PROJECT NARRATIVE

Manganese Removal at Oakdale Well
West Boylston Water District
PWSID 2321000

Detailed discussion of the problem to be solved by the project.
Identification of the project area using a site plan and/or locus map.
Detailed discussion of the severity of the existing public health issues.

The proposed project consists of a new water treatment facility to reduce manganese concentrations to acceptable levels in the Oakdale Well located in West Boylston, MA. The proposed water treatment facility will address this significant public health issue. Refer to **Appendix A – Locus for the location of the Oakdale Well.**

The District's wells have varying levels of manganese with the highest levels being observed at the Oakdale well. Concentrations of manganese in the Oakdale well exceed the Mass DEP Health Advisory Level of 0.3 mg/L and often rise to levels of 1.0 mg/L and above. The following guidance from MassDEP provides the overall basis of the potential health impacts of manganese in public drinking water and is the basis for the new treatment facility project for the Oakdale Well. See **Appendix B** report on water quality and compliance, for history of manganese levels at the Oakdale Well.

> Manganese is a mineral in drinking water which when present at elevated levels causes aesthetic and nuisance issues as follows: (1) stain laundry and water use fixtures; (2) clog household water filters; (3) prompt customer complaints; (4) support growth of Mn bacteria, non-health related bacteria that clog strainers/pumps/valves; and (5) may increase the number of coliform "hits" in the distribution system. The USEPA and MassDEP regulate manganese in drinking water as a Secondary Maximum Contaminant Level (SMCL) of 0.05 mg/L to protect public welfare and promote increased customer satisfaction.
>
> The USEPA and MassDEP have established a Health Advisory Level for manganese of 0.3 mg/L. Over a lifetime, EPA recommends that people drink water with manganese levels less than 0.3 mg/L and over the short term, the USEPA recommends that people limit their consumption of water with levels over 1 mg/L, primarily due to concerns about possible neurological effects. Additionally, the USEPA recommends that children up to 1 year of age should not be given water with manganese concentrations over 0.3 mg/L.
>
> The MassDEP states in the *Guidelines for Public Water Systems* (Chapter 5): "If the manganese concentrations in raw water exceeds 0.3 mg/L but are less than or equal to 1.0 mg/L, an assessment by MassDEP Office of Research and Standards will be necessary to determine if removal shall be required. If manganese

concentrations in raw water exceed 1.0 mg/L, removal is required. If iron, manganese, or a combination thereof exceeds 1.0 mg/L, removal is required."

Based upon the historical manganese levels in excess of 1.0 mg/L, MassDEP and the District have signed an Administrative Consent Order (ACO) which requires implementation of a treatment facility at the Oakdale Well for removal of manganese. The ACO schedule is based upon inclusion of this project on the 2020 DWSRF IUP.

In addition to the MassDEP ACO, the District is implementing this treatment project in response to ongoing customer complaints about discolored water due to manganese deposition within its distribution system. See **Appendix C** for customer complaints on elevated manganese concerns and discoloration.

System Population Affected by Proposed Project

The District's water system is separated into two zones (Low Service Area and High Service Area) with wells and storage tanks in both zones. The Oakdale Well and Pleasant Valley Well are the sole sources for and are located in the Low Service Area. The Lee Street Well is the sole source for the High Service Area. The District has four water storage tanks, at three distinct locations. The Oakdale Tank and Stockwell Road Tank are in the Low Service Area and the two Lawrence Street Tanks are in the High Service Area. The Route 12 booster station is used to transfer water from the Low Service Area to the High Service Area to supplement supply from the Lee Street Well.

The Oakdale well is the largest supply source in the District. The proposed treatment facility would directly treat water from the Oakdale well benefitting water quality for the entire town (population of approximately 7,450 residents) as the hydraulic connectivity in effect blends the water from the Oakdale well across the distribution system. Refer to **Appendix D – Capital Efficiency Plan** (pages 12-16) for water distribution system description and infrastructure.

Interactions with Regulatory Bodies

The District and MassDEP signed an Administrative Consent Order (ACO) on June 21, 2019 which requires implementation of treatment for the removal/reduction of manganese from the Oakdale Well (**Appendix E –MassDEP ACO**). The high manganese levels were first identified by MassDEP in their 2014 Sanitary Survey Report (survey completed in November 2013).

The proposed treatment facility will be constructed in accordance with the ACO deadline:

> *On or before December 31, 2022, respondents shall complete the installation and activate the treatment facility for the removal of manganese for the Oakdale source, Well 01G.*

Construction of the facility will begin in the summer of 2021. Final MassDEP inspection as well as facility startup and testing is expected to be complete by the end of year 2022.

Detailed Description of Proposed Work

The proposed treatment facility will be located in close proximity to the Oakdale Well, which is located off Thomas Street, adjacent to the Central Mass Rail Trail along the Quinapoxet River. Due to its location within the overall Wachusett Reservoir watershed, most of the surrounding land is owned and controlled by the Massachusetts Department of Conservation and Recreation (DCR) as water supply protection. The remaining land near the Oakdale Well is owned by the Town of West Boylston. The District has initiated discussions with the Town regarding land transfer or purchase, in the hopes of siting the proposed water treatment facility on Town-owned land immediately west of the Oakdale Well, along the Central Mass Rail Trail.

Treatment will consist of a pressure filtration system (GreensandPlus with anthracite) with nominal 500 gpm capacity. It will incorporate a sodium hypochlorite feed system to oxidize the manganese, along with potassium hydroxide for pH adjustment. The sodium hypochlorite chemical system can also be used for disinfection in case of the presence of microbiological contaminants.

The existing well pump will be replaced to achieve the correct pressure at the filter system inlet, with the intent of designing the treatment facility as a "pump-through" facility to avoid any need for "double-pumping". A variable frequency drive will be installed to control water flows through the treatment facility and for energy savings.

A SCADA system will be installed to allow remote control and monitoring of the entire treatment process. A propane fired emergency generator will provide backup power to the facility.

Handling of backwash residual flows will be evaluated during the conceptual design phase and generally consider one of the following two methods:

- Handle the backwash residuals entirely onsite through a series of lined settling lagoons and unlined infiltration lagoons, in conformance with MassDEP policy for handling of backwash residuals at iron/manganese facilities.
- Collection and settling of backwash residuals within an onsite basin, with the settled residuals being discharged into the Town's sewer collection system. Further evaluation of the capacity of the existing sewer collection system is required for this option.

Relative Importance of the Project

As noted previously, the proposed treatment facility is critical to the District's ability to reduce the manganese levels to below the MassDEP Health Advisory level of 0.3 mg/L. Given the District's limited number of sources and the volume of water historically supplied by the Oakdale Well, its continued viability as a source for the District is of the upmost importance. Alternative sources have been investigated extensively by the District over the years, with limited success. The only viable alternative source is presently being developed as a replacement for the District's Pleasant Valley Well, which has also exhibited high manganese levels.

***Description of Energy Efficiency Measures for the Proposed Projec*t**

The proposed water treatment facility will be designed as a "pump-through" facility, with groundwater being pumped directly from the Oakdale Well through the pressure filtration system and then directly into the District's water distribution system. This approach eliminates any need for "re-pumping" which inherently would be less efficient.

Separately, the Oakdale Well pump will be controlled with a variable frequency drive, which will allow the District to operate the Oakdale Well and proposed water treatment facility at the desired flowrates without having to throttle valves which would inherently introduce additional headlosses and associated energy inefficiency.

Back-up Systems Currently In-Place

Currently, the District relies upon the Oakdale Well as one of its three sources of supply. The District has conducted extensive groundwater investigations within the available land and is currently implementing a replacement well adjacent to its Pleasant Valley Well. This replacement well is intended to be used separately (or in conjunction with) the existing Pleasant Valley Well to address the elevated manganese levels at this source. Therefore, this replacement well would not address the potential loss of the Oakdale Well due to lack of treatment for manganese. The proposed water treatment facility for the Oakdale Well is critical to the District's ability to continue providing potable water to its customers (essentially the entire Town of West Boylston).

Project Planning Measures

The District completed a Water Quality Compliance Plan in 2018 to specifically address regulatory compliance issues related to bacteriological (total coliform) issues and the elevated manganese issues at its Oakdale Well and its Pleasant Valley Well. Recognizing the significant cost impacts associated with constructing and operating a water treatment facility for the removal of manganese, the District's initial focus over the past several years was to determine if replacement sources could be identified and developed with naturally improved water quality. For the Pleasant Valley Well, the District was successful in identifying a replacement well location, which has been successfully permitted through MassDEP as a replacement well and is pending final approval through DCR for land acquisition (ownership/easement). The final construction and implementation of this replacement well for the District's Pleasant Valley Well is expected to be concurrent with the implementation of the proposed water treatment facility for the Oakdale Well.

For the Oakdale Well, the District was unable to identify any viable replacement well. Subsequently, the District determined that treatment of this critical source for manganese removal was the only viable option.

From a financial perspective, the District operates as an independent government entity from the town. All funds stay within the District which employs full cost pricing and is structured as an Enterprise Fund. All project costs associated with implementation of the proposed water treatment facility will be covered through the District's rates and fees.

Alternatives Analysis

As noted previously, the District is concurrently working on developing a replacement well for the Pleasant Valley Well which is also experiencing elevated and increasing manganese concentrations. Note that the District reports that manganese levels in the Pleasant Valley Well were approximately 0.1 mg/L in the 1990s, 0.2 mg/L in the 2000s, and 0.3 mg/L in the 2010s with levels appearing to continue to increase. The proposed replacement well would operate separately or in conjunction with the existing Pleasant Valley Well to achieve a blended water at the system entry point with manganese less than 0.2 mg/L. The distance between the Oakdale Well and the Pleasant Valley Well is too far to allow mixing of the two sources prior to any customers.

A no action alternative was not a valid option due to the public health issues and based on the unlikely changes in water chemistry to occur at the Oakdale Well.

The District contracted with Blueleaf Inc. to complete a pilot study for the treatment at Oakdale Well. The pilot study explored two treatment methods which were biological filtration and pressure filtration using anthracite and GreensandPlus.

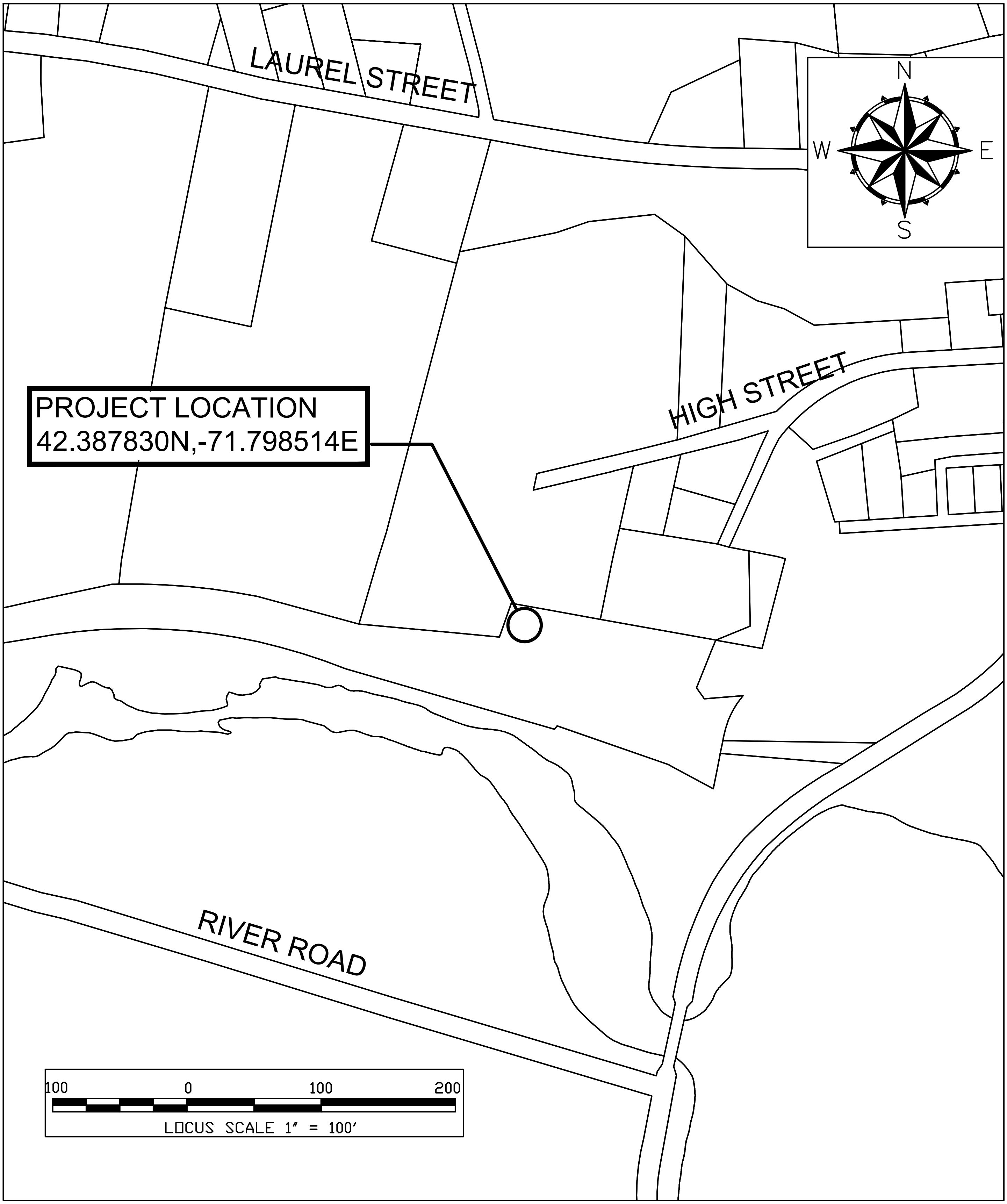
Status of Implementation Process

The District is currently awaiting the final results of the pilot study which is expected to be completed by the end of September 2019 (refer to **Appendix H for Pilot Protocol**). Based upon preliminary information and observations during the pilot study, it appears that pressure filtration using GreensandPlus media and anthracite are best suited for consistently and reliably removing manganese from the Oakdale Well. Although the biological filtration process was able to remove manganese, the pilot study indicated that it did not perform as well as the pressure filtration process with GreensandPlus/anthracite media and that the biological filtration process was susceptible to upsets ("loss of treatment effectiveness") and had significantly reduced process efficiencies (reduced run times between filter backwashes).

The conceptual design phase work has already been contracted to CEI by the District and is expected to be completed by the end of 2019.

Design and contract documents are expected to be completed by September 2020 along with submittal of the SRF application. Contractor bidding and project award and execution is expected to be completed during the winter of 2021 and construction is anticipated to take place from summer 2021 to end of year 2022. See Appendix G for a complete project timeline.

The District is currently pursuing the option to obtain land under ownership of the Town of West Boylston for the proposed Treatment Facility. As of now the District has discussed the issue with the Town at a public Select Board meeting. Land acquisition is expected to be finalized during the design phase of the project. See **Appendix I – West Boylston Select Board Meeting Minutes** (June 26, 2019 pages 3-4).



GENERAL NOTES

LOCUS MAP
PROPOSED WATER
TREATMENT FACILITY

WEST BOYLSTON WATER DISTRICT

COMPREHENSIVE ENVIRONMENTAL INCORPORATED

41 MAIN STREET
BOLTON, MA 01740

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June 26, 2018

Board of Water Commissioners
West Boylston Water District
183 Worcester Street
West Boylston, MA 01583
Attn: Mr. Michael D. Coveney, Superintendent

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RE: West Boylston Water District
Water Quality Comprehensive Compliance Plan

Dear Sirs:

Comprehensive Environmental Inc. (CEI) is pleased to provide this report to the West Boylston Water District (District) for the completion of a Water Quality Comprehensive Compliance Plan (WQCCP), as required by the Massachusetts Department of Environmental Protection (MassDEP). The goals of this project are to evaluate the water quality (raw and distribution) and chemical treatment approach for simultaneous water quality compliance balancing lead and copper corrosion control, manganese sequestering, phosphate minimization and coliform mitigation.

General Overview

The District has experienced total coliform positive detections that triggered the need to complete a Revised Total Coliform Rule (RTCR) Level 1 assessment. Separately, the District was required by the MassDEP through a Sanitary Survey to conduct a phosphate corrective action plan. In follow-up to the RTCR Level 1 assessment submitted by the District, the MassDEP has required completion of a simultaneous water quality compliance study evaluating the District's current practice of using phosphate for iron and manganese sequestering while mitigating phosphate addition and its potential impact on coliform growth and corrosion control.

Water System Overview

The District's water system is separated into two main zones (Low Service Area and the High Service Area) with wells and storage tanks in both zones. The Oakdale Well and Pleasant Valley Well are located in the Low Service Area. The Lee Street Well is located in the High Service Area. The District has four water storage tanks. The Oakdale Tank and Stockwell Road Tank are in the Low Service Area and the two Lawrence Street Tanks are in the High Service Area. The Route 12 booster station is used to transfer water from the Low Service Area to the High Service Area to supplement supply from the Lee Street Well.

Additionally, the District has several isolated areas with pressure maintained solely through a booster pumping station (Western Avenue Booster Pump Station, Laurel Street Booster Pump Station and Lee Street Booster Pump Station). The physical layout of the District's water system, demand/flow patterns and system operations can affect water quality as it is delivered to the District's customers.

225 Cedar Hill Street, Marlborough, Massachusetts 01752 508-281-5160 Fax: 508-281-5136
21 Depot Street, Merrimack, New Hampshire 03054 603-424-8444 Fax: 603-424-8441
Gateway Crossing, 1 Hartford Square-East, New Britain, Connecticut 06052 860-224-0442
www.ceiengineers.com

The District uses a proprietary blended phosphate (SLI 5385 by Shannon Chemical) for manganese sequestering. Its Material Safety Data Sheet notes that it is part of the sodium phosphate chemical family. CEI spoke with Dan Flynn of Shannon Chemical on May 8, 2018. Mr. Flynn confirmed that the blended polyphosphate was specially selected by Shannon Chemical for the District based on their specific water quality and goals (need to sequester relatively higher concentrations of manganese). The SLI 5385 polyphosphate is a blend of three polyphosphates and is a product primarily used in the Northeast for public water supply wells with higher concentrations of manganese and this product has proven success in sequestering higher concentrations of manganese when other phosphates could not.

Separate from the phosphate addition for sequestering, the District adjusts the pH of the water using 45% potassium hydroxide as part of their corrosion control program. Currently, the District adds sodium hypochlorite to the water in response to total coliform detections. The District considers this a temporary measure needed for compliance with the RTCR and would like to stop chlorinating on a full time basis.

A representative of CEI met with the District on April 3, 2018 to review preliminary findings, discuss system operations and visit the well pump station and chemical feed facilities. The facilities were found to be clean, well maintained and in general compliance with MassDEP requirements.

Manganese

The District's wells have varying levels of manganese. Manganese is a mineral in drinking water which when present at elevated levels causes aesthetic and nuisance issues as follows: (1) stain laundry and water use fixtures; (2) clog household water filters; (3) prompt customer complaints; (4) support growth of Mn bacteria, non-health related bacteria that clog strainers/pumps/valves; and (5) may increase the number of coliform "hits" in the distribution system. The USEPA and MassDEP regulate manganese in drinking water as a Secondary Maximum Contaminant Level (SMCL) of 0.05 mg/L to protect public welfare and promote increased customer satisfaction.

The USEPA and MassDEP have established a Health Advisory Level for manganese of 0.3 mg/L. Over a lifetime, EPA recommends that people drink water with manganese levels less than 0.3 mg/L and over the short term, the USEPA recommends that people limit their consumption of water with levels over 1 mg/L, primarily due to concerns about possible neurological effects. Additionally, the USEPA recommends that children up to 1 year of age should not be given water with manganese concentrations over 0.3 mg/L.

The MassDEP states in the *Guidelines for Public Water Systems* (Chapter 5): "If the manganese concentrations in raw water exceeds 0.3 mg/L but are less than or equal to 1.0 mg/L, an assessment by MassDEP Office of Research and Standards will be necessary to determine if removal shall be required. If manganese concentrations in raw water exceed 1.0 mg/L, removal is required. If iron, manganese, or a combination thereof exceeds 1.0 mg/L, removal is required."

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Note that manganese sequestering can help to mitigate the aesthetic impacts of manganese in drinking water but it does not remove the manganese, so the potential health risks remain.

Manganese – Historical Data

Figures 1, 2 and 3 present the raw water manganese for the Lee Street, Pleasant Valley and Oakdale Wells as measured by a MassDEP certified laboratory. The levels in the Lee Street Well are below both the SMCL and Health Advisory Level. The levels in the Pleasant Valley Well are above the SMCL and have been increasing to just above the Health Advisory Level over recent years. The levels in the Oakdale Well are above both the SMCL and Health Advisory Level. At times levels of manganese in this well exceed 1 mg/L.

Figure 1. Lee Street Well – Manganese (Tested by MassDEP Certified Lab)

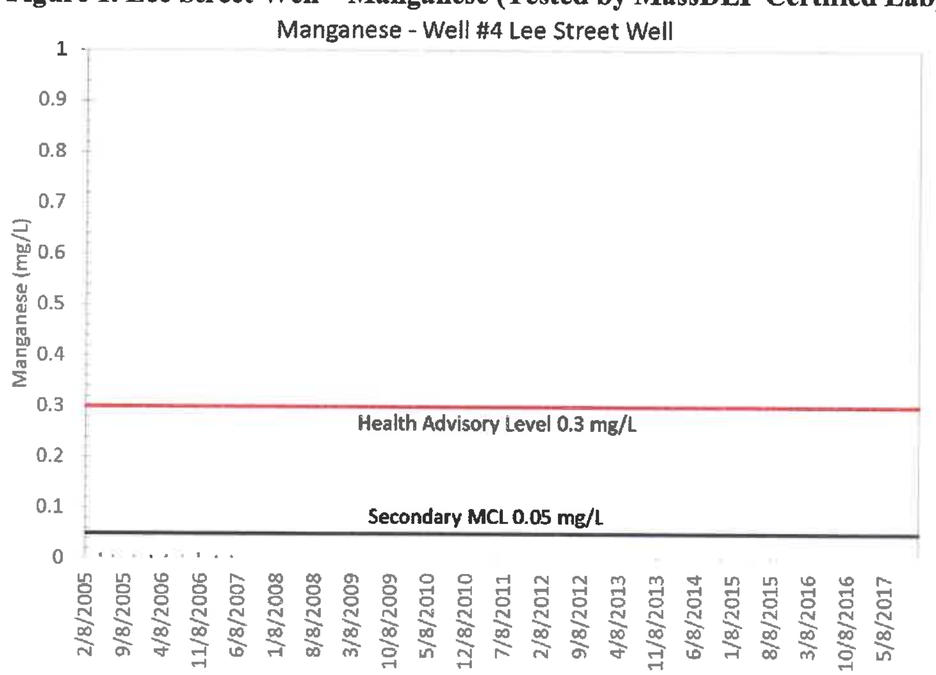

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Figure 2. Pleasant Valley Well – Manganese (Tested by MassDEP Certified Lab)

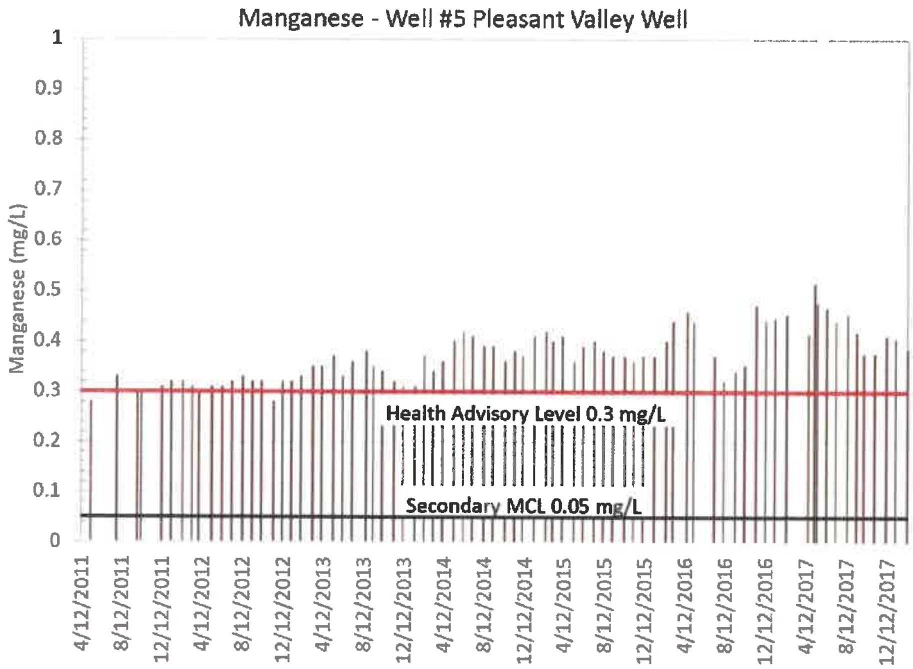
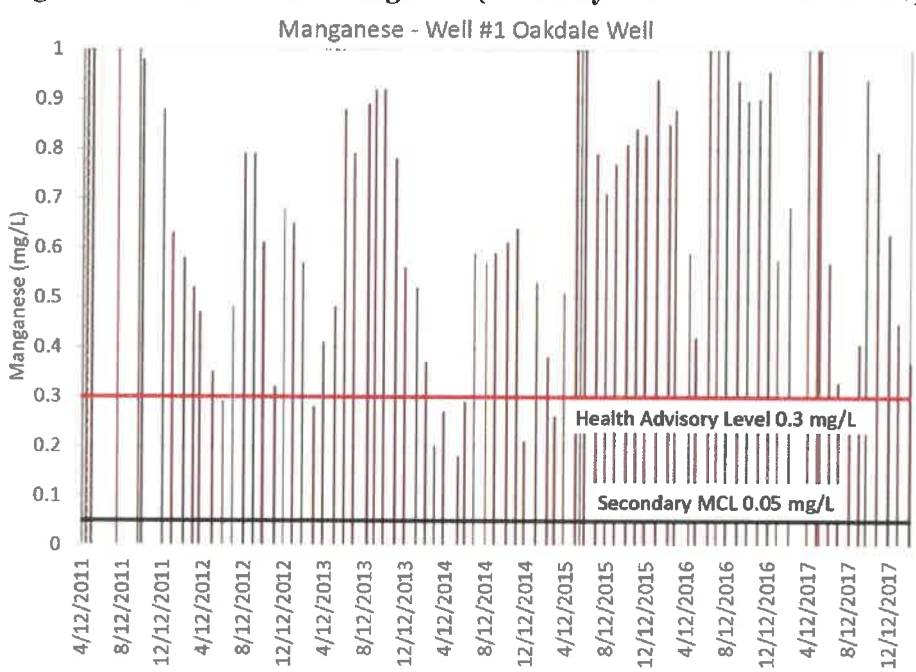


Figure 3. Oakdale Well – Manganese (Tested by MassDEP Certified Lab)



The District has also monitored for manganese within the distribution system to track levels at the tanks and customer services. This data has been collected for informational purposes and is not a MassDEP requirement. Figure 4 shows this data. The 76 N. Main Street location is a Nursing Home downstream of the Oakdale Well. The manganese results at times exceed the

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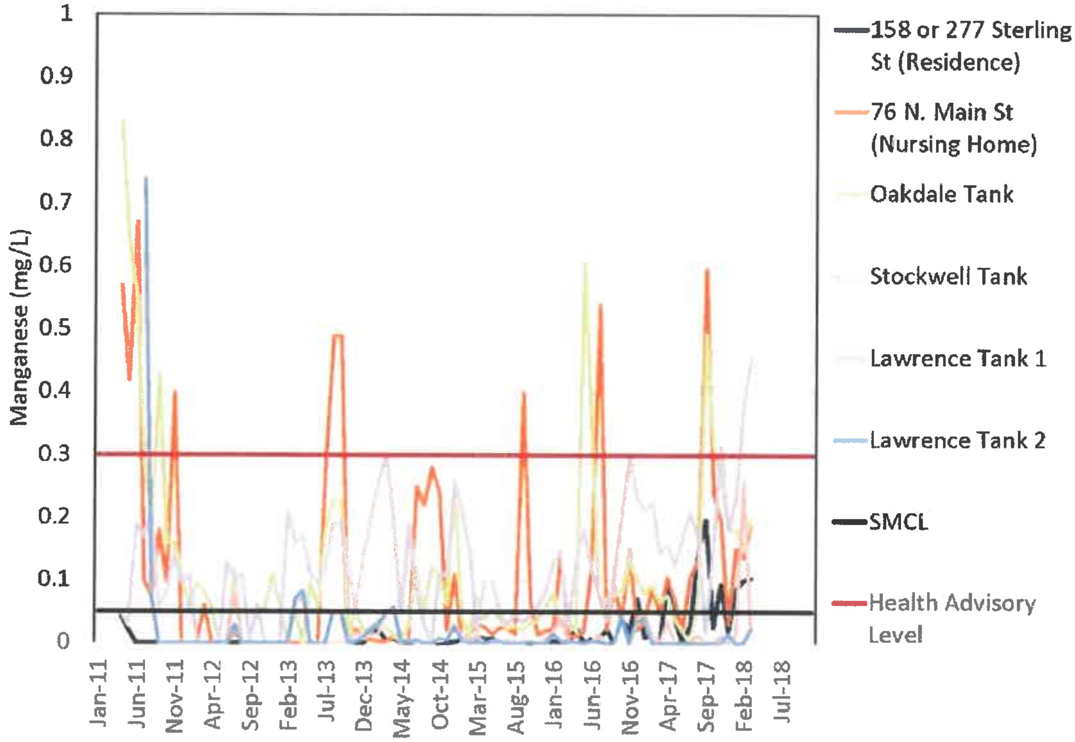
Health Advisory Level. The Sterling Street residence consistently has manganese below the Health Advisory Level.

Figure 4. Distribution System Manganese Results (Tested by MassDEP Certified Lab)



<u>Manganese – Summary of Findings</u>

The District has been monitoring manganese on a monthly basis for several years. In response to increasing manganese, the District is pursuing a new source of supply near the Pleasant Valley Well. From the test well work, a permanent well with a capacity of 500 gpm is anticipated. The test well work and water quality sampling also indicates iron and manganese are presently at non-detectable levels. The District is prepared to move forward with construction of a permanent well once an easement is in place with the Massachusetts Department of Conservation and Recreation (MassDCR), the owner of the property where the well would be located. Once the permanent well is in place, the District's plan is to (1) re-evaluate the manganese levels in the Oakdale Well to determine if inactivation is warranted should manganese levels remain above the Health Advisory Level (note that recent sampling has shown a decreasing trend in manganese) and (2) pump the existing Pleasant Valley Well concurrently with the new well to achieve a blended water at the system entry point with manganese less than 0.2 mg/L. This plan assumes that the new well would have low levels of manganese. Sometimes test well data does not indicate the presence of iron and/or manganese, but once the permanent well is in place and pumped at higher flow rates, levels of iron and/or manganese can increase. Note that the District reports that manganese levels in the Pleasant Valley Well were approximately 0.1 mg/L in the 1990s, 0.2 mg/L in the 2000s, 0.3 mg/L in the 2010s with levels appearing to continue to increase. The District will continue to monitor for manganese in the existing well and the new well; future actions will depend on the levels of manganese.

At a meeting with MassDEP on April 12, 2018, MassDEP stated that they require the District develop a plan to lower the manganese to 0.2 mg/L or less within the next 2 to 3 years. Additionally, MassDEP wants the District to include the potential need for treatment removal within the plan in the event that the new well does contain manganese and blending with the Pleasant Valley Well does not achieve the desired result. MassDEP also requires interim operational methods including more frequent water storage tank cleaning and system flushing. MassDEP suggested that an alternative to utilizing its own supplies and treating that water is the purchase of water from a neighboring public water supplier through an interconnection. System interconnection would require specific negotiating with the neighboring systems to verify the capacity and willingness of the system to supply water to the District. This process can be lengthy and the first step typically starts with contacting the system's superintendent or manager to inquire if they have enough water to sell.

Manganese – Treatment Options

There are many treatment options for the removal of manganese including pressure filtration with manganese oxide coated media, biological media filtration, membrane filtration and ion exchange. Each process offers advantages and disadvantages. As a first step, a desktop evaluation is typically conducted to layout the specifics involved with each process. During this phase, it is recommended that representatives of the District contact and/or visit facilities using each type of process. Once the District identifies the process(s) of interest, pilot testing of that process on the District's well(s) would be required. For a groundwater supply, pilot testing during one season is typically sufficient with field work requiring a couple of weeks to a month. Upon successful pilot testing, a conceptual design of the proposed facility can be completed which provides the framework for final design and helps to narrow down the cost for the proposed facility.

Total Coliforms and Chlorination

The District experiences about one or two total coliform positive detections per year in the distribution system or at water storage tanks, but not at the wells. Fecal coliforms have not been detected. The MassDEP has expressed concerns with manganese sediment accumulation within the tanks which coupled with phosphate addition may be supporting algae growth. They have additional concerns with the conditions of the tanks based on the 2016 tank inspection reports. Therefore, MassDEP is encouraging the maintenance of a chlorine residual throughout the distribution system. However, in an effort to maintain customer satisfaction, the District prefers to chlorinate only when needed to respond to a coliform detection.

October 2017 Total Coliform Event

The District experienced a total coliform positive event in October 2017. Positive total coliforms were detected on October 4, 2017 at the Oakdale Tank, 158 Sterling Street, Stockwell Tank and Lawrence Street Tank 1. On October 6, 2017 repeat sample for 158 Sterling St and 201 West Boylston Street were total coliform positive. Subsequent samples on October 10, 2017 were total coliform negative. Note that the prior routine sampling on September 13, 2017 did not have any total coliform positive results.

Upon review of the system operational records, the District had made several system operational changes in advance of the total coliform positive event. Attachment 1 shows the tank levels for September 20 – October 10, 2017. Attachment 2 shows the pump rates for September 20 – October 10, 2017. These graphs show an operational pattern change occurring from September 26 – 30, 2017 as follows:

1. Tank fill/draw level cycles changed for each tank during this period.
2. Oakdale Well pump on period decreased.
3. Pleasant Valley Well pump on period increased.
4. Lee Street Well pump on period decreased.
5. Route 12 booster pump on period increased.

After consulting with the District, it was determined that the following operational changes occurred at the end of September 2017, just prior to the total coliform positive event:

1. Oakdale Tank supply main was under construction. All summer there was a 6-inch diameter by-pass pipe to feed the Oakdale Tank. On September 15th, the new 12-inch diameter main was put on-line. Additionally, a new 12-inch diameter main was activated in Beaman Street. In advance of putting the new main on-line, it took several chlorination and flushing trials to achieve disinfection.
2. The Lee Street Well is operated on a timer since otherwise it would run all the time. The rest period is a minimum 4 hours in the summer. This rest period was increased at the end of September to manage chemical usage in advance of chemical delivery. This increased the pump rate at the Route 12 booster pump station to supply water to the High Service Area from the Low Service Area.
3. A flow test was conducted by Cogswell Sprinkler Co., Inc. on October 2, 2017 at 120 Prescott Street, West Boylston (flow was measured at 811 gpm). This location is in the northern section of the High Service Area.

These operational changes impacted system operations and disrupted normal flow paths. The flushing for the new main on Beaman Street and flow test on Prescott Street may have reversed the flow direction across the system. These higher flowrates and flow reversal would have disrupted sediments in the tanks and water mains along with any coliforms contained within those sediments. It is likely that the total coliform positive at the Lawrence Street Tank 1 was a result of the Route 12 booster pump station transferring water from the Low Service Area which had been disrupted by the new water main flushing and flow test.

Tank Conditions

The water storage tanks were inspected in 2016. Notable issues were Oakdale Tank roof cracks and Lawrence Street Tank 1 roof and wall joint/crack concerns. The reports also noted amounts of sediment in the two Low Service Area tanks that would support biological growth.

The Oakdale Tank roof was subsequently inspected by DN Tanks in June 2016 and it was determined that the tank dome was structural sound. Polyurethane caulking was installed along dome cracks to seal the tank from environmental moisture as shown in Figure 5. This is a temporary repair that could be implemented quickly; the District obtained a proposal from DN Tanks for a more permanent repair involving removal of the temporary caulking and application of Aquafin 2K-M tape and mortar system to all dome cracks to provide a flexible waterproof repair. This more permanent repair is estimated to last 5-10 years before needing to be redone, so periodic inspection would be required.

Figure 5. Oakdale Tank Temporary Roof Repairs

The Lawrence Street Tank1 has only been inspected while on-line requiring inspection by divers or remote operated vehicle (ROV). The most recent inspection in 2016 with the ROV indicated that the roof was in poor condition and wall joints may have root intrusions. Prior inspections by actual divers did not indicate these poor conditions. Therefore, the District plans to take this tank off-line for a dry inspection this year, which will allow for a more thorough evaluation of its condition. Once this inspection occurs, further needs for rehabilitation of this tank will be assessed.

Chlorination and Manganese

Manganese sequestration complexes manganese to prevent its precipitation which creates the aesthetic problems with color and staining. This is the purpose of the blended polyphosphate that is added to the District's water. The goal is to keep the manganese in solution. The District has expressed concerns that the addition of sodium hypochlorite (an oxidant) could negatively impact the sequestration efforts. However, in regards to manganese, sodium hypochlorite is a weak oxidant and is only really effective at oxidizing manganese above

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pH 9.0 (at which point discoloration would occur). Figure 6 shows the effectiveness of chlorine at reducing soluble manganese (manganese in solution) otherwise described as the effectiveness of chlorine to precipitate manganese. At pH 7.5 and 8.0 the chlorine barely impacts the manganese (most would remain in solution), but at pH 9.0 the manganese readily converts from soluble form to precipitate form, with associated discoloration problems. Since the District maintains distribution pH at or below pH 7.2, chlorination should not negatively impact the District's ability to keep manganese in solution through its present practice of sequestration using the blended phosphate SLI 5385 by Shannon Chemical.

Figure 6. Ability of Chlorine to Oxidize Manganese at Different pH's

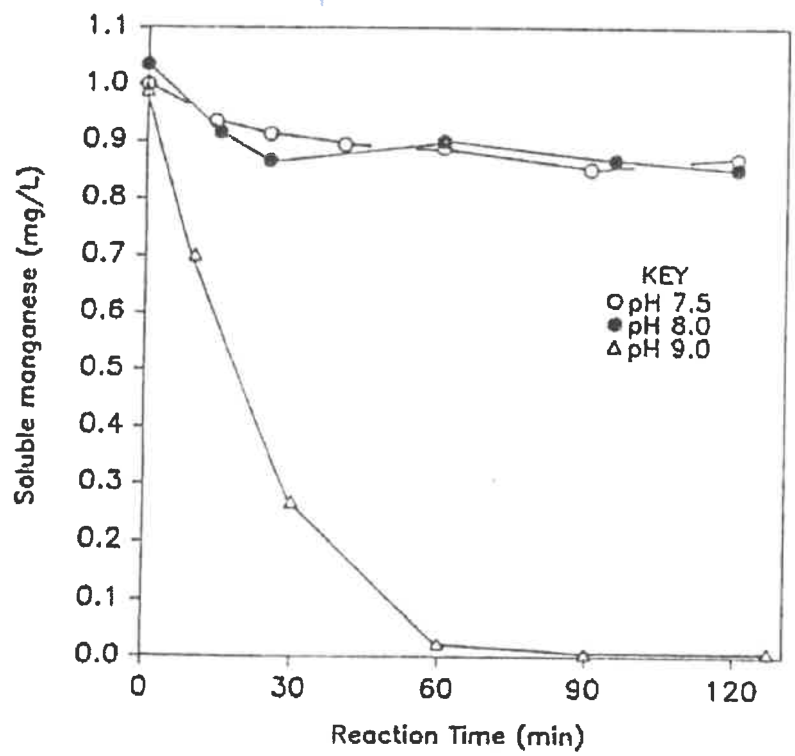

FIGURE 15. Effect of Solution pH on Mn(II) Oxidation by Free Chlorine (Temp. = 25°C; DOC < 1 mg/L; chlorine dosage equal to 4x stoichiometric).

Source: Knocke, et. al

Total Coliform and Chlorination – Summary of Findings

The total coliform events that have occurred over recent years appear to be the result of atypical system operations. Total coliforms have not been detected at the wells. Therefore, the coliforms are likely forming within the distribution system. Total coliforms can enter a water system through several sources and once in the water system may survive under certain conditions. For the District, some of the potential sources for the coliforms are:

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1. Soil and Water Surrounding Pipes – This possible source of total coliforms could have entered the water system during water main repair and construction.
2. Biofilms – This is a possible source of total coliforms although it is difficult to pin point. Random sampling of pipe surfaces may not detect the presence of biofilms.
3. Sediment in both pipes and tanks – This is a likely source of total coliforms. Legacy manganese has been observed by the District in the mains at ½ to ¾-inch thick coating. Also, the tanks collect sediment and the inspection reports indicate several inches to a foot of sediment in the Oakdale Tank and up to 2-inches in the Stockwell Road Tank. Sediment at thicknesses as low as ½-inch have been shown to support biological growth.
4. Customer Connections – This is a possible source of total coliforms that cannot be ruled out without extensive inspection.

Once in the system, coliforms are affected by several factors including water temperature, flow path changes, flow velocity changes, residence time, materials of construction and presence of nutrient sources. Note that high concentrations of phosphate can provide a nutrient source for total coliform. Bacteria will grow in phosphate stock solution unless chlorine is added (note that chlorine should not be added to zinc based phosphates). MassDEP requires a chlorine residual of 10 mg/L in the District's phosphate stock solution.

The following methods of prevention are offered as potential means to reduce the occurrence of total coliform detections within the District:

1. Disinfection during maintenance and construction – Continue to verify that contractors are taking steps to prevent contamination and properly disinfecting materials during installation.
2. Enhanced flushing program – The existing flushing program should be reviewed and enhanced to optimize flushing velocities and flow paths.
3. Remove sediment loading – Clean sediment from inside the tanks more frequently. Evaluate methods for reduction in sediment introduced into the system by reducing manganese loading.
4. Chlorination – Chlorine is often used to help reduce the occurrence of total coliforms. However, low concentrations of chlorine (normal operation chlorine levels) are not effective on bacteria in biofilms and sediments since the chlorine does not penetrate into the biofilm or sediment. Changes in the chlorine residual can also create problems. A sudden decrease in residual chlorine can cause biofilms to release bacteria into water. Continuous fluctuation in residual level can destabilize the biofilm, allowing for ongoing release of bacteria into water.
   a. MassDEP recommends chlorinating in advance and during system flushing.
   b. In addition to use of chlorination for total coliform mitigation, MassDEP recommends continuous chlorination for systems using phosphate.
   c. The MassDEP states in the *Guidelines for Public Water Systems* (Chapter 5, Section 5.6.6 Sequestering with Polyphosphates): "Where phosphate treatment is used, satisfactory chlorine residuals should be maintained in the distribution system."
5. Storage tank mixing – The storage tanks currently each have one shared inlet/outlet and no tank mixing. Addition of a mixing system would help to prevent water

stratification, reduce water temperature and reduce water age, which in turn will help reduce the occurrence of total coliform formation within the tanks.

Phosphate Addition, Manganese Sequestering and Corrosion Control

The distribution system is primarily comprised of 90% AC, 4% DI, 4% PVC, 2% CI water mains. Most of the services are iron (60%), some with cement lining and some without, and plastic (40%), with a very small portion of copper. The District has some lead goosenecks on older services. Copper is primarily used for plumbing within the customer's property. The District's most recent LCR sampling was conducted in 2017. The 90th percentile for lead was 0.0016 mg/L and for copper was 0.574 mg/L. These levels are well below the Action Levels of 0.015 mg/L for lead and 1.3 mg/L for copper.

The District only uses potassium hydroxide (pH adjustment) for corrosion control. The proprietary blended polyphosphate (SLI 5385 by Shannon Chemical) is provided for manganese sequestering, specifically for systems with high manganese levels. This blended polyphosphate has been successfully used by the District for manganese sequestration, as evidenced by the minimal number of discolored water complaints from customers. Polyphosphates, which are polymers containing linked orthophosphate ions in various structures are used mainly for sequestering iron and manganese. It may also provide a small incidental benefit for corrosion control since trace amounts of orthophosphate are detected in the distribution system (polyphosphates can convert to orthophosphate in the distribution system).

Doses of the phosphate range from an average of 4 to 6 mg/L at the three wells. Resulting orthophosphate levels within the distribution system range from non-detectable to 0.22 mg/L. These low system levels indicate that the District is appropriately feeding the phosphate.

In regards to corrosion control using potassium hydroxide, the target pH leaving the wells is about 7.2. Once in the distribution system the pH ranges from about 7.0-7.2 with alkalinity of about 40 mg/L as $CaCO_3$. Table 1 provides a summary of the pH, alkalinity and dissolved inorganic carbon or DIC (pH and alkalinity were measured and DIC is a predicted estimate of inorganic carbon based on the pH and alkalinity) at the wells and throughout the distribution system.

Table 1. pH, Alkalinity and DIC Levels

Date Sample Taken	3/28/2018			4/2/2018		
Location	pH	Alkalinity (mg/L as $CaCO_3$)	DIC*	pH	Alkalinity (mg/L as $CaCO_3$)	DIC*
Distribution System						
187 Prospect St	6.8	43	13	6.9	41	13
181 West Boylston St	7.1	32	9	7.2	33	9
76 North Main St	7.2	46	12	7.2	46	12
158 Sterling St	7.2	33	9	7.3	34	9

Date Sample Taken	3/28/2018			4/2/2018		
Location	pH	Alkalinity (mg/L as $CaCO_3$)	DIC*	pH	Alkalinity (mg/L as $CaCO_3$)	DIC*
183 Worcester St	7.2	43	11	7.3	35	9
164 Shrewsbury St	7.2	43	11	7.2	42	11
312 West Boylston St	6.9	43	13	6.8	40	13
Lawrence St Tank 1	6.9	39	13	6.9	28	8
Lawrence St Tank 2	6.7	43	14	7	43	13
Oakdale Tank	7.2	46	12	7.2	43	12
Stockwell Tank	7.2	34	9	7.2	33	9
Wells						
Oakdale Well - Treated	7.2	46	12	7.2	43	12
Oakdale Well - Raw	6.2	24	5	6.6	23	9
Lee St Well - Treated	6.6	41	15	6.9	40	12
Lee St Well - Raw	5.9	19	5	6.3	19	8
Pleasant Valley Well - Treated	7.1	36	10	7.1	37	10
Pleasant Valley Well - Raw	--	--	--	6.1	17	5

*DIC is estimated based on the measured pH and alkalinity.

Desktop verification that the target pH is in the correct range for corrosion control was conducted. First the finished water calcium and DIC were used to estimate the saturation pH of the system. Maintaining the pH below the saturation pH should help to minimize, although not eliminate, the potential for precipitating calcium carbonate which can interfere with ability to raise the pH and can physically obstruct water flow. Since the finished water calcium was not available, it was estimated with the finished water hardness (calculated by dividing finished water hardness by 2.5). For the Oakdale Well treated water, hardness is about 47 mg/L as $CaCO_3$ and calcium calculates to 19 mg/L. For the Pleasant Valley Well, hardness is about 22 mg/L as $CaCO_3$ and calcium calculates to 8.5 mg/L. For the Lee Street Well, hardness is about 48 mg/L as $CaCO_3$ and calcium calculates to 19 mg/L. Using this data, the theoretical saturation pH for calcium carbonate precipitation is estimated to be pH 8.4 – 9 (from USEPA, *Optimal Corrosion Control Treatment Evaluation Technical Recommendations for Primacy Agencies and Public Water Systems*, Exhibit 3.2, 2016). The District's target pH is 7.2 which is below the saturation pH.

The USEPA developed a screening tool for initial evaluation of corrosion control approaches using a variety of flowcharts. Using Exhibit 3.3 from the USEPA guide referenced above, Flowchart 3a was determined to be the correct flowchart for the District (presence of iron or manganese, lead and/or copper control, finished water pH less than 7.2). Since DIC is generally between 5-12 mg/L, the flowchart indicates that the corrosion control approach would involve raising the pH with caustic soda (potash is an alternative to caustic soda). This is the District's current approach to corrosion control (with potash). The USEPA guide notes three factors that could limit the use of pH/alkalinity/DIC adjustment as follows (1) optimal pH for other processes, particularly disinfection, (2) calcium carbonate precipitation and (3) oxidation of iron and manganese. It is cautioned that iron and manganese precipitates and pipe coatings can trap lead and copper and when released would be carried to the tap. Since the District has had success in compliance with the LCR, this does not appear to be a problem here.

The mechanisms involved with successful corrosion control are complex. Sudden changes in water chemistry can have adverse impacts on a corrosion control program. The District was required by the MassDEP through a Sanitary Survey to conduct a phosphate corrective action plan to minimize phosphate addition. However, based on the orthophosphate levels measured throughout the distribution system, it appears that the District is using phosphate at appropriate levels for manganese sequestering. The resulting levels in the distribution system are low. The existing pipe scale throughout the system, including legacy manganese, appears to be helping the District with LCR compliance. Depending on the system, manganese scale can assist or deter a water system's ability to meet compliance with the LCR. Recent research has shown that legacy manganese can adsorb trace amounts of inorganics, including lead, and then release contaminants at concentrated levels during a manganese release event. Should treatment changes be made, such as implementation of manganese removal treatment, the corrosion control approach must be re-evaluated.

Summary

Water quality within municipal drinking water systems is a complex and variable (system specific) issue, as acknowledged by MassDEP during recent Lead and Copper Rule training sessions offered at the various regional offices and by the USEPA corrosion control experts, particularly Michael Schock, USEPA's Office of Research and Development. Recognizing the complexity and variability of water quality issues, these experts generally advise to proceed with extreme caution when evaluating any chemistry addition modifications, as a narrow focus on one issue (i.e. reduction of phosphate addition in an effort to reduce total coliform issues) could unintentionally create new issues (increased lead and copper concentrations).

The data presented above shows that the levels of manganese in both the Oakdale Well and the Pleasant Valley Well exceed MassDEP goal of less than 0.2 mg/L. Sequestering does not remove manganese, only binds it in solution to prevent discoloration and staining so the potential health risks remain. Manganese removal requires use of a filtration type process. A new source is an alternative to removal type treatment. The District is pursuing a new well at the Pleasant Valley Well site. Test well work indicates this water could have non-detectable levels of manganese. Implementation of a permanent well and blending of this water with the existing Pleasant Valley Well could help to lower manganese levels.

The District will continue to monitor manganese levels in the Oakdale Well water and future actions will depend on multiple factors including the successful blending of the Pleasant Valley Well with the new well and the changing trend in the Oakdale Well manganese. Future actions regarding the Oakdale Well will be determined after completion of the new Pleasant Valley Well and may include (1) no action if manganese levels decrease to acceptable levels, (2) re-evaluation of the activity and treatment status of this well. Additional benefits to reducing the manganese include reducing the sediment loading to the system which may be contributing to the formation of coliforms.

The District has options for mitigating the occurrence of coliforms within the distribution system including (1) more frequent cleaning of the tanks, (2) optimized system flushing, (3) use of tank mixing systems, (3) chlorination before and during flushing. Note that should coliform "hits" become a persistent problem, MassDEP may require permanent use of chlorination. Additionally, for most manganese removal facilities, MassDEP would require carrying a chlorine residual in the finished water from the facility.

The District's current corrosion control program has been proven successful by its history of lead and copper test results. Since the blended polyphosphate used for sequestering has been shown to add measurable orthophosphate to the distribution system, this chemical may be contributing to the corrosion control program success. Care must be taken in making changes to the District's current treatment approach. Future changes, whether the addition of a new source, interconnection or treatment facility must be made after careful evaluation of the water qualities, blending potential and impacts on the distribution system.

Corrective Action Plan

The Corrective Action Plan will require implementation of methods to reduce manganese and the occurrence of total coliforms to achieve compliance with MassDEP requirements. After discussion of findings with the District at the Board of Water Commissioners' meeting on May 14, 2018, the following general plan was developed:

1. Continue plans to implement a new well at the Pleasant Valley Well site 2 and improve existing system operations
    a. Implementation of system maintenance tasks to reduce the occurrence of total coliforms including:
        i. Drain and inspect Lawrence St. Tank 1
            1. If repairs are needed, make repairs before putting tank back in service.
        ii. More frequent cleaning of the tanks,
        iii. Optimize system flushing,
        iv. Chlorinate before and during flushing.
    b. Execute easement with DCR for location of new well,
    c. Secure funding for new well,
    d. Complete design and permitting for new well,
    e. Construct new well and obtain MassDEP approval to activate supply,
    f. Commence pumping (intent is to pump Pleasant Valley Well 1 with Well 2 to provide blended supply with lower manganese),
    g. Re-evaluate the manganese levels of the Oakdale Well and its activity status,
    h. Continue water quality testing to monitor for manganese from each well and in the blended supply before the entry point to the system.
2. Consider supplemental or emergency supply from neighboring public water suppliers to improve supply redundancy should a well be off-line for any reason.

   a. Initiate discussions with neighboring public water suppliers regarding system interconnections for either emergency supply or more frequent supplemental supply.
   b. Complete Life-cycle Cost Analysis for comparison of the purchase of water through an interconnection with manganese removal treatment of the District's well(s). If Step 2b favors an interconnection, proceed to Step 2C. If treatment is preferred, then continue with Path 3 and Path 4.
   c. Complete a conceptual design for the interconnection and an intermunicipal agreement with the neighboring water supplier.
   d. Complete design, permitting and construction of interconnection infrastructure.
3. Initiate planning for manganese treatment removal of the existing Oakdale Well and/or Pleasant Valley Well in case the new well at the Pleasant Valley Well site 2 contains high manganese.
   a. Conduct desktop manganese removal treatment study including the following:
      i. Evaluate the advantages and disadvantages of various treatment process including biological, adsorptive, filtration and ion exchange media,
      ii. Conduct treatment facility site visits to other PWS treatment facilities utilizing the treatment processes included in the evaluation,
      iii. Prepare order-of-magnitude cost estimate for the various phases involved in implementing manganese treatment (pilot testing, conceptual design, full design and permitting, bid and construction)
   b. Prepare pilot protocol and submit to MassDEP for review and approval.
   c. Conduct pilot testing.
   d. Complete pilot testing report and conceptual design of treatment facility and submit to MassDEP for review and approval.
4. Depending on the results of Paths 1, 2 and 3, initiate implementation of manganese removal treatment.
   a. Secure funding for design,
   b. Complete design and permitting for treatment facility.
   c. Secure funding for construction (consider use of Drinking Water State Revolving Fund or USDA Rural Development Funds).
   d. Complete construction of new facility and DEP approval.

Paths 1, 2 and 3 are to occur concurrently so that should manganese removal treatment be required in the future, the District will have completed planning and be ready to initiate design and construction (Path 4). The attached manganese corrective action plan flow chart is provided for convenience in reviewing and discussing the above tasks and potential completion dates.

Please contact me at 508-281-5160 x399 or Michael Ohl, P.E. at x359 if you should have any questions or need any further information.

Sincerely,
COMPREHENSIVE ENVIRONMENTAL INC.

Kristen M. Berger, P.E.
Principal, Senior Engineer

encl. Attachment 1 Tank levels for September 20 – October 10, 2017
Attachment 2 Pump rates for September 20 – October 10, 2017
Flowchart 3a: Selecting Treatment for Lead and/or Copper with Iron and Manganese in Finished Water and pH<7.2
Manganese Corrective Action Plan Flow Chart

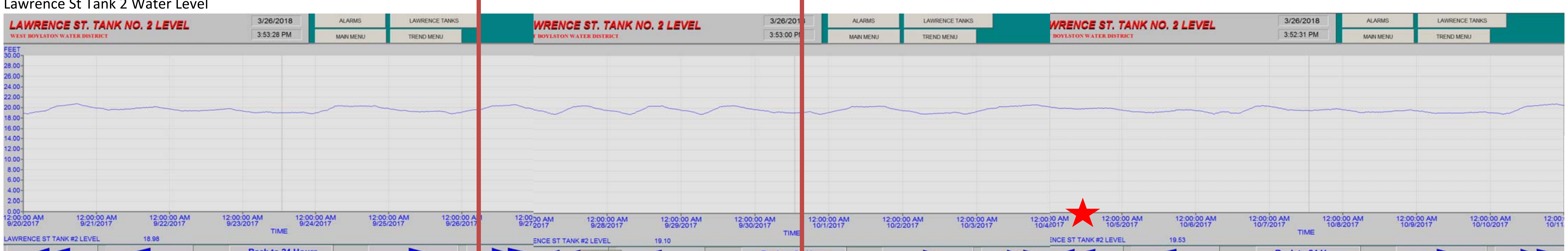
Attachment 1 – Tank Water Levels Sept/Oct 2017

Oakdale Tank Water Level

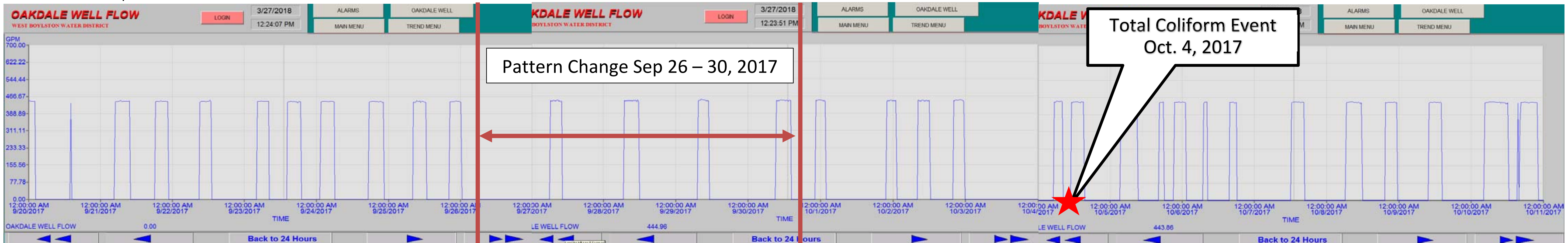
Stockwell Tank Water Level

Lawrence St Tank 1 Water Level

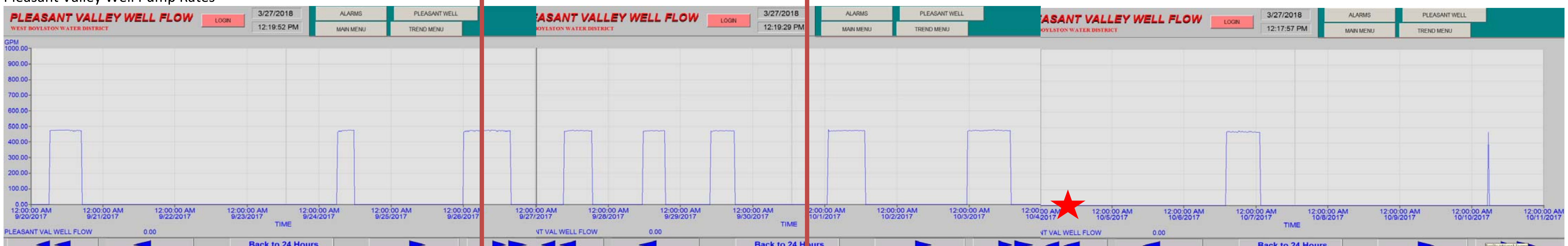
Lawrence St Tank 2 Water Level



Oakdale Well Pump Rates



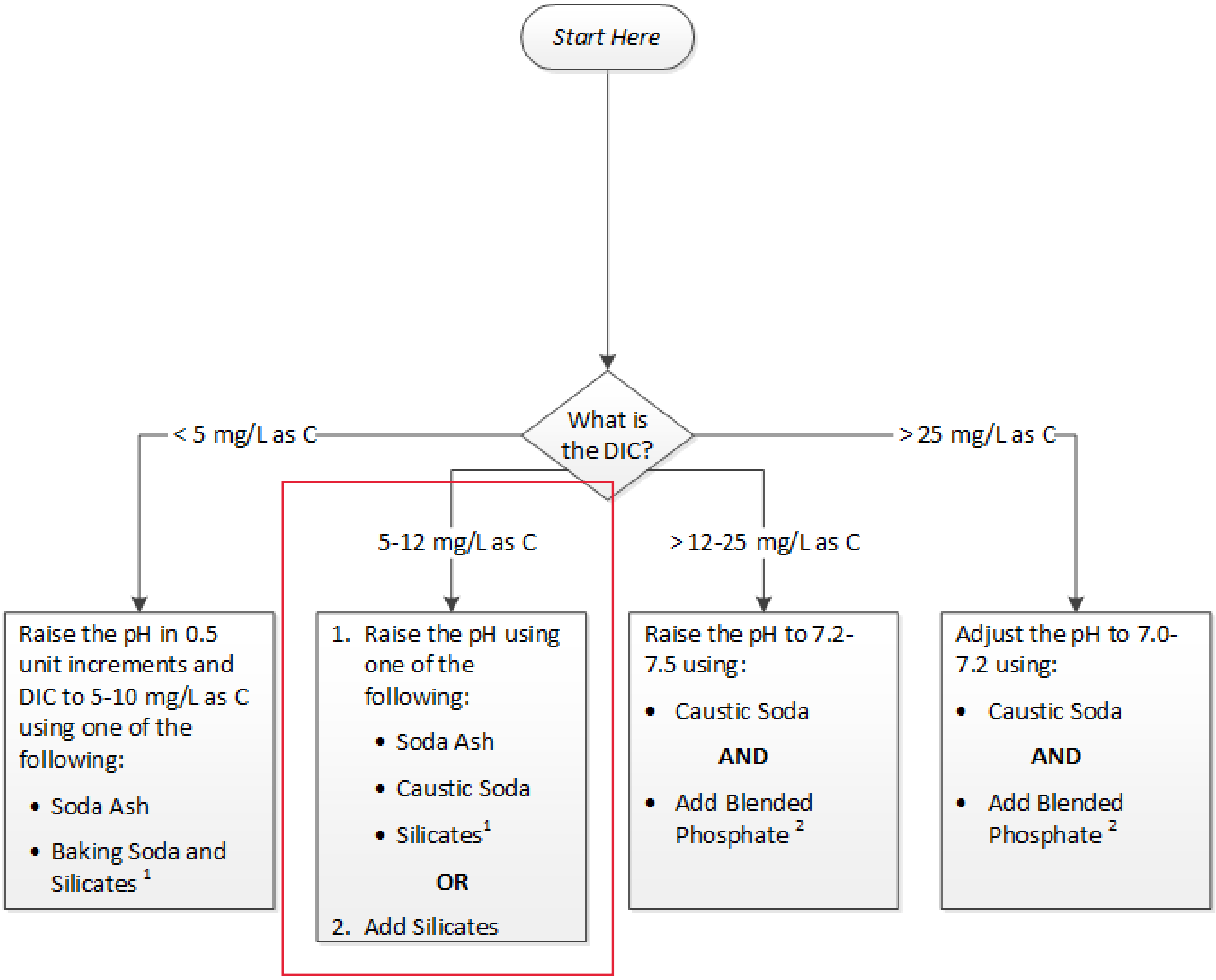
Pleasant Valley Well Pump Rates



Lee Street Well Pump Rates

Route 12 Booster Pump Rates

Flowchart 3a: Selecting Treatment for Lead and/or Copper with Iron and Manganese in Finished Water and pH < 7.2



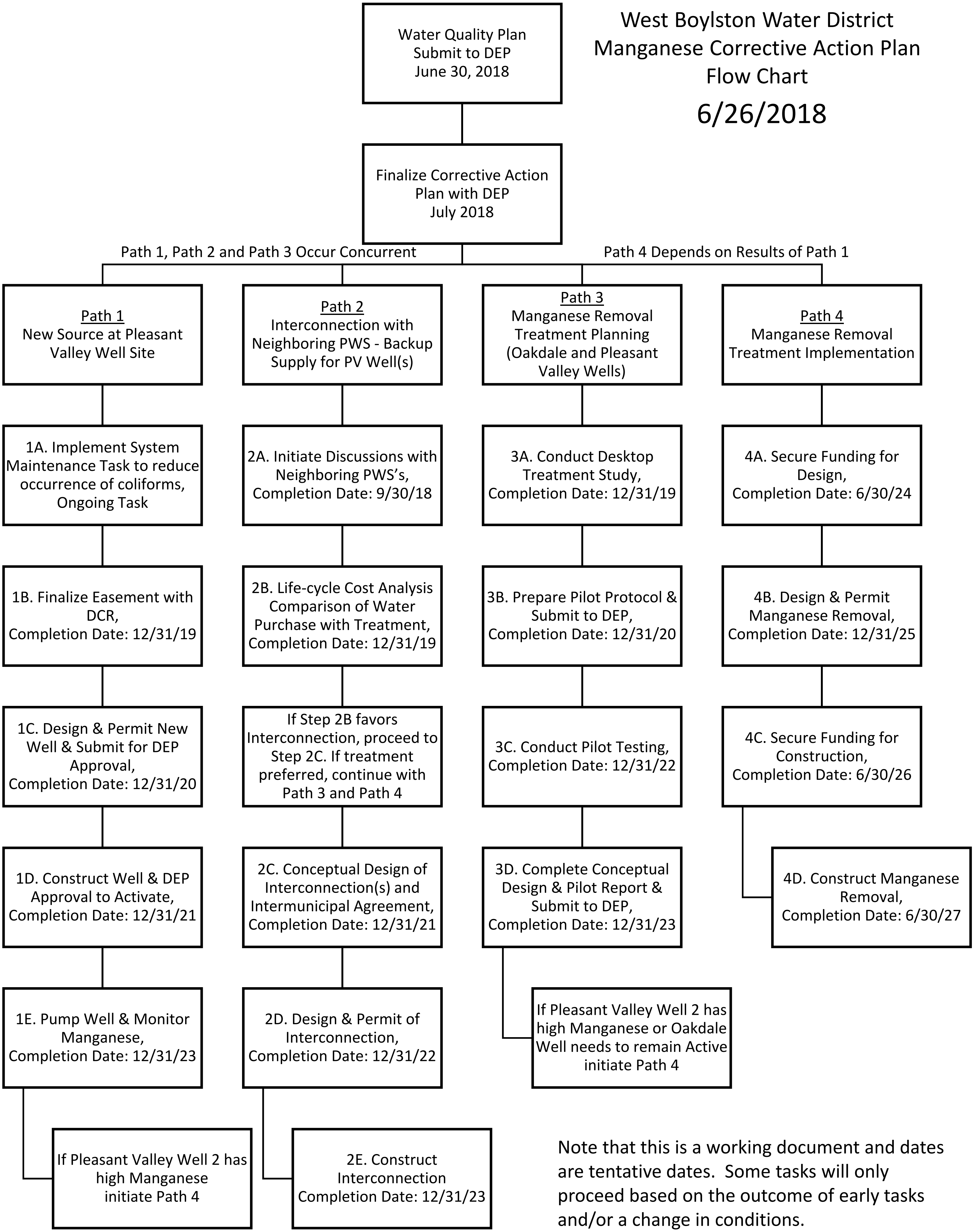
KEY:
AL = Action Level
Caustic soda = sodium hydroxide (NaOH)
DIC = Dissolved Inorganic Carbon
mg/L as C = milligrams per liter as carbon
Soda ash = sodium carbonate (Na_2CO_3)

Footnotes:

1. Silicates are most effective when combined iron and manganese concentrations are less than 1.0 mg/L.

2. The effectiveness of blended phosphate varies based on the formulation. Additional evaluation and/or monitoring is recommended. See Section 3.3.2 for additional discussion.

West Boylston Water District
Manganese Corrective Action Plan
Flow Chart
6/26/2018



Note that this is a working document and dates are tentative dates. Some tasks will only proceed based on the outcome of early tasks and/or a change in conditions.

Est. 1964
An Oriol Health Care Facility

OAKDALE REHABILITATION & SKILLED NURSING CENTER

Our family taking care of yours

August 19, 2016

VIA E-MAIL AND U.S. MAIL

Ms. Jane Downing
United States Environmental
Protection Agency-Region 1
Associate Director of Drinking Water
5 Post Office Square
Boston, MA 02109
Downing.jane@epa.gov

Ms. Yvette DePeiza
Massachusetts Department of
Environmental Protection
Director- Division of Water Supply
1 Winter Street
Boston, MA 02108
Yvette.Depeiza@state.ma.us

Mr. Michael Coveney
West Boylston Water District
Superintendent
183 Worcester St.
West Boylston, MA 01583
mcoveney@westboylstonwater.org

Re: Elevated Levels of Manganese in the Public Drinking Water Supply

Ladies and Gentleman:

I am contacting you as the government agencies responsible for the public drinking water supply in West Boylston, Massachusetts. I am the licensed Nursing Home Administrator ("NHA") of the Oakdale Rehabilitation and Skilled Nursing Center facility located at 76 North Main Street in West Boylston, Massachusetts. Recently, we detected a discoloration in sinks, toilets, and the laundry at our facility. In order to mitigate any potential health risks, we began providing bottled water to the residents, staff, and visitors as an alternate water supply, and are now also using bottled water in the kitchen. We tested the water to attempt to identify the cause of the issue.

The enclosed laboratory report identifies elevated levels of manganese in the water at our skilled nursing facility. Manganese was detected in the water at concentrations of 0.69 mg/L. This concentration exceeds both the U.S. Environmental Protection Agency ("EPA") level of .05 mg/L level for manganese and Massachusetts Department of Environmental Protection ("MDEP") Regulatory Limit for lifetime exposure to manganese at 0.3 mg/L.

We feel it is prudent to notify you of the elevated levels of manganese in the public drinking water supply. We request your immediate response to identify a resolution to this issue.

Sincerely,

Nathan Oriol

Enclosure

ETR Laboratories
Environmental Testing and Research Laboratories, Inc.
Same as Client

Report #: 81216665
Date : 8/12/2016
P.O.Number: Visa 8-12-16
Matrix: Water
Client: Oakdale Rehabilitation Attn: John Boyce
Sample Location 76 North Main Street
Oakdale MA 01583

This sample taken by Nick/ETR Labs at 2:00:00 PM on 8/12/2016. . Point of collection: Laundry Room Sink

Standard Scan Report

	Results		**Public Drinking Water EPA Limits**
General Bacteria			
Total Coliform	Absent	Animal or Vegetational Bacteria	0
Fecal/E. Coli	Absent	Animal Bacteria	0
General Chemistry			
Sodium	33.61 mg/L	20.0 mg/L is Mass. DEP Guideline	250.0 mg/L
Potassium	26.27 mg/L	A Component of Salt	No Limit
Copper	0.02 mg/L	Indicates Plumbing Corrosion	1.30 mg/L
Iron	0.07 mg/L	Brown Stains, Bitter Taste	0.30 mg/L
Manganese	0.69 mg/L	May Cause Laundry Staining	0.05 mg/L
Magnesium	1.83 mg/L	A Component of Hardness	No Limit
Calcium	17.45 mg/L	A Component of Hardness	No Limit
Arsenic (Total)	Not Detected	A Naturally Occurring Toxic Element	0.010 mg/L
Lead	Not Detected	A Toxic Metal	0.015 mg/L
Zinc.	Not Detected	A Toxic Metal	5.0 mg/L
pH	7.20 SU	Acid/Basic Determination	6.5 - 8.5 SU
Turbidity	0.02 N.T.U.	Presence of Particles	No Limit
Color	Not Detected	Clarity (0), Discoloration (15)	15.0 C.U.
Odor	Not Detected	Odor due to Contamination	3.0 T.O.N.
Conductivity	337.0 umhos	Electrical Resistance (umhos/cm)	No Limit
T.D.S.	202.2 mg/L	Total Dissolved Minerals Present	500.0 mg/L
Sediment	Absent	Undissolved Solids	Present
Alkalinity	70.0 mg/L	Ability to Neutralize acid	No Limit
Chlorine	Not Detected	A Disinfectant	4.0 mg/L
Chloride	56.11 mg/L	A component of salt	250.0 mg/L
Hardness	51.1 mg/L	0 - 75 is considered soft	No Limit
Nitrate as Nitrogen	0.79 mg/L	Indicator of Biological Waste	10.0 mg/L
Nitrite as Nitrogen	Not Detected	Indicator of Waste	1.0 mg/L
Ammonia as Nitrogen	Not Detected	Indicator of Waste	No Limit
Sulfate	9.58 mg/L	A Mineral, Can Cause Odor	250.0 mg/L

DRAFT CAPITAL EFFICIENCY PLAN™
MARCH 2016

West Boylston Water District
West Boylston, Massachusetts

TATA & HOWARD

TATA & HOWARD

March 16, 2016

Mr. Michael Coveney
West Boylston Water District
183 Worcester Street
West Boylston, MA 02043

Subject: Capital Efficiency Plan™
West Boylston Water District
T&H Project No. 3278

Dear Mr. Coveney:

In accordance with our agreement, Tata & Howard is pleased to present you with two copies of the Draft Capital Efficiency Plan™. The analysis and improvements in this report are based on the Three Circle 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.

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, water hammer, 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, Ms. Justine Carroll, P.E. served as Project Manager, Mr. Steve Daunais served as Project Engineer, Ms. Maya Rhinehart served as Engineer, Ms. Karen Gracey, P.E. provided technical reviews, and the undersigned served as Project Officer. We look forward to your review and comments on this draft report.

Tata & Howard
67 Forest Street | Marlborough, MA 01752
T: 508-303-9400 | F: 508-303-9500
www.tataandhoward.com

Other Offices
MA | NH | CT | ME | VT | AZ

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

Sincerely,

TATA & HOWARD, INC.

Jenna W. Rzasa, P.E.
Vice President

Enclosures

Capital Efficiency Plan™
West Boylston Water District
West Boylston, Massachusetts

DRAFT

Prepared by:

TATA & HOWARD

March 2016

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G	Recommended Improvements Maps

Section 1

TATA & HOWARD

SECTION 1 – Executive Summary

1.1 General

Tata & Howard, Inc. was retained by the West Boylston Water District (District) to complete a Capital Efficiency Plan™ for the West Boylston 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 District's capital budget. The study evaluates the existing water infrastructure including water transmission and distribution piping and appurtenances. In addition, water storage needs are evaluated and prioritized. The condition of the above ground facilities, including water supplies, water treatment facilities, and water storage tanks, 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 is optimized.

Population projections published in the 2012 Regional Transportation Plan developed by the Central Massachusetts Regional Planning Commission (CMRPC) were utilized for this study. The estimated 2035 population for the Town is 8,860. The District serves approximately 91 percent of the Town's population. Based on a projected service population of approximately 8,060 the projected estimate for the 2035 average day demand (ADD) is 0.70 million gallons per day (mgd). The projected ADD was used to estimate a projected 2035 maximum day demand (MDD) of approximately 1.63 mgd and a summer average day demand (SADD) of 0.80 mgd. The demand projections were input into the hydraulic model and simulations were run to identify potential system hydraulic deficiencies.

Priority 1 hydraulic improvements included recommendations that would strengthen the transmission capabilities of the system or provide an ISO recommended fire flow to a certain area. Priority 2 recommendations were identified as part of a system wide evaluation to improve estimated needed fire flows and system looping.

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 District and include water department facilities, medical facilities, schools, and business districts. Critical water mains include primary transmission lines as well as water mains that cross over major highways, rivers, and railroad tracks, and cross country mains.

An asset management assessment was completed for the system. A number of factors are considered in the ratings including: break history, material, age, diameter, soil conditions, water quality, potential for water hammer, and pressure. 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 36 are considered to be in good to excellent condition. Areas with a total rating between 36 and 49 are considered to be in fair to good condition, and areas with a total rating greater than 49 are considered to be in poor to fair condition.

Utilizing the Three Circle Approach, improvements were recommended and prioritized based on the aforementioned criteria. Phase I improvements include any recommended improvements that fall into all three circles and are therefore, hydraulically deficient, critical, and have a high asset management score. The total estimated probable construction cost of the Phase I recommended improvements is $3,041,000. 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 $14,940,000. Phase III recommendations include any recommended improvements that are needed hydraulically or that have a high asset management score indicating poor condition. The total estimated probable construction cost of Phase IIIa and Phase IIIb improvements is approximately $11,153,000. These mains are identified on the Recommendations Map in Appendix G.

Section 2

TATA & HOWARD

SECTION 2 – Existing Water System

2.1 Distribution System

The West Boylston Water District (the District) was formed by an Act of the State Legislature in 1933. Since that time, the water system has expanded throughout the Town and currently provides water service to approximately 91 percent of the Town's population. The reported service population in 2014 was 7,201.

The current system is comprised of approximately 58 miles of water mains ranging in diameter from two to 16 inches. Figure No. 2-1 shows a breakdown of the water main size distribution. Approximately four percent of the system is 16-inch diameter pipe, approximately six percent is 12-inch diameter pipe, approximately eight percent is 10-inch diameter pipe, approximately 70 percent is 8-inch diameter pipe, approximately ten percent is 6-inch diameter pipe, and approximately two percent is 4-inch diameter or smaller. These mains are constructed of various materials including asbestos cement, ductile iron, polyvinyl chloride (PVC), cast iron, and steel. There is approximately 79 percent asbestos cement, approximately nine percent ductile iron water main, approximately nine percent PVC, approximately three percent of cast iron, and less than one percent steel and Blue Brute water main. Figure No. 2-2 shows the breakdown of material distribution of the existing water system. The system also includes three groundwater supply sources at three well sites, and three water storage tanks. The wells are all located in the Nashua River basin and include Lee Street Well No. 4, Pleasant Valley Well, and Oakdale Well. A map of the existing water distribution system is included in Appendix A.

The system is divided into the High and Low Service Areas. The Low Service area (LSA) is supplied by the Oakdale Well and Pleasant Valley Well. The High Service Area (HSA) is supplied by Lee Street Well No. 4. Since no back-up power supply exists at the Lee Street supply, the Oakdale Well and Pleasant Valley Well are capable of supplying water to the High Service Area through a booster pump station on Route 12. Additionally, the High Service Area can supply water to the Low Service Area through various interconnections throughout the distribution system in an emergency. The Lee Street High Service Area, located within the HSA, and the Western Avenue High Service Area located within the LSA are serviced by booster pump stations (Lee Street Booster Pump Station and Western Avenue Booster Pump Station). In addition, the Laurel Street Pump Station boosts pressure to the western end of Laurel Street.

2.2 Water Supply Sources

The District's active water supply sources are the Oakdale Well, Lee Street Well No. 4, and the Pleasant Valley Well. In addition, there is an emergency connection with the City of Worcester and an emergency connection with the Town of Sterling.

Oakdale Well

The Oakdale Well is located on Thomas Street and serves the LSA. The Oakdale Well is a gravel packed well constructed to a depth of 56 feet. A Goulds, model 10RJLO, 500 gpm pump was installed in 2008. Potassium hydroxide is added to the water for corrosion control and blended phosphate is added for manganese sequestration. Oakdale well is equipped with an emergency power source.

Figure No. 2-1
Water Main Diameter Distribution

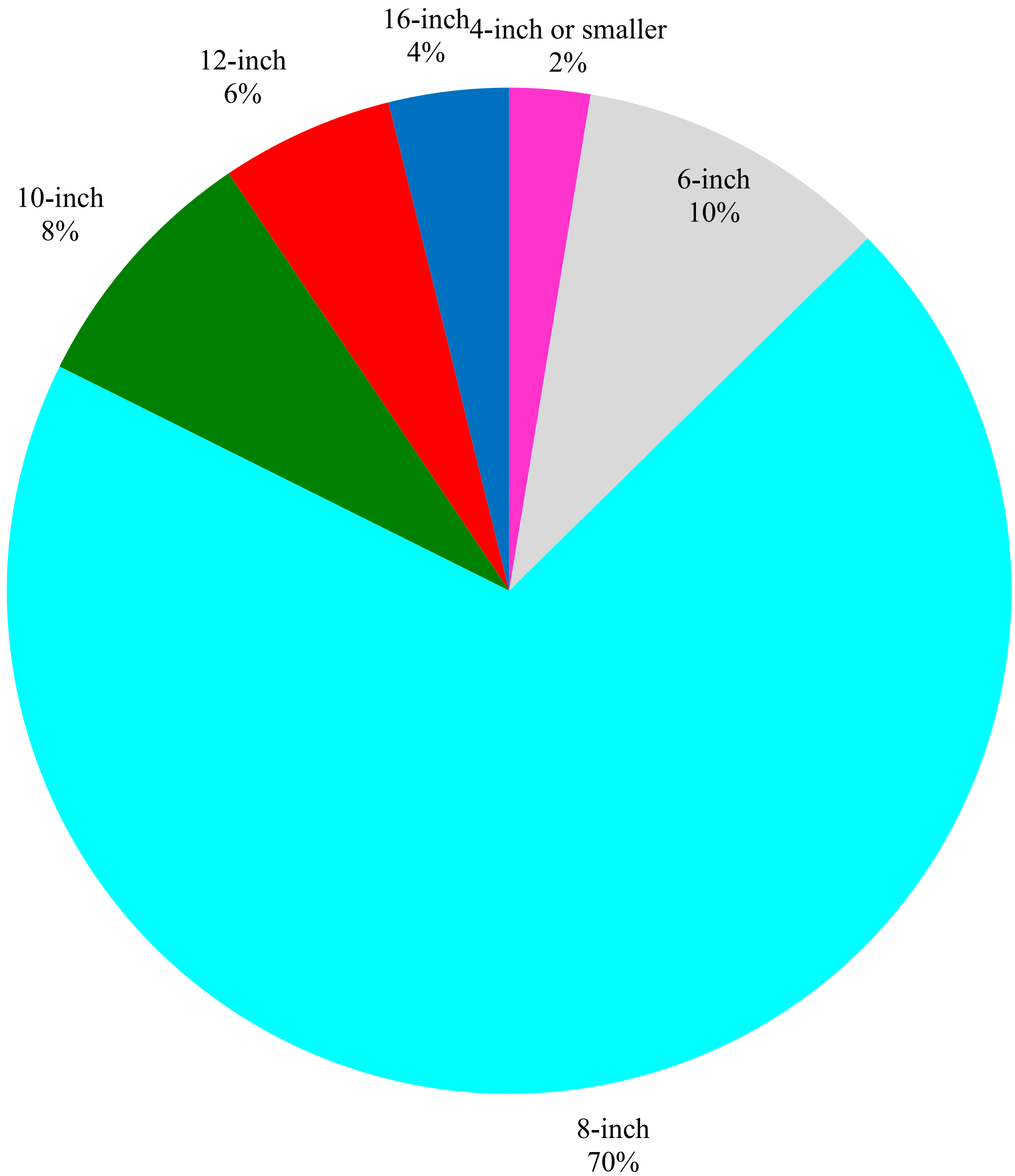
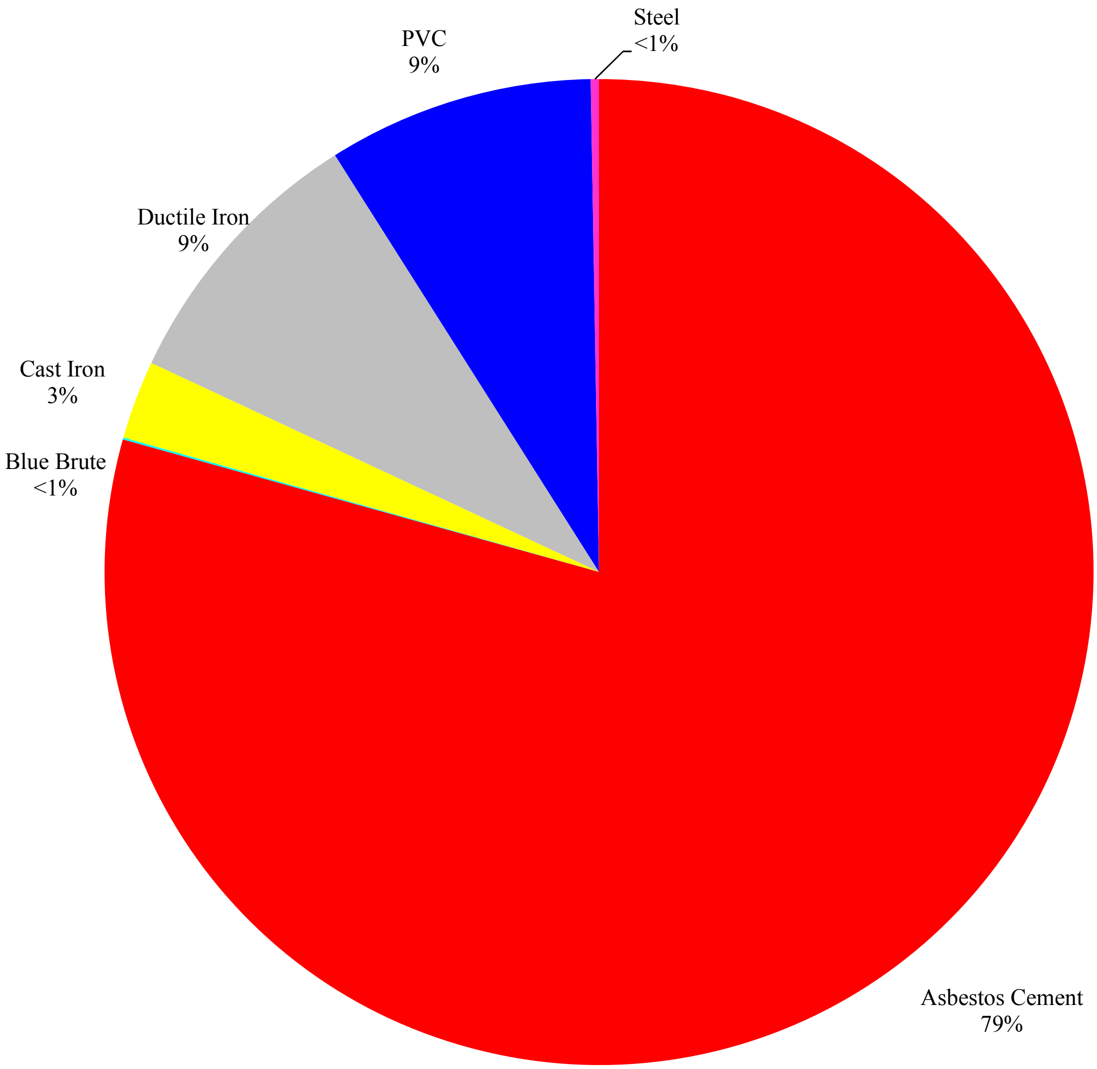


Figure No. 2-2
Water Main Material Distribution



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Lee Street Well No. 4

The Lee Street Well No. 4 is located on Lee Street and serves the HSA. The gravel packed well is constructed to a depth of 46 feet. A 250 gpm Goulds pump, model 7CHC-10 Stage, was installed in 2001. Potassium hydroxide is added to the water for corrosion control and blended phosphate is added for manganese removal. The Lee Street Well No. 4 is not equipped with an emergency power source.

Pleasant Valley Well

The Pleasant Valley Well, located at 131 Temple Street, is a gravel packed well serving the LSA. The well was constructed to a depth of 111 feet and has a Goulds, model 10RJMO, 500 gpm pump which was installed in 2008. Potassium hydroxide is added to the water for corrosion control and blended phosphate is added for manganese removal. The Pleasant Valley Well is equipped with an emergency power source.

2.3 Water Storage Facilities

Lawrence Street Storage Tank No. 1 is located off Lawrence Street in the HSA. The tank is a below grade tank with a height of nine feet, an overflow elevation of 794 feet and a capacity of 0.43 million gallons (mg). The Lawrence Street Storage Tank No. 2 is located adjacent to Lawrence Street Storage Tank No. 1. The concrete tank was constructed in 1978 with a diameter of 90 feet. It has a capacity of 1.2 million gallons (mg) and an overflow elevation of 794 feet.

The Stockwell Road Tank and the Oakdale Tank serve the LSA. The Stockwell Road Tank, constructed in 1965, is located in the central portion of the system off Route 12. It is a 70 foot diameter concrete tank with a capacity of approximately 0.95 mg and an overflow of 633 feet. The Oakdale Tank, located off Beaman Street, has a capacity of 0.5 mg and an overflow of 633 feet. The concrete tank was built in 1958 with a 50 foot diameter.

2.4 Booster Pump Stations

The Route 12 Booster Pump Station, located off West Boylston Street (Route 12), conveys water from the LSA to the HSA The pump station contains two 750 gpm Goulds model 3656 pumps installed in 2010. The Route 12 Booster Pump Station is equipped with an emergency power source.

The Laurel Street Booster Pump Station, located off Laurel Street, contains three variable speed vertical multi-stage centrifugal pumps that were installed in 2006. The three centrifugal pumps have design capacities of 25, 50, and 75 gpm, respectively. The pump station boosts pressures to the western end of Laurel Street. The Laurel Street Booster Pump Station is equipped with an emergency power source.

The Western Avenue Booster Pump Station serves the Western Avenue High Service Area located in the northern portion of the LSA off Western Avenue. Two 100 gpm pumps are located in the pump station. The station serves the higher elevations on the northern end of Prescott Street. The Wester Avenue Booster Pump Station is not equipped with an emergency power source.

The Lee Street Booster Pump Station serves the Lee Street High Service Area and contains two pumps with an aggregate capacity of 100 gpm. The pump station, located in the HSA, serves the higher elevations on Lee Street, Goodale Street, and Brooks Crossing. The Lee Street Booster Pump Station is not equipped with an emergency power source.

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 their existing demand estimates.

3.2 Population Projections

Because population has a direct correlation to water consumption, population projections published by the Central Massachusetts Regional Planning Commission (CMRPC) through the year 2035 were reviewed to consider planned growth within the Town. The following section reviews historical population data and presents an estimated future population based on available information.

According to the United States Census, the Town of West Boylston has experienced fluctuating population changes from 1980 through 2010 with an overall growth of approximately 20 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 7,669.

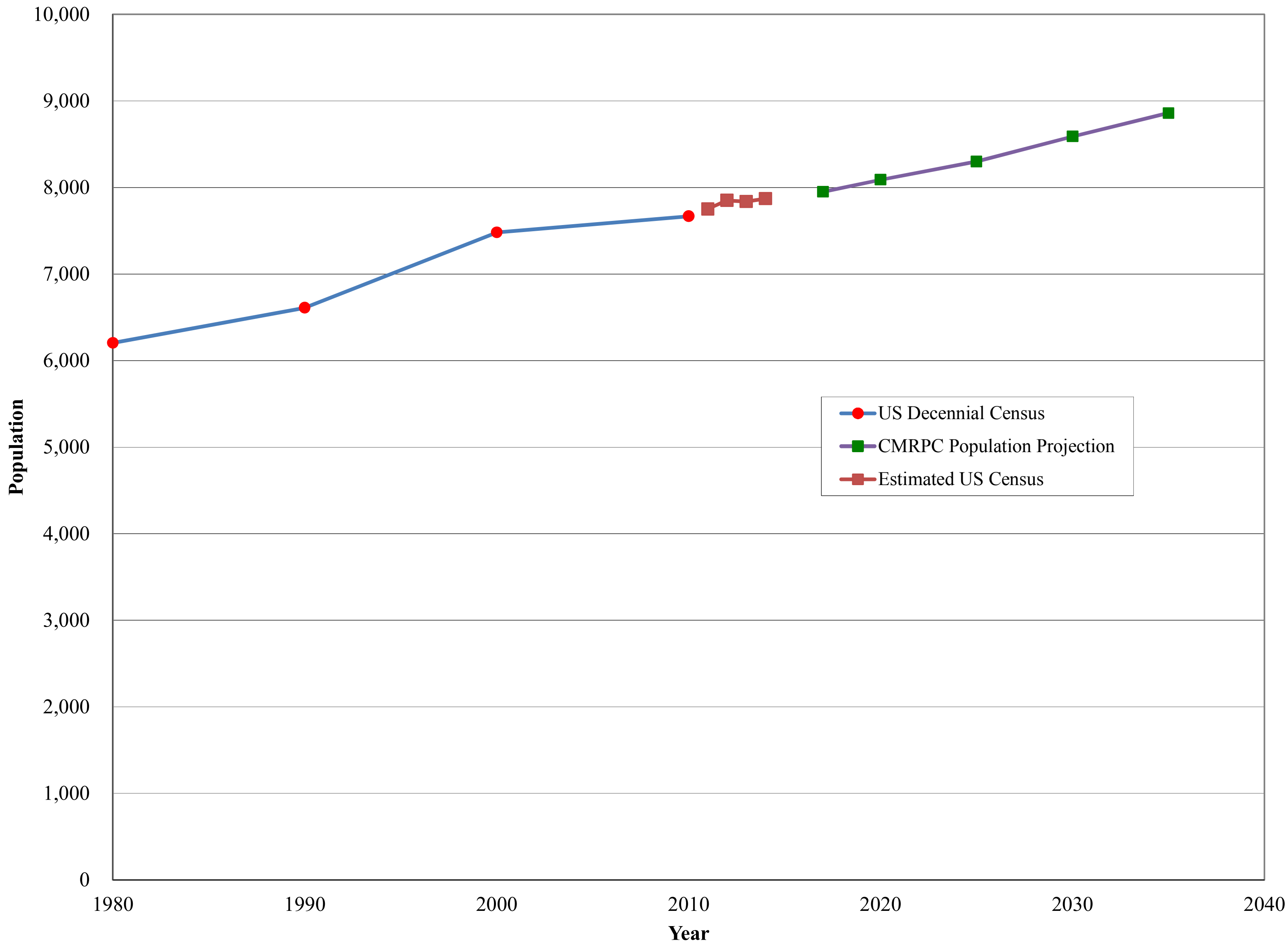
Population projection data was collected from the 2012 Regional Transportation Plan completed by the CMRPC and included in Figure No. 3-1. The projections include the year 2017 and are then provided in five year intervals from 2020 through 2035. Based on this plan, the estimated 2035 population is approximately 8,860. The District reportedly serves approximately 91 percent of the Town's population. At this time there are no plans to expand the service population. Therefore, the estimated 2035 service population is approximately 8,060.

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. It is important to note that the DCR has a key role in the water management approval process and demand projections are required to be approved by DCR before MassDEP will approve development of a new water supply source or authorize the withdrawal of additional volume from existing sources.

The DCR is in the process of preparing or updating demand projections for all Massachusetts communities in conjunction with the WMA permit renewal process. DCR has not completed demand projections for West Boylston at this time. Therefore, future demands were calculated based on the population projections developed by the CMRPC.

Figure No. 3-1
Historic and Projected Populations



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The Massachusetts Water Resource Commission (MWRC) has adopted new Conservation Standards for all registered and permitted withdrawals:

- Maximum residential consumption of 65 gallons per capita per day (gpcd)
- Maximum of 10 percent unaccounted-for water.

Residential Consumption

Residential consumption is calculated by dividing water supplied to residential connections by the reported population. There are standards for all Public Water Suppliers to meet 65 gpcd. Public Water Suppliers currently meeting 65 gpcd will be required to develop a Seasonal Demand Management Plan to manage non-essential outdoor water usage. Public Water Suppliers who have not consistently met the 65 gpcd will be required to develop and implement MassDEP approved Compliance Plans, including the use of Best Management Practices to meet the residential consumption standard. The residential consumption has ranged from approximately 52 to 60 gpcd between 2010 and 2014 as reported in the District's Annual Statistical Reports (ASR).

Non-residential Consumption

Non-residential water usage includes commercial, industrial, municipal, and recreational water use. The 2010 through 2014 Annual Statistical Reports do not indicate a trend in non-residential consumption. The average non-residential consumption between 2010 and 2014 was approximately 20 percent of total consumption. Commercial, industrial, municipal, and recreational water use is not expected to increase significantly over the next 20 years; therefore, an average non-residential consumption of approximately 20 percent of total consumption was used for water use projections.

Unaccounted-for Water

Unaccounted-for or non-revenue water consists of unmetered water used for street cleaning, water main flushing, meter inaccuracy, unauthorized water uses, fire fighting, and leakage in the distribution system. This term is typically expressed as a percentage of the total water supplied to the system. Unaccounted-for water can be estimated by taking the difference between the total amount of water supplied and the total water billed and dividing by the total water supplied. The District's reported unaccounted-for water from 2010 through 2014 has ranged from approximately one to 10 percent.

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 millions of gallons per day (mgd). This demand includes all water used for domestic (residential), commercial, industrial, agricultural, and municipal purposes. The municipal component includes water used for system maintenance such as hydrant flushing and fire flows. In addition, the ADD includes unaccounted-for water attributed to unmetered water uses and system leakage.

According to the year 2010 through 2014 ASRs, the ADD supplied for the District ranged from 0.49 mgd to 0.54 mgd. The historic ADDs are shown in Table No. 3-1.

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

- Residential consumption of 60 gpcd for existing population
- Residential consumption of 65 gpcd for projected population
- Existing service population approximately 7,201
- Year 2035 additional service population of approximately 859
- Non Residential usage remains the same at 20% of the total usage
- Maximum of 10 percent unaccounted for water

The estimated ADD for the design year 2035 based on the above criteria is approximately 0.70 mgd, as shown in Table No. 3-1.

Summer Average Day Demand

MassDEP guidelines recommend that a system consider a projected Summer ADD (SADD). The current SADD is estimated by averaging demands from the three maximum months for the past five years. Based on available data between 2010 and 2014, the SADD ranged from 0.58 mgd to 0.61 mgd. The SADD peaking factor is determined by dividing the SADD by the annual ADD for each of the past five years. These peaking factors are averaged to estimate the future summer peaking factor. Based on the 2010 through 2014 monthly demand data, the average summer peaking factor is 1.14. Based on the projected ADD of 0.70 mgd, the estimated SADD is approximately 0.80 mgd.

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. According to the 2010 through 2014 ASRs, the MDD for the District ranged from 0.91 mgd to 1.26 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. Upon comparison of the historical MDD to ADD ratios, the ratios range from 1.75 to 2.33. The resulting projected MDD, based on the highest MDD/ADD ratio of 2.33, is approximately 1.63 mgd. The historic and estimated MDD is shown in Table No. 3-1.

Peak Hour Demand

Peak hour demand is the maximum total quantity of water supplied in a single hour over a one-year period typically expressed in mgd. These demands are typically met by distribution water storage facilities.

Since system records of peak hourly demands are not available, the peaking factor for the current usage and design year 2035 was estimated based on typical historical consumption for communities of similar size. The MDD/ADD ratio for a community can be used to estimate the peak hour/ADD peaking factor. Using the MDD/ADD ratio, and the Merrimack Curve, the corresponding peak hour peaking factor for the system is approximately 4.1. Using an ADD of 0.70 mgd and current trends, the projected peak hour flow for the year 2035 is estimated at 2.8 mgd.

Table No. 3-1
Current and Projected Water Use

Year	ADD (mgd)	SADD (mgd)	Peaking Factor (SADD/ADD)	MDD (mgd)	Peaking Factor (MDD/ADD)	Peak Hour Demand (mgd)
2010	0.49	0.58	1.18	1.03	2.10	*
2011	0.47	0.55	1.17	0.91	1.94	*
2012	0.52	0.61	1.17	1.05	2.02	*
2013	0.53	0.60	1.13	0.93	1.75	*
2014	0.54	0.58	1.07	1.26	2.33	*
2035	0.70	0.80	1.14	1.63	2.33	2.80

*Peak hour information for 2010 through 2014, was not available.

3.3 Adequacy of Existing Water Supply Sources

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. However, 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 sub-basin (the basin safe yield) prior to issuing a permit. It is important to note that the basin safe yield is different from the available yield of a supply. In accordance with the WMA permit application instruction, the basin safe yield is the total water available to be withdrawn from a river basin or sub-basin, whereas the available yield of a well is the volume of water the well is capable of pumping under the most severe pumping and recharge conditions that are realistically anticipated.

The District's water supply system is comprised of three groundwater sources. The District has a registered volume of 0.56 mgd. The highest ADD in the previous five years was 0.54 mgd in 2010, just under the registered volume. The projected 2035 ADD is greater than the District's registered volume. If the population in West Boylston grows as anticipated, the District would have to obtain a Water Management Act Permit to increase the approved daily pumping rate.

MassDEP guidelines recommend that a system have adequate supply to meet (1) the MDD with all sources on-line; and (2) the SADD with the largest source off-line. Table No. 3-2 summarizes the approved daily pumping volume for each source as reported in the District's ASRs. The system's total combined daily pumping volume of the active supply sources is approximately 2.12 mgd. Compared to the projected MDD of 1.63 mgd, a surplus of 0.49 mgd is available. The Oakdale Well is the largest source for the District; therefore, the available supply with the Oakdale Well offline is 1.08 mgd. Compared to the projected SADD, there is a surplus of 0.27 mgd.

Table No. 3-2
Source Maximum Pumping Rates

Name of Supply	Maximum Pumping Rate (mgd)
Oakdale Well	1.04
Lee Street Well	0.36
Pleasant Valley Well	0.72
Total	**2.12**

The adequacy of the existing supplies is based on being able to maximize the Oakdale Well. Although the maximum daily pumping volume from the well is 1.04 mgd, the reported pump capacity is 0.72 mgd and based on the reported pumping rates, the total amount pumped from the Oakdale Well did not exceed 0.50 mgd from 2010 through 2014. The District currently does not pump this well to capacity due to water quality concerns with manganese in the water distribution system. If the existing capacity of the Oakdale Well is reduced to 0.50 mgd instead of 1.04 mgd, the total maximum pumping rate from all sources would be 1.58 mgd. Based on the projected MDD, there would be a supply deficit. The District would need to consider treatment for manganese removal at the Oakdale Well to maximize the existing supplies.

3.4 Adequacy of Existing Water Storage Facilities

Distribution storage is provided to meet peak consumer demands, such as peak hour demands and 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. The three components of the storage evaluation were calculated under current demand conditions for the LSA and HSA. Based on usage data, the LSA represents approximately 35 percent of the total demands and the HSA represents approximately 65 percent of the total demands.

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 medium 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. The West Boylston system would be considered a medium sized system. As a result, twenty percent of the 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. This basic fire flow is defined as a fire flow indicative of the quantities needed for handling fires in important districts, and usually serves to mitigate some of the higher specific fire flows. Within the West Boylston system, a basic fire flow of 2,500 gpm for a duration of two hours was used for the storage evaluation for the LSA and HSA.

The emergency storage component is typically equivalent to one ADD. However, if there is emergency power available at the sources or emergency connections with surrounding communities capable of supplying at least an ADD, the emergency storage component can be waived. Emergency power is available for the Oakdale Well and Pleasant Valley Well, therefore; the emergency component has been waived for the LSA storage evaluation. Emergency power is available at the Route 12 Pump Station, therefore, the emergency component has been waived for the HSA storage evaluation.

Since there are two service areas, each area needs to be evaluated as a separate entity. Based on the configuration of the two pressure zones, approximately 35 percent of the demands are in the Low Service Area and 65 percent are in the High Service Area. Based on these percentages, the storage evaluations were calculated under current and projected 2035 demand conditions.

Low Service Area

1. Equalization
- Medium sized system = 20 percent of the Maximum Day Demand
- LSA Maximum Day Demand in year 2014 = 0.44 mgd
- Estimated LSA Maximum Day Demand in year 2035 = 0.57 mgd

- LSA Equalization (2014) = 0.20 x 0.44 = 0.09 mg
- LSA Equalization (2035) = 0.20 x 0.57 = 0.11 mg

2. Basic Fire Flow Requirement
- Representative fire flow = 2,500 gpm
- Duration of 2 hours or 120 minutes

- Basic Fire Flow Requirement = 2,500 x 120 = 0.30 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 2014) and projected (2035) total required storage is as follows:

- Total LSA Required Storage (2014) = 0.09 mg + 0.30 mg = 0.39 mg
- Total LSA Required Storage (2035) = 0.11 mg + 0.30 mg = 0.41 mg

Under existing and projected ADD, MDD, and peak hour demands, a minimum pressure of 35 psi should be maintained throughout the distribution system. A minimum pressure of 20 psi should be maintained under MDD conditions with a coincident fire flow. The highest user, a hydrant on Campground Road, is at an elevation of approximately 563 feet. The Oakdale Tank and Stockwell Road Tank serve the LSA. To maintain a pressure of 20 psi in the LSA, the water levels in the Oakdale Tank and Stockwell Road Tank each can drop to an elevation of approximately 609 feet. Based on the overflow elevations and diameters of the tanks, the usable volume in the Oakdale Tank is approximately 0.36 mg and the usable storage in the Stockwell Road Tank is approximately 0.68 mg. The total usable storage volume in the LSA is approximately 1.04 mg. Therefore, there is approximately 0.63 mg of surplus storage in the LSA based on 2035 required storage volumes.

High Service Area

1. Equalization
- Medium sized system = 20 percent of the Maximum Day Demand
- HSA Maximum Day Demand in year 2014 = 0.82 mgd
- HSA Maximum Day Demand in year 2035 = 1.06 mgd

- HSA Equalization (2014) = 0.20 x 0.82 = 0.16 mg
- HSA Equalization (2035) = 0.20 x 1.06 = 0.21 mg

2. Basic Fire Flow Requirement
- Representative fire flow = 2,500 gpm
- Duration of 2 hours or 120 minutes

- Basic Fire Flow Requirement = 2,500 x 120 = 0.30 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 2014) and projected (year 2035) total required storage is as follows:

- Total HSA Required Storage (2010) = 0.16 mg + 0.30 mg = 0.46 mg
- Total HSA Required Storage (2035) = 0.21 mg + 0.30 mg = 0.51 mg

Lawrence Street Storage Tank No. 1 and No. 2 serve the HSA. The highest customer in the HSA is at an elevation of approximately 733 feet. Based on this elevation, the Lawrence Street Storage Tank No. 1 is fully usable and the water level in the Lawrence Street Storage Tank No. 2 can drop to an elevation of approximately 779 feet. Based on the overflow elevations and diameters of the tanks, the usable volume in the Lawrence Street Storage Tank No. 1 is approximately 0.43 mg and the usable storage in the Lawrence Street Storage Tank No. 2 is approximately 0.72 mg. The total usable storage in the HSA is approximately 1.15 mg. Based on the 2035 total required storage volume of 0.51, there is approximately 0.64 mg of surplus storage.

Section 4

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SECTION 4 – Hydraulic Evaluation

4.1 General

A comprehensive computer model was utilized to mathematically simulate the water distribution system to evaluate West Boylston's existing water distribution system and to obtain a basis for recommending water distribution system improvements. The hydraulic model uses "WaterGEMS" software which allows the user to conduct hydraulic simulations using mathematical algorithms in an ArcGIS environment. A link map of the hydraulic model is provided in Appendix B. The link map provides information on storage facilities and a general layout of the distribution system. Fire flow testing to verify the model was performed when the model was updated in 2011. As part of the Capital Efficiency Plan™, recommendations set forth by the Insurance Services Office (ISO) for water storage necessary for fire protection, fire flows, and peak demands were utilized in the analysis of the distribution system under steady state conditions. Deficiencies were identified and resulting infrastructure improvements were evaluated as discussed in this section.

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 a projected year 2035 ADD, MDD, and peak hour demand condition (no coincident fire flow), 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 552 feet in the LSA can experience pressure less than 35 psi during normal operating conditions. This area includes Campground Road. In the HSA, customers with elevations greater than 713 feet can experience pressures less than 35 psi during normal operating conditions. These areas include portions of Evans Road, Parker Street, Nevada Drive, Davidson Road, Mary Drive, and Hillside Village Drive.

An upper limiting pressure of 120 psi is generally recommended, as older fittings in the system are generally rated at 125 to 150 psi. Pressure above this level can result in increased water use from fixtures and also increased leakage throughout the distribution system. Also, plumbing code states that water heaters in homes can be affected when pressures exceed 80 psi.

Based on the current operating conditions, parts of the system experience pressures greater than 120 psi. Most of these locations are at the boundary between the LSA and the HSA. In order to reduce pressures in these locations, the District may need to modify the boundary between the two service areas so the high pressure areas in the HSA will be services by the LSA. The District can also recommend pressure reducing valves (PRV) to any customers within these areas. The PRVs would be installed at the owner's expense.

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.

The West Boylston system was last inspected for fire insurance ratings by the ISO in January 2014. The results of the ISO inspections and fire flow testing are shown in Table No. 4-1. The test results indicate the available flow and estimated recommended fire flow in various sections of the distribution system at the time of the tests. The estimated recommend fire flows established by ISO varied from 750 to 4,500 gpm, depending on the location and the structure. 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.

Additional Flow Recommendations

A review of the Town was completed to identify the recommended fire flows in areas not identified in the latest ISO evaluation. Examples include condominiums, apartment complexes, multi-family residential homes, schools, and other commercial or industrial buildings. Recommended flows were estimated for these areas using the 2014 ISO published Guide for Determination of Needed Fire Flow. The guide uses factors including building size, material, location, and contents. These factors were estimated based on aerial photos and street level observations. Not all information was readily available for the review and the estimated needed fire flow should not be used for any other purpose than evaluating the adequacy of the water distribution system.

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. The residential neighborhoods in the District were evaluated to determine average distances between homes to consider the recommended residential fire flow in those areas. An estimated fire flow of 500 or 750 gpm was used for most residential areas of the system with select neighborhoods being evaluated with a higher estimated fire flow, when necessary.

Table No. 4-1
ISO Hydrant Flow Summary

Test No.	Test Location	Service Area	Recommended Flow At 20 psi		Available Flow at 20 psi (gpm)
			Residential (gpm)	Commercial (gpm)	
1	Sterling Street at Sterling Meadows	Low		2,250	1,000
*2	Prescott Street at Mixter School Field	Low		4,500	700
*2A	Prescott Street at Mixter School	Low		2,500	700
3	Lancaster Street near Campground Road	Low		1,500	650
4	North Main and Laurel Street	Low		1,750	1,500
5	Beaman Street and Cutting Street	Low		3,000	7,600
6	Crescent Street near West Boylston Middle High School	Low		3,000	2,000
7	Prospect Street and Central Street	Low		2,250	4,000
8	Franklin Street and West Boylston Street	High		2,500	2,300
9	Prospect Street and Glenwood Street	High		2,000	550
10	West Boylston Street at Wood Pond	High		1,250	7,200
11	211 Shrewsbury Street	High		2,250	3,000
12	Maple Street and Temple Street	High		2,000	2,100
13	Lee and Prospect Street	High	750		1,200
14	Prospect Street and Wachusett Country Club	High		4,000	1,000
14A	Prospect Street and Wachusett Country Club	High	750		1,000
*Mixter School was demolished in 2014. According to the District there are no current plans to rebuild.					

4.3 Hydraulically Deficient Areas

The ISO estimated recommended fire flows were simulated on the computer model. Certain assumptions were used when running the model. All scenarios were run using 2035 MDD conditions and typical tank and booster pump operating conditions. Areas where the available fire flows did not meet the recommended fire flow were considered hydraulically deficient and improvements were developed to alleviate these deficiencies.

In general, the improvements are broken down into Priority 1 and 2 improvements relative to the water supply and distribution system. Priority 1 improvements are intended to strengthen transmission capabilities, address static pressure concerns, and mitigate ISO fire flow deficiencies. Priority 2 improvements identified areas at or near system extremities with fire flow deficiencies, as well as needed system looping in certain areas. The following list provides a summary of the Priority 1 and 2 hydraulic improvements. A map of the recommended hydraulic improvements is included in Appendix C.

Priority I Hydraulic Improvements

1. A new 16-inch diameter main is recommended along Prospect Street from Lawrence Street to Lost Oak Road and along Lawrence Street from Prospect Street to the Lawrence Street Tank to provide the recommended ISO fire flow at the Wachusett Country Club. This improvement will also improve transmission from the Lawrence Street Tank into the HSA.

2. A new 12-inch diameter water main is recommended along Prospect Street from Lawrence Street to Woodland Street. This water main will provide the ISO estimated recommended fire flow of 2,000 gpm needed for the UMASS Memorial Health Care Center.

3. To improve transmission from the Stockwell Road Tank into the LSA and to eliminate a bottleneck, a new 12-inch diameter water main is recommended on West Boylston Street and Worcester Street (Route 12) from the Stockwell Road Tank to the existing 10-inch diameter water main on Worcester Street at Goodale Street.

4. A new 12-inch diameter water main is recommended along Sterling Street from the existing 10-inch diameter water main on Prescott Street to Sterling Place. This water main will provide the ISO estimated recommended fire flow on Sterling Street at Sterling Meadows.

5. A new 12-inch diameter water main is recommended along Goodale Street from Worcester Street to Crescent Street. The new main will improve the available fire flow at the West Boylston Middle and High School. This water main will also improve transmission and eliminate the dead end on Goodale Street.

6. An estimated ISO fire flow of 1,500 gpm is recommended at the intersection of Lancaster Street and Campground Road. A new 12-inch diameter water main is recommended

along Lancaster Street from the 10-inch diameter main on Prescott Street to the intersection with Lancaster Meadows.

Priority II Hydraulic Improvements

7. A new 12-inch diameter water main is recommended along Malden Street from the intersection of Crescent Street, and along Goodale Street to the intersection of Newton Street. This water main will provide the recommended residential fire flow to the end of Malden Street.

8. New 8-inch diameter mains are recommended along the entire length of Lebanon Avenue, Bowles Avenue, Carew Avenue, and Chapman Avenue. Each new main will increase the available fire flow along these streets and eliminate dead ends improving flow.

9. It is recommended new 8-inch diameter mains be installed along Yale Avenue from Maple Street to the end of the main and along Princeton Avenue from Longview Street to the end of the main. The new mains will increase the available fire flow at these locations.

10. A new 8-inch diameter main is recommended along Alhambra Road, from Woodland Street to West Boylston Street (Route 12). The new main eliminates a dead end and improves fire flows at this location.

Section 5

TATA & HOWARD

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 medical facilities, nursing homes, schools, and business districts. All water mains within 500 feet of a critical area are considered a critical component. Because water storage tanks and sources provide water and maintain pressure to critical service areas, tanks and primary sources are also considered critical areas. Therefore, any water main within 500 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 West Boylston 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 health care facilities, and schools was completed. Table No. 5-1 presents all critical areas served including critical users and critical components of the distribution system.

Table No. 5-1
Critical Customers

Critical Area		Location
Medical Facilities		
	UMASS Memorial Health Care	242 Woodland Street
	Oakdale Rehabilitation	76 N. Main Street
	Canterbury Vision Care	360 W Boylston Street
	Living Well Adult Day Center	125 Hartwell Street
	Dr. Michael Casey-General Dentistry	71 Central Street
Schools		
	Major Edwards Elementary School	70 Crescent Street
	West Boylston Middle High School	125 Crescent Street
	Woodward Day School	100 Hartwell Street
	West Boylston Community Nursery School	26 Central Street
	Christ Lutheran Church Nursery School	9 Thomas Street
Emergency		
	Fire Station	39 Worcester Street
	Police Station	39 Worcester Street
Other Significant Water Users		
	Orchard Knoll-Elderly Housing	87 Maple Street
Water Supply Source		
	Oakdale Well	697 Thomas Street
	Pleasant Valley Well	131 Temple Street
	Lee Street Well No. 4	40 Lee Street
	Interconnection with Sterling	Sterling Border on North Main Street
	Interconnection with Worcester	Worcester Border on Malden Street
Water Storage and Pump Station		
	Lawrence Street Tanks	End of Lawrence Street
	Stockwell Road Tank	End of Stockwell Road
	Oakdale Tank	Off Beaman Street
	Laurel Street Pump Station	Off Laurel Street
	Lee Street Booster Pump Station	Off Lee Street
	Route 12 Booster Pump Station	Off West Boylston Street (Route 12)
	Western Avenue Booster Pump Station	Off Western Avenue

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 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. Prospect Street, from Newton Street to Lawrence Street, was identified as a critical main by the criticality feature in WaterGEMS.

Water mains that cross streams, rivers, or active railroad tracks, mains along cross country routes and mains greater than a depth of 10 feet 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 mains are presented in Table No. 5-2, and are highlighted on the Critical Components Map found in Appendix D.

Table No. 5-2
Critical Water Mains

Street	Description
Sterling Street	Water Crossing
Goodale Street	Water Crossing
Temple Street	Water Crossing
Thomas Street	Water Crossings
Worcester Street	Water Crossing
Temple Street	Railroad Crossing
Beaman Street	Railroad Crossing & Depth
Hartwell Street	Cross Country
Beaman Street	Cross Country
Thomas Street	Cross Country
Sterling Street	Cross Country
Lee Street	Cross Country & Depth
North Main Street	Depth

Section 6

TATA & HOWARD

SECTION 6 – Asset Management Considerations

6.1 General

The existing water distribution system includes approximately 58 miles of water mains. A number of factors including break history, material, age, diameter, soil conditions, water quality, and operating pressure affect the decision to replace or rehabilitate a water main. Using an Asset Management approach tailored for the District'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. The water mains identified as private water mains or fire service pipes were not assigned a grade.

6.2 Data Collection

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

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, static pressure, 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 District'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 West Boylston water system, a workshop was held with the system management and operators. During the discussion, it was determined that history of breaks, age, material, and diameter are of primary concern to the District. The grading system is shown in Table No. 6-1 and discussed in detail later in this section.

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.

Table No. 6-1
Asset Management Grading System

Weight	Performance Criteria	Rating	Weighted Rating
25%	Break History		
	Two or More Breaks	100	25
	One Break	80	20
	No History of Breaks	0	0
15%	Material		
	Asbestos Cement	100	15
	Unlined Cast Iron	50	7.5
	Ductile Iron	5	0.75
	PVC/Blue Brute	5	0.75
15%	Installation Date		
	1940-1945	100	15
	1946-1960	90	13.5
	1961-1969	60	9
	1970-1979	30	4.5
	1980-1989	10	1.5
	1990-1999	5	0.75
	2000-2015	3	0.45
15%	Diameter		
	2-inch water main	100	15
	4-inch water main	90	13.5
	6-inch water main	80	12
	8-inch water main	65	9.75
	10-inch water main	25	3.75
	12-inch water main	10	1.5
	16-inch water main	5	0.75
10%	Potentially Corrosive Soils		
	Identified as poor soils	100	10
	Contaminated Soil, or Ledge	90	9
	Potentially Corrosive Soils (Wetlands)	80	8
	Gravel/Sand	0	0
10%	Static Pressure		
	Greater than 120 psi	100	10
	100 to 120 psi	80	8
	80 to 100 psi	60	6
	Less than 80 psi	0	0
5%	Water Quality		
	Water quality problems	100	5
	No water quality problems	0	0
5%	Potential Water Hammer		
	Above 250 psi	100	5
	Below 250 psi	0	0

Table No. 6-2
Pipe Material by Installation Year

Installation Year	Asbestos Cement (lf)	Blue Brute (lf)	Cast Iron (lf)	Ductile Iron (lf)	PVC (lf)	Steel (lf)	Total (lf)
1940-1945	101,042		3,558				104,600
1946-1960	101,450		4,617				106,067
1961-1969	12,758						12,758
1970-1979	24,001				6,944		30,945
1980-1989		198		1,415	7,587	858	10,058
1990-1999				5,484	6,164		11,648
2000-2015				21,807	7,073		28,880
Total	239,251	198	8,175	28,706	27,768	858	304,956

Between the 1930s and 1970s, the water industry utilized asbestos cement (AC) pipe for their expanding water systems. 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. Most water mains installed in the District between 1949 through 1980 are AC. Approximately 79 percent of the system is composed of AC mains. The AC water mains have the highest rating score of all materials.

For a short time, AC pipe was lined with vinyl. It was later found that the vinyl can leach PCE into drinking water and thus the lining was discontinued. Following the discontinuation of vinyl lined AC pipe, asphalt lined AC pipe was manufactured. Although records do not indicate that the West Boylston system contains vinyl or asphalt lined AC, it should be assumed that a small percentage of the AC pipe is lined with either vinyl or asphalt.

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. The West Boylston system does not have any water mains installed prior to 1940. All cast iron installed in West Boylston is sand spun. Unlined cast iron mains increased the potential for internal corrosion. Based on information provided by District staff, all casts iron mains installed in West Boylston were installed prior to 1960 and there is no known areas of cement lined cast iron.

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. Cast iron water mains make up approximately three percent of the West Boylston water system.

Approximately nine percent of the system is cement lined ductile iron. This material was introduced in the United States in 1950s, however, was not widely used until the 1970s. 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.

PVC was first used in the United States in the early 1960s. Due to its resistance to both chemical and electrochemical corrosion, PVC pipe is not damaged by aggressive water or corrosive soils.

In addition, the smooth interior of PVC is 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. It should be noted that 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. Approximately nine percent of the system is PVC pipe.

The District reported a small percentage of 6-inch diameter, dark blue, fiberglass pipe called "Blue Brute". This pipe was installed on Lombard Road in 1979 and for the purposes of this report is assumed to be plastic pipe, as it contains similar properties.

In general, the oldest water mains in the system received a high rating of 100, while the newest received a rating of three. Figures No. 6-1 and 6-2 present the installation year of the water mains and the materials, respectively.

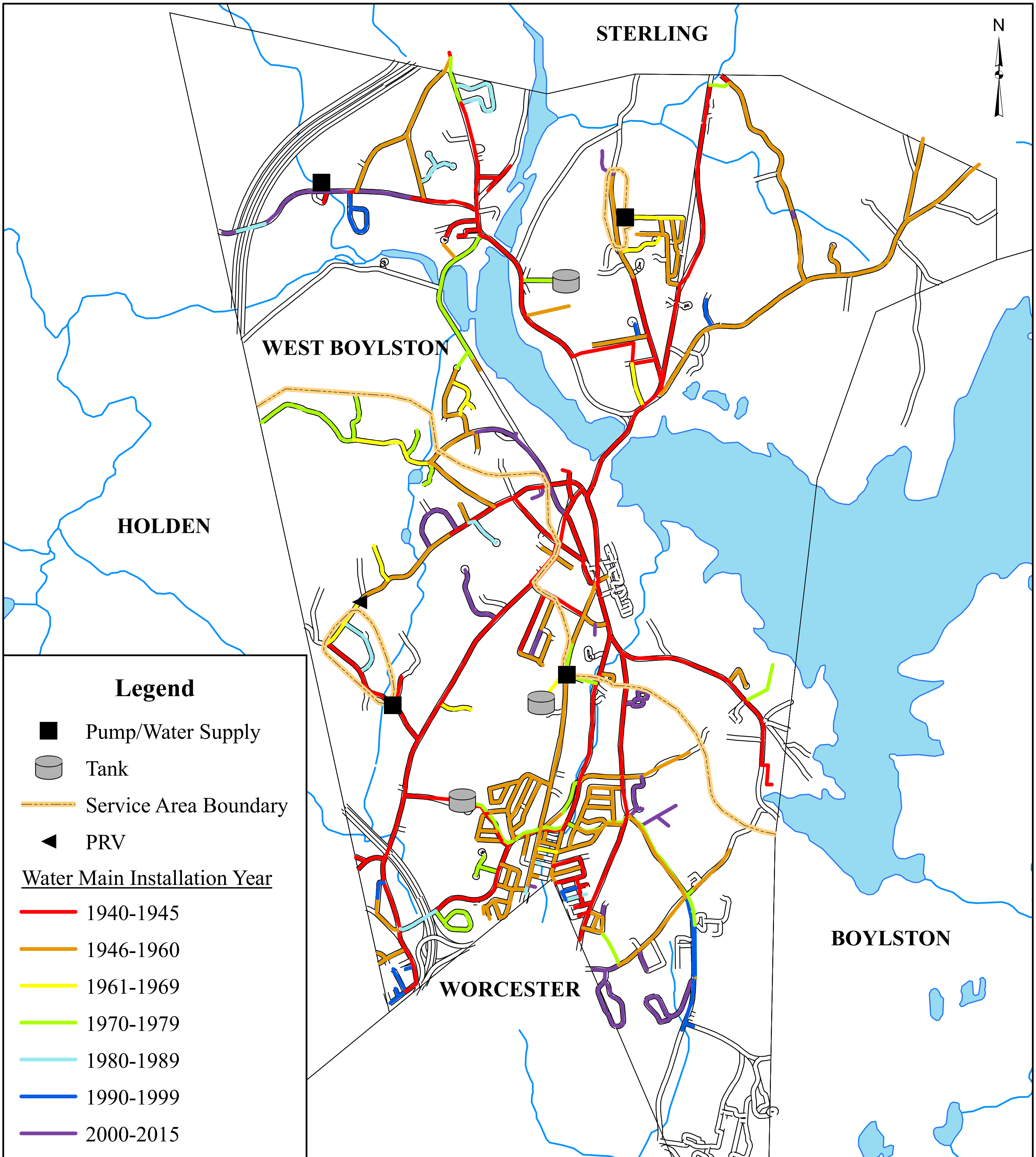
Diameter

The West Boylston water distribution system consists of water main ranging in diameter from two to 16-inches. Approximately 70 percent of the system is comprised of 8-inch diameter pipes and approximately ten percent is 6-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 2-inch diameter water mains are not as strong as 16-inch diameter water mains. Therefore, a rating of 100 was given to 2-inch diameter water mains and a rating of five was given to the 16-inch diameter and larger water mains. Table No. 6-1 shows a drop in the rating score between a 6-inch diameter water main (80) and 8-inch diameter water main (65). 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 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.



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Date: March 2016

Approximate Scale: 1" = 3,500'

Water Main Installation Year

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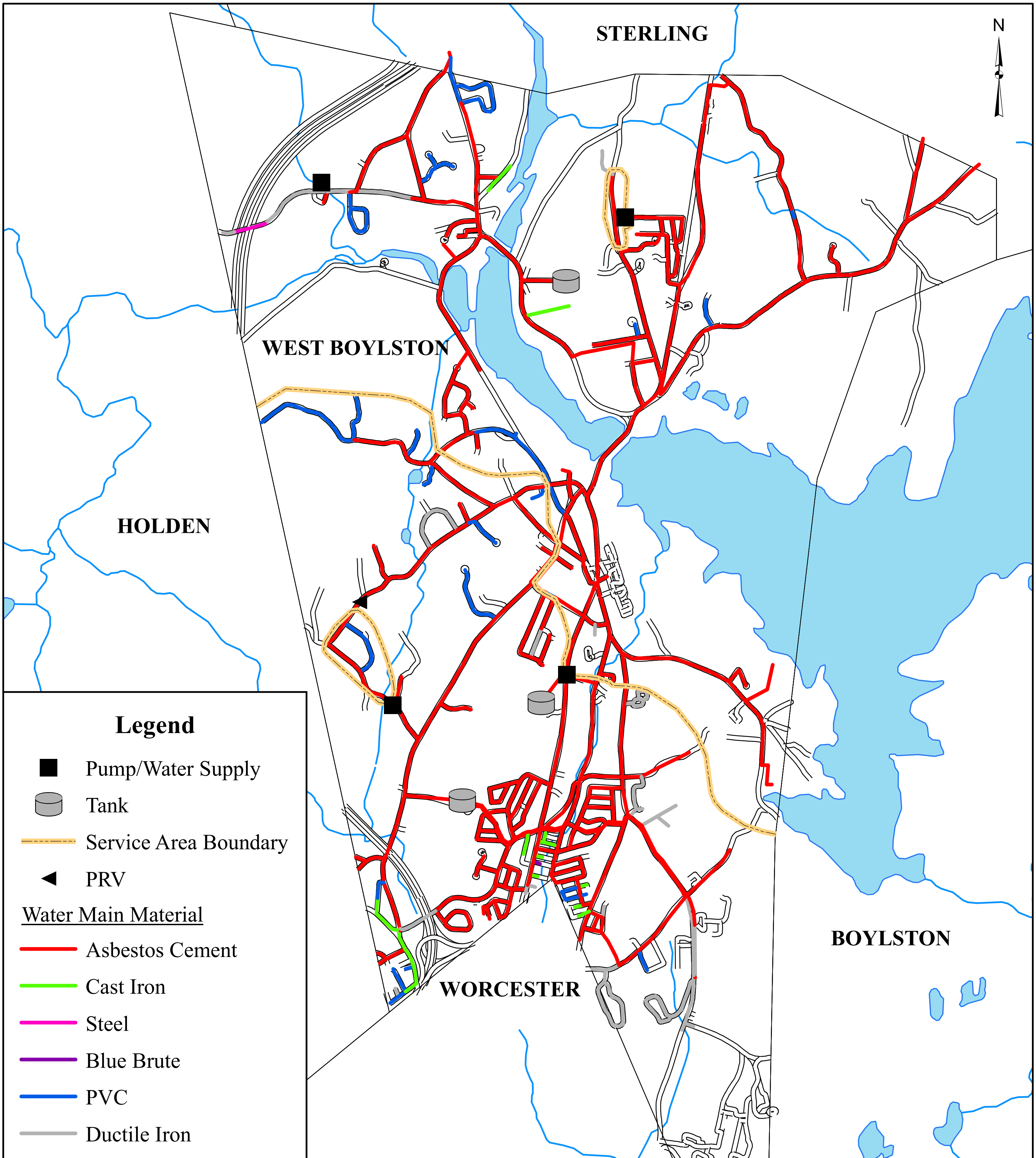
West Boylston Water District

West Boylston, MA

Figure No.

6-1



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Water Main Materials

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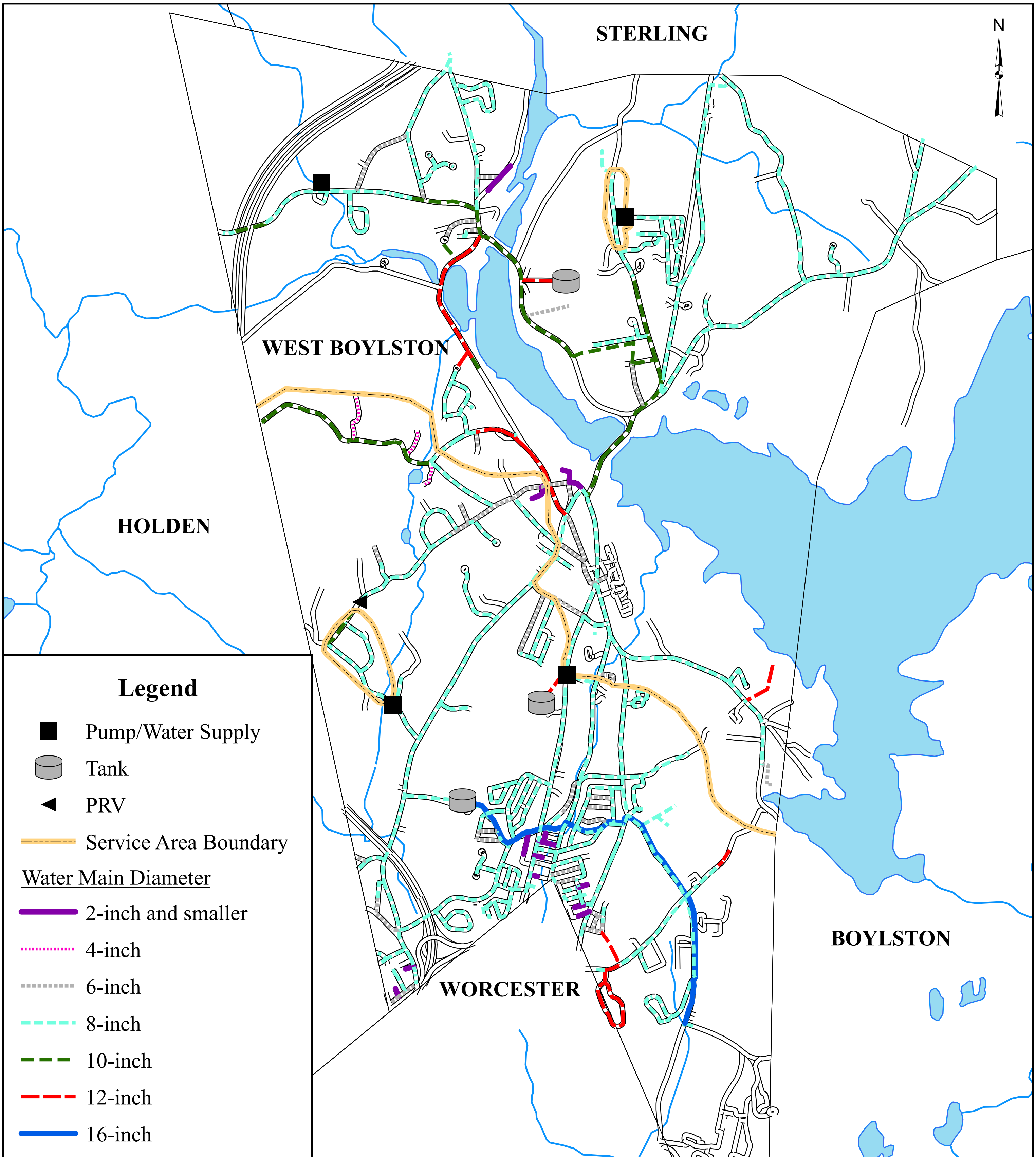
West Boylston, MA

Figure No.

6-2



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Approximate Scale: 1" = 3,500'

Water Main Diameters

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West Boylston Water District

West Boylston, MA

Figure No.

6-3

Break History

Based on conversations with District personnel and system records, the West Boylston water system experiences an average of five breaks per year. In relation to the total miles of water main in the system, this equates to approximately 10 breaks per 100 miles per year. In comparison to the national average of 25 breaks per 100 miles per year, the West Boylston water system has experienced a relatively low break rate. 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 West Boylston water main break records, there are several areas in the system that have experienced frequent breaks. The areas with more than one break are given a rating of 100, areas with one break are given a rating of 80, while areas with no known breaks received a rating of zero.

Areas that have a history of breaks are highlighted on Figure No. 6-4.

Water Quality

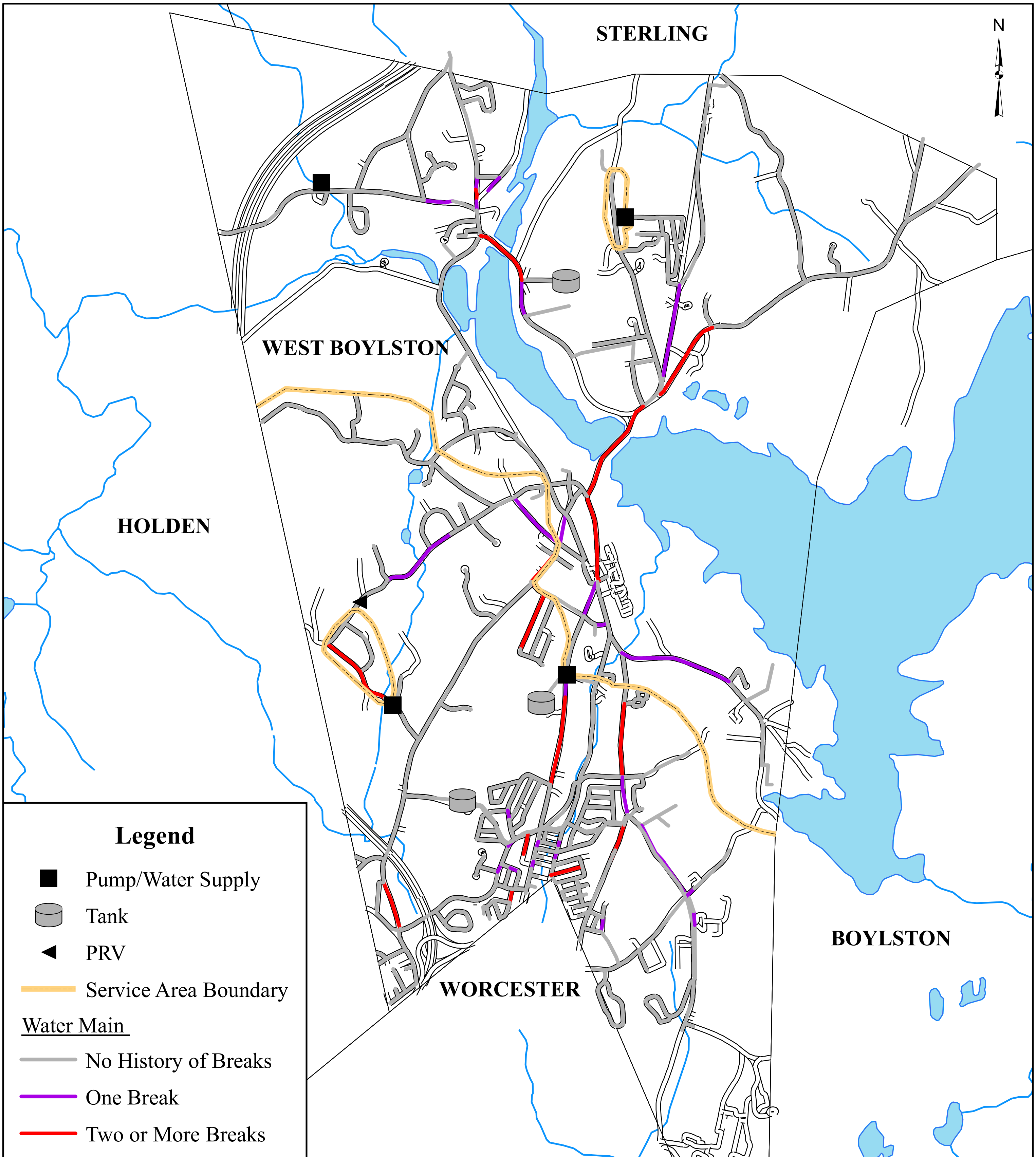
In general, the water quality in the West Boylston water system reportedly meets or exceeds state and federal water quality standards. However, based on conversations with the District, there have been water quality issues, specifically with manganese, in most of the LSA. These areas are given a rating 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. 6-5.

Soils

Water main degradation can occur both internally and externally. Factors that increase the rate of external corrosion include high 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. In addition, West Boylston has experienced external corrosion in areas where water mains are in peat, and clay. 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 with corrosion concern are highlighted on Figure No. 6-6.



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Approximate Scale: 1" = 3,500'

Areas with History of Breaks

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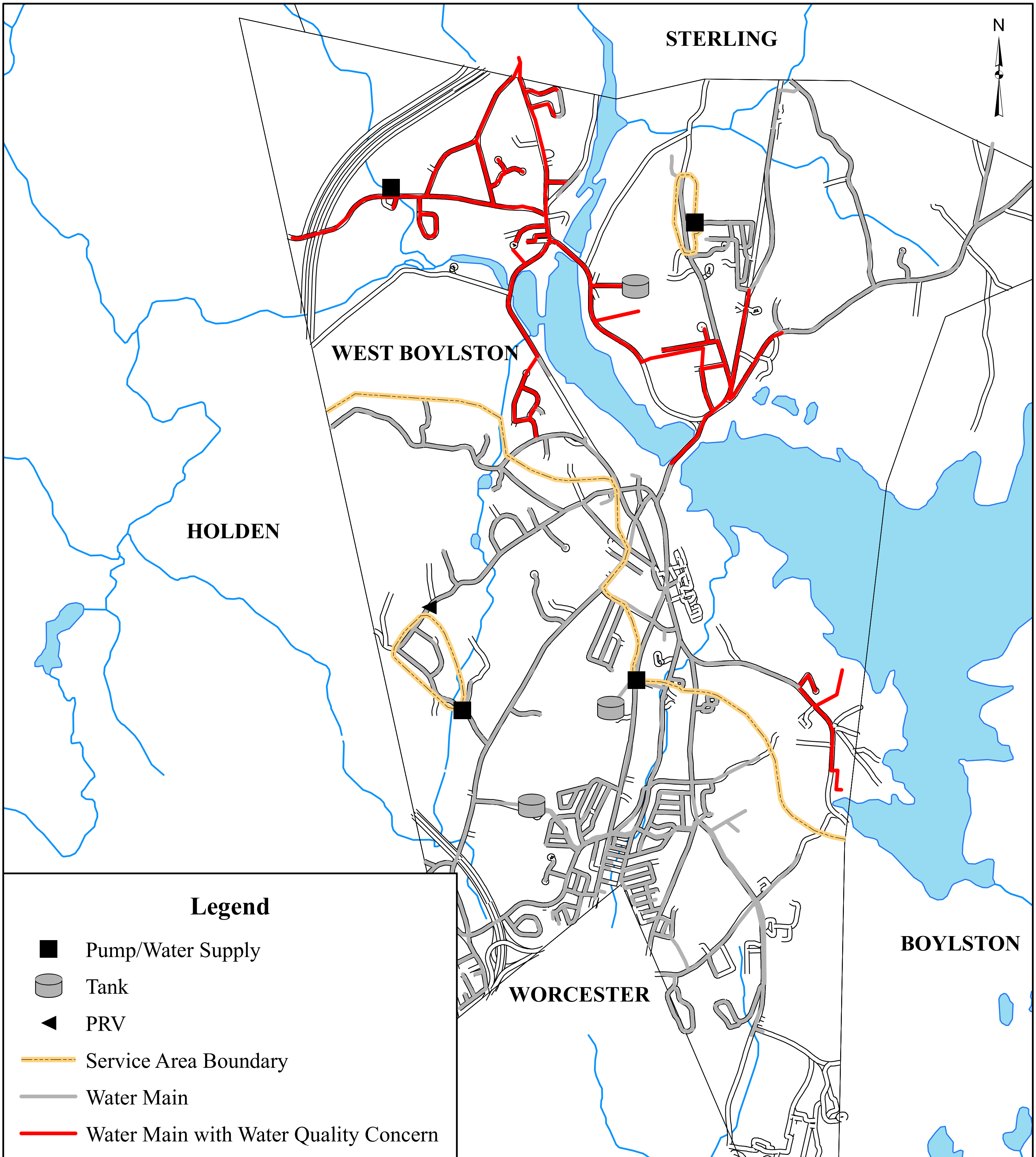
West Boylston, MA

Figure No.

6-4



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Approximate Scale: 1" = 3,500'

Areas with Water Quality Concerns

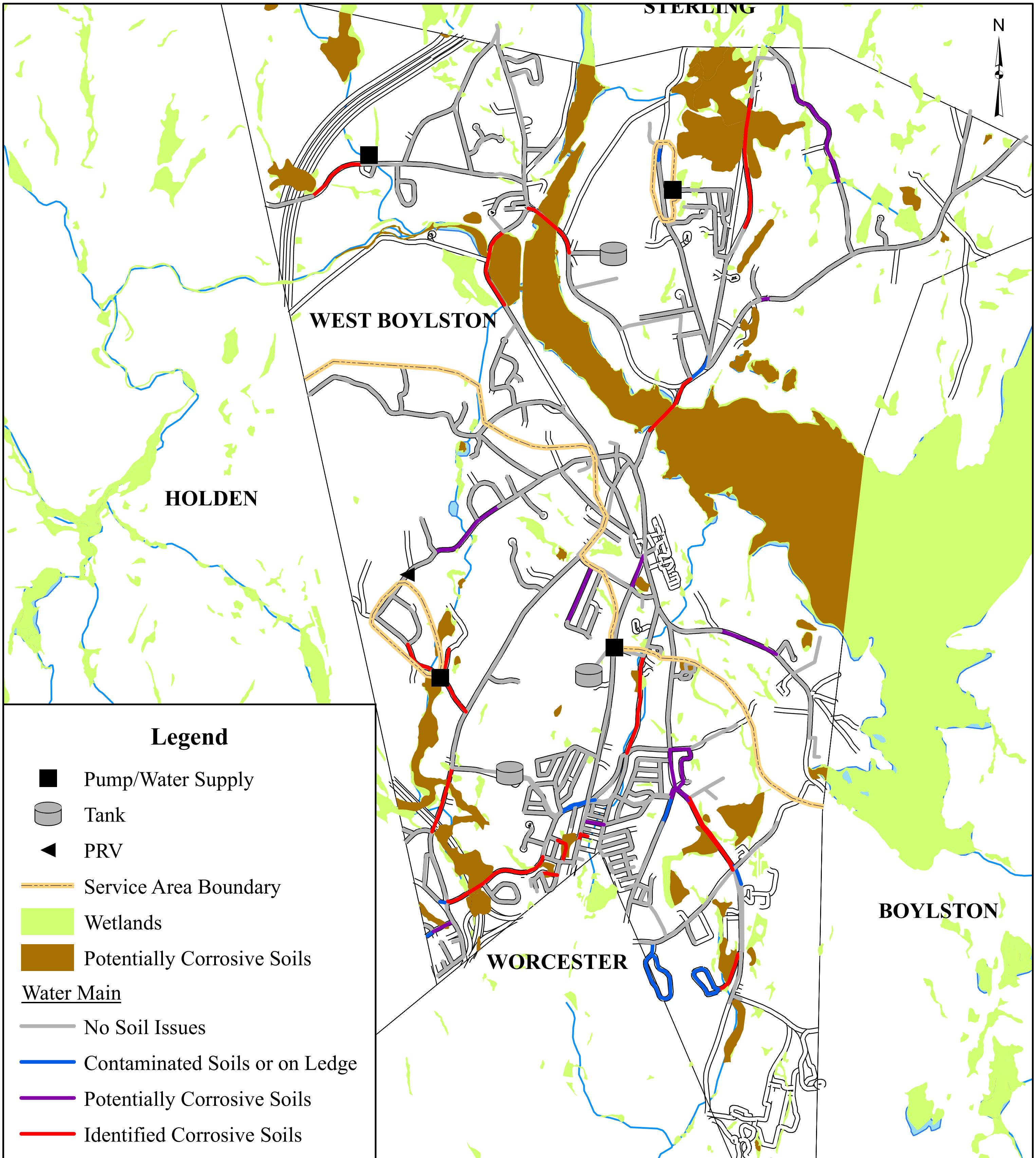
Draft Capital Effiency Plan™

West Boylston Water District

West Boylston, MA

Figure No.

6-5



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Approximate Scale: 1" = 3,500'

Potentially Corrosive Soils

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West Boylston Water District
West Boylston, MA

Figure No.

6-6

Pressure

Plumbing code states that water heaters can be affected when pressures exceed 80 psi. Pressures above 100 psi can result in increased water use from fixtures and also increased leakage throughout the distribution system. MassDEP Guidelines and Policies for Public Water System states that normal working pressures should be approximately 60 to 80 psi and not less than 35 psi. Areas with higher pressures are more susceptible to water main breaks and the effects of water hammer. In addition, main failures in areas of higher pressures typically cause more disruption, and result in more costly repairs for damages. All areas with pressures above 120 psi received the most points for static pressure, while pipes with pressures under 80 psi were given a pressure rating of zero. Figure No. 6-7 presents static pressures in the system under average day conditions. The following table provides a breakdown of pressure ranges in the system.

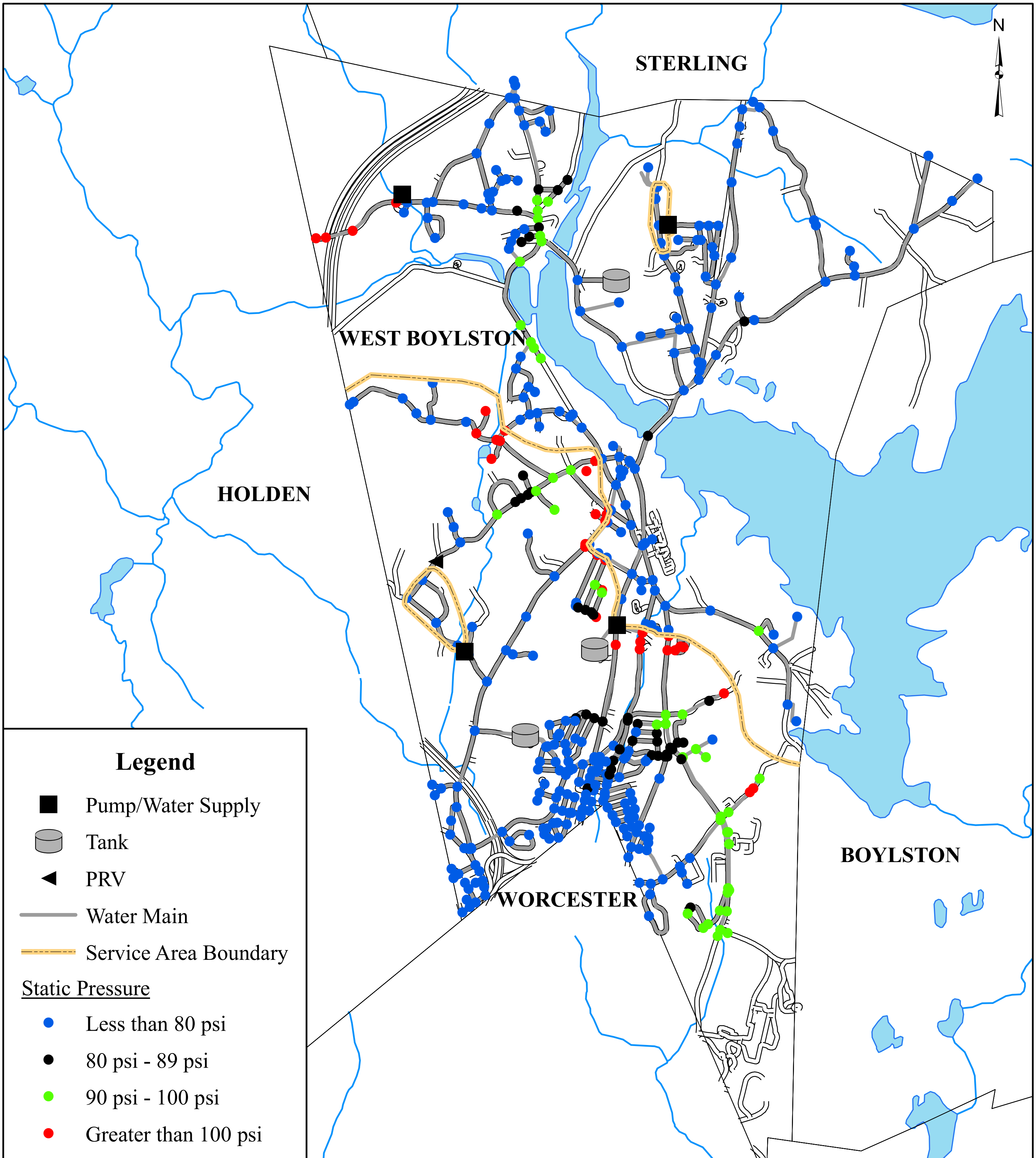
Pressure Range	Percentage in System
Less than 80 psi	65
80 – 100 psi	27
100 – 120 psi	5
Greater than 120 psi	4

Potential Water Hammer

Water hammer occurs due to a sudden change in water velocity causing a high pressure wave to propagate throughout the system. This can happen if a line valve or hydrant valve is rapidly closed or a pump stops pumping due to a power outage. A sudden pump stop often results in the rapid closure of the pump's check valve. Estimated water hammer potential was developed using the hydraulic model to determine static pressure and pipeline velocity. A potential water hammer of 250 psi approximates water traveling through a main at three feet per second with a static pressure of 100 psi. Locations with an estimated potential water hammer of 250 psi and greater were assigned 100 points. Water mains with an estimated potential water hammer of less than 250 psi were given a score of zero. Figure No. 6-8 presents the estimated potential water hammer pressures.

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 36 are considered to be in good to excellent condition. Mains with a total rating between 36 and 49 are considered to be in fair to good condition, and mains with a total rating greater than 49 are considered to be in poor to fair condition. Asset management ratings are presented graphically in Appendix E.



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Estimated Static Pressures

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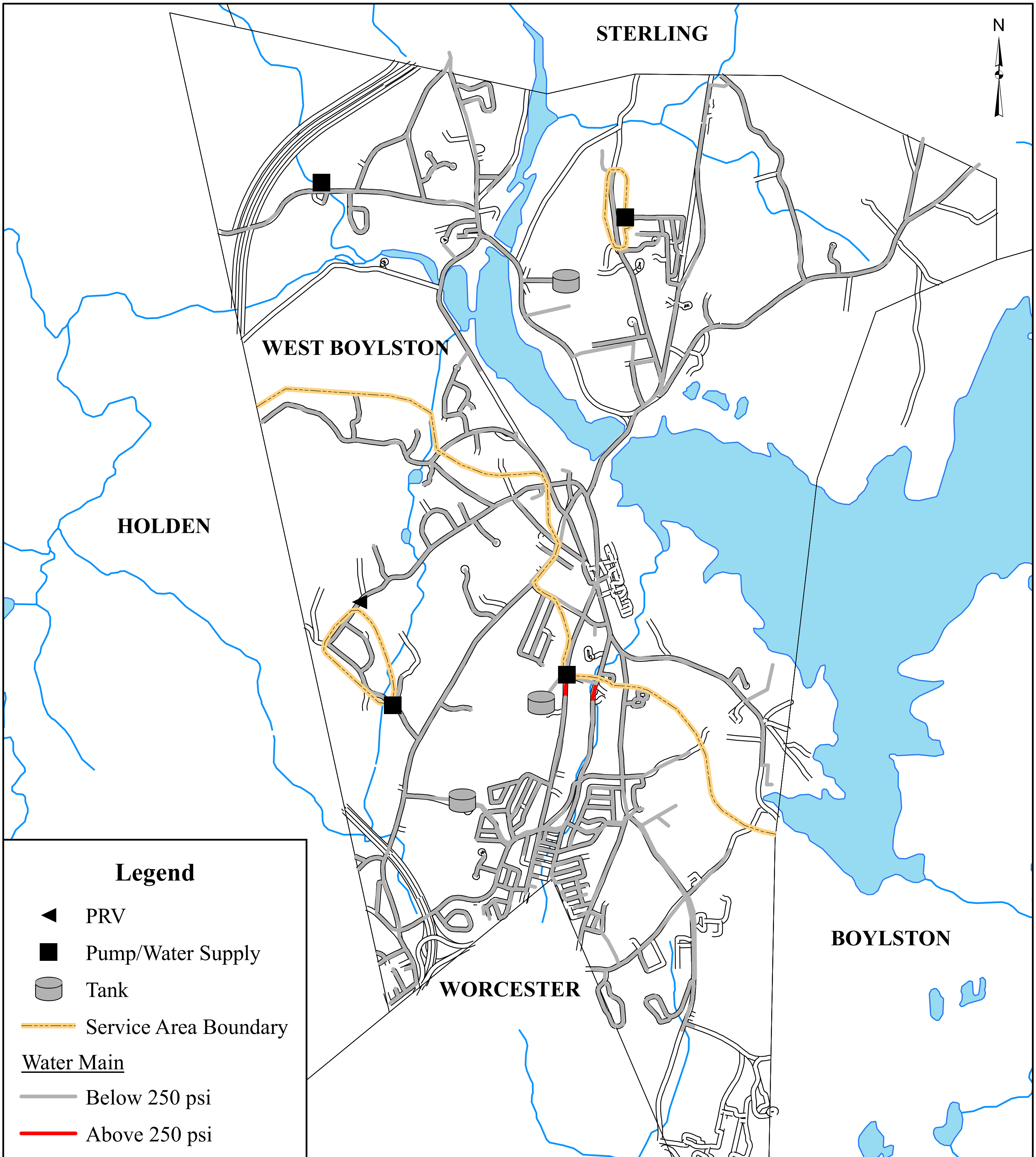
West Boylston Water District

West Boylston, MA

Figure No.

6-7



TATA & HOWARD

Date: March 2016

Approximate Scale: 1" = 3,500'

Potential Water Hammer in Water Main

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West Boylston Water District

West Boylston, MA

Figure No.

6-8

Section 7

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 the March 2016 Engineering News Record (ENR) construction cost index for Boston, Massachusetts of 13179.61 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. Costs for water main recommendations with construction lengths less than 1,000 linear feet were increased to account for increased mobilization costs. However, if several projects were bid together, increasing the total linear footage of the construction project to greater than 1,000 linear feet, the costs would likely decrease.

The capital improvement projects considered by this study will provide a direct benefit to the overall level of service to the West Boylston 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 firefighting 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 West Boylston distribution system, this would equate to approximately 3,100 linear feet 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 District continue to update the GIS based water main database and include water main failure data as well. Currently, West Boylston maintains a list of breaks, leaks, and replacements with the nearest street address and the properties of the failed main such as diameter and material. In addition, the District 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 District 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. 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 District in making water main rehabilitation and replacement decisions in the future.

Currently, there is an adequate supply of water for the District; however the projected 2035 ADD is greater than the registered volume for the District. As the population served increases, the District would have to apply for a Water Management Act permit to increase the daily pumping volume. Also, there is only adequate supply if the District maximizes the use of the Oakdale Well. Currently this supply is not maximized due to water quality. Water treatment at this source may be required to maximize this supply.

It is recommended that prior to installation of all new ductile iron water mains, the District test the soils in the area of the new main to determine corrosion potential. If the soil is found to be potentially corrosive, the District should wrap the 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.

The District should continue to perform regularly scheduled maintenance programs, including hydrant flushing, inspection and maintenance at the booster pump stations, pressure reducing valves, and meter testing/calibration. Manganese is present in much of the pipes in the LSA. To improve water quality, a unidirectional flushing program should be implemented. A unidirectional flushing program starts at a point of origin, usually a source or tank, and works outward flushing each portion of water main through clean water mains. The budgetary cost for development of a unidirectional flushing plan is $20,000. The District should continue the existing replacement program during which hydrants and valves that do not function as intended are identified and replaced. These deficiencies are normally identified through routine operation and during the system-wide flushing program.

7.3 Prioritization of Water Distribution System Improvements

Based on the Three Circle 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 Capital Efficiency Three Circle 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 District 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. Table No. 7-5 includes a prioritized list of Phase IIIa improvements and Table No. 7-6 includes the linear footage and estimated cost of each Phase IIIa improvement. Table No. 7-7 includes a prioritized list of Phase IIIb improvements and estimated cost of each Phase IIIb improvement. The recommended improvements maps are included in Appendix G. It should be noted that paving schedules or Highway and Sewer Department improvements were not evaluated as part of this study.

Phase I Improvements

1. The water from the Oakdale Well has elevated levels of manganese. It is recommended that a pilot study be conducted to determine the effectiveness of using absorptive technology which includes two filter media (Greensand Plus and LayneOx™). The estimated cost for a pilot study is approximately $75,000.

2. A new 12-inch diameter water main is recommended along Prospect Street, from Lawrence Street to Woodland Street. This new main will provide the inherent capacity for the ISO recommended fire flow at the UMASS Memorial Health Care Center, one of the District's critical customers. In addition, the main has fair and poor asset management ratings of 40 to 65 due to age, pressure, material, and

corrosive soils. The estimated probable construction cost of approximately 3,800 linear feet of 12-inch diameter ductile iron main is $1,247,000. Additional cost was factored in to the cost estimate because Prospect Street is a busy road.

3. To improve transmission and eliminate a bottleneck, a new 12-inch diameter water main is recommended on West Boylston Street and Worcester Street (Route 12) from the Stockwell Road Tank to Goodale Street. This water main is considered critical because of the tank and critical water users along Route 12. This water main has an asset management rating ranging from 30 to 71, with most of the water main considered in poor condition due to break history, age, pressure, material, and potentially corrosive soils. The estimated probable construction cost of approximately 5,000 linear feet of 12-inch ductile iron is $1,719,000. Additional cost was factored in to the cost estimate because West Boylston Street is a state highway.

Phase II Improvements

4. A new 12-inch diameter main is recommended along Goodale Street, from Worcester Road to Crescent Street. The new main will provide the recommended fire flow at the West Boylston Middle and High School. In addition, the new main will eliminate the dead end on Goodale Street. The main is considered critical because it serves the Major Edwards Elementary School and the West Boylston Community Nursery School. The estimated probable construction cost of approximately 1,300 linear feet of 12-inch diameter ductile iron water main is $407,000.

5. A new 16-inch diameter main is recommended along Prospect Street, from Lost Oak Road to Lawrence Street, and along Lawrence Street, from Prospect Street to the Lawrence Street Tank. The existing main is hydraulically deficient and is considered critical because of its proximity to the Lawrence Street Tank. The water main will provide the inherent capacity for the ISO recommended fire flow at the Wachusett Country Club. In addition, the main has a fair asset management rating of 40 due to age, material, and size. The estimated probable construction cost of approximately 7,400 linear feet of 16-inch diameter water main is $2,644,000. Additional cost was factored in to the cost estimate because Prospect Street is a busy road.

6. The existing 8-inch diameter main along Sterling Street, from Route 110 to Sterling Place is hydraulically deficient and is considered to be in poor condition. A new 12-inch diameter main is recommended to provide the inherent capacity for the ISO recommended fire flow at the residents of Sterling Place and Heritage Lane. The main has a poor asset management rating of 71 due to age, material, water quality and break history. The estimated probable construction cost of approximately 3,000 linear feet of 12-inch diameter ductile iron water main is $1,032,000. Additional cost was factored in to the cost estimate because Sterling Street is a state highway.

7. The existing 10-inch diameter main along Beaman Street (Route 140), from North Main Street to the cross country main off Beaman Street, is recommended to be replaced with a new 12- inch water main. The existing main is considered critical because it crosses train tracks and the Wachusett Reservoir. The main has a poor asset management ratings of 65 to 80 due to age, material, break history, corrosive soils, and water quality. The estimated probable construction cost of approximately 2,700 linear feet of 12-inch diameter ductile iron water main is $929,000. Additional cost was factored in to the cost estimate because Beaman Street is a state highway.

8. A new 12-inch diameter water main is recommended along Sterling Street causeway. This water main is considered critical because it travels within an earth-filled causeway and a major break could lead to a collapse within the causeway. The existing 10-inch diameter main has a poor asset management rating of 80 due to a history of breaks, corrosive soils, age, material, and water quality. The estimated probable construction cost of approximately 1,000 linear feet of 12-inch diameter ductile iron water main is $430,000. Additional cost was factored in to the cost estimate because of the causeway crossing.

9. A new 12-inch diameter water main is recommended along Lancaster Street, from Route 12 to Heritage Lane. The existing 8-inch diameter main is hydraulically deficient and has poor asset management rating. The poor asset management score of 75 is due to the age, material, and break history of the main along poor water quality and corrosive soils. The ISO has recommended fire flow of 1,500 gpm to Camp Woodhaven. The new main will improve the available flow at this location. The estimated probable construction cost of approximately 2,700 linear feet of 12-inch diameter ductile iron water main is $929,000. Additional cost was factored in to the cost estimate because Lancaster Street is a state highway.

10. It is recommended that a new 8-inch diameter main replace the existing 8-inch diameter main along West Boylston Street, from the Route 12 Booster Pump Station to Shrine Avenue. The existing main is considered to be in poor condition due to its break history, age, and high static pressures and is considered critical because of its proximity to the Route 12 Booster Pump Station. The estimated probable construction cost of approximately 3,000 linear feet of 8-inch diameter ductile iron water main is $825,000. Additional cost was factored in to the cost estimate because West Boylston Street is a state highway.

11. It is recommended a new 12-inch diameter water main along North Main Street, from Stillwater Heights Drive to Thomas Street replace the existing 8-inch diameter main. The main is considered critical due to its proximity to the Oakdale Rehabilitation Center and has a poor asset management rating. The asset management rating of 76 is due to the age, material, and break history of the main along with water quality issues. The estimated probable construction cost of approximately 3,700 linear feet of 12-inch diameter ductile iron water main is

$1,272,000. Additional cost was factored in to the cost estimate because North Main Street is a state highway.

12. A new 8-inch water main is recommended along Goodale Street from Phelps Place to Blake Avenue. The existing 6 and 8-inch diameter main is considered critical because it is located within a culvert crossing. The main received a poor asset management rating of 53 due to its age, material, diameter and the presence of potentially corrosive soils. The estimated probable construction cost of approximately 2,800 linear feet of 8-inch diameter ductile iron water main is $700,000.

13. The existing 8-inch diameter main along Lee Street from the Lee Street Pump Station to Goodale Street has a poor asset management score and is considered critical because of its proximity to the Lee Street Pump Station, a stream crossing, and part of the main is located off the road. The poor asset management rating of 75 is due to its age, material, break history, and corrosive soils. It is recommended the existing main be replaced with a new 8-inch diameter main. The estimated probable construction cost of approximately 2700 linear feet of 8-inch diameter ductile iron water main is $743,000. Additional cost was factored in to the cost estimate because Lee Street is a state highway.

14. A new 8-inch diameter water main is recommended along Maple Street, from Orchard Knoll at 87 Maple Street to Pierce Street. The existing 8-inch diameter main has a poor asset management rating of 71 due to the material and installation date of the main, corrosive soils, and high static pressures. The main is considered critical due to its proximity to the Orchard Knoll Adult Living Facility. The estimated probable construction cost of approximately 2,000 linear feet of 8-inch diameter ductile iron water main is $525,000. Additional cost was factored in to the cost estimate because Maple Street is a busy road.

15. A new 12-inch diameter water main is recommended along Cumberland Drive, from Danielian Drive to Hawthorne Drive, to replace the existing 8-inch diameter main. The main is critical due to its proximity to Canterbury Vision Care and is considered to be in poor condition due to its age, material, and break history. The estimated probable construction cost of approximately 400 linear feet of 12-inch diameter ductile iron water main is $125,000.

16. A new 12-inch water main is recommended along Temple Street, from Maple Street to Oak Avenue. The new main will replace an existing 8-inch diameter that is in poor condition due to its age, break history, water quality, and material. In addition, the main is considered critical because it is located underneath railroad tracks. The estimated probable construction cost of approximately 3,800 linear feet of 12-inch diameter ductile iron water main is $1,307,000. Additional cost was factored in to the cost estimate because Temple Street is a state highway.

17. The existing 8-inch diameter main along Prospect Street, from Central Street to Newton Street, should be replaced with a new 8-inch diameter main. The existing main received a poor asset management rating of 60 due to its age, material, and break history. The main is considered critical due to its proximity to Dr. Michael Casey General Dentistry. The estimated probable construction cost of approximately 900 linear feet of 12-inch diameter ductile iron water main is $325,000. Additional cost was factored in to the cost estimate because Prospect Street is a busy road.

18. It is recommended a new 8-inch diameter water main replace the existing 8-inch diameter main along Worcester Street, from Bancroft Street to Pierce Street. The existing main is considered critical because it is located underneath railroad tracks and has a poor asset management rating of 65 due to its age and material, corrosive soils, and potential for water hammer. The estimated probable construction cost of approximately 2,700 linear feet of 8-inch diameter ductile iron water main is $743,000. Additional cost was factored in to the cost estimate because Worcester Street is a state highway.

19. A new 12-inch water main is recommended to replace the existing 8-inch diameter HSA main along Prospect Street, from Newton Street to Lost Oak Road. This main is considered critical because it is a transmission main. The existing main received a poor asset management rating ranging from 75 to 50 due to age, break history, and material. The estimated probable construction cost of approximately 3,800 linear feet of 12-inch diameter ductile iron water main is $1,247,000. Additional cost was factored in to the cost estimate because Prospect Street is a busy road.

20. A new 8-inch diameter water main is recommended along Lee Street from the Lee Street Well to Prospect Street. The existing 8-inch diameter main has a poor asset management rating due to its age, material, and water quality issues. The main is considered critical because it connects the Lee Street Well to the distribution system and is the sole source for the Lee Street Booster Pump Station. The estimated probable construction cost of approximately 1,900 linear feet of 8-inch diameter ductile iron water main is $475,000.

21. A new 8-inch diameter water main is recommended to replace the existing 2-inch diameter main along Alhambra Road. The new main should run from Woodland Street to West Boylston Street. Replacing the existing main will improve fire flows and eliminate a dead end. The existing main received a high asset management score of 61 due to its age, material, diameter, and history of breaks. The estimated probable construction cost of approximately 900 linear feet of 8-inch diameter ductile iron water main is $282,000.

Phase IIIa Improvements - Hydraulic

22. A new 12-inch diameter main is recommended along Malden Street, from Crescent Street to Goodale Street, and along Goodale Street from Malden Street

to Newton Street. This improvement will provide the recommended residential fire flow to the end of Malden Street. The estimated probable construction cost of approximately 2,700 linear feet of 12-inch diameter ductile iron water main is $866,000.

23. The remaining water mains from Section 4 that were identified as needing to be replaced with 8-inch diameter water mains to provide the recommended residential fire flows and eliminate dead ends are Princeton Avenue, Yale Avenue, Lebanon Avenue, Bowles Avenue, Carew Avenue, and Chapman Avenue. The existing mains have asset management ratings less than 50 and are considered fair to good or good to excellent. These water mains need to be replaced to provide the recommended residential fire flow. The asset management ratings of these mains are presented in Table No. 7-5. The linear feet and estimated probable construction cost for these water mains are summarized in Table No. 7-6.

24. It is recommended a new 12-inch diameter main replace the existing main on Lancaster Street from Heritage Lane to Lancaster Meadows. The existing main is hydraulically deficient. When completed, this improvement in conjunction with the other recommended improvement along Lancaster Street will allow the District to meet the ISO recommended fire flow of 1,500 gpm at Camp Woodhaven. The estimated probable construction cost of approximately 3,500 linear feet of 12-inch diameter ductile iron water main is $1,094,000.

Phase IIIb Improvements – Asset Management

25. Based on the asset management ratings, the water mains with asset management ratings greater than 49 are considered poor to fair. This represents approximately 24 percent of the water distribution system. Some of these water mains are included in Phase I and Phase II improvements. There are approximately 14 miles of main with high asset management ratings that should be replaced as part of this recommendation. 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 and storm water work.

    These water mains are identified on the Recommended Improvements Map found in Appendix G. The total amount of recommended water main by diameter and the estimated probable construction cost to replace these water mains is summarized in Table No. 7-7. 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. It was also assumed that all 10-inch diameter and 12-inch diameter water mains would be replaced with a 12-inch diameter main.

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

Item No.	Location	From	To	Hydraulic	Asset Management Rating	Critical
1	Oakdale Well Pilot Test					
2	Prospect Street	Lawrence Street	Woodland Street	Yes	65	Yes
3	Worcester Street and West Boylston Street (Route 12)	Stockwell Road Tank	Goodale Street	Yes	30-71	Yes

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

Item No.	Location	From	To	Diameter (in)	Length (LF)	Estimated Cost
1	Oakdale Well Pilot Test					$ 75,000
2	Prospect Street	Lawrence Street	Woodland Street	12	3,800	$1,247,000
3	Worcester Street and West Boylston Street (Route 12)	Stockwell Road Tank	Goodale Street	12	5,000	$1,719,000
					Total Estimated Phase I Cost:	**$3,041,000**

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

Item No.	Location	From	To	Hydraulic	Asset Management Rating	Critical
4	Goodale Street	Crescent Street	Worcester Street	Yes	45	Yes
5	Prospect Street & Lawrence Street	Lost Oak Road	Lawrence Street Tank	Yes	40	Yes
6	Sterling Street	Route 110 Intersection	Sterling Place	Yes	71	No
7	Beaman Street	North Main Street	Cross Country Main off of Beaman Street	No	80	Yes
8	Sterling Street	Sterling Street Causeway		No	80	Yes
9	Lancaster Street	Heritage Lane	Route 12	Yes	75	No
10	West Boylston Street	Route 12 Booster Pump Station	Shrine Avenue	No	74	Yes
11	North Main Street	Stillwater Heights Drive	Thomas Street	No	76	Yes
12	Goodale Street	Phelps Place	Blake Avenue	No	53	Yes
13	Lee Street	Lee Street Pump Station	Goodale Street	No	75	Yes
14	Maple Street	87 Maple Street	Pierce Street	No	71	Yes
15	Cumberland Drive	Danielian Drive	Hawthorne Drive	No	64	Yes
16	Temple Street	Maple Street	Oak Avenue	No	68	Yes
17	Prospect Street	Central Street	Newton Street	No	60	Yes
18	Worcester Street	Bancroft Street	Pierce Street	No	65	Yes
19	Prospect Street (HSA)	Newton	Lost Oak Road	No	50	Yes
20	Lee Street	Lee Street Well	Prospect Street	No	50	Yes
21	Alhambra Road	Woodland Street	West Boylston Street	Yes	61	No

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

Item No.	Location	From	To	Diameter (in)	Length (LF)	Estimated Cost
4	Goodale Street	Crescent Street	Worcester Street	12	1,300	$ 407,000
5	Prospect Street & Lawrence Street	Lost Oak Road	Lawrence Street Tank	16	7,400	$ 2,644,000
6	Sterling Street	Route 110 Intersection	Sterling Place	12	3,000	$ 1,032,000
7	Beaman Street	North Main Street	Cross Country Main off of Beaman Street	12	2,700	$ 929,000
8	Sterling Street	Sterling Street Causeway		12	1,000	$ 430,000
9	Lancaster Street	Lancaster Meadows	Route 12	12	2,700	$ 929,000
10	West Boylston Street	Route 12 Booster Pump Station	Shrine Avenue	8	3,000	$ 825,000
11	North Main Street	Stillwater Heights Drive	Thomas Street	12	3,700	$ 1,272,000
12	Goodale Street	Phelps Place	Blake Avenue	12	2,800	$ 700,000
13	Lee Street	Lee Street Pump Station	Goodale Street	8	2,700	$ 743,000
14	Maple Street	87 Maple Street	Pierce Street	8	2,000	$ 525,000
15	Cumberland Drive	Danielian Drive	Hawthorne Drive	8	400	$ 125,000
16	Temple Street	Maple Street	Oak Avenue	8	3,800	$ 1,307,000
17	Prospect Street	Central Street	Newton Street	12	900	$ 325,000
18	Worcester Street	Bancroft Street	Pierce Street	12	2,700	$ 743,000
19	Prospect Street (HSA)	Newton Street	Lost Oak Road	12	3,800	$ 1,247,000
20	Lee Street	Lee Street Well	Prospect Street	8	1,900	$ 475,000
21	Alhambra Road	Woodland Street	West Boylston Street	8	900	$ 282,000
Total Estimated Phase II Cost:						**$14,940,000**

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

Item No.	Location	From	To	Hydraulic	Asset Management Rating	Critical
22	Malden Street & Goodale Street	Crescent Street	Newton Street	Yes	48 & 47	No
23	Princeton Avenue	Longview Street	Princeton Avenue	Yes	38	No
	Yale Avenue	Yale Avenue	Maple Street	Yes	38	No
	Lebanon Avenue	West Boylston Street	Worcester Street	Yes	36	No
	Bowles Avenue	West Boylston Street	Worcester Street	Yes	36	No
	Carew Avenue	Woodland Street	Bowles Avenue	Yes	36	No
	Chapman Avenue	West Boylston Street	Worcester Street	Yes	36	No
24	Lancaster Street	Lancaster Meadows	Heritage Lane	Yes	45	No

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

Item No.	Location	From	To	Diameter (in)	Length (LF)	Estimated Cost
22	Malden Street & Goodale Street	Crescent Street	Newton Street	12	2,700	$ 866,000
23	Princeton Avenue	Longview Street	Princeton Avenue	8	300	$ 94,000
	Yale Avenue	Yale Avenue	Maple Street	8	400	$ 125,000
	Lebanon Avenue	West Boylston Street	Worcester Street	8	600	$ 188,000
	Bowles Avenue	West Boylston Street	Worcester Street	8	500	$ 157,000
	Carew Avenue	Woodland Street	Bowles Avenue	8	400	$ 125,000
	Chapman Avenue	West Boylston Street	Worcester Street	8	600	$ 188,000
24	Lancaster Street	Lancaster Meadows	Heritage Lane	12	3,500	$ 1,094,000
					Total Estimated Phase IIIa Cost:	**$2,837,000**

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

Item No.	Location	From	To	Diameter (in)	Asset Management Rating	Length (LF)	Estimated Cost
25	Bowen Street	Franklin Street	End of Bowen Street	8	75	1,700	$ 425,000
	Maple Street	Pierce Street	261 Maple Street	8	74	2,800	$ 735,000
	Franklin Street	Prospect Street	Henry Street	8	72	800	$ 250,000
	Newton Street	Goodale Street	Prospect Street	12	70	1,700	$ 532,000
	Highland Street	Worcester Street	Peachtree Street	8	66	900	$ 282,000
	Sterling Street	Goodale Street	Causeway	12	65	1,200	$ 413,000
	Laurel Street	Keys Street	North Main Street	12	65	1,800	$ 563,000
	Waushacum Street	Reed Street	17 Waushacum Street	8	64	1,000	$ 313,000
	Bonnie View Drive	Chino Avenue	Bonnie View Drive	8	61	400	$ 125,000
	Shrine Avenue	Davidson Road	Woodland Street	8	59	600	$ 188,000
	Sterling Street	322 Sterling Street	Sterling Place	8	56	3,600	$ 990,000
	Shrewsbury Street	Maple Street	Hartwell Street	16	55	2,700	$ 929,000
	Sterling Street	Lancaster Street	Beaman Street	12	54	1,400	$ 482,000
	Goodale Street	Newton Street	Crescent Street	8	52	1,100	$ 275,000
	Green Street, Parson Street, May Street	North Main Street	May Street	8	53	700	$ 219,000
	Woodland Street	Danielian Drive	Pheasant Hill Run	8	50	2,000	$ 500,000
	MA Fisheries & Wildlife Road	Temple Street	End of Unnamed Road	8	53	900	$ 282,000
	Pine Arden Drive	Pine Arden Drive	Crescent Street	12	50	2,600	$ 813,000
	Total Estimated Phase IIIb Cost:						**$8,316,000**
	*Current 8-inch water main to be abandoned and all services moved to a new 16-inch water main.						

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Appendix A

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Water Distribution System
West Boylston Water District
West Boylston, Massachusetts

DRAFT

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Approximate Scale: 1" = 1,000'

March 2016

Appendix B

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N
STERLING
HOLDEN
WEST BOYLSTON
BOYLSTON
WORCESTER
Interconnection with Sterling
Laurel Street Pump Station
Western Avenue Booster Pump Station
Western Avenue High Service Area
Oakdale Well
Oakdale Tank Capacity: 0.50 mg Overflow: 633 feet
Wachusett Reservoir
Low Service Area
High Service Area
Goodale Street PRV
Lee Street Well No. 4
Lee Street High Service Area
Lee Street Booster Pump Station
Route 12 Booster Pump Station
Pleasant Valley Well
Stockwell Road Tank Capacity: 0.95 mg Overflow: 633 feet
Lawrence Street Tank No. 1 & No. 2 Combined Capacity: 1.63 mg Overflow: 794 feet
Interconnection with Worcester
Legend
Service Area Boundary
Water Main
Junction
Link Map
West Boylston Water District
West Boylston, Massachusetts
DRAFT
TATA & HOWARD
Approximate Scale: 1" = 1,000'
March 2016

Pipe Input Data
Capital Efficiency Plan
West Boylston, MA

Label	SAPID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Water Hammer	Asset Management Score
P-1	634	10	Asbestos Cement	1955	130	520	0	0	Gravel/Sand	Dirty Water	140	38
P-2	635	12	Asbestos Cement	1972	140	2,245	0	0	Identified corrosive soil	Dirty Water	111	44
P-4	636	12	Asbestos Cement	1972	140	598	0	0	Gravel/Sand	Dirty Water	110	34
P-4	1497	8	Ductile Iron	2005	130	808	0	0	Gravel/Sand	None	72	11
P-6	637	12	Asbestos Cement	1972	140	205	0	0	Gravel/Sand	None	100	29
P-7	1502	8	Ductile Iron	2005	130	276	0	0	Gravel/Sand	None	59	11
P-8	638	10	Asbestos Cement	1955	130	389	0	0	Gravel/Sand	None	100	41
P-10	639	12	Asbestos Cement	1972	140	550	0	0	Gravel/Sand	Dirty Water	110	34
P-11	1508	8	Asbestos Cement	1960	120	401	0	0	Gravel/Sand	None	78	39
P-12	640	8	Asbestos Cement	1960	130	390	0	0	Gravel/Sand	Dirty Water	55	44
P-12	1509	8	Asbestos Cement	1960	120	661	0	0	Gravel/Sand	None	71	39
P-13	1511	8	PVC	2005	130	190	0	0	Gravel/Sand	None	71	11
P-14	641	8	Asbestos Cement	1964	130	833	0	0	Gravel/Sand	Dirty Water	66	39
P-14	1513	8	PVC	2005	130	389	0	0	Gravel/Sand	None	71	11
P-15	1515	8	PVC	1998	130	546	0	0	Gravel/Sand	None	50	12
P-16	642	8	Asbestos Cement	1964	130	253	0	0	Gravel/Sand	None	86	40
P-16	1516	6	Cast Iron	1954	80	424	0	0	Gravel/Sand	None	44	33
P-18	643	8	Asbestos Cement	1964	130	369	0	0	Gravel/Sand	Dirty Water	95	45
P-18	1519	8	Asbestos Cement	1955	130	871	0	0	Gravel/Sand	None	67	39
P-20	644	8	Asbestos Cement	1960	130	1,379	0	0	Gravel/Sand	Dirty Water	100	50
P-20	1522	8	Asbestos Cement	1955	130	3,216	0	0	Potentially corrosive soil	None	55	47
P-22	645	8	Asbestos Cement	1960	130	589	0	0	Gravel/Sand	Dirty Water	109	50
P-23	1527	8	Asbestos Cement	1950	130	307	1	0	Potentially corrosive soil	None	97	53
P-24	646	8	Asbestos Cement	1952	130	236	0	0	Gravel/Sand	None	66	39
P-24	1528	8	Asbestos Cement	1950	130	2,556	1	0	Gravel/Sand	None	92	45
P-25	1530	8	Asbestos Cement	1940	130	1,715	1	1	Gravel/Sand	Dirty Water	99	71
P-26	1531	8	Asbestos Cement	1940	130	736	1	1	Gravel/Sand	Dirty Water	80	65
P-27	1533	8	Asbestos Cement	1950	130	922	1	3	Gravel/Sand	Dirty Water	99	75
P-28	647	12	PVC	2003	130	486	0	0	Gravel/Sand	None	60	3
P-28	1534	8	Asbestos Cement	1950	130	1,394	1	3	Gravel/Sand	Dirty Water	100	75
P-29	1536	8	Asbestos Cement	1941	130	1,416	0	1	Gravel/Sand	None	135	60
P-30	1537	8	Asbestos Cement	1941	130	1,620	0	1	Potentially corrosive soil	None	164	68
P-31	1539	8	Asbestos Cement	1949	130	423	0	0	Potentially corrosive soil	None	95	53
P-32	1540	8	Asbestos Cement	1949	130	2,225	0	0	Identified corrosive soil	None	96	55
P-33	1542	8	Asbestos Cement	1955	130	1,780	0	0	Gravel/Sand	None	43	39
P-34	649	10	Asbestos Cement	1969	150	700	0	0	Gravel/Sand	None	122	36
P-34	1543	8	PVC	2005	130	172	0	0	Gravel/Sand	None	44	11

Pipe Input Data
Capital Efficiency Plan
West Boylston, MA

Label	SAPID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Water Hammer	Asset Management Score
P-38	650	4	PVC	1978	130	784	0	0	Gravel/Sand	None	116	27
P-40	651	6	Asbestos Cement	1958	120	421	0	0	Gravel/Sand	None	51	41
P-42	652	8	Asbestos Cement	1950	150	109	0	0	Gravel/Sand	None	123	47
P-44	653	8	Asbestos Cement	1950	150	1,996	0	0	Gravel/Sand	None	120	47
P-46	654	6	Asbestos Cement	1944	150	597	1	0	Gravel/Sand	None	114	48
P-50	655	6	Asbestos Cement	1944	120	535	0	0	Gravel/Sand	None	69	42
P-54	657	12	PVC	2003	130	1,161	0	0	Gravel/Sand	None	65	3
P-56	658	6	Asbestos Cement	1944	150	831	0	0	Gravel/Sand	None	101	48
P-58	659	6	Asbestos Cement	1944	150	213	0	0	Gravel/Sand	None	123	52
P-60	660	1	PVC	2005	130	494	0	0	Gravel/Sand	None	193	27
P-62	661	2	Asbestos Cement	1942	120	484	0	0	Gravel/Sand	None	86	45
P-64	662	6	Asbestos Cement	1942	120	402	0	0	Gravel/Sand	None	78	42
P-70	665	8	Asbestos Cement	1940	130	342	0	0	Gravel/Sand	None	97	46
P-72	666	8	Asbestos Cement	1940	130	167	0	0	Gravel/Sand	None	85	40
P-74	667	8	Asbestos Cement	1942	130	102	0	0	Gravel/Sand	None	71	40
P-76	668	8	Asbestos Cement	1940	130	312	0	0	Gravel/Sand	None	82	40
P-78	669	12	PVC	2003	130	922	0	0	Gravel/Sand	None	64	3
P-82	670	6	Asbestos Cement	1941	120	752	0	0	Gravel/Sand	None	66	42
P-84	671	8	Asbestos Cement	1940	130	802	0	1	Gravel/Sand	None	58	60
P-86	672	8	Asbestos Cement	1941	130	83	0	0	Gravel/Sand	None	55	40
P-88	673	8	Asbestos Cement	1941	150	1,686	1	1	Gravel/Sand	None	140	70
P-90	674	6	Asbestos Cement	1944	150	800	1	0	Gravel/Sand	None	106	48
P-92	675	6	Asbestos Cement	1944	120	130	0	0	Gravel/Sand	None	94	48
P-96	676	8	Asbestos Cement	1948	130	981	0	0	Gravel/Sand	None	50	39
P-98	677	10	Asbestos Cement	1967	140	703	0	0	Gravel/Sand	None	76	28
P-100	678	10	Asbestos Cement	1967	140	729	0	0	Gravel/Sand	None	18	28
P-102	679	8	Asbestos Cement	1940	130	1,183	0	2	Gravel/Sand	None	9	65
P-104	680	8	PVC	1987	130	1,761	0	0	Gravel/Sand	None	41	12
P-108	682	6	Asbestos Cement	1949	120	569	0	0	Gravel/Sand	None	88	47
P-110	683	4	PVC	1978	130	664	0	0	Gravel/Sand	None	120	27
P-112	684	8	Asbestos Cement	1940	150	175	1	0	Gravel/Sand	None	140	50
P-114	685	8	Asbestos Cement	1940	150	199	1	0	Gravel/Sand	None	140	50
P-116	686	8	Asbestos Cement	1951	130	370	0	0	Gravel/Sand	None	124	49
P-118	687	8	Asbestos Cement	1951	130	75	0	0	Gravel/Sand	None	123	49
P-120	688	8	Asbestos Cement	1951	130	509	0	0	Gravel/Sand	None	54	39
P-128	689	8	Asbestos Cement	1940	150	1,299	1	0	Gravel/Sand	None	139	48
P-132	691	8	Asbestos Cement	1940	150	1,119	1	0	Gravel/Sand	None	81	40

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P-134	692	8	Asbestos Cement	1940	150	1,566	1	0	Gravel/Sand	None	85	40
P-136	693	8	Asbestos Cement	1940	130	1,796	0	0	Identified corrosive soil	None	81	50
P-138	694	8	Asbestos Cement	1940	130	637	0	0	Gravel/Sand	None	79	40
P-142	696	8	Asbestos Cement	1940	130	1,554	0	0	Gravel/Sand	None	60	40
P-144	697	8	Asbestos Cement	1940	130	796	0	0	Gravel/Sand	None	78	40
P-150	699	8	PVC	2000	130	1,809	0	0	Gravel/Sand	None	82	11
P-152	700	8	Asbestos Cement	1940	130	533	0	0	Gravel/Sand	None	61	40
P-154	701	6	Asbestos Cement	1940	120	296	0	0	Gravel/Sand	None	51	42
P-156	702	8	Asbestos Cement	1940	130	281	0	0	Gravel/Sand	None	50	40
P-162	704	6	Cast Iron	1954	80	597	0	0	Gravel/Sand	None	32	33
P-170	707	6	Cast Iron	1940	80	361	1	0	Gravel/Sand	None	106	35
P-172	708	6	PVC	1992	130	231	1	0	Gravel/Sand	None	96	14
P-174	709	6	PVC	1992	130	286	1	0	Gravel/Sand	None	95	14
P-176	710	2	Ductile Iron	1992	100	236	0	0	Gravel/Sand	None	50	17
P-178	711	8	PVC	1995	130	465	0	0	Gravel/Sand	None	46	12
P-182	712	2	PVC	1998	130	230	0	0	Gravel/Sand	None	48	17
P-186	713	8	Asbestos Cement	1950	130	582	0	0	Potentially corrosive soil	None	46	47
P-188	714	8	Asbestos Cement	1950	130	195	0	0	Other	None	38	48
P-190	715	8	Asbestos Cement	1950	130	276	0	0	Gravel/Sand	None	38	39
P-194	717	8	Asbestos Cement	1975	130	372	0	0	Gravel/Sand	None	63	30
P-196	718	8	Asbestos Cement	1975	130	1,179	0	0	Gravel/Sand	None	57	30
P-198	719	8	Asbestos Cement	1975	130	733	0	0	Gravel/Sand	None	40	30
P-200	720	8	Asbestos Cement	1942	130	1,930	0	0	Identified corrosive soil	None	82	50
P-202	721	8	Asbestos Cement	1953	130	255	0	0	Gravel/Sand	None	73	39
P-204	722	8	Asbestos Cement	1953	130	219	0	0	Gravel/Sand	None	77	39
P-206	723	8	Asbestos Cement	1953	130	69	0	0	Gravel/Sand	None	85	39
P-208	724	8	Asbestos Cement	1953	130	495	0	0	Identified corrosive soil	None	76	49
P-210	725	8	Asbestos Cement	1953	130	239	0	1	Identified corrosive soil	None	80	69
P-212	726	8	Asbestos Cement	1953	130	259	0	0	Gravel/Sand	None	76	39
P-214	727	8	Asbestos Cement	1942	130	232	0	1	Gravel/Sand	None	73	60
P-216	728	8	Asbestos Cement	1942	130	334	0	0	Gravel/Sand	None	70	40
P-218	729	8	Asbestos Cement	1953	130	534	0	0	Gravel/Sand	None	74	39
P-220	730	8	Asbestos Cement	1975	130	537	0	0	Gravel/Sand	None	61	30
P-222	731	8	Asbestos Cement	1975	130	316	0	0	Gravel/Sand	None	42	30
P-224	732	8	Asbestos Cement	1975	130	243	0	0	Gravel/Sand	None	41	30
P-226	733	8	Asbestos Cement	1953	130	305	0	0	Gravel/Sand	None	87	39
P-228	734	8	Asbestos Cement	1942	130	524	0	0	Gravel/Sand	None	77	40

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P-230	735	8	Asbestos Cement	1940	130	228	0	0	Gravel/Sand	None	62	40
P-232	736	6	Asbestos Cement	1950	120	671	0	0	Gravel/Sand	None	54	41
P-234	737	6	Asbestos Cement	1950	120	249	0	0	Gravel/Sand	None	27	41
P-236	738	8	Asbestos Cement	1950	130	510	0	0	Gravel/Sand	None	27	39
P-244	741	6	Asbestos Cement	1940	120	918	0	0	Gravel/Sand	None	58	42
P-246	742	8	Asbestos Cement	1950	130	91	0	0	Gravel/Sand	None	48	39
P-248	743	6	PVC	2002	120	287	0	0	Gravel/Sand	None	52	14
P-258	744	8	Asbestos Cement	1950	130	820	0	0	Gravel/Sand	None	121	47
P-260	745	8	Ductile Iron	2004	130	827	0	0	Gravel/Sand	None	102	19
P-266	748	8	Asbestos Cement	1954	130	109	0	0	Gravel/Sand	None	90	45
P-274	750	8	Asbestos Cement	1942	130	399	0	0	Other	None	77	49
P-276	751	8	Asbestos Cement	1942	130	367	0	0	Other	None	83	49
P-280	753	8	Asbestos Cement	1942	130	230	0	0	Gravel/Sand	None	92	40
P-284	754	8	Asbestos Cement	1954	130	362	0	3	Gravel/Sand	None	77	64
P-286	755	8	Asbestos Cement	1954	130	525	0	0	Gravel/Sand	None	75	39
P-288	756	8	Asbestos Cement	1956	130	482	0	0	Gravel/Sand	None	69	39
P-292	758	8	Asbestos Cement	1956	130	260	0	0	Gravel/Sand	None	74	39
P-294	759	8	Asbestos Cement	1956	130	98	0	0	Gravel/Sand	None	56	39
P-296	760	8	Asbestos Cement	1956	130	177	0	0	Gravel/Sand	None	60	39
P-298	761	8	Asbestos Cement	1956	130	334	0	0	Gravel/Sand	None	56	39
P-300	762	8	Asbestos Cement	1956	130	482	0	0	Gravel/Sand	None	73	39
P-302	763	6	Asbestos Cement	1950	120	474	0	0	Gravel/Sand	None	29	41
P-304	764	8	Asbestos Cement	1940	130	288	0	0	Gravel/Sand	None	51	40
P-310	767	8	Asbestos Cement	1950	130	210	0	0	Gravel/Sand	None	95	39
P-312	768	8	Asbestos Cement	1950	130	303	0	0	Gravel/Sand	None	65	39
P-314	769	8	Asbestos Cement	1950	130	251	0	1	Gravel/Sand	None	68	0
P-318	771	8	Asbestos Cement	1950	130	399	0	0	Gravel/Sand	None	105	45
P-320	772	8	Asbestos Cement	1950	130	273	0	0	Gravel/Sand	None	132	45
P-322	773	8	Asbestos Cement	1950	130	273	0	0	Gravel/Sand	None	161	45
P-324	774	8	Asbestos Cement	1955	130	324	0	0	Gravel/Sand	None	82	45
P-330	777	8	Asbestos Cement	1950	130	484	0	0	Gravel/Sand	None	78	39
P-332	778	8	Asbestos Cement	1950	130	818	0	0	Gravel/Sand	None	90	39
P-334	779	8	Asbestos Cement	1950	130	825	0	0	Gravel/Sand	None	112	45
P-336	780	8	Asbestos Cement	1950	130	765	0	0	Gravel/Sand	None	82	39
P-340	782	8	Ductile Iron	1980	130	103	0	0	Gravel/Sand	None	80	12
P-344	784	8	Asbestos Cement	1946	130	179	0	0	Gravel/Sand	None	94	39
P-346	785	8	Asbestos Cement	1946	130	192	0	1	Identified corrosive soil	None	96	69

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P-348	786	8	Asbestos Cement	1946	130	162	0	0	Gravel/Sand	None	101	45
P-350	787	8	Asbestos Cement	1946	130	195	0	0	Gravel/Sand	None	98	39
P-352	788	8	Asbestos Cement	1946	130	194	0	1	Gravel/Sand	None	94	59
P-354	789	8	Asbestos Cement	1946	130	342	0	0	Gravel/Sand	None	96	39
P-356	790	8	Asbestos Cement	1946	130	89	0	0	Gravel/Sand	None	80	39
P-358	791	8	Asbestos Cement	1946	130	1,133	0	0	Gravel/Sand	None	125	39
P-360	792	8	Asbestos Cement	1946	130	2,380	0	2	Gravel/Sand	None	209	70
P-362	793	8	Asbestos Cement	1946	130	579	0	1	Gravel/Sand	None	263	74
P-364	794	8	Asbestos Cement	1970	130	781	0	0	Gravel/Sand	None	245	40
P-374	796	8	Asbestos Cement	1962	130	563	0	0	Potentially corrosive soil	None	83	42
P-386	799	6	Asbestos Cement	1942	120	551	0	0	Gravel/Sand	None	78	42
P-388	800	8	Asbestos Cement	1942	130	996	0	0	Gravel/Sand	None	80	40
P-390	801	8	Asbestos Cement	1942	130	238	0	0	Gravel/Sand	None	52	40
P-392	802	8	Asbestos Cement	1942	130	235	0	0	Gravel/Sand	None	53	40
P-394	803	6	Asbestos Cement	1947	120	867	0	3	Gravel/Sand	None	78	66
P-396	804	8	Asbestos Cement	1942	130	246	0	0	Gravel/Sand	None	55	40
P-398	805	8	Asbestos Cement	1942	130	241	0	0	Gravel/Sand	None	52	40
P-400	806	8	Asbestos Cement	1942	130	257	0	0	Gravel/Sand	None	56	40
P-402	807	2	Cast Iron	1943	50	223	0	0	Gravel/Sand	None	57	38
P-404	808	8	PVC	1995	130	480	0	0	Gravel/Sand	None	50	12
P-406	809	8	PVC	1995	130	236	0	0	Gravel/Sand	None	61	12
P-408	810	8	PVC	1986	130	407	0	0	Gravel/Sand	None	60	12
P-410	811	8	PVC	1986	130	170	0	0	Gravel/Sand	None	53	12
P-412	812	2	Cast Iron	1943	50	231	0	0	Gravel/Sand	None	70	38
P-414	813	8	Asbestos Cement	1941	130	237	0	0	Gravel/Sand	None	57	40
P-418	814	2	Cast iron	1943	40	312	0	0	Gravel/Sand	None	71	38
P-420	815	6	Asbestos Cement	1949	130	272	0	0	Gravel/Sand	None	62	41
P-422	816	6	Asbestos Cement	1949	130	129	0	0	Gravel/Sand	None	66	41
P-426	818	6	Asbestos Cement	1949	120	241	0	0	Gravel/Sand	None	63	41
P-428	819	6	Asbestos Cement	1949	120	248	0	0	Gravel/Sand	None	63	41
P-430	820	6	Asbestos Cement	1950	120	420	0	0	Gravel/Sand	None	63	41
P-432	821	8	Asbestos Cement	1941	130	329	0	0	Gravel/Sand	None	52	40
P-434	822	8	Asbestos Cement	1941	130	473	0	0	Gravel/Sand	None	58	40
P-436	823	8	Asbestos Cement	1941	130	228	0	0	Gravel/Sand	None	63	40
P-440	824	8	Asbestos Cement	1941	130	287	0	0	Potentially corrosive soil	None	103	54
P-442	825	8	Asbestos Cement	1941	130	741	0	1	Potentially corrosive soil	None	100	74
P-444	826	8	Asbestos Cement	1941	130	284	0	1	Potentially corrosive soil	None	119	74

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P-448	827	8	Asbestos Cement	1942	130	570	1	0	Gravel/Sand	None	131	40
P-452	828	8	Asbestos Cement	1942	130	1,139	0	0	Gravel/Sand	None	97	40
P-454	829	8	Asbestos Cement	1942	130	330	1	0	Gravel/Sand	None	153	40
P-456	830	8	Asbestos Cement	1942	130	1,062	0	0	Gravel/Sand	None	65	40
P-458	831	8	Asbestos Cement	1942	130	283	0	0	Gravel/Sand	None	59	40
P-462	832	8	Asbestos Cement	1942	130	2,163	0	0	Identified corrosive soil	None	243	60
P-464	833	8	Asbestos Cement	1942	130	74	0	0	Gravel/Sand	None	153	46
P-466	834	8	Asbestos Cement	1942	130	930	0	0	Gravel/Sand	None	131	46
P-468	835	8	Asbestos Cement	1942	130	396	0	0	Gravel/Sand	None	125	46
P-470	836	8	Asbestos Cement	1950	130	273	0	0	Gravel/Sand	None	109	45
P-472	837	8	Asbestos Cement	1950	130	169	0	1	Gravel/Sand	None	109	65
P-474	838	8	Asbestos Cement	1950	130	187	0	0	Gravel/Sand	None	107	45
P-476	839	8	Asbestos Cement	1950	130	153	0	1	Gravel/Sand	None	89	59
P-478	840	8	Asbestos Cement	1950	130	239	0	0	Gravel/Sand	None	85	39
P-480	841	8	Asbestos Cement	1950	130	94	0	0	Gravel/Sand	None	81	39
P-482	842	8	Asbestos Cement	1950	130	152	0	0	Gravel/Sand	None	81	39
P-486	844	8	Asbestos Cement	1950	130	250	0	0	Gravel/Sand	None	78	39
P-492	847	8	Asbestos Cement	1955	130	356	0	0	Gravel/Sand	None	92	39
P-494	848	8	Asbestos Cement	1955	130	1,005	0	0	Gravel/Sand	None	77	39
P-498	850	8	Asbestos Cement	1955	130	193	0	0	Gravel/Sand	None	87	45
P-500	851	8	Asbestos Cement	1955	130	269	0	0	Gravel/Sand	None	84	45
P-502	852	8	Asbestos Cement	1957	130	696	0	0	Gravel/Sand	None	80	39
P-506	854	8	Asbestos Cement	1955	130	651	0	0	Gravel/Sand	None	80	39
P-508	855	8	Asbestos Cement	1955	130	111	0	0	Gravel/Sand	None	87	39
P-510	856	8	Asbestos Cement	1955	130	101	0	0	Gravel/Sand	None	87	39
P-512	857	8	Asbestos Cement	1955	130	336	0	0	Gravel/Sand	None	72	39
P-514	858	8	Asbestos Cement	1955	130	292	0	0	Gravel/Sand	None	90	45
P-516	859	8	Asbestos Cement	1955	130	257	0	0	Gravel/Sand	None	84	39
P-518	860	8	Asbestos Cement	1955	130	588	0	0	Gravel/Sand	None	89	45
P-520	861	8	Asbestos Cement	1955	130	274	0	0	Gravel/Sand	None	110	45
P-522	862	8	Asbestos Cement	1955	130	271	0	0	Gravel/Sand	None	103	45
P-524	863	8	Asbestos Cement	1955	130	252	0	0	Gravel/Sand	None	96	45
P-526	864	8	Asbestos Cement	1955	130	442	0	0	Gravel/Sand	None	94	45
P-528	865	6	Asbestos Cement	1959	120	784	0	0	Gravel/Sand	None	66	41
P-530	866	6	Asbestos Cement	1959	120	759	0	0	Gravel/Sand	None	85	47
P-532	867	6	Asbestos Cement	1959	120	635	0	0	Gravel/Sand	None	81	41
P-534	868	8	Asbestos Cement	1949	130	79	0	0	Potentially corrosive soil	None	95	53

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P-536	869	8	Ductile Iron	2013	130	260	0	0	Potentially corrosive soil	None	100	25
P-538	870	8	Ductile Iron	2013	130	1,060	0	0	Potentially corrosive soil	None	101	25
P-540	871	8	Ductile Iron	2013	130	176	0	0	Gravel/Sand	None	89	17
P-544	873	6	Asbestos Cement	1970	120	983	0	0	Gravel/Sand	None	115	32
P-546	874	8	Asbestos Cement	1950	130	1,191	0	0	Gravel/Sand	None	138	45
P-548	875	8	Asbestos Cement	1950	130	512	0	0	Potentially corrosive soil	None	104	53
P-560	878	8	Asbestos Cement	1960	130	1,496	0	0	Gravel/Sand	None	97	45
P-564	880	12	Asbestos Cement	1975	140	1,030	0	0	Gravel/Sand	None	61	21
P-572	881	12	Asbestos Cement	1964	140	1,066	0	0	Gravel/Sand	None	162	26
P-574	882	8	Asbestos Cement	1970	130	765	0	0	Gravel/Sand	None	109	30
P-576	883	8	Asbestos Cement	1946	130	835	0	0	Gravel/Sand	None	112	39
P-582	886	8	Asbestos Cement	1941	130	688	0	0	Gravel/Sand	Dirty Water	198	51
P-584	887	8	Asbestos Cement	1941	130	1,893	0	0	Gravel/Sand	Dirty Water	79	45
P-586	888	8	Asbestos Cement	1953	130	872	0	0	Gravel/Sand	Dirty Water	79	44
P-588	889	10	Asbestos Cement	1942	140	1,806	0	4	Identified corrosive soil	Dirty Water	113	80
P-594	892	6	Asbestos Cement	1967	120	1,190	0	0	Gravel/Sand	Dirty Water	96	47
P-600	894	10	Asbestos Cement	1942	140	668	1	0	Gravel/Sand	Dirty Water	78	39
P-604	895	8	Asbestos Cement	1950	130	752	1	0	Gravel/Sand	None	51	39
P-606	896	8	Asbestos Cement	1950	130	394	0	0	Gravel/Sand	None	40	39
P-608	897	8	Asbestos Cement	1950	130	551	0	0	Gravel/Sand	None	80	39
P-616	900	8	Asbestos Cement	1950	130	929	0	0	Gravel/Sand	None	48	39
P-618	901	8	Asbestos Cement	1950	130	2,577	0	0	Gravel/Sand	None	46	39
P-622	902	8	PVC	1999	130	798	0	0	Gravel/Sand	None	93	18
P-626	904	8	Asbestos Cement	1950	130	2,280	0	0	Gravel/Sand	None	16	39
P-630	906	8	Asbestos Cement	1975	130	560	0	0	Gravel/Sand	None	73	30
P-634	907	8	Asbestos Cement	1940	130	2,347	1	0	Identified corrosive soil	None	90	56
P-636	908	8	Asbestos Cement	1940	130	961	1	0	Gravel/Sand	None	67	40
P-644	911	8	Asbestos Cement	1965	130	299	0	0	Gravel/Sand	None	46	34
P-646	912	8	Asbestos Cement	1956	130	664	0	0	Gravel/Sand	None	47	39
P-648	913	8	Asbestos Cement	1956	130	278	0	0	Gravel/Sand	None	44	39
P-652	914	8	Asbestos Cement	1965	130	292	0	0	Gravel/Sand	None	48	34
P-654	915	8	Asbestos Cement	1956	130	739	0	0	Gravel/Sand	None	47	39
P-656	916	8	Asbestos Cement	1950	130	437	0	0	Gravel/Sand	None	49	39
P-658	917	8	Asbestos Cement	1952	130	114	1	0	Gravel/Sand	None	53	39
P-660	918	8	Asbestos Cement	1952	130	589	0	0	Gravel/Sand	None	45	39
P-662	919	8	Asbestos Cement	1952	130	1,210	0	0	Gravel/Sand	None	47	39
P-664	920	8	Asbestos Cement	1952	130	484	0	0	Gravel/Sand	None	56	39

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P-666	921	8	Asbestos Cement	1968	130	1,273	1	0	Gravel/Sand	None	50	34
P-668	922	8	Asbestos Cement	1956	130	788	0	0	Gravel/Sand	None	45	39
P-670	923	8	Asbestos Cement	1958	130	268	0	0	Gravel/Sand	Dirty Water	56	44
P-674	924	8	PVC	1995	130	365	0	0	Gravel/Sand	Dirty Water	64	17
P-676	925	10	Asbestos Cement	1942	140	2,256	0	0	Gravel/Sand	Dirty Water	77	39
P-680	927	10	Asbestos Cement	1942	140	1,711	0	2	Identified corrosive soil	Dirty Water	115	80
P-682	928	12	Asbestos Cement	1972	140	1,180	0	0	Gravel/Sand	Dirty Water	60	26
P-684	929	12	Asbestos Cement	1972	140	930	0	0	Gravel/Sand	Dirty Water	136	34
P-686	930	10	Asbestos Cement	1942	140	172	1	0	Gravel/Sand	Dirty Water	109	45
P-688	931	10	Asbestos Cement	1942	140	256	0	0	Gravel/Sand	Dirty Water	111	45
P-690	932	10	Asbestos Cement	1942	140	272	1	0	Gravel/Sand	Dirty Water	107	45
P-692	933	8	Asbestos Cement	1942	130	243	0	1	Gravel/Sand	Dirty Water	107	71
P-696	935	2	Cast Iron	1942	75	470	0	1	Gravel/Sand	None	153	64
P-698	936	2	Cast Iron	1942	75	430	0	0	Gravel/Sand	None	92	44
P-699	1061	8	Asbestos Cement	1942	130	322	0	2	Gravel/Sand	Dirty Water	108	76
P-700	1062	8	Asbestos Cement	1942	130	334	0	1	Gravel/Sand	Dirty Water	102	71
P-702	937	8	Asbestos Cement	1942	130	2,039	0	0	Gravel/Sand	Dirty Water	93	51
P-710	939	6	Asbestos Cement	1949	120	2,141	0	0	Gravel/Sand	Dirty Water	60	46
P-712	940	8	Asbestos Cement	1949	130	1,287	0	0	Gravel/Sand	Dirty Water	60	44
P-720	944	8	PVC	1987	130	390	0	0	Gravel/Sand	Dirty Water	73	17
P-722	945	6	Asbestos Cement	1942	120	596	0	0	Gravel/Sand	Dirty Water	96	53
P-724	946	8	PVC	1985	130	490	0	0	Gravel/Sand	Dirty Water	60	17
P-730	947	10	Asbestos Cement	1942	140	330	0	0	Gravel/Sand	Dirty Water	73	39
P-732	948	8	Ductile Iron	2006	120	565	0	0	Gravel/Sand	Dirty Water	69	16
P-734	949	8	Ductile Iron	2006	120	940	0	0	Gravel/Sand	Dirty Water	61	16
P-736	950	8	Asbestos Cement	1942	130	189	0	0	Gravel/Sand	Dirty Water	59	45
P-738	951	8	Ductile Iron	2006	120	602	0	0	Gravel/Sand	Dirty Water	57	16
P-742	952	8	Ductile Iron	2006	120	320	0	0	Gravel/Sand	Dirty Water	116	24
P-744	953	8	Asbestos Cement	1942	130	307	0	0	Gravel/Sand	Dirty Water	59	45
P-746	954	8	PVC	1992	130	459	0	0	Gravel/Sand	Dirty Water	58	17
P-748	955	6	Asbestos Cement	1942	120	448	0	0	Gravel/Sand	Dirty Water	94	53
P-754	956	6	Asbestos Cement	1942	120	332	0	0	Gravel/Sand	Dirty Water	98	53
P-756	957	8	Asbestos Cement	1942	130	356	0	0	Gravel/Sand	Dirty Water	93	51
P-760	959	6	Asbestos Cement	1960	120	167	0	0	Gravel/Sand	None	60	41
P-762	960	6	Asbestos Cement	1960	120	347	0	0	Gravel/Sand	None	51	41
P-768	963	6	Asbestos Cement	1942	120	65	0	0	Gravel/Sand	None	117	50
P-772	964	8	Asbestos Cement	1940	130	868	0	0	Gravel/Sand	None	48	40

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P-774	965	6	Asbestos Cement	1940	120	405	0	0	Gravel/Sand	None	50	42
P-776	966	8	Asbestos Cement	1940	150	83	0	0	Gravel/Sand	None	129	48
P-778	967	8	Asbestos Cement	1953	130	421	1	2	Gravel/Sand	None	124	72
P-780	968	8	Asbestos Cement	1940	130	81	0	0	Gravel/Sand	None	119	48
P-782	969	8	Asbestos Cement	1940	130	85	0	0	Gravel/Sand	None	126	48
P-784	970	8	Asbestos Cement	1940	130	70	0	0	Gravel/Sand	None	46	40
P-788	971	8	Asbestos Cement	1940	130	1,000	1	0	Identified corrosive soil	None	118	50
P-798	973	8	Asbestos Cement	1950	150	183	0	0	Gravel/Sand	None	123	39
P-804	976	8	Asbestos Cement	1940	130	1,044	0	2	Identified corrosive soil	None	73	75
P-806	977	8	Ductile Iron	2006	120	344	0	0	Gravel/Sand	Dirty Water	59	16
P-810	979	6	Asbestos Cement	1942	120	319	0	0	Gravel/Sand	Dirty Water	67	47
P-812	980	6	Asbestos Cement	1942	120	263	0	0	Gravel/Sand	Dirty Water	64	47
P-814	981	8	PVC	1970	130	396	0	0	Gravel/Sand	Dirty Water	57	20
P-816	982	8	Asbestos Cement	1942	130	144	0	0	Gravel/Sand	Dirty Water	63	45
P-818	983	8	Asbestos Cement	1950	130	423	0	0	Gravel/Sand	Dirty Water	57	44
P-820	984	8	Asbestos Cement	1962	130	536	0	0	Gravel/Sand	None	50	34
P-822	985	6	Asbestos Cement	1962	120	487	0	0	Gravel/Sand	None	49	36
P-824	986	8	PVC	1995	130	228	0	0	Gravel/Sand	None	45	12
P-826	987	2	Cast Iron	1949	50	556	0	3	Gravel/Sand	None	68	61
P-828	989	12	Asbestos Cement	1970	140	1,341	0	0	Gravel/Sand	Dirty Water	121	26
P-830	988	2	Cast Iron	1960	50	210	0	0	Gravel/Sand	None	96	36
P-832	990	6	Asbestos Cement	1941	120	822	0	0	Gravel/Sand	Dirty Water	85	53
P-840	992	16	Ductile Iron	1995	150	576	0	0	Gravel/Sand	None	100	9
P-842	993	16	Ductile Iron	1995	150	611	0	0	Gravel/Sand	None	95	9
P-844	994	8	Ductile Iron	1995	150	244	0	0	Gravel/Sand	None	94	18
P-846	995	8	Ductile Iron	1995	150	201	0	0	Gravel/Sand	None	97	18
P-848	996	8	Asbestos Cement	1940	130	263	0	0	Gravel/Sand	None	71	40
P-850	997	8	Asbestos Cement	1942	130	226	0	0	Gravel/Sand	None	97	46
P-854	999	10	Asbestos Cement	1942	130	1,095	0	2	Gravel/Sand	None	113	65
P-856	1003	8	Asbestos Cement	1940	130	872	0	0	Identified corrosive soil	None	116	50
P-862	1002	8	Asbestos Cement	1940	130	400	1	0	Gravel/Sand	Dirty Water	99	51
P-866	1004	8	Asbestos Cement	1941	130	745	0	0	Gravel/Sand	None	44	40
P-868	1005	8	Asbestos Cement	1942	130	295	0	0	Identified corrosive soil	None	252	65
P-870	1006	8	Asbestos Cement	1942	130	221	0	0	Identified corrosive soil	None	251	65
P-876	1008	8	Asbestos Cement	1941	130	184	0	0	Gravel/Sand	None	111	48
P-878	1009	8	Asbestos Cement	1940	130	541	0	0	Gravel/Sand	None	86	46
P-882	1010	8	Asbestos Cement	1940	130	519	0	0	Gravel/Sand	None	89	46

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P-884	1011	8	Asbestos Cement	1940	130	1,195	0	0	Identified corrosive soil	None	91	56
P-886	1012	8	Asbestos Cement	1950	130	1,447	0	0	Gravel/Sand	None	47	39
P-888	1013	8	Asbestos Cement	1950	130	1,047	0	0	Gravel/Sand	None	38	39
P-890	1014	8	PVC	1985	130	364	0	0	Gravel/Sand	Dirty Water	39	17
P-892	1015	8	PVC	1985	130	855	0	0	Gravel/Sand	None	33	12
P-894	1016	8	Asbestos Cement	1950	130	1,016	0	0	Gravel/Sand	Dirty Water	57	44
P-896	1017	8	Asbestos Cement	1950	130	1,001	0	0	Gravel/Sand	Dirty Water	59	44
P-898	1018	8	Asbestos Cement	1958	130	596	0	0	Gravel/Sand	Dirty Water	64	44
P-900	1019	8	Asbestos Cement	1958	130	628	0	0	Gravel/Sand	Dirty Water	63	44
P-908	1021	8	Asbestos Cement	1952	130	380	0	0	Gravel/Sand	None	115	47
P-910	1022	8	Asbestos Cement	1952	130	335	0	0	Gravel/Sand	None	48	39
P-912	1023	8	Asbestos Cement	1952	130	577	0	0	Gravel/Sand	None	45	39
P-914	1024	12	PVC	2003	130	692	0	0	Gravel/Sand	None	57	3
P-916	1025	12	PVC	2003	130	364	0	0	Gravel/Sand	None	53	3
P-918	1026	6	Asbestos Cement	1942	120	691	0	0	Gravel/Sand	None	63	42
P-920	1027	6	Asbestos Cement	1942	120	674	0	0	Gravel/Sand	None	65	42
P-922	1028	8	Asbestos Cement	1940	130	374	0	0	Gravel/Sand	None	53	40
P-924	1029	8	Asbestos Cement	1940	150	935	1	2	Gravel/Sand	None	140	75
P-926	1030	8	Asbestos Cement	1946	130	95	0	0	Gravel/Sand	None	50	39
P-928	1031	8	Asbestos Cement	1950	130	923	0	0	Gravel/Sand	None	93	45
P-930	1032	8	Asbestos Cement	1950	130	507	0	0	Gravel/Sand	None	84	45
P-932	1033	8	Asbestos Cement	1941	130	1,561	0	0	Gravel/Sand	None	58	40
P-934	1034	8	Asbestos Cement	1941	130	1,394	0	2	Other	None	68	74
P-940	1036	10	Asbestos Cement	1969	150	544	0	0	Gravel/Sand	None	115	36
P-944	1037	10	Asbestos Cement	1969	150	1,098	0	0	Gravel/Sand	None	75	28
P-952	1039	8	Asbestos Cement	1960	130	895	0	0	Gravel/Sand	None	103	47
P-954	1040	8	Asbestos Cement	1970	130	338	0	1	Gravel/Sand	None	95	56
P-960	1043	8	Asbestos Cement	1942	130	175	0	1	Gravel/Sand	None	73	60
P-962	1044	8	Asbestos Cement	1942	130	81	0	0	Gravel/Sand	None	112	40
P-964	1045	16	Asbestos Cement	1975	150	535	0	0	Other	None	95	36
P-966	1046	16	Asbestos Cement	1975	150	370	0	1	Gravel/Sand	None	98	47
P-968	1047	8	Asbestos Cement	1975	130	28	0	0	Gravel/Sand	None	98	36
P-970	1048	16	Asbestos Cement	1975	150	863	0	0	Gravel/Sand	None	86	21
P-972	1049	16	Asbestos Cement	1975	150	762	0	0	Gravel/Sand	None	82	21
P-974	1050	8	Asbestos Cement	1955	130	50	0	0	Gravel/Sand	None	98	39
P-976	1051	12	Asbestos Cement	1960	140	356	0	0	Gravel/Sand	None	97	36
P-978	1052	12	Asbestos Cement	1960	140	166	0	0	Gravel/Sand	None	102	38

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P-980	1053	6	Blue Brute	1980	130	198	0	0	Identified corrosive soil	None	83	45
P-982	1054	2	Cast Iron	1949	50	339	0	0	Gravel/Sand	None	89	36
P-984	1055	2	Cast Iron	1949	50	140	0	0	Gravel/Sand	None	103	36
P-986	1056	2	Cast Iron	1949	50	305	0	0	Gravel/Sand	None	88	36
P-988	1057	10	Asbestos Cement	1942	120	689	0	0	Gravel/Sand	Dirty Water	104	45
P-990	1058	10	Asbestos Cement	1942	120	780	0	1	Gravel/Sand	Dirty Water	95	65
P-992	1059	10	Asbestos Cement	1942	140	1,186	1	0	Gravel/Sand	None	61	34
P-994	1060	10	Asbestos Cement	1942	140	442	1	0	Gravel/Sand	None	53	34
P-1004	1066	10	Asbestos Cement	1942	140	650	0	0	Gravel/Sand	Dirty Water	79	39
P-1006	1067	6	Asbestos Cement	1944	130	236	0	0	Gravel/Sand	None	98	48
P-1018	1070	8	Ductile Iron	2000	120	276	0	0	Other	None	98	26
P-1020	1071	8	Ductile Iron	2000	120	853	0	0	Other	None	89	26
P-1024	1072	8	Ductile Iron	2000	120	616	0	0	Identified corrosive soil	None	99	27
P-1026	1073	8	Ductile Iron	2000	120	599	0	0	Identified corrosive soil	None	97	27
P-1032	1074	12	Ductile Iron	2000	130	395	0	0	Gravel/Sand	None	60	3
P-1034	1075	8	Ductile Iron	2000	130	350	0	0	Gravel/Sand	None	48	11
P-1036	1076	12	Ductile Iron	2000	130	323	0	0	Other	None	47	12
P-1038	1077	12	Ductile Iron	2000	130	2,186	0	0	Other	None	45	12
P-1040	1078	12	Ductile Iron	2000	130	772	0	0	Other	None	30	12
P-1042	1079	8	Asbestos Cement	1946	130	60	0	0	Gravel/Sand	None	301	44
P-1044	1080	8	Asbestos Cement	1946	130	43	0	0	Gravel/Sand	None	327	44
P-1048	1082	16	Asbestos Cement	1975	150	2,184	0	1	Identified corrosive soil	None	94	57
P-1052	1083	8	Ductile Iron	2013	130	476	0	0	Gravel/Sand	None	95	17
P-1054	1084	8	Ductile Iron	2013	130	581	0	0	Gravel/Sand	None	94	17
P-1056	1085	8	Ductile Iron	2013	130	400	0	0	Gravel/Sand	None	96	17
P-1058	1086	8	Asbestos Cement	1953	130	384	0	0	Gravel/Sand	None	106	39
P-1060	1087	8	Asbestos Cement	1953	130	344	0	1	Gravel/Sand	None	112	59
P-1064	1099	10	Steel	1983	100	858	0	0	Gravel/Sand	Dirty Water	125	21
P-1065	1100	8	Ductile Iron	2006	120	1,679	0	0	Identified corrosive soil	Dirty Water	126	36
P-1069	1107	8	Ductile Iron	2006	130	442	0	0	Gravel/Sand	Dirty Water	60	16
P-1070	1108	8	Ductile Iron	2006	130	372	0	0	Gravel/Sand	Dirty Water	77	16
P-1071	1116	8	PVC	1975	130	476	0	0	Gravel/Sand	Dirty Water	60	20
P-1072	1117	8	PVC	1975	130	401	0	0	Gravel/Sand	Dirty Water	59	20
P-1073	1118	8	PVC	1985	130	1,008	0	0	Gravel/Sand	Dirty Water	26	17
P-1074	1120	2	Cast Iron	1960	60	217	0	0	Gravel/Sand	None	82	36
P-1076	1123	8	PVC	1992	130	710	0	0	Gravel/Sand	Dirty Water	78	17
P-1077	1124	8	PVC	1992	130	1,130	0	0	Gravel/Sand	Dirty Water	78	17

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P-1079	1127	8	Asbestos Cement	1948	130	1,513	0	0	Potentially corrosive soil	None	93	53
P-1080	1128	8	Ductile Iron	2000	130	2,090	0	0	Gravel/Sand	None	90	17
P-1081	1130	10	Asbestos Cement	1942	140	1,716	0	0	Gravel/Sand	Dirty Water	77	39
P-1082	1131	10	Asbestos Cement	1942	140	969	0	1	Gravel/Sand	Dirty Water	91	65
P-1083	1133	6	Cast Iron	1956	60	1,220	0	0	Gravel/Sand	Dirty Water	82	44
P-1084	1135	8	Asbestos Cement	1941	130	1,974	0	2	Gravel/Sand	None	95	71
P-1085	1136	8	Asbestos Cement	1941	130	446	0	0	Gravel/Sand	None	106	48
P-1086	1138	8	Ductile Iron	2000	130	234	0	0	Gravel/Sand	None	108	19
P-1087	1140	8	Ductile Iron	2000	130	454	0	0	Gravel/Sand	None	102	19
P-1088	1142	8	Ductile Iron	2000	130	767	0	0	Gravel/Sand	None	104	19
P-1089	1143	8	Ductile Iron	2000	130	97	0	0	Gravel/Sand	None	106	19
P-1090	1144	8	Ductile Iron	2000	130	232	0	0	Gravel/Sand	None	107	19
P-1091	1145	6	Asbestos Cement	1940	120	290	0	0	Gravel/Sand	None	124	50
P-1092	1241	8	Asbestos Cement	1952	130	585	0	0	Gravel/Sand	None	58	39
P-1093	1242	8	Asbestos Cement	1952	130	286	0	0	Gravel/Sand	None	49	39
P-1094	1247	8	PVC	1986	130	150	0	0	Gravel/Sand	Dirty Water	73	17
P-1095	1248	8	PVC	1986	130	391	0	0	Gravel/Sand	Dirty Water	79	17
P-1096	1251	10	PVC	1978	130	1,687	0	0	Gravel/Sand	None	36	9
P-1097	1252	10	PVC	1978	150	140	0	0	Gravel/Sand	None	35	9
P-1098	1254	4	PVC	1978	130	1,220	0	0	Gravel/Sand	None	48	19
P-1099	1256	10	PVC	1978	130	551	0	0	Gravel/Sand	None	47	9
P-1100	1257	10	PVC	1978	130	625	0	0	Gravel/Sand	None	43	9
P-1101	1259	8	PVC	1983	150	158	0	0	Gravel/Sand	None	86	18
P-1102	1260	8	PVC	1983	150	813	0	0	Gravel/Sand	None	92	18
P-1105	1266	8	Asbestos Cement	1954	130	203	0	0	Gravel/Sand	None	89	45
P-1106	1267	8	Asbestos Cement	1954	130	94	0	0	Gravel/Sand	None	92	45
P-1107	1269	8	Asbestos Cement	1954	130	727	0	0	Gravel/Sand	None	93	45
P-1108	1270	8	Asbestos Cement	1954	130	78	0	0	Gravel/Sand	None	99	45
P-1109	1273	8	Asbestos Cement	1964	140	235	0	0	Gravel/Sand	None	52	34
P-1110	1274	8	Asbestos Cement	1964	130	637	0	0	Gravel/Sand	None	52	34
P-1111	1277	8	Asbestos Cement	1956	130	125	0	0	Identified corrosive soil	None	74	49
P-1112	1278	8	Asbestos Cement	1956	130	302	0	0	Identified corrosive soil	None	74	49
P-1113	1282	8	Asbestos Cement	1955	130	516	0	0	Gravel/Sand	None	66	39
P-1114	1283	8	Asbestos Cement	1955	130	564	0	0	Gravel/Sand	None	44	39
P-1115	1285	8	Asbestos Cement	1955	130	108	0	0	Gravel/Sand	None	52	39
P-1116	1286	8	Asbestos Cement	1955	130	439	0	0	Gravel/Sand	None	54	39
P-1117	1288	8	Asbestos Cement	1950	130	765	0	0	Gravel/Sand	None	78	39

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P-1118	1289	8	Asbestos Cement	1950	130	98	0	0	Gravel/Sand	None	99	39
P-1119	1294	8	Ductile Iron	2000	120	198	0	0	Other	None	95	26
P-1120	1295	8	Ductile Iron	2000	120	717	0	0	Other	None	98	26
P-1121	1297	8	Cast Iron	1940	33	195	1	0	Gravel/Sand	None	75	33
P-1122	1298	8	Cast Iron	1940	33	269	1	0	Gravel/Sand	None	81	33
P-1123	1300	8	Cast Iron	1940	33	214	1	0	Gravel/Sand	None	76	33
P-1124	1301	8	Cast Iron	1940	33	313	1	0	Gravel/Sand	None	80	33
P-1127	1307	8	Asbestos Cement	1954	130	234	0	0	Gravel/Sand	None	88	45
P-1128	1308	8	Asbestos Cement	1954	130	86	0	0	Gravel/Sand	None	82	45
P-1130	1312	6	Asbestos Cement	1942	120	97	0	0	Gravel/Sand	None	83	48
P-1131	1313	6	Asbestos Cement	1942	130	1,598	0	2	Potentially corrosive soil	None	81	75
P-1132	1315	8	PVC	1986	130	159	0	0	Gravel/Sand	Dirty Water	62	17
P-1133	1316	8	PVC	1986	130	471	0	0	Gravel/Sand	Dirty Water	67	17
P-1134	1318	6	Asbestos Cement	1944	130	201	0	0	Gravel/Sand	None	93	48
P-1135	1319	8	Asbestos Cement	1948	130	679	0	0	Potentially corrosive soil	None	91	53
P-1136	1321	8	Asbestos Cement	1949	130	179	0	0	Gravel/Sand	Dirty Water	64	44
P-1137	1322	6	Asbestos Cement	1949	120	335	0	0	Gravel/Sand	Dirty Water	71	46
P-1140	1325	6	Cast Iron	1954	80	127	0	0	Other	None	46	42
P-1142	1328	8	Ductile Iron	1980	110	1,088	0	0	Identified corrosive soil	None	58	22
P-1143	1329	8	Asbestos Cement	1940	130	1,320	0	2	Gravel/Sand	None	55	65
P-1144	1330	8	Asbestos Cement	1940	130	39	0	0	Gravel/Sand	None	68	40
P-1145	1332	6	Ductile Iron	1980	100	47	0	0	Gravel/Sand	None	89	15
P-1147	1334	6	Cast Iron	1954	33	40	0	0	Other	None	46	42
P-1148	1335	8	Cast Iron	1940	33	540	1	0	Gravel/Sand	None	71	33
P-1149	1337	10	Asbestos Cement	1942	140	783	0	0	Landfills/Junkyards/Contaminated	Dirty Water	105	54
P-1151	1340	10	Asbestos Cement	1942	140	412	0	0	Gravel/Sand	Dirty Water	69	39
P-1153	1343	10	Asbestos Cement	1942	140	267	0	0	Gravel/Sand	Dirty Water	103	45
P-1155	1346	8	Asbestos Cement	1940	130	116	1	0	Gravel/Sand	Dirty Water	99	51
P-1157	1348	8	Asbestos Cement	1940	130	91	1	0	Gravel/Sand	Dirty Water	110	51
P-1158	1350	2	Asbestos Cement	1942	130	348	0	0	Gravel/Sand	None	75	45
P-1160	1353	8	Asbestos Cement	1942	130	2,315	0	2	Gravel/Sand	None	99	71
P-1161	1354	8	Ductile Iron	1980	130	50	0	0	Gravel/Sand	None	77	12
P-1163	1358	6	Asbestos Cement	1946	120	245	0	0	Gravel/Sand	None	59	41
P-1165	1361	8	Asbestos Cement	1946	130	934	0	1	Potentially corrosive soil	None	71	67
P-1166	1362	6	Asbestos Cement	1942	120	791	0	0	Gravel/Sand	None	74	42
P-1167	1363	6	Asbestos Cement	1946	120	57	0	0	Gravel/Sand	None	95	41
P-1168	1365	8	Ductile Iron	1995	130	2,123	0	0	Gravel/Sand	None	96	18

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Label	SAPID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Water Hammer	Asset Management Score
P-1170	1368	8	Asbestos Cement	1949	130	69	0	0	Gravel/Sand	None	101	45
P-1172	1370	16	Ductile Iron	1995	120	1,405	0	0	Gravel/Sand	None	100	9
P-1173	1371	16	Ductile Iron	1995	120	88	0	0	Gravel/Sand	None	100	9
P-1174	1373	8	Asbestos Cement	1949	120	148	0	1	Gravel/Sand	None	63	59
P-1175	1374	6	Asbestos Cement	1949	120	223	0	1	Gravel/Sand	None	62	61
P-1176	1376	8	Ductile Iron	2005	130	308	0	0	Gravel/Sand	None	63	11
P-1177	1378	8	Asbestos Cement	1955	130	63	0	0	Gravel/Sand	None	99	45
P-1178	1379	8	Asbestos Cement	1955	130	215	0	0	Gravel/Sand	None	91	45
P-1180	1382	16	Asbestos Cement	1975	150	652	0	0	Potentially corrosive soil	None	87	35
P-1181	1383	8	Asbestos Cement	1955	130	73	0	0	Gravel/Sand	None	103	45
P-1182	1385	16	Asbestos Cement	1975	150	631	0	0	Gravel/Sand	None	79	21
P-1185	1389	8	Asbestos Cement	1950	130	540	0	0	Gravel/Sand	None	98	39
P-1186	1391	8	Asbestos Cement	1942	130	165	0	0	Gravel/Sand	None	112	40
P-1187	1392	8	Asbestos Cement	1942	130	203	0	0	Gravel/Sand	None	93	40
P-1188	1393	8	Asbestos Cement	1950	130	117	0	0	Gravel/Sand	None	96	39
P-1189	1395	8	Ductile Iron	1980	130	127	0	0	Gravel/Sand	None	91	12
P-1190	1396	8	Asbestos Cement	1946	130	283	0	0	Gravel/Sand	None	93	39
P-1191	1398	8	Ductile Iron	2005	130	212	0	0	Gravel/Sand	None	78	11
P-1192	1400	16	Asbestos Cement	1975	150	914	0	0	Other	None	98	30
P-1194	1403	16	Asbestos Cement	1975	150	1,786	0	0	Gravel/Sand	None	82	21
P-1195	1404	16	Asbestos Cement	1975	150	136	0	0	Gravel/Sand	None	70	21
P-1196	1405	16	Asbestos Cement	1975	150	254	0	0	Gravel/Sand	None	81	21
P-1198	1408	8	Asbestos Cement	1950	130	335	0	0	Gravel/Sand	None	65	39
P-1199	1410	8	Asbestos Cement	1940	130	574	0	0	Gravel/Sand	None	53	40
P-1200	1411	8	Asbestos Cement	1940	130	48	0	0	Gravel/Sand	None	59	40
P-1201	1412	8	Asbestos Cement	1950	130	214	0	0	Gravel/Sand	None	65	39
P-1204	1420	8	PVC	2003	130	107	0	0	Gravel/Sand	None	53	11
P-1207	1431	8	Asbestos Cement	1950	130	272	0	0	Gravel/Sand	None	64	39
P-1208	1432	8	Asbestos Cement	1950	130	9	0	0	Gravel/Sand	None	68	39
P-1209	1434	8	Asbestos Cement	1950	130	9	0	0	Gravel/Sand	None	79	39
P-1210	1435	8	Asbestos Cement	1965	130	951	0	0	Gravel/Sand	None	32	34
P-1212	1438	6	Ductile Iron	1950	130	11	0	0	Gravel/Sand	None	65	27
P-1213	1439	6	Ductile Iron	1950	130	9	0	0	Gravel/Sand	None	76	27
P-1218	1456	8	Asbestos Cement	1950	130	812	0	0	Gravel/Sand	None	63	39
P-1219	1457	8	Asbestos Cement	1950	130	361	0	0	Other	None	69	48
P-1226	1478	8	Asbestos Cement	1940	130	445	0	0	Gravel/Sand	None	64	40
P-1227	1486	8	Asbestos Cement	1940	150	1,540	1	0	Gravel/Sand	None	107	40

Pipe Input Data
Capital Efficiency Plan
West Boylston, MA

Label	SAPID	Diameter (in)	Material	Installation Year	Hazen-Williams C	Length (ft)	Critical	Breaks	Soil Info	Water Quality	Water Hammer	Asset Management Score
P-1228	1487	8	Asbestos Cement	1940	150	1,196	1	0	Gravel/Sand	None	90	40

Pump Input Data
Capital Efficiency Plan
West Boylston, MA

Label	Pump Definition	Elevation (ft)	Hydraulic Grade (Discharge) (ft)	Head (Design) (ft)	Flow (Design) (gpm)	Flow (Absolute) (gpm)
PMP-4	Western Avenue BPS	563.68	717	130	100	0
Rte 12 BPS	New Rt 12 BPS	512	800.52	180	750	786
PMP-2	Laurel Street	495	868.34	180	750	2
PMP-3	Western Avenue BPS	563.96	717	130	100	7

Tank Input Data
Capital Efficiency Plan
West Boylston, MA

Label	Diameter (ft)	Elevation (Base) (ft)	Elevation (Maximum) (ft)	Elevation (Initial) (ft)
Lawrence Street	90.03	778	794	789
Stockwell Road Tank	70	600	633	628
Oakdale Tank	50	600	633	628

Junction Input Data
Capital Efficiency Plan
West Boylston, MA

Label	Zone	Elevation (ft)	Demand (gpm)
J-626	Laurel Street	502	1
J-294	High Service Area	492	6
J-298	High Service Area	492	0
J-670	High Service Area	492	4
J-378	High Service Area	505	5
J-755	Laurel Street	580	1
J-296	High Service Area	512	0
J-92	High Service Area	502	0
J-70	High Service Area	502	2
J-36	High Service Area	502	1
J-94	High Service Area	505	1
J-52	High Service Area	505	4
J-30	High Service Area	512	0
J-54	High Service Area	509	3
J-608	High Service Area	518	2
J-210	High Service Area	518	2
J-586	Laurel Street	600	0
J-40	High Service Area	520	2
J-104	High Service Area	522	0
J-614	High Service Area	522	0
J-610	High Service Area	522	0
J-688	High Service Area	525	1
J-32	High Service Area	525	1
J-672	High Service Area	532	2
J-588	Laurel Street	614	0
J-224	High Service Area	541	6
J-762	High Service Area	547	6
J-765	High Service Area	547	0
J-422	High Service Area	548	1
J-226	High Service Area	551	0
J-96	High Service Area	551	2
J-764	High Service Area	552	8
J-90	High Service Area	551	3
J-430	High Service Area	554	0
J-716	High Service Area	554	1
J-2	Low Service Area	394	0
J-3	Low Service Area	394	0
J-763	High Service Area	555	1
J-4	Low Service Area	397	0
J-6	Low Service Area	397	0
J-218	High Service Area	558	4
J-448	Low Service Area	407	7

Junction Input Data
Capital Efficiency Plan
West Boylston, MA

Label	Zone	Elevation (ft)	Demand (gpm)
J-700	High Service Area	561	2
J-426	High Service Area	561	0
J-803	High Service Area	561.04	0
J-802	High Service Area	561.07	2
J-732	High Service Area	563	0
J-780	High Service Area	563	0
J-544	Low Service Area	403	1
J-428	High Service Area	564	0
J-736	High Service Area	564	0
J-8	Low Service Area	404	0
J-44	High Service Area	564	1
J-710	High Service Area	565	0
J-712	High Service Area	565	2
J-774	High Service Area	565	2
J-538	Low Service Area	405	1
J-542	Low Service Area	405	1
J-546	Low Service Area	403	11
J-730	High Service Area	569	0
J-536	Low Service Area	410	0
J-541	Low Service Area	410	6
J-424	High Service Area	571	1
J-708	High Service Area	571	0
J-706	High Service Area	571	1
J-748	High Service Area	571	0
J-650	High Service Area	571	0
J-652	High Service Area	571	0
J-654	High Service Area	571	1
J-656	High Service Area	571	8
J-744	High Service Area	574	4
J-598	Low Service Area	414	0
J-540	Low Service Area	414	0
J-750	High Service Area	575	4
J-406	High Service Area	576	1
J-759	High Service Area	575	7
J-456	Low Service Area	415	0
J-416	High Service Area	577	4
J-42	High Service Area	577	2
J-86	High Service Area	578	2
J-783	High Service Area	579	1
J-548	Low Service Area	420	1
J-370	High Service Area	581	5
J-368	High Service Area	581	2

Junction Input Data
Capital Efficiency Plan
West Boylston, MA

Label	Zone	Elevation (ft)	Demand (gpm)
J-482	Low Service Area	420	6
J-222	High Service Area	581	1
J-18	High Service Area	581.93	0
J-88	High Service Area	581	6
J-380	High Service Area	584	15
J-552	Low Service Area	423	3
J-550	Low Service Area	423	0
J-773	High Service Area	583.19	1
J-414	High Service Area	584	2
J-418	High Service Area	584	1
J-412	High Service Area	584	1
J-366	High Service Area	584	1
J-74	High Service Area	583	0
J-734	High Service Area	584	0
J-789	High Service Area	583.28	4
J-16	Low Service Area	424.21	0
J-722	Low Service Area	425	0
J-728	High Service Area	585	2
J-382	High Service Area	587	1
J-600	Low Service Area	426	1
J-408	High Service Area	587	3
J-410	High Service Area	587	3
J-364	High Service Area	587	3
J-458	Low Service Area	427	2
J-460	Low Service Area	427	0
J-664	Low Service Area	427	0
J-795	Low Service Area	427.3	3
J-796	Low Service Area	427.34	4
J-794	Low Service Area	428.23	0
J-806	High Service Area	590.07	0
J-220	High Service Area	590	2
J-390	High Service Area	591	0
J-674	Low Service Area	430	4
J-72	High Service Area	591	1
J-676	Low Service Area	431	8
J-808	High Service Area	592.73	0
J-14	Low Service Area	431.58	0
J-452	Low Service Area	442	0
J-696	High Service Area	594	2
J-492	Low Service Area	433	8
J-502	Low Service Area	433	2
J-500	Low Service Area	433	0

Junction Input Data
Capital Efficiency Plan
West Boylston, MA

Label	Zone	Elevation (ft)	Demand (gpm)
J-266	High Service Area	597	2
J-264	High Service Area	597	12
J-400	High Service Area	597	1
J-392	High Service Area	597	1
J-384	High Service Area	600	0
J-238	High Service Area	600	1
J-302	High Service Area	600	0
J-404	High Service Area	600	2
J-284	High Service Area	600	1
J-50	Low Service Area	440	0
J-660	Low Service Area	440	1
J-760	Low Service Area	440	0
J-268	High Service Area	604	2
J-785	High Service Area	603	0
J-262	High Service Area	604	5
J-304	High Service Area	604	1
J-56	Low Service Area	443	3
J-534	Low Service Area	443	9
J-797	Low Service Area	443.54	0
J-228	High Service Area	604	0
J-306	High Service Area	605	2
J-308	High Service Area	607	1
J-396	High Service Area	607	0
J-394	High Service Area	607	0
J-714	High Service Area	607	1
J-278	High Service Area	607	1
J-474	Western High	535	3
J-450	Low Service Area	456	2
J-106	High Service Area	607	4
J-720	High Service Area	607	1
J-570	Low Service Area	447	1
J-300	High Service Area	607	2
J-812	High Service Area	608	5
J-454	Low Service Area	456	2
J-767	Low Service Area	448	1
J-779	High Service Area	609	3
J-420	High Service Area	610	4
J-809	High Service Area	610	5
J-234	High Service Area	610	0
J-290	High Service Area	610	0
J-288	High Service Area	610	1
J-402	High Service Area	610	3

Junction Input Data
Capital Efficiency Plan
West Boylston, MA

Label	Zone	Elevation (ft)	Demand (gpm)
J-286	High Service Area	610	1
J-432	High Service Area	610	10
J-622	High Service Area	610	0
J-282	High Service Area	610	1
J-178	High Service Area	610	2
J-810	High Service Area	610.95	0
J-758	Low Service Area	450	4
J-787	High Service Area	611	2
J-718	High Service Area	612	1
J-757	High Service Area	612	1
J-746	High Service Area	612.5	0
PLEASANT VALLI	Low Service Area	462	-313
OAKDALE W	Low Service Area	453	-312
J-236	High Service Area	614	0
J-314	High Service Area	614	2
J-388	High Service Area	614	3
J-648	High Service Area	614	1
J-280	High Service Area	614	0
J-811	High Service Area	614	2
J-192	High Service Area	614	0
J-646	Low Service Area	463	0
J-292	High Service Area	617	0
J-310	High Service Area	617	1
J-312	High Service Area	617	1
J-316	High Service Area	617	0
J-174	High Service Area	617	1
J-240	High Service Area	617	2
J-702	High Service Area	617	1
J-12	Low Service Area	459	4
J-320	High Service Area	620	2
J-244	High Service Area	620	1
J-642	High Service Area	620	4
J-176	High Service Area	621	0
J-776	High Service Area	621	1
J-10	Low Service Area	462	2
J-568	Low Service Area	462	1
J-572	Low Service Area	462	2
J-48	Low Service Area	462	4
J-386	High Service Area	623	2
J-180	High Service Area	623	1
J-478	Western High	551	0
J-3	Western High	551	0

Junction Input Data
Capital Efficiency Plan
West Boylston, MA

Label	Zone	Elevation (ft)	Demand (gpm)
J-62	Low Service Area	463	0
J-640	High Service Area	624	1
J-498	Low Service Area	463	5
J-658	Low Service Area	463	0
J-8	High Service Area	625	0
J-9	High Service Area	625	0
J-7	High Service Area	625.09	0
J-805	High Service Area	626	2
J-276	High Service Area	630	7
J-566	Low Service Area	469	0
J-274	High Service Area	630	2
J-242	High Service Area	630	2
J-172	High Service Area	630	1
J-828	Western High	558.07	1
J-15	Low Service Area	470.49	0
J-592	Low Service Area	472	3
J-60	Low Service Area	472	3
J-58	Low Service Area	472	2
J-532	Low Service Area	472	0
J-464	Low Service Area	472	4
J-466	Low Service Area	472	12
J-11	Low Service Area	472.37	0
J-17	Low Service Area	479.02	0
J-594	Low Service Area	475	1
J-528	Low Service Area	475	1
J-596	Low Service Area	476	1
J-124	High Service Area	637	8
J-618	High Service Area	640	29
J-822	Western High	567.34	0
J-788	Low Service Area	479	2
J-270	High Service Area	640	2
J-232	High Service Area	640	1
J-398	High Service Area	640	0
J-698	High Service Area	640	2
J-342	High Service Area	640	1
J-348	High Service Area	640	1
J-624	Lee High	640	-26
J-374	Low Service Area	482	1
J-628	Low Service Area	482	0
J-578	Low Service Area	482	1
J-630	Low Service Area	482	0
J-632	Low Service Area	482	0

Junction Input Data
Capital Efficiency Plan
West Boylston, MA

Label	Zone	Elevation (ft)	Demand (gpm)
J-526	Low Service Area	482	2
J-684	Low Service Area	482	3
J-790	Low Service Area	482.68	0
J-831	High Service Area	645.28	0
J-352	High Service Area	646	1
J-354	High Service Area	646	0
J-182	High Service Area	646	1
J-476	Western High	574	3
J-206	Low Service Area	486	2
J-14	Low Service Area	486	3
J-590	Low Service Area	486	0
J-804	High Service Area	647.77	1
J-530	Low Service Area	487	3
J-813	High Service Area	649.01	0
J-230	High Service Area	650	0
J-358	High Service Area	650	1
J-356	High Service Area	650	1
J-434	High Service Area	650	3
J-620	High Service Area	650	0
J-194	High Service Area	650	1
J-248	High Service Area	650	0
J-184	High Service Area	650	1
J-170	High Service Area	650	2
J-112	High Service Area	650	4
J-164	High Service Area	650	2
J-506	Low Service Area	489	7
J-114	High Service Area	650	3
J-814	High Service Area	650.99	0
J-376	Low Service Area	492	1
J-752	Low Service Area	492	1
J-5	Low Service Area	492	0
J-799	Low Service Area	492	1
J-446	Low Service Area	492	0
J-800	Low Service Area	492	0
J-16	Low Service Area	492	1
J-564	Low Service Area	492	0
J-554	Low Service Area	492	3
J-682	Low Service Area	492	2
J-801	Low Service Area	492.06	1
J-584	Low Service Area	492	0
J-66	Low Service Area	492	4
J-694	Low Service Area	492	4

Junction Input Data
Capital Efficiency Plan
West Boylston, MA

Label	Zone	Elevation (ft)	Demand (gpm)
J-46	Low Service Area	492	2
J-64	Low Service Area	492	4
J-336	High Service Area	653	2
J-338	High Service Area	653	1
J-504	Low Service Area	492	5
J-769	High Service Area	653	0
J-350	High Service Area	654	1
J-756	Low Service Area	495	1
J-560	Low Service Area	495	2
J-26	Low Service Area	495	0
J-260	High Service Area	656	3
J-256	High Service Area	656	2
J-494	Low Service Area	495	2
J-100	Low Service Area	496	3
J-258	High Service Area	659	1
J-344	High Service Area	659	1
J-166	High Service Area	659	4
J-18	Low Service Area	499	3
J-580	Low Service Area	499	2
J-556	Low Service Area	499	0
J-558	Low Service Area	499	1
J-582	Low Service Area	499	3
J-360	High Service Area	660	1
J-246	High Service Area	660	1
J-250	High Service Area	660	0
J-562	Low Service Area	502	8
J-68	Low Service Area	502	2
J-110	High Service Area	663	4
J-252	High Service Area	663	0
J-12	Low Service Area	501.71	0
J-524	Low Service Area	502	4
J-142	High Service Area	659	1
J-204	Low Service Area	505	6
J-98	Low Service Area	505	2
J-24	Low Service Area	505	0
J-821	Low Service Area	505	0
J-332	High Service Area	666	1
J-468	Low Service Area	505	9
J-444	Low Service Area	505	0
J-778	High Service Area	667.32	2
J-330	High Service Area	669	1
J-362	High Service Area	669	1

Junction Input Data
Capital Efficiency Plan
West Boylston, MA

Label	Zone	Elevation (ft)	Demand (gpm)
J-272	High Service Area	670	1
J-196	High Service Area	670	1
J-19	<None>	509.01	0
J-781	High Service Area	667	1
J-602	Low Service Area	512	1
J-340	High Service Area	673	1
J-126	High Service Area	673	1
J-128	High Service Area	673	1
J-76	High Service Area	673	3
J-442	Low Service Area	512	2
J-782	High Service Area	672	1
J-108	High Service Area	675	4
J-775	High Service Area	675	3
J-22	Low Service Area	515	1
J-634	High Service Area	676	0
J-604	Low Service Area	518	0
J-208	Low Service Area	518	1
J-212	Low Service Area	518	0
J-20	Low Service Area	518	1
J-324	High Service Area	679	4
J-322	High Service Area	679	2
J-328	High Service Area	679	1
J-254	High Service Area	679	1
J-334	High Service Area	679	2
J-704	High Service Area	679	2
J-636	High Service Area	679	0
J-738	High Service Area	680	0
J-766	Low Pressure	519	3
J-510	Low Service Area	521	3
J-516	Low Service Area	521	9
J-488	Low Service Area	521	5
J-490	Low Service Area	521	0
J-612	Low Service Area	522	2
J-692	Low Service Area	522	3
J-724	Low Service Area	522	2
J-522	Low Service Area	522	2
J-138	High Service Area	682	2
J-144	High Service Area	679	1
J-152	High Service Area	679	1
J-146	High Service Area	679	1
J-150	High Service Area	679	1
J-690	Low Service Area	525	0

Junction Input Data
Capital Efficiency Plan
West Boylston, MA

Label	Zone	Elevation (ft)	Demand (gpm)
J-140	High Service Area	682	1
J-326	High Service Area	686	1
J-740	High Service Area	686	0
J-520	Low Service Area	525	2
J-518	Low Service Area	525	1
J-116	High Service Area	686	5
Lee Street W	High Service Area	689	-225
J-777	High Service Area	688	2
J-436	High Service Area	689	1
J-190	High Service Area	689	1
J-508	Low Service Area	528	1
J-484	Low Service Area	528	6
J-668	Low Service Area	532	3
J-770	High Service Area	690	0
J-761	Low Service Area	530	1
J-514	Low Service Area	531	3
J-512	Low Service Area	531	3
J-486	Low Service Area	531	1
J-638	High Service Area	689	0
J-186	High Service Area	695	1
J-122	High Service Area	695	7
J-148	High Service Area	689	87
J-154	High Service Area	692	1
J-470	Low Service Area	535	2
J-472	Low Service Area	535	2
J-680	Low Service Area	536	1
J-791	High Service Area	697.17	3
J-168	High Service Area	699	6
J-130	High Service Area	699	1
J-118	High Service Area	699	0
J-136	High Service Area	699	2
J-726	High Service Area	699	0
J-792	High Service Area	699	0
J-84	Lee High	699	13
J-372	Low Service Area	542	8
J-158	High Service Area	699	1
J-678	Low Service Area	540	3
J-574	Low Service Area	541	2
J-38	Low Service Area	541	2
J-815	High Service Area	705.63	1
J-686	High Service Area	705	0
J-816	High Service Area	708.23	0

Junction Input Data
Capital Efficiency Plan
West Boylston, MA

Label	Zone	Elevation (ft)	Demand (gpm)
J-120	High Service Area	709	2
J-768	High Service Area	708.44	0
J-34	High Service Area	709	0
J-742	High Service Area	713	0
J-10	High Service Area-Low Pressure	713.57	0
J-188	High Service Area	715	1
J-576	Low Service Area-Low Pressure	555	2
J-823	Low Service Area	559.7	1
J-160	High Service Area	719	1
J-162	High Service Area	719	1
J-198	High Service Area	728	1
J-200	High Service Area	728	2
J-132	High Service Area-Low Pressure	733	4
J-496	Low Service Area-Low Pressure	575	3
J-80	Lee High	748	9
J-82	Lee High	774	4

Appendix C

APPENDIX C

TATA & HOWARD

Hydraulic Improvements
West Boylston Water District
West Boylston, Massachusetts

DRAFT

TATA & HOWARD

Approximate Scale: 1" = 1,000'

March 2016

Appendix D

APPENDIX D

TATA & HOWARD

Critical Components
West Boylston Water District
West Boylston, Massachusetts
DRAFT
TATA & HOWARD
Approximate Scale: 1" = 1,000'
March 2016
N
STERLING
WEST BOYLSTON
HOLDEN
BOYLSTON
WORCESTER
Interconnection with Sterling
Laurel Street Pump Station
Western Avenue High Service Area
Western Avenue Booster Pump Station
Oakdale Well
Oakdale Tank
Capacity: 0.50 mg
Overflow: 633 feet
Low Service Area
High Service Area
Goodale Street PRV
Lee Street Well No. 4
Route 12 Booster Pump Station
Lee Street High Service Area
Lee Street Booster Pump Station
Lawrence Street Tank No. 1 & No. 2
Combined Capacity: 1.63 mg
Overflow: 794 feet
Stockwell Road Tank
Capacity: 0.95 mg
Overflow: 633 feet
Pleasant Valley Well
Interconnection with Worcester
Wachusett Reservoir
Lily Pond
RAYMOND HUNTINGTON HIGHWAY
LAUREL STREET
RIVER ROAD
MALDEN STREET
GOODALE STREET
FRANKLIN STREET
PIERCE STREET
WORCESTER STREET
WEST BOYLSTON STREET
WOODLAND STREET
PHEASANT HILL RUN
HILLSIDE VILLAGE DRIVE
PAUL X TIVNAN DRIVE
SHREWSBURY STREET
TEMPLE STREET
PINEWOOD DRIVE
WINTHROP STREET
PRESCOTT STREET
STERLING STREET
FAIRBANKS STREET
LANCASTER STREET
CAMPGROUND ROAD
Legend
Critical Users
Emergency Services
Medical Facility
School
Elderly Housing
Critical Components
Service Area Boundary
Water Main Diameter
4-inch or smaller
6-inch
8-inch
10-inch
12-inch
16-inch

Appendix E

Asset Management Rating
West Boylston Water District
West Boylston, Massachusetts

DRAFT

TATA & HOWARD

Approximate Scale: 1" = 1,000'

March 2016

Appendix F

TATA & HOWARD

N
STERLING
WEST BOYLSTON
HOLDEN
BOYLSTON
WORCESTER
Interconnection with Sterling
Laurel Street Pump Station
Western Avenue Booster Pump Station
Western Avenue
High Service Area
Oakdale Well
Oakdale Tank
Capacity: 0.50 mg
Overflow: 633 feet
Wachusett Reservoir
Low Service Area
High Service Area
Goodale Street PRV
Lee Street Well No. 4
Route 12 Booster Pump Station
Lee Street
High Service Area
Lee Street Booster Pump Station
Stockwell Road Tank
Capacity: 0.95 mg
Overflow: 633 feet
Lawrence Street Tank No. 1 & No. 2
Combined Capacity: 1.63 mg
Overflow: 794 feet
Pleasant Valley Well
Interconnection with Worcester
Legend
Service Area Boundary
Critical Component
Critical Users
Emergency Services
Medical Facility
School
Elderly Housing
Asset Management Rating
Excellent to Good
Good to Fair
Fair to Poor
Hydraulic Improvements
Priority I
Priority II
Three Circle Integration
West Boylston Water District
West Boylston, Massachusetts
DRAFT
TATA & HOWARD
Approximate Scale: 1" = 1,000'
March 2016

Appendix G

APPENDIX G

TATA & HOWARD

Recommended Improvements
West Boylston Water District
West Boylston, Massachusetts
TATA & HOWARD
Approximate Scale: 1" = 1,000'
March 2016
N
STERLING
WEST BOYLSTON
HOLDEN
BOYLSTON
WORCESTER
Interconnection with Sterling
Laurel Street Pump Station
11. North Main Street
New 12-inch Water Main
Western Avenue
High Service Area
Western Avenue Booster Pump Station
1. Oakdale Well Pilot Testing
Oakdale Well
7. Beaman Street
New 12-inch Water Main
Oakdale Tank
Capacity: 0.50 mg
Overflow: 633 feet
6. Sterling Street
New 12-inch Water Main
24. Lancaster Street
New 12-inch Water Main
9. Lancaster Street
New 12-inch Water Main
Low Service Area
High Service Area
4. Goodale Street
New 12-inch Water Main
8. Sterling Street
New 12-inch Water Main
22. Malden Street & Goodale Street
New 12-inch Water Main
17. Prospect Street
New 12-inch Water Main
12. Goodale Street
New 8-inch Water Main
3. Worcester Road & West Boylston Street
New 12-inch Water Main
19. Prospect Street (HSA)
New 12-inch Water Main
Goodale Street PRV
Pleasant Valley Well
Lee Street
High Service Area
Lee Street Well No. 4
13. Lee Street
New 8-inch Water Main
Route 12 Booster Pump Station
18. Worcester Street
New 8-inch Water Main
Stockwell Road Tank
Capacity: 0.95 mg
Overflow: 633 feet
16. Temple Street
New 12-inch Water Main
Lee Street Booster Pump Station
10. West Boylston Street
New 8-inch Water Main
14. Maple Street
New 8-inch Water Main
20. Lee Street
New 8-inch Water Main
Lawrence Street Tank No. 1 & No. 2
Combined Capacity: 1.63 mg
Overflow: 794 feet
5. Prospect Street & Lawrence Street
New 16-inch Water Main
21. Alhambra Avenue
New 8-inch Water Main
2. Prospect Street
New 12-inch Water Main
23. Lebanon Avenue
Bowles Avenue
Carew Avenue
Chapman Avenue
New 8-inch Water Main
15. Cumberland Drive
New 8-inch Water Main
23. Princeton Avenue & Yale Avenue
New 8-inch Water Main
Interconnection with Worcester
Legend
Service Area Boundary
Recommended Improvement
Phase I
Phase II
Phase IIIa
Phase IIIb
Water Main Diameter
4-inch or smaller
6-inch
8-inch
10-inch
12-inch
16-inch
Additional Recommended Improvements:
25. Phase IIIb
New 8-inch Water Main
See Table No. 7-7

MassDEP

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

Central Regional Office • 8 New Bond Street, Worcester MA 01606 • 508-792-7650

Charles D. Baker
Governor

Karyn E. Polito
Lieutenant Governor

Kathleen A. Theoharides
Secretary

Martin Suuberg
Commissioner

West Boylston Water District
Attention: Stanley Szczurko, Water Commissioner
183 Worcester Street
West Boylston, MA 01583

Re: West Boylston Water District
PWS ID# 2321000
ACO-CE-19-5D00006049
ADMINISTRATIVE CONSENT ORDER
M.G.L. Chapter 111 §160 and 310 CMR 22.00

Dear Mr. Szczurko:

Enclosed please find an executed copy of the Administrative Consent Order (ACO) that reflects the parties' agreement as a result of our negotiations. As stated in the executed ACO, you must comply with all requirements set forth in the ACO. Please review Section III, Disposition and Order, for specific instructions.

We appreciate your cooperation in negotiating this agreement. Should you have any questions concerning the ACO, please contact me at (508) 849-4036 as soon as possible.

Sincerely,

Robert A. Bostwick

Robert A. Bostwick
Drinking Water Section Chief
Bureau of Water Resources

6/21/2019
Date

enclosures

cc: West Boylston Board of Health

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION

In the matter of:	Enforcement Document Number:
	ACO-CE-19-5D00006049
West Boylston Water District	Issuing Bureau: BWR
	Issuing Region/Office: CERO
	Issuing Program: DWP
	Primary Program Cited: DWP
	FMF/Program ID #: 2321000

ADMINISTRATIVE CONSENT ORDER
AND
NOTICE OF NONCOMPLIANCE

I. THE PARTIES

1. The Department of Environmental Protection ("Department" or "MassDEP") is a duly constituted agency of the Commonwealth of Massachusetts established pursuant to M.G.L. c. 21A, § 7. MassDEP maintains its principal office at One Winter Street, Boston, Massachusetts 02108, and its Central Regional Office at 8 New Bond Street, Worcester, Massachusetts 01606.

2. West Boylston Water District ("Respondent") is a municipal water district established by Chapter 352 of the Acts of 1933. Respondent's principal office is located at 183 Worcester Street, West Boylston, Massachusetts 01583. Respondent's mailing address for purposes of this Consent Order is 183 Worcester Street, West Boylston, Massachusetts 01583.

II. STATEMENT OF FACTS AND LAW

3. MassDEP has primary enforcement responsibility for the requirements of the Federal Safe Drinking Water Act, 42 U.S.C. §300f et seq. and the regulations promulgated there under. MassDEP implements and enforces statutes and regulations of the Commonwealth of Massachusetts for the protection of the public drinking water supply, including, without limitation, M.G.L. c. 111, §5G and §160 and , the Drinking Water Regulations at 310 CMR 22.00; the Cross Connections, Distribution System Protection Regulations at 310 CMR 22.22; and the Underground Injection Control Regulations at 310 CMR 27.00. MassDEP, pursuant to M.G.L. c. 111, §160, may issue such orders as it deems necessary to ensure the delivery of fit and pure drinking water by public water systems to all consumers. MassDEP, pursuant to M.G.L. c. 111, §5G, may require by order the provision and operation of such treatment facilities as it deems necessary to ensure the delivery of a safe water supply to all consumers.

MassDEP's Drinking Water Regulations at 310 CMR 22.02 define a public water system as a system for the provision to the public of water for human consumption, through pipes or other constructed conveyances, if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days of the year. 310 CMR 22.02 also defines a supplier of water as "any person who owns or operates a public water system." MassDEP has authority under M.G.L. c. 21A, § 16 and the Administrative Penalty Regulations at 310 CMR 5.00 to assess civil administrative penalties to persons in noncompliance with the laws and regulations set forth above.

4. Respondent owns and operates a Community Public Water System ("PWS") serving a population of 7,250 persons per day under identification number PWS ID# 2321000.

5. The following facts and allegations have led MassDEP to issue this Consent Order:

   A. In October 2013, the MassDEP's Office of Research and Standards established health advisory guidelines for manganese in Massachusetts drinking waters (ORSG). The ORSG includes a lifetime health advisory value of 0.3 mg/L to protect against concerns of potential neurological effects and a 10-day health advisory of 1 mg/L for acute exposure. MassDEP recommends that infants up to 1 year of age should not be given water with manganese concentrations greater than 0.3 mg/L for more than a total of 10 days in a year, nor should the water be used to make formula for more than a total of 10 days in a year.

   B. On November 8, 2013, MassDEP conducted a Sanitary Survey inspection and issued a Sanitary Survey Report to Respondent on February 19, 2014 ("2014 Sanitary Survery"). In the 2014 Sanitary Survey, MassDEP required Respondent to submit a corrective action plan detailing how Respondent will reduce levels of manganese below the ORSG in the Oakdale Well (2321000-01G) ("Well 01G") and the Pleasant Valley Well (2321000-05G) ("Well 05G").

   C. On March 6, 2015, MassDEP issued a letter to Respondent identifying finished water from Well 01G and Well 05G had elevated levels of manganese in the drinking water above the Secondary Maximum Contaminant Level (SMCL) of 0.05 mg/L and the ORSG of 0.3 mg/L. MassDEP directed Respondent to conduct public notification for as long as levels indicate exceedance, continue monitoring and submit a final corrective action plan to reduce levels of manganese reliably and consistently below the ORSG (preferably below the SMCL) by September 30, 2015, in accordance with 310 CMR 22.03(14)a

   D. On May 7, 2015, Respondent submitted a preliminary action plan to MassDEP detailing how it planned to reduce manganese. The preliminary action plan did not include a schedule for actions.

   E. On July 23, 2015, Respondent submitted a letter to MassDEP responding to the 2014 Sanitary Survey. In the letter, to address reducing the levels of manganese, Respondent referenced the May 2015 submittal of the preliminary plan and stated that the final plan would be submitted in January 2016.

F. On August 19, 2016, Oakdale Rehabilitation & Skilled Nursing Center ("Oakdale Rehabilitation") submitted a consumer complaint to MassDEP, US EPA Region 1 and Respondent regarding elevated manganese levels at their facility. Specifically, employees at Oakdale Rehabilitation observed discoloration in sinks, toilets and laundry and subsequently took a water sample. Accordingly, the manganese level at Oakdale Rehabilitation was reported at a level of 0.69 mg/L. The letter goes on to reference both the SMCL and the MassDEP ORSG of 0.3 mg/L.

G. On September 2, 2016, Respondent submitted a draft corrective action plan which proposed to search for a new source to replace Well 05G. This plan estimated a two year time line for completion of the replacement well (pending acquisition of DCR easements), but did not include a plan or schedule to address the reduction of manganese at Well 01G.

H. On October 18, 2016, MassDEP conducted a Sanitary Survey and issued a Sanitary Survey Report on March 3, 2017 ("2016 Sanitary Survey"). The 2016 Sanitary Survey required Respondent to submit a corrective action schedule to address the reduction of manganese at Well 01G and Well 05G by December 1, 2017.

I. On October 4, 2017, Respondent triggered a MassDEP Revised Total Coliform Rule (RTCR) Level 1 Assessment ("Level 1 Assessment") pursuant to 310 CMR 22.05(4) stemming from positive coliform samples collected in October 2017. The Level 1 Assessment was to include a schedule for the submittal of a comprehensive water quality compliance plan (which would include the manganese exceedances); proposed tank maintenance schedule; and disinfection of the distribution system as part of the scheduled corrective actions to ensure the safe delivery of drinking water to consumers.

J. On November 20, 2017, Respondent submitted a Level 1 Assessment to MassDEP. MassDEP review of the tank inspection reports (Stockwell Tank, Lawrence St. Tanks #1 & Tank #2, and the Oakdale Tank) included in the Level 1 Assessment (from inspections conducted in 2016) indicated various deficiencies in tank maintenance and infrastructure that the Respondent has not corrected.

K. On January 30, 2018, MassDEP approved the corrective action schedule provided by Respondent in the Level 1 Assessment. Accordingly, Respondent is required to adhere to the approved schedule and any Department specified interim corrective actions pursuant to 310 CMR 22.05(4)(b)3.

L. On April 4, 2018, MassDEP held a technical compliance meeting with Respondent's representatives to discuss overall water quality compliance.

M. On June 26, 2018, Respondent submitted a Comprehensive Water Quality Compliance Plan.

N. On November 26, 2018, MassDEP met with Respondent to discuss Respondent's Comprehensive Water Quality Compliance Plan and implementation schedule.

O. On December 14, 2018, Respondent submitted to MassDEP a WS29 Permit Application for the installation of mechanical disinfection equipment (sodium hypochlorite feed system) for emergency use at Well 01G, Well 04G and Well 05G.

P. On December 20, 2018, Respondent submitted to MassDEP a WS21C Permit Application for a pilot study of GreensandPlus filtration media and biological media for the removal of manganese from Well 01G and Well 05G.

Q. On January 11, 2019, MassDEP issued approvals for both the WS21C and WS29 permits identified above.

III. DISPOSITION AND ORDER

For the reasons set forth above, MassDEP hereby issues, and Respondent hereby consents to, this Order:

6. The parties have agreed to enter into this Consent Order because they agree that it is in their own interests, and in the public interest, to proceed promptly with the actions called for herein rather than to expend additional time and resources litigating the matters set forth above. Respondent enters into this Consent Order without admitting or denying the facts or allegations set forth herein. However, Respondent agrees not to contest such facts and allegations for purposes of the issuance or enforcement of this Consent Order.

7. MassDEP's authority to issue this Consent Order is conferred by the statutes and regulations cited in Part II of this Consent Order.

8. Respondent shall perform the following actions:

A. On or before July 1, 2019, Respondent shall:

1) Complete the installation of the chemical addition upgrades per the WS29 approval issued on January 11, 2019, in compliance with 310 CMR 22.04(14).

2) Submit a comprehensive maintenance schedule for rehabilitation and upgrade of the following storage tanks, including but not limited to:

   i. Stockwell Tank - Complete cleaning and inspection, remove vegetation and perform exterior cleaning and coating with growth inhibitor.
   ii. Oakdale Tank – Complete cleaning and inspection.
   iii. Lawrence Tank 2 – Complete cleaning and inspection, seal coat tank exterior.

B. On or before December 31, 2019, Respondent shall:

1) Complete the repair and upgrade of Lawrence St. Tank 1, including raising access hatches, upgrade of appurtenances (vent/overflows) and any other identified repairs to meet current standards.

C. On or before December 31, 2020, Respondent shall:

1) Submit an administratively and technically complete WS23 permit application with design plans for a treatment facility for the removal of manganese at the Oakdale source, Well 01G.

2) Complete and activate the replacement well for Pleasant Valley source, Well 05G.

D. On or before December 31, 2022, Respondent shall complete the installation and activate the treatment facility for the removal of manganese for the Oakdale source, Well 01G.

E. Respondent shall maintain chemical addition of sodium hypochlorite at the entry point of each of its active sources and provide a disinfectant residual in the distribution system until further notice by the Department.

9. Except as otherwise provided, all notices, submittals and other communications required by this Consent Order shall be directed to:

Robert A Bostwick, Drinking Water Section Chief
MassDEP
8 New Bond Street
Worcester, MA 01606

Such notices, submittals and other communications shall be considered delivered by Respondent upon receipt by MassDEP.

10. Actions required by this Consent Order shall be taken in accordance with all applicable federal, state, and local laws, regulations and approvals. This Consent Order shall not be construed as, nor operate as, relieving Respondent or any other person of the necessity of complying with all applicable federal, state, and local laws, regulations and approvals.

11. Force Majeure - General

A. MassDEP agrees to extend the time for performance of any requirement of this Consent Order if MassDEP determines that such failure to perform is caused by a Force Majeure event. The failure to perform a requirement of this Consent Order shall be considered to have been caused by a Force Majeure event if the following criteria are met: (1) an event delays performance of a requirement of this Consent Order beyond the deadline established herein; (2) such event is beyond the control and without the fault of Respondent and Respondent's employees, agents, consultants, and contractors; and (3) such delay could not have been prevented, avoided or minimized by the exercise of due care by Respondent or Respondent's employees, agents, consultants, and contractors.

B. Financial inability and unanticipated or increased costs and expenses associated with the performance of any requirement of this Consent Order shall not be considered a Force Majeure Event.

C. If any event occurs that delays or may delay the performance of any requirement of this Consent Order, Respondent shall immediately, but in no event later than 5 days after obtaining knowledge of such event, notify MassDEP in writing of such event. The notice shall describe in detail: (i) the reason for and the anticipated length of the delay or potential delay; (ii) the measures taken and to be taken to prevent, avoid, or minimize the delay or potential delay; and (iii) the timetable for taking such measures. If Respondent intends to attribute such delay or potential delay to a Force Majeure event, such notice shall also include the rationale for attributing such delay or potential delay to a Force Majeure event and shall include all available documentation supporting a claim of Force Majeure for the event. Failure to comply with the notice requirements set forth herein shall constitute a waiver of Respondent's right to request an extension based on the event.

D. If MassDEP determines that Respondent's failure to perform a requirement of this Consent Order is caused by a Force Majeure event, and Respondent otherwise complies with the notice provisions set forth in paragraph C above, MassDEP agrees to extend in writing the time for performance of such requirement. The duration of this extension shall be equal to the period of time the failure to perform is caused by the Force Majeure event. No extension shall be provided for any period of time that Respondent's failure to perform could have been prevented, avoided or minimized by the exercise of due care. No penalties shall become due for Respondent's failure to perform a requirement of this Consent Order during the extension of the time for performance resulting from a Force Majeure event.

F. A delay in the performance of a requirement of this Consent Order caused by a Force Majeure event shall not, of itself, extend the time for performance of any other requirement of this Consent Order.

12. For purposes of M.G.L. c. 21A, § 16 and 310 CMR 5.00, this Consent Order shall also serve as a Notice of Noncompliance for Respondent's noncompliance with the requirements cited in Part II above. MassDEP hereby determines, and Respondent hereby agrees, that any deadlines set forth in this Consent Order constitute reasonable periods of time for Respondent to take the actions described.

13. Respondent understands, and hereby waives, its right to an adjudicatory hearing before MassDEP on, and judicial review of, the issuance and terms of this Consent Order and to notice of any such rights of review. This waiver does not extend to any other order issued by the MassDEP.

14. This Consent Order may be modified only by written agreement of the parties hereto.

15. The provisions of this Consent Order are severable, and if any provision of this Consent Order or the application thereof is held invalid, such invalidity shall not affect the validity of other provisions of this Consent Order, or the application of such other provisions, which can be given effect without the invalid provision or application, provided however, that MassDEP shall have the discretion to void this Consent Order in the event of any such invalidity.

16. Nothing in this Consent Order shall be construed or operate as barring, diminishing, adjudicating or in any way affecting (i) any legal or equitable right of MassDEP to issue any additional order or to seek any other relief with respect to the subject matter covered by this Consent Order, or (ii) any legal or equitable right of MassDEP to pursue any other claim, action, suit, cause of action, or demand which MassDEP may have with respect to the subject matter covered by this Consent Order, including, without limitation, any action to enforce this Consent Order in an administrative or judicial proceeding.

17. This Consent Order shall not be construed or operate as barring, diminishing, adjudicating, or in any way affecting, any legal or equitable right of MassDEP or Respondent with respect to any subject matter not covered by this Consent Order.

18. This Consent Order shall be binding upon Respondent and upon Respondent's employees, agents, contractors or consultants to violate this Consent Order. Until Respondent has fully complied with this Consent Order, Respondent shall provide a copy of this Consent Order to each successor or assignee at such time that any succession or assignment occurs.

19. If Respondent violates any provision of the Consent Order, Respondent shall pay stipulated civil administrative penalties to the Commonwealth in the amount of $ 1,000 per day for each day, or portion thereof, each such violation continues.

Stipulated civil administrative penalties shall begin to accrue on the day a violation occurs and shall continue to accrue until the day Respondent corrects the violation or completes performance, whichever is applicable. Stipulated civil administrative penalties shall accrue regardless of whether MassDEP has notified Respondent of a violation or act of noncompliance. All stipulated civil administrative penalties accruing under this Consent Order shall be paid within thirty (30) days of the date MassDEP issues Respondent a written demand for payment. If simultaneous violations occur, separate penalties shall accrue for separate violations of this Consent Order. The payment of stipulated civil administrative penalties shall not alter in any way Respondent's obligation to complete performance as required by this Consent Order. MassDEP reserves its right to elect to pursue alternative remedies and alternative civil and criminal penalties which may be available by reason of Respondent's failure to comply with the requirements of this Consent Order. In the event MassDEP collects alternative civil administrative penalties, Respondent shall not be required to pay stipulated civil administrative penalties pursuant to this Consent Order for the same violations.

Respondent reserves whatever rights it may have to contest MassDEP's determination that Respondent failed to comply with the Consent Order and/or to contest the accuracy of MassDEP's calculation of the amount of the stipulated civil administrative penalty. Upon exhaustion of such rights, if any, Respondent agrees to assent to the entry of a court judgment if such court judgment is necessary to execute a claim for stipulated penalties under this Consent Order.

20. Failure on the part of MassDEP to complain of any action or inaction on the part of Respondent shall not constitute a waiver by MassDEP of any of its rights under this Consent Order. Further, no waiver by MassDEP of any provision of this Consent Order shall be construed as a waiver of any other provision of this Consent Order.

21. Respondent agrees to provide MassDEP, and MassDEP's employees, representatives and contractors, access at all reasonable times to 183 Worcester Street, West Boylston for purposes of conducting any activity related to its oversight of this Consent Order. Notwithstanding any provision of this Consent Order, MassDEP retains all of its access authorities and rights under applicable state and federal law.

[No Further Text Appears on this Page]

22. The undersigned certify that they are fully authorized to enter into the terms and conditions of this Consent Order and to legally bind the party on whose behalf they are signing this Consent Order.

23. This Consent Order shall become effective on the date that it is executed by MassDEP.

SPECIAL INSTRUCTIONS:

Your two **signed copies of the** Administrative **Consent Order** (ACO) must be delivered, for execution (signature) by MassDEP, to the following address:

Robert A. Bostwick, Drinking Water Section Chief
MassDEP
8 New Bond Street
Worcester, Massachusetts 01606

MassDEP will return **one signed copy** of the ACO to you after MassDEP has signed, provided you have followed the above instructions.

Please call Robert Bostwick at (508) 849-4036 if you have questions regarding the instructions.

Consented To:
WEST BOYLSTON WATER DISTRICT

By: Stanley Szezurko
Stanley Szezurko, Water Commissioner
183 Worcester Street
West Boylston, MA 01583

Federal Employer Identification No.: 046 004 358

Date: 6/12/19

Issued By:
DEPARTMENT OF ENVIRONMENTAL PROTECTION

By: Mary Jude Pigsley
Mary Jude Pigsley, Regional Director
Central Regional Office
8 New Bond Street
Worcester, MA 01606

Date: 6/20/19

Manganese Removal Treatment Facility August 23, 2019

West Boylston Water District

PROJECT COST SUMMARY

Task/Description	Total Project Cost 2019 ENR 11500	SRF Eligible Cost	SRF Ineligible Cost
OPM Services			
Design Phase	$50,000.00		$50,000.00
Bid/Construction/Startup	$100,000.00	$100,000.00	
Engineering Services			
Piloting (Blueleaf Inc.)	$115,000.00		$114,500.00
Conceptual Design Phase	$35,500.00		$35,500.00
Design Phase	$300,000.00		$300,000.00
Bid/Construction/Startup	$250,000.00	$250,000.00	
Field Representative Services	$200,000.00	$200,000.00	
Materials Testing Services	$25,000.00	$25,000.00	
Electrical Service Extension	$25,000.00	$25,000.00	
Subtotal		**$600,000.00**	
Construction Phase			
Mobilization / Demobilization / General Conditions	$250,000.00	$250,000.00	
Site Work (*Exterior Piping, Lagoons, Clearing, Grading, Etc.*)	$750,000.00	$750,000.00	
Building Construction (*Masonry, Roofing, HVAC, Plumbing, Etc.*)	$1,000,000.00	$1,000,000.00	
Filtration System (*Tanks, Piping, Equipment, Etc* .)	$1,000,000.00	$1,000,000.00	
Chemical Feed System (*Equipment, Tanks, Piping*)	$150,000.00	$150,000.00	
Well Pump Station Upgrades	$200,000.00	$200,000.00	
Electrical *(Lights, Raceways, Cabling, Generator, Etc)*	$400,000.00	$400,000.00	
Instrumentation and Controls	$250,000.00	$250,000.00	
Subtotal		**$4,000,000.00**	
Total SRF Ineligible Costs			**$500,000.00**
Total SRF Eligible Costs		$4,600,000.00	
Contingency 10% +/-		$500,000.00	
Total SRF Eligible Costs including Contingency		**$5,100,000.00**	
Total Project Costs	**$5,600,000.00**		

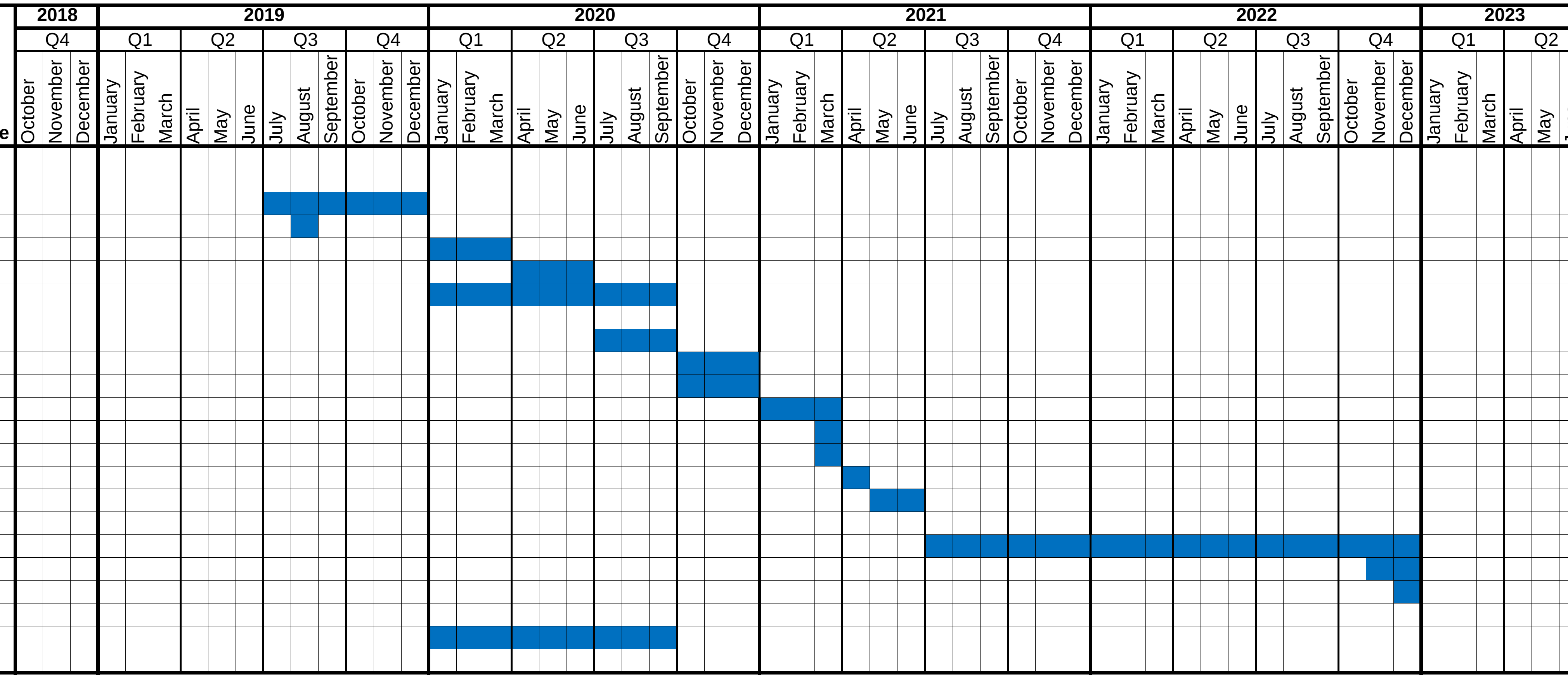
West Boylston Water District

Manganese Corrective Action Plan

PROJECT SCHEDULE

August 16, 2019

Activity	Completion Date
Manganese Removal Treatment Facility	
Complete Pilot Study Report and Conceptual Design	12/31/2019
Submit PEF for funding through SRF program	8/31/2019
Draft/Final IUP List issued for SRF program	3/31/2020
Approval of District Appropriation at Annual Meeting	6/30/2020
Design and Preparation of Bid Documents	9/30/2020
Submit Application to SRF program (incl. bid documents)	10/15/2020
SRF program issues Permission to Advertise/Bid	12/31/2020
Pre-qualification	12/31/2020
Bid Period (Filed Sub-bids and General Bids)	3/31/2021
Review/Evaluate of General Bids	3/31/2021
Submit Part B to MassDEP for DWSRF	3/31/2021
DWSRF Program Review & Approval to Award	4/30/2021
Project Award / Execution of Construction Contract	6/30/2021
Construction of Manganese Removal Treatment Facility	12/31/2022
Facility Startup and Testing	12/31/2022
Final Inspection (Building Inspector and MassDEP)	12/31/2022
Land Acquisition for Treatment Facility Site	9/30/2020



COMPREHENSIVE
ENVIRONMENTAL
INCORPORATED

- Engineering
- Design
- Construction
- Inspection

Responsive service, cost-effective solutions, technical excellence

- Drainage & Flooding
- Energy & Sustainability
- Hazardous Waste
- Permitting & NEPA
- Stormwater & LID
- Transportation
- Water & Wastewater
- Watershed Restoration

December 19, 2018

MassDEP Central Regional Office
Attn: Drinking Water Program
8 New Bond Street
Worcester, MA 01606

RE: PILOT PROTOCOL
WEST BOYLSTON WATER DISTRICT

Dear Sir or Madam:

Please find attached the request to conduct a pilot study for the Oakdale Well and Pleasant Valley Well, West Boylston Water District. This pilot will test the ability of both biological filtration and pressure filtration using anthracite and GreensandPlus to remove manganese.

Comprehensive Environmental Inc. will be working with Blueleaf Inc. to complete this pilot study. We request expedited review of this request since the goal is to initiate pilot testing as soon as possible during the first quarter of 2019.

Please contact me or Kristen Berger if you have any questions or require any additional information at 508-281-5160.

Sincerely,
COMPREHENSIVE ENVIRONMENTAL INC

Michael P. Ohl, P.E.
Principal, Senior Engineer

Enclosures

cc w/ encl.: Michael Coveney, West Boylston Water District
Erik Grotton, Blueleaf
Kristen Berger, CEI

225 Cedar Hill Street, Marlborough, Massachusetts 01752 508-281-5160 Fax: 508-281-5136
21 Depot Street, Merrimack, New Hampshire 03054 603-424-8444 Fax: 603-424-8441
Gateway Crossing, 1 Hartford Square-East, Ste. 227, New Britain, Connecticut 06052 860-224-0442
www.ceiengineers.com

Enter your transmittal number → X282147
Transmittal Number

Your unique Transmittal Number can be accessed online:
http://www.mass.gov/eea/agencies/massdep/service/approvals/transmittal-form-for-payment.html

Massachusetts Department of Environmental Protection

Transmittal Form for Permit Application and Payment

1. Please type or print. A separate Transmittal Form must be completed for each permit application.

2. Make your check payable to the Commonwealth of Massachusetts and mail it with a copy of this form to: MassDEP, P.O. Box 4062, Boston, MA 02211.

3. Three copies of this form will be needed.

Copy 1 - the original must accompany your permit application. **Copy 2** must accompany your fee payment. **Copy 3** should be retained for your records

4. Both fee-paying and exempt applicants must mail a copy of this transmittal form to:

MassDEP
P.O. Box 4062
Boston, MA 02211

*** Note:** For BWSC Permits, enter the LSP.

A. Permit Information

BRP WS 21C
1. Permit Code: 4 to 7 character code from permit instructions

To Conduct Pilot Study
2. Name of Permit Category

Protocol for Pilot Study
3. Type of Project or Activity

B. Applicant Information – Firm or Individual

West Boylston Water District
1. Name of Firm - Or, if party needing this approval is an individual enter name below:

2. **Last Name** of Individual
3. **First Name** of Individual
4. MI

183 Worcester St
5. Street Address

West Boylston — 6. City/Town
MA — 7. State
01583 — 8. Zip Code
(508) 835-3025 — 9. Telephone #
10. Ext. #

Michael Coveney
11. Contact Person

mcoveney@westboylstonwater.org
12. e-mail address

C. Facility, Site or Individual Requiring Approval

West Boylston Water District
1. Name of Facility, Site Or Individual

183 Worcester St
2. Street Address

West Boylston — 3. City/Town
MA — 4. State
01583 — 5. Zip Code
(508) 835-3025 — 6. Telephone #
7. Ext. #

PWS ID 2321000
8. DEP Facility Number (if Known)
9. Federal I.D. Number (if Known)
10. BWSC Tracking # (if Known)

D. Application Prepared by (if different from Section B)*

Comprehensive Environmental Inc.
1. Name of Firm Or Individual

225 Cedar Hill St
2. Address

Marlborough — 3. City/Town
MA — 4. State
01752 — 5. Zip Code
508-281-5160 — 6. Telephone #
7. Ext. #

Michael Ohl, P.E.
8. Contact Person
9. LSP Number (BWSC Permits only)

E. Permit - Project Coordination

1. Is this project subject to MEPA review? ☐ yes ☒ no
If yes, enter the project's EOEA file number - assigned when an Environmental Notification Form is submitted to the MEPA unit:

EOEA File Number

F. Amount Due

DEP Use Only

Permit No:

Rec'd Date:

Reviewer:

Special Provisions:

1. ☒ **Fee** Exempt (city, town or municipal housing authority)(state agency if fee is $100 or less).
There are no fee exemptions for BWSC permits, regardless of applicant status.
2. ☐ Hardship Request - payment extensions according to 310 CMR 4.04(3)(c).
3. ☐ Alternative Schedule Project (according to 310 CMR 4.05 and 4.10).
4. ☐ Homeowner (according to 310 CMR 4.02).

Check Number | Dollar Amount | Date

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Drinking Water Program

BRP WS Application

For Drinking Water Program (Water Supply) Permits or Approvals

X282147
Transmittal Number

2321000
Facility ID# (if known)

A. Application

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

1. Is this application for ☒ an Original or ☐ a Resubmittal?

2. Applicant:

West Boylston Water District	183 Worcester St
Name	Address

West Boylston	MA	01583	Michael Coveney	(508) 835-3025
City	State	Zip	Contact	Telephone

3. Consultant:

Comprehensive Environmental Inc.	225 Cedar Hill Street
Name	Address

Marlborough	MA	01752	Michael Ohl	508-281-5160
City	State	Zip	Contact	Telephone

B. Permit

Please check the permit or approval for which you are applying:

Zone II Determination for Existing Sources
- ☐ BRP WS 07 Approval to Conduct Pump Test for Zone II Delineation
- ☐ BRP WS 08 Approval of Zone II Delineation

New Technology
- ☐ BRP WS 11 Minor New Technology Approval; where no field test required
  - ☐ Drinking Water Additive
  - ☐ Cross Connection Device
  - ☐ Water Vending Machine
  - ☐ Other (specify):
- ☐ BRP WS 12 Major New Technology Approval: where field testing is required
- ☐ BRP WS 27 New Technology with Third-party Approval
- ☐ BRP WS 28 Vending Site/Source Prototype
- ☐ BRP WS 31 Vending and POU/POE Devices with Third-party Approval

New Source Approvals <70 gpm
- ☐ BRP WS 13 Exploratory Phase, Site Examination, Land Use Survey and Approval to Conduct Pumping Test
- ☐ BRP WS 15 Pumping Test Report Approval and Approval to Construct Source
- ☐ BRP WS 37 Approval of Transient Non-Community Source Less than 7 Gallons per Minute (combines BRP WS 13 and BRP WS 15 submittals)

New Source Approvals = or > 70 gpm
- ☐ BRP WS 17 Exploratory Phase, Site Examination, Land Use Survey, and Conduct Pumping Test
- ☐ BRP WS 19 Pumping Test Report Approval
- ☐ BRP WS 20 To Construct Source

Water Treatment Approvals
- ☐ BRP WS 21A To Conduct Pilot Study < 40,000 gpd
- ☐ BRP WS 21B To Conduct Pilot Study = or > 40,000 gpd and < 200,000 gpd
- ☒ BRP WS 21C To Conduct Pilot Study = or > 200,000 gpd and < 1 mgd
- ☐ BRP WS 21D To Conduct Pilot Study = or > 1 mgd
- ☐ BRP WS 22A Pilot Study Report < 40,000 gpd
- ☐ BRP WS 22B Pilot Study Report = or > 40,000 gpd and < 200,000 gpd
- ☐ BRP WS 22C Pilot Study Report = or > 200,000 gpd and < 1 mgd
- ☐ BRP WS 22D Pilot Study Report = or > 1 mgd
- ☐ BRP WS 23A To Construct Facility <40,000 gpd
- ☐ BRP WS 23B To Construct Facility = or > 40,000 gpd and < 200,000 gpd
- ☐ BRP WS 23C To Construct Facility = or > 200,000 gpd and < 1 mgd
- ☐ BRP WS 24 To Construct Facility = or > 1 mgd
- ☐ BRP WS 25 Treatment Facility Modification
- ☐ BRP WS 29 Water Treatment: Chemical Addition Retrofits of Water Systems > 3,300 people
- ☐ BRP WS 30A Vending Installation Approval
- ☐ BRP WS 30B POU/POE Installation Approval
- ☐ BRP WS 34 Water Treatment: Chemical Addition Retrofits of Water Systems = or < 3,300 people
- ☐ BRP WS 35A Multiple Vending Installation Approval
- ☐ BRP WS 35B Multiple POU/POE Installation Approval

Water Quality Assurance
- ☐ BRP WS 26 Sale or Acquisition of Land for Water Source
- ☐ BRP WS 36 Abandonment of Water Source

Distribution System Modifications
- ☐ BRP WS 32 Systems > 3,300 people
- ☐ BRP WS 33 Systems = or < 3,300 people

BRP WS Application

For Drinking Water Program (Water Supply) Permits or Approvals

X282147
Transmittal Number

2321000
Facility ID# (if known)

C. Certification

"I certify, under penalty of law, that this application and all attachments were prepared under my supervision, in accordance with a system designed to ensure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information submitted in this application, the information submitted is, to the best of my knowledge and belief, true, accurate and complete."

[signature]
Authorized Signature

December 19, 2018
Date

Michael P. Ohl, P.E.
Print Name

Senior Engineer
Position/Title

Pilot Study Proposal Manganese Removal Treatment

Completed for

West Boylston Water District
183 Worcester St
West Boylston, MA 01583

Completed by

Comprehensive Environmental, Inc.
225 Cedar Hill Street
Marlborough, MA 01752

December 2018

Table of Contents

1.0 Objective and Goals

The objectives and goals of the pilot testing are to determine the adequacy and capability of the tested processes to treat groundwater from the Oakdale Well and Pleasant Valley Well and to determine the operational parameters affecting full-scale treatment design for treating water at the MassDEP approved pumping rates, by evaluation of the following parameters:

- Treated water quality
  - Total Mn concentration in the filtered water (Goal below 0.05 mg/L)
- Treatment processes
  - Biological
  - GreensandPlus
- Hydraulic loading rates
- Operating run lengths
- Chemical feed requirements
- Waste characteristics

2.0 Source Water

The raw water quality for the wells is presented in Table 1.

Table 1. Raw Water Quality

Parameter	Oakdale Well	Pleasant Valley Well
Manganese Average Range	 0.75 mg/L 0.18 – 2.1 mg/L	 0.37 mg/L 0.26 – 0.52 mg/L
Iron	ND – 0.16 mg/L	ND – 0.1 mg/L
pH	6.2 – 6.6	6.1
Alkalinity (mg/L as CaCO3)	23 - 24 mg/L as CaCO3	17 mg/L as CaCO3

3.0 Pilot Testing

This study proposes pilot testing of two processes for comparison purposes: (1) biological filtration and (2) pressure filtration utilizing anthracite over GreensandPlus media.

Blueleaf Inc. will be conducting the pilot testing using their mobile pilot trailer. The trailer is equipped with the ability to operate four filters at a time. The pilot testing filter vessels are constructed of 6-inch diameter clear PVC cylinders, 60-inches high, flanged at the top and bottom. The media will be pre-conditioned through documented use at another pilot site. This will provide a more robust pilot test since “new” or “fresh” media can yield inaccurate pilot test results.

Pilot testing is anticipated to occur in early 2019. Refer to the attached Schedule for identification of proposed pilot runs and sampling. Generally, the following trial runs are proposed:

1. Biological at Oakdale Well
    a. Trials to determine filter loading rates versus runtime (6 and 8 gpm/sf)
    b. Trials to determine filter loading rates versus runtime (4 and 10 gpm/sf)
    c. Trials to determine recycle settled supernatant and impact on water quality and runtime
    d. Trial to show effect of loss of aeration (24 hours normal, 5 hours off, observe recovery)
    e. Trial to sow effect of stagnation (off for 5 days, observe recovery)

2. Biological at Pleasant Valley Well
    a. Trial to confirm performance

3. GreensandPlus at Oakdale Well
    a. Trial using KOH and NaOCl with filter loading rates of 4 and 6 gpm/sf
    b. Trial using KOH and NaOCl with filter loading rates of 5 and 7 gpm/sf
    c. Trial using KOH and NaOCl with best filter loading rates and with recycle water

4. GreensandPlus at Pleasant Valley Well
    a. Trial using KOH and NaOCl with best filter loading rates based on prior trials

4.0 Sampling and Analysis Protocol

The pilot system operator will manually take water samples and analyze for select parameters on site during each pilot run as shown in Table 2. A certified laboratory would perform all outside analytical services shown in Tables 3. Filter backwash will be collected as a composite representative sample and a portion sent to the certified laboratory for analysis. The remaining portion will be allowed to settle (for 1 hour) and the supernatant will be sampled for total Mn.

Table 2. Daily On-Site Testing With Portable Analytical Equipment

Parameter	Pilot Raw Water	Filter Column Effluent	Backwash Supernatant	Equipment	Method
Total Iron	Daily	Daily	End of Run	Hach DR/890	FerroVer® Method 8008
Total Manganese	Daily	Daily	End of Run	Hach DR/890	PAN Method 8149
Free Chlorine	--	Daily	End of Run	Hach DR/890	DPD Method 8021
pH	Daily	Daily	End of Run	Orion 250	Stnd Method 4500-H+B
Temperature	Daily	Daily	--	Thermometer	--
Turbidity	Daily	Daily	--	On-line Turbidimeter	--

Table 3. Off-Site Testing for Each Pilot Run at Certified Laboratory

Parameter	**During Operation**	
	Raw Water	**Filter Effluent**
Alkalinity	X	X
Carbon Dioxide	X	X
Chlorine Residual, Total	--	X
Color, apparent	X	X
Color, true	X	X
Inorganics (IOC)	X	X
pH	X	X
Secondary Contaminants	X	X
Total Suspended Solids (TSS)	X	X
Turbidity	X	X
VOCs	X	X
Coliform	X	X
Iron, Total	X	X
Iron, Dissolved	X	X
Manganese, Total	X	X
Manganese, Dissolved	X	X
Dissolved Organic Carbon (DOC)	X	X
Total Organic Carbon (TOC)	X	X
Simulated Distribution Systems	--	X
TTHM	--	X
HAA5	--	X

*Backwash residuals and supernatant to be tested for total manganese, TSS and pH at end of runs.

PROPOSED PILOT AND LABORATORY SCHEDULE FOR WEST BOYLSTON PILOT STUDY	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#
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Town of West Boylston
140 Worcester Street, West Boylston, Massachusetts 01583

Board of Selectmen/Sewer Commission Meeting Minutes

Date / Time / Location of Meeting
June 26, 2019; 6:00 p.m.; Selectmen's Meeting Room, 140 Worcester Street

Members Present
Patrick J. Crowley, Chairman Barur R. Rajeshkumar, Vice Chair John W. Hadley, Clerk Michael J. Kittredge III, Selectman Christopher A. Rucho, Selectman
Members NOT Present
Invited Guests:

Mr. Crowley convened the meeting at 6:00 p.m. All members are present.

PUBLIC COMMENT – 7:05PM:

No one came forward under this agenda item.

APPROVAL OF MEETING MINUTES:

1.June 5, 2019, regular session

Motion Mr. Hadley, second Mr. Rajeshkumar, all in favor.

2..June 5, 2019, executive session

Motion Mr. Rucho, second Mr. Hadley, all in favor.

REVIEW AND VOTE TO APPROVE WARRANTS FOR THE PERIOD COVERING JUNE 6, 2019 TO JUNE 26, 2019: Town Payable Warrants FY2019-50 & 51 and 2019-SP-1; Town Payroll Warrant FY2019-25; Sewer FY2019-SE26; Municipal Light Plant #32, 33 and 34; and School Warrant FY2019-S19

Motion Mr. Rajeshkumar, second Mr. Hadley, all in favor.

Kathryn Cannie, Public Agency Retirement Services – consider voting to have PARS be the investment firm for our OPEB Funds

Now that we have begun to fund our OPEB Trust, we need to set up a trust for those funds. Ms. Lucier held a meeting with the Town Accountant, Treasurer/Collector and Mr. Crowley .Ms. Cannie comes highly recommended by our financial advisor Todd Hassett. Mr. Crowley noted that we met he was impressed with the presentation and noted that it would be very costly for the town on their own to set up the trust.

Kate Cannie joined the Board. She works with PARS and they assist public agencies with addressing the cost and funding for retirement services. They manage OPEB trusts. They have developed a multiple employer agency trust, an established trust with custodian trustees and investment management program and all the legal documents that need to be put in place. It allows for individual agencies to join. They manage all the legal and compliance issues of the trust ongoing. No up front work that needs to be done by the town. The pool funds are pulled together to reach a more diversified level and meet your goals. They put this program together because it is economy to scale agency to join but your assets are not comingled. They are invested together as a pool to achieve the highest investment at a lower cost. Your assets are held separately in your own account and your earnings are your earnings. The management administration fee is 25 basis points, 1 point equals 1% of 1%, the Van Guard fee is 4 basis points and the custodian fee with US bank is 5 basis points. They have over $250 million dollars in this one portfolio. When they launch the Van Guard portfolio in January of 2015 the basis points were 7 basis points the investment fees are now right below 4 basis points. Each month those fees go down with agencies joining. You will have the option of selecting one of the 4 portfolios; growth, balanced, conservative and fixed income. They are based on asset allocation of equity versus fixed income.

Mr. Crowley was at the meeting and the cost is $380 per $100,000 of assets under management per year. He recommends we hire PARS and go with Van Guard fund and go with balanced investment approach. Everyone at the meeting was on board with this. If we try to do this ourselves it will cost us much more. PARS manages the trust itself and the investment management is Brian Brinkley the dedicated portfolio manager. If you want to change your portfolio you speak with Brian and the treasurer makes that call.

Motion Mr. Rucho WHEREAS the Town of West Boylston (the “Town”) has accepted the provisions of Chapter 32B, Section 20 of the Massachusetts General Laws, as amended by Chapter 218, Section 15 of the Acts of 2016; and WHEREAS it is determined to be in the best interest of the Town to participate in the PARS Public Agencies Post-Retirement Health Care Plan Trust (the “OPEB Fund”), to fund post-employment benefits for its employees as specified in the Town’s policies and/or applicable collective bargaining agreements; and WHEREAS the OPEB Fund is a tax-exempt trust and plan performing an essential governmental function within the meaning of Section 115 of the Internal Revenue Code, as amended, and the Regulations issued there under, and is a tax-exempt trust under the relevant statutory provisions of the Commonwealth of Massachusetts; and; WHEREAS the assets of the OPEB Fund shall be invested in accordance with the prudent investor rule under the provisions of Chapter 203C of the Massachusetts General Laws; and WHEREAS the Town’s adoption and operation of the OPEB Fund has no effect on any current or former employee’s entitlement to post-employment benefits; and WHEREAS the terms and conditions of post-employment benefit entitlement, if any, are separate from and independent of the OPEB Fund; and WHEREAS the Town’s funding of the OPEB Fund does not, and is not intended to, create any new vested right to any benefit nor strengthen any existing vested right; and WHEREAS the Town reserves the right to make contributions, if any, to the OPEB Fund. NOW THEREFORE, BE IT RESOLVED THAT:

The Board of Selectmen of the Town of West Boylston (the "Board") hereby adopts the Public Agencies Post-Retirement Health Care Plan Trust, including the Public Agencies Post-Retirement Health Care Plan, effective June 26, 2019; and

The Board hereby appoints the Treasurer, or his/her successor or his/her designee as the Town's Plan Administrator for the OPEB Fund, and further authorizes the investment of the OPEB Fund under the prudent investor rule established under Chapter 203C of the Massachusetts General Laws; and

The Town's Plan Administrator is hereby authorized to execute the PARS legal, investment, and administrative documents on behalf of the Town, and to take whatever additional actions are necessary to maintain the Town's participation in the OPEB Fund, and to maintain compliance of any relevant regulation issued or as may be issued; therefore, authorizing him/her to take whatever additional actions are required to administer the Town's OPEB Fund.

Motion seconded by Mr. Hadley. Vote on the motion – Messrs. Crowley, Rajeshkumar, Rucho and Hadley yes, Mr. Kittredge abstains. Town Clerk Elaine Novia certified the votes.

West Boylston Water District Commissioners – request to obtain Easement or conveyance of land in the vicinity of the Oakdale Well

Water District Commissioners Stanley Szczurko, Bob Bryngleson and Gary Flynn jointed the Board with Superintendent Michael Coveney. Mr. Szczurko reports that the Water District received an Order from DEP to construct a water treatment facility to treat and remove the manganese at the Oakdale well. It is our largest supplier of water in town, yields about one million gallons of water a day, and 98% of our entire town is served by wells. Their purpose in meeting with the Board this evening is to see if they could acquire the necessary land needed to construct the facility. They would like to know if they town would be willing to provide the necessary land area needed for construction of the facility. They do not have a definite understanding of the land area needed as the design has not yet been determined. They would like to start dialogue to see if the district could work something out with the town to acquire the granting of an Easement for the land. Mr. Crowley noted that in looking at the map provided, it will not obstruct use of the rail trial. Mr. Szczurko reports that DCR suggested we go to the town first. They are reluctant to give up what they have. Almost 100% of the town is on the Water District's water supply. He added that they have had some issues with their Pleasant Valley well and things are moving along slowly. Michael from the engineering firm of CEI is doing the pilot right now. For a facility of this nature he estimates a building 50x100 or 40x80 sq. ft. on a one-acre parcel is what they would need. They would also need space for an emergency generator. They are putting together a conceptual design this summer and the PILOT study will give what treatment would be the best approach.

Mr. Rajeshkumar asked how far along they are with the new well. Mr. Coveney reports that they are waiting for DCR to grant the easement and they are ready to sink it as soon as the paperwork is filed with the Registry of Deeds, not sure how long it will take. Even if the new well is functioning Mr. Rajeshkumar asked we will need the Oakdale well. Mr. Coveney replied yes. Pleasant Valley is on the low system and Lee Street is on the high system. Manganese has been an issue for many years, and with this treatment they will filter out the manganese. Mr. Kittredge asked do you actually have to remove the manganese. Mr. Coveney explains they have to remove the manganese and one option would be to treat it and dispose it through the sewer system. Mr. Kittredge asked do you have any removal issues when you transport it, what do you consider it? The Water District's engineer reports there are no special transport requirements. Another disposal option could be the sewer system if it has capacity and there would be a detention basin. Periodically you take the basin off line to go through a freeze thaw period. We could remove the manganese for fertilizer products and sell it to the market.

They would like to locate the facility inside the entrance gate near the fire department training facility tucked into the hill. They would like to wait until the PILOT study has been completed so they know what they have for options. The building would be the height of two stories with 16-18 foot walls with a pitched roof. It is a biological filtration system, and they just completed one in Shrewsbury with tremendous success. It was noted that manganese is fluffy, would not affect sewer pipes. We would also need to insure we have capacity within our sewer system. Mr. Crowley asked at 1 million gallons of water a day how much stuff are we talking. The Water District's engineer estimates over the course of a year when it is settled it is one inch of solids over this room. Ultimately when discharged into the sewer it goes to Upper Blackstone. Mr. Szczurko noted that it is an acceptable waste for the sewer system, not a contaminant.

Mr. Rucho asked when you do this study will you look into costs to the town. Mr. Szczurko states we are looking to see if the Board would be amiable to consider granting an easement for the Water District to locate a facility somewhere on the parcel the town owns. There will be more discussion this is initial conversation only. They do not have the final information from the pilot but wanted to let DEP know they are in the process of discussing the location of a facility. The time table set by DEP puts the Water District in some constraints. This is an issue where the allowable amounts of manganese parts per million is different so now there is a problem. Mr. Coveney reports that in 2017 DEP set a health standard for manganese at 13 for potential neurological affects for exposure. We have been pumping the Oakdale well and it was well up over 1. Prior to 2016 there was no limit on the health part of it. It is a new rule. The water has not changed the rules have changed. The manganese causes dirty water. Mr. Kittredge suggested locating the building way to the right in the back where they kept their soccer nets. There is a big area way in. They used to mow it and it is behind old sumac trees. It is out of the way up in the corner. It was noted that in the 1950's the town granted property to the Water District for the well. Mr. Szczurko states the town has been very good to the district in the past. As a result they are hoping the good will shall continue. This is not unique to West Boylston, it is happening across the state and it is a hazard because the rules have changed. Shrewsbury was also under an order from DEP and built their treatment facility last year.

Mr. Rucho asks what is the timeline. The conceptual design is scheduled to be complete by the end of the year and after the first of the year we will start on detail design. DEP has the construction documents being completed by October of 2020. Mr. Kittredge asked if there is there is any way to speed the process up. Mr. Szczurko explained that it is being done in accordance with the construction required for the various stages and we are also applying for grant funds through the state SRF program. They applied in August of this year.

Motion Mr. Hadley for the Board to work with the Water District to move forward with this plan, second by Mr. Kittredge, all in favor. The Commissioners thanked the Board and agreed to return in October or November for an update. They will also relay updates through the Town Administrator. Mr. Rajeshkumar asked if we anticipate any increase in the water rates. Mr. Coveney notes that they are applying for a loan through SRF, estimated cost $3-$5 million to build the plant and water rates will have to increase to pay for the wo-year loan on the plant.

CENTRAL MASS REGIONAL PLANNING COMMISSION – Presentation on Municipal Vulnerability Plan

Eli Goldman of CMRPC joined the Board. He reports that we held a public listening session earlier this month. The MVP Program is the state's response to climate change and provides funds to communities to begin the process of planning for and implementing climate resilience. By having a Plan you can apply for action grants that are developed through the strategies. Thus far 71 communities have gone through the first round and 82 are in the second round. The MVP program objectives include defining extreme weather both natural and climate-related hazards, identifying existing and future vulnerabilities and strengths, developing and prioritizing actions for the community and stakeholders, and identifying opportunities for the community to advance action to reduce our risks and build resilience. West Boylston has a Hazardous Mitigation Plan which was accepted by FEMA in February of 2018. The MVP plan differs from that as it is more of an awareness-building exercise. We ended up with 50 people participating in our MVA workshop which was held on May 14th. The Core Team met three times prior to the all-day workshop to guide the process. The all-day workshop had a broad scope of attendees including local officials, officials from other towns and business and non-profit groups.

The top hazards identified at the workshop included flooding, winter storms, droughts/wildfires and severe storms. We had five breakout groups, one for infrastructure, society and environment and two working on all three. Each was broken down into priority features, local strengths and strategies with corresponding maps. Following that breakout group exercise we came together and came up with long and short term and ongoing strategies. We came up with our infrastructure strengths and vulnerabilities. An example of one of our strengths was our emergency shelters but back up generators are needed at the senior center and the elementary school. With this plan we can apply for grant funds for that need. The next step is on June 30th CMRPC will submit the plan to the state and we can apply for the next round of grants in late July or August.

Mr. Hadley questioned how long the program has been going on and how many grants have been given out. Mr. Goldman reports that it is fairly new program and since the beginning of June $300,000 to $400,000 has been given out for projects relating to vulnerability risks. Some communities have applied for grants to update their bylaws and regulations to allow for development. CMRPC will be submitting the Plan to the state.

Fire Chief Thomas Welsh - considering voting to accept bids for surplus Rescue and Engine 3

Chief Welsh reports that the bids closed at 1:00 today. At noon it was at $5,000 and when it closed the high bid for the rescue truck came in at $10,200. He requested the Board vote to approve the high bid of $10,200 for the rescue truck. He is also requesting the Board lower the minimum bid for the fire truck. We initially had a minimum of $4,500 and we didn't get any bids. He recommends we start the bidding on the fire truck at $3,000 and we would take $3,500.

Motion Mr. Hadley to start the bidding on the fire truck at $3,000 and we would accept $3,500, second by Mr. Kittredge, all in favor. I was noted that we received 53 bids on the rescue truck.

Motion Mr. Rucho to accept the high bid of $10,200 on the rescue truck, second by Mr. Hadley, all in favor.

Request from PNL Deli Corp. for a Common Victuallar and Transient Vendor License to operate a food truck at 24 Worcester Street

Mr. Kittredge recused himself and sat in the audience. Perry Jano joined the Board and states that he owns a deli in Charlton. He purchased a food truck from Mike and is planning to place it on the Kittredge property located on 24 West Boylston Street. A tar pad was put in for the truck. The Charlton Health Inspector inspected it first and then the West Boylston Board of Health. He only plans to be at that location. It is a movable truck. Mr. Crowley asked about the parking situation. All departments, including the Police Chief, reported having no issue with the request. Mr. Jano plans to place a picnic table at the site and feels he could park 50 cars. Mr. Rucho is concerned about people parking on the street. Ms. Lucier noted that the Board could issue the license and should there be an issue with parking, we could invite them in for a conversation on how to resolve any issue.

Motion Mr. Hadley to approve the license pending Board of Health approval, second by Mr. Rucho, all in favor. Mr. Kittredge returned to the meeting table.

Gary Kellaher, Interim DPW Director

Mr. Kellaher reports that we had a couple of accidents at River Road and Thomas Street. The convex mirror that was on the post was ordered and has been installed. He also checked Newton Street and Prospect Street stop signs. The solar boards have an 18-month life. He has ordered new batteries.

With regard to the new crosswalk lights, Mr. Kellaher was able to borrow a piece of equipment from another community and the poles have been set and we will next install the crossing lights. They will be up and running shortly. He is getting pricing on the dead tree on the island at Malden and Goodale Streets and noted that it is going to be a costly item. He met with the engineer on the Crescent Street sidewalk project and we had an issue with a relocation of a mail box. We have a test mail box in place and we are moving forward with that project. We have been granted an extension until December 2019. He is confident, in his conversations with the contractor today that the project will be completed, with the exception of minor adjustments, by the beginning of the school year. He visited with the Gilsons and the Mudd and they have completed an easement for those two properties. All disturbed areas will be returned as close to their original condition as possible.

Mr. Kellaher reports that things are going very well and he is happy about that. The new gateway sign will be up by the end of the week. Chapter 90 works is going very well. The Hosmer Keys Streets project will start the week of July 8th and it will take three days to reclaim. Notices were mailed out to the residents on Hosmer, Keyes and Laurel Streets. The road will not be closed off. He visited with Michael Coveney regarding an Elm Street water break, which settled a little more. We are looking to extend it 500 feet and it is Chapter 90 project eligible. He reports that we are moving in the right direction.

Mr. Hadley questioned street opening permits and was of the understanding that there was a 5 year moratorium on streets recently paved. Mr. Kellaher advised if you use state aid money it is five years or it is an emergency. Mr. Hadley asked about a cut made on Prospect Street. Mr. Kellaher believes they did it for a utility connection and signs offs were prior to his arrival. It would be the DPW who would sign off on that. Mr. Hadley noted that they did the same thing on 92 North Main Street and they didn't use liquor fill. Mr. Kellaher did speak with the state about North Main Street and that was signed off on before his arrival. Mr. Kellaher noted that he always follows the seven year rule and noted it will not happen again. Mr. Rucho asked if we could require a person to cut it out and use liquor fill. Mr. Kellaher would require it.

Mr. Rucho asked regarding the stop sign batteries is it because the batteries are old. Mr. Kellaher notes that they only have an 18-month shelf life, some have been replaced and it is a job the DPW will be able to do. Mr. Rucho asked about the catch basin that need to be repaired and whether those projects has started yet. Mr. Kellaher reports that many need attention and the DPW needed the new budget monies to do those jobs, which we begin after July 1. Mr. Rucho noted that the metal is falling into the catch basin at 9 Colonial Hill Drive. It is getting worse.

Mr. Crowley asked if the cross walk signs are hard wired or solar. Mr. Kellaher replies, solar. Mr. Crowley asked what the balance in Chapter 90 would be after the Elm Street work. Mr. Kellaher estimates $225,000 to $230,000. There are going to be some additional expenses for the re-engineering of the Crescent Street crosswalk project, which will come from Chapter 90. Mr. Rucho would like replacement of solar stop sign batteries on the Municipal Calendar. Mr. Kellaher would prefer them on the shelf ready to go.

On July 22 at 6:00 p.m. we will have a Crescent Street Sidewalk information meeting. Letters have been sent out to all residents within 200 feet of the project.

NEW BUSINESS:

Mr. Kittredge returned to the meeting room table.

1. Concurrence on the reappointment of Norma Chanis to the Town-wide Planning Committee effective July 1, 2019 for a term to expire on June 30, 2022

Motion Mr. Hadley to concur with the appointment, second by Mr. Kittredge, all in favor.

2. Concurrence on the reappointment of Gary Flynn to the Open Space Implementation Committee as the Parks Commissioners designee effective July 1, 2019 for a term to expire on June 30, 2022

Motion Mr. Hadley to concur with the appointment, second by Mr. Rucho, all in favor.

3. Concurrence on the reappointment of Christine Mazeika to the Personnel Board effective July 1, 2019 for a term to expire on June 30, 2022

Motion Mr. Rucho to approve the appointment, second by Mr. Kittredge, all in favor.

4.Consider voting to recognize the acceptance of the following donations for the Bandstand Committee and to approve expenditure of these funds for general purposes: Sponsor $265 in memory of Pauline McCormick, Sponsor $265 from Michael Casey, Sponsor $265 from Webster First and Free Will Donations from June 23rd concert $168.97

Motion Mr. Hadley to recognize and accept the donations, second by Mr. Kittredge, all in favor.

5. Concurrence on reappointment of Tony Sanders to PEG Board effective July 1, 2019 for a term to expire on June 30, 2022

Motion Mr. Rucho to concur with the appointment, second by Mr. Kittredge, all in favor.

6. Concurrence on the appointment of Thomas Dillon to the Board of Health effective June 28, 2019 for a term to expire on April 30, 2022

Motion Mr. Hadley to concur with the appointment, second by Mr. Kittredge, all in favor.

7. Concurrence on the appointment of Peter Bove as a Special Officer to work detail assignments, effective July 1, 2019 for term to expire on June 30, 2020 at a rate of $49.00 per hour

Motion Mr. Hadley to concur with the appointment, second by Mr. Rucho, all in favor.

8. Concurrence on the appointment of Richard Simmarano as a resident to the PEG Board effective July 1, 2019 for a term to expire on June 3, 2020

Motion Mr. Rucho to concur with the appointment, second by Mr. Hadley, all in favor.

9. Consider voting to send a letter congratulating Kathleen Theoharides on her appointment as Secretary of Energy & Environmental Affairs and request she recommend to the Governor that the funds in the bond bill for the Goodale Park Project be released

Motion Mr. Hadley to send the letter, second by Mr. Kittredge, all in favor.

10.Consider a ban on single-use plastic bags (JH)

Mr. Hadley believes the state will be implementing this very soon and would prefer us getting ahead of the curve.

Motion Mr. Hadley to start the process to eliminate plastic bags in town, second by Mr. Kittredge.

Discussion ensued with Mr. Rucho commenting that he doesn't think this is something the town should ban, he thinks the state should do so. He added that when you go to Home Depot in Shrewsbury you get a large paper bag for a very small item, which fills up your recycling bin. Norma Chanis of SWAT joined the Board for this discussion. She reports that this is something SWAT discussed, a few towns have done a ban, however, the issue always is enforcement. Plastic bags can and are being recycled. It is not the biggest thing out there that the town should be concerned about. Many towns are banning other things like nip bottles and styrofoam. She noted that every supermarket takes plastic bags back and to her it is more of educating people. Mr. Hadley feels it is a place to start. Mr. Crowley pointed out that paper bags take up more space and take more energy to produce. He is not a fan of banning things that are legal. He noted another option would be to require stores to use biodegradable bags and they could charge if they so choose. Mr. Rucho questions where do we end.

Vote on the motion – Messrs. Hadley and Kittredge yes; Messrs. Crowley and Rucho no. Motion fails.

11.Consider changing the name of the Board of Selectmen to Selectboard (JH)

Mr. Hadley feels it is the proper step for the Board to take to change their name.

Motion Mr. Hadley to change the name from Board of Selectmen to Selectboard, second by Mr. Kittredge. For our existing bylaws, this would require town meeting and state approval and we will also change signs within town hall. Vote on the motion – all in favor.

12.Concurrence on the hiring of Karen Hennessy to the position of Clerk in the Office of the Treasurer/Collector effective July 2, 2019, for a maximum of 5 hours a week, at Step 2 of Grade 2, $15.34 per hour

Motion Mr. Hadley to approve the hiring, second by Mr. Rucho, all in favor.

Town Administrator's Report

1. Blight Bylaw

Ms. Lucier asked for an update on the Blight Bylaw. Included in this packet is the research I did back in January of 2019 and a copy of the minutes from the Board of Health Meeting at which this was discussed. Mr. Hadley noted that he and Mr. Crowley began this discussion last November with the Board of Health. They were not in favor of a bylaw and felt it was almost impossible to get it done and enforced. The enforcement person would fall on the building inspector and it doesn't work. The Board would like to invite the Board of Health and the Building Inspector in to discuss the option

2. Consider signing a contract extension with CM Geeks

Our contract with CM Geeks Inc. expires on June 30, 2019. The contact does allow the possibility of two, one year extensions at the discretion of the Town. I reached out to a number of our department heads to see if they were happy with the support and services provided to their department and I received back glowing reviews. I recommend the Board vote to approve a one-year extension of the contract with GM Greeks, Inc. for IT services.

Motion Mr. Rucho to go forward with the one-year extension of our CM Geeks IT contract, second by Mr. Kittredge, all in favor.

3. Consider signing Agreement for Collection of Soft Recyclables with Simply Recycling

At our last meeting we had a presentation from Steven Lisaukas, Vice President of Government Affairs for Waste Zero who gave a presentation on Curbside Textiles Recycling. SWAT has been working on finalizing the mailer and we are working on the other items needed to start service in West Boylston. I recommend the Board vote to enter into a 3-year contract with Simply Recycling with an option for one additional 3-year term and have the Chairman sign the contract.

Norma Chanis of SWAT joined the Board to discuss the mailer. The Board would prefer the car list all the items they take rather than directing residents to a town website. Mr. Rucho suggested using a smaller font might help fit the 12 or 14 items in the piece. We will ask for another mock up

Motion Mr. Hadley to sign the contract, second by Mr. Kittredge, all in favor.

4. Consider signing a trash metering agreement with Waste Zero

I recommend the Board vote to sign the proposed trash metering agreement. They will lock the current prices in for 3 years and are offering to cut the price of the bags by $1.00 per case. The win for Waste Zero is they get the money sooner and cut the town their net share of the bag revenue fee. We will amend the trash budget and local receipts as well.

Motion Mr. Rucho to sign the agreement, second by Mr. Hadley, all in favor.

Senior Center

1.General update

Mr. Hadley reports that work is continuing outside and they are working on grading the field. We will hold all money until the town is satisfied and it is done correctly.

2.Approval of Invoices

a. Caolo & Bieniek Associates, #5999, $2,677.50 – motion Mr. Hadley to approve, second Mr. Rucho, all in favor.

b. Yankee Engineering & Testing, #25995, $515.00 – motion Mr. Hadley to approve, second Mr. Kittredge, all in favor.

c. WB Mason #165652249, $2,399.97 (from $15,000 Gift) – motion Mr. Rucho to approve, second Mr. Kittredge, all in favor.

d. Physio-Control, Inc., #119035043, $1,495.00 – CR Plus AED Unit – Motion Mr. Hadley to approve, second Mr. Kittredge, all in favor.

e. Bound Tree, #83203610, $217.99 – Cabinet for AED Unit – motion Mr. Rucho to approve, second Mr. Kittredge, all in favor.

f. CM Geeks, Inc. #1933, $2,970.00 – labor for PC setups, routers, network, phones - motion Mr. Hadley to approve, second Mr. Kittredge, all in favor.

g. Global Equipment fuel oil fill ladder $2,365.55 - motion Mr. Hadley to approve, second Mr. Rucho, all in favor.

h. RAC Invoice #13, $278,191 – motion Mr. Hadley to approve, second Mr. Kittredge, all in favor.

Final bonding number to Town Accountant

Mr. Crowley reports that anything we borrow over $50,000 can only be used for a project with a similar borrowing term. Ms. Lucier reports that our OPM recommends we borrow the full amount. Mr. Crowley thinks the interest rate will be 2.5% to 3% and noted that we currently do not have much of an investment policy for town funds, something he intends to work on. He would prefer not to borrow the full amount. Mr. Rucho voiced concern that we told the residents we are not going to borrow any more than we need. Mr. Hadley would prefer a 6-month ban. Mr. Crowley suggested borrowing what is currently anticipated with an additional $50,000 as we could use up to that $50,000 towards the note. Ms. Lucier recommends going with another ban and waiting for the final borrowing. Mr. Hadley is concerned about the two contractor issues.

Motion Mr. Hadley to see if we can do one more ban and if we have to go for the final bonding then we go with the expected amount plus $50,000 more, second by Mr. Kittredge. Vote on the motion – Messrs. Crowley, Hadley, Kittredge yes; Mr. Rucho no. Mr. Rucho pointed out that we did tell residents that we were going to do fund raising.

MEETINGS, INVITATIONS & ANNOUNCEMENTS:

1.July 10, 2019, 6:00 p.m. next meeting of the Board

2.July 10, 2019, 7:00 FISP meeting

3.Consider changing August 7th meeting to August 14 or 21

It was agreed to meet on Thursday, August 1.

FUTURE AGENDA ITEMS/SELECTMENS REPORTS:

Mr. Hadley reports that the Malden Street bridge is scheduled to be open to traffic on Friday.

With no further business to come before the board, motion Mr. Hadley to adjourn at 8:22 p.m., second by Mr. Kittredge, all in favor.

Respectfully submitted,

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Nancy E. Lucier, Municipal Assistant

Approved:

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Patrick J. Crowley, Chairman

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Barur R. Rajeshkumar, Vice Chairman

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John W. Hadley, Clerk

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Christopher A. Rucho, Selectman

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Michael J. Kittredge III, Selectman