Town Of Hertford, North Carolina

SEWER AND WATER ASSET MANAGEMENT PLAN

ADOPTED

September 25, 2023

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

APPENDICES

Appendix I – Aerial view of sewer Lines to be rehabilitated in 2024
Appendix II – Aerial view of water Lines to be rehabilitated in 2024
Appendix III – Town Hydrant location map
Appendix IV – Listing of additional priority lines for rehabilitation
Appendix V – Site Plan of Hertford Wastewater Treatment plant
Appendix V1 – Capital Improvements Plan with project details

LIST OF ABBREVIATIONS

AC	-	Asbestos Cement Pipe
AMP	-	Asset Management Plan
CB	-	Catch Basin
CI	-	Cast Iron Pipe
CIP	-	Capital Improvement Plan
CN	-	Concrete-Not Reinforced
CR	-	Concrete-Reinforced
CU	-	Copper Pipe
DI	-	Ductile Iron Pipe
EPA	-	Environmental Protection Agency
FM	-	Forcemain
FY	-	Fiscal Year
GALV	-	Galvanized Pipe
GIS	-	Geographic Information System
GPM	-	Gallons per Minute
HDPE	-	High Density Polyethylene Pipe
ISO	-	Insurance Services Office
LF	-	Linear Feet
LOS	-	Level of Service
LWSP	-	Local Water Supply Plan
MG	-	Million Gallons
MGD	-	Million Gallons per Day
MH	-	Man hole
NCAC	-	North Carolina Administrative Code
NCDEQ	-	North Carolina Department of Environmental Quality
O&M	-	Operation and Maintenance

PSI	-	Pounds per Square Inch
PR	-	Pre-cast Concrete
PVC	-	Polyvinyl Chloride pipe
SS	-	Sanitary Sewer
SW	-	Stormwater

RCP	-	Reinforced Concrete Pipe
SCADA	-	Supervisory Control and Data Acquisition
SSO	-	Sanitary Sewer Overflow
TC	-	Terra Cotta Pipe
UGPJ	-	Underground Pipe Junction
WTP	-	Water Treatment Plant
WWTP	-	Wastewater Treatment Plant

1 Executive Summary

1.1 Purpose

The Asset Inventory and Assessment (AIA) Grant program was authorized by NC Session Law 2015-241 and is administered by the North Carolina Division of Environmental Quality (NCDEQ), Division of Water Infrastructure. The Town of Hertford is in the process of more fully developing this Asset Management Plan and will update it as information is developed. This program is intended to encourage water and sewer utilities to become more viable and proactive in the management and financing of water and wastewater infrastructure. The program is specifically useful for assisting communities with developing asset inventories, condition assessment of critical assets, and collecting other necessary components for a comprehensive asset management program.

The Town received a grant award to populate and develop a comprehensive AIA for its water and wastewater systems. That work is in progress and when complete will more fully populate this document that summarizes the Town water and wastewater systems and will serve as the Town's Sewer and Water Asset Management Plan (AMP).

1.2 Key Findings

The Town, with the ongoing assistance of selected consultants, has conducted an initial comprehensive review and assessment of the sewer collection and treatment system and water treatment and distribution system. More defined details and data related to these systems will be available in the coming year. This plan includes a current state and forecasted state for determination of asset conditions and a criticality and risk analysis. The assessment and analysis were used to develop the capital improvement projects and operations and maintenance strategies needed to improve the level of service offered by the Town's collection, treatment and distribution systems. This section is intended to summarize the key findings within these systems, and subsequent sections will describe these findings in more detail.

- Subsequent to current planned WWTP headworks repair/reconstruction projects significant recovery efforts/fixes are required to meet design and permitted capacities.
- Subsequent to 2024 Sanitary Sewer rehabilitation efforts up to 50% of the remaining sewer system gravity and force mains will require improvements consisting of some or all of:
    - installing clean outs at system connections points
    - complete line replacement
    - manhole repairs.
- Subsequent to the 2024 Water treatment plant repairs/improvements, additional controls improvements and some system process components will need replacement or improvement.
- Subsequent to the 2024 water line rehabilitation efforts, lead and copper rule driven requirements will necessitate replacement of perhaps another 300% more water lines due to materials of construction. Those specifics will not be known until the full assessment of the lines is complete. More general requirements driven by age and materials of construction will require additional replacement as lines age and failures increase.

2 Background and System Overview

2.1 Background

Hertford is in Northeastern North Carolina in Perquimans County, approximately twenty (21) miles southwest of the Elizabeth City. The population of the Town is approximately 1920 and accounts for approximately 14% of the total population in Perquimans County.

The Town received AIA grant awards of $150,000 to study its water distribution system, and $150,000 to study the waste water collection system in the Fall 2022 funding cycle. Additionally, the Town received $75,000 to study the merger of the Town of Hertford and the Town of Winfalls waste water collection systems in the 2022 funding cycle. The Grant funded Architect & Engineering consulting firm (A/E) work is inventorying and mapping in Geographic Information System (GIS), the Town of Hertford's water distribution and sewer collections systems. This data review and inventory includes manhole attributes for sewer, and hydrant information for water. That data set and GIS viewer system will not be available until the next calendar year but information from that work is included in this AMP. Meanwhile, the Town has done an initial inventory and assessment of its assets with an eye towards an update once the consultant work is complete. This Asset Management Plan documents that work. This work included a review the town's water system assets by analyzing available mapping captured in PDF format and provided to the A/E for use in the grant funded planning, field surveys of manhole locations, hydrant locations, and other field verified data. With the assistance of the North Carolina Rural Water Association (NCRWA), smoke testing, visual inspection (via camera), and other observations were used to assess locations, conditions, and potential concerns of problem sewer areas. Data collected from this review was used to make an initial assessment of critical assets. Risk based decisions have been made concerning critical projects for inclusion in the Town's Capital Improvements Plan (CIP). The Town has adopted an operating strategy for addressing sewer failures, sewer clogging, sewer pump station operations and maintenance to maintain services as critical infrastructure failures, and maintenance demands strain the Town's resources. These efforts have resulted in this Asset Management Plan and includes:

- Level of Service (LOS) Statement
- Sewer Asset Inventory
- Non-intrusive Condition Assessment
- Criticality Analysis
- Operation and Maintenance (O&M) Plan for the Sewer System
- Water Asset Inventory
- Non-intrusive Condition Assessment
- Criticality Analysis
- Capital Improvement Plan (CIP)
- Operation and Maintenance (O&M) Plan for the Water System

This AMP is intended to be a living document that is updated regularly. It is recommended that the data be stored within the Town's soon to be completed GIS system and be continually validated and updated to ensure that the most relevant and accurate representations of the current system are captured.

2.2 System Overview

2.2.1 Sewer System

The Town of Hertford's Sanitary Sewer system is comprised of a collection system that flows to the town WasteWater Treatment Plant (WWTP). The sewer collection system has a permitted capacity of 0.500 million gallons per day (MGD) serving approximately 1,000 customers. The collection system operates under the North Carolina Department of Environmental Quality (NCDEQ) Collection System Permit No. WQCS00209.

The sewer Collection system assets include approximately:

- 24 miles of gravity mains
- 5.4 miles of force mains
- 359 manholes
- 19 lift stations

The WWTP was originally designed for 1 Million gallons per day (MGD) of flow. The current plant was constructed in 2007 and was upgraded from a much smaller treatment facility that existed on the same site. The WWTP (see Illustration 1) is licensed to discharge treated water under The North Carolina Department of Environmental Quality (NCDEQ) permit No. NC0021849. The WWTP is a traditionally designed biological reactor plant using the following major components in the process:

1. Headworks consisting of;
    a. Bar Screens which remove fabrics and other "stringy" materials in the sewage that might cause jamming or clogging.
    b. A Grit chamber which removes sediments like sand, rock, and other heavy non organic materials that settle in larger chambers in the plant.
2. Influent pump station which lifts the incoming sewer to a higher elevation so that it can flow by gravity through the WWTP processes.
3. Oxidation Ditches (O2 ditches), the primary biological unit, which mixes the wastewater continuously while adding oxygen and holding the waste while biological processes convert organic matter to water, gas, and significantly reduced volume of solids.
4. Clarifiers which receive the water from the O2 ditches and serves to settle out the solids and pass the clear water through to the next process. Most of the Solids (known as RAS, Returned Activated Sludge) are returned to the headworks by way of the RAS/WAS chamber to mix with the incoming wastewater stream. Occasionally Waste activated Sludge or WAS is sent to the digester or the drying beds.
5. The Clarifier discharge (effluent) is sent to a Disc filter that further removes smaller (almost microscopic) particles. This system was included in the original plant to ensure the water that initially sprayed on an irrigation field (as final discharge from the WWTP) did not clog the sprayer heads. That irrigation has been removed from the system with NCDEQ approval.
6. Chlorine contact tanks receive the effluent from the clarifiers and Disc filter and apply chlorine to the water to kill any remaining bacteria or other pathnogenic organisms. The water remains in the tank long enough to ensure that it is safe to release to the river.
7. The Effluent pump station sends the fully treated water to a discharge point via pipeline to the bottom of the Perquimans river near the middle of the channel.

8. The digester, apart from the water treatment process, allows the biological degradation of the sludge removed in the clarifier to continue for an extended period of time by mixing and constant injection of oxygen. This results in the further reduction of solids/overall volume of waste.

   The WWTP condition is poor and is the focus of the Town's attention in terms of ensuring compliance with NCDEQ compliance and providing Sewer services to the residents.

2.2.2 Water System

The water distribution system conveys water from the municipal wells to approximately 1,000 customers, operating under Public Water System ID No. NC0472010. The water system assets include approximately:

- 31 miles of water mains
- 287 valves
- 144 fire hydrants
- 1,000 water meters
- 2 storage tanks
- 3 groundwater wells

The sewer collection and water distribution system inventories are currently stored in a PDF format compiled in 2023 and partially represented in an engineering report generated by WithersRavanel under a NCDEQ DWI Project number VUR-D-ARP-0051. Those files are currently in the conversion process to a GIS system. Field location and arrangement validation, inventory validation, and assessment is in progress. Delivery of the Town's GIS is anticipated in the first quarter of 2024.

3 Level of Service

Level of Service (LOS) criteria define the goals and standards the Town will strive to attain. LOS criteria reflect the mission of the Town and are expressed in terms of quality, quantity, reliability, responsiveness, cost, and environmental impact. Taking all these considerations into account, the Town is adopting the following LOS criteria/goals:

Table 1. Hertford, NC level of service criteria

Category	Level of Service	Performance Measure	Target /Goal
Health and Safety	**1. Water Quality** Compliance with Safe Drinking Water Act (SDWA) primary and secondary standards and Ground Water Rule (GWR)	Number of violations per year	0 violations/year
	2. Residential Back-ups and SSOs No adverse events will cause residential sewer back-ups and sanitary sewer overflows (SSOs)	Number of violations per year	0 events/year
	3. Fire Protection and Water Pressure Compliance with North Carolina Administrative Code (NCAC) and Insurance Services Office (ISO) standards	Number of violations per year	0 violations/year
	4. Water Availability No adverse event will cause the customer to be without water	Time without water	< 8 hours
	5. Sewer/Water System Performance	Main break frequency per year	≤ 15/100 miles
		Full leak detection survey - water	Every 5 years
		CCTV inspection - sewer	5% every year
Customer Service	**6. Response Time** Respond to customer complaints/requests in a timely manner	Emergency (breaks)	1-2 hours
		Leaks	1-2 hours
		Meter Repair	1-5 days
	7. Complaints Number of complaints due to unplanned or unanticipated events	Water outage	≤ 2/month
		Colored water	< 3/month
		Water with bad taste, odor	< 5/month
		Pressure	< 5/month
	8. Education and Outreach	Water conservation information included with water bill and on website	Yearly
	9. Communication Notification of planned shutdown will be provided	Number of days	≥ 5 days
	10. Customer Readings Consistent / Recurring monthly readings	Number of days for billing cyde	29-32 days per cycle
Source Water Protection	**11. Well Head Protection** Maintain areas directly adjacent to the source wells to ensure integrity of source	Landscaping, appearance, security fixtures	Weekly
Financial	**12. Financial Capability** Rates are reviewed on an annual basis and revised as needed to ensure full cost recovery	Revise, review rates	Once/year

With the LOS criteria developed, the Town has established sustainable business processes to ensure information required for measuring LOS is cost effectively available. The processes for collecting the information is part of the existing workflows. For example, the number of water main breaks per year is centrally located in the work order log, used by the Public Works Department.

3.1 **Sewer System**

The prevention of residential sewer back-ups and sanitary sewer overflows were designated as important metrics for the sewer system analysis, and Table 2 summarizes the sewer system design standards per The North Carolina Administrative Code known as NCAC. More specially subsection 02T relates to the standards for sewer systems and mechanisms. These standards were used to identify assets within the collection system that require updates to become compliant.

Table 2. Sewer system design standards per NCAC

System Parameter	Evaluation Criterion	Value	Design Standard/Guideline
Design Capacity	Daily Flow	Various[1]	15A NCAC 02T.0114
Minimum Separation	Storm Sewer	18 inches	15A NCAC 02T.0305
	Water Mains - Vertical	18 inches	
	Water Mains - Horizontal	10 feet	
	Reclaimed Water Lines - Vertical	18 inches	
	Reclaimed Water Lines - Horizontal	2 feet	
	Drinking Water Source	100 feet	
	Classified Waters[2] or Wetlands[3]	50 feet	
	Stream, Lake, Impoundment, Wetlands[4], Waters[5]	10 feet	
	Building Foundation	5 feet	
	Basement	10 feet	
	Top slope[6]	10 feet	
	Drainage System	5 feet	
	Swimming Pool	10 feet	
	Final Earth Grade	36 inches	
Minimum Nominal Diameter	Public Gravity	8-inch	15A NCAC 02T.0305
	Private Gravity	6-inch	
Minimum Slope, in feet/100 feet, by Diameter of Gravity	6-inch	0.6	15A NCAC 02T.0305
	8-inch	0.4	
	10-inch	0.28	
	12-inch	0.22	
	14-inch	0.17	

Pipe[7]	16-inch	0.15	
	18-inch	0.14	
	21-inch	0.1	
	24-inch	0.08	
Minimum Slope, in feet/100 feet, by Diameter of Gravity Pipe[7]	27-inch	0.07	
	30-inch	0.06	
	36-inch	0.05	
Manholes	Maximum Distance	425 feet	15A NCAC 02T.0305
	Minimum Diameter	4 feet	
	Minimum Bench Slope	4%	
Force Mains	Minimum Nominal Diameter	4-inch	15A NCAC 02T.0305
	Air Release Valves for Vertical Distance	> 10 feet	

1. Refer to NCAC Standard for detailed list of values.
2. Classified WS-II, WS-III, WS-IV, B, SA, ORW, HQW, SB from normal high water or tide elevation.
3. Classified as UWL or SWL or directly abutting the waters classified above.
4. Classified as WL.
5. Classified as C, SC, or WS-V, or ground water lowering and surface drainage ditches
6. Embankment or cuts of 2 feet or more vertical height.
7. Based upon a mean velocity of 2.0 feet per second and Manning's "n" of 0.0013.

3.2 Water System

Fire Protection and Water Pressure are designated as important metrics for the water system analysis, and Table 3 summarizes the water system design standards per NCAC and ISO. These standards will be used to identify assets within the distribution system that require updates to become compliant.

Table 3. Water system design standards per NCAC and ISO

System Parameter	Evaluation Criterion	Value	Design Standard/Guideline
Valves	Number at Crosses	3	NCAC T15A:18C.0907(a)
	Number at Tees	2	
	Number on Hydrant Branch	1	
System Pressure	Minimum, during PHD	30 psi	NCAC T15A:18C.0405(b)
	Minimum, during MDD + Fire Flow	20 psi	
Water Storage	Minimum Combined Elevated and Ground Storage Capacity	1/2 ADD	NCAC T15A:18C.0805
	Fire Flow Volume	Min 75,000 gal	
Minimum Residential Fire Flow, by Distance Between Buildings	> 30 ft	500 gpm	ISO Guide for Needed Fire Flow (2014)
	21 - 30 ft	750 gpm	
	11 - 20 ft	1,000 gpm	
	< 10 ft	1,500 gpm	
Minimum Nominal Diameter	Hydrant Branches	6-inch	NCAC T15A:18C.0901
	Non-Fire Protection Mains[1]	2-inch	

1. Contingent on residence restrictions per NCAC T15A:18C.0002

4 Sewer System Inventory

4.1 Gravity Mains

The Town's sewer collection system consists of approximately twenty four (24) miles of gravity mains, serving approximately 1,000 sewer customers which includes residential, commercial, industrial, and institutional classifications. Gravity main diameters range from 4 to 15 inches and materials include ductile iron (DI), high density polyethylene (HDPE), polyvinyl chloride (PVC), Asbestos Cement (AC), Reinforced Plastic Mortar, and Vitrified Clay (VCP). Table 4 provides a summary of the diameter and materials of the gravity main pipes in the system. Some portions of the gravity collection system were rehabilitated using slip forming technologies but exact details have been lost. Research to define those locations is in progress even as planned repair work to parts of the collections system continues in the design phase.

Table 4 Gravity mains by diameter and material (summarized by length in feet)

Diameter / Material	DI	Other	PVC	TC/VCP	RPM	Total	Percent of Total
4"	82		349	479		910	.9%
6"			3,536	6,006		9,542	9.7%
8"	2,938	3,303	35,909	37,618	881	80,649	82.3%
10"	28		1,052	3,485		4,565	4.7%
12"	40		709			749	.8%
15"		226				226	.2%
Unknown				1,310		1310	1.3%
Total	3,088	3,529	41,555	48,898	881	97951	
Percent of Total	3.2%	3.6%	42.4%	49.9%	.9%		

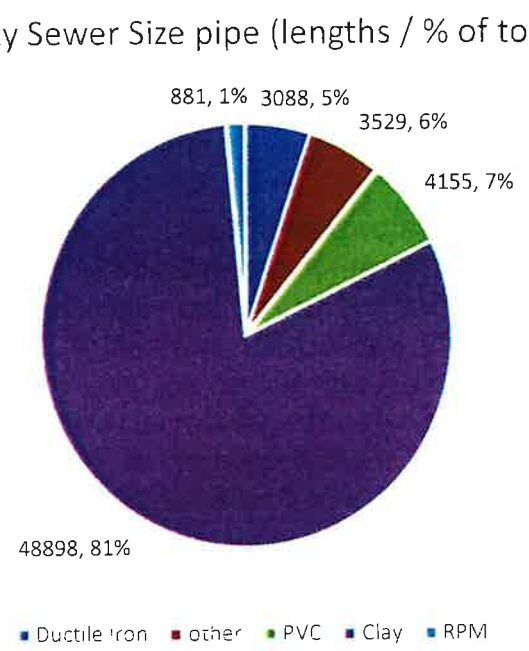


Illustration 1 Gravity Sewer Pipe Size as a % of System Total

Previous Rehabilitation Projects

The Town has implemented in the last two decades, at least three (3) projects aimed at correcting critical deficiencies in the Sewer collection system. Historical data is limited but based upon current operations, Public Works staff memory, and continuing inspections to the system, the following is understood concerning previous rehabs.

The sewer main rehabilitation project of 1995 was implemented to correct failing lines on Perry street and Dobbs street along with manholes on Hiland Park, Dobbs, and King streets. These repairs amounted to approximately 500 feet of 8 inch line and 400 feet of 10 inch line repaired insitu. Manholes on Kings street between Hyde Park and Edenton Road, and on Hiland Park at the corner of Winslow were repaired but to what extent is unknown.

In 2004 an extensive but poorly documented project was executed to clean lines and manholes in most of the streets not covered by the 1995 project and later the 2009 project.

In 2009 the rehabilitation project containing 8495 feet of 6 & 8 inch lines were Video assessed and then cleaned. Another 3200 feet of 10 inch lines were Video assessed and then cleaned. Additionally, more than 20 manholes were cleaned.

Not captured in this documentation is the slip lining of a number of streets within the town. Work on Sunset Drive provides an example of recurring customer impacts related to the sewer blackages in a sewer that has been gravity lined. Sunset Drive was slip lined in 2009, however it is one of the most problematic lines in the town. Inspections, including assessments by NC Rural Water have indicated that the 8" line has been impacted by settling of the were line bedding material, which is evident in the roadway above. In addition, preliminary information from the sewer survey work indicates that the slope of the line does not meet the .4ft/100ft

slope required for an 8" line by NCAC detailed in Table 2 above. It is likely that sand is entering the line were service connections from the homes connect to the newer slip lining. The combined event of these issues, is a sewer line that registers many customer complaints and requires frequent cleaning and maintenance. Similar conditions are evident in other locations. The Town's current understanding of the multiple issues is informing current sewer line rehabilitation projects.

4.2 Force Mains

The Town's collection system consists of approximately 5.4 miles of force mains. Force main diameters range from 2 to 12 inches and materials include ductile iron (DI), high density polyethylene (HDPE), and polyvinyl chloride (PVC) as well as some Vitrified clay and Abestos cement. Table 6 provides a summary of the diameter and materials of the force main pipes in the system.

Table 5 Force mains by diameter and material (summarized by length in feet)

Diameter / Material	DI	AC	HDPE	PVC	VC	Unknown	Total	% of Total
2	252						252	0.9%
4	335		1014	4911	25		6285	22.1%
6	4130	2096		1408		440	8074	28.3%
8	523			94		39	656	2.3%
10	2132						2132	7.5%
12	7274						7274	25.5%
Unknown	0					3830	3830	13.4%
Total	14646	2096	1014	6413	25	4309	28503	
% of Total	51.4%	7.4%	3.6%	22.5%	0.1%	15.1%		100.0%

Illustration 2 Pipe Size as a % of System Total

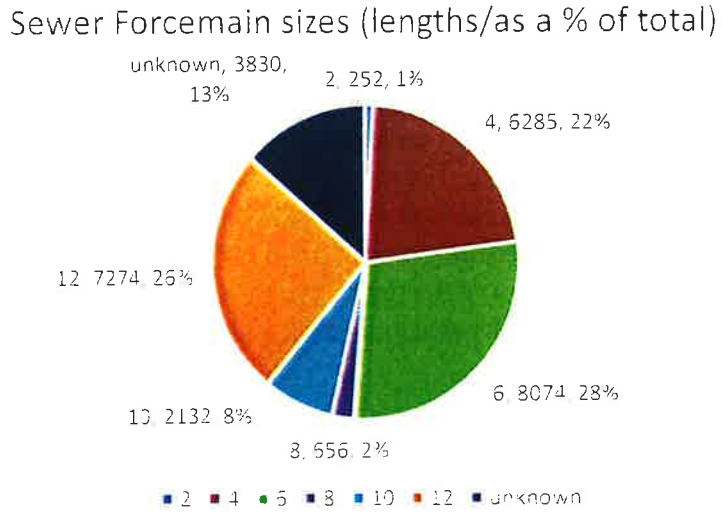
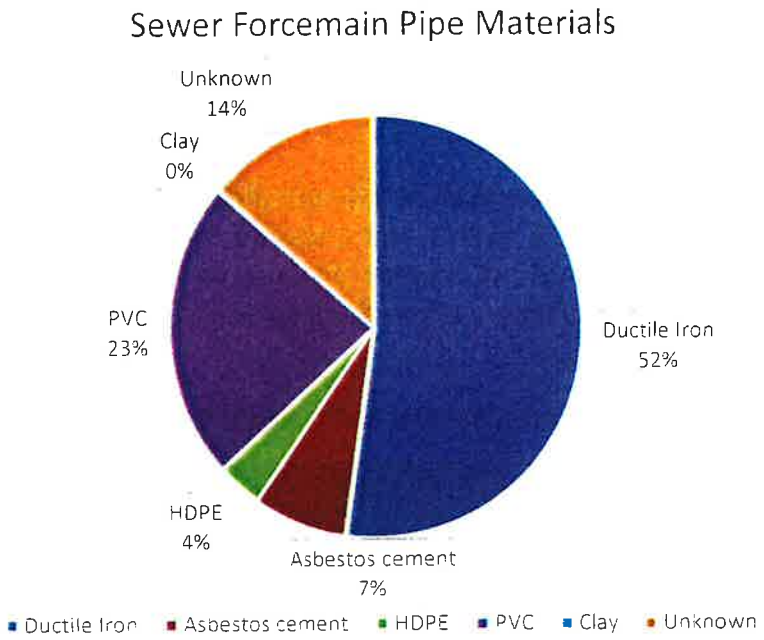


Illustration 3 Forcemain materials as a % of System Total



4.3 **Manholes**

The sewer collection system contains 359 manholes, ranging in approximate depth from 2 to greater than 15 feet. The town manholes are identified by the type of lining materials including block, brick, cementitious (non-reinforced concrete), concrete, precast concrete, and fiberglass. Due to the age of the system it is believed to also contain several manholes that have been covered by either soil or pavement. Some manholes, abandoned in place or sealed off likely exist but are not part of this inventory. Some manhole repairs or reconstruction have occurred but are not well documented. Table 7 provides a summary of the depth and material of the manholes in the Town of Hertford system. Additionally, a rating of the condition of each manhole is included based upon recent field observations.

Table 6. Manholes by depth, material, rating

Type/ Lined?	Condition	Depth of Manhole						Total/ Subtotals
		<6	6'-8'	8'-10'	10'-15'	> 15'	Unknown	
								359
Brick								169
Un-Lined	Good	9	5		2			16
Un-Lined	Fair	41	14	11	4	3	1	74
Un-Lined	Poor	32	13	3	3	3		54
Un-Lined	Unknown	8	2			1	1	12
Lined	Good	2						2
Lined	Fair	2	2					4
Lined	Poor	2	2				1	5
Unknown		1					1	2
Concrete - Non reinforced								7
Un-Lined	Good	1						1
Un-Lined	Fair	2			2			4
Un-Lined	Poor	1		1				2
Concrete - reinforced								6
Un-Lined	Good			1				1
Un-Lined	Fair		1				1	2
Un-Lined	Poor		1	1				2
Un-Lined	Unknown	1						1
Pre-cast								108
Un-Lined	Good	13	6	5	12	2		38
Un-Lined	Fair	21	3	3	3			30
Un-Lined	Poor	13	1	2			1	17
Un-Lined	Unknown	6		2	5	4		17
Lined	Good	1						1
Lined	Fair	1	1					2
Lined	Poor	1						1
Lined	Unknown	1		1				2
PVC								2
Un-Lined	Good		1					1
Un-Lined	Fair	1						1
Material of Construction Unknown - Survey in Progress								67
Un-Lined	Unknown	2						2
Unknown	Fair		1					1
Unknown	Unknown	2		1		1	60	64

4.4 Lift Stations

The collection system contains nineteen (19) lift stations. They are the backbone of the functioning wastewater collection system for the Town of Hertford. Of these 19 pump stations, one (1) is a complex station containing two pumps in addition to a manual bar screen that is serviced daily. That station, Cemetery receives a disproportionately large segment of the overall flow sent to the Hertford Wastewater Treatment Plant, including flows from 4 major system pump stations. Additionally, Cemetery Pump Station is used for the disposal point for any approved waste disposal by Vacuum truck or other hauler.

Eight (8) other stations are also duplex stations containing two pumps. These are the larger stations that handle significantly more flow than the ten (10) simplex stations that make up the remainder of the pumping system. Pump design capacities range from 50 GPM up to 800 GPM at the largest station (Cemetery), and Tables 8/9 give a summary of Duplex and Simplex Pump stations respectively. There are a number of private lift stations that transfer sewage to the gravity system.

Table 7. Duplex Lift station information

#	Pump Station Name	Capacity	Force Main Length	Force Main diameter	Manufacturer	Model
1	Cemetery	800	1821	8	Gorman-Rupp	Unknown
2	S-Bridge	75	1045	4	Fairbanks Morse	Unknown
3	AR PDC	350/500	Unknown	Unknown	Gorman-Rupp	Unknown
4	Whedbee	150	2038	4	Gorman-Rupp	Unknown
5	Feed & Seed	175	512	Unknown	Fairbanks Morse	Unknown
6	Willow	150	296	4	Fairbanks Morse	M25T136A
7	Wynne Fork	250	1040	4	Homa	AMX434-184
8	Meads	200	Unknown	Unknown	Crown?	Unknown
9	Commerce Park	200/350	Unknown	Unknown	Gorman-Rupp	Unknown

Table 8. Simplex Lift station information

#	Pump Station Name	Pump size (Hp)	Force Main Length	Force Main diameter	Manufacturer	Model
10	Wynne Fork N	2	Unknown	Unknown	Liberty	Unknown
11	Wynne Fork S	0.5	Unknown	Unknown	Liberty	Unknown
12	Clarks House	2	Unknown	Unknown	Liberty	Unknown
13	Ainsley House	0.5	Unknown	Unknown	Liberty	Unknown
14	Gaston Drive	2	Unknown	Unknown	Liberty	Unknown
15	Gaithers Street	2	Unknown	Unknown	Liberty	Unknown
16	Grubb St. East	2	Unknown	Unknown	Liberty	Unknown
17	Grubb St./ Charles	0.5	Unknown	Unknown	Liberty	Unknown
18	Punch Alley	2	Unknown	Unknown	Liberty	Unknown
19	Clark Street	2	Unknown	Unknown	Liberty	Unknown

Several of the stations noted are either at the end of a reasonable life cycle or are well past that time. Specifically, the Meads pump station has experienced numerous failures and is included in upcoming replacement work currently in the design phase with construction targeted for 2024. Meads has been on a continuous by-pass for the greater part of two years. Expenses continue to grow in maintaining the flows as by-pass pumps utilized well past their expected life have failed from long-term use and have been replaced with new pumps or rental units until new by-pass pumps are received.

The Cemetery pump station, the workhorse of the system also experienced extensive failures in August of 2023. That station is on by-pass with likely replacement of the pumps necessary along with repairs and upgrades to the control system.

Two other stations, Feed & Seed, and Willow have both had replacement of one of their pumps within 2023. Challenges with this equipment and the existing SCADA communications system lead to numerous after hour responses to ensure continuity of the operations.

5 Sewer Asset Condition Assessment

For the purposes of Asset Management, condition assessment focuses on the likelihood of failure for a given asset. Industry standards recognize three (3) major categories in which an asset can fail:

- Physical Failure
  - Asset breaks, cracks, excessive settlement, reversed grades, etc. in many cases this means beyond repair
- Performance Failure
  - Capacity, pressure, and failure to meet regulatory requirements (uncontrolled releases)
- Economic Failure
  - Asset is no longer the most cost-effective solution or is no longer required due to changes in conditions or customer needs (undersized for population or use served).

Future versions of this AMP will more fully detail the condition assessment of sewer and water assets as a combination of physical and performance failures.

5.1 Current State

WWTP

The WWTP, while originally designed for 1 Million Gallons per Day (MGD) of flow, it was only permitted to operate at 75% of that capacity or 750 thousand (k) Gallons per Day (KGD). Depending upon the season, the plant receives between 110 KGD to 650 KGD for the combined flows from the Town of Hertford and the Town of Winfall.

The headworks processes in the WWTP have been non-operational for more than 2 years. An electrical strike in 2021 impacted the Effluent pump station, and the disc filter drive motors as well as most of the controls and electronic drive mechanisms. These equipment failures have created operational, process and permit compliance issues, including:

1. Blockage of the incoming sewage at the influent screens resulting in overflows of waste onto the ground and to drainage areas. The Town of Hertford has received an NOV and fine for one particular release in 2022.
2. Accumulation of rags and stringy waste in the digester which inhibits the process and makes pumping of sludge for ultimate disposal difficult to impossible.
3. Accumulation of heavy solids in the bottom of the O2 ditches which reduces the overall volume of the chamber and reduces the available process volume for the biological process. This makes the system subject to easy upset and reduces effective treatment capacity which could result in release of partially treated sewage solids.
4. Wear on pumps, valves, and other processes exposed to abrasive grit.
5. Clogging of pumps
6. Blockages in valves (including slide gates, sluice gates, telescoping valves) which in turn limit the ability to control, isolate, and clean segments of the system.
7. Instrumentation and control system failures that make routine monitoring and trending of equipment (e.g.: drive motors, pump, instrumentation) impossible. Impacts to remote

monitoring and alarming are issues as well.

Collection System

For the purposes of this plan, the current state of all sewer assets was estimated/determined by a preliminary assessment conducted by a consultant with inputs from historical data available, data collection from work orders issued for repairs, clogs, leaks, breaks, and other system deficiencies. See tables 10 and 11 below for perspective categories for gravity sewers and force mains respectively. In addition, as part of the grant work in progress in 2023/2024 for the Town of Hertford Sewer collection and treatment system and the water treatment and distribution system, the Consultant is compiling an Asset Inventory Assessment (AIA) and documenting those findings. Advanced portions of that information is included in this planning assessment.

As described in the known metrics of each asset: age, material, diameter, capacity, etc. each of the gravity mains, force mains, manholes, and lift stations inventoried were prioritized for rehabilitation/replacement. Based on previous rehab activity success or failure, material and diameter, gravity main and force mains were selected for rehabilitation in the current Grant funding slated for 2024. Based on the condition inspections performed by town, the consultant established an inventory of proposed repair segments as shown on Illustration 2.

Subsequent assessment, which is a continuous process, has further identified / clarified sewer lines within the town which will be considered or included in the reprioritization of lines to be rehabilitated within the current grant work to be conducted in 2024. Those additional lines are tabulated in Appendix 1

Table 9: Evaluation Factors - Condition criteria for gravity main assessment

Condition	Criteria
Failed	Assets that have failed and are no longer contributing to the system
Poor	Material: RCP, TC, pipe slope <70% Standard
Fair	Material: RCP, TC pipe slope < 100% standard, >70% standard
Good	Material: DI, HDPE, PVC pipe slope meets standard, flow < 75% design capacity
Excellent	Material: DI, HDPE, PVC pipe slope/grade meets standard, flow < 50% design capacity

Table 10: Evaluation Factors - Condition criteria for force main assessment

Condition	Criteria
Failed	Assets that have failed and are no longer contributing to the system
Poor	Material: Unknown: frequent breaks/Leaks/blockages
Fair	Material: Unknown: Leaks reported/Occasional blockages
Good	Material: DI, HDPE, PVC and Diameter: 8-inch or greater
Excellent	Material: DI, HDPE, PVC and Diameter: 3, 4, and 6-inch

Using these categories in conjunction with information from work order history, frequency of required repairs, and the consultant's observations and assessments during the 2024

rehabilitation work, each gravity main asset was assessed. This information will be used to prioritize segments of the force mains, gravity sewers, and other components for repair as part of the projects forecasted in the CIP.

5.2 **Forecasted State**

The forecasted state of the sewer asset condition assessment is to collect and organize field assessments of 95% of collection system assets by the end of calendar year 2024. The information to be collected is expected to include preliminary assessments of manhole construction, condition and inverts of main sewer lines and sewer line material of construction and slopes. Assessing the condition of sewer lines will require CCTV and is would be accomplished over a 10 year time frame. Detailed assessments of Manholes would be completed in conjunction with the sewer CCTV projects. In the summer/fall of 2023, assessment of the town's sewer system began with initial assessments conducted with the aid of the North Carolina Rural Water Association (NCRWA) field team. Further and more extensive data collection is implemented via NCDEQ awarded grant monies by the Town A/E contractor WhithersRavanel.

This continuing effort will prioritize rehabilitation efforts in the immediate 2024 work and prime the system with continued follow-on projects included in the CIP.

5.2.1 Closed-Circuit Television (CCTV) inspection/Smoke Testing

Initial NCRWA CCTV inspections and smoke testing on several collection system locations were conducted in June/July of 2023. This work has provided condition information used to prioritize rehabilitation and replacement needs. That information has helped to both identifying/confirming manhole locations as well as identify significant line performance issues. Those locations and criticality has been provided to WhithersRavanel in its NCDEQ Grant funded work to rehabilitate many portions of the Town collection system. That work is anticipated to fully rehabilitate the more critical lines in 2024. Additional future work is anticipated as these further assessments are accomplished.

Recurring /Regular CCTV inspections to gather updated condition information could help the Town prevent residential back-ups and sanitary sewer overflows (SSOs) by rehabilitating or replacing assets before they fail.

5.2.2 Manhole Inspection

Manhole inspections are typically performed along with CCTV inspection initiatives as done with the 2023 NCRWA work. Additionally, with the recurring issues of collection system clogging, the Public Works staff has routinely assessed the manholes related to these now designated critical repair locations. Separately, during rain events, Public Works staff is visiting pump stations and related feeder manholes to assess the infiltration/inflow indicators for the lines and manholes. This recurring visits supplemented by regular manhole inspections will help the Town identify corrosion, inflow and infiltration, fat and grease build up, and other issues that could cause residential back-ups, SSOs or clogs in the collection system.

5.2.3 Lift Station Assessment

For the purposes of this project, lift station information was gathered by the Town Public Works staff as they conducted their daily and monthly inspections. Significantly more thorough inspections are needed.

Pump drawdown testing would provide the existing capacity for each pump to compare to the design capacity, allowing the Town to determine the remaining efficiency of the pump. Complete pump station assessment would also provide condition information for the pumps and pump accessories within the pump stations, and help the Town identify maintenance, rehabilitation, and replacement needs. The Town does not currently have a formal pump station assessment program, however recurring inspection notes are compiled and used in determining prioritization for upcoming work possible as budget/funding allows. Once completed, the GIS database of the Asset Inventory will be used to track inspection findings and documenting those findings with the system. These findings will then be used to prioritize future repair and maintenance activities as captured in the Capital Improvements Plan (CIP).

6 Sewer Criticality and Risk Analysis

Criticality refers to the level of importance placed on each asset in terms of maintaining the performance and integrity of the entire system, and risk refers to the consequence of failure placed on each asset.

This plan explains the current state of criticality and risk and prepares a forecasted state to provide ongoing condition and risk analysis that contributes to a better understanding of system criticality and risk.

6.1 Current State

For the purposes of this project and developing a program forward, the current state of the criticality and risk analysis focused on the assets that are:

1. Not already proposed for repair during the 2024 grant work currently in design.
2. Not in compliance with the NCAC sewer system design standards, that is the slopes for normal gravity flow of wastewater is inadequate .
3. Have repeated issues with clogging as documented by the Public Work order system.
4. Have indicators of line failures such as excessive sand/dirt build up, settling of pipes/pavement.
5. CCTV indicates wall failure or structural integrity issues.
6. Other indicators of line failure, infiltration, inflow, or clogging.

6.2 Forecasted State

6.2.1 Regulatory Considerations

NCDEQ adopted the Minimum Design Criteria for the permitting of Gravity Sewers in February 1996 and updated the design criteria to the 15A NCAC 2T Regulations in March 2008. The purpose of the standards described in these regulations is to protect the health and safety of the community and environment. Table 2 contains a summary of these NCAC sewer system design standards. Using these standards, the collection system assets could be evaluated to determine the assets that are not in compliance with these NCAC design standards. As the collection system assets are upgraded, rehabilitated, or replaced, the new assets are required to be in compliance with these standards.

7 Collection System Operation and Maintenance Action Plan (MAP)

Operation and Maintenance (O&M) for the wastewater system focuses on upkeep of the gravity mains, force mains, manholes, and lift stations. Maintenance consists of "Emergency Maintenance," which is corrective action needed quickly to keep the system operational, and "Preventative Maintenance," which is routine, and scheduled repair tasks to address developing failures before they arise. Other nominal repairs are also included in the mix when maintaining the Collection system in terms of longevity of the system components. System Operators and Mechanics in the performance of their daily routines include the identification of necessary repairs or other fixes. These findings are amplified with the more indepth monthly assessments of the duplex stations. These recurring findings are assembled via a "running" spreadsheet in a Maintenance Action Plan (MAP). The WWTP Operators score the various items with a priority. Based upon that scoring and assessing available budget an action plan is created to facilitate maintain the system.

The items below represent routine maintenance items performed throughout the collection system. The Town of Hertford Sewer Pump Station Operations program includes daily physical checks and inspections of all 19 stations as previously noted. Those inspection data sheets are maintained records.

7.1 Lift Station Maintenance

The routine Lift Station Operation and Maintenance Program includes the following items:

- Inspecting, cleaning, and removing debris from the pump station structure, outside perimeter, and wet well. For Cemetery Pump Station cleaning the bar screen daily.
- Inspecting and exercising all valves and assessing possible need for further repairs.
- Inspecting and lubricating pumps and other mechanical equipment.
- Verifying the proper operation of the alarms, telemetry system, and auxiliary equipment.
- Other testing procedures as recommended by the manufacturer.
- Annual flow meter calibration (at a minimum).
- NOTE: Pump stations not connected to telemetry systems must be inspected at least daily. Pump stations with telemetry must be inspected at least once per week.

The Pump Station **daily inspection** form is used for all simplex and duplex pump station inspections. In addition to the daily inspection, a monthly in-depth assessment of the duplex stations. The daily inspection form covers the following items:

- Recording total accumulated pump running hours (for both pumps in the duplex stations).
- Performing/verifying an operational test of the pumps.
- Inspecting the wet well for signs of build up, damage, debris, and float/alarm system integrity.
- Checking the high level alarm function (lights, audio, SCADA signal indicator).
- Inspect control panel switches for proper positioning.
- Look for indications of vandalism or other damage. (report immediately)
- Record any discrepancies found or repairs needed.

The Pump Station **monthly inspection** more formally documents details of the duplex stations for possible early actions or additional maintenance. The monthly report covers:

- Greasing valves and cycling valves to ensure free operation and functionality
- Recording hour meter readings
- Check by-pass operation (as applicable)
- Confirm emergency power is available
- Inspect the Pump station security (fence locks, building locks, wet well/dry well secured.
- Untangle twisted cables that may affect the automatic cycle operation.
- Inspect lighting of station
- Sweep and clean station interior and/or grounds as applicable
- Check for unusual pump noise or vibration.
- Check amp readings. Note discrepancies.
- Confirm pumps appear to be seated properly.
- Confirm that no leakage is observed. This includes both wastewater as well as lubricant oils.
- Confirm guide rails and brackets are aligned and fastened and are corrosion free or track rate of corrosion for possible maintenance action.
- Confirm that piping and valves are not leaking and that bolts and nuts are tight.
- Record findings and assessment on Monthly Utility maintenance form.

7.2 Collection System Maintenance

- Clean and video inspect at least 10% of the collection system each year. At the time of cleaning, record the date, location of cleaning, type of cleaning, and other general observations during cleaning (type of debris, quantities, etc.).
- Document all Sanitary Sewer Overflow (SSOs) using the State form or other similar form. All spills, reportable or not, must be documented. Spills that are reported to the State should be on the required form.
- Incorporate information from new construction and rehabilitation projects, including line diameter, material, and scoring for other KPIs, into the collection system GIS within 3 months of construction completion.
- All high priority lines (including aerials, sub-waterway crossings, lines contacting surface waters, lines positioned parallel to stream banks and subject to eroding in such a manner that may threaten the line, and any other segment of the system that is designated as high priority) must be inspected every six (6) months. A log must document the area inspected, the date, method of inspection, and any corrective actions performed or initiated.

8 Water System Inventory

8.1 Distribution Mains

The Town distribution system consists of approximately twenty nine (29) miles of water mains to convey water from the municipal wells to the 1,000 water customers. Pipe diameters range from 2 to 14 inches, and pipe materials include asbestos cement (AC), cast iron (CI), galvanized iron (GALV), and polyvinyl chloride (PVC). Table 13 provides a summary of the diameter and materials of the water main pipes contained in the distribution system.

Table 13 Water system by diameter and material summarized by length in feet

Diameter / Material	AC	CI	GALV	PVC	Unknown	Raw water CI	Raw Water PVC	Total	Percent of Total
2"			22283	20959			705	43947	26.99
4"	-	4076		10981				15057	9.24
6"	13031	26812	1006	36674				77523	47.61
8"		11524	-	396		4166		16086	9.88
12"		-	-	532	-			532	.33
14	9315							9315	5.72
Unknown	-	-	-	-	367			367	0.2
Total	22346	42412	23289	69542	367	4166	705	162827	
Percent of Total	13.72	26.05	14.30	42.71	.23	2.56	.43		

Over 99% of the system has known material and diameter. The most common material in the system is Polyvinyl chloride (PVC), with 43%, followed by cast iron (CI), with 26%. The most common diameter across the system is 6 inches, representing just under 47%, followed by 2 inches, representing 27%. Next is 4inch and 8 inch with 9.24% and 9.88% respectively. The unknown diameters is limited to .2% of transmission lines.

Polyvinyl chloride (PVC) representing 43% of the system materials commonly used in newer water construction projects and will likely continue to be used. Asbestos cement (AC), cast iron (CI), and galvanized iron (GALV) represents 42% of the system and are typically the oldest and potentially most compromised pipe materials as documented with the most prevalent lines requiring repairs/patches and replacement. The earliest underground systems were documented to be as old as 2200 BC and were made of terracotta (clay). Wooden pipes were used in ancient Rome and Europe until around 1700. Lead pipes were used beginning in the 1800s and ceased in the 1920s when civilization became aware of lead poisoning. More recently, Asbestos cement and cast iron were first used in the 1930s, reaching peak popularity in the 1950s and were discontinued in the 1980s. Galvanized iron was a popular construction material prior to the 1960s.

8.2 **Valves**

The distribution system in Hertford consists of an approximately 287 transmission line water valves which control the conveyance of water throughout the Town, ranging in diameter from 4 to 14 inches. Table 14 provides a summary of the valve diameters contained in the distribution system.

Table 12. Valves by diameter

Diameter	Count
< 4"	36
4"	28
6"	167
8"	40
12"	4
14"	9
Unknown	3
Total	287

8.3 **Fire Hydrants**

The distribution system contains approximately 144 fire hydrants to provide fire flow and flushing throughout the Town. The date of the first Fire hydrant installation is unknown and the most recent installation was in 2023. The Town, like many locations has an assortment of hydrants by different Manufacturers. Due to age, misuse, and damage 7 hydrants are currently out of service. The Town hydrant replacement program has begun in 2023 with 1 hydrant replacement complete and 2 additional hydrants in the process of being replaced.

Most of the existing hydrants, due to age are fitted with 4 ½ inch main line fittings for providing fire flows to Fire Pumper Trucks. This main hydrant discharge is typical along with two (2) 2 ½ inch hose lines on virtually all municipal hydrants. The town fire trucks are now fitted with 5 ¼ inch pumper truck intake lines. When connecting to most Town hydrants, an adapter, known as a "Stork" fitting adapts the hydrant discharge to take a 5 ¼ inch intake line from a Fire truck. As the Town replaces existing hydrants, the 4 ½ inch discharge is replaced with the 5 ¼ inch main line discharge, that is the new the standard size for the town.

The future years of the Town hydrant replacement program, after the replacement of broke or non-serviceable hydrants is complete, will focus on the replacement or resetting of an additional 15 hydrants that no longer sit completely at ground level. Many hydrants have settled to the point where the original base of the "plug" is below the ground level. This results in numerous instances of hydrant intakes being below the recommended 18 inches above ground. In some extreme cases, the hydrant is exceptionally low and makes the location harder to identify in case of a fire emergency. This depressed position, if left uncorrected is likely to lead to corrosion via "weep" hole plugging. In establishing this hydrant program, and facilitate future in-house repairs of hydrants, the town is establishing a list of 3 preferred hydrant manufacturers. Establishing

this standard is believed to help in ensuring applicable focused training along with maintaining some standardized parts inventory for repairs.

The town's hydrant flushing program sets a goal of fully flushing all hydrants at least once per year with some additional flushing done as necessary after repairs, as part of community programs or other events. A comprehensive log of the flushing along with a published schedule for each year is a recurring requirement of the town program.

Table 13 Fire Hydrants by Manufacturer

Hydrant Manufacturer	# Installed
Mueller	24
Waterous	30
Mathews	25
Clow	5
American Darling	31
total	**144**

8.4 Storage Tanks

The distribution system contains two (2) finished water storage tanks, tank one is located on the grounds of the Water treatment facility. The second tank is located within the fenceline of the town wastewater treatment plant. Storage tanks information is located in table16.

Table 14 Summary of storage tank information

Tank #	Tank Name	Year Built	Type	Capacity (MG)	Elevation (ft)		
					Base	Inlet / Outlet	Overflow
1	Meads Circle	1970	EST	0.5	83*	99*	109*
2	West Grubb st.	2009	EST	0.25	83.5	99.0	109.0

**Note: Meads Circle Tank data collection in progress with current Water treatment system improvements project slated for 1st quarter 2024.*

8.5 Groundwater Wells

The distribution system contains three (3) groundwater wells that provide water to the system. Information about the wells is located in Table 17.

Table 15 Summary of groundwater well information

Well #	Year Drilled	Depth (ft)	Pumping Intake Depth / Screening (ft)	Pumping rate (gpm)	24-hour water level @ max yield	Location
1	1958	127	Various	270	28.72	Ballahack rd
2	1962	117	Various	50	51	Ballahack rd
3	2008	115	Various	180	38.18	S. Edenton rd. street

Well #1 is a Grundfos submersible 15 hp pump. Well #2 is a Grundfos submersible 5 hp pump. Lastly, Well #3 is also a Grundfos submersible 7.5 hp pump. Recurring issues with maintaining flows for well #3 have lead to plans to rehabilitate well #3 to facilitate utilizing it on a recurring basis. Currently, overall system flows are limited by the production of well#3 limiting the Water Treatment Plant capacity.

8.6 Customer Meters

The distribution system contains approximately 1,000 residential and 128 commercial and industrial meters. The monthly manual meter reading process requires approximately 20 man-days of labor for initial readings. Re-reading (verifications) require an additional ½ man-day. Lastly, the turn-on/turn-off sequencing for non-payment and service starts/stops then amounts to another 1 man-day to execute. This extensive data collection and operation process does not include the complexities of manual billing inputs, corrections, and research in resolving bills that is inherent in a manual meter reading system.

The Town has begun the planning to replace the entire inventory of manually read water meters with fully remote sensing, reading, tracking, and operating meters. The Capital Improvements Plan as drafted, includes 4 stages of implementation over the same number of years. Research into a likely automated meter manufacturer has begun. Neighboring municipalities ongoing conversions are being monitored for lessons learned, cost comparisons, technical issues, supply availability, ease of implementation, and other factors. With an eye on making a optimal selection with a strong cost to benefit ratio, the town would like to move out within the next fiscal year.

9 Water Asset Condition Assessment

For the purposes of Asset Management, condition assessment focuses on the likelihood of failure for a given asset. Industry standards recognize three (3) major categories in which an asset can fail:

- Physical Failure
  - Asset breaks, cracks, etc. beyond repair
- Performance Failure
  - Capacity, pressure, and failure to meet regulatory requirements
- Economic Failure
  - Asset is no longer the most cost-effective solution

This AMP illustrates the condition assessment of water assets as a combination of physical and performance failure. Relevant characteristics of an asset's physical condition and performance metrics were analyzed in an effort to determine the likelihood of failure for each asset.

This plan explains the current state of condition assessment and prepares a forecasted state to provide ongoing condition and performance monitoring that contributes to a better understanding of asset condition.

9.1 Current State

For the purposes of this project, the current state of asset condition was determined by the known metrics of each asset: age, material, diameter, capacity, etc. Each of the water main lines, fire hydrants, and water valves inventoried were prioritized for improvement/ replacement. Based on material, diameter, frequency of leaks, breaks, and observations during repairs, were used to prioritize CIP Projects to address on a "Worst first" basis. Fire hydrants were inventoried and their functionality was assessed in consultation with the Town Fire Department. Failed fire hydrants were identified and a priority for replacement was assigned based upon Fire flow criticality. The two town water storage tanks have corrective actions being taken under the 2024 Grant work currently in the design phase.

The Town of Hertford has several recurring issues with the failure of connections with Asbestos Cement Forcemains. In addition the large volume of galvanized pipe, while smaller in diameter is also a risk factor for the Town distribution system. The age and fragile nature of the materials of both of those pipes pose a continuing risk to the system and make all repairs and repair attempts risky. The Capital Improvements Plan (CIP) identifies an intention to address those lines not fully covered in limited upcoming waterline repairs currently in the design phase with planned construction inf 2024.

As the Town's assessment methodology matures, a more detailed and accurate inventory will be included in updates to this document.

9.2 **Forecasted State**

The forecasted state of the water asset condition assessment is focused on increasing the known condition information of the distribution system.

Upon completion of the 2024 Water System repair work currently in the Design phase, a fully picture of the Town's inventory will be possible.

9.2.1 Leak Detection

As stated above, the system condition was determined based on the material and diameter of the distribution main asset and work orders tracking leaks and breaks. Leak detection and water audit initiatives will provide information about unreported water leaks or breaks and locations contributing to water loss. Conversion of the Town's manually read water meters will dramatically facilitate an improved identification system. Distribution main leaks, breaks, and other factors contributing to water loss would provide additional condition information.

9.2.2 Valve Exercising

With the coming implementation of a Geographic Information System (GIS) for all of the Towns Water and Wastewater resources, including accurate location information, implementing a recurring valve exercising program will be tremendously more viable. Current valve exercising has been limited primarily due to location accuracy. Once a comprehensive inventory and locations database is complete, establishing key indicators to help the Town prioritize rehabilitation/replacement needs will be done.

10 Water Criticality and Risk Analysis

Criticality refers to the level of importance placed on each asset in terms of maintaining the performance and integrity of the entire system, and risk refers to the consequence of failure placed on each asset.

This plan documents the current state of the Town water system. Further delineation of the criticality and risk of system components will be included in updates to this document. Along with forecasting state of the system, a risk analysis will contribute to a better understanding of system criticality and risk and aid decision makers in funding repairs, fixes, upgrade, and maintenance costs.

10.1 Current State

For the purposes of this plan, the current state of the criticality and risk analysis focused on the assets that are not fully functioning as designed or permitted, not in compliance with NCAC water system design standards, assets in proximity to critical infrastructure, well and storage tank supply lines. The ongoing AIA water line survey work, scheduled for completion in 2024, will provide information concerning where the Town's distribution system is not in compliance with the NCAC standards.

The NCAC standards focused on for the current state were the minimum nominal diameter of distribution mains and the respective valves, the number of valves on crosses, tees, and hydrant branches.

10.2 Forecasted State

10.2.1 Regulatory Considerations

In 2018, America's Water Infrastructure Act (AWIA) was signed into law. This law requires drinking water systems serving more than 3,300 people to develop or update risk and resilience assessments and emergency response plans. The information gathered for the requirements of these assessments and plans will identify critical assets in respect to crucial locations within the City, such as schools, industries, hospitals, etc.

In 1991, the Lead and Copper Rule was signed into law, with the most recent revision taking effect in June 2021. This law was implemented to minimize lead and copper levels in drinking water. It requires drinking water systems to monitor lead and copper concentrations in the drinking water at customer taps. Systems exceeding the action level require notification to the public and action taken to reduce the lead and copper concentrations in the water by implementing applicable corrosion control and treatment requirements. If the system continues to exceed the action level following these actions, lead and copper pipes shall be replaced. There has recently been indication that galvanized iron pipes will be added to this list for monitoring or replacement requirements.

In 1974, the Safe Drinking Water Act was signed into law, with the most recent revision taking effect in 1996. This law created the National Primary and Secondary Drinking Water Regulations. These regulations, last updated in 2009, are standards and treatment techniques that public water systems must follow. These standards include microorganisms, disinfectants and disinfection byproducts, inorganic and organic chemicals, and radionuclides. These standards are measured at the WTP, and the disinfectants and disinfection byproducts are additionally measured throughout the distribution system.

10.2.1 Hydraulic Model Considerations

As this document / program is initiated, and as the GIS system and inventory is established, connectivity updates, hydraulic model development, and review of recent and future state standards will be used to identify additional criticality and risk parameters that are important to the distribution system. Hydraulic Modeling has not been completed as of the initial publication/approval of this Asset Management Plan.

11 Distribution System Operation and Maintenance (O&M) Plan

Operation and Maintenance (O&M) for the water distribution system focuses on upkeep of the water mains, treatment plant, storage tanks, booster pumps, valves, and fire hydrants. Maintenance consists of "Emergency Maintenance," which is corrective action needed quickly to keep the system operational, and "Preventative Maintenance," which is routine, scheduled tasks to prevent problems before they arise. The items below represent routine maintenance items performed throughout the collection system.

11.1 Distribution Mains

Perform routine inspection or maintenance on the following items:

- Bi-annual inspection of all high priority lines. Maintain log of date, area inspected, method of inspection, and corrective action taken or initiated. High priority lines include the following:
    - Two Perquimans County System crossovers
    - Lines contacting surface waters and lines positioned parallel to stream banks and subject to eroding in such a manner that may threaten the line
    - Any other segment of the system that is designated as high priority

Utilize and maintain a Water Main Break Evaluation Log, including the following items:

- Suspected water main breaks or leaks due to unexplained wet areas on ground with the date, location, and pictures to document the unexpected wet area
- Reported water main breaks or leaks, with the date, location of break, size, material, condition, and asset identifier of water main, description of break (cause, estimated quantity of water lost, etc.), and summary of repair

Incorporate information from new construction and rehabilitation projects, including line diameter, material, and condition, into the collection system GIS within one (1) year of construction completion.

11.2 Customer Meters

Routinely reconcile water production data against water sales records

- Record non-revenue water and identify and repair leaking or under-recording customer meters

Perform meter accuracy testing and flow meter maintenance.

- Check for appropriate meter sizing and meter type for customer usage, along with checking installation, to reduce reporting errors.