City of Fall River, MA

Community Resiliency Building Workshop

Summary of Findings

June 2019

WOODARD &CURRAN

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1. OVERVIEW

The City of Fall River is a dynamic community rich in history and ready for revitalization. Its waterfront, mill buildings, diverse ethnic neighborhoods along with and parks and open space provide a foundation on which the City has been built. Fall River is unique in that over half of the City's area is forest, wetlands and water, which is permanently protected watershed land or part of the Southeast Massachusetts Bioreserve.

Located in Bristol County and the Taunton River Watershed, the City has a year-round population of approximately 89,420 (as of 2017) and a land area of 40.2 square miles. Fall River is one of the ten largest cities in Massachusetts and has approximately five miles of shoreline exposed to open ocean with the remainder forming a semi-protected bay. The City is protected from storms by natural and manmade shoreline structures (approximately 17 provide some coastal protection). A waterfront community, Fall River faces challenges along with unique opportunities to think about and manage climate change impacts. Various storm events have resulted in unfortunate situations throughout the City in recent years such as property damage, tree damage, utility disruptions, power outages, coastal erosion and flash flooding. With every storm there is a general concern over tree debris due to the age and condition of the urban tree cover in the City.

Some of the more recent storm events include:

- **March 2010 Intense Rains** - Record flooding of 5.4 inches, 3.1 inches and 7.7 inches occurred during a short timeframe. The City had already been saturated from these three storm events and then received another 8 inches of rain in 36 hours. Fall River's stormwater and wastewater infrastructure was overwhelmed and caused massive issues on Mount Hope Avenue and Columbia Street.

  Also during this period, the shoreline of Mount Hope Bay washed away from overland storm flow from Mount Hope Avenue, portions of Bell Rock road and Collins Street washed away and Cherry Street was damaged from stormwater flow.

- **August 2018 Flooding** – Approximately 2.9 inches of rain fell and the intensity and duration of the storm event caused flooding. The Braga Bridge flooded on both sides, due in part to drainage structures not functioning properly. Issues were also evident on North Main, Rodman, Pleasant and Warren Streets.

In 2018, Fall River applied for and received a Municipal Vulnerability Preparedness (MVP) Planning Grant from the Massachusetts Executive Office of Energy and Environmental Affairs. The MVP Planning Grant Program was designed to provide support for communities to plan for climate change resiliency and implement priority projects. Upon completion of the MVP program, communities can become certified as a MVP Community and become eligible for MVP Action Grant funding and other opportunities in the future.

As a City with limited financial resources, Fall River frequently seeks ways to advance mitigation, adaptation and resiliency goals and actions by seeking out supplemental funding sources. Fall River began the planning process in the fall of 2018 and held its required Community Resiliency Building (CRB) workshop in March 2019. The CRB workshop process is based on a risk matrix exercise while also utilizing current information regarding natural hazard events, understanding the latest climate change projections, evaluating information on City efforts to address resiliency and reviewing recent action items and projects to address resiliency issues.

1.1 Municipal Vulnerability Preparedness Process

Fall River began the MVP process by conducting a Kick-Off meeting with a Core Team and then the Community Resiliency Building Workshop. The City organized additional resident engagement sessions targeted toward the Portuguese speaking community.

1.1.1 Community Resiliency Building Workshop Core Team & Kick Off Meeting

Fall River's Community Resiliency Building Workshop was led by a local Core Team which included the following individuals and City departments:

- Paul Ferland, Deputy Administrator of Community Utilities | Sewer Department | Lead Project Manager for MVP/CRB
- John Lincourt, Project Manager | Sewer Department
- Terry Sullivan, Administrator of Community Utilities
- Cathy Viveiros, City Administrator
- Monica Sousa, Special Assistant to the Mayor's Office
- Marci Yazwinski, Grant Writer
- Richard Aguiar, Director of Emergency Management
- John Perry, Director of Community Maintenance
- William Roth, Planning Director

Fall River contracted with Woodard & Curran to support and help implement the Community Resiliency Building process required as a part of the MVP program. The Core Team listed above held an initial project kick off meeting on February 1, 2019 to discuss the overall MVP planning process and start planning for the upcoming CRB workshop.

1.1.2 Community Resiliency Building Workshop

Fall River held its Community Resiliency Building (CRB) workshop on March 20, 2019 at Bristol Community College located at 777 Elsbree Street. The Core Team and Woodard & Curran worked together to develop an agenda that was both informative, engaging and aligned with the objectives of the workshop which were to:

Photo: CRB Workshop, March 20, 2019

- Define extreme weather and natural and climate related hazards impacting Fall River,
- Identify existing and future vulnerabilities and strengths,
- Develop and prioritize actions for the community and broader stakeholder networks, and
- Identify opportunities for the community to advance actions to reduce risks and build resilience.

There were 35 participants for the eight-hour workshop. Other partners for the CRB workshop included Davey Resource Group and Liberty Utilities.

The agenda for the CRB Workshop built upon an exercise where participants reflected on what they think Fall River's biggest challenges are and what they hope to gain by participating in the workshop. The agenda focused on educating participants to increase their awareness of risks facing the community from natural and climate-related hazards. With this information in hand, participants worked together to identify vulnerabilities and strengths in Fall River associated with infrastructure, society and environment, developing action items based on what was identified and then discussing priorities and a timeline for each action.

1.1.3 Public Listening Session

Upon completion of the CRB Workshop, Fall River held a Public Listening Session on April 29, 2019 in the Sewer Commission conference room. The purpose of the Public Listening Session was to provide a summary of the workshop results to workshop participants and other stakeholders who may not have been able to attend the actual CRB workshop. Key topics that were discussed at the Listening Session include:

- Connecting the final MVP deliverable to existing work that has already been done in Fall River such as the Hazard Mitigation Plan and Integrated Plan so that they are all supportive of each other.
- Leveraging grant and loan opportunities as much as possible to advance MVP action items.
- Continuing public education and outreach about climate change and resiliency in Fall River.
- Focusing on flooding issues in the community as well as water supply protection and access.

The Public Listening Session was televised on the local cable channel, Fall River Television (FRTV).

1.1.4 Community Engagement Sessions

To broaden the outreach and community engagement for the Municipal Vulnerability Preparedness process, Fall River held five additional community engagement sessions in different neighborhoods which offered Portuguese Translation services. The sessions focused on reviewing the results of the CRB Workshop and Listening Session with the goal of obtaining additional feedback from the community. **Table 1-1** includes the details of the five additional community engagement sessions.

Table 1-1: Additional Community Engagement Sessions

Community Engagement Session	Location
Maplewood Neighborhood Association	Letourneau Elementary School | May 15, 2019 at 6:30pm
North End Neighborhood Association	Morton Middle School | May 15, 2019 at 6:30pm
Niagara Neighborhood Association	Green School | May 20, 2019 at 6:30pm
South End Neighborhood Association	Good Shepard Parish Hall | June 6, 2019 at 6:30pm
Flint Neighborhood Association	Fonseca School | June 26, 2019 at 6:30pm

Feedback from these community engagement sessions varied from neighborhood specific issues to larger scale community wide concerns and opportunities. Key discussion items included:

- Addressing flooding in Stafford Square,
- Role of the Fourth Street Gate House and Iron Works #7 in controlling flooding in Stafford Square and water levels in the Watuppa Pond and the Quequechan River along with installation of additional controls at the outlet of Watuppa Pond to control the river and pond levels independently and balancing flood control with recreation benefits of both water bodies,
- Addressing flooding in Davol Square,
- Removing debris or potential blockages from catch basins and pipes to mitigate any potential flooding,
- Completing co-benefit projects such as upgrading parks (like Ruggles Park) and also considering green infrastructure solutions that would help resolve other drainage or flooding issues,
- Cleaning cisterns in the Reservation that are used for fire water access along with any necessary dredging and stone wall repair,
- Regulatory enforcement for construction in the Floodplain,
- Support for LEED Construction and Certification for new buildings which would support climate change objectives, and
- Considering impacts of the Braga Bridge design life and opportunities to improve or lower hydraulic capacity of Quequechan River.

Photo: South End Neighborhood Association Meeting, June 6, 2019

1.2 Other Recent Planning Efforts

Prior to participating in the MVP Planning process, Fall River has completed several other relevant planning efforts where discussions of climate change and natural hazard impacts were included. These planning efforts were highlighted during the Community Resiliency Building workshop, Listening Session and other neighborhood engagement sessions, they include:

- FEMA approved Hazard Mitigation Plan (2016)
- Integrated Wastewater and Stormwater Master Plan (2016)

Many of the recommendations and next steps highlighted in these planning documents were discussed and considered during the Municipal Vulnerability Preparedness and Community Resiliency Building process. Specific action items that were reviewed are listed in **Table 1-2**.

Table 1-2: Action Items from Previous Planning Efforts

Plan	Action Item
Fall River Hazard Mitigation Plan (2016)	• Tree management plan and program • Secure generators for critical facilities • Formal shelter plan • Evaluate pump stations, WWTF for resiliency measures • Upgrade emergency communications system • Address National Grid substation which is in a floodplain • Upgrade and clean culverts (Steep Brook, Terry Brook, Collins Street) • Restore Mothers Brook • Reconstruct North Watuppa Pond Causeway and upgrade and clean the interceptor • Quequechan River – upgrade and clean existing infrastructure, reroute downstream portions of river • Replace Alden Street sewer
Fall River Integrated Wastewater and Stormwater Master Plan (2016)	See **Appendix B** for the Executive Summary of this Planning document which details the specific projects that need to be completed by the City related to wastewater and stormwater. Many of these projects have been recommended for flood control.
Fall River Water Master Plan (2014)	See **Appendix B** for a summary list of Fall River's Water Master Plan Capital Improvements. As a water supplier for the City and other neighboring communities, Fall River has a number of projects that need to be completed not only to meet demand, but to ensure adequacy of water quality and supply. Monitoring and managing this existing water supply is critical in the face of changing climate conditions.

2. SUMMARY OF FINDINGS

Fall River's Summary of Findings is based on the outcomes of the March 20, 2019 CRB Workshop and the overall CRB process. The purpose of the summary is to document the workshop and provide information that Fall River can leverage to move forward with resiliency, adaptation and mitigation projects that focus on reducing vulnerabilities and supporting strengths.

At the start of the CRB workshop, attendees were asked to share their thoughts by thinking about and writing down answers to the questions below.

1) **What are Fall River's biggest challenges? (infrastructure, societal, environment)**

2) **What are your goals for the day and what do you hope to gain from your participation in the workshop?**

Participants provided feedback for these questions which is summarized below in **Table 2-1**.

Table 2-1: CRB Workshop Participant Reflection Summary

What are Fall River's biggest challenges?	
• Flooding (coastal, inland and urban) - need to address this and eliminate issues • Aging infrastructure (pumps, pipes, facilities, roads, bridges, utilities) • Maintaining, developing and paying for infrastructure and services (water, sewer, schools, public safety) • Security of common resources and lack of redundancy of water supply – protection of water supply • Ability to handle major storm events • City policies and land use • Community outreach and education about issues • Development and redevelopment in vulnerable areas without regard to preparation and protection from potential impacts • Need more regional planning efforts • Flash flooding • Vulnerable populations • Illegal dumping • Understaffed City departments • Community outreach and participation • Drug use and crime • Urban land availability for civic/business users • Capacity building • Fire protection in bioreserve	• Fire • How to care for homeless during heat waves, storms and blizzards • Developing natural resources in a beneficial way (Taunton River waterfront, Bioreserve area for education and maintenance, Quequechan River watershed area) • Quality of life, promoting good healthy habits, supporting exercise and being active • Variability in precipitation conditions and how it will impact water supply and the City's ability to manage and mitigate flooding conditions • Aging tree population, need to plant trees • Incomes in Fall River are low which results in low tax revenue • Meeting Federal mandated requirements of the CSO projects • Improving water distribution in the City and increase the revenue source • Availability of funding to address issues and limited resources in general • Politics • Educational achievement

What are your goals for the day and what do you hope to gain from your participation in the workshop?	
• Identify risks to the City and prioritize actions • Better understanding of City needs and concerns • Learn about flooding and prevention • Learn about opportunities for Quequechan River • Perception of water customers regarding service and quality • Learn about key issues regarding Climate Change and City drainage issues • Increase awareness	• Learn more about the City • Understand the City's vulnerabilities better • Help support the MVP process • Increase personal awareness of issues • Develop solutions • Call attention to issues for action and increase capacity for solutions • Develop political will to tackle and maintain focus on resiliency issues

2.1 Top Natural Hazards

Participants at the CRB workshop were divided into four tables for the day. Two presentations were given which included background information about the community relevant to the discussion and a presentation from Elizabeth McKinley, Davey Resources Group, about Fall River Municipal Trees and Management. Following these presentations, attendees were asked to identify what the top four natural hazards are that Fall River faces.

The background information presentation included information about the 2016 Fall River Hazard Mitigation Planning (HMP) process where natural hazards were also discussed in detail. To further leverage this previous planning effort, workshop attendees learned that the following natural hazards were identified as impacting the community during the HMP process:

- Flood
- Hurricane
- Severe Winter Storm
- Nor'Easter/Coastal Storm
- Windstorm
- Thunder & Lightning
- Wildfire
- Extreme Temperature (Heat/Cold)
- Ice Storm
- Dam Failure
- Tornado
- Earthquake
- Coastal Erosion
- Drought
- Sea Level Rise
- Climate Change

Photo: CRB Workshop, March 20, 2019

The natural hazards of most concern to participants at the CRB Workshop include:

- Flooding
- Severe Storms
- Hurricanes

- Earthquake
- Fire
- Sea Level Rise
- Climate Change

Flooding and severe storms were identified by all four of the tables as top natural hazards of concern. **Table 2-2** indicates the natural hazards that were identified by each table of CRB participants.

Table 2-2: Natural Hazards Identified by CRB Participants

Table 1	Table 2	Table 3	Table 4
• Flooding • Hurricane or Severe Storm • Earthquake • Sea Level Rise	• Flooding • Severe Storms • Fire (Urban or Wildfire) • Chemical or Hazardous Waste Spills	• Flooding • Severe Storms • Climate Change • Earthquake	• Flood • Severe Storms (including winter storms) • Hurricanes • Fire (Urban or Wildfire

2.2 Identified Vulnerable Areas in the Community

During the CRB process various areas were identified as vulnerable to natural hazards by participants at the workshop tables. While coastal flooding and inundation are a concern, Fall River also has some unique issues associated with the City. For example, access to the watershed area which protects the City water supply was identified numerous times. Urban flooding was discussed in detail along with managing the thousands of trees that exist throughout the City. Specific locations mentioned by participants at the workshop that should be considered for their vulnerability are noted below.

Neighborhoods or Areas

- Stafford Square
- Specific Streets: Mount Hope Avenue, Columbia Street, Friendship/Riverview Street area, Davol Street, Alden Street, Brayton Avenue, Cress Brook, Middle Street, North Main Street, Central Street, Cove Street, Collins Street, Cherry Street, Remington Street, Mackenzie Street, Winslow Street, Hyacinth
- Any low-lying area
- 900 block of Langley during high precipitation
- Industrial and Commercial Uses along the shoreline
- Illegal dumping throughout the community

Ecosystems

- Urban trees throughout the City
- Watershed area protecting City Water Supply (the Bioreserve)
- Quequechan River
- Mother's Brook
- Taunton River

Transportation

- Reservation Road Quality

- Braga Bridge
- Roadways

Infrastructure

- Water, Sewer and Drainage Infrastructure
- City Pier CSO and other CSOs
- Drinking Water
- Interceptor Drain which conveys drainage form City and Route 24 to South Watuppa – this is vital to water supply and drainage in City
- Inadequate Stormwater Capacity
- North Watuppa Pond Causeway
- Culverts (Steep Brook, Terry Brook, Collins Street)
- Pump Stations
- Wastewater Treatment Facility
- Coastal Infrastructure – piers, wharves, walls, etc.

2.3 Challenges and Concerns Presented by Natural Hazards

Fall River's challenges related to natural hazards will continue to be present until the City can start implementing action items from this report and other recent planning efforts. At the CRB workshop and other resident engagement sessions, a number of concerns were discussed, and they are highlighted in the sections below.

2.3.1 Water Supply Protection

Fall River supplies approximately 100,000 customers with drinking water through over 230 miles of distribution main. The City's water sources are the North Watuppa Pond and the Copicut Reservoir, which are both owned by the City along with much of their watershed. There are approximately 8,500 acres of surrounding land on which activity is not allowed that would compromise the water supply sources. The North Watuppa Pond has been a water supply source for Fall River since the early 19th century and is one of the largest naturally occurring bodies of water in the State. These water sources are critical to the City and surrounding communities that rely on them for drinking water.

Average daily demand is 10 MGD and there are seven water storage tanks that hold 21.2 million gallons of water. The Fall River Water Division is responsible for water treatment, water main replacement and distribution. Most of the water system infrastructure was installed before 1930s.

A leak to the main water main that occurred in the spring of 2019 heightened the issue that the City does not have a redundant main or water supply. Fall River has identified this specific project as critically important along with increased inspection and maintenance of the system as well as adding interconnections to other water systems for water supply redundancy – these actions would be beneficial to the City and its water customers.

The Reservoir Causeway and its condition are also creating water supply issues. Currently the catch basins along the Causeway directly discharge to the City's drinking water supply and no water quality control is provided prior to discharge creating a source water protection issue. In addition, there is a vegetated strip along the northern edge of the Causeway that is eroded and allows stormwater runoff to discharge to the northern portion of the reservoir which results in sediment deposits, also a source water protection issue.

Changes in intensity, severity, duration and timing of heavy rain events along with air and water temperature fluctuations can compromise water supplies. Better understanding implications of climate change on the North

Watuppa Pond and Copicut Reservoir is needed along with making the capital improvements noted in the 2014 Integrated Plan.

In 2014, the City of Fall River completed a Water Master Plan (see **Appendix B** for the Capital Improvement Plan summary) which highlights the needs of the water system through 2035. In addition, in 2018, the America's Water Infrastructure Act (AWIA) was signed and requires community drinking water systems serving more than 3,300 people to develop or update risk assessments and emergency response plans. With this deadline coming in 2020, assessing the risk and resilience of Fall River's water supply and distribution system from natural hazards and malevolent acts is critical and may result in modifications to the current capital and operational needs.

2.3.2 Wastewater, Drainage & Urban Flooding

Like many older industrial cities in New England, Fall River's stormwater and sewer infrastructure is old and in need of upgrade. Fall River originally constructed its wastewater treatment facility in 1948 along with a main interceptor to convey flow to the Wastewater Treatment Facility (WWTF) instead of directly into the Taunton River or Mount Hope Bay. The existing Wastewater Treatment Plant was upgraded in 2005 and is currently designed to process 106 MGD. It is a regional system and serves Westport, Freetown and Tiverton. The City is served by a Combined Sewer System that holds and transfers both wastewater and stormwater. The system does have the capacity to help manage large quantities of water produced by storms and treats an average 31 MGD per day. Though this is the case, the City still manages serious urban flooding issues.

Recommendation items associated with urban flooding issues in Fall River that have been previously discussed during other planning efforts include:

- Elevation of homes in high impact coastal areas.
- Evaluate structural and nonstructural approaches to maximize flood control.
- Install green infrastructure to minimize flooding.
- Protect and maintain natural habitats, wetlands that protect against flooding.
- Address areas known to flood.
- Evaluate flood impacts after storm events and plan mitigation measures.

The sewers that have been built in the City were originally designed to carry both wastewater and stormwater or "combined" flows. Other interceptors were designed and constructed to divert flow that previously discharged into the Quequechan River. This combined system has been expanded and upgraded overtime. Unfortunately, the City's system was not designed to handle some of the wet weather flow that occurs which results in overflows. As a result, the City is currently under Federal and State mandate to eliminate all combined sewer overflows (CSO) into Taunton River. To date, Fall River has invested over $200M to upgrade stormwater and wastewater infrastructure to address this issue. Newer developments in the City have separate wastewater and stormwater collection systems and significant CSO controls, including wet-weather expansion of the WWTF and a 3-mile tunnel storage and conveyance system, have also been constructed to provide better management of wet-weather flows.

The City has 15 pump stations located at key areas throughout the collection system to convey wastewater flows from low-lying areas to the WWTF for treatment. Most of the City's pump stations were constructed in the 1960s or earlier.

Almost thirty years ago, the US EPA issued an initial administrative order (in 1992) that required Fall River to abate its CSO discharges and comply with the federal Clean Water Act and the City NPDES permit. In 2011, another administrative order was issued by EPA that required the City to assess the sewer system against the EPA Capacity, Management, Operations and Maintenance program. In 2015, Fall River completed an ***Integrated Wastewater and Stormwater Master Plan*** for the City which defines the issues and impacts and recommends projects to improve current conditions. The final report included a Capital Improvement Plan (CIP) for Fall River's Department of

Community Utilities and the Executive Summary is included in **Appendix B**. ***The Integrated Wastewater and Stormwater Master Plan*** should be utilized and leveraged to help determine which wastewater, drainage and urban flooding projects the City needs to address. One of the key projects detailed in the Integrated Plan includes the Steep Brook Culvert near Collins Street.

Steep Brook Culvert Near Collins Street

The Steep Brook Culvert Near Collins Street needs to be studied and repaired. This project is included in Fall River's Integrated Plan. Steep Brook is located in northwestern Fall River and conveys flow from the Fall River Industrial Park and the Great Maple Swamp to the Taunton River where it enters a culvert near Collins Street that conveys flow underneath a railroad embankment to the Taunton River. The size, capacity and configuration of the Steep Brook Culvert is unknown. When flows exceed capacity of the culvert, water pools at the inlet structures and flows along the railroad embankment to Collins Street. There is a concrete and bituminous swale in place to help convey overflowing stormwater from Steep Brook directly to the Taunton River.

During heavy rain events, the culvert can't convey all flows from Steep Brook which charges overflow along the railroad embankment toward Collins Street. Culvert size, condition and capacity are unknown and this needs to be investigated as soon as possible. The City has seen damage in the past to Collins Street, River Street and the nearby Captain O'Connell Boatyard structures because the existing swale along Collins Street can't convey larger flows from the brook. In March 2010, a heavy rainfall event caused runoff that exceeded the capacity of the swale in Collins Street resulting in a scoured gully in the road beneath the railroad bridge to the shoreline exposing existing gas, water and drainpipes. The railroad bridge over Collins Street is associated with the South Coast Rail project and flooding could impact rail operations should there be additional flooding issues, washouts, repair work to damaged utilities or the roadway or other issues.

Addressing the Steep Brook Culvert is a priority for Fall River and must be improved to support the successful operations of the South Coast Rail Project.

With a major portion of the combined sewer system being constructed over 75 years ago, which was before much of the current development in the City, or existing water regulations, discharge permits and common design practices used today, areas of the City not in identified FEMA floodplains experience chronic and sometimes acute flooding issues. The reason for this is multipronged and includes limited pipe capacity and an increase in intensity, severity and duration of heavy rain events. The urban flooding issues cause street flooding which can trap motorists, basement and yard flooding, property damage to City infrastructure and assets as well as homes and businesses and general health and safety concerns. **Table 2-3** highlights some of the areas prone to urban flooding issues.

Table 2-3: Fall River Areas Prone to Urban Flooding Issues

Area	Issue
Stafford Square	• Susceptible to Sanitary Sewer Overflows • Experiences chronic street flooding due to insufficient combined sewer capacity • Influenced by water level of Quequechan River
Globe Four Corners	• Susceptible to Sanitary Sewer Overflows
Cove Street	• Susceptible to Sanitary Sewer Overflows • Experiences chronic street flooding due to insufficient combined sewer capacity • Flood conditions exacerbated by tidal influences
Davol Street	• Susceptible to Sanitary Sewer Overflows • Experiences chronic street flooding due to insufficient combined sewer capacity • Flood conditions exacerbated by tidal influences
Alden Street	• Susceptible to Sanitary Sewer Overflows

Flooding conditions in the City area also being affected by climate change impacts. Fall River continues to face the challenge of cleaning, maintaining, replacing, upgrading, hardening and reinforcing existing utilities and infrastructure. The City also needs to increase stormwater capacity and incorporate green infrastructure techniques to address urban flooding issues. Considering the implications of climate change when designing new infrastructure or upgrading infrastructure and using design standards consistent with changing precipitation patterns remain key goals for any drainage or infrastructure projects.

2.3.3 Tree Management & Maintenance

Urban trees in Fall River were discussed at length during the CRB workshop. Trees are a tremendous asset to the community for their contribution to neighborhoods by making them safer and more sociable and the role they play in providing a tree canopy which contributes to decreasing pollution levels and other economic or health problems common in urban neighborhoods. Massachusetts has a goal of increasing urban tree canopies to reduce energy use, stormwater runoff and poor air quality. *The Greening the Gateway Cities (GGCP)* program is a tree planting program in Massachusetts to benefit communities by replenishing and supporting a dense tree canopy. Fall River is participating in this program due to its need for an improved tree canopy, its high elevation and susceptibility to heavy winds and its supportive project partners.

Benefits of a strong, healthy tree canopy in urban environments include:

- Improving social environments,
- Reducing energy consumption,
- Increasing property values,
- Decreasing air pollution and greenhouse gas emissions, and
- Improving stormwater management and runoff.

Figure 1 illustrates the areas of Fall River which are being focused on for tree planting zones through the GGCP program. According to the GGCP, *"studies show that tree canopy brings the greatest benefits when established over an entire neighborhood area, by lowering wind speeds and reducing summertime air temperature, in addition to the benefits of direct shading. It is estimated that every 1% increase in tree canopy above a minimum 10% canopy cover brings a 1.9% reduction in energy needs for cooling and up to a 1.1% reduction in energy for heating. All households*

in a neighborhood benefit, not just the ones with trees directly adjacent." The planting zone criteria includes those that have low tree canopy, older housing stock, high wind speeds and a large renter population.

Fall River also has a local Street Tree Planting Program. Inventorying existing trees in the City and developing necessary management, maintenance and capacity to foster a strong urban tree program was a strong desire of CRB participants.

Figure 1: Greening the Gateway Cities Program | Fall River Planting & Expansion Zones

Continuing to focus on, support and increase resources for Fall River's tree program will result in multiple benefits for the City including more tree canopy, new contributors to stormwater management, health benefits for residents and businesses and an increase in property values.

2.3.4 Bioreserve Roadways

The land north and east of North Watuppa Pond is referred to as the Southeastern Massachusetts Bioreserve, portions of which are in Fall River. The Watuppa Reservation is land surrounding North Watuppa Pond and Copicut Reservoir owned by the City of Fall River to provide protected, undeveloped to carrier around these drinking water supplies.

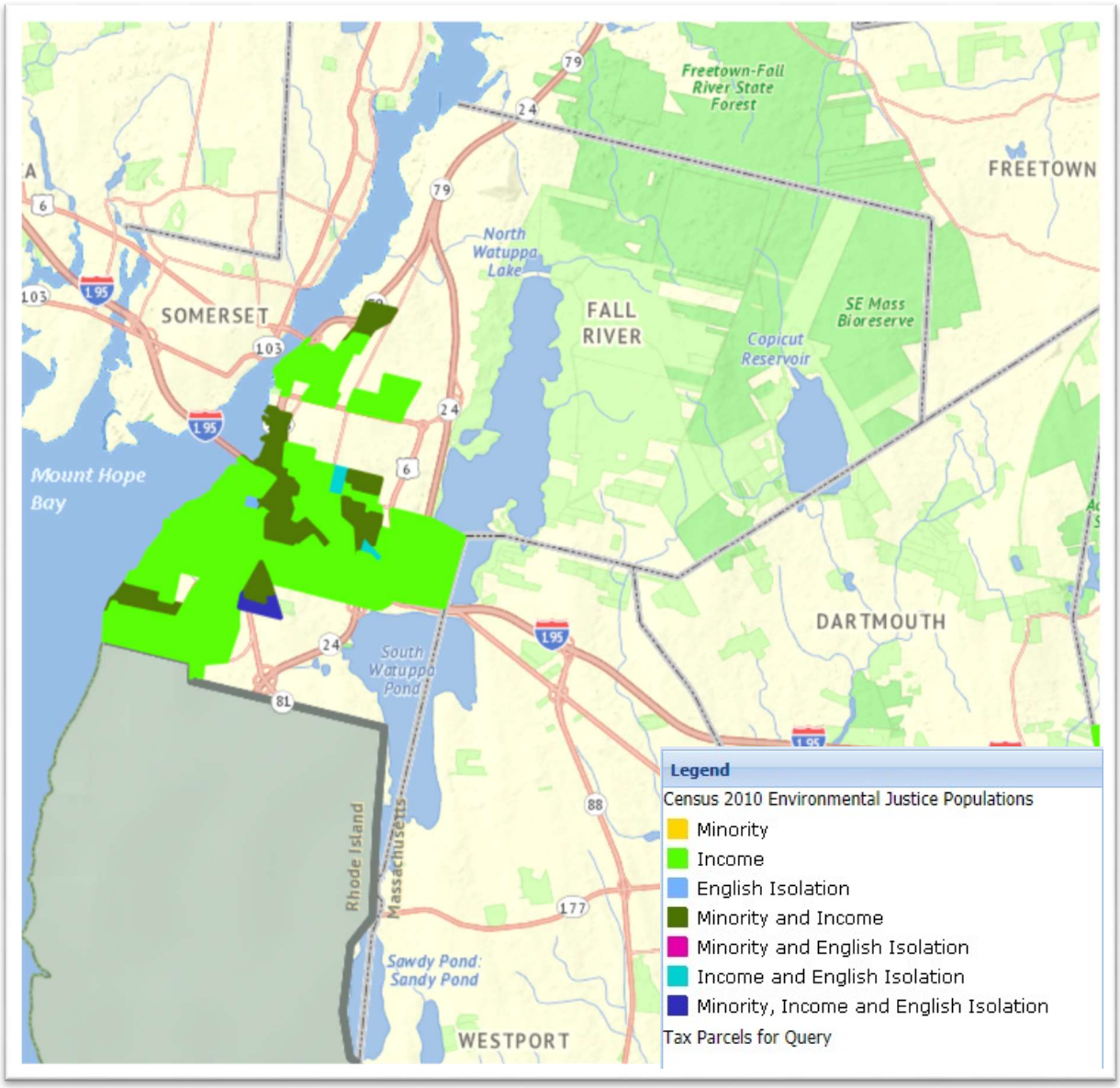
The roadways within the bioreserve are in poor condition and contain no existing drainage infrastructure. Most roads are paved, but have significant pavement settlement, cracking, rutting, and potholes. These conditions create untreated stormwater discharges, and erosion and sedimentation control issues which present a source water protection issue, as these waters are tributary to North Watuppa Pond—the City's water supply. The roadways negatively affect the quality of stormwater runoff draining directly to the North Watuppa Pond via overland flow because of the sediment and debris from the deteriorating roadways. Wetlands to either side of these roads flood and overtop these roads, with heavy rains.

The majority of the roadways are in such disrepair that emergency access, and general safe passage by the public, need to be addressed. In addition to the poor roadway conditions, there are numerous excessively large and dead trees located along the roadways and throughout the area that could potentially block roadways and promote the spread of forest fires.

2.3.5 Social Vulnerabilities

Fall River's history as a leading textile manufacturer in the 19th century provides the foundation on which the City has been trying to grow and reinvent itself. Unemployment rates are high in the City, there are a large number of vacant or abandoned buildings and there are limited resources for improvements and upgrades. Renters make up more of the housing market than owners do and there is a diversity in cultures and languages present in the City including Portuguese, Cambodian and Hispanic. Incomes in Fall River are well below the State average and over 66% of the population is in an Environmental Justice area (see **Figure 2**).

Figure 2: Fall River Environmental Justice Areas



Source: Environmental Justice, MassGIS

Not all residents are equally able to prepare for, adapt to, and bounce back from temperature, flood hazards and other natural hazards. Those most vulnerable to current hazards are expected to be impacted the most as hazards worsen with climate change. Common groups of people who are particularly vulnerable to climate change stressors include elderly, limited English speaking ability, low to no income, people with disabilities, people with chronic medical conditions and minorities.

Social vulnerabilities were discussed at the CRB workshop and building neighborhood resiliency and the ability of the City to engage and connect with residents was identified as important and necessary. Strong neighborhoods, cultures, support from community resources and engagement can reduce risk from social isolation and link residents to resources and information regarding climate change impacts.

2.4 Current Strengths and Assets

Fall River's strengths and assets were clearly identified during the CRB workshop. The City has defining characteristics that other urban environments do not have and participants saw the value in continuing to support the following strengths:

- Local water supply and surrounding watershed area (North Watuppa Pond and Copicut Reservoir)
- Existing water, sewer and drainage system and associated facilities (pump stations, wastewater treatment facility)
- Existing dams, seawalls and other coastal infrastructure that provides protection from flooding such as:
    - Route 79 Stone Revetment
    - Heritage State Park Revetment & Seawall
    - Battleship Cove Seawall
    - Ferry Street Seawall
    - Bicentennial Park Revetment
    - Remington Avenue Seawall
    - State Pier Seawall
    - City Pier
- Regulations and policies currently in place to support responsible development and redevelopment,
- Diversity of the City in terms of language, ethnicity, income and types of businesses,
- Excellent access to transportation routes including:
    - Route 6, Route 24, I-195, Route 138, Route 79 which all link Fall River to other communities.
    - Local bus service,
    - Braga Bridge and Veterans Memorial Bridge, and
    - Fall River has been included in the South Coast Rail Phasing Plan for a Commuter Rail Train stop.
- Existing shelter access points and evacuation options,
- Strong Emergency Management personnel in the City,
- Existing open space, environmental resources and urban street trees which add value to the City including:
    - Kennedy Park (designed by Olmstead and on the National Historic Register),
    - Peace Haven (Mothers Brook, Winslow's Point),
    - Quequechan River Corridor (largely buried under buildings and channels),
    - Cook Pond (154-acre State designated Great Pond),
    - Steep Brook (main tributary to the Taunton River) and
    - Taunton River (designated a Wild & Scenic river in 2009 by the National Park Service),
- The City is a regional Gateway for residents, visitors and businesses, and

Fall River has valued Fire, Police and DPW departments who respond during emergency events.

3. RECOMMENDATIONS TO IMPROVE FALL RIVER'S RESILIENCY

CRB workshop participants worked with their individual tables to consider the information presented throughout the day and then discuss the natural hazards, vulnerabilities, strengths and potential actions to improve overall resiliency of Fall River. Each group developed their own list of action items which was recorded on the matrix boards. At the end of the CRB workshop, the groups presented their findings on the top three key actions Fall River should focus on based on their discussion. Each attendee was given six dots and asked to use those dots, or spend them, to identify of the top three actions identified by each group, which is the most critical or most important. **Table 3-1** is a summary of the top priorities identified at Fall River's CRB workshop.

Table 3-1: Top Seven Recommendations to Improve Resiliency

Rank	Action	Notes
1	Drinking Water System (44 dots)	Consider, design and construct a redundant water main to serve the public drinking water system. Implement action items from the 2014 Integrated Plan and address security, fencing, cameras and the control system (SCADA). Also desire to understand climate change impacts to drinking water supply including updating risk assessments and emergency response plans to meet AWIA requirements.
2	Sewer & Drainage Infrastructure (35 dots received)	Clean, maintain, replace, upgrade, hardening and reinforcing existing utilities. There is a need to increase or improve stormwater capacity and incorporate green infrastructure to address urban flooding in the City. Fall River's Integrated Plan includes implementation steps that support this Action and this should be referenced. Addressing the culvert under the railroad is also a priority. Specifically address Stafford Square flooding.
3	Urban Trees (22 dots received)	Inventory existing trees in the City and develop necessary management, maintenance and organization capacity to foster a strong urban tree program.
4	City Regulations and Policies (21 dots received)	Improve city regulations and policies as they relate to flooding and climate change. Leverage regulations and requirements to improve City resiliency long term.
5	Communication (19 dots received)	Continued communication to a variety of audiences about the City's vulnerabilities and opportunities for improved resiliency.
6	Roadway Access at the Reservation (16 dots received)	Improve roadway access at the reservation to and from the water supply and surrounding area. Concern over drought and wildfires and not being able to adequately access this area.
7	City Street Repair (13 dots received)	Continue repair of City Streets and include drainage capacity considerations. Inventory and maintenance plan is needed.

During the CRB workshop process, City staff, workshop participants and stakeholders at other engagement efforts for this project all realized and emphasized the importance of leveraging the other recent planning studies that have been completed. Previous plans that have relevant actions and recommendations supportive of this Summary of Findings and CRB workshop can be found in the following documents:

- Fall River Hazard Mitigation Plan (2016)
- Integrated Wastewater and Stormwater Master Plan (2016)

- Fall River Waterfront Urban Renewal Plan (2018)
- Fall River Downtown Urban Renewal Plan (2017)
- Fall River Open Space and Recreation Plan (2010)
- Fall River Water System Master Plan and Capital Improvement Plan (2014)
- Fall River Parks & Cemeteries Capital Improvement Plan (2016)

These documents should be used in coordination with this report to guide and support Fall River's resiliency efforts.

3.1 Results from Additional Resident Engagement

The Listening Session and four additional resident engagement efforts resulted in the expression of similar concerns in the City as well as strengths. Specific feedback from these engagement sessions that aligns with the findings of the CRB workshop includes:

- Davol Square flooding is a concern.
- Daylighting the Quequechan River is of interest. It was noted that water quality has been a challenge with advancing this idea.
- Stafford Square Flooding, South Watuppa Pond and Quequechan River – Stakeholders were interested in the Fourth Street Gate House and Iron Works #7 and the role they play in controlling flooding in these areas. Water level control in the pond and river have been improved with the MassDOT Route 79 reconstruction project and the City can now draw down between one to one and a half inches of water per day which is an improvement. The City is considering installing another control at the outlet of the pond so they can control the river and pond levels independently from one another to try and balance flood control with recreation benefits of both water bodies.
- Cleaning and dredging of cisterns in the reservation used for fire water access was a concern along with any stone wall repair.
- Concern over new construction and redevelopment in identified FEMA floodplains.
- Desire to leverage LEED Certification for new public buildings to address climate change.
- Adopting Stretch Energy Code to also help address climate change.
- Considering the life left in the Braga Bridge and when it does need attention in the next few decades, use this as an opportunity to address the hydraulic capacity limitations of the lower sections of the Quequechan River.

3.2 Community Resiliency Building Workshop Identified Priorities

The following priorities in **Table 3-2** below are action items identified during the CRB workshop for the City of Fall River to consider for increased resiliency. These priorities should continue to be vetted and aligned with the recommendations in **Table 3-1**.

Table 3-2: Community Resiliency Building Workshop Priorities

Priority	Action Item
Highest	• Mitigate and eliminate the flooding issues in Stafford Square and Davol Square. • Develop a detour alert plan for roadways when they might become flooded to minimize public safety issues. • Increase the capacity of the drainage system and/or upgrade it to address inadequate stormwater capacity. • Identify and leverage funding sources to implement recommendations of the Integrated Wastewater and Stormwater Master Plan that will address issues Fall River has with its sewer and drainage system which will continue to be exacerbated by climate change. • Identify and leverage funding sources to implement recommendations of the Water System Master Plan. Complete AWIA risk assessment and emergency response plan of the Water System. • Address Reservoir Road deterioration and reference the list in the Integrated Wastewater and Stormwater Master Plan. Develop a funding plan for improving these roads which provides critical access to the water supply and would need to be used during any wildfire or other emergency. • Conduct a water storage study that would consider if the City is impacted by a natural hazard that would impact or limit water supply (i.e. earthquake that damages water main transmission lines or a severe storm that causes water quality issues). • Fix the Steep Brook/Collins Street drain line and culvert and address flooding issues. • Develop regulatory changes that foster and require green infrastructure for projects. • Address condition of Sandy Dam and Lake Noquochoke Dam. • Evaluate the 1933 bank wall on the North Watuppa Pond and the Kennedy Park overlook for condition and necessary maintenance. • Evaluate the need for a revetment at Heritage State Park. • Develop or support an outreach program for abandoned properties and consider reusing them or redeveloping them in a way that includes green infrastructure. • Green infrastructure education and outreach. • Map and understand existing shellfish areas in Mount Hope Bay. • During roadway and street improvements or maintenance, give consideration to natural hazards such as earthquakes. • Increase the number of trees planted to support drainage and flood storage in the Bioreserve and urban areas of the City. • Develop a formal Tree Commission and include a full tree management and maintenance plan to help reduce the impacts of climate change. • Educate the public about the importance of trees in the City and prepare a full tree inventory. • Conduct a study to understand the impacts of climate change on the watershed and Fall River's water supply. • Conduct a specific evaluation of the areas in Fall River prone to urban flooding and develop a mitigation plan. • Consider where land acquisition makes sense for flood control along with co-benefits such as parks and recreation. • Replace the generator at Durfee High School which is a shelter during emergency events. • Continue restoration of old water mains to improve water supply distribution and quality. • Acquire remaining North Watuppa shoreline properties for further water supply protection.

Priority	Action Item
Highest	• Build in redundancy for both pumping and distribution of Fall River's water supply. • Monitor and protect wetlands and critical water resource areas from illegal dumping. • Follow and enforce existing wetland protection laws on all new projects and increase regulatory requirements to address climate change. • Create a robust City Tree Department which would include creating a street tree nursery and increasing funding for staff and equipment. • Update and address resiliency needs at the South End Pump Station, Wicsaw Road Pump Station and City Pier and Allston Street CSOs.
Moderate	• Conduct an Infiltration and Inflow study. • Evaluate current emergency generator capacity in the City at shelter locations and mobile units. Secure additional generators where needed. • Develop a water supply monitoring program that would include documentation of climate change impacts. • Develop an emergency response plan for the water system specific to it being impacted by an earthquake. • Increase education and outreach about nature-based solutions in the community and how they can help address or minimize impacts from natural hazards. • Increase the amount of outreach to community liaisons and cultural centers to foster engagement, communication and support. • Conduct outreach about Environmental Justice areas through written memos, presentations, radio discussions and other resources to increase awareness and support for these populations about the term and what it means for the City. • Continue sewer separation projects to help reduce flooding and improve water quality. • Utilize technology for citizen reporting of tree conditions and where maintenance and management are needed. • Modify local regulations to better protect water resources in the City (brooks, creeks, ponds, water supply, ocean). • Increase Site Plan requirements for new development in the City to better address flooding implications. • Add security features to the water supply and distribution system including fencing, cameras, etc. • Prioritize bridge inspections and coordinate with the State. • Develop a specific study or list of vulnerable populations in the community and their locations. Conduct an annual review and update – focus on evacuation. • Develop a community plan for the physically challenged, sight or hearing impaired and multi-lingual in nature so that vulnerable populations know how to receive communications about emergency events or natural hazards and potential impacts. • Use Community Preservation Act funds to support projects that can incorporate green infrastructure and/or increase access to open space. • Continue the implementation of the City Open Space and Recreation Plan to acquire, restore, maintain and support open space in the City. Consider co-benefits and how projects can incorporate any adaptation ideas associated with climate change. • Secondary treatment process at the Wastewater Treatment Facility needs a generator. • Develop an emergency action plan for communication regarding any issues with community utilities.

Priority	Action Item
Moderate	• Develop a plan focused on energy resilience strategies throughout the City. • Market the City's drinking water to other neighboring towns and cities to increase revenue to fund other projects in this plan. • Conduct a landfill feasibility study.
Low	• Continue tree trimming program to eliminate the potential for tree debris during storm events. • Establish a greenhouse gas emission plan that will support reduction of energy use. • Create flexibility in the energy and utility systems to better withstand an earthquake event. • Conduct a vulnerability assessment of coastal infrastructure and dams throughout the City. Plan for maintenance and replacement. • Coordinate with neighboring communities and the region on various initiatives including planning for climate change. • Participate in regional planning efforts for any flooding discussions or solutions. • Identify brownfield sites susceptible to flooding, conduct feasibility studies of various solutions and leverage the recent Urban Renewal Plan. • Work with emergency management to develop drills, tabletop exercises and evacuation plans focused on the coastal areas of the City. • Develop a more detailed vulnerability assessment for industrial and commercial businesses in the City. • Commercial transportation routes have a plan in place – conduct an annual review and update it with any flooding considerations or issues. • Develop a summary of hazardous material locations in the City and consider how they might be impacted by natural hazards or climate change. • Install backup generators on any pump stations that need them.

3.3 Next Steps

The City of Fall River will leverage this Summary of Findings along with the recent Hazard Mitigation Plan, Integrated Wastewater and Stormwater Plan and Water Master Plan with the purpose of improving the City's resiliency and mitigating potential impacts from natural hazard events. The goal is to continue to seek out supplemental funding to help the City implement priority projects that have been identified in each report.

4. ACKNOWLEDGEMENTS

The Fall River CRB Workshop was managed by the municipal Core Team, led by Paul Ferland, Sewer Department, in partnership with Woodard & Curran. The Core Team guided the work throughout the project that also included insight and input from City staff, industry professionals, residents and business owners.

Special thanks to Bristol Community College, Davey Resource Group, Liberty Utilities, Letourneau Elementary School, Morton Middle School, Green School and Good Shepard Parish Hall for their participation and support during Fall River's CRB Workshop and other resident engagement sessions.

4.1 CRB Workshop Project Team - Organization and Role

The Municipal Vulnerability Preparedness process for the City of Fall River was a collaborative, team effort that engaged over seventy-five people. Listed below is the project team who was closely involved with the process.

City of Fall River, MA
Paul Ferland, Project Manager, Sewer Department | Lead Project Manager for MVP/CRB
John Lincourt, Sewer Department | Support
Terry Sullivan, Administrator of Community Utilities | Support

Woodard & Curran
Mary McCrann, AICP | Lead Facilitator
Mary House | Project Support

Bristol Community College
Provided Location for CRB Workshop

Davey Resource Group
Elizabeth McKinley | CRB Presenter

Liberty Utilities
Jim Carey | CRB Presenter

APPENDIX A: EVENT ANNOUNCEMENTS & AGENDAS

COMMITMENT & INTEGRITY
DRIVE RESULTS

40 Shattuck Road | Suite 110
Andover, Massachusetts 01810
www.woodardcurran.com

T 866.702.6371
T 978.557.8150
F 978.557.7948

AGENDA

MEETING DATE: February 1, 2019

MEETING TIME: 10:30am

LOCATION: One Government Center, 3rd Floor Sewer Office Conference Room

SUBJECT: City of Fall River, MA – Municipal Vulnerability Preparedness Program Kick-Off Meeting & Preparation for Community Resiliency Building Workshop

Invited Attendees:

Name	Organization	Telephone/email	Attended (Yes/No)
Paul Ferland	Fall River, MA	pferland@fallriverma.org	yes
John Lincourt	Fall River, MA	jlincourt@fallriverma.org	yes
Cathy Viveiros	Fall River, MA	cviveiros@fallriverma.org	yes
Monica Sousa	Fall River, MA	msousa@fallriverma.org	yes
Marci Yazwinski	Fall River, MA	grantwriter@fallriverma.org	yes
Richard Aguiar, EMA Director	Fall River, MA	emadirector@frfd.org	yes
John Perry	Fall River, MA	jperry@fallriverma.org	yes
William Roth	Fall River, MA	wroth@fallriverma.org	yes
Terry Sullivan	Fall River, MA	tsullivan@fallriverma.org	yes
Scott Medeiros, PE	Woodard & Curran	smedeiros@woodardcurran.com	yes
Mary House	Woodard & Curran	mhouse@woodardcurran.com	yes

Agenda

1. Thank You & Introductions
2. Identify Goals of Core Team – What Does Project Success Look Like to You? - All
3. Background of Fall River's Participation in the Municipal Vulnerability Preparedness Program (Current Issues in Town, Why This Program?) – Paul Ferland & John Lincourt
4. Overview of the Municipal Vulnerability Preparedness Program & Community Resilience Building Workshop – Mary House
5. Community Resilience Building Workshop & Planning for the Event (Includes Discussion of the Listening Session and Three Additional Workshops) – All
6. Discussion of Action Items/Next Steps

Meeting Objectives

Preparation for Community Resiliency Building Workshop

Goals of the Workshop are to:

- Define extreme weather and natural and climate related hazards impacting Fall River,
- Identify existing and future vulnerabilities and strengths,
- Develop and prioritize actions for the community and broader stakeholder networks, and
- Identify opportunities for the community to advance actions to reduce risks and build resilience.

Need to Identify the Following

- Workshop Goals – why does the community need to discuss current and future impacts of natural hazards?
- Workshop Date
- Workshop Location
- Workshop Timeframe (either one 8-hour session or two 4-hour sessions)
- Workshop Food (need to provide breakfast, lunch, maybe snack)
- Outreach Campaign to Secure Maximum Number of Attendees & Engage Stakeholders
    - Identify list of potential attendees/stakeholders and how best to reach out/invite them to workshop?
    - How to register attendees and designate a person to keep track
- Prepare Workshop Materials (Including Discussion of Two Other Presenters)
- Date and Location of Listening Session to Happen After Workshop
- Discussion of Additional 3 Workshops That Must Take Place with Accommodations for Other Languages

Fall River, MA

Community Resiliency Building Workshop

When: Wednesday, March 20, 2019 | Time: 7:30am – 4:30pm

Where: Bristol Community College | 777 Elsbree Street, Fall River, MA
Building G (either Atrium or Staff Lounge)

The City of Fall River received funding from the Executive Office of Energy and Environmental Affairs to complete a Community Resilience Building Workshop. The City has been impacted in the past by severe weather events and like other Massachusetts communities, now finds itself facing more unpredictable weather which brings challenges and opportunities. We are working on a Municipal Vulnerability Preparedness project that will involve an 8 hour workshop which must include input from community members. **We would love for you to participate!!!**

We will provide breakfast and lunch to those who participate. If you are interested, please contact Paul Ferland at sewer@fallriverma.org or 508-324-2320 by March 15th to pre-register or receive more information about the workshop. **Space is limited so please sign up today!**

Please contact Paul Ferland if you have any questions at pferland@fallriverma.org or 508-324-2320

WOODARD &CURRAN

Community Resiliency Building Workshop

Wednesday | March 20, 2019

Bristol Community College

777 Elsbree Street, Fall River, MA - Building C

8:00am – 4:00pm (*Registration at 7:30 am)

WORKSHOP OBJECTIVES

- Define extreme weather and natural and climate related hazards impacting Fall River,
- Identify existing and future vulnerabilities and strengths,
- Develop and prioritize actions for the community and broader stakeholder networks, and
- Identify opportunities for the community to advance actions to reduce risks and build resilience.

WORKSHOP AGENDA

7:30am – 8:00am:.....Registration & Breakfast

8:00am – 8:30am:.....Welcome & Overview (Paul Ferland, Fall River Sewer Department)

8:30am – 9:00am: .....Community Resilience Building Workshop – Why Are We Here? (Woodard & Curran)

9:00am – 9:30am:.....Identify Challenges & Goals
What Do You think Fall River's Biggest Challenges Are? What Are Your Goals/ Do You Hope to Gain From Participating in the Workshop?

9:30am – 10:00am:.....Background Information About Fall River (Woodard & Curran)

10:00am – 10:30am:.....Elizabeth McKinley, Urban Forester, Davey Resource Group
Fall River: Municipal Trees and Management

10:30am – 11:00am:.....Characterize Natural Hazards

11:00am – 12:00pm: .....Identify Community Vulnerabilities and Strengths

12:00pm – 1:00pm: .....Lunch!

1:00pm – 1:30pm:.....James Carey, Liberty Utilities

1:30pm – 3:00pm:.....Identify and Prioritize Community Actions

3:00pm – 4:00pm:.....CRB Workshop Recap and Wrap Up (Woodard & Curran)

WOODARD &CURRAN

Thank you for participating in Fall River's Community Resiliency Building Workshop!

MUNICIPAL VULNERABILITY PREPAREDNESS
COMMUNTIY RESILIENCY BUILDING WORKSHOP
FALL RIVER, MA
MARCH 20, 2019 | 7:30AM
SIGN IN SHEET

	Name	Email
1.	Jodi Raposa	jrraposa@comcast.net
2.	Celio Chaves	cchaves@goldmedalbakery.com
3.	Scott Donnelly	sdonnelly@goldmedalbakery.com
4.	Mike Labossiere	mlabossiere@fallrivermа.org
5.	Jerry Sullivan	Tsullivan@fallrivermа.org
6.	Noah Mercier	Fall River Sewer Commission
7.	Liz McKinley	elizabeth.mckinley@davey.com
8.	Jim Hawksley	Conservation Commission
9.	Karen Wood	FRSTOP
10.	J R Frey	jrfrey@fallrivermа.org
11.	Bill Reilly	WREILLY@FALLRIVERMA.GOV
12.	Mark Smith	MARK.SMITH@LIBERTYUTILITIES.com
13.	William Peck	BILL.PECK@LIBERTYUTILITIES.com
14.	Brenda Lavoie	
15.		
16.		
17.		
18.		
19.		
20.		

MUNICIPAL VULNERABILITY PREPAREDNESS
COMMUNTIY RESILIENCY BUILDING WORKSHOP
FALL RIVER, MA
MARCH 20, 2019 | 7:30AM
SIGN IN SHEET

	Name	Email
1.	Torrey Adams	claudecharest142@comcast.net
2.	Tammy Moutinho	tmoutinho@fallriverma.org
3.	Richard S. Aguiar	emadirector@FRFD.org
4.	Scott Medeiros	SMEDEIROS@WOODARDCURRAN.COM
5.	John Lincourt	JLINCOURT@FALLRIVERMA.ORG
6.	Neil Ytkin	nytkin60@gmail.com
7.	Jorge Garcia	GIS@FALLMA.ORG
8.	Denise Polseli	Blind
9.	John P Ferland	JOHNPF187@GMAIL.COM
10.	David Regan	DREGAN@BOREMCO.COM
11.	[illegible]	[illegible]
12.	Marci Mazwinski	grantwriter@fallriverma.org
13.	Paul Ferland	pferland@fallriverma.org
14.	MARC LAFERRIERE	MARC.LAFERRIERE@VEOLIA.
15.	Mary McCrann	MMCCRANN@woodardcurran.com
16.	James Casey	JAMES.CASEY@libertyutilities.com
17.	Mark Carmody	mark.carmody@bristolcc.edu
18.	Britt Selland	bselland@gmail.com
19.	DAVID GOUVEIA	dagouveia@FRPD.ORG
20.	JOHN FRIAR	JFRIAR2@CITYOFFALLRIVERMA.GOV

MUNICIPAL VULNERABILITY PREPAREDNESS
COMMUNTIY RESILIENCY BUILDING WORKSHOP
FALL RIVER, MA
MARCH 20, 2019 | 7:30AM
SIGN IN SHEET

	Name	Email
1.	Bob Smith	HarbormasterCC@FRPD.ORG
2.		
3.		
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7.		
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MUNICIPAL VULNERABILITY PREPAREDNESS
COMMUNITY RESILIENCY BUILDING WORKSHOP
FALL RIVER, MA
APRIL 29, 2019 | 5:30PM
SIGN IN SHEET

listening Session

	Name	Email
1.	Mary McCraan	mmccraan@woodardcurran.com
2.	Torney Adams	chaudchavest142@comcast.net
3.	Terry Sullivan	TSullivan@fallriverma.org
4.	Ronald L. Bergier	RLBERNIER@MBMINISTRIES.ORG
5.	Richard J. Sharpe	dchecker@AOL.com
6.	Jamey Carey	JAMES.CAREY@LIBERTYUTILITIES.COM
7.	Lt P. Cody	JLWOOD@FALLRIVERMA.ORG
8.	Alyssa Correia	1 GOUT.
9.	Tom Tighe	ttighe@fallrivermz.org
10.	Celio Chaves	cchaves@goldmedalbakery.com
11.	Paul Forland	pforland@fallrivermz.org
12.	Bill Roth	WROTH@FALLRIVERMA.ORG
13.	Neil Ytkin	nytkin60@gmail.com
14.	Tammy Mautinho	tmautinho@fallriverma.org
15.	Ned Almeida	nedalmeida@cyber
16.	Scott Donnelly	sdonnelly@goldmedalbakery.com
17.	Chris Gallagher	CGALLAGHER@FALLRIVERMA.ORG
18.		
19.		
20.		

Fall River, MA

Hurricane Inundation Zones

Legend

Worst-case Hurricane Surge Inundation Zones

Hurricane Category

- Category 1
- Category 2
- Category 3
- Category 4

Fall River Boundary

N

0 0.275 0.55 1.1 Miles

WOODARD &CURRAN

Project #: 0231848
Map Created: March 2019

Fall River, MA

FEMA Floodplains

Legend

- Fall River Boundary
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland

FEMA National Flood Hazard

- A: 1% Annual Chance of Flooding, no BFE
- AE: 1% Annual Chance of Flooding, with BFE
- AE: Regulatory Floodway
- AH: 1% Annual Chance of 1-3ft Ponding, with BFE
- AO: 1% Annual Chance of 1-3ft Sheet Flow Flooding, with Depth
- VE: High Risk Coastal Area
- D: Possible But Undetermined Hazard
- X: 0.2% Annual Chance of Flooding
- X: Reduced Flood Risk due to Levee
- Area Not Included
- Area with no DFIRM - Paper FIRMs in Effect

N

0 0.275 0.55 1.1 Miles

WOODARD &CURRAN

Project #: 0231848
Map Created: March 2019

Figure Exported: 3/11/2019 By: mroberts Using: C:\Michelle_Projects\FallRiver\FallRiver_FEMA_Floodplains_11x17.mxd

APPENDIX B: COMMUNITY RESILIENCY BUILDING PRESENTATIONS & SUPPORTING DOCUMENTATION

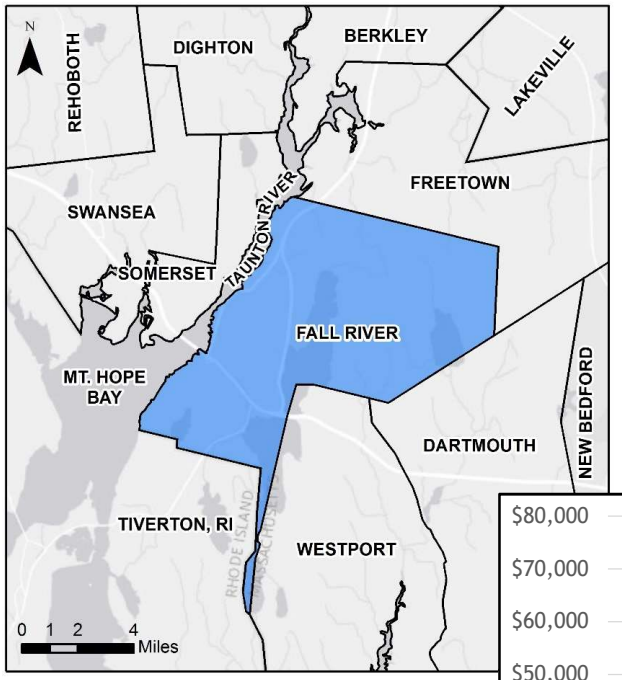
City of Fall River, Massachusetts
Municipal Vulnerability Preparedness
Workshop

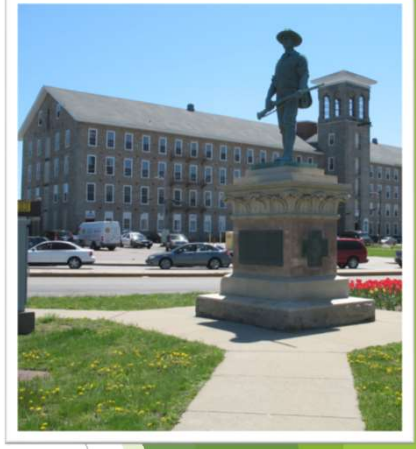
March 20, 2019

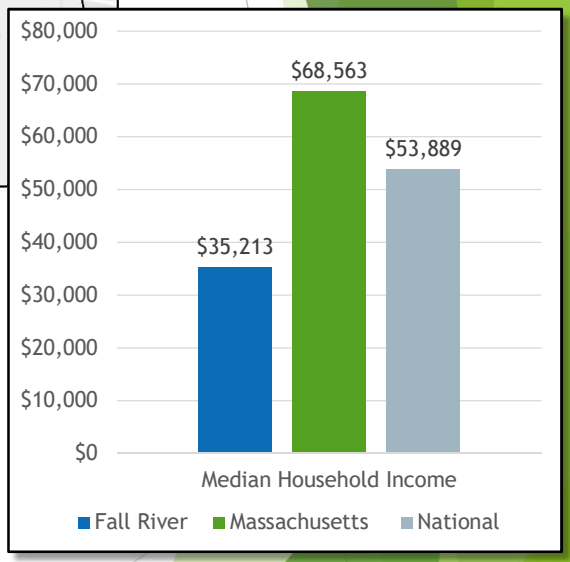
Paul J. Ferland

Fall River at a Glance

- Founded in 1803
- Over 40 square miles
- Population: 88,000
- Once the largest textile producing city in the country
- Combined sewer and water infrastructure built to support industrial/residential growth







Source: US Census Bureau, American Community Survey

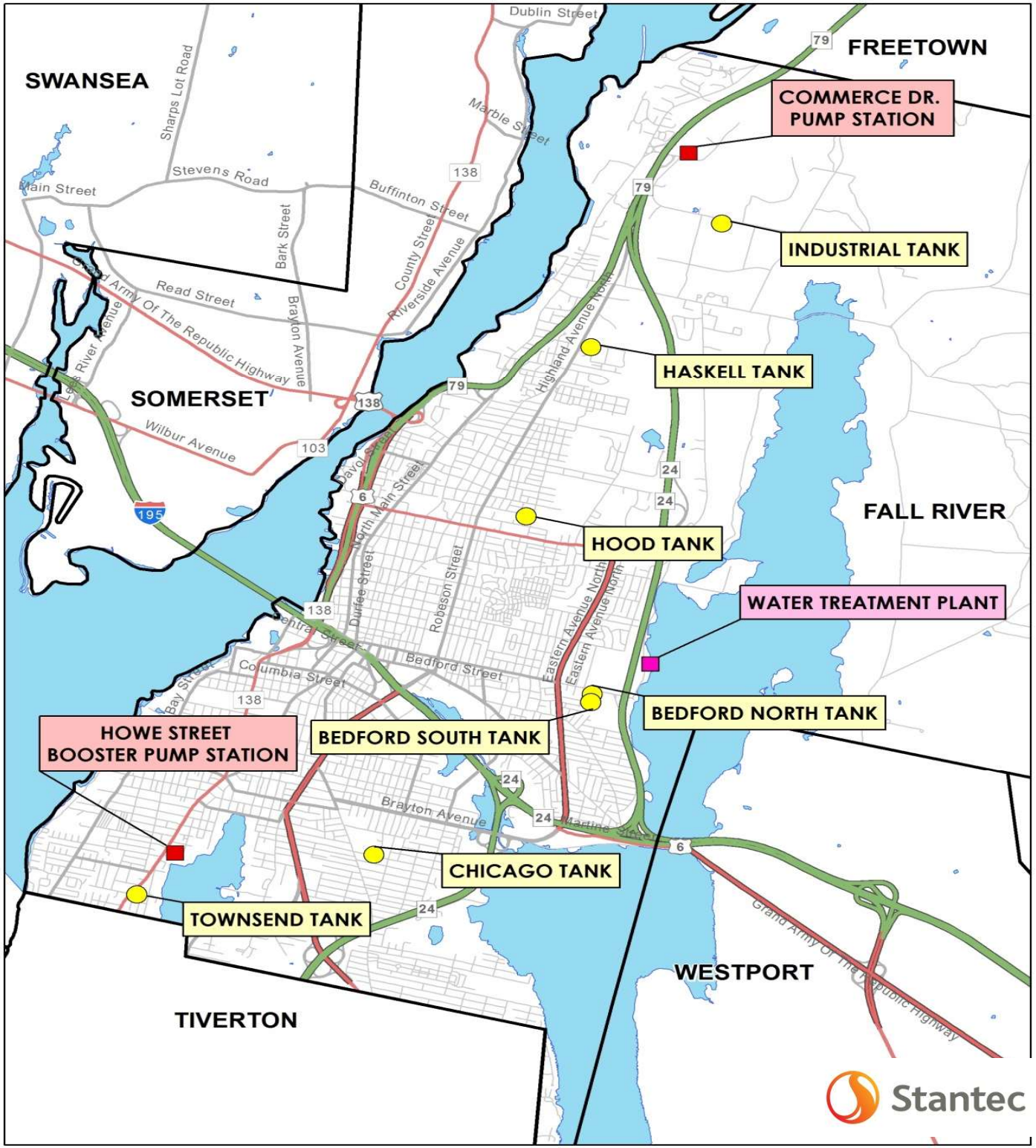
Public Education and Participation

- Public Input is Key.
- Identify Risks of Concern, such as:
  - Flooding
  - Supply of Drinking Water
  - Biological
  - Chemical
  - Snow
  - Storms
  - Other

Floods-Stafford Square 9/5/12

2010 floods

WATER SUPPLY Facilities



Water Main and Lead Service Replacement Program

- City committed to replace 100 year old, tuberculated cast iron water mains with cement lined ductile iron water mains

Water Main Service/Maintenance

Drinking Water Treatment Facility:
Need to Add a Redundant Water Main.

Water Storage Facility Rehabilitation

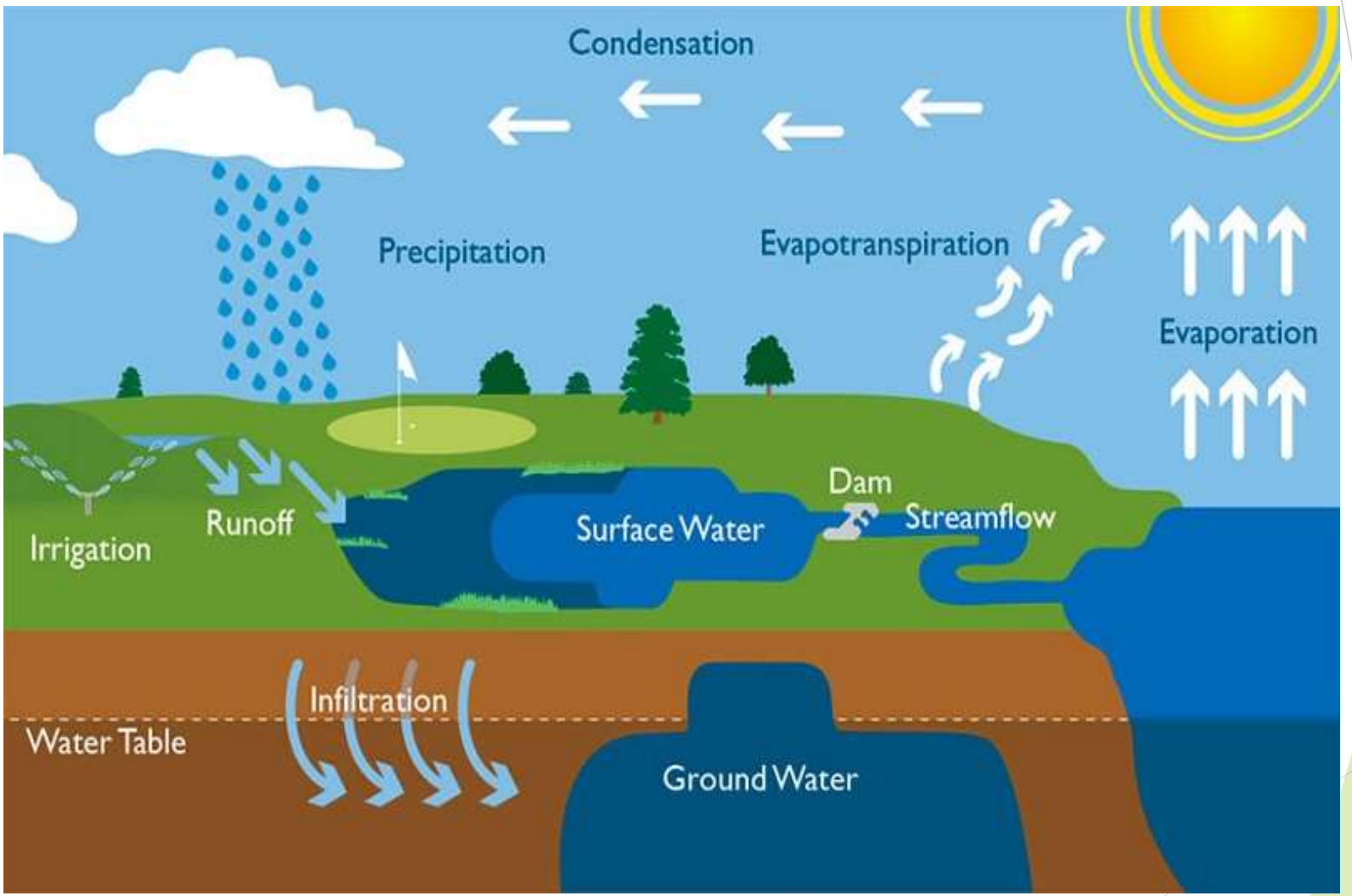
7 Tanks storing 19.6 million gallons

Bedford Street Tanks - Haskell Street Tank – Hood Street Tank were abrasive-blast-cleaned, repaired and repainted

BEFORE …

AFTER …

Biological & Chemical: Water Cycle



What Residents Can Do To Reduce Mosquito Populations

Backyard Breeding Sites:
Clogged Gutters, Trash Barrels, Empty Flower Pots, Buckets, Wheel Barrels, Animal Water Troughs and anything that can hold water

Slide-Courtesy of the Bristol County Mosquito Control Project.

Beware of Ticks!

- Active year-round
- Won't jump or drop from trees or brush
- Will wait for you to come into contact
- Stay on the trails, do not walk into the brush
- Separate yard from woods with a clear line
- Perform tick checks

Larvae as small as a poppyseed

- Slide-Courtesy of the Bristol County Mosquito Control Project

Algae Issues

South Watuppa Pond

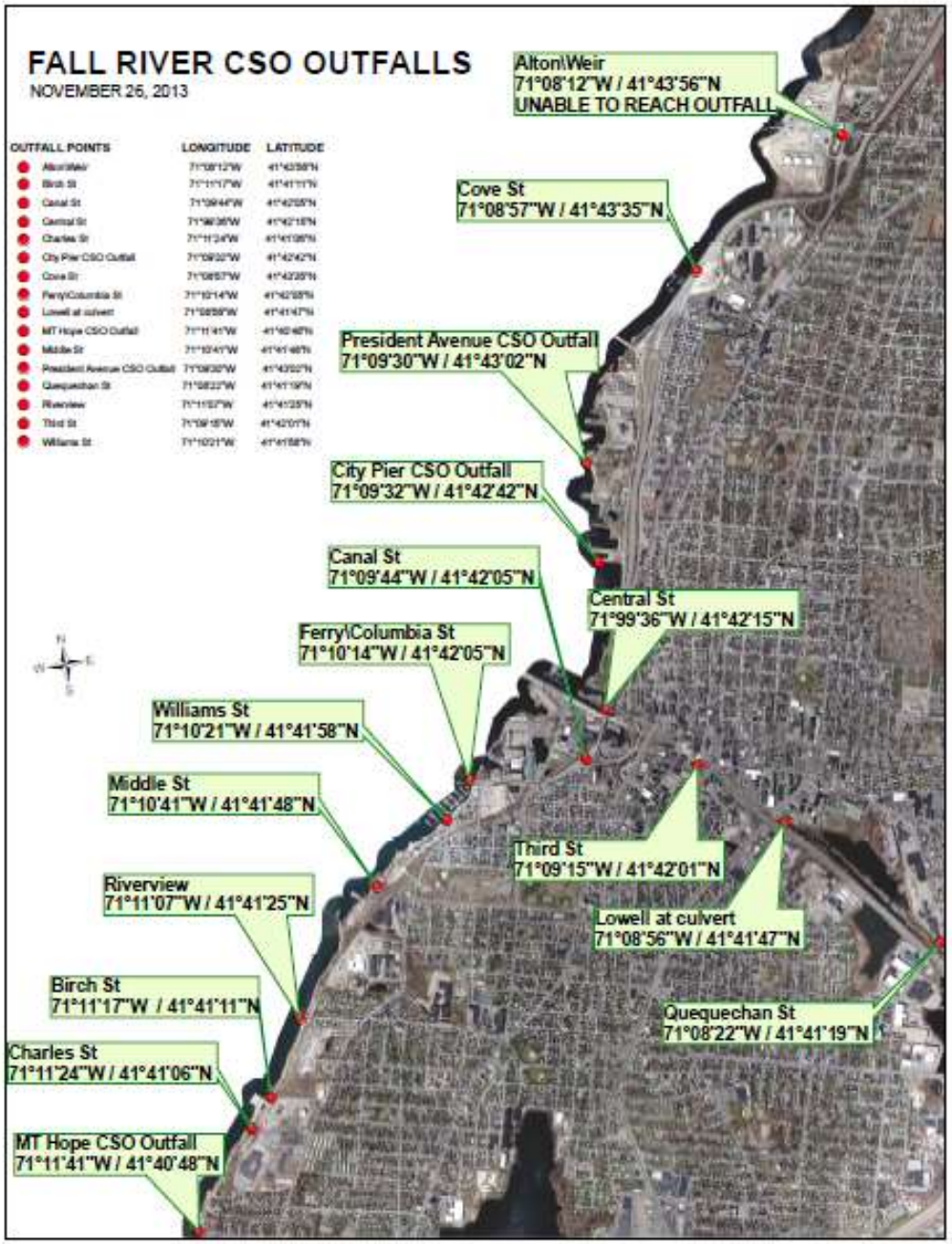
North and South Watuppa Ponds


Season Passes
Available
See attendant at ramp
or call Harbormaster Office
774-955-0123
NOTICE
FEE
REQUIRED
IN-STATE: $ 5.00
OUT OF STATE: $ 5.00
Boat
Excise Tax

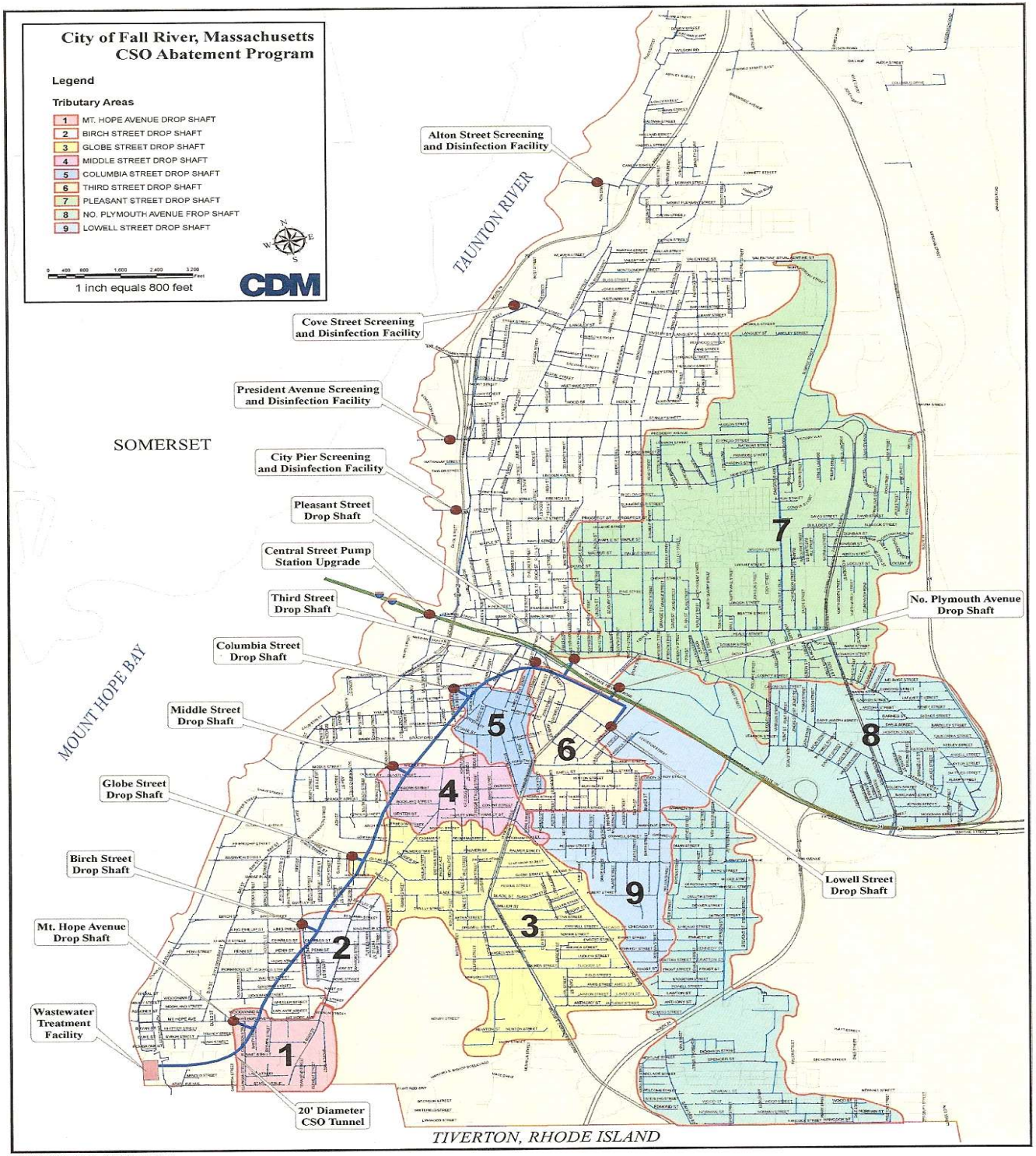
Fall River Wastewater Treatment Facilities
Facility Rehabilitation and CSO Abatement

15 Sewer Pump Stations Throughout the City

CSO Locations



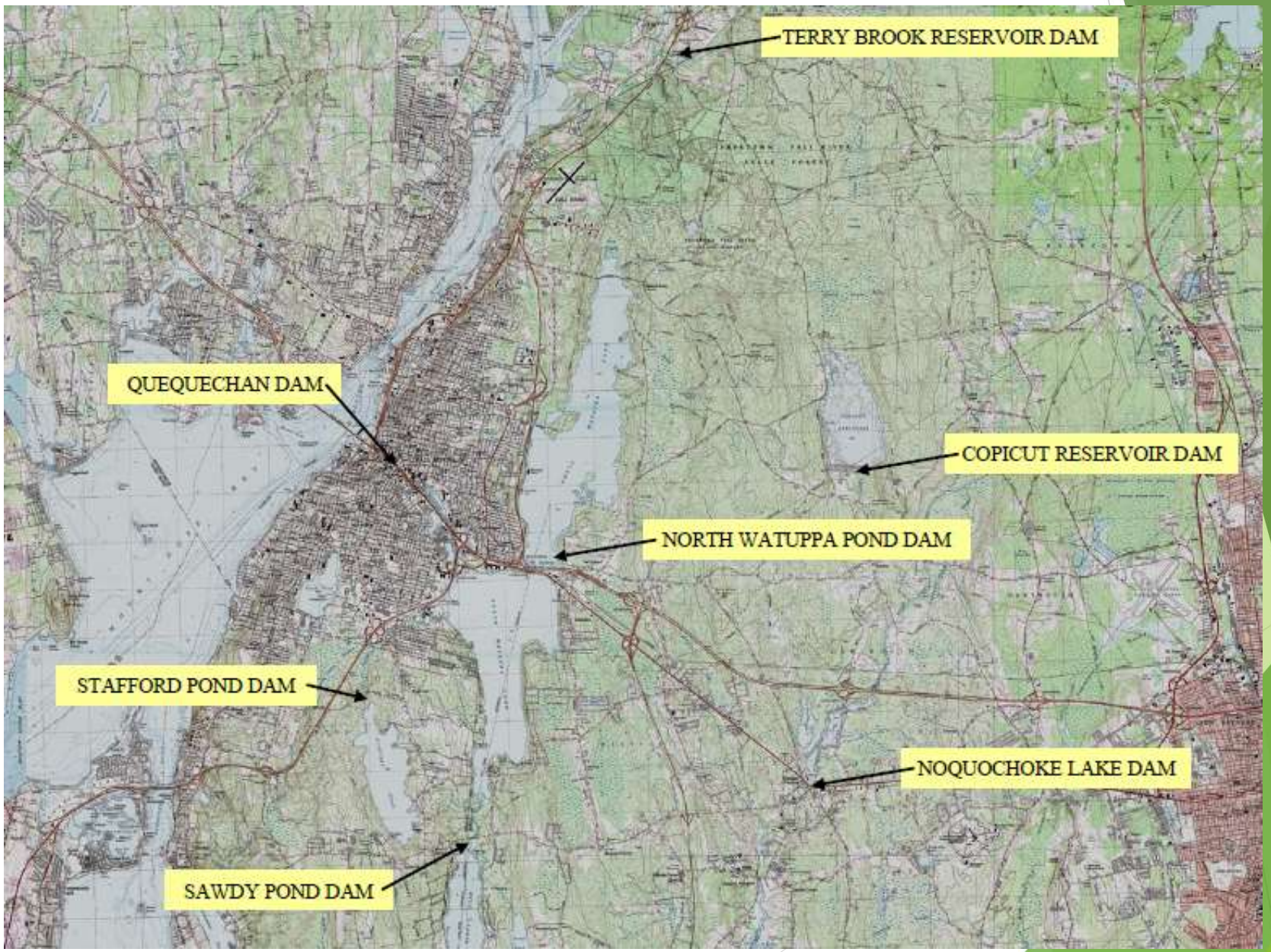
- 19 Original CSO outfalls
  - 2 closed
  - 15 controlled
- Federal Court Order to reduce overflows to 4 per year


City of Fall River, Massachusetts
CSO Abatement Program
Legend
Tributary Areas
1 MT. HOPE AVENUE DROP SHAFT
2 BIRCH STREET DROP SHAFT
3 GLOBE STREET DROP SHAFT
4 MIDDLE STREET DROP SHAFT
5 COLUMBIA STREET DROP SHAFT
6 THIRD STREET DROP SHAFT
7 PLEASANT STREET DROP SHAFT
8 NO. PLYMOUTH AVENUE FROP SHAFT
9 LOWELL STREET DROP SHAFT
1 inch equals 800 feet
CDM
Alton Street Screening and Disinfection Facility
TAUNTON RIVER
Cove Street Screening and Disinfection Facility
President Avenue Screening and Disinfection Facility
SOMERSET
City Pier Screening and Disinfection Facility
Pleasant Street Drop Shaft
Central Street Pump Station Upgrade
Third Street Drop Shaft
No. Plymouth Avenue Drop Shaft
Columbia Street Drop Shaft
MOUNT HOPE BAY
Middle Street Drop Shaft
Globe Street Drop Shaft
Birch Street Drop Shaft
Lowell Street Drop Shaft
Mt. Hope Avenue Drop Shaft
Wastewater Treatment Facility
20' Diameter CSO Tunnel
TIVERTON, RHODE ISLAND
1
2
3
4
5
6
7
8
9

CSO Tunnel

CSO Screening and Disinfection Facilities

Dam Maintenance and Rehabilitation



$3,600,000 in dam rehabilitation costs
to comply with the MA Office of Dam Safety

Quequechan River


Quequechan Surface Interceptor

- Copicut Reservoir

WaterShed Protection

- 14,000 acres of protected land
- Maintain Road Side Vegetation, Fire lanes, Fire ponds, Walking/Hiking Trails and Conservation
- Forest Management Planning

FIRE LANE VEGETATION CONTROL

QUESTIONS ?


Good Morning &
Welcome!
Fall River Community Resiliency Building Workshop
March 20, 2019

1


Fall River, MA
Community Resiliency Building Workshop
March 20, 2019
WOODARD &CURRAN

2

Community Resiliency Building Workshop

- **7:30 – 8:00 | Registration**
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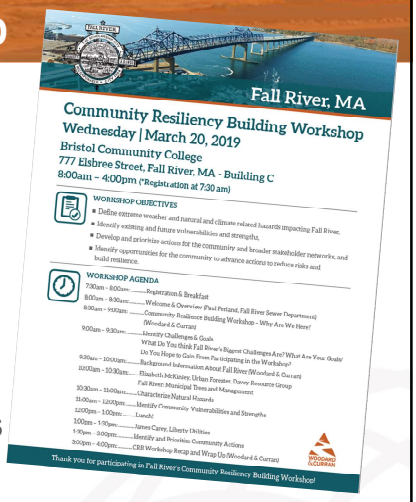


3

Community Resiliency Building Workshop

THANK YOU

4

Community Resiliency Building Workshop

BRISTOL COMMUNITY COLLEGE

Liberty Utilities

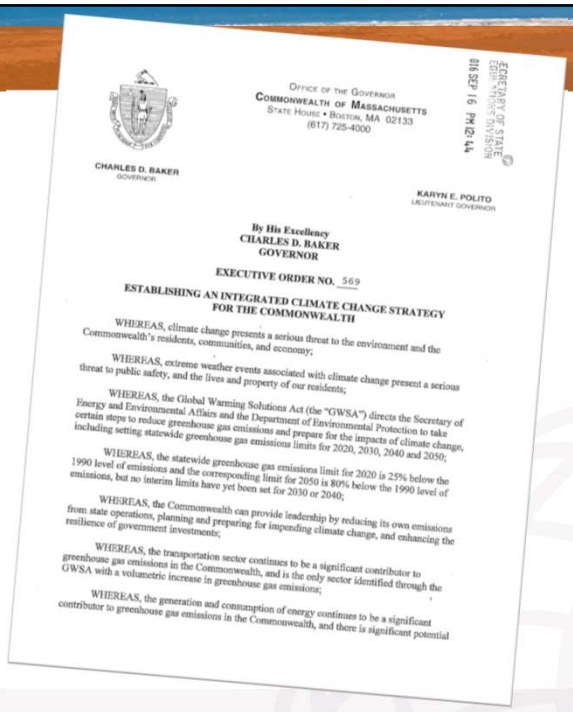
DAVEY
Proven Solutions for a Growing World

WOODARD &CURRAN

5

Executive Order 569

- In September 2016, Governor Charlie Baker signed Executive Order 569, instructing state government to **provide assistance to cities and towns to complete climate change vulnerability assessments and resiliency planning**



OFFICE OF THE GOVERNOR
COMMONWEALTH OF MASSACHUSETTS
STATE HOUSE • BOSTON, MA 02133
(617) 725-4000

CHARLES D. BAKER
GOVERNOR

KARYN E. POLITO
LIEUTENANT GOVERNOR

By His Excellency
CHARLES D. BAKER
GOVERNOR

EXECUTIVE ORDER NO. 569

ESTABLISHING AN INTEGRATED CLIMATE CHANGE STRATEGY FOR THE COMMONWEALTH

WHEREAS, climate change presents a serious threat to the environment and the Commonwealth's residents, communities, and economy;

WHEREAS, extreme weather events associated with climate change present a serious threat to public safety, and the lives and property of our residents;

WHEREAS, the Global Warming Solutions Act (the "GWSA") directs the Secretary of Energy and Environmental Affairs and the Department of Environmental Protection to take certain steps to reduce greenhouse gas emissions and prepare for the impacts of climate change, including setting statewide greenhouse gas emissions limits for 2020, 2030, 2040 and 2050;

WHEREAS, the statewide greenhouse gas emissions limit for 2020 is 25% below the 1990 level of emissions and the corresponding limit for 2050 is 80% below the 1990 level of emissions, but no interim limits have yet been set for 2030 or 2040;

WHEREAS, the Commonwealth can provide leadership by reducing its own emissions from state operations, planning and preparing for impending climate change, and enhancing the resilience of government investments;

WHEREAS, the transportation sector continues to be a significant contributor to greenhouse gas emissions in the Commonwealth, and is the only sector identified through the GWSA with a volumetric increase in greenhouse gas emissions;

WHEREAS, the generation and consumption of energy continues to be a significant contributor to greenhouse gas emissions in the Commonwealth, and there is significant potential

WOODARD &CURRAN

6

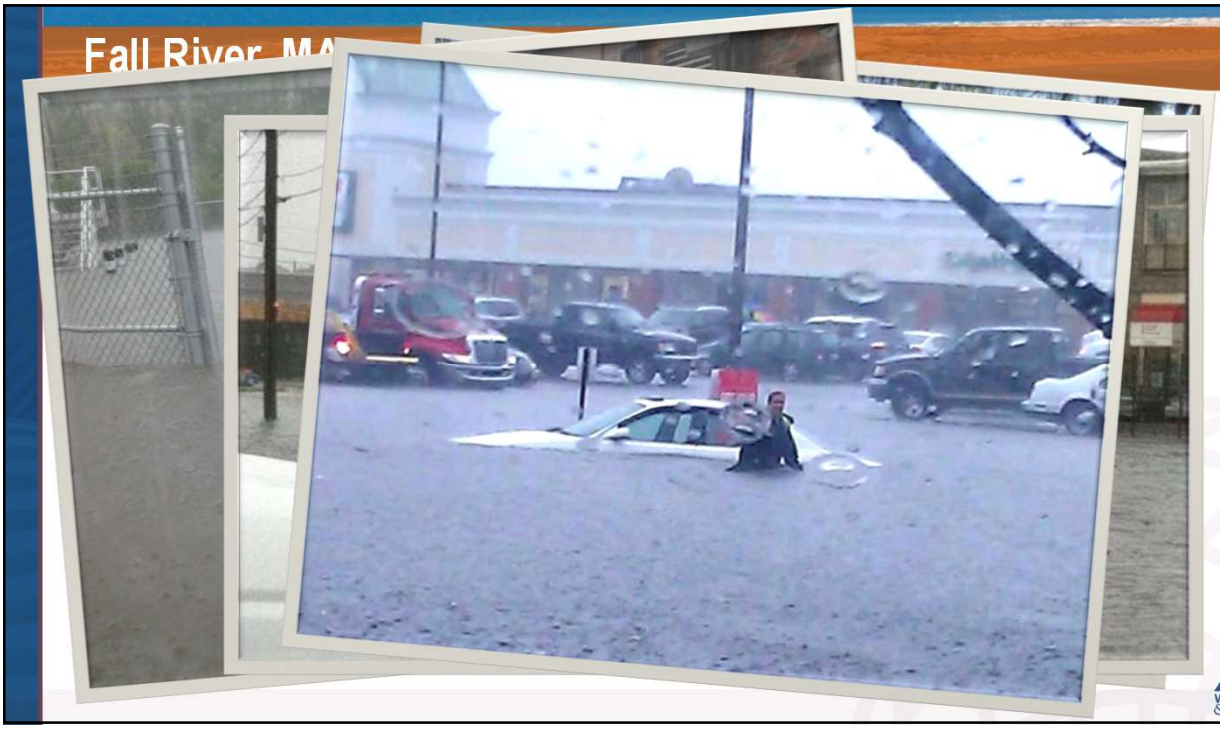
August 2018

- Governor Baker signed legislation directing $2.4 billion to Climate Change Adaptation, Environmental Protection and Community Investments
- $$ allocated capital for investments in safeguarding residents, municipalities and businesses from the impacts of climate change, protecting environmental resources, and improving recreational opportunities
- The $$ enables critical environmental investments at the state and local levels and will put into law essential components of Governor Baker's Executive Order 569

Photo: Mass.gov Press Release, August 2018

7

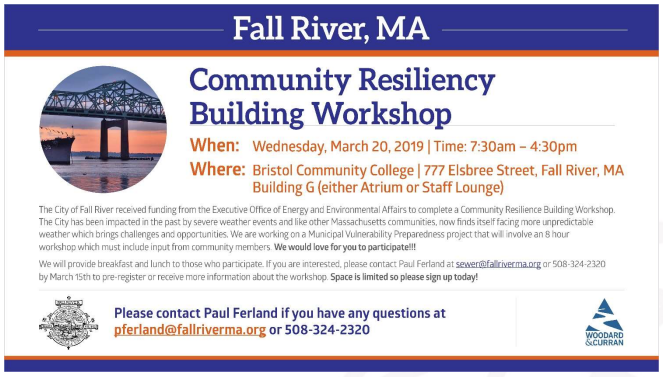
Fall River, MA



8

Municipal Vulnerability Preparedness (MVP) Grant Program

- The program helps communities achieve the following objectives:
  - Define extreme weather and natural and climate related hazards
  - Identify existing and future vulnerabilities and strengths
  - Develop and prioritize actions for the community
  - Identify opportunities to take action to reduce risk and build resilience



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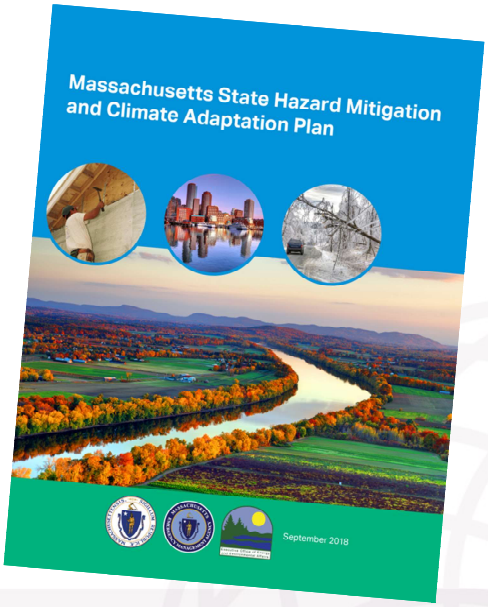
Municipal Vulnerability Preparedness (MVP) Grant Program

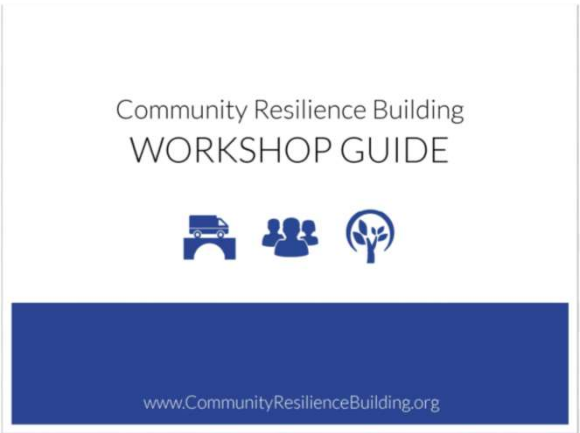
- MVP Principles
  - **Community-led process** that employs local knowledge and requires local buy-in and support
  - **Accessible** to everyone
  - **Utilizes partnerships** and leverages existing efforts
  - **Mainstreams** climate change
  - **See communities** as local innovators
  - **Frames** coordinated statewide efforts



10

Community Resiliency Building Workshop

- As part of the MVP program, participating communities MUST complete a Community Resiliency Building Workshop!
- An additional 3 sessions will be held in the spring for residents and businesses in the Portuguese community
- Upon completion of the workshop, a summary report will be submitted to EEA
- Fall River will continue to use this Summary of Findings to reinforce future planning and action item implementation



11

We will work together to….

- Understand connections between ongoing community issues, climate change, natural hazards and local planning and actions
- Understand how climate change will exacerbate or lead to new community issues, hazards and challenges
- Identify infrastructural, societal, environmental vulnerabilities and strengths that help Fall River become more resilient
- Explore nature-based solutions to build resiliency
- Develop and prioritize actions that delineate next steps for the community
- Identify how Fall River can advance actions to reduce risks and impacts of climate change and increase local and regional resilience


Fall River, MA

Community Resiliency Building Workshop
Wednesday | March 20, 2019
Bristol Community College
777 Elsbree Street, Fall River, MA - Building C
8:00am – 4:00pm (*Registration at 7:30 am)

WORKSHOP OBJECTIVES
- Define extreme weather and natural and climate related hazards impacting Fall River.
- Identify existing and future vulnerabilities and strengths.
- Develop and prioritize actions for the community and broader stakeholder networks, and
- Identify opportunities for the community to advance actions to reduce risks and build resilience.

WORKSHOP AGENDA
7:30am – 8:00am: Registration & Breakfast
8:00am – 8:30am: Welcome & Overview (Paul Ferland, Fall River Sewer Department)
8:30am – 9:00am: Community Resilience Building Workshop – Why Are We Here? (Woodard & Curran)
9:00am – 9:30am: Identify Challenges & Goals
What Do You think Fall River's Biggest Challenges Are? What Are Your Goals/ Do You Hope to Gain From Participating in the Workshop?
9:30am – 10:00am: Background Information About Fall River (Woodard & Curran)
10:00am – 10:30am: Elisabeth McKinley, Urban Forester, Davey Resource Group
Fall River: Municipal Trees and Management
10:30am – 11:00am: Characterize Natural Hazards
11:00am – 12:00pm: Identify Community Vulnerabilities and Strengths
12:00pm – 1:00pm: Lunch!
1:00pm – 1:30pm: James Carey, Liberty Utilities
1:30pm – 3:00pm: Identify and Prioritize Community Actions
3:00pm – 4:00pm: CRB Workshop Recap and Wrap Up (Woodard & Curran)

Thank you for participating in Fall River's Community Resiliency Building Workshop!

12

Community Resiliency Building Workshop

Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.org

H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S					Priority H-M-L	Time Short Long Ongoing
Infrastructural									
Societal									
Environmental									

13

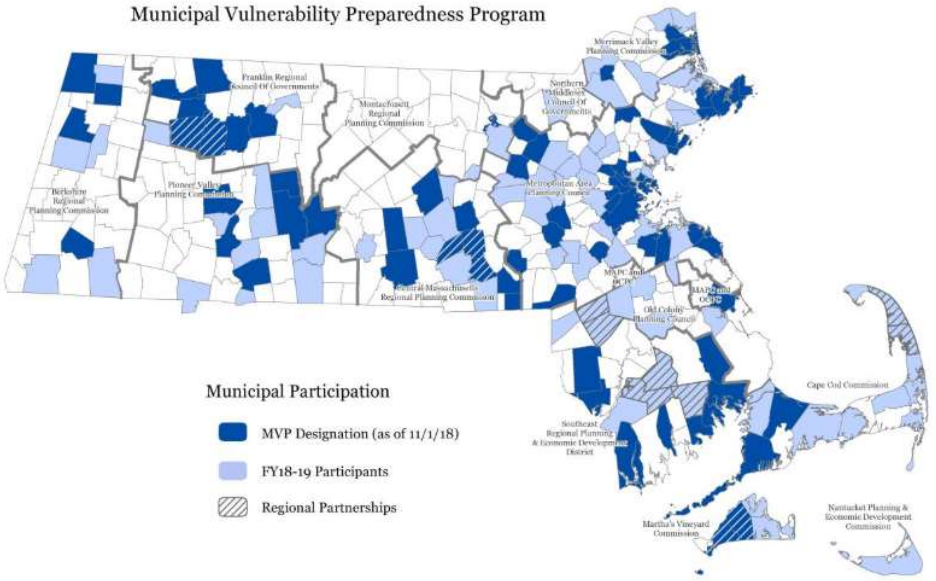
Municipal Vulnerability Preparedness (MVP) Grant Program

- Communities who complete the MVP program become certified as an MVP community and are eligible for potential follow-up grant funding and other opportunities
- Examples of other MA communities who have had projects funded!

Community	Project	Amount
Arlington	Mill Brook Corridor Flood Management Demonstration Project	$399,260
Brookline	Climate Resiliency Policy Audit & LID and Design Guidelines	$56,188
Medford	Drainage Model and Conceptual Strategies to Reduce Future Flooding in South Medford	$60,830
New Bedford	Comprehensive Climate Adaptation and Resilience Action Plan and Interactive Community Dashboard	$165,120
Weymouth	Fort Point Road Coastal Infrastructure Resilience Project	$129,557

14

What Other Communities Are in the MVP Program?



15

Two Questions for You!

The goal of the workshop is to listen and learn from attendees regarding your thoughts and ideas for meeting the CRB workshop objectives!

- **What are Fall River's biggest challenges?**
  - Think infrastructure, societal, environment
- **What are your goals for the day and what do you hope to gain from your participation in the workshop today?**

16

Community Resiliency Building Workshop

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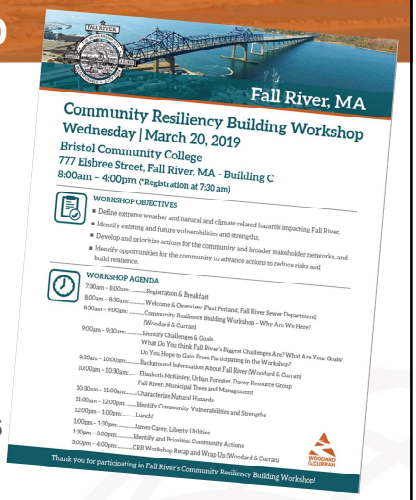

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18

1

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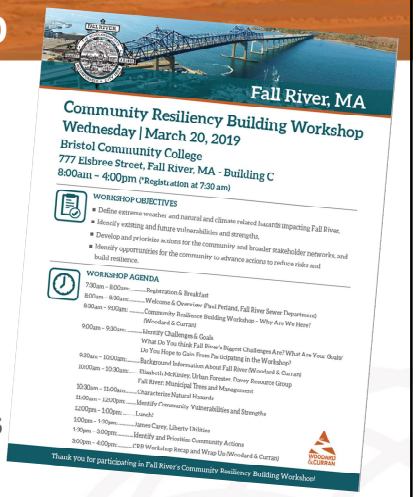

2

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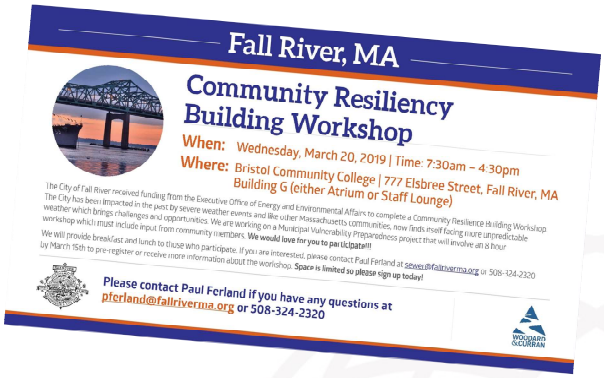

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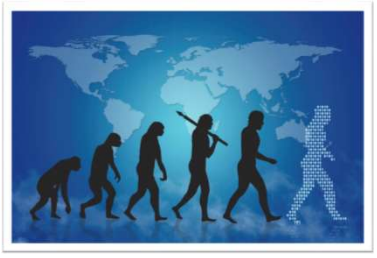
Municipal Vulnerability Preparedness (MVP) Grant Program

resilience
noun
1. *the capacity to recover quickly from difficulties; toughness*

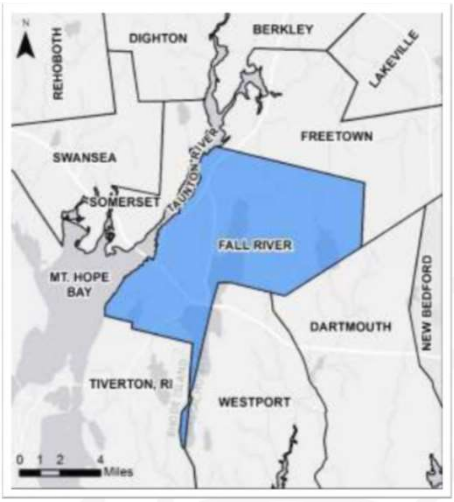


adapt
verb
1. *make (something) suitable for a new use or purpose; modify.*
2. *become adjusted to new conditions.*

4

Background Information – Fall River

- Year round population of 89,420 (as of 2017)
- 40.2 square miles
- South coast of Massachusetts, Bristol County
- Taunton River Watershed
- One of 10 larges cities in Massachusetts
- Located along Taunton River and Mount Hope Bay shoreline
- Approximately 5 miles of shoreline exposed to open ocean, remainder forms a semi-protected bay
- Protected from storms by natural and man made shoreline structures
  - Approximately 17 provide some coastal protection



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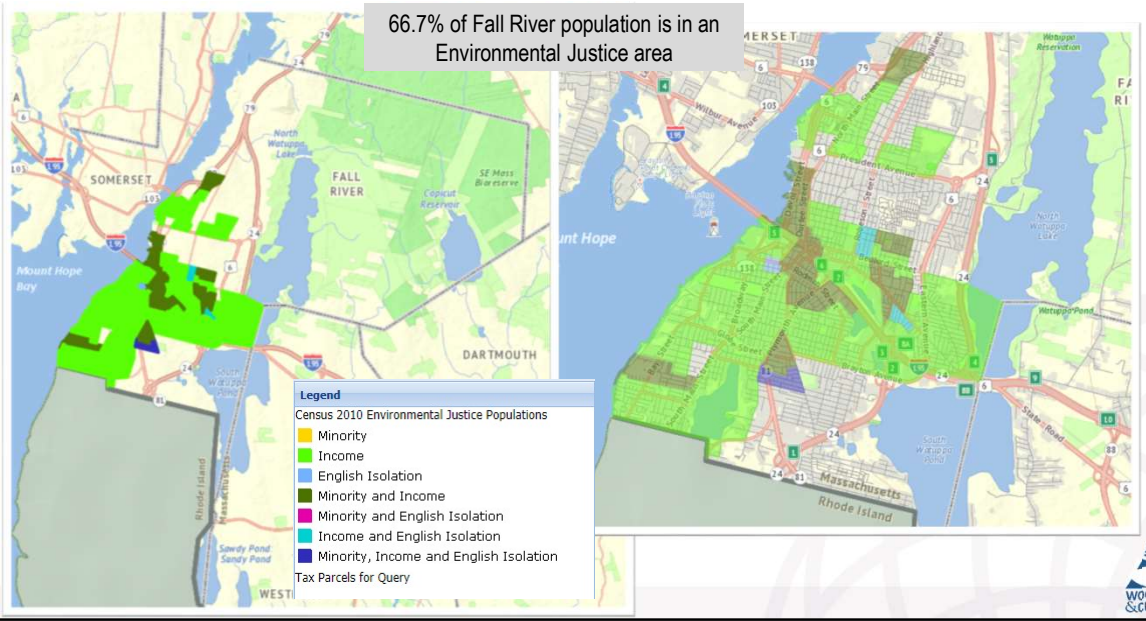
Environmental Justice Population - Income

66.7% of Fall River population is in an Environmental Justice area



6

Environment

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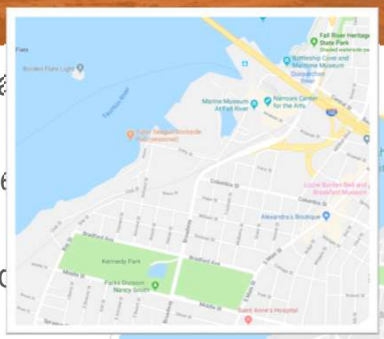
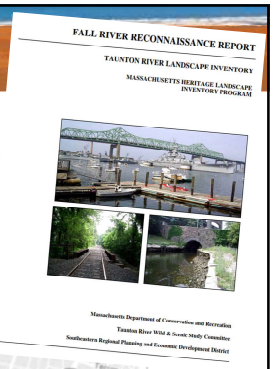
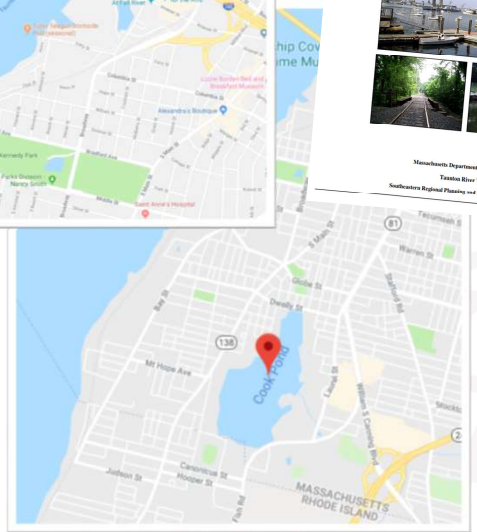
7

Environment

- Cook Pond – 154 acre state designa
  Great Pond
- Kennedy Park – designed by Olmste
  on National Historic Register
- Peace Haven (Mother Brook, Winslo
  Point)
- Quequechan River Corridor – largely buried under buildings and channels
- Steep Brook – main tributary to Taunton River
- Taunton River designated a “Wild & Scenic River” in 2009 by NPS




FALL RIVER RECONNAISSANCE REPORT
TAUNTON RIVER LANDSCAPE INVENTORY
MASSACHUSETTS HERITAGE LANDSCAPE INVENTORY PROGRAM



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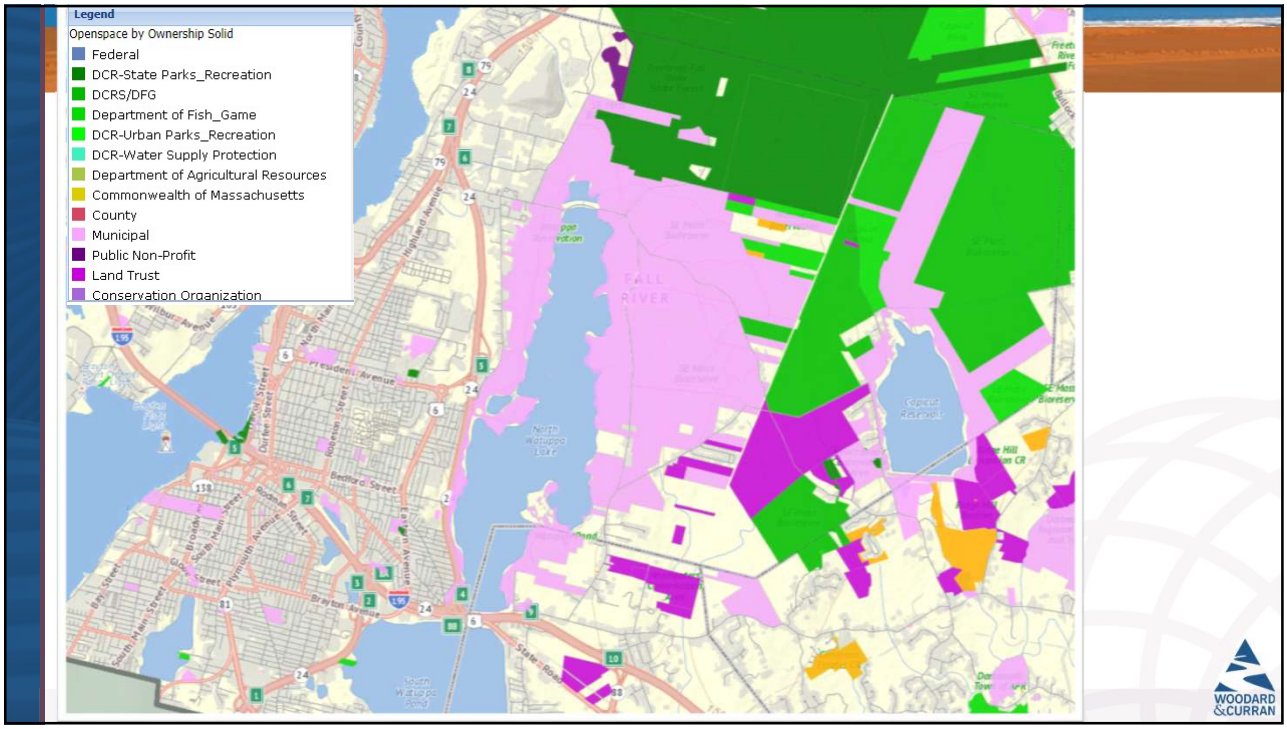

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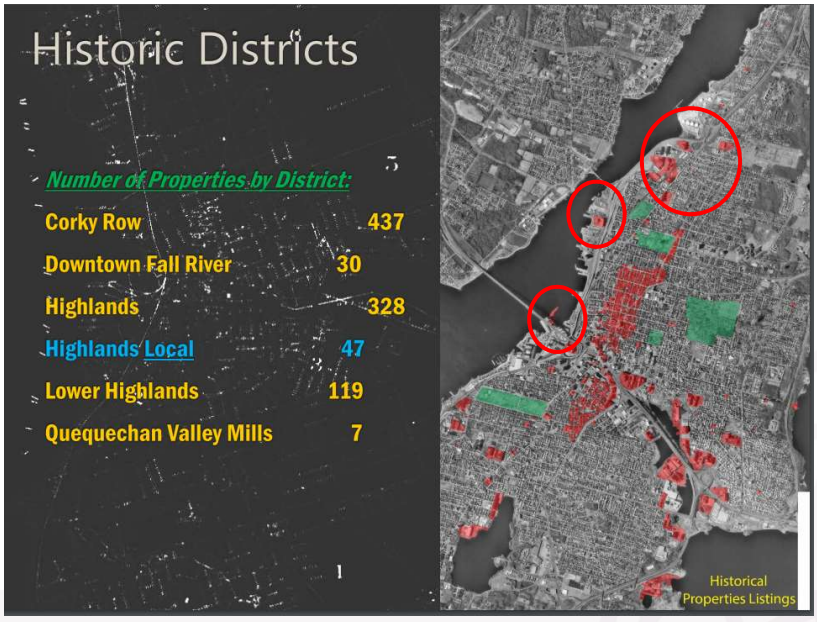
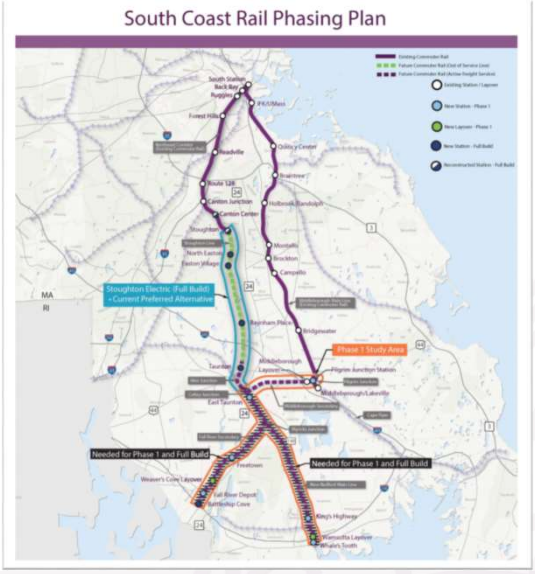
Historic Districts & Properties



10

Transportation

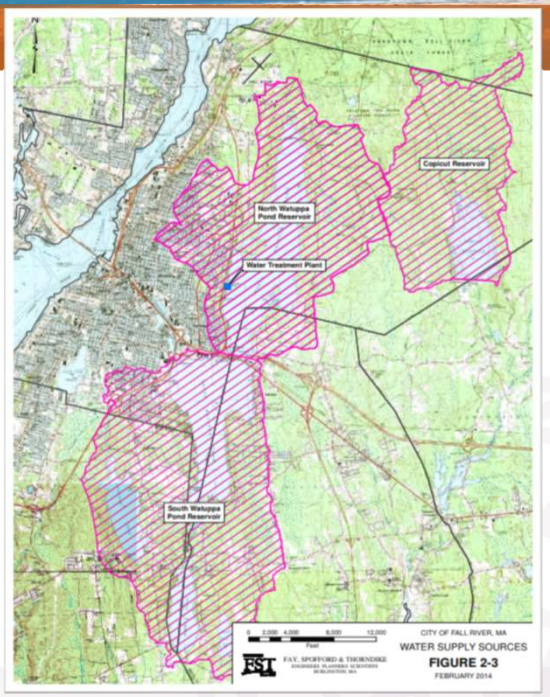
- Well served by regional roadways – Route 6, 24, I-195, 138, 79 linking Fall River to other communities
- Local bus service
- Included in South Coast Rail Phasing Plan for Commuter Rail Train stop
- Braga Bridge (I-195), Veterans Memorial Bridge



11

Water

- Two protected reservoirs provide high quality drinking water to City
  - North Watuppa Pond (2nd largest naturally occurring body of water in MA)
  - Copicut Reservoir
- Average daily demand is 10MGD
- Majority of water system infrastructure installed before 1930s
- 250 miles pipe serving approximately 100,000 customers
- 7 water storage tanks hold 21.2 million gallons of water
- Fall River Water Division responsible for water treatment, water main replacement and distribution



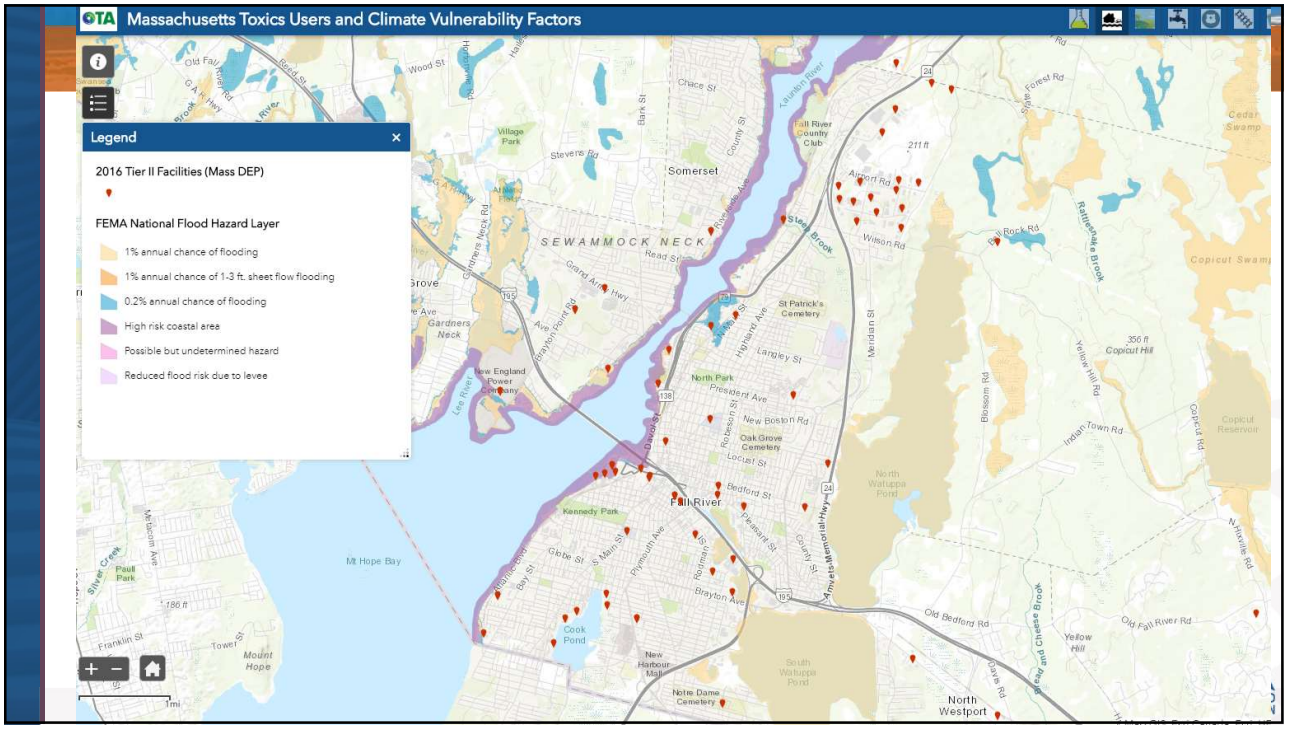
12

Sewer

- WWTP upgraded in 2005
- Designed to process 106MGD
- Regional system (Westport, Freetown, Tiverton)
- Served by a Combined Sewer System that holds and transfers wastewater and stormwater
- Has capacity to help manage large quantities of water produced by storms
- Treats average 31 MGD per day

WOODARD &CURRAN

13



14

Hazardous Waste Sites

- Identified in your Waterfront Urban Renewal Area

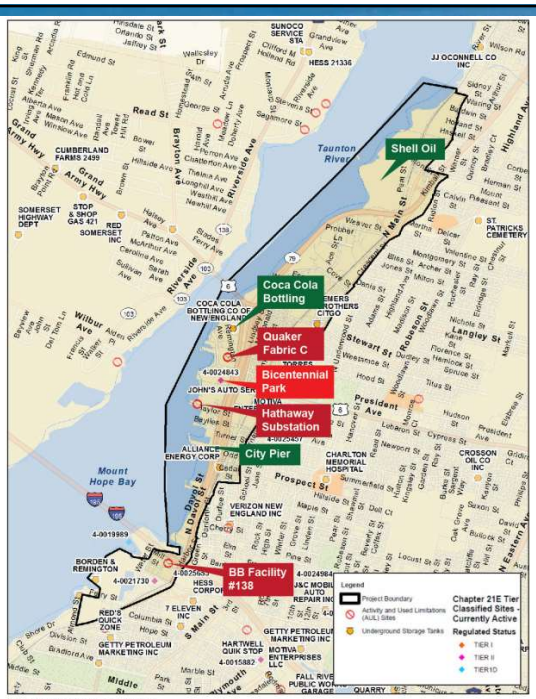


Figure 3-3: Hazardous Materials Sites

15

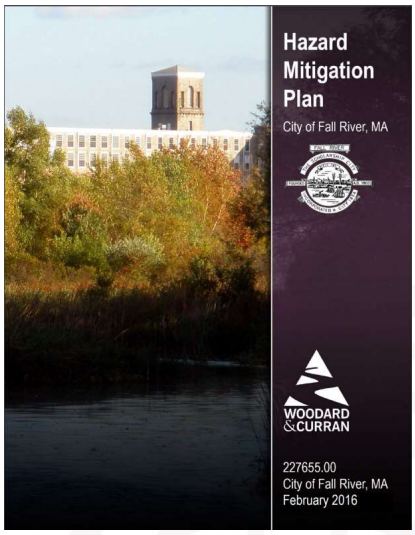
Coastal Infrastructure

- Route 79 Stone Revetment
- Heritage State Park Revetment & Seawall
- Battleship Cove Seawall
- Ferry Street Seawall
- Bicentennial Park Revetment
- Remington Avenue Seawall
- State Pier Seawall
- City Pier

16

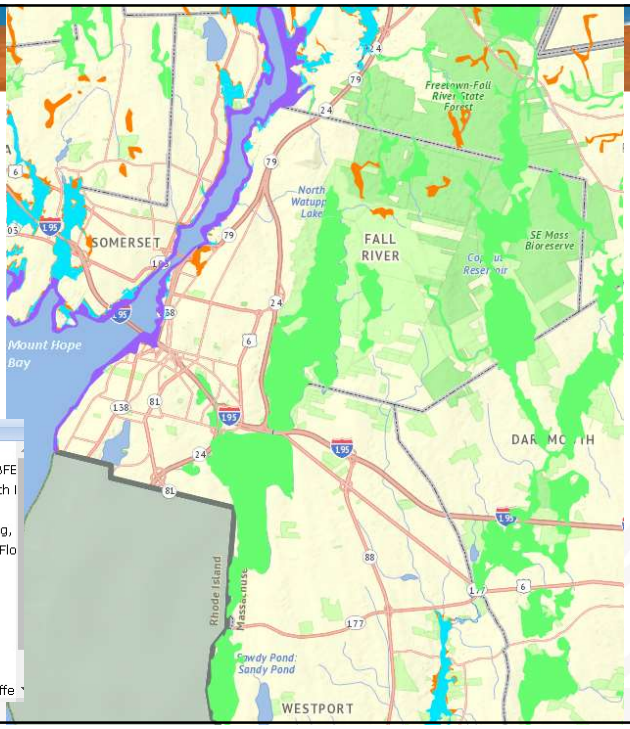
Natural Hazards Impacting Fall River

- Flood
- Hurricane
- Severe Winter Storm
- Nor'Easter/Coastal Storm
- Windstorm
- Thunder & Lightning
- Wildfire
- Extreme Temperature (Heat/Cold)
- Ice Storm
- Dam Failure
- Tornado
- Earthquake
- Coastal Erosion
- Drought
- Sea Level Rise
- Climate Change



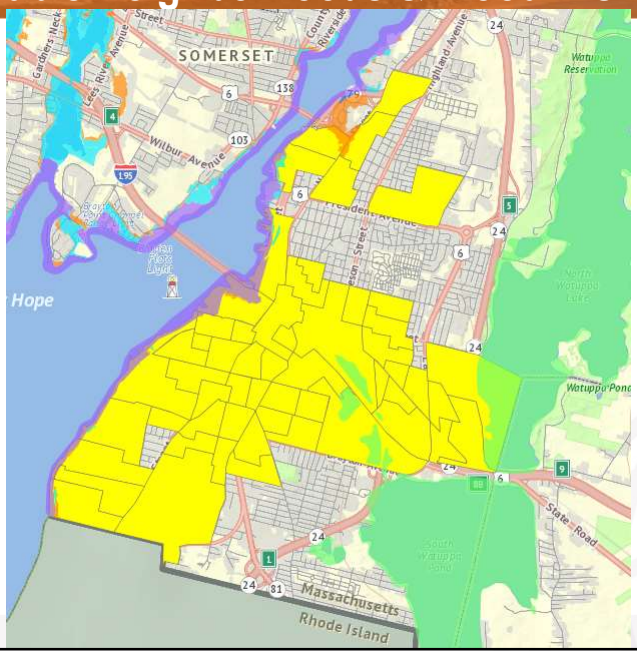
17

Flood Map



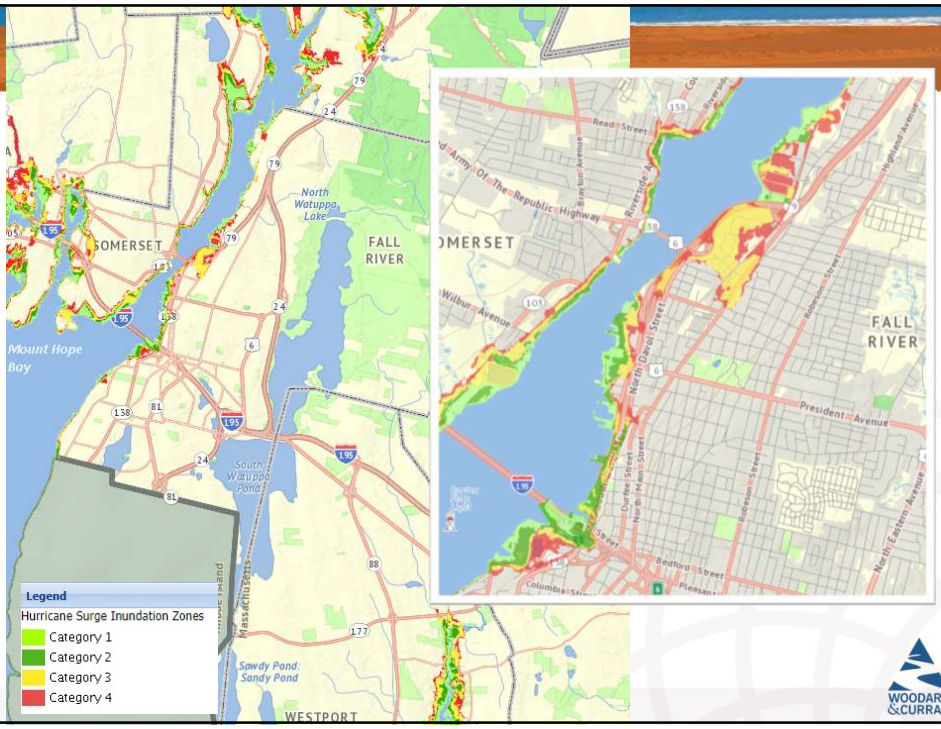
18

Socially Vulnerable Neighborhoods & Flood Risk



19

Hurricane



20

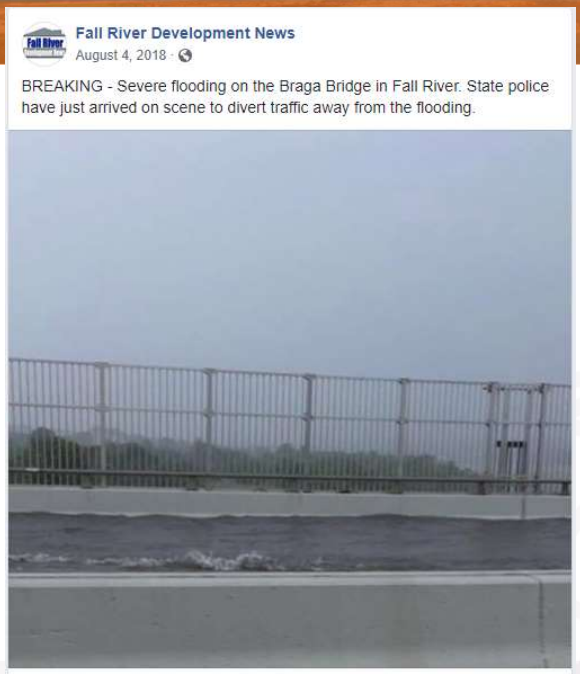
March 2010 Storm Event

- March 2010 intense rain events
  - Record flooding - 5.4 inches, 3.1 inches and 7.7 inches in short timeframe
  - Already saturated from a three day storm, received 8 inches of rain in 36 hours
  - Fall River's stormwater and wastewater infrastructure was overwhelmed and caused massive issues on Mount Hope Avenue and Columbia Street

21

August 2018 Flooding

- Approximately 2.9 inches of rain – intensity and duration caused flooding
- Braga Bridge – flooded on both sides, drainage structures not functioning properly
- Also caused issues on:
  - North Main
  - Rodman
  - Pleasant
  - Warren



22

Severe Weather

- Concern over tree debris during a hurricane or high wind event
- 1954 Hurricane Carol shut down Fall River for over a week
- Friendship/Riverview Street area has been evacuated in the past during hurricane events

23

Flood Control & Stormwater Management

- Stormwater and sewer infrastructure is old and needs updating
  - Federal and State mandate to eliminate all combined sewer overflows into Taunton River
  - Fall River has invested over $200M to upgrade stormwater and wastewater infrastructure to withstand a 3 month storm (1.76 inches of rain over 12 hour period)
  - Fall River has a lot of 8" pipe that can manage heavy precipitation loads, however there are other significant flooding issues due to old and undersized infrastructure.

Potential Mitigation Measures

- Elevation of homes in high impact coastal areas
- Evaluate structural and nonstructural approaches to maximize flood control
- Green infrastructure to minimize flooding
- Protect and maintain natural habitats, wetlands that protect against flooding
- Address areas known to flood
- Evaluate flood impacts after storm events and plan mitigation measures

24

Known Flooding Issues

- Stafford Square, Davol Street, Alden Street, Brayton Avenue, Cress Brook, Middle Street, North Main Street, Central, Cove, Collins, Cherry, Remington, Mackenzie, Winslow
- Major flooding near City Pier
- Quequechan River subject to flooding

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25

Hazard Mitigation Plan Actions

- Tree management plan and program
- Secure generators for critical facilities
- Formal shelter plan
- Evaluate pump stations, WWTF for resiliency measures
- Upgrade emergency communications system
- Address National Grid substation which is in a floodplain
- Upgrade and clean culverts (Steep Brook, Terry Brook, Collins Street)
- Restore Mothers Brook
- Reconstruct North Watuppa Pond Causeway and upgrade and clean the interceptor
- Quequechan River – upgrade and clean existing infrastructure, reroute downstream portions of river
- Replace sewer Alden Street

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Urban Flooding

- "…the inundation of property in a built environment, particularly in more densely populated areas, caused by rain falling on increased amounts of impervious surfaces and overwhelming the capacity of drainage systems."

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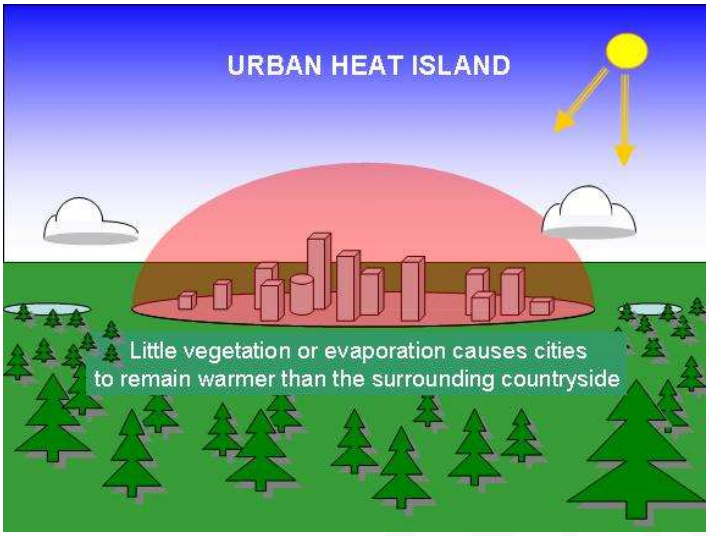
Urban Flooding – Houston, TX

Houston's risk for extreme flooding during the hurricane — a category 4 storm that caused an estimated $125 billion in damage and killed 68 people — was 21 times greater due to urbanization.

28

Urban Heat Island Impact – What Causes It?

- Impervious cover
- Development
- Building Arrangement
- Population
- Weather
- Decreased vegetation



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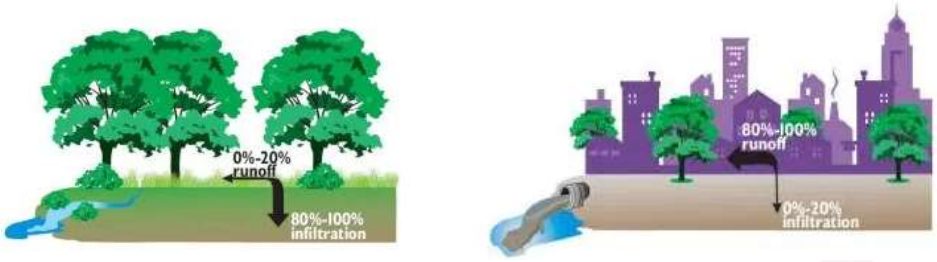
Urban Heat Island Impact



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What About the Future?
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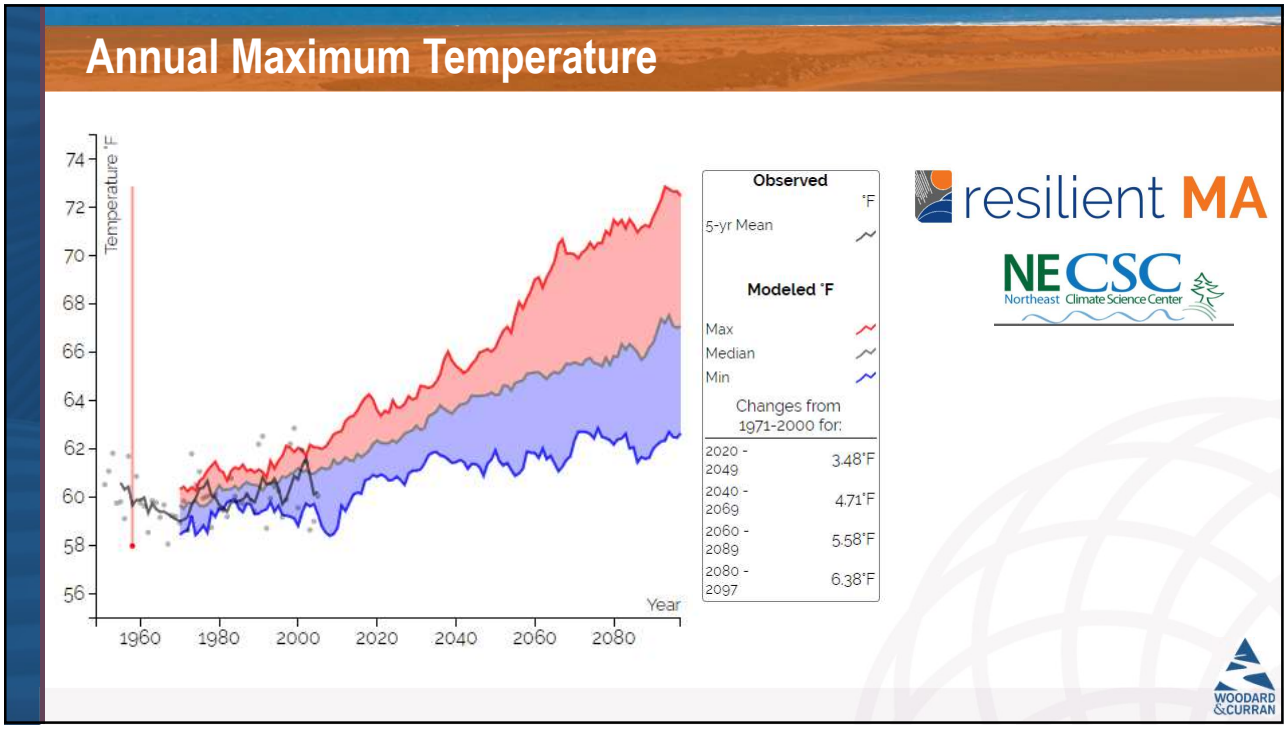
31


Annual Maximum Temperature
Temperature °F
74
72
70
68
66
64
62
60
58
56
1960
1980
2000
2020
2040
2060
2080
Year
Observed
°F
5-yr Mean
Modeled °F
Max
Median
Min
Changes from 1971-2000 for:
2020 - 2049 3.48°F
2040 - 2069 4.71°F
2060 - 2089 5.58°F
2080 - 2097 6.38°F
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NECSC
Northeast Climate Science Center
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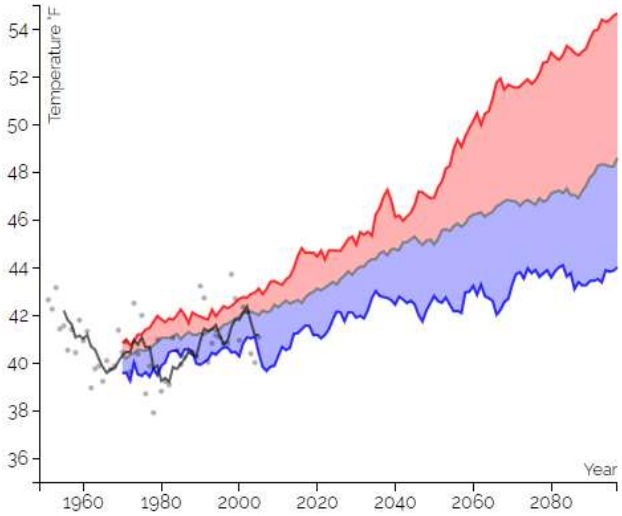
Annual Minimum Temperature



Observed	°F
5-yr Mean	
Modeled °F	
Max	
Median	
Min	
Changes from 1971-2000 for:	
2020 - 2049	3.67°F
2040 - 2069	4.99°F
2060 - 2089	6.11°F
2080 - 2097	6.70°F

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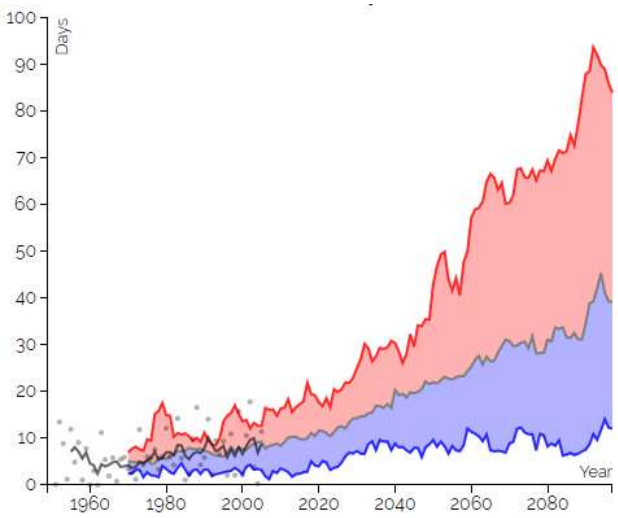
Annual Days With Maximum Temperature Above 90



Observed	days
5-yr Mean	
Modeled days	
Max	
Median	
Min	
Changes from 1971-2000 for:	
2020 - 2049	10.10 days
2040 - 2069	17.05 days
2060 - 2089	24.27 days
2080 - 2097	27.85 days

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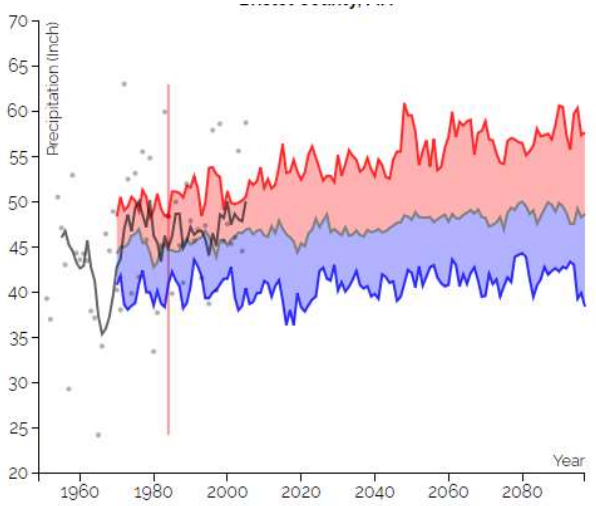
Annual Total Precipitation



Observed	Inches
5-yr Mean	

Modeled Inches 2092–2096	
Max	59.83
Median	47.65
Min	43.13

Changes from 1971-2000 for:	
2020 - 2049	0.48"
2040 - 2069	1.87"
2060 - 2089	2.29"
2080 - 2097	2.61"

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35

Climate Change – An Environmental Challenge

- It will impact….
  - The Economy
  - Public Health
  - Water Resources
  - Infrastructure
  - Coastal Resources
  - Energy Demand
  - Natural Resources
  - Recreation

How?

- Temperature
- Heat Waves
- Sea Temperature
- Precipitation

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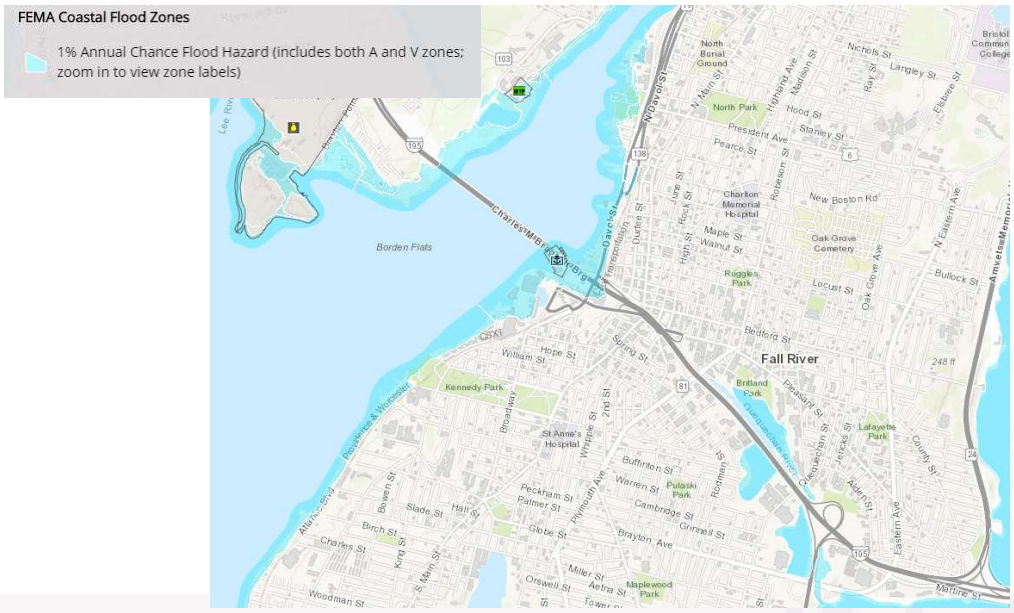
FEMA Floodmap



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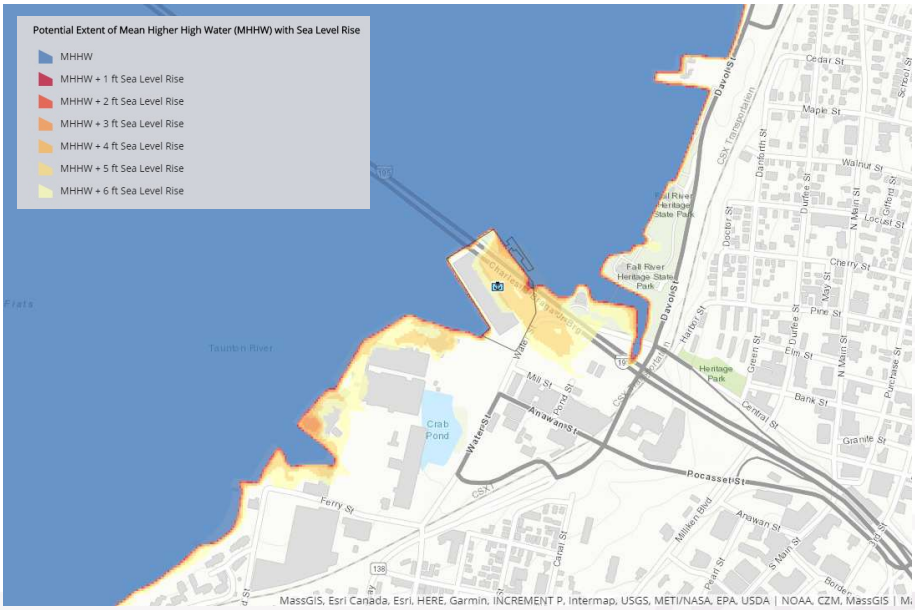
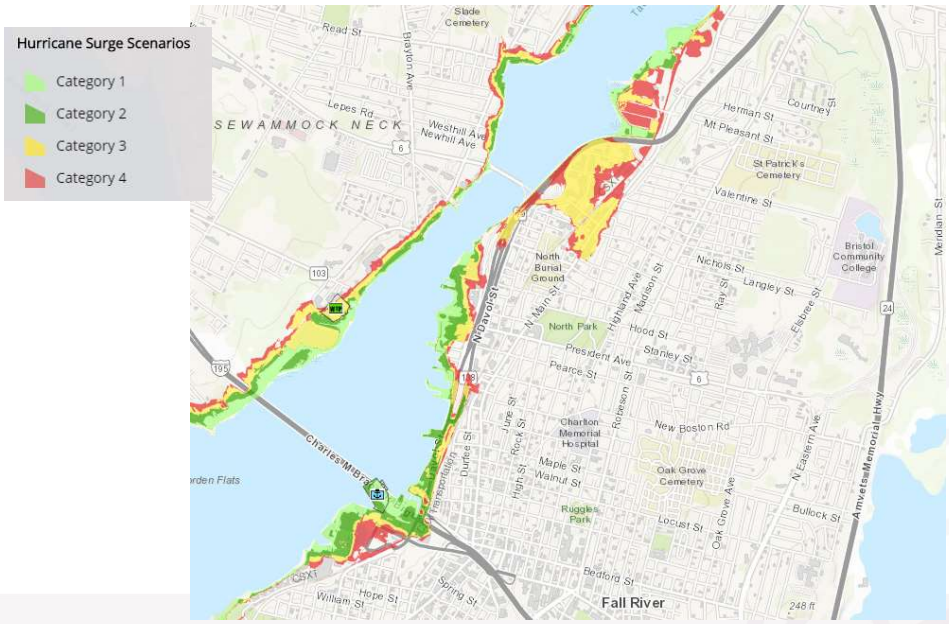
Sea Level Rise Scenarios



38

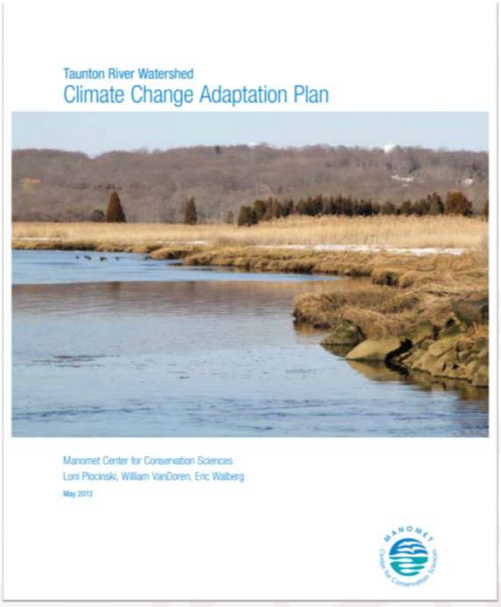
SLOSH Map



39

Taunton River Watershed – Climate Change

- Threat of freshwater flooding, particularly in urban areas with extensive impervious surface cover
- Sea level rise impacting Taunton River and shoreline
  - Has risen approximately ¾ foot in last 100 years in Narragansett Bay
  - Rate of rise projected to increase



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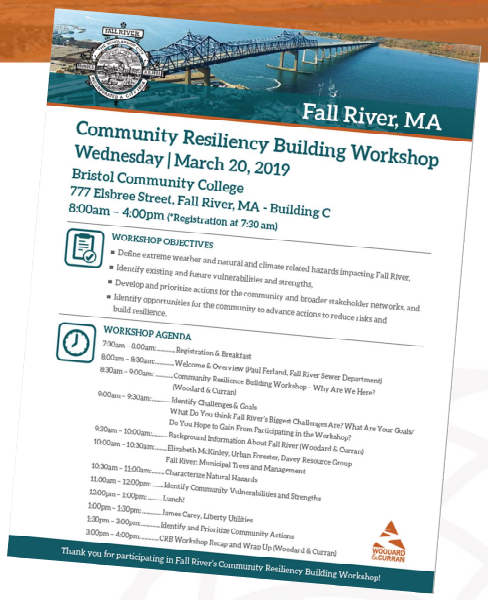
Today, we will work together to….

- Understand connections between ongoing community issues, climate change, natural hazards and local planning and actions
- Understand how climate change will exacerbate or lead to new community issues, hazards and challenges
- Identify infrastructural, societal, environmental vulnerabilities and strengths that help Fall River become more resilient
- Explore nature-based solutions to build resiliency
- Develop and prioritize actions that delineate next steps for the community
- Identify how Fall River can advance actions to reduce risks and impacts of climate change and increase local and regional resilience


Fall River, MA

Community Resiliency Building Workshop
Wednesday | March 20, 2019
Bristol Community College
777 Elsbree Street, Fall River, MA - Building C
8:00am – 4:00pm (*Registration at 7:30 am)

WORKSHOP OBJECTIVES
- Define extreme weather and natural and climate related hazards impacting Fall River.
- Identify existing and future vulnerabilities and strengths.
- Develop and prioritize actions for the community and broader stakeholder networks, and build resilience.
- Identify opportunities for the community to advance actions to reduce risks and

WORKSHOP AGENDA
7:30am – 8:00am: Registration & Breakfast
8:00am – 8:30am: Welcome & Overview (Paul Ferland, Fall River Sewer Department)
8:30am – 9:00am: Community Resilience Building Workshop - Why Are We Here? (Woodard & Curran)
9:00am – 9:30am: Identify Challenges & Goals
What Do You Think Fall River's Biggest Challenges Are? What Are Your Goals/ Do You Hope to Gain From Participating in the Workshop?
9:30am – 10:00am: Background Information About Fall River (Woodard & Curran)
10:00am – 10:30am: Elizabeth McKinley, Urban Forester, Davey Resource Group
Fall River: Municipal Trees and Management
10:30am – 11:00am: Characterize Natural Hazards
11:00am – 12:00pm: Identify Community Vulnerabilities and Strengths
12:00pm – 1:00pm: Lunch!
1:00pm – 1:30pm: James Carey, Liberty Utilities
1:30pm – 3:00pm: Identify and Prioritize Community Actions
3:00pm – 4:00pm: CRB Workshop Recap and Wrap Up (Woodard & Curran)

Thank you for participating in Fall River's Community Resiliency Building Workshop!

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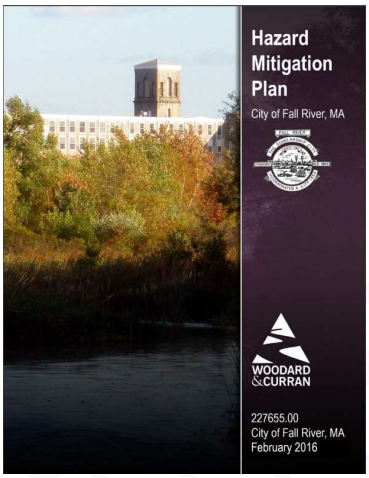
42

Recent Efforts

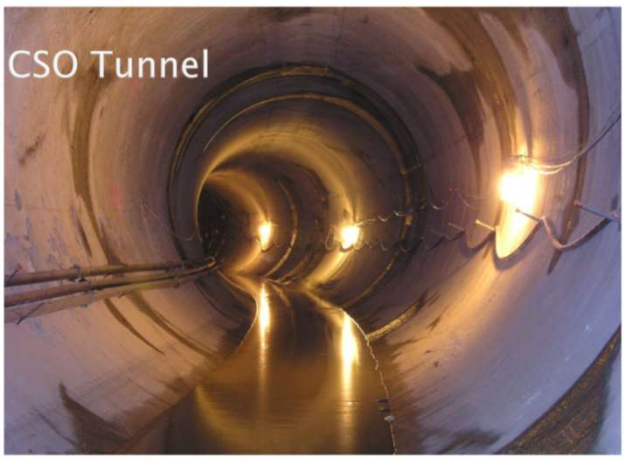
- Fall River has been actively working on addressing climate change impacts through the following projects and planning activities:
  - FEMA Approved Hazard Mitigation Plan (2016)
  - Municipal Vulnerability Preparedness Planning Grant
  - Numerous drainage and flood control improvement projects
  - Integrated Storm/Sewer Master Plan
  - City Pier and Alton Street CSO Drainage Projects
  - EPA Technical Assistance for Green Infrastructure Implementation
  - Street, water main, sidewalk improvements totaling over $45M to more than 400 streets and over 75 miles of roads



43

Recent Efforts

- Integrated Wastewater & Stormwater Master Plan
  - Sewers originally constructed to handle both wastewater and stormwater – conveying combined flow to nearest water body
  - Today, newer developments have separate wastewater and stormwater collection systems
  - 3 mile tunnel storage and conveyance system constructed to provide better management of wet weather flow



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Sewer Department

- Several repeat flooding neighborhoods
- Flooding near Davol Street
- City Pier CSO – needs storage and separation
- Stafford Square – low point in the City, not enough outfalls (can see 4-5 feet of water)
- Interceptor Drain – conveys drainage form City and Route 24 to South Watuppa. Vital to water supply and drainage in City!

Potential Mitigation Measures

- Floodproofing pump stations
- Floodproofing wastewater treatment facility
- Addressing bottlenecks in the sewer system
- Waterfront CSOs… address damaged outfall pipes that are backing up, including those that are submerged

45

Planning Department

- Need to understand vulnerability
- Preparedness for severe weather events such as hurricane
- Socio-economics of the City
- Bedford Street streetscape, Mount Hope Street greenway, Rails to Trails

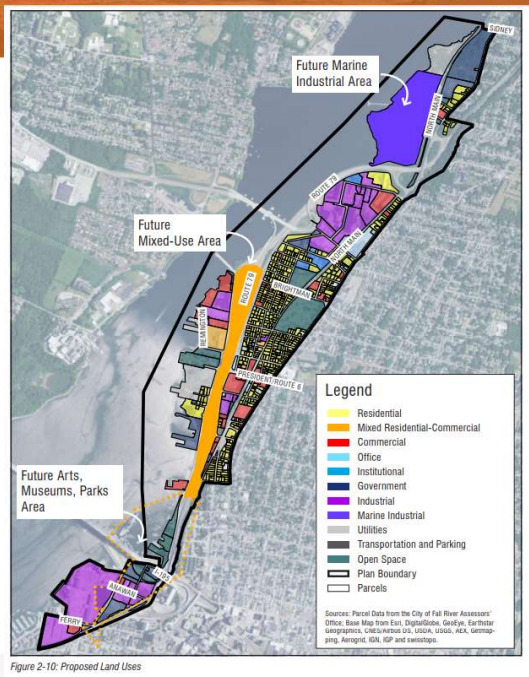

Figure 2-10: Proposed Land Uses

46

Emergency Management

- Concern over low lying areas, intersections
- Diverse city, many different cultures, language barriers
- Stafford Square, Hyacinth
- 900 block of Langley during high precipitation
- Urban trees and downed power lines
- Focus on proactive methods

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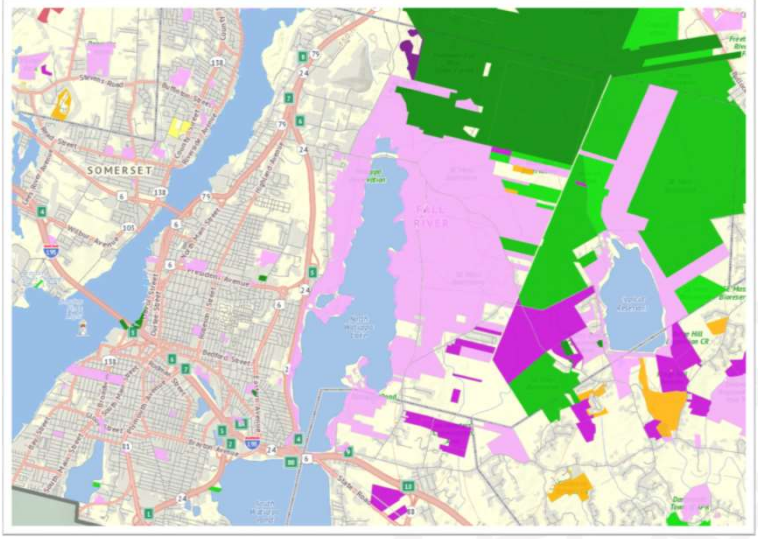
Nature Based Solutions

- 96% of the total US population lives in counties where federally-declared, weather-related disasters have occurred since 2010
- One of the best adaptation practices is preserving natural areas
- Nature-based solutions provide multiple benefits, and a higher return on investment with flood risk reduction strategies



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Nature Based Solutions – Multi Benefits

- Buffer wave action and storm surge
- Store floodwaters, recharge aquifers
- Reduce runoff
- Improve water quality
- Stabilize shorelines
- Provide habitats
- Protect property and property value

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Nature Based Solutions – Fourth Ward, Atlanta, GA

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Nature Based Solutions – Fourth Ward, Atlanta, GA

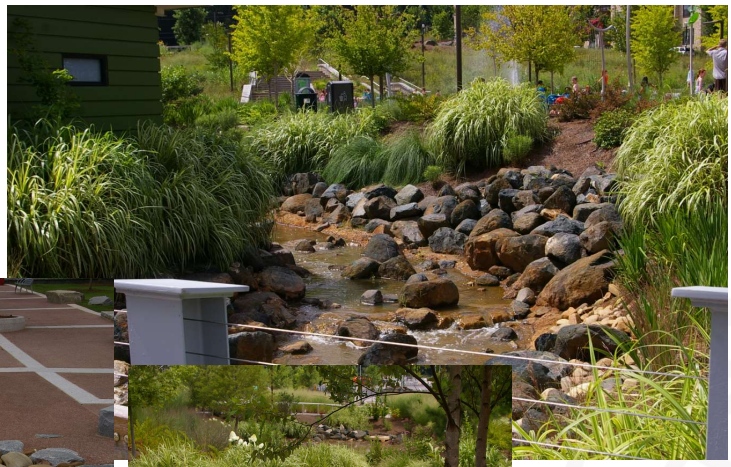
UTILITY GOALS

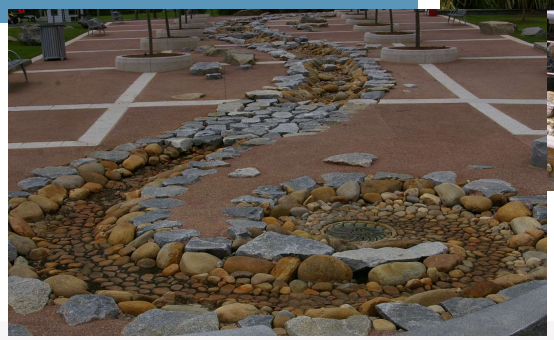
Reduce pollutant loads in rainwater

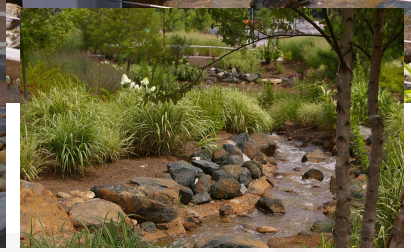
Reduce downstream damage from runoff

Safely move, control, contain rainwater

Restore or create habitat







51

Living Shorelines

- Concept is cost–effective and quickly gaining popularity.
- Broad term that includes range of shoreline stabilization techniques with a footprint that is made up mostly of native material, and incorporates vegetation or other living elements alone or in combination with some type of harder shoreline structure for stability (oyster reef).
- Maintain continuity of the natural land-water relationship and reduce erosion while providing habitat value and enhancing coastal resilience.

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Green Infrastructure & Low Impact Development

- **Green Infrastructure**
  - Incorporates natural features such as floodplains, forests, wetlands, and buffer areas
  - Refers to a designed landscape that puts natural systems to work like soil and vegetation and mimics those natural processes
- **Low Impact Development**
  - Category of green infrastructure that works with nature to manage stormwater and decrease the impact of development on surface and groundwater

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Green Infrastructure & Low Impact Development

- City continues to experience CSO discharges from combined sewer outfalls along shoreline during severe storms
- Fall River specifically wants to use green infrastructure methods to manage stormwater and improve water quality and benefits to community (increased tree canopy)

Photo: Birch Street Outfall

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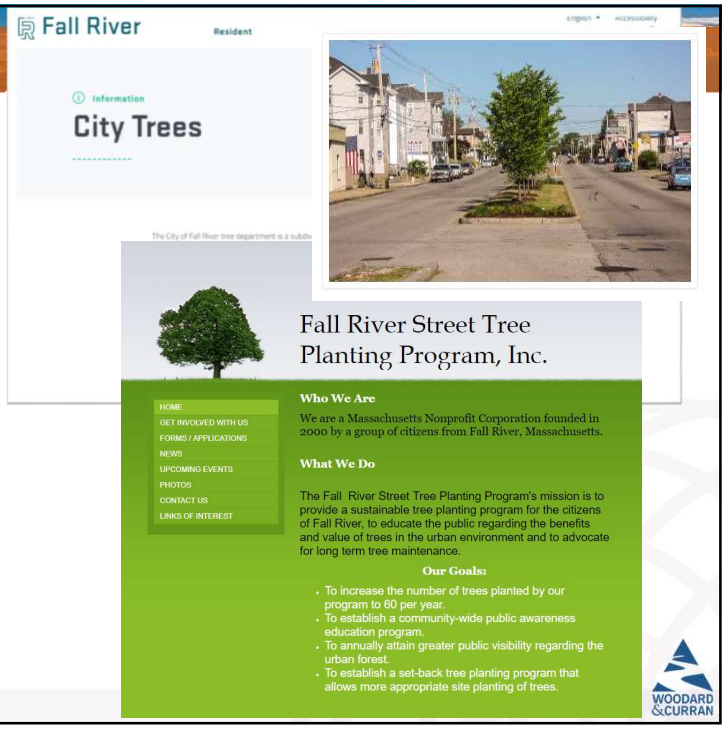
Fall River Tree Program

- Fall River selected by the state to implement a new energy efficient tree planting initiative
  - Plant up to 15,000 trees to reduce energy use in neighborhoods, lower heating and cooling costs
- Fall River Tree Committee
  - Urban tree nursery supported by volunteers



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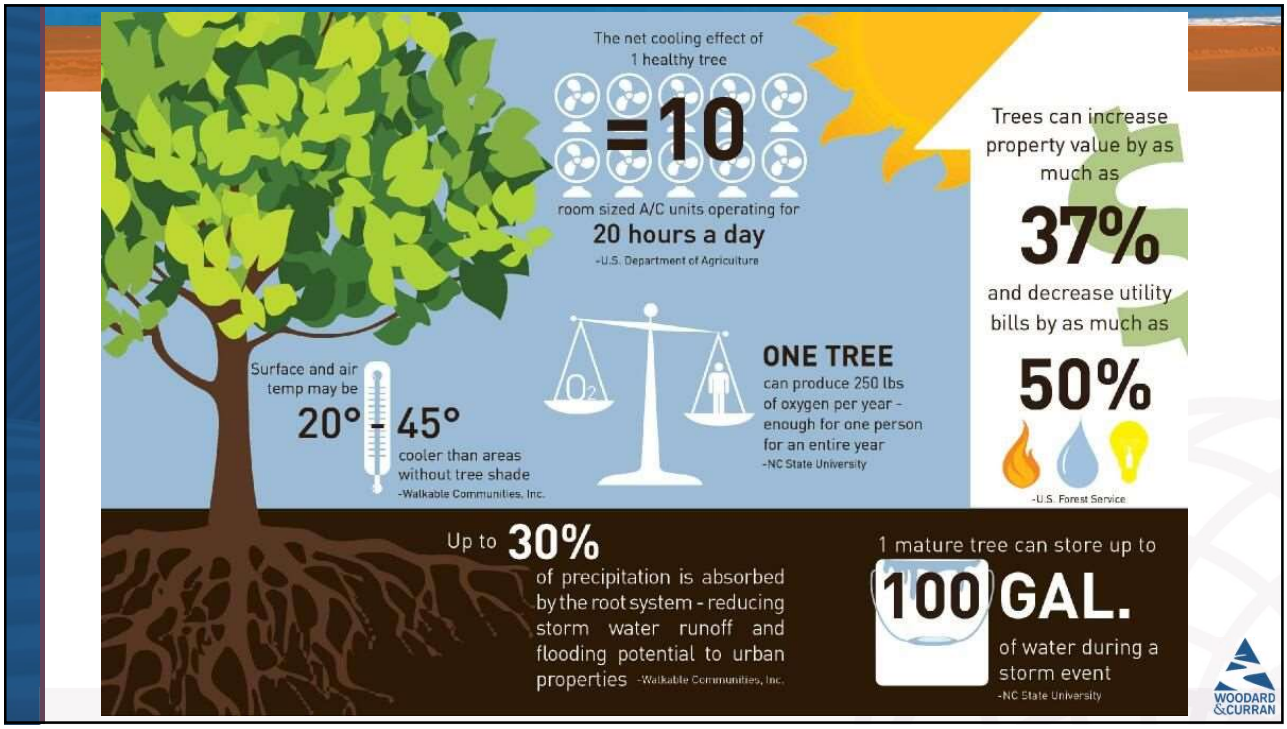

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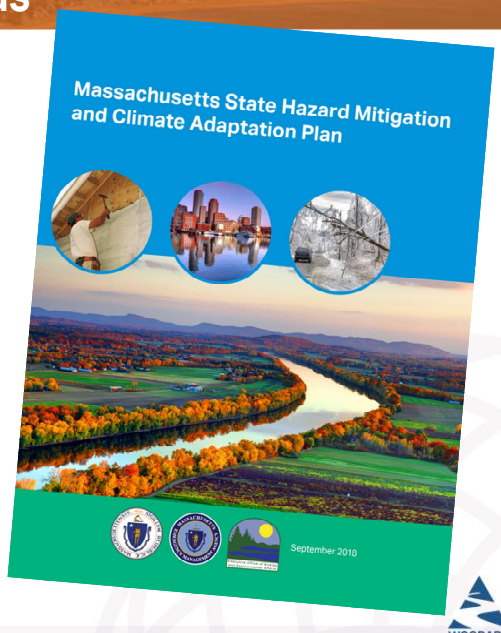
Nature Based Solutions – State Focus

- State hazard mitigation and climate adaptation strategy focuses on nature based solutions
- For implementation of certain State grant or State administered grant programs – emphasis is or may be placed on projects that outline a nature based solution



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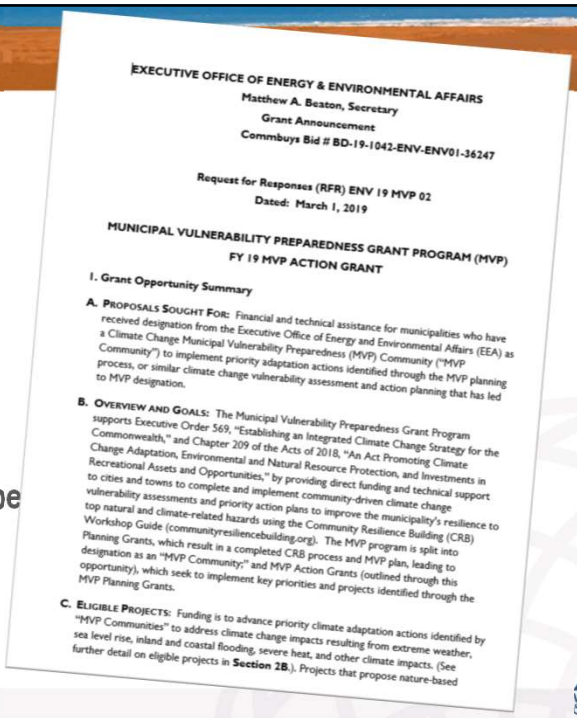
MVP Action Grant

- Projects that **build resilience**, are **proactive** and clearly demonstrate efforts to redesign, re-evaluate, or reconsider and **incorporate new climate change** data.
- Projects are encouraged to utilize **nature-based strategies** to address climate change impacts.
- **Many of these projects might also be funded through existing grant programs** (Dams and Seawalls, CZM Coastal Resiliency, DER's Culvert Replacements, MEMA)



EXECUTIVE OFFICE OF ENERGY & ENVIRONMENTAL AFFAIRS
Matthew A. Beaton, Secretary
Grant Announcement
Commbuys Bid # BD-19-1042-ENV-ENV01-36247

Request for Responses (RFR) ENV 19 MVP 02
Dated: March 1, 2019

MUNICIPAL VULNERABILITY PREPAREDNESS GRANT PROGRAM (MVP)
FY 19 MVP ACTION GRANT

1. Grant Opportunity Summary

A. PROPOSALS SOUGHT FOR: Financial and technical assistance for municipalities who have received designation from the Executive Office of Energy and Environmental Affairs (EEA) as a Climate Change Municipal Vulnerability Preparedness (MVP) Community ("MVP Community") to implement priority adaptation actions identified through the MVP planning process, or similar climate change vulnerability assessment and action planning that has led to MVP designation.

B. OVERVIEW AND GOALS: The Municipal Vulnerability Preparedness Grant Program supports Executive Order 569, "Establishing an Integrated Climate Change Strategy for the Commonwealth," and Chapter 209 of the Acts of 2018, "An Act Promoting Climate Change Adaptation, Environmental and Natural Resource Protection, and Investments in Recreational Assets and Opportunities," by providing direct funding and technical support to cities and towns to complete and implement community-driven climate change vulnerability assessments and priority action plans to improve the municipality's resilience to top natural and climate-related hazards using the Community Resilience Building (CRB) Workshop Guide (communityresiliencebuilding.org). The MVP program is split into Planning Grants, which result in a completed CRB process and MVP plan, leading to designation as an "MVP Community;" and MVP Action Grants (outlined through this opportunity), which seek to implement key priorities and projects identified through the MVP Planning Grants.

C. ELIGIBLE PROJECTS: Funding is to advance priority climate adaptation actions identified by "MVP Communities" to address climate change impacts resulting from extreme weather, sea level rise, inland and coastal flooding, severe heat, and other climate impacts. (See further detail on eligible projects in **Section 2B**.). Projects that propose nature-based

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But What Can I Do?

- Be an MVP community – participate, tell your neighbors, friends and colleagues about it!
- Talk to neighbors, friends, local board members and others in the community about Climate Change
- Make your vote count!
- Incorporate Climate Change and nature based solutions into all of your local and regional plans – including the LCP

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Community Resiliency Building Workshop

Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.org

H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S					Priority H-M-L	Time Short Long Ongoing
Infrastructural									
Societal									
Environmental									

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Community Resiliency Building Workshop

- 7:30 – 8:00 | Registration
- 8:00 – 8:30 | Welcome & Overview
- 8:30 – 9:00 | CRB Workshop Why Are We Here?
- 9:00 – 9:30 | Identify Challenges & Goals
- 9:30 – 10:00 | Background Information About Fall River
- 10:00 – 10:30 | Elizabeth McKinley, Davey Resource Group
- 10:30 – 11:00 | Characterize Natural Hazards
- 11:00 – 12:00 | Identify Community Vulnerabilities & Strengths
- 12:00 – 1:00 | LUNCH!
- 1:00 – 1:30 | James Carey, Liberty Utilities
- 1:30 – 3:00 | Identify & Prioritize Community Actions
- 3:00 – 4:00 | CRB Workshop Recap & Wrap Up

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Fall River, MA
Municipal Vulnerability Preparedness Listening Session

April 29, 2019

1

Agenda

- Overview of Community Resiliency Building Workshop
- Question & Answer

Note: *Please utilize the notecards available to share any concerns or ideas that you have and would like to make sure are documented as a part of this process. Thank you!*

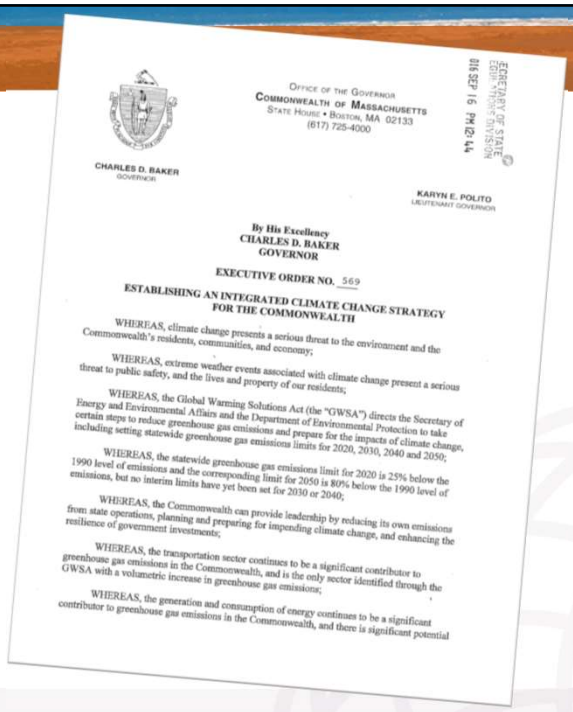
2

Background Information

3

Executive Order 569

- In September 2016, Governor Charlie Baker signed Executive Order 569, instructing state government to **provide assistance to cities and towns to complete climate change vulnerability assessments and resiliency planning**



OFFICE OF THE GOVERNOR
COMMONWEALTH OF MASSACHUSETTS
STATE HOUSE • BOSTON, MA 02133
(617) 725-4000

CHARLES D. BAKER
GOVERNOR

KARYN E. POLITO
LIEUTENANT GOVERNOR

By His Excellency
CHARLES D. BAKER
GOVERNOR

EXECUTIVE ORDER NO. 569

ESTABLISHING AN INTEGRATED CLIMATE CHANGE STRATEGY FOR THE COMMONWEALTH

WHEREAS, climate change presents a serious threat to the environment and the Commonwealth's residents, communities, and economy;

WHEREAS, extreme weather events associated with climate change present a serious threat to public safety, and the lives and property of our residents;

WHEREAS, the Global Warming Solutions Act (the "GWSA") directs the Secretary of Energy and Environmental Affairs and the Department of Environmental Protection to take certain steps to reduce greenhouse gas emissions and prepare for the impacts of climate change, including setting statewide greenhouse gas emissions limits for 2020, 2030, 2040 and 2050;

WHEREAS, the statewide greenhouse gas emissions limit for 2020 is 25% below the 1990 level of emissions and the corresponding limit for 2050 is 80% below the 1990 level of emissions, but no interim limits have yet been set for 2030 or 2040;

WHEREAS, the Commonwealth can provide leadership by reducing its own emissions from state operations, planning and preparing for impending climate change, and enhancing the resilience of government investments;

WHEREAS, the transportation sector continues to be a significant contributor to greenhouse gas emissions in the Commonwealth, and is the only sector identified through the GWSA with a volumetric increase in greenhouse gas emissions;

WHEREAS, the generation and consumption of energy continues to be a significant contributor to greenhouse gas emissions in the Commonwealth, and there is significant potential

4

August 2018

- Governor Baker signed legislation directing $2.4 billion to Climate Change Adaptation, Environmental Protection and Community Investments
- $$ allocated capital for investments in safeguarding residents, municipalities and businesses from the impacts of climate change, protecting environmental resources, and improving recreational opportunities
- The $$ enables critical environmental investments at the state and local levels and will put into law essential components of Governor Baker's Executive Order 569

Photo: Mass.gov Press Release, August 2018

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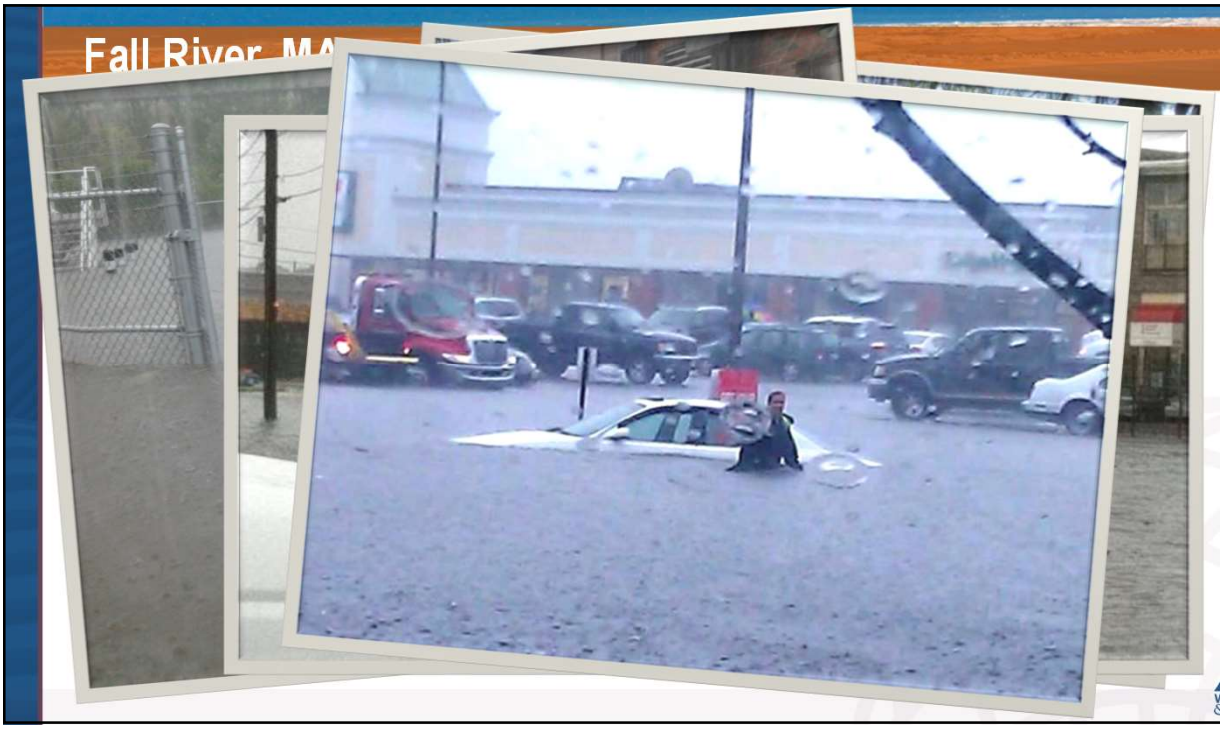
Fall River, MA



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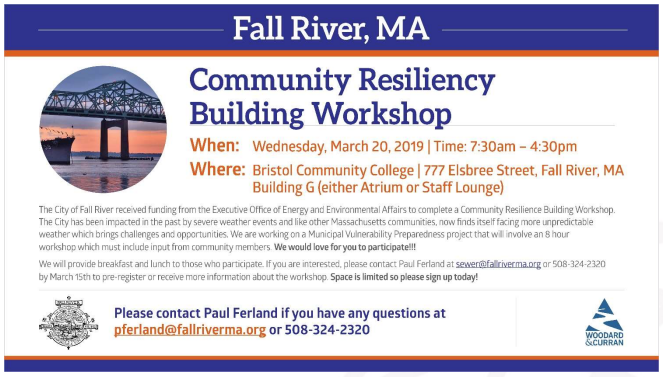
Municipal Vulnerability Preparedness (MVP) Grant Program

- The program helps communities achieve the following objectives:
  - Define extreme weather and natural and climate related hazards
  - Identify existing and future vulnerabilities and strengths
  - Develop and prioritize actions for the community
  - Identify opportunities to take action to reduce risk and build resilience



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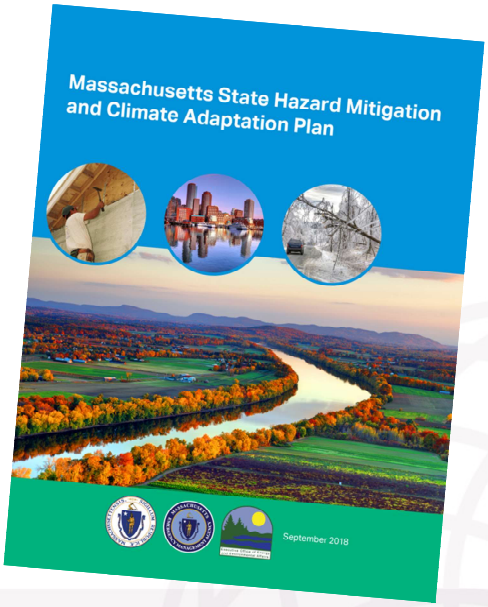
Municipal Vulnerability Preparedness (MVP) Grant Program

- MVP Principles
  - **Community-led process** that employs local knowledge and requires local buy-in and support
  - **Accessible** to everyone
  - **Utilizes partnerships** and leverages existing efforts
  - **Mainstreams** climate change
  - **See communities** as local innovators
  - **Frames** coordinated statewide efforts



8

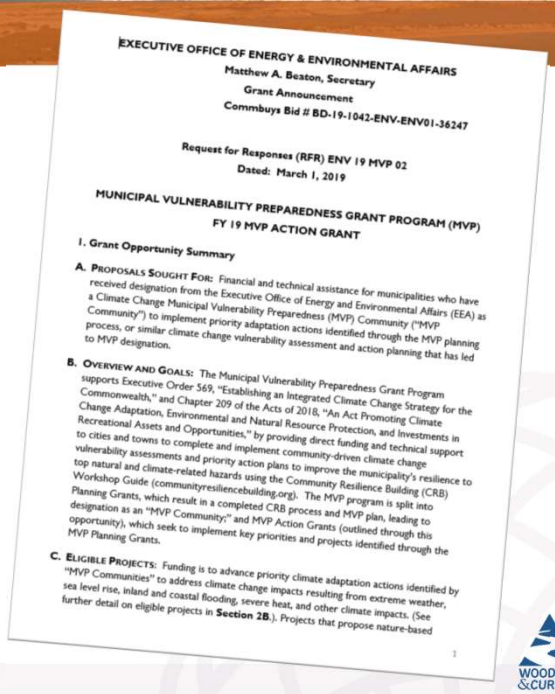
Municipal Vulnerability Preparedness (MVP) Grant Program

- Communities who complete the MVP program become certified as an MVP community and are eligible for potential follow-up grant funding and other opportunities.

9

MVP Action Grant Program

- Current MVP Action Grant Program recently closed!
- Applications were Due April 19, 2019 – may be a second round for current planning communities where applications are due in June
- Fall River would be eligible for June because of MVP Planning participation
- Can apply for up to $2,000,000
- Projects that propose nature-based solutions or green infrastructure will receive higher scores
- Eligible projects: detailed vulnerability and risk assessment, public education and communication, local bylaws, redesign and retrofit, nature based storm damage protection, nature based infrastructure, eco restoration



EXECUTIVE OFFICE OF ENERGY & ENVIRONMENTAL AFFAIRS
Matthew A. Beaton, Secretary
Grant Announcement
Commbuys Bid # BD-19-1042-ENV-ENV01-36247

Request for Responses (RFR) ENV 19 MVP 02
Dated: March 1, 2019

MUNICIPAL VULNERABILITY PREPAREDNESS GRANT PROGRAM (MVP)
FY 19 MVP ACTION GRANT

1. Grant Opportunity Summary

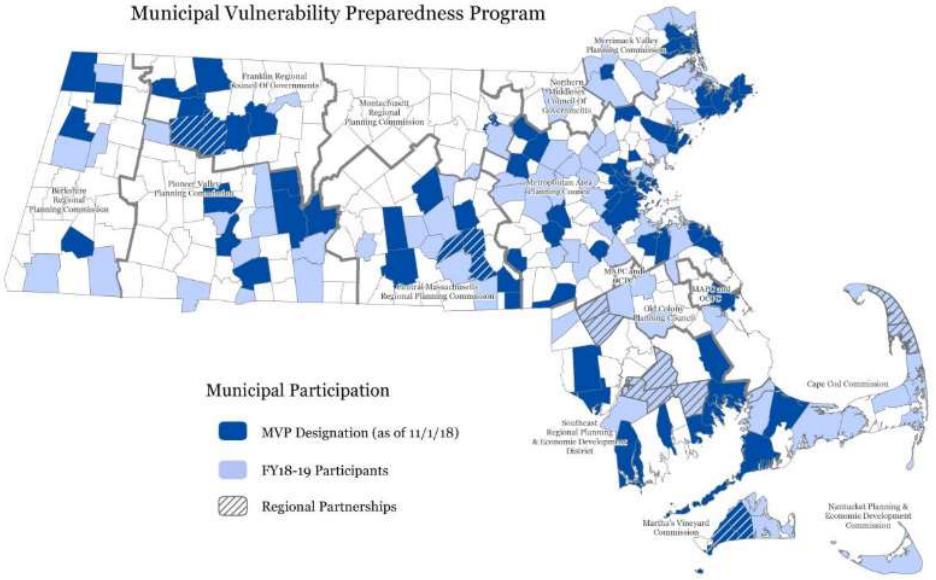
A. PROPOSALS SOUGHT FOR: Financial and technical assistance for municipalities who have received designation from the Executive Office of Energy and Environmental Affairs (EEA) as a Climate Change Municipal Vulnerability Preparedness (MVP) Community ("MVP Community") to implement priority adaptation actions identified through the MVP planning process, or similar climate change vulnerability assessment and action planning that has led to MVP designation.

B. OVERVIEW AND GOALS: The Municipal Vulnerability Preparedness Grant Program supports Executive Order 569, "Establishing an Integrated Climate Change Strategy for the Commonwealth," and Chapter 209 of the Acts of 2018, "An Act Promoting Climate Change Adaptation, Environmental and Natural Resource Protection, and Investments in Recreational Assets and Opportunities," by providing direct funding and technical support to cities and towns to complete and implement community-driven climate change vulnerability assessments and priority action plans to improve the municipality's resilience to top natural and climate-related hazards using the Community Resilience Building (CRB) Workshop Guide (communityresiliencebuilding.org). The MVP program is split into Planning Grants, which result in a completed CRB process and MVP plan, leading to designation as an "MVP Community;" and MVP Action Grants (outlined through this opportunity), which seek to implement key priorities and projects identified through the MVP Planning Grants.

C. ELIGIBLE PROJECTS: Funding is to advance priority climate adaptation actions identified by "MVP Communities" to address climate change impacts resulting from extreme weather, sea level rise, inland and coastal flooding, severe heat, and other climate impacts. (See further detail on eligible projects in **Section 2B**.). Projects that propose nature-based

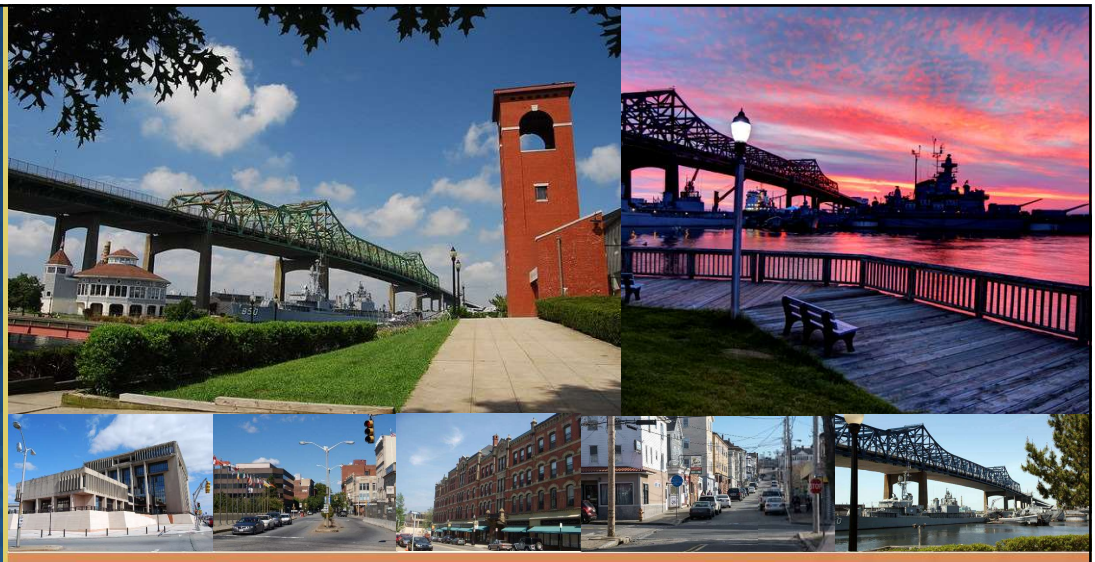
10

What Other Communities Are in the MVP Program?



WOODARD &CURRAN

11



Community Resiliency Building Workshop Results

WOODARD &CURRAN

12

Community Resiliency Building Workshop

THANK YOU

13

Community Resiliency Building Workshop

- CRB Workshop Held on March 20, 2019
- Welcome & Overview
- Individual Challenges and Goals
- Background Information About Fall River
- Fall River Municipal Trees & Management – Liz McKinley
- Characterize Natural Hazards
- Identified Community Vulnerabilities and Strengths
- Liberty Utilities Discussion – Jim Carey
- Identify and Prioritize Community Actions
- CRB Recap and Next Steps

14

Community Resiliency Building Workshop

- As part of the MVP program, Fall River completed the Community Resiliency Building Workshop on March 20th
- An additional 3 sessions will be held in the next few weeks for residents and businesses in the Portuguese community
- Upon completion of this work, a summary report will be submitted to EEA
- Fall River will continue to use this Summary of Findings to reinforce future planning and action item implementation

15

At the workshop we worked together to….

- Understand connections between ongoing community issues, climate change, natural hazards and local planning and actions
- Understand how climate change will exacerbate or lead to new community issues, hazards and challenges
- Identify infrastructural, societal, environmental vulnerabilities and strengths that help Fall River become more resilient
- Explore nature-based solutions to build resiliency
- Develop and prioritize actions that delineate next steps for the community
- Identify how Fall River can advance actions to reduce risks and impacts of climate change and increase local and regional resilience


Fall River, MA

Community Resiliency Building Workshop
Wednesday | March 20, 2019
Bristol Community College
777 Elsbree Street, Fall River, MA - Building C
8:00am – 4:00pm (*Registration at 7:30 am)

WORKSHOP OBJECTIVES
- Define extreme weather and natural and climate related hazards impacting Fall River.
- Identify existing and future vulnerabilities and strengths.
- Develop and prioritize actions for the community and broader stakeholder networks, and build resilience.
- Identify opportunities for the community to advance actions to reduce risks and

WORKSHOP AGENDA
7:30am – 8:00am: ..... Registration & Breakfast
8:00am – 8:30am: ..... Welcome & Overview (Paul Forland, Fall River Sewer Department)
8:30am – 9:00am: ..... Community Resilience Building Workshop – Why Are We Here? (Woodard & Curran)
9:00am – 9:30am: ..... Identify Challenges & Goals
What Do You think Fall River's Biggest Challenges Are? What Are Your Goals/ Do You Hope to Gain From Participating in the Workshop?
9:30am – 10:00am: ..... Background Information About Fall River (Woodard & Curran)
10:00am – 10:30am: ..... Elisabeth McKinley, Urban Forester, Davey Resource Group
Fall River: Municipal Trees and Management
10:30am – 11:00am: ..... Characterize Natural Hazards
11:00am – 12:00pm: ..... Identify Community Vulnerabilities and Strengths
12:00pm - 1:00pm: ..... Lunch!
1:00pm – 1:30pm: ..... James Carey, Liberty Utilities
1:30pm – 3:00pm: ..... Identify and Prioritize Community Actions
3:00pm – 4:00pm: ..... CBR Workshop Recap and Wrap Up (Woodard & Curran)

Thank you for participating in Fall River's Community Resiliency Building Workshop!

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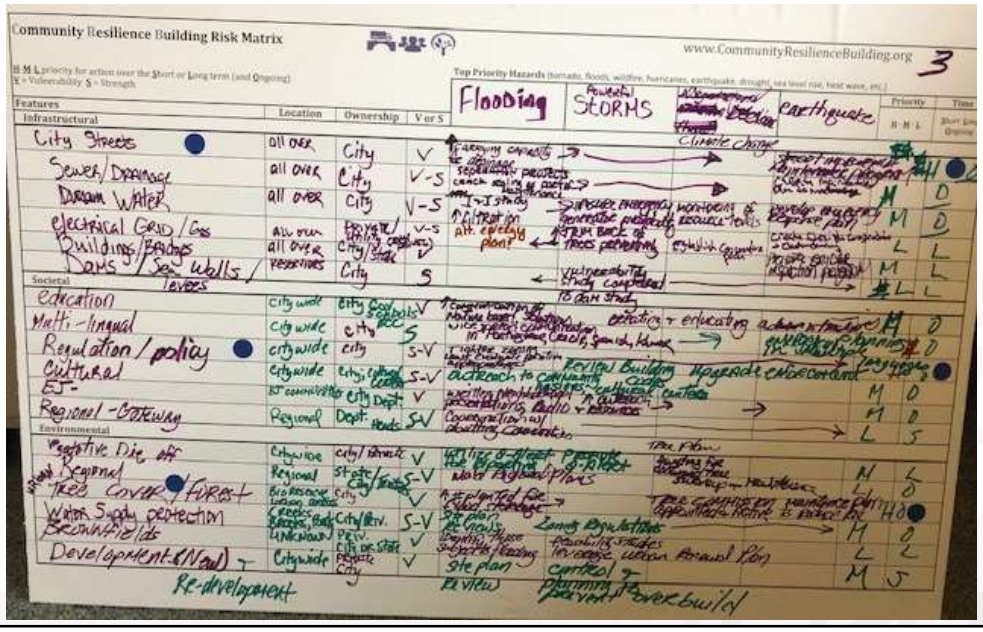
Community Resiliency Building Workshop



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Community Resiliency Building Workshop

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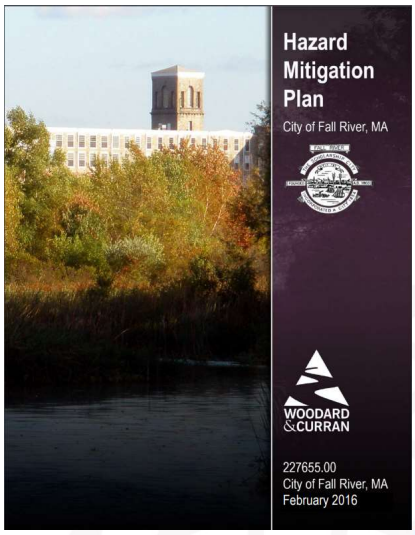
Natural Hazards Impacting Fall River

- Flood
- Hurricane
- Severe Winter Storm
- Nor'Easter/Coastal Storm
- Windstorm
- Thunder & Lightning
- Wildfire
- Extreme Temperature (Heat/Cold)
- Ice Storm
- Dam Failure
- Tornado
- Earthquake
- Coastal Erosion
- Drought
- Sea Level Rise
- Climate Change



19

Known Flooding Issues

- Stafford Square, Davol Street, Alden Street, Brayton Avenue, Cress Brook, Middle Street, North Main Street, Central, Cove, Collins, Cherry, Remington, Mackenzie, Winslow
- Major flooding near City Pier
- Quequechan River subject to flooding

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Hazard Mitigation Plan Actions

- Tree management plan and program
- Secure generators for critical facilities
- Formal shelter plan
- Evaluate pump stations, WWTF for resiliency measures
- Upgrade emergency communications system
- Address National Grid substation which is in a floodplain
- Upgrade and clean culverts (Steep Brook, Terry Brook, Collins Street)
- Restore Mothers Brook
- Reconstruct North Watuppa Pond Causeway and upgrade and clean the interceptor
- Quequechan River – upgrade and clean existing infrastructure, reroute downstream portions of river
- Replace sewer Alden Street

WOODARD &CURRAN

21

CRB Workshop – What We Heard From YOU!

- Challenges
  - Aging infrastructure
  - Cost of projects
  - Protecting drinking water supply
  - City staffing reactionary and not planning for the future
  - Infrastructure funding
  - Education of residents
  - Employment opportunities
  - Drugs
  - Coastal flooding
  - Underground explosions
  - Mitigation planning

- Challenges
  - Flooding and flood control
  - Watershed protection and maintenance
  - Managing CSO issues
  - Illegal dumping
  - Infrastructure
  - Roads and fire protection in reservation area
  - Tree management
  - Major fires
  - Politics
  - Limited resources
  - Leveraging our natural resource areas

WOODARD &CURRAN

22

CRB Workshop – What We Heard From YOU!

- Goals
  - Learn about issues other departments are having
  - Learn about the vision
  - Understand infrastructure needs to better access grant funding
  - Learn what community issues are
  - Build awareness
  - Understand more about natural hazards
  - Develop solutions
  - Call attention to problems
  - Develop political will to tackle and maintain focus on issues

- Goals
  - Assist City with MVP certification process
  - Maintain fiscal responsibility
  - Provide quality services to residents and businesses
  - Figure out what projects to focus on
  - Support additional tree program, planting and management

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Community Resiliency Building Workshop - Outcomes

- Top Natural Hazards Identified By Participants
  - **Flooding**
  - **Severe Storms/Wind**
  - **Hurricane**
  - **Earthquake**
  - Sea Level Rise
  - Severe Storms/Wind
  - Fire
  - Chemical/Hazardous Waste
  - Climate Change

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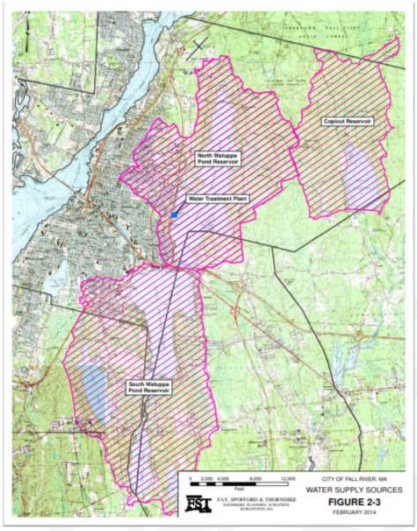
CRB Workshop – Infrastructure Vulnerabilities

- Drainage System
- CSOs
- Drinking Water
- Wastewater Treatment
- Pump Stations
- Roadways
- Public Utilities
- Inadequate Stormwater Capacity
- Reservation Road Quality
- Industrial/Commercial Uses Along Shoreline
- Bridges
- Coastal Infrastructure



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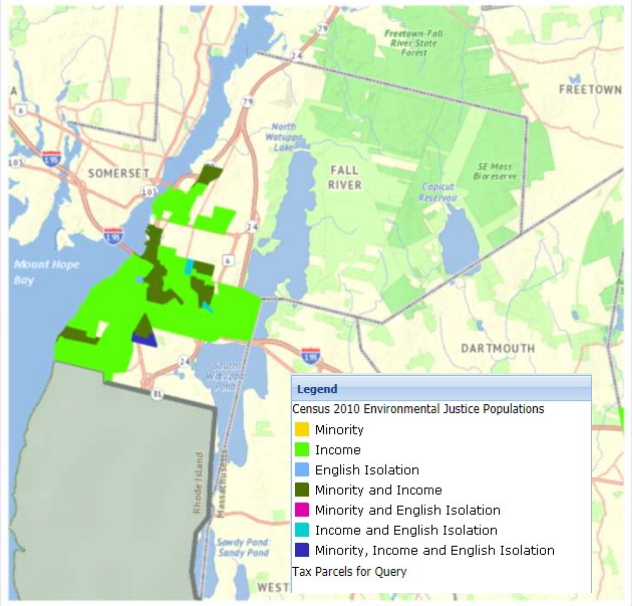
CRB Workshop – Societal Vulnerabilities



- Multi-Lingual
- Regulations, Policies
- Cultural
- Environmental Justice
- Abandoned Property and Mills
- Emergency Management
- Communication
- Vulnerable Populations
- Health, Medical
- Economic Conditions
- Evacuation

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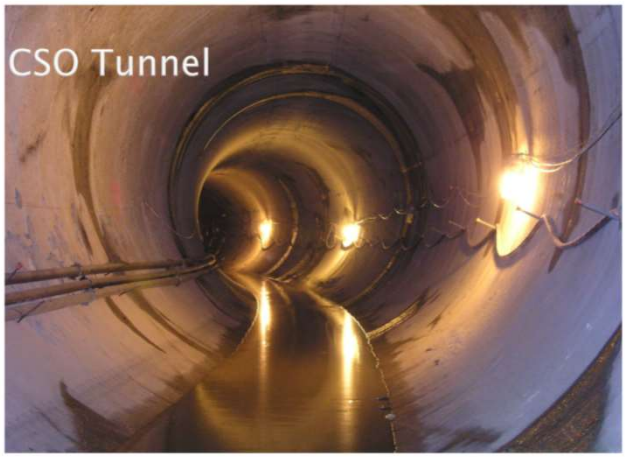
CRB Workshop – Environmental Vulnerabilities

- Trees
- Pollution
- Air Quality
- Illegal Dumping
- Hazardous Materials
- Land Use Surrounding Watershed/Water Supply Protection
- Brownfields
- Shellfish Areas
- Recreation at South Watuppa
- Water Supply
- Urban Green Space
- Wetlands
- Open Space

27

CRB Workshop – Infrastructure Strengths

- Existing Trees in City
- Sewer System
- Water System
- Utilities (Electric, Gas)
- Dams, Seawalls, Levees
- Commercial Transportation Routes
- Drainage System
- Pump Stations



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CRB Workshop – Societal Strengths

- Multi-Lingual
- Cross Cultural City
- Existing Regulations and Policies
- Regional Gateway
- Evacuation Plan
- Communication
- Shelters
- Emergency Management

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CRB Workshop – Environmental Strengths

- Water Supply for Fall River and Other Communities
- Urban Green Space
- Tree Management
- Open Space
- Wetlands
- Water Resources
- Green Infrastructure
- Land Use of Watershed Area

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Community Resiliency Building Workshop - Outcomes

- Top 3 Recommendations to Improve Resiliency
  - Used Dot Exercise to refine the top priorities

Rank	Action	
1	Drinking Water System (44 dots)	Consider, design and construct a redundant water main to serve the public drinking water system. Implement action items from the 2014 Integrated Plan and also address security, fencing, cameras and the control system (SCADA). Also desire to understand climate change impacts to drinking water supply.
2	Sewer & Drainage Infrastructure (35 dots received)	Clean, maintain, replace, upgrade, hardening and reinforcing existing utilities. There is a need to increase or improve stormwater capacity and incorporate green infrastructure to address urban flooding in the City. Fall River's Integrated Plan includes implementation steps that support this Action and this should be referenced. Addressing the culvert under the railroad is also a priority. Specifically address Stafford Square flooding.
3	Urban Trees (22 dots received)	Inventory existing trees in the City and develop necessary management, maintenance and organization capacity to foster a strong urban tree program.

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Community Resiliency Building Workshop - Outcomes

- Other Recommendations to Improve Resiliency
  - Used Dot Exercise to refine the top priorities

Rank	Action	
4	City Regulations and Policies (21 dots received)	Improve city regulations and policies as they relate to flooding and climate change. Leverage regulations and requirements to improve City resiliency long term.
5	Communication (19 dots received)	Continued communication to a variety of audiences about the City's vulnerabilities and opportunities for improved resiliency.
6	Roadway Access at the Reservation (16 dots received)	Improve roadway access at the reservation to and from the water supply and surrounding area. Concern over drought and wildfires and not being able to adequately access this area.
7	City Street Repair (13 dots received)	Continue repair of City Streets and include drainage capacity considerations. Inventory and maintenance plan is needed.

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Community Resiliency Building Workshop – Q & A

- What questions do you have?
- What comments do you have?
- Can we clarify something for you?
- What else do you want to make sure we capture through this CRB process?
- Do you have feedback or a question you would like to submit via notecard?

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Next Steps

- Conduct three additional workshops with Portuguese community
- Finalize CRB report and submit to EEA
- Upon review of CRB report by EEA, become a Certified MVP Community
- Seek out and apply for funding opportunities through grant programs for MVP communities (next opportunity June 2019!)
- Seek out and continue to apply for funding opportunities through other grant programs – CZM, PDM, FMA
- Prepare annual progress reports on MVP Implementation progress
- Continue to communicate with and engage Fall River community in resiliency discussions and decisions

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Maplewood Neighborhood Association

Municipal Vulnerability Preparedness

The City of Fall River is participating in the State Municipal Vulnerability Preparedness (MVP) program to become a certified MVP community. The program helps communities in the Commonwealth achieve the following objectives:

- Define extreme weather and natural and climate related hazards
- Identify existing and future vulnerabilities and strengths
- Develop and prioritize actions for the community
- Identify opportunities to take action to reduce risk and build resilience

Fall River has completed a workshop and listening session for this certification and would like additional feedback from you - please consider attending! Thank you!

Date: May 15, 2019

Time: 6:30pm

Location: Letourneau Elementary School

Note: Portuguese Translation Available

If you have any questions or need additional information prior to the meeting, please contact sewer@fallriverma.org

WOODARD &CURRAN

North End Neighborhood Association

Municipal Vulnerability Preparedness

The City of Fall River is participating in the State Municipal Vulnerability Preparedness (MVP) program to become a certified MVP community. The program helps communities in the Commonwealth achieve the following objectives:

- Define extreme weather and natural and climate related hazards
- Identify existing and future vulnerabilities and strengths
- Develop and prioritize actions for the community
- Identify opportunities to take action to reduce risk and build resilience

Fall River has completed a workshop and listening session for this certification and would like additional feedback from you - please consider attending! Thank you!

Date: May 15, 2019

Time: 6:30pm

Location: Morton Middle School

If you have any questions or need additional information prior to the meeting, please contact sewer@fallriverma.org

WOODARD &CURRAN

Niagara Neighborhood Association

Municipal Vulnerability Preparedness

The City of Fall River is participating in the State Municipal Vulnerability Preparedness (MVP) program to become a certified MVP community. The program helps communities in the Commonwealth achieve the following objectives:

- Define extreme weather and natural and climate related hazards
- Identify existing and future vulnerabilities and strengths
- Develop and prioritize actions for the community
- Identify opportunities to take action to reduce risk and build resilience

Fall River has completed a workshop and listening session for this certification and would like additional feedback from you - please consider attending! Thank you!

Date: May 20, 2019

Time: 6:00pm

Location: Green School

Note: Portuguese Translation Available

If you have any questions or need additional information prior to the meeting, please contact sewer@fallriverma.org

WOODARD &CURRAN

South End Neighborhood Association

Municipal Vulnerability Preparedness

The City of Fall River is participating in the State Municipal Vulnerability Preparedness (MVP) program to become a certified MVP community. The program helps communities in the Commonwealth achieve the following objectives:

- Define extreme weather and natural and climate related hazards
- Identify existing and future vulnerabilities and strengths
- Develop and prioritize actions for the community
- Identify opportunities to take action to reduce risk and build resilience

Fall River has completed a workshop and listening session for this certification and would like additional feedback from you - please consider attending! Thank you!

Date: June 6, 2019

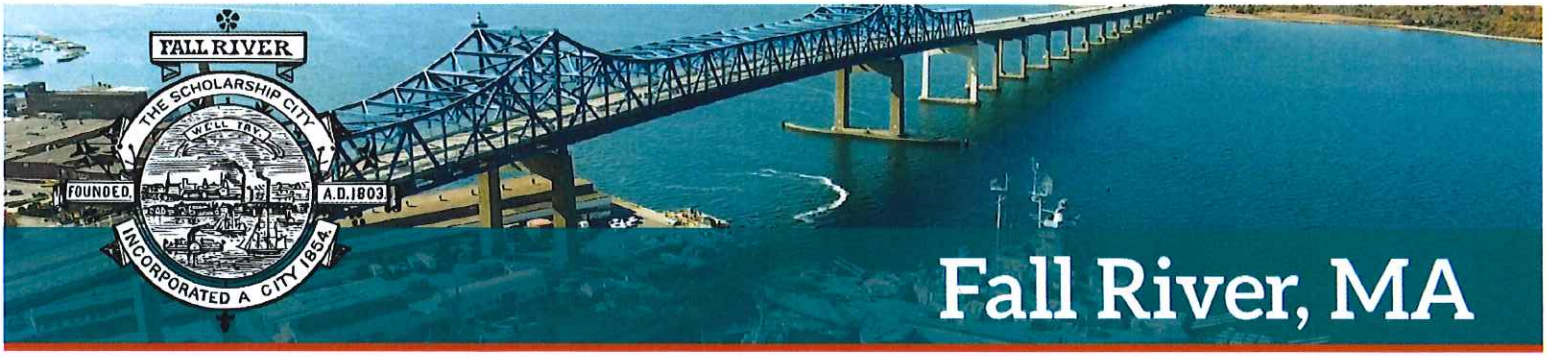
Time: 6:30pm

Location: Good Shepard Parish Hall

Note: Portuguese Translation Available

If you have any questions or need additional information prior to the meeting, please contact sewer@fallriverma.org

WOODARD &CURRAN



Flint Neighborhood Association

Municipal Vulnerability Preparedness

The City of Fall River is participating in the State Municipal Vulnerability Preparedness (MVP) program to become a certified MVP community. The program helps communities in the Commonwealth achieve the following objectives:

- Define extreme weather and natural and climate related hazards
- Identify existing and future vulnerabilities and strengths
- Develop and prioritize actions for the community
- Identify opportunities to take action to reduce risk and build resilience

Fall River has completed a workshop and listening session for this certification and would like additional feedback from you - please consider attending! Thank you!

Date: June 26, 2019

Time: 6:30pm

Location: Fonseca School

If you have any questions or need additional information prior to the meeting, please contact sewer@fallriverma.org

WOODARD &CURRAN

PLANTING THE SEEDS OF SUCCESS.

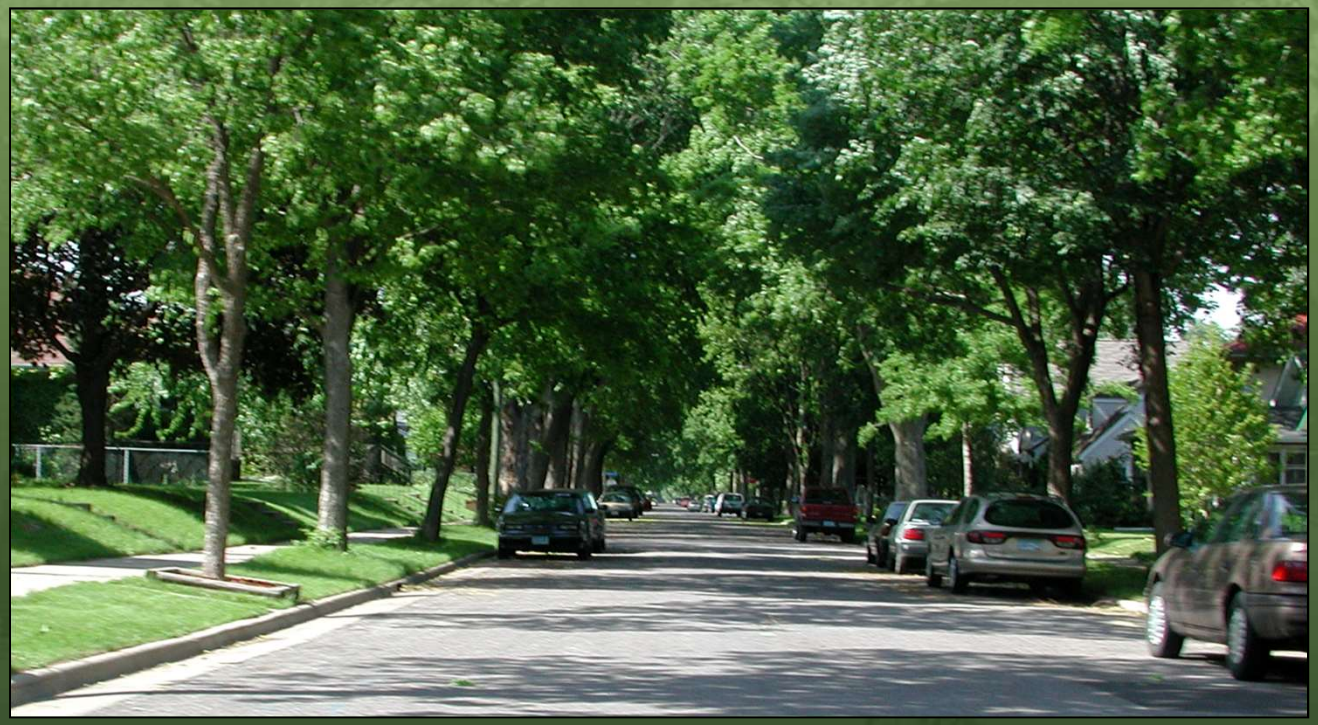
Fall River: Municipal Trees & Management

Liz McKinley, Urban Forester
ISA Certified Arborist – NE-7108A

City Trees
Streets, Parks, and Public Properties


Trees. Worth Our Time.
Worth Our Resources.
• Part of community infrastructure
• Vital to community health
• Community legacy
• Positive impact on business and homes
• Wise investment of community dollars

Trees. Vital to Community Health.



- Tree-filled neighborhoods are safer and more sociable
- Tree-filled landscapes reduce stress
- Trees decrease need for medication and speed recovery times

Trees. Important to Human Health.

In a recent study the U.S. Forest Service calculated that trees are saving more than 850 human lives a year and preventing 670,000 incidences of acute respiratory symptoms.

Source: U.S Forest Norther Research Station: Research Review No. 26, April 2015.

Trees Save the Environment.

i-Tree County: Annual Hydrological Benefits Report for Bristol County:

Rainfall Interception: 16,642.7 MG/yr
Avoided Runoff: 1,818.3 MG/yr

Benefits of $ 16,281,451

i-Tree

Trees. A Savings for Homeowners.

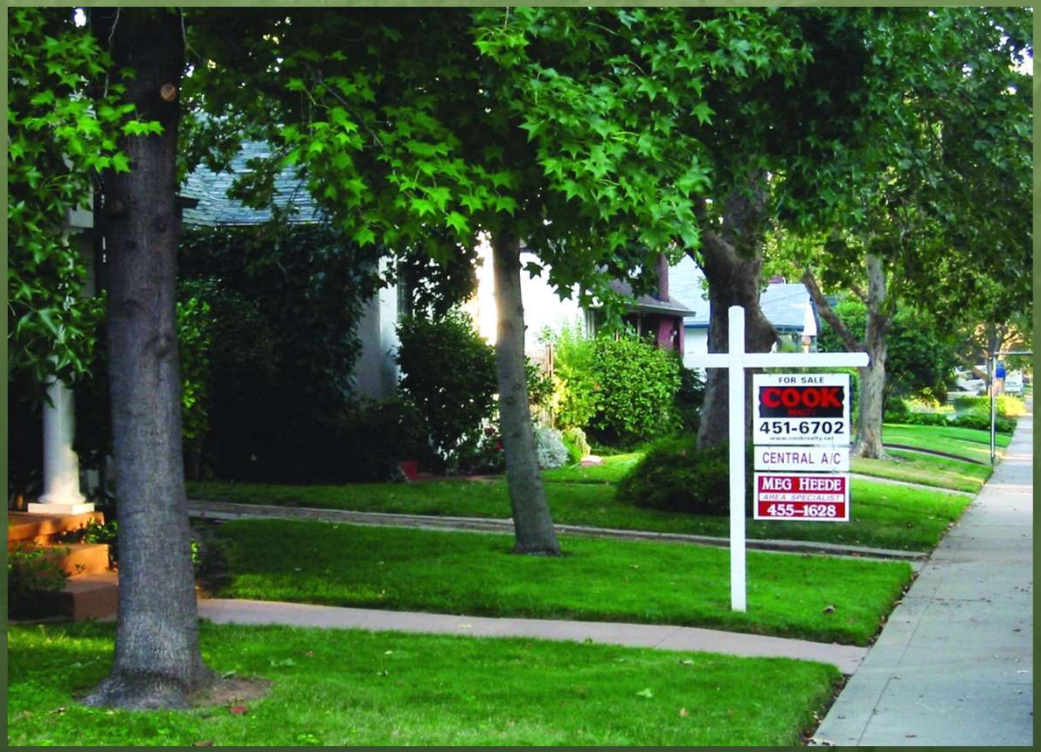
- Save on annual air conditioning costs by trees providing shade
- Save on winter heating costs by trees acting as a windbreak

Worcester MA

The Asian Long Horned Beetle (ALB) infestation required the removal of many trees. In two residential neighborhoods the electrical consumption increased by 37% in the winter of 2008-2009.

Source: The Energy Benefits of Trees: Investigating Shading, Microclimate and Wind Shielding Effects in Worcester and Springfield, Massachusetts – Emma Morzuch, UMass

Trees Sell Houses. (At higher prices.)



- The presence of street trees increased the sale prices by an average of $8,870
- A tree in front of a house increased the house's sale price by an average of $7,130. (Portland, Oregon)

Source: PNW Research Station: Science Findings, issue 126: September 2010. " Calculationg the Green in Green: What's an Urban Tree Worth?

Trees Pay Us Back.

One large public tree, 40 years after planting, averaged:	
Annual benefits	$147
Annual costs	$34
Annual net benefit	$113
Over 40 years, 100 large public trees total:	
Benefits	$587,360
Costs	$134,280
40-year net benefit	$453,080

Pay Off: $453,080

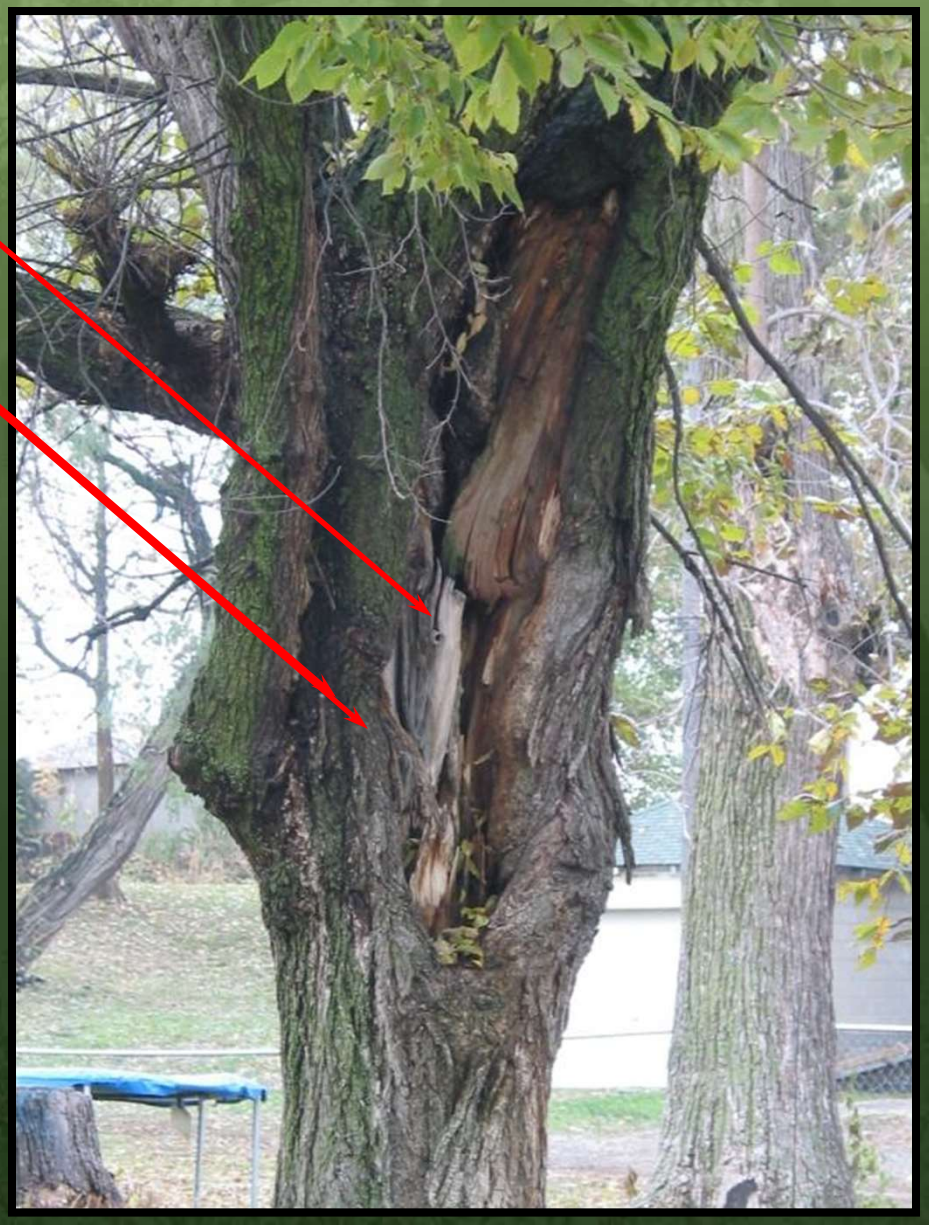
Source: USDA, May 2011 “Trees Pay us Back in the Northeast Region”

Hazard Trees

A tree with **structural defects** growing in an **environment** that increases the likelihood of failure, which could strike a **target**

Hazard Trees

A tree with **structural defects** likely to cause failure in all or part of the tree, which could strike a **target**



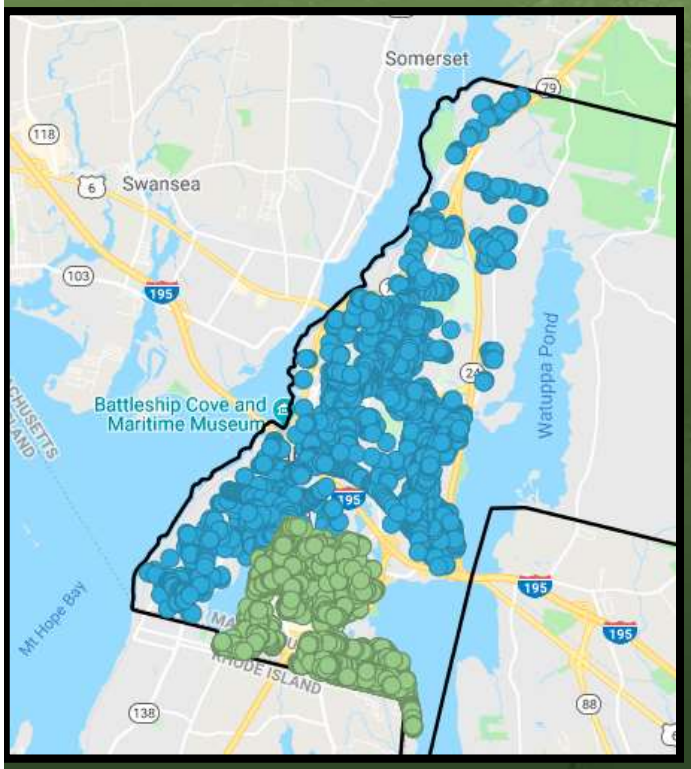
Matrix I. Likelihood Matrix

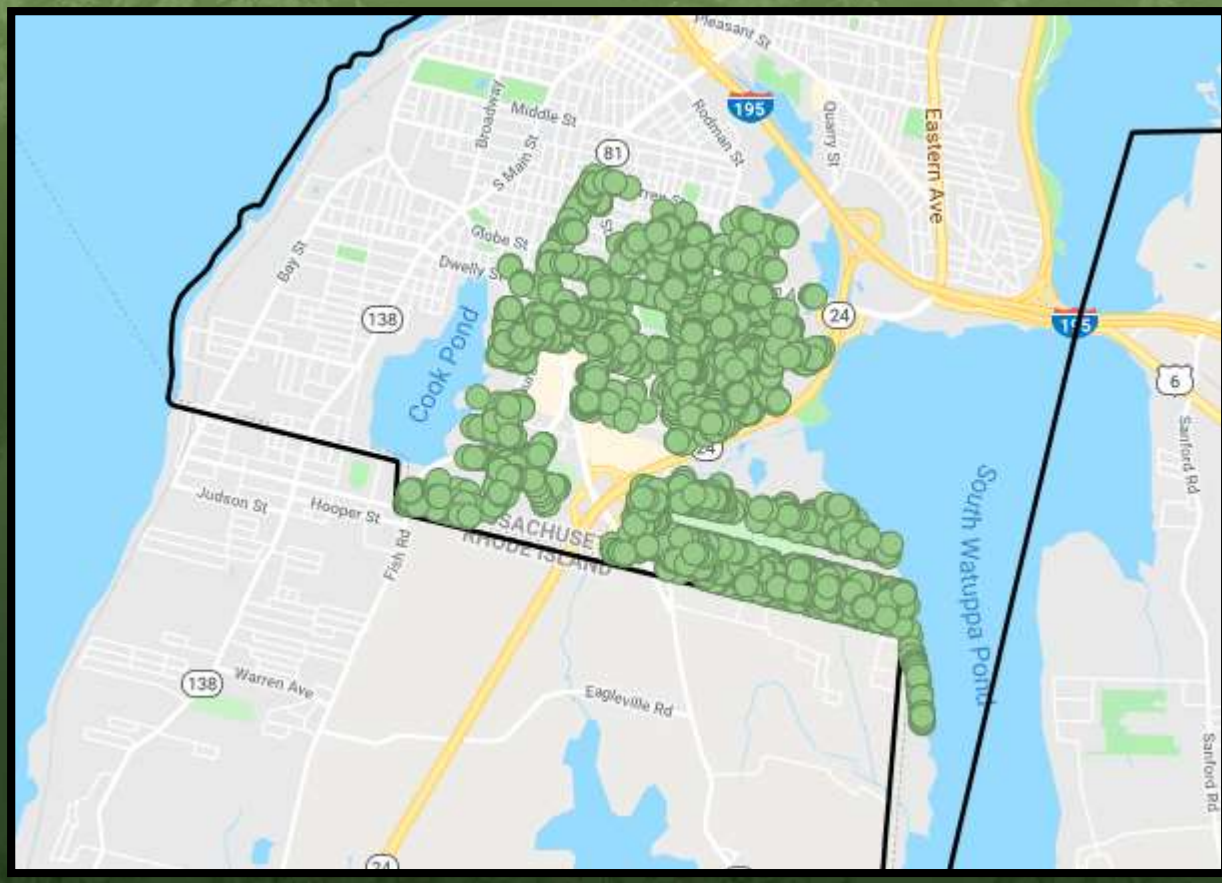
Likelihood Of Failure	Likelihood of Impacting Target			
	Very Low	**Low**	**Medium**	**High**
Imminent	Unlikely	Somewhat likely	Likely	Very likely
Probable	Unlikely	Unlikely	Somewhat likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

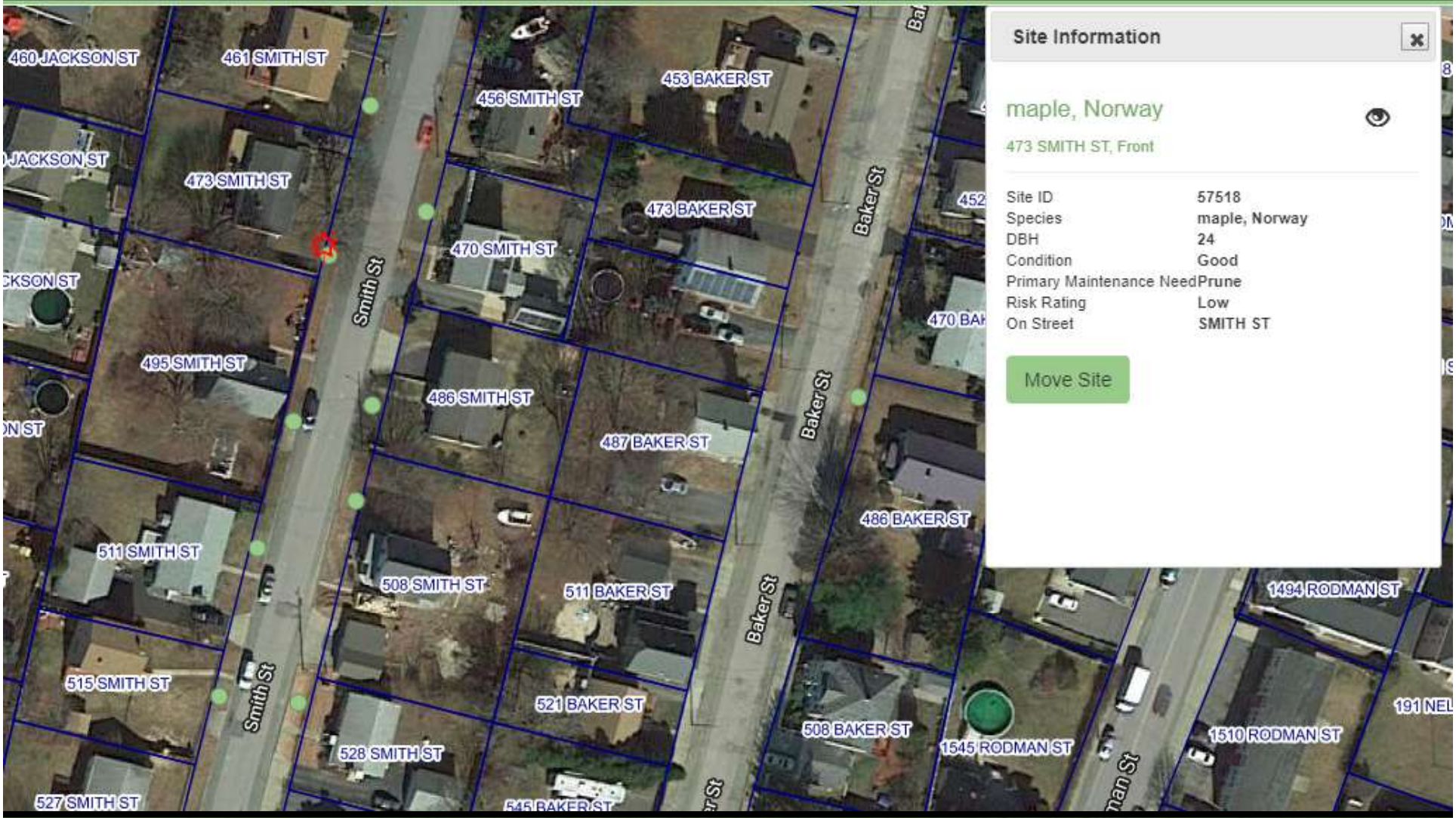
Matrix II. Risk Rating Matrix

Likelihood Of Failure & Impact	Consequences of Failure			
	Negligible	Minor	Significant	Severe
Very likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

Tree Inventory & TreeKeeper






460 JACKSON ST
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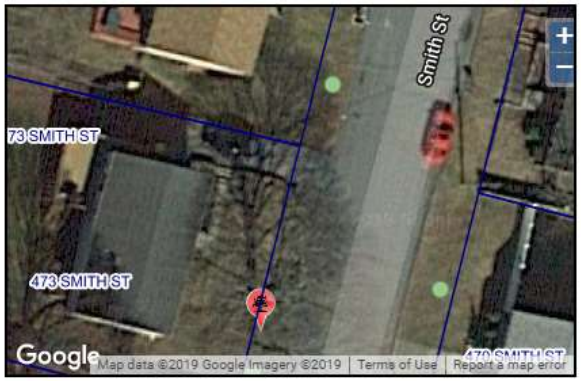
Baker St
486 BAKER ST
1494 RODMAN ST
515 SMITH ST
Smith St
521 BAKER ST
508 BAKER ST
1545 RODMAN ST
1510 RODMAN ST
528 SMITH ST
527 SMITH ST
Site Information
maple, Norway
473 SMITH ST, Front
Site ID 57518
Species maple, Norway
DBH 24
Condition Good
Primary Maintenance Need Prune
Risk Rating Low
On Street SMITH ST
Move Site

Maple, Norway at 473 SMITH ST

.jpg, .bmp, .tif, .gif



Trees

Edit

Species **maple, Norway (Acer platanoides)**	DBH **24**
MultiStem **No**	Condition **Good**
Primary Maintenance Need **Prune**	Defects **N/A**
Further Inspection **No**	

1 Selected Tree

Tree Benefits

Trees Benefits

1,266 total trees

1 Selected Sites

Total Yearly Eco Benefits

$230.31

Greenhouse Gas Benefits
$3.07
383.14 lbs CO_2 avoided
600.49 lbs CO_2 sequestered

Water Benefits
$20.58
2,572.03 gallons saved

Energy Benefits
$88.63
134.18 kWh saved
49.6 Therms saved

Air Quality Benefits
$16.34
2.61 lbs pollutants saved

Property Benefits
$101.7
169.02 leaf surface area (sq.ft.)

All inventoried in ’18

Tree Benefits

Trees Benefits

1,266 total trees

0 Selected Sites

Total Yearly Eco Benefits

$111,202.97

Greenhouse Gas Benefits
$855.32
148,776.75 lbs CO_2 avoided
139,445.02 lbs CO_2 sequestered

Water Benefits
$8,129.40
1,016,175.18 gallons saved

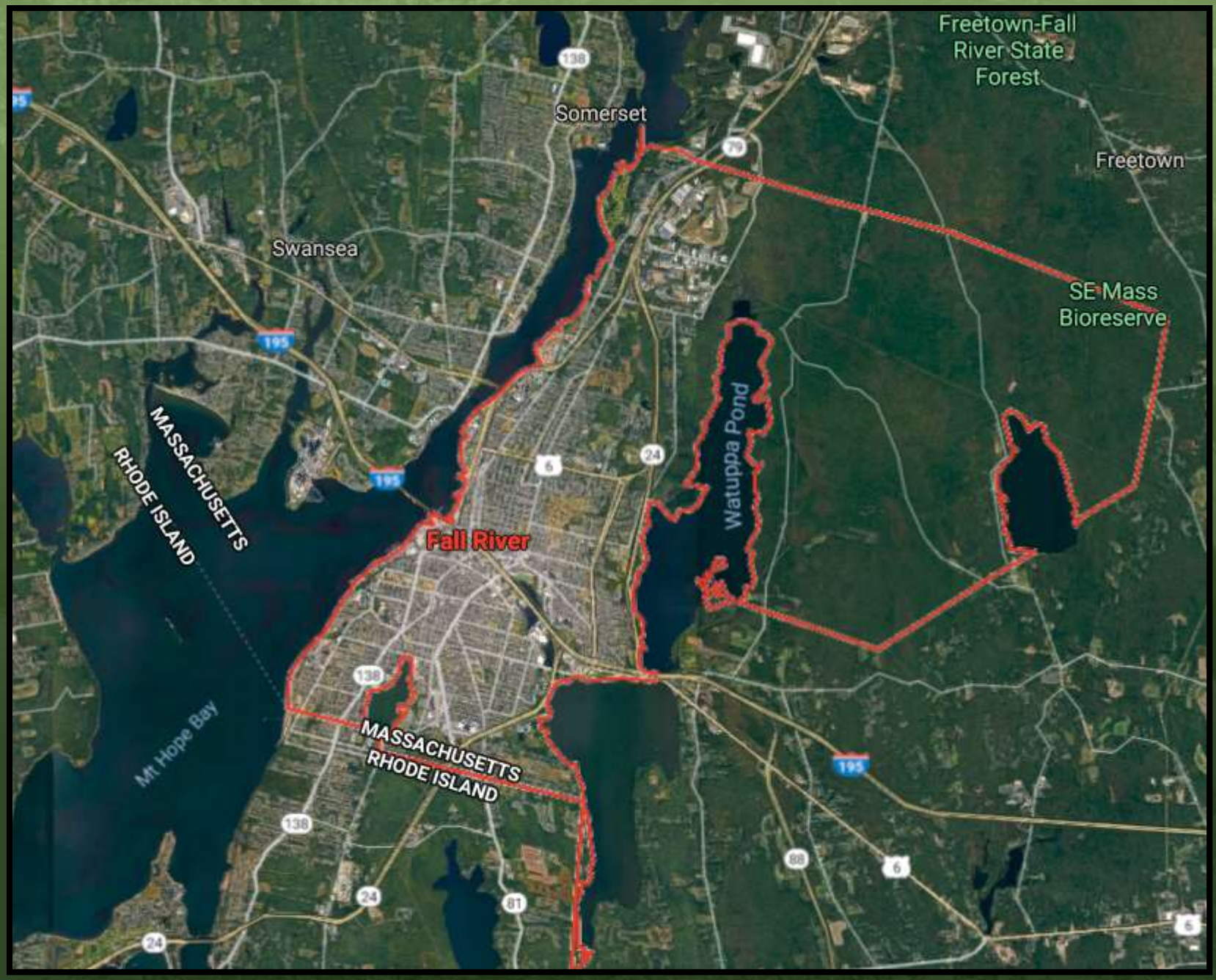
Energy Benefits
$43,854.54
65,745.40 kWh saved
24,604.84 Therms saved

Air Quality Benefits
$6,298.54
1,015.29 lbs pollutants saved

Property Benefits
$52,065.17
86,531.30 leaf surface area (sq.ft.)

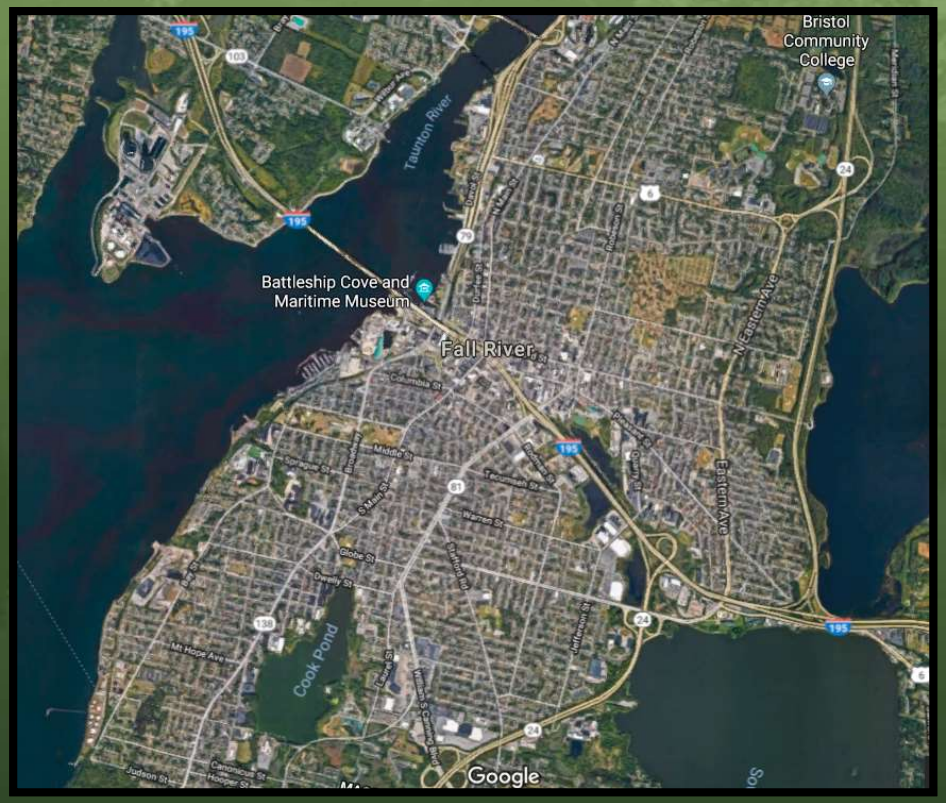
Young Tree Maintenance

Identifying planting sites



Source: Imagery @ 2019 Google, Map data

Canopy Loss



Credit: Imagery @ 2019 Google, Map data

Between 2009-2014, US urban tree cover dropped from 40.4% to 39.4%.

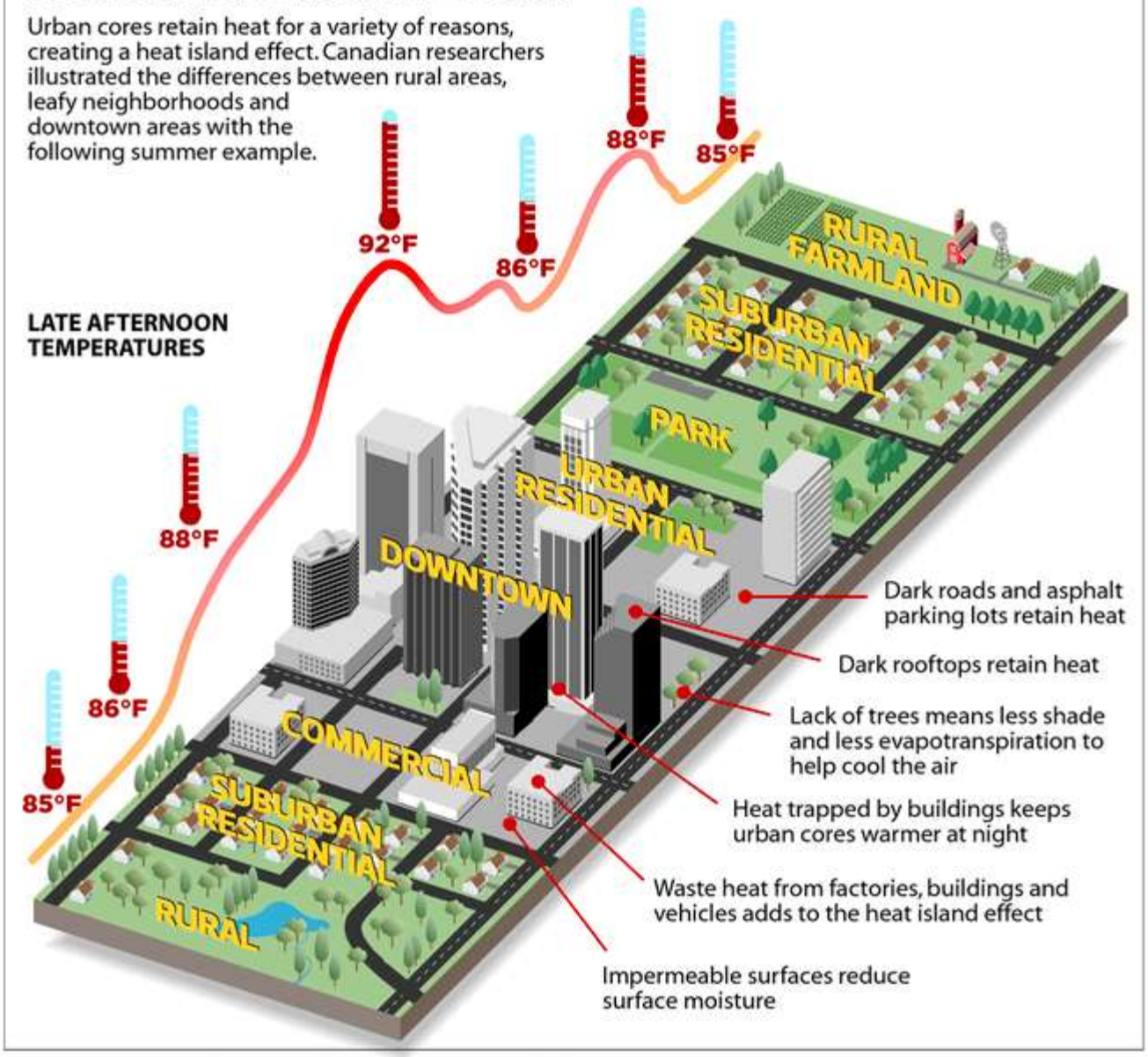
US urban impervious cover increased from 25.6% to 26.6%.

Nationally, annual urban/community tree cover loss is 175,000 acres or 36 million trees.

Source: Urban Forestry & Urban Greening, Volume 32, May 2018:
Declining urban and community tree cover in the United States

Urban Heat Island Effect

Urban cores retain heat for a variety of reasons, creating a heat island effect. Canadian researchers illustrated the differences between rural areas, leafy neighborhoods and downtown areas with the following summer example.

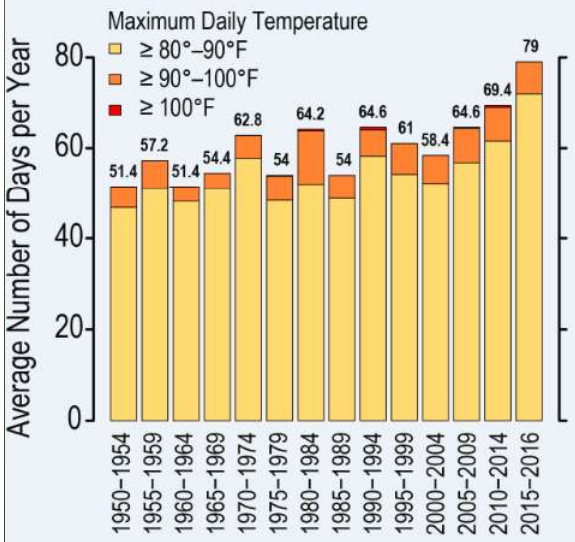


SOURCE: D.S. Lemmen and F.J. Warren, Climate Change Impacts and Adaptation

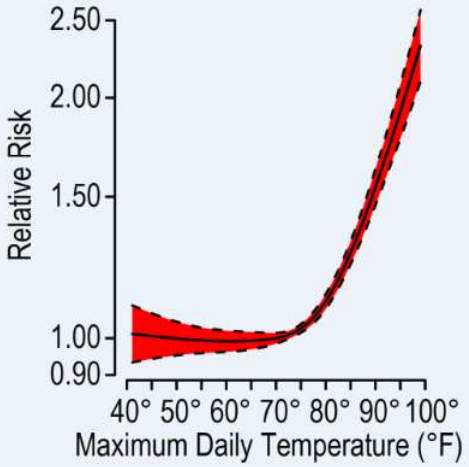
PAUL HORN / InsideClimate News

Impacts of Excess Heat on Emergency Room Visits in Rhode Island

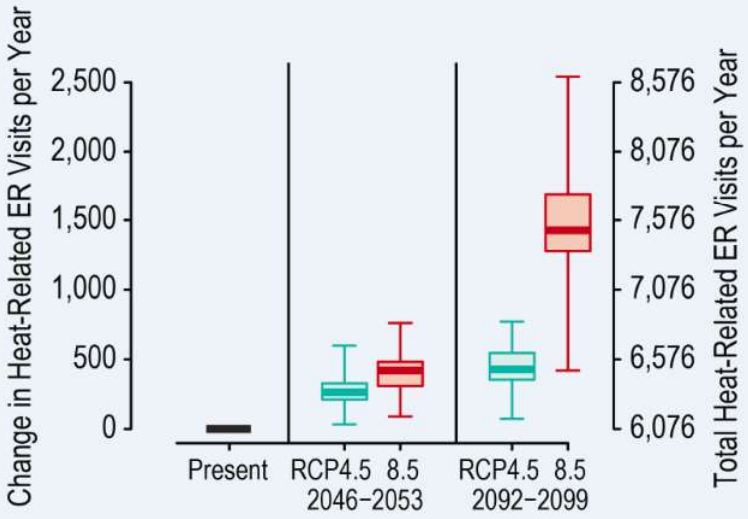
Number of Days per Year with Extreme Heat in RI



Association Between Maximum Daily Temperature and Heat–Related Emergency Room Visits



Projected Number of Future Heat-Related Emergency Room Visits



Source: 2018 Northeast: In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment

Plant Trees. Create a Legacy.

Oak Grove Cemetery

Bank St between N. Main and Green St

Where there used to be zero street trees, now there are 13!

Source: Neil Angus, AICP, Devens Enterprise Commission, 'Selecting Trees to Improve Public Health in the City'. 2019 UMass Community Tree Conference.

Bank Street

StormTree®

StormTree®

Tree Farm & FRSTPP

http://www.frstpp.org/

The Fall River Street Tree Planting Program

Street Tree Application

Name

Address

City / State Zip Code

Phone # (Day & Evening)

Email

I am (circle ONE) owner/tenant of the above address (if you are not the owner, please get the owner's permission and signature below to have a street tree planted at this address).

I request that a tree be planted along the city sidewalk adjacent to the above address. I have chosen the following:

☐ Neighborhood Group Planting: Please send me a grant application so I can organize my neighbors and apply for 5 to 10 trees (to be planted in close proximity) which would then be planted by City tree department employees.

☐ Single Planting: Enclose $100.00 per tree for this planting. I (circle ONE) do/do not want to plant this tree myself. Make your check payable to: Fall River Street Tree Planting Program

The area where the tree(s) are to be located are presently (circle ONE):

☐ concrete ☐ asphalt ☐ brick ☐ grass ☐ other (describe) _____

After the trees are planted, I promise to maintain and water the tree(s) to the best of my ability.

Signature (of person requesting tree) Date

If the above mentioned person is not the property owner, the signature of the owner is required below indicating his/her agreeing to the above tenant's request for a street tree.

Signature (of property owner if request is from tenant Date

No site will be approved until assessed by the city

Greening The Gateways Program in Fall River

The DCR and Community Forestry crews, hired within local communities, plant trees in target neighborhoods to increase tree canopy cover for environmental and energy efficiency benefits.

Total # of trees planted in Fall River is **2463** (637 public, 1826 private)

Fall River

617-997-1795

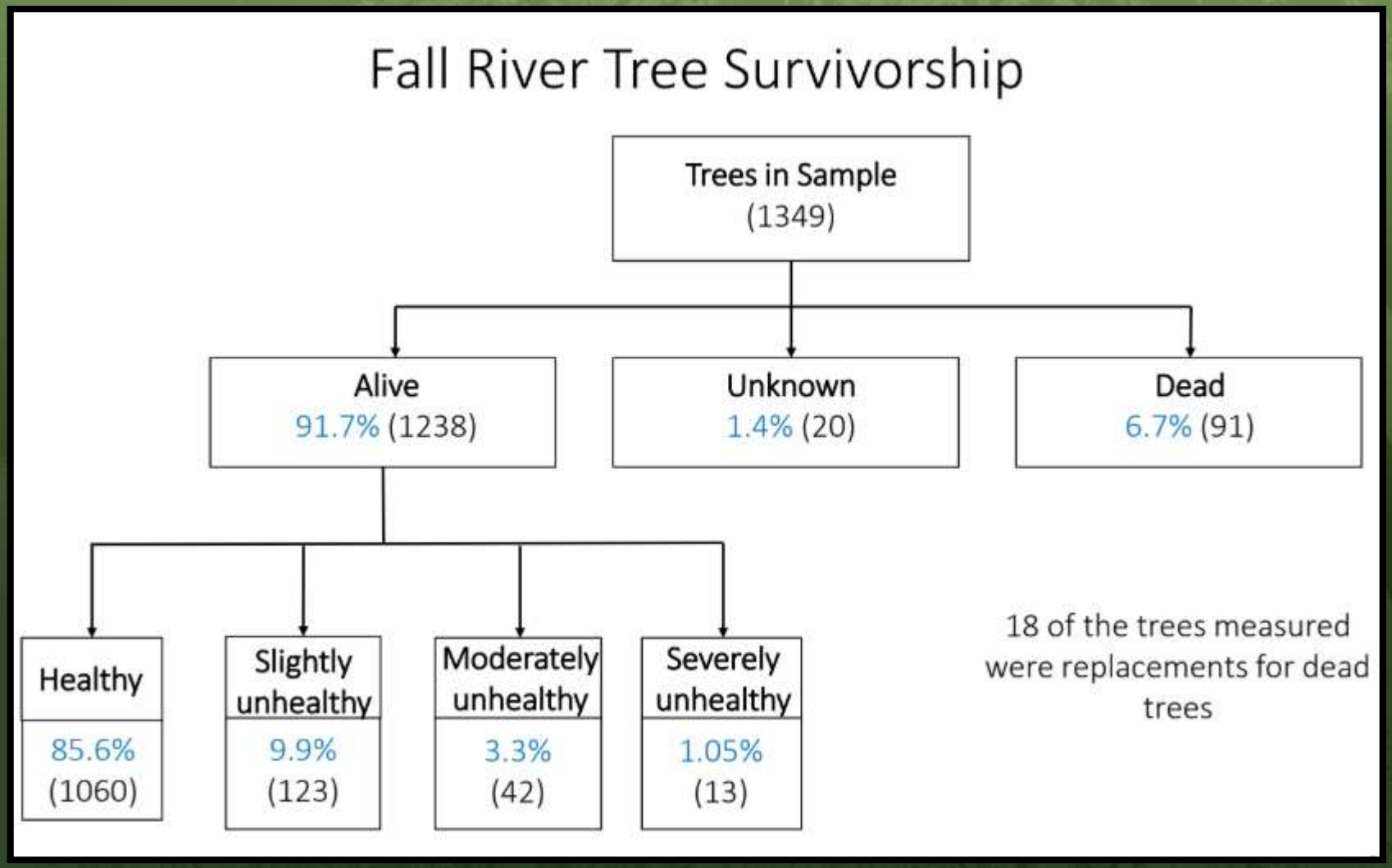
Legend

- Expansion Zone
- Planting Zone

Greening the Gateway Cities Program
South Region - Fall River

Geographic data supplied by the Office of Geographic

Clark University Hero Program: Tree Mortality Study



Top 10 Species with 100% Survivorship

European Hornbeam n=45

Persian Ironwood n=23

Apple (common) n=20

Paperbark Maple n=19

London Planetree n=18

Cornelian Cherry Dogwood n=17

Norway Spruce n=16

White Fir n=14

White Spruce n=13

Peach n=13

Increasing # of Severe Storms

Tornado 06/01/2011

Species	Number of Trees Removed
Acer platanoides	148
Acer saccharum	85
Quercus rubra	64
Tilia cordata	60
Acer rubrum	48
Quercus palustris	41
Quercus coccinea	34
Acer saccharinum	22
Tilia americana	18
Quercus alba/ Ailanathus altissima	14 (ea.)

Alex Sherman's presentation "Choosing Trees for Storm Resistance" – 2019 UMass Community Tree Conference.

Nor'easter 10/29/2011

Species	Number of Trees Removed
Acer platanoides	34
Pyrus calleryana	21
Celtis occidentalis	20
Quercus palustris	17
Tilia cordata	15
Acer saccharum	12
Acer rubrum	11
Quercus rubra	10
Malus spp.	5
Acer saccharinum	5

Alex Sherman's presentation "Choosing Trees for Storm Resistance" – 2019 UMass Community Tree Conference.

Hurricane Sandy: October 2012

Photograph by U.S. Coast Guard Petty Officer 2nd Class Rob Simpson. Photo in the public domain.

- On Long Beach, NY in 2014 more than 1400 trees were removed
- Majority of these trees were London Planes (85%)
- Symptoms of dieback/decline didn't show until the spring.

- In NYC – over 1500 London planes did not leaf out, 2500 – had 50% dieback

Source: NY State Urban Forestry Council, Flood Damage after Hurricane Sandy: Lessons and Surprises

The Bottom Line…

- Quality of life depends on tree benefits
- Benefits depend on healthy trees
- Healthy trees require quality care
- Quality care depends on you

- “Right tree, Right place”

What You Can Do…

- Establish long-term goals for the community forest
- Fund programs for maintenance and care
- Support volunteer organizations
- Increase awareness
- Champion community trees
- Continue to be A TREE CITY USA (13 Years!)

Tree City USA Requirements:

- Establish a tree board or department
- Develop and pass a community tree ordinance
- A community forestry program with a least two dollars ($2) per capita
- An Arbor Day Observance and Proclamation

PLANTING THE SEEDS OF SUCCESS.

"Trees Are the Answer"

DAVEY
Proven Solutions for a Growing World

Fall River Community Resiliency Building Workshop

March 20, 2019

Liberty Utilities (New England Natural Gas Company) Corp.
www.libertyutilities.com

1

Liberty Utilities

1

Algonquin Power & Utilities Corp. (APUC)

ALGONQUIN Power & Utilities Corp.

- APUC is Publicly Traded on NY and Toronto Stock Exchanges
- US $8.0 Billion in Assets

Liberty Utilities

- Over 33 Electric, Gas & Water Utility Systems
- Serves Approximately 760,000 customers
- Operates in 12 states

Liberty Power

- Owner/Operator of Power Generation Facilities
- Renewable and Clean Energy Facilities
- Operates in 8 States and 6 Provinces

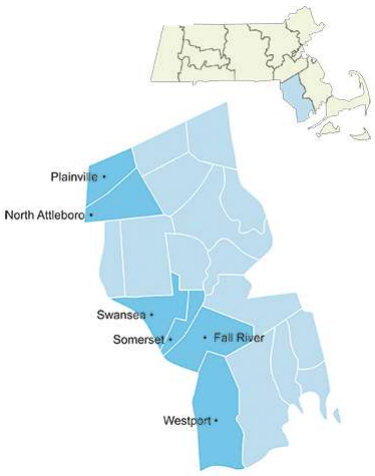
Legend:
- Transmission and Distribution Utility
- Rate Based Generation
- St. Lawrence Gas (Pending Approval)
- Operating Facility
- Development Project

2

Liberty Utilities

2

Communities We Serve in Massachusetts



- 1847 – Fall River Gas Works
- Liberty Utilities Provides Natural Gas Delivery to the Massachusetts Communities of:
  - Fall River
  - North Attleboro
  - Plainville
  - Somerset
  - Swansea
  - Westport
- Approximately 56,750 Customers
  - 62% of Customers are Located in Fall River

3

Liberty Utilities

3

Operational Safety

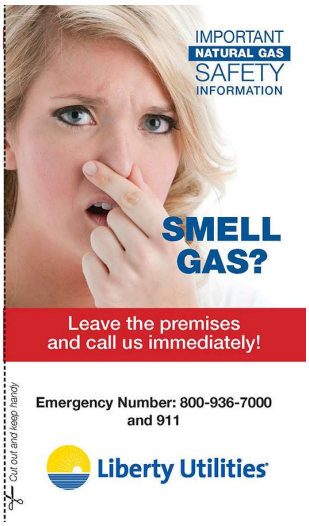
4

Liberty Utilities

4

Public Awareness Program

- API RP 1162
- Four Target Stakeholder Audiences
  - Affected Public/General Public
  - Emergency
  - Public Officials
  - Excavators



5

Liberty Utilities

5

Public Awareness Program Events

WHTB Radio Portuguese Interview
August 28, 2018

M.U.S.T. Training
February 27, 2019
White's Restaurant – Westport, MA

6

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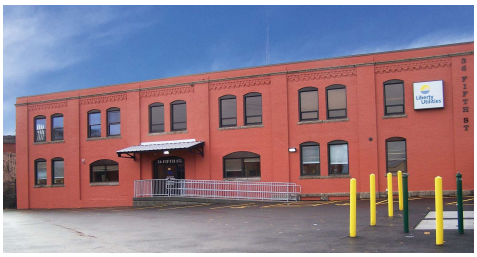
6

Community Investment

- New Hiring
  - Early 2014 – 134 Employees, Early 2019 – 159 Employees
- Modernizing Existing Facilities and Infrastructure is a Priority
  - Rehabbed 100 year old Company Owned Building in Downtown Fall River



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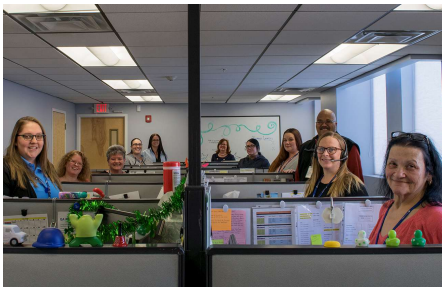
7

Community Investment

- Customer Care Center & Call Center – Fall River, MA
  - Local Call Center
  - Opened Customer Care Center in Fall River
    - 24,000 customers/year utilize Customer Care Center



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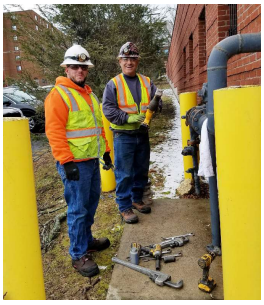
8

Investing in Sustainability and Our Community

- **Renewable Energy -** Solar Panels Installed at our Fifth Street Administrative Office and at our Construction and Maintenance Facility on Anawan Street
- **Compressed Natural Gas -** New company vehicles are being equipped to run on CNG
- Working Closely with Municipalities on Street Restoration Work
- Large Municipal Taxpayer



9

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9

Local & Responsive, We Care!

Our Company takes great pride in partnering with numerous community based organizations to help those in need.

- Salvation Army – Soup Kitchen & Food Pantry
- Salvation Army – Sponsored 5K Road Race
- American Red Cross – Support of US military member stationed in Kuwait (care packages)
- American Cancer Society's – *Relay for Life*
- Annual Fall River City Wide Cleanup
- Fall River Children's Holiday Parade
- Citizens for Citizens – *Operation Christmas*
- St. Vincent DePaul Society
- Touch-A-Truck Events in Fall River & North Attleboro
- Fall River Boys & Girls Club – Kid's Café

RELAY FOR LIFE American Cancer Society

In 2018, Liberty Employees volunteered a total of 1,200 hours.

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10

Local & Responsive, We Care!

Salvation Army Annual 5K

Relay for Life

Touch-A-Truck

Citizens for Citizens Toy Drive

11

Liberty Utilities

11

Commitment to Energy Efficiency

mass save®
Savings through energy efficiency

- Provides a Host of Services to both Residential & Commercial Customers
  - In-home Services, Rebates, Small Business Services and Custom Commercial Projects
  - Strong Partnership with Citizens for Citizens

- Energy Efficiency Budget 2019-2021 ~$13.9M
  - Provides a Direct Local Benefit to Customers, Businesses and Trade Allies
  - Expected to Produce $34M in Energy Savings and Benefits
  - Thousands of Customers Participate in Liberty's Programs Annually

12

Liberty Utilities

12

Gas System Enhancement Plan (GSEP) – Fall River

- State Law to Accelerate Replacement of Leak Prone Mains and Services
- In 2010, there were approximately 173 Miles of Main in Fall River eligible for replacement
- Through the End of CY 2018:
  - 30 miles of eligible main have been replaced (18%)
  - 2,146 eligible services have been replaced (21%)
  - Average of 8 miles of main replacement/year
  - Average of 416 Services Replaced per Year
- Based on the current run rate, the Company expects to complete its replacement efforts in 10 - 13 years or roughly 2 - 5 years ahead of schedule.

Liberty Utilities

GSEP - Environmental and Other Benefits

- Liberty Utilities Participates in the US EPA's Methane Challenge Program
- Complies with MA DEP Emissions Caps
- Replacement of Leak Prone Pipe Results in Less Methane Emissions into the Atmosphere
- Increased Safety & Reliability of our Distribution System
- Increased Tax Revenue to City
- Municipal and State Paving Coordination
  - Systematic & Predictable Scheduling
  - Shared Costs with City Paving Projects

Liberty Utilities

What is the process for replacing leak prone pipe?

- Coordinated with the local Municipalities and the Company's Distribution Integrity Management Plan (DIMP) Team
- Replacement Projects are Designed by Internal and External Resources
- Peer Reviewed Internally by:
  - Engineering Staff
  - Instrument and Regulation Group
  - PE Review and Stamp Approval
- Program Costs Reviewed and Approved by MA Department of Public Utilities

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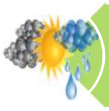
Construction Work Prioritization

Geography



Weather Constraints

Municipal Considerations

Subsequent Project Construction

16

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16

Proactive Leak Survey Schedule

- Frost Patrol Mobile Unit Surveys
- Downtown Mobile Patrol Surveys
- Walking Surveys
- Business District Surveys
- Consistent System Monitoring

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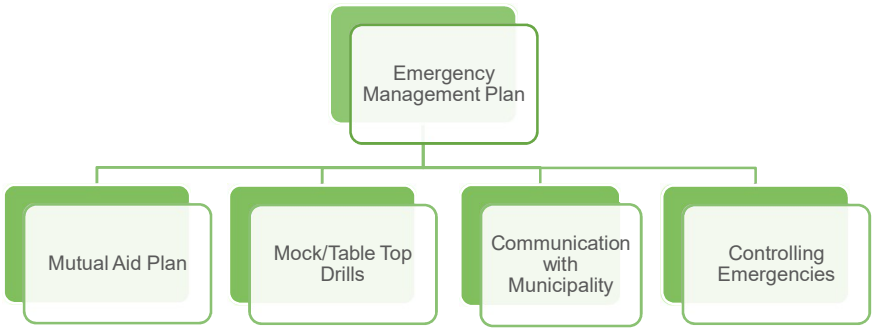
Emergency Management Plan (EMP) / Crisis Management



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18

2018 Mock & Table Top Drills

Operations & Call Center Mock Table Top Drills

- October 2018 & November 2018
- Charles Street & Fifth Street

19

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Emergency Management Plan (EMP) Key Milestones

- File Annual EMP with MA DPU
- Provide an Annual EMP to Municipal Emergency Personnel
- Meet with each Director of Emergency Management
- Conduct Liberty-Specific Annual Hurricane Preparation Meeting in June
- Conduct Liberty-Specific Annual Winter Operations Meeting in December

20

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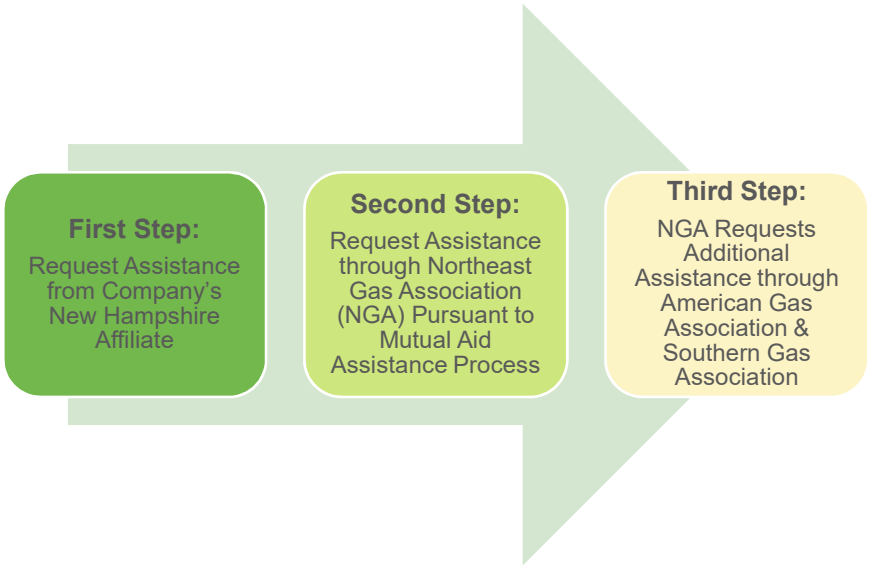
Mutual Assistance Plan



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Questions and Comments

22

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22

City of Fall River
Massachusetts
Department of Community Utilities
WATER • SEWER

JASIEL F. CORREIA II
Mayor

TERRANCE SULLIVAN
Administrator

January 13, 2016

Attorney John Davenport
Conservation Law Foundation
62 Summer Street
Boston, Massachusetts 02210

Subject: City of Fall River, Massachusetts
Federal Court Order 87-CV-3067 (RWZ)
Integrated Wastewater and Stormwater Master Plan

Dear Mr. Davenport,

Please find attached one copy of the *Executive Summary* for the *Draft Integrated Wastewater and Stormwater Master Plan*. In accordance with Federal Court Order 87-CV-3067 (RWZ), one copy of the *Draft Integrated Wastewater and Stormwater Master Plan* was submitted on December 31, 2015. Volume I contains the report and Volume II contains the appendices. This Executive Summary provides a brief summation of the report's contents.

If you should have any questions, I can be reached by phone at (508) 324-2320 or by email at tsullivan@fallriverma.org.

Terrance J. Sullivan
Administrator of Community Utilities

City of Fall River
Massachusetts
Department of Community Utilities
WATER • SEWER

JASIEL F. CORREIA II
Mayor

TERRANCE SULLIVAN
Administrator

January 13, 2016

Clerks for Civil Business
United States District Court
District of Massachusetts
John Joseph Moakley U.S. Courthouse
One Courthouse Way
Boston, Massachusetts 02210

Subject: City of Fall River, Massachusetts
Federal Court Order 87-CV-3067 (RWZ)
Integrated Wastewater and Stormwater Master Plan

To whom it may concern,

Please find attached one copy of the *Executive Summary* for the *Draft Integrated Wastewater and Stormwater Master Plan*. In accordance with Federal Court Order 87-CV-3067 (RWZ), one copy of the *Draft Integrated Wastewater and Stormwater Master Plan* was submitted on December 31, 2015. Volume I contains the report and Volume II contains the appendices. This Executive Summary provides a brief summation of the report's contents.

If you should have any questions, I can be reached by phone at (508) 324-2320 or by email at tsullivan@fallriverma.org.

Terrance J. Sullivan
Administrator of Community Utilities

Executive Summary

ES.1 Background

ES.1.1 City of Fall River

The City of Fall River (Fall River/City) is located in Bristol County, in southeastern Massachusetts. As shown in Figure ES-1, the City is located along the Taunton River and Mount Hope Bay shoreline. Interstate 195 crosses through the City and provides access to Providence, Rhode Island to the west and Cape Cod to the east. Similarly, Route 24 provides access to the Boston area in the north. Several local routes (Routes 6, 79, 81 and 138) also pass through the city, linking Fall River with its neighboring communities.

Fall River was founded in 1803 and incorporated as a city in 1854. The City is approximately 40.2 square miles in size, with a population of over 88,000 people. It is one of the ten largest cities in the Commonwealth of Massachusetts.

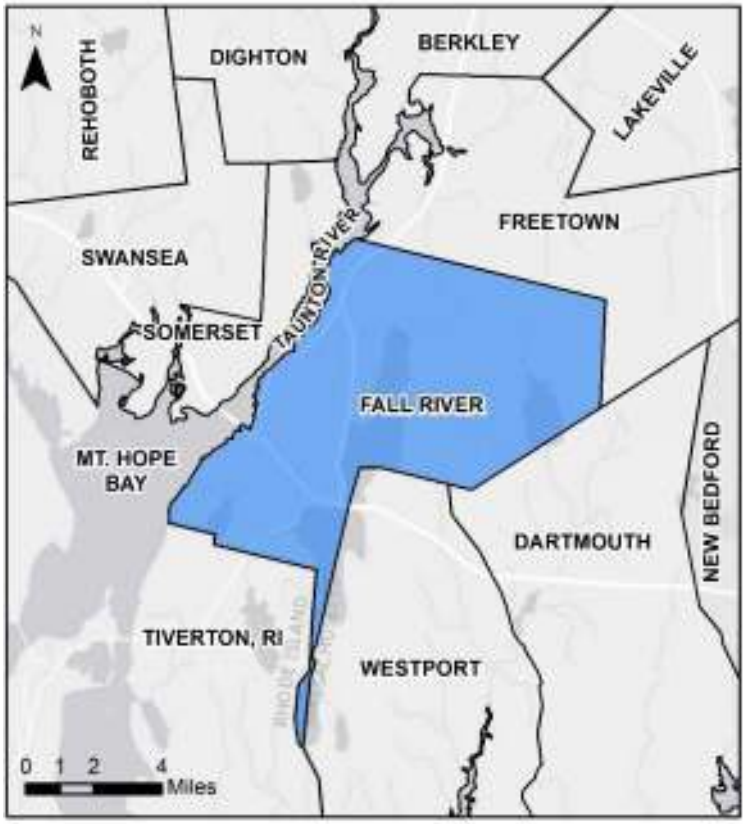


Figure ES-1: Locus Map

Fall River played an important role in the textile industry, utilizing the Quequechan River for water power and cooling water. During the 19th century, the City experienced significant economic growth with the development of numerous textile mills. Many of these mills were located along the Quequechan River. In 1876, Fall River was the largest textile producing city in the country.

Quequechan River (looking south from Britland Park area at the former Chace Mill).

The textile industry began to decline after World War I, and by the Great Depression many mills were bankrupt. Industry is dramatically reduced in the City today. While many of the original mill buildings and the infrastructure built to support them remain, the textile industry that brought economic prosperity to the City in the 19th century no longer exists. As a result, Fall River's economic status is markedly different today than in the past. The City's current economic conditions are discussed further in Section ES.8.

ES.1.2 Wastewater and Stormwater Systems

Introduction

Historically, older cities and towns—like Fall River—built sewers that collected both wastewater and stormwater and conveyed these "combined" flows to the nearest waterbody for disposal. These types of sewers are known as combined sewers. Some of Fall River's early sewers date back to the mid-19th century. As populations grew and the wastewater flows increased, the water quality of these sewers' receiving waters degraded.

In 1948, Fall River constructed a primary wastewater treatment facility (WWTF) along the shore of Mount Hope Bay near the Rhode Island state line. The Main Interceptor was also constructed along the shoreline to capture flows that were previously discharged directly to the Taunton River and/or Mount Hope Bay, to convey them to the WWTF. Similarly, additional interceptors were constructed to capture previous discharges to the Quequechan River.

A view of the CSO weir and outfall pipe inside the Davol No. 2 CSO Regulator Structure.

For combined systems, like Fall River's, weir structures—termed regulator structures—were constructed to convey dry-weather and some wet-weather flows from the original sewer outfalls to the interceptors. However, higher wet-weather flows, that the interceptor system and WWTF could not handle, would flow over the weirs to the original outfalls. These outfalls predate the WWTF and provide relief to the combined sewer system when wet-weather flows exceed the interceptor system's conveyance capacity. These wet-weather discharges are called combined sewer overflows (CSOs).

Over time, the WWTF and the combined sewer system have been expanded and upgraded. Newer developments have separate wastewater and stormwater collection systems. Significant CSO controls, including wet-weather expansion of the WWTF and a 3-mile tunnel storage and conveyance system, have also been constructed to provide better management of wet-weather flows. A summary of existing wastewater and stormwater facilities is presented below.

Wastewater Treatment Facility

The Fall River WWTF is located at 1979 Bay Street.

The Fall River WWTF is located at 1979 Bay Street—adjacent to the Rhode Island border—and discharges treated effluent to Mount Hope Bay. In 1948, the City constructed the original WWTF, which included preliminary and primary treatment, followed by disinfection. In 1979, Fall River upgraded its WWTF to include a "secondary" biological oxygen-activated sludge treatment process, which immediately followed primary treatment. This facility was designed for an average annual daily flow of 30.9 million gallons per day (mgd), with a maximum daily flow of 50 mgd. In 1998, as part of the City's CSO Abatement Program, the WWTF's wet-weather treatment capacity was increased to 106 mgd to reduce CSOs. As part of this work, the preliminary treatment, primary treatment and disinfection facilities were expanded and modified to accommodate the increased wet-weather treatment capacity.

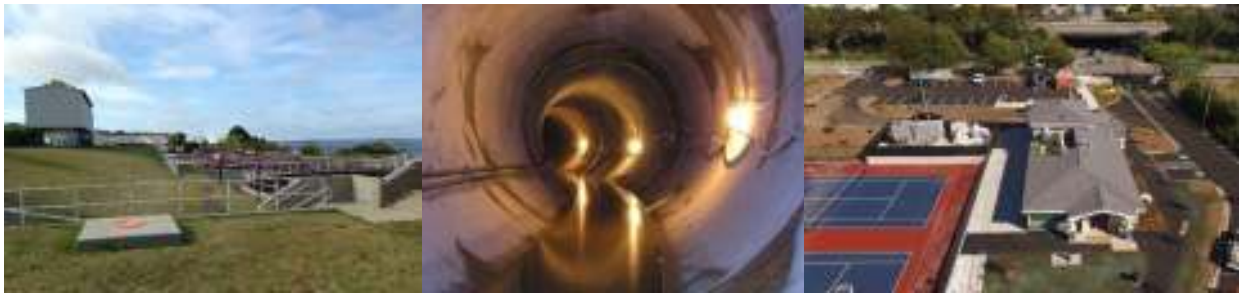
Wastewater Collection System

The City of Fall River's wastewater collection system is predominantly a combined—wastewater and stormwater together—system, with more than 200 miles of sewers. Fall River's collection system collects and transports wastewater flows from over 90,000 customers—including flows from portions of Freetown and Westport, Massachusetts and Tiverton, Rhode Island—and stormwater flows from approximately 5,000 acres.

The wastewater collection system is generally divided into three parts; namely the North System, South System, and Central System. The North System is generally comprised of sewers north of Interstate 195, with CSOs to the Taunton River. The Central System is generally comprised of inland sewers, with CSOs along the Quequechan River. The South System is generally comprised of sewers south of Interstate 195, with CSOs to Mount Hope Bay. Wastewater flows from the North and Central Systems through the South System to the WWTF for treatment.

The City has 15 pump stations located throughout the City. These pump stations are located at key areas throughout the collection system to convey wastewater flows from low-lying areas to the WWTF for treatment. Most of the City's pump stations were constructed in the 1960s or earlier.

Fall River's combined sewer system includes 19 CSO outfalls; 17 of which are active. These outfalls provide relief to the combined sewer system when wet-weather flows exceed the system's capacity. The South Plymouth Avenue CSO outfall was recently closed permanently. Additionally, the Heritage Park CSO outfall has been blocked, but not permanently closed.



The upgraded Primary Treatment Facility and Sodium Hypochlorite Storage Facility at the WWTF (left). The CSO tunnel, bored through solid rock, toward the end of its construction (center). The recently completed President Avenue CSO screening and disinfection facility at Veterans Memorial Bicentennial Park (right).

Over the last 15+ years, the City has spent approximately $190 million to mitigate the impact of its CSOs on Mount Hope Bay, the Taunton River and the Quequechan River. As part of the Fall River CSO Abatement Program, the City has implemented the following CSO controls:

- Wet-weather expansion of the WWTF to treat up to 106 mgd,
- A 3-mile, 20-foot diameter, 38-million gallon CSO storage tunnel system that diverts, stores, and conveys storm flows directly to the WWTF, and
- CSO screening and disinfection facilities constructed at the Cove Street and President Avenue outfalls to treat their flows.

Stormwater System

While the City is mostly serviced by a combined sewer system, portions of the City have separate wastewater and stormwater systems. The City has 66 miles of separate storm drains, culverts and other stormwater conveyance features (e.g., channels, swales, etc.). A majority of this drainage infrastructure is located in the newer developments on the eastern side of the City. Separate drainage facilities have also been installed by the Massachusetts Department of Transportation (MassDOT) along Interstate 195, Route 79, North Main Street and Plymouth Avenue. A portion of this stormwater infrastructure is intended to intercept storm flows, which would otherwise be tributary to the City's drinking water supplies, for source water protection.

ES.1.3 Federal Court Order and Amendments

In 1987, the Conservation Law Foundation (CLF) filed suit against the City of Fall River (Civil Action No. 87-3067-RWZ) to control its CSO discharges. Similarly, in 1989, the United States Environmental Protection Agency (EPA) issued an administrative order requiring the City to abate its CSO discharges and bring the system into compliance with the federal *Clean Water Act* and the City's National Pollutant Discharge Elimination System (NPDES) permit. As a result of the CLF's lawsuit and the EPA's 1989 Administrative Order, a federal court order was issued in 1992 which mandated the Fall River CSO Abatement Program.

As noted above, the City has spent approximately $190 million for CSO-related planning and capital improvements as a result of the federal court order. Remaining work required by the federal court order includes sewer separation projects along the Taunton River and Mount Hope Bay shoreline. These projects are needed to remove stormwater from, and/or make modifications to, the combined sewer system, and are necessary to meet the Fall River CSO Abatement Program

performance requirement of managing the 3-month storm flows. At the City's request, this *Integrated Wastewater and Stormwater Master Plan* was added as a requirement in the latest amendment of the federal court order. This report is intended to provide perspective to CSO control needs, in relation to needs associated with all other *Clean Water Act* initiatives.

ES.1.4 Administrative Order (2011)

More recently, in 2011, the EPA issued another administrative order requiring the City to perform an assessment of its sewer system in accordance with the EPA's Capacity, Management, Operations, and Maintenance (CMOM) initiative. This administrative order was issued as a result sewer system overflows, which are inconsistent with the *Clean Water Act* and the City's NPDES permit requirements. Inadvertent sewer overflows from manholes and/or catch basins, and basement back-ups—whether caused by pipe blockages or excessive stormwater flows—are collectively called SSOs (sanitary sewer overflows or sewer system overflows).

ES.2 Purpose

The purpose of this report is to provide the results of integrated wastewater and stormwater planning evaluations, including a capital improvements plan (CIP), for the City of Fall River's Department of Community Utilities. The report was submitted, as required, to the federal court and CLF by December 31, 2015. This Executive Summary includes conclusions and recommendations of the report for the following:

- Wastewater treatment facilities
- Wastewater pump stations
- CSO controls
- Sewer collection system—wet-weather
- Sewer collection system—general
- Stormwater system—general
- Stormwater system—source water protection
- Organizational and institutional

This report includes evaluations and recommendations for Fall River's wastewater and stormwater facilities and operations.

ES.3 Integrated Planning Approach

This integrated wastewater and stormwater master planning process was structured to generally follow the EPA's *Integrated Municipal Stormwater and Wastewater Planning Approach Framework* to address competing *Clean Water Act* initiatives. This framework includes the following six elements described in Figure ES-2:

1. Define water quality, public health and safety, and regulatory issues
2. Describe the existing wastewater and stormwater systems, including organization

Figure ES-2: Integrated Planning Approach

3. Stakeholder and public outreach
4. Identify, evaluate and select projects for implementation, including implementation costs and schedule
5. Measure the performance of the recommended program, as it is implemented
6. Modify the program, as necessary, based on established goals and performance

This report includes the first four elements, and suggests possible performance criteria and/or metrics for measuring success.

ES.4 Project Issues and Goals

The integrated wastewater and stormwater master plan must consider surface water quality, public health and safety, regulatory, institutional, and social issues. These issues, and the resultant project goals, must be identified during the early planning stages to guide the development and proposed implementation of the recommended plan.

ES.4.1 Surface Water Quality

The City of Fall River is located at the mouth of the Taunton River at the head of Mount Hope Bay. The Quequechan River flows through the City from South Watuppa Pond to Mount Hope Bay. South Watuppa Pond and Cook Pond are used for recreation. North Watuppa Pond and Copicut Reservoir are the City's drinking water supplies. Of primary concern to this integrated master plan are the Taunton River and Mount Hope Bay, given their environmental and recreational value. The Taunton River was also classified as a "Wild and Scenic River" by the National Park Service in March 2009.

There are numerous point (via pipe outfall) and non-point (via runoff) discharges that influence the quality of these waterbodies; both upstream and downstream of Fall River. These discharges—include, but are not limited to, WWTF effluent, combined sewer overflow (CSO) discharges, non-contact cooling water, storm drain discharges, and

Borden Flats Lighthouse and Marina, near the Ferry Street CSO outfall in Mount Hope Bay (left). Battleship boardwalk along the Taunton River north of City Pier (right).

stormwater runoff—all of which affect the ability of the receiving waters to meet surface water quality standards. The water quality of the Taunton River and Mount Hope Bay is markedly better since the City's implementation of the CSO controls noted above. However, these waters remain impaired for pathogens, nitrogen, dissolved oxygen and other criteria. It is important to remember that Fall River is not the sole source of water quality impairments in these receiving waters.

Water quality goals include current and/or potential water quality standards, NPDES permit limits, and CSO control requirements.

ES.4.2 Public Health and Safety

There are public health and safety issues associated with human contact with bacteria and other contaminants present in wastewater and stormwater discharges, and in their receiving waters. The public can come in contact with these waters in several ways, such as street flooding, basement backups, by ingesting contaminated raw shellfish, or by primary or secondary recreational contact. Perhaps the most common way for wastewater to be introduced into public areas is when the capacity of combined sewers is exceeded during storm events and CSOs occur. Wastewater and stormwater flooding inside buildings also poses a health risk.

Waterborne illnesses can potentially be carried in untreated or partially treated wastewater and stormwater discharges to receiving waters. Waterbodies where the public has recreational opportunities for exposure need to be closely monitored to ensure that pollutants of concern are not present. There are also public safety issues associated with flooding and by dam failure.

Public health and safety goals include:

- Minimizing human contact with waters, and/or fish and shellfish, carrying pathogens and other undesirable constituents. This includes improved receiving water quality, and mitigation of street, yard and basement flooding.
- Addressing street flooding in areas that would impede emergency response vehicles.
- Considering hazard mitigation for facilities located within FEMA floodplain and downstream dams or impoundments.

ES.4.3 Existing Infrastructure

The City began constructing its combined sewer system in the mid-19th century and a flurry of improvements continued through the early 1900s to support the flourishing mill industries and the population working in these mills. The primary goal of this sewer system was to improve sanitary conditions within the City. Early sewer systems conveyed wastewater away from City streets and discharged directly to the nearest receiving water. Many of these original outfalls remain as CSO outfalls today.

A large percentage of the sewer infrastructure is 75 years old or older. A significant portion of the combined sewer system—including major interceptors—was constructed at an earlier time; before upstream development/expansions, before water quality regulations and discharge permits, and before modern design practices. As a result, several areas of the City experience chronic street flooding and sewer overflows. Considerable modifications to the sewer and stormwater systems would be required to resolve these issues.

Infrastructure goals include:

- Addressing insufficient capacity, age and condition.
- Considering project phasing to prevent improvements from impacting downstream areas that are ill-equipped to handle additional flows.
- Looking for methods of controlling grit deposition that reduces capacity within the piping systems.

Closed-circuit television image showing a cracked pipe

ES.4.4 Regulatory

The *Federal Water Pollution Control Act*, enacted in 1948, was the first major federal law to address water pollution. This law was expanded/amended in 1972 in what is commonly known as the *Clean Water Act* (CWA). Subsequent amendments have modified the CWA over time, but the basic premise remains. The CWA:

- Establishes a mechanism to regulate pollutant discharges,
- Sets surface water quality standards,
- Requires discharge permits for discharge of pollutants to navigable waters,
- Establishes and provides financial assistance for construction of wastewater projects, and
- Gives the EPA authority to set and administer federal policies, rules and regulations.

National Pollutant Discharge Elimination System

The National Pollutant Discharge Elimination System (NPDES) was created in 1972. The *Water Quality Act* of 1987 expanded the NPDES program to include stormwater discharges. NPDES permits provide the means by which the EPA and the states regulate pollutant discharges from municipalities, construction activities and industries. Municipal NPDES wastewater, stormwater and construction permits control these respective discharges to receiving waters. Private industrial

discharges, with the exception of non-contact cooling water, are discharged to the municipal sewer system and treated at Fall River's WWTF. These industrial discharges are administered under the City's industrial pretreatment program, and are not specifically addressed in this document.

Combined Sewer Overflow Control

Combined sewer overflows (CSOs) are authorized wet-weather discharges of untreated or partially treated combined sewage (a mix of sanitary wastewater and stormwater) from the collection system. CSO discharges occur when the wet-weather flow is greater than the capacity of the collection system at a given location. These wet-weather discharges are allowed by a NPDES wastewater permit.

In 1994, the EPA issued the *CSO Control Policy*, including provisions for wet-weather CSO control approaches and enforcement initiatives for dry-weather CSOs. To aid wastewater permittees to comply with the requirements of the *CSO Control Policy*, the EPA issued a series of guidance documents related to the requirements of the nine minimum controls, preparation of long-term control plans, determination of financial capability, program affordability and other topics.

Sewer Overflow Control

Sewer system overflows (SSOs) are unintended, unauthorized discharges of untreated sanitary wastewater from the wastewater collection system or WWTF. These discharges are not allowed by any NPDES wastewater permit. There are two types of SSOs: dry-weather and wet-weather. Dry-weather SSOs are rare and typically associated with some form of system failure (e.g., pipe break or blockage, mechanical failure, power outage). Wet-weather SSOs are more common, often related to insufficient pipe capacity. These overflows can cause street flooding, yard flooding, basement backups, and discharges to adjacent receiving waters. As a result, SSOs can impact water quality, threaten public health and safety, and result in property damage.

Sewer system overflow from surcharging combined sewer in Globe Four Corners.

Goals related to regulatory issues include:

- WWTF resolutions should consider existing and pending NPDES permit requirements, to the extent possible.
- Sewer system resolutions should consider the requirements of EPA's CMOM initiative and eliminate SSOs to the extent practicable.
- CSO-related resolutions should consider the requirements of the federal court order, *CSO Control Policy* and other regulatory requirements, as applicable.
- Stormwater resolutions should consider the requirements of the draft NPDES Massachusetts MS4 permit and other regulatory requirements, as applicable.

ES.4.5 Climate Change

Chronic ponding/flooding in Stafford Square occurs due to the "bowl" shape of drainage basin and insufficient sewer and drain capacities.

Climate change is a rapidly evolving issue that has been a focus of the federal government, as well as many state governments, including Massachusetts. Increasingly, measures to plan for and address climate change are being incorporated into the practices of regulatory agencies such as the EPA and the Army Corps of Engineers (ACOE). Executive Order 13653 was issued by the President in November 2013 and is a key document outlining the need for increased preparation, cooperation, and planning for climate change. Similarly, Executive Order 13690 was issued by the President in February 2014 toward establishing flood risk management standards to mitigate the impacts of flooding resulting from climate change and other threats.

Climate change goals include:

- Considering the implications of climate change (e.g., sea level rise, more intense rainfall patterns, etc.) when designing new infrastructure or upgrading existing infrastructure.
- Using design standards consistent with changing precipitation patterns.

ES.4.6 Sustainability

Sustainability is characterized by the "triple bottom line"—a balance of economical demands and desirable social and environmental improvements. In many situations, the social and environmental goals do not have short-term or obvious benefits. When sustainable programs are implemented correctly, the outcome is lower-cost, higher value solutions. The goal for sustainability in this integrated master plan is to protect public health and water quality, adhere to regulatory standards, and manage financial implications of wastewater and stormwater improvements.

The essential key to sustainability is long term-planning, which can:

- Identify and prioritize need
- Provide more time to evaluate alternatives and identify any disproportionate burdens
- Improve chances to recognize combinable projects
- Allow for a long-term funding system to be put in place
- Build support in the community
- Map out strategies that can endure leadership and oversight changes

Economics is a common driver and one of the most often cited reasons for not implementing a project. This can lead to a "maybe tomorrow" mindset that leads to deteriorating systems and "reactive"—rather than proactive—system management. Reacting to emergencies or planning on a project-by-project basis can narrow goals, increase costs, and result in a piecemeal organization that does not holistically address a community's needs. Estimating the financial impact of long-term goals provides an opportunity to plan out fee structures, gain financial assistance, and ease the process of incorporating projects into budgets.

Sustainability goals include:

- Promoting a combination of gray and green infrastructure that resolves SSO control, CSO control, flood control, and improved receiving water quality.
- Implementing holistic solutions to utility construction that address sewer, stormwater, water, road reconstruction and other utility needs at one time to minimize financial and environmental impacts on the community.
- Considering energy efficient solutions in facility designs.

ES.5 Problem Identification and Resolution Processes

ES.5.1 Problem Identification and Definition Process

Based on the identified project issues and goals, a series of investigations and analyses were performed to identify and define the locations and extents of wastewater and stormwater issues. A flow chart of the problem identification process is presented in Figure ES-3. Areas of investigation were divided into eight categories, namely:

- Wastewater treatment facility issues
- Wastewater pump station issues
- Combined sewer overflow (CSO) issues
- Sewer system—wet-weather capacity issues
- Sewer system—general issues
- Stormwater system—general issues
- Source water protection issues
- Organizational/institutional issues

Figure ES-3: Project Identification Process

The problem identification process began with a series of workshops with representatives from the City's Department of Community Utilities, Veolia (the City's wastewater contract operator), and CDM Smith (the City's integrated planning consultant). CDM Smith's subconsultants, BETA

Group and Woodard & Curran, also attended many of these workshops. Each workshop was focused on a specific topic.

During these workshops, the City and Veolia noted areas of concern for further review. Identified problem areas and issues were then investigated further to better understand the issues and needs. Based on these investigations, descriptions of the problem areas were developed and organized based on the eight categories noted above.

ES.5.2 Resolution Concept Development Process

Resolution concepts have been developed for each of the identified problem areas using the multi-step process shown in Figure ES-4. Initially, the project goals were reviewed and applied, as appropriate. General design criteria were also established and applied. Based on these goals and design criteria, hydrologic and hydraulic analyses were performed to determine the level of service required.

Figure ES-4: Resolution Concept Definition Process

In many cases, several alternatives were developed and assessed. However, in some areas, an assumed level of service was applied with the understanding that additional studies would be required to define/refine the project requirements. This is especially true for sewer separation projects where recommendations are conceptual, made without the benefit of design-level documentation of existing conditions. Additional site investigations would be necessary to confirm assumptions made during this process and to properly design the recommended infrastructure.

Once the resolution concepts were conceived, implementation issues (e.g., constructability, permitting, siting, wetland impacts, etc.) and impact mitigation (e.g., pipe surcharging and/or street flooding corrected, risk of equipment failure addressed, public health and safety risks avoided, etc.) were reviewed.

Similar to the initial workshops, resolution concept workshops were also held with representatives from the City's Department of Community Utilities, Veolia (the City's wastewater contract operator), BETA Group, Woodard & Curran and CDM Smith. Again, each workshop was focused on a specific topic. During these workshops, the City and Veolia noted additional areas of concern, and/or provided additional perspective to the recommendations for further review.

ES.6 Resolution Concepts

ES.6.1 General

Based on the process described in Section ES.5 above, concept level projects were developed for each identified problem area to address their respective issues and impacts. Given the breadth of the identified problem areas and proposed resolution concepts, an anticipated 50-year forecast period was used for capital planning purposes.

Resolution concepts incorporated infrastructure renewal projects including:

- Equipment replacement at 25-year intervals; thus, replacement would occur twice within the 50-year planning period.
- Building or structure rehabilitation—including upgrades to related mechanical, plumbing and electrical facilities—at 25-year intervals; thus, building/structure rehabilitation would occur twice within the 50-year planning period.
- Upgrade of computer hardware and software associated with the instrumentation and control systems, and associated supervisory control and data acquisition (SCADA) systems, at 5-year intervals; thus, upgrades would occur ten times over the 50-year planning period.

All resolution concepts are developed to a conceptual level given the amount of information readily available. Topographic survey, borings and other subsurface investigations, hydrologic and hydraulic studies, and other analyses would need to be performed for each area during the initial phases of facility design. Many projects would require significant permitting prior to implementation.

Opinions of probable cost were developed for each resolution concept component/project based on the information available. Costs presented for capital planning/budgeting are in 2015 dollars and include all projected costs for design, permitting, construction, construction administration, resident engineering and contingencies. Premiums have also been added for rock excavation and removal, urban soil management and disposal, and police details. Costs do not include escalation to the estimated mid-point of construction, costs of land acquisition or easements, or inflation.

The following sections present a summary of the findings and proposed resolutions for the identified problem areas. The project issues and recommended projects are summarized by type, but are not presented with regard to implementation priority. Project ranking and prioritization are presented in Section ES.7.

ES.6.2 Wastewater Treatment Facility

Issues and Impacts

All wastewater and stormwater operations are based from the Fall River WWTF on Bay Street.

The Fall River WWTF, its collection system and CSO outfalls, are operated in compliance with NPDES Permit No. MA0100382. However, its current permit is expected to be superseded shortly. A total nitrogen (TN) limit is anticipated in the future, and could be significant in terms of required capital upgrade needs at the WWTF. The EPA has indicated its intention to require the WWTF to meet an effluent total nitrogen (TN) limit of either 8, 5, or 3 milligrams per liter (mg/L)—and/or mass limits based on these concentrations—on a seasonal basis (May through October). This anticipated requirement is consistent with the EPA's approach toward most WWTFs whose effluent, either directly or indirectly, eventually enter Narragansett Bay.

While the WWTF is in compliance with its NPDES permit, much of the existing infrastructure is at the end of its useful life. Most facilities were constructed or rehabilitated in the late 1970s as part of the secondary treatment upgrade. As such, most of the WWTF has not been updated in more than 35 years and demands for maintenance are growing. This includes both equipment and structures. Additionally, the sludge incinerator would need to be removed from service in March 2016, as it likely would not meet regulatory emissions requirements that take effect at that time.

Clarifier No. 3 is out of service. The center drive cage sheared and requires replacement.

The impacts of implementing nitrogen removal at the Fall River WWTF are substantial, requiring significant and costly capital improvements, and dramatically increasing long-term operational costs. It should also be noted that TN limits have tended to become more stringent with time, and that many plants that originally had a TN limit of 8 mg/L have since had their discharge permits modified to tighter TN limits, down to as low as 3 mg/L. Seasonal limits could also be changed to year-round limits at some time in the future. These are all considerations when developing a long-term capital improvement plan.

The operations buildings are insufficient and outdated by current standards. The WWTF lacks the instrumentation and controls of a contemporary treatment facility. A plant-wide SCADA system should be installed to communicate real time operations data and alarms to the Control Room. The collections system staff work from an old trailer without necessary locker room and shower facilities. The facility lacks winter garage space for collection system maintenance vehicles to prevent freezing and to maintain their readiness for use. Additional staff and maintenance equipment would be required to support regulatory initiatives contained within EPA's capacity, management, operation and maintenance (CMOM), CSO control policy, and pending Massachusetts MS4 permit requirements.

Recommended Projects

The Fall River WWTF is in need of significant capital investment, touching on every unit process and area of the plant. Essentially every unit process and area of the WWTF is in need of major capital investment. It is proposed to divide the WWTF rehabilitation into several smaller capital projects—though these "smaller" projects would each remain very significant in size. These projects should be implemented in a prioritized, sequenced manner to reduce the financial impact on the City while maintaining the operability of this critical facility during the construction process.

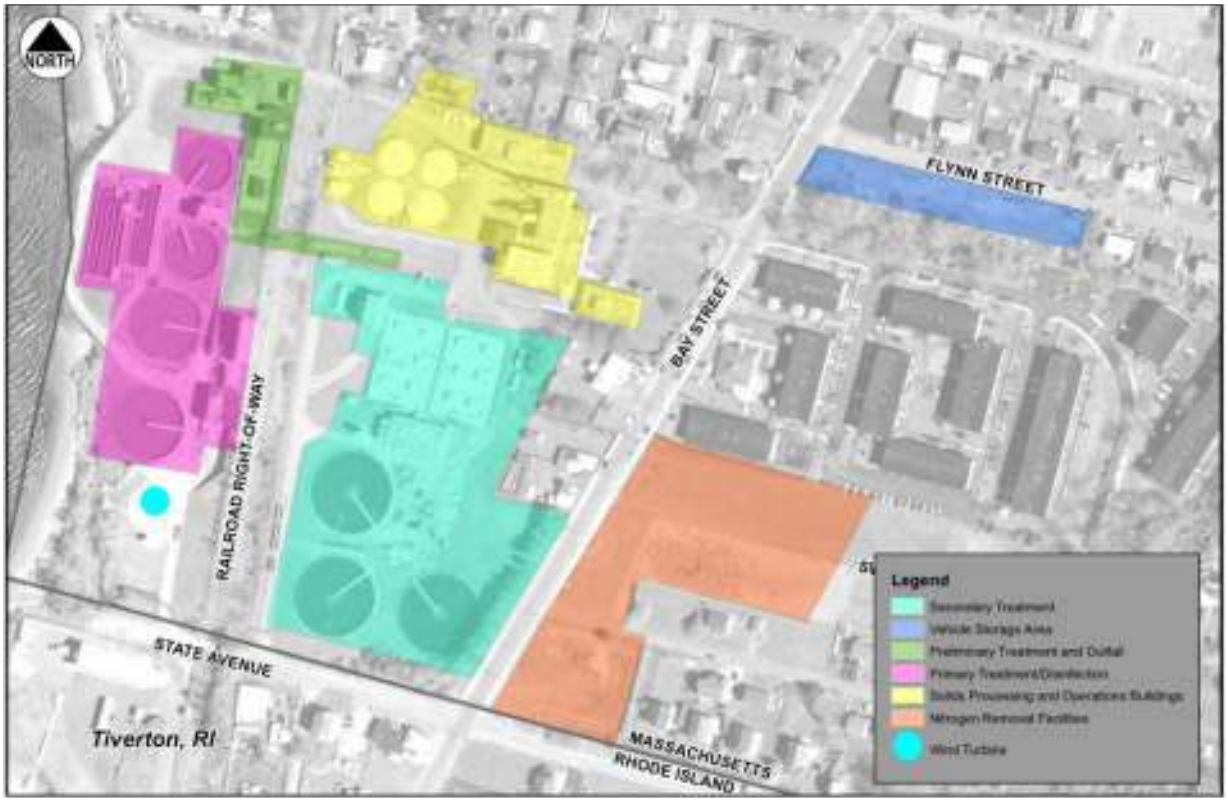
Recommended WWTF improvement projects for the 50-year forecast period total $362 million. These projects are summarized in Table ES-1. Figure ES-5 visually presents the extent of each project, based on addressing specific unit processes and/or areas of the WWTF.

Settlement exhibited in building joint and stairs at Pump House No. 2. Settlement has resulted in piping and electrical service failures.

Table ES-1: Recommended Wastewater Treatment Projects

Project Identifier	Description	Opinion of Probable Cost (2015 Dollars)
WWTF Studies	▪ Facilities Planning 1 (25-year plan) ▪ Facilities Planning 2 (25-year plan)	▪ $2 million ▪ $2 million
WWTF1	▪ Solids Handling and Operations Buildings Rehabilitation 1 ▪ Instrumentation and Controls Upgrades ($250,000 at 5-year intervals between rehabilitation projects) ▪ Solids Handling and Operations Buildings Rehabilitation 2 ▪ Instrumentation and Controls Upgrades ($250,000 at 5-year intervals between rehabilitation projects)	▪ $36 million ▪ $1 million ▪ $36 million ▪ $1 million
WWTF2	▪ Preliminary Treatment Facility Rehabilitation 1 ▪ Outfall Rehabilitation/Replacement ▪ Preliminary Treatment Facility Rehabilitation 2	▪ $16 million ▪ $5 million ▪ $16 million
WWTF3	▪ Secondary Treatment Facilities Rehabilitation 1 ▪ Secondary Treatment Facilities Rehabilitation 2	▪ $29 million ▪ $29 million
WWTF4	▪ Primary Treatment and Disinfection Rehabilitation 1 ▪ Primary Treatment and Disinfection Rehabilitation 2	▪ $18 million ▪ $18 million
WWTF5	▪ Nitrogen Removal Upgrade ▪ Nitrogen Removal Facility Rehabilitation	▪ $88 million ▪ $54 million
WWTF6	▪ Maintenance Vehicle Garage ▪ Maintenance Vehicle Garage Rehabilitation	▪ $4 million ▪ $1 million
WWTF7	▪ Wind Turbine	▪ $6 million
	Total	▪ **$362 million**

Figure ES-5: Suggested WWTF Rehabilitation Phasing



ES.6.3 Wastewater Pump Stations

Issues and Impacts

Fall River currently owns and controls the operation and maintenance of 15 pump stations. Fourteen of these pump stations are active; many of these pump stations have confined space access issues. Additionally, there are three privately-owned pump stations which may be transferred to the City at some later date. These pump stations are noted but not included in the integrated plan. The locations of all eighteen pump stations are shown in Figure ES-6.

The Middle Street pump station is currently out-of-service due to a fire at the mill buildings it supports. It is expected that this pump station would be restored as part of mill redevelopment activities when/if it occurs. As such, the needs of this pump station are not defined and its replacement is not currently included in the integrated plan.

Figure ES-6: Pump Station Locations

The President Avenue pump station is beyond its useful life and should be replaced as soon as possible. In 1981, the failing pump station wet well was retrofitted with submersible pumps—as a temporary solution. These pumps are still in service.

The two largest pump stations—Cove Street and Central Street—were constructed concurrently in the late 1940s, and upgraded (twice) at similar times. As such, these stations are very similar in construction, configuration and condition. These pump stations were recently rehabilitated and it is recommended that these facilities be utilized in their present form.

Most of the remaining pump stations were constructed in the 1960s. They are located in remote locations, including neighborhoods, commercial and industrial areas. A majority of these pump stations have already passed, or are near, the end of their useful lives.

Recommended Projects

Similar pump station configurations are recommended for each type of pump station—small, medium and large. This approach would enhance operator familiarity with facility configuration, and operation and maintenance (O&M) needs.

Recommended wastewater pump station improvement projects for the 50-year forecast period total $70 million. Projects include replacement of the aged small and medium pump stations with a standardized pump station design. The medium pump station design concept would include a small building to house a generator and pump controls. The small pump station concept would be similar to the medium pump stations but with an outdoor generator (in an enclosure) and a pump control panel instead of the small building. The large pump stations would continue to be periodically rehabilitated for the foreseeable future. These projects are summarized in Table ES-2.

Table ES-2: Recommended Wastewater Pump Station Projects

Project Identifier	Description	Opinion of Probable Cost (2015 Dollars)
PS1	▪ Joseph Drive pump station replacement/force main rehabilitation ▪ Joseph Drive pump station rehabilitation	▪ $2.4 million ▪ $0.9 million
PS2	▪ Meridian Street pump station and force main rehabilitation ▪ Meridian Street pump station rehabilitation	▪ $1.6 million ▪ $0.9 million
PS3	▪ Wilson Road pump station replacement/force main rehabilitation ▪ Wilson Road pump station rehabilitation	▪ $2.5 million ▪ $1.2 million
PS4	▪ Cove Street pump station and force main rehabilitation ▪ Cove Street pump station rehabilitation	▪ $5.9 million ▪ $5.1 million
PS5	▪ Central Street pump station and force main rehabilitation ▪ Central Street pump station rehabilitation	▪ $6.7 million ▪ $5.1 million
PS6	▪ Valentine Street pump station replacement/force main rehabilitation ▪ Valentine Street pump station rehabilitation	▪ $1.8 million ▪ $0.9 million
PS7	▪ President Avenue pump station replacement/force main rehabilitation ▪ President Avenue pump station rehabilitation	▪ $4.0 million ▪ $1.4 million
PS8	▪ East End pump station replacement/force main rehabilitation ▪ East End pump station rehabilitation	▪ $3.9 million ▪ $1.3 million
PS9	▪ Martine Street access road, site security and communications ▪ Martine Street pump station replacement/force main rehab. ▪ Martine Street pump station rehabilitation	▪ $1.2 million ▪ $3.6 million ▪ $1.1 million
PS10	▪ Ross Matthews pump station replacement/force main rehabilitation ▪ Ross Matthews pump station rehabilitation	▪ $2.6 million ▪ $0.9 million
PS11	▪ Travassos Park pump station replacement/force main rehabilitation ▪ Travassos Park pump station rehabilitation	▪ $1.9 million ▪ $0.9 million
PS12	▪ South End pump station replacement/force main rehabilitation ▪ South End pump station rehabilitation	▪ $3.6 million ▪ $1.5 million
PS13	▪ Ferry Street pump station replacement/force main rehabilitation ▪ Ferry Street pump station rehabilitation	▪ $2.9 million ▪ $1.3 million
PS14	▪ Amity Street pump station replacement/force main rehabilitation ▪ Amity Street pump station rehabilitation	▪ $2.0 million ▪ $0.9 million
	Total	▪ **$70 million**

ES.6.4 Combined Sewer Overflow Facilities

Issues and Impacts

Historically, wet-weather events caused frequent CSOs at 19 locations; 17 of which remain in operation. As a result of the federal court order, the City has invested approximately $190 million, to date, toward controlling these overflows. Maintenance and periodic rehabilitation of these facilities must be considered. Additionally, the federal court order requires additional CSO controls be implemented by 2025.

The locations of all 19 historic CSO outfalls, the CSO tunnel and the two CSO screening and disinfection facilities are shown on Figure ES-7.

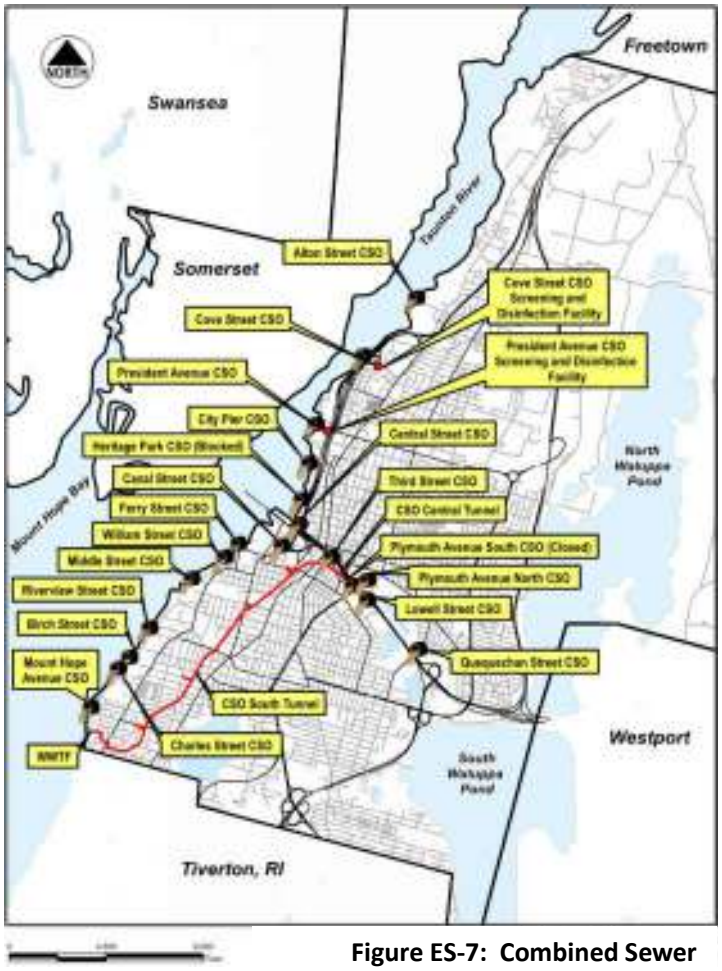


Figure ES-7: Combined Sewer Overflow Facility Locations

Recommended Projects

CSO Tunnel System

The CSO tunnel system consists of a 3-mile long, 20-foot diameter unlined deep rock tunnel, with nine drop shafts and associated structures, the plant conduit connecting the tunnel to the WWTF, and a tunnel ventilation system. The CSO tunnel provides a storage capacity of 38 million gallons to reduce CSOs in the South and Central Systems. Recommended CSO tunnel system projects include periodic cleaning, inspection and rehabilitation—including instrumentation and controls—and construction of the extreme event outfall (EEO).

Rendering of proposed tree box filters in the Birch Street Area
Source: Birch Street Drainage Area Green Infrastructure Pilot Program (Draft), Tetra Tech, January 2015

Sewer Separation Projects

The federal court order requires almost full sewer separation—providing separate drainage facilities—for the Alton Street and City Pier basins, and areas of the South System between the CSO tunnel and the Mount Hope Bay shoreline. Sewer separation removes stormwater from the combined sewer system, so that more pipe capacity is available to convey wastewater. The extent of sewer separation required is that necessary to prevent CSOs during a 3-month storm—a storm with a probability of occurring four times per year. Inclusion of "best

management practices" (BMPs) or "green infrastructure" (e.g., tree box filters, porous pavement, rain gardens, etc.) could reduce the extent of sewer separation required. However, Fall River's topography and near-surface bedrock makes implementation of infiltration-type BMPs difficult. Regulator and outfall improvements are also proposed for the Mount Hope Avenue Basin.

Recommended CSO improvement projects for the 50-year forecast period total $365 million. These projects are summarized in Table ES-3.

Photo of Mount Hope Avenue CSO Outfall looking east toward Atlantic Boulevard.

Table ES-3: Recommended Combined Sewer Overflow Projects

Project Identifier	Description	Opinion of Probable Cost (2015 Dollars)
CSO Studies	▪ CSO Facilities Plan ▪ Assessment (at 5-year intervals) ▪ Assessment (at 5-year intervals)	▪ $1 million ▪ $0.3 million ▪ $0.3 million
CSO1	▪ CSO Tunnel Inspection ▪ CSO Tunnel Inspection and Cleaning ($1.5 million at 10-year intervals)	▪ $0.5 million ▪ $7.5 million
CSO2	▪ CSO Tunnel Drop Shaft Structures Rehabilitation ▪ CSO Tunnel Drop Shaft Structures Rehabilitation	▪ $1.5 million ▪ $1.5 million
CSO3	▪ CSO Tunnel Fan Vault Rehabilitation ▪ CSO Tunnel Fan Vault Rehabilitation	▪ $3 million ▪ $3 million
CSO4	▪ CSO Tunnel Instrumentation and Controls ($0.2 million at 5-year intervals)	▪ $2 million
CSO5	▪ CSO Tunnel Extreme Event Outfall	▪ $40 million
CSO6	▪ Alton Street Basin Sewer Separation	▪ $35 million
CSO7	▪ Cove Street CSO Facility Rehabilitation/Dechlorination ▪ Cove Street Basin Sewer Separation (if required)	▪ $4.5 million ▪ $102 million
CSO8	▪ President Avenue CSO Facility Rehabilitation ▪ President Avenue Basin Sewer Separation (if required)	▪ $3 million ▪ $62 million
CSO9	▪ City Pier and Central Street Basins Sewer Separation	▪ $47 million
CSO10	▪ Ferry Street Basin Sewer Separation	▪ $10 million
CSO11	▪ Middle Street Sewer Separation	▪ $20 million
CSO12	▪ Birch Street Basin Sewer Separation	▪ $20 million
CSO13	▪ Mount Hope Avenue Outfall and Regulator Improvements	▪ $0.8 million
	Total	▪ **$365 million**

ES.6.5 Collection System—Wet-weather

Issues and Impacts

Roughly two-thirds of the City's sewer infrastructure is older than 75 years. A significant portion of the combined sewer system—including major interceptors—was constructed before upstream development/expansions, before water quality regulations and discharge permits, and before

current design practices were in place. As a result, several areas of the City experience chronic street flooding and sewer overflows related to limited pipe capacity. While moderate pipe surcharging generally goes unnoticed, SSOs cause street flooding, yard flooding, and basement backups. These can result in property damage and threaten public health and safety. Depending on their location, these overflows can also discharge to adjacent receiving waters or wetlands. As a result, SSOs can also impact receiving water quality.

Figure ES-8: Wet-weather Collection System Problem Locations

Wet-weather capacity issues are scattered throughout the City, as shown in Figure ES-8. Some areas are prone to SSOs like Stafford Square, Globe Four Corners, Cove Street, Davol Street and Alden Street. Additionally, Stafford Square, Cove Street and Davol Street also experience chronic street flooding as a result of insufficient combined sewer capacity. Conditions at Davol Street and Cove Street are exacerbated by tidal influences. Stafford Square is influenced by the water elevation of the Quequechan River.

Recommended Projects

Considerable modifications to the sewer and stormwater systems would be required to resolve the issues. The goal of the recommended improvements is to reduce peak flows and increase system capacity, thereby containing the flow below the roadway surface. As recommended system improvements alone may not resolve all back-ups into low-lying basement levels, backflow preventers would be recommended for impacted private residences to eliminate these back-ups.

Sewer overflow due to insufficient pipe capacity in Stafford Square.

Improvements are generally categorized into three types of projects:

- Sewer separation to remove stormwater from the combined sewer system,
- Enlarging the combined sewer to provide additional capacity, and

- Infiltration and inflow (I/I) removal to restore pipe capacity.

Recommended Wet-weather collection system improvement projects for the 50-year forecast period total $258 million. These projects are summarized in Table ES-4.

Table ES-4: Recommended Wet-weather Collection System Projects

Project Identifier	Description	Opinion of Probable Cost (2015 Dollars)
SWW1	▪ Sykes Road Infiltration/Inflow Removal Program	▪ $0.6 million
SWW2	▪ Highland Avenue Improvements	▪ $15 million
SWW3	▪ Cove Street Wet-weather Pump Station	▪ $12 million
SWW4	▪ Lindsey Street and Brownell Street Improvements ▪ President Avenue Drain Extension	▪ $12 million ▪ $0.9 million
SWW5	▪ Oak Grove Avenue Sewer Replacement	▪ $35 million
SWW6	▪ Stafford Square Basin Sewer Separation and Replacement	▪ $51 million
SWW7	▪ Alden Street Area – Alden Street Sewer and Drainage Improvements ▪ Alden Street Area – Eastern Avenue Sewer Replacement ▪ Alden Street Area – Gagnon/Horton Streets Drainage Improvements	▪ $20 million ▪ $2 million ▪ $9 million
SWW8	▪ Hartwell and Rodman Streets Sewer Replacement to Drop Shaft	▪ $4.7 million
SWW9	▪ Brayton Avenue Area – Brayton Avenue Sewer Separation ▪ Brayton Avenue Area – Warren Street Sewer Separation ▪ Brayton Avenue Area – Chace Pond Dredging	▪ $15 million ▪ $18 million ▪ $13 million
SWW10	▪ Globe 4 Corners and Upstream – Sewer Replacement to Drop Shaft ▪ Globe 4 Corners and Upstream – Relief Sewer to Regulator ▪ Globe Street Basin Sewer Separation	▪ $6.3 million ▪ $11 million ▪ $3.5 million
SWW11	▪ Miller Street Sewer Replacement	▪ $4 million
SWW12	▪ Carl Street and Tucker Street Sewer Replacement and Separation	▪ $25 million
	Total	▪ **$258 million**

Severe flooding on Fulton Street, looking toward Cove Street (left). Severe flooding in Stafford Square (right). [Stafford Square photo courtesy of WJAR NBC10]

ES.6.6 Collection System—General

Issues and Impacts

The City began constructing its combined sewer system in the mid-19th century and a flurry of improvements continued through the early 1900s to support the flourishing mill industries and

the population working in these mills. The primary goal of this sewer system was to improve sanitary conditions within the City. Early sewer systems conveyed wastewater away from City streets and discharged directly to the nearest receiving water. As a result of the City's industrialization, roughly two thirds of its sewer infrastructure is 75 years old, or older. Since the 1940s, sewer improvements have continued at a more limited scale, as such the City relies on a system with a backbone that is over a century old. A significant portion of the "newer" infrastructure includes the Main Interceptor, which runs along the Taunton River and Mount Hope Bay shoreline from Alton Street to the WWTF. The remainder of this "newer" infrastructure mostly supports sewer expansion into residential neighborhoods along Route 24 and development of the Fall River Industrial Park.

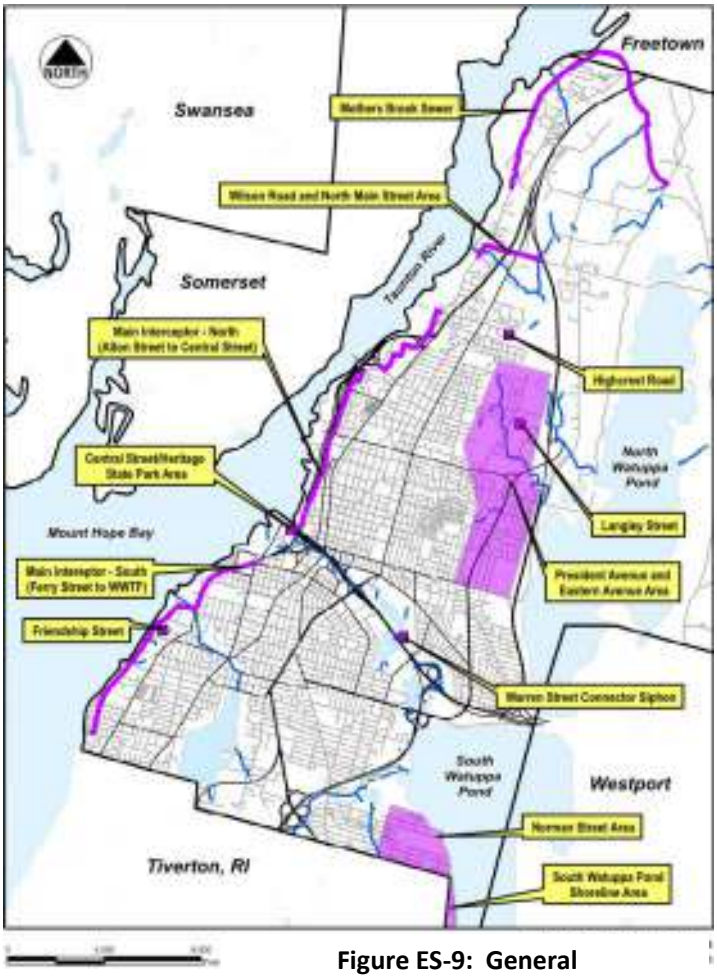


Figure ES-9: General Collection System Problem Locations

Problem areas identified in Figure ES-9 are not related to wet-weather capacity or the associated impacts. These issues are related to pipe age and condition, including:

- Open pipe joints, which significantly increase infiltration,
- Cracked pipes, which also allow infiltration and can result in pipe collapse,
- Pipe sags, which collect debris and can result in blockages,
- Pipe expansion required for economic development,
- Maintenance and access issues for critical facilities,
- Sewer system expansion to protect South Watuppa Pond water quality, and
- Infrastructure renewal needs due to pipe age.

Closed-circuit television image showing offset joints

Of critical concern is the Main Interceptor. The Main Interceptor tends to collect grit and debris carried during wet-weather flows and deposited as flows decrease and during dry weather. The City's maintenance equipment is not capable of cleaning this critical infrastructure given the pipe diameter and access issues. A specialty vendor would be required to remove the built-up grit and debris. Additionally, the interceptor crosses the Quequechan River within the open river channel. The pipe is secured with pipe couplings, which present a potential for pipe failure.

The exposed 36-inch Main Interceptor crossing within the open Quequechan River.

Recommended Projects

Recommended general collection system improvement projects for the 50-year forecast period total $70 million. These projects are summarized in Table ES-5.

Table ES-5: Recommended General Sewer System Projects

Project Identifier	Description	Opinion of Probable Cost (2015 Dollars)
SG1	▪ Mother's Brook Sewer Replacement	▪ $16.9 million
SG2	▪ Wilson Road and North Main Street Improvements	▪ $0.4 million
SG3	▪ Highcrest Road Sewer Replacement	▪ $0.2 million
SG4	▪ Langley Street Sewer Replacement	▪ $0.2 million
SG5	▪ President Avenue and Eastern Avenue Area Infiltration/Inflow Removal	▪ $2.2 million
SG6	▪ Main Interceptor-North Rehabilitation ▪ Main Interceptor-North Lining at River Crossing ▪ Main Interceptor-North Grit Chamber	▪ $2.0 million ▪ $0.1 million ▪ $5.0 million
SG7	▪ Main Interceptor-South Rehabilitation	▪ $7.8 million
SG8	▪ Central Street/Heritage Park Area Sewer Lining	▪ $0.1 million
SG9	▪ Warren Connector Siphon Access Improvements	▪ $0.6 million
SG10	▪ Friendship Street Sewer Replacement	▪ $0.2 million
SG11	▪ Norman Street/Wood Street Area Pressure Sewers	▪ $9.2 million
SG12	▪ Sewer Capital Improvement Plan ($0.5 million annually)	▪ 25 million
	Total	▪ **$70 million**

Recommended projects include:

- Structural lining of the Main Interceptor, at the Quequechan River crossong, and the Central Street sewer near Heritage State Park, to provide structural integrity and prevent infiltration/exfiltration to/from these pipes,
- Repair of known pipe sags, open joints, and other defects,

- Removal and control of grit and debris from the Main Interceptor,
- Low pressure sewers for residences along the South Watuppa shoreline,
- Expansion of the Mothers Brook sewer for economic growth within the Industrial Park, and
- A sewer system renewal CIP, totaling approximately $500,000 annually to address the aging infrastructure.

Figure ES-10: General Stormwater System Problem Locations

ES.6.7 Stormwater—General

Issues and Impacts

This Section presents stormwater management—flooding—issues related to existing separate storm drainage systems and waterways across the City. Management of drainage infrastructure is regulated under the NPDES Municipal Separate Storm Sewer System (MS4) Permit. This permit includes requirements for stormwater system operations and maintenance (O&M), and compliance monitoring. The locations of the problem areas identified in this Section are shown on Figure ES-10.

The overgrown/sedimented Quequechan River impacts combined sewer and stormwater systems along its shoreline (left). The overgrown Cress Brook channel (center) floods residences on David Street (note the sandbags at the doorway). Chronic street flooding at the intersection of Quequechan Street, Jefferson Street and Warren Street (right).

Recommended Projects

Recommended general stormwater improvement projects for the 50-year forecast period total $65 million. A significant portion of the stormwater improvements are related to improving the City's ability to control the flow of water down the Quequechan River. The lack of outlet control at South Watuppa Pond, and the limited downstream capacity in the piped lower river, create detrimental tailwater conditions to both the combined sewer and separate drainage systems along the river. River elevations play a significant role in flooding at Stafford Square, Warren Street, and the Rodman Street/Hartwell Street areas. The recommended projects are summarized in Table ES-6.

Table ES-6: Recommended General Stormwater Projects

Project Identifier	Description	Opinion of Probable Cost (2015 Dollars)
SWG1	▪ Steep Brook Culvert Replacement	▪ $1.4 million
SWG2	▪ Industrial Park Swales Cleaning and Restoration	▪ Maintenance
SWG3	▪ Elsbree Street at Valentine Street Drainage Improvements	▪ $0.3 million
SWG4	▪ North Main Street Drainage Improvements	▪ $0.2 million
SWG5	▪ Nichols and Langley Street Drainage Improvements	▪ $1.2 million
SWG6	▪ Cress Brook Area – Eastern Avenue/New Boston Road Improvements ▪ Cress Brook Area – Oak Grove Area Drainage Improvements ▪ President Avenue Rotary Drainage Improvements	▪ $5.3million ▪ $2.5 million ▪ $0.2 million
SWG7	▪ Hyacinth Street – North Drainage Improvements ▪ Hyacinth Street – South Drainage Improvements	▪ $0.7 million ▪ $1.7 million
SWG8	▪ Highland Brook Near Route 24 Drainage Improvements	▪ $0.9 million
SWG9	▪ Quequechan River Improvements	▪ $30 million
SWG10	▪ Brayton Avenue Drainage Improvements	▪ $11 million
SWG11	▪ Cook Pond and Stream Rehabilitation	▪ $2.3 million
SWG12	▪ Powell Street Area Drainage Improvements	▪ $0.7 million
SWG13	▪ Kempton/Roosevelt Streets Drainage Improvements	▪ $1.8 million
SWG14	▪ Whitefield Street Drainage Improvements	▪ $1.6 million
SWG15	▪ Dickinson Street Area Drainage Improvements	▪ $3.2 million
	Total	▪ **$65 million**

Open channel section of the existing North Watuppa Pond Interceptor Drain.

ES.6.8 Source Water Protection

Issues and Impacts

Fall River has two drinking water reservoirs, North Watuppa Pond and Copicut Reservoir. While the City has infrastructure in place to intercept storm flows to protect these "source waters", many have limited capacities. These capacity limitations result in overtopping of channels or roads with flows travelling toward the reservoirs.

The Southeastern Massachusetts Bioreservecomprises a significant portion of the reservoirs' watershed. Roads within this area are deteriorated and should be improved to prevent

sedimentation and erosion, and to provide best management practices for treatment of stormwater runoff. The locations of source water protection issues are shown in Figure ES-11.

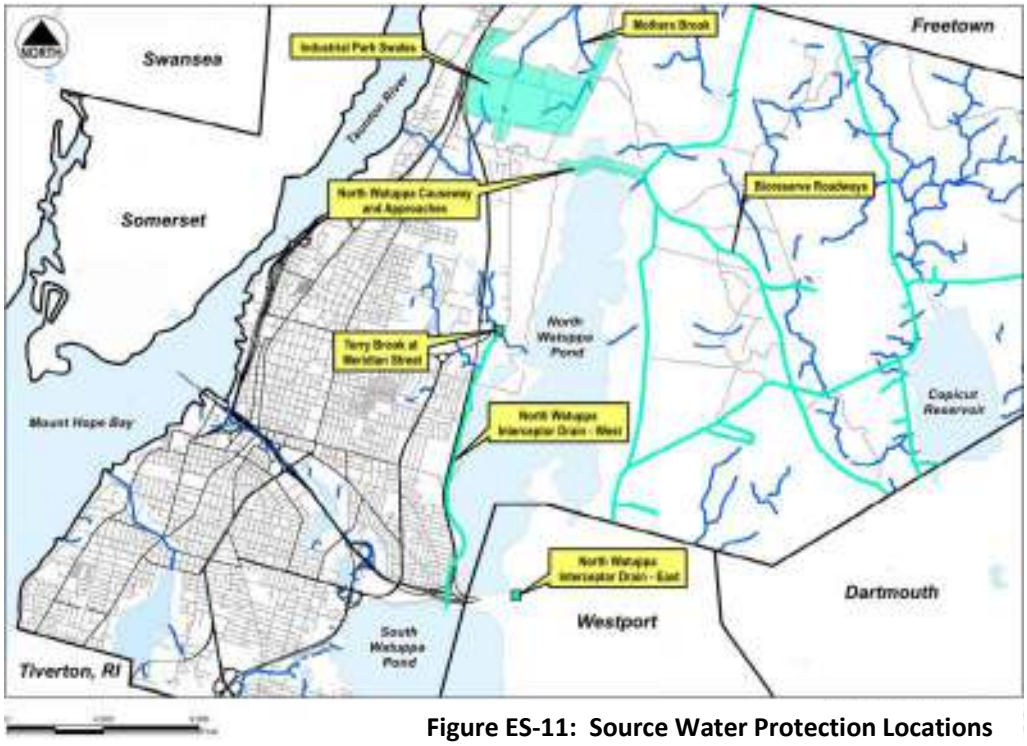


Figure ES-11: Source Water Protection Locations

Recommended Projects

Recommended source water protection projects for the 50-year forecast period total $182 million. A significant portion of the stormwater improvements are related to restoration of the bioreserve roads, including the addition of storm drainage infrastructure. The existing North Watuppa Pond Interceptor Drain also needs restoration and a second, parallel drain to adequately intercept and direct flows away from North Watuppa Pond. Additional improvements to divert stormwater away from North Watuppa Pond, and improvements to the causeway complete the recommendations for this Section. The recommended projects are summarized in Table ES-7.

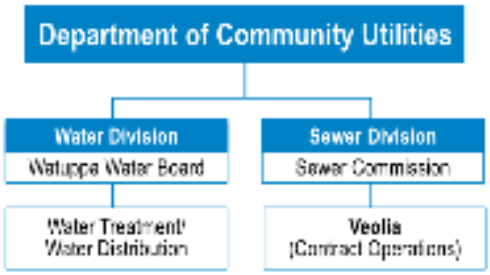
Table ES-7: Recommended Source Water Protection Projects

Project Identifier	Description	Opinion of Probable Cost (2015 Dollars)
SWP1	▪ Mothers Brook Channel Restoration	▪ $2.1 million
SWP2	▪ North Watuppa Pond Causeway and Approaches Rehabilitation	▪ $3.8 million
SWP3	▪ Bioreserve Roads Rehabilitation and Drainage Improvements	▪ $132 million
SWP4	▪ Terry Brook Channel Improvements to Interceptor Drain	▪ $3.5 million
SWP5	▪ North Watuppa Pond Interceptor Drain – West Cleaning ▪ North Watuppa Pond Interceptor Drain – West Expansion	▪ $2.3 million ▪ $36 million
SWP6	▪ North Watuppa Pond Interceptor Drain – East Cleaning	▪ $2.3 million
	Total	▪ **$182 million**

ES.6.9 Organizational/Institutional

In addition to the extensive list of infrastructure needs, there are several organizational and institutional issues that need to be addressed. These issues include:

- *Organizational structure and staffing levels:* The Department of Community Utilities administrates the Sewer Division and its contract operator (Veolia). Given pending regulatory initiatives for advanced treatment technologies, asset management, optimized system operation and maintenance, and the more intelligent instrumentation and controls to support these initiatives, additional staffing would be required in all areas.



Department of Community Utilities organizational structure.

- *City Ordinances, as they apply to the Sewer Division operations:* While the City Ordinances generally meet the current needs of the Sewer Division, there are a few instances where additional/supplemental ordinances would benefit Sewer Division operations.

- *Revenue sources (i.e., sewer and stormwater fees, grants and loans):* Fall River's rates are comparable to New Bedford, but are higher than other similar Massachusetts communities such as Lowell and Lawrence. This is attributable in part to Fall River's higher debt service caused by the federal court order mandated CSO Abatement Program. In addition to sewer and stormwater fees, the Department of Community Utilities continually searches for innovative means to fund its capital improvement projects.

- *Operation and maintenance practices, asset management and equipment:* The City's wastewater and stormwater facilities are managed by Veolia, through an agreement with the Sewer Commission. Veolia provides the expertise and resources necessary to properly operate and maintain these facilities. The Department of Community Utilities is implementing a comprehensive asset management system. Additional equipment would be required to support additional staff and for equipment renewal.

Vactor trucks are used for pipe and catch basin cleaning, and other maintenance activities.

Recommended Projects

Recommended organizational/institutional projects for the 50-year forecast period total $9 million. The recommended projects are summarized in Table ES-8, and include:

- Additional staff and equipment to address regulatory requirements and the expanded infrastructure recommended by this master plan.

- New and/or modified City Ordinances to address a variety of issues.
- Additional revenues to support optimized operation and maintenance, as well as capital improvements for infrastructure renewal. Revenues should be maximized without overburdening ratepayers.
- A combined asset management system; envisioned to be used by Department of Community Utilities, Sewer Division, Water Division and Veolia staff. Asset management should include multiple computerized maintenance management system (CMMS) and data archiving systems to replace multiple, outdated systems for enhanced, optimized management of the wastewater and stormwater systems.

Table ES-8: Recommended Organizational Projects

Project Identifier	Description	Opinion of Probable Cost (2015 Dollars)
ORG1	▪ Asset Management System – Initial Cost ▪ Asset Management System – Upgrades ($50,000 at 5-year intervals)	▪ $0.5 million ▪ $0.5 million
ORG2	▪ Replacement of Maintenance Equipment ($150,000 annually) ▪ Additional Maintenance Equipment	▪ $7.5 million ▪ $0.5 million
	Total	▪ **$9 million**

ES.7 Resolution Concept Assessment

In preparation for recommending a capital improvements program for wastewater and stormwater facilities, the resolution concepts were assessed as a group to determine their importance or benefit relative to each other. To do this required assessment process, a variety of WWTF, pump station, sewer and stormwater infrastructure, and source water protection projects were rated using a common set of criteria. This created a challenge due to the diversity of projects and their applicability to the identified project goals.

A variety of environmental, regulatory, institutional and social criteria were developed, these could be applied across all resolution concepts. These criteria each have ranking scores of 2 to -2 points, depending on the concept's ability to meet each criterion. A score of 0 is generally considered neutral or not applicable. Additional points were given to projects with overriding conditions related to critical facilities, safety/failure risks, and emergency access impacts. These scores ranged from 2 to 0. The criteria were then weighted based on their importance, and the respective assessment scores were summed. Assessment criteria and weights are summarized in Table ES-9. While each category of criteria was given an equal weight, the weights for criteria within each category varied based on their relative importance.

An assessment score was determined for each resolution concept based on the various criteria and criteria weights, as shown in Table ES-10 (attached at the end of this Executive Summary). Projects were then ranked in order of descending assessment score. Rankings shown on this table do not reflect the need for some projects to precede others. This would need to be considered to avoid transferring flows—and associated issues—to downstream locations before those areas are capable of accommodating them.

The assessment results are summarized below:

- In general, rehabilitation of the existing WWTF scored highly; ranked 1, 5, 10 and 11 of 90 projects. Nitrogen removal was ranked 55 of 90 projects; largely due to operational requirements and post-construction impacts.
- Most of the wastewater pump stations scored in the top one-third of projects. These pump stations are critical facilities within the collection system.
- CSO projects recommending sewer separation scored highly; 19 or higher of 90 projects. All CSO projects ranked in the top one-half of projects with the exception of the extreme event outfall.
- Wet-weather collection system projects at Stafford Square, Cove Street and the Brayton Avenue area scored in the top one-third of projects; ranked 13, 26 and 28, respectively. However, most of the wet-weather projects scored in the mid-third.

Table ES-9: Assessment Criteria and Weights

Category/Criteria	Category Weight	Criteria Weight	Effective Weight
Environmental	20%		
▪ Water Quality		▪ 50%	▪ 10%
▪ Climate Change		▪ 20%	▪ 4%
▪ Adaptability to Change		▪ 30%	▪ 6%
Regulatory	20%		
▪ Wastewater Permits		▪ 30%	▪ 6%
▪ Stormwater Permits		▪ 30%	▪ 6%
▪ Federal Court Order		▪ 40%	▪ 8%
Institutional	20%		
▪ Administrative/Operational		▪ 25%	▪ 5%
▪ Project Integration		▪ 25%	▪ 5%
▪ System Reliability/Renewal		▪ 50%	▪ 10%
Social	20%		
▪ Public Health and Safety		▪ 50%	▪ 10%
▪ Property Damage		▪ 45%	▪ 9%
▪ Post-Construction Impacts		▪ 5%	▪ 1%
Overriding Considerations	20%		
▪ Critical Facility		▪ 40%	▪ 8%
▪ Failure/Safety Risk		▪ 40%	▪ 8%
▪ Emergency Access		▪ 20%	▪ 4%

- General collection system projects all scored in the bottom one-half. The most highly ranked general collection system projects are related to cleaning of the Main Interceptor, lining of the Main Interceptor's crossing of the Quequechan River and lining of the Central Street Sewer adjacent to Heritage State Park.
- The Quequechan River improvements ranked 18 of 90 projects, due to the extensive flooding, and combined sewer and stormwater system impacts that occur due to the lack of appropriate controls. The Cook Pond dam and stream rehabilitation was also ranked 36 of 90 projects, due to the public health and safety benefit provided by the dam. Despite the existing chronic street flooding, most general stormwater projects ranked in the lower one-half of projects.
- The North Watuppa Pond Interceptor Drain-West was ranked 27 (rehabilitation) and 39 (expansion) of 90 projects due to its beneficial diversion of runoff away from the city's

primary drinking water supply. The remainder of the source water protection projects were ranked in the middle one-third of projects; higher than many general stormwater projects.

- The asset management system ranked 2 of 90 projects; showing its importance toward optimization of the City's existing and future infrastructure.
- The vehicles and equipment ranked 8 of 90 projects; indicating the need to acquire sufficient levels to properly operate and maintain the wastewater and stormwater systems.

ES.8 Financial Considerations

Construction, operation and maintenance of sanitary and stormwater infrastructure improvements have significant costs. This Section summarizes the existing and potential mechanisms for providing the funds for future work. It also provides an assessment of the City's ability to pay for the projects identified for the capital program.

Under an ideal situation—with funding not being an issue for project implementation—projects would be scheduled in accordance with the priority list shown in Table ES-10, and in accordance with all regulatory and court mandates. However, Fall River's economic conditions do not present an ideal situation. Project affordability is a real issue.

Fall River City Hall

All costs of the Department of Community Utilities' Sewer Division (i.e., capital, O&M, and administrative) are paid for through sewer and stormwater rates. Low-interest loans and/or grants, as available, are sought to help control costs. Since most of the City is sewered, most residents in Fall River pay both sewer and stormwater fees. The current typical residential dwelling's sewer fee is approximately $225 annually, based on an average water use of 53 hundred cubic feet. The City also charges residential parcels a wet-weather fee of $140 per parcel. This fee is used to pay the City's stormwater costs and some CSO-related costs. Since many residential parcels in Fall River include multi-unit housing, it is estimated that the average dwelling unit currently pays approximately $61 per year for its share of this wet-weather fee. Thus, most residential dwellings (or households) currently pay $286 for sewer and wet-weather fees.

ES.8.1 Project Affordability

Project affordability—as defined by the EPA—is determined through a two-part financial capability assessment approach set forth in EPA's *Combined Sewer Overflows—Guidance for Financial Capability Assessment and Schedule Development* as modified by EPA's November 2014 *Financial Capability Assessment Framework*. Phase I of the financial capability assessment is used to determine the impact of the anticipated capital improvements on the average residential ratepayer/household. Phase II of the EPA financial capability assessment is an evaluation of socio-economic factors as compared to EPA benchmarks (i.e., bonding rate, unemployment rate, median household income, property tax revenues and collection rate, etc.).

The Phase I assessment expresses the typical dwelling unit/household bill as a percentage of the median household income (MHI); where 1 percent of MHI is considered a mid-range burden and 2 percent is considered a high burden. This value is known as the "Residential Indicator," and is used as a benchmark by the EPA in assessing the affordability of a proposed program. For reference, Fall River's current MHI is estimated to be $34,217, based on U.S. Census Bureau, American Community Survey (ACS) estimates. MHI would be expected to increase 1.0 percent annually.

When the Phase I approach was tested for all projects identified as "resolution concept projects," it demonstrated conclusively that the City does not have the ability to pay for all of the mandated and high priority projects, both near- and long-term. With a level spending approach over the 50-year planning period, the residential indicator would increase steadily, and linearly, to a burden of almost 4.5 percent in the first 20 years, and remain there for following 30 years. Thus, unless there are significant changes to the current and projected economic climate of the city, there would need to be a significant compromise in scheduling for construction of all project categories, including those mandated by the court order and anticipated regulatory mandates.

In response to this finding, a rate of spending that would give consideration to affordability was investigated. Once this rate of spending was developed, using a combination of project priorities and costs, the recommended approach and schedule for the capital improvements would be developed. The assumed capital spending rate (basis being 2015 dollars) is shown in Table ES-11. The corresponding recommended plan for implementation is presented in Section ES.9.

Table ES-11: Recommended Spending Plan

Fiscal Year	Cost ($ 2015)
2017	$17,975,000
2018	$27,680,000
2019	$26,190,000
2020	$23,790,000
2021	$31,450,000
2022	$30,825,000
2023	$29,933,000
2024	$32,517,000
2025	$28,087,000
2026	$31,088,000
2027	$4,800,000
2028	$4,900,000
2029	$6,200,000
2030	$4,000,000
2031	$6,300,000
2032	$6,300,000
2033	$6,000,000
2034	$6,400,000
2035	$3,700,000
2036	$5,300,000
Total Program Cost	**$333,435,000**

This section summarizes the projected revenue requirements for the City under the first 20 years of capital spending for the spending approach shown in Table ES-11, to give the appropriate consideration for affordability. Under the first 20 years of the $1.38-billion capital program, an estimated $333.4 million would be spent. The impacts of this program are be evaluated using the assumptions previously listed and within the context of the City's current rate structure. Since the capital costs of the program as summarized in Table ES-11 are stated in 2015 dollars.

As noted above, the current combined sewer and wet-weather household bill in Fall River is $286—an estimated $225 annual sewer fee and $61 wet-weather fee. The projected growth in the typical household combined sewer and wet-weather bill, MHI and the corresponding Residential Indicator are shown in Table ES-12 for the proposed $333.4 million program. Figure ES-12 shows graphically the increase in the household burden through FY 2036. Years shown in the figure reflect fiscal years.

Table ES-12: Projected Median Household Income, Household Bill, and Residential Indicator

Criteria	FY 2016	FY 2021	FY 2026	FY 2031	FY 2036
Median Household Income	$34,217	$35,963	$37,797	$39,725	$41,752
Estimated Household Bill	$286	$582	$964	$1,056	$1,110
Residential Indicator (% of MHI)	0.84%	1.62%	2.55%	2.66%	2.66%

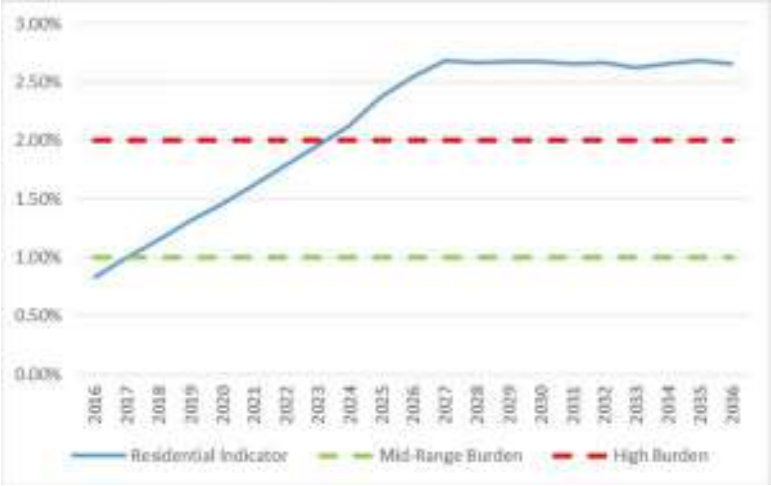


Figure ES-12: Projected Residential Indicator

The EPA guidance documents define a "mid-range burden" as a Residential Indicator of 1 percent of MHI, and a "high burden" as a Residential Indicator of 2 percent of MHI. For the proposed program, the Residential Indicator exceeds 2 percent by FY 2024. By FY 2026, the burden exceeds 2.5 percent and remains above that level through the remainder of the projection period. A program of this size would create a significant burden on the City's residents.

ES.8.2 Required Funding Approvals

In order to proceed with spending in accordance with the recommended program, a series of authorizations and approvals must take place. A Loan Authorization must be developed; this authorization would ultimately require approval by the voters of the city in a city-wide ballot that requires a majority approval.

The Department of Community Utilities would work with elected officials and the Mayor's office to develop a draft loan authorization. This authorization would be developed with the need to acquire public support in mind. Ultimately, this draft authorization would be presented to the City Council for approval. With the approval of the Mayor and the Council, the Loan Authorization would then be voted on in a city-wide referendum vote.

ES.9 Recommended Plan

The Recommended Plan presents a spending plan to address the more pressing wastewater and stormwater issues within the City. While it presents a "high burden," the recommended plan is significantly reduced from the identified 1.38 billion program, Table ES-13 estimates the recommended spending by decade for the first 20 years, as well as for all recommended "resolution concept" projects. The recommended year-by-year schedule for project spending for the first 20 years of the CIP is presented in Figure ES-13. Spending during the first ten years totals $277.5 million; spending during the following ten years—$58.5 million—is at a much reduced rate to maintain affordability.

Table ES-13: Recommended Plan				
Years	**2016-2025**	**2026-2035**	Remaining Projects	All Projects
Time Span	**10 Years**	**10 Years**		
Wastewater Treatment Facility Issues (Including anticipated NPDES mandates)	**$85.3M**	**$16.6M**	$260.1M	$362M
Wastewater Pump Station Issues	**$17.2M**	**$1.6M**	$51.2M	$70M
Combined Sewer Overflow (CSO) Issues (Including Federal Court Order)	**$92.2M**	**$21.5M**	$251.3M	$365M
Sewer System - Wet-Weather Capacity Issues (Including SSOs)	**$57.3M**	**$0M**	$199.7M	$257M
Sewer System - General Issues	**$17.2M**	**$5.4M**	$47.4M	$70M
Stormwater System - General Issues	**$6.2M**	**$7.5M**	$51.3M	$65M
Stormwater System - Source Water Protection Issues	**$0M**	**$4.3M**	$177.6M	$182M
Organizational/Institutional Issues	**$2.1M**	**$1.6M**	$5.3M	$9M
Subtotal	**$277.5M**	**$58.5M**	$1044M	$1380M

2015 Dollars (No Inflation) In Millions (M)

The highest priority projects were scheduled for the first ten years, these projects total $277.5 million and are as follows:

- WWTF1—Solids Handling and Operations Buildings ($38 million, including planning studies for the entire WWTF).
- WWTF3—Secondary Treatment ($29 million).
- WWTF4—Primary Treatment and Disinfection Facilities ($18 million).
- PS1, PS3, PS6, PS7, PS12, and PS13—Small and medium pump station replacements/ upgrades to replace aged facilities ($17.2 million).
- CSO6 and CSO9—Sewer separation of the Alton Street Basin and City Pier/Central Street Basin. These projects are required to meet North System CSO Federal Court Order mandates ($83.3 million including CSO planning studies and assessments).
- CSO11—Middle Street basin partial sewer separation; part of the work required to meet the Federal CSO Court Order mandate for the South System partial sewer separation, and to mitigate street flooding ($7.2 million).
- SWW6—Stafford Square basin sewer separation to address SSOs and flooding ($51 million)
- SWW10—Globe Four Corners area sewer improvements to address SSOs ($6.3 million)
- SG5—President Avenue/Eastern Avenue area sewer studies and rehabilitation for infrastructure renewal and to reduce infiltration and inflow ($2.2 million).
- SG6 and SG7—Main Interceptor (North and South) cleaning, inspection and rehabilitation. These projects would restore its design capacity ($9.9 million).

- SG12—Annual sewer CIP for infrastructure renewal ($5 million).
- SWG6—Cress Brook/Eastern Avenue and New Boston Road area drainage improvements to mitigate flooding ($5.5 million).
- Other smaller projects that comprise the remainder of the first 10-year budget.

After the first ten years, spending needs to be at a reduced rate. During this period an additional $58.5 million in spending is planned, including the following:

- WWTF2—Preliminary Treatment ($16 million).
- PS2—Meridian Street (medium) pump station replacement/upgrade to replace aged facilities ($1.6 million).
- CSO7 and CSO8— Rehabilitation of the Cove Street and President Avenue CSO screening and disinfection facilities to maintain their readiness for CSO treatment ($7.5 million).
- CSO 10—Ferry Street basin partial sewer separation; part of the work required to meet the Federal CSO Court Order mandate for the South System partial sewer separation ($5.3 million including a CSO assessment study).
- CSO12— Birch Street basin partial sewer separation; part of the work required to meet the Federal CSO Court Order mandate for the South System partial sewer separation ($6.8 million).
- SWG9—Construction of the South Watuppa Pond outlet structure to appropriately control Quequechan River water levels at lower levels to mitigate flooding and CSO outfall backups along the river alignment ($7.5 million).
- Other smaller projects that comprise the remainder of the second 10-year budget.

ES.10 Conclusions

Upon initiation of this report, the stated goal was to develop a CIP to address wastewater and stormwater issues. The total cost of all identified projects, in "uninflated" or "year 2015" dollars, is approximately $1.38 billion dollars that, over a 50-year period, would require $23.6 million in new capital spending every year. Unfortunately, as demonstrated in Section ES.8 above, spending at this rate would greatly exceed the affordable levels for the City and its ratepayers; it would be more than twice the EPA's "high burden" guideline of 2 percent of MHI. Notably, even spending at this unaffordable rate would be insufficient to meet federal court ordered schedule mandates, anticipated NPDES permit requirements and critical infrastructure requirements. Thus, the recommended CIP required compromise.

Because of the need for compromise and prioritization, the recommended CIP is presented as a 20-year scheduled plan, with the rest of the work to occur beyond the first 20 years and not on a fixed schedule. The program should be reassessed every 5 years for all project needs, debt service for completed work, affordability and projected costs and schedule for remaining work and the CIP should be adjusted, as required.

Figure ES-10: Assessment Results

Project Description	Project Identification Number	Environment			Regulatory			Institutional			Social			Overriding Considerations			Assessment Score	Rank
		Water Quality	Climate Change	Adaptability to Changing Regulations and Environment	Federal Permit/Regulatory Compliance (Wastewater)	NPDES Compliance (Stormwater)	CSO Federal Court Order Compliance	Administrative/Operational Considerations	Integration with Other Projects	System Reliability/ Infrastructure Renewal	Public Health & Safety	Property Damage	Post-construction impacts (odors, noise, dust, traffic,	Critical Facility	Failure Risk/Safety Risk at Failure	Emergency Access		
Category Weight		**20%**			**20%**			**20%**			**20%**			**20%**				
Criterion Weight		50%	20%	30%	30%	30%	40%	25%	25%	50%	50%	45%	5%	40%	40%	20%		
Effective Weight		10%	4%	6%	6%	6%	8%	5%	5%	10%	10%	9%	1%	8%	8%	4%		
WWTF Upgrades (Solids Processing/Operations Buildings)	WWTF1	2	1	2	2	0	1	0	0	2	2	0	2	2	2	0	130	1
Asset Management System	ORG1	0	0	2	2	1	0	1	2	2	2	2	2	2	1	0	129	2
Middle Street Sewer Separation	CSO11	0	2	0	2	1	2	-1	2	1	1	2	2	2	2	2	127	3
City Pier/Central Street Sewer Separation	CSO9	0	2	0	2	1	2	-1	2	1	1	2	2	2	2	2	127	4
WWTF Upgrades (Primary Treatment/Disinfection)	WWTF4	2	1	1	2	0	1	0	0	2	2	0	2	2	1	0	116	5
Globe Street Sewer Separation	CSO12	0	1	2	2	1	2	0	2	1	1	1	2	1	1	2	115	6
Mt. Hope CSO Improvements	CSO13	0	1	2	2	1	2	0	2	1	1	1	2	1	2	0	115	7
Vehicles and Equipment	ORG2	0	0	2	2	1	0	-2	2	2	2	2	2	2	1	0	114	8
President Avenue Pump Station	PS7	1	0	2	0	0	0	2	0	2	1	2	1	2	2	0	113	9
WWTF Upgrades (Preliminary Treatment)	WWTF2	2	1	1	2	0	1	0	0	2	1	0	1	2	2	0	113	10
WWTF Upgrades (Secondary Treatment)	WWTF3	2	1	1	2	0	1	0	0	2	1	0	1	2	2	0	113	11
President Avenue Basin Sewer Separation	CSO8	0	1	0	2	1	2	-1	2	1	1	2	2	2	1	1	111	12
Stafford Square Sewer Separation	SWW6	1	1	-1	1	1	0	-1	1	2	1	2	2	2	2	2	110	13
Ferry Street Basin Sewer Separation	CSO10	0	1	1	2	1	2	-1	2	1	1	1	2	2	1	1	108	14
Wilson Road (aka North End) Pump Station	PS3	1	0	2	0	0	0	2	0	2	1	1	0	2	2	0	103	15
Birch Street Sewer Separation	CSO12	0	1	0	2	1	2	-1	2	1	1	1	2	2	1	1	102	16
Alton Street Sewer Separation	CSO6	0	1	0	2	1	2	-1	2	1	1	1	2	2	1	1	102	17
Quequechan River (dredging and control structures)	SWG9	1	2	-1	0	1	0	-2	-1	2	2	2	2	2	2	0	95	18
Cove Street Basin Sewer Separation	CSO7	0	1	0	2	1	2	-1	2	1	1	1	2	2	0	1	94	19
South End Pump Station	PS12	0	0	2	0	0	0	2	0	2	1	1	0	2	2	0	93	20
Amity Street (aka McMahon Street) Pump Station	PS14	1	0	2	0	0	0	2	0	1	1	1	0	2	2	0	93	21
Valentine Street Pump Station	PS6	1	0	2	0	0	0	2	0	1	1	1	0	2	2	0	93	22
East End Pump Station	PS8	0	0	2	0	0	0	2	0	2	1	1	0	2	2	0	93	23
Ferry Street Pump Station	PS13	1	1	2	0	0	0	2	0	2	0	0	0	2	2	0	88	24
Joseph Drive Pump Station	PS1	0	0	2	0	0	0	2	0	1	1	1	0	2	2	0	83	25
Cove Street at Fulton Street Wet-weather Pump Station	SWW3	0	2	-1	1	1	0	-1	-1	1	1	2	2	2	2	1	80	26
North Watuppa Pond Interceptor Drain (West) Rehabilitation/Access	SWP5	0	1	-1	0	1	0	-2	1	2	1	2	0	2	2	0	79	27
Brayton Avenue Sewer Separation	SWW9	0	1	-1	1	1	0	-1	1	2	1	1	1	2	1	1	78	28
CSO Fan Vault Rehabilitation	CSO3	0	0	0	0	0	1	0	1	2	1	1	0	1	2	0	76	29
CSO Drop Shaft Sluice Gates and Controls Rehabilitation	CSO2	0	0	0	0	0	1	0	1	2	0	2	0	1	2	0	75	30
CSO Instrumentation and Controls	CSO4	0	0	0	0	0	1	0	1	2	0	2	0	1	2	0	75	31
Ross Mathews (aka Father Devalles Blvd.) Pump Station	PS10	1	0	2	0	0	0	2	0	1	0	0	0	2	2	0	74	32
Travassos Park Pump Station	PS11	1	0	2	0	0	0	2	0	1	0	0	0	2	2	0	74	33
Rodman/Hartwell Interceptor Replacement to Drop Shaft	SWW8	0	0	-1	1	0	0	0	1	2	1	1	1	2	1	1	73	34
Globe Street Area Sewer Improvements	SWW10	0	1	-1	1	0	0	0	1	2	0	1	1	1	2	2	71	35
Cook Pond Dam and Stream Rehabilitation	SWG11	1	2	-1	0	1	0	-2	-1	2	1	2	1	0	2	0	68	36
Alden Street Area (sewer and drainage improvements)	SWW7	0	1	-1	1	1	0	-1	1	2	0	1	1	2	1	1	68	37
Cove Street Dechlorination	CSO7	0	1	0	2	1	2	-1	1	2	1	0	-1	0	0	0	67	38
North Watuppa Pond Interceptor Drain (West) Expansion	SWP5	1	1	-1	0	1	0	-2	-1	2	1	2	2	2	0	0	65	39
Highland Avenue Drainage Improvements	SWW2	0	0	-1	1	1	0	-1	1	1	1	1	1	2	1	1	64	40
Lindsey Street / Brownell Street Drainage Improvements	SWW4	0	0	-1	1	1	0	-1	1	1	1	1	1	2	1	1	64	41
Oak Grove Avenue Area Sewer Replacement	SWW5	0	0	-1	1	0	0	0	1	1	1	1	1	2	1	1	63	42
Cove Street CSO Facility Rehabilitation	CSO7	0	1	0	2	1	2	0	1	2	0	0	0	0	0	0	63	43
President Avenue CSO Facility Rehabilitation	CSO8	0	1	0	2	1	2	0	1	2	0	0	0	0	0	0	63	44
North Watuppa Pond Interceptor Drain (East) Rehabilitation	SWP6	0	1	-1	0	1	0	-2	1	1	1	2	1	1	2	0	62	45
CSO Tunnel System Cleaning, Inspection, and Repair	CSO1	0	0	0	0	0	1	0	0	1	0	2	0	1	2	0	60	46
Main Interceptor Lining (North)	SG6	2	0	0	0	0	0	0	1	1	0	0	1	1	2	0	60	47
Eastern Avenue/New Boston Road/Rotary Drainage Improvements	SWG6	1	0	-1	0	1	0	-2	1	2	2	1	1	0	0	1	59	48
Terry Brook Channel to Interceptor Drain	SWP4	1	0	-1	0	1	0	-2	1	1	1	1	0	2	1	0	58	49
Steep Brook at Collins Street Improvements	SWG1	1	1	-1	0	1	0	-2	-1	2	2	1	1	0	1	0	57	50
Highland Brook Channel Restoration	SWG8	1	0	-1	0	1	0	-2	1	1	2	1	1	0	1	0	53	51
Central Street/State Pier Area [lining]	SG8	2	0	0	0	0	0	0	1	1	0	0	1	1	1	0	52	52
Carl Street / Tucker Street Sewer and Drainage Improvements	SWW12	0	0	-1	1	1	0	-1	1	1	1	1	1	1	1	0	52	53
Causeway and Approaches Rehabilitation	SWP2	1	2	-1	0	1	0	-2	-1	1	1	0	0	2	1	1	51	54
WWTF Upgrades (Nitrogen Removal)	WWTF5	2	0	1	2	0	0	-1	0	0	2	0	-2	0	0	0	51	55
Bioreserve Roadways Rehabilitation and Drainage Improvements	SWP3	1	0	1	0	1	0	-2	0	1	1	0	0	1	1	0	48	56
Nichols Street - Langley Street Drainage Improvements	SWG5	1	0	-1	0	1	0	-2	1	1	2	1	1	0	0	0	45	57
Eastern Avenue Area Sewer Improvements	SWW7	0	0	-1	1	0	0	0	1	1	0	1	1	1	1	1	45	58
Main Interceptor Rehabilitation (North)	SG6	0	0	0	0	0	0	0	1	1	0	1	0	1	1	1	44	59
Gagnon Street to Horton Street Area Drainage Improvements	SWW7	0	0	-1	1	0	0	-1	1	1	0	1	1	2	1	0	44	60
Martine Street Pump Station	PS9	1	0	1	0	0	0	2	0	0	0	0	1	1	1	0	43	61
Mothers Brook at Riggenbach Road	SWP1	1	0	-1	0	1	0	-2	1	1	1	0	1	1	1	0	42	62
Miller Street Sewer Replacement	SWW11	0	0	-1	1	0	0	0	1	1	0	1	1	1	1	0	41	63
Brayton Avenue/Warren Street Area Drainage Improvements	SWG10	1	0	-1	0	1	0	-2	1	1	1	1	1	0	0	1	39	64
Main Interceptor Rehabilitation (South)	SG7	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	36	65
Norman Street Area Pressure Sewers	SG11	2	0	1	0	0	0	-1	1	1	0	0	-1	0	0	0	35	66
Cress Brook Area, Oak Grove Cemetery Drainage Improvements	SWG6	1	0	-1	0	1	0	-2	1	1	1	1	1	0	0	0	35	67
Meridian Street Pump Station	PS2	0	0	1	0	0	0	2	0	0	0	0	0	1	1	0	32	68
Mothers Brook Sewer Replacement	SG1	1	0	1	0	0	0	0	1	1	0	0	1	0	0	0	32	69
Dickinson Street Area Drainage Improvements	SWG15	1	0	0	0	1	0	-2	1	1	1	0	1	0	0	0	32	70
Sykes Road Infiltration/Inflow Program	SWW1	1	0	-1	1	0	0	1	1	1	-1	0	1	1	0	0	29	71
Siphon - Warren Street Connector Access Improvements	SG9	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	27	72
President Avenue/Eastern Avenue Infiltration/Inflow Removal Program	SG5	1	0	0	0	0	0	0	1	1	0	0	1	0	0	0	26	73
Highcrest Road Sewer Replacement	SG3	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	24	74
Langley Street Sewer Replacement	SG4	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	24	75
North Main Street Drainage Improvements	SWG4	1	1	-1	0	1	0	-2	1	1	0	0	1	0	0	1	24	76
Kempton Street Area Drainage Improvements	SWG13	1	0	0	0	1	0	-2	1	1	0	0	1	0	0	0	22	77
Whitefield Street - Frederick Street Drainage Improvements	SWG14	1	0	0	0	1	0	-2	1	1	0	0	1	0	0	0	22	78
Industrial Park Swale Cleaning and Restoration	SWG2	1	0	-1	0	1	0	-2	1	1	0	0	1	0	0	0	16	79
Elsbree Street at Valentine Street Drainage Improvements	SWG3	1	0	-1	0	1	0	-2	1	1	0	0	1	0	0	0	16	80
Hyacinth Street Area Drainage Improvements	SWG7	1	0	-1	0	1	0	-2	1	1	0	0	1	0	0	0	16	81
Central Street Pump Station	PS5	1	1	0	0	0	1	0	0	-1	0	0	0	0	0	0	12	82
Main Interceptor Grit Chamber	SG6	0	0	0	0	0	0	-1	-1	1	0	1	-1	0	0	0	8	83
Powell Street Drainage Improvements	SWG12	1	0	-1	0	1	0	-2	-1	1	0	0	1	0	0	0	6	84
Friendship Street Sewer Replacement	SG10	0	0	0	0	0	0	0	1	1	-1	0	0	0	0	0	5	85
Wilson Road and North Main Street Sewer Improvements	SG2	0	0	-1	0	0	0	0	1	1	-1	0	0	0	0	1	3	86
Cove Street Pump Station	PS4	0	1	1	0	0	0	0	0	-1	0	0	0	0	0	0	0	87
CSO Tunnel Extreme Event Outfall	CSO5	0	1	0	2	1	0	0	0	0	-2	0	-2	0	0	0	0	88
Wind Turbine	WWTF7	0	0	0	0	0	0	0*	0	0	-1	0	-2	0	0	0	-12	89
WWTF Upgrades (Vehicle Storage Facility)	WWTF6	0	0	0	0	0	0	-1	0	0	-1	0	-1	0	0	0	-16	90

Year:	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	$336M
Yearly Cost (In Millions):	$18.2M	$28M	$26.4M	$24.2M	$30.2M	$29.7M	$28.6M	$32.9M	$28.4M	$31.2M	$5.1M	$4.8M	$6.2M	$4M	$6.3M	$6.3M	$6.1M	$6.5M	$6M	$7.4M	
WWTF Solids & Operations Buildings (WWTF1)	Study $2.0M	$12M	$12M	$12M																	$38M
WWTF Preliminary Treatment (WWTF2)																	$5.4M	$5.3M	$5.3M		$16M
WWTF Secondary Treatment (WWTF3)								$9.7M	$9.7M	$9.6M											$29M
WWTF Primary Treatment and Disinfection (WWTF4)					$6M	$6M	$6M														$18M
WWTF Instrumentation and Controls (WWTF1)								$0.3M					$0.3M					$0.3M			$0.9M
President Avenue Pump Station (PS7)	Study	$2M	$2M																		$4M
Wilson Road Pump Station (PS3)						$1.3M	$1.2M														$2.5M
South End Pump Station (PS12)				$1.8M	$1.8M																$3.6M
Ferry Street Pump Station (PS13)								$1.5M	$1.4M												$2.9M
Joseph Drive Pump Station (PS1)										$2.4M											$2.4M
Valentine Street Pump Station (PS6)				$1.8M																	$1.8M
Meridian Street Pump Station (PS2)																				$1.6M	$1.6M
City Pier/Central Street CSO Basin Sewer Separation (CSO9)	Study $1.0M	$7.9M	$7.8M	$7.8M		Study $0.3M	$7.9M	$7.8M	$7.8M		Study $0.3M										$48.6M
Alton Street CSO Basin Sewer Separation (CSO6)					$8.8M	$8.7M			$8.8M	$8.7M											$35M
Ferry Street CSO Basin Sewer Separation (CSO10)						Operate					Operate		$5M								$5M
Middle Street CSO Basin Sewer Separation (CSO11)	$7.2M					and					and										$7.2M
Birch Street CSO Basin Sewer Separation (CSO12)						Assess					Assess			$3.4M	$3.4M						$6.8M
Mount Hope CSO Basin Improvements (CSO13)			$0.8M																		$0.8M
CSO Tunnel System Rehabilitation (CSO1,CSO2,CSO3,CSO5)		$0.5M										$1.5M									$2M
Cove Street CSO Facility Rehabilitation (CSO7)											$3M	$1.5M									$4.5M
President Avenue CSO Facility Rehabilitation (CSO8)																				$3M	$3M
Instrumentation and Controls/Communications (CSO4)			$0.2M					$0.2M					$0.2M					$0.2M			$0.8M
Globe Street Area--Four Corners to Drop Shaft (SWW10)	$6.3M																				$6.3M
Stafford Square Sewer Separation and Replacement (SWW6)				Study	$12.8M	$12.7M	$12.8M	$12.7M													$51M
President Avenue Sewers Infiltration/Inflow Removal (SG5)	Study	$2.2M																			$2.2M
Main Interceptor-North Rehabilitation and Lining (SG6)	$0.1M									$2M											$2.1M
Main Interceptor-South Rehabilitation (SG7)										$7.8M											$7.8M
Wilson Road Sewer Rehabilitation (SG2)															$0.4M						$0.4M
Central Street Lining (SG8)	$0.1M																				$0.1M
Sewer Capital Improvement Plan (SG12)	$0.5M	$0.5M	$0.5M	$0.5M	$0.5M	$0.5M	$0.5M	$0.5M	$0.5M	$0.5M	$0.5M	$0.5M	$0.5M	$0.5M	$0.5M	$0.5M	$0.5M	$0.5M	$0.5M	$0.5M	$10M
Cress Brook Area Drainage Improvements (SWG6)		$2.7M	$2.9M																		$5.5M
Quequechan River System Control Structure and Rehabilitation (SWG9)															$1.9M	$5.6M					$7.5M
Hyacinth Street Area Drainage Improvements (SWG7)	$0.7M																				$0.7M
NW Interceptor Drain-West Rehabilitation (SWP5)											$1.2M	$1.1M									$2.3M
Mothers Brook Channel Restoration (SWP1)																				$2.1M	$2.1M
Asset Management System/CMMS (ORG1)	$0.1M	$0.1M	$0.1M	$0.1M	$0.1M					$0.1M					$0.1M					$0.1M	$0.7M
Vehicles and Equipment (ORG2)	$0.15M	$0.15M	$0.15M	$0.15M	$0.15M	$0.15M	$0.15M	$0.15M	$0.15M	$0.15M	$0.15M	$0.15M	$0.15M	$0.15M	$0.15M	$0.15M	$0.15M	$0.15M	$0.15M	$0.15M	$3M

2015 Dollars (No Inflation) In Millions (M)

City of Fall River, Massachusetts
Integrated Wastewater and Stormwater Master Plan

Figure ES-13
Schedule and Projected Annual Costs of Recommended Plan

FALL RIVER, MASSACHUSETTS

TABLE 1-7: 20-YEAR CAPITAL IMPROVEMENT PLAN

PROJECT TASKS	COST	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	TOTAL 20-YEAR COST	sum
																									$0
WATER SUPPLY IMPROVEMENTS																									$0
1. Conduct Water Audit	$30,000		$30,000																					**$30,000**	$30,000
2. Conduct Safe Yield Study	$40,000			$40,000																				**$40,000**	$40,000
3. Conduct Feasibility and Pilot Study for treatment of South Watuppa Pond	$400,000						$200,000	$200,000																**$400,000**	$400,000
4. Upgrades to Copicut Transfer Station	$250,000				$250,000																			**$250,000**	
5. Watershed Facilities Improvements	$750,000		$250,000	$250,000	$250,000																			**$750,000**	$750,000
6. Dam Improvements	$1,725,000	$413,000	$413,000	$343,000	$409,000	$147,000																		**$1,725,000**	$1,725,000
7. Update Watershed Protection Plan to conform to DEP guidelines	$50,000		$50,000																					**$50,000**	$50,000
8. Evaluate Raw Water Intake	$30,000			$30,000																				**$30,000**	$30,000
SUB-TOTAL WATER SUPPLY IMPROVEMENTS																								**$3,275,000**	
																									$0
WATER TREATMENT IMPROVEMENTS																									$0
1. Chlorine Feed Relocation	$0																							**$0**	$0
2. SCADA System and Process Control Equipment	$50,000		$50,000																					**$50,000**	$50,000
3. Telemetry Upgrade	$250,000				$125,000	$125,000																		**$250,000**	$250,000
4. Annual Budget to Replace Aging Equipment / Maintain Building	$200,000 /yr		$175,000	$150,000	$125,000	$200,000	$250,000	$215,000	$145,000	$250,000	$250,000	$250,000	$250,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000	**$4,260,000**	$4,260,000
5. Filter Media Replacement	$125,000 /10yr		$125,000																					**$125,000**	$125,000
6. Turbidimeters and Monitoring Equipment	$5,000 /yr		$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	**$105,000**	$105,000
7. Rehabilitation of Low Lift Pumps & new VFD's	$150,000			$150,000																				**$150,000**	$150,000
8. Refurbish/Replace Three High Lift Finish Water Pumps	$325,000						$75,000	$125,000	$125,000															**$325,000**	$325,000
9. Training for Plant Personnel	$10,000 /yr		$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	**$210,000**	$210,000
10. Residual Disposal and Management	$800,000		$100,000	$700,000																				**$800,000**	$800,000
11. Backwash Segregation and Recycling	$2,000,000			$150,000	$1,850,000																			**$2,000,000**	$2,000,000
12. Emergency Reserve Fund	$350,000			$350,000																				**$350,000**	$350,000
13. Convert from Gas to Liquid Chlorine	$600,000					$600,000																		**$600,000**	$600,000
14. Electrical Systems Upgrade	$125,000				$125,000																			**$125,000**	$125,000
Advanced Treatment (pending regulatory requirements)																									
15. Intermediate Pumping and GAC Filtration or Membrane Filtration	$18,000,000 *							$2,000,000	$8,000,000	$8,000,000														**$18,000,000**	$18,000,000
16. Ozonation	$5,600,000						$1,600,000	$4,000,000																**$5,600,000**	$5,600,000
SUB-TOTAL WATER TREATMENT IMPROVEMENTS																								**$32,950,000**	$0
																									$0
TRANSMISSION AND DISTRIBUTION SYSTEM IMPROVEMENTS																									$0
Transmission System Improvements																									
1. Redundant Transmission Line from WTP	$3,000,000																	$1,500,000	$1,500,000					**$3,000,000**	$3,000,000
																									$0
Annual Pipe Replacement Program																									$0
2. Annual pipe replacement program	-$4,300,000 /yr	$1,200,000	$4,533,570	$3,822,200	$3,223,800	$4,033,800	$2,430,000	$4,244,400	$4,422,600	$4,941,000	$3,207,600	$3,742,200	$2,284,200	$3,223,800	$4,260,600	$4,584,600	$4,941,000	$4,536,000	$4,163,400	$2,559,600	$3,936,600	$4,924,800	$4,860,000	**$84,076,770**	$84,076,770
3. Paving allowance for annual pipe replacement program	-$2,200,000 /yr	$950,000	$2,895,000	$2,436,750	$1,993,500	$2,406,000	$1,409,250	$2,379,000	$2,405,250	$2,611,500	$1,650,750	$1,870,500	$1,140,750	$1,574,250	$1,927,500	$2,018,250	$2,284,500	$2,045,250	$1,838,250	$1,125,000	$1,733,250	$2,173,500	$2,143,500	**$43,011,500**	$43,011,500
																									$0
Storage Tank Improvements																									$0
4. Cleaning and Painting of Storage Tanks (every 15-20 yrs)	$8.500.000												$2.000.000	$2.000.000		$1.000.000				$2.500.000		$1.000.000		**$8.500.000**	$8.500.000
																									$0
Airport Road High Service Area Improvements																									$0
5. Replace Airport Road tank, construct Commerce Drive Pump Station	$4,000,000	$3,000,000	$1,000,000																					**$4,000,000**	$4,000,000
6. Future High Service Area Dedicated Water Main	$500,000				$500,000																			**$500,000**	$500,000
																									$0
Distribution System Operation Improvements																									$0
7. Investigation and Improvements for Low Pressure Areas	$4,100,000	$25,000	$25,000	$50,000	$2,000,000	$2,000,000																		**$4,100,000**	$4,100,000
8. Perform Leak Detection Survey of 250 miles of water main (every 2 years)	$40,000 /2yrs		$40,000		$40,000		$40,000		$40,000		$40,000		$40,000		$40,000		$40,000		$40,000		$40,000		$40,000	**$440,000**	$440,000
9. Allowance for leak repair	$50,000 /yr	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	**$1,100,000**	$1,100,000
10. Comprehensive Hydrant Flushing & Valve Exercising Program	$60,000 /yr		$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	**$1,260,000**	$1,260,000
11. Valve and Hydrant Replacement Allowance	$50,000 /yr		$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	**$1,050,000**	$1,050,000
12. Storage Facility Inspections (every 3 to 5 years)	$20,000 /3yrs			$20,000			$20,000			$20,000			$20,000			$20,000			$20,000			$20,000		**$140,000**	$140,000
13. Annual Meter Replacement Program (1,000 meters per year)	$300,000 /yr		$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	**$6,300,000**	$6,300,000
Distribution Area Maintenance Improvements																									$0
14. Debris Removal along Bedford Street	$1,400,000		$400,000		$1,000,000																			**$1,400,000**	$1,400,000
15. Distribution Maintenance Area, Buildings, and Structures																									$0
Distribution Maintenance Building	$700,000		$150,000	$550,000																				**$700,000**	$700,000
Maintenance Building	$2,800,000					$1,400,000	$1,400,000																	**$2,800,000**	$2,800,000
Area	$1,700,000					$850,000	$850,000																	**$1,700,000**	$1,700,000
16. Evaluate / Remove 1950 Pump Station and Screen House	$1,000,000				$1,000,000																			**$1,000,000**	$1,000,000
17. Repair and Rehabilitate Structures of Historical Significance	$2,500,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000													**$2,500,000**	$2,500,000
18. Distribution Vehicle Maintenance and Replacement	$2,200,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	**$2,200,000**	$2,200,000
SUB-TOTAL DISTRIBUTION SYSTEM IMPROVEMENTS																								**$169,778,270**	$0
TOTAL COST PER YEAR		**$5,988,000**	**$11,061,570**	**$9,867,950**	**$13,716,300**	**$12,586,800**	**$9,099,250**	**$13,988,400**	**$15,962,850**	**$16,647,500**	**$5,973,350**	**$6,437,700**	**$6,309,950**	**$7,573,050**	**$7,003,100**	**$8,397,850**	**$8,040,500**	**$8,856,250**	**$8,336,650**	**$6,959,600**	**$6,484,850**	**$8,893,300**	**$7,818,500**	**$206,003,270**	$206,003,270

* Membrane filtration is estimated at approximately $22.2 million.

	% of average annual	58%	107%	96%	133%	122%	88%	136%	155%	162%	58%	63%	61%	74%	68%	82%	78%	86%	81%	68%	63%	86%	76%		
25 or 30,000 for leak repair																									
150 or 160 water replacement and hydrant replacement																									
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035		
Pipe Construction & Engineering Services		1200000	4533570	3822200	3223800	4033800	2430000	4244400	4422600	4941000	3207600	3742200	2284200	3223800	4260600	4584600	4941000	4536000	4163400	2559600	3936600	4924800	4860000		
Paving Budget		950000	2895000	2436750	1993500	2406000	1409250	2379000	2405250	2611500	1650750	1870500	1140750	1574250	1927500	2018250	2284500	2045250	1838250	1125000	1733250	2173500	2143500	0	0
		Ph 13-design	Ph14-PEF																						

Tank Rehab													2000000	2000000		1000000				2500000		1000000			
													Bedford N&S	Twnsnd Hill/Haskell		Chicago				Hood		Airport			

Maintenance Area items			Engineering	Construction	Contingency	Total	Years planned
13. Cobblestone Removal along Bedford Street			$ 200,000.00	$ 1,000,000.00	$ 200,000.00	$ 1,400,000.00	2015, 2017
14. Distribution Maintenance Area, Buildings, and Structures					$ -	$ -	
Distribution Maintenance Building			$ 100,000.00	$ 500,000.00	$ 100,000.00	$ 700,000.00	2015, 2016
Maintenance Building			$ 400,000.00	$ 2,000,000.00	$ 400,000.00	$ 2,800,000.00	2018, 2019
Area			$ 250,000.00	$ 1,200,000.00	$ 250,000.00	$ 1,700,000.00	2018, 2019
15. Evaluate / Remove 1950 Pump Station and Screen House			$ 100,000.00	$ 750,000.00	$ 150,000.00	$ 1,000,000.00	2017
16. Repair and Rehabilate Structures of Historical Significance			$ 1,000,000.00	$ 5,000,000.00	$ 1,000,000.00	$ 7,000,000.00	2014 thru 2027

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COMMITMENT & INTEGRITY DRIVE RESULTS