CAPITAL EFFICIENCY PLAN™
FEBRUARY 2018

Manchester-by-the-Sea, Massachusetts

TATA & HOWARD

Capital Efficiency Plan™
Manchester by the Sea, Massachusetts

Prepared by:

TATA & HOWARD

February 2018

TATA & HOWARD

February 13, 2018

Ms. Carol Murray, Interim Director
Department of Public Works
10 Central Street
Manchester by the Sea, MA 01944-1399

Subject: Capital Efficiency Plan™
Manchester by the Sea, Massachusetts
T&H No. 4568

Dear Ms. Murray:

In accordance with our agreement, Tata & Howard is pleased to present two copies of the Draft Capital Efficiency Plan™ for the Town of Manchester-by-the-Sea's water distribution system. The analysis and improvements in this report are based on the Three Circles Approach for optimum capital efficiency, which combines hydraulic and critical component considerations with an asset management rating system to evaluate the condition of the water mains in the distribution system. Supply and storage needs were also evaluated in this report.

Hydraulic recommendations were developed as part of this study. Critical areas of the system were identified and tested on the hydraulic model for redundancy. Finally, each segment of water main was evaluated based on age, material, diameter, break history and soil conditions to determine an asset management score. The results were combined to determine the water mains most in need of replacement and establish a prioritized set of improvements in the system. A detailed description of the improvements and estimated costs is presented in Section 7.

During the course of this project, the undersigned served as Project Manager, Ms. Patricia L. Kelliher served as Project Engineer, Mr. Dustin J. Lacombe served as Assistant Project Engineer, Ms. Justine M. Carrol, P.E. provided technical reviews, and Ms. Karen L. Gracey, P.E. served as Project Officer.

At this time, we wish to express our continued appreciation to the Town for their participation in this study and for their help in collecting information and data. We appreciate the opportunity to assist the Town on this important project

Sincerely,

TATA & HOWARD, INC.

Paul E. Cote, P.E.
Associate

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Section 1

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SECTION 1 – EXECUTIVE SUMMARY

1.1 General

Tata & Howard, Inc. was retained by the Town of Manchester-by-the-Sea (Town) to complete a Capital Efficiency Plan™ for the Town's water system. The purpose of the plan is to identify areas of the water distribution system in need of rehabilitation, repair, or replacement; and prioritize improvements to make the most efficient use of the Town's capital budget. The study evaluates the existing water infrastructure including water transmission and distribution piping and appurtenances. In addition, water storage and supply needs were evaluated and prioritized. The condition of the above ground facilities, including water supplies, the water treatment facility, and the water storage tank, were not evaluated as part of this study.

Tata & Howard evaluated the water distribution system using the Three Circle Approach, which consists of the following evaluation criteria:

- System hydraulic evaluation,
- Criticality component assessment,
- Asset management considerations.

Each circle represents a unique set of evaluation criteria for each water main segment. From each set of criteria, system deficiencies are identified. System deficiencies from each circle are then compared. Any deficiency that falls into more than one circle is given higher priority than one that does not. Using the Three Circle Approach, recommended improvements will result in the most benefit to the system. In addition, the Three Circle Approach allows us to identify any situations that mitigate a deficiency in one circle and eliminate a deficiency in another circle. By integrating all three sets of criteria, the infrastructure improvement decision making process and overall capital efficiency are optimized.

Data provided by the U.S. Census and population projection data provided by the Metropolitan Area Planning Council (MAPC) and the University of Massachusetts Donahue Institute (UMDI) were analyzed to determine an estimated 2035 population. The estimated 2035 population for the Town is 4,900. The current consumption data shows a 2035 average day demand (ADD) of 0.62 million gallons per day (mgd). Based on the 1980 to 2010 US Census data, the Town population has been decreasing. As a result, the projected ADD estimated from the 2035 population is less than historic ADD. This would result in a 2035 maximum day demand (MDD) and summer average day demand (SADD) less than historic values. Based on the US Census Population Estimates Program, the US Census shows the population increasing from 2010 to 2015. Furthermore, over the past five years, it appears that consumption in the summer months has been increasing. This is likely a direct result of an increase in residential irrigation system installations and consequently increased lawn irrigation. For this reason, a conservative approach has been taken with future demand planning. The projected 2035 MDD and SADD are equivalent to the highest historical demands of 2.03 mgd and 1.00 mgd, respectively.

Hydraulic recommendations were originally developed in earlier studies. These recommendations were updated based on completed projects and used in this report. Priority 1 hydraulic improvements included recommendations that would strengthen the transmission capabilities of the system, address areas of low static pressure, or provide an Insurance Services Office (ISO) recommended fire flow to a certain service area. Priority 2 recommendations were identified as part of a system wide evaluation to provide estimated residential fire flows.

A critical component assessment was performed for the water distribution system to evaluate the impact of potential water main failures on the system. The critical component assessment includes identification of critical areas served, critical water mains, and the need for redundant mains. Critical areas served were identified by the Town and include water department facilities, emergency service facilities, nursing homes, schools, and interconnections. Critical water mains include primary transmission lines as well as water mains that cross streams and railroad tracks.

An asset management assessment was completed for the water system. A number of factors are considered in the ratings including: age, material, diameter, break history, soil conditions, and water quality. These factors affect the decision to replace or rehabilitate a water main. Using our asset management rating approach, each water main in the system was assigned a rating based on these factors. Water mains with a total rating less than 30 are considered to be in good to excellent condition. Areas with a total rating between 30 and 45 are considered to be in fair to good condition, and areas with a total rating greater than 45 are considered to be in poor to fair condition.

Utilizing the Three Circles Approach, improvements were recommended and prioritized based on the aforementioned criteria. Phase I improvements generally include any recommended improvements that fall into all three circles and are hydraulically deficient, critical, and have a high asset management score. The total estimated probable construction cost of the Phase I recommended improvements is $2,144,000. Phase II improvements include any recommended improvements that fall into two of the circles. The total estimated probable construction cost of Phase II recommended improvements is approximately $10,662,000. Phase III recommendations include any recommended improvements that are needed hydraulically or any recommended improvements that have a high asset management score indicating poor condition. Phase III improvements have been split into three categories. Phase IIIa improvements represent any remaining hydraulic improvements, Phase IIIb improvements are the water mains with high asset management scores that do not fall into the other two circles, and Phase IIIc improvements are for critical water mains that also do not fall into any other circle. The total estimated probable construction cost of Phase IIIa improvements is approximately $3,218,000. The total estimated probable construction cost of Phase IIIb improvements is approximately $304,000. The total estimated probable construction cost of Phase IIIc improvements is approximately $12,712,000. These mains are identified on the Recommendations Map in Appendix G. The order of the recommendations in Phase IIIc was determined utilizing the Pavement Management Plan by BETA Group, Inc. Recommended water system improvements with pavement improvement recommendations were given higher priority than those with deferred pavement improvement recommendations. The pavement management plan lists the Town's roadways and suggested repairs based on inspections performed in 2014. The list of recommended pavement projects is included in Appendix H for reference.

Section 2

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SECTION 2 – EXISTING WATER SYSTEM

2.1 Distribution System

The Town's water distribution system consists of approximately 37 miles of public water mains ranging in size from two to 16-inches in diameter. Figure No. 2-1 shows a breakdown of the water main size distribution of the existing water system. Approximately four percent is 16-inch diameter, four percent is 14-inch diameter, ten percent is 12-inch diameter, seven percent is 10-inch diameter, 23 percent is 8-inch diameter, 48 percent is 6-inch diameter, and four percent is 4-inch or smaller diameter.

The water mains are constructed of various materials. The water industry in the United States followed certain trends over the last century. The installation date of a water main correlates with a specific pipe material that was used during that time. For example, up until about the year 1958 unlined cast iron water mains were the predominant pipe material installed in water systems. Factory cement lined cast iron mains were generally manufactured from the late 1950s to about 1970, when pipe manufacturers switched primarily to factory cement lined ductile iron pipe. During the workshop with the Town, it was indicated that the distribution system cast iron pipe is primarily unlined, and areas where there may be lined cast iron pipe was not identified, therefore, no lined cast iron water main was included in this report. According to the available information, the Town's system contains approximately 76 percent cast iron (CI), 17 percent asbestos cement (AC), five percent ductile iron (DI), two percent polyvinyl chloride (PVC), and less than one percent copper. Figure No. 2-2 shows the breakdown of material distribution of the exiting water system.

The system also includes two water supply sources and one water storage tank. The sources are located within the North Coastal Basin Watershed. The distribution system service elevations range from sea level to approximately 196 feet above mean sea level (MSL).

2.2 Water Supply Sources

As previously stated, the Town has two finished water supply sources, Gravelly Pond and the Lincoln Street Well. Gravelly Pond is supplemented in part by Round Pond Well No. 1. Round Pond No. 1 is a raw water well that is pumped into a sandbed outside of Gravelly Pond and infiltrates into the Pond to supplement the source. The raw water pumped from Gravelly Pond is treated at the Gravelly Pond Water Treatment Facility. The Lincoln Street Well is treated at the Lincoln Street Well Corrosion Control Facility. The Town's Water Management Act (WMA) registered authorized watershed withdrawal volume is 0.72 million gallons per day (mgd).

Gravelly Pond

Gravelly Pond is a surface water supply source located in Hamilton, Massachusetts off Chebacco Road. The pond has been used as the Town's primary water supply source since the early 1900s and has an estimated volume of approximately 360 million gallons (mg). It is approximately 49 acres in size and has a maximum depth of around 57 feet. According to the Town's Annual Statistical Reports (ASR) the safe yield of Gravelly Pond is 0.12 mgd. The Town is currently evaluating the safe yield under another study.

Figure No. 2-1
Water Main Diameter Distribution

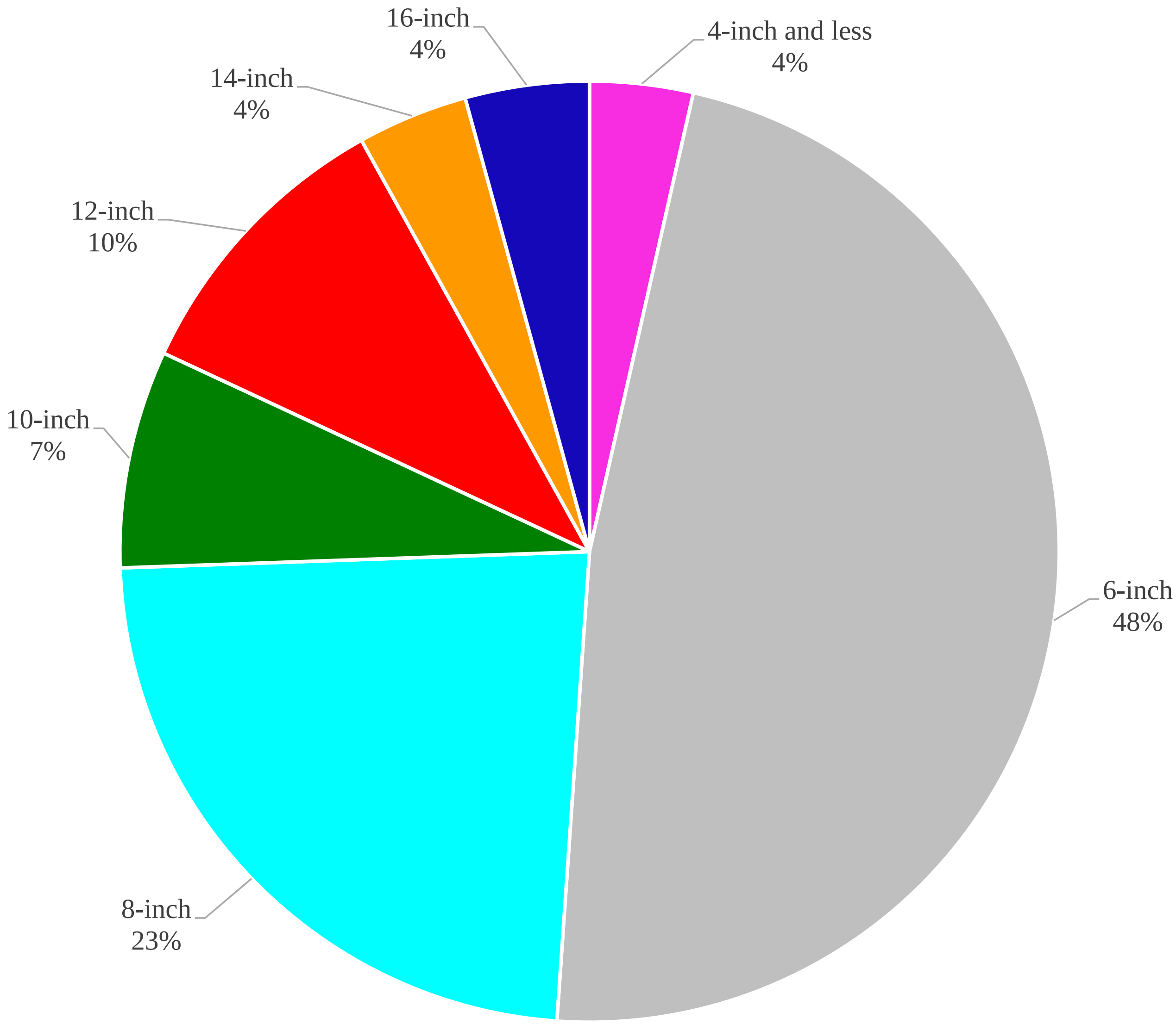
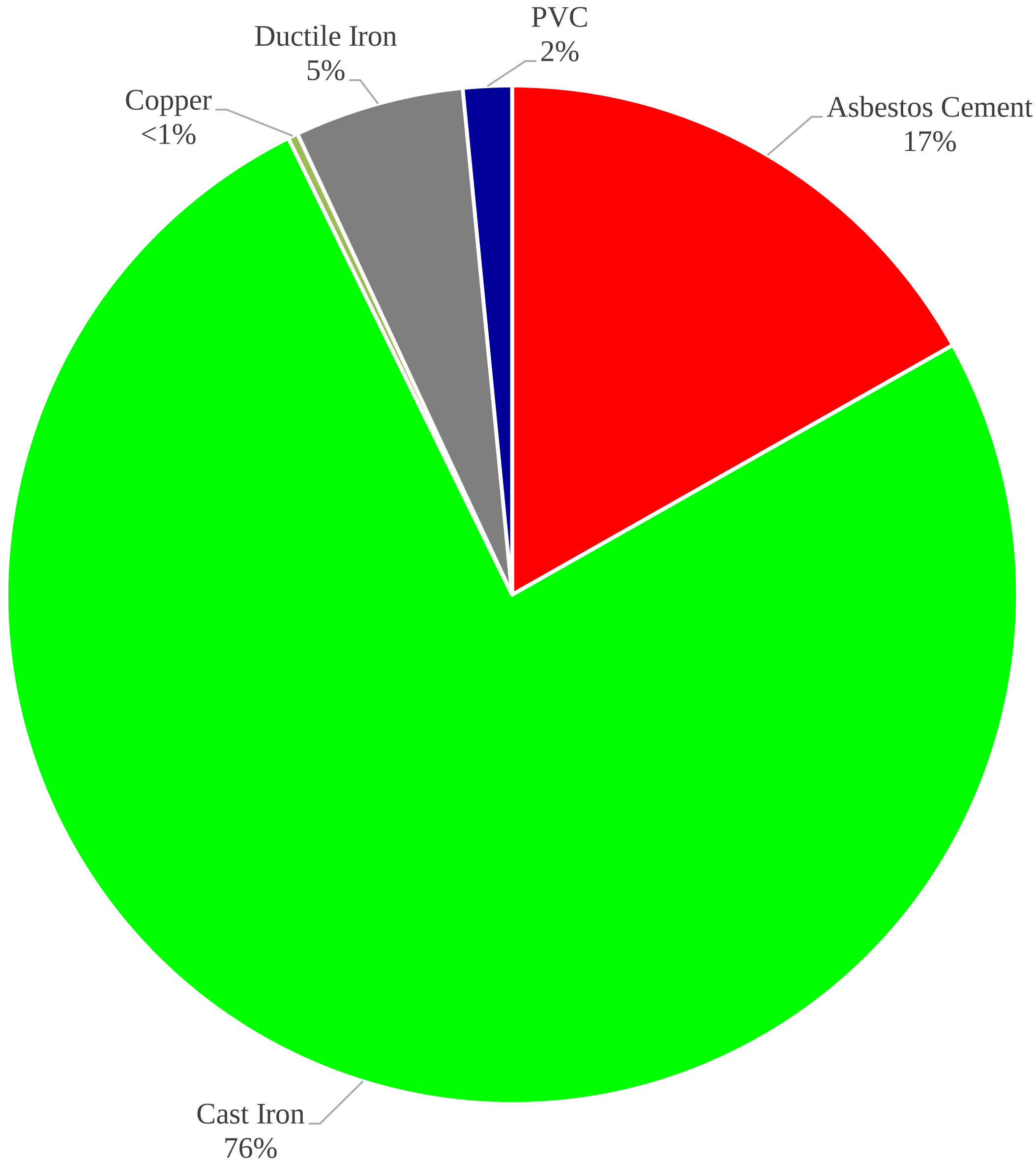


Figure No. 2-2
Water Main Material Distribution



The water from Gravelly Pond is pumped to and treated by the Gravelly Pond Water Treatment Facility. The facility was completed in May 1997. The maximum aggregate capacity of the finished water pumps is 3,000 gallons per minute (gpm) or 4.32 mgd. A Supervisory Control and Data Acquisition (SCADA) system is located at this facility and used to operate and monitor components of the water treatment and distribution systems.

The facility treats the raw water with sodium hypochlorite for disinfection, sodium hydroxide for pH adjustment, zinc orthophosphate for corrosion control, and sodium fluoride for dental health. In addition to disinfection, corrosion control, and fluoridation, the facility also has a clarification/filtration system. Clarification/filtration is provided by a Trident Microfloc package treatment system and consists of two basic treatment components. The first component is an upflow clarifier used to remove the larger particles in the water. The coagulation chemical used for this process is aluminum sulfate. The second component is the filter itself, which removes any remaining particulates. This process allows the Town to reduce the turbidity and produce water meeting the requirements of the Safe Drinking Water Act. The facility also contains a clearwell which has a volume of approximately 0.48 million gallons.

Round Pond Wells

To supplement the Gravelly Pond supply and provide water recharge, the Town pumps water from Round Pond Well No. 1 located along Chebacco Road in Hamilton into a series of surface water ponds that flow by gravity to Gravelly Pond. The gravel packed well was constructed in 1966. In 1996 Round Pond Well No. 1 was permitted by MassDEP to act as an overland discharge to supplement Gravelly Pond with a maximum discharge rate of 300 gpm.

Round Pond Well No. 2 was a tubular wellfield also located along Chebacco Road in Hamilton. The Town did not renew the Water Management Permit for Round Pond Well No. 2 in 2009. Well No. 2 was constructed as a tubular wellfield consisting of seven 2-1/2-inch diameter wells, pumped with a centrifugal pump. The well has been offline for a number of years and would be required to go through the Drinking Water New Source Approval process before it could be restored and placed back online. The previously approved MassDEP maximum daily withdrawal rate for Round Pond Well No. 2 was 0.36 mgd or 250 gpm as stated in the permit issued February 15, 1991.

Lincoln Street Well

The Lincoln Street Well is a 24-inch diameter gravel packed well located on Lincoln Street adjacent to the Manchester Essex Regional High School. The well was constructed in 1958. It was constructed to a depth of 68 feet in a confined sand and gravel deposit, with approximately 15 feet of clay overlying the water bearing material at the well. The capacity of the well is approximately 600 gpm. The approved withdrawal rate is 0.38 mgd.

The Lincoln Street Well Corrosion Control Facility was constructed in 1997. The facility treats the raw water with sodium hypochlorite for disinfection, sodium hydroxide for pH adjustment, a 70/30 percent non-sodium, non-zinc poly orthophosphate blend for corrosion control and prevention of colored water, and sodium fluoride for dental health. In April of 2016, the Town installed a new hydrant and a serpentine pipe system provide additional chlorine contact time prior to finished water entering the system.

2.3 Existing Water Storage Facility

Moses Hill Standpipe

The Moses Hill Standpipe is located off Pine Street on Moses Hill. The standpipe was constructed of prestressed concrete in 2001 and has a storage capacity of approximately 1.7 mg. The standpipe is approximately 78 feet to overflow and 60 feet in diameter. The base elevation is approximately 195 feet and the overflow elevation is approximately 273 feet above MSL.

2.4 Interconnections

The water system has two interconnections with the City of Gloucester and one interconnection with the City of Beverly. The Gloucester interconnections are located at the Gloucester border on Raymond Street and Summer Street. The Beverly interconnection is located at the Beverly border on Bridge Street. The interconnections are used only as emergency connections. Both adjacent systems have a lower hydraulic gradeline elevation than Manchester-by-the-Sea, therefore, a pumping system would be required to serve Manchester-by-the-Sea. In February 2015, a 460 gpm, diesel powered portable pump was purchased to provide the pumping capacity to receive water from Beverly in an emergency. This pump could also be utilized at the Gloucester interconnections with modifications to the pipe configuration at the two locations.

Section 3

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SECTION 3 – WATER SYSTEM DEMANDS

3.1 General

For the purposes of evaluating the water needs of a community, several parameters are typically reviewed to better understand the demands of a distribution system. These parameters are defined in the sections below and are presented with existing and projected demand estimates.

3.2 Population Projections

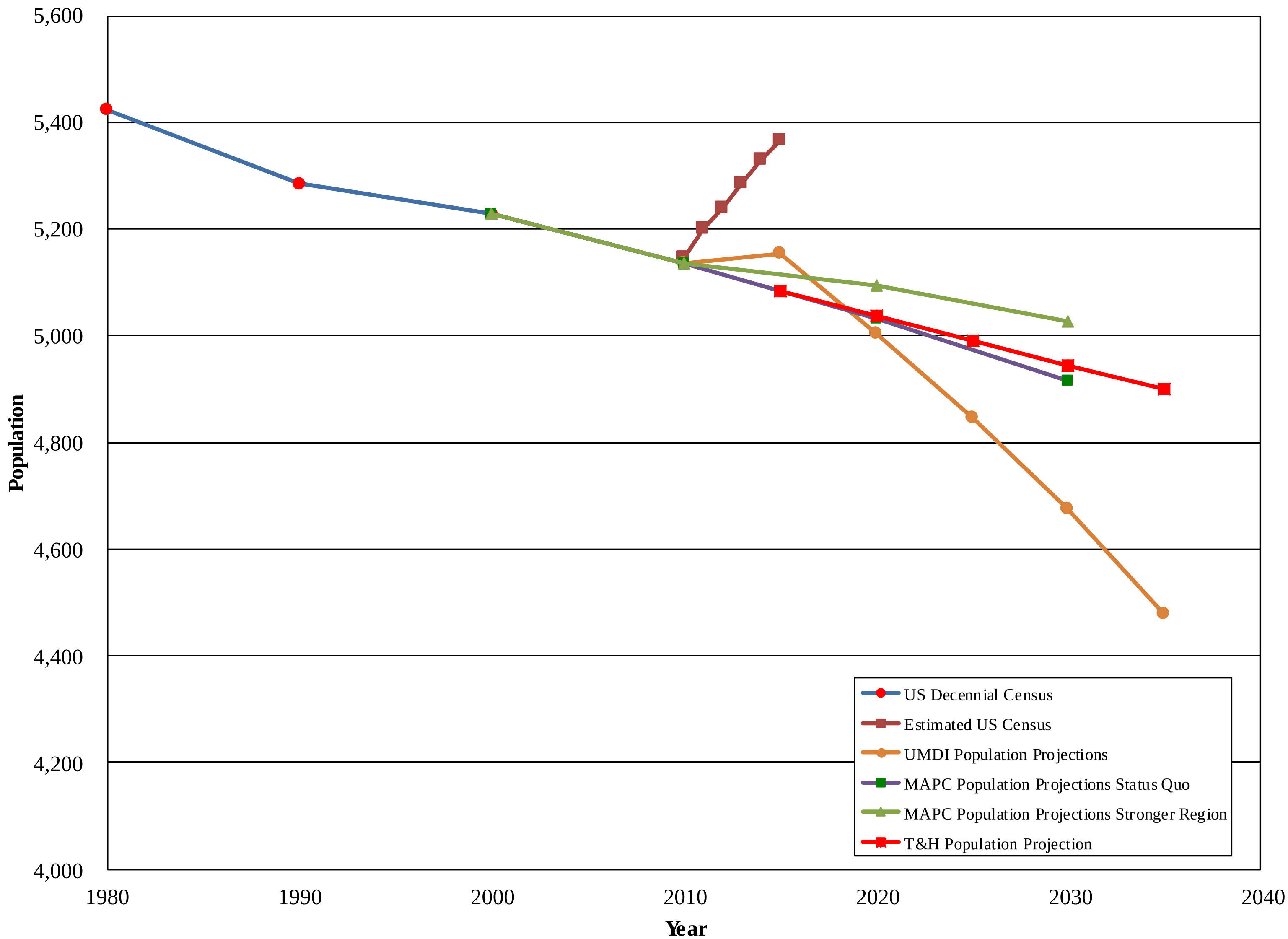
Because population has a direct correlation to water consumption, population projections from various sources through the year 2035 were reviewed to reflect actual and planned growth within the Town. The following section reviews historical population data and presents an estimated future population.

According to the United States Census, the Town of Manchester-by-the-Sea has experienced a slight annual population decline ranging from approximately 0.1 percent to 0.3 percent per year from 1980 through 2010 with an overall decline of approximately 5.3 percent. The population recorded during each decennial census has been plotted in Figure No. 3-1. According to the 2010 US Census, the population in the Town was 5,136.

Population projection data was collected from the University of Massachusetts Donahue Institute (UMDI) and is included in Figure No. 3-1. The projections are provided in 5-year intervals from 2010 through 2035. Based on UMDI, the estimated 2035 population is approximately 4,478. As shown in Figure No. 3-1, the UMDI population decreases significantly compared to other projections discussed in this study. Because of the large decrease in population, the projected 2035 UMDI population was not used to determine the Town's estimated population projection.

The Metropolitan Area Planning Council (MAPC) published population projections for the Town in the Population and Housing Demand Projections for Metro Boston in January 2014. The population projections were estimated using two scenarios. The two scenarios are Status Quo and Stronger Region. The Status Quo scenario is based on existing rates of births, deaths, migration, and housing occupancy. Based on existing rates, the population in the Town is expected to decrease through 2030 by an average decline of approximately 11 people per year. The Stronger Region scenario considers changing trends resulting in higher growth. This scenario results in a decrease in population through 2030 with an average decline of approximately five people per year. The population projections are also shown in Figure No. 3-1. Based on the Status Quo Scenario, the estimated 2035 population is 4,533 and based on the Stronger Region Scenario, the estimated 2035 population is 4,994.

Figure No. 3-1 Historic and Projected Populations



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In earlier studies, the 2035 population projection was assumed to have no growth nor decrease. After further discussion with the Town, T&H prepared population projections based on the current and estimated decrease in population. The 2035 population projection is based on the linear trend line of the 1980 through 2010 US Decennial Census historical data. The trend line projects an estimated 2035 population of approximately 4,900 people, which is equivalent to a decrease in approximately 10 people per year.

The US Census Bureau also has a Population Estimates Program that considers different data series such as births, deaths, federal tax returns, etc. to estimate changes in population since the completion of the latest census. The Population Estimates Program estimated annual population has also been included in Figure No. 3-1. Between 2010 and 2015, the U.S. Census estimated annual population increases by approximately 4.1 percent. Compared to data collected by the Town, the population has actually decreased by approximately 3.3 percent from 2010 through 2015, therefore, the census estimated annual population was not used to determine population projections. However, if the population does not continue to decrease, the demand projections would have to be reevaluated.

3.3 Water System Demands

The Massachusetts Department of Conservation and Recreation (DCR) follows specific guidelines when projecting the water usage for communities in conjunction with the MassDEP Water Management Act (WMA) program. These guidelines incorporate trends in the use of water conservation devices in homes and industry, and emphasize the importance of monitoring the distribution system through water audits and leak detection surveys to reduce unaccounted-for water. It is important to note that the DCR has a key role in the water management approval process. Any alternative demand projections must be approved by the DCR before the MassDEP will approve development of a new water supply source or authorize the withdrawal of additional volume from existing sources.

The DCR has not completed demand projections for the Town of Manchester-by-the-Sea because the 2012 & 2013 ASRs were not filed, large metering discrepancies were found in previously submitted ASRs, and the reported Unaccounted-for Water is high.

Tata & Howard has been working with the Town to determine the large metering discrepancies and all ASRs have now been filed with MassDEP. Evidence to confirm the data and calculations input to the ASRs prior to 2013 could not be found, therefore, this data is assumed to not be accurate and was not used for this study.

It should be noted that the raw water pumped volume, as reported in the ASRs from 2013 through 2015, includes the water pumped by Round Pond Well No. 1 to Gravelly Pond. The finished water pumped volume does not include Round Pond Well No. 1 since this water is pumped into Gravelly Pond and not directly to the water treatment facility. Round Pond Well No. 1 is manually operated based on a visual inspection and determination of a low water level within Gravelly Pond. Based on records collected at the water treatment facility over the past ten years, Round Pond Well No. 1 has contributed approximately 0.22 mgd to Gravelly Pond excluding days when the well was not operational.

The Town is conducting a water audit and leak detection study to evaluate the high unaccounted-for water. As part of the water audit & leak detection study, the Town has completed two leak detection surveys, two master meter tests, and service meter testing. On July 19, 2016, a master meter test at the Gravelly Pond Water Treatment Facility was conducted by Environmental Instrument Services Inc. (EIS). The test resulted in an approximate 30 percent to 35 percent error between the Treatment Facility's D/P Cell meter and the SCADA finished water flow totalizer. As a result of the master meter flow test results, Woodard & Curran, Inc. (W&C) reported on July 28, 2016, that the Programmable Logic Controller (PLC) was over registering the finished water flow by approximately 30 percent, matching the results by EIS. W&C estimated that the time frame the PLC was adjusted to reflect the 30 percent error, was between November 2, 2009 and January 28, 2010. Figure No. 3-2 illustrates the total finished water pumped reported in the ASRs compared to the revised finished water pumped with the 30 percent totalizer error.

Residential Consumption

Residential consumption is calculated by dividing water supplied to residential connections by the reported population. MassDEP has developed standards for all Public Water Suppliers. The performance standard for rgpcd water use is 65 gallons per capita per day. The rgpcd water use is reported annually within the ASRs. When the performance standard for rgpcd is not met and the water supplier's annual average consumption value is above the permitted or registered volume, then a Residential Gallons Per Capita Day Compliance Plan (RGPCD Plan) must be filed with the ASR. The 2013 through 2015 ASRs indicate that the water system has a residential consumption between 61 rgpcd and 76 rgpcd and the system has not exceeded its registered volume of 0.72 mgd. Because the Town has not exceeded its registered volume, an RGPCD Plan is not required at this time.

Table No. 3-1
ASR Reported RGPCD

Year	RGPCD (gallons)
2013	61
2014	71
2015	76
2016	69*

* Assuming the population for 2016 is similar to 2015

Based on the monthly residential usage, rgpcd values were calculated for both winter and summer. Winter is defined as January through April and September through December and summer is defined as May through August. As shown in Table No. 3-2, the winter rgpcd values for 2013 through 2015 remain below the performance standard of 80. The summer rgpcd values for 2013 and 2014 are significantly higher than both the winter rgpcd values and the performance standard of 80. The summer rgpcd in 2013 is slightly lower than the performance standard, but still significantly higher than the winter rgpcd. The increase in rgpcd values is likely due to increased irrigation throughout the summer months.

Table No. 3-2
Winter and Summer RGPCD

Year	Winter RGPCD (gallons)	Summer RGPCD (gallons)
2013	48	73
2014	63	87
2015	56	107
2016	49*	95*

* Assuming the population for 2016 is similar to 2015

As outlined in Section 3.2, the population has decreased over the past several years, however, the residential usage has increased in both the summer and winter months. Figure No. 3-3 illustrates the rgpcd per month for 2013, 2014, 2015, and 2016 to date.

Occasionally Public Water Suppliers not meeting the rgpcd performance standard will be required to develop a Seasonal Demand Management Plan to manage non-essential outdoor water usage. Seasonal Demand Management Plans must restrict, at a minimum, nonessential outdoor water use from May 1st through September 30th to one day a week outside the hours of 9:00 AM and 5:00 PM when the Massachusetts Drought Management Task Force declares a drought advisory, drought watch, drought warning, or drought emergency for the North Coastal Watershed. Nonessential outdoor water use is defined as uses that are not required: (1) for health or safety reasons; (2) by regulation; (3) for the production of food and fiber; (4) for the maintenance of livestock; or (5) to meet the core functions of a business.

This past July, MassDEP sent the Town a letter indicating a Drought Warning for Northeast Massachusetts. As a result of the drought, the town imposed voluntary use restrictions. These restrictions limited customers to hand held use only. As a result, the total finished water flow dropped from 37.77 MGD in July to 24.48 MGD in August. Based on the 2015 estimated service population, the residential usage dropped from approximately 137 rgpcd in July to approximately 87 rgpcd in August. The high summer rgpcd in 2015 and 2016 seem to be a direct result of an increase in residential irrigation usage due to decreased rainfall and the drought conditions between 2015 and 2016. To be consistent with recent historic values, 80 rgpcd was used for demand projections through the year 2035. This value is higher than the State standards, but it does reflect the water use habits of the Town. If the Town does exceed the registered volume of 0.72 mgd then the Town will be subject to the more stringent usage standards of 65 rgcpd.

Figure No. 3-2 Total Finished Water Pumped

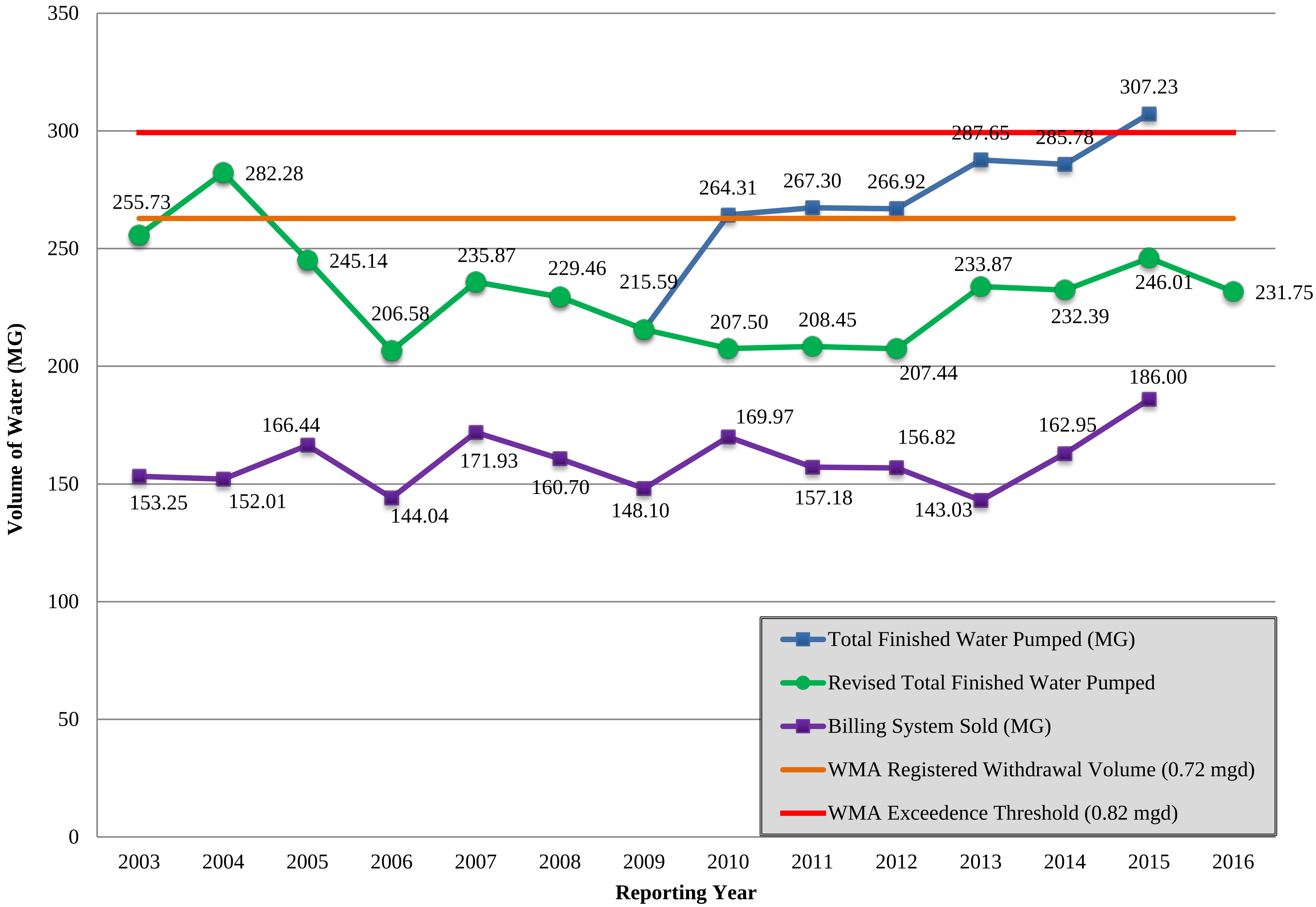
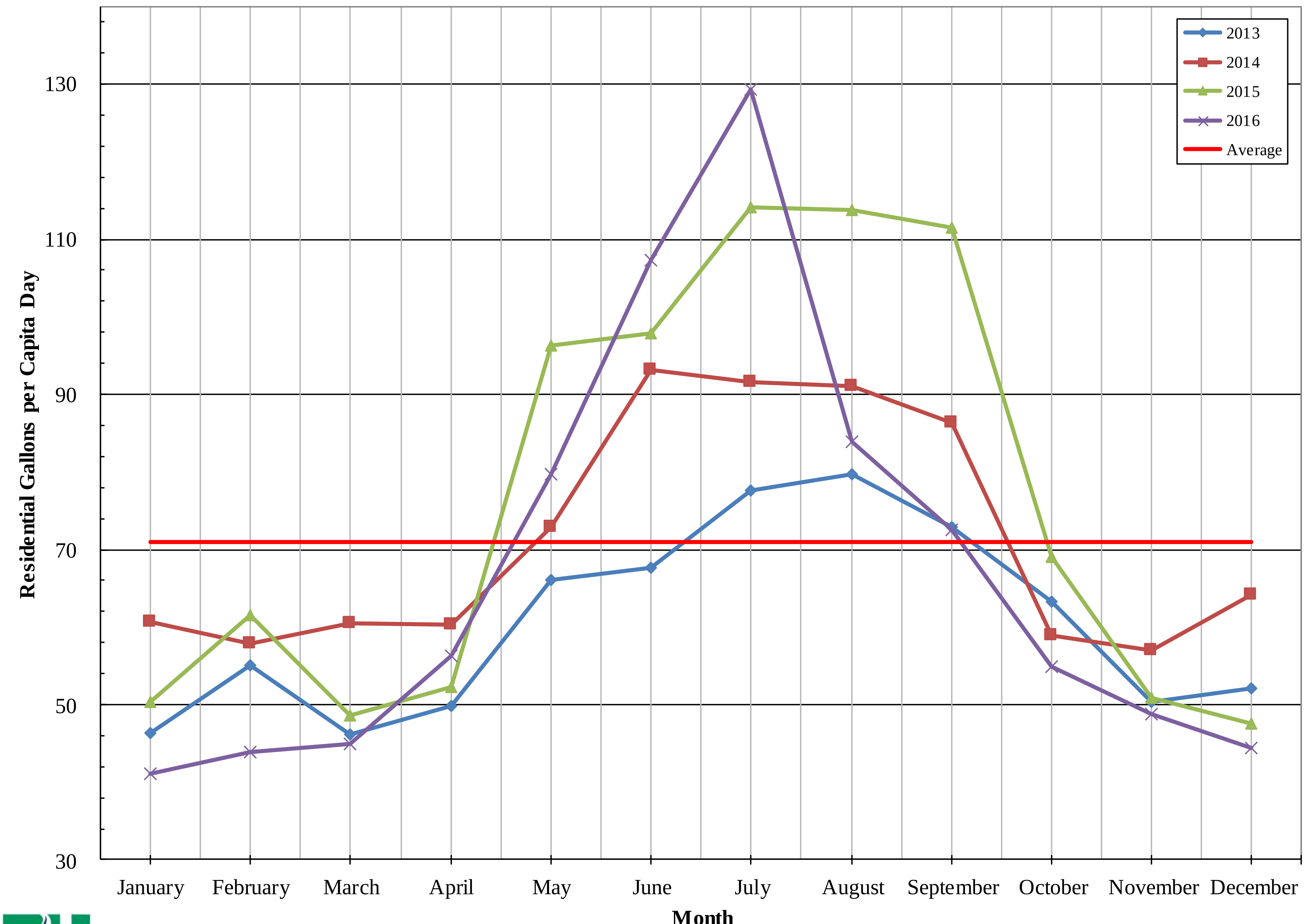


Figure No. 3-3 Residential Gallons per Capita Day



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Non-Residential Consumption

Non-residential water usage includes commercial, municipal, and Confidentially Estimated Water Use. The average non-residential consumption within the Town from 2013 through 2015 has remained consistent at approximately twelve percent of the total water pumped. The non-residential water use is not expected to increase over the next 20 years; therefore, the average non-residential consumption of approximately 12 percent of total consumption was also assumed for water use projections.

Unaccounted-for Water

Unaccounted-for water is defined as the remaining volume of water resulting from the total volume of water supplied to the distribution system as measured by master meters minus the sum of all volumes of water measured by consumption meters in the distribution system and minus the confidently estimated and documented volumes of water used for municipal purposes. This term is typically expressed as a percentage of the total water supplied to the system. Unaccounted-for water may consist of, but is not limited to, meter inaccuracy, leakage, unauthorized hydrant use, illegal connections, or undocumented fire fighting uses.

Examples of confidently estimated municipal uses include, but are not limited to, storage tank overflows and drainage, water main flushing and flow testing, fire fighting, and street cleaning. Confidently estimated usages are required to be documented in writing and reported with the ASR.

The unaccounted-for water percentage in the system was reported in the ASRs as 43.4 percent in 2013, 36.1 percent in 2014, and 39.0 percent in 2015. These numbers have been adjusted to reflect the PLC error correction. The revised unaccounted-for water is 31.0 percent, 21.4 percent, 23.9 percent for 2013, 2014, and 2015, respectively.

If the results of the historical water usage analysis indicate unaccounted-for water percentages greater than 10 percent and the Town exceeds the average annual withdrawal volume of 0.72 mgd, then the Town will be required to develop, implement, and file an Unaccounted-for Water Compliance Plan (UAW Plan) with MassDEP. The filing of a UAW Plan does not constitute a return to compliance, nor does it affect MassDEP's authority to take action in response to the Town's failure to meet the UAW performance standard. The UAW Plan must include measures that will be implemented to meet the performance standard and a schedule for implementing those measures.

The Town will likely have a choice to file a UAW Plan with measures tailored to its specific issues and needs (Individualized UAW Plan) or a UAW Plan that includes Best Management Practices (BMP UAW Plan). At a minimum, the UAW Plan must include a detailed:

1. Description of the actions taken during the prior calendar year to meet the applicable performance standard;
2. Analysis of the cause of the failure to meet the performance standard;
3. Description and schedule of the actions that will be taken to meet the performance standard; and

4. Analysis of how the actions described in 3 will address the specific circumstances that resulted in the failure to meet the performance standard.

A BMP UAW Plan must include all of the following actions:

1. Within one year of filing the UAW Plan, complete a water audit and leak detection survey of the entire system and submit completed audit and survey to the Department;
2. Within one year of completing the audit and leak detection survey, conduct sufficient repairs to reduce by 75% (by water volume) all leaks detected in the survey;
3. Within one year of completing such repairs, conduct additional repairs of leaks detected in the survey as may be necessary to reduce permittee's UAW to 10% or less;
4. Implementation of a program that ensures the inspection and evaluation of all water meters and, as appropriate, the repair, replacement and calibration of water meters in accordance with the following schedule:
   a. Large Meters (2" or greater) - within one year of filing the BMP UAW Plan;
   b. Medium Meters (1" or greater and less than 2") - within two years of filing the BMP UAW Plan;
   c. Small Meters (less than 1") - within three years of filing the BMP UAW Plan.
5. Implementation of monthly or quarterly billing within three years of filing the BMP UAW Plan, and;
6. Within one year of filing the UAW Plan, implementation of a water pricing structure that achieves sufficient revenues to pay the full cost of operating the system including, without limitation, the cost of repairs under paragraph a., the costs of meter repairs, replacements and calibrations under paragraph b., the costs of employees and equipment, and ongoing maintenance and capital costs.

An Individualized UAW Plan may include any of the actions outlined in the BMP UAW Plan. The requirements of the UAW Plan are based on the Modified Water Management Act Permit 9P-3-18-166.01 issued to the Town of Manchester-by-the-Sea by MassDEP on November 16, 2007.

The Town and Tata & Howard are currently working with MassDEP to develop ways to decrease the Town's UAW. In addition to the water audit and leak detection surveys, the Town is also under contract with Tata & Howard, Inc., to develop a meter replacement program. The first round of meter replacement includes metering the Town's unmetered buildings and facilities and meter the Town's highest users.

To be conservative, demand projections through 2035 used an UAW value of 25 percent to reflect current trends. However, as described above, the Town is doing their due diligence to decrease the UAW to meet MassDEP performance standard of 10 percent unaccounted-for water. When the Town completes the meter replacement program, it is recommended to reevaluate the demand projections.

Average Day Demand

Average day demand (ADD) is the total water supplied to a community in one year divided by 365 days. This term is commonly expressed in mgd. This demand includes all water used for domestic (residential), commercial, and municipal purposes. The municipal component includes water used for system maintenance such as water main flushing and fire flows. In addition, the ADD includes unaccounted-for water attributed to unmetered water uses and system leakage. Although the 2016 Annual Statistical Report (ASR) has not been filed, the finished water ADD supplied for the system was estimated at 0.63 mgd based on data collected by the Town.

The following criteria were used to develop the ADD for the design year 2035:

- Residential consumption of 80 gpcd
- Year 2035 service population of 4,900
- Non-residential usage estimated to be 12% of the total usage
- Maximum of 25 percent unaccounted for water

The above criteria, used to develop the ADD for the design year 2035, is lower than the existing ADD because of the projected decrease in service population and the decrease in unaccounted for water. The estimated ADD for the design year 2035 is approximately 0.62 mgd, as shown in Table No. 3-3.

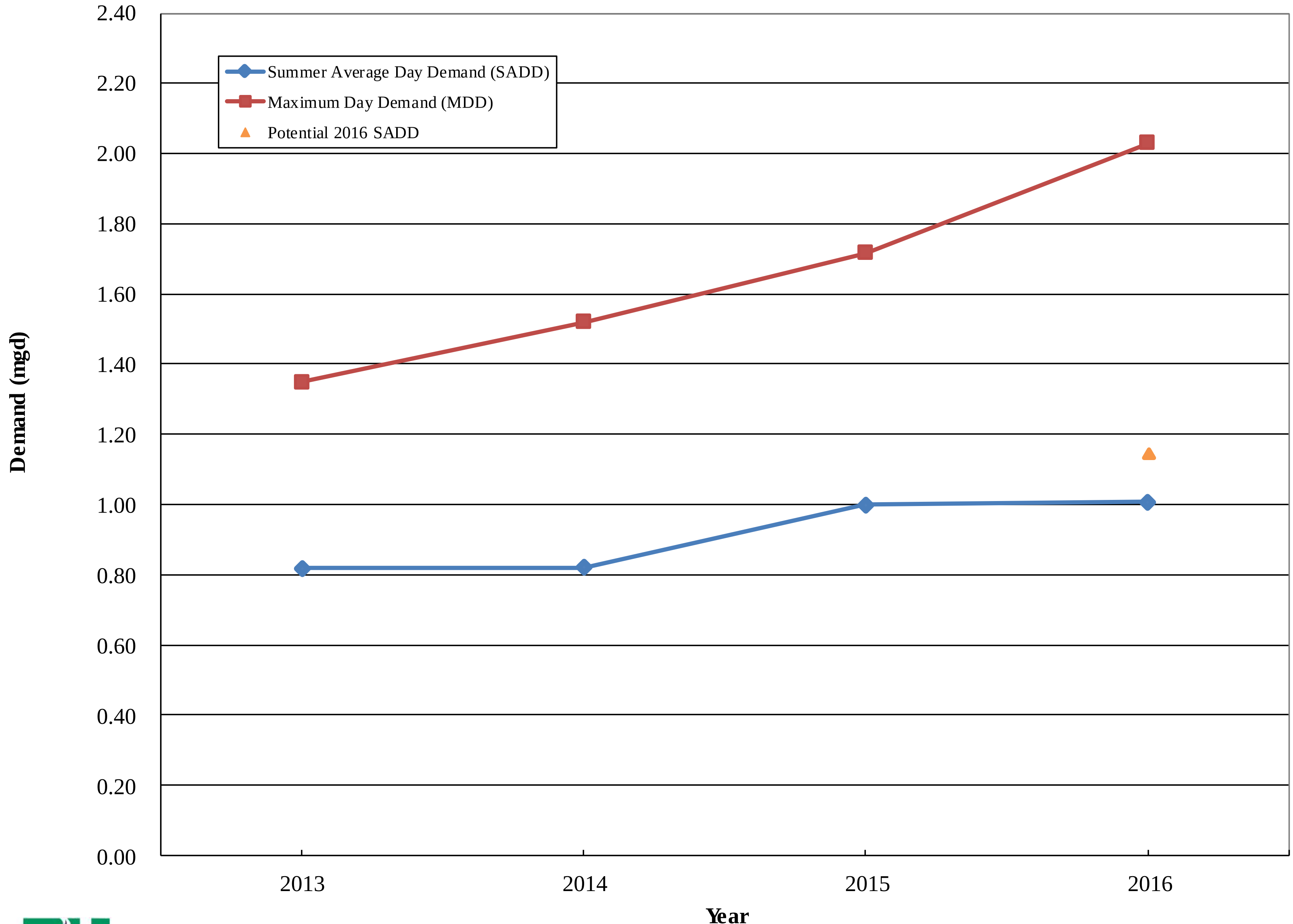
Summer Average Day Demand

MassDEP guidelines recommend that a system consider a projected summer average day demand (SADD). The current SADD is estimated by averaging demands from the three maximum months for the past four years. Based on available data between 2013 and 2016, the SADD ranged from 0.82 mgd to 1.01 mgd. The SADD peaking factor is determined by dividing the SADD by the annual ADD for each of the past four years. Based on the 2013 through 2016 monthly demand data, the average summer peaking factor is 1.36. Based on the projected ADD of 0.62 mgd and the average SADD/ADD peaking factor of 1.36, a projection of the 2035 SADD would be 0.84 mgd. In the case of Manchester-by-the-Sea, the average summer peaking factor does not accurately represent an increasing SADD due to residential irrigation usage and a slight decrease in population.

Due to the lack of rainfall in 2016, the Town implemented a system-wide water ban at the end of July. As a result of this water ban, the Town experienced significant reduction in water usage in the month of August. Furthermore, there was a trend of increased water usage beginning in the month of May which coincides with residential irrigation usage. Summer water usage for the Town of Manchester-by-the-Sea is clearly driven by the use of irrigation systems not population. SADD between 2013 and 2016 is shown in Figure No. 3-4. A decrease in the SADD occurs in 2016 due to the water ban, however, the trend line indicates a slight increase in SADD over the past four years. Had the water ban not been in place for 2016 the SADD could have been as high as 1.14 mgd. Assuming the trend of increased residential irrigation usage continues to grow despite the slight decrease in population we project the 2035 SADD to be 1.25 mgd.

If the SADD continues to grow the Town will eventually exceed the registered authorized average annual withdrawal volume of 0.72 mgd, at which point they will be required apply for a MassDEP permit and, as mentioned above, will be subject to the more stringent usage standards. It is recommended that the Town continue instilling water conservation efforts with water customers to avoid exceeding the existing registered withdrawal allowance.

Figure No. 3-4 Historical SADD and MDD



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Maximum Day Demand

Maximum day demand (MDD) is the maximum one-day (24-hour) total quantity of water supplied during a one-year period. This term is typically expressed in mgd.

The projected MDD can be estimated by the MDD/ADD ratio. The MDD/ADD ratio provides a relationship between the two demands which can be used to estimate future demands. However, because the MDD has been increasing despite decreases in the ADD, the projected MDD would be significantly less than the existing MDD using the highest MDD/ADD ratio. Therefore, to be conservative, the estimated 2035 MDD is equal to the highest historical MDD of 2.03 mgd observed in 2016.

Table No. 3-3
Current and Projected Water Use

Year	ADD (mgd)	SADD (mgd)	Peaking Factor (SADD/ADD)	MDD (mgd)	Peaking Factor (MDD/ADD)
2013	0.65	0.82	1.27	1.35	2.09
2014	0.64	0.82	1.29	1.52	2.39
2015	0.67	1.00	1.48	1.72	2.55
2016	0.63	1.01	1.58	2.03	3.20
2035	0.62	1.25	2.02	2.03	3.27

3.4 Adequacy of Existing Water Supply Source

In accordance with standard waterworks practices and current MassDEP guidelines, the supply sources of a water system must be capable of meeting MDD conditions with all supplies online and SADD conditions with the largest source out of service. Additionally, the sources should be permitted or registered to withdraw volumes adequate to meet ADD.

In 1987, the WMA program was implemented by MassDEP to regulate withdrawal of water from the State's watershed basins. Under this program, all new sources withdrawing more than 100,000 gallons per day (gpd) and existing sources exceeding their registered withdrawal volume by 100,000 gpd are required to obtain a withdrawal permit under the WMA. When first implemented, the registered withdrawal volume for a public water system was based on that system's historical pumping rate of the water supply source(s) between 1981 and 1985. Permits can be renewed and amended as system demands increase and additional supply sources are utilized. The WMA program considers the need for the withdrawal, the impact of the withdrawal on other hydraulically connected water suppliers, the environmental impacts of the withdrawal and the water available in the river basin or subbasin (the basin safe yield) prior to issuing a permit. It is important to note that the basin safe yield is different from the safe yield of a supply. In accordance with the WMA Permit application instructions, the basin safe yield is the total water available to be withdrawn from a river basin or subbasin, whereas the safe yield of a well is the volume of water the well is capable of pumping under the most severe pumping and recharge conditions that can be realistically anticipated.

The Manchester-by-the-Sea system is currently registered to withdraw an average daily volume of 0.72 mgd. Currently, all of the Town's sources are registered and not permitted. MassDEP is currently in the process of renewing the existing permits within the Commonwealth to include revisions to the WMA regulations, which are intended to manage water withdrawals to ensure an appropriate balance among competing long-term water needs of communities and the preservation of water resources and aquatic ecosystems. The revisions to the regulations implement a framework to establish a methodology for relating impacts to the aquatic resources to natural manmade conditions, including the withdrawal of water. The allowable volume the Town is authorized to withdraw from the North Costal River Basin could change due to the new regulations, therefore, impacting the available water supply. Using recent demand data and taking into account the water usage correction determined from the totalizer error, Manchester-by-the-Sea currently does not exceed the total registered average daily withdrawal volume of 0.72 mgd, therefore, is not required to permit the sources until MassDEP reviews and processes a new permit. The projected ADD of 0.62 mgd is below the registered withdrawal volume.

Current authorized average daily withdrawal volume and maximum approved pumping rates for each source were obtained from the 2016 ASR. For registered sources, the maximum pumping rates are typically the pump capacity. The Gravelly Pond Water Treatment Facility does not have an approved daily pumping volume. The combined pumping capacity from the treatment facility is 3,000 gpm or 4.32 mgd. Lincoln Street has an approved daily pumping volume of 0.38 mgd, which is less than the maximum pumping capacity at the well of 0.864 mgd. Table No. 3-4 outlines the Maximum Daily Withdrawal Rates for each finished water supply.

Table No. 3-4
Supply Summary

Name of Supply	Maximum Daily Withdrawal Rates (mgd)
Lincoln Street Well	0.38
Gravelly Pond	4.32
Round Pond Well No. 1	Raw water
Round Pond Well No. 2	Offline
Total *:	**4.70**

*MassDEP maximum average daily withdrawal volume is 0.72 mg.

According to the 2016 usage data, the Manchester-by-the-Sea ADD was 0.63 mgd, the MDD was 2.03 mgd, and the SADD was 1.25 mgd. The system's total combined maximum daily withdrawal rate of all active finished water supply sources is 4.70 mgd. Round Pond Well No. 2 is currently offline and will remain offline indefinitely. Therefore, the pumping rate for Round Pond Well No. 2 has not been included in the calculations. The pumping capacity is not directly related to the capacities of the individual sources of supply. The Gravelly Pond Water Treatment Facility is the Town's largest water source. Round Pond Well No. 1 also pumps into Gravelly Pond and is, therefore, considered to be a supplement to the largest source. There is extensive redundancy within the treatment facility. The Gravelly Pond Water Treatment Facility is equipped with four (4) finished water pumps. The capacity of the pumps are as follows: one (1) pump at 500 gpm, two (2) pumps at 750 gpm, and one (1) pump at 1,000 gpm. If an equipment failure was to occur to the largest finished water pump at the water treatment facility this source will still be capable of supplying the maximum combined daily withdrawal from the remaining three pumps.

Projected demands were used to evaluate the adequacy of the Town's water supply sources in 2035. The projected 2035 ADD, MDD, and SADD are 0.62 mgd, 2.03 mgd, and 1.25 mgd, respectively. Compared to the projected 2035 MDD, a surplus in pumping capacity of 2.67 mgd is estimated. The maximum pumping rate of the water treatment facility with the largest pump offline is 2.88 mgd. Compared to the projected 2035 SADD of 1.25 mgd, a surplus of 1.63 mgd is estimated. The interconnection with Beverley or Gloucester can also provide redundancy to the system with the 460 gpm capacity portable pump. With the largest source offline, the portable pump at an interconnection, and the Lincoln Street Well running at approved daily capacity, the system is capable of supplying 1.04 mgd. Compared to the SADD of 1.25, a deficit of 0.21 mgd is estimated. The likelihood of the entire water treatment facility being offline at one time is extremely unlikely due to the redundancy in pumping capability therefore this is not viewed as a deficit.

3.5 Adequacy of Existing Water Storage Facilities

Distribution storage is provided to meet peak consumer demands such as peak hour demands and additionally, to provide a reserve for firefighting. Storage may also serve to provide an emergency supply in case of temporary breakdown of pumping facilities, or for pressure regulating during periods of fluctuating demand.

There are three components that must be considered when evaluating storage requirements. These components include equalization, fire flow requirements, and emergency storage.

Equalization storage provides water from the tanks during peak hourly demands in the system. Typically, this quantity is a percentage of the maximum day demands. The percentages can range from fifteen to twenty-five percent, with fifteen percent used for a large system, twenty percent for a mid-sized system and twenty five percent used for a small system. A system is considered small if it has less than 3,300 customers, while a system is considered large if it has more than 50,000 customers. With a projected population served of approximately 4,900 people, the Town's system would be considered mid-sized. As a result, twenty percent of maximum day demand was used for the equalization storage calculations.

The fire flow storage component is based on the basic fire flow requirement multiplied by the required duration of the flow. For the Town's system, a basic fire flow of 2,250 gpm with a two hour duration was used for the storage evaluation. The basic fire flow is typically equal to the fifth highest ISO required fire flow.

The emergency storage component is typically equivalent to an average day demand. However, if there is emergency power available at the sources, capable of supplying at least an average day demand, the emergency storage component can be waived. There is a generator located at the Lincoln Street Pump Station and the Gravelly Pond Treatment Facility, therefore, this component was waived from subsequent calculations.

The three components of the storage evaluation were calculated under current and future demand conditions:

1. Equalization
- Midsized system = 20 percent of the Maximum Day Demand
- Maximum Day Demand in year 2016 and 2035= 2.03 mgd
- Equalization = 0.20 x 2.03 = 0.41 million gallons (mg)

2. Basic Fire Flow Requirement
- Representative fire flow for Manchester-by-the-Sea = 2,250 gpm
- Duration of 2 hours or 120 minutes
- Basic Fire Flow Requirement = 2,250 gpm x 120 min = 0.27 mg

3. Emergency - Waived

The total required storage for any given year is the equalization component plus the basic fire flow requirement. Therefore, the current (year 2015) and projected (year 2035) total required storage is as follows:

Total Required Storage = 0.41 + 0.27 = 0.68 mg

A minimum pressure of 20 pounds per square inch (psi) should be maintained under MDD conditions with a coincident fire flow. The highest customer in the distribution system is at an elevation of approximately 185 feet above mean sea level. To maintain a pressure of 20 psi at this elevation during fire flow conditions, the tank must maintain a minimum level of approximately 231 feet. The overflow elevation of the tank is 273 feet. Based on this scenario, 42 feet of the tank is usable, therefore, usable storage of the Moses Hill Standpipe is approximately 0.88 mg. Based on the total usable storage, the Town's system has approximately 0.20 mg of surplus storage.

Section 4

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SECTION 4 – HYDRAULIC EVALUATION

4.1 General

Tata & Howard used the hydraulic model to evaluate the Town's water distribution system as a basis for recommending water distribution system improvements. The computer model is represented by the node, pipe, and tank information provided in Appendix B. A node map of the water distribution system is also provided in Appendix B. The hydraulic input data in Appendix B provides data on system demands, length and diameter of water mains, roughness coefficient or c-value of water mains, elevations, pumping rates at water supply sources, and overflow elevations at storage facilities.

The hydraulic model was verified under steady state conditions based on fire flow testing and information pertaining to the sources and storage facilities. The verified model was used to evaluate recommendations set forth by the Insurance Services Office (ISO) for water storage necessary for fire protection and peak demands were utilized in the analysis of the distribution system under steady state conditions.

4.2 Evaluation Criteria

The Hydraulic Evaluation facet of the Three Circle approach evaluates the system's ability to meet varying demand conditions. In general, a minimum pressure of 35 psi at ground level is required during average day, maximum day, and peak hour demand conditions. During MDD with a coincident fire flow, a minimum pressure of 20 psi is required at ground level throughout the system. To evaluate the system's ability to meet these criteria, the following hydraulic simulations were run in the model.

Minimum/Maximum Pressures

During existing and projected ADD, MDD, and peak hour demand conditions (no coincident fire flow), the recommended minimum pressure requirement to be met at street level throughout the distribution system is 35 psi. A minimum pressure of 35 psi is met in the majority of the distribution system. Areas that cannot maintain 35 psi during ADD, MDD, and peak hour demand conditions are at higher elevations, and the inability of the distribution system to meet the pressure requirement in these areas is primarily due to elevation. In general, customers located at elevations greater than 194 feet can experience pressure less than 35 psi during normal operating conditions. There are no customers off the Town's public water system at elevations greater than 194 feet. There are customers off private water mains in the system at elevations greater than 194 feet, however, private water mains were not included in this study. Therefore, the Town's water distribution system can meet the minimum pressure recommendation of 35 psi under normal average day and maximum day demand conditions.

An upper limiting pressure of 120 psi is generally recommended, as older fittings in the system are generally rated at 125 to 150 psi. The MassDEP published Guidelines for Public Water Systems recommends that pressure reducing devices be utilized on mains or on individual services lines when static pressures exceed 100 psi. Pressure above this level can result in increased water use and leaks from fixtures and also increased leakage throughout the distribution system. In addition, plumbing code states that water heaters in homes can be affected by pressures greater than 80 psi.

Based on the overflow elevation of the tank and the ground elevations within the system, there are areas within the Town's water distribution system that could experience pressure greater than 100 psi. These areas can be found in Figure No. 4-1.

Insurance Services Office (ISO) Fire Flow Recommendations

The recommended fire flow in any community is established by the ISO. The ISO determines a theoretical flow rate needed to combat a major fire at a specific location; taking into account the building structure, floor area, the building contents, and the availability of fire suppression systems. In general, the flows recommended for proper fire protection are based on maintaining a residual pressure of 20 psi. This residual pressure is considered necessary to maintain a positive pressure in the system to allow continued services to the customers and avoid negative pressures that could introduce groundwater into the system through joints and cracks in the water main.

The Manchester-by-the-Sea system was inspected for fire insurance ratings by the ISO in 1982 and 1997. The results of the 1997 ISO inspections are shown in Table No. 4-1. The test results indicate the available flow and the estimated recommended fire flow in various sections of the distribution system at the time of the tests. The estimated recommended fire flows established by ISO varied from 750 to 4,500 gpm, depending on the location and the structures. It should be noted that a water system is only required to provide a maximum of 3,500 gpm at any point in the system.

Table No. 4-1
ISO Fire Flow Data (1997)

Test No.	Type Dist.	Test Location	Available Flow (gpm @ 20 psi)	Needed Flow (gpm @ 20 psi)
1	Commercial	End of Brookwood Road	500	4,500*
1-A	Residential	End of Brookwood Road	500	750*
2	Commercial	Ashland Street @ Bridge Street	900	1,500*
3	Commercial	Bridge Street @ Highland Avenue	1,600	3,000*
4	Commercial	Lincoln Street @ Summer Street	2,700	3,000*
5	Commercial	Tappan Street @ Sea Street	3,500	3,000
6	Commercial	Union Street @ School Street	2,000	1,500
7	Commercial	Raymond Street @Butler Avenue	300	1,250*
8	Commercial	Beach Street @ Summer Street	2,000	1,500
9	Commercial	Desmond Avenue @ Bridge Street	1,100	2,250*
10	Residential	Masconomo Street @ Proctor Street	1,000	750

*Tests did not meet the ISO fire flow requirement.

The estimated needed ISO fire flows were simulated on the computer model. All of the deficient ISO fire flow locations identified in 1997 remain deficient today, with the exception of Test No. 2 located at Ashland Street and Bridge

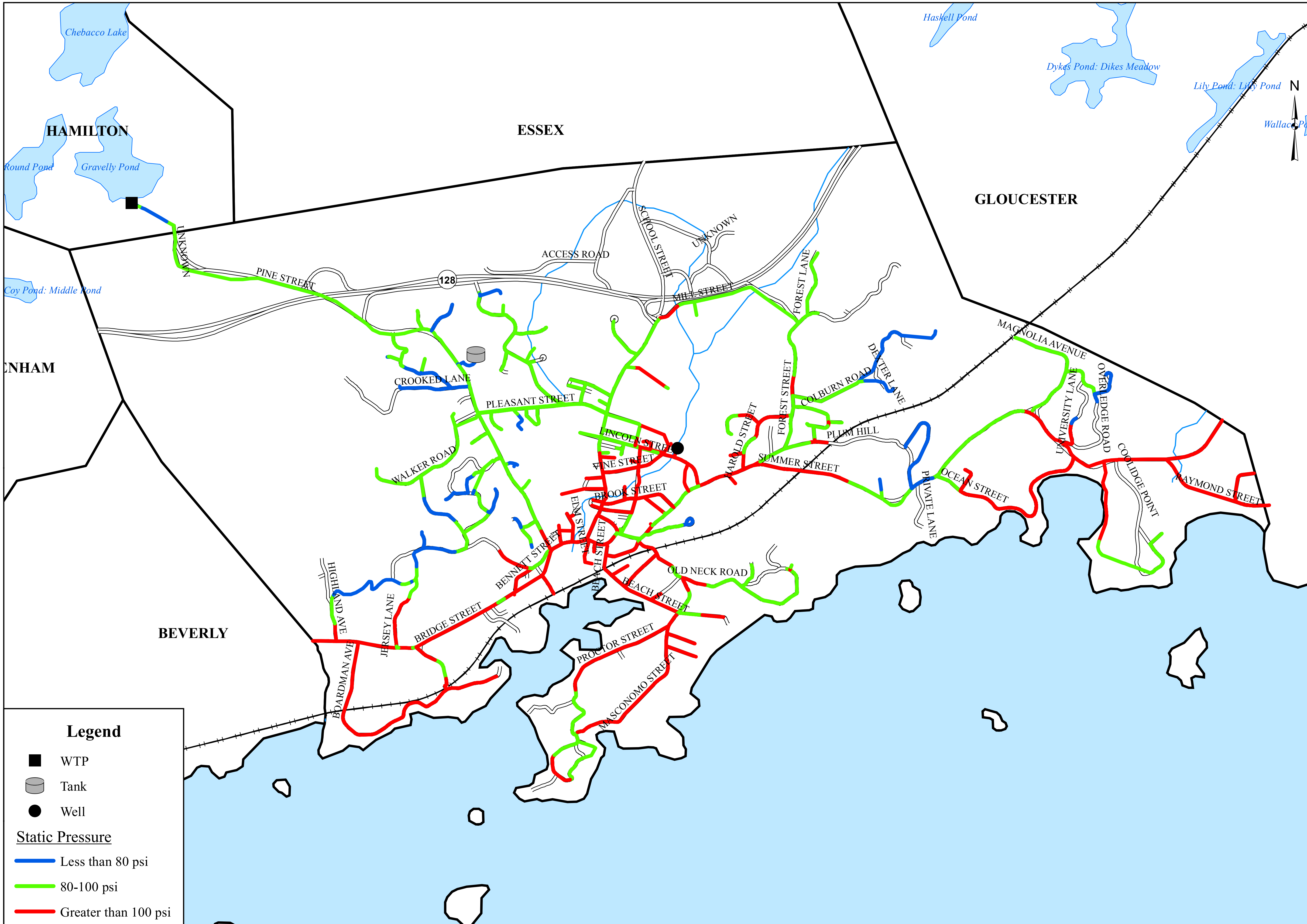

Figure No. 4-1

Estimated Static Pressures

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Manchester by the Sea, Massachusetts

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Date: February 2017
Approximate Scale: 1" = 2,000'

Street. Additionally, the model estimates that Test No. 5 located at Tappan Street and Sea Street can no longer provide the ISO required fire flow. Recommendations to alleviate the remaining deficiencies are discussed later in this section.

Additional Flow Recommendations

According to the 2014 ISO published Guide for Determination of Needed Fire Flow, the minimum recommended fire flow in residential areas with homes greater than 30 feet apart is approximately 500 gpm. The recommended fire flow for homes between 21 feet and 30 feet apart is approximately 750 gpm. Areas with homes between 11 feet and 20 feet have a recommended fire flow of 1,000 gpm. A fire flow of 1,500 gpm is recommended for homes closer than 10 feet apart. Based on a review of the Town, the Town's system generally requires residential flows of 500 gpm to 750 gpm. Table No. 4-2 lists areas within the distribution system that do not meet the recommended residential fire flows based on data from the computer model. Improvements were recommended for areas in the system that could not meet the respective minimum fire flow recommendation. A description of the recommended improvements is provided in the Priority 2 recommendations below.

Table No. 4-2
Estimated Residential Fire Flow Model Deficiencies

No.	Location	Available Flow (gpm @ 20 psi)	Recommended Flow (gpm @ 20 psi)
1	Butler Avenue	400	500
2	Colburn Road	250	500
3	Coolidge Point	325	500
4	Old Essex Road (upper)	400	500
5	Blue Heron Lane	400	500
6	Magnolia Avenue (upper)	400	500
7	Andrews Avenue	425	500
8	Big Rock Road	425	500
9	Millets Lane	450	500
10	Overledge Road	450	500
11	Eaglehead Road (last hydrant)	450	500

4.3 Hydraulically Deficient Areas

Priority 1 hydraulic improvements included recommendations that would strengthen the transmission capabilities of the system, address areas of low static pressure, or provide an ISO recommended fire flow to a certain service area. Priority 2 recommendations were identified as part of a system wide evaluation to provide estimated residential fire flows. A map depicting areas with hydraulic deficiencies can be found in Appendix C.

Priority 1 Hydraulic Improvements

1. A new 12-inch diameter ductile iron water main is recommended on Lincoln Street from Summer Street to Vine Street to improve fire flow to the extremities of Town south of Lincoln Street and to improve the inherent capacity for the ISO recommended fire flow of 3,000 gpm at Summer Street and Lincoln Street. This improvement will also improve transmission capabilities for the distribution system.

2. The results of fire flow tests conducted during previous studies, suggest that the 12-inch diameter water main on Summer Street is restricting flow to the eastern portion of the distribution system. To improve hydraulic capacity and the inherent capacity for the ISO recommended fire flow of 1,250 gpm at Raymond Street and Butler Avenue, the existing 12, 10, and 8-inch diameter water mains along Summer Street from Lincoln Street to Raymond Avenue, should be cleaned and lined and the existing 6-inch diameter water main on Raymond Avenue should be replaced with a new 8-inch diameter ductile iron water main.

   Analysis of a one foot segment of pipe would determine the structural integrity of the water mains and if the pipe is a candidate for cleaning and lining or if replacement will be necessary. In addition, the Town should conduct c-factor flow tests along Summer Street to verify that the water main has excessive tuberculation.

   This improvement will also improve the inherent capacity to meet residential fire flows on Raymond Avenue from Summer Street to the Gloucester town line, and Butler Avenue from Raymond to the Gloucester town line.

3. To improve the inherent capacity to meet the ISO recommended fire flow at Summer Street and Beach Street, cleaning and lining is recommended to on the existing 8-inch diameter water main on Beach Street from Union Street to Summer Street. The inherent capacity for the ISO recommended fire flow at Summer Street and Beach Street cannot be achieved without completing Improvement No. 3 and Improvement No. 4.

4. The results of fire flow tests conducted during previous studies, suggest that the 12-inch diameter water main on Summer Street from Sea Street to Lincoln Street is restricting flow due to tuberculation. To improve the hydraulic capacity of this transmission main and to provide the estimated needed fire flow of 2,500 gpm at ISO No. 8, Beach Street and Summer Street, the water main should be cleaned and lined. Analysis of a one foot segment of pipe would determine the structural integrity of the water main and if it is a candidate for cleaning and lining or if replacement will be necessary. The inherent capacity for the ISO recommended fire flow at Summer Street and Beach Street cannot be achieved without completing Improvement No. 3 and Improvement No. 4.

5. To provide the recommended fire flows in the commercial downtown area where there are many large wood framed buildings in close proximity to each other, it is recommended that the existing 12-inch diameter water main on Central Street and Union Street be cleaned and lined from Pine Street to Beach Street.

6. The results of fire flow tests conducted during previous studies, suggest that the water main on Pleasant Street from Pine Street to the end of the existing 16-inch diameter water main on Lincoln Street is restricting flow due to tuberculation. To improve the hydraulic capacity of the transmission main and to provide the estimated recommended fire flow at ISO No. 4 at Lincoln Street and Summer Street, the water main should be cleaned and lined. Analysis of a one foot segment of pipe would determine the structural integrity of the water main and if it is a candidate for cleaning and lining or if replacement will be necessary. The inherent capacity for the ISO recommended fire flow at Summer Street and Lincoln Street cannot be achieved without completing Improvement No. 1 and Improvement No. 6.

7. To provide the recommended ISO fire flow at Bridge Street and Highland Avenue and to improve the recommended ISO fire flow at the end of Brookwood Road, it is recommended that the existing 12-inch diameter water main on Bridge Street from Pine Street to Ashland Avenue be cleaned and lined, the existing 10-inch water main on Bridge Street from Ashland Avenue to Highland Avenue be replaced with a 12-inch diameter ductile iron water main, and the existing 6-inch diameter water main on Highland Avenue be replaced with a 12-inch diameter ductile iron water main.

8. To provide system redundancy and eliminate dead ends it is recommended to install a new 8-inch diameter water main along Plum Hill Road and cross country to loop Ancient County Way to Hickory Hill Road. This water main will provide redundancy to supply the northeast section of the distribution system.

9. It is recommended to install approximately 2,000 linear feet of new 12-inch diameter water main cross country between Magnolia Avenue and Colburn Road. The new water main will enhance system redundancy to the northeast portion of the distribution system and eliminate two dead ends.

   This improvement will also improve residential fire flows on Colburn Road, Magnolia Avenue from Overledge Road to the railroad tracks, Overledge Road, and Big Rock Road.

Priority 2 Hydraulic Improvements

10. To improve the inherent capacity to provide residential fire flows, it is recommended to connect the existing 6-inch diameter water mains on Currier Road, Pulaski Drive, Old Essex Road, and Willmonton Avenue, services and hydrants to the 16-inch water main on Pleasant Street. The improvement will provide the recommended fire flows on Old Essex Road from Millets Lane to the end of the 8-inch diameter water main, Blue Heron Lane, Andrews Avenue, The Plains, and Millets Lane. All hydrants and service connections off the 6-inch diameter water main on Pleasant Street are recommended to be tied over to the 16-inch diameter water main on Pleasant Street. A new 8-inch water main on Old Essex Road is also recommended to provide the recommended residential fire flow.

11. To provide the recommended residential fire flows along Coolidge Point a new 8-inch diameter water main is recommended along Coolidge Point from Summer Street to the existing 6-inch diameter water main.

12. To provide the recommended residential fire flows at the end of Eaglehead Road a new 8-inch diameter water main is recommended to replace the existing 6-inch diameter water main on Eaglehead Road from Old Neck Road to Valve No. G_N44.

Section 5

TATA & HOWARD

SECTION 5

SECTION 5 – CRITICAL COMPONENT ASSESSMENT

5.1 General

A critical component assessment was performed for the water distribution system to evaluate the impact of potential water main failures. The critical component assessment includes identification of critical areas served, critical water mains, and the need for redundant mains.

5.2 Evaluation Criteria

Critical areas served are locations in the distribution system that require continual water supply for public health, welfare, or financial reasons. Examples of critical service areas include emergency service facilities, nursing homes, schools, and interconnections. All water mains within 1,000 feet of a critical area are considered a critical main. Because water storage tanks and sources provide water and maintain pressure to critical service areas, tanks and primary sources are also considered components. Therefore, any water main within 1,000 feet of a water storage tank or primary source is considered a critical component.

Critical water mains are those mains that are the sole transmission main from a source or tank are considered critical components. In addition, main transmission lines that do not have a redundant main are considered critical. The evaluation included a visual review of the water mains leading into and out of the critical areas and the transmission grid.

5.3 Critical Components

Critical areas served, critical supply mains, and redundant mains were evaluated in the Manchester-by-the-Sea water system based on the criteria described above. The following provides a listing of the areas that are considered critical components. A map of the critical components is included in Appendix D.

Critical Areas Served

A system-wide review of critical areas served such as emergency service facilities, nursing homes, schools, and interconnections was completed. Table No. 5-1 presents all critical areas served including critical users and critical components of the distribution system.

Critical Water Mains

Critical water mains include primary transmission lines as well as mains connecting water storage tanks and sources to the system. Critical transmission mains are highlighted on the Critical Components Map found in Appendix D.

Critical water mains were identified based on a review of the distribution system model and using the model's criticality feature. The criticality feature simulates breaks on each pipe in the model. The model calculates if the system can still be served with adequate flow and pressures after a pipe is taken out of service. This feature also takes into consideration valves. Areas where there are inadequate valves to shut down the water main in case of a break, are also considered critical. This feature can identify areas served by multiple mains, but would no longer be able to serve customers if one of the mains were taken out of service. Critical water mains identified include Masconomo Street from Proctor Street northeast 600 feet, Beach Street at Masconomo Street 200 feet to the east and west of the intersection, Summer Street from Harold Street to Ocean Street, and Pine Street from the Moses Hill Standpipe to Pleasant Street.

Table No. 5-1
Critical Areas

Critical Area		Location
Schools/Day Care Facilities		
	Brookwood School	1 Brookwood Road
	Landmark Elementary and Middle School	167 Bridge Street
	Manchester Essex Regional Middle High School	36 Lincoln Street
	Manchester Memorial Elementary School	43 Lincoln Street
Elderly Housing		
	Senior Care Inc.	Newport Pike
	Drumlin Companies	76 Summer Street
Water Distribution System Components		
	Gravelly Pond Water Treatment Facility	Gravelly Pond, Hamilton
	Lincoln Street Well	Lincoln Street
	Round Pond Wells	Chebacco Road, Hamilton
	Moses Hill Standpipe	Pine Street
Emergency Source		
	Interconnection with Gloucester	Raymond Street
	Interconnection with Gloucester	Summer Street
	Interconnection with Beverly	Bridge Street
Emergency Services		
	Manchester Police Department	10 Central Street
	Manchester Fire Department	12 School Street

Water mains that cross major highways, for example the water main that crosses Route 128, cross streams, and rivers are also considered critical because of the costly consequences of failure that could occur if a water main broke in these areas, and the difficulty in repairing the mains in these locations. Critical crossings in the Town include all water crossings and railroad crossings. Critical mains are highlighted on the Critical Components Map found in Appendix D.

Section 6

TATA & HOWARD

SECTION 6 – ASSET MANAGEMENT CONSIDERATIONS

6.1 General

The existing water distribution system includes approximately 37 miles of public water mains. A number of factors including break history, material, installation year, diameter, soil characteristics, and water quality affect the decision to replace or rehabilitate a water main. Using an Asset Management approach tailored for the Town's system, each water main in the system was assigned a grade based on these factors. The grades were then used to establish a prioritized schedule for water main replacement or rehabilitation.

6.2 Data Collection

Information regarding the water main diameters, materials, and installation years was obtained from existing water distribution system maps, tie cards, Town records, and ArcGIS layers. Information regarding break history, water quality concerns, and known soil conditions was obtained from workshops with system managers and operators and system records. The development of data was a collaborative effort with the Town.

6.3 Evaluation Criteria

To prioritize water main replacement or rehabilitation, a water main grading system has been established. The grading system uses the water main characteristics such as age, material, break history, water quality, diameter, and soil characteristics to assign point values to each pipe in the system. Each category is assigned a rating between zero and 100 with zero being the most favorable and 100 being the worst case within the category. Each category is then given a weighted percentage, which represents priorities within the system. It is at the client's discretion to adjust the weight based on system performance and condition. Our recommendation is to assign a maximum of 30 percent to any one category. The rating is then multiplied by the weight. The weighted rating for each performance criteria will be utilized to determine the overall rating per pipe. Those pipes with the highest grade are most in need of replacement or rehabilitation.

To establish a rating system specific to the Town's water system, a workshop was held with the system management and operators. During the discussion, it was determined that history of breaks, areas with poor soil quality, and pipe size are of primary concern to the Town. The grading system is shown in Table No. 6-1 and discussed in detail later in this section.

Table No. 6-1
Asset Management Grading System

Weight	Performance Criteria	Rating	Weighted Rating
30%	Break History		
	One or More Breaks	100	30
	No History of Breaks	0	0
20%	Soils		
	Identified poor soils	100	20
	Pipe on rock	100	20
	Potentially poor soils	80	16
	Non-corrosive soils	0	0
20%	Diameter		
	4-inch water main or smaller	100	20
	6-inch water main	100	20
	8-inch water main	40	8
	10-inch water main	20	4
	12-inch water main	10	2
	14-inch water main	5	1
	16-inch water main or larger	1	0.2
15%	Water Quality		
	History of water quality issues	100	15
	No history of water quality issues	0	0
10%	Material		
	Asbestos Cement	100	10
	Cast Iron	80	8
	PVC	5	0.5
	Ductile Iron	1	0.1
5%	Installation Date		
	Pre 1900	85	4.25
	1900-1909	80	4
	1910-1919	75	3.75
	1920-1932	70	3.5
	1930-1939	100	5
	1940-1949	95	4.75
	1950-1959	90	4.5
	1960-1969	30	1.5
	1970-1979	20	1
	1980-1989	10	0.5
	1990-1999	5	0.25
	2000-2016	3	0.15

Break History

The Manchester-by-the-Sea water system historically experiences of 3 to 5 breaks per year, based on conversations with Town personnel. In relation to the total miles of water main in the system, this equates to approximately 8 to 14 breaks per 100 miles per year. Manchester-by-the-Sea experiences a relatively low number of breaks when compared to the national average of 25 breaks per 100 miles per year. Each water main break costs time and labor. Breaks also cause disruption to the public and water consumers. At some point, it becomes more efficient to replace the main than to continue repairs. Based on Town water main break records, there are several areas in the system that have experienced frequent breaks. These areas are given a rating of 100 while areas with no known breaks received a rating of zero. Areas that have a history of breaks are highlighted on Figure No. 6-1.

Soils

Water main degradation can occur both internally and externally. Factors that increase the rate of external corrosion include high groundwater, brackish groundwater, soils with low calcium carbonate, or soils with high acidity or sulphate. Wetlands areas have greater potential to cause external corrosion of water mains than other soil conditions. Water main installed on rock can also cause frequent water main breaks. Areas of identified rock ledge were assigned a rating of 100. Areas of identified corrosion concerns were assigned a rating of 100. Areas of potentially corrosive soils, including wetlands, received a rating of 80. All other pipe was assigned a rating of zero. Areas where corrosion is of concern are highlighted on Figure No. 6-2.

Diameter

The Manchester-by-the-Sea water distribution system consists of water mains ranging in diameter from four to 16-inches. Approximately 48 percent of the system is comprised of 6-inch diameter pipes and approximately 23 percent is 8-inch diameter pipes.

In general, as the diameter of a pipe increases, the strength increases. In most cases, failure occurs in the form of ring cracks. This is primarily the result of bending forces on the pipe. Pipes that are 6-inch in diameter are more likely to deflect or bend than a larger diameter main. Pipes that are 8-inch in diameter for example are less likely to break from bending forces due to the increased wall thickness and increased moment of inertia.

In addition, the pipe wall thickness typically increases as the pipe diameter increases. Pipes that are 16-inches in diameter and larger have significantly thicker walls than 12-inch diameter pipe and smaller, therefore, in addition to superior bending resistance, larger diameter pipes also are much more resistant to failure from pipe wall corrosion.

The rating system for the diameter of the water mains follows the concept that 4-inch diameter water mains are not as strong as 12-inch diameter water mains. Therefore, a rating of 100 was given to 4-inch diameter and smaller water mains and a rating of five was given to the 16-inch diameter and larger water mains. Table No. 6-1 shows a significant drop in the rating score between a 6-inch diameter water main (90) and 8-inch diameter water main (40). This is due to wall thickness and field experience. An 8-inch diameter water main has proven to have nearly twice the bending strength of a 6-inch diameter water main. In general, 8-inch diameter water

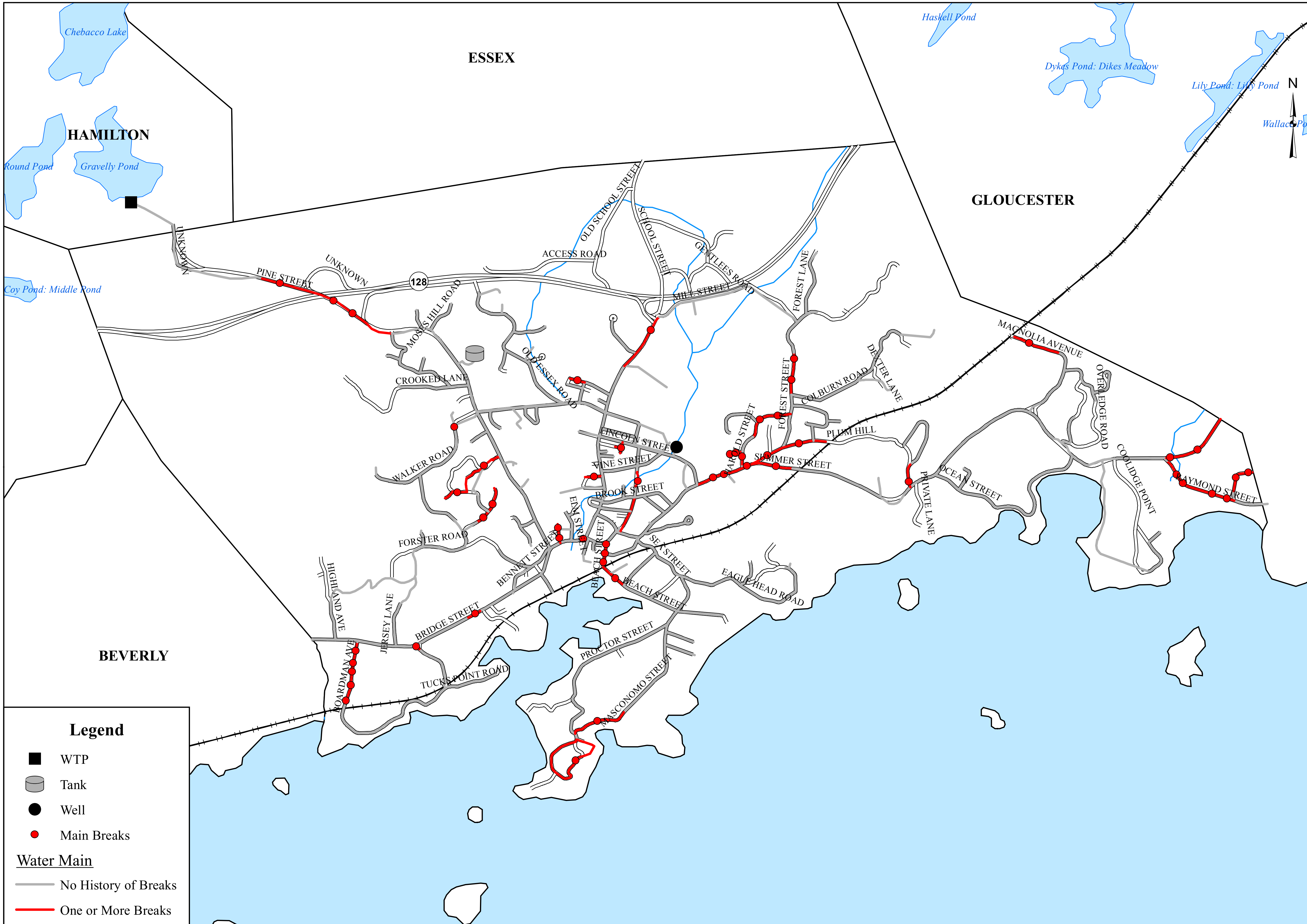

Figure No. 6-1

Areas with History of Breaks

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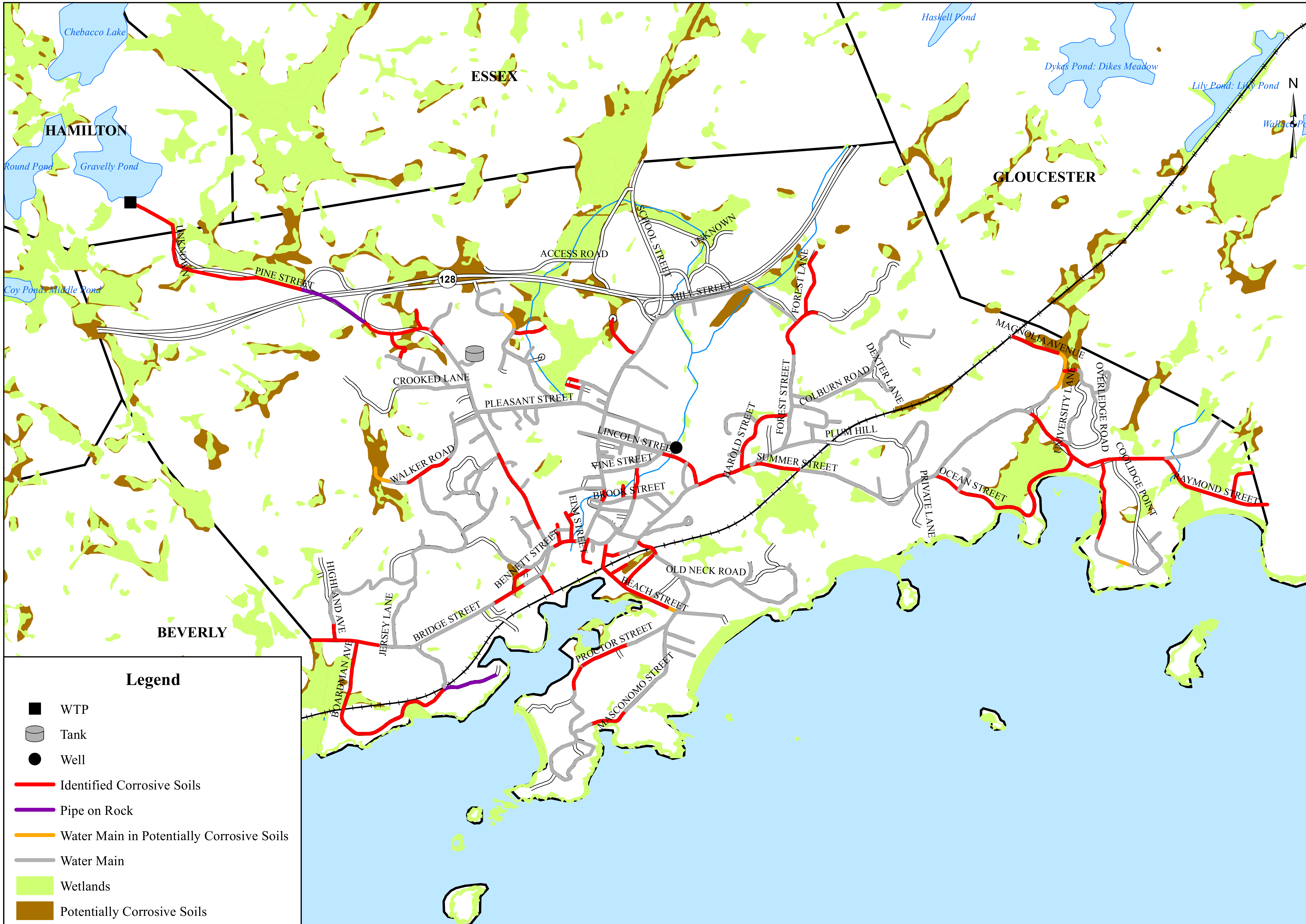

Figure No. 6-2

Potentially Corrosive Soils

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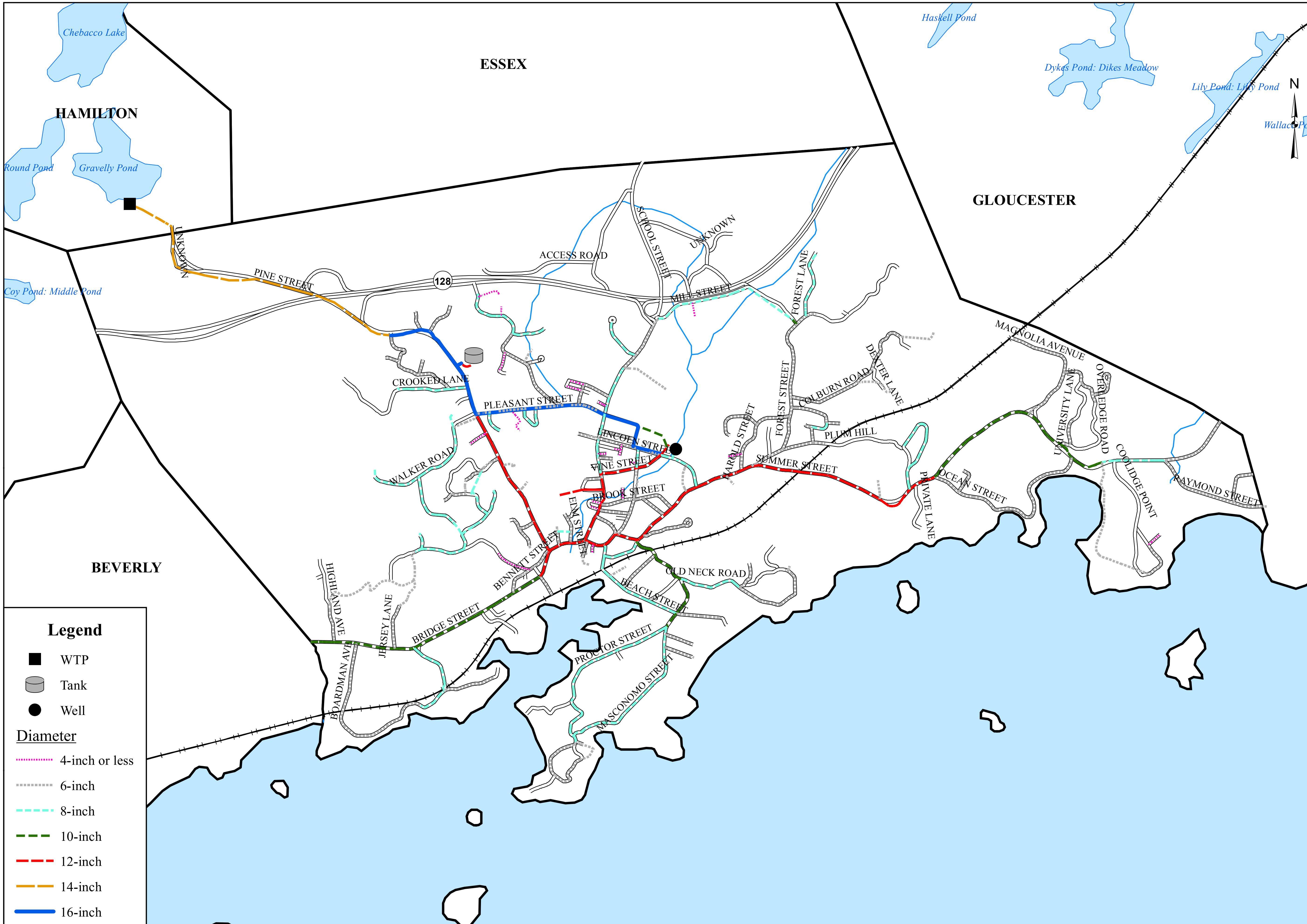

Figure No. 6-3

Water Main Diameters

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mains are stronger and less likely to break than 6-inch diameter pipes. Figure No. 6-3 presents the various diameter sizes throughout the distribution system.

Water Quality

In general, the water quality in the Manchester-by-the-Sea water system reportedly meets or exceeds state and federal water quality standards. However, based on conversations with the Town, there have been water quality issues in a few areas. These areas are given a rating of 100 while areas with no known water quality issues received a rating of zero. Areas where water quality is of concern are highlighted on Figure No. 6-4.

Age/Material

The water industry in the United States followed certain trends over the last century. The installation date of a water main correlates with a specific pipe material that was used during that time as shown on Table No. 6-2. For example, up until about the year 1958 unlined cast iron water mains were the predominant pipe material installed in water systems. Factory cement lined cast iron mains were manufactured from the 1950s to about 1970, when pipe manufacturers switched primarily to factory cement lined ductile iron pipe.

Cast iron water mains consist of two types; pit cast and sand spun. Pit cast mains were manufactured up to the year 1930 while sand spun mains were manufactured between 1930 and 1970. Pit cast mains with diameters between 4-inch and 12-inch do not have a uniform wall thickness and may have “air inclusions” as a result of the manufacturing process. This reduces the overall strength of the main, which makes it more prone to leaks and breaks. Although sand spun mains have a uniform wall thickness, the overall wall thickness was thinner than the pit cast mains. The uniformity provided added strength, however, the thin wall thickness made it more susceptible to breaks. Pit cast mains 16-inch diameter and larger have thicker pipe walls and are generally stronger than the thinner walled sand spun cast mains. While the transition to factory cement lined cast iron mains had begun in the late 1940s, prior to the year 1958, most cast iron water mains that were manufactured were still unlined. Unlined cast iron mains increased the potential for internal corrosion. Based on information provided by Town staff, unlined cast iron water mains were installed until approximately 1957. Also, by 1958, rubber gasket joints were also introduced. Prior to this date, joint material was jute (rope type material) packed in place with lead or a lead-sulfur compound, also known as “leadite” or “hydrotite”. Leadite type joint materials expand at a different rate than iron due to temperature changes. This can result in longitudinal split main breaks at the pipe bell. Sulfur in the leadite can promote bacteriological corrosion that can lead to circumferential breaks of the spigot end of the pipe. Unlined cast iron water mains make up approximately 76 percent of the Manchester-by-the-Sea water system.

Factory lined cast iron was manufactured and installed up until about 1973. Overlapping this period, factory cement lined ductile iron main was manufactured from the 1950s, and continues to be manufactured today, although most New England water utilities did not begin to install ductile iron pipe until the late 1960s. Factory cement lined cast iron and ductile iron pipe provided increased protection against internal corrosion. During the workshop with the Town, it was indicated that the distribution system cast iron pipe is primarily unlined, and areas where there may be lined cast iron pipe was not identified, therefore, no lined cast iron water main was included in this report.

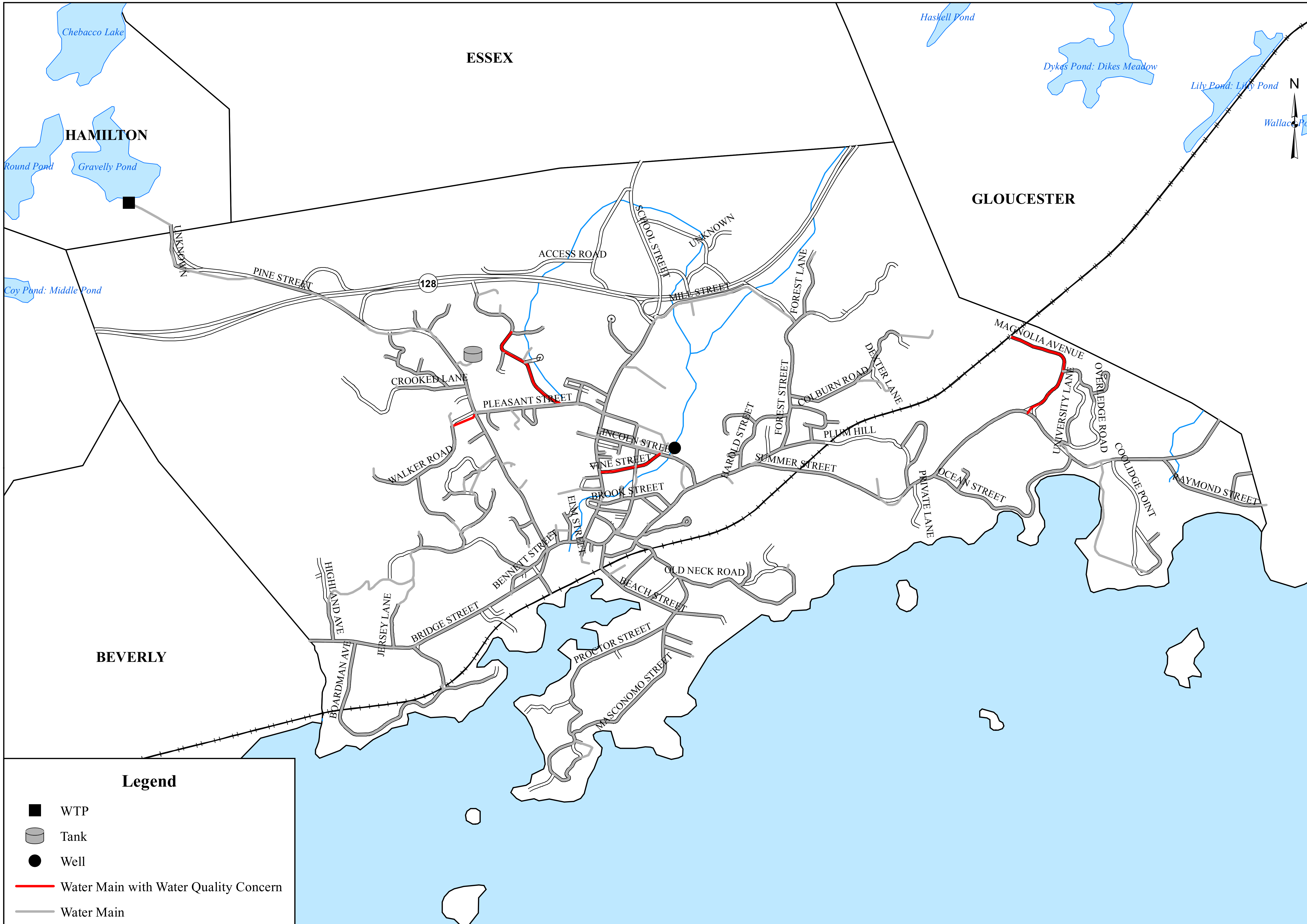

Figure No. 6-4

Areas with Water Quality Concerns

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Table No. 6-2
Pipe Material by Installation Year

Installation Year	Asbestos Cement (lf)	Cast Iron (lf)	Copper (lf)	Ductile Iron (lf)	PVC (lf)	Total (lf)
Pre 1900	-	115,723	391	-	-	116,114
1900-1909	-	18,346	-	-	-	18,346
1910-1919	-	939	-	-	-	939
1920-1929	-	440	-	-	-	440
1930-1939	-	-	-	-	-	-
1940-1949	-	981	-	-	-	981
1950-1959	2,664	4,342	211	-	-	7,217
1960-1969	20,926	1,578	-	-	-	22,504
1970-1979	8,022	-	-	-	-	8,022
1980-1989	-	-	-	499	2,494	2,993
1990-1999	-	-	-	878	-	878
2000-2016	-	-	-	8,790	437	9,227
Total (lf)	31,612	142,349	602	10,167	2,931	187,661

Approximately five percent of the system is ductile iron. According to the Ductile Iron Pipe Research Association (DIPRA), ductile iron pipe retains all of cast iron's qualities such as machinability and corrosion resistance, but also provides additional strength, toughness, and ductility.

Between the 1930s and 1970s, the water industry also utilized asbestos cement (AC) pipe as a preferred water main material. An advantage of AC pipe is that it resists tuberculation build up, resulting in less system head loss. However, depending on the water quality, the structural integrity of AC mains can deteriorate over time, thereby, becoming sensitive to pressure fluctuations and/or nearby construction activities. In addition, external influences such as soil type and high groundwater can corrode AC mains, thus reducing the strength further. Approximately one percent of the system is composed of AC mains. The AC water mains have the highest rating score of all materials due to the minimal amount left within the system and issues associated with construction on AC water mains. Approximately 17 percent of the system is made up of AC water main.

Plastic pipes, such as Polyvinyl Chloride (PVC), were first used in the United States in the early 1960s. Because of its smooth interior, PVC pipe resists tuberculation and generally maintains high c-values throughout its life. Due to its resistance to both chemical and electrochemical corrosion, PVC pipe is not damaged by aggressive water or corrosive soils. The smooth interior of PVC is also resistant to tuberculation. The 1994 "Evaluation of Polyvinyl Chloride (PVC) Pipe Performance" by the AWWA Research Foundation, found that utilities have experienced minimal long term problems with PVC pipe. Generally, problems with PVC occurred when the area surrounding the pipe was disturbed after installation of the pipe, indicating that PVC pipe is not as strong as ductile iron with disturbances such as impact from excavation equipment after installation. It should be noted that PVC is a permeable material. Low molecular weight petroleum products and organic solvents can permeate PVC pipe if the contaminants are found in high concentrations in the soil surrounding the pipe. The Manchester-by-the-Sea water distribution system is made up of approximately two percent of the system consists of PVC mains.

Less than one percent of the system is copper main. The copper main consists of 2-inch diameter main installed on Knight Circle, Filias Circle, and the Plains. Typically, small diameter water mains are for services. The copper water main listed in this report for the Town are long service lines that serve customers with the highest residential use, therefore, were included in the report.

In general, the oldest water mains in the system received a high rating of 100, while the newest received a rating of zero. The exception to this is the 1930s, and the 1940s. These installation years have been given the highest rating because of the known problems with unlined cast iron pipe from this time period. A significant rating decrease occurs around 1960 which represents the timeframe when factory lining was introduced. Figures No. 6-5 and 6-6 present the installation year of the water mains and the materials, respectively.

The majority of the Town's water system was installed in the early 1900s with cast iron main. There is no indication that age and pipe material directly correlate with pipe condition. The Town elected to place more weight on break history and areas with poor soil conditions in the asset management grading criteria because it better prioritizes improvements for their system.

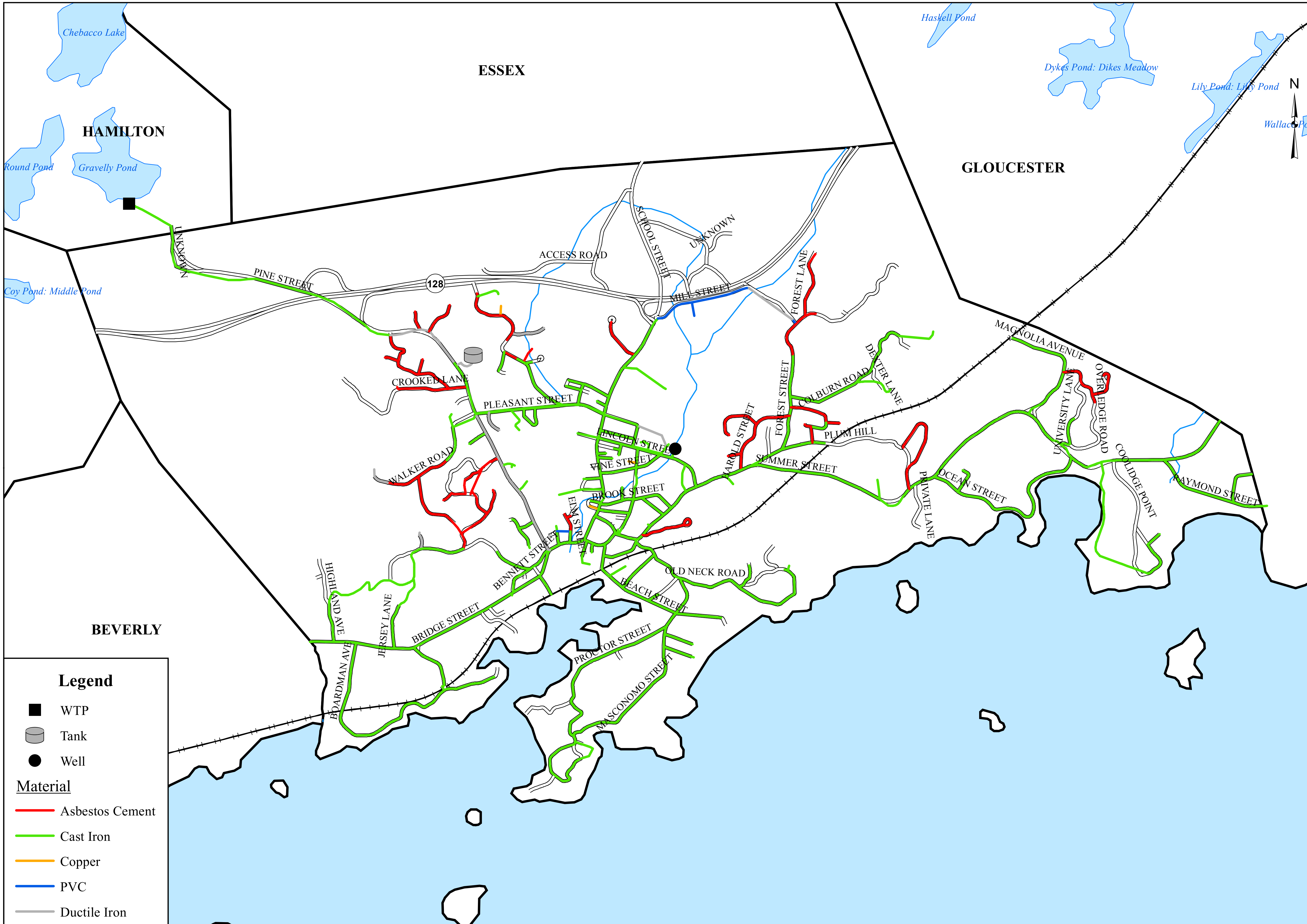

Figure No. 6-5

Water Main Materials

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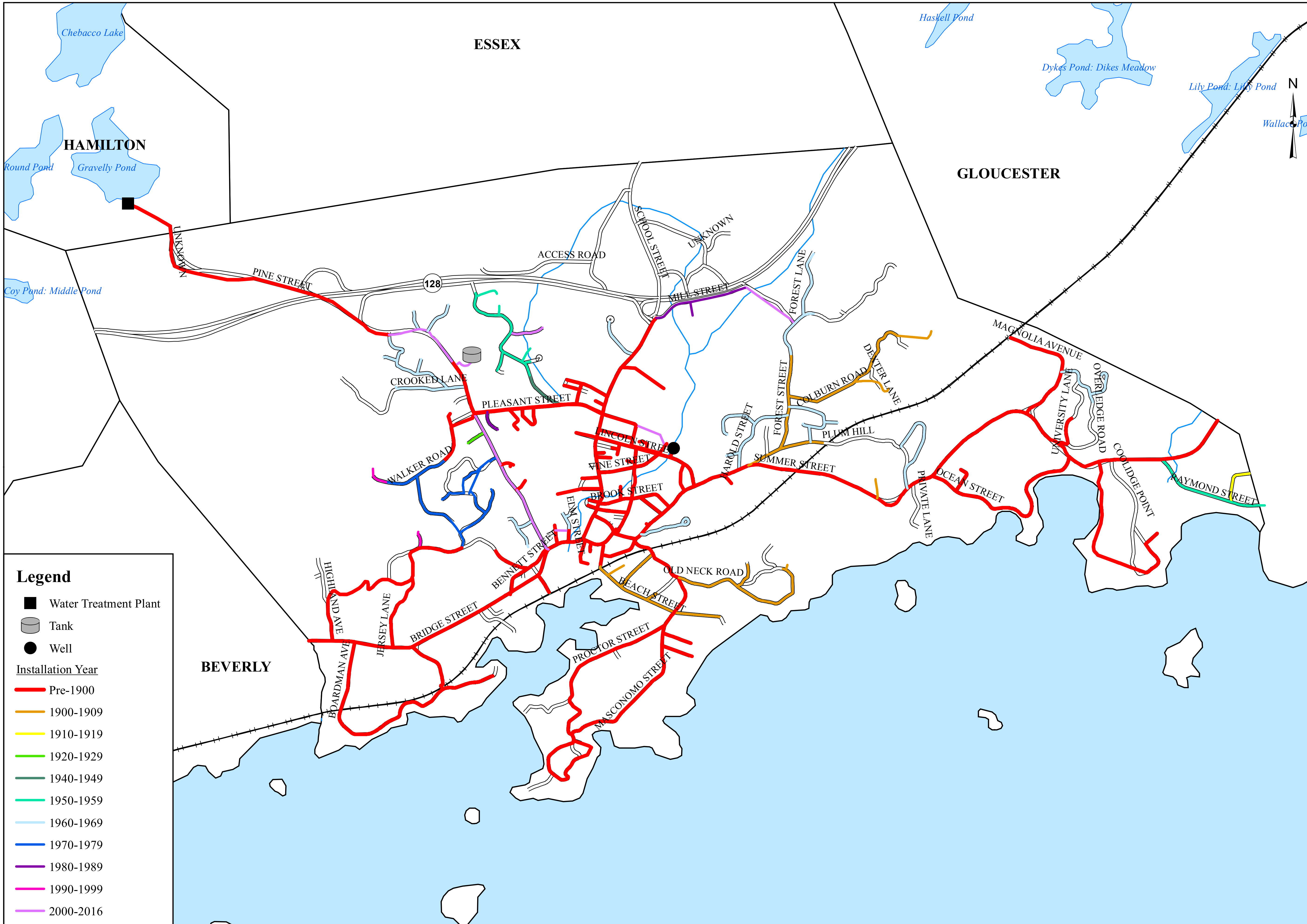

Figure No. 6-6

Water Main Installation Year

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6.4 Asset Management Areas of Concern

Based on the asset management ratings, there are several areas of concern in the system. Water mains with a total rating between zero and 29 are considered to be in good to excellent condition. Mains with a total rating between 30 and 45 are considered to be in fair to good condition, and mains with a total rating greater than 45 are considered to be in poor to fair condition. Asset management ratings are presented graphically in Appendix E.

Section 7

TATA & HOWARD

SECTION 7 – RECOMMENDATIONS AND CONCLUSIONS

7.1 General

The following summarizes the findings of the study and presents a prioritized plan for recommended improvements and associated costs. The prioritization of improvements allows for constructing the necessary improvements over an extended period of time as funds allow. Costs are based on recent bid tabulations and include costs associated with water services, hydrants, appurtenances, permanent and temporary trench pavement, and a 25 percent allowance for engineering and contingencies. Costs are based on the December 2016 Engineering News Record (ENR) construction cost index for Boston, Massachusetts of 13533.09 and include costs associated with water services, hydrants, and other appurtenances, permanent and temporary trench pavement, and a 25 percent allowance for engineering and contingencies. Estimates do not include costs for land acquisition, easements, or legal fees.

The capital improvement projects considered by this study will provide a direct benefit to the overall level of service to the Manchester-by-the-Sea customers, reduce operation and maintenance costs by reducing the frequency of water main failures and the damage they cause, as well as improve fire protection to the homeowners and businesses.

The Water Research Association's (formerly the American Water Works Research Foundation) study on "Cost of Infrastructure Failure," which was completed in 2002, found that in addition to direct costs paid by water utility ratepayers for water main failures, there are also societal costs, which are paid by the public. Examples of the direct costs include outside contractor costs, engineering costs, police assistance, fire department assistance, electrical, telephone, and gas utility damage costs, landscaping restoration costs, and laboratory costs. Examples of societal costs included the cost of traffic impacts, business customer outage impacts, public health impacts (including loss of life), property damage not covered by direct costs, and the cost of reduced fire fighting capability during the failure event.

Rehabilitation and replacement of one percent of a system each year (a 100 year replacement cycle) is a reasonable guideline based on industry experience and analysis. For the Manchester-by-the-Sea distribution system, this would equate to approximately one half of mile of water main replacement each year as a guideline. Regular rehabilitation of water mains reduces main failures, leakage, and water quality issues. Water main rehabilitation can also provide socio-economic benefits by reducing operational costs associated with chemical and energy usage. Also, rehabilitation or replacement of water mains that are inadequately sized to provide needed fire protection will improve public safety.

7.2 General Recommendations

To maintain a comprehensive database of the condition of the system, it is recommended that the Town continue to provide Tata & Howard with their break data regularly in order to update the water main database. Currently, the Town does not maintain documentation of breaks, leaks, and replacements. The Town should implement a break history database documenting the break, leak, and replacement with the nearest street address and the properties of the failed main such as diameter and how the break was replaced. In addition, the Town should record, joint type, type of lining, and type of failure such as ring crack, lateral split, hole in the pipe, "punky" AC pipe failure, or joint leak. If possible, the Town should include the apparent cause of the failure such as frost load, traffic load, direct contractor damage, settlement, water hammer, external soil corrosion, or stray current. The documentation should also be filed electronically immediately after each event. This data can be used to create a Water Main Failure Map for identifying areas of concern in the system on an ongoing basis. The map can be used to easily identify break locations and determine if streets or areas have a higher frequency of failures and to view any patterns in the location, type, pipe manufacturer, or other patterns in occurrences of failure. The water main failure database will aid the Town in making water main rehabilitation and replacement decisions in the future.

In addition, it is recommended that the Town collect and maintain data on pipe crushing results from water mains that have failed. At the time of a main failure, a one foot section of the water main should be cut from the pipe that will remain in place (adjacent to the repair). The sample will need to be marked with date of break occurrence, installation date, diameter, location and any information regarding the type of main failure. It is recommended that this coupon be analyzed further and data recorded on results. Samples should also be taken when a water main is accessible to review properties of mains in the system that have not failed. It is also recommended that the Town continue to update the database of new or rehabilitated water mains. The database should include diameter, material, lining, joint type, soil conditions, and date of installation.

The estimated unaccounted-for water in the Town according to ASRs has been between 43.4 and 11.5 percent in the past five years. After finding an error with the flow totalizer at the Gravelly Pond Water Treatment Facility which was determined to have occurred in late 2009, the flow data was adjusted and it now appears that the unaccounted-for water actually ranged between 21.4 and 30.4 percent from 2013-2016. Data from previous years is found to be inaccurate, therefore, the UAW values were not calculated. Unaccounted for water does not take into consideration that some water will always be physically lost from the system regardless of the management of a system. These unavoidable losses are not technically feasible to identify and repair. The term unaccounted for water also does not differentiate between real losses and apparent losses and does not differentiate nonrevenue water from revenue water. Also, the amount of unaccounted-for water can vary significantly if total water production or the amount of wholesale water varies from year to year due to the impacts of weather.

The Town received approval at the annual Town Meeting and by ballot in May 2016 to appropriate $2,000,000 in funding for water and sewer improvements in 2016-17. For the water system, this money will be used to fund a meter replacement program, valve and hydrant maintenance plan, safe yield study for Gravelly Pond, Emergency Response Plan training and a valve and hydrant replacement project along with other small miscellaneous projects.

In 2015 the Town conducted a water audit in order to locate additional areas of nonrevenue water usage in the Town. The water audit, based on AWWA M36, assisted in tracking and quantifying water losses throughout the distribution system. The audit used the Infrastructure Leakage Index (ILI), a dimensionless indicator that tracks aspects of the management of a water utility and takes into consideration both real and apparent losses. ILI allows water utilities to benchmark performance and compare it to other utilities, both locally and nationally. The water audit is currently being finalized for the Town. A unidirectional flushing program has also been completed for the Town.

The Town of Manchester-by-the-Sea should continue to perform regularly scheduled maintenance programs, including hydrant flushing, leak detection, and meter testing/calibration. The Town should continue the existing replacement program during which hydrants and valves that do not function as intended are identified and replaced. These deficiencies can be identified through routine operation and during the implementation of the system-wide flushing program.

It is recommended that prior to installation of all new ductile iron water main, the Town should test the soils in the area of the new main to determine corrosion potential. If the soil is found to be potentially corrosive, the Town should consider installing HDPE water main or wrapping ductile iron water main with polyethylene to protect against external corrosion. Wrapping is a relatively inexpensive practice that can extend the life of new ductile iron pipe. In addition, wrapping helps to protect the pipe from stray currents that may develop near the main. HDPE water main is recommended for new water main installed by the Town in areas influenced by salt water. Historically, iron pipe in salt water has experienced multiple external corrosion issues on both the pipe and the fittings.

7.3 Storage Recommendations

The Moses Hill Water Storage Tank is in good condition, however it is the Town's only Water Storage facility. We recommend completing a siting study for a second tank to evaluate the different tank options, including overflow elevation, construction material, locations, size, operating conditions, and funding mechanisms. The study will evaluate costs, construction feasibility, and operating scenarios. The estimated cost of a tank siting study is $50,000. The recommendations from the tank siting study should be used to plan for, design, and construct a new water storage tank. A new water storage tank will also provide the Town with redundancy in the event that the existing water storage tank is taken offline for maintenance. The tank evaluation will consider the impacts to the recommended water distribution system improvements outlined below.

7.4 Prioritization of Water Distribution System Improvements

Based on the Three Circles Approach, a prioritized list of improvements was created. Improvements were separated into three phases. The Phase I and Phase II improvements are prioritized based on hydraulic needs, location in the distribution system, and the condition of the water main. In general, the Phase I improvements include water mains that fall into all three circles. Phase II improvements generally include water mains that fall into two circles. These improvements strengthen the transmission grid, eliminate potential asset management concerns, and provide redundancy.

Phase III improvements generally fall into one circle. These improvements include the remaining hydraulic recommendations from Section 4 and areas with high asset management ratings. The hydraulically deficient areas, critical component considerations, and asset management ratings are combined on one Three Circles Integration Map included in Appendix F.

It should be noted that the list of improvements is extensive due to the nature of this report. This results in a high associated cost if all of the suggested improvements were constructed. The intent of the prioritization is to serve as a guide for implementation from the most needed to the least needed improvements based on the prioritization and weighted criteria established jointly by the Town and Tata & Howard. These improvements would most logically be constructed over an extended period of time.

Table No. 7-1, at the end of this section, includes a prioritized list of Phase I improvements and the hydraulic, critical component, and asset management status of each improvement. Table No. 7-2 includes the linear footage and estimated cost of each Phase I improvement. Table No. 7-3 includes a prioritized list of Phase II improvements and Table No. 7-4 includes the linear footage and estimated cost of each Phase II improvement.

Phase III improvements have been divided into three sections (Phase IIIa, b and c). Phase IIIa improvements represent the remaining hydraulic improvements from Section 4. Phase IIIb improvements include pipes that are identified as critical and Phase IIIc improvements include the water mains that have high asset management ratings. These improvements should be implemented when funding becomes available. Table No. 7-5 includes a list of Phase IIIa Improvements and the hydraulic, critical, and asset management status of each improvement. Table No. 7-6 includes the linear footage and estimated cost of each Phase IIIa improvement. The Phase IIIb recommended improvements are listed in Table No. 7-7. The estimated probable construction cost to replace these water mains is included in Table No. 7-8. Table No. 7-9 includes a list of Phase IIIc Improvements and the hydraulic, critical, and asset management status of each improvement. Table No. 7-10 includes the linear footage and estimated cost of each Phase IIIc improvement. The recommended improvements map is included in Appendix G.

Phase I Improvements

1. A new 12-inch diameter water main is recommended on Lincoln Street from Summer Street to Vine Street. This water main will improve transmission by eliminating the existing bottleneck and provide the inherent capacity for the ISO recommended fire flow to the Manchester Essex Regional High School and improve flow to the east side of the water system. This water main also serves a critical area. These existing water mains have an asset management rating of 41 and are considered in fair to good condition. Although the asset management rating for this pipe does not classify it as poor, there is other Town owned infrastructure in the area that is failing and in need of replacement, therefore, this project has been identified as a Phase I improvement. This water main is also in a location identified in the Town's pavement management plan for a recommended surface treatment. The estimated probable construction costs for approximately 1,200 linear feet of 12-inch diameter water main is $464,000. Additional cost was factored in due to the culvert crossing.

2. A new 12-inch diameter water main is recommended on Summer Street from Lincoln Street to the railroad tracks on Summer Street. This water main will improve transmission to the east side of the distribution system. This water main also serves a critical area. Hydraulically, this water main improvement was recommended to be cleaned and lined but due to the asset management score, replacement is recommended. These existing water mains have an asset management rating of 65 and are considered in poor to fair condition. The high asset management rating is due to the material, corrosive soils and break history. The estimated probable construction costs for approximately 2,300 linear feet of 12-inch diameter water main is $870,000. Additional cost was factored in to the cost estimate because Summer Street is a Massachusetts Department of Transportation road.

3. A new 8-inch diameter water main is recommended on Raymond Street from Summer Street to the Gloucester town line. This water main will improve transmission and provide the inherent capacity for the ISO recommended fire flow to the area. The existing water main has an asset management rating of 83 and is considered in poor to fair condition. The high asset management rating is due to the size, material, installation year, corrosive soils, and break history. The proposed new water main will provide the capacity for the ISO recommended fire flow in the area. This water main is also in a location identified in the Town's pavement management plan for a section of roadway reclamation and another section for mill and overlay. The estimated probable construction cost for approximately 2,700 linear feet of 8-inch diameter water main is $810,000. Additional cost was factored in due to the culvert crossings.

Phase II Improvements

4. It is recommended to clean and line the existing 12-inch diameter water main on Summer Street from the railroad tracks on Summer Street to Ocean Street. This water main will improve transmission by increasing the c-factor of the water main and provide the inherent capacity for the ISO recommended fire flow to the area. The portion of the water main that is under the railroad tracks is considered critical by the Town because of the difficulties that would arise during a break. Due to its location, repairs would be difficult and material erosion around the railroad tracks would be problematic. We recommend cleaning and lining of this main because even though the pipe is over one hundred years old, with no break history the pipe is considered to be in good overall condition. The estimated probable construction costs for cleaning and lining approximately 3,700 linear feet of 8-inch diameter water main is $1,050,000. Additional cost was factored in to the cost estimate because Summer Street is a Massachusetts Department of Transportation road and also because of additional costs associated with the railroad crossing.

   Analysis of a one foot segment of pipe would determine the structural integrity of the water mains and if the mains are candidates for cleaning and lining or if replacement will be necessary. In addition, the Town should conduct c-factor flow tests along Summer Street to verify that the water main has excessive tuberculation.

5. The existing 10-inch water main on Summer Street from Ocean Street to Coolidge Point and existing 8-inch diameter water main from Coolidge Point to Raymond Street should be cleaned and lined. Cleaning and lining these water mains will improve transmission and provide the inherent capacity for the ISO recommended fire flow to the area. The section of water main between Ocean Street and Coolidge Point is identified as critical because of the magnitude of customers impacted by a water main failure. Due to its location, repairs would be difficult and material erosion around the railroad tracks would be problematic. We recommend cleaning and lining of this main because even though the pipe is over one hundred years old, with no break history the pipe is considered to be in good overall condition. The estimated probable construction costs for cleaning and lining approximately 4,900 linear feet of 10-inch diameter water main and approximately 1,400 linear feet of 8-inch diameter water main is $1,638,000. Additional cost was factored in to the cost estimate because Summer Street is a Massachusetts Department of Transportation road.

   Analysis of a one foot segment of pipe would determine the structural integrity of the water mains and if the mains are candidates for cleaning and lining or if replacement will be necessary. In addition, the Town should conduct c-factor flow tests along Summer Street to verify that the water main has excessive tuberculation.

6. It is recommended to tie the existing water mains, services, and hydrants connected to the 6-inch diameter water main on Pleasant Street be connected to the 16-inch diameter water main on Pleasant Street. The side streets connected to the existing 6-inch diameter water main include Currier Road, Pulaski Drive East, Old Essex Road, and Willmonton Avenue. The 6-inch diameter water main should be abandoned after the connections are completed.

   The hydraulic recommendations in Section 4 included cleaning and lining the existing 16-inch diameter water mains on Pleasant Street from Pine Street to Arbella Street, Arbella Street from Pleasant Street to Lincoln Street, and on Lincoln Street from Arbella to Vine Street. As the water mains, services, and hydrants are connected to the 16-inch diameter water main on Pleasant Street, one foot coupons of the 16-inch water main should be removed at various locations visually inspected for tuberculation and physically tested for the remaining factor of safety in the water main. This evaluation should be completed prior to cleaning and lining the water main. Based on the evaluation, the water main may be considered for cleaning and lining or replacement. These mains are considered critical by the Town because it serves the School. These water mains are also located in areas identified in the Town's pavement management plan for recommended reclamation, mill and overlay, surface treatment, and crack seal. The estimated probable construction cost to tie over the hydrants, services and side streets connected to the 6-inch water main to the 16-inch water main is approximately $140,000. If necessary, the estimated probable construction costs for cleaning and lining approximately 5,000 linear feet of 16-inch diameter water main is $2,008,000. The total estimated construction cost for the improvement is approximately $2,148,000.

7. A new 8-inch diameter water main is recommended on Old Essex Road from Pleasant Street to Blue Heron Lane. This improvement will provide the recommended residential fire flow to the area. The existing water main has an asset management rating of 50 and is considered in poor to fair condition. The high asset management rating is due to the size, material, installation year, and water quality. This water main is also in a location identified in the Town's pavement management plan for a recommended reclamation. The estimated probable construction cost for approximately 2,400 linear feet of 8-inch diameter water main is $660,000.

8. A new 16-inch diameter water main is recommended on Pine Street from Hydrant No. 154 on Pine Street to Rockwood Heights and a new 8-inch diameter water main is recommended on Rockwood Heights Road from Pine Street to Pinewood Road. The existing water mains have an asset management rating of 64 and 52 and are considered in poor to fair condition. The high asset management rating is due to the size, material, installation year, corrosive soils, shallow mains, and break history. This transmission main from the water treatment facility to the tank is also considered critical. The estimated probable construction cost for approximately 3,300 linear feet of 16-inch diameter water main and 900 linear feet of 8-inch diameter water main is $1,610,000.

9. A new 12-inch diameter water main is recommended on Beach Street from Union Street to Summer Street. The existing 12-inch diameter water main on Bridge Street from Bennett Street to Pine Street, and Union Street and Central Street from Pine Street to Beach Street and existing 12-inch and 8-inch diameter water mains on Summer Street from Beach Street to Lincoln Street are recommended to be cleaned and lined. We recommend cleaning and lining of the main on Union Street, Central Street, and Summer Street because even though the pipe is over one hundred years old, with no break history the pipe is considered to be in good overall condition with asset management ratings ranging from 15 to 41. These water main improvements will provide the recommended fire flows in the commercial downtown area where there are many large wood framed buildings in close proximity to each other. The existing water main on Beach Street has an asset management rating ranging from 71 to 51 and is considered in poor to fair condition. The high asset management rating is due to the size, material, installation year, and break history. These water mains are also located in areas identified in the Town's pavement management plan for recommended surface treatment, and crack seal. The estimated probable construction costs for cleaning and lining approximately 3,500 linear feet of 12-inch and 1,200 linear feet of 8-inch diameter water main and replacing 300 linear feet of 8-inch diameter water main is $1,435,000. Additional cost was factored into the cost estimate because Union, Bridge, and Summer Streets are busy roads and there is a culvert crossing on Bridge Street. This project, due to its size and estimated cost, may be more feasible by splitting it into multiple smaller projects.

10. A new 12-inch diameter water main is recommended on Magnolia Avenue from the 6-inch water main on Colburn Road to the railroad tracks on Magnolia Avenue, new 8-inch diameter water main on Magnolia Avenue from the railroad tracks to Summer Street, and 8-inch diameter water main on Overledge Road from Magnolia Avenue to 2 Overledge Road. These water mains will improve redundancy and available flow by creating a loop

to the east side of the system. The estimated probable construction costs for approximately 2,000 linear feet of 12-inch diameter water main is $718,000. Additional cost was factored in due to the railroad crossing.

11. A new 8-inch diameter water main is recommended on Plumb Hill Road from the railroad tracks to Hickory Hill Road. This water main provides redundancy to the system and inherent capacity for the ISO recommended fire flow to the east side of the system. The estimated probable construction cost for approximately 1,900 linear feet of 8-inch diameter water main is $553,000. Additional cost was factored in due to the railroad crossing.

12. A new 8-inch diameter water main is recommended on Summer Street from Raymond Street to the Gloucester town line. This main is considered critical by the Town because of a stream crossing and also the interconnection with the Town of Gloucester. The existing water main has an asset management rating of 63 and is considered to be in poor to fair condition. The high asset management ratings are due to the size, material, installation year, and break history. The estimated probable construction costs for approximately 1,700 linear feet of 8-inch diameter water main is $545,000. Additional cost was factored in due to the culvert crossing.

13. A new 8-inch diameter water main is recommended on Bennett Street from Bridge Street to Foster Road. The existing water main has an asset management rating of 53 and is considered to be in poor to fair condition. The high asset management ratings are due to the size, material, installation year, and corrosive soils. The estimated probable construction costs for approximately 800 linear feet of 8-inch diameter water main is $305,000. Additional cost was factored in due to the culvert crossing.

Phase IIIa Improvements – Hydraulic

14. A new 16-inch diameter water main is recommended on Bridge Street from Highland Avenue to Pine Street and a new 12-inch diameter water main on Highland Avenue from Bridge Street to Ox Pasture Road. This water main will provide the ISO recommended fire flow and recommended residential fire flow to the area. These water mains are also located in areas identified in the Town's pavement management plan for recommended reclamation, and mill and overlay. The estimated probable construction costs for approximately 6,300 linear feet of 12-inch diameter water main is $2,342,000.

15. A new 8-inch diameter water main is recommended on Eaglehead Road from Old Neck Road to 3 Eaglehead Road. The existing 6-inch diameter water main creates a bottle neck restricting the fire flow capacity to residents at the end of Eaglehead Road. This water main will provide recommended residential fire flow to the area. The water main is also located in an area identified in the Town's pavement management plan for recommended mill and overlay. The estimated probable construction cost for approximately 700 linear feet of 8-inch diameter water main is $241,000.

16. A new 8-inch diameter water main is recommended on Coolidge Point Road from Summer Street to 45 Coolidge Point Road. This main will create a loop and provide

redundancy and increased fire flow capacity to meet the recommended residential fire flow in the area. The estimated probable construction cost for approximately 2,200 linear feet of new 8-inch diameter water main $635,000. Additional cost was factored in due to the culvert crossing.

Phase IIIb Improvements – Critical

17. A redundant 16-inch diameter water main is recommended on Pine Street from the tank access road to Pleasant Street. This water main will add redundancy to the distribution system improve transmission from the tank to the rest of the system. This water main is also in a location identified in the Town's pavement management plan for a recommended crack seal. The estimated probable construction costs for approximately 650 linear feet of 16-inch diameter water main is $304,000. Additional cost was factored into the cost estimate because Pine Street is a busy road.

Phase IIIc Improvements – Asset Management

18. Based on the asset management ratings, the water mains with asset management ratings greater than 45 are considered poor to fair. This represents approximately 25 percent of the water distribution system. Some of these water mains are included in Phase I and Phase II improvements. There are approximately seven miles of main with high asset management ratings that have not been included as Phase I, II, IIIa or IIIb. In general, the water mains with the highest asset management rating should be replaced first. These mains should be completed as funds become available. Also, these mains should be considered when reviewing road paving schedules, wastewater, and storm water work. We modified the order of our Phase IIIc Improvements based on the Town's pavement management plan.

    The water mains with high asset management ratings are identified on the Recommended Improvements Map found in Appendix G. The total amount of recommended water main by diameter is listed in Table No. 7-9. The estimated probable construction cost to replace these water mains is also included in Table No. 7-10. These water mains were not considered to be hydraulically deficient, however, while estimating costs, it was assumed that all water mains with diameter 8-inch or less would be replaced with an 8-inch diameter main. The location of the water main being replaced should be evaluated to determine if a smaller diameter main would be appropriate.

Table No. 7-1
Prioritization of Improvements - Phase I

Item No.	Location	From	To	Hydraulic	Critical	Asset Management Rating
1	Lincoln Street	Summer Street	Vine Street	Yes	Yes	41
2	Summer Street	Lincoln Street	Railroad tracks	Yes	Yes	65
3	Raymond Street	Summer Street	Gloucester town line	Yes	Yes	83

Table No. 7-2
Estimated Improvement Cost - Phase I

Item No.	Location	From	To	Diameter (in)	Length (LF)	Estimated Cost
1	Lincoln Street	Summer Street	Vine Street	12	1,200	$464,000
2	Summer Street	Lincoln Street	Railroad tracks	12	2,300	$870,000
3	Raymond Street	Summer Street	Gloucester town line	8	2,700	$810,000
					Total Estimated Phase I Cost:	**$2,144,000**

Table No. 7-3
Prioritization of Improvements - Phase II

Item No.	Location	From	To	Hydraulic	Critical	Asset Management Rating
4	Summer Street	Railroad Tracks	Ocean Street	Yes	Yes	15
5	Summer Street	Ocean Street	Magnolia Ave	Yes	No	17
	Summer Street	Magnolia Ave	Ocean Street	Yes	No	37
	Summer Street	Ocean Street	Coolidge Point	Yes	Yes	37
	Summer Street	Coolidge Point	Raymond Street	Yes	No	41
6	Pleasant St	Pine Street	Arbella Street	Yes	Yes	13
	Arbella Street	Pleasant Street	Lincoln Street	Yes	Yes	13
	Lincoln Street	Arbella Street	Vine Street	Yes	Yes	13
	Lincoln Street Tie over	6-inch Water Main	16-inch Water Main	Yes	Yes	13
7	Old Essex Road	Blue Heron Lane	Pleasant Street	Yes	No	50
8	Pine Street	Pine Street	Rockwood Heights Road	Yes	No	64
	Rockwood Heights Road	Pine Street	Pinewood Road	Yes	No	52
9	Bridge Street	Ashland Avenue	Pine Street	Yes	No	15
	Union Street	Pine Street	Beach Street	Yes	No	15/35
	Beach Street	Union Street	Summer Street	Yes	No	51/71
	Summer Street	Beach Street	Lincoln Street	Yes	No	15/21/41
10	Magnolia Avenue	6-inch main on Colburn Road	Railroad Tracks	Yes	No	-
11	Plumb Hill Road	Ancient County Way	Hickory Hill Road	Yes	No	-
12	Summer Street	Raymond Street	Gloucester town line	No	Yes	63
13	Bennett Street	Bridge Street	Forster Road	No	Yes	53

Table No. 7-4
Estimated Improvement Cost - Phase II

Item No.	Location	From	To	Diameter (in)	Length (LF)	Estimated Cost
4	Summer Street	Railroad Tracks	Ocean Street	12	3,700	$1,050,000
5	Summer Street	Ocean Street	Magnolia Ave	10	2,700	$711,000
	Summer Street	Magnolia Ave	Ocean Street	10	1,400	$369,000
	Summer Street	Ocean Street	Coolidge Point	10	800	$240,000
	Summer Street	Coolidge Point	Raymond Street	8	1,400	$318,000
6	Pleasant St	Pine Street	Arbella Street	16	3,800	$1,497,000
	Arbella Street	Pleasant Street	Lincoln Street	16	500	$207,000
	Lincoln Street	Arbella Street	Vine Street	16	700	$304,000
	Lincoln Street Tie over	6-inch Water Main	16-inch Water Main	Varies	100	$140,000
7	Old Essex Road	Blue Heron Lane	Pleasant Street	8	2,400	$660,000
8	Pine Street	Pine Street	Rockwood Heights Road	16	3,300	$1,300,000
	Rockwood Heights Road	Pine Street	Pinewood Road	8	900	$310,000
9	Bridge Street	Ashland Avenue	Pine Street	12	600	$216,000
	Union Street	Pine Street	Beach Street	12	1,300	$352,000
	Beach Street	Union Street	Summer Street	8	300	$109,000
	Summer Street	Beach Street	Lincoln Street	12	2,800	$758,000
10	Magnolia Avenue	6-inch main on Colburn Road	Railroad Tracks	12	2,000	$718,000
11	Plumb Hill Road	Ancient County Way	Hickory Hill Road	8	1,900	$553,000
12	Summer Street	Raymond Street	Gloucester town line	8	1,700	$545,000
13	Bennett Street	Bridge Street	Forster Road	8	800	$305,000
					Total Estimated Phase II Cost:	**$10,662,000**

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Table No. 7-5
Prioritization of Improvements – Phase IIIa Hydraulic

Item No.	Location	From	To	Hydraulic	Critical	Asset Management Rating
14	Bridge Street	Highland Ave	Ashland Avenue	Yes	No	17/37
	Highland Ave	Ox Pasture Road	Bridge Street	Yes	No	33/53
15	Eaglehead Road	Old Neck Road	3 Eaglehead Road	Yes	No	32
16	Coolidge Point	Summer Street	45 Coolidge Point	Yes	No	-

Table No. 7-6
Estimated Improvement Cost – Phase IIIa Hydraulic

Item No.	Location	From	To	Diameter (in)	Length (LF)	Estimated Cost
14	Bridge Street	Highland Ave	Ashland Avenue	12	5,100	$1,050,000
	Highland Ave	Ox Pasture Road	Bridge Street	12	1,200	$553,000
15	Eaglehead Road	Old Neck Road	3 Eaglehead Road	8	700	$545,000
16	Coolidge Point	Summer Street	45 Coolidge Point	8	2,200	$305,000
Total Estimated Phase IIIa Hydraulic Cost:						**$3,218,000**

Table No. 7-7
Prioritization of Improvements – Phase IIIb Critical

Item No.	Location	From	To	Hydraulic	Critical	Asset Management Rating
17	Pine Street	Crooked Lane	Pleasant Street	No	Yes	13

Table No. 7-8
Estimated Improvement Cost – Phase IIIb Critical

Item No.	Location	From	To	Diameter (in.)	Length (LF)	Estimated Cost
17	Pine Street	Crooked Lane	Pleasant Street	16	700	$304,000
					Total Estimated Phase IIIb Critical Cost:	**$304,000**

Table No. 7-9
Summary of Improvements – Phase IIIc Asset Management

Item No.	Location	From	To	Pavement Management	Hydraulic/ Critical	Asset Management Rating
18	Magnolia Avenue	Railroad Tracks	Summer Street	1,2,4	No	98/48
	Overledge Road	Magnolia Avenue	2 Overledge Road	4	No	52
	Norwood Ave	Washington Street	Vine Street	2,4	No	83/63/53
	Boardman Avenue	Bridge Street	Harbor Street		No	83/41/33
	Tucks Point Point Road	Harbor Street	Cul-de-sac	1	No	53
	Morse Court	Bridge Street	Cul-de-sac		No	83
	Harold Street	Summer Street	Forest Street	1,2	No	82/62/52
	Mark Street	Harold Street	dead end	4	No	62
	Butler Avenue	Raymond Street	Gloucester town line		No	82
	Masconomo Street	Smith Point Road	48 Masconomo Street	2	No	71/51/41
	Smith Point Road	Smith Point Road loop	Masconomo Street		No	63
	Beach Street	Summer Street	Tappan Street	4	No	71
	40 Beach St	Beach Street	end of 6-inch main		No	52
	Tappan Street	Beach Street	Sea Street	1	No	52
	Burnham Lane	School Street	Sumac Lane	2	No	63
	Windemere Park Extention	Willmonton Ave	end of 2-inch		No	63
	Knight Road	Willmonton Ave	end of 2-inch	2	No	53
	School Street	155 School Street	Mill Street	4	No	63
	Jefferey Court	Lincoln Street	dead end		No	63
	Stanley Ave	Jeffery Court	end of 2-inch		No	63
	Forest Street	Colburn Road	Loading Place Road	4	No	62/52
	Ancient County Way	Summer Street	Railroad Tracks	2,4	No	62
	Woodholm Lane	Pine Street	Woodholm Circle cul-de-sac	2,4	No	61

Table No. 7-9 (continued)
Summary of Improvements – Phase IIIc Asset Management

Item No.	Location	From	To	Pavement Management	Hydraulic/ Critical	Asset Management Rating
18 cont.	Hickory Hill Road	Summer Street	Hickory Hill Road	2	No	50
	Ocean Street	Summer Street	Summer Street	1,2,3	No	53
	Putnam Court	Brook Street	dead end	2	No	53
	Elm Street	Bridge Street	end of 6-inch main	2	No	52/53
	Walker Road	Pine Street	7 Walker Road	2	No	51/48
	Ashland Avenue	Bridge Street	Railroad tracks	4	No	53
	Church Street	Bridge Street	end of 6-inch main		No	53
	Coolidge Point Cross Country	Summer Street	Coolidge Reservation Land		No	53
	Harrington Way	Pine Street	Cul-de-sac		No	52
	Woodcrest Road	East cul-de-sac	West cul-de-sac		No	49

Note: Pavement Management – 1 = Reclamation, 2 = Mill and Overlay, 3 = Surface Treatment, 4 = Crack Seal

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Table No. 7-10
Estimated Improvement Cost – Phase IIIc Asset Management

Item No.	Location	From	To	Diameter (in)	Length (LF)	Estimated Cost
18	Magnolia Avenue	Railroad Tracks	Summer Street	8	2,900	$997,000
	Overledge Road	Magnolia Avenue	2 Overledge Road	8	300	$104,000
	Norwood Ave	Washington Street	Vine Street	8	1,600	$470,000
	Boardman Avenue	Bridge Street	Harbor Street	8	4,700	$1,323,000
	Tucks Point Point Road	Harbor Street	Cul-de-sac	8	1,200	$347,000
	Morse Court	Bridge Street	Cul-de-sac	8	500	$172,000
	Harold Street	Summer Street	Forest Street	8	2,000	$550,000
	Mark Street	Harold Street	dead end	6	400	$125,000
	Butler Avenue	Raymond Street	Gloucester town line	8	1,000	$344,000
	Masconomo Street	Smith Point Road	48 Masconomo Street	8	1,300	$358,000
	Smith Point Road	Smith Point Road loop	Masconomo Street	8	3,100	$853,000
	Beach Street	Summer Street	Tappan Street	8	1,000	$391,000
	40 Beach St	Beach Street	end of 6-inch main	8	500	$181,000
	Tappan Street	Beach Street	Sea Street	8	1,100	$303,000
	Burnham Lane	School Street	Sumac Lane	8	400	$138,000
	Windemere Park Extention	Willmonton Ave	end of 2-inch	6	400	$125,000
	Knight Road	Willmonton Ave	end of 2-inch	6	400	$125,000
	School Street	155 School Street	Mill Street	8	1,400	$405,000
	Jefferey Court	Lincoln Street	dead end	6	300	$94,000
	Stanley Ave	Jeffery Court	end of 2-inch	6	140	$44,000
	Forest Street	Colburn Road	Loading Place Road	8	2,300	$633,000
	Ancient County Way	Summer Street	Railroad Tracks	8	1,800	$495,000
	Woodholm Lane	Pine Street	Woodholm Circle cul-de-sac	8	1,800	$495,000

Table No. 7-10 (continued)
Estimated Improvement Cost – Phase IIIc Asset Management

Item No.	Location	From	To	Diameter (in)	Length (LF)	Estimated Cost
18 cont.	Hickory Hill Road	Summer Street	Hickory Hill Road	8	600	$237,000
	Ocean Street	Summer Street	Summer Street	8	4,400	$1,301,000
	Putnam Court	Brook Street	dead end	8	300	$104,000
	Elm Street	Bridge Street	end of 6-inch main	8	800	$275,000
	Walker Road	Pine Street	7 Walker Road	8	700	$241,000
	Ashland Avenue	Bridge Street	Railroad tracks	8	500	$202,000
	Church Street	Bridge Street	end of 6-inch main	8	700	$241,000
	Coolidge Point Cross Country	Summer Street	Coolidge Reservation Land	8	1,900	$523,000
	Harrington Way	Pine Street	Cul-de-sac	8	500	$172,000
	Woodcrest Road	East cul-de-sac	West cul-de-sac	8	1,000	$344,000
Total Estimated Phase IIIc Asset Management Cost:						**$12,712,000**

Appendix A

TATA & HOWARD

Water Distribution System
Capital Efficiency Plan™
Manchester by the Sea, MA
TATA & HOWARD
Approximate Scale: 1" = 750'
February 2017
Legend
Water Main Diameter
4-inch or less
6-inch
8-inch
10-inch
12-inch
14-inch
16-inch
ESSEX
GLOUCESTER
BEVERLY
Gravelly Pond
Gravelly Pond Water Treatment Facility
Moses Hill Standpipe
Capacity: 1.7 mg
Overflow Elevation: 273 feet
Lincoln Street Well
Gloucester Interconnections
Beverly Interconnection
N
PINE STREET
PLEASANT STREET
LINCOLN STREET
SCHOOL STREET
SUMMER STREET
MAGNOLIA AVENUE
BRIDGE STREET
BEACH STREET
PROCTOR STREET
MASCONOMO STREET
SMITH'S POINT ROAD
GALES POINT ROAD
FOREST STREET
MILL STREET
ATWATER AVENUE
OLD SCHOOL STREET
ACCESS ROAD
COLBURN ROAD
ANCIENT COUNTY WAY
PLUM HILL
OCEAN STREET
RAYMOND STREET
BUTLER AVENUE
OLD NECK ROAD
EAGLE HEAD ROAD
HARBOR STREET
HIGHLAND AVE
JERSEY LANE
BOARDMAN AVE
FORSTER ROAD
WALKER ROAD
WOODCREST ROAD
DEER HILL ROAD
BENNETT STREET
WASHINGTON STREET
UNION STREET
NORTH STREET
VINE STREET
BROOK STREET
SEA STREET
TAPPAN STREET
BLOSSOM LANE
COBB AVENUE

Appendix B

APPENDIX B

TATA & HOWARD


Link Map
Capital Efficiency Plan™
Manchester by the Sea, MA
TATA & HOWARD
Approximate Scale: 1" = 750'
February 2017
Legend
Junction
Water Main
ESSEX
GLOUCESTER
BEVERLY
Gravelly Pond
Gravelly Pond Water Treatment Facility
Moses Hill Standpipe
Capacity: 1.7 mg
Overflow Elevation: 273 feet
Lincoln Street Well
Gloucester Interconnections
Beverly Interconnection
N

Pipe Input Data
Capital Efficiency Plan^{TM}
Manchester-by-the-Sea, MA

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
G_111A-A	1640	6	AC	1969	130	46	0	0	Gravel/Sand	None	32
G_111A-B	1641	6	AC	1969	130	46	0	0	Gravel/Sand	None	32
G_N53-B	1725	8	AC	1970	60	55	0	0	Identified corrosive soil	None	39
G_N49-A	1736	6	AC	1969	130	69	0	0	Gravel/Sand	None	32
G_N49-B	1737	6	AC	1969	130	69	0	0	Gravel/Sand	None	32
G_N35-A	1775	6	AC	1960	130	29	0	0	Gravel/Sand	None	32
G_N35-B	1776	6	AC	1960	130	29	0	0	Gravel/Sand	None	32
G_N32-A	1784	6	AC	1960	130	53	0	0	Gravel/Sand	None	32
G_N32-B	1785	6	AC	1960	130	53	0	0	Gravel/Sand	None	32
G_N30-A	1790	6	AC	1960	130	71	0	0	Gravel/Sand	None	32
G_N30-B	1791	6	AC	1960	130	71	0	0	Gravel/Sand	None	32
G_N25-A	1805	6	AC	1960	130	42	0	0	Gravel/Sand	None	32
G_N25-B	1806	6	AC	1960	130	42	0	0	Potentially corrosive soil (wetlands or poor soils)	None	44
G_N23-A	1811	6	AC	1970	130	5	0	1	Gravel/Sand	None	61
G_N23-B	1812	6	AC	1970	130	5	0	1	Gravel/Sand	None	61
G_N16-A	1832	8	AC	1967	130	25	0	0	Identified corrosive soil	None	40
G_N16-B	1833	8	AC	1967	130	25	0	0	Identified corrosive soil	None	40
G_N12-A	1844	6	AC	1970	130	8	0	1	Gravel/Sand	None	61
G_N12-B	1845	6	AC	1970	130	8	0	1	Gravel/Sand	None	61
G_N04-A	1868	6	AC	1962	130	2	0	0	Gravel/Sand	None	32
G_N04-B	1869	6	AC	1962	130	2	0	0	Gravel/Sand	None	32
G_N02-A	1874	8	AC	1950	130	23	0	0	Gravel/Sand	None	23
G_N02-B	1875	8	AC	1950	130	23	0	0	Gravel/Sand	None	23
G_97A-A	1892	6	AC	1960	130	17	0	0	Identified corrosive soil	None	52
G_97A-B	1893	6	AC	1960	130	17	0	0	Identified corrosive soil	None	52
G_85B-A	1931	6	AC	1969	130	32	0	0	Gravel/Sand	None	32
G_85B-B	1932	6	AC	1969	130	32	0	0	Gravel/Sand	None	32
G_80A-A	1973	4	AC	1960	130	56	0	2	Gravel/Sand	None	62
G_80A-B	1974	4	AC	1960	130	56	0	2	Gravel/Sand	None	62
G_75B-A	2018	6	AC	1960	130	23	0	0	Gravel/Sand	None	32
G_75B-B	2019	6	AC	1960	130	23	0	0	Gravel/Sand	None	32
G_69B-A	2036	8	AC	1970	130	44	0	0	Gravel/Sand	None	19
G_69B-B	2037	8	AC	1970	130	44	0	0	Gravel/Sand	None	19
G_69A-A	2039	8	AC	1970	130	96	0	0	Gravel/Sand	None	19

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
G_69A-B	2040	8	AC	1970	130	96	0	0	Gravel/Sand	None	19
G_66F-A	2051	8	AC	1965	130	37	0	0	Gravel/Sand	None	20
G_66F-B	2052	8	AC	1965	130	37	0	0	Gravel/Sand	None	20
G_66E-A	2054	8	AC	1965	130	4	0	0	Gravel/Sand	None	20
G_66E-B	2055	8	AC	1965	130	4	0	0	Gravel/Sand	None	20
G_66D-A	2057	8	AC	1965	130	25	0	1	Gravel/Sand	None	50
G_66D-B	2058	8	AC	1965	130	25	1	1	Gravel/Sand	None	50
G_66C-A	2060	6	AC	1969	130	37	0	0	Identified corrosive soil	None	52
G_66C-B	2061	6	AC	1969	130	37	0	0	Identified corrosive soil	None	52
G_66B-A	2063	6	AC	1960	130	28	0	2	Gravel/Sand	None	62
G_66B-B	2064	6	AC	1960	130	28	0	2	Gravel/Sand	None	62
G_66A-A	2066	6	AC	1960	130	4	0	0	Gravel/Sand	None	32
G_66A-B	2067	6	AC	1960	130	4	0	0	Gravel/Sand	None	32
G_59E-A	2102	8	AC	1961	80	44	0	0	Identified corrosive soil	None	40
G_59E-B	2103	8	AC	1961	80	44	0	0	Identified corrosive soil	None	40
G_59D-A	2105	8	AC	1961	80	36	0	0	Identified corrosive soil	None	40
G_59D-B	2106	8	AC	1961	80	36	0	0	Identified corrosive soil	None	40
G_59C-A	2108	6	AC	1960	80	24	0	0	Identified corrosive soil	None	52
G_59C-B	2109	6	AC	1960	80	24	0	0	Identified corrosive soil	None	52
G_59B-B	2112	6	AC	1960	80	14	0	0	Identified corrosive soil	None	52
G_57E-A	2123	8	AC	1950	130	3	0	0	Gravel/Sand	None	23
G_57E-B	2124	8	AC	1950	130	3	0	0	Gravel/Sand	None	23
G_57D-A	2126	6	AC	1950	130	67	0	0	Gravel/Sand	Dirty Water	50
G_57D-B	2127	6	AC	1950	130	67	0	0	Gravel/Sand	Dirty Water	50
G_57A-A	2135	6	AC	1950	130	87	0	0	Gravel/Sand	Dirty Water	50
G_57A-B	2136	6	AC	1950	130	87	0	0	Gravel/Sand	Dirty Water	50
G_56A-A	2141	6	AC	1968	60	20	0	0	Landfills/Junkyards/Contaminated	None	52
G_56A-B	2142	6	AC	1968	60	20	0	0	Landfills/Junkyards/Contaminated	None	52
G_50C-A	2174	8	AC	1969	130	16	0	0	Gravel/Sand	None	20
G_50C-B	2175	8	AC	1969	130	16	0	0	Gravel/Sand	None	20
G_50B-A	2177	8	AC	1969	130	10	0	0	Gravel/Sand	None	20
G_50B-B	2178	8	AC	1969	130	10	1	0	Gravel/Sand	None	20
G_193-A	2285	8	AC	1970	130	117	0	0	Gravel/Sand	None	19
G_193-B	2286	8	AC	1970	130	117	0	0	Gravel/Sand	None	19

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
G_192-A	2288	8	AC	1970	130	28	0	0	Gravel/Sand	None	19
G_192-B	2289	8	AC	1970	130	28	0	0	Gravel/Sand	None	19
G_191B-A	2291	6	AC	1970	130	20	0	1	Gravel/Sand	None	61
G_191B-B	2292	6	AC	1970	130	20	0	1	Gravel/Sand	None	61
G_191A-A	2294	6	AC	1970	130	23	0	1	Gravel/Sand	None	61
G_191A-B	2295	6	AC	1970	130	23	0	1	Gravel/Sand	None	61
G_190A-A	2300	8	AC	1970	130	14	0	2	Gravel/Sand	None	49
G_190A-B	2301	8	AC	1970	130	14	0	2	Gravel/Sand	None	49
G_190-A	2303	8	AC	1970	130	29	0	2	Gravel/Sand	None	49
G_190-B	2304	8	AC	1970	130	29	0	2	Gravel/Sand	None	49
G_189-A	2309	8	AC	1970	130	30	0	0	Gravel/Sand	None	19
G_189-B	2310	8	AC	1970	130	30	0	2	Gravel/Sand	None	49
G_187B-A	2315	8	AC	1970	130	41	0	0	Identified corrosive soil	None	39
G_187B-B	2316	8	AC	1970	130	41	0	0	Identified corrosive soil	None	39
G_187A-A	2318	8	AC	1970	130	101	0	0	Gravel/Sand	None	19
G_187A-B	2319	8	AC	1970	130	101	0	0	Gravel/Sand	None	19
G_187-A	2321	8	AC	1970	130	56	0	0	Identified corrosive soil	None	39
G_187-B	2322	8	AC	1970	130	56	0	0	Identified corrosive soil	None	39
G_143D-A	2450	6	AC	1960	130	7	0	0	Identified corrosive soil	None	52
G_143D-B	2451	6	AC	1960	130	7	0	0	Identified corrosive soil	None	52
G_138B-A	2486	6	AC	1962	130	5	0	0	Gravel/Sand	None	32
G_138B-B	2487	6	AC	1962	130	5	0	0	Gravel/Sand	None	32
G_123A-A	2543	8	AC	1970	130	35	0	0	Gravel/Sand	None	19
G_123A-B	2544	8	AC	1970	130	35	0	0	Gravel/Sand	None	19
G_121C-A	2555	6	AC	1969	130	17	0	0	Landfills/Junkyards/Contaminated	None	52
G_121C-B	2556	6	AC	1969	130	17	0	0	Landfills/Junkyards/Contaminated	None	52
G_121B-A	2558	6	AC	1969	130	0	0	0	Gravel/Sand	None	32
G_121B-B	2559	6	AC	1969	130	0	0	0	Gravel/Sand	None	32
G_121A-A	2561	6	AC	1969	130	32	0	0	Gravel/Sand	None	32
G_121A-B	2562	6	AC	1969	130	32	0	0	Gravel/Sand	None	32
P185	2606	6	AC	1968	130	12	0	0	Gravel/Sand	None	32
P11	2647	6	AC	1969	130	38	0	0	Gravel/Sand	None	32
P_9	2675	6	AC	1960	130	184	0	0	Gravel/Sand	None	32
P_888	2688	8	AC	1950	130	146	0	0	Potentially corrosive soil (wetlands or poor soils)	None	35

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_887	2689	8	AC	1950	130	51	0	0	Potentially corrosive soil (wetlands or poor soils)	None	35
P_84	2741	8	AC	1950	130	39	0	0	Gravel/Sand	None	23
P_83	2752	8	AC	1950	130	36	0	0	Gravel/Sand	None	23
P_82	2763	8	AC	1950	130	645	0	0	Gravel/Sand	None	23
P_815	2768	8	AC	1967	130	391	0	0	Identified corrosive soil	None	40
P_814	2769	8	AC	1967	130	57	0	0	Identified corrosive soil	None	40
P_811	2772	6	AC	1970	130	168	0	1	Gravel/Sand	None	61
P_810	2773	6	AC	1970	130	30	0	1	Gravel/Sand	None	61
P_81	2774	6	AC	1950	130	109	0	0	Gravel/Sand	Dirty Water	50
P_809	2775	6	AC	1970	130	44	0	1	Gravel/Sand	None	61
P_808	2776	6	AC	1970	130	27	0	1	Gravel/Sand	None	61
P_805	2779	6	AC	1970	130	119	0	1	Gravel/Sand	None	61
P_804	2780	6	AC	1970	130	232	0	1	Gravel/Sand	None	61
P_803	2781	8	AC	1970	130	495	0	2	Gravel/Sand	None	49
P_802	2782	8	AC	1970	130	27	0	2	Gravel/Sand	None	49
P_801	2783	8	AC	1970	130	331	0	0	Gravel/Sand	None	19
P_800	2784	6	AC	1970	130	19	0	0	Gravel/Sand	None	31
P_80	2785	6	AC	1950	130	50	0	0	Gravel/Sand	Dirty Water	50
P_799	2787	8	AC	1970	130	523	0	0	Gravel/Sand	None	19
P_798	2788	8	AC	1970	130	19	0	0	Gravel/Sand	None	19
P_797	2789	8	AC	1970	130	243	0	2	Gravel/Sand	None	49
P_796	2790	8	AC	1970	130	35	0	0	Gravel/Sand	None	19
P_795	2791	8	AC	1970	130	29	0	2	Gravel/Sand	None	49
P_781	2806	6	AC	1962	130	787	0	0	Gravel/Sand	None	32
P_780	2807	6	AC	1962	130	73	0	0	Gravel/Sand	None	32
P_755	2835	8	AC	1965	130	403	0	1	Gravel/Sand	None	50
P_754	2836	8	AC	1965	130	78	1	1	Gravel/Sand	None	50
P_730	2862	6	AC	1960	130	33	0	0	Identified corrosive soil	None	52
P_729	2863	6	AC	1960	130	404	0	0	Gravel/Sand	None	32
P_728	2864	6	AC	1960	130	34	0	0	Gravel/Sand	None	32
P_698	2898	8	AC	1970	130	295	0	0	Gravel/Sand	None	19
P_697	2899	8	AC	1970	130	221	0	0	Gravel/Sand	None	19
P_696	2900	8	AC	1970	130	94	0	0	Gravel/Sand	None	19
P_695	2901	8	AC	1970	130	301	0	0	Gravel/Sand	None	19

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_692	2904	8	AC	1950	130	98	0	0	Gravel/Sand	None	23
P_691	2905	8	AC	1950	130	52	0	0	Gravel/Sand	None	23
P_690	2906	6	AC	1950	130	317	0	0	Gravel/Sand	Dirty Water	50
P_69	2907	6	AC	1969	130	489	0	0	Gravel/Sand	None	32
P_689	2908	6	AC	1950	130	58	0	0	Gravel/Sand	Dirty Water	50
P_68	2918	6	AC	1969	130	59	0	0	Gravel/Sand	None	32
P_67	2929	6	AC	1969	130	124	0	0	Identified corrosive soil	None	52
P_664	2935	6	AC	1968	60	45	0	0	Landfills/Junkyards/Contaminated	None	52
P_663	2936	6	AC	1968	60	15	0	0	Landfills/Junkyards/Contaminated	None	52
P_642	2959	8	AC	1961	80	683	0	0	Identified corrosive soil	None	40
P_641	2960	8	AC	1961	80	19	0	0	Identified corrosive soil	None	40
P_640	2961	8	AC	1961	80	49	0	0	Identified corrosive soil	None	40
P_639	2963	6	AC	1960	80	156	0	0	Identified corrosive soil	None	52
P_638	2964	6	AC	1960	80	37	0	0	Identified corrosive soil	None	52
P_627	2976	6	AC	1960	130	273	0	0	Gravel/Sand	None	32
P_626	2977	6	AC	1960	130	84	0	0	Gravel/Sand	None	32
P_623	2980	6	AC	1960	130	442	0	0	Gravel/Sand	None	32
P_622	2981	6	AC	1960	130	46	0	0	Gravel/Sand	None	32
P_62	2984	8	AC	1969	130	921	0	0	Gravel/Sand	None	20
P_617	2987	6	AC	1960	130	167	0	0	Gravel/Sand	None	32
P_616	2988	6	AC	1960	130	47	0	0	Gravel/Sand	None	32
P_61	2995	8	AC	1969	130	203	0	0	Gravel/Sand	None	20
P_609	2996	6	AC	1960	130	681	0	2	Identified corrosive soil	None	82
P_608	2997	6	AC	1960	130	54	0	2	Gravel/Sand	None	62
P_607	2998	6	AC	1960	130	369	0	0	Gravel/Sand	None	32
P_606	2999	6	AC	1960	130	51	0	0	Gravel/Sand	None	32
P_605	3000	6	AC	1960	130	303	0	0	Identified corrosive soil	None	52
P_604	3001	6	AC	1960	130	117	0	0	Identified corrosive soil	None	52
P_603	3002	4	AC	1960	130	150	0	2	Gravel/Sand	None	62
P_602	3003	4	AC	1960	130	44	0	2	Gravel/Sand	None	62
P_601	3004	6	AC	1960	130	286	0	1	Identified corrosive soil	None	82
P_600	3005	6	AC	1960	130	70	0	0	Identified corrosive soil	None	52
P_599	3008	8	AC	1965	130	653	0	0	Gravel/Sand	None	20
P_598	3009	8	AC	1965	130	205	0	0	Gravel/Sand	None	20

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_597	3010	8	AC	1965	130	118	0	0	Gravel/Sand	None	20
P_51	3106	8	AC	1969	130	357	0	0	Gravel/Sand	None	20
P_49	3129	6	AC	1950	60	130	0	0	Gravel/Sand	None	35
P_38	3251	8	AC	1970	130	68	0	0	Gravel/Sand	None	19
P_373	3258	8	AC	1970	130	73	0	0	Gravel/Sand	None	19
P_347	3285	8	AC	1970	150	194	0	0	Identified corrosive soil	None	39
P_346	3286	8	AC	1970	150	20	0	0	Identified corrosive soil	None	39
P_345	3287	8	AC	1970	130	22	0	0	Gravel/Sand	None	19
P_344	3288	8	AC	1970	130	490	0	0	Identified corrosive soil	None	39
P_343	3289	8	AC	1970	130	21	0	0	Identified corrosive soil	None	39
P_341	3291	8	AC	1970	60	64	0	0	Identified corrosive soil	None	39
P_326	3308	6	AC	1969	130	126	0	0	Gravel/Sand	None	32
P_325	3309	6	AC	1969	130	45	0	0	Gravel/Sand	None	32
P_324	3310	6	AC	1969	130	184	0	0	Identified corrosive soil	None	52
P_323	3311	6	AC	1969	130	46	0	0	Identified corrosive soil	None	52
P_322	3312	6	AC	1969	130	280	0	0	Gravel/Sand	None	32
P_321	3313	6	AC	1969	130	26	0	0	Gravel/Sand	None	32
P_320	3314	6	AC	1969	130	183	0	0	Gravel/Sand	None	32
P_319	3316	6	AC	1969	130	23	0	0	Gravel/Sand	None	32
P_318	3317	6	AC	1969	130	107	0	0	Gravel/Sand	None	32
P_317	3318	6	AC	1969	130	48	0	0	Gravel/Sand	None	32
P_316	3319	6	AC	1969	130	170	0	0	Gravel/Sand	None	32
P_315	3320	6	AC	1969	130	25	0	0	Gravel/Sand	None	32
P_314	3321	6	AC	1969	130	28	0	0	Landfills/Junkyards/Contaminated	None	52
P_313	3322	6	AC	1969	130	23	0	0	Landfills/Junkyards/Contaminated	None	52
P_302	3334	8	AC	1969	130	17	1	0	Gravel/Sand	None	20
P_301	3335	8	AC	1969	130	14	0	0	Gravel/Sand	None	20
P_295	3343	6	AC	1950	60	226	0	0	Gravel/Sand	None	35
P_29	3349	6	AC	1970	130	120	0	1	Gravel/Sand	None	61
P_288	3351	8	AC	1970	150	447	0	0	Gravel/Sand	None	19
P_287	3352	8	AC	1950	130	347	0	0	Potentially corrosive soil (wetlands or poor soils)	None	35
P_254	3388	6	AC	1960	130	364	0	0	Gravel/Sand	None	32
P_253	3389	6	AC	1960	130	281	0	0	Gravel/Sand	None	32
P_222	3423	6	AC	1969	130	440	0	0	Gravel/Sand	None	32

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_221	3424	6	AC	1969	130	438	0	0	Gravel/Sand	None	32
P_220	3425	6	AC	1969	130	735	0	0	Landfills/Junkyards/Contaminated	None	52
P_211	3435	8	AC	1967	130	429	0	0	Identified corrosive soil	None	40
P_210	3436	8	AC	1967	130	56	0	0	Identified corrosive soil	None	40
P_207	3440	6	AC	1970	130	313	0	1	Gravel/Sand	None	61
P_206	3441	6	AC	1970	130	184	0	1	Gravel/Sand	None	61
P_205	3442	6	AC	1970	130	368	0	1	Gravel/Sand	None	61
P_204	3443	8	AC	1961	80	515	0	0	Identified corrosive soil	None	40
P_203	3444	8	AC	1961	80	67	0	0	Identified corrosive soil	None	40
P_201	3446	6	AC	1960	80	218	0	0	Identified corrosive soil	None	52
P_200	3447	6	AC	1960	80	55	0	0	Identified corrosive soil	None	52
P_191	3458	6	AC	1960	130	657	0	0	Gravel/Sand	None	32
P_190	3459	6	AC	1960	130	345	0	2	Identified corrosive soil	None	82
P_189	3461	8	AC	1965	130	670	0	0	Gravel/Sand	None	20
P_188	3462	8	AC	1965	130	104	0	0	Gravel/Sand	None	20
P_187	3463	8	AC	1970	130	316	0	0	Gravel/Sand	None	19
P_186	3464	8	AC	1970	130	24	0	2	Gravel/Sand	None	49
P_176	3475	6	AC	1962	130	510	0	0	Gravel/Sand	None	32
P_14	3515	6	AC	1960	130	156	0	0	Gravel/Sand	None	32
P_136	3519	8	AC	1970	130	359	0	0	Gravel/Sand	None	19
P_134	3521	6	AC	1969	130	29	0	0	Gravel/Sand	None	32
P_132	3523	6	AC	1968	130	173	0	0	Landfills/Junkyards/Contaminated	None	52
P_131	3524	6	AC	1968	130	97	0	0	Landfills/Junkyards/Contaminated	None	52
P_13	3526	6	AC	1960	130	299	0	0	Gravel/Sand	None	32
P_128	3528	6	AC	1970	130	23	0	1	Gravel/Sand	None	61
P_125	3531	8	AC	1970	130	37	0	0	Gravel/Sand	None	19
P73	3574	6	AC	1950	130	32	0	0	Gravel/Sand	None	35
P71	3575	6	AC	1950	130	24	0	0	Gravel/Sand	None	35
P69	3577	6	AC	1950	130	21	0	0	Potentially corrosive soil (wetlands or poor soils)	None	47
P67	3583	6	AC	1950	130	23	0	0	Gravel/Sand	None	35
P661	3588	6	AC	1960	130	47	0	0	Gravel/Sand	None	32
P657	3589	8	AC	1970	130	225	0	0	Gravel/Sand	None	19
P619	3601	8	AC	1969	130	30	0	0	Gravel/Sand	None	20
P581	3621	6	AC	1969	130	47	0	0	Gravel/Sand	None	32

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P579	3622	6	AC	1969	130	31	0	0	Gravel/Sand	None	32
P453	3690	6	AC	1960	130	53	0	0	Gravel/Sand	None	32
P451	3691	6	AC	1960	130	65	0	0	Gravel/Sand	None	32
P441	3697	6	AC	1960	130	59	0	0	Gravel/Sand	None	32
P439	3698	6	AC	1960	130	60	0	0	Gravel/Sand	None	32
P437	3699	6	AC	1960	130	71	0	0	Gravel/Sand	None	32
P39	3725	6	AC	1970	130	46	0	0	Gravel/Sand	None	31
P33	3757	6	AC	1969	130	55	0	0	Gravel/Sand	None	32
P31	3768	6	AC	1969	130	52	0	0	Gravel/Sand	None	32
P29	3779	6	AC	1969	130	69	0	0	Potentially corrosive soil (wetlands or poor soils)	None	44
P27	3790	6	AC	1969	130	49	0	0	Gravel/Sand	None	32
P25	3801	6	AC	1969	130	47	0	0	Gravel/Sand	None	32
P23	3812	6	AC	1969	130	63	0	0	Gravel/Sand	None	32
P-26	3861	6	AC	1960	130	189	0	0	Identified corrosive soil	None	52
P-27	3862	6	AC	1960	130	332	0	0	Gravel/Sand	None	32
P-28	3865	6	AC	1960	80	484	0	0	Identified corrosive soil	None	52
P-29	3866	6	AC	1960	80	310	0	0	Identified corrosive soil	None	52
P-53	3909	6	AC	1970	130	21	0	1	Gravel/Sand	None	61
P-55	3911	6	AC	1970	130	32	0	1	Gravel/Sand	None	61
P-62	3923	6	AC	1968	130	154	0	0	Landfills/Junkyards/Contaminated	None	52
G_118-A	1595	6	CI	1891	60	73	0	1	Gravel/Sand	None	63
G_118-B	1596	6	CI	1891	60	73	0	1	Gravel/Sand	None	63
G_117-A	1598	8	CI	1891	60	1	0	0	Gravel/Sand	None	21
G_117-B	1599	8	CI	1891	60	1	0	0	Gravel/Sand	None	21
G_116-A	1601	8	CI	1891	60	14	0	0	Gravel/Sand	None	21
G_116-B	1602	8	CI	1891	60	14	0	0	Gravel/Sand	None	21
G_114-A	1604	8	CI	1891	60	41	1	0	Gravel/Sand	None	21
G_114-B	1605	8	CI	1891	60	41	0	0	Gravel/Sand	None	21
G_113F-A	1607	8	CI	1891	60	3	0	0	Gravel/Sand	None	21
G_113F-B	1608	8	CI	1891	60	3	0	0	Gravel/Sand	None	21
G_113E-A	1610	16	CI	1890	60	55	0	0	Gravel/Sand	None	13
G_113E-B	1611	16	CI	1890	60	55	0	0	Gravel/Sand	None	13
G_113D-A	1613	16	CI	1890	60	21	0	0	Gravel/Sand	None	13
G_113D-B	1614	16	CI	1890	60	21	1	0	Gravel/Sand	None	13

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
G_113C-A	1616	6	CI	1890	60	76	0	0	Gravel/Sand	None	33
G_113C-B	1617	6	CI	1890	60	76	0	0	Gravel/Sand	None	33
G_113B-A	1619	16	CI	1890	60	89	0	0	Gravel/Sand	None	13
G_113B-B	1620	16	CI	1890	60	89	0	0	Gravel/Sand	None	13
G_113A-A	1622	6	CI	1890	60	65	0	0	Gravel/Sand	None	33
G_112F-A	1625	6	CI	1890	60	54	0	0	Gravel/Sand	None	33
G_112F-B	1626	6	CI	1890	60	54	0	0	Gravel/Sand	None	33
G_112E-A	1628	6	CI	1890	60	95	0	0	Gravel/Sand	None	33
G_112E-B	1629	6	CI	1890	60	95	0	0	Gravel/Sand	None	33
G_112D-A	1631	8	CI	1890	60	24	0	0	Gravel/Sand	None	21
G_112D-B	1632	8	CI	1890	60	24	0	0	Gravel/Sand	None	21
G_112C-A	1634	6	CI	1890	60	79	0	0	Gravel/Sand	None	33
G_112C-B	1635	6	CI	1890	60	79	0	0	Gravel/Sand	None	33
G_112B-A	1637	8	CI	1890	60	28	0	0	Gravel/Sand	None	21
G_112B-B	1638	8	CI	1890	60	28	0	0	Gravel/Sand	None	21
G_11-A	1643	8	CI	1900	60	49	0	1	Identified corrosive soil	None	70
G_11-B	1644	8	CI	1900	60	49	0	1	Identified corrosive soil	None	70
G_103B-A	1646	14	CI	1890	80	172	0	2	Pipe on rock	None	64
G_103B-B	1647	14	CI	1890	80	172	0	2	Pipe on rock	None	64
G_103A-A	1649	14	CI	1890	80	133	0	1	Identified corrosive soil	None	64
G_103A-B	1650	14	CI	1890	80	133	0	1	Pipe on rock	None	64
G_101E-A	1655	16	CI	1890	60	12	0	0	Gravel/Sand	None	13
G_101E-B	1656	16	CI	1890	60	12	0	0	Gravel/Sand	None	13
G_101D-A	1658	16	CI	1890	120	46	0	0	Gravel/Sand	None	13
G_101C-A	1661	16	CI	1890	60	29	0	0	Gravel/Sand	None	13
G_101C-B	1662	16	CI	1890	60	29	0	0	Gravel/Sand	None	13
G_101B-A	1664	16	CI	1890	60	17	1	0	Gravel/Sand	None	13
G_101B-B	1665	16	CI	1890	60	17	0	0	Gravel/Sand	None	13
G_101A-A	1667	6	CI	1890	60	13	0	0	Gravel/Sand	Dirty Water	48
G_101-A	1670	16	CI	1890	60	6	1	0	Gravel/Sand	None	13
G_101-B	1671	16	CI	1890	60	6	1	0	Gravel/Sand	None	13
G_10-A	1676	8	CI	1900	60	25	0	1	Identified corrosive soil	None	70
G_10-B	1677	8	CI	1900	60	25	0	1	Identified corrosive soil	None	70
G_1-A	1679	6	CI	1890	30	61	0	0	Gravel/Sand	None	33

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
G_1-B	1680	6	CI	1890	30	61	0	0	Gravel/Sand	None	33
G_N67-A	1682	6	CI	1890	60	71	0	0	Gravel/Sand	None	33
G_N67-B	1683	6	CI	1890	60	71	0	0	Gravel/Sand	None	33
G_N66-A	1685	6	CI	1950	60	36	0	0	Identified corrosive soil	None	53
G_N66-B	1686	6	CI	1950	60	36	0	0	Identified corrosive soil	None	53
G_N65-A	1688	6	CI	1890	60	14	0	0	Gravel/Sand	None	33
G_N65-B	1689	6	CI	1890	60	14	0	0	Gravel/Sand	None	33
G_N64-A	1691	14	CI	1890	80	30	0	0	Identified corrosive soil	None	34
G_N64-B	1692	14	CI	1890	80	30	0	0	Identified corrosive soil	None	34
G_N63-A	1694	14	CI	1890	80	29	0	0	Identified corrosive soil	None	34
G_N63-B	1695	14	CI	1890	80	29	0	0	Identified corrosive soil	None	34
G_N58-A	1709	2	CI	1890	60	71	0	0	Gravel/Sand	None	33
G_N58-B	1710	2	CI	1890	60	71	0	0	Gravel/Sand	None	33
G_N57-A	1712	8	CI	1890	60	48	0	0	Gravel/Sand	None	21
G_N57-B	1713	8	CI	1890	60	48	0	0	Gravel/Sand	None	21
G_N55-A	1718	14	CI	1890	80	67	0	0	Identified corrosive soil	None	34
G_N55-B	1719	14	CI	1890	80	67	0	0	Identified corrosive soil	None	34
G_N54-A	1721	14	CI	1890	80	195	0	0	Identified corrosive soil	None	34
G_N54-B	1722	14	CI	1890	80	195	0	0	Identified corrosive soil	None	34
G_N53-A	1724	8	CI	1890	60	55	0	0	Identified corrosive soil	None	41
G_N52-A	1727	6	CI	1950	60	29	0	0	Gravel/Sand	None	33
G_N52-B	1728	6	CI	1950	60	29	0	0	Gravel/Sand	None	33
G_N51-A	1730	6	CI	1894	42	26	0	5	Identified corrosive soil	None	83
G_N51-B	1731	6	CI	1894	42	26	0	5	Identified corrosive soil	None	83
G_N47-A	1742	6	CI	1890	60	128	0	0	Potentially corrosive soil (wetlands or poor soils)	None	45
G_N47-B	1743	6	CI	1890	60	128	0	0	Gravel/Sand	None	33
G_N46-A	1745	10	CI	1890	60	47	0	0	Identified corrosive soil	None	37
G_N46-B	1746	10	CI	1890	60	47	1	0	Identified corrosive soil	None	37
G_N45-A	1748	8	CI	1890	60	29	0	0	Gravel/Sand	None	21
G_N45-B	1749	8	CI	1890	60	29	0	0	Gravel/Sand	None	21
G_N44-A	1751	6	CI	1900	60	26	0	0	Gravel/Sand	None	32
G_N44-B	1752	6	CI	1900	60	26	0	0	Gravel/Sand	None	32
G_N43-A	1754	6	CI	1900	60	58	0	0	Gravel/Sand	None	32
G_N43-B	1755	6	CI	1900	60	58	0	0	Gravel/Sand	None	32

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
G_N40-A	1760	6	CI	1890	60	15	0	0	Identified corrosive soil	None	53
G_N40-B	1761	6	CI	1890	60	15	0	0	Identified corrosive soil	None	53
G_N39-A	1763	6	CI	1890	60	66	0	0	Gravel/Sand	None	33
G_N39-B	1764	6	CI	1890	60	66	0	0	Gravel/Sand	None	33
G_N38-A	1766	12	CI	1891	60	10	0	0	Gravel/Sand	None	15
G_N38-B	1767	12	CI	1891	60	10	0	0	Gravel/Sand	None	15
G_N37-A	1769	10	CI	1890	60	10	1	0	Identified corrosive soil	None	37
G_N37-B	1770	10	CI	1890	60	10	1	0	Identified corrosive soil	None	37
G_N36-A	1772	8	CI	1894	42	17	0	0	Identified corrosive soil	None	41
G_N36-B	1773	8	CI	1894	42	17	0	0	Identified corrosive soil	None	41
G_N34-A	1778	8	CI	1890	40	15	0	0	Identified corrosive soil	None	41
G_N34-B	1779	8	CI	1890	40	15	0	0	Identified corrosive soil	None	41
G_N33-A	1781	6	CI	1892	60	9	0	0	Identified corrosive soil	None	53
G_N33-B	1782	6	CI	1892	60	9	0	0	Identified corrosive soil	None	53
G_N29-A	1793	6	CI	1892	60	25	0	0	Identified corrosive soil	None	53
G_N29-B	1794	6	CI	1892	60	25	0	0	Identified corrosive soil	None	53
G_N28-A	1796	6	CI	1892	60	2	0	0	Gravel/Sand	None	33
G_N28-B	1797	6	CI	1892	60	2	0	0	Gravel/Sand	None	33
G_N26-A	1802	10	CI	1890	60	4	1	0	Gravel/Sand	None	17
G_N26-B	1803	10	CI	1890	60	4	0	0	Gravel/Sand	None	17
G_N24-A	1808	6	CI	1892	60	6	1	0	Identified corrosive soil	None	53
G_N24-B	1809	6	CI	1892	60	6	0	0	Identified corrosive soil	None	53
G_N21-A	1817	6	CI	1890	60	13	0	0	Gravel/Sand	None	33
G_N21-B	1818	6	CI	1890	60	13	0	0	Gravel/Sand	None	33
G_N19-A	1823	6	CI	1890	30	36	0	1	Gravel/Sand	None	63
G_N19-B	1824	6	CI	1890	30	36	0	1	Gravel/Sand	None	63
G_N14-A	1838	10	CI	1890	36	21	0	0	Identified corrosive soil	None	37
G_N14-B	1839	10	CI	1890	36	21	0	0	Identified corrosive soil	None	37
G_N13-A	1841	6	CI	1900	60	35	0	0	Gravel/Sand	None	32
G_N13-B	1842	6	CI	1900	60	35	0	0	Gravel/Sand	None	32
G_N11-A	1847	6	CI	1900	60	23	0	0	Gravel/Sand	None	32
G_N11-B	1848	6	CI	1900	60	23	0	0	Gravel/Sand	None	32
G_N09-A	1853	2	CI	1890	60	11	0	0	Gravel/Sand	None	33
G_N09-B	1854	2	CI	1890	60	11	0	0	Gravel/Sand	None	33

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
G_N08-A	1856	8	CI	1897	60	1	0	3	Gravel/Sand	None	51
G_N08-B	1857	8	CI	1897	60	1	0	3	Gravel/Sand	None	51
G_N07-A	1859	6	CI	1900	60	85	0	0	Identified corrosive soil	None	52
G_N07-B	1860	6	CI	1900	60	85	0	0	Identified corrosive soil	None	52
G_N06-A	1862	6	CI	1890	60	16	0	0	Gravel/Sand	None	33
G_N06-B	1863	6	CI	1890	60	16	0	0	Gravel/Sand	None	33
G_93-A	1901	6	CI	1892	60	50	1	0	Identified corrosive soil	None	53
G_93-B	1902	6	CI	1892	60	50	0	0	Identified corrosive soil	None	53
G_92-A	1904	8	CI	1890	60	65	0	0	Gravel/Sand	None	21
G_92-B	1905	8	CI	1890	60	65	0	0	Gravel/Sand	None	21
G_91A-A	1907	8	CI	1890	60	23	0	0	Gravel/Sand	None	21
G_91A-B	1908	8	CI	1890	60	23	0	0	Gravel/Sand	None	21
G_90A-A	1910	6	CI	1890	60	18	0	1	Identified corrosive soil	None	83
G_90A-B	1911	6	CI	1890	60	18	0	0	Identified corrosive soil	None	53
G_90-A	1913	6	CI	1890	30	30	0	0	Identified corrosive soil	None	53
G_90-B	1914	6	CI	1890	30	30	0	1	Identified corrosive soil	None	83
G_9-A	1916	8	CI	1900	60	33	0	1	Identified corrosive soil	None	70
G_9-B	1917	8	CI	1900	60	33	0	1	Identified corrosive soil	None	70
G_89-A	1919	6	CI	1890	60	22	0	0	Identified corrosive soil	None	53
G_89-B	1920	6	CI	1890	60	22	0	0	Identified corrosive soil	None	53
G_88-A	1922	6	CI	1890	60	33	0	1	Gravel/Sand	None	63
G_88-B	1923	6	CI	1890	60	33	0	1	Gravel/Sand	None	63
G_87-A	1925	6	CI	1890	60	1	0	0	Gravel/Sand	None	33
G_87-B	1926	6	CI	1890	60	1	0	0	Gravel/Sand	None	33
G_86-A	1928	6	CI	1890	60	51	0	0	Gravel/Sand	None	33
G_86-B	1929	6	CI	1890	60	51	0	0	Gravel/Sand	None	33
G_85A-A	1934	6	CI	1890	60	28	0	2	Landfills/Junkyards/Contaminated	None	83
G_85A-B	1935	6	CI	1890	60	28	0	2	Landfills/Junkyards/Contaminated	None	83
G_85-A	1937	6	CI	1890	60	21	0	2	Landfills/Junkyards/Contaminated	None	83
G_85-B	1938	6	CI	1890	60	21	0	2	Landfills/Junkyards/Contaminated	None	83
G_84-A	1952	6	CI	1890	30	100	0	1	Gravel/Sand	None	63
G_84-B	1953	6	CI	1890	30	100	0	1	Gravel/Sand	None	63
G_83B-A	1955	8	CI	1891	58	1	0	1	Gravel/Sand	None	51
G_83B-B	1956	8	CI	1891	58	1	0	1	Gravel/Sand	None	51

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Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
G_83A-A	1958	8	CI	1891	50	13	0	0	Gravel/Sand	None	21
G_83A-B	1959	8	CI	1891	50	13	0	0	Identified corrosive soil	None	41
G_83-A	1961	8	CI	1891	60	18	1	0	Gravel/Sand	None	21
G_83-B	1962	8	CI	1891	60	18	0	0	Gravel/Sand	None	21
G_82A-A	1964	10	CI	1897	40	17	1	0	Gravel/Sand	None	17
G_82A-B	1965	10	CI	1897	40	17	1	0	Gravel/Sand	None	17
G_82-A	1967	10	CI	1897	40	41	0	0	Gravel/Sand	None	17
G_82-B	1968	10	CI	1897	40	41	1	0	Gravel/Sand	None	17
G_81-A	1970	10	CI	1897	40	21	0	0	Gravel/Sand	None	17
G_81-B	1971	10	CI	1897	40	21	0	0	Gravel/Sand	None	17
G_80-A	1976	6	CI	1890	60	29	0	0	Gravel/Sand	Dirty Water	48
G_80-B	1977	6	CI	1890	60	29	0	0	Gravel/Sand	Dirty Water	48
G_8-A	1979	8	CI	1897	60	32	0	3	Identified corrosive soil	None	71
G_8-B	1980	8	CI	1900	60	32	0	1	Identified corrosive soil	None	70
G_79A-A	1982	8	CI	1890	40	14	0	0	Identified corrosive soil	None	41
G_79A-B	1983	8	CI	1890	40	14	0	0	Identified corrosive soil	None	41
G_79-A	1985	8	CI	1890	40	21	0	0	Identified corrosive soil	None	41
G_79-B	1986	8	CI	1890	40	21	0	0	Identified corrosive soil	None	41
G_78E-A	1988	8	CI	1890	40	4	0	0	Identified corrosive soil	None	41
G_78E-B	1989	8	CI	1890	40	4	0	0	Identified corrosive soil	None	41
G_78D-A	1991	6	CI	1890	30	28	0	0	Gravel/Sand	None	33
G_78D-B	1992	6	CI	1890	30	28	0	0	Gravel/Sand	None	33
G_78C-A	1994	8	CI	1890	60	34	0	0	Gravel/Sand	None	21
G_78C-B	1995	8	CI	1890	60	34	0	0	Gravel/Sand	None	21
G_78B-A	1997	6	CI	1890	60	26	0	0	Gravel/Sand	None	33
G_78B-B	1998	6	CI	1890	60	26	0	0	Gravel/Sand	None	33
G_78A-A	2000	6	CI	1890	60	21	0	0	Gravel/Sand	None	33
G_78A-B	2001	6	CI	1890	130	21	0	0	Gravel/Sand	None	33
G_78-A	2003	16	CI	1890	60	45	0	0	Gravel/Sand	None	13
G_78-B	2004	16	CI	1890	60	45	0	0	Gravel/Sand	None	13
G_77-A	2006	8	CI	1890	60	19	0	0	Gravel/Sand	None	21
G_77-B	2007	8	CI	1890	60	19	0	0	Gravel/Sand	None	21
G_76A-A	2009	6	CI	1890	60	95	0	0	Gravel/Sand	None	33
G_76A-B	2010	6	CI	1890	60	95	0	0	Gravel/Sand	None	33

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
G_76-A	2012	6	CI	1890	60	60	0	0	Gravel/Sand	None	33
G_76-B	2013	6	CI	1890	60	60	0	0	Gravel/Sand	None	33
G_75C-A	2015	8	CI	1960	60	1	0	0	Gravel/Sand	None	18
G_75C-B	2016	8	CI	1960	60	1	0	0	Gravel/Sand	None	18
G_75-A	2021	6	CI	1890	60	20	0	0	Gravel/Sand	None	33
G_75-B	2022	6	CI	1890	60	20	0	0	Gravel/Sand	None	33
G_74-A	2024	6	CI	1890	60	22	0	0	Gravel/Sand	None	33
G_74-B	2025	6	CI	1890	60	22	0	0	Gravel/Sand	None	33
G_73-A	2027	6	CI	1890	60	14	0	0	Gravel/Sand	None	33
G_73-B	2028	6	CI	1890	60	14	0	0	Gravel/Sand	None	33
G_72-A	2030	6	CI	1890	60	41	0	0	Gravel/Sand	None	33
G_72-B	2031	6	CI	1890	60	41	0	0	Gravel/Sand	None	33
G_69-A	2042	6	CI	1890	60	17	0	0	Gravel/Sand	None	33
G_69-B	2043	6	CI	1890	60	17	0	0	Gravel/Sand	None	33
G_68-A	2045	6	CI	1890	60	52	0	0	Gravel/Sand	None	33
G_68-B	2046	6	CI	1890	60	52	0	0	Gravel/Sand	None	33
G_67-A	2048	6	CI	1890	60	36	0	0	Identified corrosive soil	None	53
G_67-B	2049	6	CI	1890	60	36	0	0	Identified corrosive soil	None	53
G_66-A	2069	8	CI	1894	42	23	0	0	Identified corrosive soil	None	41
G_66-B	2070	8	CI	1894	42	23	0	0	Identified corrosive soil	None	41
G_65A-A	2072	8	CI	1891	60	20	0	0	Gravel/Sand	None	21
G_65A-B	2073	8	CI	1894	60	20	0	0	Gravel/Sand	None	21
G_64-A	2075	8	CI	1891	60	12	0	0	Gravel/Sand	None	21
G_64-B	2076	8	CI	1891	60	12	0	0	Gravel/Sand	None	21
G_62-A	2081	8	CI	1891	60	25	0	1	Gravel/Sand	None	51
G_62-B	2082	8	CI	1891	60	25	0	1	Gravel/Sand	None	51
G_60-A	2090	12	CI	1890	60	91	0	0	Gravel/Sand	None	15
G_60-B	2091	12	CI	1890	60	91	0	0	Gravel/Sand	None	15
G_5A-A	2093	6	CI	1897	60	37	0	0	Identified corrosive soil	None	53
G_5A-B	2094	6	CI	1941	60	37	0	0	Identified corrosive soil	None	53
G_59H-A	2096	8	CI	1890	60	28	0	0	Gravel/Sand	None	21
G_59H-B	2097	8	CI	1890	60	28	0	0	Gravel/Sand	None	21
G_59G-A	2099	8	CI	1890	60	30	0	0	Gravel/Sand	None	21
G_59G-B	2100	8	CI	1890	60	30	0	0	Gravel/Sand	None	21

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
G_59B-A	2111	6	CI	1900	30	14	0	2	Gravel/Sand	None	62
G_59A-A	2114	6	CI	1900	130	38	0	1	Gravel/Sand	None	62
G_59A-B	2115	6	CI	1900	130	38	0	1	Gravel/Sand	None	62
G_57-A	2138	6	CI	1940	60	41	0	0	Gravel/Sand	Dirty Water	48
G_57-B	2139	6	CI	1940	60	41	0	0	Gravel/Sand	Dirty Water	48
G_56-A	2144	6	CI	1890	60	69	0	0	Landfills/Junkyards/Contaminated	None	53
G_56-B	2145	6	CI	1890	60	69	0	0	Landfills/Junkyards/Contaminated	None	53
G_55-A	2147	6	CI	1890	60	63	0	0	Gravel/Sand	None	33
G_55-B	2148	6	CI	1890	60	63	0	0	Gravel/Sand	None	33
G_54-A	2150	6	CI	1890	60	29	0	0	Gravel/Sand	None	33
G_54-B	2151	6	CI	1890	60	29	0	0	Gravel/Sand	None	33
G_51-A	2162	2	CI	1920	60	13	0	0	Gravel/Sand	None	32
G_51-B	2163	2	CI	1920	60	13	0	0	Gravel/Sand	None	32
G_50F-A	2165	6	CI	1960	60	35	0	0	Gravel/Sand	None	30
G_50F-B	2166	6	CI	1960	60	35	0	0	Gravel/Sand	None	30
G_50E-A	2168	6	CI	1960	60	12	0	0	Gravel/Sand	None	30
G_50E-B	2169	6	CI	1960	60	12	0	0	Gravel/Sand	None	30
G_50D-A	2171	6	CI	1960	60	32	0	0	Gravel/Sand	None	30
G_50D-B	2172	6	CI	1960	60	32	0	0	Gravel/Sand	None	30
G_50-A	2180	2	CI	1920	60	13	0	0	Gravel/Sand	None	32
G_50-B	2181	2	CI	1920	60	13	0	0	Gravel/Sand	None	32
G_5-A	2183	6	CI	1897	60	35	0	0	Identified corrosive soil	None	53
G_5-B	2184	6	CI	1897	60	35	0	0	Identified corrosive soil	None	53
G_47B-A	2186	6	CI	1890	60	42	0	0	Identified corrosive soil	None	53
G_47B-B	2187	6	CI	1890	60	42	0	0	Identified corrosive soil	None	53
G_47A-A	2189	6	CI	1890	60	34	0	0	Identified corrosive soil	None	53
G_47A-B	2190	6	CI	1890	60	34	0	0	Identified corrosive soil	None	53
G_47-A	2192	6	CI	1890	60	26	0	0	Gravel/Sand	None	33
G_47-B	2193	6	CI	1890	60	26	0	0	Gravel/Sand	None	33
G_45-A	2198	6	CI	1890	60	51	0	0	Identified corrosive soil	None	53
G_45-B	2199	6	CI	1890	60	51	0	0	Identified corrosive soil	None	53
G_43-A	2204	6	CI	1891	60	51	0	0	Gravel/Sand	None	33
G_43-B	2205	6	CI	1891	60	51	0	0	Gravel/Sand	None	33
G_42-A	2207	2	CI	1890	60	46	0	0	Gravel/Sand	None	33

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
G_42-B	2208	2	CI	1890	60	46	0	0	Gravel/Sand	None	33
G_41A-A	2210	6	CI	1890	60	11	0	0	Identified corrosive soil	None	53
G_41A-B	2211	6	CI	1890	60	11	0	0	Identified corrosive soil	None	53
G_41-A	2213	6	CI	1890	60	22	0	0	Identified corrosive soil	None	53
G_41-B	2214	6	CI	1890	60	22	0	0	Identified corrosive soil	None	53
G_40-A	2216	2	CI	1890	60	15	0	0	Gravel/Sand	None	33
G_40-B	2217	2	CI	1890	60	15	0	0	Gravel/Sand	None	33
G_38-A	2222	12	CI	1891	36	8	0	0	Identified corrosive soil	None	35
G_38-B	2223	12	CI	1891	36	8	0	0	Identified corrosive soil	None	35
G_37-A	2225	12	CI	1891	36	20	0	0	Gravel/Sand	None	15
G_37-B	2226	12	CI	1891	36	20	0	0	Gravel/Sand	None	15
G_36-A	2228	6	CI	1910	60	30	0	0	Identified corrosive soil	None	52
G_36-B	2229	6	CI	1910	60	30	0	0	Identified corrosive soil	None	52
G_35-A	2231	6	CI	1890	60	66	0	1	Gravel/Sand	None	63
G_35-B	2232	6	CI	1890	60	66	0	1	Gravel/Sand	None	63
G_34-A	2234	12	CI	1891	36	43	0	0	Gravel/Sand	None	15
G_34-B	2235	12	CI	1891	36	43	0	0	Gravel/Sand	None	15
G_33-A	2237	6	CI	1890	35	28	0	0	Gravel/Sand	None	33
G_33-B	2238	6	CI	1890	35	28	0	0	Gravel/Sand	None	33
G_32-A	2240	6	CI	1890	35	3	0	0	Gravel/Sand	None	33
G_32-B	2241	6	CI	1890	35	3	0	0	Gravel/Sand	None	33
G_31A-A	2243	6	CI	1890	35	6	0	0	Gravel/Sand	None	33
G_31A-B	2244	6	CI	1890	35	6	0	0	Gravel/Sand	None	33
G_31-A	2246	6	CI	1890	60	16	0	0	Gravel/Sand	None	33
G_31-B	2247	6	CI	1890	60	16	0	0	Gravel/Sand	None	33
G_30-A	2249	6	CI	1890	60	28	0	0	Gravel/Sand	None	33
G_30-B	2250	6	CI	1890	60	28	0	0	Gravel/Sand	None	33
G_27-A	2255	10	CI	1890	36	15	0	0	Identified corrosive soil	None	37
G_27-B	2256	10	CI	1890	36	15	0	0	Identified corrosive soil	None	37
G_26-A	2258	10	CI	1890	36	3	0	0	Gravel/Sand	None	17
G_26-B	2259	10	CI	1890	36	3	0	0	Gravel/Sand	None	17
G_25-A	2261	10	CI	1890	45	51	0	1	Gravel/Sand	None	47
G_25-B	2262	10	CI	1890	45	51	0	1	Gravel/Sand	None	47
G_24-A	2264	10	CI	1890	45	68	0	0	Identified corrosive soil	None	37

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
G_24-B	2265	10	CI	1890	45	68	0	0	Identified corrosive soil	None	37
G_23-A	2267	10	CI	1890	45	131	0	0	Identified corrosive soil	None	37
G_23-B	2268	10	CI	1890	45	131	0	0	Identified corrosive soil	None	37
G_22-A	2270	10	CI	1890	45	122	0	0	Gravel/Sand	None	17
G_22-B	2271	10	CI	1890	45	122	0	0	Gravel/Sand	None	17
G_21-A	2273	12	CI	1891	45	25	0	0	Gravel/Sand	None	15
G_21-B	2274	12	CI	1891	45	25	0	0	Gravel/Sand	None	15
G_20-A	2276	6	CI	1894	42	3	0	0	Gravel/Sand	None	33
G_20-B	2277	6	CI	1894	42	3	0	0	Gravel/Sand	None	33
G_2-A	2279	6	CI	1890	30	40	0	0	Gravel/Sand	None	33
G_2-B	2280	6	CI	1890	30	40	0	0	Gravel/Sand	None	33
G_19A-A	2282	6	CI	1894	42	48	0	5	Identified corrosive soil	None	83
G_19A-B	2283	6	CI	1894	42	48	0	0	Identified corrosive soil	None	53
G_19-A	2306	6	CI	1894	42	34	0	5	Identified corrosive soil	None	83
G_19-B	2307	6	CI	1894	130	34	0	5	Identified corrosive soil	None	83
G_188-A	2312	8	CI	1890	60	39	0	1	Gravel/Sand	None	51
G_188-B	2313	8	CI	1890	60	39	0	1	Gravel/Sand	None	51
G_18-A	2324	6	CI	1894	42	103	0	5	Identified corrosive soil	None	83
G_18-B	2325	6	CI	1894	42	103	0	5	Identified corrosive soil	None	83
G_176-A	2327	6	CI	1890	60	61	0	0	Gravel/Sand	None	33
G_176-B	2328	6	CI	1890	60	61	0	0	Gravel/Sand	None	33
G_171-A	2336	6	CI	1900	60	37	0	0	Gravel/Sand	None	32
G_171-B	2337	6	CI	1900	60	37	0	0	Gravel/Sand	None	32
G_170-A	2339	6	CI	1900	60	130	0	0	Gravel/Sand	None	32
G_170-B	2340	6	CI	1900	60	130	0	0	Gravel/Sand	None	32
G_17-A	2342	6	CI	1891	60	30	0	0	Gravel/Sand	None	33
G_17-B	2343	6	CI	1891	60	30	0	0	Gravel/Sand	None	33
G_169A-A	2345	6	CI	1909	60	78	0	0	Gravel/Sand	None	32
G_169A-B	2346	6	CI	1909	60	78	1	0	Gravel/Sand	None	32
G_166A-A	2360	6	CI	1890	30	33	0	0	Gravel/Sand	None	33
G_166A-B	2361	6	CI	1890	30	33	0	0	Gravel/Sand	None	33
G_166-A	2363	6	CI	1890	30	37	0	0	Gravel/Sand	None	33
G_166-B	2364	6	CI	1890	30	37	0	0	Gravel/Sand	None	33
G_165D-A	2366	2	CI	1890	60	71	0	0	Identified corrosive soil	None	53

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
G_165D-B	2367	2	CI	1890	60	71	0	0	Identified corrosive soil	None	53
G_165C-A	2369	6	CI	1890	60	18	0	0	Gravel/Sand	None	33
G_165C-B	2370	6	CI	1890	30	18	0	0	Gravel/Sand	None	33
G_165B-A	2372	2	CI	1890	60	69	0	1	Gravel/Sand	None	63
G_165B-B	2373	2	CI	1890	60	69	0	1	Gravel/Sand	None	63
G_165A-A	2375	6	CI	1890	30	36	0	0	Gravel/Sand	None	33
G_165A-B	2376	6	CI	1890	30	36	0	0	Gravel/Sand	None	33
G_164-A	2378	12	CI	1897	60	11	0	0	Gravel/Sand	None	15
G_164-B	2379	12	CI	1897	60	11	0	0	Gravel/Sand	None	15
G_162A-A	2381	12	CI	1890	60	96	0	0	Gravel/Sand	Dirty Water	30
G_162A-B	2382	12	CI	1890	60	96	0	0	Gravel/Sand	Dirty Water	30
G_162-A	2384	12	CI	1890	60	32	0	0	Gravel/Sand	Dirty Water	30
G_162-B	2385	12	CI	1890	60	32	0	0	Gravel/Sand	Dirty Water	30
G_161A-A	2387	12	CI	1890	60	32	0	0	Gravel/Sand	Dirty Water	30
G_161A-B	2388	12	CI	1890	60	32	0	0	Gravel/Sand	Dirty Water	30
G_161-A	2390	12	CI	1890	60	18	0	0	Gravel/Sand	Dirty Water	30
G_161-B	2391	12	CI	1890	60	18	0	0	Gravel/Sand	Dirty Water	30
G_160A-A	2393	6	CI	1892	60	83	0	0	Gravel/Sand	None	33
G_160A-B	2394	6	CI	1892	60	83	0	0	Gravel/Sand	None	33
G_160-A	2396	6	CI	1890	60	8	0	0	Gravel/Sand	None	33
G_160-B	2397	6	CI	1890	60	8	0	0	Gravel/Sand	None	33
G_16-A	2399	6	CI	1890	60	46	0	0	Identified corrosive soil	None	53
G_16-B	2400	6	CI	1890	60	46	0	0	Identified corrosive soil	None	53
G_159-A	2402	12	CI	1891	60	41	0	0	Gravel/Sand	None	15
G_159-B	2403	12	CI	1891	60	41	0	0	Gravel/Sand	None	15
G_156-A	2405	6	CI	1894	60	3	0	0	Pipe on rock	None	53
G_156-B	2406	6	CI	1894	60	3	0	0	Pipe on rock	None	53
G_155-A	2408	6	CI	1900	60	76	0	0	Identified corrosive soil	None	52
G_155-B	2409	6	CI	1900	60	76	0	0	Identified corrosive soil	None	52
G_154-A	2411	6	CI	1900	60	47	0	0	Identified corrosive soil	None	52
G_154-B	2412	6	CI	1900	60	47	0	0	Identified corrosive soil	None	52
G_152B-A	2420	6	CI	1890	60	84	0	1	Gravel/Sand	None	63
G_152B-B	2421	6	CI	1890	60	84	0	1	Gravel/Sand	None	63
G_152A-A	2423	6	CI	1890	60	43	0	1	Gravel/Sand	None	63

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Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
G_152A-B	2424	6	CI	1890	60	43	0	1	Gravel/Sand	None	63
G_152-A	2426	8	CI	1890	60	44	0	0	Identified corrosive soil	None	41
G_152-B	2427	8	CI	1890	60	44	0	0	Identified corrosive soil	None	41
G_151A-A	2429	8	CI	1890	60	15	0	0	Identified corrosive soil	None	41
G_151A-B	2430	8	CI	1890	60	15	0	0	Identified corrosive soil	None	41
G_151-A	2432	10	CI	1890	60	69	0	0	Identified corrosive soil	None	37
G_151-B	2433	10	CI	1890	60	69	1	0	Identified corrosive soil	None	37
G_15-A	2435	6	CI	1890	60	71	0	0	Identified corrosive soil	None	53
G_15-B	2436	6	CI	1890	60	71	0	0	Identified corrosive soil	None	53
G_149-A	2438	10	CI	1890	60	36	0	0	Identified corrosive soil	None	37
G_149-B	2439	10	CI	1890	60	36	0	0	Identified corrosive soil	None	37
G_146A-A	2441	12	CI	1891	60	95	1	0	Gravel/Sand	None	15
G_146A-B	2442	12	CI	1891	60	95	1	0	Gravel/Sand	None	15
G_146-A	2444	12	CI	1891	60	16	1	0	Gravel/Sand	None	15
G_146-B	2445	12	CI	1891	60	16	1	0	Gravel/Sand	None	15
G_145-A	2447	6	CI	1900	60	58	0	1	Gravel/Sand	None	62
G_145-B	2448	6	CI	1900	60	58	1	1	Gravel/Sand	None	62
G_143B-A	2456	12	CI	1891	40	18	0	4	Identified corrosive soil	None	65
G_143B-B	2457	12	CI	1891	40	18	0	4	Identified corrosive soil	None	65
G_143A-A	2459	6	CI	1891	60	50	0	0	Gravel/Sand	None	33
G_143A-B	2460	6	CI	1891	60	50	0	0	Gravel/Sand	None	33
G_143-A	2462	12	CI	1891	40	29	0	0	Gravel/Sand	None	15
G_143-B	2463	12	CI	1891	40	29	0	0	Gravel/Sand	None	15
G_142A-A	2465	6	CI	1890	30	26	0	0	Gravel/Sand	None	33
G_142A-B	2466	6	CI	1890	30	26	0	0	Gravel/Sand	None	33
G_142-A	2468	12	CI	1891	40	22	0	0	Gravel/Sand	None	15
G_142-B	2469	12	CI	1891	40	22	0	0	Gravel/Sand	None	15
G_140B-A	2471	6	CI	1891	60	11	0	0	Gravel/Sand	None	33
G_140B-B	2472	6	CI	1891	60	11	0	0	Gravel/Sand	None	33
G_140A-A	2474	12	CI	1891	40	5	0	0	Gravel/Sand	None	15
G_140A-B	2475	12	CI	1891	40	5	0	0	Gravel/Sand	None	15
G_140-A	2477	8	CI	1891	60	24	0	0	Gravel/Sand	None	21
G_140-B	2478	8	CI	1891	60	24	0	0	Gravel/Sand	None	21
G_14-A	2480	6	CI	1890	60	8	0	0	Gravel/Sand	None	33

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
G_14-B	2481	6	CI	1890	60	8	0	0	Gravel/Sand	None	33
G_139-A	2483	8	CI	1891	60	31	0	0	Identified corrosive soil	None	41
G_139-B	2484	8	CI	1891	60	31	0	0	Identified corrosive soil	None	41
G_136A-A	2489	6	CI	1900	60	21	0	0	Gravel/Sand	None	32
G_136A-B	2490	6	CI	1900	60	21	0	0	Gravel/Sand	None	32
G_136-A	2492	6	CI	1900	60	11	0	0	Gravel/Sand	None	32
G_136-B	2493	6	CI	1900	60	11	0	0	Gravel/Sand	None	32
G_135A-A	2495	8	CI	1900	60	6	0	0	Gravel/Sand	None	20
G_135A-B	2496	8	CI	1900	60	6	0	0	Gravel/Sand	None	20
G_135-A	2498	10	CI	1897	40	25	0	0	Gravel/Sand	None	17
G_135-B	2499	10	CI	1897	40	25	0	0	Gravel/Sand	None	17
G_134-A	2501	10	CI	1897	40	6	0	0	Gravel/Sand	None	17
G_134-B	2502	10	CI	1897	40	6	0	0	Gravel/Sand	None	17
G_133-A	2504	10	CI	1897	40	25	0	0	Gravel/Sand	None	17
G_133-B	2505	10	CI	1897	40	25	0	0	Gravel/Sand	None	17
G_132-A	2507	8	CI	1890	30	9	0	0	Gravel/Sand	None	21
G_132-B	2508	8	CI	1890	30	9	0	0	Gravel/Sand	None	21
G_131A-A	2510	8	CI	1890	30	24	0	0	Gravel/Sand	None	21
G_131A-B	2511	8	CI	1890	30	24	0	0	Gravel/Sand	None	21
G_131-A	2513	8	CI	1890	60	46	0	0	Gravel/Sand	None	21
G_131-B	2514	8	CI	1890	60	46	0	0	Gravel/Sand	None	21
G_130-A	2516	8	CI	1890	60	16	0	0	Gravel/Sand	None	21
G_130-B	2517	8	CI	1890	60	16	0	0	Gravel/Sand	None	21
G_13-A	2519	6	CI	1900	60	79	0	0	Gravel/Sand	None	32
G_13-B	2520	6	CI	1900	60	79	0	0	Gravel/Sand	None	32
G_12A-A	2522	6	CI	1900	60	94	1	0	Gravel/Sand	None	32
G_12A-B	2523	6	CI	1900	60	94	0	0	Gravel/Sand	None	32
G_129-A	2525	8	CI	1890	60	70	0	0	Gravel/Sand	None	21
G_129-B	2526	8	CI	1890	60	70	0	0	Gravel/Sand	None	21
G_128-A	2528	12	CI	1890	60	47	0	0	Gravel/Sand	None	15
G_128-B	2529	12	CI	1890	60	47	0	0	Gravel/Sand	None	15
G_127-A	2531	12	CI	1890	60	18	0	0	Identified corrosive soil	None	35
G_127-B	2532	12	CI	1890	60	18	0	0	Identified corrosive soil	None	35
G_126-A	2534	12	CI	1890	60	6	0	0	Identified corrosive soil	None	35

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
G_126-B	2535	12	CI	1890	60	6	0	0	Identified corrosive soil	None	35
G_125-A	2537	12	CI	1890	60	6	0	0	Gravel/Sand	None	15
G_125-B	2538	12	CI	1890	60	6	0	0	Gravel/Sand	None	15
G_124-A	2540	12	CI	1890	60	41	0	0	Gravel/Sand	None	15
G_124-B	2541	12	CI	1890	60	41	0	0	Gravel/Sand	None	15
G_123-A	2546	6	CI	1890	60	134	0	0	Gravel/Sand	None	33
G_123-B	2547	6	CI	1890	60	134	0	0	Gravel/Sand	None	33
G_122-A	2549	6	CI	1890	60	142	0	0	Gravel/Sand	None	33
G_122-B	2550	6	CI	1890	60	142	0	0	Gravel/Sand	None	33
G_121D-A	2552	6	CI	1900	60	3	0	0	Gravel/Sand	None	32
G_121D-B	2553	6	CI	1900	60	3	0	0	Gravel/Sand	None	32
G_121-A	2564	6	CI	1950	60	41	0	0	Identified corrosive soil	None	53
G_121-B	2565	6	CI	1950	60	41	0	0	Identified corrosive soil	None	53
G_120-A	2567	6	CI	1950	60	27	0	0	Identified corrosive soil	None	53
G_120-B	2568	6	CI	1950	60	27	0	4	Identified corrosive soil	None	83
G_12-A	2570	8	CI	1900	60	65	0	0	Potentially corrosive soil (wetlands or poor soils)	None	32
G_12-B	2571	8	CI	1900	60	65	1	0	Potentially corrosive soil (wetlands or poor soils)	None	32
G_11C-A	2573	8	CI	1900	60	39	0	0	Identified corrosive soil	None	40
G_11C-B	2574	8	CI	1900	60	39	0	0	Identified corrosive soil	None	40
G_11B-A	2576	6	CI	1900	60	42	0	0	Gravel/Sand	None	32
G_11B-B	2577	6	CI	1900	60	42	0	0	Gravel/Sand	None	32
G_11A-A	2579	8	CI	1900	60	54	0	0	Identified corrosive soil	None	40
G_11A-B	2580	8	CI	1900	60	54	0	0	Identified corrosive soil	None	40
G_119-A	2582	2	CI	1890	60	58	0	0	Identified corrosive soil	None	53
G_119-B	2583	2	CI	1890	60	58	0	0	Identified corrosive soil	None	53
G_118B-A	2585	6	CI	1891	60	18	0	1	Gravel/Sand	None	63
G_118B-B	2586	6	CI	1891	60	18	0	1	Gravel/Sand	None	63
P21	2592	6	CI	1950	60	52	0	0	Gravel/Sand	None	33
P195	2600	6	CI	1890	60	41	0	0	Gravel/Sand	None	33
P193	2601	6	CI	1891	60	35	0	0	Gravel/Sand	None	33
P19	2603	6	CI	1890	60	76	0	0	Potentially corrosive soil (wetlands or poor soils)	None	45
P187	2605	6	CI	1890	60	32	0	0	Gravel/Sand	None	33
P183	2607	6	CI	1890	60	42	0	2	Gravel/Sand	None	63
P17	2614	6	CI	1890	60	79	0	0	Potentially corrosive soil (wetlands or poor soils)	None	45

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P15	2625	6	CI	1890	100	73	0	0	Gravel/Sand	None	33
P13	2636	6	CI	1890	100	83	0	0	Gravel/Sand	None	33
P_99	2653	10	CI	1890	36	472	0	0	Identified corrosive soil	None	37
P_98	2654	10	CI	1890	36	395	0	0	Gravel/Sand	None	17
P_94	2658	10	CI	1890	36	113	0	0	Identified corrosive soil	None	37
P_93	2659	10	CI	1890	36	69	0	0	Identified corrosive soil	None	37
P_91	2663	6	CI	1890	60	90	0	0	Gravel/Sand	None	33
P_909	2664	2	CI	1920	60	218	0	0	Gravel/Sand	None	32
P_908	2665	2	CI	1920	60	143	0	0	Gravel/Sand	None	32
P_907	2666	2	CI	1920	60	27	0	0	Gravel/Sand	None	32
P_900	2673	10	CI	1890	36	315	0	0	Gravel/Sand	None	17
P_90	2674	6	CI	1890	60	398	0	0	Gravel/Sand	None	33
P_899	2676	10	CI	1890	36	71	0	0	Gravel/Sand	None	17
P_898	2677	10	CI	1890	36	402	0	0	Identified corrosive soil	None	37
P_897	2678	10	CI	1890	36	23	0	0	Identified corrosive soil	None	37
P_896	2679	6	CI	1890	60	288	0	0	Identified corrosive soil	None	53
P_895	2680	6	CI	1890	60	37	0	0	Identified corrosive soil	None	53
P_894	2681	6	CI	1890	60	198	0	0	Identified corrosive soil	None	53
P_893	2682	6	CI	1890	60	15	0	0	Identified corrosive soil	None	53
P_89	2686	6	CI	1890	60	413	0	0	Gravel/Sand	None	33
P_889	2687	8	CI	1894	60	12	0	0	Gravel/Sand	None	21
P_884	2692	6	CI	1890	30	38	0	0	Gravel/Sand	None	33
P_883	2693	6	CI	1890	30	15	0	0	Gravel/Sand	None	33
P_882	2694	6	CI	1890	60	261	0	0	Gravel/Sand	None	33
P_881	2695	6	CI	1890	60	12	0	0	Gravel/Sand	None	33
P_880	2696	6	CI	1890	60	36	0	0	Gravel/Sand	None	33
P_88	2697	6	CI	1890	60	160	0	0	Gravel/Sand	None	33
P_879	2698	6	CI	1890	60	28	0	0	Gravel/Sand	None	33
P_878	2699	16	CI	1890	60	203	0	0	Gravel/Sand	None	13
P_877	2700	16	CI	1890	60	20	0	0	Gravel/Sand	None	13
P_876	2701	12	CI	1890	60	244	0	0	Gravel/Sand	None	15
P_875	2702	12	CI	1890	60	30	0	0	Gravel/Sand	None	15
P_874	2703	2	CI	1890	60	154	0	0	Identified corrosive soil	None	53
P_873	2704	2	CI	1890	60	21	0	0	Identified corrosive soil	None	53

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_872	2705	12	CI	1897	60	19	0	0	Gravel/Sand	None	15
P_871	2706	12	CI	1897	60	16	0	0	Gravel/Sand	None	15
P_870	2707	6	CI	1890	35	48	0	0	Gravel/Sand	None	33
P_869	2709	6	CI	1890	35	14	0	0	Gravel/Sand	None	33
P_868	2710	6	CI	1890	60	165	0	0	Gravel/Sand	None	33
P_867	2711	6	CI	1890	60	13	0	0	Gravel/Sand	None	33
P_866	2712	6	CI	1890	60	583	0	0	Gravel/Sand	None	33
P_865	2713	6	CI	1890	60	26	0	0	Potentially corrosive soil (wetlands or poor soils)	None	45
P_864	2714	2	CI	1890	60	183	0	0	Gravel/Sand	None	33
P_863	2715	2	CI	1890	60	28	0	0	Gravel/Sand	None	33
P_859	2720	6	CI	1890	60	41	0	0	Gravel/Sand	None	33
P_858	2721	6	CI	1890	60	27	0	0	Identified corrosive soil	None	53
P_857	2722	6	CI	1890	60	83	0	0	Identified corrosive soil	None	53
P_856	2723	6	CI	1890	60	150	0	0	Identified corrosive soil	None	53
P_855	2724	6	CI	1890	60	655	0	0	Identified corrosive soil	None	53
P_854	2725	6	CI	1890	60	13	0	0	Identified corrosive soil	None	53
P_853	2726	10	CI	1890	60	433	1	0	Identified corrosive soil	None	37
P_852	2727	10	CI	1890	60	32	0	0	Identified corrosive soil	None	37
P_851	2728	8	CI	1890	60	317	0	0	Identified corrosive soil	None	41
P_850	2729	8	CI	1890	60	26	0	0	Identified corrosive soil	None	41
P_847	2733	8	CI	1890	60	102	0	0	Identified corrosive soil	None	41
P_846	2734	8	CI	1890	60	36	0	0	Identified corrosive soil	None	41
P_845	2735	6	CI	1890	60	239	0	1	Gravel/Sand	None	63
P_844	2736	6	CI	1890	60	41	0	1	Gravel/Sand	None	63
P_843	2737	6	CI	1950	60	483	0	4	Identified corrosive soil	None	83
P_842	2738	6	CI	1950	60	54	0	0	Identified corrosive soil	None	53
P_841	2739	6	CI	1950	60	59	0	0	Identified corrosive soil	None	53
P_840	2740	6	CI	1950	60	16	0	0	Identified corrosive soil	None	53
P_839	2742	6	CI	1950	60	75	0	0	Identified corrosive soil	None	53
P_838	2743	6	CI	1910	60	99	0	0	Identified corrosive soil	None	52
P_837	2744	6	CI	1910	60	61	0	0	Identified corrosive soil	None	52
P_836	2745	6	CI	1890	60	208	0	1	Gravel/Sand	None	63
P_835	2746	6	CI	1890	60	43	0	1	Gravel/Sand	None	63
P_822	2760	8	CI	1890	40	115	0	0	Gravel/Sand	None	21

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Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_821	2761	8	CI	1890	30	59	0	0	Gravel/Sand	None	21
P_820	2762	6	CI	1890	30	61	0	1	Gravel/Sand	None	63
P_819	2764	6	CI	1890	30	16	0	1	Gravel/Sand	None	63
P_818	2765	6	CI	1890	30	620	0	1	Gravel/Sand	None	63
P_817	2766	6	CI	1890	60	850	0	0	Gravel/Sand	None	33
P_816	2767	6	CI	1890	60	66	0	0	Gravel/Sand	None	33
P_791	2795	6	CI	1890	60	184	0	0	Gravel/Sand	None	33
P_790	2796	6	CI	1890	60	19	0	0	Gravel/Sand	None	33
P_79	2797	6	CI	1950	60	355	0	0	Gravel/Sand	Dirty Water	48
P_789	2798	6	CI	1960	60	278	0	0	Gravel/Sand	None	30
P_788	2799	6	CI	1960	60	44	0	0	Gravel/Sand	None	30
P_785	2802	6	CI	1960	60	191	0	0	Gravel/Sand	None	30
P_784	2803	6	CI	1960	60	36	0	0	Gravel/Sand	None	30
P_783	2804	6	CI	1960	60	273	0	0	Gravel/Sand	None	30
P_782	2805	6	CI	1960	60	33	0	0	Gravel/Sand	None	30
P_779	2809	6	CI	1890	30	267	0	0	Gravel/Sand	None	33
P_778	2810	6	CI	1890	30	31	0	0	Gravel/Sand	None	33
P_777	2811	6	CI	1890	30	67	0	0	Gravel/Sand	None	33
P_776	2812	6	CI	1890	30	52	0	0	Gravel/Sand	None	33
P_775	2813	6	CI	1890	35	109	0	0	Gravel/Sand	None	33
P_774	2814	6	CI	1890	35	53	0	0	Gravel/Sand	None	33
P_773	2815	6	CI	1890	35	30	0	0	Gravel/Sand	None	33
P_772	2816	12	CI	1891	40	136	0	0	Gravel/Sand	None	15
P_771	2817	12	CI	1891	40	16	0	0	Gravel/Sand	None	15
P_770	2818	6	CI	1890	30	46	0	0	Gravel/Sand	None	33
P_769	2820	6	CI	1890	30	39	0	0	Gravel/Sand	None	33
P_768	2821	6	CI	1890	30	382	0	0	Gravel/Sand	None	33
P_767	2822	6	CI	1890	30	65	0	0	Gravel/Sand	None	33
P_766	2823	12	CI	1891	40	167	0	0	Gravel/Sand	None	15
P_765	2824	12	CI	1891	40	23	0	0	Gravel/Sand	None	15
P_764	2825	8	CI	1890	40	339	0	0	Identified corrosive soil	None	41
P_763	2826	8	CI	1890	40	28	0	0	Identified corrosive soil	None	41
P_762	2827	8	CI	1890	40	175	0	0	Identified corrosive soil	None	41
P_761	2828	6	CI	1909	60	202	0	0	Gravel/Sand	None	32

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_760	2829	6	CI	1909	60	37	1	0	Gravel/Sand	None	32
P_753	2837	10	CI	1890	60	485	0	0	Gravel/Sand	None	17
P_752	2838	10	CI	1890	60	73	1	0	Gravel/Sand	None	17
P_75	2841	6	CI	1890	60	139	0	0	Gravel/Sand	None	33
P_749	2842	6	CI	1892	60	369	0	0	Identified corrosive soil	None	53
P_748	2843	6	CI	1892	60	44	1	0	Identified corrosive soil	None	53
P_745	2846	6	CI	1892	60	404	0	0	Gravel/Sand	None	33
P_744	2847	6	CI	1892	60	52	0	0	Gravel/Sand	None	33
P_74	2852	8	CI	1890	60	29	0	0	Gravel/Sand	None	21
P_739	2853	6	CI	1892	60	390	0	0	Identified corrosive soil	None	53
P_738	2854	6	CI	1892	60	59	0	0	Identified corrosive soil	None	53
P_737	2855	6	CI	1892	60	589	0	0	Identified corrosive soil	None	53
P_736	2856	6	CI	1892	60	52	0	0	Identified corrosive soil	None	53
P_735	2857	6	CI	1890	60	684	0	0	Gravel/Sand	Dirty Water	48
P_734	2858	6	CI	1890	60	16	0	0	Gravel/Sand	Dirty Water	48
P_727	2865	6	CI	1892	60	149	0	0	Identified corrosive soil	None	53
P_726	2866	6	CI	1892	60	578	0	0	Identified corrosive soil	None	53
P_725	2867	6	CI	1892	60	82	1	0	Identified corrosive soil	None	53
P_724	2868	12	CI	1890	60	361	0	0	Gravel/Sand	Dirty Water	30
P_723	2869	12	CI	1890	60	63	0	0	Gravel/Sand	Dirty Water	30
P_722	2870	6	CI	1890	60	333	0	1	Identified corrosive soil	None	83
P_721	2871	6	CI	1890	60	75	0	0	Identified corrosive soil	None	53
P_720	2872	6	CI	1890	60	37	0	0	Identified corrosive soil	None	53
P_72	2873	16	CI	1890	60	12	1	0	Gravel/Sand	None	13
P_719	2874	6	CI	1890	60	29	0	0	Identified corrosive soil	None	53
P_718	2875	12	CI	1890	60	13	0	0	Identified corrosive soil	None	35
P_717	2876	12	CI	1890	60	6	0	0	Identified corrosive soil	None	35
P_716	2877	6	CI	1894	60	287	0	0	Pipe on rock	None	53
P_715	2878	6	CI	1894	42	79	0	0	Pipe on rock	None	53
P_714	2879	6	CI	1890	60	394	0	0	Gravel/Sand	None	33
P_713	2880	6	CI	1890	60	266	0	0	Gravel/Sand	None	33
P_712	2881	6	CI	1890	60	376	0	0	Gravel/Sand	None	33
P_711	2882	6	CI	1890	60	22	0	0	Gravel/Sand	None	33
P_710	2883	6	CI	1890	60	339	0	0	Gravel/Sand	None	33

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_71	2884	8	CI	1890	30	20	0	0	Gravel/Sand	None	21
P_709	2885	6	CI	1890	60	57	0	0	Gravel/Sand	None	33
P_704	2890	6	CI	1890	60	877	0	0	Gravel/Sand	None	33
P_703	2891	6	CI	1890	60	37	0	0	Gravel/Sand	None	33
P_702	2892	6	CI	1890	60	453	0	0	Gravel/Sand	None	33
P_701	2893	6	CI	1890	60	232	0	0	Gravel/Sand	None	33
P_700	2894	8	CI	1890	60	731	0	0	Gravel/Sand	None	21
P_7	2896	8	CI	1890	30	215	0	0	Gravel/Sand	None	21
P_699	2897	8	CI	1890	60	169	0	0	Gravel/Sand	None	21
P_688	2909	6	CI	1950	60	66	0	0	Gravel/Sand	None	33
P_687	2910	6	CI	1950	60	22	0	0	Gravel/Sand	None	33
P_686	2911	2	CI	1890	60	191	0	0	Identified corrosive soil	None	53
P_685	2912	2	CI	1890	60	23	0	0	Gravel/Sand	None	33
P_684	2913	2	CI	1890	60	178	0	1	Identified corrosive soil	None	83
P_683	2914	2	CI	1890	60	29	0	1	Gravel/Sand	None	63
P_682	2915	6	CI	1890	30	279	0	0	Gravel/Sand	None	33
P_681	2916	6	CI	1890	30	113	0	0	Gravel/Sand	None	33
P_680	2917	6	CI	1890	30	93	0	0	Gravel/Sand	None	33
P_679	2919	6	CI	1890	30	18	0	0	Gravel/Sand	None	33
P_678	2920	2	CI	1890	60	123	0	0	Gravel/Sand	None	33
P_677	2921	2	CI	1890	60	15	0	0	Gravel/Sand	None	33
P_676	2922	8	CI	1890	60	205	0	0	Gravel/Sand	None	21
P_675	2923	8	CI	1890	60	16	0	0	Gravel/Sand	None	21
P_674	2924	16	CI	1890	60	252	0	0	Gravel/Sand	None	13
P_673	2925	16	CI	1890	60	15	0	0	Gravel/Sand	None	13
P_672	2926	8	CI	1890	30	105	0	0	Gravel/Sand	None	21
P_671	2927	8	CI	1890	40	24	0	0	Gravel/Sand	None	21
P_669	2930	16	CI	1890	60	17	0	0	Gravel/Sand	None	13
P_668	2931	6	CI	1890	60	312	0	0	Gravel/Sand	None	33
P_667	2932	6	CI	1890	60	26	0	0	Gravel/Sand	None	33
P_666	2933	6	CI	1890	30	242	0	0	Gravel/Sand	None	33
P_665	2934	6	CI	1890	30	15	0	0	Gravel/Sand	None	33
P_662	2937	8	CI	1890	60	17	0	0	Gravel/Sand	None	21
P_661	2938	8	CI	1890	60	8	0	0	Gravel/Sand	None	21

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_660	2939	8	CI	1890	40	182	0	0	Identified corrosive soil	None	41
P_66	2940	16	CI	1890	60	341	0	0	Gravel/Sand	None	13
P_659	2941	8	CI	1890	40	128	0	0	Identified corrosive soil	None	41
P_658	2942	8	CI	1890	40	188	0	0	Identified corrosive soil	None	41
P_657	2943	8	CI	1890	40	41	0	0	Identified corrosive soil	None	41
P_656	2944	8	CI	1890	60	24	0	0	Gravel/Sand	None	21
P_655	2945	8	CI	1890	60	30	0	0	Gravel/Sand	None	21
P_654	2946	8	CI	1890	60	14	0	0	Gravel/Sand	None	21
P_653	2947	6	CI	1890	60	127	0	0	Gravel/Sand	None	33
P_652	2948	6	CI	1890	60	45	0	0	Gravel/Sand	None	33
P_65	2951	8	CI	1891	60	402	0	0	Gravel/Sand	None	21
P_649	2952	6	CI	1890	60	20	0	0	Gravel/Sand	None	33
P_648	2953	6	CI	1890	60	248	0	0	Gravel/Sand	None	33
P_647	2954	6	CI	1890	60	38	0	0	Gravel/Sand	None	33
P_645	2956	6	CI	1900	30	449	0	2	Gravel/Sand	None	62
P_64	2962	8	CI	1891	60	280	0	0	Gravel/Sand	None	21
P_635	2967	6	CI	1900	60	1,231	0	0	Gravel/Sand	None	32
P_634	2968	6	CI	1900	60	57	0	0	Gravel/Sand	None	32
P_631	2971	6	CI	1900	60	768	0	0	Gravel/Sand	None	32
P_630	2972	6	CI	1900	60	68	0	0	Gravel/Sand	None	32
P_63	2973	6	CI	1891	60	23	0	1	Gravel/Sand	None	63
P_629	2974	6	CI	1900	60	1,021	0	0	Gravel/Sand	None	32
P_628	2975	6	CI	1900	60	85	0	0	Gravel/Sand	None	32
P_625	2978	8	CI	1960	60	260	0	0	Gravel/Sand	None	18
P_624	2979	8	CI	1960	60	90	0	0	Gravel/Sand	None	18
P_621	2982	6	CI	1900	60	610	0	1	Gravel/Sand	None	62
P_620	2983	6	CI	1900	60	73	1	1	Gravel/Sand	None	62
P_619	2985	6	CI	1900	130	441	0	1	Gravel/Sand	None	62
P_618	2986	6	CI	1900	130	38	0	1	Gravel/Sand	None	62
P_615	2989	6	CI	1891	60	110	0	0	Gravel/Sand	None	33
P_614	2990	6	CI	1891	60	40	0	0	Gravel/Sand	None	33
P_60	3006	6	CI	1890	60	213	0	0	Identified corrosive soil	None	53
P_6	3007	16	CI	1890	60	586	1	0	Gravel/Sand	None	13
P_595	3012	12	CI	1891	60	81	1	0	Gravel/Sand	None	15

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_594	3013	12	CI	1891	60	400	1	0	Gravel/Sand	None	15
P_593	3014	12	CI	1891	60	65	1	0	Gravel/Sand	None	15
P_582	3026	10	CI	1890	60	340	0	0	Identified corrosive soil	None	37
P_581	3027	10	CI	1890	60	232	0	0	Identified corrosive soil	None	37
P_580	3028	10	CI	1890	60	223	0	0	Identified corrosive soil	None	37
P_58	3029	12	CI	1891	45	30	0	0	Gravel/Sand	None	15
P_579	3030	10	CI	1890	60	32	1	0	Identified corrosive soil	None	37
P_578	3031	10	CI	1890	60	90	1	0	Identified corrosive soil	None	37
P_577	3032	10	CI	1890	60	53	1	0	Identified corrosive soil	None	37
P_576	3033	6	CI	1890	60	222	0	0	Identified corrosive soil	None	53
P_575	3034	6	CI	1890	60	44	0	0	Identified corrosive soil	None	53
P_574	3035	6	CI	1890	60	130	0	0	Gravel/Sand	None	33
P_573	3036	6	CI	1890	60	49	0	0	Gravel/Sand	None	33
P_572	3037	12	CI	1891	60	16	0	0	Gravel/Sand	None	15
P_571	3038	12	CI	1891	60	13	0	0	Gravel/Sand	None	15
P_570	3039	8	CI	1890	60	167	0	0	Gravel/Sand	None	21
P_57	3040	6	CI	1890	60	79	0	0	Gravel/Sand	None	33
P_569	3041	8	CI	1890	60	37	0	0	Gravel/Sand	None	21
P_568	3042	8	CI	1890	60	144	0	0	Gravel/Sand	None	21
P_567	3043	8	CI	1890	60	40	0	0	Gravel/Sand	None	21
P_566	3044	8	CI	1890	60	30	0	0	Gravel/Sand	None	21
P_565	3045	12	CI	1890	60	120	0	0	Gravel/Sand	None	15
P_564	3046	12	CI	1890	60	48	0	0	Gravel/Sand	None	15
P_563	3047	6	CI	1890	60	150	0	1	Gravel/Sand	None	63
P_562	3048	6	CI	1890	60	49	0	1	Gravel/Sand	None	63
P_561	3049	6	CI	1890	60	148	0	0	Gravel/Sand	None	33
P_560	3050	6	CI	1890	60	49	0	0	Gravel/Sand	None	33
P_559	3052	8	CI	1890	60	164	0	0	Gravel/Sand	None	21
P_558	3053	8	CI	1890	60	48	0	0	Gravel/Sand	None	21
P_557	3054	12	CI	1890	60	29	0	0	Gravel/Sand	Dirty Water	30
P_556	3055	12	CI	1890	60	25	0	0	Gravel/Sand	Dirty Water	30
P_555	3056	12	CI	1890	60	489	0	0	Gravel/Sand	Dirty Water	30
P_554	3057	12	CI	1890	60	42	0	0	Gravel/Sand	Dirty Water	30
P_553	3058	12	CI	1890	60	73	0	0	Gravel/Sand	Dirty Water	30

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_552	3059	6	CI	1890	60	26	0	0	Identified corrosive soil	None	53
P_551	3060	6	CI	1890	60	18	0	0	Identified corrosive soil	None	53
P_550	3061	6	CI	1890	60	33	0	0	Identified corrosive soil	None	53
P_55	3062	6	CI	1890	60	347	0	0	Gravel/Sand	None	33
P_549	3063	12	CI	1890	60	113	0	0	Identified corrosive soil	None	35
P_548	3064	12	CI	1890	60	102	0	0	Identified corrosive soil	None	35
P_547	3065	6	CI	1890	60	190	0	0	Gravel/Sand	None	33
P_546	3066	6	CI	1890	60	33	0	0	Gravel/Sand	None	33
P_545	3067	6	CI	1890	60	342	0	0	Gravel/Sand	None	33
P_544	3068	6	CI	1890	60	61	0	0	Gravel/Sand	None	33
P_543	3069	6	CI	1890	60	151	0	0	Gravel/Sand	None	33
P_542	3070	6	CI	1890	60	37	0	0	Gravel/Sand	None	33
P_541	3071	6	CI	1890	60	273	0	0	Gravel/Sand	None	33
P_540	3072	6	CI	1890	60	50	0	0	Gravel/Sand	None	33
P_54	3073	6	CI	1890	60	299	0	0	Gravel/Sand	None	33
P_539	3074	12	CI	1890	60	344	0	0	Gravel/Sand	None	15
P_538	3075	12	CI	1890	60	24	0	0	Gravel/Sand	None	15
P_537	3076	6	CI	1890	60	176	0	0	Gravel/Sand	None	33
P_536	3077	6	CI	1890	60	48	0	0	Gravel/Sand	None	33
P_535	3078	6	CI	1890	60	395	0	1	Gravel/Sand	None	63
P_534	3079	6	CI	1890	60	44	0	1	Gravel/Sand	None	63
P_533	3080	12	CI	1891	60	228	0	0	Gravel/Sand	None	15
P_532	3081	12	CI	1891	60	29	0	0	Gravel/Sand	None	15
P_531	3082	6	CI	1890	60	258	0	0	Gravel/Sand	None	33
P_530	3083	6	CI	1890	60	39	0	0	Gravel/Sand	None	33
P_53	3084	6	CI	1890	60	51	0	0	Gravel/Sand	None	33
P_529	3085	6	CI	1900	60	530	0	0	Gravel/Sand	None	32
P_528	3086	6	CI	1900	60	34	0	0	Gravel/Sand	None	32
P_527	3087	12	CI	1891	40	113	0	0	Gravel/Sand	None	15
P_526	3088	12	CI	1891	40	90	0	0	Gravel/Sand	None	15
P_524	3090	10	CI	1897	40	20	0	0	Gravel/Sand	None	17
P_523	3091	6	CI	1900	60	225	0	0	Gravel/Sand	None	32
P_522	3092	6	CI	1900	60	44	0	0	Gravel/Sand	None	32
P_521	3093	6	CI	1900	60	32	0	0	Gravel/Sand	None	32

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_520	3094	6	CI	1900	60	300	0	0	Gravel/Sand	None	32
P_52	3095	8	CI	1890	60	60	0	0	Gravel/Sand	None	21
P_519	3096	6	CI	1900	60	123	0	0	Gravel/Sand	None	32
P_518	3097	6	CI	1900	60	306	0	0	Gravel/Sand	None	32
P_517	3098	6	CI	1900	60	122	0	0	Gravel/Sand	None	32
P_516	3099	6	CI	1900	60	49	0	0	Gravel/Sand	None	32
P_515	3100	6	CI	1900	60	20	0	0	Gravel/Sand	None	32
P_510	3105	6	CI	1891	60	670	0	1	Gravel/Sand	None	63
P_509	3107	6	CI	1891	60	35	0	1	Gravel/Sand	None	63
P_508	3108	6	CI	1891	60	537	0	1	Gravel/Sand	None	63
P_507	3109	6	CI	1891	60	29	0	1	Gravel/Sand	None	63
P_506	3110	8	CI	1891	58	372	0	1	Gravel/Sand	None	51
P_505	3111	8	CI	1891	58	81	0	1	Gravel/Sand	None	51
P_504	3112	8	CI	1891	60	102	0	0	Gravel/Sand	None	21
P_503	3113	8	CI	1891	60	83	0	0	Gravel/Sand	None	21
P_500	3116	8	CI	1891	60	59	0	0	Gravel/Sand	None	21
P_50	3117	14	CI	1890	80	646	0	1	Identified corrosive soil	None	64
P_499	3119	8	CI	1891	60	30	0	0	Gravel/Sand	None	21
P_496	3122	8	CI	1891	50	830	0	1	Identified corrosive soil	None	71
P_495	3123	8	CI	1891	50	34	0	0	Gravel/Sand	None	21
P_494	3124	8	CI	1891	60	501	0	0	Identified corrosive soil	None	41
P_493	3125	8	CI	1891	60	20	0	0	Gravel/Sand	None	21
P_490	3128	6	CI	1891	60	576	0	0	Gravel/Sand	None	33
P_489	3130	6	CI	1891	60	32	0	0	Gravel/Sand	None	33
P_488	3131	6	CI	1891	60	569	0	0	Gravel/Sand	None	33
P_487	3132	6	CI	1891	60	33	0	0	Gravel/Sand	None	33
P_486	3133	8	CI	1891	50	92	1	0	Gravel/Sand	None	21
P_485	3134	8	CI	1891	50	51	0	0	Gravel/Sand	None	21
P_484	3135	8	CI	1891	60	822	0	0	Gravel/Sand	None	21
P_483	3136	8	CI	1891	60	76	1	0	Gravel/Sand	None	21
P_482	3137	10	CI	1897	40	255	1	0	Gravel/Sand	None	17
P_481	3138	10	CI	1897	40	39	1	0	Gravel/Sand	None	17
P_480	3139	6	CI	1900	60	229	0	0	Gravel/Sand	None	32
P_479	3141	6	CI	1900	60	41	0	0	Gravel/Sand	None	32

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_478	3142	8	CI	1900	60	431	0	0	Gravel/Sand	None	20
P_477	3143	8	CI	1900	60	74	0	0	Gravel/Sand	None	20
P_476	3144	10	CI	1897	40	281	0	0	Gravel/Sand	None	17
P_475	3145	10	CI	1897	40	23	0	0	Gravel/Sand	None	17
P_474	3146	10	CI	1897	40	144	0	0	Gravel/Sand	None	17
P_473	3147	10	CI	1897	40	115	0	0	Gravel/Sand	None	17
P_472	3148	10	CI	1897	40	421	0	0	Gravel/Sand	None	17
P_471	3149	10	CI	1897	40	26	1	0	Gravel/Sand	None	17
P_470	3150	6	CI	1900	60	279	0	0	Gravel/Sand	None	32
P_47	3151	8	CI	1891	60	135	0	0	Gravel/Sand	None	21
P_469	3152	6	CI	1900	60	71	1	0	Gravel/Sand	None	32
P_468	3153	8	CI	1900	60	179	0	0	Identified corrosive soil	None	40
P_467	3154	8	CI	1900	58	106	1	0	Potentially corrosive soil (wetlands or poor soils)	None	32
P_466	3155	8	CI	1900	60	117	0	0	Identified corrosive soil	None	40
P_465	3156	8	CI	1900	60	44	0	0	Identified corrosive soil	None	40
P_464	3157	8	CI	1900	60	424	0	0	Identified corrosive soil	None	40
P_463	3158	8	CI	1900	60	33	0	0	Identified corrosive soil	None	40
P_462	3159	6	CI	1900	60	150	0	0	Gravel/Sand	None	32
P_461	3160	6	CI	1900	60	34	0	0	Potentially corrosive soil (wetlands or poor soils)	None	44
P_460	3161	10	CI	1897	40	27	0	0	Gravel/Sand	None	17
P_459	3163	10	CI	1897	40	13	0	0	Gravel/Sand	None	17
P_458	3164	6	CI	1900	60	100	0	0	Identified corrosive soil	None	52
P_457	3165	6	CI	1900	60	40	0	0	Identified corrosive soil	None	52
P_456	3166	6	CI	1900	60	589	0	0	Identified corrosive soil	None	52
P_455	3167	6	CI	1900	60	55	0	0	Identified corrosive soil	None	52
P_454	3168	8	CI	1900	60	97	0	1	Identified corrosive soil	None	70
P_453	3169	8	CI	1900	60	49	0	1	Identified corrosive soil	None	70
P_452	3170	8	CI	1900	60	176	0	1	Identified corrosive soil	None	70
P_451	3171	8	CI	1900	60	24	0	1	Identified corrosive soil	None	70
P_450	3172	8	CI	1900	60	48	0	1	Identified corrosive soil	None	70
P_45	3173	10	CI	1890	36	89	0	0	Identified corrosive soil	None	37
P_449	3174	6	CI	1900	60	229	0	0	Identified corrosive soil	None	52
P_448	3175	6	CI	1900	60	28	0	0	Identified corrosive soil	None	52
P_447	3176	8	CI	1897	60	51	0	3	Identified corrosive soil	None	71

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_446	3177	8	CI	1891	60	391	0	0	Gravel/Sand	None	21
P_445	3178	8	CI	1891	60	77	0	0	Gravel/Sand	None	21
P_444	3179	8	CI	1891	60	270	0	0	Identified corrosive soil	None	41
P_443	3180	8	CI	1891	60	31	0	0	Identified corrosive soil	None	41
P_442	3181	8	CI	1897	60	206	0	3	Identified corrosive soil	None	71
P_441	3182	8	CI	1897	60	26	0	3	Gravel/Sand	None	51
P_440	3183	2	CI	1890	60	150	0	0	Gravel/Sand	None	33
P_44	3184	8	CI	1891	50	280	0	0	Gravel/Sand	None	21
P_439	3185	2	CI	1890	60	21	0	0	Gravel/Sand	None	33
P_438	3186	12	CI	1890	60	96	0	0	Gravel/Sand	None	15
P_437	3187	12	CI	1890	60	27	0	0	Gravel/Sand	None	15
P_436	3188	6	CI	1890	60	35	0	0	Identified corrosive soil	None	53
P_435	3189	6	CI	1890	60	33	0	0	Identified corrosive soil	None	53
P_434	3190	6	CI	1890	60	138	0	0	Identified corrosive soil	None	53
P_433	3191	6	CI	1890	60	21	0	0	Identified corrosive soil	None	53
P_432	3192	12	CI	1891	36	113	0	0	Gravel/Sand	None	15
P_431	3193	12	CI	1891	36	45	0	0	Gravel/Sand	None	15
P_430	3194	12	CI	1891	36	158	0	0	Identified corrosive soil	None	35
P_43	3195	12	CI	1891	60	88	1	0	Gravel/Sand	None	15
P_429	3196	12	CI	1891	36	15	0	0	Identified corrosive soil	None	35
P_427	3198	6	CI	1890	60	27	0	0	Landfills/Junkyards/Contaminated	None	53
P_426	3199	6	CI	1890	60	241	0	2	Landfills/Junkyards/Contaminated	None	83
P_425	3200	6	CI	1890	60	26	0	2	Landfills/Junkyards/Contaminated	None	83
P_424	3201	6	CI	1890	60	59	0	2	Landfills/Junkyards/Contaminated	None	83
P_421	3204	10	CI	1890	45	120	0	0	Gravel/Sand	None	17
P_420	3205	10	CI	1890	45	31	0	0	Identified corrosive soil	None	37
P_419	3207	12	CI	1891	36	126	0	0	Identified corrosive soil	None	35
P_418	3208	12	CI	1891	36	22	0	0	Gravel/Sand	None	15
P_417	3209	12	CI	1891	45	450	0	0	Gravel/Sand	None	15
P_416	3210	12	CI	1891	45	37	0	0	Gravel/Sand	None	15
P_414	3212	6	CI	1897	60	54	0	0	Identified corrosive soil	None	53
P_413	3213	6	CI	1897	60	239	0	0	Identified corrosive soil	None	53
P_412	3214	6	CI	1897	60	58	0	0	Identified corrosive soil	None	53
P_411	3215	6	CI	1890	60	489	0	0	Gravel/Sand	None	33

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_410	3216	6	CI	1890	60	15	0	0	Gravel/Sand	None	33
P_41	3217	2	CI	1890	60	224	0	0	Gravel/Sand	None	33
P_409	3218	2	CI	1890	60	738	0	0	Gravel/Sand	None	33
P_408	3219	2	CI	1890	60	95	0	0	Gravel/Sand	None	33
P_407	3220	10	CI	1890	45	43	0	0	Gravel/Sand	None	17
P_404	3223	10	CI	1890	45	168	0	0	Identified corrosive soil	None	37
P_403	3224	10	CI	1890	45	37	0	0	Identified corrosive soil	None	37
P_400	3227	10	CI	1890	45	133	0	1	Gravel/Sand	None	47
P_40	3228	6	CI	1891	60	343	0	1	Gravel/Sand	None	63
P_399	3230	10	CI	1890	45	73	0	1	Gravel/Sand	None	47
P_398	3231	6	CI	1894	42	459	0	5	Identified corrosive soil	None	83
P_397	3232	6	CI	1894	42	54	0	5	Identified corrosive soil	None	83
P_396	3233	10	CI	1890	36	185	0	0	Identified corrosive soil	None	37
P_395	3234	10	CI	1890	36	31	0	0	Identified corrosive soil	None	37
P_394	3235	6	CI	1894	42	658	0	0	Identified corrosive soil	None	53
P_393	3236	8	CI	1894	42	31	0	0	Identified corrosive soil	None	41
P_392	3237	8	CI	1894	42	159	0	0	Identified corrosive soil	None	41
P_391	3238	6	CI	1894	42	13	0	0	Gravel/Sand	None	33
P_390	3239	8	CI	1891	60	134	0	0	Gravel/Sand	None	21
P_389	3241	8	CI	1891	60	38	0	1	Gravel/Sand	None	51
P_388	3242	8	CI	1891	60	35	0	1	Gravel/Sand	None	51
P_385	3245	6	CI	1894	42	354	0	0	Identified corrosive soil	None	53
P_384	3246	6	CI	1894	42	68	0	0	Identified corrosive soil	None	53
P_383	3247	6	CI	1894	42	135	0	5	Identified corrosive soil	None	83
P_382	3248	6	CI	1894	42	372	0	5	Identified corrosive soil	None	83
P_381	3249	6	CI	1890	42	28	0	0	Identified corrosive soil	None	53
P_376	3255	6	CI	1890	60	159	0	0	Gravel/Sand	None	33
P_375	3256	6	CI	1890	60	26	0	0	Gravel/Sand	None	33
P_374	3257	8	CI	1890	60	32	0	0	Gravel/Sand	None	21
P_372	3259	6	CI	1890	60	241	0	0	Gravel/Sand	None	33
P_371	3260	6	CI	1890	60	134	0	0	Gravel/Sand	None	33
P_370	3261	6	CI	1890	60	64	0	0	Gravel/Sand	None	33
P_37	3262	6	CI	1900	60	71	0	0	Gravel/Sand	None	32
P_369	3263	6	CI	1890	60	36	0	0	Gravel/Sand	None	33

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_368	3264	6	CI	1890	60	190	0	0	Gravel/Sand	None	33
P_367	3265	6	CI	1890	60	29	0	0	Gravel/Sand	None	33
P_366	3266	6	CI	1940	60	835	0	0	Gravel/Sand	Dirty Water	48
P_365	3267	6	CI	1940	60	27	0	0	Gravel/Sand	Dirty Water	48
P_364	3268	6	CI	1890	60	413	0	0	Gravel/Sand	None	33
P_363	3269	6	CI	1890	60	8	0	0	Gravel/Sand	None	33
P_362	3270	8	CI	1890	60	390	0	0	Gravel/Sand	None	21
P_361	3271	8	CI	1890	60	13	0	0	Gravel/Sand	None	21
P_360	3272	8	CI	1890	60	353	0	0	Gravel/Sand	None	21
P_36	3273	12	CI	1891	60	147	0	0	Gravel/Sand	None	15
P_359	3274	8	CI	1890	60	14	0	0	Gravel/Sand	None	21
P_356	3277	6	CI	1890	60	227	0	0	Gravel/Sand	None	33
P_355	3278	6	CI	1890	60	181	0	0	Gravel/Sand	None	33
P_351	3282	16	CI	1890	60	219	0	0	Gravel/Sand	None	13
P_35	3284	12	CI	1891	60	64	0	0	Gravel/Sand	None	15
P_342	3290	8	CI	1890	60	635	0	0	Gravel/Sand	None	21
P_340	3292	8	CI	1890	60	12	0	0	Gravel/Sand	None	21
P_34	3293	12	CI	1891	60	113	1	0	Gravel/Sand	None	15
P_339	3294	8	CI	1890	60	203	0	0	Gravel/Sand	None	21
P_338	3295	16	CI	1890	60	11	1	0	Gravel/Sand	None	13
P_337	3296	16	CI	1890	60	7	1	0	Gravel/Sand	None	13
P_336	3297	16	CI	1890	60	210	0	0	Gravel/Sand	None	13
P_335	3298	16	CI	1890	60	149	0	0	Gravel/Sand	None	13
P_334	3299	16	CI	1890	60	41	1	0	Gravel/Sand	None	13
P_333	3300	16	CI	1890	60	25	0	0	Gravel/Sand	None	13
P_331	3302	16	CI	1890	120	25	0	0	Gravel/Sand	None	13
P_33	3304	12	CI	1891	60	424	1	0	Gravel/Sand	None	15
P_312	3323	14	CI	1890	80	540	0	1	Pipe on rock	None	64
P_311	3324	14	CI	1890	80	32	0	1	Pipe on rock	None	64
P_310	3325	14	CI	1890	80	702	0	1	Identified corrosive soil	None	64
P_309	3327	14	CI	1890	80	1,256	0	0	Identified corrosive soil	None	34
P_308	3328	14	CI	1890	80	299	0	0	Identified corrosive soil	None	34
P_307	3329	14	CI	1890	80	52	0	0	Identified corrosive soil	None	34
P_306	3330	14	CI	1890	80	618	0	0	Identified corrosive soil	None	34

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_305	3331	14	CI	1890	80	36	0	0	Identified corrosive soil	None	34
P_304	3332	14	CI	1890	60	26	0	0	Identified corrosive soil	None	34
P_303	3333	14	CI	1890	80	37	0	0	Identified corrosive soil	None	34
P_300	3336	6	CI	1890	60	260	0	0	Gravel/Sand	Dirty Water	48
P_298	3340	6	CI	1950	60	152	0	0	Gravel/Sand	Dirty Water	48
P_297	3341	6	CI	1950	60	48	0	0	Gravel/Sand	Dirty Water	48
P_290	3348	8	CI	1890	60	18	0	0	Gravel/Sand	None	21
P_286	3353	12	CI	1890	60	194	0	0	Gravel/Sand	None	15
P_285	3354	12	CI	1890	60	70	0	0	Gravel/Sand	None	15
P_284	3355	12	CI	1890	60	42	0	0	Identified corrosive soil	None	35
P_283	3356	12	CI	1891	60	863	1	0	Gravel/Sand	None	15
P_280	3359	6	CI	1909	60	33	0	0	Gravel/Sand	None	32
P_28	3360	12	CI	1890	60	112	0	0	Gravel/Sand	None	15
P_279	3361	12	CI	1891	60	169	1	0	Gravel/Sand	None	15
P_278	3362	12	CI	1891	60	107	1	0	Gravel/Sand	None	15
P_274	3366	12	CI	1891	60	474	1	0	Gravel/Sand	None	15
P_273	3367	12	CI	1891	60	59	1	0	Gravel/Sand	None	15
P_272	3368	12	CI	1891	60	95	1	0	Gravel/Sand	None	15
P_271	3369	10	CI	1890	60	494	0	0	Gravel/Sand	None	17
P_270	3370	10	CI	1890	60	468	0	0	Gravel/Sand	None	17
P_27	3371	6	CI	1900	30	245	0	0	Gravel/Sand	None	32
P_269	3372	10	CI	1890	60	193	0	0	Gravel/Sand	None	17
P_268	3373	10	CI	1890	60	583	0	0	Gravel/Sand	None	17
P_267	3374	10	CI	1890	60	178	0	0	Gravel/Sand	None	17
P_266	3375	10	CI	1890	60	179	0	0	Gravel/Sand	None	17
P_265	3376	10	CI	1890	36	41	0	0	Identified corrosive soil	None	37
P_264	3377	6	CI	1890	60	325	0	1	Gravel/Sand	None	63
P_263	3378	6	CI	1890	60	3	0	0	Gravel/Sand	None	33
P_262	3379	6	CI	1892	60	125	0	0	Identified corrosive soil	None	53
P_26	3382	6	CI	1900	30	189	0	0	Gravel/Sand	None	32
P_259	3383	6	CI	1892	60	127	0	0	Identified corrosive soil	None	53
P_258	3384	6	CI	1890	60	506	0	0	Potentially corrosive soil (wetlands or poor soils)	Dirty Water	60
P_257	3385	6	CI	1890	60	1,044	0	1	Identified corrosive soil	Dirty Water	98
P_256	3386	6	CI	1890	60	369	0	0	Potentially corrosive soil (wetlands or poor soils)	Dirty Water	60

Pipe Input Data
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Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_255	3387	6	CI	1890	60	21	0	0	Identified corrosive soil	Dirty Water	68
P_252	3390	6	CI	1890	60	40	0	0	Potentially corrosive soil (wetlands or poor soils)	None	45
P_251	3391	6	CI	1890	60	300	0	0	Gravel/Sand	None	33
P_250	3392	6	CI	1890	60	365	0	0	Gravel/Sand	None	33
P_25	3393	16	CI	1890	60	293	0	0	Gravel/Sand	None	13
P_249	3394	6	CI	1950	60	809	0	4	Identified corrosive soil	None	83
P_248	3395	6	CI	1950	60	520	0	4	Identified corrosive soil	None	83
P_247	3396	6	CI	1900	60	707	0	0	Gravel/Sand	None	32
P_246	3397	6	CI	1900	60	76	0	0	Gravel/Sand	None	32
P_245	3398	8	CI	1960	60	83	0	0	Gravel/Sand	None	18
P_242	3401	10	CI	1890	60	367	0	0	Identified corrosive soil	None	37
P_241	3402	6	CI	1890	60	161	0	0	Gravel/Sand	None	33
P_240	3403	10	CI	1890	60	36	0	0	Identified corrosive soil	None	37
P_24	3404	2	CI	1890	60	140	0	1	Gravel/Sand	None	63
P_239	3405	16	CI	1890	60	227	0	0	Gravel/Sand	None	13
P_238	3406	6	CI	1890	35	112	0	0	Gravel/Sand	None	33
P_237	3407	8	CI	1890	60	20	0	0	Gravel/Sand	None	21
P_236	3408	6	CI	1950	60	450	0	0	Identified corrosive soil	None	53
P_235	3409	6	CI	1910	60	719	0	2	Identified corrosive soil	None	82
P_234	3410	6	CI	1890	60	324	0	1	Gravel/Sand	None	63
P_233	3411	6	CI	1890	60	249	0	1	Gravel/Sand	None	63
P_232	3412	6	CI	1890	60	142	0	1	Gravel/Sand	None	63
P_231	3413	6	CI	1890	60	131	0	1	Gravel/Sand	None	63
P_23	3415	8	CI	1890	60	86	0	0	Gravel/Sand	None	21
P_228	3417	6	CI	1900	60	105	0	0	Gravel/Sand	None	32
P_227	3418	6	CI	1900	60	373	0	0	Gravel/Sand	None	32
P_226	3419	8	CI	1891	50	478	0	0	Gravel/Sand	None	21
P_225	3420	8	CI	1891	50	380	0	0	Gravel/Sand	None	21
P_224	3421	10	CI	1897	75	39	1	0	Gravel/Sand	None	17
P_223	3422	6	CI	1890	30	53	0	0	Gravel/Sand	None	33
P_22	3426	2	CI	1890	60	125	0	1	Gravel/Sand	None	63
P_218	3428	6	CI	1890	60	101	0	0	Identified corrosive soil	None	53
P_217	3429	6	CI	1890	60	461	0	0	Gravel/Sand	None	33
P_216	3430	6	CI	1890	30	208	0	1	Gravel/Sand	None	63

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_215	3431	6	CI	1890	30	177	0	1	Gravel/Sand	None	63
P_214	3432	8	CI	1890	30	370	0	0	Gravel/Sand	None	21
P_213	3433	8	CI	1890	30	166	0	0	Gravel/Sand	None	21
P_212	3434	6	CI	1890	60	53	0	0	Gravel/Sand	None	33
P_21	3437	2	CI	1890	60	194	0	0	Gravel/Sand	None	33
P_202	3445	6	CI	1900	30	468	0	2	Gravel/Sand	None	62
P_20	3448	12	CI	1890	60	34	0	0	Gravel/Sand	None	15
P_2	3449	2	CI	1950	60	445	0	0	Gravel/Sand	None	33
P_198	3451	6	CI	1900	60	56	0	0	Gravel/Sand	None	32
P_197	3452	6	CI	1900	60	1,394	0	0	Gravel/Sand	None	32
P_196	3453	6	CI	1900	130	28	0	1	Gravel/Sand	None	62
P_195	3454	6	CI	1900	130	123	0	1	Gravel/Sand	None	62
P_193	3456	12	CI	1891	40	204	0	4	Identified corrosive soil	None	65
P_185	3465	6	CI	1890	60	169	0	0	Gravel/Sand	None	33
P_184	3466	6	CI	1890	60	113	0	0	Gravel/Sand	None	33
P_183	3467	10	CI	1890	45	62	0	0	Identified corrosive soil	None	37
P_182	3468	10	CI	1890	45	57	0	0	Identified corrosive soil	None	37
P_181	3469	6	CI	1960	60	73	0	0	Gravel/Sand	None	30
P_18	3471	16	CI	1890	60	167	0	0	Gravel/Sand	None	13
P_178	3473	12	CI	1891	40	391	0	0	Gravel/Sand	None	15
P_177	3474	12	CI	1891	40	258	0	0	Gravel/Sand	None	15
P_175	3476	12	CI	1891	40	37	0	0	Gravel/Sand	None	15
P_174	3477	6	CI	1890	35	280	0	0	Gravel/Sand	None	33
P_173	3478	6	CI	1890	35	250	0	0	Gravel/Sand	None	33
P_172	3479	12	CI	1891	40	452	0	0	Gravel/Sand	None	15
P_171	3480	12	CI	1891	40	42	0	0	Gravel/Sand	None	15
P_170	3481	6	CI	1890	60	610	0	0	Gravel/Sand	None	33
P_17	3482	2	CI	1890	60	125	0	1	Gravel/Sand	None	63
P_169	3483	6	CI	1890	60	183	0	0	Gravel/Sand	None	33
P_168	3484	6	CI	1890	60	233	0	0	Gravel/Sand	None	33
P_167	3485	6	CI	1890	60	44	0	0	Gravel/Sand	None	33
P_166	3486	12	CI	1891	60	271	0	0	Gravel/Sand	None	15
P_165	3487	12	CI	1891	60	111	0	0	Gravel/Sand	None	15
P_164	3488	8	CI	1900	60	399	0	0	Gravel/Sand	None	20

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_163	3489	8	CI	1900	60	363	0	0	Gravel/Sand	None	20
P_162	3490	8	CI	1900	60	136	0	0	Gravel/Sand	None	20
P_161	3491	6	CI	1891	60	476	0	1	Gravel/Sand	None	63
P_16	3493	6	CI	1900	130	273	0	1	Gravel/Sand	None	62
P_158	3495	6	CI	1891	60	534	0	1	Gravel/Sand	None	63
P_157	3496	6	CI	1891	60	80	0	1	Gravel/Sand	None	63
P_156	3497	8	CI	1891	60	53	0	0	Gravel/Sand	None	21
P_155	3498	8	CI	1891	60	262	0	0	Gravel/Sand	None	21
P_154	3499	8	CI	1891	60	446	0	0	Identified corrosive soil	None	41
P_153	3500	16	CI	1890	60	121	0	0	Gravel/Sand	None	13
P_151	3502	6	CI	1890	60	66	0	0	Gravel/Sand	None	33
P_150	3503	8	CI	1890	60	19	0	0	Gravel/Sand	None	21
P_15	3504	8	CI	1890	60	175	0	0	Gravel/Sand	None	21
P_149	3505	8	CI	1890	60	120	0	0	Gravel/Sand	None	21
P_148	3506	6	CI	1890	60	158	0	0	Identified corrosive soil	None	53
P_147	3507	8	CI	1897	60	24	0	3	Gravel/Sand	None	51
P_146	3508	12	CI	1890	60	538	0	0	Gravel/Sand	None	15
P_145	3509	12	CI	1890	60	33	0	0	Identified corrosive soil	None	35
P_144	3510	6	CI	1890	60	48	0	0	Gravel/Sand	None	33
P_143	3511	12	CI	1891	60	41	0	0	Gravel/Sand	None	15
P_142	3512	6	CI	1890	60	37	0	1	Gravel/Sand	None	63
P_141	3513	12	CI	1890	60	135	0	0	Gravel/Sand	None	15
P_140	3514	12	CI	1890	60	28	0	0	Gravel/Sand	None	15
P_139	3516	8	CI	1897	60	143	0	3	Identified corrosive soil	None	71
P_138	3517	12	CI	1891	60	191	0	0	Gravel/Sand	None	15
P_137	3518	12	CI	1891	60	67	0	0	Gravel/Sand	None	15
P_133	3522	12	CI	1891	36	138	0	0	Identified corrosive soil	None	35
P_130	3525	12	CI	1891	36	63	0	0	Identified corrosive soil	None	35
P_129	3527	12	CI	1891	45	62	0	0	Gravel/Sand	None	15
P_124	3532	8	CI	1891	60	425	0	0	Identified corrosive soil	None	41
P_123	3533	8	CI	1891	50	1,006	0	0	Gravel/Sand	None	21
P_122	3534	8	CI	1891	60	301	0	0	Identified corrosive soil	None	41
P_121	3535	6	CI	1900	60	50	0	0	Gravel/Sand	None	32
P_120	3536	10	CI	1897	40	58	1	0	Gravel/Sand	None	17

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_12	3537	6	CI	1892	60	48	0	0	Identified corrosive soil	None	53
P_119	3538	10	CI	1897	40	421	0	0	Gravel/Sand	None	17
P_118	3539	8	CI	1900	60	107	0	0	Identified corrosive soil	None	40
P_117	3540	8	CI	1900	60	56	0	1	Identified corrosive soil	None	70
P_116	3541	10	CI	1890	45	350	0	0	Gravel/Sand	None	17
P_115	3542	10	CI	1890	45	84	0	0	Identified corrosive soil	None	37
P_112	3545	10	CI	1890	45	565	0	0	Gravel/Sand	None	17
P_111	3546	10	CI	1890	45	773	0	0	Gravel/Sand	None	17
P_110	3547	8	CI	1891	60	177	0	0	Gravel/Sand	None	21
P_11	3548	6	CI	1892	60	361	0	0	Identified corrosive soil	None	53
P_109	3549	8	CI	1891	60	38	0	0	Gravel/Sand	None	21
P_108	3550	8	CI	1891	60	476	0	0	Gravel/Sand	None	21
P_106	3552	6	CI	1894	60	808	0	0	Pipe on rock	None	53
P_104	3554	6	CI	1894	42	494	0	0	Identified corrosive soil	None	53
P_103	3555	6	CI	1894	42	614	0	0	Identified corrosive soil	None	53
P_101	3557	8	CI	1891	60	218	0	0	Gravel/Sand	None	21
P_100	3558	10	CI	1890	36	43	0	0	Gravel/Sand	None	17
P_10	3559	6	CI	1890	60	123	0	0	Potentially corrosive soil (wetlands or poor soils)	Dirty Water	60
P709	3576	6	CI	1890	60	301	0	0	Gravel/Sand	Dirty Water	48
P687	3579	16	CI	1890	60	307	0	0	Gravel/Sand	None	13
P679	3580	8	CI	1890	60	41	0	1	Gravel/Sand	None	51
P673	3582	6	CI	1900	60	112	0	0	Gravel/Sand	None	32
P669	3584	8	CI	1890	60	231	0	0	Identified corrosive soil	None	41
P665	3586	6	CI	1890	60	485	0	0	Gravel/Sand	None	33
P651	3590	14	CI	1890	80	51	0	1	Identified corrosive soil	None	64
P65	3591	6	CI	1950	60	31	0	0	Gravel/Sand	None	33
P647	3592	14	CI	1890	80	903	0	0	Identified corrosive soil	None	34
P645	3593	12	CI	1891	40	56	0	4	Identified corrosive soil	None	65
P641	3595	14	CI	1890	80	52	0	0	Identified corrosive soil	None	34
P639	3596	14	CI	1890	80	636	0	2	Pipe on rock	None	64
P611	3605	6	CI	1891	60	17	0	0	Gravel/Sand	None	33
P605	3608	6	CI	1891	60	37	0	0	Gravel/Sand	None	33
P603	3609	6	CI	1891	60	30	0	0	Gravel/Sand	None	33
P567	3629	6	CI	1890	60	36	0	0	Gravel/Sand	None	33

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P513	3658	6	CI	1897	60	44	0	0	Gravel/Sand	None	33
P51	3660	6	CI	1890	60	13	0	0	Gravel/Sand	None	33
P495	3668	6	CI	1890	60	62	0	0	Gravel/Sand	None	33
P491	3670	6	CI	1960	60	57	0	0	Gravel/Sand	None	30
P49	3671	6	CI	1890	60	17	0	0	Gravel/Sand	None	33
P485	3674	6	CI	1891	60	16	0	0	Gravel/Sand	None	33
P481	3676	6	CI	1890	60	22	0	0	Gravel/Sand	None	33
P479	3677	6	CI	1891	60	40	0	0	Gravel/Sand	None	33
P463	3685	6	CI	1900	60	68	0	0	Gravel/Sand	None	32
P457	3688	6	CI	1900	60	84	0	0	Gravel/Sand	None	32
P455	3689	6	CI	1960	60	63	0	0	Gravel/Sand	None	30
P449	3693	6	CI	1900	60	59	0	0	Gravel/Sand	None	32
P447	3694	6	CI	1900	60	62	0	0	Gravel/Sand	None	32
P445	3695	6	CI	1891	60	78	0	0	Gravel/Sand	None	33
P443	3696	6	CI	1891	60	83	0	0	Gravel/Sand	None	33
P435	3700	6	CI	1891	60	72	1	0	Gravel/Sand	None	33
P433	3701	6	CI	1891	60	63	1	0	Potentially corrosive soil (wetlands or poor soils)	None	45
P35	3746	6	CI	1890	60	50	0	0	Gravel/Sand	None	33
P341	3751	6	CI	1890	60	55	0	0	Gravel/Sand	None	33
P339	3752	6	CI	1890	60	45	0	0	Gravel/Sand	None	33
P337	3753	6	CI	1891	60	47	0	0	Gravel/Sand	None	33
P335	3754	6	CI	1890	60	47	0	0	Gravel/Sand	None	33
P333	3755	6	CI	1890	60	40	0	0	Gravel/Sand	None	33
P331	3756	6	CI	1890	60	52	0	0	Gravel/Sand	None	33
P329	3758	6	CI	1890	60	44	0	0	Gravel/Sand	None	33
P321	3762	6	CI	1890	60	50	0	0	Gravel/Sand	None	33
P319	3763	6	CI	1890	60	45	0	0	Gravel/Sand	None	33
P317	3764	6	CI	1890	60	40	0	0	Gravel/Sand	None	33
P315	3765	6	CI	1890	60	42	0	0	Gravel/Sand	None	33
P313	3766	6	CI	1890	60	46	0	0	Gravel/Sand	None	33
P311	3767	6	CI	1890	60	58	0	1	Gravel/Sand	None	63
P305	3771	6	CI	1890	60	42	0	0	Gravel/Sand	None	33
P303	3772	6	CI	1890	60	30	0	0	Gravel/Sand	None	33
P301	3773	6	CI	1890	60	34	0	0	Gravel/Sand	None	33

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P299	3774	6	CI	1890	60	30	0	0	Gravel/Sand	None	33
P297	3775	6	CI	1890	60	107	0	0	Gravel/Sand	None	33
P295	3776	6	CI	1890	60	36	0	0	Gravel/Sand	None	33
P261	3795	6	CI	1890	60	38	0	0	Gravel/Sand	None	33
P259	3796	6	CI	1890	60	30	0	0	Gravel/Sand	None	33
P257	3797	6	CI	1890	60	35	0	0	Gravel/Sand	None	33
P-4	3828	16	CI	1890	60	358	0	0	Gravel/Sand	None	13
P-7	3832	16	CI	1890	60	138	0	0	Gravel/Sand	None	13
P-8	3833	16	CI	1890	60	365	0	0	Gravel/Sand	None	13
P-10	3836	16	CI	1890	60	476	0	0	Gravel/Sand	None	13
P-11	3837	16	CI	1890	60	129	0	0	Gravel/Sand	None	13
P-13	3840	16	CI	1890	60	7	0	0	Gravel/Sand	None	13
P-14	3841	16	CI	1890	60	242	0	0	Gravel/Sand	None	13
P-16	3844	16	CI	1890	60	76	0	0	Gravel/Sand	None	13
P-17	3845	16	CI	1890	60	416	0	0	Gravel/Sand	None	13
P-22	3855	8	CI	1890	60	139	0	0	Identified corrosive soil	None	41
P-23	3856	8	CI	1890	60	430	0	0	Identified corrosive soil	None	41
P-24	3858	6	CI	1890	60	250	0	0	Gravel/Sand	None	33
P-25	3859	6	CI	1890	60	567	0	0	Identified corrosive soil	None	53
P-30	3868	12	CI	1891	60	138	1	0	Identified corrosive soil	None	35
P-31	3869	12	CI	1891	60	316	1	0	Gravel/Sand	None	15
P-32	3871	8	CI	1894	42	193	0	0	Identified corrosive soil	None	41
P-33	3872	8	CI	1894	42	206	0	0	Identified corrosive soil	None	41
P-34	3874	6	CI	1894	42	180	0	0	Identified corrosive soil	None	53
P-35	3875	6	CI	1894	42	174	0	0	Identified corrosive soil	None	53
P-45	3897	6	CI	1890	60	61	1	0	Gravel/Sand	None	33
P-46	3898	6	CI	1890	60	4	1	0	Gravel/Sand	None	33
P-47	3900	16	CI	1890	60	13	1	0	Gravel/Sand	None	13
P-48	3901	16	CI	1890	60	25	1	0	Gravel/Sand	None	13
P-49	3902	6	CI	1890	60	12	1	0	Gravel/Sand	None	33
P-58	3916	12	CI	1890	60	8	0	0	Gravel/Sand	None	15
P-59	3917	12	CI	1890	60	111	0	0	Gravel/Sand	None	15
P-61	3922	6	CI	1890	60	84	0	0	Landfills/Junkyards/Contaminated	None	53
P-64	3926	6	CI	1890	60	39	0	0	Gravel/Sand	None	33

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P-81	3955	8	CI	1891	60	30	0	0	Gravel/Sand	None	21
P-82	3956	8	CI	1891	60	48	0	0	Gravel/Sand	None	21
P-83	3958	10	CI	1897	40	166	0	0	Identified corrosive soil	None	37
P-84	3959	10	CI	1897	40	301	0	0	Identified corrosive soil	None	37
P-89	3967	6	CI	1892	60	827	0	0	Identified corrosive soil	None	53
P-90	3968	6	CI	1892	60	420	0	0	Identified corrosive soil	None	53
G_N22-A	1814	2	CICL	1950	60	10	0	0	Gravel/Sand	None	33
G_N22-B	1815	2	CICL	1950	60	10	0	0	Gravel/Sand	None	33
G_57B-A	2132	2	CICL	1950	60	42	0	0	Gravel/Sand	None	33
G_57B-B	2133	2	CICL	1950	60	42	0	0	Gravel/Sand	None	33
P_694	2902	2	CICL	1950	60	382	0	0	Gravel/Sand	None	33
P_693	2903	2	CICL	1950	60	16	0	0	Gravel/Sand	None	33
P615	3603	2	CICL	1950	60	20	0	0	Gravel/Sand	None	33
G_57F-A	2120	2	Copper	1890	60	37	0	0	Gravel/Sand	None	33
G_57F-B	2121	2	Copper	1890	60	37	0	0	Gravel/Sand	None	33
G_57C-A	2129	2	Copper	1950	60	42	0	0	Potentially corrosive soil (wetlands or poor soils)	None	45
G_57C-B	2130	2	Copper	1950	60	42	0	0	Gravel/Sand	None	33
P_651	2949	2	Copper	1950	60	99	0	0	Gravel/Sand	None	33
P_650	2950	2	Copper	1950	60	28	0	0	Potentially corrosive soil (wetlands or poor soils)	None	45
P_46	3162	2	Copper	1890	60	105	0	0	Gravel/Sand	None	33
P-60	3919	1.5	Copper	1890	130	212	0	0	Gravel/Sand	None	33
G_102-A	1652	16	DI	2001	120	25	0	0	Gravel/Sand	None	1
G_102-B	1653	16	DI	2001	120	25	0	0	Gravel/Sand	None	1
G_101D-B	1659	16	DI	2015	120	46	0	0	Gravel/Sand	None	1
G_101A-B	1668	6	DI	2016	120	29	0	0	Gravel/Sand	Dirty Water	36
G_100-A	1673	12	DI	2016	120	10	1	0	Gravel/Sand	None	3
G_100-B	1674	12	DI	2016	120	10	0	0	Gravel/Sand	None	3
G_N60-A	1703	12	DI	2001	120	7	0	0	Gravel/Sand	None	3
G_N60-B	1704	12	DI	2001	120	7	0	0	Gravel/Sand	None	3
G_N56-A	1715	12	DI	2001	120	5	0	0	Gravel/Sand	None	3
G_N56-B	1716	12	DI	2001	120	5	0	0	Gravel/Sand	None	3
G_N50-A	1733	8	DI	2000	120	20	0	0	Identified corrosive soil	None	29
G_N50-B	1734	8	DI	2000	120	20	0	0	Identified corrosive soil	None	29
G_99A-A	1880	12	DI	2016	120	54	0	0	Gravel/Sand	None	3

Pipe Input Data
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Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
G_99A-B	1881	12	DI	2016	120	54	0	0	Gravel/Sand	None	3
G_98B-A	1883	12	DI	2016	120	14	0	0	Gravel/Sand	None	3
G_98B-B	1884	12	DI	2016	120	14	0	0	Gravel/Sand	None	3
G_98A-A	1886	12	DI	2016	120	17	0	0	Identified corrosive soil	None	23
G_98A-B	1887	12	DI	2016	120	17	0	0	Identified corrosive soil	None	23
G_98-A	1889	12	DI	2016	120	17	0	0	Identified corrosive soil	None	23
G_98-B	1890	12	DI	2016	120	17	0	0	Identified corrosive soil	None	23
G_61A-A	2084	8	DI	1983	100	11	0	0	Gravel/Sand	None	9
G_61A-B	2085	8	DI	1983	100	11	0	0	Gravel/Sand	None	9
P_906	2667	12	DI	2016	120	17	0	0	Gravel/Sand	None	3
P_905	2668	12	DI	2016	120	15	1	0	Gravel/Sand	None	3
P_904	2669	12	DI	2001	120	369	0	0	Gravel/Sand	None	3
P_903	2670	12	DI	2001	120	29	0	0	Gravel/Sand	None	3
P_902	2671	12	DI	2001	120	36	0	0	Gravel/Sand	None	3
P_901	2672	12	DI	2001	120	17	0	0	Gravel/Sand	None	3
P_886	2690	8	DI	2000	120	172	0	0	Identified corrosive soil	None	29
P_885	2691	8	DI	2000	120	24	0	0	Identified corrosive soil	None	29
P_794	2792	12	DI	2016	120	292	0	0	Identified corrosive soil	None	23
P_793	2793	12	DI	2016	120	50	0	0	Identified corrosive soil	None	23
P_792	2794	12	DI	2016	120	248	0	0	Identified corrosive soil	None	23
P_78	2808	8	DI	1983	100	423	0	0	Gravel/Sand	None	9
P_77	2819	8	DI	1983	100	20	0	0	Gravel/Sand	None	9
P_76	2830	12	DI	2016	120	27	0	0	Gravel/Sand	None	3
P_70	2895	16	DI	2015	120	287	0	0	Gravel/Sand	None	1
P_5	3118	8	DI	1999	120	331	0	0	Gravel/Sand	None	9
P_423	3202	12	DI	2016	120	62	0	0	Gravel/Sand	None	3
P_422	3203	12	DI	2016	120	29	0	0	Gravel/Sand	None	3
P_358	3275	8	DI	1983	100	18	0	0	Gravel/Sand	None	9
P_357	3276	8	DI	1983	100	16	0	0	Gravel/Sand	None	9
P_354	3279	12	DI	2016	120	282	0	0	Gravel/Sand	None	3
P_353	3280	12	DI	2016	120	19	0	0	Gravel/Sand	None	3
P_332	3301	16	DI	2015	120	112	0	0	Gravel/Sand	None	1
P_330	3303	16	DI	2001	120	45	0	0	Gravel/Sand	None	1
P_329	3305	16	DI	2001	120	29	0	0	Gravel/Sand	None	1

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
P_32	3315	12	DI	2016	120	175	0	0	Identified corrosive soil	None	23
P_3	3338	16	DI	2015	120	471	0	0	Identified corrosive soil	None	21
P_294	3344	10	DI	2001	120	33	0	0	Gravel/Sand	None	5
P_289	3350	8	DI	1998	130	490	0	0	Potentially corrosive soil (wetlands or poor soils)	None	21
P_209	3438	12	DI	2016	120	301	0	0	Gravel/Sand	None	3
P_208	3439	12	DI	2016	120	270	0	0	Gravel/Sand	None	3
P_180	3470	12	DI	2016	120	339	0	0	Identified corrosive soil	None	23
P_179	3472	12	DI	2016	120	261	0	0	Identified corrosive soil	None	23
P_152	3501	12	DI	2016	120	22	0	0	Identified corrosive soil	None	23
P_126	3530	12	DI	2016	120	109	0	0	Identified corrosive soil	None	23
P_1	3560	16	DI	2015	120	210	0	0	Landfills/Junkyards/Contaminated	None	21
P689	3578	10	DI	2008	120	588	0	0	Gravel/Sand	None	5
P583	3620	8	DI	1999	120	57	0	0	Gravel/Sand	None	9
P577	3623	6	DI	2000	120	43	0	0	Gravel/Sand	None	21
P575	3624	6	DI	2000	120	65	0	0	Potentially corrosive soil (wetlands or poor soils)	None	33
P573	3625	10	DI	2008	120	277	0	0	Gravel/Sand	None	5
P57	3627	6	DI	1983	60	41	0	0	Gravel/Sand	None	21
P55	3638	6	DI	1983	60	38	0	0	Gravel/Sand	None	21
P53	3649	6	DI	2016	120	37	0	0	Gravel/Sand	None	21
P515	3657	6	DI	2016	120	46	0	0	Gravel/Sand	None	21
P-38	3880	12	DI	2016	120	371	0	0	Gravel/Sand	None	3
P-39	3881	12	DI	2016	120	255	0	0	Identified corrosive soil	None	23
P-40	3883	16	DI	2015	120	415	0	0	Landfills/Junkyards/Contaminated	None	21
P-41	3884	16	DI	2015	120	258	0	0	Identified corrosive soil	None	21
P-50	3904	12	DI	2016	120	50	0	0	Identified corrosive soil	None	23
P-51	3905	12	DI	2016	120	74	0	0	Identified corrosive soil	None	23
P-56	3913	8	DI	2016	120	13	0	0	Gravel/Sand	None	9
P-57	3914	8	DI	2016	120	10	0	0	Gravel/Sand	None	9
P-85	3961	8	DI	2014	130	384	0	0	Gravel/Sand	None	9
P-86	3962	8	DI	2014	130	815	0	0	Gravel/Sand	None	9
P-87	3964	8	DI	2000	120	184	0	0	Identified corrosive soil	None	29
P-88	3965	8	DI	2000	120	331	0	0	Identified corrosive soil	None	29
G_84E-A	1940	10	PVC	2014	130	27	0	0	Gravel/Sand	None	5
G_84E-B	1941	10	PVC	2014	130	27	0	0	Gravel/Sand	None	5

Pipe Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	ID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Asset Management Score
G_84D-A	1943	8	PVC	1980	130	72	0	0	Potentially corrosive soil (wetlands or poor soils)	None	21
G_84D-B	1944	8	PVC	1980	130	72	0	0	Gravel/Sand	None	9
G_84C-A	1946	8	PVC	1980	130	93	0	0	Gravel/Sand	None	9
G_84C-B	1947	8	PVC	1980	130	93	0	0	Gravel/Sand	None	9
G_84A-A	1949	8	PVC	1980	130	41	0	0	Gravel/Sand	None	9
G_84A-B	1950	8	PVC	1980	130	41	0	0	Gravel/Sand	None	9
P_828	2754	8	PVC	1980	130	167	0	0	Gravel/Sand	None	9
P_827	2755	8	PVC	1980	130	52	0	0	Potentially corrosive soil (wetlands or poor soils)	None	21
P_826	2756	8	PVC	1980	130	403	0	0	Gravel/Sand	None	9
P_825	2757	8	PVC	1980	130	334	0	0	Gravel/Sand	None	9
P_824	2758	8	PVC	1980	130	727	0	0	Gravel/Sand	None	9
P_823	2759	8	PVC	1980	130	36	0	0	Gravel/Sand	None	9
P_644	2957	10	PVC	2014	130	45	0	0	Gravel/Sand	None	5
P_643	2958	10	PVC	2014	130	35	0	0	Gravel/Sand	None	5
P_42	3206	2	PVC	1980	130	304	0	0	Gravel/Sand	None	21
P_229	3416	8	PVC	1980	130	59	0	0	Gravel/Sand	None	9
P-63	3924	8	PVC	2010	130	303	0	0	Gravel/Sand	None	9

Tank Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Diameter (ft)	Elevation (Base) (ft)	Elevation (Maximum) (ft)	Elevation (Initial) (ft)
T5002	60	195	273	272.5

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
G_1_ND	29	0
G_1_NU	29	0
G_2_ND	26.84	0
G_2_NU	26.84	0
G_5A_ND	11.97	0
G_5A_NU	11.97	0
G_5_ND	27.48	0
G_5_NU	27.48	0
G_8_ND	9	0
G_8_NU	9	0
G_9_ND	9	0
G_9_NU	9	0
G_10_ND	9	0
G_10_NU	9	0
G_11A_ND	9	0
G_11A_NU	9	0
G_11B_ND	9	0
G_11B_NU	9	0
G_11C_ND	9	0
G_11C_NU	9	0
G_11_ND	9	0
G_11_NU	9	0
G_12A_ND	39	0
G_12A_NU	39	0
G_12_ND	25.97	0
G_12_NU	25.97	0
G_13_ND	22.65	0
G_13_NU	22.65	0
G_14_ND	19.19	0
G_14_NU	19.19	0
G_15_ND	9	0
G_15_NU	9	0
G_16_ND	11.75	0
G_16_NU	11.75	0
G_17_ND	29	0
G_17_NU	29	0
G_18_ND	15.24	0
G_18_NU	15.24	0
G_19A_ND	9	0
G_19A_NU	9	0
G_19_ND	9	0
G_19_NU	9	0
G_20_ND	19	0
G_20_NU	19	0

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
G_21_ND	19.19	0
G_21_NU	19.19	0
G_22_ND	29	0
G_22_NU	29	0
G_23_ND	11.75	0
G_23_NU	11.75	0
G_24_ND	25.45	0
G_24_NU	25.45	0
G_25_ND	29	0
G_25_NU	29	0
G_26_ND	39	0
G_26_NU	39	0
G_27_ND	12.38	0
G_27_NU	12.38	0
G_30_ND	9.63	0
G_30_NU	9.63	0
G_31A_ND	19	0
G_31A_NU	19	0
G_31_ND	19	0
G_31_NU	19	0
G_32_ND	19	0
G_32_NU	19	0
G_33_ND	32.68	0
G_33_NU	32.68	0
G_34_ND	18.53	0
G_34_NU	18.53	0
G_35_ND	19	0
G_35_NU	19	0
G_36_ND	9	0
G_36_NU	9	0
G_37_ND	9	0
G_37_NU	9	0
G_38_ND	9	0
G_38_NU	9	0
G_40_ND	21.54	0
G_40_NU	21.54	0
G_41A_ND	9	0
G_41A_NU	9	0
G_41_ND	12.92	0
G_41_NU	12.92	0
G_42_ND	49	0
G_42_NU	49	0
G_43_ND	29	0
G_43_NU	29	0

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
G_45_ND	21.5	0
G_45_NU	21.5	0
G_47A_ND	16.7	0
G_47A_NU	16.7	0
G_47B_ND	9	0
G_47B_NU	9	0
G_47_ND	39	0
G_47_NU	39	0
G_50B_ND	68	0
G_50B_NU	68	0
G_50C_ND	88.35	0
G_50C_NU	88.35	0
G_50D_ND	49.4	0
G_50D_NU	49.4	0
G_50E_ND	87.15	0
G_50E_NU	87.15	0
G_50F_ND	78	0
G_50F_NU	78	0
G_50_ND	68	0
G_50_NU	68	0
G_51_ND	68	0
G_51_NU	68	0
G_54_ND	19	0
G_54_NU	19	0
G_55_ND	29	0
G_55_NU	29	0
G_56A_ND	17.92	0
G_56A_NU	17.92	0
G_56_ND	9	0
G_56_NU	9	0
G_57A_ND	67.91	0
G_57A_NU	67.91	0
G_57B_ND	108.02	0
G_57B_NU	108.02	0
G_57C_ND	61.55	0
G_57C_NU	61.55	0
G_57D_ND	49.87	0
G_57D_NU	49.87	0
G_57E_ND	49.62	0
G_57E_NU	49.62	0
G_57F_ND	22.34	0
G_57F_NU	22.34	0
G_57_ND	49	0
G_57_NU	49	0

Junction Input Data
Capital Efficiency Plan^{TM}
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
G_59A_ND	40.14	0
G_59A_NU	40.14	0
G_59B_ND	56.4	0
G_59B_NU	56.4	0
G_59C_ND	49	0
G_59C_NU	49	0
G_59D_ND	49	0
G_59D_NU	49	0
G_59E_ND	49	0
G_59E_NU	49	0
G_59G_ND	138.01	0
G_59G_NU	138.01	0
G_59H_ND	59.36	0
G_59H_NU	59.36	0
G_60_ND	19	0
G_60_NU	19	0
G_61A_ND	68	0
G_61A_NU	68	0
G_62_ND	30.25	0
G_62_NU	30.25	0
G_64_ND	24.84	0
G_64_NU	24.84	0
G_65A_ND	28.15	0
G_65A_NU	28.15	0
G_66A_ND	39.49	0
G_66A_NU	39.49	0
G_66B_ND	35.85	0
G_66B_NU	35.85	0
G_66C_ND	71.91	0
G_66C_NU	71.91	0
G_66D_ND	97.41	0
G_66D_NU	97.41	0
G_66E_ND	127.74	0
G_66E_NU	127.74	0
G_66F_ND	130.77	0
G_66F_NU	130.77	0
G_66_ND	16.91	0
G_66_NU	16.91	0
G_67_ND	9	0
G_67_NU	9	0
G_68_ND	60.61	0
G_68_NU	60.61	0
G_69A_ND	68	0
G_69A_NU	68	0

Junction Input Data
Capital Efficiency Plan^{TM}
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
G_69B_ND	108	0
G_69B_NU	108	0
G_69_ND	107.4	0
G_69_NU	107.4	0
G_72_ND	29.48	0
G_72_NU	29.48	0
G_73_ND	62.5	0
G_73_NU	62.5	0
G_74_ND	75.45	0
G_74_NU	75.45	0
G_75B_ND	50.6	0
G_75B_NU	50.6	0
G_75C_ND	36.48	0
G_75C_NU	36.48	0
G_75_ND	99.01	0
G_75_NU	99.01	0
G_76A_ND	49	0
G_76A_NU	49	0
G_76_ND	49	0
G_76_NU	49	0
G_77_ND	33.33	0
G_77_NU	33.33	0
G_78A_ND	19	0
G_78A_NU	19	0
G_78B_ND	27.71	0
G_78B_NU	27.71	0
G_78C_ND	19	0
G_78C_NU	19	0
G_78D_ND	17.64	0
G_78D_NU	17.64	0
G_78E_ND	10.98	0
G_78E_NU	10.98	0
G_78_ND	19	0
G_78_NU	19	0
G_79A_ND	29.45	0
G_79A_NU	29.45	0
G_79_ND	19	0
G_79_NU	19	0
G_80A_ND	19	0
G_80A_NU	19	0
G_80_ND	30.21	0
G_80_NU	30.21	0
G_81_ND	35.62	0
G_81_NU	35.62	0

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
G_82A_ND	30.97	0
G_82A_NU	30.97	0
G_82_ND	41.04	0
G_82_NU	41.04	0
G_83A_ND	18.29	0
G_83A_NU	18.29	0
G_83B_ND	49.47	0
G_83B_NU	49.47	0
G_83_ND	24.54	0
G_83_NU	24.54	0
G_84A_ND	19	0
G_84A_NU	19	0
G_84C_ND	54.74	0
G_84C_NU	54.74	0
G_84D_ND	39.25	0
G_84D_NU	39.25	0
G_84E_ND	53.39	0
G_84E_NU	53.39	0
G_84_ND	49	0
G_84_NU	49	0
G_85A_ND	19	0
G_85A_NU	19	0
G_85B_ND	87.66	0
G_85B_NU	87.66	0
G_85_ND	19	0
G_85_NU	19	0
G_86_ND	19	0
G_86_NU	19	0
G_87_ND	40.01	0
G_87_NU	40.01	0
G_88_ND	39	0
G_88_NU	39	0
G_89_ND	19	0
G_89_NU	19	0
G_90A_ND	9.77	0
G_90A_NU	9.77	0
G_90_ND	19	0
G_90_NU	19	0
G_91A_ND	19	0
G_91A_NU	19	0
G_92_ND	24.27	0
G_92_NU	24.27	0
G_93_ND	59	0
G_93_NU	59	0

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
G_97A_ND	49	0
G_97A_NU	49	0
G_98A_ND	59.39	0
G_98A_NU	59.39	0
G_98B_ND	24.82	0
G_98B_NU	24.82	0
G_98_ND	59.96	0
G_98_NU	59.96	0
G_99A_ND	68	0
G_99A_NU	68	0
G_100_ND	68	0
G_100_NU	68	0
G_101A_ND	68	0
G_101A_NU	68	0
G_101B_ND	70.84	0
G_101B_NU	70.84	0
G_101C_ND	84.46	0
G_101C_NU	84.46	0
G_101D_ND	80.8	0
G_101D_NU	80.8	0
G_101E_ND	79.91	0
G_101E_NU	79.91	0
G_101_ND	68	0
G_101_NU	68	0
G_102_ND	87.07	0
G_102_NU	87.07	0
G_103A_ND	68.42	0
G_103A_NU	68.42	0
G_103B_ND	59	0
G_103B_NU	59	0
G_111A_ND	78	0
G_111A_NU	78	0
G_112B_ND	59.3	0
G_112B_NU	59.3	0
G_112C_ND	68	0
G_112C_NU	68	0
G_112D_ND	59	0
G_112D_NU	59	0
G_112E_ND	59	0
G_112E_NU	59	0
G_112F_ND	59	0
G_112F_NU	59	0
G_113A_ND	68	0
G_113A_NU	68	0

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
G_113B_ND	49	0
G_113B_NU	49	0
G_113C_ND	49	0
G_113C_NU	49	0
G_113D_ND	68	0
G_113D_NU	68	0
G_113E_ND	49	0
G_113E_NU	49	0
G_113F_ND	9	0
G_113F_NU	9	0
G_114_ND	21.53	0
G_114_NU	21.53	0
G_116_ND	39	0
G_116_NU	39	0
G_117_ND	49.14	0
G_117_NU	49.14	0
G_118B_ND	39	0
G_118B_NU	39	0
G_118_ND	39.04	0
G_118_NU	39.04	0
G_119_ND	19	0
G_119_NU	19	0
G_120_ND	18.59	0
G_120_NU	18.59	0
G_121A_ND	98	0
G_121A_NU	98	0
G_121B_ND	83.54	0
G_121B_NU	83.54	0
G_121C_ND	62.28	0
G_121C_NU	62.28	0
G_121D_ND	100.58	0
G_121D_NU	100.58	0
G_121_ND	9	0
G_121_NU	9	0
G_122_ND	49	0
G_122_NU	49	0
G_123A_ND	68	0
G_123A_NU	68	0
G_123_ND	47.7	0
G_123_NU	47.7	0
G_124_ND	11.37	0
G_124_NU	11.37	0
G_125_ND	17.23	0
G_125_NU	17.23	0

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
G_126_ND	9	0
G_126_NU	9	0
G_127_ND	10.55	0
G_127_NU	10.55	0
G_128_ND	19	0
G_128_NU	19	0
G_129_ND	29	0
G_129_NU	29	0
G_130_ND	49	0
G_130_NU	49	0
G_131A_ND	49	0
G_131A_NU	49	0
G_131_ND	49	0
G_131_NU	49	0
G_132_ND	49	0
G_132_NU	49	0
G_133_ND	28.06	0
G_133_NU	28.06	0
G_134_ND	18.22	0
G_134_NU	18.22	0
G_135A_ND	31.03	0
G_135A_NU	31.03	0
G_135_ND	29	0
G_135_NU	29	0
G_136A_ND	49	0
G_136A_NU	49	0
G_136_ND	49	0
G_136_NU	49	0
G_138B_ND	92.67	0
G_138B_NU	92.67	0
G_139_ND	9	0
G_139_NU	9	0
G_140A_ND	39	0
G_140A_NU	39	0
G_140B_ND	29.29	0
G_140B_NU	29.29	0
G_140_ND	19.42	0
G_140_NU	19.42	0
G_142A_ND	29	0
G_142A_NU	29	0
G_142_ND	41.31	0
G_142_NU	41.31	0
G_143A_ND	19.03	0
G_143A_NU	19.03	0

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
G_143B_ND	19	0
G_143B_NU	19	0
G_143C_ND	19	0
G_143C_NU	19	0
G_143D_ND	19	0
G_143D_NU	19	0
G_143_ND	38.49	0
G_143_NU	38.49	0
G_145_ND	19	0
G_145_NU	19	0
G_146A_ND	19.17	0
G_146A_NU	19.17	0
G_146_ND	29.31	0
G_146_NU	29.31	0
G_149_ND	13.24	0
G_149_NU	13.24	0
G_151A_ND	19.92	0
G_151A_NU	19.92	0
G_151_ND	21.49	0
G_151_NU	21.49	0
G_152A_ND	17.25	0
G_152A_NU	17.25	0
G_152B_ND	29	0
G_152B_NU	29	0
G_152_ND	21.96	0
G_152_NU	21.96	0
G_154_ND	9	0
G_154_NU	9	0
G_155_ND	9.44	0
G_155_NU	9.44	0
G_156_ND	27.35	0
G_156_NU	27.35	0
G_159_ND	41.18	0
G_159_NU	41.18	0
G_160A_ND	29	0
G_160A_NU	29	0
G_160_ND	19.84	0
G_160_NU	19.84	0
G_161A_ND	19	0
G_161A_NU	19	0
G_161_ND	20.05	0
G_161_NU	20.05	0
G_162A_ND	19	0
G_162A_NU	19	0

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
G_162_ND	16.82	0
G_162_NU	16.82	0
G_164_ND	38.8	0
G_164_NU	38.8	0
G_165A_ND	62.24	0
G_165A_NU	62.24	0
G_165B_ND	63.93	0
G_165B_NU	63.93	0
G_165C_ND	63.93	0
G_165C_NU	63.93	0
G_165D_ND	64.05	0
G_165D_NU	64.05	0
G_166A_ND	51.8	0
G_166A_NU	51.8	0
G_166_ND	49	0
G_166_NU	49	0
G_169A_ND	67.24	0
G_169A_NU	67.24	0
G_170_ND	39	0
G_170_NU	39	0
G_171_ND	57.36	0
G_171_NU	57.36	0
G_176_ND	49	0
G_176_NU	49	0
G_187A_ND	68	0
G_187A_NU	68	0
G_187B_ND	68	0
G_187B_NU	68	0
G_187_ND	68	0
G_187_NU	68	0
G_188_ND	68	0
G_188_NU	68	0
G_189_ND	78	0
G_189_NU	78	0
G_190A_ND	88	0
G_190A_NU	88	0
G_190_ND	84.28	0
G_190_NU	84.28	0
G_191A_ND	94.3	0
G_191A_NU	94.3	0
G_191B_ND	100.05	0
G_191B_NU	100.05	0
G_192_ND	78.01	0
G_192_NU	78.01	0

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
G_193_ND	63.1	0
G_193_NU	63.1	0
G_N02_ND	76.43	0
G_N02_NU	76.43	0
G_N04_ND	39.41	0
G_N04_NU	39.41	0
G_N06_ND	68.66	0
G_N06_NU	68.66	0
G_N07_ND	9	0
G_N07_NU	9	0
G_N08_ND	19.11	0
G_N08_NU	19.11	0
G_N09_ND	38	0
G_N09_NU	38	0
G_N11_ND	37.61	0
G_N11_NU	37.61	0
G_N12_ND	59	0
G_N12_NU	59	0
G_N13_ND	71.21	0
G_N13_NU	71.21	0
G_N14_ND	9	0
G_N14_NU	9	0
G_N15_ND	68.33	0
G_N15_NU	68.33	0
G_N16_ND	49	0
G_N16_NU	49	0
G_N19_ND	49	0
G_N19_NU	49	0
G_N21_ND	80	0
G_N21_NU	80	0
G_N22_ND	130.77	0
G_N22_NU	130.77	0
G_N23_ND	59	0
G_N23_NU	59	0
G_N24_ND	9	0
G_N24_NU	9	0
G_N25_ND	29.21	0
G_N25_NU	29.21	0
G_N26_ND	59	0
G_N26_NU	59	0
G_N28_ND	9	0
G_N28_NU	9	0
G_N29_ND	9	0
G_N29_NU	9	0

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
G_N30_ND	38.17	0
G_N30_NU	38.17	0
G_N32_ND	88.39	0
G_N32_NU	88.39	0
G_N33_ND	9	0
G_N33_NU	9	0
G_N34_ND	19	0
G_N34_NU	19	0
G_N35_ND	39.05	0
G_N35_NU	39.05	0
G_N36_ND	27.12	0
G_N36_NU	27.12	0
G_N37_ND	19.68	0
G_N37_NU	19.68	0
G_N38_ND	39	0
G_N38_NU	39	0
G_N39_ND	29.2	0
G_N39_NU	29.2	0
G_N40_ND	18.15	0
G_N40_NU	18.15	0
G_N43_ND	49	0
G_N43_NU	49	0
G_N44_ND	51.05	0
G_N44_NU	51.05	0
G_N45_ND	19	0
G_N45_NU	19	0
G_N46_ND	19.34	0
G_N46_NU	19.34	0
G_N47_ND	39	0
G_N47_NU	39	0
G_N49_ND	80.32	0
G_N49_NU	80.32	0
G_N50_ND	53.66	0
G_N50_NU	53.66	0
G_N51_ND	19.61	0
G_N51_NU	19.61	0
G_N52_ND	61.27	0
G_N52_NU	61.27	0
G_N53_ND	68	0
G_N53_NU	68	0
G_N54_ND	68	0
G_N54_NU	68	0
G_N55_ND	71.23	0
G_N55_NU	71.23	0

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
G_N56_ND	193.66	0
G_N56_NU	193.66	0
G_N57_ND	68	0
G_N57_NU	68	0
G_N58_ND	39.4	0
G_N58_NU	39.4	0
G_N60_ND	106.69	0
G_N60_NU	106.69	0
G_N63_ND	118	0
G_N63_NU	118	0
G_N64_ND	118	0
G_N64_NU	118	0
G_N65_ND	52.28	0
G_N65_NU	52.28	0
G_N66_ND	9.55	0
G_N66_NU	9.55	0
G_N67_ND	54.75	0
G_N67_NU	54.75	0
H-1	28.7	0.06
H-2	88.8	0.06
H-3	32.01	0.06
H-4	17.3	0.06
H-5	26.86	0.06
H-6	9	0.06
H-7	9	0.06
H-8	9	0.06
H-9	9	0.06
H-10	25.15	0.06
H-11	19	0.06
H-12	49.32	0.06
H-13	9	0.06
H-14	119.01	0.06
H-15	19	0.06
H-16	9	0.06
H-17	36.87	0.06
H-18	38.31	0.06
H-19	29.41	0.06
H-20	11.25	0.06
H-21	27.07	0.06
H-22	18.84	0.06
H-23	39.52	0.06
H-24	25.59	0.06
H-25	19	0.06
H-27	40.9	0.06

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
H-28	19	0.06
H-29	15.24	0.06
H-30	9	0.06
H-32	19	0.06
H-33	28.33	0.06
H-34	29	0.06
H-35	37.8	0.06
H-36	11.16	0.06
H-37	15.51	0.06
H-38	9	0.06
H-39	15.34	0.06
H-40	11.36	0.06
H-41	9	0.06
H-42	9	0.06
H-43	9	0.06
H-44	18.98	0.06
H-45	46.57	0.06
H-46	39	0.06
H-47	59.26	0.06
H-48	67.54	0.06
H-49	59.81	0.06
H-50	73.52	0.06
H-52	19	0.06
H-53	49	0.06
H-54	49.32	0.06
H-55	60.55	0.06
H-56	44.9	0.06
H-57	98.62	0.06
H-58	49.79	0.06
H-59	67.72	0.06
H-60	68.09	0.06
H-61	41.57	0.06
H-62	60.33	0.06
H-63	46.54	0.06
H-64	9	0.06
H-64A	59.89	0.06
H-65	136.35	0.06
H-65A	37.81	0.06
H-66	147	0.06
H-67	27.57	0.06
H-68	108	0.06
H-69	68	0.06
H-70	84.19	0.06
H-71	37.83	0.06

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
H-72	50.1	0.06
H-73	37.99	0.06
H-74	27.98	0.06
H-75	9.82	0.06
H-76	29.12	0.06
H-77	61.18	0.06
H-78	129.96	0.06
H-79	117.48	0.06
H-80	122.38	0.06
H-81	59	0.06
H-82	53.68	0.06
H-83	25.28	0.06
H-84	72.63	0.06
H-85	108	0.06
H-86	111.7	0.06
H-87	90	0.06
H-89	39.13	0.06
H-90	87.58	0.06
H-91	71.67	0.06
H-92	99.65	0.06
H-94	55.94	0.06
H-95	32.25	0.06
H-96	49.17	0.06
H-97	49	0.06
H-98	38.76	0.06
H-99	29	0.62
H-100	19	0.06
H-101	23.89	0.06
H-102	19	0.06
H-103	19	0.06
H-104	19	0.06
H-107	52.44	0.06
H-108	79.2	0.06
H-109	52.16	0.06
H-110	39.15	0.06
H-111	20.2	0.06
H-112	36.55	0.06
H-113	59.37	0.06
H-113A	19.05	0.06
H-114	17.95	0.06
H-115	29.48	0.06
H-116	39	0.06
H-117	49	0.06
H-118	50.02	0.06

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
H-119	19	0.06
H-120	108.88	0.06
H-121	108.17	0.06
H-122	39	0.06
H-123	39	0.06
H-124	29	0.06
H-125	19	0.06
H-126	10.1	0.06
H-127	37.6	0.06
H-129	9	0.06
H-130	16.87	0.06
H-131	9	0.06
H-132	53.32	0.06
H-134	49.32	0.06
H-135	78.27	0.06
H-136	69.01	0.06
H-138	46.81	0.06
H-139	49	0.06
H-140	49	0.06
H-141	74.4	0.06
H-142	68.26	0.06
H-143	97.49	0.06
H-144	29	0.06
H-145	59.29	0.06
H-147	59	0.06
H-148	61.32	0.06
H-149	99.11	0.06
H-150	49	0.06
H-150A	69.88	0.06
H-151	68	0.06
H-153	75.18	0.06
H-154	72	0.06
H-155	72.83	0.06
H-160	43.92	0.06
H-161	61.09	0.06
H-162	52.28	0.06
H-163	61.7	0.06
H-164	70.1	0.06
H-165	29	0.06
H-166	18.74	0.06
H-167	9	0.06
H-168	36.95	0.06
H-169	38.07	0.06
H-170	70.64	0.06

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
H-172	9	0.06
H-173	9	0.06
H-174	9	0.17
H-175	78	0.06
H-176	104.13	0.06
H-177	88.12	0.06
H-178	66.72	0.06
H-179	47.7	0.06
H-180	20.77	0.06
H-181	19	0.06
H-182	9.63	0.06
H-183	19	0.06
H-184	39	0.06
H-185	49.17	0.06
H-186	49	0.06
H-187	50.28	0.06
H-188	49	0.06
H-189	49	0.06
H-191	19.69	0.06
H-192	49.82	0.06
H-193	29.58	0.06
H-194	107.89	0.06
H-195	50.17	0.06
H-196	39.04	0.06
H-197	20.9	0.06
H-197A	68.77	0.06
H-198	59	0.06
H-199	14.05	0.06
H-201	9	0.06
H-202	38.8	0.06
H-203	29.29	0.06
H-204	41.31	0.06
H-205	29	0.06
H-206	27.74	0.06
H-207	19	0.06
H-208	19	0.06
H-209	20.13	0.06
H-210	45.72	0.06
H-211	60.13	0.06
H-212	96.12	0.06
H-213	66.96	0.06
H-214	50.87	0.06
H-214A	51.06	0.06
H-215	32.72	0.06

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
H-216	44.64	0.06
H-217	32.11	0.06
H-218	9	0.06
H-219	21.85	0.06
H-220	28.6	0.06
H-221	40.42	0.06
H-221A	26.85	0.06
H-222	29	0.17
H-222A	29	0.06
H-226	28.85	0.06
H-227	18.82	0.06
H-228	20.09	0.06
H-235	68	0.06
H-236	68.57	1.1
H-239	64.02	0.06
H-240	9	0.06
H-240A	49	0.06
H-241	88.13	0.06
H-243	98	0.06
H-244	91.65	0.06
H-245	88.17	0.06
H-245A	98.07	0.06
H-247	68	0.06
H-248	68	0.06
H-249	37.13	0.06
H-344	21.79	0.06
H-N01	118	0.06
H-N02	68	0.06
H-N03	68.92	0.06
H-N04	99.06	0.06
H-N08	96.12	0.06
H-N09	88.25	0.06
H-N10	78	0.06
H-N11	59	0.06
H-N12	97.88	0.06
H-N13	77.83	0.06
H-N14	41.55	0.06
H-N15	12.76	0.06
H-N16	57.94	0.06
H-N17	59	0.06
H-N18	49	0.06
H-N19	86.12	0.06
H-N20	96.92	0.06
H-N21	195.8	0.06

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
HP51	117.35	0.06
J-1	54.87	0
J-2	52.43	0
J-3	51.49	0
J-4	55.75	0
J-5	59.01	0
J-6	69.32	0
J-9	29.42	0
J-10	31.95	0
J-11	55.9	0
J-13	59.52	0
J-14	19.84	0
J-15	22.27	0
J-16	21.67	0
J-18	41.11	0
J-19	69.62	0
J-28	68	0
J-29	68	0
J-30	59.93	0
J-31	59	0
J-32	59	0
J-33	18.3	0
J-34	18	0
J-36	9	0
J-37	68	0
J-44	26.13	0
J-45	24.56	0
J-46	45.27	0
J-47	52.41	0
J-48	15.11	0
J2240	70.95	0.18
J2242	68	0.23
J2244	68	0.29
J2246	68	0.25
J2248	74.55	0.33
J2250	66	0.17
J2252	50	0.17
J2254	76.2	0.18
J2256	45	0.17
J2258	19.52	0.42
J2262	9.09	0.17
J2266	88	0.38
J2268	69.7	0.43
J2270	28.15	0.18

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
J2272	38.92	0.25
J2274	27.07	0.39
J2276	68.3	0.39
J2278	88	0.28
J2280	106.93	0.79
J2282	100.05	0.25
J2284	96.16	0.18
J2286	68	0.18
J2288	68	0.66
J2290	68	0.6
J2292	68	0.06
J2294	68	0.06
J2296	68	0.06
J2298	98	0.65
J2300	88.83	1.07
J2302	78.27	0.39
J2304	80.65	0.71
J2306	69.49	0.35
J2308	59.82	0.32
J2310	110.44	0.38
J2312	69.01	0.06
J2316	29.16	0.23
J2318	39	0.06
J2320	44.18	0.18
J2322	38.63	0.92
J2326	9.6	0.18
J2330	33.09	0.31
J2332	39.1	0.73
J2334	15.41	0.41
J2336	88.25	0.61
J2338	19	0.6
J2340	49	0.29
J2342	134.82	0.29
J2344	147	1.08
J2346	143.53	0.29
J2348	29.67	1.21
J2350	49	0.52
J2354	37.47	0.33
J2356	44.51	0.41
J2366	9	0.18
J2368	9	0.47
J2370	9	0.27
J2374	19	1.61
J2376	49.32	0.8

Junction Input Data
Capital Efficiency Plan^{TM}
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
J2378	18.47	1
J2380	27.07	0.73
J2382	29.07	0.89
J2384	9	0.99
J2386	11.99	0.91
J2388	9	0.39
J2390	11.36	0.17
J2392	9	0.28
J2394	29.48	3.98
J2396	57.86	0.18
J2398	99.65	1.38
J2400	86.12	0.78
J2402	7	1.45
J2404	18.74	0.91
J2406	39.04	0.18
J2408	65.55	0.18
J2410	21.54	0.17
J2412	9	0.18
J2414	11.99	0.18
J2416	19	0.69
J2418	77.11	0.3
J2420	49.4	0.83
J2422	15.18	0.28
J2426	19	0.33
J2430	9	0.17
J2432	20.05	0.18
J2434	30.54	0.78
J2436	60.83	0.73
J2440	38.63	0.25
J2442	49	0.26
J2446	49.06	1.2
J2448	49	0.39
J2450	84.19	0.75
J2452	59.3	0.21
J2454	59	0.18
J2456	51.97	0.22
J2458	62.24	0.77
J2460	49	0.53
J2462	58.62	0.55
J2464	63.93	0.35
J2466	49	0.38
J2468	98.23	0.54
J2470	61.27	0.18
J2472	59	0.59

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
J2474	17.24	1.71
J2476	27.61	0.44
J2478	29	0.26
J2480	19	3.8
J2482	27.1	0.18
J2484	28.21	0.23
J2486	38.35	0.18
J2488	9	0.23
J2490	9	0.18
J2492	29	0.18
J2496	9	0.76
J2498	18.22	0.37
J2500	29.56	1
J2502	39	0.24
J2504	39	0.34
J2506	41.18	0.27
J2510	38.95	0.34
J2512	29	0.6
J2514	41.31	0.36
J2516	19	0.48
J2518	19	0.06
J2520	21.41	0.32
J2522	19	0.29
J2524	9	0.6
J2526	38.5	0.47
J2528	19	0.44
J2530	18.15	0.06
J2532	90	0.59
J2534	99.06	0.48
J2536	21.46	0.39
J2538	20.77	2.06
J2540	9	4.68
J2542	9	0.33
J2544	34	1.15
J2546	15.18	0.32
J2548	29	0.9
J2550	39	0.25
J2552	29	2.22
J2554	18.69	0.86
J2556	7	0.35
J2558	21	0.23
J2560	30.41	0.87
J2562	105.04	0.18
J2564	19.35	0.98

Junction Input Data
Capital Efficiency Plan^{TM}
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
J2566	20.9	1.39
J2568	14.16	0.36
J2570	19	0.29
J2572	19.11	0.18
J2574	9	0.5
J2576	19	0.4
J2578	39	0.67
J2580	49	0.32
J2582	107.57	0.54
J2584	59.86	0.4
J2586	60.64	0.39
J2588	59	0.89
J2590	36.98	0.79
J2592	38.87	0.38
J2594	19	0.28
J2596	39	0.3
J2598	42.09	0.41
J2600	33.3	0.34
J2602	49	0.3
J2604	37.8	0.46
J2606	49	0.18
J2608	49	0.62
J2610	49	0.47
J2612	49	1.45
J2614	45	0.17
J2616	49	0.28
J2618	74.43	0.63
J2620	19	0.28
J2624	21.09	0.54
J2628	19	0.55
J2630	40.71	1.72
J2632	29.62	0.36
J2634	29	0.29
J2636	108	0.57
J2638	51.67	0.27
J2640	66.51	0.29
J2642	29	1.01
J2644	39	0.44
J2646	42.71	0.18
J2648	40.07	0.19
J2650	38.23	0.38
J2652	32.53	0.35
J2654	49	0.18
J2656	29.24	0.06

Junction Input Data
Capital Efficiency Plan^{TM}
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
J2658	96.12	0.18
J2660	65.7	0.21
J2662	37.76	0.97
J2664	127	0.37
J2666	32	0.51
J2668	50	0.29
J2670	39.4	0.06
J2672	61.18	0.69
J2674	9	0.06
J2676	9	2.22
J2678	18.9	0.06
J2680	19.34	0.26
J2682	19.84	0.06
J2684	29	0.17
J2686	88.07	0.54
J2688	59.31	0.19
J2690	91.42	0.34
J2692	100.81	0.85
J2694	64.02	0.19
J2696	28.21	0.52
J2698	35	0.96
J2702	60.55	1.19
J2704	60	1.21
J2706	50	0.49
J2708	49	0.39
J2710	39	0.06
J2712	19.65	0.53
J2716	33.12	0.06
J2720	10.07	0.06
J2726	29	0.51
J2728	35.62	0.24
J2730	28.6	0.2
J2732	9	0.71
J2734	9	0.45
J2736	7	0.9
J2738	19	0.06
J2740	29	0.35
J2742	27.71	0.27
J2744	21.85	1.73
J2746	9	1.4
J2748	14.37	0.06
J2750	98.07	0.86
J2752	19	1.04
J2754	118.59	0.43

Junction Input Data
Capital Efficiency Plan^{TM}
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
J2756	99.16	1.18
J2760	19.34	0.06
J2762	21.25	0.3
J2768	20.13	0.49
J2770	19	0.27
J2772	19	0.06
J2774	65.48	0.77
J2776	49.89	0.46
J2778	43.45	0.58
J2784	9	0.22
J2786	84.59	0.43
J2788	43.92	0.45
J2790	49.19	0.48
J2792	69.91	0.26
J2794	115.64	0.26
J2796	112.79	0.93
J2798	87.07	0.18
J2800	71.12	0.38
J2802	80.43	0.37
J2804	49	0.18
J2806	68	0.18
J2810	78.31	0.8
J2814	68	0.77
J2816	63	0.55
J2818	49	0.18
J2820	60.91	1.12
J2822	52.28	0.52
J2824	59	0.54
J2826	70.1	0.92
J2828	68	0.18
J2830	68	0.31
J2832	84.19	0.34
J2834	68.92	0.91
J2836	61.02	0.38
J2838	49	0.57
J2840	53.32	1.42
J2842	59.37	0.38
J2844	49.32	0.62
J2846	78.27	0.53
J2848	69.01	0.18
J2858	59.2	0.28
J2862	72.63	0.5
J2864	107.02	0.18
J2866	109.1	0.35

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
J2868	99.65	0.84
J2870	89.02	0.29
J2872	87.58	0.18
J2874	11.42	1.26
J2878	9	0.18
J2884	19	0.42
J2886	33	0.63
J2888	30.25	0.58
J2892	9.59	0.45
J2894	27	2.29
J2896	35	0.75
J2898	36.87	2.86
J2900	16.91	0.47
J2902	27.98	0.58
J2904	37.98	1.84
J2906	60.92	0.18
J2908	49	0.57
J2910	18.82	1.49
J2912	31.8	0.47
J2914	42.05	0.18
J2918	29	0.32
J2922	39	0.9
J2926	25.5	0.18
J2930	23	0.69
J2932	28	0.58
J2936	33	0.29
J2940	9	0.28
J2942	9	0.18
J2944	9	0.18
J2946	9	0.72
J2948	9.08	0.99
J2950	9	0.18
J2952	18.22	0.48
J2954	49.82	1.43
J2956	52.2	1.3
J2958	37.5	0.18
J2960	9	0.85
J2962	19	1.65
J2964	25.15	2.22
J2966	19	2.52
J2968	33.83	1.44
J2970	24	3.21
J2972	8	2.74
J2974	19.43	2.06

Junction Input Data
Capital Efficiency Plan^{TM}
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
J2976	9	1.87
J2978	29.1	1.28
J2982	39	0.18
J2986	39	0.18
J2988	56.6	0.35
J2992	68.77	1.22
J2994	59	0.18
J3000	14.05	3.22
J3002	38.11	0.32
J3004	44.9	0.35
J3006	45.65	0.27
J3008	49	0.26
J3010	49	0.4
J3012	49	1.69
J3014	39.09	0.76
J3016	38.8	0.18
J3018	39	0.9
J3020	38.8	0.3
J3022	43.88	0.3
J3024	47.7	0.25
J3026	49	0.71
J3028	39	0.27
J3030	42.22	0.55
J3032	19	0.18
J3034	19	0.18
J3036	19	0.18
J3038	11.22	0.18
J3040	29.71	0.39
J3042	19	1.66
J3044	38.56	0.34
J3046	25	0.65
J3048	21	0.37
J3050	41.31	0.18
J3052	28.7	1.08
J3054	98	1.29
J3056	34.49	0.55
J3060	61.94	0.18
J3062	59	0.36
J3064	88	0.52
J3066	78	0.22
J3068	60.83	0.18
J3070	136.7	1.67
J3072	32	0.18
J3074	59	0.2

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
J3076	88.13	0.87
J3078	84.83	0.18
J3080	71.91	0.47
J3082	63.1	0.31
J3084	78	0.38
J3086	126.5	0.62
J3088	126.74	0.77
J3090	44.77	0.38
J3092	47.54	2.79
J3094	31.04	0.18
J3096	19	0.32
J3098	19	0.28
J3100	30.1	0.4
J3102	35.42	0.44
J3104	40.71	0.22
J3106	130	0.23
J3108	59.01	0.18
J3112	106.8	0.45
J3114	52.23	0.55
J3116	150.68	0.51
J3118	49	0.31
J3120	57.62	0.18
J3122	61.52	0.63
J3124	52.74	0.18
J3126	43.64	0.49
J3128	77.55	1.18
J3130	72	0.27
J3132	66	0.64
J3136	94.22	0.18
J3138	97.88	1.03
J3140	78.6	0.25
J3142	69.33	1.02
J3144	96.59	1.12
J3146	69.56	0.18
J3148	49	0.37
J3150	39	0.18
J3152	49	0.3
J3154	59.29	1.08
J3156	37.81	0.18
J3158	45	0.21
J3160	45	0.37
J3162	43	0.18
J3164	39.44	0.18
J3166	49.1	0.21

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
J3168	60.36	0.41
J3170	9	1.5
J3174	39	0.18
J3176	21.5	0.69
J3180	26.4	0.18
J3182	59.07	0.95
J3184	58.06	1.1
J3186	39	0.18
J3188	43.73	0.18
J3190	15.94	0.31
J3192	20.91	0.23
J3194	30.72	0.36
J3196	29	0.63
J3198	109.02	0.67
J3200	114.34	0.3
J3202	70.27	0.66
J3204	69.19	0.18
J3206	50	0.18
J3208	68	0.55
J3210	52.44	0.72
J3212	50	0.48
J3216	11.6	0.18
J3218	9	0.18
J3220	18.22	0.3
J3224	37.6	0.36
J3228	48.32	0.44
J3230	19	0.31
J3232	97.35	0.3
J3234	19	0.73
J3236	15.24	0.18
J3238	28	0.6
J3240	41	0.46
J3242	42	0.2
J3244	44	0.56
J3246	44	1.7
J3254	28.05	0.18
J3256	103.47	0.29
J3258	56.61	0.18
J3260	62.03	0.18
J3262	75.42	0.18
J3264	78	1.12
J3272	68.26	0.27
J3274	88.01	0.22
J3282	60.13	0.18

Junction Input Data
Capital Efficiency Plan™
Manchester-by-the-Sea, MA

Label	Elevation (ft)	Demand (gpm)
J3284	103.47	0.32
J3292	50	0.4
J3294	9	0.3
J3296	19	0.18
J3298	64.21	0.61
J3300	74.78	0.23
J3302	58.56	0.49
J3304	66	0.3
J3306	134.82	0.61
J3308	108.33	0.22
J3314	119.71	0.18
J3316	193.66	0.18
J3318	195.8	0.37
J3322	59	1.18
J3324	49	0.18
J3326	59.98	0.41
J3328	88.17	0.52
J3330	59.32	0.27
J3332	107.57	0.18
J3334	100.05	0.2
J3336	18.53	0.19
J3338	19.19	0.18
J3340	15.34	0.6
J3342	17.92	0.23
J3344	30.65	0.27
J3346	9	0.35
J3348	96.79	0.18
J3350	23.95	0.28
J3352	130.77	0.23
J3354	92.09	0.81
J3356	9	0.36
J3360	19	-349.83
J3364	68	0.17
J3366	70	-999.83
J3368	38.5	0.17
J3370	71	0.17
J3372	60	0.17
J3374	49	0.17
J3376	68	0.17
J3378	37	0.17
J3380	29	0.17
J3382	45.6	0.17
J3386	68	0.17
J3388	43.9	0.17

Appendix C

APPENDIX C

TATA & HOWARD

Hydraulic Improvements Map
Capital Efficiency Plan™
Manchester by the Sea, MA

TATA & HOWARD

Approximate Scale: 1" = 750'

February 2017

Appendix D

TATA & HOWARD

Critical Components
Capital Efficiency Plan™
Manchester by the Sea, MA
TATA & HOWARD
Approximate Scale: 1" = 750'
February 2017
N
ESSEX
GLOUCESTER
BEVERLY
Gravelly Pond
Gravelly Pond Water Treatment Facility
Moses Hill Standpipe
Capacity: 1.7 mg
Overflow Elevation: 273 feet
Lincoln Street Well
Gloucester Interconnections
Beverly Interconnection
Legend
Critical Users
Emergency Services
School
Elderly Housing
Stream Crossing
Critical Components
Water Main Diameter
4-inch or less
6-inch
8-inch
10-inch
12-inch
14-inch
16-inch
Private Mains
128
PLEASANT STREET
SUMMER STREET
MAGNOLIA AVENUE
FOREST STREET
SCHOOL STREET
OLD NECK ROAD
PROCTOR STREET
MASCONOMO STREET
RAYMOND STREET

Appendix E

TATA & HOWARD

Asset Management Rating
Capital Efficiency Plan™
Manchester by the Sea, MA
TATA & HOWARD
Approximate Scale: 1" = 750'
February 2017
Legend
Asset Management
Excellent to Good
Good to Fair
Fair to Poor
N
ESSEX
GLOUCESTER
BEVERLY
Gravelly Pond
Gravelly Pond Water Treatment Facility
Moses Hill Standpipe
Capacity: 1.7 mg
Overflow Elevation: 273 feet
Lincoln Street Well
Gloucester Interconnections
Beverly Interconnection
PINE STREET
ACCESS ROAD
OLD SCHOOL STREET
SCHOOL STREET
ATWATER AVENUE
MILL STREET
GENTLEES BRIDGE
LOADING PLACE ROAD
FOREST LANE
FOREST STREET
HARRINGTON LANE
BLUE HERON LANE
OLD ESSEX ROAD
PINEWOOD ROAD
ANTHONY AVENUE
CROOKED LANE
PARSON'S LANE
PLEASANT STREET
WINDEMERE PARK
KNIGHT ROAD
HIDDEN LEDGE ROAD
CRAFTS COURT
WALKER ROAD
HIGHWOOD ROAD
WOODHOLM ROAD
WOODCREST ROAD
DEER HILL ROAD
FORSTER ROAD
BENNETT STREET
BRIDGE STREET
CENTRAL STREET
UNION STREET
NORTH STREET
WASHINGTON STREET
SEA STREET
TAPPAN STREET
OLD NECK ROAD
BEACH STREET
EAGLE HEAD ROAD
PRIVATE AVENUE
BLOSSOM LANE
COBB AVENUE
PROCTOR STREET
MASCONOMO STREET
SMITH'S POINT ROAD
GALES POINT ROAD
TUCKS POINT ROAD
HARBOR STREET
BOARDMAN AVE
HIGHLAND AVE
JERSEY LANE
LINCOLN AVENUE
ROSEDALE AVENUE
STANLEY AVENUE
LINCOLN STREET
FLATLEY AVENUE
VINE STREET
BURNHAM LANE
SUMAC LANE
KNIGHT CIRCLE
DESMOND AVENUE
BROOK STREET
SPY ROCK HILL ROAD
SKYTOP DRIVE
HAROLD STREET
MARK STREET
MACHAN WAY
ANCIENT COUNTY WAY
LEDGEWOOD ROAD
LEDGEWOOD CIRCLE
COLBURN ROAD
DEXTER LANE
PLUM HILL
HICKORY HILL ROAD
PRIVATE LANE
VICTORIA ROAD
OCEAN STREET
MAGNOLIA AVENUE
UNIVERSITY LANE
OVERLEDGE ROAD
BIRCH ROAD
SUMMER STREET
COOLIDGE POINT
BUTLER AVENUE
RAYMOND STREET
UNKNOWN
128

Appendix F

TATA & HOWARD

Three Circles Integration Capital Efficiency Plan™ Manchester by the Sea, MA

TATA & HOWARD

Approximate Scale: 1" = 750'

February 2017

Appendix G

APPENDIX G

TATA & HOWARD

Recommended Improvements
Capital Efficiency Plan™
Manchester by the Sea, MA

TATA & HOWARD

Approximate Scale: 1" = 750'

February 2017

TATA & HOWARD

OFFICE LOCATIONS:
MA | NH | CT | ME | VT | AZ | TX

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