TECHNICAL, MANAGERIAL, AND FINANCIAL CAPACITY EVALUATION

TRENTON WATER WORKS

H2M Project No.
NJDP2301

January 2025

Prepared for:

New Jersey Department of Environmental Protection
401 East State Street
Trenton, NJ 08625

Prepared by:

H2M Associates, Inc.
4810 Belmar Blvd, Suite 201
Wall Township, NJ 07753

Patrick K. Cole, P.E.
New Jersey Professional Engineer
License No. 24GE04587100

Please be advised that this is a redacted version of the Trenton Water Works Technical, Managerial, and Financial Capacity Evaluation. Certain sections of the document have been redacted because they are considered sensitive information. Sensitive records are considered non-public records and are therefore exempt from the New Jersey Open Public Records Act (N.J.S.A. 47:1A-9a). Sensitive records, are described as those records that if released, "would substantially interfere with the State's ability to protect and defend the State and its citizens against acts of sabotage or terrorism, or which if disclosed would materially increase the risk or consequence of potential acts of sabotage or terrorism." This statutory language is reiterated in the Department's Non-Public Record rules at N.J.A.C. 7:1D-3.2(b).

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABBREVIATIONS

ºF	Degrees Fahrenheit
Ø	Diameter
A	Ampere
ANSI	American National Standards Institute
AMP	Asset Management Plan
ASTM	American Standard of Testing and Materials
AWQR	Annual Water Quality Report
AWWA	American Water Works Association
BAT	Best Available Technology
CEA	Critical Environmental Area
CCR	Consumer Confidence Reports
CD	Capacity Development
CDP	Capacity Development Program
CDS	Capacity Development Strategy
CFR	Code of Federal Regulations
C.I.	Cast iron
Cl	Chlorine
CIP	Capital Improvement Plan
CMMS	Computerized Maintenance Management System
CRR	Code of Rules and Regulations
CSI	Construction Specifications Institute
CWS	Community Water System
CPE	Comprehensive Performance Evaluation
CTA	Comprehensive Technical Assistance
CWA	Federal Clean Water Act
DCA	New Jersey Department of Community Affairs
D/DBP	Disinfectants and Disinfectant By-Products
D/DBPR1	Disinfectants and Disinfectant By-Products Rule - Stage 1
D/DBPR2	Disinfectants and Disinfectant By-Products Rule - Stage 2
DAF	Dissolved Air Flotation
DBP	Disinfectant By-Products
DLGS	Division of Local Government Services
DRBC	Delaware River Basin Commission
E. coli	Escherichia coli

ABBREVIATIONS

e.g.	For example
EHS	Extraordinarily Hazardous Substance
EPA	United States Environmental Protection Agency
EPR	Energy Profile Report
gal	Gallon
gpd	Gallons per Day
gph	Gallons per Hour
gpm	Gallons per minute
gpm/ft^2	Loading rate in gallons per minute per square foot/feet
HAA5	Haloacetic Acids
HMI	Human Machine Interface
HOA	Hand/Off/Auto (switch)
hp	Horsepower
HUC	Hydrologic Unit Code
HVAC	Heating, Ventilation, Air Conditioning
IESWTR	Interim Enhanced Surface Water Treatment Rule
IFE	Individual Filter Effluent
I&C	Instrumentation and Controls
i.e.	That is
I/O	Input/Output
IOC	Inorganic Compounds
IST	Inherently Safer Technology
KPI	Key Performance Indicator
kVA	Kilovolt-Amps
lb	Pounds
lb/gal	Pounds per Gallon
lb/MG	Pounds per Million Gallons
lb/yr	Pounds per Year
LCC	Life Cycle Cost
LCR	Lead and Copper Rule
LOR	Local/Off/Remote (switch)
LRAA	Locational Running Annual Average
LT2ESWTR	Long-Term 2 Enhance Surface Water Treatment Rule
MCC	Motor Control Center
MCL	Maximum Contaminant Level

ABBREVIATIONS

MCOEM	Mercer County Office of Emergency Management
MG	Million Gallons
mg/L	Milligrams per Liter
MGD	Million Gallons per Day
MGY	Million Gallons per Year
MRDL	Maximum Residual Disinfectant Level
N/A	Not applicable
ND	Non-detect
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NJEIT	New Jersey Environmental Infrastructure Trust
NJIB	New Jersey Infrastructure Bank
NJPDES	New Jersey Pollutant Discharge Elimination System
NIPDWR	National Interim Primary Drinking Water Regulation
NPDWR	National Primary Drinking Water Regulation
NSDWR	National Secondary Drinking Water Regulation
NSF	National Sanitation Foundation at the University of Michigan
NTU	Nephelometric Turbidity Units
O&M	Operation and Maintenance
OEL	Operational Evaluation Level
OSHA	Occupational Safety and Health Administration
PCCP	Prestressed Concrete Cylinder Pipe
PEOSH	Public Employees Occupational Safety and Health (NJ)
P&ID	Piping and Instrumentation Diagram
pcf	Pounds per Cubic Feet
PDD	Peak Daily Demand
pH	Decimal logarithm of reciprocal of hydrogen activity (i.e. <7.0 acidic pH, >7.0 basic pH)
PLC	Programmable Logic Controller
PPE	Personal Protective Equipment
PRV	Pressure Relief Valve
psf	Pounds per Square Feet

ABBREVIATIONS

psig	Pounds per Square Inch Gauge
PWS	Public Water System
PWSID	Public Water System Identification Number
RTCR	Revised Total Coliform Rule
SCADA	Supervisory Control and Data Acquisition
SDWA	Federal Safe Drinking Water Act
SMCL	Secondary Maximum Contaminant Level
SOP	Standard Operating Procedure
SWTR	Surface Water Treatment Rule
SWAP	Surface Water Assessment Program
TBD	To Be Determined
TCPA	Toxic Catastrophe Prevention Act
TCR	Total Coliform Rule
TDH	Total Dynamic Head
TDS	Total Dissolved Solids
THM	Trihalomethanes
TMP	Triggered Monitoring Plan
TMDL	Total Maximum Daily Load
TMF	Technical, Managerial, and Financial
TSS	Total Suspended Solids
TTHM	Total Trihalomethanes
UCMR3	Unregulated Contaminants Monitoring Rule - Third Round
µg/L	Microgram Per Liter
USGS	United States Geological Survey
VOC	Volatile Organic Compound
WMP	Watershed Management Plan
WTP	Water Treatment Plant

DISCLAIMER: The findings of this report follow the issuance of a Unilateral Administrative Order (UAO), through which the NJDEP and their assigned consultants have directed many technical and organizational improvements within the TWW system to optimize their operation. As such, the findings and conclusions discussed herein are representative of TWW after receiving independent third-party direction. Based on a comparison of the findings in the UAO, some areas of improvement are evident.

EXECUTIVE SUMMARY

This report provides a comprehensive evaluation of the Technical, Managerial, and Financial (TMF) capacity of the Trenton Water Works (TWW or Utility), a division of the City of Trenton's Water and Sewer Department. The Safe Drinking Water Act provides a regulatory framework for states to develop and implement programs that ensure the maintenance of technical, managerial, and financial capacity for public water systems. In New Jersey, the Department of Environmental Protection (NJDEP) administers the Safe Drinking Water Act, and a Capacity Development Program (CDP) was approved by the US Environmental Protection Agency (USEPA) to define the criteria for review of public water systems under this strategy. The benchmarking criteria for such a review is defined at NJAC 7:10-13.1 et seq and is given full narrative treatment in the NJDEP document entitled "Capacity Development Program (CDP), Criteria and Benchmarks for Technical, Managerial, and Financial Capacity."

Trenton Water Works (PWSID 1111001) operates as a Department within the governmental structure of the City of Trenton. TWW is responsible for the treatment, transmission, and distribution of finished water to roughly 220,000 people in Trenton, Ewing, Lawrence, Hopewell, and Hamilton. TWW operates a central water treatment plant, several pump stations, the Pennington Reservoir, and a collection of storage tanks, all of which serve their regional customer base. As one of the oldest water systems in the State of New Jersey, TWW's water assets and scope of supply have expanded as regulations developed and the service area expanded. Over the years, TWW has consistently struggled to meet drinking water quality standards, sustain system reliability, maintain aging infrastructure, and satisfy many other public health and safety obligations, which have resulted in the NJDEP's issuance of several administrative consent orders (ACO's). These ACOs have included remediation obligations and schedules that TWW has agreed to follow; in many instances, however, these schedules are not met, and the system improvements necessary to protect public health and safety are not made. After several such failings to adhere to the terms of its ACOs, TWW was placed under a unilateral administrative order (UAO) issued by the NJDEP, whereby the NJDEP asserted direct operational oversight of TWW. One of the terms of the UAO included an audit of TWW against the above stated TMF criteria and benchmarks.

On behalf of the NJDEP, H2M architects + engineers (H2M) has undertaken a review of all aspects of technical, managerial, and financial capacity, in accordance with the benchmarks codified at NJAC 7:10-13.1 et seq, and the Capacity Development Program (CDP) document.

The general conclusion of the evaluation is that Trenton Water Works and the City of Trenton demonstrate consistent noncompliance with TMF criteria. Despite a physical system which was largely designed and constructed properly, TWW as an institution has routinely neglected the requisite maintenance and upkeep of said system, resulting in shortened service life, diminished capacity and redundancy, and improper operation of treatment and distribution assets. In short, the predominant failings within TWW are of an organizational and managerial nature, which have a deleterious impact on the technical and financial aspects of the Utility.

This report identifies five primary categories of deficiency which are interwoven between technical, managerial, and financial subject areas.

1. Non-Compliance with Safe Drinking Water Regulatory Requirements

TWW has a storied history of non-compliance, violations, and administrative orders issued by the NJDEP. Many of the recorded violations pertained to administrative non-compliance, such as failing to report certain water quality parameters, failing to take samples on the required schedule, and failure to submit paperwork. Section 1.3 provides greater detail on TWW's compliance history. However, non-administrative violations with considerable implications for the health and safety of TWW customers have been numerous.

Like all water systems in the State, TWW is responsible to meet or exceed all regulations imposed by the US EPA and NJDEP, including those pertaining to water quality. Recent significant water quality issues include a Legionella outbreak in TWW's service area, midge larvae in the distribution system, the continued operation of a non-compliant open-air finished water reservoir, challenges in adequately operating the Superpulsator units at the treatment plant that are necessary to remove foreign material from source water, and an accidental release of zinc orthophosphate into said reservoir, which has the potential to spur algal blooms and subsequent cyanobacteria / cyanotoxin issues.

Further, over the course of many years and across mayoral/council administrations, TWW has repeatedly failed to achieve compliance with the requirements of various Administrative Consent Orders that TWW entered voluntarily in order to cure longstanding deficiencies at the Utility. This pattern demonstrates TWW's lack of consistent and proficient executive leadership and capable management, both of which are required to act as stewards of the Utility. These systemic organizational weaknesses are reflected in many examples of consistent non-compliance with Safe Drinking Water requirements, including TWW's inability to timely meet its lead service line replacement obligations, and a continued lack of progress towards replacing the uncovered finished water reservoir. In some cases, it was not until the NJDEP became directly involved that suitable corrective actions were taken.

2. Chronic Lack of Proper Management and Maintenance

The physical assets of TWW suffer from mismanagement and a chronic lack of maintenance. The systemic organizational weaknesses have a trickle-down effect on the condition of the treatment plant and the system at large. Many examples of poor maintenance and mechanical breakdown were observed and are described in the body of this report, which speaks to a lack of personnel training, poor performance of critical system functions, and a general disregard for recommended operations and maintenance (O&M) practices. Chronically deferred maintenance items, such as roof replacement and HVAC improvements at the treatment plant, reflect an organization that is unable to meet basic upkeep requirements.

Drinking water systems are a critical infrastructure necessary for the public health and to support commercial activity. A component of asset management for every water system is ensuring facility security. [redacted]

There exists within the TWW organizational structure a dedicated Maintenance Division, which is nominally responsible for upkeep of the plant and its equipment, such as chemical metering pumps, sensors and instruments, piping repair, troubleshooting any process issues, miscellaneous cleaning, and ancillary building system upkeep. However, the Maintenance Division routinely neglects the performance of essentially all tasks except janitorial duties and the most basic equipment maintenance. It has been reported that the Maintenance personnel frequently fail to perform manufacturer recommended O&M on equipment, demonstrating a profound lack of understanding of basic treatment plant operation and maintenance. A variety of causes likely contribute to the ineptitude of the Maintenance Division:

- *Inadequate management and poor supervision*: As noted, there is a general lack of appropriate training across the organization. In addition, the current maintenance supervisor has tangentially relevant experience as a mechanic in the City's vehicle garage but does not appear to have water sector-specific or the managerial ability necessary to direct the Maintenance personnel. There is no evidence that Maintenance personnel understand the nature and scope of their responsibilities, i.e., why their positions exist or what purpose they are intended to serve within the TWW organizational structure
- *Lack of accountability*: Lack of accountability is a recurring issue within TWW and not specific to Maintenance staff; this is further discussed below. In its current form, the Maintenance Division is performing janitorial duties. Personnel have been allowed to abdicate the responsibilities customarily expected of a drinking water system maintenance division; they are assigned one or two cleaning or minor equipment repairs each day. There is no impetus for improving productivity and no motivation to achieve anything more than the bare minimum. A majority of the true maintenance done at the treatment plant has been outsourced under various contracts to outside contractors.

3. Operational Continuity and Reliability Concerns

Operational continuity is multi-faceted, encompassing tangible treatment and distribution assets, retaining staff with deep water sector and/or TWW-specific experience and knowledge, maintaining a uniform direction from executive leadership, and ensuring that all Utility procedures are written, established, implemented, and maintained under the guidance and supervision of proficient management.

The physical assets of TWW, including the treatment plant, booster pump stations, and the transmission and distribution system, have largely been constructed properly for its service area and demands. However, decades of inattention and minimal to no preventive maintenance has resulted in the degradation of these assets. In some instances, this condition has caused a loss of redundancy and reliability of pumps, pipes, and other equipment. In the event of unexpected operating conditions or an operational emergency, there exists a real possibility that a combination of poor equipment conditions and insufficiently experienced staff may result in an inadequate response to a given event. Recent conditions, such as the failure of pre-treatment Superpulsator units and a Legionella outbreak, are examples of such a confluence of events that pose significant risks to the health and safety of TWW customers. Each of those conditions are discussed in more detail throughout this report.

TWW suffers from a stark lack of institutional knowledge, with some Divisions worse than others. An example of this is the Engineering Division; the longest tenured staff in the group has been with TWW for about four years; the remaining two engineers have three or fewer years of history with TWW. Compounded by poor recordkeeping, this lack of knowledge severely limits the ability of Engineering and the other Divisions within TWW to effectively perform their duties.

There is also a noteworthy lack of stability in the Executive Director position at TWW. One responsibility of this top level position is to communicate the organization's mission, vision, and values. In other words, the Executive Director steers the ship in the direction it needs to go. Lacking a consistent, strong presence at this level leaves an organization rudderless. TWW especially is in desperate need of an experienced, strong leader in this position who can commit to a lengthy tenure.

In accordance with AWWA Standard G200-15, utilities shall have procedures established, documented, implemented and maintained. A review of available documentation indicates that TWW has documented written operating procedures and personnel policies, the latter of which are incorporated into the onboarding process for new hires. However, the comprehensive implementation of standardized procedures remains an open question; based on training records, staff do not receive training on atypical operating conditions (i.e., emergency response plans, emergency communication plan, risk and resilience, etc.), and may only receive cursory training on standard operating procedures.

No records related to succession planning or contingencies for the departure of key personnel were provided for review during the preparation of this TMF.

4. Poor Management Practices

The majority of TWW's failings stem from a lack of physical management of its assets, compounded by the systemic organizational weaknesses discussed throughout this report. The TWW infrastructure was largely constructed with primary treatment processes sized correctly, proper plant hydraulics (i.e., water moves from one process to the next by gravity), and a distribution system that, despite its age, continues to largely meet domestic and fire demands. However, the physical system does not operate in a vacuum, instead requiring perpetual attention, repair, modification, and improvement by its operators and competent staff. Furthermore, despite the adequate quantity of water being produced, there has been a pattern of water quality issues in recent history.

The proficient management of a water system depends upon proficient communication within the organization, as well as with customers and other external stakeholders. TWW and its management struggle with communication as a whole. This statement encompasses internal communication between Divisions, between TWW and the Mayor and City Council, and between TWW, the City of Trenton, and the other municipalities served by TWW. Meeting minutes are not generated following the meetings that do occur, resulting in an inability to properly track action items and ensure tasks are completed. The City's governing body, having ultimate responsibility and financial control over TWW, appears only tangentially aware of the complexities of operating a water utility, and receives a majority of TWW-related information and requests through the City Administrator's office.

Hiring and promoting under-qualified staff is another area which reflects how managerial conditions erode the TMF capacity of TWW. First, Trenton has a residency mandate in place for City personnel, requiring that candidates and employees live within the City limits, with some exceptions. It is only after all avenues of hiring are exhausted that candidates from outside of this area are considered. Civil Service and Union employment policies, while not unique to Trenton and not inherently problematic, do impart additional sets of rules and approvals that add complexity to the hiring process. It is not uncommon that a current employee of the City with a comparable Civil Service title applies for an open position within TWW, and despite being weakly qualified, will get the job.

TWW struggles to retain competent, motivated staff for various reasons: poor compensation, insufficient stipends for obtaining licensure, and burnout caused by the high vacancy rate within the organization. The employees that remain are either intrinsically dedicated to protecting the welfare of Trenton's customers, or view their job at TWW as one that can be lackadaisically performed simply to collect a paycheck.

According to anecdotal reports made during the course of this TMF review, because many laborer-level employees see their positions at TWW as just a paycheck, management lacks the empowerment, ability, and / or stomach to instill discipline. Multiple anecdotes were received that describe TWW management as "looking the other way" or being overly lenient upon reported employee malfeasance. One such example from 2019 involved a laboratory technician who was found to be falsifying sample data. An internal investigation concluded that this employee was under-trained, and rather than being terminated, was transferred to a different position within the City government. This pattern of behavior was solidified by a similar case that has recently been made public regarding a TWW sample collector who, despite being responsible for collecting compliance samples from specified locations throughout the system, was going home instead and collecting the full day's water samples from his own residence. This occurred between October 2022 and December 2023. TWW initially placed this sample collector on administrative leave, and ultimately terminated his employment.

TWW lacks the culture of professionalism and accountability that is customary within broader sector and would be expected from public servants at a municipally-owned and operated utility. For instance, TWW does not perform employee performance reviews, despite this requirement being stated in union policies. Without annual check-ins with superiors, TWW staff are never informed on areas of improvement, goals to aspire to reach, or any other type of career advice or development. This contributes to an attitude of stagnation and complacency throughout the organization. Further compounding these deficiencies is a lack of adequate job-specific training, which limits the ability of staff to perform ordinary duties to their fullest.

In addition, the utility lacks the competent financial personnel necessary to adequately assess and communicate its needs internally and externally, including with Mayor and Council. This leads to the inability to secure approvals for expenditures which impacts that financial capacity of TWW. For example, the lack of TWW and City staff who are sufficiently knowledgeable in financial processes and procedures inhibits TWW's ability to have waivers and purchase orders approved in a timely manner, including critical purchases such as chemicals. TWW is currently experiencing a significant amount of delinquent customer accounts, which has accumulated to $23 million as of the end of 2023. Despite some external forces limiting the Utility's ability to shut off delinquent customers, once these limiting factors were lifted, TWW was delayed in undertaking any comprehensive collections program.

5. Complacent Staff and Leadership

For the purposes of this report, complacency is used in the context of its definition within AWWA Manual G100 as follows:

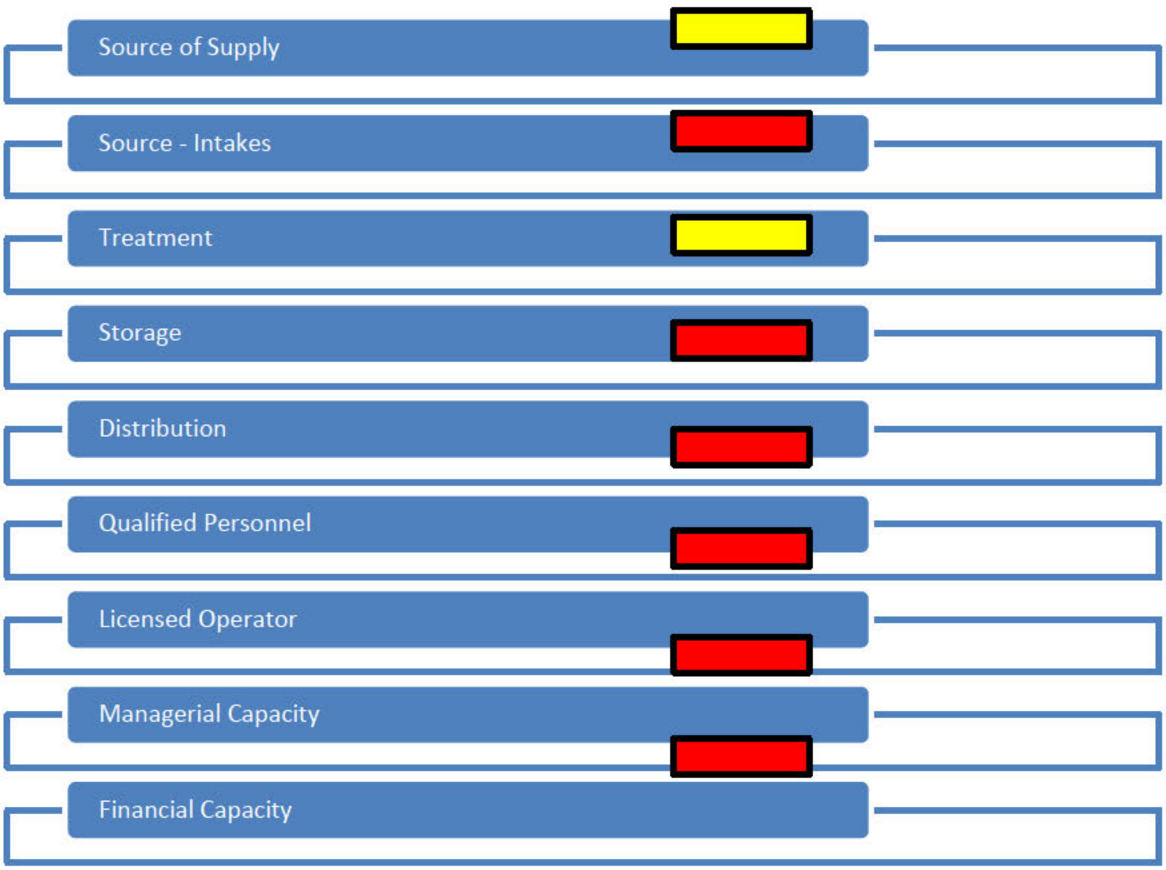
> *"Failure to maintain a culture focused on both routine attainment of water quality goals and an awareness of operational risks that threaten attainment of those goals. For example, inadequate effort, planning, or provision of capital and human resources to maintain acceptable water quality is evidence of complacency".*

The culture within the overall TWW organization was found to closely align with this definition. This attitude of complacency was observed more in certain Divisions than others, most notably within the Maintenance Division. Reports from various parties stated that some City staff view positions within the water department as being an easy, not demanding, and secure job, which appears to have attracted those individuals who do not want to put much effort into their work while collecting a paycheck. It is a failing in management and executive leadership which allows a culture such as this to continue.

This complacency has led to poor upkeep and maintenance of system assets, outsourcing work to contractors that would typically be handled by in-house staff, and an overall absence of purpose. This lack of job performance and motivation is worsened by the lack of a rigorous training program.

Criteria and Benchmarks for Technical, Managerial, and Financial (TMF) Capacity

The guidance published by the NJDEP entitled "Criteria and Benchmarks for Technical, Managerial, and Financial (TMF) Capacity" provides direction to those who are performing such an evaluation. Namely, there are eight areas of TMF capacity with four levels ranging from black (worst) to green (best). The specific criteria of the four categories (black, red, yellow, green) are unique to the component of the utility being assessed. The findings of each respective section in this report are summarized below.



Conclusion

As stated, TWW's primary deficiencies are either directly or indirectly attributable to organizational failures. Water treatment infrastructure doesn't run itself and is highly influenced by the people who are responsible for its maintenance, rehabilitation, and operation. Improper maintenance, failure to follow recommended equipment O&M practices, and a general complacency throughout the organization has resulted in the diminished technical and managerial capacity of TWW. This inadequate organizational leadership has also detracted from the financial health of TWW by allowing delinquent accounts to grow considerably. Further, the lack of TWW and City staff who are sufficiently knowledgeable in financial processes and procedures inhibits TWW's ability to have waivers and purchase orders approved in a timely manner, including critical purchases such as chemicals.

Substantial organizational change, likely over a long duration, is necessary to address the TMF capacity deficiencies identified in this report. If TWW leadership cannot empower and motivate personnel to improve both their individual job performance and the assets of the Utility, a change in personnel at all levels is warranted. Concurrently, a sizeable financial commitment is required to adequately respond to the deteriorating condition of TWW's physical assets and ensure the health and safety of TWW's customers.

1.0 INTRODUCTION

The City of Trenton, with a population of approximately 280,000, is the tenth largest city in the State of New Jersey, as well as being the county seat of Mercer County and the state capital. Located on the east bank of the Delaware River, the City of Trenton was historically a major industrial and manufacturing center beginning in the early 18th century. The City's population is supplied potable water through a large system of source, treatment, transmission, distribution, and storage facilities, some of which exhibit an age of over 150 years. As one of the largest publicly owned and operated water systems in the State of New Jersey, the system provides approximately 35 million gallons per day (MGD) of water to a service population of over 200,000 customers within the City of Trenton and through retail sale to several surrounding communities.

Trenton Water Works (TWW) is responsible for managing a very precious water resource and providing residents, business customers, and municipal bulk sale customers with a continuous supply of reliable and adequate potable water of superior quality, in the most efficient and cost-effective manner, while meeting or exceeding all current Federal and State regulations.

In recent years, TWW has been issued numerous notices of violation for a variety of deficiencies, including the continued operation of an open-air finished water reservoir, and MCL violations for disinfection byproducts (DBP's). Concurrent with repeated water quality violations, the City failed to enact the financial policy changes required by the NJ Environmental Infrastructure Trust (NJEIT) to avoid default on outstanding loans, jeopardizing the ability of TWW to obtain critical funding needed to address the issues identified by the NJDEP in its various administrative consent orders (ACO's). The lack of action on the part of TWW and the City of Trenton to adhere to the requirements stated in the ACO's necessitated the NJDEP's issuance of a unilateral administrative order (UAO), which granted the NJDEP the power to assume direct oversight of TWW.

The NJDEP, as part of its duty under the UAO, has authorized H2M Associates, Inc. (H2M) to evaluate the Technical, Managerial, and Financial (TMF) capacity of the Trenton Water Works, as the nominal owner and operating entity for its Public Water System (PWSID No. NJ1111001).

1.1 Purpose of Evaluation

As directed by NJDEP, H2M will perform, evaluate, and report upon the Trenton Water Works' technical, managerial, and financial capacities, as per State Safe Water Drinking regulations. This evaluation will elucidate TWW's strengths and weaknesses in relation to the codified requirements for operational regulatory compliance in the State of New Jersey as well as various industry standards and best practices.

1.2 History of the Trenton Water System

The origins of the Trenton Water Works can be traced back to Stephen Scales, a local farmer who owned property near the present-day Stadium property. In 1801, Scales began supplying his neighbors with water from a spring on his farm via pipes in the public streets. By 1802, Scales sold his franchise rights to sell water to a group of wealthier individuals, who formed a company under the name of “The President and Directors of the Trenton Water Works”. This group took ownership and assumed operation of the spring and associated assets originally owned by Stephen Scales.

On February 29, 1804, the company was incorporated an Act of the Legislature, and the company began the construction of a fountain to supply the “mains”, which were constructed out of bored logs connected end to end.

In 1811, the Trenton Aqueduct Company was incorporated by the City, which became a direct competitor to the Trenton Water Works. Several attempts were made to consolidate the two water systems, and ultimately the Trenton Aqueduct Company was absorbed into Trenton Water Works.

As the City continued to grow, representatives recognized in 1839 the need for an increase in capacity and the modernization of the water system’s assets. This included assessing the existing spring source for its ability to produce an adequate supply of water as well as the modernization of wooden mains to iron pipes.

The initial spring source on Scales’ property began to fall short of the growing system demand in 1851, and in 1852 the City authorized Trenton Water Works to withdraw source water from the Delaware River. Concurrently, TWW constructed a reservoir on Reservoir Street with an approximate capacity of 1.4 million gallons and an associated pump station.

In March of 1858, a referendum was passed to allow the City of Trenton to purchase the privately owned “Trenton Water Works” company, shifting ownership to the municipality for the first time in its history. The water works’ administration was place in the hands of a board of commissioners where it would remain until 1892, at which time the management responsibilities were transferred to the board of public works.

Various modifications and improvements were made to the pumping and storage facilities through the years, including a larger Worthington pump (1884), a new 10-MG capacity triple compound engine (1892), new pump house (1896), a new reservoir at Pennington Avenue (1896).

In 1911, the first pass at water treatment was began through the dosing of hypochlorite of lime (and shortly thereafter switched to chlorine gas) in an effort to reduce the typhoid death rate, which was reported as 54 in 1908, 36 in 1909, and 53 in 1910. While the safety of the water was improved, aesthetic qualities such as color and taste went uncontrolled until 1912 when TWW designed and installed rapid sand filters with a 30 million gallon per day (MGD) capacity. The 1911 population was reported as 100,000 persons, using 20 MGD and a peak demand of 31.4 MGD.

Between 1912 and the present day, various improvements and treatment processes of varying cost and complexity were introduced to either optimize the treatment of water or to meet new, more stringent water quality requirements. The last major update to the treatment plant occurred in 2008; this project was multi-faceted and included the replacement of the existing gravity clarifiers with Superpulsator units, replaced or introduced several new treatment chemicals, updated several key electrical components, installed a significant number of new process instrumentation, and many other modifications. Projects were additionally completed in 2018 and 2022 to replace the filter media and the raw water intake structure, respectively.

1.3 History Prompting Evaluation

Over the 20th century, manufacturing began transitioning out of the US and into other countries. For a municipality like Trenton with a historically manufacturing-centric economy, this shift had a deleterious effect on the prosperity of the City; businesses closed or moved away, residents suffered loss of employment, and the City as a whole experienced an economic downturn. In turn, lower tax revenue and water consumption due to the decrease in commercial and residential customers diminishes the revenue potential for TWW and the City as a whole to maintain the water system's assets. Over time, this lack of maintenance inevitably leads to chronic failure of the water infrastructure.

As made available on the NJ Data Miner public-facing database, between 2001 (first date which electronic records are available) and March 2024, the TWW Water Filtration Plant (Site ID 13797) has 132 pages of violations. These violations range in severity, including such items as:

- 2009 through 2024: failure to report the concentrations of several regulated contaminants in at least 16 instances
- 2011 through 2014, 2016, 2021: Failure to provide Consumer Confident Reports to customers and DEP by July 1 each year
- 2014: failure to follow proper DPCC procedures, specifically the lack of secondary containment for delivery vehicles, unregistered persons found to be filling buried storage tanks, failure to register said tanks,

- 2016, 2017, and 2018: failed to maintain a detectable disinfectant residual concentration in the distribution system for at least one sampling period each year
- 2019: introduced a hazardous substance into a regulated underground storage tank that was not properly registered, and was known or suspected to be leaking
- 2019: failure to inspect equipment, including three years of no inspection for a 2,000 gallon diesel tank, failure to follow inspection schedule for sodium hypochlorite and diesel drum storage areas
- Repeated violations for failure to provide adequate job-specific training to employees
- 2017 through 2023: failures related to lead & copper rule monitoring and reporting, failure to maintain optimal water quality parameters, and failure to comply with the LSL replacement requirements

The majority of these violations were subsequently noted as having been addressed, however there is an apparent track record of the improper operation of the critical treatment assets and the necessary reporting, compliance, and personnel training necessary to satisfactorily run their treatment and distribution assets.

As a result of chronic noncompliance, the NJDEP and TWW have entered into a number of administrative consent orders (ACO), which establish schedules and performance metrics that TWW must meet in order to remain in compliance. A list of recent ACO's and other major events and regulatory actions is provided below.

1.3.1 Trenton Water Crisis, August-September 1975

The first major instance of system failure occurred between August 31 and September 8, 1975, during which time TWW suffered a nearly complete loss of function. Several weaknesses led to this failure, including "human error, equipment failure, and design vulnerability" (Report on the Trenton Water Crisis, NJDEP, May 1976). The erroneous closure of a small diameter water supply valve to the high lift pumps likely triggered a cascade of equipment failure. Partially open cone valves at the discharge of the high lift pumps allowed water to flow in reverse through the pumps into the clearwell below, which overflowed and flooded the pump room to a depth of 12 feet. Following the loss of the pump at the plant, the Pennington Reservoir (finished water) ran dry, and the entire City was without water. Four emergency connections were made between the TWW system and neighboring systems by connecting a series of fire trucks spaced 700 feet apart and pumping up to 2.5 miles to reach the TWW distribution system; these connections proved inadequate to meet the nearly 30 MGD demand of the Trenton system. Potable water for drinking and cooking were trucked in by members of the Civil Defense. In the end, the structural damage was fully repaired in March of 1976 and the plant did not recover to its full filtration capacity until April 1976. Similar organization and staffing issues persist today, with personnel not fully versed on the workings of the plant or its many systems and pieces of equipment, posing a continued risk of making an incorrect operational change with sizeable downstream consequences.

1.3.2 Administrative Consent Order, March 24, 2009

On March 24, 2009, TWW acknowledged receipt of an administrative consent order (ACO) issued by the NJDEP for noncompliance with 40 CFR 141.714, specifically its continued operation of an uncovered finished water reservoir past the State-approved deadline of April 1, 2009. This ACO set firm milestones that TWW agreed to meet in order to complete the "Pennington Road Reservoir Cover Project", including a project in-service date of March 1, 2013.

1.3.3 Administrative Consent Order, February 1, 2014

As a direct extension of the 2009 ACO, the February 1, 2014 ACO extended the interim and final deadlines by which TWW was required to complete the finished water reservoir cover project. The updated in-service date for the covered reservoir was adjusted to July 30, 2019. All previous requirements, such as the submission of quarterly progress reports, remain in effect under this updated ACO.

1.3.4 Administrative Consent Order, February 5, 2018

The NJDEP issued another ACO on February 5, 2018, based upon two notices of violation (NOV) dated July 21, 2017 and January 5, 2018, stemming from the findings of a Technical, Managerial, and Financial (TMF) assessment report dated September 25, 2017. Specifically, it was found that TWW was operating with 68 vacancies, which represented 39% of the positions at TWW.

New requirements were set forth in this ACO, including:

- Submit an asset inventory with a plan to expand said inventory
- Description of any TWW assessments for criticality and vulnerability of assets
- A report describing the costs associated with operation, maintenance, repair, replacement, and major capital improvements made in the previous year (2017) as well as the costs planned for the upcoming year (2018)
- Provide update and schedule for the Ewing Booster Station project
- Provide a detailed plan for compliance with the Water Quality Accountability Act
- Submit an asset management program plan.
- Develop a protocol for operating the water system, including details for each employee's responsibilities

- Possess readily available written O&M procedures
- Perform interconnection flow testing for all interconnections six-inch and larger
- Engage in all reasonable attempts to obtain written agreements with other water systems that share an interconnection with TWW
- Submit an action plan for validation protocols, which will serve to verify water quality data obtained through SCADA readings
- Develop and implement an adequate emergency response plan (ERP)
- Determine the feasibility of the Phase II interconnection with NJ American Water
- Fully and adequately staff the organization, with specific hiring goals for various positions
- Maintain compliance with the Reservoir Covering Permit
- Complete specific SCADA system updates
- Evaluate the Delaware River Intake and complete preliminary designs to minimize disruptions to plant operation under adverse river conditions
- Complete a large diameter valve exercising and evaluation project (8-inch and above), including providing to the NJDEP a list of valves to be exercised / evaluated
- Submit a revised draft Emergency Action Plan (EAP) for continuing operation when the Reservoir is offline
- Complete construction of a new disinfection system at the WTP and Reservoir Gatehouse
- Build and calibrate a hydraulic model of the TWW system
- Several requirements related to the corrective measures for the open air finished water reservoir covering project and respective deadlines, including the completion of the project by July 31, 2023

1.3.5 ACO, July 26, 2018

Another ACO was issued in July 2018 for non-compliance on several water quality deficiencies:

- TWW failed to take the required number of samples for its Water Quality Parameter (WQP) monitoring program; specifically, results for three reporting periods were submitted late, and for the Q3/Q4 2017 sampling period, TWW collected 49 of the required 50 distribution system samples for alkalinity, which resulted in the NJDEP issuing a Notice of Non-Compliance (NONC) on August 21, 2017.
- In the first half of 2017 and again in the first half of 2018, TWW had Lead Action Level Exceedances (ALE)
- Following an ALE, systems are required to provide to the NJDEP an optimal corrosion control recommendation; TWW failed to meet the deadline for this submission. TWW received a NONC for this missed deadline, and was given 15 days to submit; this deadline

was also missed, and TWW eventually submitted the required documents about 75 days after the new deadline

- Per the August 21, 2017 NONC, TWW was required to perform source water sampling from all entry points to the distribution system (EPDS) and permanent interconnections following the lead ALE; TWW failed to conduct or submit these samples by the deadline
- Following the ALE in the first half of 2017, TWW was required to replace 7% of the lead service lines (LSLs) in its system. TWW did not meet the June 15, 2018 deadline for this LSL replacement requirement
- Further, if a system exceeds the Lead Action Level after implementation of corrosion control measures, it is required to submit documentation to the NJDEP identifying the initial number of LSLs in the system and a schedule for replacing at least 7% annually. TWW failed to provide the required documentation, resulting in the issuance of an NONC.
- For its failure to submit its LSL inventory, replacement schedule, and source water treatment recommendation documents within the required timelines, NJDEP issued an Administrative Order and Notice of Civil Administrative Penalty Assessment (AONOCAPA), which carried a penalty of $13,000.

1.3.6 NJDEP Inspection, June 2019

A Compliance Evaluation and Assistance Inspection was conducted April 16 through April 18, 2019, with several deficiencies noted, including:

- Non-compliance with an NOV issued April 5, 2018 related to the rehabilitation of the chlorine contact tanks and replacement of filter bed media
- Continued excursions above the MCL for haloacetic acids (HAA5) and trihalomethanes (TTHM)
- TWW failed to conduct continuous monitoring for two of its filters for a duration of about 6 hours. The lack of response and the failure to collect manual grab samples resulted in the issuance of a Notice of Non-Compliance by the Bureau of Safe Drinking Water (BSDW)
- TWW failed to comply with its requirement to reduce its 31.9% non-revenue water to below 15%
- Inspectors noted discrepancies in the water allocation logs for raw water intake
- TWW could not confirm compliance with the requirement to meter all services
- Failure to submit lead and copper monitoring samples within the required deadline, resulting in TWW being required to issue a Tier 3 Public Notice
- Inspectors reviewed recent tank inspection and evaluation reports, which detailed deficiencies at several TWW storage tanks that must be addressed

- The Whitehorse Tank foundation was found to be breaking away from one of the stands, and the Mercerville Tank had a loose bolt; these items were to be addressed within 30 days
- Malfunctioning high-level sensor at the Whitehorse Tank
- Issues identified with the lead and copper sampling results for the first half of 2018 necessitated the review of previously submitted form BSDW-56 for accuracy

1.3.7 NJDEP Inspections, October 2021 through February 2022

The NJDEP conducted another round of inspections on October 26 and 27, 2021, November 8, 2021, and February 3, 2022, as detailed in a report dated September 27, 2022. During the course of this inspection, the NJDEP noted various concerns and observations, including:

- The failures or refusal of the City Council to adequately fund TWW to advance critical, regulatorily necessary improvements as well as ordinary maintenance required to protect public health
- Failure to comply with the February 2018 ACO requirement to adequately staff the water department
- Failure to stay within the required timeframe for the finished water reservoir covering project, as outlined in a plan dated June 10, 2021
    - Due to the delays in progressing the reservoir covering project, the Pennington finished water reservoir has experienced significant quality issues, including the presence of midges throughout the distribution system and the over-dosing of zinc orthophosphate, which led to the presence of cyanobacteria in the finished water
- NJDEP inspectors found that the O&M manual for the treatment plant does not meet the requirements stated in N.J.A.C 7:10A-1.12(a)1, including the omission of a section related to standard operating procedures (SOPs)
- Two of the four Superpulsator clarifier units were offline at the time of inspection due to lack of maintenance and poor asset condition. This reduction in ability to remove organic content from the plant influent is a likely cause of several water quality issues, including increased DBP formation and the presence of pathogens such as giardia, cryptosporidium, and legionella
    - Of note, Superpulsator #3 suffered a critical malfunction in May 2021 during which the backflow of sludge damaged the settling plates. Despite TWW submitting a

schedule to repair the clarifier unit with a completion date of December 2022, however no updates to this schedule were sent to the NJDEP

- Superpulsator #4 was observed to have significant floc formation on the surface, indicating a lack of regular maintenance activities. The unit's underperformance was further confirmed by the effluent turbidity data, which showed approximately 8-10 NTU compared to <1 NTU for the effluent from unit #2.
- Both of the in-line rapid mixers were not operational and were removed from service in August 2021 due to damage to the shafts and paddles. TWW was not able to establish the length of time that the second mixer was not functioning properly or when damage had occurred.
- The river side chlorine contact basin was offline at the time of inspection due to a shear pin failure, which led to additional damage to the residuals collection system. While TWW possesses a second chlorine contact basin, the loss of redundancy limits the ability to properly clean and maintain the single in-service basin. This in turn can lead to an increase in DBP's and the reduction of CT effectiveness, potentially allowing for the growth of viruses and giardia.

1.3.8 I-Bank Deficiency Letter, July 28, 2022

The Trenton City Council received a letter from the New Jersey Infrastructure Bank (I-Bank) on July 28, 2022, informing them of an impending default due to two primary factors:

- The City's violation of N.J.S.A 40A:4-10 by failing to submit its annual budget to the State within the required timeframe
- The Trenton City Council refused to approve payment of its debt service on existing bond obligations, which raised concerns regarding the City's intent and ability to make required payments on its debts with the I-Bank

At the time of this letter, the City held eight (8) outstanding loans with the I-Bank, with the next payment due in August 2022 in the amount of $5,613,823.80. Should the City default on its debt obligations, it will become ineligible for future I-Bank funding.

1.3.9 Water Bank Deficiency Letter, August 16, 2022

A follow up letter was sent by the I-Bank after the City successfully paid its August 2022 debt payment. This letter served to reiterate the importance of enacting a budget, and restated the consequences of failing to do so, including ineligibility for future loans, ineligibility to receive principal forgiveness on the City's outstanding loans, and the potential acceleration of repayment on the City's existing construction loans.

1.3.10 Water Bank Forbearance Letter, October 12, 2022

Due to the City Council's delay in developing and enacting a budget as required in each of its loans with the I-Bank and as reiterated in previous correspondence, the NJDEP and I-Bank issued a letter of forbearance to warn the Trenton City Council about the pending consequences of noncompliance. Specifically, the July 28, 2022 correspondence identified "Material Events" which result in a "Finding of Unacceptable Credit Risk".

The Trenton City Council was granted until November 25, 2022 to enact a budget in order to remain in good standing on its current loans and to maintain its eligibility for future loans through the I-Bank. Pursuant to this letter, Trenton was able to enact its budget.

1.3.11 NJDEP Unilateral Administrative Order, October 12, 2022

On October 12, 2022, the NJDEP "determined that conditions exist at the [TWW] System that may present an imminent and substantial endangerment to the health of persons" and issued a Unilateral Administrative Order (UAO) in order to protect public health.

Citing many of the previous notices, inspection reports, and Administrative Consent Orders, the DEP justified the cause for issuing the UAO, including chronic noncompliance on water quality, lack of maintenance, continued understaffing of the TWW department, insufficient funding approval from the City Council, and failure to meet the agreed upon schedules for several critical capital improvement projects, including the covering of the open-air finished water Pennington Reservoir.

This UAO granted the NJDEP authority to oversee the daily operations of the treatment and distribution activities of TWW, including the placement of a third party agency to monitor and assess system operations and maintenance. The goal was to add capacity and make recommendations to bring the system into compliance, while TWW maintained operation of the system. The UAO additionally necessitated the preparation of several studies and reports by third parties, including this TMF report, a 360-degree organizational audit, and a Comprehensive Performance Evaluation (CPE) of the treatment plant.

1.4 System Overview

PWS No. NJ1111001 is composed of a single source of supply, treatment, transmission, and distribution, beginning along the Delaware River Water Treatment Plant, with about 30% of finished water going directly to some customers (Gravity Zone) and 70% conveyed into the open-air Pennington Reservoir before being pumped into higher zones and outlying towns that are served by TWW (Hamilton, Hopewell, Lawrence, and Ewing). A map of the City's water supply system is shown in **Figure 1-1.** In total, the TWW distribution system contains four pressure zones:

1. Gravity Zone – Located along the Delaware River
2. Central Pumping Zone – the majority of the area served by TWW, including most of the City proper, Hamilton Township, Lawrence Township, and portions of Ewing Township
3. Klockner Booster Zone – relatively small region at the north of the TWW service area, also known as the Brandon Farms Area
4. Booster 3 Zone – located on the west side of the TWW service area, includes a portion of Ewing Township and Hopewell Township

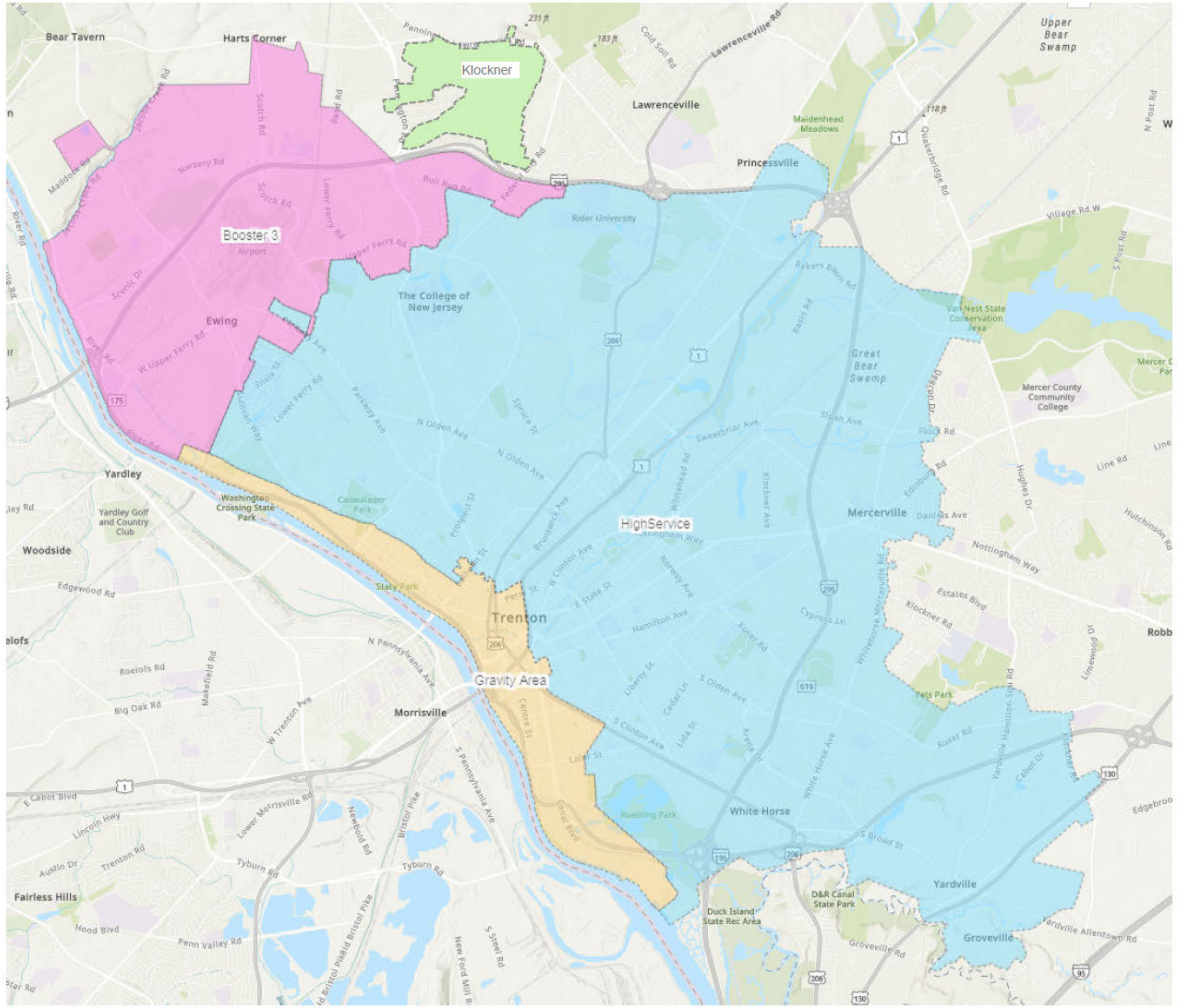


Figure 1-1: Service area of Trenton Water Works, color coded by pressure zone. Source: TWW GIS Database.

1.4.2 Service Area

As a regional water supplier, Trenton Water Works is the responsible agency for operating and maintaining the potable water system located in the City of Trenton as well as most or all of neighboring municipalities including Lawrence, Ewing, Hamilton, and Hopewell. Water is provided through the distribution system on a retail basis to homes, businesses, industries, and institutions throughout the service area for purposes of domestic consumption, commercial and industrial use, and fire protection. TWW possesses two interconnections with New Jersey American Water (NJAW) which can be used on an emergency basis to convey water from NJAW into the TWW system. Three additional emergency interconnections are present between TWW and Aqua New Jersey.

1.4.3 Supply

The Trenton Water Works system has a single raw water source of supply, located on the Delaware River. [redacted] The Delaware River Basin Commission is tasked with protecting and monitoring the source waters and watershed areas that drain into the Delaware River.

There are no groundwater sources of supply in the TWW service area.

TWW maintains two emergency interconnections with the New Jersey American Water Company, Inc. (NJAWC) in Lawrence and Hamilton Townships, respectively, each with an assumed capacity of 5 MGD from NJAWC into the TWW system. Three emergency interconnections (two 8-inch and one 12-inch) existing between the TWW distribution system and Aqua New Jersey. These interconnects only allow TWW to transfer water to Aqua NJ, therefore auxiliary pump would be required for Aqua NJ to feed TWW. The realistic capacities of these interconnections are unconfirmed; at the direction of the NJDEP, TWW will test each NJAWC interconnection to verify the true capacity of each location.

1.4.4 Transmission

Treated effluent from the Filtration Plant is pumped by the finished water pumps into a 48-inch transmission main and a 36-inch transmission main. Both of these redundant transmission mains discharge into the Pennington Reservoir located north of the treatment plant. The initial installation of the 48-inch main was completed at the time the treatment plant was constructed, and unlined cast iron pipe (CIP) was used. In 1995, portions were replaced with steel pipe.

From the Pennington Reservoir to the Central Pump Station, two 48-inch CIP mains are in service which convey flow for roughly 70% of customers in the distribution system. [redacted]

[redacted]

Figure 1-2: TWW Transmission Mains In Service, 20-Inch and Greater

[redacted]

[redacted] The TWW distribution system evolved and expanded over time to meet the needs of new customers in new service areas, and the transmission system has been adapted to meet these new demands.

1.4.5 Storage

The TWW system contains nine (9) finished water storage facilities ranging from 600,000 gallons (Hopewell Tank) to the 78 million gallon Pennington Avenue finished water reservoir. Two (2) storage tanks have been constructed adjacent to the Pennington Avenue Reservoir, which will provide backup storage for the duration of the reservoir covering project. Storage facilities are shown in **Table 1-1**.

With the exception of the Gravity zone, each pressure zone possesses at least one storage tank whose water level is roughly equivalent to the zone's hydraulic grade line (HGL). The Gravity zone utilizes the Pennington Reservoir for equalization storage.

Table 1-1: Storage Tanks in the TWW System

Name	Zone Served	Type	Nominal Volume (MG)
Hopewell Elevated #5	Klockner Booster	Hydropillar	0.6
Ewingville Elevated #4	Central	Multi-leg	1
Jones Farm	Booster #3	Standpipe	1.3
Lawrence Elevated #3	Central	Multi-leg	1
Mercerville Elevated #2	Central	Multi-leg	1
White Horse Elevated #1	Central	Multi-leg	1

Specific information and assessments for each tank are located in Section 3.5.

1.4.6 Pumping Stations

TWW relies on the finished water pumps located at the treatment plant to convey all of the finished water to the Gravity Zone and to the reservoir. Central Pumping Station (CPS) boosts the pressure to the High Service Zone which encompasses roughly 70% of the system and represents the single largest pumping facility outside of the treatment plant.

The Ewing and Klockner Booster Pump Stations pull water from the High Service Zone and move it into the Booster 3 Zone and the Klockner Zone, respectively. These two pumped zones are geographically smaller than the High Service Zone and are located in the higher elevation regions of the TWW service area.

The Central Pumping, Ewing, and Klockner Booster Pump Stations are discussed in greater detail in Section 3.6.

1.4.7 Distribution

The TWW distribution system is a network of approximately 287 miles of pipe, arranged in a grid serving almost every property in the City of Trenton and portions of neighboring municipalities, with a range of pipeline sizing from 2" to 48" (TWW GIS mapping, November 2023).

The GIS is considered the most up-to-date data source for distribution system information. Despite this, there are significant areas of missing data. For example, 6,743 feet of the total 1,406,599 total footage are missing diameters (0.5%) of the system. 1,394,422 feet of the total 1,406,599 feet do not include data for installation year (99.1% of the system), and 1,122,436 feet do not include data for "lining year" (79.8% of the system. All mains have been assigned a material type, however due to the lack of information present in other fields, it is assumed that material types were globally assigned without confirmation from record drawings or field observation.

For valves, 1,764 out of 17,422 are missing diameters (about 10%), 1,501 do not state the operating direction (clockwise or counterclockwise), and installation year isn't included as a field in the GIS. Hydrants include very few attributes, lacking such fields as manufacturer, installation date, last maintenance date (possibly hosted elsewhere in the GIS system), and open direction.

[redacted]

Figure 1-3: TWW Distribution System color coded by pressure zone.

The City's water distribution system is divided into four major pressure zones. The "High Zone" or "Central Pumping Zone" is the largest zone, covering approximately 70% of customers and providing suction pressure and capacity for two of the other pressure zones. The Central Pumping Station is the sole supply for this zone. Four elevated tanks serve this zone: Ewing, Lawrence, Mercerville, and Whitehorse tanks all provided gravity storage and equalization volume. The hydraulic grade line (HGL) of the zone is set at 231 feet above mean sea level (AMSL).

Downstream from the High Zone are two smaller dead-end zones: the first is the "Booster 3 Zone", which serves a portion of Ewing and Hopewell Townships. Geographically, this zone covers the second most area after the High Zone. Pressure and flow are provided by the Ewing Booster Station, located at the same parcel as the Ewing Tank. The zone is served by the Jones Farm Tank, a 1 million gallon standpipe. The HGL of the Booster 3 Zone is established by the water level in the Jones Farm Tank.

The second zone downstream of the High Zone is the "Klockner Booster Zone", which is located in Lawrence Township. The Klockner Booster Pump Station draws water from the High Zone and discharges into the Klockner Zone. The Hopewell / Brandon Farms Tank is a 1 million gallon hydropillar tank which provides gravity storage to the zone.

The final pressure zone in the TWW distribution system is the "Gravity Zone", located along the Delaware River in the City of Trenton. Unlike the other three zones, supply is provided directly from the finished water pumps at the Treatment Plant rather than through the Central Pumping Station and floats on the level of the Pennington Reservoir. Because of this, the HGL of the zone is tied to the discharge head of the finished water pumps at approximately 146 feet.

1.5 Overview of Other Major Regional Water Systems

The Trenton Water Works water system provides supply to several other communities separate from the City proper, making the City's water system a "regional" system. Due to Trenton's central location in Mercer County and as a center of urbanization for the region, Trenton is located in close proximity to several other community and regional water supply systems. These other systems are of interest to the City for the following reasons:

- The TWW obtains all of its water supply from the Delaware River surface water drainage basin. Several other water systems also withdraw water from surface water sources within the same basin. As a limited resource, surface water has many issues that impact its allocation. The Delaware River Basin Commission (DRBC) was established in 1961 to protect the river and its watershed
- Interconnections between TWW and neighboring systems allow water to move from one to another in times of drought and other water supply emergencies
- Several water supply contracts exist that create direct or indirect relationships between the other major regional suppliers and Trenton.

The TWW maintains several interconnections with adjacent distribution systems of other public community water systems at multiple locations. The New Jersey Water Supply Management Act (N.J.A.C. 7:19-6.9) requires annual testing and written agreements in place between interconnected purveyors for each interconnection 6 inches in diameter and larger.

1.5.1 New Jersey American Water Company

New Jersey American Water (NJAW) is an investor-owned utility company providing retail and wholesale water service to a large portion of New Jersey. [redacted]

[redacted]

TWW is interconnected in two locations with the NJAWC Raritan Millstone system: [redacted] Each interconnection is designed to provide 5 MGD for a total of 10 MGD (further testing is needed to verify these capacities). Standard operating procedures from TWW state that the typical operation is to operate both interconnections concurrently in the event that flow is needed from one system to the other.

The [redacted] interconnection is a prefabricated / pre-engineered vault which allows for water to move from the NJAWC system to TWW either through modulating control valves, or through a throttled butterfly valve. The vault also houses two booster pumps which have the ability to boost water from TWW into the NJAWC system should the need arise, however this is not the typical operation of the interconnection. The station was constructed by Engineered Fluids, Incorporated (EFI). Pressure on the TWW side of the interconnection is kept between 50psi and 80psi, and pressure on the NJAW side of the interconnection is maintained between 60psi and 110psi.

The [redacted] interconnection is configured nearly identically to the [redacted] facility; it is a buried prefabricated vault-style station with control valves and pumps to allow bi-directional flow.

An interconnection agreement between Trenton Water Works and New Jersey American Water was signed on January 17, 2012, which encompasses the use of the [redacted] and [redacted] interconnections. This interconnection was reported to be inadequate to meet the demands of TWW under emergency conditions.

1.5.2 Aqua New Jersey

Trenton Water Works is interconnected with the Aqua New Jersey system in four locations:

- An 8-inch connection at [redacted]
    - Pressure in the TWW system is maintained between 40psi and 55psi

  - Pressure in the Aqua system is maintained between 40psi and 55psi
- A 12-inch connection at [redacted]
- An interconnection at [redacted]
- An 8-inch connection at [redacted]

Interconnection agreements were created between TWW and two public water systems that predate their acquisition by Aqua New Jersey; one agreement was made with the Lawrenceville Water Company and a second was made with Consumers Water Company. All four interconnections are currently configured to allow one-way flow from the TWW system into the Aqua New Jersey system. Typically, these interconnections are only used during peak demands or during emergencies in the Aqua New Jersey system, with flow rates typically not exceeding 0.5 MGD. Contractually, one of the interconnection agreements allows up to 500,000 gallons per day while the other allows 3 MGD to be transferred from TWW to Aqua.

2.0 REVIEW OF EVALUATION CRITERIA, BENCHMARKS AND BEST PRACTICE

This section provides an overview of the criteria and benchmarks used as the basis for the evaluation of the Trenton Water Works' Technical, Managerial, and Financial (TMF) capacity. In addition to the primary evaluation criteria outlined in Section 2.1, other standards and best practices will also be cited over the course of this evaluation. These standards include the Ten States Standards for Water Works (TSSWW) and the American Water Works Association Standard G100-11 (AWWA G100-11) for Water Treatment Plan Operation and Management.

2.1 TMF Capacity Evaluation Criteria and Benchmarks

The primary regulatory framework that governs this evaluation is NJDEP's Capacity Development Program (CDP), developed in accordance with the 1996 amendment to USEPA's Federal Safe Drinking Water Act (SDWA). This amendment establishes a focus on capacity development by requiring States to develop and implement programs to ensure that new systems demonstrate capacity and to assist existing systems in acquiring and maintaining capacity.

As defined by NJDEP in N.J.A.C. 7:10-13.2, capacity is defined as "the overall capability of a water system to reliably produce and deliver water meeting all national primary drinking water regulations and applicable State regulations. Capacity encompasses the technical, managerial, and financial (TMF) capabilities that enable the water system to plan for, achieve, and maintain compliance with applicable drinking water standards." Capacity Development (CD) focuses on cultivating a system's TMF capabilities to improve the system's long-term viability.

New Jersey's original Capacity Development Strategy (CDS) was originally approved by USEPA on September 28, 2000 with a new revision recently approved by the USEPA, which addresses the basic requirements detailed in Section 1420(c)2 of the SDWA regarding the development of a strategy to ensure the TMF capacity of existing public water systems (PWS) in New Jersey. The document entitled "Capacity Development Program: Criteria and Benchmarks for Technical, Managerial, and Financial Capacity" was prepared by NJDEP as part of an effort to revise/update New Jersey's approved CDS and incorporates the concept of asset management as a central tool to developing long term planning for affected water systems. The benchmarks described in this document help measure whether or not a PWS has adequate TMF capacity to sustain its long-term viability. These benchmarks supplement the criteria defined in the approved CDS and together they will serve as the future standards to evaluate TMF capacity.

Based on the criteria and benchmark document noted above, the evaluation is focused on the following key components:

- Technical Capacity
    1. Infrastructure
        a. Source Infrastructure
            i. Allocation/Diversion
            ii. Intakes and Interconnections
        b. Treatment Infrastructure
        c. Finished Water Storage Infrastructure
        d. Distribution System Infrastructure
    2. Qualified Personnel
    3. Licensed Operator
- Managerial Capacity
    - Organizational Structure
    - City Governmental Support & Interaction
- Financial Capacity

2.2 New Jersey Water Supply Infrastructure Regulatory References

2.2.1 Water Quality and Water Supply

1. NJ Safe Drinking Water Act (NJSDWA) (N.J.S.A. 58:12A-1 et seq.)
2. NJSDWA Rules (effective 1/4/2011; N.J.A.C. 7:10)
3. Certification of Laboratories & Environmental Metrics (N.J.A.C. 7:18)
4. Private Well Testing Act (N.J.S.A. 58:12A-26)
5. Private Well Testing Act Rules (N.J.A.C. 7:9E)
6. Licensing of Water/Wastewater Operators (N.J.S.A. 58:11-64 to 73)
7. Licensing Rules (effective 11/20/2008) (N.J.A.C. 7:10A)
8. Unapproved Interconnections (N.J.S.A. 58:11-9.1 to 58:11-9.11)
9. Realty Improvement Sewerage/Facilities Act (N.J.S.A. 58:11-23 et seq.)
10. Water Supply Management Act (N.J.S.A. 58:1A-1 et seq.)
11. Water Supply Management Act Rules (N.J.A.C. 7:19 Subchapter 6)
12. Water Quality Accountability Act (P.L. 2017, c. 133, revised by P.L. 2021, c. 262)

2.2.2 Water Allocation

1. Water Supply Management Act (N.J.S.A. 58:1A-1 et seq.)
2. Water Supply Management Act Rules (N.J.A.C. 7:19 Subchapter 6)
3. Water Supply Allocation Rules (effective 10/10/2008; N.J.A.C. 7:19)

2.2.3 Management and Finance

1. Optional Municipal Charter Law (Faulkner Act) ((N.J.S.A 40:69A-1, et seq.)
2. Civil Service Commission of New Jersey (Title 4A)
3. Local Public Contracts Law (N.J.S.A 40A:11-1 et seq. and N.J.A.C. 5:34)
4. New Jersey Local Budget Law (N.J.S.A. 40A:4-1 et seq.)
5. Financial Affairs Law
6. PERC Law

2.2.4 Land Use

1. Residential Site Improvement Standards (N.J.A.C. 5:21-5.1)

2.2.5 Industry Standards

1. American Water Works Association, Manual G100-17 “Water Treatment Plant Operation and Maintenance”
2. American Water Works Association, Manual G200-15 “Distribution Systems Operations and Maintenance”
3. American Water Works Association, Manual G400-18 “Utility Management System”
4. American Water Works Association, Manual G410-19 “Business Practices for Operation and Management”

2.3 Standardized Qualitative Reporting Nomenclature

Assessment of various components of the TWW system and organization was performed as a combination of quantitative and qualitative observations. To ensure all instances of qualifying statements are cohesive and represent the same level of concern or condition, these terms are defined as follows:

- **Complacency:** failure to maintain a culture focused on both routine attainment of water quality goals and an awareness of operational risks that threaten attainment of those goals. For example, inadequate effort, planning, or provision of capital and human resources to maintain acceptable water quality is evidence of complacency.[1]

[1] As defined by AWWA in *Manual G100: Water Treatment Plant Operation and Management*, 2017.

- **Lack of Maintenance:** an area, system, or process which, based on previous experience and observations at other water utilities, shows signs of inattention and / or poor upkeep. Examples of conditions that may be deemed as "lacking maintenance" include minor to moderate corrosion on piping and metallic equipment, peeling paint, small leaks in piping systems, equipment or assets at or moderately beyond its useful service life.
- **Neglect:** an area, system, or process which, based on previous experience and observations at other water utilities, which shows signs of condition deterioration that a typical operator or engineer would acknowledge needs to be fixed but has not been addressed, nor is there a plan to address. Examples include widespread or especially notable corrosion, spilled chemicals that were never cleaned up, or equipment which failed for any reason and was left inoperable. The key differentiators between lack of maintenance and neglect involves the scale, duration, and intent.
- **Profound Neglect:** an area, system, or process which has failed or is at imminent risk of failing due to prolonged delays in upkeep, and may have a detrimental effect on the ability to produce or convey treated water to customers.

Three classifications were used for ranking an asset or component of managerial or financial capacity using the following general descriptions:

- **Good:** asset condition was found to be satisfactory or adequate, with only minor improvements recommended
- **Fair:** asset condition was found to be deficient in at least one aspect, and improvements or upgrades are recommended
- **Poor:** asset condition was significantly deficient, inoperable, anticipated to experience failure in the short term, and replacement is required

3.0 TECHNICAL CAPACITY EVALUATION

This section provides an assessment of the technical capacity of the TWW water supply system. Technical capacity refers to the adequacy of the source, infrastructure, operation, and maintenance of a PWS. Infrastructure refers to the physical and mechanical components of the source, treatment, storage, and distribution network of the PWS. To demonstrate adequate technical capacity, a PWS must have adequate source and infrastructure, qualified personnel with sufficient technical knowledge available to operate and maintain the PWS, and an operator of the proper license and classification.

Critical infrastructure assets evaluated within this section include the watershed, reservoirs, dams, intake structures, treatment facilities, transmission facilities, storage facilities, distribution facilities, and operational facilities. The existing condition of infrastructure assets are based on prior performed inspections and/or functional analyses, as well as field inspection conducted by H2M. The evaluation of these facilities, as applicable, is based upon the following criteria:

1. Regulatory Citation – references to pertinent governing design and/or regulatory codes.
2. Functional Capacity – the ability of the facility to fulfill its intended purpose.
3. Conditional Assessment – an indication of the overall condition of the facility, developed based on prior observations by third parties, comparison to industry standards and best practices, as well as field inspections performed by H2M to evaluate the condition of the facilities as part of this evaluation.
4. Recommendations – scope, schedule, and budget as warranted for any improvements required to mitigate major deficiencies noted in the Conditional Assessment. Technical capacity recommendations are summarized in Section 6.0 of this report.

As stated previously, the findings pertaining to technical capacity of Trenton Water Works are based on observations and conditions present subsequent to the NJDEP's issuance of the Unilateral Administrative Order and assuming direct operational oversight.

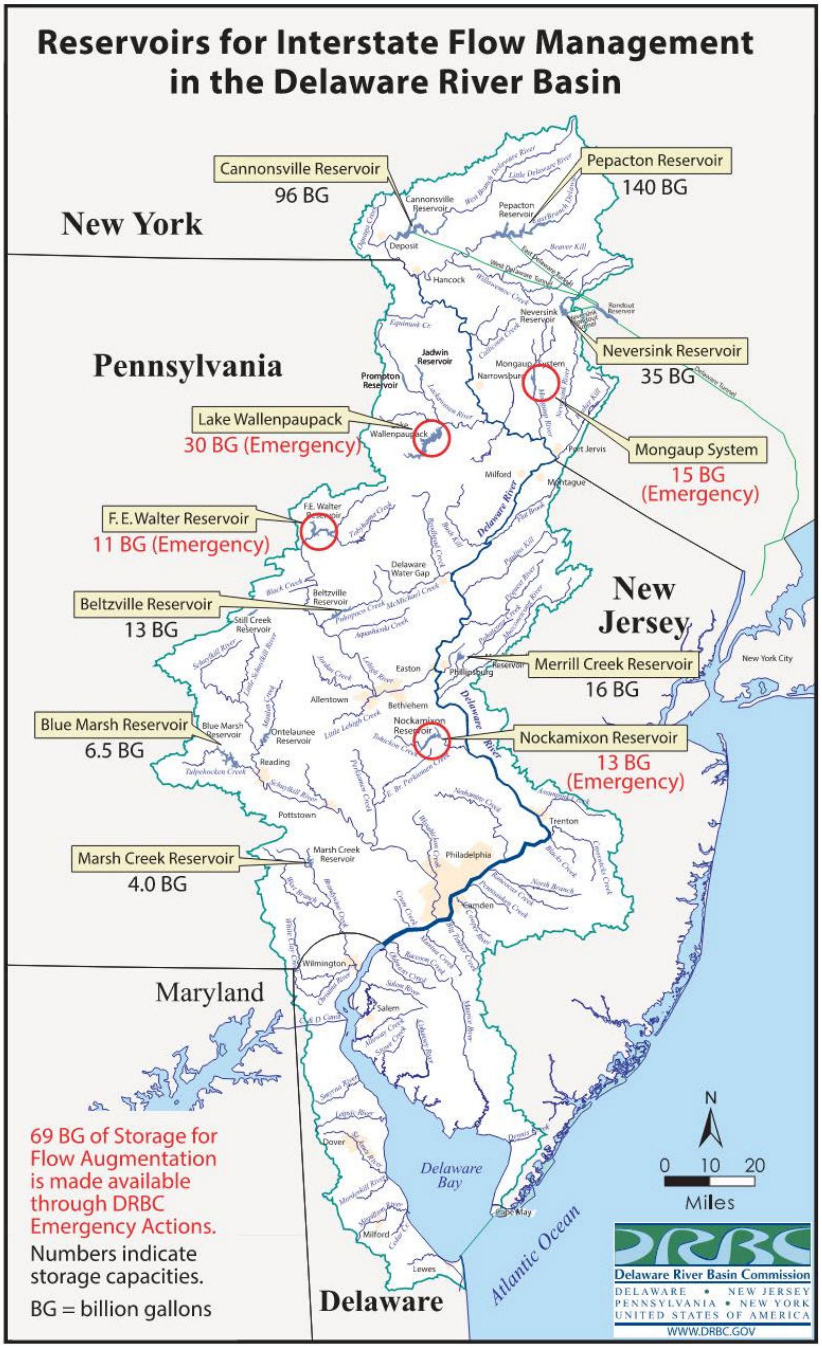
3.1 Capacity of Source Water Supply

Trenton Water Works is supplied by one major source: an intake on the Delaware River, owned and operated by TWW.

The Delaware River is a major source of water for the region, including the States of New York, Pennsylvania, New Jersey, and Delaware. Due to its regional significance, the Delaware River is regulated, monitored, and administratively controlled by the Delaware River Basin Commission (DRBC), a multi-state agency including New York, New Jersey, Pennsylvania, and Delaware. In New Jersey, the authority of the DRBC is established by N.J.A.C 7:9B-1.13 and 1.14. The Delaware River Basin extends from Schoharie County in New York, along the state line separating New Jersey and Pennsylvania, as far west as Lebanon County, PA and east into Monmouth County, NJ, before discharging into the Delaware Bay. The Delaware River Basin encompasses 12,700 square miles of land area, 9,080 miles of named waterways, and a population of 8.63 million people *(DRBC, 2022 DRBC Water Quality Assessment Report)*. Water is withdrawn from the Delaware River and its many tributaries for various purposes, including public water supply, agriculture, golf course irrigation, industrial, and thermoelectric power generation.

Along the full route of the Delaware River, there are eleven (11) reservoirs totaling 379.5 billion gallons of storage, sixty-nine (69) of which can be made available through emergency actions taken by the Delaware River Basin Commission (DRBC). A map of these reservoirs is shown in **Figure 3-1**.

Figure 3-1: Flow management and emergency reservoirs in the Delaware River Basin

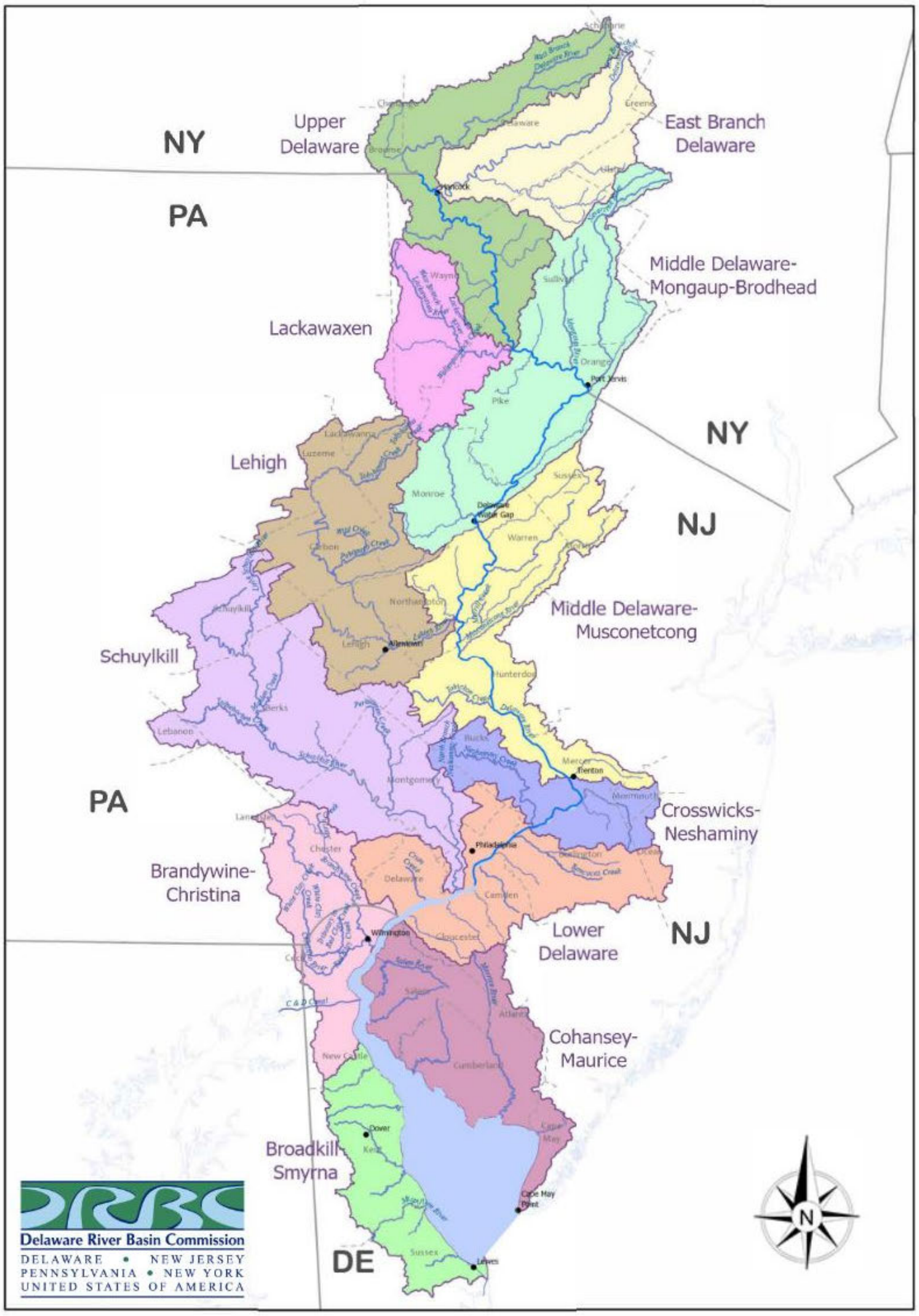


Source: Delaware River Basin Commission, https://www.nj.gov/drbc/basin/map/

3.2 Subbasin (HUC-8) Watersheds

The City of Trenton and its raw water intake on the Delaware River are located within the Middle Delaware-Musconetcong hydrologic unit code 8 (HUC-8) subbasin watershed, near the southerly dividing line between this watershed and the Crosswicks-Neshaminy watershed (**Figure 3-2**). Five additional upstream HUC-8 watersheds contribute to the Delaware River prior to TWW's intake: the Upper Delaware, East Branch Delaware, Middle Delaware-Mongaup-Brodhead, Lackawaxen, and Lehigh watersheds.

Figure 3-2: Delaware River Basin, HUC-8 Watersheds



Source: Delaware River Basin Commission, https://www.nj.gov/drbc/basin/map/

The management, protection, and planning for the Delaware River Basin are subject to several regulations, including the following:

- Surface Water Quality Standards (N.J.A.C. 7:9B)
  The Surface Water Quality Standards outlined in N.J.A.C. 7:9B designate the water bodies that are classified as Category One. Waters under Category One classification are designated for special protection from degradation resulting from development by establishing a 300 feet wide riparian zone along both sides of the water body and all upstream tributaries situated within the same HUC 14 watershed.

- Water Quality Management Planning Rules (N.J.A.C. 7:15)
  The Water quality Management Planning Rules outline the development of Total Maximum Daily Loads (TMDLs) for surface water bodies. TMDLs represent the assimilative capacity of a water body for a single pollutant that takes into account point and nonpoint sources of pollution, natural background, and surface water withdrawals. TMDLs are required by the Federal Clean Water Act (CWA) to be developed for water bodies that cannot meet surface water quality standards and can be developed and submitted to NJDEP by a permittee, applicant for a permit, watershed associations, or other interested parties. NJDEP proposes a TMDL as a proposed Water Quality Management Plan Amendment. This is subject to a public comment period and approval by USEPA Region 2. In 2003, a TMDL for polychlorinated biphenyls (PCBs) was established, which is a commonly used lubricating and cooling chemical recognized as a probable human carcinogen by the US EPA. The regions of the Delaware Basin known to possess increased levels of PCBs begin near Trenton and extend downstream into the Delaware Bay. Compliance and contaminant reduction efforts for PCB in the Delaware River are coordinated by the Delaware River Basin Commission.

- Source Water Assessment Program (SWAP)
  The 1996 amendments to the Federal Safe Drinking Water Act require all States to establish SWAP for all public water systems. NJDEP is responsible for SWAP implementation and has cited that "The purpose of SWAP is to provide for the protection and benefit of public water systems and to increase the public awareness and involvement in protecting these sources".

- Watershed Management Plans
  Section 303(d) of the Federal Clean Water Act (CWA, 22 USC 1250, et seq., at 131(d)), requires States to identify waters that do not meet water quality standards after applying certain required technology-based effluent limits ("impaired" water bodies). States are required to compile this

information in a list, known as Section 303(d) for impaired waters, and submit the list to USEPA for review and approval. States are developing watershed management plans to prioritize the waters/watersheds for future development of Total Maximum Daily Load (TMDL). The Delaware River has been identified as an "impaired" water body due to the presence of certain contaminants, namely PCBs.

- Watershed Planning Recommendations contained within the Safe Drinking Water Act:
  - Surface Water Treatment Rule (SWTR)
    The Surface Water Treatment Rule (SWTR) contains a provision requiring a watershed control program for unfiltered supplies. Although the TWW utilizes filtration in the treatment process, a watershed control program can also benefit TWW by providing protection for maintaining the source water quality, thereby reducing the level of disinfection required at the water treatment plant and / or better understanding the potential for other contaminants. The SWTR recommends that all systems, including filtered systems, conduct the basic elements of a watershed control program.

  - Interim Enhanced Surface Water Treatment Rule (IESWTR)
    The Interim Enhanced Surface Water Treatment Rule (IESWTR) requires the State to conduct a sanitary survey of water systems. The sanitary survey includes a review of existing watershed protection programs in place with the water utility.

  - Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR)
    Under this regulation, water utilities receive 0.5 log credit towards the inactivation of *Cryptosporidium* through the implementation of a watershed protection program.

<u>Assessment</u>

Given its scale, the Delaware River basin and its twelve (12) subbasin watersheds cannot be characterized via individual locational conditional assessments, but rather by the bulk, streaming raw water quality it provides the Trenton Water Treatment Plant, which exhibits an average turbidity of low double digit NTU. Excepting the occasional spikes in turbidity caused by storm events, this profile has been consistent over the long history of plant operations. The Delaware River Basin Commission (DRBC) has additionally established a TMDL for PCBs in the river, stemming from various industrial facilities located throughout the river basin's watershed area. This aggregate criteria indicates a watershed of average quality.

Trenton has reported past issues with frazil ice clogging the traveling screen intakes. Frazil ice occurs when moving water begins to freeze, forming an ice "slushy" that is neither liquid nor fully solid. Despite the design of passive intakes extending to the riverbed and an airblast system to remove debris or ice, in January 2025, the new intakes were rendered unusable due to ice in the river, forcing TWW to shut down the plant.

Recommendations

H2M recommends TWW leadership become actively involved in the Delaware River Basin Commission subcommittee on source water protection, collaboratively sharing data, resources, and information related to the raw water quality in the Delaware River. The DRBC maintains the regulatory responsibility for overseeing the river's flow and contaminant management practices, however TWW has a vested interest in the overall health of the river and should be an active member in the process.

As evidenced by the failure of the intakes under icy conditions, TWW should study the feasibility of constructing a second, redundant intake either up or downstream of the current intake. The current configuration offers no backup to an event which takes the intakes offline.

While no historical contamination events were reported by TWW that impacted the treatment plant, the potential exists for a catastrophic spill or contaminant release into the Delaware River. The watersheds upstream of the TWW intakes are largely developed, possessing significant commercial and industrial uses that pose a potential contamination risk. Currently, TWW's standard operating procedure (SOP) for handling averse raw water conditions is to shut the plant down and rely on the Pennington Reservoir's storage capacity until the raw water conditions improve. This is an inadequate approach to addressing raw water concerns for multiple reasons: first, it does not adequately handle any turbidity or contamination issues lasting more than about three days, after which time the Pennington Reservoir will be drained. Secondly, TWW will soon be replacing the 78 MG reservoir with a significantly smaller volume of stored finished water, removing the operational flexibility granted by having a large volume of water to rely upon. Updates will be required to TWW's Emergency Response Plan and the SOP for operating the intakes as well as the plant overall.

3.3 Raw Water Reservoirs

Within the Trenton Water Works system, there are no raw water reservoirs. As discussed previously, the DRBC maintains several large reservoirs connected to the Delaware River which can be used to supplement the base river flow during times of drought or low river flow, mitigating drought risk to public water systems, agriculture, power generators, and the environment, all of which rely on a consistent minimum flow in the river. TWW does not have the ability to control the operation or flow into or out of these reservoirs, however their presence still provides TWW the benefit of a more stable and redundant source of raw water supply.

3.4 Water Treatment Facilities

The Trenton Water Treatment Plant (WTP) is the sole treatment facility for all supply that originates from the Delaware River. The treatment facilities include a new Passive Screening Facility, the Traveling Screen Facility, Pre-Treatment Facility, the Main Treatment Facility, Raw and Finished Water Pumping Facilities, and the Residuals Handling Facility. An overview of the Trenton Water Works WTP's treatment process is provided in **Figure 3-3**. The water treatment plant employs raw water pumping, superpulsator rapid settling basins, sedimentation / contact basins, filtration, chemical feed processes, and finished water pumping. Many treatment systems and auxiliary equipment have been installed and are still physically present, but not used. A schematic of the water treatment process is provided in **Figure 3-4**, and the residuals handling process is depicted in **Figure 3-5**.

The TWW Water Treatment Plant was constructed in 1912 to improve the safety and aesthetic qualities of the water withdrawn from the Delaware River. This original plant was replaced by a new plant in the 1950's and has since been expanded and upgraded through a series of projects. Previously, TWW was an early adopter of using chlorine for disinfection, however this did not address taste, odor, and turbidity issues present in surface water sources. The TWW WTP was constructed primarily as a sand filtration facility. Various additional treatment systems were installed over the years to meet regulatory standards for drinking water.

The TWW Water Filtration Plant has a firm supply capacity of 60 MGD, as reported by the NJDEP Public Water System Deficit / Surplus database and detailed in the Engineer's Report for the 2007 Pre-Treatment and Facilities Improvements Project prepared by MWH. More recent reports show that the realistic firm capacity is closer to 40 MGD. It is important to note, however, that this stated capacity may be reduced due to suboptimal operation or condition of assets, components temporarily taken out of service due to mechanical or other failure, problems with raw water quality or quantity, and other events that negatively impact the plant's operations. Further, typical daily flows leaving the plant are between 25 and 31 MGD.

Figure 3-3: Treatment Facilities Map

[redacted]

Figure 3-4: Trenton WTP Process Schematic

[redacted]

Figure 3-5: Trenton WTP Residuals Handling System Schematic

[redacted]

3.4.1 General Assessment

Several unit process upgrades have been designed and constructed since the current treatment facility was placed into operation in the mid 1900's. As noted previously in this section, many process modifications were installed with specific goals, however they either did not perform as intended or fell into disrepair without being maintained or brought back online. Process changes that were made to improve performance include:

- Replace traveling screens with passive intake screens and a compressed air system to purge the screens of debris
- Sand separator (not used)
- In-line rapid mixers (did not work as intended, have since been removed)
- Pre-superpulsator mixing basins, two stages
- Superpulsator units (4)
- Vacuum prime system for raw water pumps (not used)
- Addition of various chemicals into the process, modifying the types and dosing locations for varying purposes, etc.
- Residuals handling (thickeners, belt filter presses for dewatering)

Each of the following sections includes an assessment of condition. This condition is reported as the asset was found at the time of H2M's plant tours, which occurred about a year after the DEP's oversight began. The overarching categories have been characterized based on the NJDEP Criteria and Benchmarks for Technical, Managerial, and Financial (TMF) Capacity. This system uses four colors to rank primary asset categories: black, red, yellow and green. The specific significance of each color varies between categories, so it will be defined at the start of each section. Further ranking was done for the individual components in each major category according to the good, fair, and poor terminology defined in Section 2.3.

The Water Treatment Plant is in overall fair condition. The major unit processes appear to have been designed properly and can largely function as intended to treat water, provided they are operated and maintained adequately. However, due to the age of the facility and a significant amount of the original equipment and large diameter process piping still in service, many upgrades and improvements of varying cost and scale are necessary. These needed improvements include but are not limited to a new roof, a full scale HVAC rehabilitation / replacement, large diameter pipe replacement and / or repainting, structural improvements, electrical service upgrades, VFD and other electrical equipment replacement, and improvements to several chemical handling and feed systems, among others. An assessment of the on-site generator should be performed to confirm it is able to adequately power all required pumps and equipment. Additional rehabilitation and improvement items are listed in Table 6-1.

3.4.2 Water Filtration Plant – Source

Assessment: Yellow

The NJDEP Criteria and Benchmarks for Technical, Managerial, and Financial (TMF) Capacity document includes rankings for general source water, as well as ground water and surface water intakes. TWW receives all of its non-emergency supply from the Delaware River. Based on the sizeable volume of water available in the Delaware River, the physical volume of water available to the treatment plant's intake is not a concern. The TWW source category was determined to be yellow in accordance with the following criteria:

- Unauthorized diversion or PWS has 4 or more violations over the term of a required permit/registration; current and future projected use/demand are unknown; current demand not met; no plans to address problems
- Authorized diversion but PWS has 2-3 violations over the term of a required permit/ registration; current use/demand is known but not always met; future projected use/demand and associated permitting needs are unknown; no plans to address problems
- Authorized diversion but PWS has 1 violation over term of permit/registration; current use/ demand is known and met; future projected use/demand and associated permitting needs are not clear, but there are plans to address lack of information
- Authorized diversion with no violations over term of required permit/registration; current use/demand is known and met; future projected use/demand and associated permitting needs are known, plans are in place to secure adequate supply to meet future use/demand

Determination: Yellow

TWW has no known or reported violations related to source water capacity, and its current demands are being met. The NJDEP Supply / Deficit web page states that as of September 2024, TWW has a surplus allocation capacity of 11.12 MGD. At the time of reporting, it was unclear whether TWW had a firm grasp on future demands or related projections, thus the classification of yellow being assigned. Despite having a sizeable amount of additional allocation at its disposal, a water system that is performing according to industry standards will have a firm understanding of future demand projections, which can inform additional capital improvements to other treatment and pumping facilities.

3.4.3 Water Filtration Plant – Source - Surface Water

Assessment: Red

The NJDEP Criteria and Benchmarks for Technical, Managerial, and Financial (TMF) Capacity document includes rankings for general source water, as well as ground water and surface water. Considering the TWW WTP pulls from the Delaware River, H2M used the source water criteria shown below:

- Intake specifications and permit status are unknown, intake condition is poor, water quality problems exist, and there are no plans to refurbish or replace the intake
- Intake is permitted but old and older design does not conform to current regulations, intake condition is poor, water quality problems exist, and there are no plans to refurbish/ replace the intake
- Intake is permitted and design conforms to current regulations, intake condition is fair, sporadic water quality problems exist, and there are plans to refurbish/replace the intake
- Intake in good condition, constructed/permitted in accordance with applicable regulations, no water quality problems exist, and AMP/CIP contains long-term plans

Determination: Red

Despite a newly constructed passive intake in the river, H2M identified the "Intake" category as red due to the intake's reported failure under icy conditions in January 2025. This event resulted in the shutdown of the treatment plant and required TWW to issue an emergency water use alert, limiting customers to only essential uses. This indicates a potentially improperly designed, provisioned, or operated intake structure which is now proven to not function correctly under any river condition. The plant lacks a redundant intake at another location on the Delaware River, which could have mitigated the loss of raw water supply from its sole and primary intake. This event highlighted the single point of failure represented by the intake structure and the significant risk posed to customers by its loss of service.

There have been reports that the intakes are drawing in sand and similar material, which may be due in part to the orientation of the new passive intakes. Additionally, the NJDEP has issued two notices of non- compliance related to the intakes and raw water pumps, both in 2018: first was a failure to provide records that the raw water pump had been calibrated in the previous five (5) years, and second, failure to receive approval from the Bureau of Water Allocation prior to increasing the pumping equipment capacity.

Two components were identified which fall under the heading of "Intake": the intake structure itself and the raw water pumps that convey this water to the head of the plant. The observed conditions for each of these assets are described in the following sections.

Table 3-1: Condition Overview – Intake Water Systems

Source	
Intakes	Good
Screening Facility	Good
Raw Water Pumps	Fair

The condition ratings stated in Table 3-2 follow the standard nomenclature defined in Section 2.3. Justifications and additional details on each assessed condition are included in the corresponding sections below.

While not a true source, TWW relies heavily on the oversized storage volume of the uncovered finished water Pennington Reservoir in managing periods of poor river water quality, up to and including shutting down the plant to wait out high turbidity events and pumping out of the reservoir to meet system demands. This purpose is in addition to the Reservoir's primary function as the source of finished water supply to approximately 70% of TWW's customer base. Due to the reservoir being uncovered, there exists the potential for pathogens to be introduced to the finished water; as such, rechlorination is a requirement to ensure the sanitary condition of water re-entering the distribution system. The finished water reservoir is non-compliant and is years overdue for demolition and replacement, proposed as smaller enclosed tanks. Without this reservoir, the existing operating practices will not be possible; operators will be required to learn how to continue treating water with higher than typical raw water turbidity.

3.4.3.1 Pre-Treatment – Intakes and Screening Facility - Good

The TWW WTP intake was originally designed as a pair of traveling screens on the bank of the Delaware River. In April 2022, construction was completed for a new intake structure extended farther into the river which utilizes passive screens and a compressed air system to remove built up debris.

Plant operators report past issues with frazil ice and / or river weed clogging the intakes at certain times of year, reducing the capacity of the plant and ultimately caused the operators to shut down for a period of time. In January 2025, the Delaware River experienced icy conditions, and the new passive intakes failed to continuously provide raw water to the plant. This resulted in the shutdown of the treatment plant, demonstrating the susceptibility the newly designed and constructed passive intakes to ice.

[redacted] The compressor room houses compressor pumps and motors, a large compressed air tank, and a control panel to operate the system. The screens are typically cleared of debris once per hour, but can be initiated manually if the river water quality requires more frequent cleaning.

Until the passive screen system is tested under all reasonably expected river conditions (high level, low level, increased conveyance of debris, frazil and sheet ice, etc.), operators continue to operate one of the two existing traveling screens to provide a level of comfort.

Screening Facility Conditional Assessment

The passive screening facility was very recently constructed and placed into service; as such, the facility is in good operating condition with some caveats. Specifically, the operation of the new intakes has not been tested during frazil ice conditions. Further, as of early 2024, operators report notable amounts of sand and grit traveling through the initial pretreatment processes and reaching the mixing basins. This is a somewhat recent discovery and the cause is currently unknown.

It has been noted that the passive screens were constructed in series with the traveling screens, and no provision was made to properly decommission the traveling screen facility. This will complicate the eventual cut-over in operation from both screening facilities to only the newer passive screens.

While there are plans to ultimately abandon and / or bypass the traveling screen facility, one of the two remains in service in conjunction with the new passive screens. The condition of the screen house is poor; significant corrosion was observed on a variety of ferrous equipment, including the control panel for the facility. Standing water, peeling and chipping paint, vines growing through the windows, and other signs of neglect were observed. Operators report very infrequently visiting the traveling screen room, which was evidenced by an abundance of spider webs across the walkways. Given the potential for mechanical issues in the traveling screen building, it would be expected that staff include this area in their daily checks.

3.4.3.2 Main Treatment – Raw Water Pumps - Poor

Raw water flows through the screening facilities and into a large channel which supplies the suction capacity for the three (3) raw water pumps located in the central operating floor of the treatment building. The raw water pumps are all split case centrifugal style with the following capacities:

- Pump #1 (northernmost pump):
  - Horizontal split case, manufactured by Paterson Pump (Gorman Rupp)
  - 20,833 GPM at 60 feet of total dynamic head (TDH)
  - 36” suction flange, 30” discharge flange
  - 400 HP, 505 RPM
- Pump #2 (middle pump):
  - Horizontal split case, manufactured by Paterson Pump (Gorman Rupp)
  - 20,833 GPM at 60 feet of total dynamic head (TDH)
  - 36” suction flange, 30” discharge flange
  - 400 HP, 505 RPM
- Pump #3 (southernmost pump):
  - Horizontal split case, manufactured by Paterson Pump (Gorman Rupp)
  - 20,833 GPM at 60 feet of total dynamic head (TDH)
  - 36” suction flange, 30” discharge flange
  - 400 HP, 505 RPM

All three pumps are equipped with VFD’s. Pump suction ports are located below the pumps, while the discharges are above slab. Discharge piping is welded steel, with several supports present that were constructed of I-beams anchored into the concrete floor.

Raw Water Pumping Condition Assessment

The raw water pumps, motors, and piping are currently in fair to poor condition; as of early 2024, only pump #3 can be run as intended. The motor bearings for pump #1 recently went bad and cannot be used. The VFD for pump #2 is currently broken, and the impeller of the pump is damaged, resulting in a maximum capacity of 20 MGD. TWW intends to move the motor from pump #2 to #1, enabling a second pump to be available for use. However, in order to remove the motor from pump #2, essential water and electrical lines which physically impede the ability to remove the motor from its pedestal will need to be relocated without interrupting their service, which may pose a complicated challenge.

TWW staff have also stated that the raw water pumps experience issues with electrical brownouts, which may be due in part to insufficient service capacity for such large pumps.

Housekeeping in the raw water pump area of the plant was observed to be poor during the site walkthrough. Four ceiling mounted light fixtures are present to illuminate the area, but only one of these lights was functioning. This resulted in a dark operating area. Further, various hoses, drainage trenches without grating, and other material and equipment obstructed the walking surfaces near the pumps. Standing water was observed near the pumps, especially just north of the pumps near the vacuum prime system in the corner of the room. Subsequent visits to the plant revealed a noticeable leak emanating from the check valve on Pump No. 3, which was cascading onto the floor below and ultimately into the drainage trenches along the floor. The repair of this condition should be prioritized.

3.4.4 Water Filtration Plant Facility – Treatment

Assessment: Red

The NJDEP Criteria and Benchmarks for Technical, Managerial, and Financial (TMF) Capacity document provides a single raking description for the entire treatment process, as can be seen below:

- (Black) Water consistently has multiple contaminant(s) above primary standards; treatment unit(s) not installed or not maintained; no backup equipment available to meet demand when largest unit(s) out of service; no plans to address problems;
- (Red) Water consistently has at least 1 contaminant above primary standards; treatment unit(s) not installed or not maintained; no backup equipment available to meet demand when largest unit(s) out of service; no plans to address problems;
- (Yellow) Water occasionally has contaminant(s)above primary standards and consistently exceeds secondary standards, treatment unit(s) installed but O&M needs improvement; backup equipment in place to meet demand when largest unit(s) out of service, plan exists to address problems
- (Green) Water quality consistently meets primary and secondary standards, treatment unit(s) installed with proper O&M, backup equipment in place to meet demand when largest unit(s) out of service

Determination: Red

Based on these criteria, H2M found the TWW treatment plant to be in the red ranking. The plant typically meets water quality standards but has had several notable water quality excursions in its recent history. Non-compliance with disinfection by-products (DBP's) are a continuing issue for TWW, which is in part due to treatment practices at the plant. Operation and maintenance practices are a notable deficiency of the plant. Further, while TWW has some backup equipment and redundancy for most unit processes, not all of it is in proper working order or has been fully tested. The physical plant appears to have been designed a constructed with sufficient capacity and most processes have redundancy, and the assignment of a red ranking is largely due to slow response to addressing mechanical breakdown or other maintenance issues. These delays in performing the required maintenance can typically be linked back to the general lack of training and operational knowledge amongst the maintenance staff. Failure to resolve these shortcomings will result in the treatment system falling deeper into a state of disarray.

Table 3-2 provides a high-level summary of the observed conditions of the various processes and critical components at the TWW Filtration Plant.

Table 3-2: Condition Overview – Treatment Systems

Unit Processes	
Sand Separators	Poor
Mixers	Fair
Superpulsators	Fair
Contact Basins	Fair
Conventional Sand Filters	Fair
Clearwell	Poor
Finished Water Pumps	Poor
Chemicals	
Sodium Hypochlorite	Good
Ferric Chloride	Poor
Polymer (Treatment)	Good
Polymer (Residuals)	Good
Hydrofluorosilicic Acid	Poor
Powdered Activated Carbon	Fair
Lime	Poor
Potassium Permanganate	Good
Zinc Orthophosphate	Good
Residuals Handling System	
Backwash Holding Tanks	Unknown

Sludge Mixing and Equalization Basins	Unknown
Gravity Thickeners	Fair
Thickened Sludge Mixing and Equalization Basins	Unknown
Mechanical Dewatering Facility	Good

The condition ratings stated in Table 3-2 follow the standard nomenclature defined in Section 2.3. Justifications and additional details on each assessed condition are included in the corresponding sections below.

3.4.4.1 Pre-Treatment – Sand Separators - Poor

Following the raw water pumps, water passes through a sand and grit separator unit [redacted] The separator was manufactured by Eutek Systems and is comprised of two square tanks, each with a conical grit collector centered in the tank. This system was designed to allow heavier particulates to settle out of suspension and the effluent to pass over a wall. These solids would then be conveyed out of the separator room on a belt which would empty into a dumpster parked below.

Pre-lime is injected [redacted], and ferric chloride and coagulant aid polymer are dosed [redacted]. The ferric and coagulant aid polymer injection point was chosen to achieve better mixing through the turbulence leaving the sand separator. Of note, the chemicals are allowed to free fall several feet to the surface of the water, rather than being injected via a drop tube; this configuration is suboptimal and should be addressed. Historically, these two treatment chemicals were injected into the mixing basin effluent pipe immediately upstream of an in-line mixer, however due to the failure of this mixer, the injection points were relocated to their current location.

<u>Sand Separator Condition Assessment</u>

Facility operators indicated that the system never functioned as designed, and had never been truly placed into service for any length of time. One of the two separator units is empty while the other acts solely as an equalization tank, providing a buffer between the raw water pumps and the influent to the mixing basins. Given its apparent inability to perform its intended purpose, the sand separator unit was determined to be in poor condition.

3.4.4.2 Pre-Treatment – Mixers - Fair

Water then passes through two stages of mixers; each stage has two mixers, one of the mixing stages spins at a higher RPM. Operators reported that typically all four mixers are operated, however at the time of inspection one of the mixing units was offline for repairs.

Operators reported that a rapid in-line mixer had been utilized in the past, but the system failed and was ultimately removed. Prior to the 2008 pre-treatment facilities improvements project, the mixing basins were operated as flash mixers with a detention time of 27 seconds at a flow rate of 45 MGD.

<u>Mixing Basin Condition Assessment</u>

The mixing basin facility was found to be in fair condition, based on the combination of being properly sized for the plant capacity and possessing redundancy, balanced by apparent mechanical failures of the mixers and motors. H2M has performed several site visits throughout the second half of 2023 and early 2024. During the first tour, one of the stage one mixers was offline due to mechanical failure. TWW continued to operate both halves of the mixing basins despite lacking one of the two stages of mixing. This mixer was brought back online prior to H2M's next inspection of the mixing basins, however at this tour in early 2024, an apparent lubricant leak was observed at the base of a second stage mixer; TWW repairers were observed checking the mixer and motor and presumably attempted a repair.

Based upon observations from the plant, mechanical reliability is an ongoing challenge for mixers and motors. A more frequent maintenance and inspection SOP may prove beneficial to stay ahead of premature equipment failure.

3.4.4.3 Pre-Treatment – Superpulsators - Fair

The Trenton Water Works Filtration Plant utilizes four superpulsator units for turbidity removal prior to the conventional sand filter beds. Four sluice gates outside of the building control flow into the units. Each gate has a reported hydraulic capacity of 20 MGD; typically, two gates are utilized, and only under the highest of flow conditions will a third be opened.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Of note, chlorine contact time is achieved at the effluent side of the superpulsator units. This is the only stage of the treatment process where significant CT is provided. This “intermediate chlorine” injection point is located in the space near the vacuum pumps; evidence of past and current chemical leaks were observed. To contain potential leaks, a berm of absorbent media was piled around the injection area, some of which appeared darkened due to contact with chemical / liquid.

<u>Superpulsator Condition Assessment</u>

In general, the superpulsator facility is in fair condition. Several of the units were offline and drained at the time of inspection, indicating excess capacity relative to the capacity of the plant overall and the required production volume at the time of the inspection. In the basement area, several minor deficiencies were noted, such as trip hazards, poor lighting, general cleanliness issues, and non-operating motor operated valves for sludge blowdown.

The intermediate chlorine injection location was found to be in fair to poor condition. The feed piping itself is constructed of double wall, fusible HDPE in good condition. However, there is no true containment provided; a small berm of absorbent media was placed around the injection points to collect spilled chemical. A ladder for access to the roof is located partially within the “containment” berm, posing an accessibility issue. Further, the chlorine injection location showed signs of leaking, including dampened absorbent media. It is recommended to investigate and repair any leaks and install proper a proper containment curb around the injection points to prevent the spread of any spilled chemical.

A potential structural concern was observed in the Superpulsator room, at the concrete block partition wall separating Superpulsators #3 and #4 from the central control area. The main longitudinal I-beam which supports the roof structure has one end supported by this CMU wall. At this intersection of beam and wall, the concrete blocks around and below the beam have begun to crack and fall into the Superpulsator below. Upon further investigation, several lesser cracks were observed in both partition walls separating the central area which houses the vacuum pumps from the Superpulsator units. Further evaluation by a licensed structural engineer is recommended.

As mentioned at the beginning of this report, reports from various sources indicate a stark difference in performance between the TWW plant before NJDEP assumed operational oversight and after said oversight was enacted. Nowhere was this difference greater than the Superpulsators; prior to the UAO, an apparent lack of understanding of the basic operation of Superpulsator units resulted in several issues. First, the thickness of the sludge blankets in the Superpulsator basins went unmonitored. When TWW operators attempted to drain one of the units, the excessively thick and heavy sludge blanket settled onto the angled fiberglass settling plates and shattered them.

Another anecdote received during the course of data collection was that TWW had no reliable method to confirm that the vacuum pulsation system was actually working. At the direction of NJDEP / their third party operator, sight tubes were installed to visually verify the frequency and operation of the vacuum system.

To further demonstrate the lack of basic maintenance and housekeeping, a tree was reported to have been growing in a corner of the Superpulsator room. It is unclear how a tree, approximately 5 or 6 feet in height, was allowed to grow inside this building.

3.4.4.4 Main Treatment – Contact Basins - Fair

Two covered rectangular contact basins are located [redacted] basins were constructed with a horizontal baffle which directs the water to the south end, over the baffle wall, and back northward where it enters the filter effluent channel. The basins are equipped with chain and flight style sludge scrapers to collect settled floc and sediment from the tanks. Each bed has approximate dimensions of 25 feet wide by 275 feet long.

Typically, both basins are used in parallel, but the plant can operate in its typical capacity with only one contact basin in service. The flow from the basins is combined into a single effluent stream, [redacted]

These basins provide contact time for chlorine from the "intermediate chlorine" injection point to achieve the required inactivation / removal of *Cryptosporidium* and other waterborne pathogens. At a typical treatment plant, CT is achieved at the end of the treatment process. At the TWW treatment plant, due to spatial constraints between the finished water discharge pumps and the distribution system, there is no other point throughout the treatment process where CT is achieved. The introduction of sufficient chlorine to achieve CT in the middle of the treatment process may be a factor in TWW's repeated exceedance of total trihalomethane (TTHM) and other DBP's in the distribution water samples.

<u>Contact Basins Condition Assessment</u>

The basins are in fair condition. During the August 2023 site visit by the H2M team, one of the two basins was out of service due to a broken chain in the sludge removal system. During a subsequent tour of the plant in February 2024, the other basin was offline for service. The areas inside the basins that were readily visible without entering the basins appeared to be in fair condition; the concrete surface showed a lot of aggregate, but otherwise appeared acceptable given its age. Issues with the sludge removal system seem to be frequent, which forces TWW to shut off and drain the affected basin until the equipment can be repaired.

3.4.4.5 Main Treatment – Conventional Sand Filters and Backwash Tank - Fair

The primary filtration of water at the TWW Treatment Plant is achieved through conventional sand bed filtration. [redacted]

There is no gravel bed or air scour system at the TWW Filtration Plant, however the backwash system is equipped with surface wash functionality. The media for all filters at the plant were replaced in 2018. Major filter improvements, including effluent and washwater piping, controls, underdrains, and other accessories were completed in 2000. The typical flow rate per filter bed is between 1 and 2 MGD (700 GPM to 1,400 GPM), up to a maximum of 3.2 MGD (2,200 GPM). Each filter bed has approximate dimensions of 15 feet by 24 feet for a total area of 360 square feet, resulting in a loading rate of about 3.89 GPM/sf (at 2 MGD per filter). As of the filter improvements project completed in 2000, the filters possess plastic block underdrains which support the sand layer and allow water to pass through into the clearwell below.

Under typical operation, each filter is backwashed every 70 hours, with filter run times reported between 50 to 80 hours. Should the operators observe high head loss through a filter, the backwash process can be manually initiated from the SCADA control room; personnel are typically not present at or near the filters as they are being backwashed. While not an uncommon practice, it’s recommended to regularly visually observe the backwash process to ensure effective cleaning of the media is being provided.

[redacted]

[redacted]

[redacted]

[redacted]

The filters are backwashed either automatically or manually via SCADA. TWW standard operating procedure WTP-O No. 15 (document 10 of 25) details the process by which filters are backwashed. The primary tasks include:

- Water level is lowered to 1.5 feet by opening the effluent rate controller and effluent valve. In instances of effluent turbidity exceeding 0.3 NTU, the filter to waste valve is utilized instead
- Open the surface wash valve to 40%-50%, allow to run for about two minutes
- Open the wash water valve to the low setpoint, which is about 5 MGD, or 3,500 GPM (10%-15% open)
- After two minutes, close the surface wash valve and open the wash water valve to about 50%. This should equate to roughly 18 MGD (12,500 GPM) and is known as the high wash mode
- Wash in high mode for eight minutes, then reduce flow rate back to 5 MGD. Close the drain valve and allow the bed level to refill to 3.5 feet
- Close the wash water rate control valve and wait five minutes for media to compact
- Open influent valve and the filter to waste valve. Continue until effluent turbidity falls below 0.25 NTU
- Filter is placed back into service

Filter backwash can be initiated locally at the filter itself, however this is not a typical operating condition for TWW; no reports were received that any of the filters are regularly backwashed in local mode.

<u>Conventional Filters Condition Assessment</u>

The filters and backwash tank were found to be in fair condition. Several housekeeping items were found to be deficient in the filter gallery area. The lighting was poor due to several fixtures being inoperable, either due to burned out light bulbs / fluorescent tubes, or severe corrosion of the entire fixture. Widespread corrosion was observed throughout the room, including the light fixtures, pipe brackets, bolts, structural members in the filter beds, and other ferrous materials. The suspected cause of this corrosion is chlorine vapors coming out of solution from the post-CT raw water and inadequate ventilation in the space, leading to a corrosive environment.

In the lower levels of the filter house, several deficiencies were noted. First, multiple instances of structural concrete cracking or splitting were noted. One such crack was located in the mezzanine walkway, extending fully across and through the slab. Two other locations sections of appreciable spalling and cracking were noted on the top edge of the concrete cross members near the wall below the filter beds. A comprehensive structural study should be performed of the entire plant, and especially these areas of observed degradation.

The filtration unit process itself appears to be operating well. The filters achieve very long run times; the combination of the Superpulsators for initial turbidity removal followed by sedimentation occurring within in the Contact Basins improves the filter influent water quality and allows for those very long run times. The media's recent replacement indicates that there is sufficient remaining useful life, provided the filters are operated and maintained properly. Interactions with TWW operations leadership gave the impression that the operators understand the filter process and can competently make adjustments within the normal operating conditions of the plant.

An in-depth investigation into the condition of the filter beds was performed as part of a concurrent Comprehensive Performance Evaluation (CPE). The media samples taken and studied show that backwashing is generally effective at cleaning particulate from the filters, however a layer of polymer was observed coating the media granules, which may indicate TWW is overfeeding this chemical. Optimization of chemical dosages and backwash practices is recommended.

The schedule-driven initiation of backwashes via SCADA is both a benefit and a detraction; maintaining a regular wash cycle for filters maintains their effectiveness and prevents buildup of sludge, however it removes the need for operators to visually witness each backwash. Without watching how each filter responds to a backwash, there is the potential for filters to develop pockets that aren't thoroughly cleaned or develop channels through the media, allowing flow to short circuit the filter. It is a best practice to observe most if not all backwashes in person to understand the performance of each filter.

The exterior of the tank used to hold potable water for backwashing of the filters was observed to be in good condition. Evidence of a recent repainting was noted, however a full coatings assessment, including the interior, was not conducted. The room at the top of the plant which encloses the tank was found to be clean and well lit, however some cracking was observed in pilasters on the exterior west-facing wall, as well as in the curb surrounding the bottom of the tank. Given the immense weight of this tank at full capacity, it is recommended that a structural engineer perform a detailed assessment of this room and the supporting structure below.

3.4.4.6 Clearwell - Poor

[redacted] Each clearwell has an approximate capacity of 375,000 gallons.

Portions of the clearwell were observed through the use of a submersible remote operated vehicle (ROV) lowered into the clearwell. This inspection revealed large pieces of concrete partially blocking the flow of water. These concrete slabs fell into the clearwell during the plant failure in the mid 1970's, when excess water pressure heaved and broke the floor between the raw and finished water pumps. The slabs in the clearwell are pieces of the old floor slab which were never removed. Ideally, these slabs would be removed from the clearwell to restore its full capacity, however this would be a difficult undertaking. TWW's time and capital are better spent on more critical projects.

The ROV inspection further revealed that an extensive buildup of a white crystalline material is present on nearly all surfaces of the clearwell. This is likely a combination of various treatment chemicals, including polymer and lime, the latter of which is injected directly into the clearwell (post-lime).

Clearwell Condition Assessment

The condition as shown in the 2019 ROV inspection is poor. The concrete debris represents a significant impediment to the free movement of water and a reduction of the usable volume of the clearwell. Removing the debris and crystalline buildup will be a challenge, since the clearwells cannot be taken offline for any period of time. Further, there are limited points of access, and much of the debris in the clearwell is too large to be removed without being broken into much smaller pieces. This condition, specifically the buildup of crystalline material, indicates ongoing neglect of the clearwells by operators and TWW management; at a minimum, the precipitated chemicals should be cleaned and chemical dosing practices reviewed to minimize the continued buildup in the future.

3.4.4.7 Finished Water Pumps - Poor

[redacted]. Four identical pumps are present with the following characteristics:

- Horizontal split case, manufactured by Paterson Pump (Gorman Rupp)
- 13,888 GPM at 165 feet of total dynamic head (TDH)
- 24” suction flange from bottom, horizontal 16” discharge flange
- 700 HP

Of the four total pumps, Pump #1 and Pump #3 share a single VFD, Pump #2 has its own dedicated VFD, and Pump #4 is across the line. Due to limitations on the electrical utility service to the plant, only two of the four pumps can operate at any given time. Pumps #1 and #3 can be operated simultaneously, however one of the pumps will be run across the line in bypass mode.

Operators report that Pump #4 is typically run as a base flow pump, and one of the other finished water pumps will be brought online when system demands exceed the capacity of Pump #4. Pump #4 is often throttled via a partially closed downstream valve to allow the VFD-operated pump to remain within its operating range. TWW aims to maintain a level rate of flow leaving the plant and limit large, rapid swings, which is important to maintain accurate dosing of chemical throughout the treatment process.

[redacted]

Finished Water Pumps Condition Assessment

Overall, the finished water pumps were found to be in poor condition, with some components in worse condition than others. The largest deficient condition of the finished water pumping system is the inability to operate more than two pumps at any given time. This limitation was reported by TWW operators as a consequence of the limitations imposed on service to the plant by the electric utility, which directly impacts TWW's ability to ramp up output capacity should the system experience a large spike in demand. This limitation is currently being studied by outside consultants. Additionally, sharing a single VFD between two pumps is an atypical and suboptimal operating configuration; combined with the reported issues with the VFD's, indicates a need for all new drives for at least the three finished water pumps that currently have VFD control.

Throttled or partially closed valves are an inefficient method to reduce flow through a pump; energy is wasted to boost the pressure just to have that pressure "burned off" at the throttled valve. It is recommended to either equip Pump #4 with an efficient VFD, or utilize one of the other VFD-controlled pumps for base flow leaving the plant.

Several of the manual pressure gauges downstream of each finished water pump were found to be broken and unusable. Pressure transmitters with no local readout were present, but their proper operation was not verified. The primary pressure sensor which provides boosted water pressure to SCADA was not located near the finished water discharge piping, and operators were unable to clearly state its location when asked.

The small room that houses the common discharge header was found to be in poor condition. Piping in this area was painted green, which typically indicates raw water pipe, rather than blue for finished water. The pipe coatings were in poor condition throughout, with widespread cracking, delaminating, and corrosion noted on pipes and valves. A leak was noted emanating from the operating nut of the 36-inch gate valve located on the common header between pumps #3 and #4. The floor of this room is at a lower elevation than the finished water pump area, which results in any excess water, dirt, and other debris ending up in this space. Wooden pallets were placed to allow for a dry walking surface, however the buildup of dirt, debris, and what appeared to be spilled chemical, should be cleaned and properly maintained in the future. A drain was observed near the water quality analyzers, however it appeared to be at least partially blocked and not performing as intended.

3.4.4.8 Chemical Feed Systems

Several chemicals are utilized at the TWW Water Filtration Plant at various stages of the treatment process. This section details which chemicals are used, where they are injected, the purpose of each chemical, how they are stored, contained, and dosed, and the observed conditions of each chemical system.

3.4.4.8.1 Sodium Hypochlorite - Good

Sodium hypochlorite is used as both a pre-oxidant and for disinfection. AWWA Manual B300 provides industry best practices for the handling, storage, dosing, and use of hypochlorites. The treatment plant possesses a room dedicated to hypochlorite storage and feed. This room houses three bulk tanks with a nominal volume of 5,800 gallons (17,400 gallons of total bulk storage volume), a 950-gallon day tank, two transfer pumps (about 30 GPM each), and four metering pumps (Disinfection Upgrades Project Record Drawings, 2018). These metering pumps are able to inject chemical at three stages throughout the treatment process: [redacted] There are two Verderflex Dura10 pumps and two Verderflex Dura15; the Dura15 pumps are used for intermediate injection due to their higher relative output. The two intermediate hypochlorite feed pumps provide the chlorine contact time (CT) for the plant; this is the only stage of the treatment process where CT is achieved. The discharge piping is configured to allow redundant service for the various injection points, specifically the suction side of the finished water pumps. The disinfection system at the treatment plant was converted from gaseous chlorine to liquid sodium hypochlorite in 2018.

[redacted] Plant operators noted that the bulk storage for sodium hypochlorite is currently less than a 30-day supply, which was attributed to the elevated dose currently required by the NJDEP to combat *Legionella* and other known issues in the distribution system. Under historical operating conditions, the volume of storage provided for sodium hypochlorite is suitable for about 30 days, with a caveat that TWW may need to permanently increase the chlorine dosage in order to prevent future biological issues in the extremities of the system.

The average free chlorine residual leaving the plant over 2023 was reported to be 1.7 mg/L, based on Monthly Operating Report (MOR) data. A portion of this residual carries through from the intermediate injection point (pre-contact basins), and supplemental chlorine is added before water leaves the plant.

<u>Hypochlorite Condition Assessment</u>

The condition of the chlorine storage and metering room was observed to be good to fair overall. The space was well-lit, spacious enough to allow access to all equipment, and was well organized, with sufficient room to move around and operated the various equipment. A number of minor issues were noted, including an apparent mis-labeling of metering pump discharge lines, some spilled product from bulk tank #2 which appears to be running into a sump or drain of some sort, and some corrosion on the two transfer pumps. The leak from bulk tank #2 was reportedly an ongoing and long-duration issue which was found to have been addressed as of March 2024. These deficiencies do not affect the performance of the equipment and therefore pose minimal risk to the continued operation of the chlorine feed system.

3.4.4.8.2 Ferric Chloride - Poor

Ferric chloride is used as a flocculant and coagulation aid, allowing for more efficient removal of turbidity and suspended particulate matter from the raw water. AWWA Manual B407 provides the industry best practices for the storage, handling, and feed of ferric chloride. [redacted] This pin floc, or small flocculated suspended solids, is grouped into “macro floc” by the two types of polymer used in this location (coagulation aid followed by blanket polymer). The ferric chloride system at the treatment plant was installed in 2010.

[redacted]. The max usable volume per tank is 2,300 gallons for a total usable bulk storage volume of 4,600 gallons. This volume represents approximately 30 days of storage for the TWW treatment plant, as reported by the plant operators. From here, product is metered through four peristaltic style Verderflex Dura 15 and Dura 25 metering pumps to the injection point. [redacted]

[redacted] The ferric system lacks a day tank as part of the configuration. Containment is provided via a small concrete curb separating the ferric dosing area from the rest of the basement.

<u>Ferric Chloride Condition Assessment</u>

The condition of the ferric chloride bulk tanks are unknown due to the fact that they are buried. Fill ports for the bulk tanks are located [redacted] a [redacted] which appear to be in good condition despite obvious chemical staining present on the concrete of the containment area and nearby wall.

The condition of the metering pump area was noted as poor. Housekeeping did not appear to have been performed in some time, with significant chemical staining on the floors, walls, and equipment. The metering pumps themselves did not appear clean, with corrosion noted on bolts and flange fittings. Support brackets for the piping and electrical conduits were in poor condition due to extensive corrosion, resulting in significant metal loss. A metallic support column for the large diameter piping opposite the metering pumps was suffering from similarly severe metal loss due to corrosion. Further, the distance between the pumps and the control panels on the opposite side of the space was very tight, a potential concern from an ergonomic and safety standpoint. The control panels appeared unclean, and the various pushbuttons and lights were rather corroded. These panels were not opened, however it is suspected that the corrosion extends to the internals of the panels. Finally, due to the lack of a day tank, a catastrophic leak could effectively empty the bulk tanks. The small curb used for containment would be insufficient to contain the volume of the bulk tanks, which would lead to chemical flooding a large portion of the basement area.

3.4.4.8.3 Polymer (Treatment) - Good

Two types of polymer, SUPERFLOC® manufactured by Kemira and Magnafloc® LT7981 by Solenis LLC, are used at the treatment plant as a blanket polymer and a coagulation aid, respectively. The coagulation aid polymer is injected first in the process, immediately after the sand separators, along with ferric chloride. Like the ferric chloride injection point, the polymer product is allowed to freefall several feet before reaching the water surface in the effluent channel from the sand separator. While this does not negatively impact the performance of the chemical, it's an atypical installation; chemicals are typically injected below the water surface at mid-stream to assist in the dispersion through the water channel.

AWWA M37 is the industry reference for the operational control of coagulation and filtration processes, and includes detail on the use of polymer products for coagulation.

Polymer and ferric chloride are then mixed in the mixing basins prior to entering the superpulsator facility. The blanket polymer system at the treatment plant was installed in 2010.

[redacted]. The day tank is refilled as needed from 55-gallon drums of stored chemical located in the room.

The second type of polymer used in the treatment process is SUPERFLOC. This polymer is used to maintain the sludge blanket in the superpulsator units.

[redacted]. Chemical is received and stored in 55-gallon plastic drums placed on movable containment skids. Polymer is transferred into a day tank, then metered into a steady of flow of plant water (also called “chase water”) and mixed thoroughly through glass beads to ensure proper dispersion of the polymer in the water. Five LMI / Milton Roy brand metering pumps are located in the polymer room: one per superpulsator unit, plus a spare. The discharge piping from the pumps is configured to allow redundancy between pumps, as well as the ability to direct chemical into two injection points located between the mixing basins; this injection configuration was used previously for blanket polymer, but recent modifications were made to optimize floc formation in the superpulsator process.

Historically, polymer was injected at a third location: directly before the sand filters as a filter aid. The use of polymer at this stage in the treatment process had been stopped at some point in the past.

Polymer Condition Assessment

The two polymer metering and storage rooms were found to be in good condition. The rooms were clean, well lit, and no obvious maintenance issues were observed. From an operational perspective, there is a long distance between the coagulant aid polymer metering room and the injection point; should TWW experience operational challenges with the feed system for this product, consideration should be given to relocating the metering pumps and chemical storage to be in closer proximity to the injection point.

Additionally, drop tubes should be installed to direct the discharge of chemical below the water surface to prevent splashing and suboptimal mixing.

3.4.4.8.4 Polymer (Residuals Handling) - Good

Polymer is additionally used in the residuals handling process to aid in the formation of floc. [redacted] Dry powdered CLARIFLOC ® A-333P by Polydyne Incorporated, stored in 50 pound bags. The dry chemical is mixed in 360-gallon batches with a typical concentration of 0.25% prior to being used. Four skid-mounted polymer handling and metering pump systems are located adjacent to the stainless steel batch tanks; each pump is intended to serve one of the four belt filter presses.

Residuals Polymer Condition Assessment

Similar to the coagulant aid polymer, the residuals polymer storage and feed equipment was found to be in good condition, with no concerns of note.

3.4.4.8.5 Hydrofluorosilicic Acid (HFSA) - Poor

Hydrofluorosilicic acid (HFSA, or fluoride) is a common additive to drinking water as a dietary supplement of fluoride, which has long been considered beneficial to healthy teeth, primarily for children. Public water systems are not required by regulation to introduce fluoride into the water supply, however many municipalities have their own requirements.

AWWA Manual M4 is the industry standard for water fluoridation, and includes information related to the handling and feed of fluoride products into drinking water.

[redacted] The maximum usable volume for each bulk tank is 2,800 gallons, and deliveries are typically around 4,000 gallons (TWW SOP WTP-O No. 20). Operators report the volume of the bulk tanks represents a 30-day supply of chemical.

[redacted] There are two peristaltic pumps located on a concrete pedestal which serve a single injection point. Injection occurs in the finished water pump room; HFSA is injected into the suction side clearwell before the pumps.

Fluoride Condition Assessment

The fluoride handling system was found to be in poor condition caused by profound neglect. Evidence of past chemical spills was observed on the walls and floors in this area, with no signs that effort was made to clean them up. The concrete pedestal meant to support the two metering pumps showed severe deterioration, and rather than replace the pedestal, TWW personnel placed plastic boards under each pump, without anchoring them down. This allows the pumps to freely walk around during operation, a significantly deficient condition that lends itself to equipment breakage and chemical leaks and should be addressed immediately.

Lack of containment is also a concern. [redacted] Without a day tank as an intermediate step, the containment for this chemical system is profoundly undersized; if a hose were to separate or a pipe to break, the amount of chemical that could enter the basement would far exceed the volume of the containment curb. Due to the extremely aggressive nature of HFSA, this type of chemical release would pose a significant hazard to health and safety.

3.4.4.8.6 Powdered Activated Carbon (PAC) - Fair

Powdered activated carbon (PAC) is typically used to remove taste and odors from the water supply, which is more of a concern in systems that utilize surface water as a raw water supply, as is the case with Trenton. The PAC system at the treatment plant was installed in 2010.

AWWA B600 is the industry guidance document for the handling, storage, feed, and application of powdered activated carbon.

[redacted] Standard operating procedure documents from TWW state that bulk deliveries are typically between 3 and 5 tons at a time (SOP WTP-M No. 12). The metering pumps (Verderflex Dura25) for PAC are located in the basement of the filter building, behind the ferric chloride metering pumps. PAC is injected into the process water before the mixing basins. An apparent discrepancy between the written SOP for PAC and real-world practice was noted; per the SOP, the concentration dosed ranges between 1 mg/L and 23 mg/L depending on raw water quality, with a typical average value of 2 mg/L (550 GPD) used. However, operators reported that the dosing rate never changes, regardless of plant flow or raw water quality. The concentration may fluctuate depending on the strength of the PAC slurry, but the volume of slurry remains constant. The main cause of this inconsistent dosing is a lack of gravimetric or volumetric feeders in the PAC system. Without the addition of proper feed equipment, it is nearly impossible for operators to achieve uniform PAC slurry concentrations. At this location, the PAC is able to adsorb a portion of the organic carbon material before it itself is flocculated and removed. There are two injection points, a primary and a spare, located near an exterior wall on the roof north of the sand separator system immediately upstream of the mixing basins.

<u>PAC Condition Assessment</u>

The condition of the bulk storage tanks is unknown due to the buried nature of the tanks. The metering pump area was found to be in fair to poor condition. Housekeeping continues to be an issue, with extensive corrosion, poor lighting, spilled chemical on the floor and walls, and poor labeling and signage.

Visual observation in October 2023 of the accumulation of floating matter on the surface of the superpulsator units indicate that TWW is overdosing PAC. These blankets are uniformly black, which is likely caused by an excess of PAC being flocculated and floated within the basins. It is recommended that TWW and the operators revisit its dosing selection to optimize the performance of PAC in the removal of turbidity and organic content, while reducing the potential of wasted product through overdosing.

3.4.4.8.7 Lime - Poor

Lime, specifically quick lime, is used to remove hardness in the source water, as well as to raise pH of the water. [redacted] The quick lime system at the treatment plant was installed in 2010.

AWWA Manual B202 provides the proper storage, handling, feed, and use of quicklime and hydrated lime for water treatment applications.

[redacted]. The lime room houses two independent handling systems. The room contains three large water softening vessels as well as the electrical and control panels required for the lime slaking and metering system. Softened water is used for lime dissolution to minimize scaling in the transfer and feed lines. Containment is provided by a curb across the entryway to the room, with a ramped walkway for easier entry.

Lime is dosed at two locations in the treatment process: first, it is injected into the raw water influent before the superpulsators. The second location, known as post-lime, is in a small room that houses various equipment such as two small booster pumps, an air compressor, and fire sprinkler piping. In the treatment process, this second location is after the filters on the suction side of the finished water pumps. Metering is achieved through the use of two (2) Watson Marlow Bredel SPX 20 pumps for the pre-lime injection points, one Watson Marlow Bredel SPX 32 for post-lime injection and one Verderflex Dura15 for post-lime injection.

Lime Condition Assessment

Condition overall as well as housekeeping were observed to be in poor condition; while not an uncommon appearance for industrial lime rooms, nearly every surface was white with spilled or sprayed chemical, and pooled water was noted in several locations. No guard or separation was provided between the chemical handling components and the control panels; evidence of previous chemical spray was noted on the front of the control panels and covering the electrical breakers on the south wall. Similar evidence of past spilled chemical was noted at both of the injection points.

A fire was reported to have occurred in the late summer 2023 on the roof of the lime room. The suspected cause of this was due to a the water added to the quick lime causing an exothermic reaction, which can lead to combustion. Proper maintenance and cleaning is essential for mechanical equipment handling a challenging product such as granular lime, especially given the long transfer lines between the bulk storage silo and the feed system.

3.4.4.8.8 Potassium Permanganate - Good

Potassium permanganate is used to remove iron, manganese, and other compounds from water as well as an oxidant to address taste and odor. The primary purpose for potassium permanganate at the TWW plant is to oxidize taste and odor causing compounds. At the TWW treatment plant, permanganate is delivered in 55-gallon drums of CAIROX® branded dry potassium permanganate. [redacted] The permanganate system at the treatment plant was installed in 2010.
AWWA B603 is the industry standard for the handling, storage, feed, and application of permanganates, including potassium permanganate.

Product is transferred from drums to a 2,000-gallon bulk tank which is used as a batch mixer to create a 3% solution of potassium permanganate. Chemical is then pumped to a 200-gallon day tank near the four metering pumps. Both the bulk / batch tank and the day tank are equipped with mechanical mixers which operate on a timer. Only one of the four pumps is a duty pump; the remaining three serve as spare / backup pumps. All four are Watson Marlow model 620Du. The dosing rate of the pumps is controlled based on the raw water flow rate (flow paced) via SCADA interface.

Potassium permanganate is injected into the raw water stream directly after the screening facility and before the raw water pumps. Physically, this injection point is located in a long dead-end hallway behind the raw water pumps, with two injection quills installed in the middle of the floor.

Permanganate Condition Assessment

The potassium permanganate storage and metering pump room was found to be in good condition at the time of H2M's visit; the space was well lit, partly thanks to natural light entering through windows on the east-facing wall. There were no housekeeping deficiencies observed, and all equipment appeared to be well maintained. Past issues with housekeeping were noted by outside stakeholders, as well as a leak in the roof hatch during rain events. While this was not observed firsthand, it is worth noting as an item needing to be addressed, potentially as part of the roofing replacement project.

The permanganate injection location, however, was poorly lit, had substantial dirt and water accumulation on the floors, concerning cracks in the concrete ceiling and floor, limited labeling of the various pipes and conduits along the wall, and the general appearance of an unmaintained space. The concrete cracks pose the largest potential for hazard. The totality of flow entering the plant flows underneath of this room; any failure of the structure in this portion of the plant would result in a full cessation of raw water into the process and consequently stop the ability of the plant to produce treated water. Since a failure of this channel would result in a failure of the full plant, this area should be inspected by a structural engineer.

3.4.4.8.9 Zinc Orthophosphate - Good

While it is not currently in use at the TWW Treatment Plant, there still exists a complete storage, feed, and handling system for zinc orthophosphate. The zinc orthophosphate system at the treatment plant was installed in 2021 / 2022.

Per the operator, corrosion control chemical is now introduced at the Central Pumping Station instead of the treatment plant. Small diameter piping is routed through a portion of the filter basement and main pump room which conveys zinc orthophosphate from the metering room to the injection point at the discharge of the finished water pumps.

As reported by the DEP, repeated issues with failing check valves at the Pennington Reservoir has prevented TWW from utilizing corrosion control for the Gravity Zone. Currently, no corrosion control is used in this zone, and TWW is required to perform enhanced water quality parameter (WQP) monitoring until such time that zinc orthophosphate is able to be reliably reintroduced at the treatment plant rather than only at the discharge from CPS.

Zinc Orthophosphate Condition Assessment

The zinc orthophosphate storage and feed area was found to be in good condition. It is recommended to install a short dividing wall between the zinc orthophosphate system and the polymer storage and feed area to prevent a potential spill of one chemical from impacting the operation of the other.

The feed lines between the metering pumps and the injection points were found to be single-walled plastic pipes; it is recommended that should the zinc orthophosphate system be placed back into service, these lines be replaced with double wall containment piping to protect against damage and potential leaks.

3.4.4.9 Residuals Handling System

3.4.4.9.1 Backwash Holding Tanks – Unknown

The first component in the residuals handling process are six (6) backwash holding tanks, each with a nominal volume of 100,000 gallons. These tanks allow equalization of the flow from the filter backwash system prior to the sludge settling, mixing, and equalization basins (SMEB's). The volume of water used to backwash a single filter bed typically fills two of the backwash holding tanks, or just under 200,000 gallons. Settling time in these basins was reported to be about 17 or 18 minutes.

There are two decant pumps which convey supernatant water back to the head of the plant. Three sludge pumps transfer sludge from the holding tanks into the SMEB's for further thickening; each pump has a capacity of 300 GPM.

Backwash Holding Tanks Condition Assessment

The condition of the backwash holding tanks was unknown due to the inability to enter each basin. Further assessment is recommended, if feasible. The walkways and basement area near the bulkheads to the holding tanks were in good condition, with clean walking surfaces and adequate lighting.

3.4.4.9.2 Sludge Mixing and Equalization Basins (SMEB's) - Unknown

The second component in the residuals handling process are two sludge mixing and equalization basins (SMEB's). These are located in the treatment plant building east of the east filter beds. Wastewater is sent to the SMEB's from various sources, including backwashing of the sand filters, settled solids from the superpulsators, and settled solids from the contact basins.

Each SMEB is equipped with a mixer. Settled sludge is transferred via an array of three pumps to the gravity thickeners. These pumps are manufactured by Hayward Gordon and are capable of about 100 GPM each. Decant water is pumped back to the head of the plant.

SMEB Condition Assessment

Similar to the backwash holding tanks, the condition of the SMEB's was not verified. The portion of the plant which houses the mixing pump and various equipment for the SMEB's was found to be in good condition, with adequate lighting and clear walking surfaces. The labels on the pipes in this area are all acronyms, some of which refer to processes that are no longer present at the treatment plant. An example of this is "ACS", which stands for "accelerator sludge"; this process was replaced in 2011 by the Superpulsators. It is recommended to update these labels, spelling them out in full words to allow a wider audience to understand the function of each pipe following ANSI/ASME A13.1 Standard for Enhanced Pipe Labeling.

3.4.4.9.3 Gravity Thickeners - Fair

In the next step of the residuals handling process, partially concentrated sludge is sent to two gravity thickeners. These 80-foot diameter gravity thickeners are located outside to the south of the residuals handling building, near the MDF pump house. Sludge is pumped to the middle of the circular basin, and as the water flows outward the sludge settles to the bottom, where it is collected by a rotating scraper arm and directed into a central thickened sludge outlet. Clarified water flows over weir teeth at the edge of the thickeners, is collected, and pumped to the head of the plant.

Gravity Thickeners Condition Assessment

The gravity thickeners appeared to be in good condition structurally; some leaves were observed in the weir teeth. NJDEP personnel report that the outlet configuration is not optimized for these thickeners, leading to inefficiencies and sludge blockages in the collection system. An anecdote was relayed during a site visit, which stated that an inexperienced operator once noted excessive differential head in the thickeners. In a panic, the operator opened a valve which dumped thickened sludge to the head of the plant, which then shut the plant down for a period of time. While this speaks more to system mismanagement and inadequate training of staff, improvements at the thickeners could result in more reliable operation of the gravity thickeners.

3.4.4.9.4 Thickened Sludge Mixing and Equalization Basins (TSMEB's) - Unknown

The thickened sludge mixing and equalization basins (TSMEB's) are the final step before thickened sludge is sent to the mechanical dewatering facility (MDF). The two basins are located adjacent to the SMEB's in the treatment plant building, and each is equipped with a mixer directly preceding the thickened sludge transfer pumps. The TSMEB operating range is typically maintained between 3.5 feet and 6.5 feet.

Four transfer pumps move thickened sludge from the TSMEB's to the MDF for the final stage of dewatering.

TSMEB Condition Assessment

The condition of the thickened sludge basins is unknown due to the inability to enter the concrete basins. The rooms which house various piping, pumping, and control equipment for the sludge handling equipment were in overall fair condition. General housekeeping items such as mopping and replacing light bulbs are necessary for the lower areas which house the thickened sludge pumps. The stairwells used for access between the levels, as well as into the rest of the treatment facility and the residuals handling area, were observed to have areas of cracking concrete and peeling paint, especially at the joints between the walls and ceiling. It is recommended that this section of the plant be inspected by a structural engineer to confirm any possible issues.

3.4.4.9.5 Mechanical Dewatering Facility (MDF) - Good

The thickened sludge from the backwash wastewater collection system is held in two thickened sludge holding basins (TSMEB's). Sludge pumps convey the sludge from these basins to the mechanical dewatering facility (MDF). Four belt filter presses are housed on the second level of the MDF; the dewatered cake falls through openings in the floor directly into dumpsters to dispose of the cake offsite. Under typical plant production and raw water quality conditions, one or two of the belt presses are used at a time. The typical sludge loading rate is 25 gallons per minute per belt filter press. A dedicated control room is located in the MDF which communicates back to the central control room in the main treatment plant.

<u>MDF Condition Assessment</u>

The MDF was found to be in good condition. The facility was constructed more recently than most of the processes at the TWW treatment plant, resulting in a longer remaining service life and better overall condition. The space was well lit, clean, and in good working order. The resultant cake leaving the dewatering belt presses visually appeared to have a low water content, and the presses themselves were clean and well maintained. [redacted]

3.4.5 Standby Emergency Generator - Unknown

Backup power for the facility is provided in the form of a single 2,000 kW / 2,500 kVA diesel-driven emergency generator, Caterpillar model 3516C. The generator reportedly has the ability to operate the entire facility under normal conditions, however operators have reported that this functionality had never been tested. The 50% Design Engineer's Report for the Pre-Treatment and Facilities Improvement Project (MWH, dated November 2005) indicated that the generator was sized to allow the plant to produce 30 MGD, including one raw water pump, two finished water pumps, and other smaller loads necessary to operate the plant.

Standby Generator Condition Assessment

The generator and the room in which it is housed were found to be in good condition. The generator had recently been receiving monthly inspections as of August 2023. It is recommended to perform a full load test to determine the generator's actual performance during a power outage and to verify its ability to support continued production. Specifically, the National Fire Protection Association in code NFPA 110 requires generators to be tested for a minimum of 30 minutes a month with additional testing on regular (annual/ biannual, triannual, etc,) basis depending on the generator's emergency power supply system level rating.

3.5 Water Storage Facilities

Assessment: Yellow

The NJDEP Criteria and Benchmarks for Technical, Managerial, and Financial (TMF) Capacity document provides a single raking description for the entire treatment process, as can be seen below:

Black	Storage capacity inadequate; facility past useful life, improperly designed, in disrepair, ill-equipped, and/or poorly maintained; finished water quality impaired; minimum pressure insufficient; no plans to address problems. Facility not inspected within last 5 years.
Red	Storage capacity adequate; facility has little remaining useful life, improperly designed, in disrepair, ill-equipped, and/or poorly maintained; finished water quality impaired; minimum pressure insufficient; no plans to address problems. Facility not inspected within last 5 years.
Yellow	Storage capacity adequate; facility has some remaining useful life and few if any design or equipment issues; existing O&M procedures could be improved; finished water quality satisfactory; sporadic problems with maintaining minimum pressure; plans exist to address problems. Facility inspected within last 5 years.
Green	Storage capacity adequate per applicable regulations; facility is new and/or in good condition with no design, repair, equipment, and/or maintenance deficiencies, finished water quality satisfactory, minimum pressure maintained. Facility routinely inspected at least every 5 years.

Determination: Yellow

TWW currently has much more storage capacity than they need when including the non-compliant reservoir. TWW has been out of compliance with LT2 for over 15 years, so storage is only adequate from continuous rule violations and inability to address the ongoing health risks from the uncovered reservoir. Most of the facilities were inspected in 2023 and found to be in fair condition, with some signs of corrosion and chalking. Based on these findings and the above guidelines, H2M determined the storage to fall under the yellow ranking. It should be noted that plans are in place to take the Pennington Road Reservoir out of service and replace it with closed storage tanks. This will reduce the available capacity but ensure cleaner water. The storage rating may change once this work is done.

Table 3-3: Condition Overview – Storage

Storage Facility	
Pennington Road Reservoir	Poor
Ewing Elevated Tank	Good
Hopewell / Brandon Farms	Fair
Lawrence Tank	Good
Whitehorse Tank	Good
Jones Farm Tank	Fair
Mercerville Tank	Good
Temporary GST's at Reservoir	Unknown

The condition ratings stated in Table 3-3 follow the standard nomenclature defined in Section 2.3. Justifications and additional details on each assessed condition are included in the corresponding sections below.

3.5.1 Pennington Road Reservoir - Poor

Originally constructed in 1899, the Pennington Reservoir is a 78-million gallon open-air finished water reservoir. Nearly all of the treated water from the TWW Filtration Plant is pumped into the reservoir, then boosted in pressure for use in the Central Pumping Zone. This inflow of finished water is directed over a semicircular spillway to dissipate the velocity and prevent any damage to the reservoir structure.

The reservoir was built by creating earthen embankments on all sides. The interior of the reservoir is lined with large stones and hydraulic cement to prevent seepage of water into the surrounding soil. The parcel on which the reservoir was constructed is bound on three sides by streets and is immediately adjacent to several residential properties. A gate house is located on the north side of the reservoir, which is now used for equipment storage and sodium hypochlorite storage and feed.

The adjacent gatehouse is currently used for storage as well as to house a sodium hypochlorite disinfection system, which is used to disinfect the water leaving the reservoir prior to being pumped through the Central Pumping Station. Due to the reservoir being uncovered, there exists the potential for pathogens to be introduced to the finished water; as such, rechlorination is a requirement to ensure the sanitary condition of water re-entering the distribution system. There are three (3) identically sized 1,250 gallon bulk tanks, and four (4) metering pumps. This chlorine system was installed in 2018.

Pennington Road Reservoir Condition Assessment

The physical condition of the reservoir was found to be in fair condition. The reservoir is an old asset and as such possesses a proportional service life loss; despite this, the impoundment itself was free of noticeable leaks or other concerning failure points. The gatehouse, which houses the rechlorination system for water leaving the reservoir, was in fair condition. Lighting was observed to be inadequate, and several of the spaces were repurposed for storage of miscellaneous parts and equipment. The hypochlorite room was in good condition with no observed deficiencies. However, non-compliance with federal and state drinking water quality regulations supersedes the physical condition of the reservoir, resulting in this storage facility being assigned a poor ranking.

3.5.2 Ewing Elevated Tank - Good

The Ewing Tank is a one million gallon (1 MG) elevated multi-leg tank [redacted] This tank serves as gravity storage for the Central Pumping Zone, the largest pressure zone in the TWW distribution system. The last inspection was performed on July 19, 2022 and documented in a report dated August 16, 2022 by Veolia Advanced Solutions. The tank and the Ewing Pump Station share the same parcel of land.

As reported in the latest inspection report, the Ewing Tank was constructed of welded steel in 1961 by Chicago Bridge and Iron Company with a diameter of 77 feet, a high water level (HWL) of 128 feet 2 inches (elevation 231.27 feet AMSL), and a low water level (LWL) of 84 feet 6 inches (elevation 201.27 feet AMSL). The tank also possesses the following appurtenant equipment and accessories:

- Cathodic protection
- Passive mixing system
- Cable climb system on exterior ladder

The report stated that the tank's structural elements and coating systems are in very good condition, with no remediation work required. The exterior coating system tested positive for lead (2,787 µg/g) and chromium (147 µg/g). The interior coating sample showed low levels of lead (76 µg/g) and non-detect (ND) for chromium.

Ewing Tank Condition Assessment:

H2M visited the Ewing Tank on October 17, 2023. At the time of inspection, the tank was drained and offline due to recent service having been performed. Exterior coatings appeared to be in good condition when viewed from the ground.

3.5.3 Hopewell / Brandon Farms Tank - Fair

The Hopewell / Brandon Farms Tank is a six hundred thousand gallon (0.6 MG) hydropillar consisting of a fluted column and sloped-bottom, straight walled tank [redacted]. This tank serves as gravity storage for the Klockner Zone. The most recent inspection was performed on April 26, 2023 by USG Water Solutions.

As stated in the inspection report, the Hopewell Tank was constructed in 1996 by the Pittsburgh - Des Moines Steel Company with a diameter of 57 feet, a HWL of 118' overall (339.27 feet AMSL), and a LWL of 67 feet (299.27 feet AMSL). The date of last rehabilitation / repainting was not reported.

At the time of last inspection on April 26, 2023, the exterior coatings were found to be in fair condition, exhibiting widespread thinning and corrosion. Interior coatings were found to be in good condition, with a few areas of corrosion noted. The interior and exterior coatings were found to be absent of detectable lead and chromium.

Hopewell Tank Condition Assessment:

The general condition assessment of this tank was fair, which aligns with the most recent inspection. H2M visited the Hopewell Tank on October 17, 2023. The condition of the tank remained unchanged from what was stated in the April 26, 2023 report. Graffiti was noted at the ground level on the exterior of the tank. Inside the base of the tank, the steel walls and ceiling had been covered with spray on insulation. The piping and equipment in the base of the tank appeared to be in good condition, with minimal rust staining noted on some of the components.

3.5.4 Lawrence Tank - Good

The Lawrence Tank is a 1.0 million gallon multi-leg elevated tank [redacted] The Lawrence Tank serves as gravity storage for the Central Pumping Zone alongside the Mercerville Tank, the Whitehorse Tank, and the Ewing Tank. The last inspection was performed on June 27, 2023 by USG Water Solutions. The tank is equipped with an impressed current cathodic protection system.

As reported in the June 27, 2023 report, the year of construction of the Lawrence Tank is unknown. The HWL of the tank is 118 feet (205.27 feet AMSL), the LWL is 88 feet (175.27 feet AMSL), and the diameter is 74 feet. The date of the last rehabilitation / repainting was not reported. At the time of the last inspection, the interior and exterior coating systems were observed to be in good condition, with no detectable lead or chromium.

<u>Lawrence Tank Condition Assessment:</u>

H2M visited the Lawrence Tank on October 17, 2023. The exterior of the tank appeared in good condition as viewed from the ground, with minor chalking and biological growth observed. Some damage was observed in the perimeter fencing which should be repaired. Two power cables were observed to be poorly supported, with wires hanging low between the altitude valve vault and the nearest tank support leg. The overflow pipe is fitted with a fine mesh insect screen; however a tear was noted in this screen, which would allow insects into the overflow pipe. In front of the tank near East Darrah Road, TWW has a sample station. The placard with the site ID and address was incorrect, indicating a different site address. The latter two observations are not overly large or complicated tasks and can and should be addressed.

3.5.5 Whitehorse Tank - Fair

The Whitehorse Tank is a 1.0 MG multi-leg elevated tank [redacted] This tank serves as gravity storage in the Central Pumping Zone alongside several other tanks. The last inspection was performed by USG Water Solutions on July 18, 2023.

As reported in the latest inspection report, the tank was constructed in 1990. The HWL is 89 feet 7 inches (192.77 feet AMSL), the LWL is 57 feet 2 inches (162.77 feet AMSL), and the diameter is 76 feet. The date of the last rehabilitation / repainting was not reported. The tank is equipped with an impressed cathodic protection system and a passive mixer.

The interior and exterior coatings were observed to be in good condition, with minimal corrosion noted in selected locations. The coatings present on the tank were found to be absent of detectable lead and chromium.

Whitehorse Tank Condition Assessment

H2M visited the Whitehorse Tank on October 17, 2023. At the time of this visit, the exterior coatings visible from ground level were in good condition, with no chalking or biological growth observed. Operators reported that the altitude valve had recently failed, which resulted in the overfilling of the tank. To emphasize this, water was observed leaking through the duckbill check valve on the overflow pipe, exemplifying the high water level present in the tank. Because of the inability to control the high water level, a valve on the inlet / outlet pipe was closed, isolating the tank from the system. Operators were unable to definitively state when the malfunction of the altitude valve occurred or how long the tank was offline, however it was indicated that the duration of the tank shutdown had been at least a week. Concerns exist over the loss of chlorine residual in the tank once the altitude valve is repaired and the tank is placed back into service.

The altitude valve vault appeared in good condition, with no standing water, accumulated sediment, or significant corrosion. Adjacent to the vault appeared to be two direct buried pumps with pitless adapters; the functionality and condition of these pumps was not immediately evident, and operators present were unable to clearly state the direction of flow or intended hydraulic operation.

3.5.6 Jones Farm Tank - Fair

The Jones tank is the only standpipe-style tank in the Trenton Water Works' distribution system. [redacted], this 1.0 million gallon tank serves the Booster 3 pressure zone. No inspection or maintenance records were provided by TWW for this tank.

It appears the tank was raised at some point in the past; there is a welded plate over what appears to have been a manway on the third shell ring up from the bottom, indicating that three rungs were added to raise the maximum elevation of water. Record drawings for this tank or the subsequent modifications were not made available for this study.

Jones Farm Tank Condition Assessment:

H2M visited the Jones Farm Standpipe on October 17, 2023. At the time of the visit, the exterior coatings visible from the ground appeared to be in fair condition. Widespread chalking and rust staining were noted. Woody vegetation was observed growing from the foundation of the tank which should be removed. [redacted]

3.5.7 Mercerville Tank – Undergoing Rehabilitation

The Mercerville Tank is a 1-million gallon elevated tank located behind [redacted]. This tank serves the Central Pumping Zone. The latest inspection of the Mercerville Tank was performed in 2022 by Suburban Consulting Engineers and was comprised of an ultrasonic thickness test. Previous to this report, SUEZ Advanced Solutions prepared a Condition Assessment Report in April 2019, which recommended a complete renovation of the tank's interior and exterior coating systems.

Mercerville Tank Condition Assessment:

H2M visited the Mercerville Tank on October 17, 2023. The tank was offline at the time of the visit, with a tank maintenance contractor actively working on site. As part of the ongoing work by Municipal Maintenance, a new valve vault was installed along with new site piping. Distribution operators report that the tank has been offline for about a year, and is expected to return to service in the near future.

Based on the completion of the scheduled work, the Mercerville Tank is expected to be in good condition. Any defects or issues with the coatings or mechanical systems at the tank are expected to be addressed prior to returning the tank to active service.

3.5.8 Kulp Street Tanks

As part of the Pennington Reservoir Improvements Project, two bolted steel ground tanks were constructed to the northwest of the reservoir. However, the tanks have not been utilized for their intended purpose, and currently sit empty.

3.6 Pumping Stations

Outside of the treatment plant's finished water pumps, the TWW system has three (3) primary booster pump stations: the Central Pumping Station, the Ewing Booster Pump Station, and the Klockner Booster Pump Station.

Table 3-4: Condition Overview – Pumping Stations

Pumping Facility	
Central Pumping Station	Fair
Klockner Booster Pump Station	Good
Ewing Booster Pump Station	Good

3.6.1 Central Pumping Station - Fair

[redacted] Its purpose is to draw water from the reservoir and boost pressure into the Central Pumping Zone, which serves approximately 70% of the customers in the TWW service area. Two downstream pressure zones, the Klockner Zone and the Booster 3 zone (served by the Ewing Pump Station), receive water from the CPS zone and therefore from the Central Pump Station. This station is one of the most critical pieces of infrastructure in the TWW system as there is no redundancy to its operation. The station houses four pumps of varying capacities for a total firm capacity of 45 MGD:

- Pump #1: 10 MGD
- Pump #2: 15 MGD
- Pump #3: 20 MGD (with VFD)
- Pump #4: 24 MGD (with VFD)

The larger two pumps (#3 and #4) are operated on VFD, while the smaller two (#1 and #2) are across the line. All four pumps have a target TDH of 125 feet. 48-inch diameter suction and discharge lines are located in the basement area below the pumping floor. Also located in the basement area is the zinc orthophosphate system, including bulk storage, containment, and metering.

Due to the critical nature of this station, two large generators are located on site inside of a sound attenuated building. These two generators are sized to allow all four pumps plus auxiliary systems (SCADA, HVAC, lighting, etc.) to operate during a loss of utility line power. [redacted] a room within the generator building contains all switchgear, automatic transfer switches, and other emergency standby power controls. Utility power is provided via an on-site substation with dual 26kV feeds.

Central Pumping Station Condition Assessment:

The condition of the CPS was found to be fair. Operationally, the station has the capacity and pumping redundancy to serve its intended purpose, with no major recent operational issues reported. However, several housekeeping, security, and maintenance deficiencies were noted. First, sections of piping in the basement area were experiencing coatings failures, with some areas exhibiting significant delamination of the paint. An area of spilled chemical was observed near an injection quill placed into the top of the discharge piping, which had pooled on the floor near the pipe. It was further reported by operators that the isolation valves for each of the pumps did not all function properly, and their operation was considered unreliable. Without the ability to isolate the pumps, performing maintenance on the station while maintaining pumping capacity is not possible, and a significant threat to meeting the capacity outside of the gravity zone.

Due to concerns regarding pipe condition and pump age, TWW has contracted a consulting firm to study potential improvements at the CPS, including replacement of all four pumps with identically sized models and individual VFD's, new piping, and miscellaneous other upgrades.

[redacted]

In contrast with the fair condition of the Central Pumping Station is its unique operational status as the single largest point of failure in the entire TWW system, save for the treatment plant itself. Should CPS experience any extended outage, a majority of TWW customers would be without water. A condition assessment of “fair” should not preclude the performance of conceptual and preliminary design work to provide redundancy for CPS.

3.6.2 Klockner Booster Pump Station - Good

The Klockner BPS serves to boost pressure from the Central Pumping Zone into the Klockner Booster Zone, which serves a region of Hopewell Township. The station contains three pumps: two pumps with rated capacities of 600 GPM at 160 feet TDH (Pumps #1 and #2) and one pump with a capacity of 1,200 GPM at 160 feet TDH (Pump 3). All pumps are equipped with VFD’s. The station’s firm pumping capacity is 1.8 MGD. At the time of H2M’s inspection, Pump #3 was out of service. Pump #2 serves as the lead pump, with Pump #1 acting as a lag pump to provide additional flow as needed. When it is operable, Pump #3 is the lag-lag pump used for emergencies or other high-demand events in the downstream pressure zone.

The booster station houses a 200KW emergency standby diesel generator as well as bathroom facilities.

The station is controlled via SCADA, which is monitored by the operators at the central treatment plant control room. The pump operation is automated and modulated based on the level of the Hopewell Tank.

<u>Klockner BPS Condition Assessment:</u>

The pump station was in overall good condition, with the largest issue being the current inoperability of the higher-capacity Pump #3.

When asked about the functionality of a section of piping along the back wall of the station, operators were unable to provide a clear answer. Without the knowledge of basic functionality of the equipment at the pump station, it is unlikely that the W-4 of record or his staff would be able to identify malfunctioning equipment, and even less likely that the appropriate repairs would be made. While TWW’s assignment of responsibilities places the operation of the tanks under the purview of Facilities (i.e., operators at the plant), it is the distribution team that spends the most time throughout the distribution system and physically present at the tanks and remote pump stations. As such, these personnel should be versed enough to provide a basic explanation of how the system operates and to know if something has malfunctioned.

3.6.3 Ewing Booster Pump Station - Good

The Ewing Booster Pump Station is located on the same parcel as the Ewing Elevated Tank [redacted]. The station contains four pumps: two (2) 800 GPM at 150 feet TDH and two (2) 1,400 GPM at 150 feet TDH. This station serves to convey water from the adjacent tank and the High Service Zone into the Booster #3 zone. At the time of H2M's inspection, Pumps #2 and #3 were running, and the bucket in the MCC for Pump #4 was marked with warning tape, indicating that the starter for Pump #4 was inoperable. The roof appeared to be constructed using a membrane for waterproofing, which isn't as common as asphalt shingles for a peaked roof structure.

The station is equipped with an emergency generator located in a separate room within the building. The generator uses fuel oil; the fuel oil storage tank for the generator is located outside the building under a protective overhanging roof. The pump station also houses the control panel for the impressed cathodic corrosion control system for the Ewing Tank.

Ewing BPS Condition Assessment:

The pump station was observed to be largely in good condition, with some minor deficiencies noted. The electrical and control gear appeared to be vintage, possibly original, and due for replacement. This was evidenced by the inoperable state of the starter for pump #4. Only one of the four pumps possessed legible nameplates; the other three were either missing or had been painted over.

3.7 Transmission and Distribution System

Assessment: Red

This section describes and assesses the critical infrastructure associated with City's water transmission system, which consists of the following major components:

- 48-Inch Finished Water Transmission Main (WTP to Reservoir)
- 36-Inch Finished Water Transmission Main (WTP to Reservoir)
- 36-Inch Transmission Main (CPS into Main Zone)
- Parallel 30-Inch Transmission Mains (CPS into Main Zone)
- Pennington Finished Water Reservoir

Condition observations included within this section are based on inspections conducted by H2M in August 2023, as well as interviews with TWW Operations and T&D personnel and review of GIS and other record documentation. Recommendations for capital improvements to correct major deficiencies are also provided.

H2M also ranked the distribution / transmission system using the TMF Capacity Development below guidelines.

Black	Location, age, construction, and condition of distribution system components unknown; high percentage of unaccounted for water loss; history of customer complaints due to water quality, water pressure, and/or service interruptions with poor response times; no plans to address problems
Red	Limited knowledge on location, age, construction, and condition of distribution system; high percentage of unaccounted for water loss; history of customer complaints due to water quality, water pressure, and/or service interruptions with poor response times; no plans to address problems
Yellow	Location, age, construction, and condition of distribution system components known; low to moderate percentage of unaccounted for water loss; moderate volume of localized customer complaints due to water quality, water pressure, and/or service interruptions; poor response times; plans exist to address problems
Green	Location, age, construction, and condition of distribution system components known and mapped; low percentage of unaccounted for water loss; few if any customer complaints; water quality and pressure satisfactory; service interruptions are infrequent and receive prompt response when they occur

Determination: Red

TWW has a relatively extensive GIS model of its distribution system. There is little question on the locations of distribution assets. There are areas where information is unknown or missing, such as size and age of construction, but overall, there is a mostly complete record of this system. Despite this, the TWW system was determined to fall under the red ranking. This was decided based on historical water quality issues, including legionella and disinfection byproduct exceedances in the distribution system. TWW also has a high percentage of unaccounted for water, typically around 40%.

Table 3-5: Condition Overview – Transmission and Distribution System

Transmission & Distribution	
Transmission Mains	Fair
Distribution Mains	Poor
Valves	Fair
Hydrants	Fair
Services	Poor
Unaccounted for Water	Poor

The condition ratings stated in Table 3-5 follow the standard nomenclature defined in Section 2.3. Justifications and additional details on each assessed condition are included in the corresponding sections below.

3.7.1 Transmission Mains - Fair

3.7.1.1 48-Inch Finished Water Transmission Main (WTP to Pennington Reservoir)

The 48-inch transmission main represents the primary flow of finished water leaving the treatment plant. [redacted] This finished water transmission was completed in the early 1900's concurrent with the treatment plant and reservoir and was originally constructed of cast iron. In 1995, roughly a mile (5,200 feet) of the total 6,900 feet was replaced with steel pipe, including the critical crossing of the Delaware and Raritan Canal. [redacted]

3.7.1.2 36-Inch Finished Water Transmission Main (WTP to Pennington Reservoir)

The 36-inch transmission main serves as a redundant flow path for the 48-inch transmission main, conveying water from the treatment plant into the Pennington Reservoir. [redacted] The 36-inch main is shown has being constructed of cast iron, with no installation year provided in the TWW GIS database. This rough is roughly 7,250 feet in length from the treatment plant to the Pennington Reservoir.

3.7.1.3 36-Inch Transmission Main (CPS into Main Zone)

Central Pumping Station (CPS) represents the single most critical pumping facility in the distribution system, conveying water from the Pennington Reservoir to the Central Pumping Zone and two other zones served solely by the Central Pumping Zone (Booster 3 and Klockner). This area serves roughly 70% of the customers in the TWW system. [redacted]

[redacted] This section of 36-inch is roughly 4,750 feet in length before reducing to 30-inch, which continues east and south an additional 6,100 feet.

3.7.1.4 Parallel 30-Inch Transmission Mains (CPS into Main Zone)

In addition to the 36-inch main leaving CPS, two parallel 30-inch diameter cast iron mains [redacted]. The TWW GIS database shows that the northern 30-inch main was installed in 1956, and does not provide an installation date for the second main. [redacted]

Transmission System Condition Assessment

TWW staff have reported no significant concerns or break histories associated with a majority of the major transmission mains, aside from a 16-inch main on [redacted] which is scheduled for replacement in the next few years. As with most systems of similar age and size, certain types of pipes, especially 1950's and 1960's ductile iron and older some unlined cast iron, will experience a higher break rate than other materials and vintages.

H2M reviewed the documentation made available at the time of report writing; some investigative work may have been performed without record information being provided. It is recommended that additional condition assessments be performed to verify the integrity and remaining useful life of buried infrastructure, especially the critical transmission mains. This can be accomplished in several ways, including collecting coupons from mains, pipe divers, and / or acoustic surveys.

3.7.2 Distribution System - Poor

The City's distribution system includes approximately 287 miles of piping ranging from 2-inches to 48-inches in diameter. The system is subject to the Water Supply Management Act (N.J.S.A. 58:1A-1 et seq.) and the Water Supply Management Act Rules (N.J.A.C. 7:19 Subchapter 6).

3.7.2.1 Piping Network

The piping network consists of pipes that have been in service as early as 1907 according to GIS records. Water main breaks are logged in a dashboard on the TWW GIS system. Unaccounted for water rates are reported to be around 40%; this value was calculated prior to the ongoing low velocity flushing program in place to address the *Legionella* issues in the system. This is above the industry average and regulatory maximum, likely due to a combination of factors including the overall age and maintenance history of the distribution system. This significant unaccounted for water loss has an adverse impact on the financial capacity of the system, in that the system is losing revenue from incurring unnecessary expenses for treating water that is wasted, which decreases the money available for investment in the technical and managerial resources of the system.

The TWW GIS data for pipe diameters, installation years, and lining year contain notable amounts of unknown values. Unknowns are assigned a value of "-999". Table 3-6 lists the total pipe counts and footages with unknown values which are also owned by Trenton Water Works; privately owned mains are included in the GIS for reference purposes but have been removed from this analysis.

Table 3-6: Unknown Values for TWW-Owned Water Mains

Value	Count of Unknown	Unknown Footage	Unknown % by Length
Diameter	396	6,743	0.5%
Install Year	14,261	1,394,422	99.1%
Lining Year	11,401	1,122,436	79.8%

The data field for material information does not appear to have any unknowns or missing data, however it is suspected that this is due to all of the pipes having been initialized with a material of "CIPA" at the time of GIS creation, and only updated to other values when specific information was available or new assets were installed. Pipes assigned a material of "CIPA" comprise 76.1% of all TWW-owned mains by footage.

Reports from TWW staff indicate that water main replacements are not a common activity in the distribution system, with some cleaning and lining projects performed. This is a concern since the infrastructure as a whole will continue to age and there will come a time when an impractically large amount of main will begin to experience failures simultaneously, and TWW will be unable to keep up with the replacement needs. AWWA recommends a 1% renewal program, which provides an average useful life of 100 years for mains. In the TWW system, this equates to 2.87 miles of main replaced annually, or about 15,150 feet. A comprehensive water main replacement program should be developed which identifies the order of which mains should be replaced based on a combination of factors including break history, consequence of failure, likelihood of failure, age, water quality complaints, and known upcoming road resurfacing projects.

3.7.2.2 Water Services - Poor

The TWW GIS system includes roughly 62,500 service accounts. TWW has an ongoing lead service line replacement program, which consists of ten (10) phases of work and is expected to continue through the year 2032. Currently, Phases 1 and 2 have been completed as part of an ACO issued by the NJDEP. Phase 3 received funding through the Water Infrastructure Improvements for the Nation (WIIN) Act and is currently in progress. Due to the age of the system, lead and galvanized service lines are commonplace; the exact number of lead and galvanized lines is currently unknown and investigation is ongoing as part of the LSLR program.

TWW is reportedly falling short of the required 10% of lead service line replacements annually. The scope of Phase 4 is to replace lead and galvanized service lines in Hamilton Township based on the EPA Lead Accelerator Program. However, due to TWW's inability to remain on schedule with lead replacements, NJDEP has brought in additional technical assistance to advance the LSLR program. At the time of this report, few to no lead service lines are actively being replaced.

New services under 6-inch in diameter are typically installed by TWW staff. Services to new developments 6-inch diameter and larger are installed by the developer's contractor to TWW standards and inspected by TWW personnel. Prospective developers within the TWW service area are given a standard new construction packet with information related to requesting service, types and brands of material to be used, and standard construction details for typical installations (service laterals, hydrants, water main, trench restoration, etc.).

Following a review of the "Developer's Packet" it is recommended that some updates be made. The last revision was made May 31, 2022; all four of the contacts listed (Mark Lavenberg, David Smith, Edmund Johnson, and Scott Holmes) are no longer at TWW or serving in different roles than listed. Other inconsistencies were noted, including the number of site plans needed for review.

3.7.2.3 Gradient Isolating Valves

There are a total of 59 gate valves identified in the TWW GIS database whose purpose is to create division between pressure zones. Known as “pressure zone boundary” valves in GIS, these are located between the Central Pumping Zone and the Gravity Zone, as well as between the Central Pumping Zone and the two higher-HGL pressure zones served by booster pump stations.

3.7.2.4 Valves - Fair

The TWW GIS database accounts for nearly all valves in the TWW distribution system. Valve locations were determined through a combination of GPS data collection and verification from record drawings. A total of 17,422 valves are present in the GIS, of which 1,932 are either privately owned or owned by neighboring public water systems. Of those valves owned and maintained by TWW, 3,494 are hydrant gate valves, nine (9) are check valves, one (1) is a pressure reducing valve, thirteen (13) are air release valves, and 10,804 are line valves.

Excluding privately owned valves and hydrant gate valves, the remaining system valves (11,991 total) range in diameter from 3/4-inch to 48-inch, and 1,034 valves have unknown diameters. Despite a recent valve exercising and inspection program performed by an outside contractor, it appears that the information from this exercising program were not incorporated into the GIS database, leaving gaps in the record information.

Due in part to the acquisition-based growth of the TWW service area, the valves throughout the system are a combination of open-right and open-left. This has caused confusion for distribution operators, leading to some valves being inadvertently left closed, impacting water quality and quantity in certain areas of the system. It is recommended that TWW institute a more thorough valve operation and maintenance program, as well as make efforts to standardize to a uniform open direction for new and replacement valves.

TWW maintains a GIS dashboard to track valve inspection and operation activities in accordance with WQAA requirements. Valves identified as inoperable or broken are added to the list of valves to be repaired. While possibly due to a recent switch to using an outside company for valve maintenance, this dashboard has not been updated with inspection or exercising records since May 31, 2023.

3.7.2.5 Hydrants - Fair

According to the TWW GIS database, there are 4,000 total hydrants in the distribution system; 238 of these are privately owned and maintained, two are of unknown ownership, and 3,760 are owned and maintained by TWW. Trenton Water Works staff have indicated that they inspect and exercise all hydrants annually to ensure operability. These hydrant inspections and flushing activities are documented via GIS dashboards and electronic work orders. In 2023, the GIS dashboard reported 2,097 hydrants inspected, 9 currently out of service, and 62 of the tested hydrants characterized by an available flow rate below 550 GPM. The TWW system is divided into ten (10) hydrant inspection zones which allow field crews to effectively track which areas are in need of flushing and inspection activities. The hydrants with reported low available flows should be investigate and corrected where feasible.

A majority of the hydrants are manufactured by U.S. Pipe (models Metro 250, straight and wide bottom, as well as Metro M94), followed by A.P. Smith as the second most installed hydrant. TWW also has a small number of hydrants Corey and Mueller. It is recommended that hydrants identified as needing replacement are replaced by a standard model, such as the Metro 250 straight bottom. This simplifies the process for ordering and storing spare parts and replacement hydrants.

Since TWW operates in several municipalities, TWW must coordinate with the representative fire departments of Trenton, Ewing, Lawrence, Hopewell, and Hamilton. Personnel from all fire departments are given access to the TWW GIS to assist in location hydrants for use during emergencies. A special dashboard has been developed by TWW that shows operable vs. inoperable hydrants and includes a search bar for entering an address; based on the address provided, a list of nearby hydrants within a given radius are displayed and listed.

3.7.2.6 Dead End Mains

While effort is made to eliminate dead ends or to avoid creating new dead ends in the system, there are still a number of such locations throughout the system. Current AWWA guidance is to eliminate or loop dead end mains where practical. Additional attention has been directed at these locations due to the potential for water quality concerns, especially in light of the recent *Legionella* outbreak.

Using the TWW GIS, operators have identified 371 dead ends throughout the system. Sixty seven (67) of these dead ends have a hydrant that can be used to properly flush the main; 185 dead ends are confirmed to have no infrastructure available to flush, 115 have yet to be confirmed by field staff, and one is equipped with a permanent auto-flushing device. TWW plans to install more auto-flushers at locations of known water quality concerns.

As part of a water main replacement and renewal program, effort should be made to loop existing dead ends where possible. By removing dead ends from the distribution system, the need for increased flushing or other water quality interventions is removed, allowing the distribution crews to focus on more important work.

Problematically, the informational packet that is provided to prospective developers within TWW's service area does not restrict or even advise against the creation of new dead ends; it simply says that a blow off connection must be provided. This information packet should be updated to dissuade or otherwise prevent developers from creating new dead ends in the distribution system.

3.7.2.7 Unaccounted for Water / Non-Revenue Water - Poor

A public water system's most significant source of revenue is realized by selling treated drinking water to customers. It costs TWW money to withdraw water from the Delaware, purify it through a variety of treatment and disinfection processes, then pump it to customers' taps. In an ideal world, all of the water leaving the TWW filtration plant would pass through a customer meter and be accounted for in billings. In reality, all water systems experience some degree of water loss caused by a combination of factors:

- Inaccurate metering (production or consumption meters)
- Leaks
- Water main breaks
- Theft of service
- Unreported fire department use of hydrants
- Inaccuracies in recordkeeping
- Unreported flushing, hydrant flow testing, or similar activities

As of 2021, TWW supplied 9,775.2 million gallons to the system; of this volume, 6.938.0 million gallons were metered and accounted for. The remaining 2,837.5 million gallons are considered unaccounted for water, representing 29% of the total water produced. Previous and subsequent years revealed much higher unaccounted for water percentages; for example, 2020's UAW stood at 47%. 2022 and 2023 experienced much higher unmetered water usage due to the ongoing low velocity flushing program to remove pathogens from the distribution system.

UAW rates between 29% and 47% are well above the industry average and the regulatorily required 15% limit, likely due to a combination of vintage mains and unmaintained and uncalibrated meters. Other avenues of water loss cannot be ignored, and all causes should be thoroughly investigated. Reducing the UAW rate will have a direct positive impact on the operational costs of the system, specifically chemicals needed for treatment and electricity to pump the water that is currently being lost.

Overall Distribution System Assessment

In aggregate, the TWW distribution system (non-transmission mains, valves, hydrants, services, and non-revenue water) is in poor condition. Largely due to its age, lack of regular upkeep and replacement, and a lack of water quality optimization leaving the plant, the physical assets of the distribution system have either reached or surpassed their expected useful lives. This is evidenced by the notably high unaccounted for water rates seen in the system; older and under-maintained systems generally lose more water to leaks.

TWW either lacks or was unable to provide a distribution system master plan at the time of report writing, indicating that there is limited planning attention being paid to its distribution assets.

Overall Distribution System Recommendation

Trenton Water Works possesses a fairly comprehensive GIS mapping system that has been implemented and adopted by its staff, including field crews for generating, receiving, documenting, and completing work orders for distribution assets. This is a relatively advanced capability among water purveyors and serves TWW well in its ongoing efforts to maintain its assets. Further discussion on maintaining the TWW GIS and experienced staff is discussed in Section 4. It is recommended that the existing gaps in asset information, such as missing diameters, operating direction on valves, etc. be investigated and entered into GIS.

However, as is true of the treatment plant and other vertical assets in the system, there appears to be significant deferment of asset maintenance and replacement, with minimal regular pipe replacement or renewal occurring outside of one-off and infrequent projects. It is recommended that TWW ramp up its water main replacement program to reach a 1% replacement rate, or roughly 2.87 miles per year. The looping of existing dead ends mains should be an important consideration when planning water main replacements.

It is recommended that TWW address its unaccounted for water issues from multiple angles. First, TWW should continue the use of acoustic leak detection, which may be supplemented by other technologies (LiDAR, GPR, etc.). Next, all of the production meters should have their calibration verified to ensure that the amount shown as having been produced is accurate. Customer meters, beginning with the largest in service, should be recalibrated to confirm proper functionality. As a final step in better understanding the movement of water through the distribution system, bi-directional meters may be installed at key locations to create District Metered Areas (DMA's). By dividing the system into smaller regions, large and / or new leaks can be more readily detected and the search area reduced.

Water quality concerns, both past and current, indicate a distribution system lacking proper maintenance and operation. As reported by the NJDEP, TWW has historically failed to maintain accurate and comprehensive records. Without records, it is impossible to confirm that any of the required maintenance activities were conducted. TWW has taken recent steps to improve the functionality of its GIS as a maintenance tracking and recordkeeping asset, but it is imperative that TWW use the tools at its disposal to keep ahead of major system deficiencies such as bacteriological outbreaks and inoperable hydrants and valves.

3.8 Overall Facility Security, Accessibility & Safety

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

3.9 Identification of Critical Facilities

[redacted]

- [redacted]

- [redacted]

- [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

3.10 Evidence of Land Ownership / Access Rights

H2M reviewed the available City of Trenton tax assessment map documentation prepared by Van-Note Harvey Associates, P.C. in 2000 and revised / updated Remington & Vernick Engineers in 2020 to determine the land ownership of the primary TWW facilities. Tax assessment maps for the surrounding towns were additionally reviewed (Ewing, Pennington, Hamilton, Lawrence).

[redacted]

3.11 Technical Capacity Conclusions and Recommendations

3.11.1 Technical Capacity Assessment

The various processes and assets within the TWW utility presented a mix of results. Generally, the utility's age and insufficient maintenance and deferred improvements contribute to many components being assessed a ranking of either fair or poor. The treatment plant was designed with proper hydraulics, capacities, and redundancies; however, inadequate upkeep and reactive maintenance frequently results in diminished capacity (relative to its rated 60 MGD capacity) and loss of redundancy. TWW falls short of many of the recommended practices stated in AWWA G100, including those pertaining to recordkeeping, housekeeping, quality assurance practices, system failure training, and equipment maintenance programs.

3.11.2 Treatment Plant Recommendations

Various deficient conditions were observed throughout the treatment plant, ranging from minor housekeeping needs to more significant operational issues. Major improvements needed to the functionality of the primary unit processes are noted in **Section 6.0** as capital projects to be completed within a 10-year time frame.

One recurring observation from numerous tours of the facility was a lack of staff in the operating areas of the plant. While there were of course exceptions to this statement, the TWW treatment facility gave the impression of being largely devoid of personnel. It is unclear where TWW staff spend the majority of their working time, aside from a handful who are assigned to specific stations (SCADA operators, MDF personnel, laboratory technicians).

Housekeeping: a recurring observation which persisted in almost every room of the treatment plant is that of proper housekeeping. This applies to the cleanliness of the floors and walls, presence of improperly stored equipment, spare parts, and general rubbish, inadequate lighting, and lack of sufficient signage and labeling. Some spaces appeared in much better condition than others, such as the sodium hypochlorite room, potassium permanganate room, the SCADA control room, testing laboratory, and the main electrical room, however the majority of the operating and process mechanical areas suffered from the above noted housekeeping issues. Cleanliness requirements are outlined in AWWA G100 section 4.2.4, stating that "*areas of the plant shall be maintained in a neat and orderly condition. Operation and maintenance functions should be conducted in such a manner that plant site safety and water quality are not compromised.*" These issues are directly correlated to the Complacent Staff and Leadership, Property Management and Maintenance, and Poor Management Practices categories referenced in the Executive Summary.

The current maintenance staff are typically unaware of what needs to be done to properly maintain equipment and are generally unmotivated to learn or improve.

Clearwell Debris Removal / Cleaning: Ideally, TWW could remove the large concrete slabs in the finished water clearwell, thereby reinstating the full volume and cross sectional flow area of the clearwell. However, it is acknowledged that removing these large pieces will be very challenging, and TWW's efforts may be better spent elsewhere. At a minimum TWW should remove the built-up lime precipitate to restore a portion of the flow area in the clearwell.

Maintenance, SOP's, and Updated Documents: TWW's technical capacity is limited by the chronic lack of upkeep and preventive maintenance of equipment. This neglect often leads to premature equipment failure, hindering the efficient operation of the plant and ultimately costing more money to replace parts before their normal service lives.

Additionally, although TWW possesses written SOP's for operating various treatment processes, it is suspected that this information is not routinely revisited by most of the staff that should be informed on the content. Updating and communicating these documents is essential to creating staffing redundancies in the event that the primary operators are unavailable. Additionally,

Finally, public-facing documents were found to be out of date and / or inconsistent. An example of this was the developer's information packet, which references staff no longer employed at TWW and other errors. Additionally, TWW should maintain a live version of hierarchy, which includes all names and positions of employees, as well as any vacancies that must be filled.

Structural Issues: Potential structural issues were noted in multiple locations throughout the plant. It is recommended that a more thorough structural inspection be performed at the treatment plant, with special attention in the following areas:

- Stairwells near the backwash water effluent holding tanks
- First basement level of the west filters – concrete walkway observed to have a crack extending through the entire slab in one location, as well as several cracks in other places
- Lower basement level of the west filters – horizontal concrete members exhibiting spalling near the walls in at least two locations

- Superpulsator facility – structural concerns noted in the CMU walls separating the central control room from the Superpulsator units. Specifically, cracking and missing concrete was observed under and around the main longitudinal roof support beam over units #3 and #4
- Backwash water storage tank – cracking observed on north facing exterior wall and in the curbing around the tank
- Hallway over raw water pump suction channel (potassium permanganate injection area) – cracking noted in both the floor and the ceiling. Ceiling cracks appear to be admitting water into the space, evidenced by moisture and a buildup of lime deposits

Pipe Coatings: The overall condition of the finished water pump discharge piping was found to be poor. Piping in the small space immediately prior to water leaving the plant had been painted green, which normally indicates raw water. These coatings showed significant cracking, peeling, and delaminating; it is recommended to remove the existing coatings and all corrosion, and repaint these pipes blue to signify finished water.

The pipes being coated in the incorrect color was likely an oversight at the time the pipes were installed. This can and should be corrected when the pipes get recoated. The current condition of the pipes can be attributed to poor maintenance and overall neglect. The longer the coating issues get ignored, the more the pipe underneath will corrode and deteriorate, potentially requiring the pipes to be replaced rather than recoated, which considering their placement, would be exceptionally difficult.

Equipment Leaks: Leaks were observed in two critical components: the swing check valve for raw water pump #3 and one of the 36-inch gate valves present downstream of the finished water pumps. These should be investigated and remedied before a more significant failure occurs.

These leaks are a sign of lack of maintenance and neglect by staff and leadership, as well as improper property management and maintenance issues. Leaks, especially in such critical areas as the electrical room and laboratory, should be addressed as quickly as possible. The combination of leaking pipes and poor HVAC, the corrosion of equipment is expedited, putting the system at a higher risk for catastrophic failure.

Building Systems: Reports from both operations and engineering indicate that the roof and the HVAC systems of the treatment plant are in need of full replacement. This preventative work should be performed to mitigate the potential for water damage to the building or its contents, and to maintain a comfortable working temperature for personnel.

Notably, several ongoing leaks in the roof were either observed or reported, including:

- Multiple leaks in the laboratory space. Sunlight is visible through one of these holes in the roof. Staff reported that they have to place buckets and garbage cans throughout the room to catch the intruding rainwater
- Leaking hatch in the potassium permanganate room
- Leak over and onto primary electrical switchgear panels, posing a significant cause for concern. Evidence of past leaks was observed in the form of lime deposits

As with many of the previous topics covered, these are instances of negligence. Roof leaks and HVAC system problems may be beyond the scope of general maintenance staff would handle, but it is the responsibility of executive leadership to bid and award the work to a qualified contractor in a timely manner. As these problems have continued to get worse, the corrosion and deterioration of the plant associated with them have also gotten significantly worse. While design plans have been developed, funding and approval has not been given. The longer these problems are ignored, the more costly and extensive the repairs will become. Upper management cannot afford to remain complacent with these issues.

[redacted]

[redacted]

[redacted]

[redacted]

Superpulsators: Operators reported ongoing corrosion issues related to valve hardware currently in service in the superpulsator units. The ferric chloride used for floc formation is a corrosive chemical, leading to premature failure for uncoated metallic components not constructed of stainless steel. A symptom of this issue was noted during a walkthrough of the room, at which time a current was observed disturbing the surface of the water in one of the superpulsator units. This current is suspected to be caused by the failure of and ultimate leak from a submerged valve. This condition is problematic since it impedes the ability of the superpulsator to effectively settle out the flocculated solids from the water. Ideally, valves would be regularly inspected and/ or exercised by maintenance staff to prevent issues or catch them before they become more problematic.

The inspection tags present on the blowdown valves and various other pieces of equipment indicate the previous dates of inspection performed. Using the blowdown valves as an example, the first monthly inspection date noted was April 18, 2023 and the last inspection occurred on August 23, 2023. This appeared to be the last monthly inspection to take place, indicating an inconsistent inspection schedule. This statement is not specific to the blowdown valves or the Superpulsator facility; a similar cessation of monthly equipment inspections occurred throughout the plant after August 2023. It is suspected that these inspections were initiated at the direction of the NJDEP or their assigned third-party operator, and without continued oversight, TWW staff reverted to performing only the limited and reactive maintenance tasks strictly necessary to keep the plant running. AWWA G100 requires that plants have standard operating procedures in place for all of its systems. Written SOP’s have been prepared and were reviewed, but it is assumed that they are not strictly followed by all staff in all scenarios. Further, no written or documented inspection schedule or preventive maintenance program was identified, which very likely limits TWW’s ability to properly maintain its assets. AWWA G100 also calls for plants to have “maintenance goals [that] shall include inspection frequency for the process units associated with plant operations.” In reviewing the to-do lists prepared by the maintenance supervisor, there was no indication that inspections, or anything process related for that matter, are included. Staff are likely unaware of the recommended inspection frequencies for the various equipment and instrumentation in the plant. There is not anyone in the plant working to ensure relevant maintenance goals are met.

Chemical Feed Systems: Extensive issues were observed in several of the chemical handling and feed systems:

- The areas and equipment which pertain to powdered activated carbon (PAC), ferric chloride, and hydrofluorosilicic acid (HFSA) were found to be in poor condition. Inadequate operating space, widespread corrosion, poor lighting, evidence of past spills, and general poor condition of equipment necessitates the full replacement of each system. Additionally, due to prolonged exposure to ferric chloride, metallic supports for the large diameter piping in this area of the basement exhibited severe metal loss; these supports, as well as other impacted equipment such as the control panels, should be replaced. Maintenance staff should be working to ensure spills are cleaned in a timely manner and all chemical systems are properly maintained per manufacturer specifications. Allowing spills, debris, and other messes to remain in operating spaces of the plant is indicative of the complacent and negligent culture that has grown within TWW.
- The HFSA metering pumps were installed on a concrete pedestal which is surrounded by a low containment curb. Standing liquid / chemical was observed in this containment area. Further, HFSA spills have significantly deteriorated the concrete of the pedestal; in a bid to prevent continued concrete loss, TWW placed a plastic board under one of the two pumps. This pump was observed to be unbolted and able to move around freely. A short-term recommendation is to properly anchor all metering pumps to prevent movement; in the long term, all of the HFSA equipment and supporting structures and equipment needs to be replaced.
- It is recommended to determine if alternate spaces may be available to house new PAC and ferric chloride systems, as the existing corner in the basement is not large enough to properly configure the necessary equipment for these chemicals. Consideration should be given to the potential relocation of coagulant aid polymer from its current location in the MDF building to be closer to the injection point.
- The PAC, ferric chloride, and HFSA systems all lack day tanks, which serve various purposes, one of which is to provide separation between the bulk tanks and the injection points to limit the impact of an unintended overdosing of chemical. A day tank should be included as part of the replacement designs for these three chemicals.
- Ferric chloride and coagulant aid polymer are added to the raw water stream as it leaves the sand separator unit; the chemical feed lines terminate several feet above the surface of the water, allowing chemical to freefall. It is recommended to install drop tubes to allow

these chemicals to be introduced into the middle of the water column rather than falling onto the surface.

- Several chemicals, including zinc orthophosphate, PAC, fluoride, and ferric chloride are transferred from their respective metering pumps to the injection points via single-walled plastic pipes. These transfer lines should be double walled to protect the carrier pipe from damage as well as to contain the potential for leaks or spills.
- The sodium hypochlorite intermediate injection location is not provided with appropriate containment; a berm of absorbent granules is the only form of “containment” to prevent a leak from spreading across the floor. Evidence of past spills was observed as darkened spots within this absorbent media. It is recommended to remove the absorbent media and construct a proper containment berm with a chemical resistant coating.
- The sodium hypochlorite storage and metering room was found to possess minor issues as well. First, labeling on the small diameter feed lines was found to be contradictory; one line was labeled as both “pre-injection” and “intermediate injection”. When this was raised to the operators, they indicated that they were aware of the mis-labeled pipes. The fact that these changes have not been made to labeling despite staff being aware of the issue is yet another example of their complacency, as it should be a quick and easy change. Second, corrosion was noted on the two transfer pumps. This condition should be monitored and addressed before the corrosion leads to pump failure. If corrosion of ferrous equipment continues to be an issue in this space, TWW should investigate improvements to the HVAC system as well as looking to utilize alternate pump manufacturers with more chemically resistant pumps and motors.
- Improvements may be possible to the operation of the lime transfer system; the current system experiences frequent mechanical failures and requires a high level of maintenance. The challenges associated with lime, and specifically moving dry powdered lime over long distances, led to a fire on the roof of the treatment building in the late summer of 2023. Proper equipment maintenance is essential to prevent similar issues in the future. Additionally, the lime slurry room displayed unclean conditions, with sprayed / splashed chemical over most surfaces including the ceiling. Adding additional Plexiglas guards and ensuring spills are cleaned up in a timely manner are recommended measures to protect the electrical and control equipment in the room.
- Finally, there are notable issues across all of the various chemical systems that are directly related to complacency and neglect from the responsible staff. First, a lack of calibration for chemical pumps and repeated issues with procurement of chemicals. AWWA G100 indicates that plants should be calibrating and checking the accuracies of its chemical feed

systems at least weekly. During H2M's plant tours in early 2024, TWW operations staff verbalized that the calibration of metering pumps is never verified, and calibration columns are never used. This may be attributed to factors such as lack of knowledge of the correct procedure for calibrations, insufficient time for those with some knowledge of the procedure to perform the work, and a lack of incentive to perform this work. Likewise, chemical procurement deviates from the AWWA G100 standard, which requires plants to have standard chemical delivery schedules. TWW laboratory staff indicated that chemical deliveries are often sporadic due to delays in the procurement process and exacerbated by supply chain issues. A pronounced lack of knowledge and communication between various departments in the City of Trenton and TWW often leaves TWW in the dark on the status of purchases, resulting in chemical rationing to avoid shutting down the treatment plant. These issues are prime examples of the key deficiency factors referenced in the Executive Summary.

Electrical Improvements: Multiple deficient conditions were raised by operators related to the electrical systems and equipment. First, upgrades to the incoming utility power must be made in order for more than two finished water pumps to be operated simultaneously. These upgrades should also serve to mitigate the ongoing issue of brownouts at the treatment plant; a power study prepared by PS&S included a list of forty eight (48) plant shutdowns between 2012 and 2022, a majority of which were due to power issues. Second, it is recommended to provide new VFD's for all finished water pumps, granting greater flexibility to how the plant can be operated; this was one of the recommendations arising from the Electrical Power Reliability Study performed by PS&S. Third, raw water pump #1 is in need of a new motor. The current plan is to remove the motor from pump #2 and install it on pump #1, since the impeller of pump #2 is damaged and unable to provide its design flow. However, critical electrical and plant supply water lines physically obstruct the existing motor from being removed from pump #2 and a new motor being installed. The conflicting utilities must be relocated and the motor replaced.

It is recommended to full load test the generator to ensure it is capable of running the entire plant on emergency power for an extended duration.

Critically, a safety concern exists in the primary electrical equipment room. The cabinets and enclosures in this room are rated for dry environments, however a major leak in the roof allows for water to fall onto the panels, risking a major short circuit and / or a catastrophic explosion. This deficient condition must be addressed to protect the continued operation of the treatment plant.

Filter Room Corrosion: Significant corrosion was observed impacting metallic equipment above the water line in the filter rooms. The suspected cause of this is the off-gassing of chlorine vapor from the water; since CT can only be achieved before the filters, operators must maintain a certain level of chlorine in the filter influent. The effect of chlorine vapors is especially problematic in the warmer summer months; reports from personnel who have been in the filter rooms state that there is a strong chlorine odor which burns the eyes. It is recommended to improve the ventilation rate in these rooms, as well as replace all metallic brackets and other equipment with corrosion resistant plastics or stainless steel.

The treatment plant's outdated and inefficient HVAC system is a primary driver of corrosion in the filter room and other areas throughout the plant, since built-up vapors are not adequately vented. Industry guidance on air changes per hour in pump rooms is 5 ACH, and 10-15 for rooms with fumes or moisture issues.

Filter Performance: Physical inspection and sample collection from one of the filters indicated that the backwash process is not optimized for effectiveness. This has resulted in a buildup of sediment and mud at the bottom of the wash layer. Further, TWW should review its polymer dosage rates; samples indicate a coating is forming on the media, which reduces its effectiveness.

It is additionally recommended that TWW personnel be physically present during most filter backwash events in order to visually confirm effectiveness of the wash and identify any potential complications.

Residuals Handling: the pipes in the backwash holding tank / SMEB / TSMEB area were labeled with acronyms, some of which refer to processes that are no longer present at the plant. As with the improper labeling referenced elsewhere, there should be no reason why these labels have not been replaced. Complacent leadership and poor management have led to the promulgation of these lower-level issues being ignored. It is recommended that these labels be updated with clearer, spelled out labels to assist operators with understanding the purpose of each pipe.

Inspection of In-Service Tanks: it is recommended to properly inspect the tanks that could not be easily drained and made accessible as part of this report. These include the backwash water tank (upper floor), backwash water holding tanks (concrete, in basement), SMEB's, and TSMEB's.

3.11.3 Distribution System and Miscellaneous Recommendations

Labeling: The sample station at the Lawrence Tank, located near the road in front of the facility, was found to be incorrect. This label should be replaced with a corrected label, and the remaining signs in the system should be verified for correctness.

Whitehorse Tank: At the time of our visit to this facility, the tank was offline due to a failure of the altitude valve, resulting in the tank overfilling. Operators were unable to state when the failure occurred or when the valve was scheduled to be repaired. This indicates that TWW as an organization needs to improve its communication, reporting, and training procedures to ensure all staff are informed of potential issues with the operation of the system.

Central Pumping Station: The valves used to isolate pumps from the common suction and discharge headers were reported to be unreliable. Further, the coatings on the valves and pipes in the basement area were found to be in poor condition, with large areas of peeling and delaminating paint. It is recommended that these valves be inspected and repaired, and if needed, replaced. The existing coatings on all pipes and associated equipment should be removed and replaced with new coatings to prevent further rusting and deterioration of the assets.

It is further recommended to investigate ways to provide redundancy to this pump station, as it currently represents a single point of failure for over 70% of customers in the system.

[redacted]. Current leadership is complacent in their ignorance of ongoings at their facilities.

Staff Knowledge and Training Needs: The Distribution Division currently operates as part of the Construction and Maintenance Division. Their responsibilities reportedly do not extend to the tanks or pump stations throughout the system, which is atypical for a distribution group. The personnel who spend most of their time outside of the treatment plant should at a minimum have an understanding of each pump station and tank's function and normal operating conditions, as they are among the most likely to physically visit these locations. At the time of our visit, distribution staff were unable to answer basic questions related to pump operation, pipe configuration, on / off setpoints, and many other questions. It is recommended to cross-train these employees with plant operators, and at a minimum provide read-only access to the SCADA system to better inform the distribution team of how the system is performing and operating. Whether this is a result of turnover interrupting the management of distribution system assets or the responsibilities of pump and tank management have always belonged to the plant operators, it is inefficient for TWW to operate in this manner. It overburdens operators who should be focused on the plant assets and promotes complacency amongst distribution staff. This system of operating is a glimpse at the atypical and sub-optimal management practices implemented by TWW and the City.

In preparing this TMF, a variety of documentation was reviewed, ranging from SOPs to record drawings, from operational data to emergency response plans. It is quite apparent that staff are unfamiliar with most of these documents. AWWA G-100 suggests that staff run drills with the plant in manual emergency mode to ensure staff know how to respond to various failures around the plant. Not only are there no records or reports that these drills are conducted, but it is unlikely that staff would know how to maintain operations manually if required. With this unawareness of emergency operating procedures and the continued failure to pass down institutional knowledge, TWW is operating in a risky scenario where water production is sometimes stopped when there is a system failure. While these shutdowns are not currently catastrophic, they will become much more problematic once the Pennington Reservoir is shut down.

Hydrants and Dead Ends: It is recommended to ensure that each dead end in the system which cannot be looped is equipped with a hydrant or similar asset to allow for regular flushing as needed to remove sediment buildup and to remove excessively old water. Autoflushers may be used for long dead ends with known water quality issues or customer complaints. TWW has begun addressing dead ends as part of the NJDEP-directed work to mitigate *Legionella* in the distribution system; this program should be expanded to include more dead ends with known water quality issues.

As hydrants are installed and / or replaced, TWW should standardize around a single model, such as the Metro 250 straight bottom (the most common hydrant currently installed in the TWW system). Due to the growth pattern of TWW over the years (i.e., acquiring neighboring systems with their own standards), the TWW system has become a patchwork of various hydrants with different parts, open direction, hose connection styles, and replacement parts. If not already done so, TWW should only permit a single hydrant model to be installed to simplify system operation and the inventory process. Coordination will likely be needed with the local fire departments to ensure all fire personnel have the tools and knowledge to operate any type of hydrant they may interact with.

Distribution System Programs: it is recommended to institute and / or expand plans to inspect and maintain all system valves, hydrants, and water mains. TWW should select a single model hydrant and ensure all new or replacement hydrants are of the same style. Further, TWW should aim to replace at least 1% of its water mains annually to refresh its service life over time.

Condition Assessments: It is recommended that TWW design and perform a comprehensive condition assessment of the distribution system mains, both transmission and distribution. Based on the review of the available GIS data, there is an apparent gap in data related to pipe materials and ages. The gaps in information may be attributed to the lack of operational continuity, although it is fairly common for older systems to have knowledge gaps of this nature. Without these datasets, the only way to verify system condition is physical investigation through means such as acoustic pipe thickness testing, removing and reviewing pipe coupons (thin sections of pipe which are then repaired with a repair clamp or sleeve), or pipe divers. This condition assessment will better inform a pipe replacement program for TWW.

4.0 MANAGERIAL CAPACITY EVALUATION

Assessment: Red

Managerial capacity refers to the expertise required of the personnel who oversee the overall water system operations. To ensure adequate managerial capacity, the PWS must demonstrate that relative to its water system, it has clear ownership, proper and organized staffing with relevant job-specific training, effective interaction with regulators, and effective interaction with customers. The standards for the Technical, Managerial, and Financial Capacity of the Trenton Water Works system are based upon those found within the N.J.A.C. 7:10 Subchapter 13. The structure of this section is based upon the water system managerial standards located at N.J.A.C. 7:10-13.4 et seq.

As stated in the Executive Summary, Trenton suffers from myriad deficiencies related to its leadership, management, and organizational competencies. Issues range from unqualified staff, excessive vacancies throughout the organization, insufficient compensation, a workplace culture lacking motivation and accountability for actions, lack of recordkeeping, poor communication internally and with external departments and organizations, and a limited depth of institutional knowledge due to high turnover. This Section will provide specifics and additional descriptions of these weaknesses in Trenton's managerial capacity.

A significant portion of management, supervisory, and operational personnel were interviewed plus various documents relevant to the management, operation, and financing of the Trenton Water Utility (TWW) were reviewed. Good cooperation was received. This analysis is based upon these interviews and observations on the principal operational units in the Utility.

The findings detailed in this section are representative of an organization receiving direct operational oversight from a regulatory body and are not necessarily indicative of the managerial conditions of TWW when operating independently. Increased efforts will be needed by TWW staff to ensure the state of the department does not revert back to such conditions which required the intervention of the NJDEP in the first place.

The NJDEP TMF benchmarking document includes a heading of "managerial capacity", in addition to other parameters such as qualified staff and licensed operators. Based on the four criteria which contribute to ranking an organization's "managerial capacity", TWW is positioned in the yellow level. The definitions of each of the four rankings are included below by reference.

- PWS in receivership and/or cannot demonstrate clear ownership; organizational structure not clearly defined; no emergency management plan (if required), AMP/CIP, licensed operator succession plan or other required plans
- PWS not in receivership, but cannot demonstrate clear ownership; organizational structure not clearly defined; no emergency management plan (if required), AMP/CIP, licensed operator succession plan or other required plans
- PWS not in receivership and demonstrates clear ownership; organizational structure clearly defined; no emergency management plan (if required), AMP/CIP, licensed operator succession plan or other required plans
- PWS not in receivership and demonstrates clear ownership; organizational structure clearly defined; emergency management plan (if required), AMP/CIP, licensed operator succession plan and other required plans in place

Determination: Red

TWW is not in receivership and there are no questions regarding ownership. However, its documented organizational structure is both outdated and incomplete. TWW possesses a written emergency action plan, asset management plan, and a capital improvement plan, and no licensed operator succession plan. Of the three documents provided, it is suspected that their implementation is surficial, and the information is not widely communicated.

4.1 Organizational Structure

The City of Trenton operates under the Mayor and Council form of government in which the elected Mayor serves as the Chief Executive Officer of the City. The City government is organized into departments and the water and sewer utilities of the City are organized under one department entitled the Department of Water and Sewer. Pursuant to state law, this Department is headed by an appointed Director who reports to the Mayor. The operations of the Department of Water and Sewer are also subject to actions by the elected City Council in matters of contract award, finance and budgeting, and personnel management as required by various state and local statutes.

Figure 4-1 provides an organizational chart for Trenton Water Works at the conclusion of this Section.

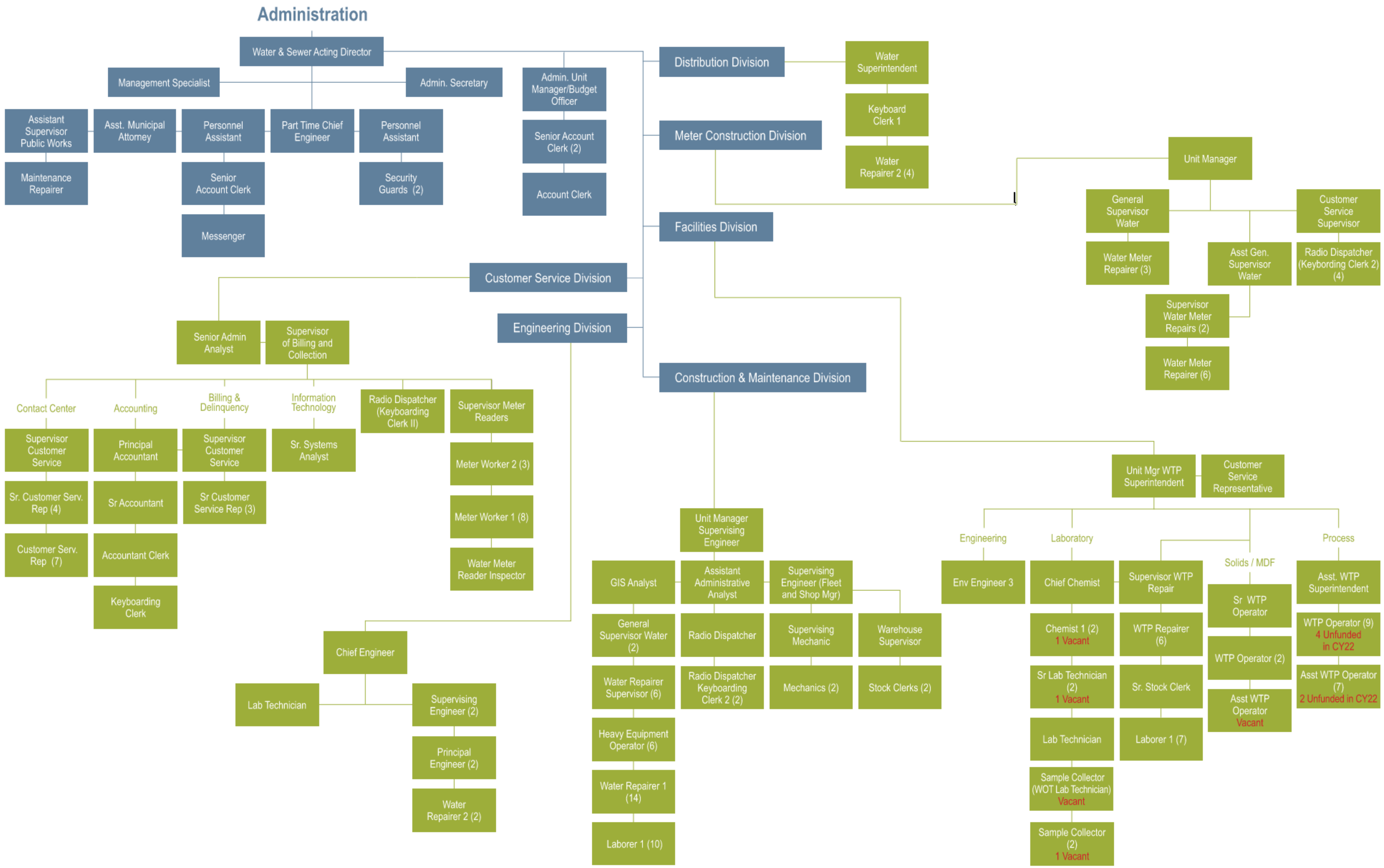
The Trenton Water Works (TWW) divided into seven main functional groups:

- Central Management
- Water Treatment Plant
- Water Distribution System
- Construction and Maintenance

- Engineering
- Customer Service and Billing
- Meter Installation and Maintenance

Figure 4-1 shows the overall structure of the TWW organization. Administration (Central Management) oversees all of the other Divisions. Note that unfunded / vacant positions are only shown for the Facilities Department, as this is the most critical Division to the core operation of the system. Additionally of note, this hierarchy reflects the state of TWW as of September 29, 2023, which is the date when TWW provided a report on current staffing status; some changes are likely to have been made since. A tabulation of the various operator’s licenses held by TWW staff is shown in Table 4-1.

Figure 4-1: TWW Organization Chart



4.1.1 Central Management

4.1.1.1 Function

The provision of management control over the entire water utility as well as the interface of the TWW into the Trenton City government, the other municipal customers of the water utility, the various agencies responsible for the water utilities; expenditure reporting and processing, personnel processing, and budget tracking and preparation. The operation and management of the Sewer utility is included under this Central Management function.

Central Management is responsible for compliance with established environmental and public health regulations and for communication with the governing bodies and general public served by the utility. Management control includes the typical functions of budgeting, revenue generation, appropriations and expenditure authorization and verification, personnel recruiting and retention, compliance monitoring, and management of all operations.

4.1.1.2 Assessment

There has been excessive turnover in leadership and technical people throughout the organization but especially in the Utility's overall management. The instability of the Director's position, as cited later in this Report, has significantly negatively impacted the overall Water Utility operation by loss of continuity in focus and policy as well as employee expectations. This is the crux of the "Operational Continuity and Reliability Concerns" focal point described in the executive summary.

The interaction between current managerial and technical staff is evolving and it is too early to determine its long-term effectiveness.

There are several key staff positions that must be filled with experienced qualified personnel, especially in the budgeting / financial management functions. This is much too large an organization and financial operation to not have adequate accounting controls and management. Although the account clerks try to understand and work within the City's appropriation accounting system, upon questioning they had no real understanding of the system or the rules and regulations governing governmental finance. Many Division heads expressed no knowledge of the budget status or the procurement and budgetary processes. Staff are complacent in their lacking knowledge and there is little to no emphasis on or encouragement to enhance their understanding of the financial system.

4.1.1.3 Conclusions

While there have been admitted breakdowns in the past when it comes to Central Management, there is an appearance that Central Management is moving in a positive direction based on observations during interviews and site visits. However, opportunities for improvement exist, including:

- The issues of “political oversight” and utility structure as described in other sections of this Report
- The permanent appointment of a Director, namely Mr. Semple, is a positive development. The “revolving door” of Directors, some more or less qualified and committed than others, has been a major hindrance to the proper management of the TWW and simply cannot continue if the utility is to be managed properly.
- Mr. Semple’s area of expertise leans toward distribution operations. However, one of his main strengths seems to be working with staff members. In this context he is attempting to develop a team approach to management by instituting weekly meetings of key unit personnel. Some feedback was received during staff interviews that thus far, there may be a reluctance by some to fully participate in open discussions. Hopefully this cooperative interaction will improve over time.

Mr. Semple reports to have a good working relationship with the current City Administrator Cruz and he believes he has a “good cabinet” under him. He indicated that he was establishing a focus on compliance issues and meetings with affected staff.

Mr. Semple reports that he has a good working relationship with the two unions (colloquially the Supervisors and Laborers Unions); this could be important if he is to make effective changes in the near future.

The appointment of a “Deputy Director” position by the City Administrator is a positive move. While, as acknowledged above, the Director’s area of expertise leans towards operations, the Deputy Director’s expertise is in administration and personnel. The creation of this position frees up the Director to concentrate on areas of operation that need to be improved upon, while providing a top manager adept at handling administrative and personnel issues with the ability to concentrate on fixing areas of deficiency (a number of which are identified in the “Personnel” section below).

Within the Director's "Administration" Division, the "Budget Officer" position must be filled to give the financial management required of this $50,000,000 operation, as well as to interface with the City's Financial Officer in matters concerning the water and sewer utilities. This need will only increase as the proposed aggressive Capital Improvement Program is implemented and becomes financially feasible.

4.1.2 Water Treatment Plant / Facilities

4.1.2.1 Function

The operation of the Water Treatment Plant (WTP) including the water supply, treatment, and pumping of potable water to the supply facilities (the Pennington Reservoir, elevated tanks, and the gravity zone). This includes being responsible for the distribution system pump stations (Central, Ewing, and Klockner).

4.1.2.2 Assessment

Excessive Overtime – Due to the lack of a sufficient number of licensed operators, there is a consistent requirement for excessive overtime by the license-holding staff to cover the 24/7 operation of the treatment facility. Historically, TWW failed to provide 24/7 operator coverage as required by law. The NJDEP issued a directive to TWW to ensure full time operator oversight by operators of all levels of licensure, which very likely increased the number of hours each existing T-4 operator needs to work each week seeing as there are so few of them currently employed at TWW. A good example is that the Chief Chemist and Environmental Engineer, among others, are consistently relied on to cover licensed operator's shift. This not only puts pressure on these operators, but also tends to contribute to "burnout" and potentially to personnel turnover. Although there are fewer vacancies in the organizational hierarchy when compared to the observations of the 2017 TMF study performed by Mott MacDonald, it is still a problem that must be adequately addressed for a critical operation such as Trenton Water Works.

The same issue exists within the mechanical dewatering facility and the overall residuals handling operation; the lack of sufficient personnel to cover the required shift demands excessive overtime.

Contributing to this issue is inadequate compensation, both salary and license stipends, resulting in fewer employees availing themselves of licensing opportunities. It encompasses difficulties with recruitment, retention, and incentive for advancement. The issue of compensation will be addressed as its own topic in another section of this Report because it crosses over into multiple Division and functional areas; however, it needs to be emphasized here, due to the importance of operators safeguarding water quality.

Poor maintenance - Proper maintenance of the WTP has not been performed, allegedly due to the lack of Capital funding and delays in obtaining necessary equipment replacements even when funded. The WTP executive staff also acknowledged that proper supervision and work productivity are ongoing issues. In reviewing a sample daily work sheet prepared by the Maintenance Supervisor, a large majority of tasks assigned to the maintenance personnel are janitorial in nature, including such items as sweeping and mopping common areas as well as cleaning staff bathrooms. Of note, TWW does not utilize the computerized maintenance management system (CMMS) they have, e-Maint, for tracking work orders; comparing to equivalent utilities, this lack of CMMS adoption hampers the ability for TWW to maintain its assets. Examples of major deferred maintenance, by way of two critical facility requirements, are:

- HVAC upgrade and replacement
- Roof replacement

In addition, there is a strong need for:

- Security System upgrades
- Lime Slacker upgrades / replacement
- Various out of service pumps and systems

Additional recommended improvements and replacements for the treatment plant facility are detailed in Section 3.11.1 and Section 6.0.

Facility Operational Deficiencies - There is a recognition that the daily equipment and facility maintenance operations need improvement both in terms of supervision and performance. Routine equipment and facility maintenance is not being done in a timely manner and the availability of rapid response is lacking due to the limited manpower availability (working a standard "business week" versus a 24 / 7 schedule needed by an operation such as TWW). These limitations are directly impacting:

- Maintenance system controls
- Treatment Pump maintenance
- Distribution pumping stations maintenance
- Electrical Substations Systems
- Building maintenance

Laboratory - The NJDEP raised serious questions about the reliability and accuracy of the existing in-house laboratory in the Water Treatment Plant and hinted at the potential for outsourcing certain laboratory functions. The Chief Chemist recognized the NJDEP concerns but felt the operation had improved to satisfy those concerns and would remain fully compliant if additional (trained and qualified) personnel were added. The recent improvements in the operation of the laboratory facilities are likely due at least in part to the collaboration between the TWW Chief Chemist and the third-party overseer provided through the NJDEP's UAO involvement.

Despite these recent improvements, there appears to be a lack of standardized training for laboratory staff and operators, no established routine for downloading data from field equipment, and no established procedure or interval for spot checking field instrumentation; all of which are common practice for similar laboratories at other treatment facilities.

Further, TWW relies heavily on jar testing to inform dosing rates, specifically for polymer, ferric chloride, and permanganate. Comparable water systems with laboratories will utilize zetasizers or other more automated equipment to inform chemical dosing needs. Jar testing is a very inefficient method of determining chemical dosing requirements and is an atypical approach for comparable utilities.

4.1.2.3 Conclusions

The Water Treatment Plant Superintendent position requires a T-4 license to ensure that the water produced and sent into the water distribution system meets all required NJDEP and EPA water quality standards. Overall, the leadership of the WTP is comprised of a number of dedicated / properly licensed operators in supervisory roles. This leadership is acceptably versed in technical system operation, but seems to struggle with personnel matters such as encouraging productivity, accountability, and instilling a positive organizational culture. One of the primary issues to be addressed is the lack of sufficient

Senior Water Treatment Operators requiring the central office staff, who have the requisite licenses, to handle regular operation shifts in addition to their other duties, and the existing Senior Water Treatment Operators to work excessive shifts. The probable result of this deficiency is burnout of the licensed personnel and / or inattention to other duties due to this important additional function. There is a strong probability that this burnout will continue to result in the exiting of existing experienced personnel to competing utilities.

Additional issues recognized by the Superintendent relate to maintenance and supervision issues for WTP facilities and equipment, and should be addressed as additional resources and training are provided. A significant portion of equipment repair and maintenance is already performed by Municipal Maintenance, an outside firm who specializes in utility maintenance and upkeep. It is likely that Municipal Maintenance is performing tasks which would typically be handled by in-house Water Repairers and Mechanics. There is a great need for improved focus on productivity of TWW mechanics and water repairers in the Maintenance group. Areas such as accountability, attendance, quality and quantity of work, job-specific training, documentation, and adhering to written SOP's and checklists must be enforced and emphasized. The leadership of each division is responsible for instituting these improvements, and ensuring that their staff adhere to them. If the above cannot be properly addressed, removing a majority of the Maintenance group is an option, since Municipal Maintenance is already doing most of their work. The proper adoption and implementation of an e-maintenance system is strongly recommended to improve efficiency, recordkeeping, and work accountability.

The Laboratory Director when interviewed recognized the outstanding issues and should be given the opportunity to overcome the legitimate NJDEP concerns provided that she obtains the necessary equipment upgrades and staffing. Concurrently, it is necessary for TWW to address its staffing needs to allow the Laboratory Director to focus on her primary role, rather than sharing her time between the lab and serving as a backup operator.

Since the availability of timely water quality data is critical to system operation, it is recommended that maintaining the laboratory facilities and staff will be a better long-term solution than a contract service. In order to maintain the existing in-house laboratory functions, TWW must improve its training protocols, formalize and enforce SOP's, and ensure a sufficient number of qualified staff are available. The Laboratory Director indicated her desire to expand the constituents the TWW lab can test, however it is recommended to continue outsourcing samples until such a time that the laboratory functions are standardized and align with similar labs at other water treatment plants.

The organizational chart provided by TWW showed 6 unfunded positions and 5 unfilled vacant positions. Based upon discussion with supervisory personnel, at least 2 of the unfunded Senior WTP operator positions must be funded with their hiring a priority, an additional Senior WTP operator provided in the residuals handling division, and two of the laboratory staff need to be hired. Based upon opinions formed during staff interviews and data review, the requested Water Operator / Assistant Water Treatment Operator positions can await further evaluation of the effectiveness of in-house maintenance versus contracted maintenance.

Training records for the Facilities unit were provided and reviewed. There is an apparent inconsistency in how training is assigned within each class of employee. For example:

- Four of the six WTP Repairers received training in lock out / tag out (LOTO) procedures and confined space entry; two did not.
- None of the plant operators at any level have documented OSHA PPE training. Two of the Assistant WTP Operators did not receive DEI, Bullying, Bystander Intervention, or Conflicts in the Workplace training.
- None of the seven (7) Laborer 1's received training for Trenching and Shoring, Traffic Control and Flagging, Ladder Safety, First Aid / CPR / AED, Bloodborne Pathogens, or Substance Abuse. Four of the Laborer 1's have no documented Rigging Safety, Back Injury Prevention, or PPE training.

Continuing education records (TCH courses) for staff holding T and / or W licenses were not included in the training records. It is recommended that TWW place a much greater emphasis on employee training, both job-specific and general, and ensure that training is uniformly assigned as needed based on employee level and job function. Implementing a standardized training platform for all employees which can automatically assign various training programs (safety, technical, etc.) based on employment title and level would streamline the process and avoid missing critical training being provided.

Training records were not provided for other operating units within TWW.

4.1.3 Water System Distribution

4.1.3.1 Function

The supervision, monitoring, and testing of the quality of the water provided to all customers to ensure that it meets NJDEP and USEPA standards. The Division supervisor serves as the "licensed operator of the distribution system" (Water Superintendent), a W-4 requirement for a system of this size.

4.1.3.2 Assessment

In November 2023, the current Division Supervisor holding the required W-4, license Mr. Edmund Johnson, began an extended leave. Although he returned to duty on January 2, 2024, he was not available for interview as part of this TMF preparation process and has since filed for a medical leave. In his absence, the Director of the Water Utility has reassigned an alternate supervisor who has a W-3 license to assume these responsibilities on an interim basis, with the understanding and concurrence of the NJDEP that the W-3 will obtain a W-4 license in a reasonable timeframe.

The Distribution Division's purview is largely limited to maintaining water mains, valves, hydrants, and customer services. TWW is structured such that Operations staff at the WTP are responsible for the tanks and pump stations, functions which typically reside with the Distribution team at other water systems. No explanation was given for this imbalanced division of responsibilities between WTP staff and Distribution staff. The Distribution Division personnel aren't even given read-only access to SCADA, and therefore have no ability to directly interact with the vertical assets located throughout the system. Despite its truncated scope, this Division provides a very vital function within TWW. Historically it was headed by a single middle manager (pay grade 10 [mid-level] in the Supervisory CBA) and supported by a group of Water Repairer 2's.

The Distribution Division personnel are now assigned as a Branch of the Construction and Maintenance Division, and are being retrained and instructed as to the proper flushing of the system as well as sampling. Additional personnel from the Construction and Maintenance Unit are assisting in the ongoing effort to address recent failures to maintain water quality compliance, with direct program implementation provided by NJDEP. Once the distribution system is brought back into compliance on all known violations and deficiencies, the focus of the Distribution Division then becomes ensuring proper system maintenance is being done on a continuing basis. Again, performance standards, adequate training, and monitoring are key.

The system reportedly has over 371 dead end mains and a number of water mains that are not in a looped configuration, thereby allowing water to reside in mains for extended time periods. The NJDEP has become directly involved in providing guidance to the Water Utility in the best practices to overcome these deficiencies and the Utility is currently pursuing an extensive low velocity flushing program as well as regular high velocity hydrant flushing / testing and monitoring program to correct these and other existing deficiencies. It is imperative that this Division be kept up to date on best practices in dealing with these situations to maintain water quality.

4.1.3.3 Conclusions

Previously the Distribution Water Superintendent with a W-4 license served as the compliance officer for the water system to ensure all water quality standards are met in water delivered to the customers. Under his watch, there has been a history of water quality deficiencies which have been primarily attributable to the failure of the personnel to properly monitor as well as flush / maintain the water distribution system. A prime example of this is the recent, ongoing Legionella concerns and investigations.

There is an absolute necessity to prioritize the management of this vital function to ensure that all personnel are managed, trained, and made accountable to understand the requirements of maintaining water quality throughout the Distribution system. The integrity of water quality must be maintained from the source to end user (retail customer). It is vital that the performance of this Division's assigned function be maintained.

In the absence of the W-4 Water Superintendent and the Distribution Division's track record of deficiencies, the TWW Director integrated the Distribution System functions into the Construction and Maintenance Division. It is assumed that this integration is intended to provide adequate supervision of the unit's compliance responsibilities as well as to provide additional personnel who can assist as necessary in the flushing program. A W-3 license holder supervises the Construction and Maintenance Division. TWW staff report that this reassignment is working, and the day-to-day functions assigned to the Distribution system are being accomplished. Preventive and proactive system maintenance is not performed on the schedule expected, including activities such as hydrant flushing, water main replacements, and others.

However, this compliance process is a very important function and is recommended to be a standalone operation reporting directly to the TWW Director. If this function is to be combined into the existing Construction and Distribution Maintenance Division, then it must be a separate entity within the Division with its own supervision by a W-4 license holder who reports directly to the TWW Director. One of the reasons for this separation is the necessity that the personnel of the Distribution system must provide oversight and “supervise” or “inspect” distribution system repairs to ensure that water quality standards are maintained before the repairs are returned to active operation.

If a person holding a W-4 license cannot be hired, the TWW Director is proposing that the unit continue to operate under the W-3 license held by the Supervisor of the Division of Construction and Distribution Maintenance. If this were to happen, TWW must hire an alternate / backup W-3 for periods when the W-4 of record is unavailable. Proper succession planning should be instituted to ensure operational continuity in the event that the W-4 leaves TWW.

It is our understanding that the current Division manager who holds a W-3 license is in the process of obtaining a W-4 license. NJDEP has allowed this individual to serve as the Water Distribution Superintendent (technical title for the responsibility of this function) in the interim in 2023 until the return of the current license holder. This temporary solution seems to be working properly as an interim solution. It is recommended that the NJDEP allow this interim solution to continue until a new license W-4 employee is hired or until the existing W-3 license holder obtains his W-4 license, who has reportedly set a date to sit for the W-4 exam. It is important to note that the NJDEP’s interim allowance for a W-3 to serve as an operator of record is temporary and limited, and a W-4 should be provided as soon as possible.

The existing Distribution Division W-4 Superintendent should not be allowed to assume oversight or authority for the water distribution system given the track record of system failures in prior years under his supervision. During the data gathering and interview portion of this TMF, he was found to be unable to answer basic questions related to system operation, such as the direction a certain pump moves water. A new licensed holder should be recruited or promoted to this position. TWW should consider removing this staff member from the utility.

The preferred organizational configuration is to have a qualified W-4 unit supervisor with supporting staff in a separate Division who reports directly to the Utility Director, rather than consolidating the Distribution Division into the Construction and Maintenance Division. However, the suggested compromise (see above) is workable in the interim. Further, in order for the existing W-3 to assume the full responsibility as the W-4 of record, he will need to transition his current managerial and GIS duties to other staff within the Construction and Maintenance division, either in-house or to a new hire.

4.1.4 Construction and Maintenance

4.1.4.1 Function

The maintenance of the distribution system including more than 3500 hydrants, 683 miles of mains of various sizes, and over 24,000 services; plus the construction of any required new or replacement infrastructure that is not assigned to a private contractor.

4.1.4.2 Assessment

This Division theoretically (and in the budget) is fairly well staffed and supervised. The equipment nominally available for use on a daily basis is reasonable, although there is some concern over the age of some of the specialty equipment. In theory there are six (6) work crews each with a foreman, heavy equipment operator, truck drivers and laborers (six total positions per crew). With vacancies and turnover, the "daily goal" is five (5) crews in operation. The reality is only four (4) crews operate each day. The nominal "crew size" is large and could function with fewer if everyone was crossed trained and functioning as a cohesive unit. There should be consideration of greater flexibility relative to crew size staffing on specific tasks without compromising safety.

The Division is short one foreman and one of the two general supervisors will be retiring shortly, leaving one supervisor to be responsible for the working crews.

The TWW Director was the former head of this Division. The Construction and Maintenance Division is now being managed by the GIS specialist who has the proper licenses and knowledge. He has a proven track record of achievement and by all appearances is well positioned to assume lead of the Division. He is moving very rapidly to automate all reporting systems in the Division with foremen being monitored via field tablets assigned to and used by each foreman. Unfortunately, since he is the only GIS specialist, his active involvement in daily operations limits his ability to continue the expanded use of the GIS technology (or, if he concentrates on his GIS commitments, he is limited in his managerial functioning). This issue is covered in the “Summary” section below.

The lack of routine training is a commonly cited needed improvement, related to both safety and production issues. In addition, there is an acknowledged failure to proactively enforce work standards and productivity. Several of those interviewed cited the belief that there was an "entitlement" attitude amongst many: "they are entitled to a paycheck rather than having to earn it". Attendance is an issue as well as work production in the field. Equipment downtime for maintenance requirements is cited as an excuse for lower field productivity.

The Division has numerous operational responsibilities; in reality, it is the fallback option to assist any other Division's activity that needs assistance.

With the incorporation of the Distribution Division into the Construction and Maintenance Division, one of the major issues to be addressed is the "unaccounted for water" losses in the system. Attached is a comparison of the AWWA reports for 2017 through 2021 provided by the Engineering office showing water loss calculations which were performed by several different Water Utility personnel. A review of AWWA annual calculations for water losses for the years provided indicate some variation but for 2021, there was an average of 26.78 MGD taken from the river, with 15.7 MGD “Billing Metered” resulting in a 41% unaccounted for water ratio.

4.1.4.3 Conclusions

With the promotion of Mr. Semple (the former long term Division head) to Director, the promotion of Timothy London to Division Manager of Construction and Maintenance is a positive move. Mr. London is an experienced, knowledgeable, and dedicated licensed (W3/T1) manager. He has a very good knowledge of the system, both from an operational and personnel standpoint, and has positive ideas for improvement to both areas. His former position was a concentration in the GIS system, in which he has done an excellent job, and needs to continue to be built upon. However, in his new role, with other very important responsibilities, a new qualified GIS Analyst needs to be hired to continue his work under Mr. London’s oversight (or integrated into the Engineering Division, see below).

This unit appears to be properly staffed and operating satisfactorily with NJDEP oversight, however there is a need for stronger field leadership and accountability. There is a history of inadequate enforcement of safety policies and procedures as well as issues related to work productivity, which is the responsibility of leadership positions including knowledgeable and efficient foremen and their direct supervisors.

Foremen obtain their position via succession through the ranks from laborer to truck driver, then heavy equipment operator and / or senior driver status. This type of career progression is normal; however, upon promotion, there should be a formal period of apprenticeship in the new position, focusing on training the recently promoted employee on the aspects of their new job, including leadership, encouraging and directing staff, discipline procedures, safety, and the other duties of the position.

There needs to be an increased emphasis on attendance and meeting established and justifiable standards of work production, i.e., not every task requires a full 8-hour shift to complete; multiple assignments per day must be the routine expectation. The Division needs to establish formal field work SOP's that can be used to foster increased productivity in addition to instituting standard performance benchmarks and metrics. This statement is true for all TWW staff, including the water repairers and mechanics at the treatment plant.

These issues pertaining to supervision, accountability, enforcement, productivity, training are covered in the "Personnel" section of this report.

There needs to be recognition of the amount of non-revenue water in the distribution system, the causes of which can vary from unreported leaks in mains and services to meter underreporting. The treated water loss attributable to the line loss can increase if left uncorrected and can result in other costly infrastructure degradation. TWW staff reported that, other than major leaks with direct public impact, the priority focus of the Construction and Maintenance Division was not on leak detection / resolution. If this is the case, this may be a reasonable policy position; however, this is not a viable long term policy. This treated water loss also has a very significant impact on revenue and the general fiscal health of the water utility.

4.1.5 Engineering

4.1.5.1 Function

The provision of engineering services to the operating Divisions in the utility; the planning for the capital improvements required by the system to replace ageing infrastructure as well as staying abreast of new water quality rules and regulations; the monitoring and control of third party engineering firms doing design work as well as construction inspection; the review / approval / monitoring and inspection of new development activities throughout the system; the maintenance of the maps / plans of the system facilities.

4.1.5.2 Assessment

Due to the 100% turnover in personnel as well as the level of experience in new personnel, and the tremendous ongoing and forecasted capital improvement work, the Engineering Division is an area that requires a lot of attention. There are multiple areas of concern, including:

- As noted above, this Division is severely short staffed. In addition, the overall experience level of the recently hired personnel limits their ability to immediately impact any ongoing activities. Further, due to the limited tenure of engineering staff at TWW, there is a lack of deep understanding of the overall TWW system and its intricacies that can only be acquired over a long career at a single utility.
- The Mission and Responsibilities of this Division need to be defined and clarified. Each member must have specific assignments with a priority ranking of the assignments. There must be a decision by the Utility Director as to how the required work is to be assigned between in-house personnel and third party engineers. For work awarded to outside consulting engineering firms, clarity must be provided on how TWW personnel will oversee the execution of contracted projects.
    - Within this assignment of duties, there must be a clear understanding of the responsibilities / chain of command for all involved.
- There is a need for the hiring of additional Engineering Technicians to conduct required inspections in a variety of projects, both for the utility and private development as well as providing field information for all projects. If this cannot be accomplished, there needs to be an on-call third party survey / inspection firm that can respond quickly for requested information.
- Current success stories include grant applications to replace 9,000 lead service lines (estimated 25,000 more to be done); an acoustical leak survey in progress (marginal success reported); water main cleaning and relining (which is in alignment with a high priority recommendation of this Report); analysis and selection of new customer meters and software billing. The 9,000 lead service line grant was reported by TWW Engineering staff and may have been misstated as a

grant when in reality it is a principal forgiveness loan from the I-Bank, or it may be a true grant which hasn't shown up on any financial audits or AFS records yet.

- Due to staff shortages, the Engineering Division is more reactive to existing problems than proactive in avoiding problems (i.e., TWW struggles to schedule its work in roadways prior to repaving, and does not have a thorough prioritization program to identify more critical mains or services).
- Currently short staffed, the Division is concentrating on plan review / inspection on new development (which has time constraints established within state regulations) and several projects focused on existing known deficiencies, such as the removal of lead services and leak detection. In addition, the staff is involved in the ongoing distribution main cleaning / lining program. The Division head is devoting a lot of his time to the management of larger capital projects, such as the replacement of the Pennington Reservoir. Consequently, there is little or no time to carry out in-house design or to properly manage staff activities and development, or long term planning.
- Rather than being an "isolated function" within the Utility, the Division needs to be better integrated into the overall operation of the TWW.
    - Staff needs to be organized with specific goals and objectives that tie into the overall operation of the utility, and not as isolated tasks
    - This condition speaks to ineffective organizational structuring and intra-utility communication
- By way of example, and in no way exhaustive, there are a number of project areas involving engineering personnel other than the ongoing capital projects that need to be addressed, including:
    - Need to update the utility's Master Plan
    - Need to update water and sewer infrastructure mapping and GIS systems
    - Need to integrate Engineering with GIS function and mission
    - Need to provide advice to operations and maintenance personnel in response to specific occurring events.
- Engineering staff lack broader context of other projects and the interplay between these external projects and the engineering-controlled work. An example of this is the LSLR program; the Engineering Division does not coordinate with other

departments to find ways to combine road projects, which may limit disruption and reduce restoration costs.

4.1.5.3 Conclusions

Due to the turnover and shortage of staff, the existing personnel cannot provide the ongoing technical assistance to operations personnel on system deficiencies / maintenance requirements, to the detriment of the water system's long term operation. In addition, the large CIP envisioned by all involved cannot be handled in-house in terms of design, bidding, and construction inspection / approval. Consequently, numerous outside engineering firms are working for the city semi-independently of each other and without direct city involvement. This lack of direct involvement of TWW personnel in these processes due to the manpower shortage in the Engineering Office can result in end products that may not be adequately integrated into the overall existing operation, potentially resulting in its inability to perform as intended. In addition, the digital recordkeeping of water system improvements is not being properly performed, potentially limiting the accuracy of the TWW's GIS database. For example, one probable failure of this is the inability to properly calculate the cost and revenue fees associated with the fire water flow system, a potentially significant revenue source.

It is recommended that within the Engineering Division, there needs to be at least one qualified engineer dedicated to the maintenance of the system's functions (e.g. leak analysis, lead service line replacement, water main cleaning and lining / water main replacements); one engineer dedicated to capital planning and integration of these improvements into the overall system operations; one to serve as coordinator of system construction activities and the external consulting engineers involved in their design and possible construction phase monitoring; one engineer (or more depending upon developer generated work load) for review and monitoring of new development activity; and one engineer to maintain the hydraulic model for the system. An additional engineer / technician / draft person is needed for maintenance of the system mapping, data archives, and GIS integration. Finally, there is a need for several field technicians who can provide the data needed for internal design and verification. Outside consulting firms can be used to supplement in-house engineering, but these supplemental firms must be closely monitored by the directly responsible in-house engineers.

4.1.6 Customer Service and Billing

4.1.6.1 Function

The reading of meters, preparation of utility bills, process the utility bills, receiving utility payments and handling all initial customer service communications.

4.1.6.2 Assessment

This Division has two (2) primary functions, each of which has a Supervisor reporting to the Head of the Division. The head of the Division reports to Director of the Utility.

- Billing: includes meter reading, billing, and collections
- Customer Service: front line with customers; inquiries, billing discrepancies, final readings, receiving and processing customer complaints

The Customer Service and Billing Division has a history of delayed billings, billing errors, excessive estimated bills, and a significant growth in accounts payable and delinquencies.

There appears to be a lack of internal communication plus communication with the Meter Division. There is a growing emphasis on written work orders / electronic communications which can be useful, but this needs to be reinforced at times by direct personnel involvement and the establishment of mandatory Standard Operating Procedures (SOP's) to ensure compliance.

It is acknowledged by the Division head that the Division is adequately staffed; which is a good development in comparison to the previous 2017 TMF report that observed significant short-staffing in most functional areas of the utility.

Unfortunately, this Division has experienced a series of setbacks that have adversely affected the TWW:

- The Division acknowledges that estimated readings are often more than 25% of the total number of bills sent each billing cycle. This may be improved by the completion of a proposed AMI program in the TWW system
- Since 2017, fire protection billings based upon inch/foot water mains have not been billed. For example, according to audit reports, Fire revenues were $849,176 in FY 2016, compared to $837,990 in FY 2017 and $648,490 in FY 2021

- Private hydrants at times have not been properly billed
- In the fourth quarter of 2021 (Q4 2021), the entire system was not billed resulting in five (5) quarterly billings for the entire system in 2022. Understandably, this resulted in considerable customer dissatisfaction.
- There was an issue of postage not being paid to the 3rd party billing vendor resulting in billing / delinquency notices to be delayed

Included elsewhere in this Report are comments on the account receivable delinquency status. In essence, long term delinquencies (more than 120 days) more than doubled during the COVID-19 pandemic ($7,511,656 at September 30, 2019 from 14,052 customer accounts versus $18,567,238 at September 30, 2023 from 19,045 accounts). It is acknowledged that customers did not pay bills because they knew that they would not be turned off during much of 2020, all of 2021 and 2022. When the shut off moratorium was lifted in the Spring of 2023 and the utility began shut offs, the Utility was stopped so that customers to apply to NJDCA for utility assistance aid. Finally, shutoffs resumed in late September 2023, but were stopped in mid-November due to the state-wide winter utility shut off prohibition mandate.

Based on discussions with TWW staff, much of the office equipment in the Division is reported to be antiquated and in need of update. There exists some concern over the impact of new software programs and how they will integrate with existing equipment and software. Despite this expressed concern the entire process would benefit by an automated Customer Relation Management (CRM) system to cut down on manual verification and enhance automated “flagging”.

It is acknowledged that there is a lack of adequate on-boarding training with new personnel. This is not unique to this Division and is addressed in the general “Personnel” section of this report.

4.1.6.3 Conclusions

Based on record review and anecdotal evidence, it is apparent that historically there has been a significant lack of leadership / management and accountability in this function. Although the Division leadership has evolved and acknowledges the prior deficiencies, it is not known if positive change is occurring.

Although several individuals within TWW stated that the entire system is metered and the customer database is accurate, there has not been an audit and cross referencing to other available databases to ensure that all customers of the system are being billed and billed properly. Given the fact that the water utility serves multiple jurisdictions, this verification process would be difficult. However, within the City of Trenton, it would be possible to cross check the water utility database to that of the City's Division of Assessment to ensure that all existing lots are in fact metered if in use. In addition, such a verification could be required in the other using municipalities, for instance, through the use of tax and property records. The Meter unit supervisor acknowledged that there has been a recent surge in discovery of unmetered customers.

The existing utility fee structure amended in October of 2020 by an adopted ordinance appears to be adequate; however, no data was provided to verify that the billing software adequately mirrors the legal fee structure. Revenue billing data shows $22,232,448.00 for July, August, and September 2019 versus $25,610,397.84 for the same time period in 2022 and $15,233,681.66 in 2023. The 2023 billing data was not available, however data provided in Section 5.0 implies that the 2020 rate increase was implemented in subsequent billings.

The basic message that must become a priority for the utility's economic survival is the need to reestablish customer accountability - this can only be accomplished by an aggressive and consistent delinquent account collection program culminating in the shut off of delinquent accounts after a 120 day delinquency, with the only exceptions being made for those customers who qualify for shut off protection under various State programs.

The Water Utility is on a pathway to insolvency. A recent report supplied by the Utility to the NJBPU, and summarized in the BPU data sheet in the Financial Section, provides the following startling data:

For September delinquencies over 120 days for the selected years totaled:

- September 30, 2023: $18,567,238 in 19,045 accounts with an average of $803 for small meters and $10,143 for large;
- September 30, 2022: $18,641,597 in 19,694 accounts with an average of $750 for small meters and $10,694 for large;

- September 30, 2019: $7,511,656 in 14,052 accounts with an average of $446 in small meters and $9,013 for large meters

The shut off moratorium ended on March 16, 2024, however TWW was slow to begin a program to shut off delinquent customers. It is recommended that this process continue, and ensure it is being implemented for at least 50 delinquent customer accounts (over 120 days old) each Monday, Tuesday, Wednesday, and Thursday morning / early afternoon. These shut offs should be spread throughout the franchise area in hope that all delinquent customers will realize that failure to pay their utility bills will no longer be accepted. This effort should be publicized as a positive development, making delinquent customers accountable, thereby reducing the financial burden on TWW’s paying customers.

During the interview conducted with the Supervisor of Collections, the existing installment payment plans available to TWW customers were reviewed. These were reasonable given the scope of the delinquencies. It must be emphasized to customers that failure to comply with the approved payment plan will either result in the shut off continuing until paid and, for City residents, the delinquency may be collected through the tax sale lien process which could result in the loss of their property. Delinquent customers at risk of shutoff should be made aware of the various assistance programs available to them through the New Jersey Department of Community Affairs (DCA).

In reference to the other observed areas of concern, there have been some proactive steps taken, including:

- A new third party vendor responsible for billing
- As of November 2023, postage is now included in billing contract rather than being a separate function ensuring coordination between the two functions
- The billing vendor is now paid by Accounts Payable, not by Customer Service & Billing to simplify the payment process

4.1.7 Meter Installation and Maintenance

4.1.7.1 Function

The installation, replacement, maintenance, repair of all customer meters; the inspection of questionable accounts and meter readings. There are over 63,000 meters installed in the system.

4.1.7.2 Observations

In conducting interviews with a variety of personnel in this Division, it was very obvious that there was a wide range of perception about the handling of personnel issues, ranging from good to very poor in very specific areas:

- Productivity
- Work ethic
- Absenteeism (sick time & workers compensation)
- Accountability
- Favoritism

Many of these issues are addressed in the “Personnel” section below, and have been acknowledged, in general, by TWW management as issues that need to be prioritized and addressed across most if not all Divisions of TWW.

TWW personnel reported that all meters over 2-inch were periodically calibrated. This could not be confirmed. This is an important factor to consider, since larger meters have the ability to convey significantly more water than smaller meters. The TWW GIS shows that out of the 62,529 services, 2,038 of these are 2-inch and larger, accounting for about 3.3% of the system’s services. No data was directly available on meters, so an assumption was made that meter sizes match the service diameter.

All meters are installed within structures with remote readers mounted on an outside wall (with a wire connection). Many of these meters are 25 or more years old resulting in questionable read accuracy. There is a program to upgrade the meters to "smart meters" that can be remotely read versus the current system. The City has an I-Bank loan for $20 million to change out 63,000 meters, which represents all of the meters in the TWW system. In-house staff are performing 5,000 meter replacements, and contract installers will be installing the rest of the new meters. Reports from TWW staff indicated that the contract installers were doing at least five (5) per day per employee versus only two (2) by in-house staff. Some concern was expressed over replacing the meter manufacturer / software provider (changing from Sensus meters to Neptune meters) and integrating this new software into the overall billing operation.

There is some friction from the Billing Division and the Meter Maintenance Division that must be addressed given the close working cooperation needed. The current division of responsibilities between meter reading personnel (readers do not go inside a structure or handle any meter issues) and meter maintenance and repair staff (meter repairers handle meter complaints, reading issues and discrepancies, etc.,) make routine daily communication essential.

A new unit supervisor was recently appointed who seems to be more organized than the predecessors and aware of prior deficiencies and concerns.

4.1.7.3 Summary

It is yet to be determined if the new unit supervisor has the capability to implement a change in the unit's operations to increase productivity to a reasonable level by providing the guidance, discipline, best practices, and output goals necessary to overcome the cited observations. The long term beneficial financial impact of the meter replacement program can be significant, as evidenced by comparable history in other water utilities.

There is a need for more emphasis on improving productivity for existing personnel by establishing standard workload expectations versus actual work production.

The collection of delinquent accounts and the associated turn off / turn on procedures for customers with past due balances exceeding 120 days must be given priority in terms of personnel and focus to help restore the utility’s fiscal solvency.

4.1.8 Purchasing

4.1.8.1 Function

The purchasing function is tightly regulated by state regulation as well as local policies and implementation procedures. In the City of Trenton, purchasing is a central management operation focused in the City Administrator’s office. This is a fairly common organizational structure requiring the operating departments to supply the technical requirements for items to be purchased and often competitive quotes, and/or cooperative purchasing research separately or in conjunction with the central purchasing office.

In discussions with the Water Utility staff, complications and delays when dealing with purchasing issues were a universal area of concern. One of the issues is that key middle management water utility personnel perceive themselves to be so removed from the process (too many layers) that they feel that they cannot address or attain their needs, which are often technical in nature. From an external perspective, this is a two-way street, with some of the utility managers lacking an adequate understanding of the Local Public Contracts Law (LPCL) process and procedures. In all probability, there is a comparable need for the purchasing agent and staff to have a better understanding of the complex requirements of operating a water utility, especially with regard to chemicals and mechanical components.

Regardless, the purchasing process is perceived as a hindrance and bottleneck in both the timeliness and ability to acquire much needed equipment, sometimes on an expedited basis for critical operations. It also impacts the necessity of maintaining inventory of critical parts and equipment. This situation can likely be improved following the hiring of the new Deputy Director who is a Qualified Purchasing Agent (QPA) with utility experience. With his background and understanding of the process, it is envisioned that, in his position, he will have the ability to “bridge” the implied divide between the TWW and City Hall and will improve both the perception and actual process when dealing with purchasing issues. Although this may be a new position in the Utility, in the future, in the absence of this Deputy Director, there should be a specific purchasing specialist within the TWW organizational hierarchy to manage and advocate for purchasing related issues.

4.1.8.2 Summary

There is a need for training for all supervisory personnel in the TWW on Local Public Contracts Law as well as the City of Trenton’s purchasing procedures. There is a comparable need to educate the Purchasing Officials in the City Purchasing division in the operation of the water and sewer utilities, including site visits to promote a better understanding of the unique responsibilities assigned to these entities.

Formal and on-the-job training was found to be lacking for almost all staff throughout TWW. It is recommended that TWW institute a formal training program for all employees, in additional to expanding and enforcing SOP’s, documentation requirements, and strengthening accountability procedures.

4.2 TWW Personnel

Assessment: Red

The staffing at TWW was found to be deficient, both in terms of quantity and quality. This statement is made about the organization as a whole and is not intended to imply that every single person within TWW is unqualified. However, a lack of documented job-specific training, hiring candidates who barely meet the minimum job requirements, minimally implemented SOP's and O&M procedures that go unfollowed, and a general attitude of complacency contribute to TWW's personnel being assigned a red category based on the NJDEP's TMF criteria, referenced below.

- (Black) Personnel are unqualified to perform assigned work because they do not possess knowledge of system policies/procedures, have not been trained, and/or lack necessary skills
- (Red) Personnel are poorly qualified due to limited knowledge, received inadequate training, and/or do not possess all necessary skills
- (Yellow) Personnel are fairly qualified, but need to improve knowledge on system policies/procedures, require more training, and/or need to improve the skills they already possess
- (Green) Personnel are qualified to perform assigned work, know policies/procedures, are properly trained, and have all necessary skills

Determination: Red

4.2.1 Overview

The organization of personnel by function and operation in the TWW is an extremely complicated process, and TWW struggles to keep up with the complexities and processes. Every utility, including TWW, can be defined by a set of factors, with interplay between factors either helping or hindering the ultimate efficiency and efficacy of the organization.

The foundational factor is the actual operations of the organization – the people performing their assigned tasks according to established protocols. This is where the individual title, pay grade and personnel assignment come into play.

The second factor is the organizational rules and regulations governing these daily TWW operations, which are locally created, controlled, and implemented. These can be changed by local authorities within the TWW.

The third factor is the unions contracts which establish additional rules and requirements governing the various employee performance. Employees of the TWW are included in one of the two citywide union contracts. Change in this area requires acceptance by union representatives and membership who may not be knowledgeable about the specific work assignment.

The fourth factor for a utility is the rules, regulations, licensing requirements, and procedural guidelines of the NJ Department of Environmental Protection. In reality, the City has little control over these issues.

The fifth factor are the rules / regulations / policies of the City of Trenton governing such issues as residency requirements, preferential treatments (e.g. veteran's preferences), etc. These can be changed but require acceptance by City officials who may or may not be knowledgeable about, or aware of the impact on the operational issues involved.

The sixth factor is the financial restrictions established by the approved appropriations and the rules / regulations governing local finance and purchasing in New Jersey. This also involves the entire budget process involving not only the Administration and Finance departments, but also the elected officials. This is outside of local TWW control.

The seventh factor is the City Administration administrative review / approval / financing of a specific personnel item. Although outside of the TWW control, it is subject to TWW involvement.

The eighth factor is the acceptance of the expenditure through the Local Finance Board Transitional Aid program. Although outside of the TWW control, it is subject to TWW involvement.

The ninth factor is the review and approval of the elected officials if it involves any changes to existing labor contracts, personnel policies, or the procedures, financial or otherwise, which may impact utility users. Although outside of the TWW control, it is subject to TWW involvement.

The tenth and final factor is the potential involvement of the NJ Board of Public Utilities if the change has impact on the non-residential users of the system. Although outside of the TWW control, it is subject to TWW involvement.

4.2.1.1 Summary of Overview

It is widely acknowledged by most that change within TWW and the City of Trenton is needed and possible. A common thread throughout the interview process was the blanket acknowledgement that there is room for, and the need for, improvements throughout TWW, from the top executive leadership down to the rank and file employees. Due to the number of stakeholders, regulatory agencies, and interested parties, TWW staff reported feeling that the process is very convoluted, time consuming, and discouraging. A better understanding and awareness of the entire process from initiation of a requisition request through approval by DCA and the City Administration, is needed by all, and given this understanding, a better planning and development of realistic timelines for all items requiring change. Collaboration of all key stakeholders is critical to the progression through this process. It is strongly suspected that the current state of TWW's financial and accounting personnel is not adequately trained or staffed to proficiently handle its budgeting, purchasing, and approvals processes.

4.2.2 Compensation

Inadequate compensation was almost universally acknowledged by management and TWW personnel as a hindrance to recruitment, motivation for advancement, and the retention of qualified personnel, especially in technically oriented roles. It plays an integral role in personnel's desire (or lack thereof) for upward mobility, especially when coupled with a qualified individual's ability to seek better compensation from a competing utility. The issue of compensation will be expanded upon in the narrative below.

4.2.2.1 Summary of Compensation

This issue can only be addressed by developing benchmarks that can be used to show City Officials that the existing compensation schedules are not adequate to recruit and retain qualified personnel; that the two utilities unique and licensed labor market is often different and more competitive from normal DPW and similar operations.

4.2.3 Union Contracts

The issue of compensation is complicated by the fact that the vast majority of personnel in the TWW fall under two (2) Collective Bargaining Agreements (CBA's), AFSCME Locals 2281 (commonly referred to as the Supervisors contract) and 2286 (commonly referred to as the Laborers contract). While this is very common in the municipal government environment, their impact on the TWW needs to be addressed. Because the TWW employees are under the same CBA's as many other Trenton employees in other functional areas, it is at times difficult to isolate specific employment and compensation issues for unique titles or technical requirements within the utility. Historically, these issues do not rise to the level necessary to be individually addressed, in light of all of the other competing demands of other personnel in the CBA, however, they should be addressed for the long term stability of the TWW.

While this CBA-operated utility may not be as big an issue with “traditional” municipal functions as to comparability with other local government compensation packages, in the context of TWW, however, the utility is also competing with private, investor-owned utilities and MUA’s that are geared toward the technical functions required of water utility staff. These referenced utilities are much more adept at addressing the unique needs of their technical personnel (specialized training, continuing education, licensure, etc.). In light of this, the TWW is notably not competitive in the areas of personnel recruitment and retention. With the burden of having no choice but to deal with the issues associated with traditional municipal CBA’s, there needs to be a concerted effort on the part of the city administration to address the compensation and specific technical needs of TWW in the context of the union environment.

As part of the documentation provided to prepare this report, TWW furnished a list of employees and their “payroll titles”; an attempt was made to correlate these individual employees into the established pay plan. Unfortunately, many of the “payroll titles” do not match the established contract titles making this comparison incomplete. Consequently, final conclusions could not be made as to the structuring of the individual salaries versus salaries for other titles within the pay plans. However, for those which could be identified, their organizational responsibilities did not seem to align with comparable titles in other City entities.

Within the AFSME 2286 contract (the “Laborer’s Union”), for titles comparable to DPW and similar other activities, there were a number of instances where individuals with specific water (and comparable sewer) licenses were equated with standard DPW titles wherein it could be argued that their paygrade should be higher due to the licenses or the shift work often involved. The section on license stipends, below, addresses some of this issue but not inclusively. Attached is a summary of position titles within the existing labor contracts coded by organization affiliation. It shows “comparability” of various titles to pay ranges as envisioned within these contracts. Unfortunately to revise a listing in the current format can be difficult since it requires union concurrence as well as governmental action.

4.2.3.1 Summary of Union Contracts

The preferred solution is to create separate labor contracts for water and sewer employees, which will reflect their unique status in the labor market. This preferred solution is difficult; a more limited solution would be that compensation of the water and sewer utility employees be established in a separate compensation schedule within the existing contracts. This would allow a better alignment of salaries to position requirements within the overall labor marketplace, ultimately resulting in higher employee retention and job commitment.

4.2.4 Residency Requirement

The residency requirement for employees of the City of Trenton has been cited many times as having a negative impact on the ability to recruit qualified personnel, especially in technically oriented positions (there is an exception for licensed personnel; however, this does not address the issue of hiring personnel in non-licensed titles, when that particular position's "upward mobility" requires the attaining of a license). While the City's goal of employing its own residents is laudable, the benefit of a wider pool of qualified applicants in technical positions needs to be addressed.

When a position is opened, there is a strict procedure for how that position is filled. The first round of recruiting is done internally; the position is posted and anyone within the City government can apply. Many times, positions are filled based predominantly on seniority, with unqualified staff with little to no relevant water operation experience receiving the job. An example of this can be seen in TWW's new Maintenance Supervisor, who was previously a supervising mechanic in the DPW vehicle yard and carries no specific knowledge of water systems, pump repair and maintenance, or any other specifics of the division responsible to keep the treatment plant and outlying stations in working order. Next, if the position is not filled internally, only then are residents of Trenton allowed to apply. If no candidates are selected at this stage, it is then opened to residents of Mercer County.

While the City's provision that those holding required technical licenses can be recruited from and live outside of the City limits, there are many other important employee titles that do not require technical licenses that experience ongoing recruitment and retention issues. Under Civil Service regulations, hiring and promotional lists are developed for City residents, then County residents then all others. The City's residency requirement is imposed on top of this Civil Service ranking. This combination makes recruiting difficult for non-licensed, semi-technical positions.

4.2.4.1 Summary of Residency Requirement

At a minimum, the City should expand its personnel recruitment / retention base to the franchise area serviced by TWW. This would provide an expanded employment pool for recruitment while still emphasizing the importance of City (or service area) residency.

4.2.5 License Stipends

The existing CBA includes a provision for stipends in addition to established salaries to recognize technical licenses obtain and maintained by employee. This is a fairly common practice to recognize the value to the employer of the employee having obtained and maintained the license while still within an existing pay range. This stipend encourages employees to obtain and retain these licenses. Once earned, the stipend is an annual increase to an employee's salary.

For the stipend to be effective, it must be significant enough to cause an employee to take the necessary training and testing to acquire the desired license. Currently, unless an obtained license results in a higher title with the requisite higher salary, the existing license stipends for water utility personnel are so de minimis that they are not effective in attracting employee interest. This is adversely affecting the water utility in several basic critical areas, such as 1) personnel striving for advancement (with the increased responsibility that goes along with it), 2) maintaining adequate qualified personnel in key regulated roles, and 3) the retention of qualified personnel.

Current water utility license stipends covered by the two Collective Bargaining Agreements (CBA's) are as follows:

- AFSCME 2281
    - NJ State Certified Laboratory Manager - $1,000
    - Professional Engineers License - $1,500
    - Water Treatment License W-2 - $500
    - Water Treatment License W-3 - $1,000
    - Water Treatment License W-4 - $1,500
    - Water Dist. System License T-2 - $500
    - Water Dist. System License T-3 - $1,000

  - Water Dist. System License T-4 - $1,500

- AFSCME 2286
  - Chemist Water Analysis Lab, Mgr., Lab Supv. $1,000
  - Water Treatment Plant Operator (T1, T2) $500
  - Water Treatment Plant Operator (T3) $1,000
  - Water Treatment Plant Operator (T4) $1,500
  - Water Treatment Plant Operator (W1, W2) $500
  - Water Treatment Plant Operator (W3) $1,000
  - Water Treatment Plant Operator (W4) $1,500

4.2.5.1 Summary of License Stipends

It is strongly recommended that these stipends be at least doubled (if not tripled) to encourage more eligible employees to obtain them (and seek promotions) as well as to retain those who have the licenses. In today's very competitive utility employment market, increasing a stipend is one of the more effective and least costly alternates available to an employer.

4.2.6 Civil Service

Complications and delays when dealing with civil service (NJCSC) issues was again a universal area of concern. In a manner similar to purchasing (cited above), key middle management personnel perceive themselves to be so removed from the process that they feel they cannot address or attain their employment needs. Similar to the topic of purchasing, the cause of and solution to this issue is, in part, a two-way street, with some managers not having an adequate understanding of CSC process and procedures. Regardless, the civil service process is perceived as a hindrance and a bottleneck in both the timeliness and ability to hire qualified personnel. It was noted that TWW managers actually hire under-qualified entry level personnel with the intent to bypass the CSC process. This is simply counterproductive in the long term. An important consideration is that at some point, if the new employee is to advance, he/she must pass Civil Service requirements. This situation can likely be improved upon following the recent hiring of the Deputy Director. With his background and understanding of the process, it is envisioned that, in his position, he will have the ability to “bridge” the layers between the TWW, City Hall and the CSC in a way that will improve both the perception and actual process when dealing with civil service issues. In the absence of this Deputy Director, there should be a specific personnel specialist within the water and sewer Department to manage and advocate for personnel related issues.

4.2.6.1 Summary of Civil Service

Given the current organizational configuration of TWW as a Department within the Trenton City government, Civil Service is simply a fact of life. More importantly, it is critical that TWW leadership gain a better understanding of the Civil Service process as well as the position title inventory; this alone could ease some of TWW's staffing issues.

4.2.7 Licensed Operators

Assessment: Red

Trenton Water Works, as a public community water system, is required to retain licensed operators to oversee and assume responsibility for treatment and distribution activities, accordance with N.J.S.A. 58:11-64 et seq and the "Rules and Regulations Governing the Licensing of Water Supply and Wastewater Treatment Systems Operators, N.J.A.C. 7:10A". Given its customer base of greater than 50,000 people, TWW is required to have at least one W-4 of record and one T-4 license holder of record on staff at all times (N.J.A.C. 7:10A-1.14(b)2 and (b)5). Further, TWW is required to have an operator holding any T-license present at the plant at all times (N.J.A.C 7:10A-1.10(c)(8)(g)). Further, due to the population served, TWW is required to have properly licensed backup operators available during periods when the primary operator is unavailable.

- (Black) No licensed operator as required
- (Red) Licensed operator does not have the appropriate license; duties, recordkeeping, and reporting not performed as required; O&M manual does not exist or does not conform to regulations; licensed operator not familiar and/or does not ensure compliance with all applicable laws, rules, regulations, and license conditions; monthly reports not submitted as required.
- (Yellow) Licensed operator has appropriate license but needs to improve performance of duties, recordkeeping, and reporting; O&M manual exists but does not fully conform to regulations; monthly reports submitted as required.
- (Green) Licensed operator has appropriate license; performs all required duties, recordkeeping, and reporting as required; O&M manual current and conforms to regulations; licensed operator is familiar and ensures compliance with all applicable laws, rules, regulations, and license conditions; monthly reports submitted as required.

Determination: Red

Using the Benchmarking Criteria published by the DEP and included above, TWW's licensed operators were determined to fall into the red category.

Due to the departure of Mr. Johnson from the leadership role within the Distribution Division, TWW currently lacks a suitably licensed W-4 of record. The NJDEP has given interim approval for a W-3 to be the distribution system operator of record, pending this employee taking his W-4 exam at the earliest available date. This assessment is not a critique of all of the licensed operators within TWW, however when viewing the operations team as a whole, there are profound gaps in knowledge, particularly on the distribution side, and a profound lack of operators on the treatment side which limits the overall effectiveness of those who are on staff.

Table 4-1 shows the licenses present within each Division of TWW. Note that in some instances, a single employee holds both a T and a W license. There are no licensed operators in the Customer Service & Billing or Engineering Divisions.

Table 4-1: Operator Licenses within the TWW Organizational Structure

Administration					Facilities			
License	Count	License	Count		License	Count	License	Count
T-1		W-1			T-1	1	W-1	1
T-2		W-2	1		T-2	1	W-2	1
T-3		W-3			T-3	2	W-3	1
T-4	1	W-4	1		T-4	2	W-4	
Construction & Maintenance					**Meter Construction**			
License	Count	License	Count		License	Count	License	Count
T-1		W-1	1		T-1		W-1	
T-2	1	W-2			T-2	1	W-2	
T-3		W-3	1		T-3		W-3	
T-4		W-4	1		T-4		W-4	
Distribution								
License	Count	License	Count					
T-1	1	W-1	1					
T-2		W-2						
T-3		W-3	1					
T-4		W-4	*					

While TWW maintains some records and has O&M manuals at the treatment plant, TWW has a long history of many failures to report required data to the NJDEP. Monthly reports are submitted, however specific pieces of data are occasionally omitted; in some instances, sampling is simply not performed or reported.

4.2.8 Personnel Management

The new "Deputy Director" was brought into the operational in the 4th quarter of 2023, as a “Supervising Employment Specialist” / Deputy Director of Water. Impressions gathered thus far indicate that this is an excellent hire. He is an experienced local government attorney, personnel and purchasing official. His employment demonstrates the City and TWW acknowledgement and commitment to seriously address the general personnel management deficiencies and inconsistencies that have hampered the optimal operation of the water system. Having him as the Director's administrative arm grants the Director the ability to concentrate on operational issues, while having an experienced, trusted counterpart to concentrate on general personnel management issues. Ultimately the creation of this position has the potential to improve the organizational culture of the Trenton Water Works.

In discussions with the Deputy Director on personnel issues, the following areas / concerns were identified as significant to the intent of this report:

- Consistency – Some Divisions within TWW have displayed better personnel management than others. It was pointed out that, in some cases, there exists a “culture of entitlement” with some personnel. This needs to be changed to a culture of respect, responsibility, accountability, and consistent positive work ethic.
- Accountability & Follow Up – Management standards need to be established through goal setting, benchmarking, accountability and follow through. Where possible, measurable objectives, targets and timetables should be established and monitored to ensure productivity and pre-determined goals are being met.
- Progressive Discipline – During the various interviews, it was evident that there existed a wide range of opinions and perceptions of how enforcement actions are handled in different Divisions and sub-Divisions. Consistent, objective personnel enforcement must be maintained through the TWW to avoid low employee morale and motivation.
- Training – During the interview process it was obvious that there existed a wide range of opinions, perceptions, and realities of how personnel were (a) on-boarded and trained in new positions, and (b) provided continuing training, which is needed for both new and existing personnel. In a utility environment safety must be prioritized through an ongoing safety training program. There is a need to establish specific standard operating procedures (SOP’s) for a variety of positions, especially in areas that directly impact water quality and physical plant and distribution operations.

- Succession Planning – This issue is somewhat more problematic due to the high rate of personnel turnover and short notice of same; however, there should, at a minimum, be a plan in place for succession and transition for essential positions, plus an emphasis on the necessity to receive proper notice of pending employment changes. Maximizing promotional opportunities can also become a vital part of succession planning.
- SOP’s (Standard Operating Procedures) – The need to improve upon many SOP's was a consistent message as well as recognition of the role of NJDEP in encouraging and / or requiring these upgrades. The review and updating of existing SOP's can be a productive management exercise encouraging open communication and cohesion in any organization, especially where there are multiple separate tasks involved. On a consistent basis, TWW should engage in an organizational effort to update its SOP’s and involve as many of the affected employees as possible in the process to achieve the necessary “buy in” to make the desired changes.
- Communication – Two-way communication is critical to the successful operation of the utility. Information and ideas need to flow in both directions. It is noted that periodic, recurring staff meetings have been established at various levels to open the communication process. This needs to continue, be expanded upon, and standardized throughout the organization. Participating personnel should be encouraged to provide constructive input and share information that would be beneficial to their own, and other, operational areas. It is imperative that proper communication exist within Divisions as well as across Divisions at the upper levels of management and supervision.

4.2.9 Role of the Division of Local Government Services (DLGS)

At multiple times throughout the interview process, the oversight process required by the DLGS as a byproduct of transitional state aid to the City was cited as being detrimental to the ability of the TWW to overcome some of its problems. As part of the fact-finding effort made in aid of preparing this TMF report, conversations were held with NJDCA / DLGS representatives about their role in theory and actual operation. Currently, DLGS personnel as well as the Department of Community Affairs supervisors are well aware of the involvement of NJDEP in the TWW. DLGS personnel gave verbal assurance during interviews that they are not interfering in the operation of the TWW. In recent times, they have not opposed requested improvements, hirings, etc. (although they emphasized that the TWW must follow standard procedures and supply all requested documentation).

DLGS staff have raised questions about the priority of some of these hirings and expenditures and cannot allow policies which are applied uniformly to the entire organization to be ignored by TWW unless proper justification is made for the exception. This requirement is reasonable; the issue is largely related to communications between the TWW and the DLGS staff monitoring the City's operation, with the involvement of the DEP if necessary. In addition, DCA acknowledges that they consider themselves secondary to the NJDEP's requirements to address health and safety issues.

4.2.10 Role of the New Jersey Department of Environmental Protection

The NJ Department of Environmental Protection has a long history of direct involvement with the Trenton Water Works. Apart from the involvement relating to water quality and supply issues in the 1970's, within the last 10 years they have required a TMF in 2017, issued several Administrative Consent Orders (ACO) related to the findings of that TMF, and became actively involved in 2022 following the issuance of a Unilateral Administrative Order (UAO), dated October 22, 2022. In recent years they have directly commissioned several engineering firms to work with TWW in water plant operations and in distribution issues, as well as direct involvement of NJDEP personnel on the daily operations. At this time, NJDEP continues to provide direct oversight and monitoring of the TWW's treatment plant and distribution operations. TWW management personnel acknowledge this direct involvement and indicated their appreciations for this assistance and expertise. Additionally, they acknowledge that the ACO's were necessary to get the necessary changes implemented.

Generally, TWW management have indicated that the weekly (and sometimes daily) presence of NJDEP personnel and its designated consultants have been an asset to TWW, and are a basic reason for many of the recent improvements. In essence, NJDEP's presence reinforced the desire of the TWW management to make many of the changes that they knew were necessary but difficult to initiate and complete without the assistance of external parties.

An open question to be addressed in this TMF is the future of NJDEP involvement in the TWW's operations. It is recommended that NJDEP maintain its oversight role of TWW operations to provide stable and consistent guidance through the implementation of the recommendations contained within this Report. Some recommendations will be notably more difficult to implement than others, such as the recommendations concerning the financial condition of the utility. The requirement for periodic status reports regarding each of the key recommendations plus ongoing periodic site visits will be necessary to ensure their implementation (or modification / implementation after review of the modifications). The NJDEP's long-term presence should maintain a strong focus on the management and financial sectors to support the operational changes initiated under NJDEP guidance.

4.3 Managerial Recommendations

Comments related to the management of TWW will be organized into 4 aspects of the organization's current operation: continuity of leadership, organization role in City government, interacting with regulating authorities and customers, and daily and long term planning / management of the TWW. In addition to these core responsibilities, there are the traditional responsibilities of overseeing the financial stability of the utility as well as the supervision of personnel and daily activities.

4.3.1 Political Oversight

The City of Trenton has a history of various controversies, some of which have impacted TWW as reported upon by the local news media over the years. Potential issues can evolve from the institutional friction between the Mayor and Council, and the operation of an essential utility within this organizational environment. Part of this conflict is the natural evolution of the local political processes inherent to local municipal government. This inherent friction can be exasperated by personality conflict as well as political ambitions.

In the instance of the water system, there has been significant instability in the utility leadership since the utility become a separate department in 2018. **Table 4-2** lists the staff who have served as either Director or Acting Director of Trenton Water Works over a relatively short period of time.

Table 4-2: Historical List of TWW Directors

Date	Event
2017	Sean Semple, Assistant Director, Dept. of Public Works
June 2018	Merkle Cherry served as Director of Public Works
September 2018	Shing Fe Hsueh appointed as Director
October 2018	Water Utility made a separate Department withing the City
September 2019	Steve Picco appointed as Acting Director
January 2020	Dave Smith (in-house Chief Engineer) appointed as Acting Director
July 2020	Mark Lavenberg appointed as Director
January 2023	Sean Semple appointed as Acting Director

This turnover, coupled with the system's age and deficiencies, likely contributed to the inability for the system to function in a consistent, reasonable, and responsive manner, resulting in the existing large backlog of needed change.

In reality, in a municipality with the level of political discord that has characterized Trenton in recent years, the person serving as the Director of the Water and Sewer utilities is typically subject to change every 4 years (the mayoral term) or less; within the state statutes the Mayor or City Council had the stated ability to replace a Director mid-term, with no statutory protection granted to the position. Consequently, the ability to make significant positive changes in personnel, policies, or operations for a large organization in this political and legal environment is difficult. Too often this leads to an organization-wide attitude toward inconsistent top management that results in a "laissez faire" culture. Compounding this challenge is the fact that TWW also serves four neighboring municipalities who demand a level of performance and accountability that is difficult to provide.

4.3.2 Alternatives Analysis

One of the documents provided in aid of this report was a 2012 report by Hatch Mott McDonald outlining alternate methods of reorganizing the Trenton Water Utility. The analysis was prepared by the legal firm of Genoa Burns, Giantomasi and Webster. In 2017 Mott McDonald also did a Technical, Management and Financial (TMF) review of the water system. It appears that the 2017 TMF as well as the information provided in 2012 resulted in the Water and Sewer Utilities being restructured as a separate department of the City Government in the fall of 2018. Prior to that time, the Utility was a Division under the Department of Public Works. In this prior organizational structure, while the DPW Director was subject to change every 4 years (the term of the Mayor), the Water Utility management was isolated from this constant threat of change. It is assumed that this move to make the Water and Sewer Utilities separate departments was to allow greater individual accountability as well as closer central management control under the Mayor.

This change in organizational structure from Trenton Water Works being designated as a Division within the Department of Public Works to that of a standalone utility, although positive, also contributed to the lack of consistency in management for TWW.

It is assumed that this 2012 Alternates Report issued by Hatch Mott McDonald was paid for by the City. Consequently, it is a "public document" and available for usage in this 2024 report. This report was reviewed in preparation of this TMF and was found to be a well prepared and accurate statement of the issues involved as of 2012. The issues outlined in this 2012 report seemingly remain substantially unchanged and are still relevant today. This 2012 Report is attached to and made a part of this Report.

In 2015 the State Legislature adopted the 40-58:30 Water Infrastructure Protection Act (PL 2015 c 18). Attached is a summary of the relevant provisions of this act. The language and requirements are very specific and any local change under the act would require some expertise to implement. It is important to note that, although the purpose of this act appears to make the privatization or long term lease of a public utility a more viable option, the assignment of responsibilities and thresholds for approval are significant and the threshold for requiring a public referendum on any proposed change is fairly low.

4.3.3 Recommendations

Reorganization: It is recommended that the City consider reorganizing the governance and management of the TWW to provide for more continuity in central management as well as greater interaction with elected leaders and customers. The Water Utility (as well as the Sewer Utility) should be in a separate and distinct Department (as provided for in the 2018 reorganization) under the overall guidance of an appointed Executive Director pursuant to the state statutes governing the Mayor / Council form of government. This Executive Director must be highly compensated, highly visible, and be highly proactive, structure-oriented, and an excellent communicator. This individual must be hired externally, without the existing residency limitations. As evidenced by TWW's improvement under NJDEP oversight, the utility is in need of outside industry experts who can apply their expertise to continue improving the operation of TWW.

Under this politically appointed Executive Director of Utilities, there should be two distinct Divisions for Water and Sewer, each headed by a Deputy Director who has a "permanent appointment" serving under the direct supervision and oversight of the Executive Director. In the case of the Water Division, it is recommended to mirror the existing configuration of Mr. Semple as Deputy Director of Operations and Maintenance, and Mr. Wakefield as Deputy Director of Organizational Operations. This dual approach allows each employee to focus on their strong areas of leadership. This leadership structure, although cumbersome, will provide the long term continuity required of any public utility within the overall structure of the Mayor / Council form of government. The primary goal of this organizational format is continuity of leadership and retention of institutional knowledge; frequent turnover in leadership positions for any reason leaves an organization rudderless and incapable of achieving any long-term goals. The foundational knowledge needed by leadership resides at the Deputy Director level, therefore if the Executive Director is replaced by an unfriendly Mayor and Council, TWW's daily operations should go largely uninterrupted. However, should a Deputy Director be found incapable of adequately managing their respective utility, they could be demoted or removed under Civil Service due process standards, or via a local ordinance process for exempt employees.

Communication Improvements: A key issue that remains unresolved is the need for meaningful, constant communication and oversight of TWW by the City of Trenton, as well as improved access to and even involvement in the utility operation by its primary customers, including representatives from Ewing, Lawrence, Hopewell, and Hamilton. The Mayor and City Council have numerous other issues that constantly demand their attention, denying them the time to properly oversee their public water and sewer utilities. There is a need for continuous involvement by the governing body, not just intervention in a reactive mode.

A common observation throughout the interviews conducted was a lack of proper communication, and especially written, formal communication. To improve communication at the leadership level, a Water Utility Advisory Committee to provide continuous oversight / involvement for TWW which will report to the Mayor and Council on an established periodic schedule as well as in response to any issues being raised by the elected officials. It is recommended that this Water Utility Advisory Committee be comprised of representatives from the Administration (the Mayor or his designee), the governing body (two elected council members), the NJDEP, possibly DCA-DLGS, and one member of each of the neighboring municipalities which receive water service (Hamilton, Ewing, Lawrence, and Hopewell). The Water Advisory Committee should meet monthly or more if necessary and receive reports from the Executive Director and the Deputy Directors on the operations of the utility; its financial status; any compliance issues; and personnel recruitment, retention, and performance. The Advisory Committee would also be responsible for assisting the City Administrator in preparing an annual budget and recommending personnel changes, as well as advising their other serving jurisdictions on budget and financial issues. The City Administrator or his / her designee shall serve as the staff support for the Committee and the Executive Director shall serve as the secretary for the Committee. Formal documented minutes including action items will be prepared and disseminated following each meeting. The primary role of the Advisory Committee is not only to assist the Mayor in TWW management, but also to serve as a communication bridge between the TWW and the elected officials of Trenton and the surrounding jurisdictions served by TWW.

Compliance Officer: TWW currently lacks a full time compliance officer. It is recommended that TWW hire an individual for this position who possesses relevant compliance and regulatory knowledge. Having such a person on staff, and empowering them to alert leadership to potential compliance issues, will allow TWW to operate proactively instead of reactively to Notices of Violation and similar correspondence from the NJDEP.

Budget Officer: It is recommended for TWW to hire a Chief Accountant / Budget Officer to oversee the financials of the utility. This individual would provide valuable oversight and control where such direction and knowledge is currently lacking. This individual would also interface with the City financial staff, ideally improving the communication between the utility and the City.

Previous W-4 of Record: The former licensed water distribution operator of record, Edmund Johnson, has since been replaced on an interim basis by a W-3 license holder with permission from the NJDEP. Mr. Johnson now serves in an administrative capacity as both the TWW representative for the Supervisor's Union and as compliance officer. H2M's belief is that Mr. Johnson is unqualified to serve as compliance officer or any other role at Trenton Water Works, and therefore should be removed or relocated to another department within the City.

Residency Requirements: the residency requirements for recruitment and hiring must be removed for the water department. While a policy of this nature may be fine for some departments, the skills required for TWW staff set a higher bar for job candidates, and limiting the applicant pool to the City greatly limits the number of qualified people who can apply, ultimately forcing to choose between a smaller group of less qualified applicants. TWW as an organization has become especially insular.

Laboratory Capabilities: it is recommended that the TWW in-house laboratory not expand its testing capabilities and instead it should focus on improving its current procedures. In conversation with the laboratory supervisor, it was noted that a handful of the existing equipment is in need of replacement. The lab would also benefit from the purchase and use of a zetasizer, which could help reduce their reliance on frequent jar testing.

Training: TWW staff need to be provided additional training, both technical and job-specific. It is recommended that TWW utilize a standardized training platform which automatically assigns training content as needed, which will simplify and document the training process.

As part of training, any new hires into the Department or recently promoted persons should follow a formal apprenticeship program, where they are assigned to a more experienced employee to learn the processes and procedures.

Engineering Staffing: the engineering division is understaffed, which may be hindering TWW's ability to plan, design, and execute capital projects and programs. Even if the majority of engineering work is outsourced to consultants, there still needs to be a certain level of oversight by the Owner (in this case, TWW) to ensure projects are scoped and constructed to meet the needs of the system.

If the above changes occurred and prove to be ineffective in obtaining and maintaining the proper continuity and operation of one or both utilities, then either the sale or long term lease of the Water Utility or the establishment or a formal Municipal Utility Authority may be considered. However, in either case, these alternate processes may be cumbersome given the existing financial structure of the water utility and multi-jurisdiction service area franchises as well as personnel and Civil Service issues.

It must also be noted that the selling or leasing of the system would in all probability involve a public referendum which may not be successful in the City of Trenton under the current laws governing the process.

Concurrent with the preparation of this TMF, the NJDEP has commissioned Black and Veatch to perform a separate 360-degree report which aims to evaluate the governance structure of TWW. The 360 Audit and this TMF may be used in conjunction to inform any improvements or modifications to the structure of TWW.

A potential alternative organizational chart for the Department of Utilities follows.

EXECUTIVE DIRECTOR OF WATER AND SEWER

Central Management
Daily management / supervision of the water utility
Budgeting
Purchasing
Personnel recruitment, retention, training, and licensing
Legal and management analysis
Accounts Payable
Personnel / Payroll

DEPUTY DIRECTOR O&M | DEPUTY DIRECTOR ORG OPS | SEWER DEPUTY DIRECTOR

Customer Service Billing and Collection
- Financial Administration (serves both utilities)
- Meter Reading and Billing
- Revenue Collections
- Customer Service

Water Treatment Plant — Sewer Plant Operations
- WTP operations
- Laboratory
- Primary Distribution: Pumping Stations and Storage
- Facility / Equipment Repair and Maintenance

Construction and Maintenance — Sewer Collection system
- Routine Maintenance
- Emergency Repairs / Maintenance
- Construction / reconstruction of facilities
- Service Laterals replacement

Distribution – Water Quality Compliance
- Hydrant and system flushing and testing

Engineering — Engineering
- New Development review
- Maintenance of Plans / GIS systems
- CIP management
- Supervision of outside engineering firms
- Technical Services to Utility Operations
- Field construction monitoring / data collection

Meters
- Repair / testing of existing meters
- Meter replacement / upgrade

4.3.4 Ongoing Role of NJDEP within TWW

The UAO issued by the NJDEP and the subsequent direct oversight of the TWW system has led to many improvements in water treatment and distribution, as well as organizational improvements. The DEP forced TWW and the City to take positive steps towards improving water quality, asset management, and the overall operation of the water system. Such examples include the low velocity flushing program to mitigate *Legionella* in the distribution system and operational optimization of the Superpulsators.

While improvements have been made, it is unlikely that TWW as an organization has been rehabilitated to the point of achieving full self-sufficiency. It is probable that, should the DEP withdraw from TWW in the short term, TWW will revert to its status pre-UAO, undoing all of the forward momentum that has been built over the past several years.

It is recommended that the NJDEP establish a 10-year timeline for a gradual withdrawal, allowing the implemented changes discussed above to take hold. This timeline is as follows:

- Years 0-3 (beginning in 2024): NJDEP maintains active oversight and involvement in TWW
- Years 4-6: NJDEP ends active oversight and instead provides semi-annual inspections to ensure compliance with regulations, the UAO, and ACO's, and other guidance issued to TWW by NJDEP
- Years 7-10: NJDEP performs annual check-ins with Trenton and TWW leadership and inspects the operations of the WTP and other critical assets

If TWW has met the expectations of NJDEP at the end of the 10-year probationary period described above, the DEP's oversight may be allowed to end.

Institutional change does not occur overnight, especially when the challenges facing an organization are multifaceted and deeply ingrained. TWW requires the steady presence of outside agencies to promote its technical, managerial, and financial capacity.

5.0 FINANCIAL CAPACITY EVALUATION

Assessment: Red

5.1 Overview

The financial state of TWW is a reflection of its managerial practices: its inability to retain qualified financial staff, the lack of proper training for existing staff in the processes and procedures to efficiently perform their duties, lack of effective and documented communication between TWW and the City government, and a lack of decisive leadership has prevented TWW from instituting a comprehensive shutoff and collections program, which has allowed its delinquent account value to reach $23 million as of the end of 2023. This poses a clear threat to the financial health of TWW. Financial records indicate that TWW is budgeted more than it spends each year; while causes can vary for this, it is believed that TWW's staff are unable to organize themselves in order to fully expend the money allotted to them in the annual budget. In other words, a combination of vacancies and the lack of qualified, knowledgeable staff prevents TWW from carrying out projects which would fully utilize its budget, resulting in a sizeable portion going unused at the end of each year. Another example of TWW's past organizational failures impacting its financial performance took place in late 2021, when the billing department failed to send the fourth quarter bills on schedule, resulting in only three bills being sent in 2021 and five quarterly bills being sent in 2022. This type of fluctuation in accounts receivable, not to mention the impact on TWW's customers, is unacceptable and exemplifies the effects of poor management on TWW and the communities it serves.

This chapter presents:

- A history of revenues and expenditures of the Trenton Water Works (TWW) from 2016 through 2023
- An examination of the actual versus budgeted revenues and expenditures for the years in question
- An examination of the accounts receivable system and status
- A review of the debt status as of 12.31.2022 with principal payments projected for the next 7 years
- A projected inclusion of the projected Capital Improvement Program into this financial structure
- A projected budget for the next 7 years

While a portion of the data reviewed in preparation of this report preceded the direct operational oversight of TWW by the NJDEP, the most recent data available is representative of TWW while receiving direct assistance from NJDEP staff. Further, DCA maintains a presence within the TWW financial framework due to financial assistance given to the City through the Division of Local Government Services (DLGS). Without the input from these two state agencies, the City of Trenton and Trenton Water Works must make a conscious and continued effort to proactively manage the operation of the water system from a technical, managerial, and financial perspective.

The financial capacity of TWW was compared against the TMF benchmarking criteria provided by the NJDEP, with the four classifications included below.

- ● (Black) No financial plan for future revenues, operating expenses, reserves, and capital improvements; do not have information needed to calculate financial indicator ratios; insufficient reserve accounts; no annual operating budget; water system revenues are siphoned off for non-utility use.
- ● (Red) Financial plan exists, but does not cover future revenues, operating expenses, reserves, and capital improvements; financial indicator ratios in the red; insufficient reserve accounts; annual operating budget has insufficient revenue to meet all expenses; no AMP/CIP, water system revenues are siphoned off for non-utility use.
- ● (Yellow) Financial plan exists and covers most but not all future revenues, operating expenses, reserves, and capital improvements; financial indicator ratios mix of red, yellow, and green; insufficient reserve accounts; annual operating budget has sufficient revenue to meet all expenses; no AMP/CIP, water system revenues dedicated for utility use.
- ● (Green) Financial plan covers future revenues, operating expenses, reserves, and capital improvements; financial indicator ratios in the green, sufficient reserve accounts; annual operating budget has sufficient revenue to meet all expenses; AMP/CIP exists and is being implemented; water system revenues dedicated for utility use.

Determination: Red ■

Based on the above, Trenton Water Works was assigned a capacity of the red category. TWW's recordkeeping, especially when it comes to financial information, was extremely difficult to acquire for this report, and the information that was received is poorly formatted and unclear. TWW has both an Asset Management Plan and a Capital Improvement Plan, however both documents are not inherently tied to true expenditures. TWW does contribute a portion of its revenue to the City of Trenton, however this amount is justified by the services rendered from the City to TWW (financial, human resources, vehicle maintenance, etc.). There are two additional factors that degrade TWW's capacity; first, they have limited financial staff with limited financial competency, and a significant delinquent accounts problem. To address the former, TWW must hire a budget and financial compliance officer and provide significantly more training for accounting staff. Addressing the latter is a larger undertaking involving a comprehensive shutoff and collections program, up to and including legal action against the largest delinquent account holders.

Of further note, the financial section of the TMF benchmarking document includes several financial ratios which can be utilized to gage financial capacity.

5.2 Limitations of Available Data

The accounting and financial data available for review is limited and in a format that makes multiyear comparisons of the budgets, particularly the operating budgets, very difficult. Due to the inability to access the financial software system used by the City (the Edmunds system) this report was prepared based upon published Audits (prepared by independent auditors) and Annual Financial Statements (AFS) (prepared by the City Chief Financial Officer) and several limited data downloads from the City Budgetary system. At the time of writing, access was only available to the 2022 and 2023 budget appropriations and expenditure detail. A draft 2023 Annual Financial Report (AFS) was reviewed late in the report preparation process. Historically the water and sewer systems were in the City's DPW budget and not assigned to a separate utility budget format. The City is in the process of reorganizing the utility accounting system into a more appropriate program based budgetary and expenditure control systems for the TWW in future years. Due to the confusion in the financial data available, coupled with the transition from a State Fiscal year in 2021 (July 1 through June 30) to a calendar year (January 1 through December 31) it would be very time consuming to trace program expenditures for the 3 to 5 years that would be preferable for projecting the water utility budget forward for the next 5 years. Consequently, the projection was made on an aggregate basis rather than the preferred programmatic basis.

In terms of expenditure history, as noted in the 2017 TMF, there was a dramatic underfunding of the utility at that time and this underfunding continued for the next several years (see comments under Actual Costs, below). By the 2022 and 2023 budgets, a more normal expenditure pattern for operational costs evolved. For 2024 through 2030, a projected budget was prepared based upon historic expenditure data plus recommended operational improvements as cited in the Managerial section.

5.3 Revenues

5.3.1 Revenue Budget Overview

The main subjects in this discussion are:

- A summary overview of the budget revenue projections
- The billing operation of the TWW
- The Collections operation of the TWW
- The current accounts receivable status of the TWW

Attached is a dataset "1. Revenues" showing the overall revenue budget from 2016 through 2023. It shows the budget versus the actual collections. In many of the budget years the actual revenues collected exceed the budget and the results are fairly close, an indication of good revenue projection. In several years these revenues were not met: SFY 2018, SFY 2020, SFY 2021. Of note, the City operated on a State Fiscal Year which runs from July 1 to June 30 of the following year, up until 2021, after which it switched to a Calendar Year. Due to this shift, the 2021 data is difficult to assign. Recent information indicates that in CY 2023 the budgeted revenues were also not met. The reasons for SFY 2018 are not known; however, SFY 2020 and 2021 are related to the COVID shut down and collection issues, which are discussed in further detail below. Data on the 2023 collection activities was not provided for this analysis; however, it appears that the continuation of a shut off moratorium may be the primary cause. Of interest, there appears to be a reliance on large Utility Operating Fund surpluses for revenues in a number of years, which largely consisted of cancellations of prior year unexpended budgeted appropriations. However, these fund balances have decreased over the years from approximately $25 million in 2016 to only $6 million in 2022 with a further reduction projected for the 2023 year end, not a stable revenue source which could result in a future imbalance in the operating budget.

The “rents” collected are “billed user charges for water consumption or potential consumption”. It must be emphasized that a water utility revenue flow is significantly different from a governmental revenue flow: government revenues are largely due in specific time periods so a “fiscal year” is a standalone accounting process. The Trenton WW uses a “rolling revenue” system wherein usage charges are calculated and billed on a continual revolving cycle. Consequently, December billings are collected in January or February of the next calendar year (or August / September of the Fiscal Year). Accordingly, the revenue projections must be based upon collection data and not billing data. There was a rate increase in late 2020, and the 2021 and 2022 revenue billing data reflects this rate increase which is significant given the growing accounts receivable problem resulting from COVID collection restrictions as discussed below.

Unfortunately, at the time of the preparation of this study, the detailed information on the CY 2023 revenues, particularly the total billing and accounts receivable collected / delinquent was not available. The draft AFS data reflects a continuation of the very poor collection history in recent years with an increase in accounts receivable over $23 million as of the end of 2023.

Also included in this dataset is information on the actual revenues obtained that generate surplus. The major source is from “appropriations lapsed”: appropriations from the budget two years prior that were unexpended in the budget year and “encumbered” (set aside for payment) until the start of the budget starting 12 months in the future. These cancellations were a significant surplus source in 2016 - 2020. (see lines 23 – 29 of the “Revenues” attachment, Section D1 of the Audit, Other revenues).

The budgeted versus actual received for "rents" (user charges) has been fairly accurate in this budget history. Looking at CY2022 versus SFY2020 in the “Revenues” attachment gives an indication of the impact of the October 2020 rate increase, especially considering the large delinquency increase that affected the 2022 rent collections. In reality, the impact of this rate increase remains unknown until the collection ratio returns to a more "normal" range.

5.3.2 Comparison of Billed Amounts and Received Amounts

The attached dataset (2. Billing versus Received) is a comparison of the data from the Division of Billing and Collections (Division) versus actual collections as shown in the Annual Audits / Annual Financial Statements (AFS). The annual billings data (Line 4) is taken from a report prepared by the Division providing total billings for specified fiscal or calendar years. The total revenue data (Line 21) from the Division represents billings for both the water and sewer utilities. The collections data represent the Annual Audit and AFS findings of actual cash receipts in the calendar year for each utility. It is critical to state that the billing data represents current usage whereas collections data will lag behind (e.g. the December billings will not be collected until January / February of the following year) plus user payment history can vary dramatically from year to year and month to month. Consequently, it is not possible to have the two datasets match; however, on an annualized basis, the two datasets should give an approximation of the utility’s annualized cash flow and should represent dramatic changes in that cash flow (for example, resulting from a change in the rate structure) (Line 4 versus Line 21).

In this context, there was a rate adjustment in late 2020 which is represented by the billing increase in 2021. In late 2021, TWW failed to issue one of the quarterly bills, resulting in only three bills being sent to customers in 2021 and five quarterly bills being sent in 2022. This created an imbalance in billing between 2021 and 2022 and obfuscated the ability to immediately observe the effect of the rate increase on billing and revenues. Despite this failure to issue bills in a timely manner, the data implies that the rate increase did in fact become implemented as intended. Looking at the “average billing data” from 2016-2019 (2. Billings versus Received, line 4) of $51,364,077 whereas total billings after the October 2020 rate increase appear to be approximately 10% greater (this can be better seen when the final 2023 billing data is available).

The Billing data is on Line 4. Since the Division bills for both the water and sewer utilities, the database shows actual collection data from both utilities (Lines 8 through 15). This is followed by a total (Line 17) then interest with a grand total collected on Line 21. Although this does not match the billing line, there is a good match until 2020 and 2021 when the COVID restrictions on utility shut offs for non-pay had a dramatic impact. For 2022 (CY) the collections exceed the billing reflecting a small decrease in consumer accounts receivable (delinquencies) that accumulated in 2020 and 2021. As noted above, the 2023 data is not available.

The remainder of the database shows the status of the consumer accounts receivable data (Lines 24 through 31). There are two separate datasets provided: the Annual Financial Statement (AFS) from the City Chief Financial Officer (Lines 24 through 310) and another being Section DS-8 of the Annual Audit, prepared by an independent auditor (Lines 41-51). These two data sources present the same data with some slight differences.

In essence, up to the COVID time period, there was a fairly consistent year end accounts receivable of approximately 20% of the starting delinquencies plus the current year billings (Line 39). This non collection ratio ballooned to more than 30% due to COVID and the restriction on utility shut off. What is remarkable is that the rents received continued to increase even with this delinquency ratio increasing dramatically. This implies that with reasonable collection practices, there should be not only an immediate infusion of cash in 2024 and 2025, but also the baseline revenue collections should increase by approximately $5,000,000 annually. While not necessarily desirable, this will result in a return to pre-COVID year-end collection ratio of 20%, or an uncollectable amount between $10 million and $12 million.

The double impact on the TWW fiscal condition by addressing the increased delinquency collections must be emphasized: firstly, the collection of prior delinquent revenues will immediately increase fund balance available for future budget use; and secondly, the overall current "rents collected" budget line will increase by improving the number of on-time collections.

5.3.3 Accounts Receivable

The attached dataset “3. Accounts Receivable” is predominantly a repeat of the same data as the “Billing versus Received” dataset but focuses upon the water utility only. The above comments under Billing versus Received are also relevant here.

5.3.4 Accounts Receivable Delinquency Status

A report was filed by TWW with the NJ Board of Public Utilities (BPU) in the Fall of 2023, for a study by the BPU for all utilities in the State on the impact of COVID and the State regulation prohibiting utility shutoffs for non-payment during the pandemic (dataset “4. BPU Usage and Delinquency Data rev). This report compared the TWW financial operation for the months of July, August, and September in 2023 to those same months in 2022 and 2019. This analysis was found to be particularly applicable to this TMF which quickly highlights some of the issues facing TWW. The data reported has not been audited; rather it is data generated by the internal billing and receipting operation of the Utility and not the City’s Finance office. However, assuming the data is correct, the financial condition of TWW is very precarious at this juncture and cannot be ameliorated until TWW has the ability to, and actually accomplish, reinstitute existing delinquent collection and shut off practices.

The dataset “4. BPU Usage and Delinquency Data rev” is a summary excerpt of this submittal to NJ BPU as well as supplemental data available. As cited elsewhere in this Report, the delinquent balance of accounts has escalated to the extent that $18,567,238 is owed by 22,119 customers (arrearages, Line 12) who, as of September 2023, are eligible to be disconnected for non-payment exceeding 120 days past due. For comparability purposes, similar data for 2019 is $7,511,656 (Line 32) owed by 3,555 customers. In essence, assuming the total customer base approximates 64,000 accounts, more than one third is delinquent and the amount of the total delinquency approximates 41% of the total annual billings. A small silver lining is that the amount of the total number of delinquent accounts has reduced when comparing September 2023 to 2022; however, the value has not reduced proportionally, resulting in a higher per-account delinquent amount, indicating that the remaining delinquent customers are accruing additional past due bills. Assuming this data is reasonably accurate, the primary goal of TWW in 2024 must be to enforce collections to return the utility to a financial status similar to 2019; while still unfavorable, the utility was at least able to maintain itself reasonably solvent. Improving the collections program beginning in 2024 will improve the overall financial condition of TWW, providing a continuation of the fund balance usage as in the past.

For September delinquencies over 120 days for the selected years totaled:

- 2023: $18,567,238 in 19,045 accounts with an average of $974 per account;
- 2022: $18,641,597 in 19,694 accounts with an average of $946 per account;
- 2019: $7,511,656 in 14,052 accounts with an average of $534 per account

As noted in several other locations, the account receivable delinquency status must be a primary focus and goal of TWW. While acknowledging the real impacts of COVID, it is nevertheless imperative for TWW to bring its past due AR to an “industry acceptable” standard. A detailed plan must developed, implemented, and monitored to ensure the success of the program. The fiscal integrity of TWW is at stake, and this effort must reflect the gravity of failure in this regard.

5.3.5 Cash Reserves

This database (5. Cash and Reserve rev) provides a comparison of the overall financial summary for TWW (Schedule D of the annual audit) for the years 2016 through 2022. The year 2021 saw a transition between a State Fiscal Year and a Calendar year so the data does not fully align with the other audits, which all have a 12 month duration.

Key areas of concern in the Operation Fund are the accounts receivable at year end, the cash and investments multiyear status, and the fund balance status. The fund balance in 2022 was at the lowest level over the seven years of available data.

The Capital Fund cash and investments were found to be extremely low in 2022 compared to prior years; however, the encumbrances are also low indicating that at the end of 2022, there were fewer contracts / capital equipment purchases in process. The combined debt structure serial bonds, serial bonds qualified, Bond Anticipation Notes (BAN's) are up slightly from 2020, approaching $140 million. However, added to that in 2022 is close to an additional $72 million of authorized but unfunded debt bringing the total debt load to approximately $212 million.

5.3.6 Capital Budget and Capital Improvement Plan

The Technical section of this report includes a recommended Capital Improvement Program for TWW. The findings of the financial section of this report do not specifically integrate the existing Capital programming of TWW. Instead, a review was performed of existing funded and unfunded Capital ordinances, which indicates that many significant capital projects are already included in approved authorizations. As such, they are included in the funding of existing authorized but unfunded debt. However, a review of the listed recommended capital items shows priority needs for certain facility rehabilitation issues (roof replacements, HVAC replacements, etc.) that do not appear to be in existing approved funded or unfunded debt. Maintenance of existing capital plant to prevent further deterioration is normally ranked as a system priority. The same needs for replacing operational equipment and vehicles on a periodic replacement schedule basis is also a normal priority for continuation of operational efficiencies. Consequently, as a minimum, without identifying specific items, the recommendations of this TMF include in the future debt schedule $40 million in new funding by way of two ordinances: one for $20 million in 2024 and a second one for $20 million in 2027. These two ordinances are intended to account for priority capital projects not already included in various approved authorizations, with the specific selection and sequence of the new projects to be determined by TWW. Both proposed ordinances are shown on the Future Bonds and Notes schedule set forth in Section 5.3.7.3 below. As noted in other parts of this Report, no assumptions were made to include any potential grant funding for these projects, representing a worst-case financial scenario. This assessment assumes full funding by TWW (excluding existing grants in place) with any grant funding serving to reduce the funding requirements.

Trenton is eligible for significant additional funding from the New Jersey Infrastructure Bank (I-Bank), large portions of which could be eligible for principal forgiveness. Namely, two pending applications totaling $141.5 million were submitted to address the finished water reservoir as required by an ACO, as well as $24 million for a meter replacement program. If TWW and the City can maintain their creditworthiness, I-Bank will remain a viable source of external funding for capital improvements.

5.3.7 Existing Debt

5.3.7.1 Debt

The dataset "7. Debt" portrays the existing debt of TWW beginning in 2016 and extending through the 2022 Audit. All of the information is based upon the Annual audits showing funded debt. This dataset is followed by the dataset "8. Bonds and Notes" (see below) that documents the debt structure in detail.

5.3.7.2 Bonds and Notes

The dataset “8. Bonds and Notes” takes the 2022 existing debt structure and presents it in an annual profile so that the future debt load can be identified by specific authorization. The information is from schedules D4A and D10A of the Annual Audit. Note that the totals shown do not agree with the debt summary as shown in the Audit Note D of the Introductory Audit Comments shown on lines 120 to 125 of this database. It is assumed that this discrepancy is due to the issue of outstanding Bond Anticipation Notes (BAN’s) which require annual interest payments plus some principal payments after certain time spans. It is assumed that this temporary debt has been added to this data base based upon information in the 2022 Audit for “Debt”. However, the detailed bond repayment schedules included in this dataset are informative since they document the life span of the existing debt.

5.3.7.3 Future Debt

For the purposes of this report, a detailed in depth, review of each bond statement was not performed, due in part to the unwillingness or inability of the City to provide said documents; rather, the summary financial information in the various Audits was used for financial projections. The goal of this report is to give an approximation of the future expenditure needs and required revenues to support these needs. The specific determination of the exact amount of the future requirements, as well as bond life and issuance realities, requires extensive further analysis as well as decision making.

A review of the existing authorized but unfunded debt (see dataset “8. Bonds and Notes”, Environmental Trust Fund Loan, Lines 58 and 59) indicates $25 million in an Environmental Trust Fund (EITF) line of credit for future use for replacing lead service lines, plus $16,896,000 in existing issued Bond Anticipation Notes that must be converted to permanent funded debt within the near future (Lines 115-116). In addition, the 2022 Annual Audit, Schedule D-7 indicates there is $72,938,651 in authorized but unfunded improvement authorizations which must be either cancelled or funded. Rather than trying to reprioritize these various funded / unfunded projects, the analysis presented in this Report assumed the $25 million EITF line of credit for lead service line replacement will be used thereby allowing city ordinances for similar projects to be cancelled. In regard to authorized but unfunded debt, it is assumed that only $60 million will be funded; the remainder will be cancelled or funded by alternate means. Additionally, portions of the unfunded projects in D7 will be either used or cancelled / reprogrammed to align with the updated CIP. The $16 million in unfunded BAN's must be permanently funded since they represent current ongoing projects.

In the dataset “9. Future Debt” there are two authorizations ($20 million in 2024 and $20 million in 2027) for new debt for those items in the recommended CIP but not specifically included in existing funded or unfunded debt structure (mainly facility maintenance issues and equipment replacements).

The dataset "9. Future Debt" attempts to integrate these unfunded debt requirements into the existing long term debt of TWW. Again, it must be emphasized that these are unrefined cost assignments that can be greatly improved upon; however, the goal of this report is to establish approximate future debt levels and the revenue flows required to fund those levels, assisting TWW and City officials in making the optimal decisions for financing their needs.

This database (9. Future Debt) starts with the "existing debt" summary of "8. Bonds and Notes rev" (Lines 3 through 6) and then adds to it the debt schedule summary as shown in the Audit Note D of the 2022 Introductory Audit comments (Lines 9 through 14). The totals shown do not agree with the debt summary as shown in the Bonds and Notes Schedule, however this Audit summary was used as a starting point for this analysis. The "future debt" dataset assumes four separate payment plans for this unfunded debt as detailed below. It is important to note that the following debt projections use a 2.0% or a 2.5% interest rate. The actual interest rate will be determined at the time of issuance. For the purposes of this report, these projected interest rates are used solely to give an order of magnitude of the cost for borrowing these funds in these unrefined cost projections. In addition, the bonds issued are "backloaded" as shown on Line 63; debt principal payments are weighted into the later bond years.

1. For the EITF, a 50 year payout with a 2% annual interest rate on the unfunded balance with principal payments starting in 2027 (Lines 16 through 20).

2. For the $60 million in existing approved but unfunded debt, a 20 year bond at a 2.5% annual interest rate starting in 2027 (Lines 23 through 33).

3. For the issued BAN's, using $15 million as the debt, a 20 year bond at a 2.5% annual interest rate starting in 2028 (Lines 37 through 43). Note the BAN's were issued in 2020 and 2021 and therefore must be refunded within 10 years with minimal annual payments up to the time of bond issuance. In reality, since the principal / interest on the short term debt approximates the principal and interest on the long term given the principal repayment scheduled used (See Line 43 on the data sheet: back loaded payment plan), there is no significant advantage to delay the issuance of the bonds unless market interest rates change significantly.

4. For the two new debt authorizations, two 20-year bonds are to be issued (Lines 45 through 58).

Lines 60 and 61 show the total annual debt payment for existing and new debt. A 20 year debt payment schedule is used due to a lack of detailed information on each bond's individual debt term in addition to the reality that longer terms bonds are less attractive to many investors.

5.3.8 Capital Fund

Included in this dataset is a history of the financial status of the TWW Capital Fund as well as its current status (2022 Audit). This is provided for informational purposes indicating the limited financial condition of the Capital fund at this point in time.

5.3.9 Expenditures

Included in this dataset (11. Expenditures) is the history of TWW appropriations from 2016 through 2023, showing budget versus year end results. The data is obtained from the annual budgets of the City coupled with the audit statements to determine final expenditures. The "actual" column reflects the budget versus year-end actual expenditures. Under New Jersey budget / finance regulations, any unexpended budget appropriation is either "reserved", i.e., set aside for use during the remainder of the year, or carried through to the following year, or "cancelled" which returns the unexpended / uncommitted funds to year end fund balance. The key takeaway from this overview is that the TWW budgets in the operations and Salary and Wages (S&W) calculations have fairly liberal appropriations compared to the actual expenditure history of the utility.

Line 37 reflects the year end status for each budget year: actual expenditures versus appropriations. Line 38 are the reserves and Line 39 are the cancellations. Line 42 reflects the budget totals. Although the “budget” reflects significant growth, the actual year end expenditures are lower and show slower / less growth. However, one of the significant issues is the amount of the original budget that is unexpended at year end with a significant amount placed in a reserve account to be used during the succeeding year or, if unexpended, cancelled with the unexpended funds going directly to fund balance for reuse in the following year. An argument could be made that these budgetary practices of allocating a sizable amount of money to TWW and not authorizing many of the expenditure requests simply shifts the true cost of system upkeep further into the future, while giving the City the appearance of being generous with the TWW’s annual budgets.

The issue to be addressed is determining the actual total expenditures associated with each fiscal year: what is actually expended each year versus what is annually budgeted. A history of actual expenditures can serve as a benchmark for projecting future expenditure levels. The reality is that the TWW annual budget in recent years has had an appropriation level that has been overly optimistic and not realistic given the historic expenditure level. A well prepared budget should provide a level of appropriations that that can address recurring needs as well as providing for a reasonable level of unforeseen expenditures (e.g. a major equipment failure / excessive distribution system failures, etc.). This provides some organizational flexibility without the need to return to the governing body for “emergency appropriations” to address these unforeseen happenings. But in TWW, the amounts set aside for these unforeseen requirements seem to be excessive.

What this expenditure dataset shows is the year end status of the TWW utility appropriations, both actual expended and those remaining to be committed. Under budget law, when a project, repair activity, purchasing activity, or similar is undertaken, the cost must be anticipated and purchase orders established at the beginning to pay for the purchase, contracts for services, etc. which is being initiated. This guarantees that funding is available to pay these costs. At the end of a fiscal year the department managers should make sure that for projects under way there are funds available. This is done by creating an encumbrance of these needed funds. In the year end statement (for example, see “11. Expenditures”, D-3, year 2017, columns G and H) the “Actual” (column H) shows the actual expended appropriations as well as the reserves / encumbrances set aside for these ongoing / continuing costs initiated within the 2017 budget year. From a financial management viewpoint, these encumbrances remain until the end of the succeeding budget year (2018) and then, those not firmly committed to specific authorized activities, lapse to fund balance (line 45) for reuse in the subsequent budget year (2019).

In the dataset, the reserve / encumbrance at the end of the succeeding budget year (2018) that is to be cancelled is subtracted from the initial reserve / encumbrance for the year in question (2017) with this value then being added to the initial total expenditures for the initial year (2017 in this example) resulting in the true total cost for 2017 (line 47). This allows a comparison of the actual “total expenditures” for each of the budget years reflecting the true growth in the utility’s expenditures from 2016 through 2021, which was found to be relatively small. Information for 2022 is unavailable until the 2023 Audit is released.

5.3.9.1 Contributions / Transfers to the City

Included within the overall budget process are two distinct transfers of funds from TWW to the General Fund of the City. One is obvious in the Budget document (and is shown directly in the General Fund budget as income from the Water Utility): Contribution to the General Fund. This is shown on Line 40 of dataset 11. Expenditures. In 2022, this amounted to $2.65 million being moved from TWW to the General Fund for the City. One can justify this contribution as being similar to a "PILOT" (payment in lieu of taxes) since TWW is a publicly owned utility and not a private utility which would pay taxes to the City. For many years this contribution was stable but in recent years it has decreased due to the financial issues of TWW, namely its growing uncollected accounts receivable challenges.

The second transfer is included in the budget detail and is shown for budget years 2022 and 2023. Information from the rate analysis completed by Mr. Howard Woods (see below) shows that these costs occurred in prior years. This is a payment to the General Fund for specific allocated services rendered to TWW that are paid out of the city's current fund; for example, time expended by the Mayor's Office, the City Clerk's Office, the City Administrator, the Purchasing Agent, the Legal department, the City Finance Office, the Personnel Office, Data Processing, the Fire dept., and some miscellaneous consultant services and insurance items, etc. These are shown on the dataset in Line 43 for CY 2022 and 2023. In essence the total of these financial transfers in the last two years approximate 10% of the total budget. While these allocations may be reasonable, given the size of the utility, a detailed allocation methodology should exist, or in its absence, be developed to provide for justification of these allocations for existing and future years.

5.3.10 Budget Expenditure Projections

The dataset tab "12 Budget Expenditure Projections" contains the overall expenditure budget summaries for 2022 and 2023 as well as budget projections through the 2030 budget using the actual expense methodology. Various notes in this dataset provide information on the methodology of the various projections. In essence, there is a projected budget increase in 2024 (Line 31) and continuing forward due to a number of factors, including debt and anticipated inflationary increases and the need to address salary deficiencies. There are no significant recommendations as to operational changes that have budget impact (other than salary adjustments and new employees recommended for 2024, which are shown as add-ons). Hopefully some of the improvements and replacements funded through debt will provide some operational cost reductions / revenue improvements (e.g. reduced building maintenance expense due to building improvements, or meter replacements resulting in a revenue increase), but these savings are not included in the calculations for this evaluation.

5.3.11 Budget Revenue Projections

NJDEP provided a rate analysis and a ten-year revenue/expenditure projection, and subsequent ten-year rate projection prepared by Howard Woods, which has been reviewed as part of this report. Mr. Woods, prior to his passing in September 2023, was a well-respected professional engineer formerly employed by American Water who subsequently formed his own business specializing in rate analyses. Mr. Woods' analysis of Trenton Water Works was found to be very thorough. Mr. Woods apparently had extensive access to Trenton financial information, capital planning, revenue database, etc. The analysis is based upon his projection of the 2023 budget with data carried forward based his analysis on historic trend lines.

The preliminary analysis provided in this study uses a different methodology to project future needs and revenue requirements. As noted previously, the intent of this Section is to focus on identifying trends and approximations of current actual expenditures and future financial conditions. Specific detailed expenditure data was not readily available on a user friendly basis. For reasons cited elsewhere, this analysis uses aggregated historic expenditure data supplemented with funding for improvements noted in the Management section is a more reasonable approach to the future needs of TWW. However, more important than the development of a long term revenue flow, is the immediate and significant requirement (and revenue opportunity) to restore a reasonable accounts receivable balance.

Although the revenue projection includes two projected rate increases, in terms of equity, it is imperative to collect delinquent balances to ensure that any rate increase impacts all of the using customers. To allow existing delinquencies to continue only increases the amount of the rate increase upon paying customers further rewarding the delinquent customers who are not paying their fair share. The Budget projection anticipates a hopeful return to the “normal” delinquent balance of 12% to 15% by 2026 / early 2027.

In addition to the capturing of existing billed revenues funds, the funded ongoing replacement of all existing customer meters should result in a higher revenue flow by reducing the system’s “unaccounted for water”, one cause of which is the result of old meters' under-reading. This is a normal result of meter replacement, and, as noted elsewhere, it is common that the cost of meter replacement is recaptured within a relatively short time frame indicating a long term positive revenue flow from what is considered normal system maintenance. Additionally, the projected HVAC equipment replacements and various pumping replacements are likely to result in some energy reductions.

In sum, the recapture of existing delinquencies, plus the corrections of current revenue deficiencies in the billing structure, plus the revenue enhancements in meter replacement, plus various expenditure reductions, plus two projected rate increases. should allow the TWW to implement an aggressive Capital Improvement Program as well as meet all required water quality standards.

In addition to these revenues enhancements and expenditure savings, there exists opportunities to reduce City expenditures via grant and / or governmental funding. This Report assumes that all the required improvements are being accomplished without additional state or federal assistance.

In reality, TWW should receive funding assistance through the various federal and state lead reduction programs, as well as other infrastructure funding. These grants should decrease local debt and expenditure requirements in future years, further reducing future revenue requirements.

The dataset "13. Budget Revenue Projections" utilizes the 2022 and 2023 revenue structure of TWW to project forward the probable revenues for the next seven (7) years, through 2030. Line 4 is the annual expenditure requirement as shown in the Expenditure Budget Projection. In essence this is the need to be met by the revenue flow. Lines 6 through 17 are the anticipated revenue flows for the designated revenue sources. Most of these are based upon historical trend lines plus existing (2023) cash positions. The key lines are 8 thru 12, rents collected, including two potential Rate increases. Included in the dataset are footnotes as to the methodology of the calculations, and the collection of current delinquent accounts receivable as well as revenue increases that can be anticipated if these collections occurred. It is assumed that excess revenues in any one year will lapse to surplus to be reappropriated in subsequent years. Previous comments in this Report as to delinquent collections as well as billing corrections as to fire inch foot calculations are the underlying assumptions as to these calculations.

In sum, this analysis anticipates a 5% rate increase in 2024 and a 10% rate increase in 2029 to fund the projected expenditure pattern / debt service requirements.

6.0 SUMMARY AND CONCLUSIONS

6.1 Overall Summary

Notwithstanding recent steps taken at the direction of the NJDEP to address certain health and safety concerns associated with TWW's treated water, improve operational efficiencies, and to develop an increased focus on the proper maintenance of equipment, there remain many deficiencies and areas in critical need of improvement within Trenton Water Works. Broadly stated, TWW's lack of adequate TMF capacity can be attributed to systemic organizational and managerial failures, which have trickle-down effects on the technical and financial health of the utility. Unfilled positions at all employment levels, coupled with a lack of proper staff training and understanding of purpose, insufficient oversight, and lack of accountability has led to a culture of complacency across the organization. These include, but are not limited to, the areas of deficiency stated below.

6.1.1 Technical Capacity Summary and Conclusions

The Trenton Water Works' technical capacity is summarized as fair to poor. An overall theme of poor and deferred maintenance detracts from TWW's technical capacity by diminishing its mechanical reliability, redundancy, and treatment capacity. Below are several of the primary observations and conclusions found:

- The TWW treatment plant exhibits a combination of age-related issues and chronically deferred maintenance, which will require a significant degree of financial commitment to adequately address. These are described in greater detail in Section 3.11.1.

- The raw water supply sourced from the Delaware is more than sufficient for the demands of the system; no concerns were reported relative to loss of operation under drought conditions. Occasional plant shutdowns were reportedly necessary due to frazil ice as well as high raw water turbidity conditions in the river while using the previous screening facility. Reports from early 2024 indicate sand and grit are being drawn in and progressing through the raw water pumps to the effluent side of the mixing basins.

- Positive changes have been enacted since the involvement of NJDEP-appointed oversight contractors at the TWW treatment plant. Further improvements to sample collection, water quality monitoring, chemical dosing, equipment inspection and maintenance, and other operational considerations are still needed. A large-scale organizational mentality shift will be required to continue these new practices if and when NJDEP oversight ends, or TWW risks returning to a state of chronic noncompliance. This goal may be aided through improvements to TWW's hiring practices, general and job-specific training, enacting policies for employee accountability, continuity of executive leadership, and improvements to employee retention and compensation to recruit and keep skilled, dedicated employees.

- Most of the storage tanks in the system have recently been rehabilitated and repainted, which is a step in the right direction.
- Similar to the equipment at the treatment plant, TWW's buried assets have been neglected for many years. TWW purports to have a cleaning and lining program, however the proper forward-looking maintenance recommended by AWWA is to target a 100-year replacement cycle, resulting in the need to replace 1% of the system annually. By all indication, TWW replaces essentially no water main on a regular basis.
- Despite making progress in its lead service line replacement program, TWW has failed to meet the replacement rate as required by State law and preexisting Administrative Consent Orders (ACOs). A significant amount of lead services remain in the system; TWW has developed a conceptual ten-phase replacement plan to remove all known lead and galvanized services. Funding for later phases is unknown or uncertain. Historical delinquencies on loan payments have complicated TWW's ability to receive State funding for its LSLR program.
- In recent history, TWW has failed to comply with USEPA and NJDEP requirements, as well as several ACOs to address the open-air finished water Pennington Reservoir. This is a significant project with an equally significant financial commitment need from TWW and the City of Trenton. Until this ongoing violation is rectified, there exists an elevated likelihood of water quality issues throughout the system, including poor chlorine residuals/excessive disinfection by-product formation, growth of microbiological contaminants such as *Legionella* and *Cryptosporidium*, algal blooms and resultant cyanotoxin formation, and a recurrence of the spread of midge larvae throughout the distribution system.
- TWW has developed and actively maintains a GIS database, which is broadly used to record asset information, assign, and document maintenance activities, inform field crews of field assets, and track various programs including flushing, hydrant inspections, and valve exercising. This is a valuable asset to the overall operation of the distribution system and emphasis should be given to the ongoing updating and maintaining of the GIS database. Specifically, data gaps remain, such as installation years for mains; these data fields should be updated to the extent possible, and maintenance dashboards should be actively updated.

6.1.2 Managerial Capacity Summary and Conclusions

Several organizational issues were identified as part of this assessment, including:

- Historically, there has been frequent turnover in the Director position at TWW. This inconsistency in leadership has increased the difficulty to institute meaningful long-term improvements to employee morale, performance, structural and organizational efficiency, or any other facet of TWW.
- A lack of collaboration between Trenton Water Works and the Mayor and Council has led to a lack of understanding on both sides of how each operates. Specifically, there is an apparent unfamiliarity of the Mayor and Council of the unique needs of the Utility in terms of employment, equipment procurement, and other organizational items.
- There is a recognition of challenges posed by operating within the constraints of two distinct collective bargaining agreements (CBAs). Most if not all policy changes that impact members of these unions must be presented to and agreed upon by both TWW and the respective union. Additionally, there is an attitude amongst TWW personnel of protecting their own, which results in a lack of accountability.
- The pay structure and license stipends are not competitive with similar utilities. This is especially problematic for technical positions which require licenses; employees with these licenses are highly sought after and are more likely to look for higher compensation at other utilities.
- At least one member of TWW leadership should be actively involved in the DRBC; as one of the larger stakeholders and users of water from the Delaware, TWW has a vest interest in understanding the direction in which the DRBC is headed.
- Many employees within TWW lack proper training on their specific job duties. This statement extends from water repairers to staff in the Billing Division.
- Many vacancies exist within TWW organizational structure, with only some of these positions being funded by the City of Trenton. This lack of proper staffing leads to excessive overtime for the existing staff, ultimately increasing the likelihood of employee burnout.

6.1.3 Financial Capacity Summary and Conclusions

- Historically, TWW appears to have been adequately funded; the primary issue has been TWW’s inability to implement funded programs.

- At this time, there is a significant lack of experienced, knowledgeable leadership within TWW to manage and supervise its financial operations. A number of deficiencies exist in the billing operation.
- There is a significant number of delinquent accounts and a correspondingly high dollar value in outstanding collections. Previous moratoriums on utility shutoffs initiated during the COVID-19 pandemic as well as the NJDCA regulations barring wintertime shutoffs have limited Trenton Water Works' ability to enforce payment of bills.

6.2 Selected Recommendations

6.2.1 Technical Capacity Recommendations

Below is a summary the findings and recommendations which are fully stated in Section 3.011:

- Water Treatment Plant
    - Replace roof
    - Replace HVAC systems
    - Replace several chemical feed and handling systems, including ferric chloride, PAC, and fluoride. Improvements needed to the lime transfer system and piping
    - Electrical service upgrades to address intermittent brown-outs and limitations on finished water pump operation
    - Address deficiencies with raw water pumps and motors
    - Replacement and / or new VFD's for all four finished water pumps
    - Address widespread housekeeping issues, including inadequate lighting, dirty floors, debris and miscellaneous equipment and parts in walking areas, areas of spilled chemical and standing water, etc.
    - Rehabilitation / replacement of finished water discharge piping in crawlspace, including such work as repainting piping and valves blue rather than green, fix or replace the leaking gate valve, address poor access into this area
    - Rehabilitate or replace leaking swing arm check valve downstream of raw water pump #1
    - Address corrosion issues in the filter rooms by replacing corroded equipment and increasing airflow through the rooms to prevent buildup of chlorine vapor

  - [redacted]
  - Install or otherwise repair the currently non-functioning fire alarm system throughout the plant
  - Commission a full structural assessment of the plant, with specific attention to the lower areas between the filter galleries and the stairwells in the residuals handling building
  - Address effluent turbidity issues in Superpulsator unit #1, which is suspected to be due to a submerged leaking valve
  - Replace submerged valve hardware in the Superpulsators with stainless steel to address corrosion issues
  - Install a washdown system for the Superpulsator units
  - Modify the discharge outlet for the two clarifiers to optimize the collection of thickened sludge

- Booster Pump Stations

  [redacted]

  - Central Pumping Station
    - Remove existing coatings from pipes and equipment in the basement area and repaint to extend the remaining service life of these critical assets
    - Investigate various approaches to providing redundancy to this facility; currently, a failure at CPS will result in 70% to 80% of the customers losing service
  - Klockner Booster Station
    - Rehabilitate pump #3, which was inoperable at the time of inspection
  - Ewing Booster Station
    - Replace or rehabilitate the MCC, specifically the starter for pump #4, which was out of service at the time of inspection
- Distribution System
  - Continue implementation of the Lead Service Line Replacement Program

- Commit to a 100-year water main replacement cycle, resulting in approximately 3 miles of main replaced annually. A comprehensive water main replacement program should be instituted, which will include a methodology for prioritization of pipes, design of construction documents, justification of costs to decisionmakers and City officials, and the administration of construction phase activities
- Rehabilitation and repainting of the Hopewell Tank and the Jones Farm Tank
- Implementation of a system-wide, continuous leak detection program to address the excessively high unaccounted-for water (UAW) rates. Leak detection and repair work should continue until UAW rates fall into an acceptable range relative to other systems of comparable age and size
- Implement a meter replacement program to improve billing accuracy and theoretically reduce UAW. A formal testing and calibration schedule should be developed for larger and / or more critical meters in the system
- Address water quality issues related to dead end mains by providing infrastructure to allow for effective flushing of the mains. Where possible, dead ends should be looped to ensure the continual movement of water through the mains
- Comply with the requirements of the Water Quality Accountability Act, including maintenance activities such as valve exercising, hydrant inspection, and hydrant flushing
- Advance the Pennington Reservoir Improvements Project to comply with USEPA and NJDEP regulatory requirements pertaining to the operation of uncovered finished water reservoirs
- Perform condition assessments on critical transmission mains 20-inch and larger, prioritizing pipes with known break histories and those with little or no available record information
- Update GIS with missing asset information, such as diameters and operating direction for valves

A Summary of Proposed Capital Improvements is provided in **Table 6-1**.

Table 6-1: Summary of Proposed Water System Capital Improvements

Project No.	Priority Ranking	Asset Category	Primary Need	Risk	Project Description	Immediate (<1 yr)	2-3 Years	4-5 Years	6-10 Years
1	High	Distribution and Transmission	Regulatory	High	Lead Service Line Replacement Plan (Phases 3 through 10)	$14,300,000	$29,150,000	$32,500,000	$71,450,000
2	High	Pennington Reservoir Improvements	Regulatory	High	Pennington Reservoir Improvements	$3,000,000	$53,700,000	$73,000,000	$0
3	Medium	Distribution and Transmission	Renewal / Replacement	High	Water Main Replacements, 1% Replacement Rate	$6,000,000	$12,000,000	$12,000,000	$24,000,000
4	Medium	Distribution and Transmission	Operational Efficiency	Medium	Dead End Mains - Auto-Flushers	$1,200,000	$500,000	$0	$0
5		Distribution and Transmission	Capacity		Main Extensions - Sylvia St, Jacobs Creek, etc.	$0	$1,500,000	$200,000	$300,000
6		Distribution and Transmission	Operational Efficiency		Bulk Sale Interconnection with Bordentown	$0	$0	$3,000,000	$0
7	High	Meters	Operational Efficiency	Low	Phase I Meter Replacement Program	$10,000,000	$10,000,000	$0	$0
8	High	Meters	Operational Efficiency	Low	Phase II Meter Replacement Program	$0	$12,000,000	$13,000,000	$8,000,000
9	Low	Storage Facilities	Renewal / Replacement	Low	Brandon Farms (Hopewell Tank) Rehabilitation	$0	$0	$0	$2,200,000
10	Low	Storage Facilities	Renewal / Replacement	Low	Jones Farm Tank Rehabilitation	$0	$0	$0	$1,500,000
11	Low	Facilities	Security	Low	WTP Fire Alarm System Upgrades	$2,000,000	$0	$0	$0
12	High	Facilities	Renewal / Replacement	High	WTP Roof and HVAC Replacements	$2,000,000	$20,000,000	$0	$0
13	Low	Treatment	Process Improvements	Low	WTP Superpulsator Washdown System	$1,000,000	$0	$0	$0
14	Low	Treatment	Process Improvements	Medium	WTP Lime Feed Piping Improvements	$100,000	$400,000	$0	$0
15	Low	Treatment	Renewal / Replacement	Medium	WTP Clearwell Conduit Repairs	$600,000	$0	$0	$0
16	Medium	Treatment	Process Improvements	High	WTP High Service Pump VFD's	$400,000	$800,000	$0	$0
17	High	Treatment	Renewal / Replacement	High	WTP Raw Water Pump & Motor Replacement	$0	$750,000	$0	$0
18	Low	Treatment	Renewal / Replacement	Low	WTP Gravity Thickener Rehabilitation	$1,000,000	$1,000,000	$0	$0
19		Treatment	Process Improvements		WTP BFP Emulsion Polymer Feed System	$0	$500,000	$0	$0
20	High	Treatment	Renewal / Replacement	High	WTP Chemical System Improvements (Ferric, PAC, Fluoride)		$1,500,000		
21	High	Facilities	Operational Efficiency	High	WTP Electrical System Improvements and Service Upgrades	$750,000	$2,500,000	$0	$0
22	Low	Facilities	Operational Efficiency	Low	WTP Misc. Electrical and Lighting Improvements	$0	$200,000	$250,000	$560,000
23	Low	Facilities	Operational Efficiency	Low	WTP Laboratory Upgrades	$100,000	$400,000	$0	$0
24	Low	Treatment	Process Improvements	Low	WTP Gatehouse Repairs	$200,000	$0	$0	$0
25	Low	Treatment	Operational Efficiency	Low	SCADA Improvements	$0	$400,000	$0	$0
26	Low	Administration	Security	Low	Security Improvements - Treatment Plant	$0	$400,000	$0	$0
27	Low	Administration	Security	Low	Security Improvements - Remote Sites	$600,000	$0	$0	$200,000
28	Low	Misc Facility Improvements	Security	Low	Security Improvements - Cortland Street	$400,000	$100,000	$0	$0
29	Low	Misc Facility Improvements	Security	Low	Cortland Street Fence and Gate Improvements	$900,000	$0	$0	$0
30	Low	Misc Facility Improvements	Renewal / Replacement	Low	Cortland Street Office Renovation / Satellite Office	$0	$2,000,000	$0	$0
31	Low	Misc Facility Improvements	Operational Efficiency	Low	Cortland Street Salt Storage	$0	$0	$1,000,000	$0
32	Low	Misc Facility Improvements	Renewal / Replacement	Low	Cortland Street Roof Replacement	$500,000	$600,000	$0	$0
33	Low	Vehicles	Renewal / Replacement	Low	Vehicles	$1,340,000	$840,000	$1,385,000	$10,300,000
34		Administration	Planning	Low	Hydraulic Model Recalibration and UDF Development	$0	$0	$100,000	$0
					Totals	$46,390,000	$151,240,000	$136,435,000	$118,510,000

6.2.2 Managerial Capacity Recommendations

This report contains numerous suggestions throughout on managerial areas in need of improvement. This section only highlights those priority recommendations required to address the basic functioning of TWW. A full listing of recommendations on managerial capacity can be found in Section 4.3.

6.2.2.1 Priority Recommendations

1. DEP should continue providing oversight of TWW according to the 10-year schedule stated in this report.
2. Immediately implement a strict delinquent account collections process to restore the fiscal integrity of the water and sewer utilities.
   a. Reestablishment of structured turnoff process for delinquent customers
3. Immediately remove the residency requirement for hiring within TWW.
4. Protect current operation
   a. Additional WTP Senior Operators staffing to avoid burnout and resignations (for alternate jobs)
      i. Recruit an additional Senior Operator for the Solids / MDF
      ii. Recruit the necessary lab personnel to maintain the viability of this in-house function
   b. Obtain a W-4 distribution system operator to serve as system compliance officer, separate from other Divisions and who will report directly to Water Utility Division Manager
   c. Recruit a Chief Accountant / Budget Officer to maintain financial records and monitor accounts receivable
   d. Compensation – Establish competitive compensation for all employees, and specifically critical technical positions that are being lost to other utilities offering higher compensation and benefits
      i. Increase license stipends to encourage more upward mobility of qualified personnel as well as to retain existing licensed personnel
      ii. Expand the recruitment base for skilled personnel to include at least the neighboring municipalities which receive water service from TWW. A

second level of applicant recruiting should extend to the County level, with the understanding that this second level of recruitment can only be used in the absence of qualified recruits on the City only list.

5. Organizational changes

    a. Create an Executive Director position in charge of the water and sewer utilities. Create three Deputy Directors: one for the sewer utility and two for the water utility (DD of Operations and Maintenance, and DD of Organizational Operations). Only the Executive Director position is politically appointed by the City. This structure will provide continuity of leadership and limit the loss of institutional knowledge due to frequent turnover in leadership positions. Titles are placeholders and should be reviewed against existing titles within Civil Service, where applicable.

    b. Hire a qualified, experienced, full time regulatory compliance officer.

    c. Remove Mr. Johnson from any duties related to the water utility.

    d. Mayor to establish Oversight Committee by administrative order or (the preferred recommendation) established by City Council through ordinance change (permanent change), or by passage of a Resolution (temporary implementation)

6. Sunsetting NJDEP Oversight

    a. Establish a 10-year plan to slowly withdraw NJDEP support from TWW to encourage the positive improvements in operations to become permanent. Provide progressively less frequent inspections and check-ins as TWW demonstrates its ability to independently generate sufficient TMF capacity.

6.2.2.2 Secondary Recommendations

1. Personnel Management – Establish and enforce consistent personnel policies and procedures

    a. There is a need for more emphasis on productivity for existing personnel by establishing standard workload expectations versus actual work production

2. Engineering Division – complete restructure and expansion of Division to integrate engineering function into all areas of TWW operation. Provide the Engineering Division with a proper mission, responsibilities and adequate staff to accomplish same.

3. Customer Service & Billing – Establish SOP’s to ensure billing & collection standards are met and that all accounts are accurately read in a timely manner.

4. Review all existing SOP's and amend, revise, and expand as necessary to meet current requirements, train all personnel in these requirements, and enforce the standards for all employees through a progressive disciplinary process if necessary.
5. Review the laboratory and maintenance operations at the Water Treatment Plant and determine what portions of these functions should be privatized or performed by in house personnel.

6.2.2.3 Other Recommendations

These are included in the Summary sections for the various Divisions of Trenton Water Works and are repeated here:

1. Need to incentivize personnel to strive for upward mobility and obtain appropriate licensing through an updated compensation structure and increased licensing stipends.
    a. The W-1 and T-1 licensing should be a basic requirement for all Operations personnel
2. Establish and enforce consistent personnel policies and procedures for:
    a. Progressive Discipline - dealing with absenteeism (sick time & workers compensation) and the elimination of favoritism
    b. Training, including both onboarding and continuing education for existing staff
    c. Succession and transition planning
    d. Standard Operating Procedures – established, updated, maintained, communicated, and monitored
    e. Communication – sharing of ideas, top down, bottom up, and laterally across Divisions as appropriate and necessary
3. There is a need for more emphasis on productivity for existing personnel by establishing standard workload expectations versus actual work production
4. There is a need to verify if the existing customer base is accurate and reflects all users.
5. There is a concern that the existing rate billing structure does not fully conform with the revised 2020 rate structure since the available data does not show a comparable revenue increase.

a. Need to coordinate with the Meter Division, audit unmetered customers, and cross reference available databases of existing customers.

6.2.3 Financial Capacity Recommendations

Below is a summary of recommendations found throughout Section 5.0.

6.2.3.1 Priority Recommendations

1. Immediately implement a strict accounts receivable collection process to restore the fiscal integrity of TWW
2. Correct billing deficiencies
3. Employ a competent budget / fiscal officer and cross train all accounting personnel in proper expenditure / encumbrance processes

6.2.3.2 Other Recommendations

1. Complete residential meter replacement program and verify the calibration of all other meters in the distribution system to resolve one component of the lost water issue

7.0 BIBLIOGRAPHY

1. NJDEP Capacity Development Capacity, Criteria and Benchmarks for Technical, Managerial, and Financial (TMF) Capacity, August 2000. https://www.nj.gov/dep/watersupply/pdf/capdev.pdf

2. New Jersey Safe Drinking Act Water Rules N.J.S.A. 7:10 et. Seq.

3. Administrative Consent Order, New Jersey Department of Environmental Engineering, NEA090001-1111001, March 24, 2009.

4. Administrative Consent Order, New Jersey Department of Environmental Engineering, NEA090001-1111001, January 27, 2014.

5. Administrative Consent Order, New Jersey Department of Environmental Engineering, NEA180001-1111001, February 5, 2018.

6. Administrative Consent Order, New Jersey Department of Environmental Engineering, NEA180002-1111-001, July 26, 2018.

7. Inspection Report, New Jersey Department of Environmental Protection, sent on June 10, 2019.

8. Inspection Report, New Jersey Department of Environmental Protection, sent on September 27, 2022.

9. Unilateral Administrative Order, New Jersey Department of Environmental Protection, October 12, 2022.

10. Report of the Trenton Water Crisis, New Jersey Department of Environmental Protection, May 1976.

11. Forbearance letter to the Mayor and Council of Trenton, New Jersey Infrastructure Bank, October 12, 2022.

12. US Environmental Protection Agency, Polychlorinated Biphenyls (PCB's), https://www.epa.gov/pcbs/learn-about-polychlorinated-biphenyls#healtheffects

13. Standard Operating Procedures for Trenton Water Works, documents 1 through 25, various authors, various creation dates and revision dates.

14. Asset Management Plans for Trenton Water Works, documents 1 through 15, various authors, various creation dates and revision dates.

15. Operation and Maintenance Documentation for Trenton Water Works, documents (a) through (g), various authors, various creation and revision dates.

16. Emergency Response Plan for Trenton Water Works, documents (a) through (c), original document dated September 2003, last revision March 18, 2022.

17. GIS Database (ArcGIS Online), Trenton Water Works, hosted by Civil Solutions, various dashboards.

18. Capital Improvements Plan, Calendar Year 2023 Through 2032, Trenton Water Works Engineering Department, updated September, 27, 2023.

19. Technical, Managerial, and Financial Capacity Assessment of Trenton Water Works, Mott MacDonald, September 25, 2017.

20. Inspection Report of the Whitehorse Elevated Tank, Nick Rapagnani, USG Water Solutions, July 18, 2023

21. Inspection Report of the Ewing Tank, Veolia, August 16, 2022.

22. Inspection Report of the Lawrenceville Tank, Nick Rapagnani, USG Water Solutions, June 27, 2023.

23. Inspection Report of the Hopewell Tank, Nick Rapagnani, USG Water Solutions, April 26, 2023.

24. Mercerville 1,000,000 Gallon Elevated Tank Condition Assessment Report, Nick Rapagnani, SUEZ Advanced Solutions, April 18, 2019.

25. Technical Memorandum of Ultrasonic Thickness Testing at the Mercerville Tank, Robert Wells, Suburban Consulting Engineers Inc., April 14, 2022.

26. Monthly Operating Reports, TWW, January 2023 through December 2023.

27. Electrical Power Reliability Study, PS&S, October 18, 2023.

28. Department of Homeland Security, Critical Infrastructure & Key Resources Sector Specific Plan as Input to the National Infrastructure Plan, May 2007.

29. PEOSH & OSHA citations for chemical and confined space entry.
    http://www.osha.gov http://www.state.nj.us/health/peosh

30. American Water Works Association, Manual ANSI/AWWA G100-17 Water Treatment Plant Operation and Management, 2017.

31. American Water Works Association, Manual ANSI/AWWA G200-15 Distribution Systems Operation and Management, 2015.

32. American Water Works Association, Manual ANSI/AWWA G400-18 Utility Management System, 2018.

33. American Water Works, Manual ANSI/AWWA G410-18 Business Practices for Operation and Management, 2018.

Appendix F-1 - Revenues

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
1	**1. TWW REVENUES: ANNUAL BUDGET VERSUS ACTUAL FROM ANNUAL AUDITS**																												
2				**2016**	**2016 Actual**		**2017**	**2017 Actual**		**2018**	**2018 Actual**		**2019**	**2019 Actual**		**2020**	**2020 Actual**		**2021 (FY)**	**2021 actual**		**2021 TY(AFS)**	**1 TY Actual (AFS)**		**2022**			**2023**	**2023**
3	**source: D-2**			**SFY**			**SFY**			**SFY**			**SFY**			**SFY**			**SFY**			**6/30/2021**	**12/31/2021**			**actual**			**AFS draft**
4				BUDGET	6.30.16		BUDGET	6.30.17		BUDGET	6.30.18		BUDGET	6.30.19		BUDGET	6.30.20		BUDGET	6.30.21					BUDGET	12.31.22		Budget	12.31.23
5	**REVENUES**																												
6	Surplus			6,218,731	6,218,730		12,605,359	12,605,359		14,263,359	14,263,359		14,116,396	14,116,396		9,038,414	9,038,414		7,093,158	7,093,158		7,093,158	-		10,990,716	10,990,716		5,078,067	5,078,067
7	rents			39,571,683	39,699,553		39,650,000	39,295,266		39,200,000	39,002,602		39,000,000	39,744,236		37,300,000	35,287,335		35,287,335	39,982,667		39,982,667	25,201,412		44,817,811	47,566,857		47,566,858	45,252,202
8	fire hydrant rental			700,000	849,176		700,000	837,990		800,000	650,955		650,000	991,769		850,000	785,248		785,248	648,489		648,489	443,820		1,092,310	701,847		701,847	533,562
9	Misc			100,000	181,417		100,000	330,118		285,000	594,989		330,000	984,149		800,000	607,928		607,928	225,431		225,431	173,573		322,125	800,047		800,047	1,485,136
10	grants																					433,044	324,783						
11	reserves: vac & sic payout			500,000	500,000		1,000,000	1,000,000		1,000,000	1,000,000		-	-					4,238,845	-									
12		total		47,090,414	47,448,876		54,055,359	54,068,733		55,548,359	55,511,905		54,096,396	55,836,550		47,988,414	45,718,925		48,012,514	47,949,745		47,949,747	26,143,588		57,222,962	60,059,467		54,146,819	52,348,967.00
13																													
14	**Inc in above - Rents**																												
15	consumer accts receivable				39,712,630			39,263,106			38,979,386			39,727,955			35,342,565			40,017,634		15,319,492	32,691,791			47,587,363			45,756,415
16	consumer lien receivable				83,913			126,664			121,738			112,537			41,668			67,286			67,355			72,235			
17	pay state tax				(96,990)			(94,504)			(98,522)			(96,257)			(96,899)			(102,253)									
18																													
19	**Inc in Misc above**																												
20	interest				78,665			217,885			488,020			887,399			483,590			13,052						243,055			924,241
21	other misc				102,751			112,233			106,969			96,750			124,338			212,378									
22																													
23	**source: D-1**																												
24	**Other Revenues**																												
25	approp lapsed				9,041,092			8,081,383			11,338,784			3,896,138			9,285,261			4,450,870		4,450,870	1,542,258			2,022,432			5,109,671
26	prior yr accts payable				12,452			679,103			61,344			195,161			491,120			348,436		348,436	926,170			0.00			
27	cancel reserve/ retro payroll							3,704,448			1,000,000						194,203			-									
28	Def. Charges Overexpenditure										17,985																		
29																													
30	Unallocated Receipt													110															
31																													
32																													
33																													
34				**2016**	**2016 Actual**		**2017**	**2017 Actual**		**2018**	**2018 Actual**		**2019**	**2019 Actual**		**2020**	**2020 Actual**		**2021 (FY)**	**2021 actual**		**2021 TY(AFS)**	**1 TY Actual (AFS)**		**2022**			**2023**	**2023**
35	**source: D-2**			**SFY**			**SFY**			**SFY**			**SFY**			**SFY**			**SFY**			**6/30/2021**	**12/31/2021**			**actual**			**AFS draft**
36				BUDGET	6.30.16		BUDGET	6.30.17		BUDGET	6.30.18		BUDGET	6.30.19		BUDGET	6.30.20		BUDGET	6.30.21					BUDGET	12.31.22		Budget	12.31.23
37	**Fund Balance**																												
38	currect year excess revenue				9,633,945			**11,758,612**			11,992,336			6,438,107			8,005,157			5,465,813			5,096,050			**5,200,515**			3,495,275
39	fund balance beginning of yr				16,879,132			20,294,347			19,447,601			17,176,578			9,498,289			8,465,032			6,837,687			11,933,737			6,544,049
40		total			26,513,077			32,052,959			31,439,937			23,614,685			17,503,446			13,930,845			11,933,737			17,134,252			
41	less fund balance utilized				(6,218,730)			(12,605,359)			(14,263,360)			(14,116,396)			(9,038,414)			(7,093,158)			*0			(5,078,067)			5,078,067
42																							*10,990,715			*10,990,715			
43	**fund balance end of year**				**20,294,347**			**19,447,601**			**17,176,577**			**9,498,289**			**8,465,032**			**6,837,687**			**11,933,737**			**12,056,185**			**4,961,257**
44																									* possible error in 2022 audit				
45	**source: D2 - RENTS**																												
46	accts receivable				39,712,630			39,263,107			38,979,386			39,727,955			35,342,565			40,017,634						42,407,697			
47	liens receivable				83,913			126,664			121,738			112,537			41,668			67,286						52,423			
48	Sales tax payment				(96,991)			(94,504)			(98,522)			(96,257)			(96,899)			(102,253)						(92,740)			
49		TOTAL			39,699,552			39,295,266			39,002,602			39,744,235			35,287,334			39,982,667						42,367,380			
50																													
51	**source: D14- Operating Fund Res. For Encumberance**																												
52	Beg. Bal				3,337,530			3,958,597			3,334,636			6,590,654			7,607,373			5,641,890			6,706,766			6,706,766			
53	Increased by New PO										6,590,654			7,607,373			5,641,891			6,706,766			2,232,069			6,330,316			
54	Decrease by Prior Year PO										3,334,636			6,590,654			7,607,373			5,641,890			6,706,767			2,232,069			
55	closing bal				3,958,597			3,334,636			6,590,654			7,607,373			5,641,891			6,706,766			2,232,068			10,805,013			
56																													
57	**source: Unaudited AFS Data from TWW**																												
58	Consumer Accounts Receivable																												
59	Opening Balance							9,067,373			7,809,679			12,448,200			11,134,230			8,899,069		8,899,069	15,319,492			22,734,669			
60	Billed							39,464,114			44,365,827			39,602,461			34,204,917			47,158,243		47,158,243	32,691,791			46,161,410			
61	Transferred to Lien							627,224			67,857			244,791			281,248			2,843		2,843	67,355			52,423			
62	Collected							40,094,584			39,687,306			40,956,431			36,158,829			40,737,821		40,737,821	25,276,613			48,335,188			
63	Closing balance							7,809,679			12,488,200			11,134,230			8,899,069			15,319,492		15,319,492	22,734,669			20,281,959			
64																													
65	note: year 2021 data questionable given the transition from a fiscal to a calendar year in that time frame																												
66	2023 Audit not available. Year end balance provided by City Finance Office																												

Appendix F-2 - Billings Versus Received (Revised)

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**2. Revenue Report from the Division of Collections and Billing versus Audit Receipts**												
2					**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2021**	**2022**	**2023**
3					**SFY**	**SFY**	**SFY**	**SFY**	**SFY**	**SFY**	**SFY**	**CY**	**AFS**
4	**Annual total billings**						52,851,662	51,060,170	49,135,756	55,363,467		59,104,778	
5	source: Revenue Report (total billings for the cited year)												
6													
7	**source: Annual Audits D1 and F1 - income realized**												
8	Water	rents collected					39,002,601	39,744,235	35,287,334	39,982,667		47,566,857	
9		hydrants					650,955	991,768	785,247	648,489		701,846	
10		misc					594,988	984,149	607,928	225,431		800,047	
11							40,248,544	41,720,152	36,680,509	40,856,587		49,068,750	45,756,415
12	Sewer												
13		fees and charges					11,469,752	11,379,716	10,294,618	9,888,604		10,622,075	
14		rentals					31,900	31,900	-	31,900		31,900	
15							11,501,652	11,411,616	10,294,618	9,920,504		10,653,975	
16													
17		total collections					51,750,196	53,131,768	46,975,127	50,777,091		59,722,725	
18													
19		interest					53,157	91,895	2,678	63,996		54,626	
20													
21	**total realized**						51,803,353	53,223,663	46,977,805	50,841,087		59,777,351	
22													
23													
24	**Unaudited AFS Data**												
25	Consumer Accounts Receivable for the Water Utility									**6.30.21**	**12.31.21**	**12.31.22**	
26													
27	Opening Balance					9,067,373	7,809,679	12,488,200	11,134,230	8,899,069	15,319,492	22,734,669	20,281,959
28	Billed					39,464,114	44,365,827	39,602,461	34,204,918	47,158,243	32,691,791	46,161,410	49,098,007
29	Transferred to Lien					627,224	67,857	244,791	281,249	2,834	67,355	52,423	
30	Collected					40,721,808	39,687,306	40,711,640	36,158,829	40,737,821	25,276,613	48,561,697	46,291,634
31	Closing balance					7,809,679	12,488,200	11,134,230	8,899,069	15,319,492	22,734,669	20,281,959	23,088,332
32													
33													
34					**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2021**	**2022**	
35					**SFY**	**SFY**	**SFY**	**SFY**	**SFY**	**SFY**	**SFY**	**CY**	
36													
37	Delq. as % of total due												
38		total due				48,531,487	52,175,506	52,090,661	45,339,148	56,057,312	48,011,283	68,896,079	
39		Delq as % of total				0.1609	0.2393	0.2137	0.1963	0.2733	0.4735	0.2944	
40													
41	**Audit - Schedule D-8 for the Water Utility**												
42	Opening Balance				na	na	7,809,679	12,488,200	11,134,230	8,899,069		22,734,669	
43													
44	Billed	customer accts rec					40,272,260	35,505,156	30,059,804	42,982,090		42,407,696	
45		inch foot					3,247,999	3,251,014	3,251,014	3,251,014		2,784,975	
46		hydrants					845,568	845,290	846,049	846,049		689,805	
47			total				44,544,921	39,610,544	34,173,900	47,079,154		45,882,478	
48													
49	Collected	rents					39,147,587	39,976,388	35,687,120	40,017,634		47,587,363	
50		hydrants					650,955	991,768	785,247	648,489		701,846	
51		trans to liens					67,857	244,791	281,248	2,834		52,423	
52							39,866,399	41,212,947	36,753,615	40,668,957	-	48,341,632	
53													
54	Closing balance						12,488,200	11,134,230	8,899,069	15,319,492		20,281,959	

Appendix F-3 - Accounts Receivable

	A	B	C	D	E	F	G	H	I	J	K	L
1	**3. Accounts Receivables**		**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2021 AFS**	**2022**	**2023**	
2	**Schedule D 8 of Annual Audit**					6.30.19	6.30.20	6.30.21	12.31.21	12.31.22	12.31.23	
3	Opening balance			9,067,373		12,488,200	11,134,230	8,899,069		22,734,669	20,281,959	
4	Billed											
5		consumer Accts		39,464,114		35,505,156	30,059,804	42,982,090		42,407,696		
6		inch foot charge				3,251,014	3,251,014	3,251,014		2,784,975		
7		fire hydrant serv				846,290	846,049	846,049		689,805		
8		refund pr yr rev				8,083	17,032					
9		total				39,610,543	34,173,899	47,079,154		45,882,476		
10	Received											
11		collections	39,712,630	40,094,584		39,976,388	35,687,120	40,173,660		47,764,289		
12		refunds				(248,434)	(344,555)	(156,026)		(176,925)		
13		refund prior yr						(4,557)		(6,445)		
14		hydrants	849,176			991,768	785,247	648,489		701,846		
15		trans to lien		627,224		244,791	281,248	2,934		52,423		
16												
17		total		40,721,808		40,964,513	36,409,060	40,664,500		48,335,188		
18												
19	year end closing			7,809,679		11,134,230	8,899,069	15,319,492		20,281,959		
20												
21												
22			**2016 Actual**	**2017 Actual**	**2018 Actual**	**2019 Actual**	**2020 Actual**	**2021 Actual**		**2022 Actual**	**2023**	
23	**Unaudited AFS Data**		**FY**	**FY**	**FY**	**FY**	**FY**	**FY**		**CY**	AFS draft	
24	Consumer Accounts Receivable											
25												
26	Opening Balance		9,837,163	8,805,523	7,547,829	12,226,350	10,872,380	8,637,219	15,319,492	11,600,439	20,281,959	
27	Billed		38,667,914	39,464,114	44,365,828	39,602,461	34,204,918	47,158,244	32,691,797	46,161,411	49,098,007	
28	Transferred to Lien			627,224	67,858	244,791	281,249	(2,835)	(67,355)	52,423	535,218	
29	Collected		39,699,553	40,094,584	39,619,448	40,711,640	36,158,829	40,740,656	25,276,613	48,561,698	45,756,415	
30	Closing balance		8,805,523	7,547,829	12,226,350	10,872,380	8,637,219	15,057,642	22,734,669	9,147,729	23,088,332	
31												
32												
33												
34												
35												
36												
37												
38												
39												
40												
41												-

Appendix F-4 - BPU Usage & Delinquency Data (Revised)

	A	B	C	D	E	F	G	H	I	J	K	L
1	**4. BPU Submission: Customers, Financials, Usages**							equals questionable data				
2	source: W. Hood: Report to BPU Nov. 22, 2023											
3				H	I	M	P	R	T	V	Y	Z
4	2023			usage: water thru meter	revenues collected	# of customers	aver $ billed	median $ billed	aver usage	median usage	total $ billed	total $ collected
5				gallons	$							
6												
7	July	small meters		501,338,024	3,173,832	27,960	218	85	18	7,330	6,072,978	3,173,832
8		large meters		521,142,072	1,159,706	767	5,049	50,265	774,357	37,400	3,640,031	1,159,706
9												
10	August	small meters		380,476,932	4,458,068	23,727	124	96	16,195	7,480	2,923,105	4,458,068
11		large meters		66,321,420	2,110,583	587	88,909	842	130,297	89,137	476,555	2,110,583
12												
13	Sept.	small meters		135,497,208	3,887,049	10,794	113	65	13,015	2,992	1,185,181	3,887,049
14		large meters		168,679,236	1,722,665	398	229,816	(134)	465,964	(147,979)	935,831	1,722,665
15												
16	summer 2023 totals			1,773,454,892	16,511,903	64,233	324,229	51,219	1,399,847	(3,640)	15,233,682	16,511,903
17												
18	2022											
19	July	small meters		476,351,084	2,660,377	31,545	194	90	15,062	4,338	8,581,999	2,660,377
20		large meters		245,839,924	1,321,227	841	4,046	73,095	395,241	51,425	2,617,664	1,321,227
21												
22	August	small meters		312,148,628	4,458,068	23,203	131	99	13,668	8,677	2,999,826	4,240,942
23		large meters		118,242,344	1,834,815	564	1,712	756	249,456	71,958	809,713	1,834,815
24												
25	Sept.	small meters		338,876,912	3,394,493	22,897	329	90	1,272,055	4,862	7,569,366	3,394,493
26		large meters		629,712,776	1,156,929	918	4,010	38,926	870,972	63,954	3,031,830	1,156,929
27												
28	summer 2022 totals			2,121,171,668	14,825,909	79,968	10,423	113,056	2,816,454	205,214	25,610,398	14,608,783
29												
30												
31												
32												
33	2019											
34	July	small meters		300,486,560	2,568,847	21,307	137	76	14,207	6,732	2,903,837	2,568,847
35		large meters		135,585,756	1,499,484	620	3,861	121,824	309,100	104,720	1,737,331	1,499,484
36												
37	August	small meters		291,356,472	3,003,252	21,725	198	79	13,508	8,976	4,284,029	3,003,252
38		large meters		??	1,365,664	524	??	3,341	??	??	8,925,197	7,071,583
39												
40	Sept.	small meters		225,388,108	1,922,569	14,476	168	67	12,034	5,086	2,461,535	1,922,569
41		large meters		492,950,700	786,955	896	3,340	707	789,985	49,867	1,920,519	786,955
42												
43	summer 2019 totals				11,146,771	59,548		126,094			22,232,448	16,852,690
44												
45					**Summary Data Comparison**							
46					small meters 2023	2022	2019		small meters 2023	2022	2019	
47					small meters $ collected comparison				small meters amount billed comparison			
48					3,173,832	2,660,377	2,568,847		6,072,978	8,581,999	2,903,837	
49					4,458,068	4,458,068	3,003,252		2,923,105	2,999,826	4,284,029	
50					3,887,049	3,394,493	1,922,569		1,185,181	7,569,366	2,461,535	
51												
52					11,518,949	10,512,938	7,494,668		10,181,264	19,151,191	9,649,401	

Appendix F-4 - BPU Usage & Delinquency Data (Revised)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	**ARREARAGES**		source: W. Hood: Report to BPU Nov. 22, 2023								equals questonable data								
2	**2023**			**number of customers**					**arrearage in $**					**average arrearage in $**					**eligible for**
3				30-59 days	60-89 days	90-119 days	Over 120 days		30-59 days	60-89 days	90-119 days	Over 120 days		30-59 days	60-89 days	90-119 days	Over 120 days		**disconnect**
4	July	small meters		8,588	3,428	4,698	21,041		1,105,919	434,378	732,320	17,035,233		129	127	156	810		15,450
5		large meters		283	116	82	433		501,324	171,207	105,335	4,163,920		1,771	1,476	1,285	9,616		408
6																			
7	August	small meters		14,113	4,897	3,146	19,767		3,292,462	625,017	386,363	15,946,958		233	128	123	807		18,189
8		large meters		390	114	100	369		1,831,977	264,433	103,393	3,666,482		4,697	2,320	1,034	9,936		466
9																			
10	Sept.	small meters		37	1,428	5,710	18,696		768,422	2,715,887	568,493	15,025,591		20,768	1,902	100	156,517		21,573
11		large meters		160	259	95	349		210,172	910,420	197,430	3,541,647		1,314	3,515	2,078	10,148		546
12				totals as of 10.1.2023			19,045				as of 10.1.2023	18,567,238					as of 10.1.2023		22,119
13	**2022**			30-59 days	60-89 days	90-119 days	Over 120 days		30-59 days	60-89 days	90-119 days	Over 120 days		30-59 days	60-89 days	90-119 days	Over 120 days		
14	July	small meters		12,302	2,467	6,734	20,267		2,196,246	313,756	1,289,753	14,821,275		179	127	192	731		9244
15		large meters		593	42	141	421		1,589,379	44,197	320,267	4,270,501		2,680	1,052	2,271	10,144		27
16																			
17	August	small meters		12,823	8,777	1,991	20,176		2,404,239	1,549,045	257,489	15,140,665		187	176	129	750		9610
18		large meters		266	320	34	383		1,247,327	834,228	29,395	4,095,695		4,689	2,607	865	10,694		250
19																			
20	Sept.	small meters		6,604	9,738	7,387	19,340		844,922	1,878,434	1,327,351	14,666,694		128	193	180	758		10073
21		large meters		152	166	241	354		238,263	1,007,264	572,524	3,974,903		1,568	6,068	2,376	11,229		546
22				as of 10.1.2023			19,694				as of 10.1.2023	18,641,597					as of 10.1.2023		10,619
23	**2019**			30-59 days	60-89 days	90-119 days	Over 120 days		30-59 days	60-89 days	90-119 days	Over 120 days		30-59 days	60-89 days	90-119 days	Over 120 days		
24	July	small meters		7,347	5,151	3,859	13,999		1,202,016	489,615	505,039	6,420,281		164	95	131	459		3,253
25		large meters		137	117	26	155		205	145,661	17,719	1,921,086		1,500	1,245	682	12,394		88
26																			
27	August	small meters		8,139	6,018	3,329	13,913		1,185,794	968,518	315,811	6,313,382		146	161	95	454		3331
28		large meters		115	103	80	140		583,772	147,736	91,708	1,653,917		5,076	1,434	1,146	11,814		90
29																			
30	Sept.	small meters		6,545	6,459	5,537	13,906		630,520	953,938	883,242	6,195,816		96	148	160	446		3,463
31		large meters		143	84	90	146		179,222	502,118	108,941	1,315,840		1,253	5,978	1,210	9,013		92
32				as of 10.1.2023			14,052				as of 10.1.2023	7,511,656					as of 10.1.2023		3,555

Appendix F-4 - BPU Usage & Delinquency Data (Revised)

	A	B	C	D	E	F	G
1	**comparison of BPU data to other relevant data from the Division of Billing and Collections**						
2	July collections are prior quarter billings						Total
3				**2023**			Revs Billed
4		prior quarter		April	small meters		3,390,455
5					large meters		1,217,798
6				May	small meters		1,470,031
7					large meters		268,700
8				June	small meters		2,309,439
9					large meters		1,116,949
10						total	9,773,372
11							
12	**2023**				revs collected		Revs Billed
13	July	small meters			3,173,832		6,072,978
14		large meters			1,159,706		3,640,031
15	August	small meters			4,458,068		2,923,104
16		large meters			2,110,583		476,554
17	Sept.	small meters			3,887,049		1,185,180
18		large meters			1,722,665		935,831
19							
20	summer 2023 totals				16,511,903		15,233,678
21							
22				**2022**			Revs Billed
23		prior quarter		April	small meters		3,343,036
24					large meters		4,390,103
25				May	small meters		2,218,166
26					large meters		490,927
27				June	small meters		2,442,820
28					large meters		1,911,730
29							4,354,550
30							
31	**2022**				revs collected		Revs Billed
32	July	small meters			2,660,377		8,709,101
33		large meters			1,321,227		2,617,664
34	August	small meters			4,458,068		2,999,825
35		large meters			1,834,815		809,713
36	Sept.	small meters			3,394,493		7,569,366
37		large meters			1,156,929		3,031,829
38							
39	summer 2022 totals				14,825,909		14,410,733
40							
41				**2019**			
42		prior quarter		April	small meters		3,007,312
43					large meters		1,146,340
44				May	small meters		2,542,633
45					large meters		1,421,134
46				June	small meters		2,219,865
47					large meters		3,146,287
48							13,483,571
49	**2019**				revs collected		
50	July	small meters			2,568,847		
51		large meters			1,499,484		
52	August	small meters			3,003,252		
53		large meters			1,365,664		
54	Sept.	small meters			1,922,569		
55		large meters			786,955		
56							
57	summer 2019 totals				11,146,771		
58							
59				equals questonable data			

Appendix F-5 - Cash and Reserves (Revised)

	A / B / C / D	E	F	G	H	I	J	K	L	M	N	O
1	**4. Cash and Reserves**											
2		**2016 audit**	**2017 audit**	**2018 audit**	**2019 Audit**	**2020 Audit**		**2021 (FY) audit**	**2021 CY Audit**		**2022**	**2023**
3		**6.30.2016**	**6.30.2017**	**6.30.18**	**6.30.2019**	**6.30.2020**		**6/30/2021**	**12/31/2021**		**Audit**	**AFS draft**
4	**Audit Sch D**								**from 2022 audit**			
5	**Operation Fund**											
6	Cash	4,710,065	5,970,144	4,599,253	4,804,215	3,345,746		7,194,293	2,513,731		6,006,617	3,460,735
7	investments	35,313,652	32,500,968	30,908,476	27,503,060	21,847,405		12,857,795	12,860,506		16,100,652	15,011,402
8	interfunds receivable	6,712	22,394	27,522	27,522	4,241		5	8,494,068		695,719	629,245
9	revs with receivables											
10	customer accts	9,067,373	7,809,679	12,488,200	11,134,230	8,899,069		15,319,492	22,734,669		20,281,959	23,088,332
11	water liens	640,001	1,069,565	835,575	808,940	822,757		616,115	548,744		528,932	950,542
12	deferred chaqrges			17,984		83,951		-				
13												
14	reserves											
15	encumbrances	3,958,596	3,334,636	6,590,654	7,607,373	5,641,890		6,706,766	2,232,068		6,330,315	6,692,811
16	approp reserves	8,805,523	11,894,849	7,933,228	11,251,424	5,349,339		2,112,516	3,057,081		6,191,382	3,014,424
17	deposits	21,314	21,314	21,314	21,314	21,314		21,314	21,314		21,314	21,314
18	accts payable	914,961	684,130	880,274	1,178,267	2,914,524		1,461,349	3,455,859		1,035,688	1,078,903
19	accrued interest payable	1,196,159	1,131,045	1,254,163	1,029,353	1,380,188		1,233,585	1,473,246		605,289	1,349,811
20	interfunds payable	563,367	517,820	327,821	426,252	251,215		463,330	427,468		1,348,002	808,153
21	sick and vacation	500,000	1,462,611	1,365,224	1,323,023	1,258,341		1,216,043	1,215,453		1,180,537	1,174,706
22												
23	total reserves for receivables	88,798,244	9,707,375	13,323,776	11,943,171	9,721,827		15,935,607	23,283,413		20,810,891	
24	Operating Fund balance	20,294,347	14,447,601	17,176,577	9,498,289	8,465,032		6,837,687	11,933,737		6,544,049	4,961,257
25												
26	**CAPITAL**											
27	**cash**	2,954,041	3,895,437	6,986,617	2,624,629	2,084,660		2,662,078	1,327,705		59,533	191,484
28	**investments**	10,146,974	7,177,544	9,258,056	10,050,871	192,779		7,190,116	192,820		195,730	205,616
29	serial bonds NJIB & TWW Bonds	69,654,805	71,974,029	64,710,841	58,102,687	68,627,894		60,130,438	80,027,972		74,094,537	
30	serial bonds qualified	42,770,000	46,200,000	44,000,000	61,711,000	58,610,000		60,452,000	57,465,000		54,535,000	
31	BAN's	18,900,000	19,800,000	23,467,000	4,607,775	7,959,775		8,266,000	8,266,000		16,896,000	
32	interfunds payable			4,472	13,561	-		5	8,492,809		695,719	
33	encumbrances	11,476,854	13,646,325	2,820,353	23,903,777	28,031,150		16,376,677	27,059,867		1,402,176	
34												
35		**2016 audit**	**2017 audit**	**2018 audit**	**2019 Audit**	**2020 Audit**		**2021 (FY) audit**	**2021 CY Audit**		**2022**	**2023**
36		**6.30.2016**	**6.30.2017**	**6.30.18**	**6.30.2019**	**6.30.2020**		**6/30/2021**	**12/31/2021**		**Audit**	
37	Improvement Authorizations											
38	funded	999,942	999,734	6,999,734	2,054,832	6,780,580		668,655	668,655		668,655	668,655
39	unfunded	80,278,293	61,890,512	79,298,249	72,879,958	43,678,466		89,788,256	63,482,953		59,454,062	41,047,522
40												
41	Reserves for											
42	NJIB Loan	1,667,217	1,625,202	1,625,202	1,625,202	1,625,202		1,625,202	1,625,202		1,571,960	
43	CIP	295	6,000,295	6,000,295	6,000,000	1,230,975		1,230,975	1,230,975		1,230,975	1,230,975
44	encumbrances	13,646,325	11,476,854	2,820,353	23,903,777	28,031,150		16,376,677	27,059,867		9,742,324	22,078,118
45												
46	Capital Fund Balance	627,858	684,447	684,447	1,273,064	1,273,064		1,402,176	1,402,176		1,402,176	1,611,079
47												
48	Bonds and Notes authorized											
49	but not issued	82,452,496	69,982,282	79,562,297	93,449,989	71,127,952		107,189,307	100,816,913		72,938,651	

Appendix F-6 - TWW Capital Plan

Project No.	Priority Ranking	Asset Category	Primary Need	Risk	Project Description	Immediate (<1 yr)	2-3 Years	4-5 Years	6-10 Years
1	High	Distribution and Transmission	Regulatory	High	Lead Service Line Replacement Plan (Phases 3 thru 10)	$14,300,000	$29,150,000	$32,500,000	$71,450,000
2	High	Pennington Reservoir Improvements	Regulatory	High	Pennington Reservoir Improvements	$3,000,000	$53,700,000	$73,000,000	$0
3	Medium	Distribution and Transmission	Renewal / Replacement	High	Water Main Replacements, 1% Replacement Rate	$6,205,000	$13,026,000	$13,847,000	$30,156,000
4	Medium	Distribution and Transmission	Operational Efficiency	Medium	Dead End Mains - Auto-Flushers	$1,282,000	$551,000	$0	$0
5		Distribution and Transmission	Capacity		Main Extensions - Sylvia St, Jacobs Creek, etc.	$0	$1,688,000	$234,000	$382,000
6		Distribution and Transmission	Operational Efficiency		Bulk Sale Interconnection with Bordentown	$0	$0	$3,513,000	$0
7	High	Meters	Operational Efficiency	Low	Phase I Meter Replacement Program	$10,684,000	$11,026,000	$0	$0
8	High	Meters	Operational Efficiency	Low	Phase II Meter Replacement Program	$0	$13,163,000	$14,984,000	$9,847,000
9	Low	Storage Facilities	Renewal / Replacement	Low	Brandon Farms (Hopewell Tank) Rehabilitation	$0	$0	$0	$2,802,000
10	Low	Storage Facilities	Renewal / Replacement	Low	Jones Farm Tank Rehabilitation	$0	$0	$0	$1,808,000
11	Low	Facilities	Security	Low	WTP Fire Alarm System Upgrades	$2,068,000	$0	$0	$0
12	High	Facilities	Renewal / Replacement	High	WTP Roof and HVAC Replacements	$2,068,000	$21,642,000	$0	$0
13	Low	Treatment	Process Improvements	Low	WTP Superpulsator Washdown System	$1,034,000	$0	$0	$0
14	Low	Treatment	Process Improvements	Medium	WTP Lime Feed Piping Improvements	$103,000	$427,000	$0	$0
15	Low	Treatment	Renewal / Replacement	Medium	WTP Clearwell Conduit Repairs	$621,000	$0	$0	$0
16	Medium	Treatment	Process Improvements	High	WTP High Service Pump VFD's	$414,000	$855,000	$0	$0
17	High	Treatment	Renewal / Replacement	High	WTP Raw Water Pump & Motor Replacement	$0	$818,000	$0	$0
18	Low	Treatment	Renewal / Replacement	Low	WTP Gravity Thickener Rehabilitation	$1,034,000	$1,068,000	$0	$0
19		Treatment	Process Improvements		WTP BFP Emulsion Polymer Feed System	$0	$534,000	$0	$0
20	High	Treatment	Renewal / Replacement	High	WTP Chemical System Improvements (Ferric, PAC, Fluoride)		$1,637,000		
21	High	Facilities	Operational Efficiency	High	WTP Electrical System Improvements and Service Upgrades	$776,000	$2,671,000	$0	$0
22	Low	Facilities	Operational Efficiency	Low	WTP Misc. Electrical and Lighting Improvements	$0	$214,000	$284,000	$694,000
23	Low	Facilities	Operational Efficiency	Low	WTP Laboratory Upgrades	$103,000	$427,000	$0	$0
24	Low	Treatment	Process Improvements	Low	WTP Gatehouse Repairs	$207,000	$0	$0	$0
25	Low	Treatment	Operational Efficiency	Low	SCADA Improvements	$0	$435,000	$0	$0
26	Low	Administration	Security	Low	Security Improvements - Treatment Plant	$0	$427,000	$0	$0
27	Low	Administration	Security	Low	Security Improvements - Remote Sites	$621,000	$0	$0	$241,000
28	Low	Misc Facility Improvements	Security	Low	Security Improvements - Cortland Street	$414,000	$107,000	$0	$0
29	Low	Misc Facility Improvements	Security	Low	Cortland Street Fence and Gate Improvements	$931,000	$0	$0	$0
30	Low	Misc Facility Improvements	Renewal / Replacement	Low	Cortland Street Office Renovation / Satellite Office	$0	$2,181,000	$0	$0
31	Low	Misc Facility Improvements	Operational Efficiency	Low	Cortland Street Salt Storage	$0	$0	$1,137,000	$0
32	Low	Misc Facility Improvements	Renewal / Replacement	Low	Cortland Street Roof Replacement	$517,000	$641,000	$0	$0
33	Low	Vehicles	Renewal / Replacement	Low	Vehicles	$1,386,000	$912,000	$1,607,000	$12,994,000
34		Administration	Planning	Low	Hydraulic Model Recalibration and UDF Development	$0	$0	$114,000	$0
					Totals	$47,768,000	$157,300,000	$141,220,000	$130,374,000

Appendix F-7 - Debt

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	**7. Existing Debt**														
2			**2017**	**2018**	**2019**		**2020**		**2021**		**2021**		**2022 CY**		**2023 CY**
3	**Summary of all Debt Owed -**		6.30.17	6.30.18	6.30.19		6.30.20		6.30.21		6.30.22		12.31.22		budget
4	**Bonds**	**D 10**													
5	Starting Balance for all Bonds		42,770,000	46,200,000	44,000,000		61,711,000		58,610,000		60,452,000		57,465,000		54,535,000
6	Principal paid		(1,970,000)	(2,200,000)	(2,080,000)		(2,761,000)		(2,765,000)		(3,797,000)		(2,930,000)		(2,755,000)
7	net total														
8	Bonds Issued		5,400,000		19,791,000		(340,000)		4,607,000						
9	Total Issued Water Debt		46,200,000	44,000,000	61,711,000		58,610,000		60,452,000		56,655,000		54,535,000		51,780,000
10															
11	**Notes D 5**														
12	Starting Balance for all Notes		18,900,000	19,800,000	23,467,000		4,607,775		7,959,775		8,266,000		8,266,000		16,896,000
13	Bond Issued replacing ban				(19,791,000)				(4,607,000)						
14	Principal paid				(3,676,000)		-		(3,352,775)		-				
15	New Notes issued		900,000	3,667,000	4,607,775		3,352,000		8,266,000		-		8,630,000		
16	Notes yr end		19,800,000	23,467,000	4,607,775		7,959,775		8,266,000		8,266,000		16,896,000		16,896,000
17	Total Temporary Water Debt														
18															
19	**Infrastructure Loan**	**D 4**													
20	Starting Balance		69,654,805	71,974,029	64,710,842		58,102,687		68,627,894		60,920,467		80,676,418		74,742,985
21	Principal Paid		(7,527,687)	(7,263,188)	(6,608,154)		(6,541,152)		(7,707,427)		(5,244,049)		(5,933,433)		(6,000,000)
22	New Loan		9,846,911				15,000,000				25,000,000				
23			71,974,029	64,710,842	58,102,687		68,627,894		60,920,467		80,676,418		74,742,985		68,742,985
24															
25	Source: Annual Audit														

Appendix F-8 - Bonds and Notes (Revised)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	**8. Existing Bonds and Notes**																
2	**Environmental Infrastructure trust fund loans**																
3	**Detailed Information**		source: 2022 Audit														
4	source: D4A- State Infra structure loans			**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**
5	**State Loans**		balance														
6			12.31.22														
7	Oct 2004	principal	746,261	7,048	400,000	420,000	(80,786)										
8	clean & lining	interest	5.0-4.375	37,313													
9																	
10	Oct 2004	principal	703,267	350,426	352,840												
11	clean & lining	interest	na														
12																	
13	Nov 2006	principal	3,280,709	815,000	850,000	895,000	930,000	(209,290)									
14	pretreat	interest	4.25-5	139,430													
15																	
16	Nov 2006	principal	1,149,942	222,579	221,762	220,931	222,033	221,153	41,481								
17	pretreat	interest	na														
18																	
19	Nov 2006	principal	6,382,491	550,177	1,882,332	1,887,183	1,881,289	181,508									
20	pretreat	interest	na														
21																	
22	Nov. 2007	principal	816,000	220,000	225,000	235,000	33,348	102,652									
23	pretreat #2	interest	4.2-5	34,680													
24																	
25	Nov. 2007	principal	1,009,371	498,866	490,898	19,606											
26	pretreat #2	interest	na														
27																	
28	Mar 2010	principal	912,000	120,000	125,000	130,000	140,000	140,000	150,000	155,000	(48,000)						
29	pumping	interest	4	36,480													
30																	
31	Mar 2010	principal	2,282,415	326,059	326,059	326,059	326,059	326,059	326,059	326,059							
32	pumping	interest	na														
33																	
34	Dec 2010	principal	2,639,000	305,000	320,000	335,000	355,000	370,000	390,000	410,000	430,000	(276,000)					
35	reservoir	interest	5	131,950													
36																	
37	Dec 2010	principal	2,081,695	260,211	260,211	260,211	260,211	260,211	260,211	260,211	260,211						
38	reservoir	interest	na														
39																	
40	May 2015	principal	1,605,000	125,000	130,000	135,000	145,000	150,000	155,000	160,000	170,000	175,000	180,000	39,822	40,178		
41	clean & lining	interest	5	80,250													
42																	
43	May 2015	principal	4,130,873	256,065	484,351	484,351	484,351	484,351	484,351	484,351	484,351	484,351	after year 1				
44	clean & lining	interest	na														
45																	
46	May 2017	principal	1,835,000	410,000	115,000	115,000	120,000	120,000	255,000	255,000	265,000	265,000	435,000 thru	435,000	435,000		

Appendix F-8 - Bonds and Notes (Revised)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
47	clean & lining	interest	5-2.5-3	91,750													
48																	
49	May 2017	principal	4,520,509	322,893	322,893	322,893	322,893	322,893	322,893	322,893	322,893	322,893	322,893	322,893	322,893	322,893	322,893
50	clean & lining	interest	na														
51																	
52	May 2019	principal	11,110,000	616,666	616,666	616,666	616,666	616,666	616,666	616,666	616,666	616,666	616,666	616,666	average to 2041		
53	lead removal	interest	na														
54																	
55	May 2019	principal	3,890,000	305,000	160,000	165,000	170,000	175,000	180,000	185,000	255,000	255,000	255,000	255,000	average to 2040		
56	lead removal	interest	na														
57																	
58	? No id.	principal	25,000,000	a	-	-	-	-	-	-	-	-	-	-	average tp 2053		
59	lead removal	interest	na														
60																	
61	**total outstanding / prin paid**		**74,094,533**	**5,710,990**	**7,283,012**	**6,567,900**	**5,926,064**	**3,261,203**	**3,181,661**	**3,175,180**	**2,756,121**	**1,842,910**	**1,374,559**	**1,669,381**			
62	prin remaining			68,383,543	61,100,531	55,389,541	49,027,583	45,791,746	42,635,451	39,485,637	36,754,882	34,937,338	33,127,779	31,458,398			
63	est interest at stated value			**551,853**													
64																	
65	total payments			6,262,843	7,283,012	6,567,900	5,926,064	3,261,203	3,181,661	3,175,180	2,756,121	1,842,910	1,374,559	1,669,381			
66																	
67	2023 budget		prin	6,000,000*													
68			int	650,000*													
69	na = no interest listed on D4A, 2022 Audit																
70	a= no payments shown - line of credit payable up to 2053																
71																	
72	**Serial Bond Funds Qualified**			**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**		
73			balance														
74			12.31.22														
75	June, 2010	principal	6,405,000	380,000	380,000	38,000	380,000	380,000	380,000	380,000	380,000	380,000	380,000	380,000	to 2040		
76	refunding bonds	interest	4.25-4.5	272,213													
77																	
78	Jan. 2012	principal	19,348,000*	matured 2022?													
79	distribution system	interest	4.25														
80																	
81	Mar. 2013	principal	5,245,000	490,000	490,000	490,000	485,000	485,000	480,000	470,000	465,000	455,000	450,000	330,000	to 2035		
82	refunding	interest	4 - 3.5	209,800			3.0	3.0	3.1	3.3	3.4						
83																	
84	June.2015	principal	4,275,000	140,000	140,000	140,000	140,000	140,000	140,000	140,000	140,000	140,000	140,000	140,000	to 2045		
85	distribution	interest	4.0-3.0	171,000													
86																	
87	Sept. 2015	principal	1,245,000	180,000	180,000	180,000	180,000	180,000	175,000	170,000	?	?					
88	refunding	interest	5	62,250				3.75									
89																	
90	June.2017	principal	4,750,000	150,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	to 2046		
91	distribution	interest	3	142,500										3.125			
92																	

Appendix F-8 - Bonds and Notes (Revised)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
93	Dec. 2019	principal	17,390,000	600,000	600,000	600,000	625,000	625,000	650,000	650,000	675,000	700,000	725,000	750,000	to 2043		
94	series 2018	interest	5	869,500						3.25	3.25	3.38		3.50			
95																	
96	Dec. 20220	principal	4,365,000	625,000	625,000	625,000	625,000	135,000	145,000	155,000	165,000	175,000	190,000	200,000	to 2045		
97	series 2020	interest	2	87,300				2.00		3.00		2.00					
98																	
99																	
100	Dec. 2021	principal	10,860,000	715,000	720,000	725,000	730,000	730,000	730,000	730,000	730,000	730,000	730,000	725,000	to 2037		
101	refunding bonds	interest	4	434,400													
102																	
103	total outstanding / prin paid		54,535,000	**3,280,000**	**3,335,000**	**2,998,000**	**3,365,000**	**2,875,000**	**2,900,000**	**2,895,000**	**2,755,000**	**2,780,000**	**2,815,000**	**2,725,000**			
104	principal remaining			51,255,000	47,930,000	44,932,000	41,567,000	38,692,000	35,792,000	32,897,000	30,174,000	27,367,000	24,552,000	21,827,000			
105	est interest at stated value			**1,976,750**													
106																	
107	total			5,256,750	3,335,000	2,998,000	3,365,000	2,875,000	2,900,000	2,895,000	2,755,000	2,780,000	2,815,000	2,725,000			
108																	
109	2023 budget		prin	2,755,000*													
110			int	2,060,538*													
111																	
112	**total prin to be paid**			**8,990,990**	**10,618,012**	**9,565,900**	**9,291,064**	**6,136,203**	**6,081,661**	**6,070,180**	**5,511,121**	**4,622,910**	**4,189,559**	**4,394,381**			
113	Est. interest to be paid			**2,528,603**													
114																	
115	**Bond Anticipation Notes - D 5**			**16,896,000**													
116	2023 budget		prin	650,000													
117			int	510,000													
118																	
119																	
120	**Debt Projected in 2022 Audit Item D "Long Term Debt" of the Notes to Fiscal Statements:**																
121				**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**				
122	Principal			9,114,379	9,821,424	9,205,262	9,303,989	6,590,111	5,872,897*	5,872,897*	5,872,897*	5,872,897*	5,872,897*				
123	Interest			2,779,582	2,961,277	2,677,446	2,481,301	2,242,340	1,767,582*	1,767,582*	1,767,582*	1,767,582*	1,767,582*				
124				0.0540	0.0610	0.0590	0.0596	0.0579	0.0493								
125				0.0540	0.0610	0.0590	0.0596	0.0579	0.0493								
126	annual interest % , from bonds and notes page,= line 119 (interest) divided by total amount outstanding (line 101)																
127	Total for 2028-2032 (5 yrs)		chart 2028-2032 uses annual avarage					principal	29,364,489								
128								interest	8,837,911								

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**9. Future Debt Projections**												
2				**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
3	**Existing Debt**		existing debt from line 109 and 110 of data base "bonds notes"										
4													
5	total prin paid			8,990,990	10,618,012	9,565,900	9,291,064	6,136,203	6,081,661	6,070,180	5,511,121	4,622,910	4,189,559
6	Est. interest paid			2,528,603									
7				0.049	est @ .05								
8													
9	**Debt Projected in 2022 Audit Item D "Long Term Debt" of the Notes to Fiscal Statements:**												
10	Principal			9,114,379	9,821,424	9,205,262	9,303,989	6,590,111	5,872,897	5,872,897	5,872,897	5,872,897	5,872,897
11	Interest			2,779,582	2,961,277	2,677,446	2,481,301	2,242,340	1,767,582	1,767,582	1,767,582	1,767,582	1,767,582
12				0.0540	0.0610	0.0590	0.0596	0.0579	0.0493				
13	Total for 2028-2033 (5 yrs)			uses annual avarage				prin	29,364,489				
14								int	8,837,911				
15													
16	**Debt to be added**												
17	**State Loans**												
18	? No id.		principal	25,000,000				500,000	500,000	500,000	750,000	750,000	750,000
19	lead removal		interest			500,000	500,000	490,000	480,000	470,000	455,000	440,000	425,000
20			principal to be oaid over a 50 year period										
21			assume interest payments stating in 2025 at 2% annual of unpaid debt										
22													
23	**Exisiting Autherized but Unfunded Debt**												
24		**D7**		72,938,651	authorized but not funded bonds does not include 16,896,000 in issued notes								
25		note: some of the listed appropriations may be superceded by other loans / grants, or may be cancelled.											
26		if cancelled, this TMF assumes they will be replaced by other compatable capital projects											
27		consequently a total of 60,000,000 is used to reflect potential existing and future funding requirements											
28		note: in addition to this 60,000,000, this projection includes an additional 15,000,000 in existing BANS to be permanently funded											
29		**2027 new bond for 20 yrs at 2.5%**											
30			principal		60,000,000			1,800,000	1,800,000	1,800,000	2,184,000	2,184,000	2,184,000
31			principal outstanding					58,200,000	56,400,000	54,600,000	52,416,000	50,232,000	48,048,000
32			int		2.50%			1,500,000	1,455,000	1,410,000	1,365,000	1,310,400	1,255,800
33													
34													
35				**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
36													
37	**Existing BANS**			16,896,000									
38		note: BANs require a paydown of pricipal over a 10 year perioid or permanent refunding											
39		**2026 new bond for $15,000,000 for 20 yrs at 2.5%**											
40			principal	510,000	600,000	796,000	450,000	450,000	450,000	546,000	546,000	546,000	600,600
41			principal outstanding				14,550,000	14,100,000	13,650,000	13,104,000	12,558,000	12,012,000	11,411,400
42		Note	interest	650,000	650000	650.000							
43		Bond	interest		2.50%		375,000	363,750	352,500	341,250	327,600	313,950	300,300
44													
45	**New Debt for CIP**												
46	**Facilities and Equipment**			**new bond for $20,000,000 for 20 years at 2.5%**									
47	issued 2024												
48		BAN's for 3 yrs - interest @ 2%				400,000	400,000	400,000					
49	Funded 2028	Principal								600,000	600,000	600,000	470,000
50		principal remaining							20,000,000	19,400,000	18,800,000	18,200,000	17,600,000
51		bond interest @ 2.5%							500,000	500,000	485,000	470,000	455,000
52													
53				**2029 new bond for 20 yrs at 2.5%**									
54	issued 2027	BAN's for 3 yrs - interest @ 2%						400,000	400,000	400000			
55	Funded 2030	Principal										600,000	600,000
56		principal remaining									20,000,000	19,400,000	18,800,000
57		bond interest @ 2.5%									500,000	500,000	485,000
58		2031 new bond for 20 yrs at 2.5%											
59													
60	Total projected Principal and interest per year												
61				13,053,961	14,032,701	13,179,406	13,510,290	14,736,201	13,577,979	14,207,729	14,853,079	15,354,829	15,166,179
62													
63	bond / note payment schedule: assume 20 year payment schedule, backend base loaded with 2.5% interest on outstanding principal												
64		yrs 1-3, 3% of principal; 4-6, 4%; 7-9, 5%; 10-18, 6%; 5%; 18-20											

Appendix F-10 - Capital Fund

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	**CAPITAL IMPROVEMENT FUND**																
2				**2016 Actual**		**2017 Actual**		**2018 Actual**		**2019 Actual**		**2020 Actual**		**2021 TY Actual**		**2022**	**2023**
3	**source:Annual Audit: D-2**			**SFY**		**SFY**		**SFY**		**SFY**		**SFY**		**12/31/2021**		**Audit**	**AFS**
4														**(AFS)**			
5	Capital Improvement Fund																
6	opening bal			295		295		6,002,295		6,002,295		6,002,295		1,232,975		1,232,975	1,230,975
7	appropiation			1,000,000		6,000,000						1,230,680					
8	authorizations			1,000,000								6,000,000					
9	yr end			295		6,000,295		6,002,295		6,002,295		1,232,975		1,232,975		1,232,975	1,230,975
10																	
11	Capital fund Balance																
12	opening bal			627,858		627,858		684,447		684,447		1,273,064		1,273,064		1,273,064	1,402,176
13	change					56,588				588,617							208,903
14	closing bal			627,858		684,447		684,447		1,273,064		1,273,064		1,273,064		1,273,064	1,611,079
15																	
16	**D-13: Statement of Encumbrances CAPITAL**																
17	Capital fund reserve for encumbrances																
18	opening bal			12,158,322		13,646,326		11,476,855		2,820,353		23,903,777		28,031,150		38,714,341	
19	increased			13,646,326		11,476,854		2,820,353		23,903,777		28,031,150		27,059,868		9,742,325	
20	trans to Imp Authorizations			12,158,322		13,646,325		11,476,855		2,820,353		23,903,777		16,376,677		27,059,868	
21	closing bal			13,646,326		11,476,855		2,820,353		23,903,777		28,031,150		38,714,341		21,396,798	

Appendix F-11 - Expenditures

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE
1	**11. EXPENDITURE HISTORY OF THE TWW**																														
2				**2016**	**Actual**		**2017**	**Actual**		**2018**	**Actual**		**2019**	**Actual**		**2020**	**Actual**		**2021 (FY)**	**actual**		**2021 TY(From AI**	**21 TY Actual (AFS)**		**2022**	**actual**		**2023**	**est**		
3				**SFY Budget**	**6.30.16**		**SFY Budget**	**6.30.17**		**SFY Budget**	**6.30.18**		**SFY Budget**	**6.30.19**		**SFY Budget**	**6.30.20**		**SFY Budget**	6.30.21		**12/31/2021**	**12/31/2021**		**CY Budget**	12.31.22		**CY Budget**	**12.30.23**		
4	**EXPENDITURES D3**																														
5	Personnel services S & W			8,887,761	6,612,338		9,337,095	6,301,691		10,127,169	9,201,852		11,866,749	7,082,054		10,074,879	8,859,418		10,385,531	9,665,286		5,716,744	5,573,858		13,542,809	11,721,010		14,191,600	12,103,174		
6		reserved*			2,275,422*			3,035,403*			925,316*			4,784,694*			1,215,460*			720,244*						1,760,661*			2,088,425*		
7	Other Expenses			19,738,956	14,248,481		20,418,979	12,756,527		21,398,101	14,703,017		24,884,905	18,683,378		20,251,220	16,209,259		21,558,338	20,425,972		9,170,471	6,482,577		23,792,015	20,462,716		21,487,169	14,291,894		
8		reserved*			5,490,474*			7,662,451*			6,695,083*			6,201,527*			4,041,960*			1,132,366*			2,232,069*			3,326,298*			7,195,275*		
9	reserves: vac & sic payout			500,000	500,000		1,000,000	1,000,000		1,000,000	1,000,000		-	-		-	-		-												
10		reserved*																													
11	Capital Improvement fund contribution			1,000,000			6,000,000	6,000,000		6,000,000	6,000,000		-	-		-	-		-									-			
12	Capital Outlay			1,000,000	189,290		1,000,000	24,267																	1,000,000	-		275,000	-		
13		reserved*			810,710*			975,733*																		1,000,000*					
14	Debt principal			5,900,562	5,900,552		6,098,481	6,098,479		6,450,464	6,170,463		6,608,155	6,608,155		5,888,690	5,867,632		5,861,749	5,861,749		5,620,659	5,244,049		6,648,348	5,933,433		6,000,000	5,982,769		
15	reserved	cancelled **						1*			280,001**						21058*									714,915*					
16	BAN Principle			1,284,888	1,083,111		1,140,972	883,201		1,207,654	848,066		1,036,555	706,522		944,601	644,568		873,690	379,257		788,964	(167)		1,129,201	947,061		650,000	417,713		
17	reserved	cancelled **			201,776**			257,770*			359,587**			330033**			300033*			494,433*						182,139*					
18	Note Principal												9,000	9,000					775	775											
19	Interest on Notes			94,435	72,859		319,734	307,377		366,552	384,537		589,959	343,775		123,460	227,415		214,057	(14,933)		103,502	6,398		274,826	274,826		510,000	536,538		
20	reserved	cancelled **			21,575**			12,357*						246184**						228,990**											
21																															
22	PERS			1,072,573	1,072,573		1,116,982	1,116,982		1,161,949	1,161,949		1,296,591	1,296,591		1,296,591	1,296,591		1,296,591	1,296,591		-			1,826,099	1,826,099		2,017,000	2,017,000		
23	FICA			748,777	519,860		770,489	549,227		831,058	588,841		801,853	604,781		770,728	740,596		878,643	805,393		356,639	613,382		956,922	955,500		1,100,000	970,201		
24		reserved*			228,916*			221,261*			242,216*			197,071*			30132*			73250*						1422*					
25	UE			63,622	63,621					70,612	-		68,131	-		61,786.00	-		74,655	-		50,000	-		100,000	-		50,000	-		
26		reserved*									70,612*			68,131*			61786*			74655*						100,000*					
27	Comp General Liability																		112,000												
28		reserved*																		112000*											
29	Deferred Charges (Over Exp)												17,985	17,985		20,000	20,000		83,951	83,951								400,512	400,512		
30	Qual Bond			3,648,850	3,641,870		3,637,161	3,620,474		3,784,801	3,784,800		3,766,514	3,728,103		5,506,459	5,506,456		5,022,532	5,012,124		3,362,649	2,488,070		5,302,741	5,302,741		4,815,538	4,815,535		
31	reserved	cancelled **			6,979**			16,686*						38,410**			2*			10408*											
32																															
33																															
34				**2016**	**Actual**		**2017**	**Actual**		**2018**	**Actual**		**2019**	**Actual**		**2020**	**Actual**		**2021 (FY)**	**actual**		**2021 TY(From AI**	**21 TY Actual (AFS)**		**2022**	**actual**		**2023**	**est**		
35				**SFY Budget**	**6.30.16**		**SFY Budget**	**6.30.17**		**SFY Budget**	**6.30.18**		**SFY Budget**	**6.30.19**		**SFY Budget**	**6.30.20**		**SFY Budget**	6.30.21		**12/31/2021**	**12/31/2021**		**CY Budget**	12.31.22		**CY Budget**	**12.30.23**		**AFS**
36																															
37	Grand total			43,940,424	33,904,555		50,839,893	38,658,225		52,398,360	43,843,525		50,946,397	39,080,344		44,938,414	39,371,935		46,362,512	43,516,165		25,169,628	20,408,167		54,572,961	47,423,386		51,496,819	41,535,336		48,228,128
38		reserves			8,805,523*			11,894,848*			7,933,228*			11,251,423*			5,349,339			2,112,516*						6,191,382*			6,692,811*		3,014,424
39		cancelled			230,332**			286,814**			639,590**			614,627**			321,093**			733,831**						897,055*			254,265*		
40	transferred to the GF			3,150,000	3,150,000		3,150,000	3,150,000		3,150,000	3,150,000		3,150,000	3,150,000		3,050,000	3,050,000		1,650,000	1,650,000					2,650,000	2,650,000		2,650,000	2,650,000		2,650,000
41																															
42	current fund budget total			47,090,424	37,054,555		53,989,893	41,808,225		55,548,360	46,993,525		54,096,397	42,230,344		47,988,414	42,421,935		48,012,512	45,166,165					57,222,961	50,073,386		54,146,819	44,185,336		51,257,635
43		internal transfers																							1,899,499***			1,974,499***			
44	**D-1**																														
45	appr reserves lapsed				8,081,383			11,338,784			3,896,138			9,285,261			4,450,870			2,022,432											
46	approp reserved actually expended				724,140			506,064			4,037,090			1,966,162			898,469			90,084											
47	total exp				34,628,695			39,164,289			47,880,615			41,046,506			40,270,404			43,606,249											
48																															
49	Note: line 38, reserves, represents appropriations/ encumbrances unexpended at year end which are set for the remained of the year should the expense expense require payment.																														
50		The following year they are cancelled at year end with those funds being lapsed to fund																													
51	Note: line 39, cancelled, represents appropriations cancelled at year end with those funds being lapsed to fund balance (surplus)																														
52	Note: line 40 is an annual contribution to the General Fund in lieu of taxes that would be paid by a private entity																														
53	Note: line 43 ***represents payments by the TWW to the General Fund for services rendered to the TWW																														
54		They are already included in the Expended totals above																													
55	Note: line 45, appr reserves lapsed, is from succeeding year Audit, schedule D1 - revenues from prior year budget reservations, encumbrances cancelled																														
56		with this amount cancelled to surplus																													
57	Note line 46: reserves expended respresents reserves established (line 38) less reserves lapses (line 45)																														
58	Note: line 47, Total expense, is sum of line 37 total expenditure plus future year cancellations (indicating these prior year encumbrances were not expended)																														

Appendix F-12 - Budget Expenditure Projection

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	**12. EXPENDITURE BUDGET PROJECTION**																		
2				**2022**	**Audit D 3**		**2023**	**Yr end data**			**2024**		**2025**		**2026**	**2027**	**2028**	**2029**	**2030**
3	**EXPENDITURES**			**CY Budget**	**12.31.22**		**CY Budget**	**12.31.23**		**notes**	**Projected**	**notes**	**Projected**	**notes**	**Projected**	**Projected**	**Projected**		
4										a	700,000								
5	Personnel services S & W			13,542,809	11,721,010		14,191,600	12,103,174		b	13,313,491	5%	14,714,166	3%	15,155,591	15,610,259	16,078,566	16,560,923	17,057,751
6		reserved*			1,760,661*			2,088,425*											
7	Other Expenses			23,792,015	20,462,716		21,487,169	14,291,894		c	22,508,988	5%	23,634,437	5%	24,816,159	26,056,967	27,359,815	28,727,806	30,164,196
8		reserved*			3,326,298*			7,195,275*											
9	Capital Improvement fund contribution						-			d	500,000		500,000		750,000	750,000	750,000	750,000	1,000,000
10	Capital Outlay			1,000,000	-		275,000	-			500,000		500,000		500,000	500,000	500,000	500,000	500,000
11		reserved*			1,000,000*														
12	Debt principal			6,648,348	5,933,433		6,000,000	5,982,769		e	14,032,701		13,179,406		13,510,290	14,736,201	13,577,979	14,207,729	14,853,079
13	reservec	cancelled **			714,915*														
14	BAN Principle			1,129,201	947,061		650,000	417,713		inc									
15	reservec	cancelled **			182,139*														
16	Interest on Notes			274,826	274,826		510,000	536,538		inc									
17	reservec	cancelled **																	
18	PERS			1,826,099	1,826,099		2,017,000	2,017,000		f	2,077,510	3%	2,139,835		2,204,030	2,270,151	2,338,256	2,408,403	2,480,656
19	FICA			956,922	955,500		1,100,000	970,201		g	1,051,012	calc	1,103,562		1,136,669	1,170,769	1,205,892	1,242,069	1,279,331
20		reserved*			1422*														
21	UE			100,000	-		50,000	-			50,000		50,000		50,000	50,000	50,000	50,000	50,000
22		reserved*			100,000*														
23	Deferred Charges (Over Exp)						400,512	400,512		h	-								
24	Qual Bond			5,302,741	5,302,741		4,815,538	4,815,535		inc									
25																			
26	Grand total			54,572,961	47,423,386		51,496,819	41,535,336			54,733,702		55,821,407		58,122,739	61,144,347	61,860,509	64,446,931	67,385,013
27		reserves			6,191,382*			6,692,811*											
28		cancelled			897,055*			254,265*											
29	transferred to the GF			2,650,000	2,650,000		2,650,000	2,650,000		i	2,650,000		2,650,000		2,650,000	2,650,000	2,650,000	2,650,000	2,650,000
30																			
31	Budget total			57,222,961	50,073,386		54,146,819	44,185,336		j	57,383,702		58,471,407		60,772,739	63,794,347	64,510,509	67,096,931	70,035,013
32				1,899,499***			1,974,499***												
33				*** transfers to General Fund inc. in above Grand Total															
34																			
35	a - this represents employees to be added to those employed in 2023 and included under Expended 2023																		
36	b - for 2024 a 10% increase over 2023 actual expenditures is provided in S&W representing not only standard salary increments and COLA's,																		
37		but also some salary adjustments to encouragement recruitment / retention																	
38		for 2025, the supplemental increase is added to the projected base and a 5% toal increase is budgeted																	
39		for subsequent years, a 3% total cost increase is budgeted																	
40	c - 2023 O&E expenditures were unusually low. For budget projections 2022 actual expenditures of																		
41		$20,462,716 is used as the base and 10% is added representing increases in supply costs																	
42		for subsequent years, a 5% increase is projected																	
43	d. annual contributions to both Capital Projects and Capital Improvement fund are recommended																		
44		Whatever is not expended during the year should be transferred into the Capital fund for future use																	
45	e. uses the projected debt schedule of the alternate data set. Year 2023 budget lines included in this one total are identified by "inc"																		
46	inc. indictaes that data is included in the debt projections																		
47	f. Budget 2023 was ususally high but that number is carried forward with a 3% COLA																		
48	g. .075 of S&W																		
49	h. no budget - this is only for overexpenditures of routine budget items																		
50	i. the projection assumes a constant General Fund Contribution																		
51	j. the projected budget continues the transfers from the Water Utility to the General fund in the same manner as provided																		
52		in the 2023 budget plus standard COLA increases																	

Appendix F-13 - Budget Revenue Projection

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1				**2022**	**actual**		**2023**	**est**		**2024**		**2025**		**2026**		**2027**		**2028**		**2029**		**2030**
2				**CY Budget**	**12.31.22**		**CY Budget**	**12.31.23**	**notes**	**Projected**	**notes**	**Projected**	**notes**	**Projected**	**notes**	**Projected**	**notes**	**Projected**	**notes**	**Projected**	**notes**	**Projected**
3																						
4	**Expenditure Budget Projections**			57,222,961	50,073,386		54,146,819	44,185,336		57,383,702		58,471,407		60,772,739		63,794,347		64,510,509		67,096,931		70,035,013
5																						
6	**REVENUE REQUIREMENTS**																					
7		Surplus		10,990,716	10,990,716		5,078,067	5,078,067		5,000,000		6,000,000		7,000,000		8,000,000		8,000,000		7,000,000		7,000,000
8		rents		44,817,811	47,566,857		47,566,858	45,252,202	a	45,252,202	a	46,252,202	a	48,252,202	a	50,252,202	a	52,752,202	e	53,752,202		53,752,202
9									b.	1,500,000	b	2,262,610	b	2,312,610	b	2,412,610	b	2,512,610	b	2,512,610	b	2,512,610
10									c.										c	2,687,610	c	5,375,220
11									d	3,100,000	d	3,000,000	d	3,000,000	d	2,000,000						
12									e	1,000,000	e	2,000,000	e	2,000,000	e	2,500,000						
13																						
14		fire hydrant rental		1,092,310	701,847		701,847	533,562	f	850,000	f	900,000	f	1,000,000	f	1,000,000	f	1,000,000	f	1,100,000	f	1,100,000
15		Misc		322,125	800,047		800,047	1,485,136		800,000		800,000		850,000		850,000		900,000		900,000		900,000
16		grants																				
17		total		57,222,962	60,059,467		54,146,819	52,348,967		57,502,202		61,214,812		64,414,812		67,014,812		65,164,812		67,952,422		70,640,032
18																						
19	Expenditure Budget Projections from dataset of "budget exp proj"																					
20	a - 2022 collected rents reflect a rate increase but also were inflated due to billing errors in 2021. The 2023 rents collected, although a preliminary unaudited data,																					
21		reflects a reasonable base collection number for projectiion forward. As delinquencies are collected, the total rents collected will increase																				
22		assuming that the prior delinquent accounts remain current																				
23	b - assumes a 5% rate increase phased in in 2024.																					
24	c - assumes a 10% rate increase phased in in 2029																					
25	d - assumes increased collection of prior delinquencies over the next several years. In 2028, it should return to a normal collection cycle																					
26		and that is included under the rent heading																				
27	e - assume an additional user fee income as delinquent accounts become current plus other revenue enhancements e.g. meter replacements.																					
28		This sum increases normal rents in subsequent years																				
29	f - assme increased biling / collections for fire rates overcoming prior billing deficiencies																					
30																						
31	note: as the current excessive delinquencies are collected in 2024, 2025, and 2026, those collections not used in the subsequent budget																					
32		should remain in surplus for use in later year budgets																				