projects and initiatives for the Wastewater System. The CIP includes projects that are required to replace aging infrastructure, enhance or expand services to customers, provide resiliency and redundancy, and increase cost effectiveness and efficiency. Portions of the CIP are related to repair and replacement of assets that are beyond their useful life and other portions address requirements under the Consent Decree, the LTCP, and other regulatory driven projects.

CRW's CIP as of the date of this report is summarized in Table 5-1. Below is a brief discussion of the capital projects and a summary of the review findings.

### 5.2 AWTF Upgrades

In March 2016, CRW completed an upgrade to its AWTF, adding biological nutrient removal in order to comply with the Chesapeake Bay Tributary Strategy and meet new NPDES permit discharge requirements.

In addition, the following maintenance projects were completed at the AWTF in 2020<sup>2</sup>:

- Replaced the Dorr-Oliver Hydrogritter Unit.
- The new Electrical building, which will serve as the power center for most solids treatment equipment, has been completed. The first primary digester unit was completed and the second unit is under rehabilitation.
- Begin Primary Clarifier mechanical equipment replacement in tank No. 1. Delivery of replacement equipment was delayed due to COVID.
- Replace Diluent Water Pump No. 2 at the Settled Sewage Pumping Station.
- Replace Thickened Sludge Pump No. 2.
- Replace Dewatering Pump No. 1 for the Belt Filter Presses.
- Replace Pump No. 1 for the Plant Water Skid.

The following are anticipated projects at the AWTF for 2021:

- Rehabilitation of the 2<sup>nd</sup> primary digester unit.
- Switchgear and New Line for Cryo Compressors.
- Computer upgrade to WIMS.
- Replace Hydrogritter Roof.
- Rebuild and Replace 2 pumps in the Settled Sewage Pumping Station.
- Belt Filter Press Rehabilitation.

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<sup>2</sup> Chapter 94 Municipal Wasteload Management Report and Semi-Annual Report on Consent Decree Implementation, March 2021.

- Return Sludge Pump Station Valve Replacement.

### 5.3 Pump Station Capital Improvements

The Front Street Pumping Station was recently upgraded and completed in 2021. CRW plans to evaluate options for potential upgrades of the Spring Creek Pumping Station once the Front Street Pumping Station has been operating for an extended period of time and an evaluation of the overall system can be made.

### 5.4 Conveyance Capital Improvements

CRW has included several conveyance capital improvements in its CIP for FY 2022 shown in Table 5-1. These include the Paxton Creek, Front Street, and the Arsenal Boulevard sewer improvements. Currently the Paxton Creek Interceptor rehabilitation experienced unexcepted high costs due to difficult site conditions and was stopped in December 2018. The project may be reassessed and rebid and the budget for this project may need to be re-evaluated once the approach to rehabilitating the remaining portion of the pipe is determined. CRW will evaluate the schedule and design for Spring Creek Interceptor improvements after the upgrades of the Spring Creek Pump Station are confirmed.

In addition, collection system cleaning, rehabilitation, and replacement work is expected to be an ongoing annual capital need. In addition to the conveyance capital improvements, CRW plans to implement multiple Long-Term Control Plan related capital projects, including several green stormwater infrastructure projects, as shown on the “SW” line in **Table 5-1**.

### 5.5 Discussion

CRW's capital plan is in general alignment with Arcadis' observed requirements for the Wastewater System. However, currently the capital plan does not include improvements to the Spring Creek Interceptor. Once the improvements to the Spring Creek Pump Station that is fed by the Spring Creek Interceptor are finalized, the capital plan should be revised as necessary. CRW generally has a good understanding of capital project needs and should prioritize projects based on urgency and affordability. CRW may proceed to reschedule and reprioritize various projects to balance the capital needs over the next several years. It is recommended that CRW update its cost estimates and capital funding plans for these projects as additional information becomes available.

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Table 5-1: Capital Improvement Plan

Location	Description	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026
AWTF	Cogeneration (CHP) Improvements	\$ 8,025,000	-	-	-	-
AWTF	Primary Digester Insulation (ECM)	\$ 250,000	\$ 250,000	-	-	-
AWTF	Primary Clarifier Improvements & Repairs	\$ 168,000	\$ 3,960,000	\$ 3,410,000	-	-
AWTF	Spring Creek Pump Station Improvements	-	-	-	-	\$ 4,700,000
AWTF	Plant Window/Door Replacements	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000
AWTF	Hoffman Blowers	\$ 200,000	-	-	-	-
AWTF	Truck Crane	-	\$ 200,000	-	-	-
AWTF	Trmt Minor Capital Improvements	\$ 344,700	\$ 35,000	\$ 60,000	\$ 95,000	\$ 95,000
Convey	Paxton Creek Interceptor Repairs	\$ 10,000,000	\$ 10,000,000	-	-	-
Convey	Front Street Interceptor Rehab Phase II	\$ 10,000,000	\$ 10,000,000	-	-	-
Convey	Arsenal Boulevard Sewer Improvements - Phase I	\$ 1,042,000	-	-	-	-
Convey	Collection System Rehabilitation	\$ 5,000,000	\$ 5,000,000	\$ 5,000,000	\$ 5,000,000	\$ 5,000,000
Convey	Field CIP Budget	\$ 150,000	\$ 150,000	\$ 150,000	\$ 150,000	\$ 150,000
Convey	Camera & Crawler	\$ 110,000	\$ 110,000	-	\$ 100,000	-
Convey	Camera Truck	\$ 200,000	-	-	-	-
Convey	Gap Vax Units	\$ 200,000	\$ 200,000	-	-	-
Convey	Street Restoration	\$ 206,000	\$ 212,180	\$ 218,545	\$ 225,102	\$ 225,102
Convey	Collection Minor Capital Improvement	\$ 35,000	\$ 35,000	\$ 35,000	\$ 65,000	\$ 65,000
Convey	PennDOT I-83 Expansion WW Impacts	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000
SW	Future Stormwater CIP	\$ 6,465,000	\$ 4,666,000	\$ 2,714,000	\$ 1,149,000	\$ 2,601,000
<b>Total</b>		<b>\$ 43,425,700</b>	<b>\$ 35,848,180</b>	<b>\$ 12,617,545</b>	<b>\$ 7,814,102</b>	<b>\$ 13,866,102</b>

<sup>1</sup>Project costs are presented in 2021 dollars.

<sup>2</sup>Collection System Rehab estimates subject to change based on ongoing asset management efforts, and do not include separate stormwater system rehab needs, which are not quantified.

## 6 Operations and Maintenance Expenses Review

### 6.1 Overview

The Trust Indenture (Section 7.12) requires CRW to adopt a Wastewater System budget each year. CRW typically adopts a finalized budget in November, two months prior to the start of the new fiscal year. CRW utilizes the capital plan and O&M recommendations in this CEAR to assist in establishing the budget. However, it should be noted that this CEAR only serves to provide advice and recommendations regarding capital additions and amount of funds that should be expended to meet incremental O&M expenses. CRW must then establish a realistic funding and financing plan that serves to meet these goals, which may necessitate reprioritization of projects and programs.

### 6.2 Historical Wastewater System Expenses

A summary of CRW's historical actual O&M expenses for FY 2019 and FY 2020 and the budgeted O&M expenses for FY 2021 are shown in Table 6-1. These expenses were reviewed to and determined to be in general alignment with overall O&M needs of the Wastewater System.

Table 6-1: Historical Wastewater System Expenses

Description	Historical		Budget
	FY 2019	FY 2020	FY 2021
<b>O&amp;M Expenses:</b>			
Salaries and Wages	\$ 2,896,677	\$ 3,278,162	\$ 3,368,551
Benefits and Taxes	\$ 1,430,512	\$ 1,405,484	\$ 1,675,853
Contracted and Professional Services	\$ 800,766	\$ 1,255,994	\$ 1,361,800
Repairs, Maintenance, and Supplies	\$ 530,711	\$ 637,637	\$ 758,051
Electricity	\$ 842,332	\$ 728,599	\$ 838,000
Chemicals	\$ 513,718	\$ 387,454	\$ 543,700
Water	\$ 171,410	\$ 172,062	\$ 160,000
Refuse	\$ 590,796	\$ 644,417	\$ 655,000
Nutrient Credits	-	-	\$ -
Insurance	\$ 336,410	\$ 360,038	\$ 432,363
Administrative Fee	\$ 2,896,717	\$ 2,863,837	\$ 3,311,439
Street Sweeping Services	\$ 596,628	\$ 197,094	\$ 313,120
Other Operating Expenses	\$ 219,488	\$ 358,517	\$ 412,370
<b>Total Annual O&amp;M Expenses</b>	<b>\$ 11,826,163</b>	<b>\$ 12,289,295</b>	<b>\$ 13,830,247</b>

Source: Historical actual expenses in FY 2019 and FY 2020 and budgeted expenses in FY 2021 provided by CRW.

## 7 Conclusions

Set forth below are the principal conclusions that have been reached regarding our review of the Wastewater System and associated information provided by CRW:

1. In 2020, the AWTF had no hydraulic or organic overloads recorded as the monthly average flow did not exceed the design capacity and no organic overload conditions are expected through 2025.
2. There were 18 secondary bypass events during 2020, where there was excess wastewater flow received at the secondary treatment train of the AWTF causing wastewater flow to bypass secondary treatment. These were due to wet weather.
3. Based on Arcadis' field inspection, the AWTF and Spring Creek Pump Station are aged but generally in good operating condition and requiring capital investment within 5 years. Based on Arcadis' field inspections and review of documentation, the Front Street Pump Station, City Island Pump Stations, Market Street Pump Station, and combined sewer overflow regulators are in good condition with no known capital requirements currently. Overall, the Wastewater System is in fair condition requiring capital investment within 5 years.
4. CRW's capital plan is in general alignment with Arcadis' observed requirements for the Wastewater System. CRW generally has a good understanding of capital project needs and should prioritize projects based on urgency and affordability. Once CRW completes the evaluation of improvements to the Spring Creek Pump Station and Spring Creek Interceptor, the capital plan should be revised.
5. CRW should perform an evaluation of the adequacy of collection system rehabilitation (budgeted in the Rapid Assessment Report) as it advances its asset management program to assure that the level of service goals for the collection system are achieved.
6. An arc flash study is recommended for the wastewater system in order to be in compliance with current NFPA 70E and OSHA 1910 (Subpart S) regulations. CRW intends to perform the arc flash studies in 2022.

This CEAR summarizes the work completed up to the date of the issuance of this CEAR. Changed conditions occurring or becoming known after such date could affect the material presented to the extent of such changes. Arcadis has no responsibility for updating this CEAR for changes that occur after the date of this report.

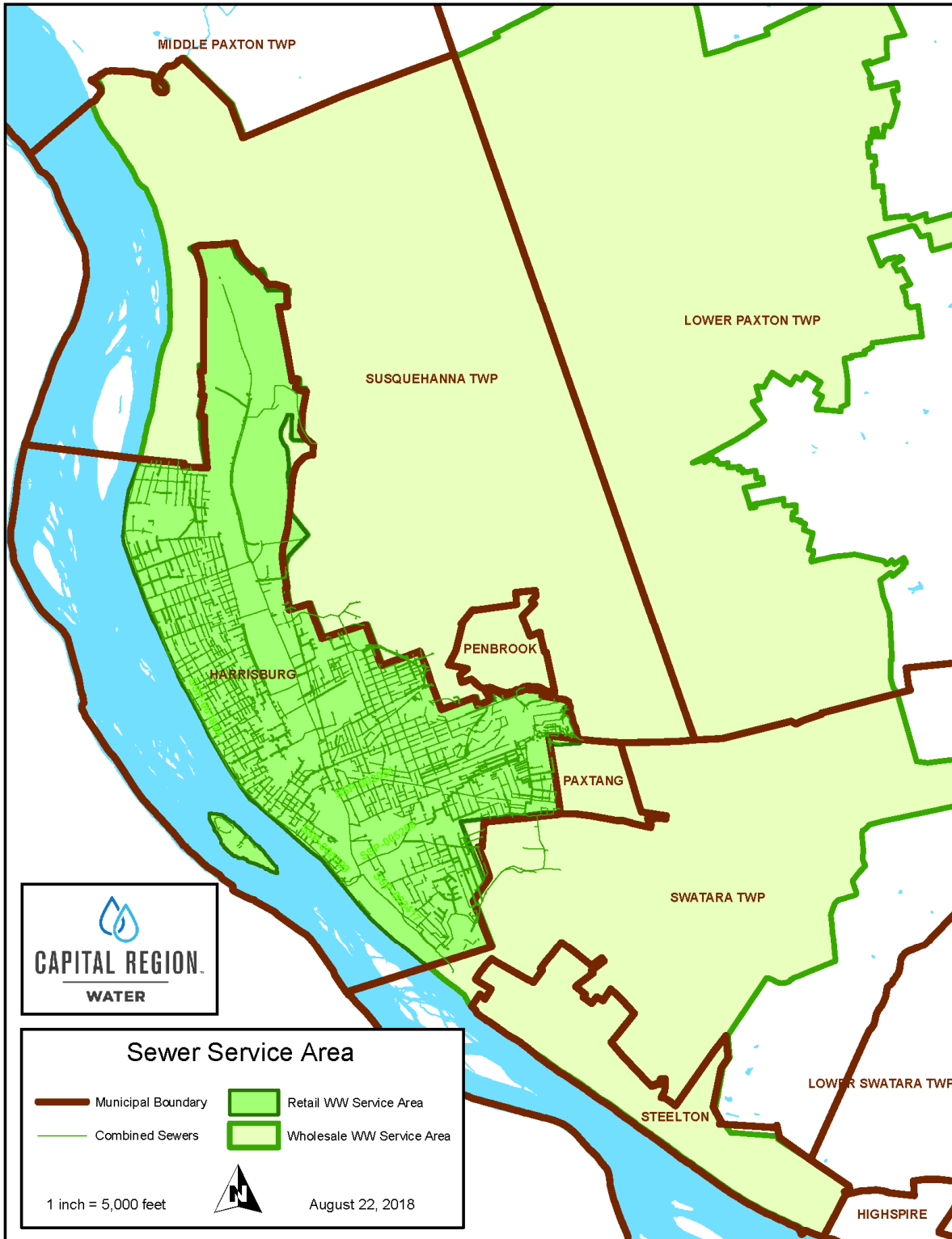
In preparation of this CEAR, Arcadis has relied upon financial, engineering and operational data, and assumptions prepared by and / or provided by CRW. In addition, information and projections have been provided by other entities working on behalf of CRW. We believe such sources are reliable and the information obtained to be appropriate for the review undertaken and the conclusions reached in this CEAR. To the best of our knowledge, information and belief, the information does not omit material facts necessary to make the statements herein. However, Arcadis has not independently verified the accuracy of the information provided by CRW and others. To the extent that the information is not accurate, the findings and recommendations contained in this CEAR may vary and are subject to change.



Arcadis devoted effort in making such opinions consistent with that degree of care and skill ordinarily exercised by members of the same profession currently practicing under same or similar circumstances and the time and budget available for its work in its efforts to endeavor to provide such opinions. The opinions are based on information provided by and consultations with CRW. No responsibility was assumed for inaccuracies in reporting by CRW or any third-party data source used in preparing such opinions. Arcadis' opinions represent its professional judgment. Neither Arcadis nor its parent corporation, or their respective subsidiaries and affiliates, makes any warranty, expressed or implied, with respect to such opinions.

# Appendix A

## Wastewater System Service Area



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