ASSET MANAGEMENT PLAN

Borough of Bloomingdale
Water Distribution System
PWSID No. 1601001

101 Hamburg Turnpike
Bloomingdale, New Jersey 07403

H2M Project No.
BLMD2302

September 2023

Prepared for:

Borough of Bloomingdale
101 Hamburg Turnpike
Bloomingdale, New Jersey 07403

Prepared by:

H2M Associates, Inc.
1250 State Route 23 North
Butler, New Jersey 07405

H 2 M architects + engineers

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DRAWINGS

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1.0 CERTIFICATIONS

1. Water System Operator: Billy J. Doty
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2. Water System Engineer: Mark Meneghin, P.E.
H2M Associates
1250 Rt. 23 North
Butler, NJ 07405

3. Name and Address of Owner: Borough of Bloomingdale
101 Hamburg Turnpike
Bloomingdale, NJ 07403

I have examined the Asset Management Plan for the Borough of Bloomingdale Water System in Bloomingdale, New Jersey, and being familiar with the provisions of N.J.S.A. 58:31-1 et seq., I attest, by means of this certification, that the attached Plan has been prepared in accordance with good engineering practices, including consideration of applicable industry standards, and with the requirements of N.J.S.A. 58:31-1 et seq.

(Seal)

	GE038574	
Mark Meneghin, P.E.	PE License No.	Date

Billy J. Doty, Operator	License No.	Date

I attest, by means of this certification, that this Asset Management Plan will be implemented as herein described.

Michael Sondermeyer, Business Administrator Bloomingdale, New Jersey	Date

2.0 INTRODUCTION

2.1 General

The Borough of Bloomingdale's water system Asset Management Plan (AMP) facilitates the integration of economics, engineering, management, social, and environmental effects to optimize asset performance. The goal of asset management is to provide recommendations for operating the assets, mitigate the risk of failure, and ensure that assets are managed in a cost-effective manner. The AMP will improve the long-term sustainability and quality of the Borough's water supply system.

2.2 Scope

The scope of this AMP is the prioritized replacement of existing infrastructure. This AMP is not a vulnerability analysis or a hydraulic evaluation. The need for new infrastructure to reinforce the existing infrastructure, e.g. for fire protection or to add redundancy, was not evaluated as part of this AMP. Additionally, pipes that are under 2 inches in diameter are not included in the scope this AMP.

2.3 Water Quality Accountability Act (WQAA)

The Borough of Bloomingdale's AMP was developed to comply with the New Jersey Water Quality Accountability Act (WQAA), found in N.J.S.A. 58:31-7. The WQAA requirements include a 150-year replacement cycle for water mains and a maintenance and replacement program for the water supply and treatment facilities. Lastly, the WQAA dictates the requirement that the AMP be used to determine the highest priority assets and have the water provider dedicate funds on an annual basis to address and remediate those assets. The WQAA also indicates that a report (Capital Improvement Report) based on the AMP shall be prepared each year. This report should identify the infrastructure improvements undertaken in the previous year, the current year, and expected to be undertaken in the coming year.

3.0 WATER SYSTEM OVERVIEW

3.1 Ownership/Service Area/Customer Base

The Borough of Bloomingdale (Borough) owns and operates a public community water system. The water system is licensed under the New Jersey Department of Environmental Protection (NJDEP) as PWSID No. 1601001.

The Borough's water system includes approximately 2,550 service connections serving a population of approximately 7,800 persons. The customer base is approximately 73% residential (based on volume of water), with the remainder being commercial and industrial. Most of the customers' water meters are equipped with automated radio meter readers. There is an antenna at the top of the Star Lake Tank that can pick up a large portion of the meters.

3.2 Service Area/Distribution System

The Borough's water distribution system is comprised of approximately 26 miles of water main, including approximately 1,694 feet of 2-inch pipe, 7,330 feet of 4-inch pipe, 39,697 feet of 6-inch pipe, 69,992 feet of 8-inch pipe, 11,933 feet of 10-inch pipe, 8,564 feet of 12-inch pipe, and 358 feet of 16-inch pipe. Most of these water mains are located within the paved roadway, while others are located in the public right-of-way but outside of the roadway or in easements. There are approximately 219 fire hydrants and 653 water main valves in the water system, excluding valves on fire hydrant branch lines and in buildings.

The oldest water mains in the Borough are located on Hamburg Turnpike near Main Street. These water mains were installed in the early 1920's. These water mains, along with several other sections of water mains located throughout the Borough, are constructed of cast iron (CI) pipe. CI pipe has been used throughout the world for several centuries and its service life is well documented. The large wall thickness of CI pipe provides a buffer for corrosion before the pipe fails. For the preparation of this AMP, a useful service life of 150 years (an average value) was selected for CI pipe.

Approximately half of the Borough's main water system was installed between 1950 and 1970. Water mains installed during this period are composed of asbestos cement (AC) pipe. This type of pipe was chosen by developers during the post-war housing boom due to its lower material and installation costs, as compared to CI pipe.

Failure of AC pipe, also known as transite pipe, can be due to mechanical loading or corrosion of the pipe wall. Aggressive water composition and soil characteristics contribute to corrosion-related pipe failures. Corrosion-related failure rates increase linearly with age. However due to the low failure rate observed by the Borough the soil conditions in the Borough are favorable to the use of transite pipe.

The useful service life of AC pipe varies tremendously based on water characteristics and soil conditions. Most technical papers list the useful service life of AC pipe as 40-70 years, though some research indicates that AC pipe can last for more than 100 years in the right environment. Bloomingdale's water department has observed low failure rates of the AC pipe. This is most likely due to the water and the soil conditions being optimal, which lead to generally longer useful service life for AC pipe. Without the benefit of a detailed forensic analysis of the AC pipe in various locations in the Borough, a useful service life of 85 years was selected for the

preparation of this AMP. This number can be refined for different areas of the Borough should any detailed forensic analyses be conducted in the future.

The newest sections of the main water system are composed of ductile iron (DI) pipe. DI pipe has similar properties to CI pipe but is also stronger and tougher. It is assumed that DI pipe in the Brough is Class 52 thickness. Based on this, a useful service life of 150 years was selected for DI pipe to match CI pipe.

The material and installation year of the water mains in the Borough's main water system are shown on Drawings AMP1 and AMP2, respectively.

3.3 Water Supply Source

The water system is supplied by an active interconnection with the Borough of Butler's water system. The active interconnection with the Borough of Butler is located on Hamburg Turnpike at the intersection of Main Street. There are also emergency interconnections with both the Borough of Butler and Passaic Valley Water Commission (PVWC). The Butler emergency interconnection is located on Paterson Hamburg Turnpike near Macopin Road. The PVWC interconnection includes a PVWC-owned pump station on Mathews Lane in Riverdale and a valve near Brandt Lane in Bloomingdale. Drawing AMP1 shows the locations of the Borough's interconnections with the Borough of Butler and PVWC.

Water system demand, as recorded during the five-year period from 2018 to 2022 by the Bloomingdale Water Department, is as follows:

- Max Annual Average Daily Demand:

  0.570 MGD (Last 5 years, 2018)

- Average Daily Demand During Maximum Month:

  0.683 MGD (Last 5 years, July 2018)

3.4 Water System Treatment

The water that is supplied to the Borough from the Borough of Butler is fully treated. No additional treatment of the purchased water is needed before it is pumped into the distribution system.

3.5 Water Storage Facilities and Booster Pumping Stations

The Bloomingdale water system includes one booster pump station. This pump station boosts the pressure of the water supplied by the Borough of Butler at the interconnection so that it is sufficient to fill the water storage tank and serve the Borough.

The water distribution system includes a water storage tank to provide water to meet peak hourly demands as well as provide water for emergency demand conditions, including fire protection and loss of water supply. The water storage tank is located off of Star Lake Road (see Water Distribution System Facilities and Pipe Material, Drawing AMP1). The tank, with a capacity of 0.5 MG, is a welded steel tank.

3.6 SCADA

The Borough utilizes Supervisory Control and Data Acquisition (SCADA) to monitor, record, and control the operations of the water system. The Borough's water system facilities communicate through the use of a cellular data connection using the Verizon network.

3.7 Emergency Standby Power

The Borough maintains a diesel-fueled emergency portable generator for use at the Butler booster pump station. The emergency portable generator is stored at the water tank when not in use.

4.0 ASSET INVENTORY

4.1 General

The Borough's water system contain millions of different components. While each of these components is an asset, the failure of many of these components would have little or no impact on the operation of the water system. However, there are certain major assets whose failure would have a great impact on the operation of the respective water system. Additionally, major assets are either expensive, not readily obtained, or are important for emergency situations. Only major assets have been inventoried and included in this AMP.

4.2 Asset Inventory Organization

The assets were divided into two groups to facilitate analysis of each group and allow for different grading criteria to be used for each group of assets. The two groups are facilities and water mains/appurtenances.

4.2.1 Facilities

Facilities include booster pump stations, interconnections, and water storage tanks (see Table 1). The inventoried components of each facility include only the most important equipment and structures at the respective facility.

4.2.2 Water Mains and Appurtenances

Water mains and appurtenances have been inventoried by surveying water system valves, hydrants, and valve vaults. A Geographic Information System (GIS) database was created and populated with the survey points of all water system appurtenances by DMC Associates, Inc. Land Surveyors (DMC). The GIS database provided to H2M by DMC was updated based on information obtained from the Bloomingdale Department of Public Works (DPW). The GIS database of the water mains and appurtenances is maintained by the DPW. The Water Distribution System Facilities and Pipe Material, Drawing AMP1 shows locations of the inventoried water mains and appurtenances.

5.0 LEVEL OF SERVICE

5.1 Level of Service Overview

The Borough has anticipated the expected Levels of Service demanded by its customers in order to set level of service goals and to characterize the importance of each asset component to the day-to-day operation of the utility. The water utility is bounded in its Level of Service by two criteria: the system must meet the requirements of State and Federal regulations (the minimum level of service a system can provide) and the system cannot exceed the maximum capabilities of the assets (the maximum level of service a system can provide.)

5.2 Level of Service Goals

The following Level of Service goals are established to prioritize the maintenance, repair, and replacement of assets critical to the sustained performance of the water system:

1.) The Water System shall meet all State and Federal regulatory standards.

2.) The US EPA's secondary standards related to aesthetics shall be met by the system.

3.) The Water Utility will strive to reduce complaints to fewer than 5 complaints per month.

4.) Complaints will be addressed within 24 hours of receipt 95% of the time.

5.) Under normal conditions, pressures will be maintained between 30 and 70 psi.

6.) Drought restrictions will be enacted whenever the source cannot meet daily demands.

7.) Customers will receive written notice 24 hours in advance of any planned interruption in service.

8.) Planned interruptions will only occur between the hours of 9:00 AM and 4:00 PM Monday through Friday 90% of the time.

9.) For unplanned interruptions, 15 minutes of notice prior to shut down will be provided, unless there is a critical emergency.

10.) Service will be restored within 6 hours of shut down 90% of the time.

11.) Rates will be reviewed on an annual basis and raised as needed to ensure full cost recovery.

6.0 ASSET RISK EXPOSURE ASSESSMENT CALCULATIONS

6.1 Overview

Asset Risk Exposure Assessment (AREA) provides a method to analyze assets and prioritize the allocation of funds. The AREA generates a factor that ranges from 1 to 25. A score of 1 indicates that the asset has the lowest possible exposure risk and a score of 25 indicates the highest possible exposure risk.

6.2 AREA Calculations for Facilities

Two factors are used to develop the AREA: Consequence of Failure (how important an asset is to the system) and Probability of Failure (how likely the asset is to stop working). These two factors are multiplied to obtain the AREA.

6.2.1 Consequence of Failure

The Consequence of Failure is composed of six categories, each given a rating between 1 and 5. A rating of 1 indicates that the asset has little or no impact on the respective category and a rating of 5 indicates that the asset has a significant impact for that category. The six categories are:

1. *Importance to Facility*: This is a measure of how important the asset is to the facility. The rank assigned reflects the severity of the impact that the failure of the asset would have on the facility. In this section, a rank of 1 would indicate that the asset's failure presents no impact to the facility's function. A rank of 5 for this section indicates that the asset's failure would cause the facility to shut down until the asset was replaced.

2. *Water Quality*: This category indicates the affect an asset has on water quality. A rank of 1 would indicate that there is no effect on water quality due to the asset failing. A rank of 5 would indicate that failure of the asset would have a significant impact on water quality.

3. *Water Availability*: This category indicates whether a failure of the asset would prevent the facility from supplying water to the distribution system. A rank of 1 would indicate that the facility would remain functional even if the asset failed and a rank of 5 would indicate that the facility would not be able to supply water to the distribution system until the asset was replaced.

4. *Economy (cost of replacement):* This category provides an indication of how the failure of an asset would affect the economy of the area affected by the failure. A rank of 1 would indicate that the economy of the area served by the facility would not be impacted. A rank of 5 would indicate that the economy of the area would be negatively impacted by a failure of the asset.

5. *Environmental*: It is important to consider the environmental impact of asset failures. This category determines the environmental impact of a failure. A score of 1 would

indicate no impact to the environment, while a score of 5 would indicate the need for significant environmental clean-up due to the failure.

6. *Consumer Trus*t: Consumer trust is one of the most important aspects of the Borough's water utility. Consumers are not always aware of how different assets impact a water system and may only become aware of certain assets when there is publicity surrounding a failure of an asset. A score of 1 would indicate that there would be no impact on consumer trust if the asset failed. However, a score of 5 would indicate that the failure of the asset would cause consumers to lose trust in the Borough's water utility.

The scores for each of these six categories are listed in Table 2.

6.2.2 Probability of Failure

The likelihood of an asset to fail is developed based on three criteria. Each inventoried asset was assigned a score for the following three criteria:

Condition: This criterion was based on a visual inspection of the item. The better the condition of the asset, the lower the assigned value. New assets were assigned a value of 0.1. A value of 5 would indicate that the condition of the asset is impairing its function.

Service Rating: The service rating is based on how the asset has held up over time. This rating is determined by the number of unexpected malfunctions the asset has had. A value of 1 would indicate that there have been no unexpected malfunctions, while a value of 5 would indicate that there has been a significant number of unexpected malfunctions.

Life Expectancy: This criterion is based on the expected life span of the asset. A new asset starts with a value of 1. This value continues to increase until it reaches a rating of 5, which indicates that the asset has reached the end of its useful life.

The values for each of these three criteria are listed in Table 3.

6.2.3 AREA Rating

The consequence of failure and probability of failure factors derived for each asset are multiplied together to obtain the final AREA factor. The table below provides a visual display of how the AREA table ranking is calculated:

Probability	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
		Risk				

The AREA calculation results are included in Table 4.

6.3 AREA Calculations for Water Mains and Appurtenances

Similar to facilities, two factors are used to develop the AREA for water mains: Consequence of Failure (how important an asset is to the reliability of the water distribution system) and Probability of Failure (how likely the asset is to fail). These two factors are multiplied to obtain the AREA. AREA for fire hydrants and valves have not been determined.

6.3.1 Probability of Failure

Probability of failure is based on the remaining useful service life of the water main. In the future, as incidents of water main breaks are recorded in the GIS database, patterns relating to the probability of water main failures may become evident and will be factored into the probability of failure analysis. Water mains were assigned the following values for probability of failure:

- Improbable: 0-1
- Remote: >1-2
- Occasional: >2-3
- Probable: >3-4
- Imminent: >4-5

Drawing AMP3 Water Distribution System Probability of Failure drawing 3 shows the probability of failure of the water mains in the main water system.

6.3.2 Consequence of Failure

Water mains were visually ranked on a scale of 1 through 5 based on the service area and type of customers who would be without water if the water main were to fail. Water mains were assigned the following values for consequence of failure:

- Lowest disruption: 1
- Low disruption: 2
- Medium disruption: 3
- High disruption: 4
- Highest disruption: 5

Water Distribution System Consequence of Failure Drawing AMP4 shows the ranking of the water mains in the main water system.

6.3.3 AREA Factor

The consequence of failure and probability of failure ratings derived for each water main are multiplied together to obtain the final AREA ratings. The AREA calculation results are for the main water system are included on Drawing AMP5 Water Distribution System AREA Rating. The following is a list of risk exposure levels and their corresponding numerical AREA rating:

- New Infrastructure: 0-1
- Lowest risk exposure: >1-3
- Very low risk exposure: >3-4
- Low risk exposure: >4-5
- Moderately low risk exposure: >5-6
- Moderate risk exposure: >6-9
- Moderately high risk exposure: >9-12
- High risk exposure: >12-15
- Very high risk exposure: >15-20
- Immediate risk exposure: >20-25

7.0 PRIORITIZED PROGRAM

7.1 Prioritizing Asset Replacements and Rehabilitations

Generally, the magnitude of the AREA factors is used to set priorities for the management of the water system assets. Assets have been categorized as follows:

1. *Significant Risk Exposure Assets* - are those assets that scored above a 12 on the AREA rating. These are critical assets that need to be repaired or replaced as soon as possible. This will help to ensure that the system remains operational and there is no drop in the level of service provided.
2. *Moderate Risk Exposure Assets* - are those assets with an AREA rating above 5 and up to 12. The repair and rehabilitation of assets that rank as moderate risk exposure should be considered for a lower budget appropriation than critical assets.
3. *Low Risk Exposure Assets* - are those assets with an AREA rating of 5 and below. These assets are in good condition and, under normal circumstances, do not present any near-term risk of failure or malfunction. Routine operation and maintenance procedures are appropriate for the risk exposure assets.

7.2 Significant Risk Exposure Assets

There are no assets categorized as significant risk exposure assets.

7.3 Moderate Risk Exposure Assets

The following assets are categorized as moderate risk exposure assets:

- Star Lake Water Tank. This is rated as a moderate risk exposure asset because it is the only water tank in the Borough, its replacement cost is significant, and considering there are 37 years left on its expected life.

- Numerous water mains in the Borough are rated as moderate risk exposure assets. This is because if these water mains broke, they would cause large water outages or significantly reduce the water system's capacity. The following are improvements that can reduce the AREA rating for many of these assets:

    - Eliminating 2-, and 4-inch water mains from the system.
    - Create redundancy in the system by looping the water mains and not having dead ends.
    - Replacing the water mains that are at or nearing the end of their useful life.
    - Conducting water main condition evaluations on older transmission mains in the Borough.

7.4 Low Risk Exposure Assets

Other assets are categorized as low risk exposure assets.

8.0 LIFE CYCLE COSTS

8.1 Overview

Each year, the Borough's Water Department establishes an operating budget for the entire water system, which includes funds for the operation and maintenance (O&M), repairs and replacements, and capital improvement projects.

8.2 Operation and Maintenance

O&M functions relate to the day-to-day running and upkeep of assets and are particularly relevant to short-lived dynamic assets (such as pumps) where deterioration through lack of regular maintenance may result in rapid failure.

O&M procedures are routinely assessed and revised as appropriate to improve the efficiency of system operations. The O&M budget for each year is set by the Borough with input from the Water System Operator.

8.3 Repairs and Replacements

8.3.1 Asset Valuation – Facilities

All assets in the inventory were assigned an estimated replacement cost and rehabilitation cost (Table 5). The values are a rough order of magnitude costs and were estimated based on current costs. For many assets, product details were not available to determine a detailed valuation and assumptions were made to estimate the current replacement value of the asset.

8.3.2 Asset Valuation – Distribution System Piping

Recent project cost data were used to prepare rough order of magnitude replacement costs for water mains. In the current water distribution system, 35% of the pipes are smaller than 8-inch. Since these pipes were installed, the NJDEP has updated their minimum pipe size requirements to 8-inch. The Borough could establish a more robust water system by replacing small diameter piping. The estimated current replacement costs for water mains are as follows:

Pipe Dia. (in)	Cost / Linear Foot
8	$365
10	$415
12	$419
16	$439

8.4 Asset Expected Life

Eventually, all assets will need to be replaced. Estimated asset lives are used to predict the timing of asset renewals. Each of the inventoried assets were assigned a useful life and rehabilitation frequency period.

Published values of asset longevity were found to have significant variation. The variation is understandable given that the useful life is dependent upon many variables, including soil corrosivity, stress of service, environmental exposure, etc. However, the variation is not consequential in the calculation of the required annual renewal funding due to the long planning period for the asset renewal (150-years).

8.5 150-Year Projected Renewals

The 150-year renewal funding requirements for facilities and water mains are shown in Figure 1. The results indicate that the Borough will need to plan for, on average, $460,000 of replacements/renewals per year to sustain the reliability of the assets based on the management strategies established.

8.6 Water Main Replacement Cycle

The water system dates back to the 1920s and water mains were added in subsequent years (see Figure 2). The water mains that were installed in the 1940s are starting to reach the end of their expected useful life. Figure 1 shows the high costs of replacing the aging water mains when they reach the end of their useful life. A plan to replace 1,000 to 2,000 linear feet of water main each year will serve to distribute the water main replacement costs over time and reduce the reliance on water mains that have exceeded their service life (Figure 3).

9.0 FUNDING STRATEGY

9.1 General

The Bloomingdale Water Department has an excellent track record of regular maintenance, rehabilitation, and replacement of their assets. Moving forward, the AREA rating will be reviewed to determine what assets need to be rehabilitated or replaced in the next several years. The assets with higher AREA ratings will be considered and will be evaluated to determine whether the assets will be rehabilitated or replaced. An estimation of the cost will also be determined during the review. By maintaining an outlook of several years, appropriate budgets can be established and water rates can be adjusted accordingly.

9.2 Funding Sources

The Borough will utilize the following funding sources for infrastructure improvement:

- Water Utility Capital Fund & Operating Funds
- Grant Funds, when available
- Local Assessment, when and where appropriate

9.3 Project Report

As part of the WQAA, the Borough is required to prepare the Capital Improvement Report (CIR) annually. The CIR will identify the infrastructure improvements undertaken in the previous year, the current year, and expected to be undertaken the following year. This AMP will be used to help select the future projects to add to the Capital Improvement Report.

The AMP report will be updated on an as-needed basis.

Figure 1:
150-Year Projected Renewals
Facilities and Water Mains

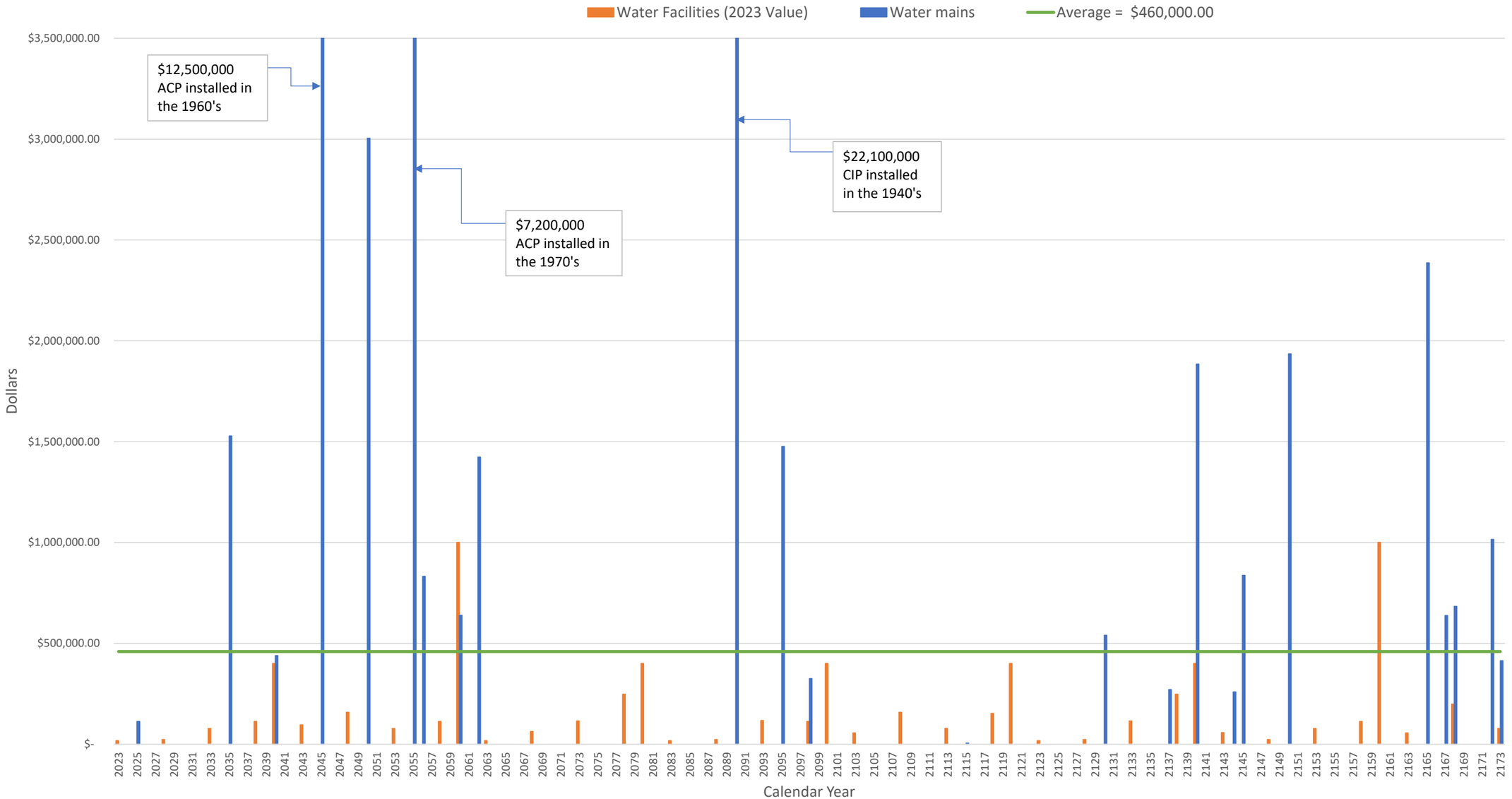


Figure 2:
Cumulative Installed Water Main
Length Over Time

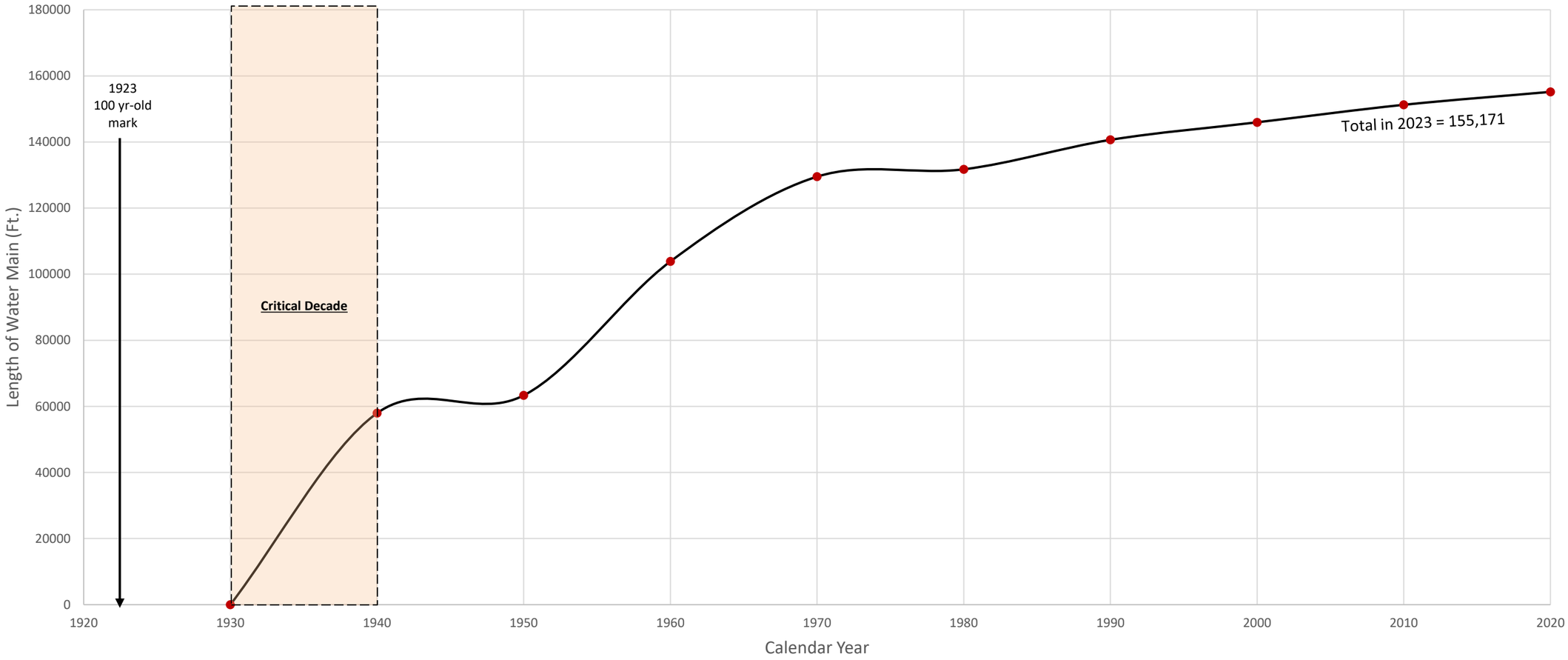
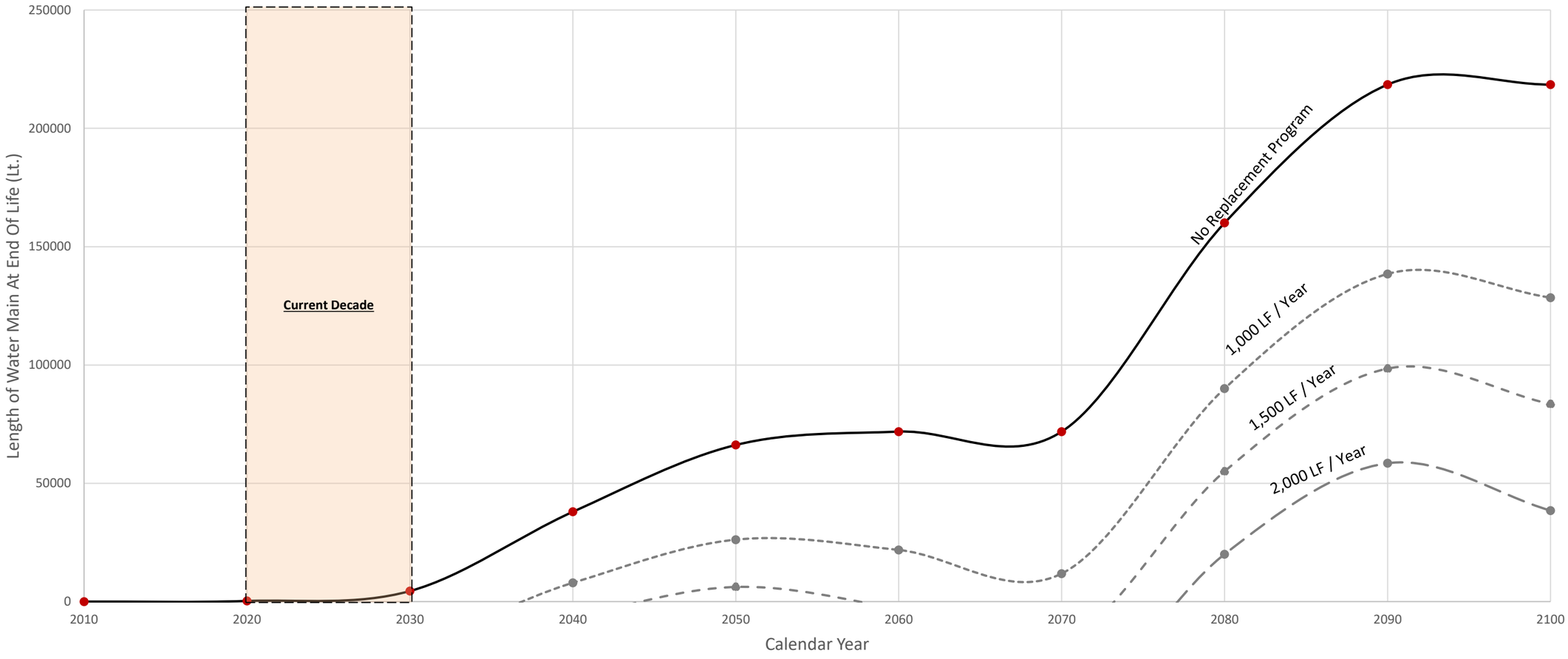
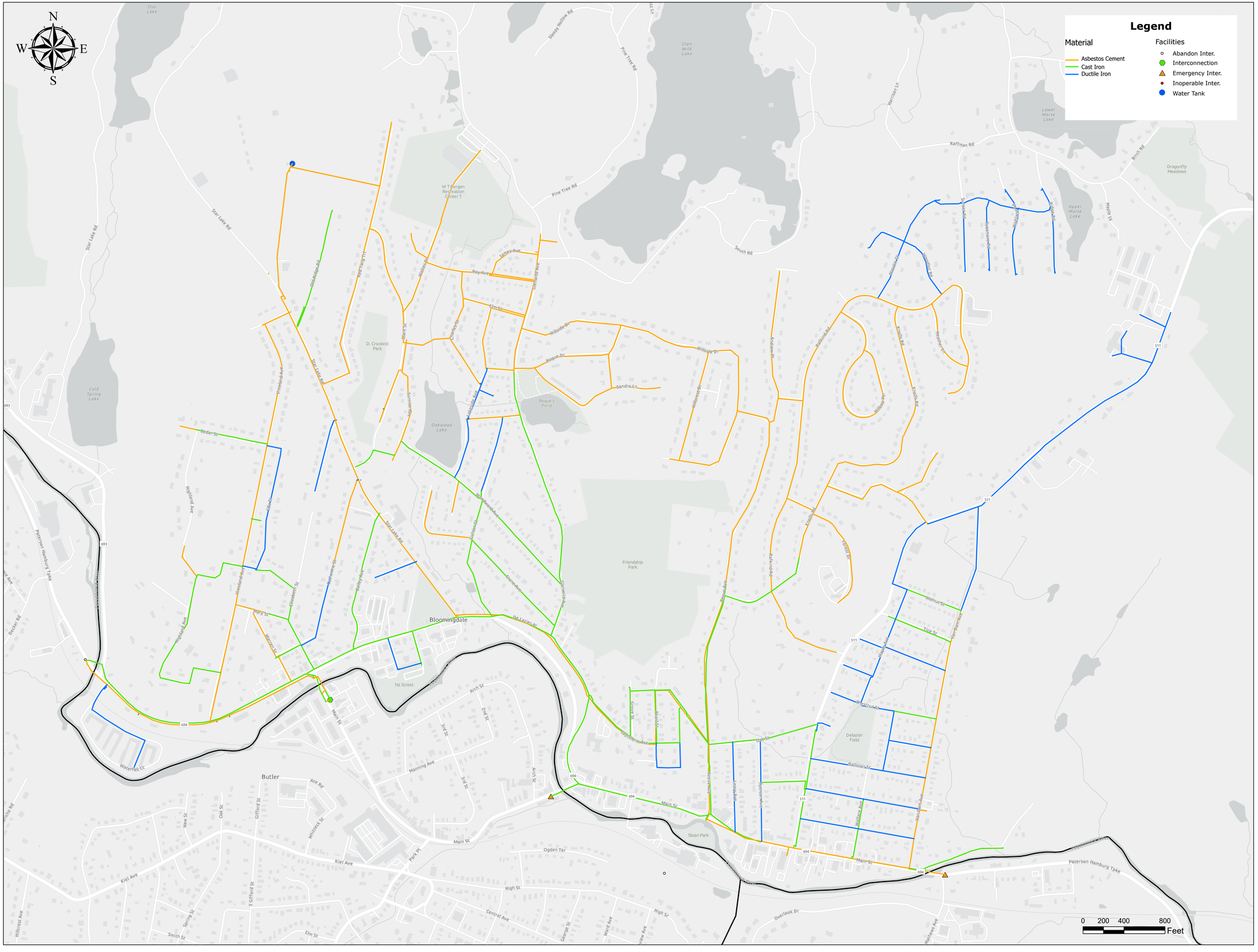


Figure 3:
Water Main Replacment Cycle
Compared with Forecast Water Main Age





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MARK	DATE	DESCRIPTION

PROJECT #: BLMD2302

DATE: August 2023

DESIGNED BY: G Forstrom

DRAWN BY: G Forstrom

CHECKED BY: | REVIEWED BY:

CLIENT

Borough of Bloomingdale
Water Department
Passaic County, New Jersey

CONTRACT

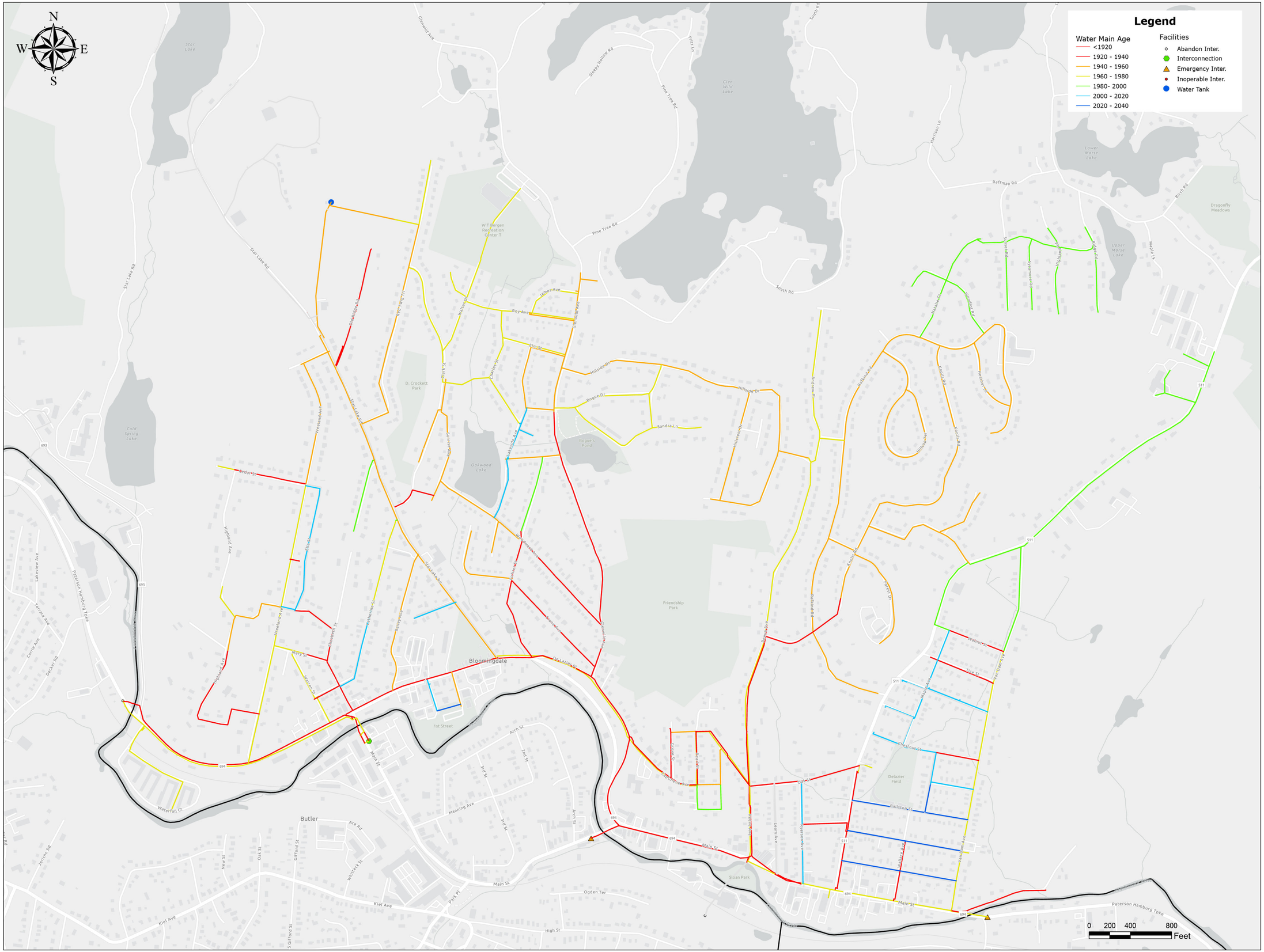
SHEET TITLE

Asset Management Plan 2023

Water Distribution System Facilities and Pipe Material

SHEET #

AMP1



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Water Department
Passaic County, New Jersey

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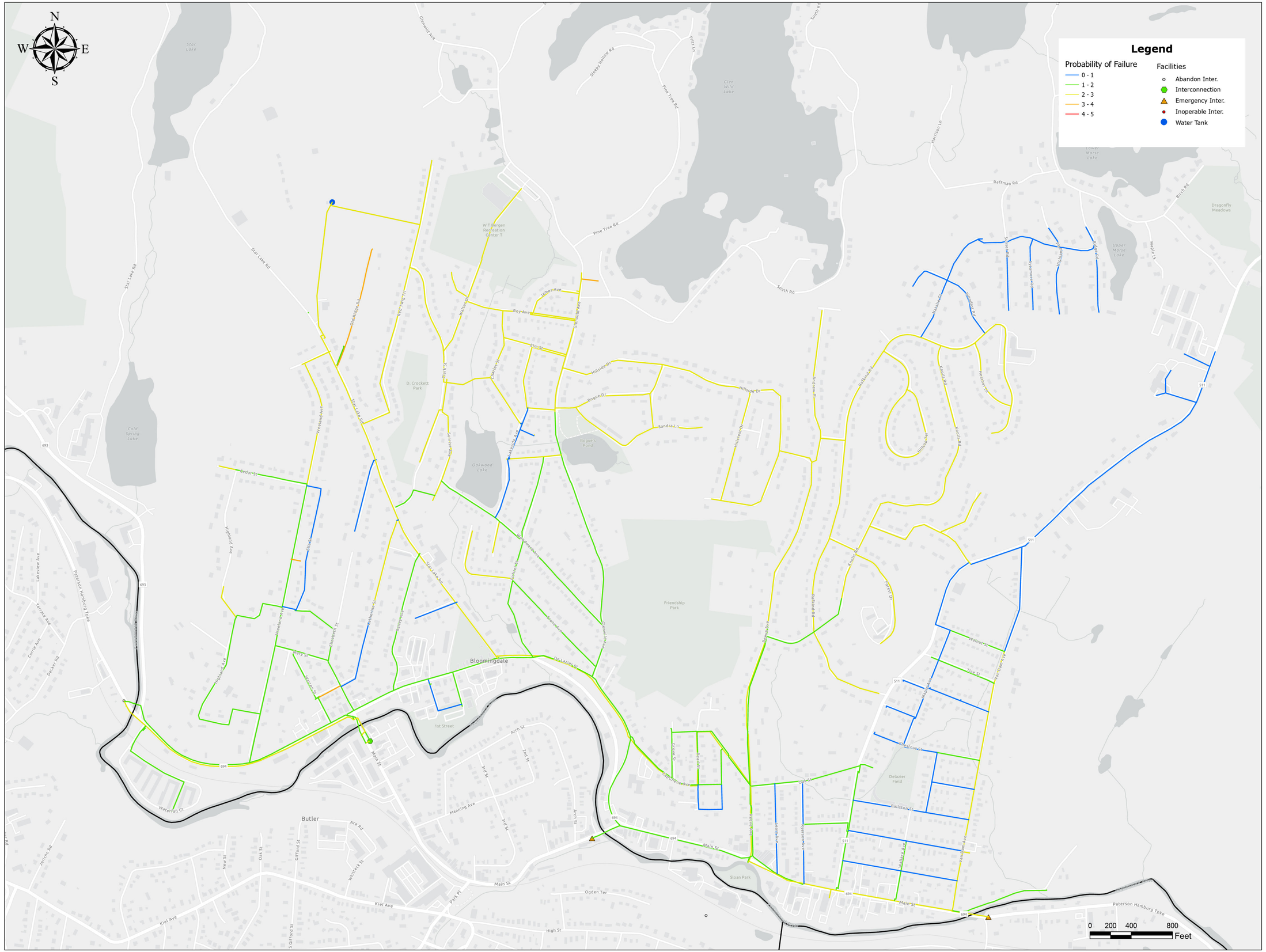
SHEET TITLE

Asset Management Plan 2023

Water Distribution System Year Installed

SHEET #

AMP2



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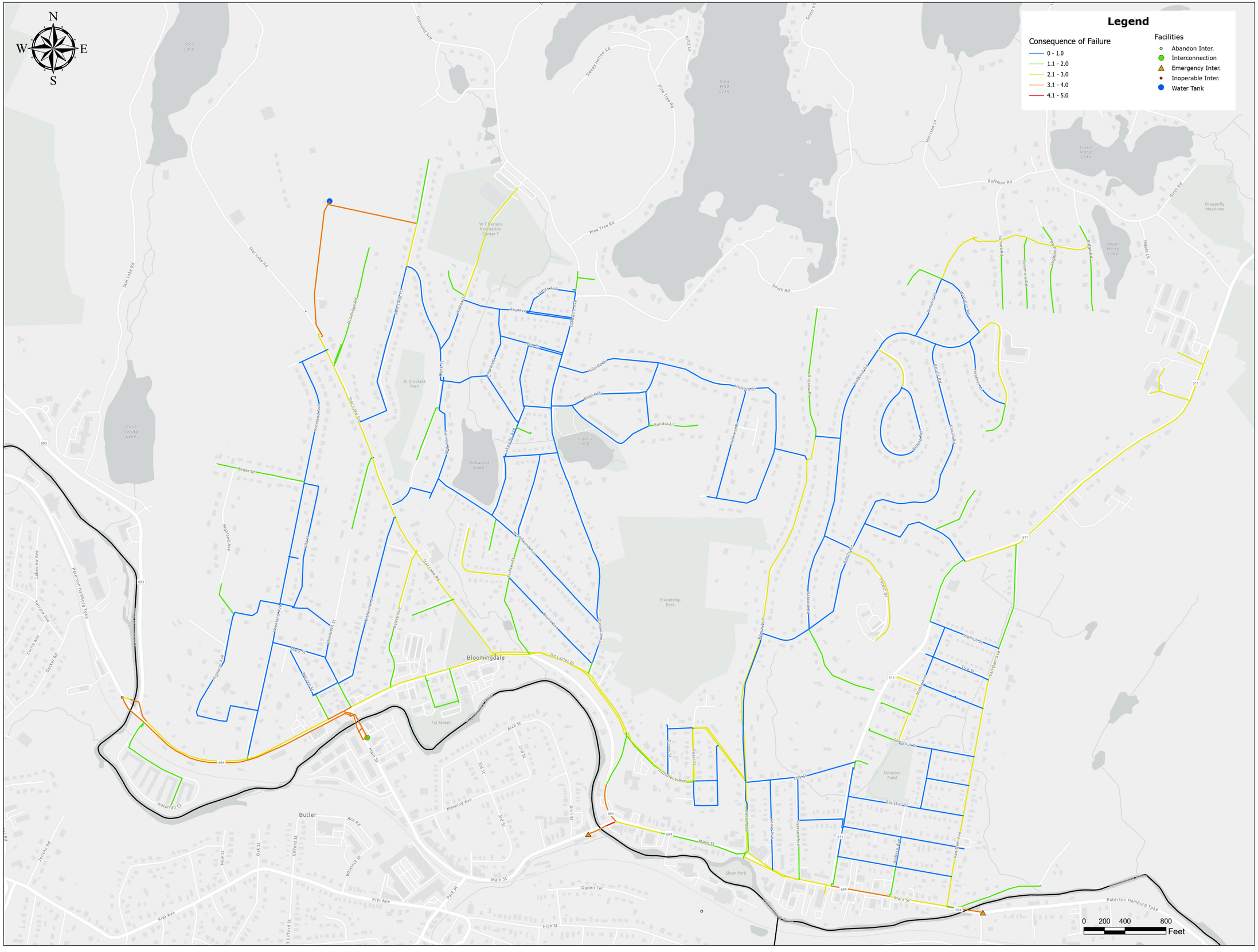
SHEET TITLE

Asset Management Plan 2023

Water Distribution System Probability of Failure

SHEET #

AMP3



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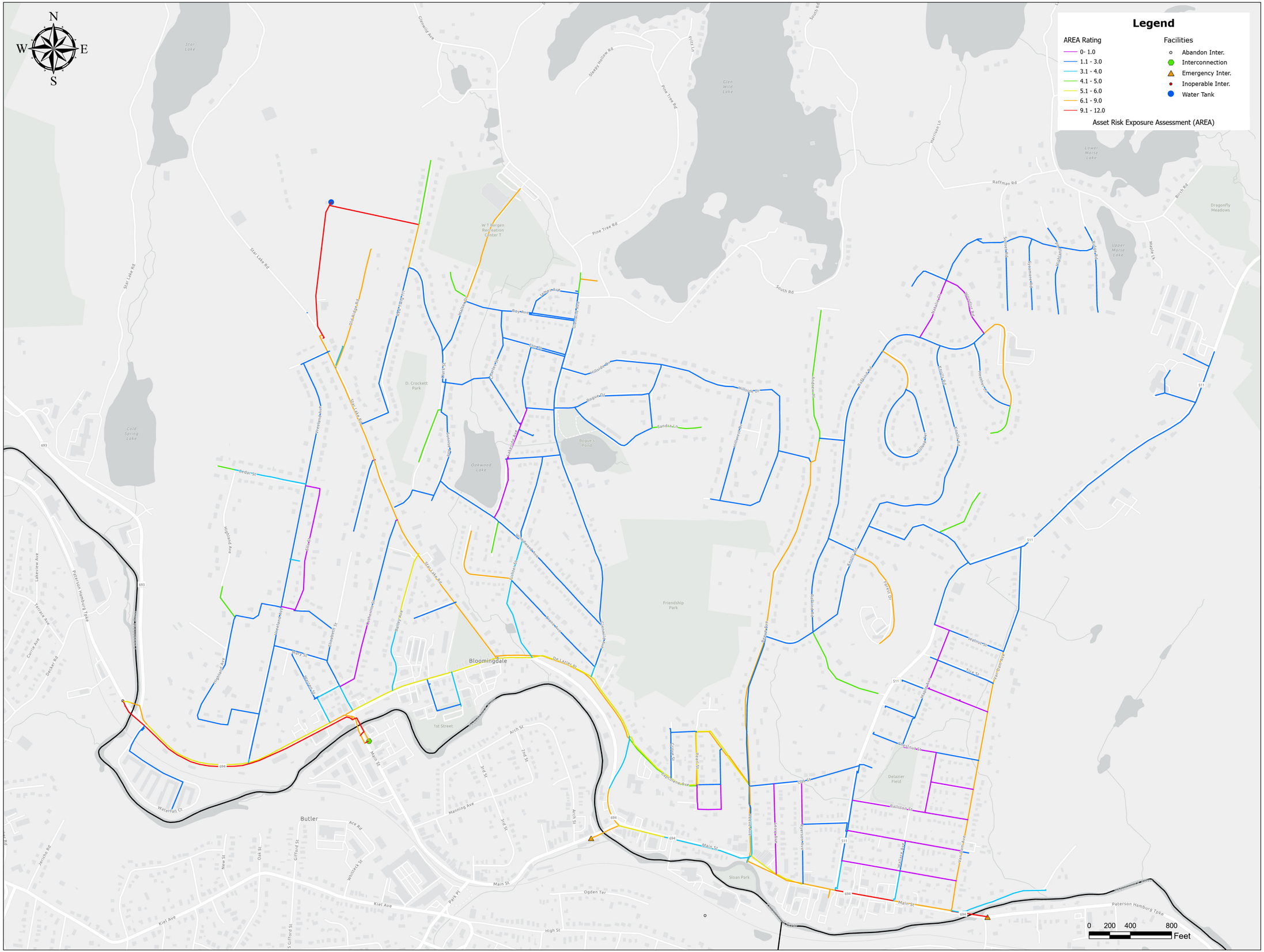
SHEET TITLE

Asset Management Plan 2023

Water Distribution System Consequence of Failure

SHEET #

AMP4



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MARK	DATE	DESCRIPTION

PROJECT #: BLMD2302

DATE: August 2023

DESIGNED BY: G Forstrom

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CHECKED BY:

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CLIENT

Borough of Bloomingdale
Water Department
Passaic County, New Jersey

CONTRACT

SHEET TITLE

Asset Management Plan 2023

Water Distribution System AREA Rating

SHEET #

AMP5

Table 1 - Inventory of Facilities		
Location	**Address**	**Description**
Interconnection - Pump Station (Butler)	Hamburg Turnpike	Water Supply From Butler
King's Corner Emergency Interconnection	146 Main St	Emergency Interconnection with Butler
PVWC Emergency Interconnection	Hamburg Turnpike	Emergency Interconnection with PVWC
Water Tank	Star Lake Rd	0.5 Million Gallon Welded Tank

Table 2 - Consequence of Failure (CF) Ranking										
Location	Asset	Importance to Facility	Water Quality	Water Quantity / Availability	Economy (Cost)	Environmental	Consumer Trust	Raw Rating CF	Facil. Import. to System	Rating CF
Interconnection - Pump Station (Butler)	Building	4	2	3	1	1	5	2.67	5	2.67
Interconnection - Pump Station (Butler)	Booster Pump	5	2	5	2	1	4	3.17	5	3.17
Interconnection - Pump Station (Butler)	Booster Pump	5	2	5	2	1	4	3.17	5	3.17
Interconnection - Pump Station (Butler)	VFD	4	1	4	1	1	2	2.17	5	2.17
Interconnection - Pump Station (Butler)	VFD	4	1	4	1	1	2	2.17	5	2.17
Interconnection - Pump Station (Butler)	Controls	1	1	2	1	1	1	1.17	5	1.17
Interconnection - Pump Station (Butler)	SCADA System	1	1	1	1	1	1	1.00	5	1.00
Interconnection - Pump Station (Butler)	Cellular Communication system	2	2	5	2	1	4	2.67	5	2.67
Interconnection - Pump Station (Butler)	Emergency Generator (Portable)	3	1	3	3	2	2	2.33	5	2.33
King's Corner Emergency Interconnection	Interconnection Valve	3	2	5	1	1	3	2.50	3	1.50
PVWC Emergency Interconnection	Interconnection Valve	3	2	5	1	1	3	2.50	3	1.50
Water Tank	Welded Steel Tank	5	3	5	1	3	5	3.67	5	3.67
Water Tank	SCADA System	3	1	3	1	1	1	1.67	5	1.67
Water Tank	Tank Safety Items	2	1	1	1	1	4	1.67	5	1.67
Water Tank	Cellular Communication system	3	1	3	1	1	1	1.67	5	1.67
Water Tank	Radio Communication Repeater	1	1	1	1	1	5	1.67	5	1.67
Water Tank	Valve Turning Trailer	1	2	2	1	1	3	1.67	5	1.67

Table 3 - Probability of Failure (PF) Ranking								
Location	Asset	Condition	Condition (Rating)	Service (rating)	Install Date	Expected Life	Life (Rating)	Rating PF
Interconnection - Pump Station (Butler)	Building	New	0.1	1	2018	200	1	0.70
Interconnection - Pump Station (Butler)	Booster Pump	New	0.1	1	2018	30	1	0.70
Interconnection - Pump Station (Butler)	Booster Pump	New	0.1	1	2018	30	1	0.70
Interconnection - Pump Station (Butler)	VFD	New	0.1	1	2018	20	1	0.70
Interconnection - Pump Station (Butler)	VFD	New	0.1	1	2018	20	1	0.70
Interconnection - Pump Station (Butler)	Controls	New	0.1	1	2018	30	1	0.70
Interconnection - Pump Station (Butler)	SCADA System	New	0.1	1	2018	30	1	0.70
Interconnection - Pump Station (Butler)	Cellular Communication system	New	0.1	1	2018	10	2	1.03
Interconnection - Pump Station (Butler)	Emergency Generator (Portable)	New	0.1	1	2018	30	1	0.70
King's Corner Emergency Interconnection	Interconnection Valve	Fair	2.5	1	1960	100	3	2.17
PVWC Emergency Interconnection	Interconnection Valve	Fair	2.5	1	1960	100	3	2.17
Water Tank	Welded Steel Tank	Good	1.5	1	1960	100	3	1.83
Water Tank	SCADA System	Good	1.5	1	2013	30	2	1.50
Water Tank	Tank Safety Items	Good	1.5	1	2013	20	2	1.50
Water Tank	Cellular Communication system	Good	1.5	1	2013	10	4	2.17
Water Tank	Radio Communication Repeater	55000	1.5	1	2013	20	2	1.50
Water Tank	Valve Turning Trailer	Good	1.5	1	2018	25	1	1.17

Table 4 - Asset Risk Exposure Assessment (AREA) Scores				
Location	Asset	Rating CF	Rating PF	AREA Rating
Interconnection - Pump Station (Butler)	Building	2.67	0.70	2.00
Interconnection - Pump Station (Butler)	Booster Pump	3.17	0.70	3.00
Interconnection - Pump Station (Butler)	Booster Pump	3.17	0.70	3.00
Interconnection - Pump Station (Butler)	VFD	2.17	0.70	2.00
Interconnection - Pump Station (Butler)	VFD	2.17	0.70	2.00
Interconnection - Pump Station (Butler)	Controls	1.17	0.70	1.00
Interconnection - Pump Station (Butler)	SCADA System	1.00	0.70	1.00
Interconnection - Pump Station (Butler)	Cellular Communication system	2.67	1.03	3.00
Interconnection - Pump Station (Butler)	Emergency Generator (Portable)	2.33	0.70	2.00
King's Corner Emergency Interconnection	Interconnection Valve	1.50	2.17	4.00
PVWC Emergency Interconnection	Interconnection Valve	1.50	2.17	4.00
Water Tank	Welded Steel Tank	3.67	1.83	7.00
Water Tank	SCADA System	1.67	1.50	3.00
Water Tank	Tank Safety Items	1.67	1.50	3.00
Water Tank	Cellular Communication system	1.67	2.17	4.00
Water Tank	Radio Communication Repeater	1.67	1.50	3.00
Water Tank	Valve Turning Trailer	1.67	1.17	2.00

NOTES:
PF - Probability of Failure
CF - Consequence of Failure
AREA - Asset Risk Exposure Assessment

Table 5 - Life Cycle Cost						
Location	Asset	Install Date	Expected Life	Rehab Period	Rehab Cost % of Replacement	Replacement Cost
Interconnection - Pump Station (Butler)	Building	2018	200	20	10%	$ 750,000.00
Interconnection - Pump Station (Butler)	Booster Pump	2018	30	15	0%	$ 5,000.00
Interconnection - Pump Station (Butler)	Booster Pump	2018	30	15	0%	$ 5,000.00
Interconnection - Pump Station (Butler)	VFD	2018	20	10	20%	$ 9,000.00
Interconnection - Pump Station (Butler)	VFD	2018	20	10	20%	$ 9,000.00
Interconnection - Pump Station (Butler)	Controls	2018	30	10	5%	$ 40,000.00
Interconnection - Pump Station (Butler)	SCADA System	2018	30	10	5%	$ 40,000.00
Interconnection - Pump Station (Butler)	Cellular Communication system	2018	10	1	0%	$ 10,000.00
Interconnection - Pump Station (Butler)	Emergency Generator (Portable)	2018	30	5	10%	$ 55,000.00
King's Corner Emergency Interconnection	Interconnection Valve	1960	100	1	0%	$ 1,000.00
PVWC Emergency Interconnection	Interconnection Valve	1960	100	1	0%	$ 1,000.00
Water Tank	Welded Steel Tank	1960	100	20	40%	$ 1,000,000.00
Water Tank	SCADA System	2013	30	10	5%	$ 40,000.00
Water Tank	Tank Safety Items	2013	20	1	0%	$ 40,000.00
Water Tank	Cellular Communication system	2013	10	1	0%	$ 10,000.00
Water Tank	Radio Communication Repeater	2013	20	10	0%	$ 20,000.00
Water Tank	Valve Turning Trailer	2018	25	1	0%	$ 55,000.00