BEFORE THE
STATE OF NEW JERSEY
BOARD OF PUBLIC UTILITIES

IN THE MATTER OF THE PETITION OF
NEW JERSEY-AMERICAN WATER COMPANY, INC.
FOR APPROVAL OF INCREASED TARIFF RATES
AND CHARGES FOR WATER AND WASTEWATER SERVICE, AND
OTHER TARIFF MODIFICATIONS

BPU Docket No. WR2201____

Direct Testimony of

DONALD C. SHIELDS

January 14, 2022

Exhibit P-5

NEW JERSEY-AMERICAN WATER COMPANY, INC.

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1. Q. Please state your name and business address.

A. My name is Donald C. Shields, and my current business address is 1 Water Street, Camden, New Jersey 08102.

2. Q. By whom are you employed and in what capacity?

A. I am employed by American Water Works Service Company, Inc. ("Service Company") as Vice President of Engineering supporting New Jersey-American Water Company, Inc. ("NJAWC" or the "Company"), Virginia-American Water Company ("VAWC") and Maryland-American Water Company ("MAWC").

3. Q. What are your responsibilities in this position?

A. My present responsibilities include providing oversight, expertise and consultation for comprehensive system planning for use in developing system priorities and projecting capital spending, as well as the planning, design and construction of capital improvement projects for NJAWC, VAWC and MAWC.

4. Q. Please describe your educational background and business experience.

A. Please refer to Appendix A for a summary of my educational background and business experience.

5. Q. Have you previously testified in regulatory proceedings?

A. Yes. I have previously testified on behalf of NJAWC in the Company's base rate case applications in BPU Docket Nos. WR15010035, WR17090985 and WR19121516, and in the Company's joint petition for approval of the acquisition of Shorelands Water Company, BPU Docket No. WM16101036. In addition, I

have previously testified on behalf of Applied Wastewater Management, Inc. in its base rate case applications in BPU Docket Nos. WR08080550 and WR03030222.

6. Q. What is the purpose of your testimony in this proceeding?

A. I will explain NJAWC's capital investment planning process and describe and support the Company's investments in water and wastewater utility plant and equipment since the last base rate case through the end of the test year in this case, 12 months ending June 30, 2022 ("Test Year") and the six months post-test year ending December 31, 2022 ("Post-Test Year" or "PTY"), totaling approximately $943.2 million. Although my testimony will highlight certain capital projects through the end of the PTY period, all of our capital investments, including our recurring projects, are reasonable and necessary to continue to provide safe and reliable water and wastewater service for the benefit of our customers. I will also describe the Company's plan for the engineered coating of steel structures. Finally, I describe some of the risks associated with the provision of water service, the provision of wastewater service and the challenges increased climate variability creates for water and wastewater utilities.

7. Q. Do you sponsor any schedules as part of your Direct Testimony?

A. Yes. I am sponsoring Schedule DCS-1 Test Year plant additions and Post-Test Year plant additions supporting the Company's capital expenditures utilized in rate base. The Schedule was prepared by me and under my supervision and direction and will be updated over the course of the proceeding to include actual data for both

the full twelve-months for the Test Year as well as the 6-month Post-Test Year period.

I. NEW JERSEY-AMERICAN WATER'S CAPITAL INVESTMENT PROGRAM

8. Q. Please explain the Company's capital investment planning and governance process.

A. The Company uses a standardized Capital Program Management ("CPM") process to manage all its capital investments. NJAWC conducts comprehensive planning studies ("CPS") to assess and make project recommendations for its capital assets and evaluates capital needs on an ongoing basis to assess any changed circumstances and ensure that appropriate projects are being prioritized. Capital investment programs and projects are prioritized within an overall strategic planning process, utilizing drivers associated with various asset investment strategies (such as safety, regulatory compliance, capacity, customer satisfaction, etc.) to formulate a five-year strategic capital investment plan, which largely supports the Company's capital construction plan.

Detailed design engineering is conducted, and implementation plans are developed for investment projects contained within the five-year strategic capital investment plan. Main replacement projects are examined annually and assigned priorities on a state-wide basis. Numerous factors are considered when determining funding allocations for infrastructure investment, such as current and future service needs, assessments of the physical condition of existing plant, economic and risk factors, performance characteristics, regulatory compliance, financial impacts to customers

(rate impact) and the potential to coordinate with municipalities and other utilities in joint improvement projects. The CPM governance process provides for formal approvals and consistent controls that optimize the effectiveness of asset investment. Strategic project planning, budgeting and ongoing reviews ensure that NJAWC can manage a wide variety of projects within the overall cost of its plant construction budget.

9. Q. Please describe the CPS process and project prioritization activities in more detail.

A. The CPS process includes a thorough evaluation of demand projections, regulatory requirements, asset service reliability and quality, infrastructure condition, asset impacts on safety and efficiency, customer rates, public fire protection, and environmental sustainability. The CPS identifies, assesses, and provides project recommendations for the Company's capital assets on a multi-year planning horizon and includes a thorough planning level evaluation of each component of utility infrastructure. The Company also undertakes separate studies or evaluations for specific capital projects that emerge between each CPS. Capital investment projects are identified and are prioritized using asset investment strategy considerations of safety, regulatory compliance, capacity and growth, infrastructure renewal, efficiency, resiliency, reliability, and quality of service. Each CPS and any additional prioritization of identified capital investment projects are key inputs to the Company's capital investment plan. Because of the specific nature of the large asset class of distribution system mains, the Company completes a separate

distinct evaluation for identifying capital investment priorities in the distribution system. This evaluation is a detailed prioritization modeling of the distribution system piping that, as further described below, assesses service risks associated with pipeline failure risks for all the Company's approximately 9,200 miles of mains.

10. Q. Please describe the distribution system prioritization modeling in more detail.

A. As discussed in the Company's Distribution System Improvement Charge ("DSIC") Foundational Filings, most recently NJBPU Docket No. WR20030256 (Appendix A), the Company maintains a GIS-based prioritization model using GIS software and prioritization modeling software for identifying and prioritizing pipeline replacement investments across its systems. The model prioritizes pipe replacements through identification of service risks associated with pipe failure. Pipe failure risks are identified through pipe failure history, pipe material type, the decade pipe was installed, and pipe diameter. Pipe failure history is a significant input into the main replacement prioritization model. These pipe failures are identified not only during the Company's unscheduled main replacement projects but also during pipeline repair work. Pipe failure data is collected and tracked in the Company's GIS system. Consequences of pipe failures, which include customer impacts, are also an input to the prioritization model. Pipe failures not only impact individual customers but can also cause consequences that are major in nature to businesses, hospitals, governmental buildings, and the ability to provide fire service.

11. Q. How does the Company develop and update its capital investment plan?

A. Investment projects are profiled in the capital investment plan to address priorities in each CPS in an appropriate time frame. For example, infrastructure capacity expansion investment projects are scheduled based on demand projections. Capital investment projects required to meet environmental or water quality regulations are scheduled for completion before compliance deadlines to allow adequate time for testing and operational performance monitoring of the new facility/assets to ensure compliance. This process ensures the facility operates successfully through varying operating conditions. Rehabilitation projects for service reliability are scheduled with consideration of existing asset characteristics, and risks and impacts of failure on service reliability and quality. The Company's main replacement program is generally planned and managed through the DSIC program, except for any emergency replacement and repair projects.

12. Q. Please describe the general project categories in the Company's capital investment plan.

A. The Company's capital investment plan can be divided into two distinct areas: recurring projects ("RPs" or "RP") and investment projects ("IPs" or "IP"). RPs are designated as such because they are the type of capital projects that the Company undertakes on a frequent and regular basis, require less long-term financial and capital planning than an IP, and can be performed with either the Company's current workforce or existing contractors. IPs on the other hand, are typically projects that require a more significant amount of planning and capital

resources. Whether RPs or IPs, all aspects of the Company's capital program are essential to continuing to provide safe and adequate service to NJAWC's customers and support the long-term viability, reliability and resiliency of the Company's water and wastewater systems.

13. Q. Please describe the RPs that are included within the Company's capital investment plan.

A. NJAWC's RPs include main projects generally 12 inches in diameter and smaller, reinforcement and replacement of service line and meter setting installations, meter purchases, projects to replace and maintain treatment equipment, vehicle replacements and to a lesser extent the purchase of tools, furniture, and equipment. The Company's RP investments during the Test Year and PTY total approximately $437.5 million.

14. Q. Are RP projects a critical component of the Company's five-year strategic capital investment plan?

A. Yes, RPs are critical investments for both the Company and customers as these investments support the backbone of NJAWC's water systems by increasing both system resiliency and reliability.

15. Q. Please describe how RPs are included within the Company's capital investment plan.

A. Recurring construction project costs for the various line items are trended from historical and forecasted data, with specific project details accounted for where available; main replacements are planned in accordance with the Company's

project prioritization plan as described herein. Estimates are prepared for the installation of new mains and service lines, meter settings, and the purchase of new meters based on preliminary plats from the appropriate governmental planning agencies and consultations with developers, homebuilders, and engineering firms. The criteria for evaluating the priority of the recurring projects are engineering requirements, consideration of national, state, and local trends, environmental impact evaluations, and water resource management. NJAWC engineering criteria are based on accepted engineering standards and are developed from regulations, professional standards and NJAWC engineering policies and procedures. The engineering criteria support NJAWC's ability to have a water system that will continue to provide adequate capacity and appropriate levels of reliability to satisfy residential, commercial, industrial, and public authority needs, and provide flows for fire protection.

16. Q. Please describe how IPs are included within the Company's capital investment plan.

A. IPs represent investments made to meet environmental or water quality regulations, infrastructure capacity expansion or rehabilitation or replacement of aging facilities. These projects allow the Company to meet the service demands of the community, maintain regulatory compliance, and reduce asset failure.

The determination to include an IP within the capital investment plan begins with the development of the anticipated demand projections of the system, the identification of improvements needed to meet those demands and the adoption of

strategies designed to bring about the correct prioritization and distribution of capital spending for the various requirements of the business. Specific capital planning requirements are addressed in both the short term (one year) and the longer term (five years). Projects are prioritized using objective criteria that validate the need for a project and assess the risk of not doing the project. A key aspect of this planning technique is that it is flexible and can be adjusted as needed to address new priorities, such as unplanned equipment failures, large or sudden growth of a service area and new regulatory requirements.

17. Q. Please describe the Company's recent performance with respect to its capital investment plan.

A. NJAWC has delivered its capital investment plan within 0.96% of the plan cumulatively over the past five years. Capital investment plans, actual capital investment deliveries, and variances to the plan by year are shown in the table below:

NJAWC Net Capital Investment Plan v. Actual Capex				
Year	**Plan**	**Actual**	**Variance**	
2016	$ 310,129,159	$ 312,717,235	$ 2,588,076	0.83%
2017	$ 395,807,573	$ 396,832,035	$ 1,024,462	0.26%
2018	$ 343,331,837	$ 347,782,915	$ 4,451,078	1.30%
2019	$ 344,838,815	$ 362,158,711	$ 17,319,896	5.02%
2020	$ 438,245,187	$ 430,413,130	($ 7,832,057)	(1.79%)
Cumulative	$1,832,352,571	$1,849,904,026	$17,551,455	0.96%

18. Q. Does NJAWC focus on control of capital expenditure costs in its normal day-to-day activities?

A. Yes. All significant construction work is performed by independent contractors and some significant purchases are completed pursuant to a bid solicitation process. NJAWC maintains a list of qualified bidders, and Service Company annually receives competitive bids for materials and supplies, such as pipe, valves, fittings, meters, chemicals, and other commodity items that are either manufactured or distributed both regionally and nationally through its centralized procurement group. NJAWC has the advantage of being able to purchase these materials and supplies on an as-needed basis at favorable prices. In recent years, Service Company also has undertaken procurement initiatives for services and materials to reduce costs or mitigate price increases through either streamlined selection or utilization of large volume purchasing power. Among the initiatives that have directly impacted capital expenditures are the use of master services agreements with pre-qualified engineering consultants, national vehicle fleet procurement, and national preferred vendor identification. Mr. Shroba describes how NJAWC utilizes the Supply Chain team within Service Company to take advantage of the purchasing power of the entire American Water enterprise and control costs.

19. Q. Please describe some key achievements realized by the capital investment program at the Company.

A. There are several key areas that NJAWC has addressed with its capital investment program. First, we've made significant improvement in replacing aging

infrastructure, largely attributable to the DSIC program. Less than ten years ago, approximately 40 percent of NJAWC's water pipe was 70 years old, or older, and nearing the end of its useful life. Today, that percentage is just over 17 percent. In that same period, pipe that is more than 100 years old decreased from 20 percent to 6 percent.

Since NJAWC implemented the DSIC program in 2012, the Company has:

- replaced over 774 miles of main, 102,171 service lines, 14,471 hydrants and 25,579 valves.
- lowered its water main replacement rate from over 500 years to below 110 years, which is within the New Jersey Water Quality Accountability Act requirement of 150 years.
- invested a total of $1.267 billion in DSIC-eligible system improvement projects to replace or rehabilitate aging infrastructure—that's over $140 million annually since inception of the program.

DSIC is a proven regulatory tool that allows for modest surcharges outside of the general rate proceeding for rehabilitating and replacing aging infrastructure, while maintaining BPU oversight.

Second, the Company has made significant enhancements for system reliability and resiliency. Some key projects completed within the last five years include:

- Raritan Millstone Flood Wall and Back up Generation upgrades: while the remnants of Hurricane Ida severely impacted the central New Jersey region, the flood of record resulting from Ida was held back by the recently completed

flood wall. In addition, the newly installed backup generators worked to maintain power after loss of the main power feed. This kept millions of people in the region supplied with safe drinking water and reliable sanitation.

- Oak Glen Water Treatment Plant Expansion and Back Up Generation upgrades helped alleviate critical water supply issues in the Coastal North Region.
- Swimming River Clearwell Expansion allowed for the retirement of an over 100-year-old gravity main that was identified as a critical risk for the Company and its customers.

Lastly, the Company has invested significantly in facilities for regulatory compliance. Of note, the Company has managed projects to treat for (now regulated) perflourinated compounds (PFOA, PFOS and PFNA) at many facilities throughout the State. These include the following:

- Baltusrol Groundwater Station – 2 million gallons per day ("MGD") plant where an anion exchange ("AIX") resin system was deployed within an existing building for PFOA removal.
- Hummocks Groundwater station – 1.5 MGD treatment system that includes Granular Activated Carbon ("GAC") for removal of PFOA/PFOS as well as ultraviolet light and peroxide treatment (also known as Advanced Oxidation) for removal of 1,4-dioxane, a volatile organic carbon ("VOC") related chemical that is currently expected to have a new maximum contaminant level ("MCL")

limit issued by New Jersey Department of Environmental Protection ("NJDEP").[1]

- Nazareth Groundwater Station – 0.16 MGD plant where an AIX resin system was deployed within an existing building for PFOA removal.
- Short Hills Groundwater Station – 2.8 MGD where an AIX resin system was deployed within an existing building for PFOA removal. NJAWC received the 2020 New Jersey Governor's Environmental Excellence award for this project.
- Springfield Groundwater Station – 3.0 MGD where an AIX resin system was deployed within an existing building for PFOA removal.

As further discussed below in my Direct Testimony, the Company continues to prepare for new and more stringent regulations on emerging compounds and will take early action on planned upgrades and operational mitigation strategies to address these regulatory challenges.

II. DESCRIPTION OF PLANT ADDITIONS

20. Q. How much capital investment is the Company seeking to recover in this case?

A. Since the effective date of rates in the Company's last rate case, the Company has invested, or will invest, approximately $985 million in capital expenditures through the end of 2022. As shown on Schedule DCS-1, beginning July 1, 2021, and through the end of the post-test year, the Company has invested or plans to invest over $726 million in its water and wastewater facilities. Of that amount, $454

[1] As noted later in my testimony, the Drinking Water Quality Institute has recommended an MCL of 0.33 parts per billion to NJDEP.

million will be invested during the Test Year and an additional $272 million will be invested during the Post-Test Year. In total, of the $726 million in investments, $301 million is DSIC-eligible investment.

21. Q. Please describe some of the key objectives related to the Company's investments and how they benefit customers.

A. The Company's investments since the last rate case address key issues for our customers, including improving asset resiliency, managing source of supply and system demands, renewing aging assets, increasing operational efficiency and maintaining regulatory compliance. The projects the Company undertakes are designed to achieve multiple goals and are essential for the Company to continue to provide safe, adequate and reliable service to our customers in a manner that is in the long-term interest of our customers. For example, many of these projects in Schedule DCS-1 are described below and include improved resiliency and reliability at treatment plants, as well as in the distribution system, managing source of supply both from a treatment and capacity perspective, improved pump efficiency, treatment changes to maintain regulatory compliance and so on. Additional examples include investments that further enhance the Company's hardware, software, and related technology appurtenances and systems. In each instance, these projects support the Company's continued provision of safe, adequate and reliable service to customers.

22. Q. Please describe generally the capital expenditures through the Test-Year as detailed further in Schedule DCS-1.

A. Schedule DCS-1 provides a summary of capital expenditures for the Test Year and Post-Test Year periods. It includes five months of actual capital expenditure data for the period July 1, 2021, through November 30, 2021 and seven months of projected capital expenditure data for the period December 1, 2021 through June 30, 2022. As shown on Schedule DCS-1, the total projected plant expenditures including the DSIC spend for the Test Year period are approximately $451 million. As the Test Year is fully realized, NJAWC will supplement the projected data with actual data through June 30, 2022, in the Company's 9&3 and 12&0 updates to be submitted in this case.

23. Q. Please summarize the Post-Test Year capital expenditures for which NJAWC is seeking rate relief in this proceeding as shown on Schedule DCS-1.

A. The Company's Post-Test Year investment of approximately $289 million is based on projected capital expenditures NJAWC plans to make during the six-month period July 1, 2022, through December 31, 2022. NJAWC's Post-Test Year capital expenditures are known and measurable consistent with Board precedent, including *In Re Elizabethtown Water Company*, BPU Docket No. WR8504330 (May 23, 1985). Moreover, NJAWC's Post-Test Year capital expenditures are "prudent and major in nature and consequence," and therefore, have been included in rate base for cost recovery.

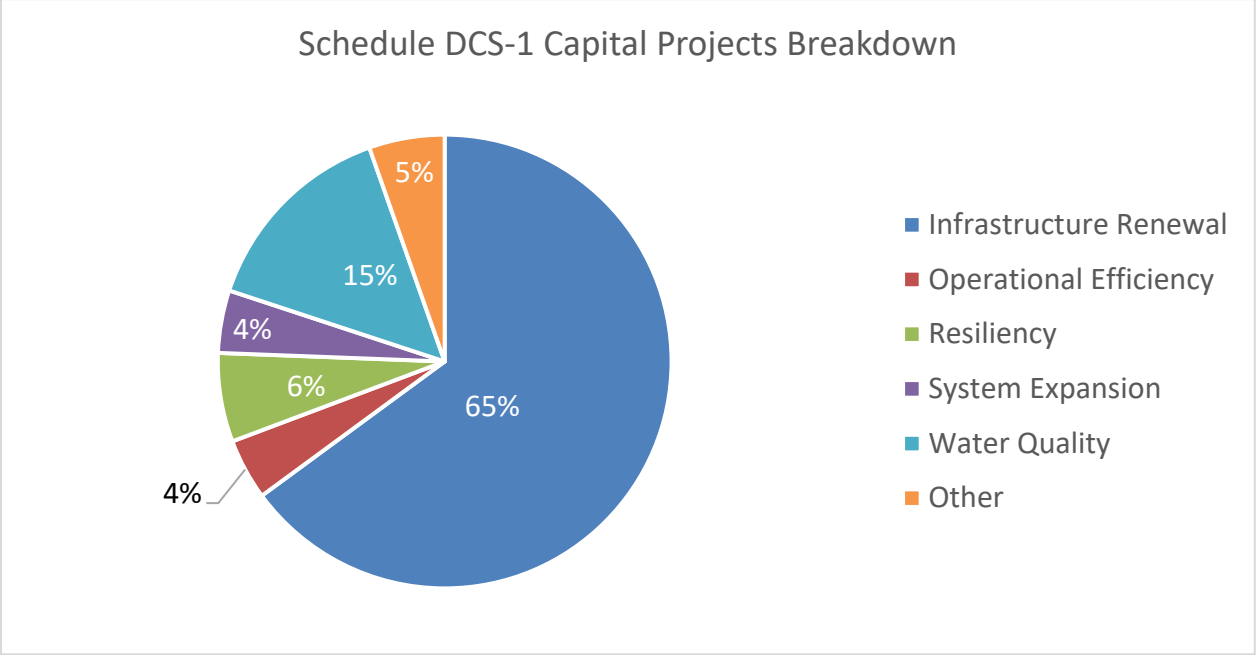
24. Q. Please provide an overview of the investments included in Schedule DCS-1.

A. As described in my Direct Testimony above, the capital program is driven by investments in plant to address the following issues:

- Infrastructure Renewal
- Operational efficiency
- Water Quality
- System Expansion
- Resiliency/Reliability
- Other – administrative and facilities

Projects can fall into several categories that meet various identified needs. For example, a filter upgrade project at a remote groundwater station can be identified as an asset renewal project if it is needed to replace outdated technology, which would also qualify it for operational efficiency. In addition, the project could also be categorized as a water quality enhancement should the filtration technology be upgraded to also remove new emerging compounds.

As can be seen in the chart below, the vast majority of NJAWC's projects fall into the Infrastructure Renewal category.



A further explanation and description of these categories is included herein, along with additional details regarding certain projects in each category. Additional information regarding all the projects or line items in Schedule DCS-1 can be provided upon request.

25. Q. Please describe the Company's infrastructure and asset renewal investments in more detail.

A. Asset management is recognized as an industry best practice, and the United States Environmental Protection Agency ("USEPA") has been directed under American's Water Infrastructure Act of 2018 ("AWIA") to require states to incorporate asset management into their capacity plans, with several states having adopted requirements for water utilities to complete asset management plans ("AMPs"). Additionally, under the New Jersey Water Quality Accountability Act ("WQAA"), water utilities are required to maintain an AMP similarly to the AWIA

requirements. NJAWC follows the key steps set forth by both USEPA and WQAA for sound asset management, including maintaining an accurate inventory of assets, providing an assessment of the condition and performance of these assets, with particular emphasis on high-criticality assets, performing risk assessment of assets in terms of their criticality and potential for failure and service disruption, and providing a recommended renewal program that includes operations and maintenance ("O&M") and inspection.

It is well documented that the water and wastewater utility industry is faced with significant capital investment needs to renew aging infrastructure, with estimates topping $1 trillion across the U.S. needed to maintain and expand service to meet demands over the next 25 years.[2] Nationwide, water system pipeline replacement rates are in the range of 0.45% per year, which translates to a replacement cycle of approximately 200 years. Through heightened focus on this issue, and as described herein, NJAWC has significantly improved its pipeline replacement rate over the last few years, from near industry average levels in 2011 to a five-year average rate of 0.85% from 2017-2021.

NJAWC regularly assesses whether the current asset renewal investment levels, for both above ground and buried assets, are sufficient to maintain appropriate levels of service. NJAWC employs a multi-faceted approach to managing assets, including the use of innovative technologies to detect, mitigate, or repair asset

[2] *See, e.g.,* American Water Works Association, *Buried No Longer: Confronting America's Water Infrastructure Challenge* (2012), https://www.awwa.org/Portals/0/AWWA/Communications/BNLReport.pdf.

failures; condition-based and/or reliability-centered maintenance; and a risk-based strategic plan and framework for prioritizing and implementing asset renewal while considering the impact on customer rates. Alternative asset renewal technologies, including pipeline rehabilitation, is considered wherever cost-effective.

Some examples of infrastructure and asset renewal projects included on Schedule DCS-1 follow:

Raritan Millstone Water Treatment Plant ("RMWTP") Filter Rehabilitations

This project includes various phases. The existing RMWTP Filters 1-30 were constructed over the course of many decades since the original plant construction: Filters 1-6 (1920's - original); Filters 7-18 (1950's); Filters 19-24 (1970's) and Filters 25-30 (1980's). All filters are operational and vary in filtration rates ranging from 2.5 to 5 gallons per minute ("GPM") per square foot ("SF"). Many components, however, are nearing their end of service life, requiring costly and sometimes emergency repairs. In addition, the RMWTP has recently been placed in the Bin 2 Classification regulations of the Long Term 2 Enhanced Surface Water Treatment ("LT2") Rule, and upgrades to filter performance and reliability are required in order to maintain compliance. The work includes removal and rehabilitation and/or replacement of the filter underdrains, media, gallery piping, valves, flowmeters, filter controls, control room and lab, new air scour blower and piping, water quality ("WQ") instruments, and associated electrical, mechanical, process, supervisory control and data acquisition ("SCADA") and security system upgrades.

River Road Main Replacement

This project involved the replacement of various mains and services to enhance the resiliency and reliability of the Coastal North Region, as well as address pressure and flow challenges experienced in the Borough of Rumson in the past. The Company had an opportunity to complete the project in conjunction with Monmouth County, Rumson and Fair Haven as they were executing a repaving project along River Road extending a total length of approximately 2.5 miles. Within these 2.5 miles, there was an 18-inch cast iron water main estimated to be 115 years old, which was heavily tuberculated, causing water quality issues as well as reduced structural integrity. In addition, approximately 36 side street connections were replaced, some of which eliminated dead ends and will improve water quality in the area as a result. During the project, the Company also replaced approximately 300 water services, including fire services and domestic services ranging in sizes between ¾- and 6-inch. Three water crossings were also replaced. The 18-inch cast iron main was replaced with a 16-inch ductile iron pipe ("DIP") at a total length of 14,500 feet.

Clark Cleaning and Lining

This project consisted of the cleaning and lining of approximately 16,029 linear feet ("LF") of 6-inch cast iron pipe ("CIP") with Warren Epoxy 301-01 and included 12 valve replacements and 18 fire hydrant replacements. It also included the installation of approximately 200 LF of 6-inch DIP in various locations to loop and tie-in water mains for improved flow and pressure. In addition to asset

replacement, this project also improves water quality by remediating discolored water issues and enhances reliability and operational efficiency by improving fire flows and reducing operating pressures.

Canal Road Flocculation and Sedimentation Basins 1-2 Upgrades

The scope of this project is to replace both the flocculation equipment and sludge collection systems in basins 1&2 at the Canal Road Water Treatment Plant. In addition, a Morton-style building will be erected to cover the flocculation basins to aid in freeze reduction of the gear drives during winter months. As such, in addition to asset replacement, this project can also be considered within the reliability category.

Diamond Hill Booster Upgrade.

The Diamond Hill booster station is a critical facility that is utilized year-round and transfers an average of 4-10 MGD of water supply from the Raritan to the Passaic systems. The existing electrical, mechanical (pumping) and HVAC systems are aging and in need of replacement. In addition, there are potential hydraulic surge issues that could result in water hammer issues along the supply pipeline to the station (which is prestressed concrete cylinder pipe – a material that has a history of failures), which could result in the loss of the station and adversely impact service to customers. Accordingly, this project includes the replacement of all four pumps, motor controls, main transformer and substation, HVAC, and hydraulic surge control mechanical improvements. In addition, the existing emergency

generator diesel storage tank will also be replaced to enhance reliability and resiliency.

Roberts Road Booster Station Electric and Generator Upgrades

The Roberts Road booster pump station is a critical facility built over 30 years ago with emergency power and equipment at the end of its useful life that is required to run continuously to keep up with demand in the peak summer months. This facility has required frequent repairs, which can be costly and time consuming as certain replacement parts are no longer available. In addition, power outages are frequent in the area and can last several days at a time, which can result in significant service disruptions. As such, this project, which includes the installation of a backup generator with an automatic transfer switch ("ATS"), removal of an existing natural gas drive from pump #2, removal of an existing natural gas generator used for lights and ancillary equipment, both the replacement of existing variable frequency drives ("VFD") and installation of new VFDs for all pumps, and replacement of pump motors, improves reliability of the station and the system.

26. Q. Please describe the Company's operational efficiency investments in more detail.

A. Targeted capital investment can improve operational efficiency which can decrease, or mitigate increases to, O&M expenses. For example, NJAWC routinely seeks opportunities for energy use reduction when evaluating equipment rehabilitation and replacement needs to continue to support the provision of reliable service. While the primary focus is on pumps and motors, alternative energy

production is also considered, as these technologies are becoming more cost-effective, especially where incentives are available. NJAWC also has identified advanced leak detection methods that can more efficiently identify and address leakage. Reducing water loss has the attendant benefit of reducing the costs associated with producing and pumping the non-revenue water over time. These types of projects, along with technology solutions that improve worker productivity, streamline the customer experience, or improve overall system efficiency to help keep our costs down.

Some examples of operational efficiency projects included on Schedule DCS-1 follow:

Canal Road Water Treatment Plant ("WTP") Solar Array

This project involves the installation of 7.2 megawatt ("MW") direct current ("dc") net metered solar array consisting of a roof mount, ground mount and car port type components at the Canal Road WTP that will allow the Company to offset grid energy and enhance reliability at the WTP. The installation of the solar array will be done as a Power Purchase Agreement ("PPA") with a solar developer. NJAWC has entered a 15-year PPA agreement with the developer which would satisfy over 25% of the Canal Road WTPs current electric usage. NJAWC will not own the array but will purchase the electricity from the solar developer for an agreed upon price of $ 0.0675 per kilowatt-hour ("kWh").

Canoe Brook Solar Expansion

The Canoe Brook solar expansion will also allow the Company to offset grid energy and enhance reliability at the Canoe Brook WTP. It involves the installation of an 8.5 MW dc net metered solar array floating on the Canoe Brook Reservoir #1. NJAWC has entered into a 15-year PPA agreement with the developer which would satisfy 80% - 90% of the Canoe Brook WTP's current electric usage. NJAWC will not own the array but will purchase the electricity from the solar developer for an agreed upon price of $ 0.0675 per kWh.

Like the Canal Road WTP solar array, this net-metered solar project will help the Company reduce its carbon footprint while mitigating costs through the use of a PPA that requires most of the capital outlay and all of maintenance of the solar array to be done by the solar developer. These projects demonstrate the Company's commitment to mitigating costs, increasing reliability and contributing to the state's renewable energy goals.[3]

Phase 4 NRW 2021

This project is one of several phases that helps the Company reduce non-revenue water ("NRW") losses with the installation of permanent acoustic monitoring devices. Previous phases of NRW projects have provided for the installation of about 3,700 devices in the Company's North operating area. This project involved

[3] The State of New Jersey released the Draft 2019 Energy Master Plan "EMP"), which provides an initial blueprint for the total conversion of New Jersey's energy profile to 100 percent clean energy by 2050. The plan defines clean energy as carbon neutral electricity generation and maximum electrification of the transportation and building sectors to meet or exceed the Global Warming Response Act greenhouse emissions reductions of 80 percent relative to 2006 levels by 2050.

the installation and management of 837 hydrant mounted permanent acoustic monitoring devices (EchoShore DX) for the balance of the North operating area. The 2021 phase included coverage for Millburn/Short Hills and Springfield.

North West Orange EchoShore DX Upgrade 2021.

This project included the replacement and upgrade of approximately 951 EchoShore DX advanced metering infrastructure ("AMI") fixed nodes nearing the end of the useful life to cellular nodes. Upgrade and continued EchoShore DX coverage in West Orange is critical to the progress that has been made in the North operating area regarding NRW reduction.

EchoShore DX Central Region 2021-2022

This project includes the purchase, installation, and management of EchoShore DX devices for the Central operating area. The 2021 phase includes coverage for Green Brook, Princeton, North Plainfield, Middlesex, and portions of Bridgewater, as well as replacement of devices in Frenchtown. The 2022 phase will include Linden and North Plainfield.

27. Q. Please describe the Company's water quality investments in more detail.

A. NJAWC is committed to maintaining compliance with existing drinking water standards and works hard to identify and address potential water quality issues before they become MCL exceedances. Water quality projects are considered high priority as they are related to public health protection of our customers.

As described elsewhere in my testimony, the USEPA's LT2 Rule requires drinking water utilities to monitor source water supplies for the presence of cryptosporidium. NJAWC has found this pathogen to be present in the source water supplies for the Raritan Millstone WTP at levels that necessitate steps be taken to provide additional protection against cryptosporidium under the LT2 Rule. Upgraded filtration facilities have been constructed and placed into service at the WTP and are listed in Schedule DCS-1. Additional capital projects related to LT2 Rule compliance, or any other applicable environmental regulation, are also included to ensure any compliance deadlines are met.

Over the past few years, there has been an increasing concern regarding the presence of compounds of emerging concern ("CECs") such as per- and polyfluoroalkyl substances ("PFAS") and 1,4-dioxane in drinking water supplies. Recent advances in analytical methods have revealed the presence of CECs in some drinking water supplies at previously undetectable parts-per-trillion ("ppt") levels. Research is ongoing, but some scientific studies have identified potential health concerns for a number of these compounds even at the low ppt levels. As a result, USEPA has established health advisory levels ("HALs") for some PFAS and other CECs and has begun the process to establish MCLs for PFOA and PFOS. Also, as described elsewhere in my testimony, the State of New Jersey has established MCLs for some CECs, most recently PFAS and PFOA,[4] in advance of USEPA

[4] On April 1, 2019, NJDEP proposed new MCLs for PFOA (14ng/l) and PFOS (13ng/l) (aka PFAS) that were adopted on June 1, 2020.

establishing federal limits. The Company has completed or is in the process of completing several projects to meet both existing and proposed state MCLs.

Some examples of water quality projects included on Schedule DCS-1 follow:

Baltusrol Station PFAS System

This project, which addressed PFOA removal and included infrastructure renewal and reliability, included design, construction and commissioning a new 2 MGD PFAS treatment system addition to the existing Baltusrol well facility, including a new pre-filtration system as well as other required process, mechanical, electrical, HVAC, instrumentation and control, and SCADA work. Prior to the final adoption of the PFOA and PFOS MCLs, the levels at the Baltusrol well facility influent ranged from 14.4-19.3 ng/l for PFOA and 5.6 ng/l for PFOS. Thus, the PFAS treatment system was installed to continue operations at the Baltusrol well facility. Finished, treated water sent to the distribution system meets all required standards.

Delaware River Regional WTP ("Delran WTP") Treatment Improvements

The improvements at the Delran WTP include belt filter press ("BFP") replacement, ferric storage and feed system replacement, and the addition of a hydrogen peroxide storage and feed system for treatment of the emerging compound – 1,4-dioxane. The Delran WTP utilizes three (3) Komline-Sanderson BFPs for dewatering water treatment process residuals. The presses were installed at the time of construction of the plant in 1994, are at the end of their useful life and cannot keep up with treating WTP residuals. This project will replace the existing

BFPs and associated appurtenances with three (3) centrifuges dewatering units and three (3) sludge feed pumps, including VFDs and flow meters.

Replacement of the ferric storage and feed system will enhance reliability of this portion of the chemical feed system that recent inspections indicate is at the end of its useful life. The addition of hydrogen peroxide is a new treatment process that is proposed to treat 1,4-dioxane which has been detected in raw water quality sampling.

1,4-dioxane is a persistent synthetic industrial chemical that is completely immiscible in water. The NJDEP has adopted a limit of 0.4 µg/L for 1,4-dioxane in their Interim Ground Water Standards. In September 2020, the New Jersey Drinking Water Quality Institute ("DWQI") proposed a MCL of 0.33 µg/L to the NJDEP, which is expected to be promulgated in 2022. While ozonation has been effective in reducing 1,4-dioxane concentrations at the Delran WTP, as the concentrations in the source rise, so do the levels in the plant effluent. This project will add hydrogen peroxide to existing ozone contactors to form powerful oxidizing hydroxyl radicals to oxidize and degrade 1,4-dioxane. In general, the major improvements involve modifying existing rooms and creating new rooms within the WTP to accommodate the new treatment process and installing hydrogen peroxide storage and feed equipment along with new feed piping and accessories from the hydrogen peroxide feed pumps to the application points, providing new control systems and making electrical upgrades to support all equipment, lighting, and ventilation for the hydrogen peroxide room.

Pottersville Well-Gas Membrane

The Pottersville well station, located in the Pottersville gradient in Tewksbury Township, was removed from service due to elevated radon levels. Demand in the Pottersville gradient warrants consideration of rehabilitation and treatment of this facility. NJAWC performed pump tests which revealed the presence of toluene, iron, lead, and zinc, though these were likely due to the pumping equipment, a conclusion supported by water quality data from when the well was last operational. The well, currently listed in a Water Use Registration permit, has a rated production capacity of 0.1 MGD or 69 GPM. After evaluating the feasibility of rehabilitation and different treatment technologies for radon removal, the Company determined that installation of a trailer mounted gas membrane treatment system was the appropriate option to bring the well station back to service.

Oxford Well Station ("OWS") Treatment Upgrades

The OWS treats water from two wells for VOC removal with GAC adsorption and sodium hypochlorite is added for disinfection. Low levels of trichloroethene ("TCE") are treated with a temporary treatment system consisting of seven (7) GAC contactors. As part of its permit renewal process, NJDEP required that the temporary GAC units be replaced with a permanent treatment solution. In addition to the VOC removal, 1,4-dioxane has also been detected at the wells. Because these wells are the primary source of water for Oxford customers, the Company plans to install a new treatment system designed to address VOCs and 1,4-dioxane in

addition to TCEs. The system includes AIX and peroxide for advanced oxidation for 1,4-dioxane removal while also removing the VOC's in the raw water.

Kent Avenue Well 1 Arsenic Removal

Kent Avenue Well Station has been using Isolux arsenic adsorption system to remove arsenic from local groundwater supply. The existing treatment vessel is undersized and has had significant clogging concerns when pumped at the well's rated capacity. This project includes replacing the Isolux treatment system with an AdEdge Water Technologies arsenic adsorption system, which is more cost effective.

28. Q. Please describe the Company's resiliency and reliability investments in more detail.

A. The increasing frequency of extreme weather events and other natural disasters as magnified by climate variability has significantly challenged NJAWC's infrastructure. Water and wastewater systems have been traditionally designed and maintained to provide reliable service under standard design conditions (e.g., 1-in-50 year drought, 1-in-100 year flood, etc.). Such standards, however, are based on historic climate patterns that may no longer be typical. Systems may be expected to cope with more extreme and frequent droughts, floods, power outages, and storms that may impact service. In addition, other man-made events such as source water contamination, and accidental or purposeful damage to facilities may result in significant impacts on customer service and asset integrity.

For NJAWC's most critical assets, defined as those with the highest consequence of failure, capital investments to further "harden" systems against identified natural threats are prioritized for implementation. Non-capital solutions are also part of the solutions toolkit to provide more system resiliency in mitigating such risks, such as more robust emergency response plans ("ERPs"), drought management plans, condition-based and/or reliability-centered maintenance, and other operations plans and asset management strategies that enable better preparedness and ultimately more assurance that reliable service can be maintained.

In October 2018, Congress passed AWIA, which includes revisions to the Safe Drinking Water Act ("SDWA") that require all water systems serving populations greater than 3,300 people to complete Risk & Resiliency Assessments ("RRAs") and update their ERPs over a three-year period. NJAWC has completed RRA's for affected systems in accordance with compliance deadlines. Capital improvements identified through this process aimed at reducing risk and improving system resiliency are considered for incorporation into the Company's capital plan.

Some examples of resiliency and reliability projects included on Schedule DCS-1 follow:

Phase 2 of Howell-to-Lakewood Transmission Main Project

The Howell to Lakewood Transmission Main Project was identified as an important project to provide an additional water supply to both Howell and Lakewood Townships and provide increased flows and reliability to the growing Ocean County area. The Company estimated through its CPS process that demands would

increase from 8.3 MGD to 15 MGD by 2030. This pipeline supports the potential transfer of 6 MGD surplus water from the Howell Township area to the Lakewood Township area. The Phase 1 Lakewood to Howell Transmission Main Project was completed in 2017. The Lakewood to Howell Transmission Main Project Phase 2 project route included approximately 11,500 LF of 36-inch DIP main, 2,500 LF of 36-inch high density polyethylene ("HDPE") directional drill and a 335 LF of 36-inch ductile-iron cement lined ("DICL") pipe for the micro-tunnel crossing of Route 195. There is also a segment of pipeline to eliminate dead-end piping within the distribution system, which also enhances water quality in the area. This part of the project consisted of approximately 6,700 LF of 16-inch DICL pipe and fittings.

Bridgeport-Logan Systems Consolidation Main

This project provides for increased flows and reliability after decommissioning of the Bridgeport groundwater station and tank for both PFAS and storage tank structural integrity issues. With the removal of the tank from the system, as well as the loss of supply from the well station decommissioning, available fire flows in the area have been reduced. In order to increase reliability of the system and increase fire flows, this project involved the connection of the Bridgeport system to the Logan system via a new 12-inch transmission main installed along the Southbound side of Route 130, from High Hill Road to Island Avenue, and installation of a new interconnect chamber with a motorized valve, pressure reducing valve ("PRV"), and flow meter.

Coles Ave Booster Replacement

The Coles Ave booster pump station ("BPS") was built in 1969 and supplies the Prospect Avenue gradient with approximately 290 customers. The Coles Ave BPS is located in an old below-grade vault within the Coles Avenue roadway right of way. The pumps are subjected to undue wear due to the damp environment and poor structure of the vault and the facility has reached the end of its useful life. This project includes the replacement of the existing Coles Ave BPS with a new above ground BPS building located adjacent to our Coles Ave standpipe within our easement from Union County on the Watchung Reservation. Not only will this project improve reliability, but it will also improve safety for our employees and our customers by moving it above ground and out of the roadway.

Raritan Millstone WTP Ammonia Handling Facility Improvements

This project includes design and construction of a new aqua ammonia handling facility to replace the existing anhydrous ammonia handling system at the RMWTP. The existing anhydrous (gas) ammonia handing has been in use for many decades at the RMWTP and is at the end of its useful life. In addition, the use of ammonia gas presents a safety concern and replacement of the system with a suitable, less hazardous alternative would prevent the negative impacts of an accidental release and mitigate safety concerns. The 2017 CPS recommended replacement of the anhydrous system with a 19% ammonium hydroxide (aqua ammonia) system which is less hazardous. A new ammonia building will be constructed on the north side of the filter building and will house two bulk storage tanks, a day tank, transfer pumps,

and feed pumps. Double walled containment piping will be used between the ammonia building and the five feed points, and safety eyewash/showers, SCADA, fire suppression, fire alarm, security and other ancillary work is included in the project. The anhydrous ammonia system will be demolished and retired after the new system has been placed in operation.

Jerusalem Rd Booster Station Improvements –

This project includes design and construction work to replace the existing below grade Jerusalem Road pump 1 and 2 booster station with a new above grade booster station building with individual mechanical and electrical rooms. The existing booster station has reached the end of its useful life and is in poor condition, with the pumps and electrical equipment requiring upgrades. Servicing this facility also presents a safety hazard, as pumps 1 and 2 are in an underground vault (confined space entry). Improvements are needed for safe and continued operation of the booster station. Targeted piping replacement is also needed at the station to improve hydraulic conveyance. The new booster station will include two 1,500 gpm vertical turbine pumps equipped with VFD's and an emergency backup generator. The new pumps will be installed along with new 16-inch suction and discharge piping. Electrical upgrades to site power and SCADA control functionality will also be included. In addition, a motor-operated control valve MOV (altitude valve) is to be installed for the storage tank.

Canal Road WTP Ozone Conversion to Liquid Oxygen ("LOx")

The existing ozone system was installed during initial plant construction nearly 30 years ago. As the system has reached the end of its useful life, maintenance is becoming increasingly challenging; replacement parts are expensive and difficult to find as some of the equipment manufacturers are no longer in business. This project includes design and construction to upgrade the ozone system at Canal Road WTP from an ambient air-fed system to a LOx-fed system. Upgrades will include replacement of three ozone generators, cooling skids, PSUs, ozone destructors, removal of all existing air-prep equipment, and installation of two LOx storage tanks, vaporizers, pressure relief/control valves, and a nitrogen injection system. The LOx-fed ozone generators are smaller and more energy-efficient when compared to the existing air-fed ozone generators. The use of a pure oxygen source for ozone generation allows for the more efficient operation of both the ozone generators as well as other downstream processes.

Mill Road Groundwater Supply Station Iron & Manganese Removal

In the past, this station has experienced higher levels of iron and manganese. While iron and manganese are secondary drinking water standards, at current levels they do contribute to pipeline clogging (MN deposition within the pipe) as well as deterioration of customer appliances and fixtures from both clogging (MN) and discoloration and staining. These issues can lead to customer complaints and excessive flushing/maintenance. This project provides treatment to address the high levels of iron and manganese detected in the water leaving this facility.

Kent Ave Back-up Well

NJAWC provides water service to customers in the Hunterdon County community of Frenchtown. Source of supply for Frenchtown is derived from four open-hole bedrock wells. The yield capacities of two of the wells tested to be lower than their allocated capacity and improvements to these wells may not be feasible or only result in nominal gain. Consequently, firm capacity supply reserve within the Frenchtown system is limited and failure of any of the wells may result in loss of service to customers. The project includes work to drill a new well near Kent Avenue Well #1 with a pumping capacity of 130 GPM with the intention of increasing firm capacity within Frenchtown system.

29. Q. Please describe the Company's administrative and facilities investments in more detail.

A. While the above categories are broad and generally encompass nearly all projects within the Company's capital program, there are certain projects that may fall into the facilities category. This category can contain elements of each area above. For instance, older facilities may lack important security features, may have inadequate ingress or egress, or may have substandard fire detection and suppression systems. Mechanical and electrical systems may be old and inefficient resulting in higher electric and gas expense charges. And in some cases, the facilities are simply inadequate to handle the materials and equipment necessary to manage the required repairs and replacements for the level of service that customers expect and deserve. Lack of adequate storage space for materials and equipment is often a key driver

for facility improvements. Projects for facility upgrades also include investments in employee offices, restrooms, lockers and other support facilities. These are key investments in infrastructure necessary to a attract and retain an engaged workforce.

Some examples of administrative and facilities projects included on Schedule DCS-1 follow:

Raritan Millstone WTP Flood Risk Reduction Phase 1

This is the first part of a multiphase project to address potential buoyancy/uplift impacts on structures resulting from the increased flood stage level of the new flood wall/levee design elevation of 48 feet. A report entitled "RMWTP Buoyancy Study for Flood Risk Reduction Improvements" identified several vulnerable structures (e.g., High-Lift Pumping Station at Filters #13-19 and Filters 19-24, Diesel High-Lift Pumping Station, Summer Filters #31-36, and the Electric High-Lift Pumping Station) that need to be addressed. The work in this phase includes the design and implementation of a wall strengthening system for the pipe gallery under Filters 7-12 as well as the design and implementation of a wall strengthening system for the overflow chamber at the Electric High Lift Pumping Station. Future phases will address the other locations identified in the report.

Belle Mead Training Yard Expansion

The scope of this project is to expand the training grounds at Belle Mead Operations Center, used for utility mechanic ("UM") and field service representative ("FSR") training. Currently, there is one section of DI pipe exposed above ground used for training purposes. The proposed project will add a second above-ground section of

pipe, two hydrants, three sheds (to simulate customer homes), meter pits, and a covered pavilion for training.

Netherwood Office Building Upgrades

This project will upgrade the existing facility by enhancing the space with a more functional lay-out that can be used to better accommodate a variety of work groups, including the transmission and distribution ("T&D") field staff, the production group, the FSRs), and GIS personnel. Facility structures will be rehabilitated and relocated as needed to accommodate the changes. Lighting will also be improved and the antiquated fire alarm system will be upgraded. The upgraded facility will provide a better functioning and safer work space for our employees.

Long Hill Wastewater Vactor Truck Building

This project will house a wastewater vactor truck and mobile wastewater camera unit, as well as provide some additional office space for the team supporting the Long Hill Township wastewater system. The truck is a vital piece of equipment for plant and system operations and requires storage in an enclosed heated space to prevent freezing of its water tank and appurtenant lines during winter months. The project includes a new 72ft x 40ft steel framed building (3,000 SF footprint with a 1,000 SF mezzanine) being built on a re-purposed portion of an existing abandoned concrete foundation. There will also be second garage bay for equipment storage in addition to locker and laundry rooms, as well as caged storage. In addition, renovations are planned for the existing administration building to allow for additional permanent office space meeting all current ADA requirements.

Howell Field Operations Center

The Company recently relocated from its facilities in Lakewood to the new site located 149 Yellowbrook Road in Howell Township. The facility had been the site of a construction company for nearly 15 years and was well suited for the Company's operations facilities. The Company has completed work to modify the existing facility including conversion of an existing warehouse to a truck storage and maintenance facility as well as conversion of a workshop to a locker room/ready room facility for field personnel. Significant improvements in site security, lighting, site access/egress (driveways and access roads), and grounds (new site backup/emergency generator) have also been completed under prior phases.

This particular phase of the project includes renovations to the existing facilities including the meter shop (testing and maintenance), training room, conference rooms, as well as various electrical improvements in the office building.

Southwest Operations Center

The Southwest Operations Center involves the design and construction of a new 55,000 SF facility to accommodate our T&D Operations staff for the Southwest Operating Area since they have outgrown the existing leased facilities in Delran. The operations center will include offices, conference rooms, training areas, garage bays and a storage yard for equipment. The operations will be more centrally located within the operating area should improve efficiencies associated with travel time between work sites.

30. Q. Are the projects about which you are testifying in this proceeding necessary and prudent in order for the Company to continue to provide safe, adequate and reliable utility service?

A. Yes, they are. At the highest level, these projects are necessary to continue to provide safe, adequate and reliable water service in a manner that is in the long-term best interest of our customers. For example, plant improvements designed to meet water quality regulations, will minimize the risk of both Notices of Violation ("NOVs") and MCL violations. Projects aimed at addressing health and safety risks mitigate potential accidents and improve both employee and customer safety. Projects designed to improve energy efficiency help to achieve the goals of improving operational efficiency and reducing energy usage. Replacement of deteriorated assets can reduce the risk of system outages, which helps promote high customer satisfaction. All of these examples show that prudent capital investment is in the best long-term interest of our customers.

III. WATER STORAGE TANK REINVESTMENT PROGRAM

31. Q. Please describe the Company's water storage tank reinvestment program ("WSTR"), also referred to as Engineered Coating of Steel Structures.

A. The Company invests millions of dollars each year in its WSTR to extend the service life of these critical distribution system storage assets. NJAWC owns and operates 187 structures to store potable water in distribution systems for fire protection, flow equalization and pressure management as well as management of peak demands. Another 58 process tanks are used at treatment plants to provide

potable water to customers across the state. The integrity of these structures is crucial to helping to protect public health and providing safe, adequate and reliable water service to customers. Investments in these structures include the replacement of corroded steel components, safety and security upgrades, and renewal or replacement of existing paint (coating) systems.

The WSTR entails an inspection of the interior and exterior structure of the tank, a prioritization program to define an annual program, bidding the work to qualified licensed contractors, awarding contracts and scheduling the work, releasing the tank to the contractor for the replacement of corroded steel components, the installation of new safety and security upgrades, and the coating reinvestment work, followed by disinfecting the tank and returning the tank to service.

32. Q. Please describe the service life considerations for water storage tanks in distribution systems.

A. Water storage tanks are generally constructed of steel or concrete, and can be configured as ground level storage tanks, elevated tanks or standpipes. Material of construction and type of tank are dictated by service requirements and cost. Of NJAWC's tank inventory of 245 tanks, 207 are steel and 38 are concrete. If properly designed, constructed and maintained, these tanks can be expected to have service lives of numerous decades despite exposure to harsh environmental conditions. A majority of these tanks are located outside and are exposed to a wide range of air temperature, humidity, water temperatures, wind loading, and seasonal weather conditions. Steel tanks need to be protected from exterior corrosion that can result

from the harsh outdoor environment and interior corrosion that can result from the effects of chlorinated water. This is especially true for coastal areas where salt air is highly corrosive to steel surfaces. In general, minor corrosion spots can be repaired; however, significant corrosion, if left unattended, can lead to structural damage and poor aesthetic conditions. In addition, this corrosion could potentially result in a breach of the tank, which could lead to contamination of the tank contents from infiltration or worse, tank structural failure. Proper inspection, ongoing routine care to address spot corrosion, and major recoating projects can therefore extend the service life of steel tanks. Concrete tanks are generally more costly to construct than steel but do not require the same level of exterior reconditioning.

33. Q. Please describe the importance of the WSTR.

A. Steel tanks require occasional, but significant investment in the coating system. NJAWC utilizes a high-performance engineered coating system on both interior and exterior surfaces of tanks. The service life of the interior and exterior coatings varies depending upon several conditions, but typical high-performance coatings can last up to about 20 years. Installation of new coating systems on existing tanks typically requires removal of existing coatings to bare metal through abrasive blasting and then installation of a new, engineered, three-coat system that will coat the structural metal and extend its useful life significantly. Containment systems are often used to control dust and overspray during blasting and coating installations. Some existing steel structures may have previously been coated with lead-based paint systems. Under those circumstances, the project activities are

supplemented with lead abatement efforts to contain, collect, and properly dispose of possible lead-based residuals and other efforts to help protect workers and the environment.

34. Q. What annual amount is the Company requesting for annual tank rehabilitation?

A. The Company estimates its annual rehabilitation costs to be $6.9 million.

35. Q. What factors are taken into consideration when determining this cost?

A. The detailed tank inspections and subsequent report and recommendations will weigh heavily in determining the actual tank rehabilitation needs and priorities. Further, the various geographical differences in tank location, *i.e.*, tanks located along the coastal regions may have a decreased coating life compared to a tank in more remote wooded regions in the central part of the state.

36. Q. Does the Company complete inspections and development of detailed plans and specifications for the WSTR work on an annual basis?

A. Yes, the Company performs inspections and has detailed plans and specifications prepared for the work identified in the inspections every year. It is the foundation for the tank rehabilitation program.

IV. THE RISKS OF FURNISHING WATER AND WASTEWATER SERVICES

A. Public Water Service

37. Q. Please provide an overview of the risks associated with furnishing safe and adequate water quantity and water quality and complying with drinking water

and environmental regulations that apply to NJAWC's water supply facilities and operations.

A. Water supply utilities are subject to a complex array of regulations at the federal, state and local levels with respect to water quantity, water quality and other environmental aspects of their facilities and operations. NJAWC's surface water and groundwater sources are subject to run off from upstream sources that can lead to possible contamination and resulting treatment challenges such as cryptosporidium, PFAS, or an unexpected chemical release upstream. These episodic challenges will continue to face the Company, all while needing to meet the everyday requirements imposed by programs administered by the NJDEP.

Drinking water quality is addressed by a combination of federal regulations established under the SDWA coupled with state regulations and enforcement. The federal act established the USEPA as the federal regulatory authority on drinking water. Under that authority, USEPA has created standards for contaminant levels in drinking water and a series of mandatory treatment method standards, coupled with monitoring and reporting requirements, and public notification mandates in the event of contaminant level or treatment method noncompliance. The USEPA has granted primacy to the NJDEP, which administers the federal regulatory standards. In recent years there has been an increase in public concern over water quality standards and regulation. This increase has led to growth and increased stringency in USEPA and state drinking water research and regulation.

The following is a brief summary of some of the key risk issues associated with current and prospective regulation of water quantity, quality and other environmental aspects of water supply system operations:

In addition to existing rules such as the Long Term 2 Enhanced Surface Water Treatment Rule ("LT2ESWTR") and Stage 2 Disinfectants and Disinfection Byproducts Rule ("Stage 2 DBPR") that continue to evolve, the Third Unregulated Contaminant Monitoring Rule ("UCMR 3") is a rule published by the USEPA in 2012 that assesses the prevalence in water supplies of certain contaminants not currently regulated under the SDWA. Certain contaminants have received particular scrutiny under UCMR 3. These include perfluorooctanoic acid ("PFOA"), 1,4-dioxane, and hexavalent chromium (chromium (VI)). PFOA is a perfluorinated compound ("PFC"), a manmade chemical used in a variety of consumer products. PFOA is prevalent in New Jersey, particularly in groundwater sources that have a history of contamination from other VOCs. Previous studies have documented developmental effects from PFOA including liver toxicity, kidney toxicity, immune effects, and cancer. Since the UCMR 3 rule requirement, the NJDEP has enacted MCL levels for PNFA, PFOA, PFOS[5], at the following limits:

- PFOA: 14 ng/L, or 0.014 µg/L
- PFNA: 13 ng/L, or 0.014 µg/L
- PFOS: 13 ng/L, or 0.014 µg/L

[5] https://www.nj.gov/dep/newsrel/2020/20_0025.htm

Prior to this regulation, PFOA had a health reference level established by the New Jersey Drinking Water Quality Institute ("NJDWQI") of 40 ng/L. PFOA has been detected in many system wells above the concentration of the NJDEP MCL. Several wells in the Central Region had been found to have elevated levels of PFOA, including: Charles St, Quinton Ave, Green Brook, Rock Ave Piscataway, Clinton Ave, Netherwood, Hummocks, and Springfield.

This NJDEP MCL promulgation for PFOA has had a significant impact on the groundwater supply of NJAWC's systems. Regulation requires discontinued use of affected wells or installation of treatment systems. Since the implementation of the new limits, NJAWC has discontinued use of PFOA impacted wells at Greenbrook Station, Charles Street Station, Quinton Ave. Station, Rock Avenue Station and Clinton Avenue Station. Many of these stations were repurposed to act as boosters to move surface water into the associated pressure gradients. The Company has mitigated the risks of a system supply deficit which could compromise system integrity if not addressed through its proactive efforts to discontinue the use of certain wells and/or install effective treatment at others. Supply, capacity and distribution system improvements were completed in order to comply with the regulation and to ensure adequate levels of service are provided. As described within my testimony, there are several projects that the Company has completed or will complete that address the PFOA (and broader PFAS) issues throughout the state. Recent completions include Baltusrol Station, Short Hills Station as well as

Springfield Station and Hummocks Station. Treatment for the Netherwood Station is planned and construction expected to start in 2022.[6]

Regarding 1,4-dioxane, the state of New Jersey is investigating the regulation of this compound through the Drinking Water Quality institute. Recently the DWQI recommended to the NJDEP that a MCL of 0.33 parts per billion ("ppb") be approved by the NJDEP for implementation. During this time, NJAWC has actively participated in monitoring both surface water and groundwater systems for 1,4-dioxane. Advanced Oxidation treatment using peroxide and ultraviolet light is in place at the Hummocks station (which also has PFAS removal equipment). Additionally, as indicated elsewhere in my testimony, the Company is installing treatment for 1,4-dioxane at the Delran WTP, in response to increased levels in the Delaware River.[7]

As the result of conditions that arose in Flint, Michigan and other jurisdictions across the country, including Newark, increased scrutiny is being placed at all levels concerning lead concentrations in water systems and the adoption[8] of more stringent requirements under the federal Lead and Copper Rule. The lead issue typically arises not from constituents in source water, but rather from the leaching of lead from older pipes and joints into the water as it passes through household service lines and plumbing. While providing centralized treatment that adjusts the

[6] In the interim, these wells are not in use. Supply from the Raritan Millstone and Canal Road WTPs is available to serve customers in the region. This station is one of several groundwater stations used for resiliency in Central Region.
[7] https://www.nj.gov/dep/14-dioxane/
[8] https://www.epa.gov/newsreleases/epa-announces-intent-strengthen-lead-and-copper-regulations-support-proactive-lead

pH can, in many cases, help minimize lead corrosion, the fact is that the plumbing in many older communities (including those in NJAWC's service territory) are older lead pipes or contain the type of copper and galvanized pipes with solder joints where lead contamination is an increased risk.

The USEPA recently issued and formally adopted Long Term Revisions to the Lead and Copper Rule ("LCR" or "Rule"). Generally, the revisions center around providing for a more protective and enforceable health standard. Key areas that the revised Rule covers include more robust inventory management, strengthened corrosion control, treatment, increased sampling, and improved risk communication. The Rule as promulgated will impose significant additional capital investment requirements and increased operating expenses on all water systems. In addition, the New Jersey legislature has supplemented USEPA's recommendations with legislation (A5343/SS3398) that provides for more stringent inventory and lead line replacement requirements than the revised LCR ("NJ LSL Legislation").[9]

Most details of the changes to the Rule, as supplemented by the NJ LSL Legislation, include the following:

1. Identifying areas most impacted: this will require a lead line inventory for the first time, due in 2024. The NJ LSL Legislation requires a first inventory in January 2022.

[9] *See* https://www.asdwa.org/2021/07/26/nj-governor-signs-law-requiring-all-lead-service-lines-to-be-replaced-in-10-years/#:~:text=10%20Years%20%2D%20ASDWA-,NJ%20Governor%20Signs%20Law%20Requiring%20All%20Lead%20Service,be%20Replaced%20in%2010%20Years&text=Last%20Thursday%20(7%2F22),service%20lines%20within%2010%20years; *see also* https://nj.gov/governor/news/news/562021/approved/20210722a.shtml

2. Strengthening Treatment Requirements: a new trigger limit of 10 ppb; systems that currently provide for corrosion control treatment, such as certain NJAWC systems, would be required to optimize the existing treatment scheme. Systems that do not practice corrosion control would be required to complete a corrosion control study.
3. Replacing Lead Service Lines: The 10 ppb trigger would require the utility to work with the state to set an annual goal of lead service line replacement so that a level below the 10 ppb trigger could be achieved. Also, partial lead service line replacements would not be allowed under the proposed Rule. The NJ LSL Legislation requires all lead service lines to be removed within 10 years, including galvanized lines.
4. Increased Sampling Reliability: a new sampling techniques and selection criteria to ensure the most at-risk communities receive the greatest sampling efforts.
5. Improving Risk Communication: 24-hour notification of any action exceedance levels, along with requiring systems to make the lead service line inventory publicly available. There are also additional annual reporting requirements under NJ LSL Legislation.
6. Protecting Children in Schools: schools are required to sample and test schools and day care facilities in a similar manner to public water systems. The NJ LSL Legislation has additional requirements for schools and other community facilities.

In addition to the items above, NJDEP has shared a few ideas with external stakeholders through various workshops and stakeholder meetings that suggest it is considering changes above and beyond the USEPA revised Rule as published.

38. Q. Are there any additional contaminant testing initiatives from USEPA?

A. Yes, in 2016, the USEPA issued the Fourth Unregulated Contaminant Monitoring Rule ("UCMR 4"), which required monitoring for 30 chemical contaminants[10] between 2018 and 2020 using analytical methods developed by the USEPA and consensus organizations to provide a basis for future actions to help protect public health.

Following a successful UCMR4 sampling effort, NJAWC has used the resulting data to direct current and future operational mitigations and projects. Specifically, the Company has directed resources and expertise in expanding its utility-owned laboratory cyanotoxin analytical capabilities. Cyanotoxins, especially microcystin, can now be detected at levels far below what was previously possible. Our water quality laboratory staff have trained and supported the efforts of the NJDEP and NJWSA for drinking water reservoir monitoring and management. These capabilities have made proactive WTP and reservoir management programs possible and strengthen the protection of public health for New Jersey drinking water customers. Disinfection byproduct ("DBP") sampling results have

[10] The 30 chemical contaminants included 10 cyanotoxins (nine cyanotoxins and one cyanotoxin group) and 20 additional contaminants (two metals, eight pesticides plus one pesticide manufacturing byproduct, three brominated haloacetic acid ("HAA") disinfection byproducts groups, three alcohols, and three semivolatile organic chemicals ("SVOCs").

highlighted the importance of balancing strong surface water treatment programs, disinfection, and distribution system water quality. Comprehensive programs are in place to manage DBP formation from source water to customer taps.

Most recently, the USEPA released the Final Fifth Unregulated Contaminant Monitoring Rule ("UCMR 5").[11] According to the USEPA,

> UCMR 5 requires sample collection for 30 chemical contaminants between 2023 and 2025 using analytical methods developed by EPA and consensus organizations [].[12] This action provides EPA and other interested parties with scientifically valid data on the national occurrence of these contaminants in drinking water. Consistent with EPA's PFAS Strategic Roadmap, UCMR 5 will provide new data that is critically needed to improve [US]EPA's understanding of the frequency that 29 PFAS (and lithium) are found in the nation's drinking water systems and at what levels. This data will ensure science-based decision-making and help prioritize protection of disadvantaged communities.[13]

The Company is well prepared to execute this updated sampling plan and, given its track record of implementing solutions for PFAS, plans to engage with USEPA and the NJDEP in helping to provide solutions for providing treatment for these compounds. Given the extensive work done under prior UCMR efforts, the Company expects a significant level of increased operational and capital outlays in future years. In fact, the USEPA has estimated the annual average cost to manage the UCMR5 effort for very large systems to be $2.2 million.[14] This only includes

[11] https://www.epa.gov/dwucmr/fifth-unregulated-contaminant-monitoring-rule
[12] Planning activities are expected to start in 2022, with final reporting completed in 2026 in accordance with the rule.
[13] *Id.*
[14] *See* Federal Register, Vol. 86, No. 245, p. 73135 (Dec. 27, 2021) available at https://www.govinfo.gov/content/pkg/FR-2021-12-27/pdf/2021-27858.pdf.

the monitoring and analysis related to the UCMR5 CECs. Should the USEPA or NJDEP decide to implement new MCL's related to any of these compounds, further expenses would be incurred for ongoing monitoring, customer communication, and if needed, capital outlays for system improvements needed to treat for these compounds. As noted by USEPA:

> The public benefits from the information about whether or not unregulated contaminants are present in their drinking water. If contaminants are not found, consumer confidence in their drinking water should improve. If contaminants are found, related health effects may be avoided when subsequent actions, such as regulations, are implemented, reducing or eliminating those contaminants.[15]

B. Public Wastewater Service

39. Q. Please provide an overview of the risks that environmental regulation poses for NJAWC as the owner and operator of public sewer systems.

A. Like the provision of public water supply service, the operation of wastewater collection and treatment systems entails a range of environmental regulatory risks. Sewer operations are also regulated at both the federal and state levels pursuant to a number of statutes and voluminous regulations. At the federal level, sewer systems are regulated pursuant to the Clean Water Act and numerous regulations adopted by the USEPA under that law, which programs are administered by the NJDEP pursuant to regulations adopted in furtherance of setting standards for the construction and operation of sewer treatment systems.

[15] *Id.*

The significant risks associated with operating wastewater systems include the following:

Effluent limitations imposed on wastewater treatment plant discharges are stringent and can become more stringent over time. The Clean Water Act requires wastewater systems to obtain and comply with National Pollutant Discharge Elimination System ("NPDES") permits, which, in New Jersey, are issued and enforced by the NJDEP. These NPDES permits establish stringent effluent limits based upon the stricter of: (1) technology-based effluent limits; and (2) water quality based effluent limits.

Several NJAWC treatment plants, including the Homestead wastewater treatment plant ("WWTP") and the Long Hill WWTP face more stringent effluent limits for a series of parameters, particularly lowering ammonia and phosphorous limits due to classification of the receiving stream.

More stringent effluent limits may be imposed when technology evolves or stream conditions and discharge requirements change, engendering requirements for significant capital improvements and/or increased operating costs for enhanced treatment performance. Every 3-5 years, NPDES permits are up for renewal, and in any such renewal, more stringent limits may be triggered.

Other potential liability risks from wastewater system operations arise from backups, overflows or releases that may occur from the collection system onto private property or into the environment. The Company has deployed level sensing

and alarming technology (Telog and SmartCover) which provide effective monitoring for optimized cleaning to help prevent such backups and potential overflows. As an example, some wastewater system operators have been confronted with claims under the federal Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA") for cleanup of contamination that occurred when wastewater containing "hazardous substances" leaked from wastewater lines into soils or groundwater. While not as extreme, liabilities resulting from wastewater backups into buildings or other unplanned discharges are an inherent part of wastewater system risks.

C. Climate Variability

40. Q. Does climate variability pose additional risk for water supply utilities such as NJAWC?

A. Yes. Whatever the debate may be concerning the causes of climate variability, water supply utilities face the reality of climatic variability and attendant stresses on water resources and system recovery. The recent trend in precipitation throughout Northeastern United States has been towards increases in rainfall intensity and rainfall is also projected to increase in amount and persistence in addition to intensity.[16] That means we can expect more intense high-precipitation events, river and coastal floods, along with high damaging storm events – which

[16] USGCRP, 2018: *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II*, Chapter 18 - Northeast [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 1515 pp. doi: 10.7930/NCA4.2018, available at https://nca2018.globalchange.gov/chapter/18/

impact water utilities. In addition, these climate-related disruptions will exacerbate existing aging infrastructure issues experienced by water utilities.[17]

Recently the remnants of Hurricane Ida devastated much of Central New Jersey.[18] The storm claimed five lives and resulted in millions of dollars in property damage. Fortunately, the Company had completed a $35 million improvement in the RMWTP's floodwall system back in 2018 and as a result of these improvements was able to sustain safe, reliable service throughout the storm event. Additionally, the Company also upgraded its backup generator system that provided uninterrupted power during the event (even though utility side power was interrupted). Had these improvements not been made, hundreds of thousands would have been without safe, reliable water during this event.[19] These investments demonstrated clearly the wisdom and prudence of Company's focus on reducing risk and maintaining safe and reliable service to its customers. Water supply systems are fundamentally resource-dependent and, therefore, the effects of climate variability pose a significant on-going risk and create challenges with regard to maintaining a reliable water supply during the full range of potential future conditions, including even what might be assumed to be "normal" periods. The safe yields of water supply sources have historically been evaluated based on historical

[17] *Id.*
[18] https://www.tapinto.net/towns/bridgewater-slash-raritan/sections/somerset-county-news/articles/somerset-county-one-of-6-in-new-jersey-named-in-major-disaster-declaration-after-tropical-storm-ida
[19] https://www.roi-nj.com/2021/09/10/industry/energy-utilities/at-njaw-preparing-for-100-year-floods-that-now-come-every-few-years/?utm_source=ROI-NJ+MAIN+Newsletter+List+%282%2F4%2F19%29&utm_campaign=b8a2a59891-EMAIL_CAMPAIGN_2021_09_09_11_48&utm_medium=email&utm_term=0_6732b2b110-b8a2a59891-44402630

climatic patterns, data from so called "droughts of record" or dry period frequency analysis. Changing climatic conditions, however, suggest that historical hydrologic data (which in many cases only reflect 50-100 years of rainfall and stream flow measurement collection – a quite short period in geologic or climatic time) may not accurately predict future conditions. Thus, the calculated safe yield of streams, reservoirs and groundwater wells are put in question as the effects of climate variability are experienced across the southeastern United States. Thus, in response to climate variability, water supply systems must address the risks posed to the reliability and resilience of their sources. While droughts are the major challenge for water supply systems, heavy precipitation and high-flow events are the concern of wastewater systems.

The effects of climate variability impact the resiliency of a system to withstand an event without disrupting service to customers or, if service is interrupted, to restoring the service in a timely manner. Like all large users dependent on electricity from the grid, water utilities must plan for power outages and develop plans for maintaining continuity of operations when such outages occur. Nonetheless, recent weather patterns combined with the issue of aging infrastructure are causing utilities to review traditional planning and design criteria. The design standards for supplies, treatment plants, pump stations and tanks are taken together to achieve a level of zero service outages. The so-called new normal has led experts to look beyond traditional reliability and emergency planning into a world that needs the speed of recovery and resiliency for much more widespread

and damaging events. Updating infrastructure to keep up with the increase in extreme weather and ensuring that adequate service can be maintained for extended time periods after an extreme event is just as important as addressing the aging infrastructure.

The Company looks for ways to reduce or mitigate increases in expense in many areas of the business, which also have an environmental benefit. Examples such as increased leak detection allow for more efficient routing of repair crews to the highest priority leaks. Controlling leaks before they create larger issues results in less fuel usage, and minimizes excavation and repair materials; not to mention inconvenience to customers from interruptions in service, detours and, etc. This proactive approach of deploying active leak detection not only minimizes treatment exposure but also helps preserve source water; every gallon that is saved is a gallon that can be provided at a later date, particularly during times of drought.

In addition, NJAWC has and will continue to evaluate its systems and systematically look for opportunities to add additional standby power capacity, look for ways to diversify its fuel supply and review and implement various other projects to minimize its potential impact to climate change.

41. Q. Does this conclude your Direct Testimony?

A. Yes, it does.

NEW JERSEY-AMERICAN WATER COMPANY, INC.

Appendix A

1. Q. Please describe your educational background and professional associations.

A. I earned a Bachelor of Mechanical Engineering degree (1991) from Villanova University, Villanova, Pa. I am a registered Professional Engineer in the State of New Jersey and am currently licensed in an inactive status in multiple states including Pennsylvania, Ohio, New York, Missouri, Maryland, and Delaware.

2. Q. What has been your business experience?

A. I have over twenty-six years of experience in the water and wastewater utility engineering field. From 1991 to 2001, I was employed by the Bergen County Utilities Authority ("BCUA") in various engineering positions of increasing responsibility including, Assistant Engineer and Senior Environmental Engineer where I designed, managed, and commissioned multi-disciplined wastewater infrastructure projects. I led projects that were focused on operational efficiency and data collection along with significant plant and collection system improvements. Some examples include:

- Upgrade of all of the BCUA's open channel flow metering equipment.
- Management of permitted overflow level monitoring
- Replacement of 42" PCCP Force Main
- Rehabilitation of 12" Gravity sewers with fold and form lining technology
- Treatment plant additions including addition of Sludge thickening centrifuge and associated equipment; polymer feeds, electrical equipment and controls
- Replacement of Waste Activated Sludge Pumping System

From 2001 through 2011 I was employed by Applied Water Management Inc. ("AWM"), where I worked in various positions of increasing responsibility from staff engineer to Design Build Director (Company Officer). I also held a position of Officer and Director on the Board of Applied Wastewater Management, Inc. ("AWWM"), a New Jersey Board of Public Utilities ("BPU" or "Board") -regulated subsidiary of AWM. Much of my experience at AWM was in design construction and operations of small, decentralized water and wastewater treatment facilities. My work included responsibility for complete design, construction and facility commissioning for Integrated Biological Membrane Filtration Plants for sewage treatment and discharge to ground water. These plants were designed for strict groundwater discharge limits (Nitrogen) and allowed for a high degree of automation for continuous unattended operation. Water systems design and construction included well stations with treatment (air stripping, disinfection) and distribution equipment (hydro pneumatic tanks, pumping systems, fire flow systems).

AWM was a subsidiary company of American Water Works Company, Inc. ("AWW") until 2011. Upon the completion of the sale of AWM in December 2011, I took a position with AWW as an engineer with the American Water Works Service Company, Inc. ("AWWSC"). I held a Director of Engineering position, primarily supporting business development activities as a technical expert. I also provided engineering support and leadership for various strategic initiatives including wastewater growth opportunities and water/wastewater system planning and infrastructure renewal. In

January of 2014 I was appointed to the position of Vice President - Engineering for NJAWC which position I held until being appointed to my current position as Vice President of Engineering for the Eastern Division in September of 2019.

NJAW Additions to Plant in Service 07/01/21 - 12/31/22

Project	Description	Project Total	Est In Service Date
I18-150118-01	CBWTP Mtl Storage&Building Improvem	1,316,003	04/13/20
I18-180031-01	SRWTP's 2nd Clearwell	1,588,555	12/22/20
I18-180050-01	36-inch CI-Rumson Pl-Little Silver	1,245,797	04/30/21
I18-180070-02	Tinton/Ave of Mem Main Post DSIC	404,909	10/01/21
I18-150124-01	Baltusrol Station PFAS System, Interim	2,027,712	9/14/2021
I18-250035-03	RMWTP Phase 3: Filters 15-18	3,161,816	9/15/2021
I18-190046-01	Howell-to-Lakewood Trans Ph 2	23,284,202	9/22/2021
I18-180065-01	Tinton Ave 24" Main Replacement/Ext	5,227,827	10/1/2021
I18-130104-01	Bridgeport-Logan Syst Consolidation Main	2,971,481	10/20/2021
I18-180078-01	River Rd Main Replacement Rumson	7,057,739	10/27/2021
I18-260120-02	Central LSL Replacements	4,496,809	10/29/2021
I18-260112-01	2021 Clark C&L	3,200,748	10/31/2021
I18-130052-01	Southwest A&C Upgrades Phase 4 (CPS-A4)	2,104,490	12/31/2021
I18-150112-01	Phase 4 NRW 2021	1,239,755	12/31/2021
I18-150120-01	Pottersville Tank Rechloramination (temp)	468,151	12/31/2021
I18-150129-01	North West Orange DX Upgrade 2021	1,038,339	12/31/2021
I18-180050-02	36-inch CI - Rumson Pl - Little Silver	250,000	12/31/2021
I18-180070-01	Tinton/Ave of Mem 24" Main Ph 1/3c/3e/4	1,866,596	12/31/2021
I18-190021-01	Coastal North A&C Upgrades Phase 2	2,184,320	12/31/2021
I18-190022-01	Coastal North A&C Upgrades Phase 3	710,206	12/31/2021
I18-230036-01	Lakewood WW C&L 2020	609,061	12/31/2021
I18-250035-06	RMWTP Control Room	2,017,377	12/31/2021
I18-250101-01	CRWTP:Floc/SedBsn 1-2 CPS:B17	12,646,939	12/31/2021
I18-250120-01	Bridgewater Tank Rechlor	1,588,221	12/31/2021
I18-260066-01	Central A&C Upgrades Ph 6 & 6f CPS:B10	4,608,759	12/31/2021
I18-130131-01	DRRWTP Treatment Improvements	4,327,979	2/28/2022
I18-190041-02	Lakewood Facility Relocation - Ph2	2,787,779	2/28/2022
I18-250035-04	RMWTP Phase 4: Filters 1-6	4,374,129	2/28/2022
I18-250136-01	Belle Mead Training Yard Expansion	530,406	2/28/2022
I18-150119-01	Mendham Low Booster Improvements A5:CPS	3,213,572	3/31/2022
I18-180071-01	Roberts Rd Booster Sta-Gen/Elect Upgrade	1,066,321	3/31/2022
I18-190051-01	Lakewood C&L 2021	4,024,220	4/30/2022
I18-190052-01	Bay Head HDD and Main	1,625,628	4/30/2022
I18-190053-01	James Street Lakewood Water Main	1,712,728	4/30/2022
I18-260129-01	60-in PCCP Piscataway Spot Repairs	3,969,100	4/30/2022
I18-150052-01	Diamond Hill Booster Upgrades	3,009,191	5/31/2022
I18-150052-03	Diamond Hill Booster Upgrades Phase 2	1,102,110	5/31/2022
I18-150079-01	Pottersvlle Well-Gas Mmbrane B21:CPS	638,235	6/30/2022
I18-180077-01	Turf Reduction Demonstration Project	575,814	6/30/2022
I18-180079-01	Glendola to JB Raw Water Main Insp&Impr	1,222,463	6/30/2022
I18-180080-01	Shrewsbury Ops Backup Generator	587,981	6/30/2022
I18-180084-01	Meridian Building Rehab	1,411,716	6/30/2022
I18-250114-01	RMWTP Flood Risk Reduction Ph I	231,563	6/30/2022
I18-260086-01	Coles Ave Booster Repl CPS:B-2	1,359,857	6/30/2022
I18-260121-01	Netherwood Office Building Upgrades	928,338	6/30/2022
I18-250035-05	RMWTP Phase 5: Filters 7-14	5,487,628	7/31/2022
I18-190050-02	Oak Glen Production & Water Quality Lab - Ph2	2,051,139	8/31/2022
I18-250079-01	RMWTP Ammonia Hand Facility Impr CPS B-6	6,670,095	9/30/2022
I18-350002-01	Phosphorous Removal Project	819,748	10/31/2022
I18-190049-01	Howell Field Ops Center	8,025,097	11/30/2022
I18-350001-01	Long Hill WW Vac Truck Building	5,510,913	6/30/2022
I18-260100-01	Jerusalem Rd Booster Sta Imprv CPS:B1	3,439,611	12/31/2022
I18-250139-01	CRWTP Solar Array (7.2MW)	588,672	12/31/2022
I18-170008-01	Oxford Sta Treatment Upgrades	5,270,243	12/31/2022
I18-220006-01	W 17th Street Lift Station	2,702,490	12/31/2022
I18-280003-01	Glen Meadows - Treat Unit Upgrade (A-4)	3,220,043	12/31/2022
I18-260067-01	Central A&C Upgrades Ph 6a-d CPS:B10	4,738,693	12/31/2022
I18-260108-01	EchoShore DX Central Region 2021-2022	3,719,626	12/31/2022

NJAW Additions to Plant in Service 07/01/21 - 12/31/22

Project	Description	Project Total	Est In Service Date
I18-350003-01	Long Hill PS Improvements Project	1,532,528	12/31/2022
I18-150109-01	Canoe Brook Solar Expansion (PPA)	579,829	12/31/2022
I18-250036-01	CRWTP Ozone Conversion to LOX CPS A-17	20,029,482	12/31/2022
I18-120049-01	Mill Road Station Iron & Mn Removal Proj	17,542,690	12/31/2022
I18-130089-01	Southwest Operations Center	23,464,491	12/31/2022
I18-130114-01	Woodlane Plant Improvements (A3)	10,203,466	12/31/2022
I18-130125-01	Runnemede/Somerdale Detention Mains	833,333	12/31/2022
I18-130143-01	Delran Roof Replacements	1,500,000	12/31/2022
I18-150113-01	Phase 5 NRW 2022	1,475,004	12/31/2022
I18-150132-01	Irvington LSL Replacement	5,011,436	12/31/2022
I18-190054-01	Rt 9 Water Main Replacement - Lkwd	13,995,847	12/31/2022
I18-190055-01	Farmingdale Transmission Loop	5,039,042	12/31/2022
I18-250140-01	Kent Ave Back-up Well	368,590	12/31/2022
I18-250126-01	CRWTP Alum Tank Replacements	2,000,000	12/31/2022
I18-250137-01	Kent Avenue Well 1 Arsenic Removal	1,726,008	12/31/2022
I18-250138-01	BM Ops & RMWTP Admin HVAC Impr	1,013,333	12/31/2022
I18-260122-01	Westfield Structural C&L-E Broad St	5,000,000	12/31/2022
I18-260128-01	Netherwood Ops Center Storage Yard Impro	800,000	12/31/2022
I18-270004-01	Homestead Chem Feed & Storage	2,390,021	12/31/2022
I18-340002-01	2nd Ave Lift Station Replacement	2,618,165	12/31/2022
I18-190045-01	Monterey Backup Well (A-17)	2,269,430	12/31/2022
I18-280005-01	Statewide Sewer A&C Upgrades Ph 1 2022	1,901,990	12/31/2022
Total IP		299,553,625	

NJAW Additions to Plant in Service 07/01/21 - 12/31/22

Project	Description	Project Total	Est In Service Date
RP-A	New Mains	9,776,794	Various
RP-B	Replaced Mains	172,657,193	Various
RP-C	Unscheduled Main Replacements	13,635,392	Various
RP-E	New Hydrants & Valves	5,976,592	Various
RP-F	Replaced Hydrants & Valves	23,792,941	Various
RP-G	New Services	21,450,954	Various
RP-H	Replaced Services	48,449,323	Various
RP-I	New Meters	2,786,162	Various
RP-J	Replaced Meters	36,027,702	Various
RP-K	ITS Equipment & Enterprise Solutions	3,150,083	Various
RP-L	SCADA	3,033,928	Various
RP-M	Security	3,102,572	Various
RP-N	Offices & Facilities	6,440,105	Various
RP-O	Vehicles	18,354,587	Various
RP-P	Tools & Equipment	4,195,749	Various
RP-Q	Plant Process Equipment	31,016,397	Various
DV	Developer Funded Projects	22,279,668	Various
Total RP/DV		426,126,142	

Total Additions to Plant in Service 07/01/2021 - 12/31/22	725,679,767