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
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WATER • SEWER

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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
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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.

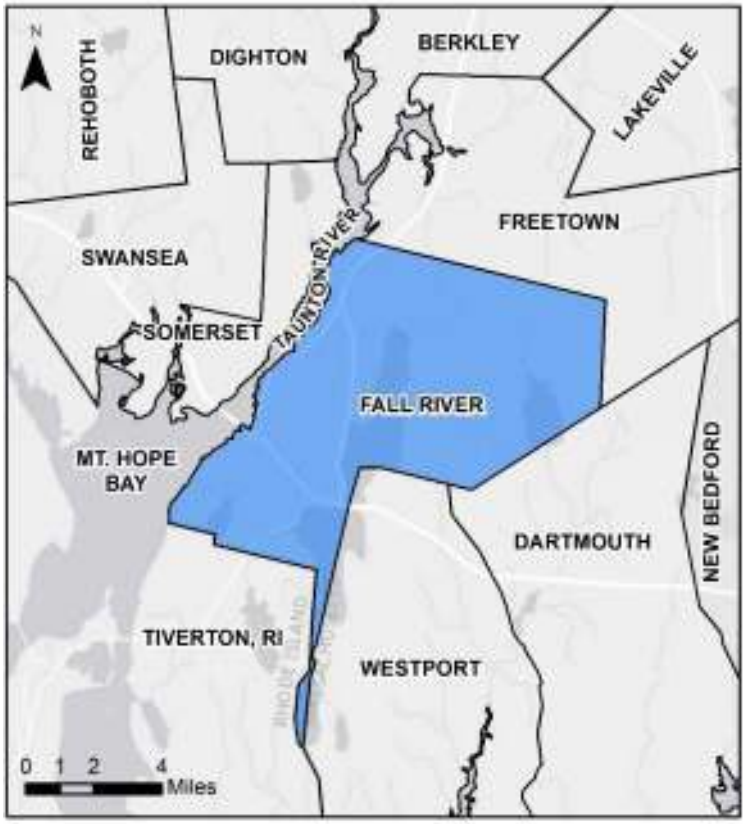


Figure ES-1: Locus Map

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.

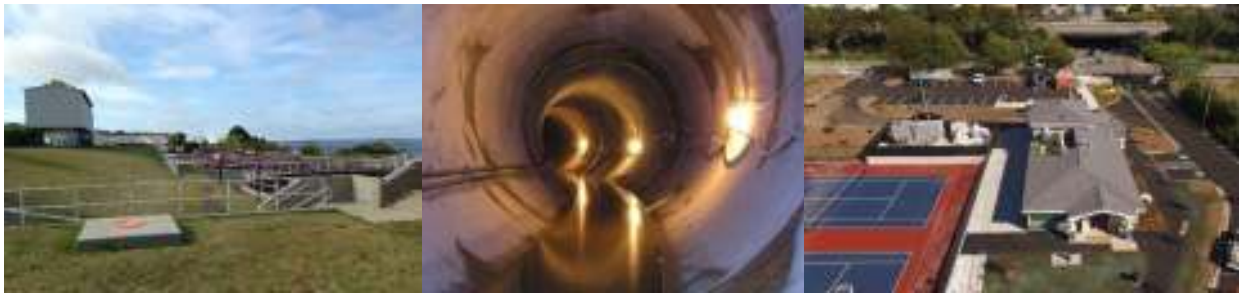
Wastewater Collection System

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.

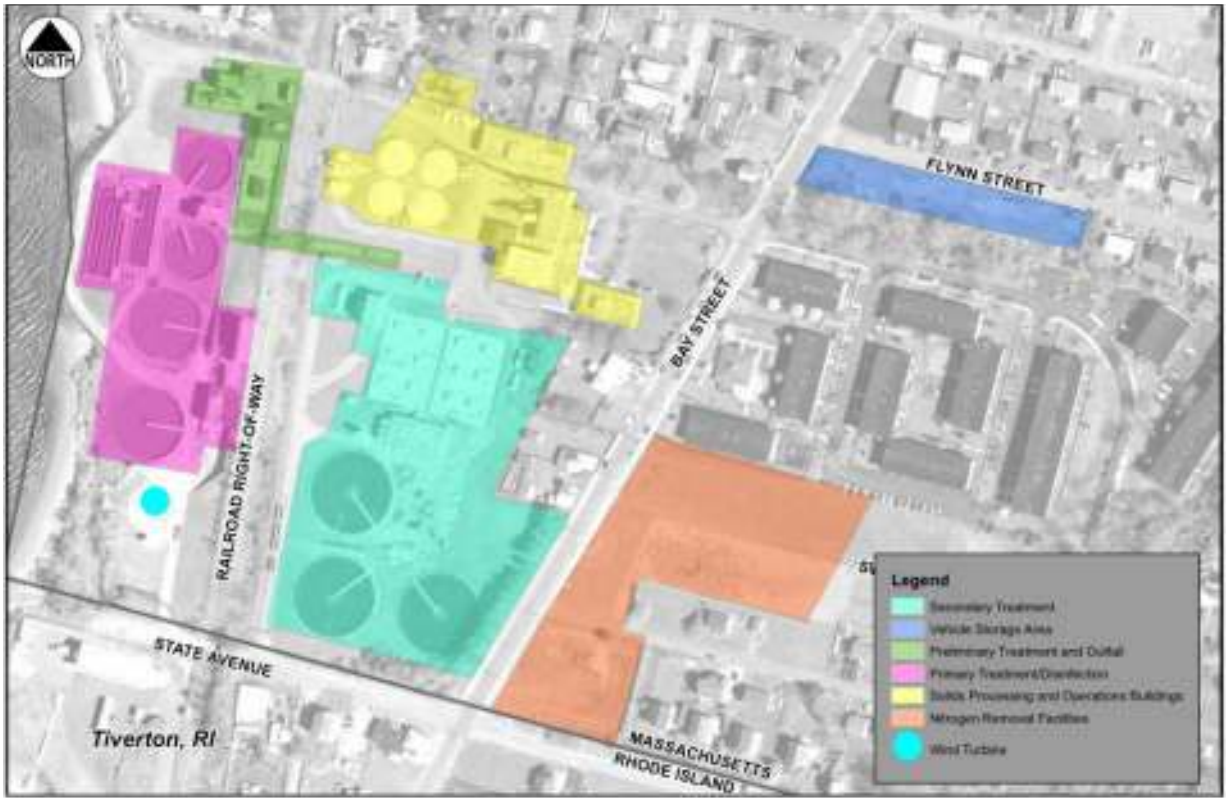
Recommended WWTF improvement projects for the 50-year forecast period total $362 million. These projects are summarized in Table ES-1. Figure ES-5 visually presents the extent of each project, based on addressing specific unit processes and/or areas of the WWTF.

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.

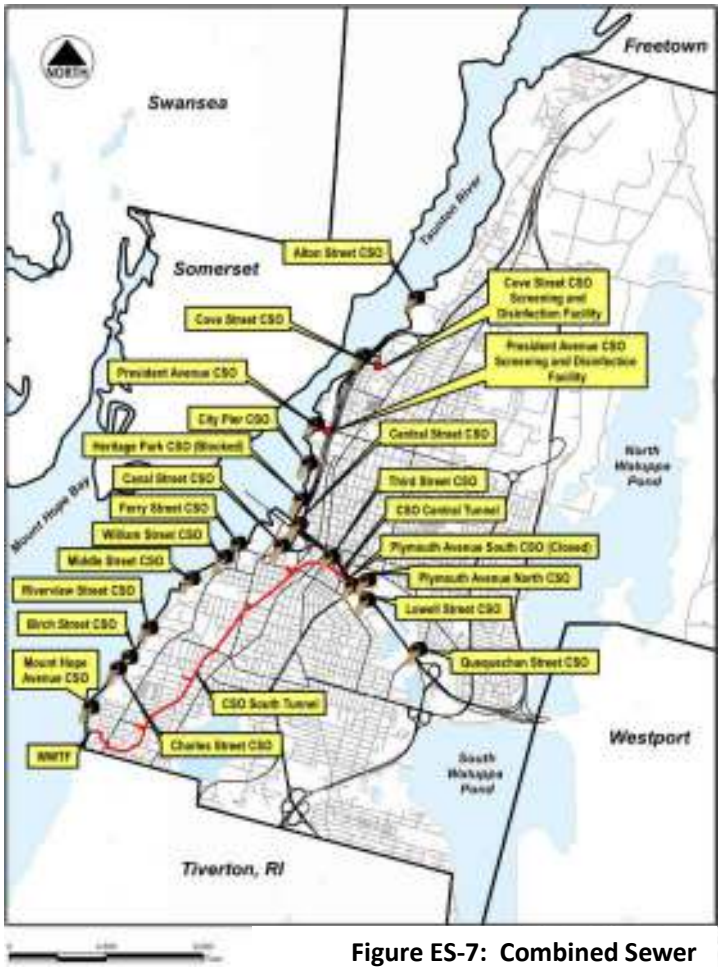


Figure ES-7: Combined Sewer Overflow Facility Locations

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.

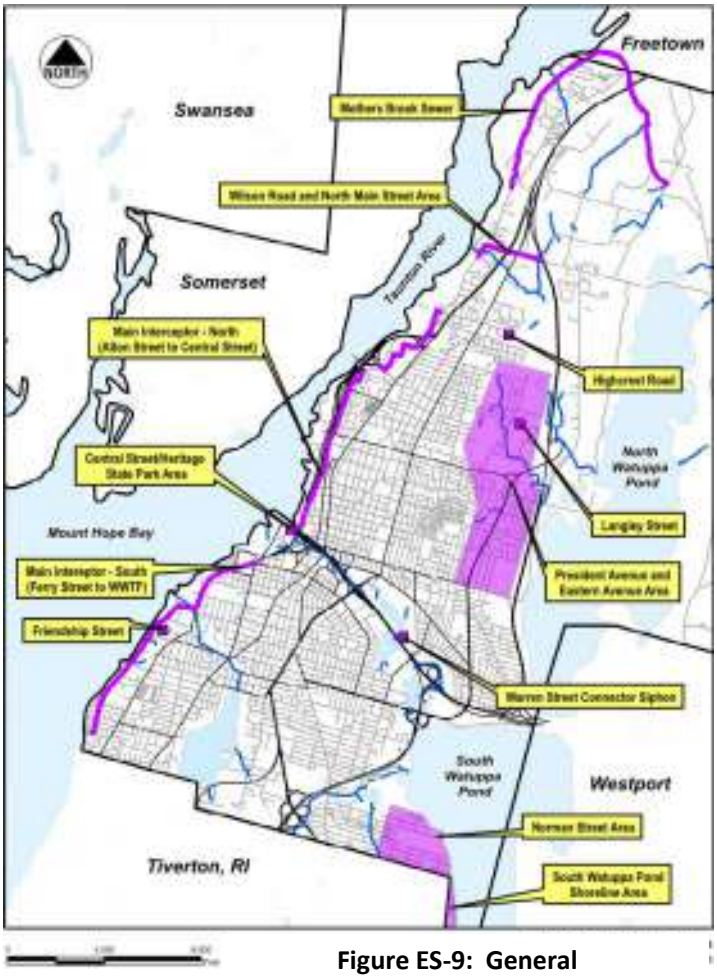


Figure ES-9: General Collection System Problem Locations

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.

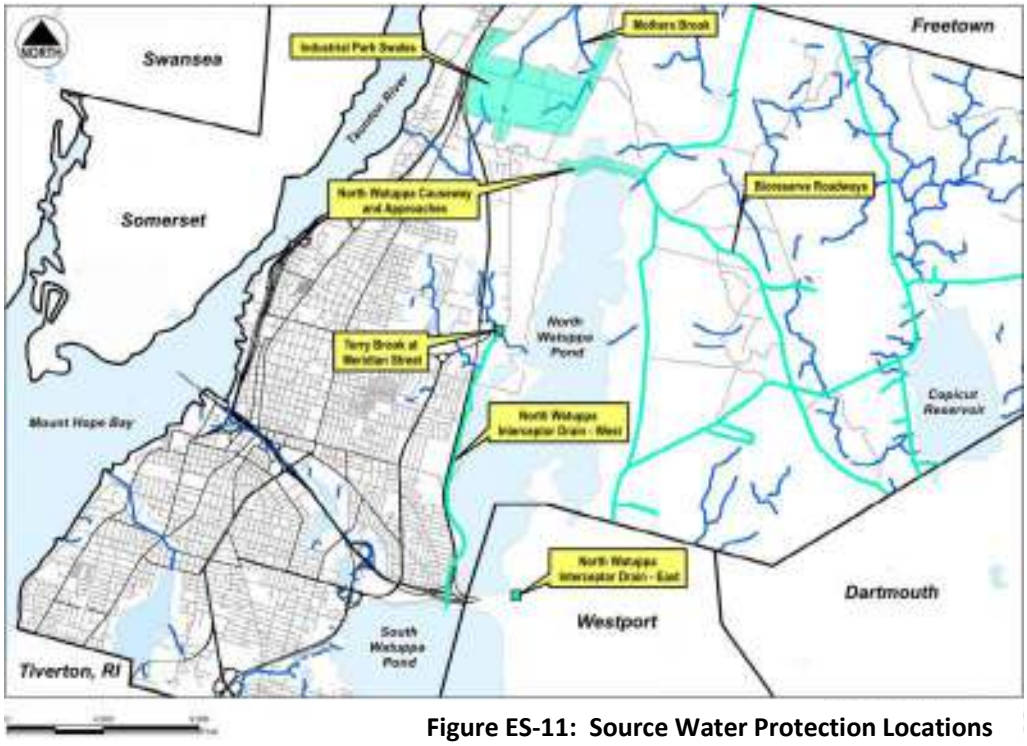


Figure ES-11: Source Water Protection Locations

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.

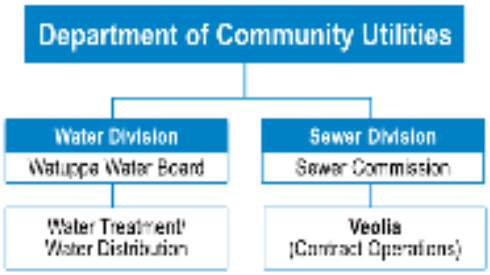
Table ES-7: Recommended Source Water Protection Projects

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.

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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%

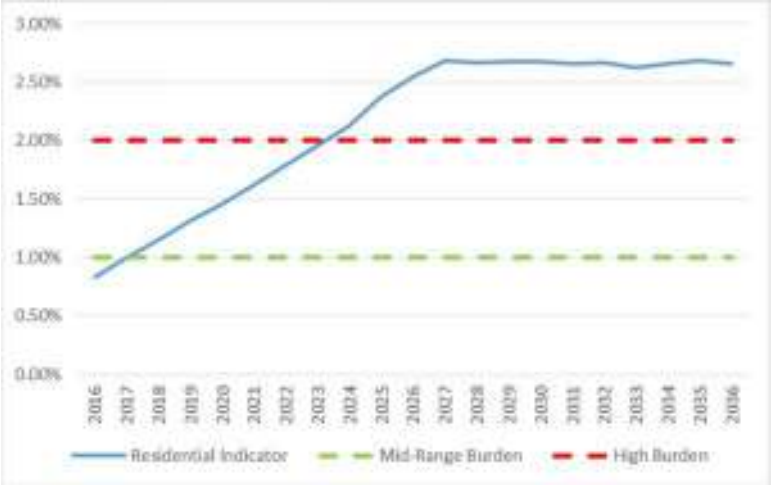

Figure ES-12: Projected Residential Indicator

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