COMMONWEALTH OF MASSACHUSETTS

Toward Financial Sustainability

Water Infrastructure Finance Commission
Draft Final Report

December 6, 2011

EXECUTIVE SUMMARY

Water is an essential asset of the Commonwealth. A well maintained and resilient water infrastructure is integral to the Commonwealth's health, economy, environment, and cultural vitality.

Healthy aquifers, rivers, streams, lakes, ponds, wetlands, and coastal resources support the state's water supplies, wildlife, and aquatic habitats. Our water infrastructure brings clean water supplies to our homes, schools, hospitals, businesses and industries; treats our wastewater; and keeps wastes from entering our water resources. Our municipal water systems have many assets that need investment, including miles of pipes, sophisticated treatment works, pump stations, and more. Like the homeowner who postpones repairs until the roof leaks, we jeopardize our water services when we fail to maintain and upgrade our existing infrastructure.

Municipalities are facing needed investment in their basic water infrastructure assets at a time when sources of revenues at the federal, state, and municipal level are declining.

The result is a substantial and growing "gap" between the anticipated revenues needed for water infrastructure investments and level of the available resources.

Over the past decade, many studies have highlighted the need for investment in the nation's drinking water, wastewater, and stormwater infrastructure. While estimates of the size of the gap vary, the underlying message is clear. A significant increase in spending above current levels will be necessary to meet this investment need. And, while federal subsidies will continue at some level, it is clear that the states and local governments across the country will need to prepare integrated responses to this impending crisis. [1]

In 2009, the Massachusetts Legislature established the Water Infrastructure Finance Commission ("The Commission") to explore this issue in Massachusetts.

The Commission finds that Massachusetts, like other states, faces a substantial water infrastructure gap. Using the best available data, the Commission estimates that the Commonwealth conservatively faces a $10.2 billion gap in resources for drinking water and an $11.2 billion gap in resources for clean water projects over the next 20 years. It is further estimated that costs to address stormwater concerns and comply with proposed federal stormwater regulations could exceed $18 billion.

The Commission's gap estimates include capital investment, repair and replacement, operations & maintenance and debt service. Estimates do not include the cost of evolving regulatory requirements or investments to accommodate economic growth. As such, these estimates are more likely to understate than overstate the gap and the funding need.

"Although the figures are staggering, it is critical that our nation invest in infrastructure for the long-term protection of public health, our environment, and the economy. EPA is committed to promoting sustainable practices that will help reduce the gap between funding needs and spending at the local level. EPA believes that better management practices, efficient water and energy use, the full cost pricing of services, and using a watershed approach when making funding decisions can all help responsible municipalities and utilities operate more sustainably, now and in the long term." **Water Infrastructure Funding Options For A Sustainable Future. US EPA New England October 2008 EPA 901-F-08-011**

Major factors are widening this gap.

Water utilities face many cost challenges

- Aging systems need investments
- Serious environmental concerns persist and need to be addressed. The costs of addressing them is high and sometimes unpredictable
- Security and redundancy must be addressed
- Operating costs include rising costs such as energy and employee benefits
- Important areas of the state face critical environmental or growth issues that may require new infrastructure or a new paradigm that re-imagines the way we provide water and wastewater services
- There is inconsistency in application of "Best Management Practices" for efficient management of water utilities

Revenues are not keeping pace with the need

- Federal and state funding sources are trending downward
- Rates vary widely and do not always cover the full cost of service
- Unanticipated financial effects of water conservation have an impact on utilities' bottom lines

The gap is not a static number – its actual size will depend on a wide range of variables and our actions over the next twenty years**. As a Commonwealth, we can and must take strategic steps to reduce the size of the predicted gap.**

The public is often unaware of the true costs necessary to fully support, operate, maintain, and invest in the Commonwealth's water-related infrastructure. The **costs** of water include all the direct and indirect expenses of providing service (including such diverse items as labor, power, chemicals, benefits, taxes, pensions, retirement, administration, overhead, and capital costs including debt, depreciation, and replacement of assets).

At the same time, consumers generally fail to consider the consequences of failing to invest, and underestimate the **value** of water for the protection of public health, public safety, fire protection, economic vitality, jobs, and environmental benefits.

The Commission proposes a road map to a sustainable future

The Commission sees the solutions as multi-dimensional. We must simultaneously manage our water resources in an ever-more environmentally and sustainable way; increase and wisely use available funds for critical investments; and embrace new ways of managing our infrastructure to find efficiencies and cost savings.

This will require the adoption of principles and policies that encourage both financial and environmental sustainability.

As a Commonwealth, our future water resource protection investments will likely include a mix of natural and flexible decentralized approaches integrated with more traditional infrastructure in a way that optimizes water resource availability.

As we build on our many accomplishments, the Commonwealth has an opportunity to continue to bring the most modern, science-based understanding of water resources to future decisions and investments.

Closing the gap in Massachusetts will require a combination of measures. Simply put, the state needs to employ these basic strategies:

- **Increase funds available for water-related infrastructure**
  - With sustained federal funding
  - With strategic increases in state support put into trust for the purpose of water investment
  - Through rates that reflect the full cost pricing of water services

- **Reduce costs and find efficiencies**
  - Through best management practices, including asset management, capital planning, enterprise fund accounting, appropriate regional solutions, and sustainable infrastructure
  - Using a watershed approach when making funding decisions
  - Through efficient water and energy use
  - Public-private partnerships

- **Address the issue of affordability**

  Rate payers are very concerned about the cost of service, and system managers must address affordability in setting their rates. Keeping water and sewer service affordable is of particular concern to individuals on low or fixed incomes. As water infrastructure is paid for increasingly with user rates, it is important to recognize that different communities have different abilities to pay for necessary improvement. For policy makers, the issue is finding ways to utilize full cost pricing in a way that doesn't make water rates unaffordable for low and moderate income individuals and communities.

- **Assist municipalities with debt**

- **Seek solutions that are environmentally sustainable**

- **Embrace approaches and new technologies that offer opportunities for integrating science-based, sustainable solutions to water management**
- **Collect and utilize better information about the status of our water infrastructure assets and needs**
- **Invest in consumer education about the true costs and value of our water infrastructure**

Massachusetts has strengths that will help us solve these issues.

Finding solutions to these issues opens doors for Massachusetts – whose academic, professional, and business leadership is poised to make our state a hub of innovation for water infrastructure. The state can play a role in capturing the benefits of emerging technology.

TABLE OF CONTENTS

INTRODUCTION

"When the well is dry, we know the worth of water." Benjamin Franklin

A well maintained and resilient water infrastructure is integral to the Commonwealth's health, economy, environment, and cultural vitality. For a number of years, environmental advocates, engineers, and water professionals have been concerned that the current rate of investment in these areas is inadequate to meet the identified needs, and that the "gap" between current investments and what is needed is growing and will lead to potentially costly and even catastrophic outcomes.

There is an increasingly urgent need to address the backlog of critical investments in our existing drinking water, wastewater, and stormwater systems, as well as to address new infrastructure investments to support economic development and growth and to meet new regulatory requirements aimed at protecting public health and water quality. Taken together, these investments will create a large and growing demand for revenues to be spent on water, wastewater, and stormwater infrastructure.

National trends are alarming. A 2011 report by the Urban Land Institute (ULI) lays out the stark challenges at all levels of government and outlines how changing times require that we revisit how to plan for, manage and pay for our critical water systems. The report concludes that infrastructure is aging, particularly in older cities. There is less federal funding. There are interagency conflicts. More responsibility for funding is falling to the states and municipalities, due in part to the partisan politics over taxes and the long term debt. The decline in federal funding is happening at a time when states are facing overall declining revenues, the end of stimulus money, and huge structural liabilities, particularly in health care. The ULI report finds that states face difficult choices—often choosing to reduce infrastructure budgets rather than calling for tax increases or rate hikes. This all trickles down to the municipal level, where local officials struggle to keep systems going, and may not have the political will to raise rates or fees.[2]

The US Environmental Protection Agency took on the task of estimating the gap between needs and resources at the national level in 2002, at the thirty year anniversary of the landmark Clean Water Act of 1972. That analysis utilized existing data as a starting point, and using various projections, found staggering capital needs across the country for clean water projects, drinking water investments, and operation and maintenance.[3]

"In 2002, the U.S. EPA released the Clean Water and Drinking Water Gap Analysis. This report estimated that if investment in water and wastewater infrastructure does not increase to address anticipated needs, the funding gap over the next 20 years could grow to $122 billion for clean water capital costs and $102 billion for drinking water capital costs. There is also a funding gap for operation and maintenance, which was found to be $148 billion for clean water and $161 billion for drinking water. This points to a total gap of over $500 billion dollars.

Closing the gap is possible if utilities undertake the work that needs to be done to address aging infrastructure and if the public understands and supports the investments needed to ensure access to safe and clean water." USEPA Fact Sheet.

Convinced of the serious implications of inadequate water infrastructure investment, Massachusetts is one of the first states to act on these concerns by establishing the Water Infrastructure Finance Commission. The objective of the Commission, established in 2009, is to quantify the funding needed to adequately manage our water service and to identify ways the Commonwealth can meet this gap through sound planning and reforms.

The Commission's goal is to lay out a vision for the future and identify recommendations that will ensure our infrastructure is protected.

WHY THE URGENCY AROUND WATER INFRASTRUCTURE?

"All the water on earth has been here for 4.5 billion years."
Charles Fishman- Author of The Big Thirst

Water is perhaps our most precious commodity and assuredly our most recycled resource.

Despite the important role that water plays in our lives and our society, the infrastructure that is crucial to its delivery is often taken for granted. Our water infrastructure protects us from disease, provides fire protection, supports our economy, provides recreational opportunities, and meets our most basic daily needs. However, as long as clean water is available when the faucet is open, the public pays little attention to what it takes to maintain these important systems. Unlike roads and bridges where potholes and corrosion are often visible, much of our water infrastructure is buried underground where deterioration is less evident. In the public sphere, the most visible needs and loudest voices are often addressed first, and in recent years our water infrastructure has been "out of sight, out of mind."

This is starting to change. Highly publicized interruptions to service in the Commonwealth and across the nation have caught the public's notice. Strong voices of concerned advocates, including municipal officials, water professionals, and environmental advocates are being heard in Washington, D.C. and across the country. Recent reports from the federal government, public interest groups, think tanks, and researchers highlight significant concerns not only about our willingness to invest in a plentiful supply of clean and readily available water for growth, economic development, industry, and tourism but also our commitment to protecting the public health and safety.

"After more than 30 years of conspicuously underfunding infrastructure and faced with large budget deficits, increasing numbers of national and local leaders have come to recognize and discuss how to deal with evident problems. But a politically fractured government has mustered little appetite to confront the daunting challenges, which include finding an estimated $2 trillion just to rebuild deteriorating networks. Operating beyond their planned life cycles, these systems include roads, bridges, water lines, sewage treatment plants, and dams serving the nation's primary economic centers."
Infrastructure 2011: A Strategic Priority. Urban Land Institute and Ernst and Young 2011

In the aftermath of the mortgage crisis and subsequent economic collapse of 2008, the federal government, states and municipalities are faced with increasingly difficult choices about how to allocate scarce resources to core services that have traditionally been provided by the public sector -- including public safety, education, social safety nets and infrastructure. As policy discussions evolve around public investments, it is critical that our water infrastructure remain "on the radar," and in fact, occupy a high place on the priority list.

In creating the Massachusetts Water infrastructure Finance Commission, the Legislature has recognized that assets in many water infrastructure systems are coming to the end of their useful lives, and that there is a lack of available funding to successfully maintain and replace these systems. The Commission was created to find out what is happening with water infrastructure investments in Massachusetts, and to respond thoughtfully; to educate the public about the extensive systems that allow us to provide safe drinking water; and to help raise the public consciousness and political will to ensure that adequate funding is provided for these essential systems.

Through this report, the Commission hopes to stimulate an overdue public conversation about the implications of failing to invest in our water systems and about how we need to act to ensure their future. The Commission also hopes to support approaches and technologies that offer sustainable solutions for cities and towns. The report paints a vision and a presents a roadmap for Massachusetts to manage and develop water infrastructure policy over the next twenty years.

The Commission believes that the Commonwealth has an opportunity to reduce the likelihood of inconvenient or catastrophic water system failures that threaten public health and safety and our economic well being. We also can embrace tremendous opportunities for innovation that can stimulate research and development, provide good jobs, and lay the groundwork for a twenty-first century water infrastructure network that is sustainable, cost-efficient and protective of our environment and future generations.

THE COMMONWEALTH RELIES ON WATER FOR ESSENTIAL SERVICES, ECONOMIC VITALITY, AND QUALITY OF LIFE

PUBLIC HEALTH

The most basic and crucial function of our water infrastructure is to provide clean drinking water for public use, and to safely dispose of wastewater. Our water systems prevent waterborne diseases such as giardia, cholera, botulism, and dysentery and are crucial for the safe functioning of hospitals and health care facilities. New concerns about the extent of pharmaceuticals and lawn-care products in our drinking water supply are being discussed and may lead to new needs in water treatment and management to protect the public health. Because our water treatment systems have been so effective, threats from these and other diseases can seem remote, but absent sound maintenance and planning, they could have very real effects on our communities.

"How safe is my drinking water?"

"Every day, more than six million Bay Staters turn on the tap and take a drink of water from a public water supply. The public water supplies in Massachusetts are among the best in the country, and they are subject to the most stringent government standards in the world. To protect your health, both the U.S. Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MassDEP) maintain exacting standards. MassDEP requires your local water supplier to perform ongoing tests for the presence of bacteria, lead and other heavy metals, herbicides and pesticides, and industrial solvents. If testing reveals an exceedance of a federal standard, the water supplier is required to notify customers through local news media. If bacteria or chemicals are found in levels that pose a threat to your health, the water supply is treated to remove the contaminants or taken out of service if the problem can't be solved immediately." **DEP Drinking Water Program website http://www.mass.gov/dep/water/drinking/drink.htm**

PUBLIC SAFETY & NATIONAL SECURITY

In a post-9/11 society, the need to anticipate and plan for resilience and redundancy in critical infrastructure, including water systems, is essential to our safety and security. Whether the threat is from a natural disaster such as an earthquake or hurricane; or from an unanticipated interruption in service due to a leak, contamination or asset failure; or from a terrorist attack; the state and its municipalities must plan for emergencies, employ back-up systems and consider redundancies which may not currently be in place.

A water system that provides reliable water at a high pressure and volume can also be the difference between a fire easily management by firefighters and an urban inferno. Fire protection is supplied by many miles of water mains, which must be of sufficient size and condition to handle peak flows needed in fire incidents. In addition to water mains, water storage tanks need to be of sufficient size and condition to provide needed fire reserves, and in growing areas, water supplies need to be upgraded to provide the needed capacity to fight fires.

The future of water infrastructure planning and engineering must include additional attention to and preparation for possible human threats and natural disasters. Anyone impacted by an interruption in water or sewer service is quickly reminded of the inconveniences and urgencies of service interruptions, and the fact that redundancies and emergency planning can make a huge difference in getting services back on line.

THE ENVIRONMENT & TOURISM

Healthy rivers, streams, lakes, ponds, wetlands, and coastal resources are the cornerstone of a healthy environment for the Commonwealth. The flora and fauna that thrive in our waters and wetlands are important to the food chain across the Commonwealth, New England, and the North America. Our wetlands support natural processes that cleanse our waters, and support fisheries, bird migration, and wildlife. Our ground waters are used for water supplies and maintain water levels in our lakes, rivers, and streams. Our lakes, rivers, wetlands and coastal waters support boaters, canoeists, kayakers, swimmers, fishermen, and birdwatchers. In Massachusetts, our tourism industry is strongly connected to the quality of our waters.

There is a deep connection between the way water is used, treated, and discharged on the one hand, and the health of our natural water systems on the other. There is a need to integrate science-based, sustainable principles into our water management to protect our water resources while using water wisely to support our economy and our residents.

The Commonwealth faces a number of significant water resource management challenges in water quantity, quality, and management. Many of these challenges stem from disruptions to the "natural hydrologic cycle" through human intervention. Threats to our waters include issues relative to both water quantity and water quality.

Some areas of the state are experiencing noticeable periodic, seasonal, or sustained degradations of the natural water systems including drought, low flow, frequent flooding, loss of wetlands, loss of habitat, or eutrophication. We know that a number of our river basins qualify as "stressed" and are experiencing dramatic seasonal decreases in flow and resulting impacts on river habitats and the use of water. There are many causes of this phenomenon, and regulations are in place or pending to pull stressed basins back from the brink. Strategies for resolving the issue of stressed river basins are largely focused on two approaches – limiting water withdrawals and making investments in stormwater management that replicate natural water cycles, including recharging the groundwater. [4]

There are special concerns for the city of Boston. Steadily decreasing groundwater levels in the city have exposed to the air some of the older wooden pilings which support many of our historic buildings. This exposure causes decay and loss of structural integrity. Investment in better water management practices, including improved stormwater that recharges the local groundwater supply rather than sending it directly to the ocean, is an important part of the solution.

ECONOMIC DEVELOPMENT AND JOBS

The quality of our water systems has a direct impact on the economy and jobs in the Commonwealth. In addition to our tourism industry, water is critical to many other sectors. Many of our manufacturing industries, including our important life sciences industry, are reliant on the use of high quality water. Our historic fishing and agricultural industries depend on our ability to protect and manage water sustainably. Water has been identified as the "single most important resource in growing cranberries,"[5]an historic Massachusetts crop, and is also essential for farmers raising fruits, vegetables, and animals.

Each of these sectors generates waste water, and each poses particular challenges in the treatment and management of waste. Massachusetts continues to innovate in the field of waste management, notably through the Commonwealth's groundbreaking Toxic Use Reduction Act, and in the private sector. Most of these industries face regulations affecting their use of water. For example, any user, including manufacturers and farms, that pump over 100,000 gallons per day for three consecutive months of the year must have a permit under the state's Water Management Act. These industries must also comply with a myriad of rules and regulations regarding use of toxic materials, and are encouraged to conserve water and energy.

The availability of adequate and affordable water and sewer infrastructure is one of the primary requirements of firms looking to locate and expand in Massachusetts. For communities that are competing with water-challenged states in the Southeast and West for businesses that rely on plentiful water, investments in water can pay long dividends. On the other hand, communities that fail to invest, or that lack sufficient water infrastructure investment, may fail to attract businesses that want to locate here.

Massachusetts has the chance to lead the nation with a focused vision for water management and to take advantage of opportunities to create new jobs and generate economic activity. Massachusetts' plentiful average of over 40" of water per year should be viewed as a competitive advantage, and investment in water infrastructure is an investment in our future competitiveness.

From a jobs perspective, it's estimated that 57,400 jobs are created for every $1 billion spent on the drinking water infrastructure[6], including jobs related directly and indirectly to water infrastructure engineering and construction. The Associated General Contractors of America have estimated that for every $1 billion spent on non-residential construction including water infrastructure, approximately $2.2 billion is added to the state's Gross Domestic product, and about $680 million to personal earnings, created or sustaining 17,000 jobs directly or indirectly.

Massachusetts, by setting a vision for water and harnessing its strengths in innovation and intellectual talent, also has an opportunity to become an innovation leader. As other parts of the country and the world face increasing water challenges from growth and possible impacts from increasing global temperatures, a new generation of water technologies will contribute to the global market.

WE HAVE ALREADY MADE MAJOR INVESTMENTS IN WATER INFRASTRUCTURE

Because a safe, clean water supply is critical for societies, communities for centuries have invested in systems to supply drinking water and dispose of wastewater. In earlier times, these systems simply transported clean water to residents and transported waste water away. But over the last century, advances in the scientific understanding of how diseases are transmitted and how our environment is impacted by waste products have led to increasingly sophisticated treatment choices and requirements.

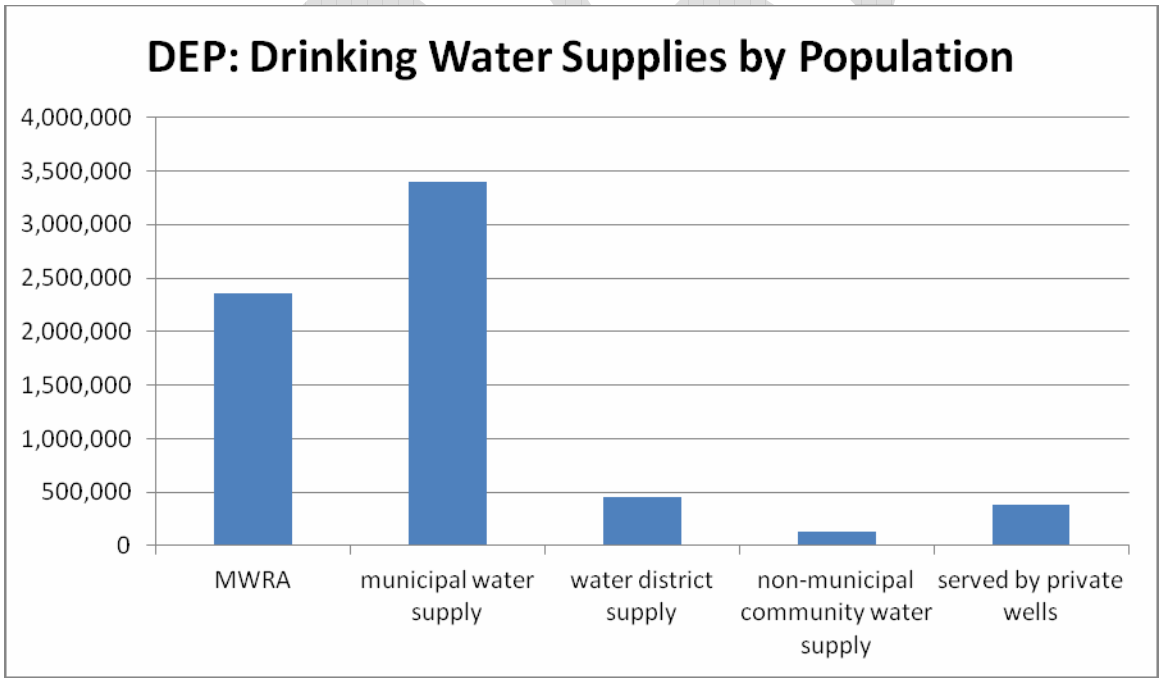
The following provides a brief description of the various water supply systems and entities that are currently responsible for providing water, wastewater, and stormwater services in the Commonwealth.

DRINKING WATER SYSTEMS

According to the DEP Drinking Water Program[7], 6,215,067 residents of Massachusetts (out of a total population of 6,593,587)[8] get their water from public water supplies.

Of those on public water supplies, approximately 2,360,000 residents are served by the Mass Water Resources Authority (MWRA) and another 455,171 are served by water districts. The remaining residents, approximately 3,399,896 in number, get their water from publicly operated municipal water districts.

Over 135,026 customers are served by privately owned public water systems in all or part of 31 communities, while 378,520 residents are served by private wells. [9]



There are certain categories of public water supplies that service schools, individual restaurants, campgrounds, and the like. These are denoted "transient or non-transient, non-community" public water supplies. Transient non-community water systems provide drinking water to a population that changes day to day. They include, among others, campgrounds, hotels, rest areas, and restaurants with their own water supplies. A non-transient, non-community public water system serves the same individuals every day (such as a school, daycare, or business).

There are 43 communities[10] with no community public water supply – many are smaller communities in the western part of the state, Cape Cod and the Islands, and others scattered across the state. Residents in these communities have private wells or other private supplies.

In Massachusetts, there are a small number of private drinking water utilities, providing water service to approximately 135,000 customers. Private water suppliers serve all or parts of 31 towns.[11]

According to the Tighe and Bond 2010 water rate survey[12], about 57% of the community water supplies use groundwater as their primary water source, with the remaining 43% relying on surface water sources, including the Quabbin Reservoir in western Massachusetts which provides drinking water to MWRA customers.

The history of our drinking water systems dates back to the 1800's, when towns and cities in Massachusetts began constructing water systems to supply residents with water for consumption and fire suppression. The city of Boston developed distribution reservoirs around the city, fed by nearby rivers and lakes, and in the 1890s flooded portions of the Nashua River Valley at the Wachusett Dam. At the time the Wachusett Dam was built, its reservoir serviced 29 municipalities within 10 miles of the State House and was the largest public water supply reservoir in the world. The Quabbin Tunnels and Reservoir were constructed between 1926 and 1946. According the MWRA, at the time of its completion, the Quabbin was the largest man-made reservoir in the world devoted solely to water supply. High pressure aqueducts were completed to carry water and were paid for with water rates.

While water supply began early on, treatment to ensure water quality[13] was rare in the United States until well into the 20th century. Poughkeepsie, NY used sand filtration in the 1870's, and in 1908, Jersey City, NJ began to chlorinate its water. Both of these steps had huge implications for the reduction of water disease outbreaks. Eventually, the federal government began to regulate the quality of drinking water. The 1974[14] Safe Drinking Water Act established a system of nationwide standards for drinking water, and today EPA regulates more than 80 drinking water contaminants. As a result, the vast majority of the nation's population drinks treated water, and systems have only rare violations of drinking water standards.

"MWRA has a 275-mile long network of large water pipelines to deliver water from tunnel systems to community meters. A large proportion of these pipes are unlined cast-iron mains from the late 1800s and early 1900s. MWRA has a systematic 20-year program to replace or rehabilitate these mains. Dozens of pipeline projects have been completed, many in dense urban areas or on busy roadways. Rehabilitated pipelines greatly improve drinking water quality, system reliability and water pressure. MWRA's Local Pipeline Assistance Program provides $25 million per year in zero-interest financing to communities for their own pipeline rehabilitation projects. MWRA communities in the Metro Boston area own over 5,000 miles of smaller pipelines."
http://www.mwra.state.ma.us/osu/osumain.html

MASSACHUSETTS WATER RESOURCES AUTHORITY

The Massachusetts Water Resources Authority (MWRA), a quasi-public agency, was established by an act of the legislature in 1985 as an independent authority to assume the management and upkeep of many of the Commonwealth's public water facilities formerly managed by the state Metropolitan District Commission (MDC, now DCR), including those that supply the city of Boston. The Authority provides wholesale water and sewer services to its member communities and funds its operations primarily through user assessments and charges. The systems currently operated by MWRA include 61 communities, in whole or in part, located primarily in eastern and central Massachusetts.[15] Fifty-one cities, towns and special purpose entities currently are supplies with drinking water by the MWRA and forty-three cities, towns and special purpose entities connect their local sewer systems to the MWRA regional sewage collection and treatment facilities. Approximately 2.55 million people in 890,000 households are served by MWRA systems.[16]

In addition to its operating responsibilities, the Authority is responsible for rehabilitating, repairing and maintaining its systems and for operating them in compliance with evolving environmental laws including requirements of the federal Safe Drinking Water Act and the federal Clean Water Act. Since assuming ownership and operations of the systems in 1985, the Authority has undertaken a program of capital improvements through the implementation of rolling five-year capital improvement programs, including the Boston Harbor Cleanup Project which dramatically improved the water quality in Boston Harbor and revived the recreational use and economic vitality of the harbor and surrounding properties. The MWRA provides wholesale water and sewer services to its communities, each of whom has its own distribution network that must be maintained. MWRA communities in the metropolitan Boston Area own over 5,000 miles of smaller pipelines. [17]

CLEAN WATER SYSTEMS

The term "clean water" infrastructure is used to describe the network of collection, treatment, and disposal facilities that collect and manage sewage (wastewater) and stormwater. These facilities include pipes, sewage treatment plants and disposal/outfall facilities and their necessary supporting infrastructure.

The Commonwealth has many large metropolitan water and sewer districts, but it also has tiny, rural sewer districts serving a relatively small population. In some areas of the state, wastewater districts have been established by an act of the Legislature and operate independently of city and town governments, setting their own rates, and managing their own finances, including the ability to utilize debt.[18]

Some utilities are run with the most up-to-date technology and the most current "best practices" that emphasize fiscal responsibility, sustainability, and water conservation. Others are underfunded, undercapitalized, and struggling.

Paralleling the history of Massachusetts' drinking water systems, the development of early sewer systems also followed the growth of towns and cities. Some of the state's centralized waste water systems date back to the end of the nineteenth century, when industrialists harnessed rivers for manufacturing, built cities around factories and mills, and used the rivers of the Commonwealth for disposal of industrial and human waste. The first sewers and collection systems were built in the late 1800s, but these were largely collection and transport mechanisms, which collected waste and sent it into harbors or down rivers and streams. Treatment plants that attempted to clean water before disposal were an innovation of the twentieth century. In Boston, the first treatment plant for primary wastewater treatment was built at Nut Island in the 1950s.

Following the passage of the Clean Water Act in 1972, the federal and state government passed a series of laws requiring primary and secondary treatment for all municipal sewer systems. In the decades that followed, extraordinary investments were made by the federal, state, and municipal governments, bringing many of our rivers back to fishable and swimmable quality, cleaning our harbors, and restoring wetlands and coastlines.

Approximately 56% of the 352 cities and towns in the Commonwealth have some level of public sewerage service.[19] According to the EPA[20], by 2008 seventy percent (70%) of Massachusetts residents received centralized wastewater treatment services at the secondary, advanced, or no discharge treatment level. This is largely as a result of the extraordinary investments in wastewater treatment plants by the federal, state, and municipal governments in the decades since Congress passed the Clean Water Act in 1972. At that time, only 12% of residents in the state had such treatment services.

Facilities known as "small community wastewater facilities" serve nine percent (9%) of the population, and comprise 10% of the total wastewater treatment and collection needs.

Residents not served by centralized treatment rely on septic systems or cesspools, which dispose of wastewater on site, and which require regular pumping to remove untreated solid waste.

STORM WATER

As a Commonwealth and a nation we are just beginning to appreciate the magnitude of the challenge of increased management of storm water. The impacts of stormwater can cause changes in the hydrology and water quality of a watershed, leading to a series of interrelated problems, including increases in flooding, habitat modification and loss, nutrient pollution, increased sedimentation, erosion, public health issues, decreases in habitat diversity, and aesthetic degradation.

Waterways near urban and suburban areas are most impacted by storm water runoff. The degree and type of impact varies depending on location, but the contribution is often significant when compared to other sources of environmental degradation. [21] The National Water Quality Inventory of 1996 Report to Congress (US EPA 1998) found urban runoff to be the leading source of pollutants causing water quality impairments in ocean shoreline waters and the second leading cause of pollutants in estuaries across the country. Urban stormwater runoff was also found to be a significant source of impairment in rivers, lakes, and wetlands.[22]

Common pollutants include oil and grease from roadways, pesticides from lawns, sediment from construction sites, and various trash such as cigarette butts, paper wrapper, and plastic bottles. In addition to pollutants in stormwater,

alterations in the hydrologic characteristics of the water body due to stormwater are very detrimental. Precipitation that would naturally have recharged into the groundwater is instead directed more quickly through drains and catchbasins into receiving waters. Streams receiving stormwater runoff characteristically have higher peak flow rates, issues related to erosion and scouring, increased flooding, and reduced baseflow levels.[23]

Once pollutants make their way into a water body, and particularly after such pollutants have negatively impacted the water and habitats, it is very difficult and expensive to restore it. It is much more cost effective to prevent, rather than to treat. As a result, the US EPA has passed a series of rules and regulations aimed at preventing or reducing stormwater pollution and related streamflow problems. [24]

The attempt to manage stormwater is not new. In the 1800s Massachusetts' industrial cities built collection systems that were designed to collect both sewage and stormwater in the same pipe. Massachusetts has 23 communities permitted with combined sewer overflows, or CSOs. These communities include Boston, New Bedford, Worcester, and Springfield. [25]

There are many stormwater installations and techniques, including many low impact designs. Some of the techniques most widely used include: drains, cisterns, spillways, swales, catch basins, detention structures, retention structures, sediment chambers, stormwater basins, vegetative buffers, ground covers, roof treatments, low impact development techniques, and piping. Some of this infrastructure is installed and maintained by the municipality – such investments as drains and catch basins along roads and highways collect water that sheets off the pavement.

Other requirements for stormwater mitigation are built into some building and zoning codes and are built and maintained by private owners.

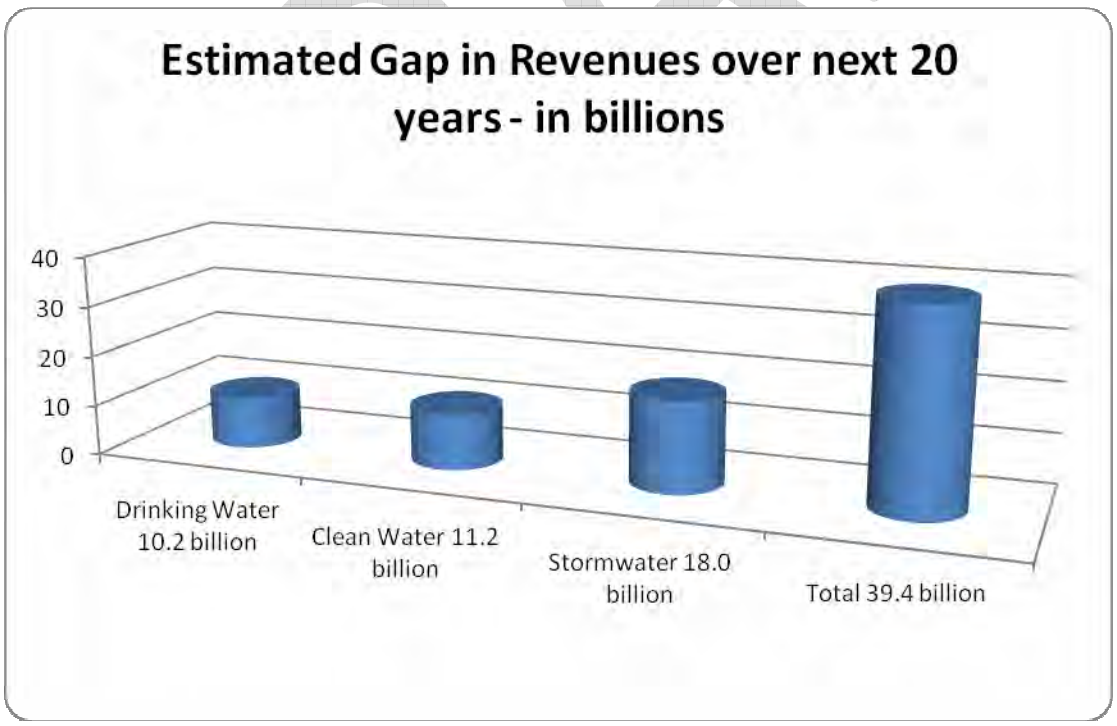
Currently, only a handful of communities in Massachusetts have created stormwater utilities to raise revenues and spend money to address the growing need for stormwater mitigation. More communities are likely to create these utilities in the years to come in response to recent initiatives of the federal government.

THERE IS A SUBSTANTIAL AND GROWING "GAP" BETWEEN THE NEED FOR WATER INFRASTRUCTURE INVESTMENT AND AVAILABLE REVENUE

A primary charge of the Water Infrastructure Finance Commission was to "examine the water infrastructure needs of the Commonwealth for the next 25 years as they relate to the funding gap between the water infrastructure needs of the Commonwealth and the existing, available sources of funding." A similar analysis of national water infrastructure was conducted by a consultant to the federal Environmental Protection Agency in 2002 and found the gap between what's needed to maintain our national water infrastructure and the revenue streams to meet the need is estimated at $224 billion over the next 20 years.

For Massachusetts, the Commission finds that there is a significant gap between available revenues and water infrastructure needs over the next 20 years. Using the best available data, the Commission estimates that the Commonwealth conservatively faces a $10.2 billion gap in resources for drinking water and an $11.2 billion gap in resources for clean water projects.

Gap estimates include capital investment, repair and replacement, operations & maintenance and debt service. Estimates do not include the cost of evolving regulatory requirements or investments to accommodate economic growth. As such, these estimates are more likely to understate than overstate the gap and the funding need.
It is further estimated that costs to address stormwater concerns and comply with proposed federal stormwater regulations could reach $18 billion.



GAP ANALYSIS

The model used to calculate the Massachusetts gap is a shorthand approach of the state-level gap analysis completed by Pennsylvania in 2007. [26] Commission members reviewed the Pennsylvania approach and consulted with individuals involved in that study to design an abridged methodology that provides a reasonable order of magnitude estimate of the Massachusetts gap. Given budget constraints, the Massachusetts study does not include data from individual system surveys and interviews as the Pennsylvania study did, however, the results from the abridged methodology do provide a sound basis for policy discussion. The Commission continues to recommend, as it did in its June 2011 initial report, that funding should be dedicated to perform a more detailed, asset-based analysis that includes more extensive surveying of water systems state-wide.

Of note, the Commission performed its gap analysis on a 20-year, rather than a 25-year basis as specified in the enabling legislation. Use of a 20-year timeframe enabled the use of federal Drinking Water[27] and Clean Water Needs Survey [28] data which will increase the reliability of estimates, while still looking far enough into the future to provide a basis for long-term planning that satisfies the intent of the legislative mandate.

ESTIMATING THE GAP

The Gap is defined as the difference between expected revenue and total expected cost of needed capital improvements, operations and maintenance (O&M), repair and replacement, and debt service.

Gap = Revenue – [Capital Investment + O & M + Repair & Replacement + Debt Service]

In the simplified infrastructure gap model used by the Commission:

Gap = 20-year Est. Rate Revenue – [EPA Needs Survey capital estimates + estimated percentage annual increase in both O & M and Debt Service]

Where the following are assumed:

- Current annual rate revenue calculated on a community basis using the 2010 Tighe & Bond Rate Studies.
- Current annual rate revenue is assumed equal to current O&M costs and current debt service.
- Current debt service is reduced as loans are repaid and the freed-up funds are directed to repairs that are not included in the Needs Survey capital figures.
- O & M plus debt service will increase at three percent (3%) per year above inflation to maintain and repair aging infrastructure.

Results of Massachusetts Gap Analysis

	20-Year Est. Rate Revenue	-	[EPA Needs Survey Estimate of 20-Year Capital Needs		20-Year Increase in O&M and Debt Service]	=	**20-Year Gap**
Drinking Water	$11.4b	-	[$6.8b	+	$14.8b]	=	**$10.2b**
Clean Water	$10.4	-	[$8b	+	$13.5b]	=	**$11.2b**

Note: Numbers in chart do not total accurately due to rounding.

For comparison purposes, the chart below shows that the results of the Massachusetts analysis are consistent with the Pennsylvania gap relative to total population.

	Pennsylvania	Massachusetts	% of Population
Population	12,734,905	6,559,644	51.5%
Gap	$43.8B	$21.5B	49.1%

A priority of the Commission was to be conservative in its estimates. Given the following factors which were not explicitly included in the estimates, it is unlikely that the figures overestimate the total gap:

- Costs of compliance with new and evolving regulatory requirements
- Investments for economic growth.
- Estimated $3b in wastewater improvements needed to comply with regulatory and environmental concerns on Cape Cod.[29]
- Substantial debt load carried by the MWRA for past work on the Boston Harbor cleanup and other projects, including those mandated by the courts.

It is also important to recognize that these estimated funding gaps ought not to be considered "an inevitability." [30] Rather, they are a potential outcome if we don't make the investments we need to make. Moreover, there are many variables that can potentially increase or decrease the estimate.

The gap estimate could also be affected by the following factors:

Factors that could decrease estimate[31]	**Factors that could increase estimate**
• Decreasing labor costs due to integration of services • Regionalization of services • Asset Management strategies • Technology innovations • Energy Efficiency	• Increasing costs of chemicals and power • Increasing regulatory requirements • Population growth • Economic expansion • Increased borrowing costs

STORMWATER GAP

Given growing concerns with the effects of stormwater, it is widely expected that stormwater investment in the coming years will need to grow exponentially. This is based on flooding concerns and an increasing understanding of the impact of stormwater contaminants, including fertilizers and roadway runoff, on drinking water supply resources and habitats. Estimating the cost of these improvements poses a significant challenge given limited historic data.

The Commission felt it important to calculate a stormwater estimate given the magnitude of expected need for these systems, however the model is speculative and will need to be monitored as stormwater policy is refined. Back of the envelope estimates made by the Commission were derived using the following formula:

Stormwater Gap = Acres of impervious surface x cost of stormwater management per acre

Impervious acreage was derived from EPA documents[32] for Massachusetts communities which are required to implement a stormwater management program under current EPA National Pollutant Discharge Elimination System (NPDES) regulation.[33] This acreage (354, 701 acres) was multiplied by a modest $50,000 per acre estimate for design and

construction of stormwater management systems. The resulting figure is a possible $18b in long-term stormwater capital investment need, which would not include associated operation and maintenance costs.

There was significant discussion about whether $50,000 was an accurate per acre cost, given the recognition that actual costs will vary greatly depending on proximity to local waters, design strategies, level of urbanization in the surrounding area, and soil conditions. Recent EPA estimates completed for a pilot program in the towns of Milford, Franklin and Bellingham, found per acre costs to be as high as $150,000, suggesting that $50,000 may be a low estimate. On the other hand, studies including the recently released Massachusetts Climate Change Adaptation Report indicate that more cost-effective alternatives may be found in what has been termed "soft engineering" or bio-mimicry.[34] After discussion, the $50,000 estimate was settled upon and generally supported by those with experience in stormwater treatment system design and construction.

WHY DO WE HAVE THIS GROWING GAP?

The Gap is a result of simultaneously increasing costs (needs) and decreasing revenues. Many surveys and studies over the last decade have identified a number of major factors driving costs of water infrastructure nationwide, including aging infrastructure, the cost of environmental regulation, the cost of municipal debt, and the need to invest in security and redundancy in our infrastructure.[35] At the same time, revenues are increasingly scarce at the federal, state, and local level.

The Commission found that these factors and others are at play in the Commonwealth of Massachusetts. At our four public hearings and in written testimony, all of these issues were raised.

MAJOR FACTORS ARE DRIVING UP COSTS

AGING SYSTEMS NEED INVESTMENTS

The Commission finds that many communities in the Commonwealth are facing serious challenges posed by the cost of needed upkeep, upgrades, and improvements to aging water and sewer systems.

Many communities came to testify at four public hearings held by the Commission across the state, and their message was clear and consistent. Water and sewer systems are aging, and many towns are overwhelmed by the need for replacement and upkeep of aging assets.

Some water and sewer systems in Massachusetts' older cities were constructed as early as the 1800s; major federal investments in water and waste water in the 1970s and 1980s brought new plants and new technologies to many towns, but many of these assets are nearing the end of their intended service life.

What the Commission heard was consistent with national studies conducted by the Environmental Protection Agency (EPA) on aging systems.[36] Most municipalities nationwide are facing needed investment in their basic assets, such as power equipment, pipe, manholes, pumps, water and wastewater treatment plants, outfalls, filter beds, and the many other components of their water and sewer systems.

When older infrastructure goes without necessary maintenance, failures become more likely. Infrastructure failures can be small annoyances that affect a few homes – or they can be extremely disruptive due to the size

"It is the pipes installed between 1920 and 1959 that give us the most trouble. How long will the older pipes provide reliable service? How long can we continue to band aid the pipes that are already failing? How will we pay to replace them in an age of skyrocketing project costs?" ***---Craig W. Jalbert Monson Water and Sewer Department; Testimony November 15, 2010***

"We, like many other systems, have a long list of necessary critical infrastructure improvements including the rehabilitation of water mains, valves, hydrants, and services. Prioritizing the existing infrastructure needs over a ten year period would cost in excess of $6 to $7 million, not including interest. At a time when we should be performing infrastructure improvements to protect the public's assets, limited funds and resources are being wasted on repairs and other emergency situations." ***--Barry W. Woods Superintendent Buzzards Bay Water District; Testimony November 10, 2010***

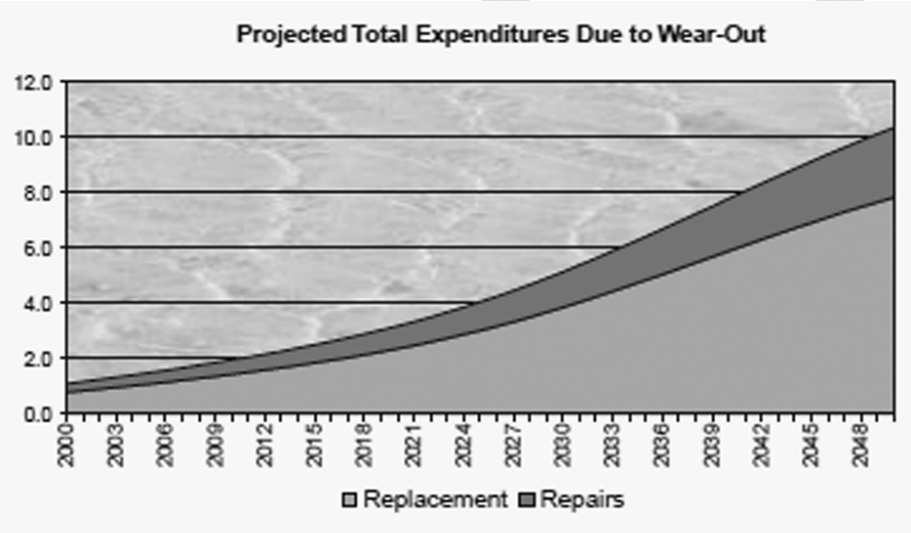
Grafton Water District. The Grafton Water District is located in Central Massachusetts and serves a population of just over 10,000 residents. They system has four gravel-packed wells and one treatment plant. In 2010 the water rates were $4.57 per thousand gallons with a $12.50 minimum charge. The average bill was approximately $126.75 per quarter. The district has over 25 miles of water main that is over 80 years old. Using the existing rates, the District could replace approximately one mile of pipe per year over the next 25 years, but would have no other revenue for any other capital expenditure. It is estimated that rates would need to be raised by approximately 59% to meet the depreciation of the system. **Based on testimony of Matthew Pearson, Manager Grafton Water District October 20, 2010**

of the failure, the length of time to repair, or the strategic location of the problem.

In Massachusetts, it estimated that there is a need for investments in an estimated 21,000[37] miles of pipe alone, made of such diverse materials as wood, brick, cast iron, lead, clay, concrete, asbestos, and PVC. Older pipes become blocked and corroded from the inside, impeding the flow of water or sewage. Others leak, allowing precious treated water to be wasted or contaminated sewage to leak into ground water. These issues can lead to degraded water quality, reduced pressure that can compromise fire protection, and in the worst case, catastrophic failure that can affect a few homes, a neighborhood, an entire city, or a region. Given the cost to repair a failed water system, and the costs of associated economic and household disruption, the institution of a planned investment and maintenance program is not only good planning, but makes the most fiscal sense.

The need for increased investment in system repair and replacement is not unexpected. Given a 60 to 95 year [38]useful life of a water or sewer pipe (cite source), and the fact that the bulk of our infrastructure was installed post-1950, it's clear that the need to replace existing systems will grow dramatically over the next several decades as the existing systems reach the end of their useful life.

A delay in investment is not a savings: eventually the investment must be made either in postponed maintenance, or in response to failure.



This chart displays estimated annual replacement costs (in millions of dollars – Year 2000 dollars) for pipes needing to be replaced in Boston between the year 2000 and 2028. This chart was prepared by the American Water Works Association, and is based on the estimated aged of the pipes and their useful life expectancy. [39]

ENVIRONMENTAL CONCERNS NEED TO BE ADDRESSED, WITH HIGH AND SOMETIMES UNPREDICTABLE COSTS

Another major concern is that many systems are in need of improvements and upgrades in their level of treatment in order to meet stronger environmental or public health. The Commission heard that many municipal systems are facing repetitive, increasingly expensive, and unfunded court orders and regulatory requirements to address various environmental or public health requirements. These costs are a major "driver" of the need for water infrastructure investments.

There are many regulations that impact municipalities, but a few stand out as posing significant challenges. Chief among these regulations and orders are:

- limits to water withdrawals, including water conservation restrictions, which reduce income to utilities
- ever more stringent nutrient reductions in treated wastewater, which demand increasingly sophisticated and expensive treatment options
- ever more stringent treatment of drinking water, which demand sophisticated and expensive treatment options
- pending federal requirements for mitigation of stormwater impacts.
- Regulation of "lost water" leaking from pipes
- Updates to drinking water standards

Regulatory compliance is very expensive for communities. Communities complain that the goals of regulation, although important, are continually changing, difficult to predict, and not always well coordinated among agencies. And, while many communities agree with the goals of regulation, communities are not convinced that limited dollars are being well spent to achieve the most public benefit. Finally, municipalities and districts are angry that the brunt of the cost is being borne at the local level by taxpayers or rate payers, when the benefits are realized statewide.

Many municipalities are frustrated by the length of the permit approval process, and the overlapping layers of bureaucracy within that process. In order to implement water infrastructure projects in the Commonwealth, a number of local, state, and federal permits may be required, depending on the complexity of the project.

Communities have commented that paperwork and long delays have a significant cost to municipalities. Unfortunately, because of staff reductions at the Department of Environmental Protection (DEP), permitting process are expected to face longer, rather than shorter, waits for permit reviews. These delays in permit review slow down the overall rate that the Commonwealth is able to address our infrastructure backlog.

In the face of shrinking municipal budgets, difficulty in raising rates, and declining state and federal funding, many towns shared a disturbing refrain: that funds that need to be directed toward maintaining systems are instead being directed toward regulatory compliance for which many did not see commensurate environmental or public benefits.

The City of Fall River: The City of Fall River was mandated --by the EPA Federal Clean Water Act and a federal court order resulting from a lawsuit filed by the Conservation Law Foundation-- to mitigate and upgrade its Combined Sewer Overflow. Between 1984 and 1994, over $10.6 million was spent on planning and design. Between 1997 and 2010, $160.5 million was spent on construction. Over the next seven years, and additional $24.5 million remains to be spent on construction. The total project costs from 1984 to 2018 are $196,605,708. The city was able to obtain federal grants for $14.5 million (8%) of the project. Between 1994 and 2010, the state has provided $144.1 million (85%) in low interest loans through the SRF project. The remainder (7% of the project or $11.7 million) was bonded on the open market at higher interest.

The current impact of the debt associated with the SRF and open market loans is an annual debt service cost of $7,920,000 which is 45% of the entire Sewer Division budget. As a result, there has been a dramatic increase in sewer user fees and a new storm water fee.

At the same time, the City has made significant investments in its drinking water system, including an annual water improvement program begun in 2000. Over 50 miles of old cast iron water pipes have been replaced in the past 10 years, with an additional 70 miles more to be done. The Water Treatment Facility has been upgraded, as has the booster station and four of the seven water storage tanks. Three tanks remain to be upgraded. Over ten years, these improvements have cost $44 million, most of which has been borrowed through the SRF program. **Based on testimony of William A. Flanagan, Mayor City of Fall River October 13, 2010**

The Commission believes that there is room for improvement in tying regulation to science-based data, and in aligning and coordinating regulatory requirements and compliance between federal, state and local governments; among state agencies; and across the "silos" of water regulatory authority including drinking water wastewater and stormwater.

Against the background of these general comments, the Commission particularly highlights three major issues:

LACK OF STATE PRIMACY OVER FEDERAL CLEAN WATER PERMITS MAY BE HAMPERING BEST OUTCOMES

The National Pollution Discharge Elimination System (NPDES) program regulates discharges of pollutants to waters of the United States through the issuance of discharge permits under the Federal Clean Water Act. Since enactment in 1972, the NPDES permit program has led to significant improvements in the quality of the nation's water.

Many are surprised to learn that Massachusetts is one of only four states in the nation that has not adopted responsibility ("primacy") for the state level regulation of the NPDES program from the federal government.

Because the federal government currently has authority over wastewater and storm water permitting, all municipal and regional waste water utilities must deal with a complex interaction of federal and state regulatory agencies. Wastewater managers must report to both EPA and DEP on most performance issues. Duplicate reporting can be more complicated, and the reporting of violations is often confused by the overlapping responsibilities of the two agencies. When permit violations occur, the agencies must collaborate to determine which will take responsibility for investigation, determination, and enforcement, increasing delays and complexities for affected municipalities. Currently, anyone wishing to discharge pollutants to surface water in Massachusetts must receive permits from both DEP under state law and from EPA under the Federal Act.

There is also some evidence that lack of state primacy may encourage the EPA to institute more stringent regulatory requirements. For example, the NPDES aluminum requirements are only required of states in the New England EPA region (Region 1) where the EPA has federal authority in both Massachusetts and New Hampshire.[40]

In light of current fiscal constraints, and trends toward increasing regulation of both wastewater and storm water, the Commission finds many reasons why the state might benefit from assuming NPDES responsibility from the EPA. While past assessments have found that the costs have outweighed the benefits, there is reason to believe that in the current climate, taking primacy may result in both better planning, prioritization of projects and possible savings to the state. At a time when municipalities are facing mounting regulation related to both wastewater and storm water, coupled with decreased funding to meet new requirements, the costs and benefits of primacy need to be revisited.

Specifically, assumption of "primacy" would allow DEP to be the single point of contact for the Federal and State pollution discharge permit programs, eliminating dual permitting. It could also allow the state to:

- Tailor its NPDES permit program to meet specific State needs, while still meeting the requirements of the federal program
- Directly integrate NPDES permitting decisions into the local water management framework
- Reduce the burden imposed on the regulated community by separate, and sometimes redundant, federal and state permitting programs
- Independently interpret and apply state water quality standards in issuing permits
- Set state permitting schedules and priorities

Under this model, the NPDES program would still be a partnership between Massachusetts and EPA. While the state would take the lead in administering the program in Massachusetts, EPA would remain responsible for ensuring that the state carries out its responsibilities, and would retain independent authority to enforce its requirements. In practice, DEP would need to continue to work with EPA. If the state is to adopt responsibility, the following should be demonstrated:

- That the state program would use sound scientific information to determine permitting decisions.
- That there would be flexibility to allow cost benefit analysis and to search for the best solutions using limited dollars
- The evolving role of the EPA needs to be settled
- The state must demonstrate that it can afford to administer the program
- The state must demonstrate that it can deliver an improvement in benefits to the environment.

NUTRIENT POLLUTION IS ONE OF THE MOST COSTLY CONSIDERATIONS FOR COMMUNITIES ACROSS THE STATE

NPDES permits are used to address serious concerns over nutrient pollution. Over the last decades, NPDES permits required communities to greatly reduce the level of nitrogen and/or phosphorous allowed in the discharge of treatment plants. In many communities, newer, lower limits are on the horizon, many of which will require additional and expensive technical solutions. At the same time, NPDES permits are more aggressive in reducing nutrients through stormwater mitigation, which is also expensive.

Nutrients, particularly nitrogen and phosphorous from septic systems, wastewater treatment plants, farms, lawns and storm water, leach into groundwater and are discharged to surface water bodies. The nutrients flow into lakes, rivers, streams, and our coastal estuaries, where they act as fertilizer to aquatic plants. The nutrients effectively accelerate the growth of nuisance plants, algae, and weeds. This in turn reduces available oxygen in the water, forcing out shellfish, indigenous plants, and fish. The term for this situation is "eutrophication." Eutrophic waters are smelly, unsightly, and unable to support natural processes.

Depending on the region of the state, both phosphorous and nitrogen are important to reduce. In Metrowest, the key nutrient is phosphorous, and NPDES permits have succeeded in dramatic reductions in point source discharges. More needs to be done in non-point source reduction, particularly in stormwater.

In coastal regions, the key nutrient is nitrogen, and the presence of this nutrient threatens the estuaries of southeastern Massachusetts which provide habitat for shellfish and sea grasses, and are breeding grounds for commercial fisheries. Tidal estuaries have become choked with stagnant nutrients, leading to the eutrophication of harbors and bays around southeastern Massachusetts. Much of the Cape Cod area is now served primarily by septic systems. Communities there are struggling to make decisions about how best to reduce nutrient contamination in a region with very little centralized treatment. There is little doubt that failure to address the concerns on the Cape will not only harm coastal habitats, but also the tourism industry.

The importance of nutrient reduction across the Commonwealth is not in doubt, but many communities are wrestling to propose the most appropriate strategies. Many are calling for a new "watershed" cost/ benefit approach to nutrient reduction. The idea is to take a holistic look at all the contributing factors to nutrient loading in a watershed and evaluate the most cost effective strategies regardless of political boundaries.

This analysis would allow regulators and communities to propose strategic approaches: Is it more cost-effective over the long run for a municipal treatment plant to reduce phosphorous or nitrogen in its discharge to ever lower concentrations, or would the same resources have a better outcome if were spent on stormwater mitigation approaches in urban areas? If a city addresses its combined sewer overflows, would it gain more than if it acquired land in its watershed?

"We believe that the Massachusetts Estuaries Project (MEP) has done solid work. I know some have raised sincere questions about the MEP, and we need to hear those questions and make sure that we have the best available science. But we can't be paralyzed by doubts, or strive for perfection, because perfection is the enemy of the good. The question we need to ask is whether the science is strong enough now to form the basis for making responsible decisions. If we are not there yet, let's figure out what else we need to know, and do it quickly... because time is wasting. Second. We need to think and act regionally to solve the problem. Cape Cod has a sole source aquifer. Groundwater moves through that common aquifer across town lines. All towns contribute to the problem, and all of the towns will need to play a role in solving it - because each town has a stake in the environmental and economic health of the Cape, no matter what its percentage contribution to the nitrogen in our estuaries. This will mean, for the Cape towns, a need to think outside town boundaries and embrace acting jointly with your neighboring communities. And we at MassDEP will be thinking hard in the coming months about the ways we can use our regulatory powers and financial leverage to encourage and reward regional approaches."
DEP Commissioner Kenneth Kimmel speech at Ocean Outfall Symposium, May 25, 2011
http://www.mass.gov/dep/about/nutloadcc.htm

COMMUNITIES FACE POTENTIALLY STAGGERING COSTS FOR FEDERALLY MANDATED STORMWATER MITIGATION

The National Pollution Discharge Elimination System (NPDES) program regulates discharges of pollutants to waters of the United States through the issuance of discharge permits under the Federal Clean Water Act. Because of the growing understanding of the negative effects of stormwater on water quality and stream flow, the Environmental Protection Agency now requires all Municipal Separated Storm Sewer Systems (so-called "MS4" systems) that have traditionally captured stormwater runoff through storm drains to obtain a NPDES permit and to develop a storm water management program. Cities and towns in the districts governed by so-called "MS4 permits" (Municipal Separated Storm Sewer Systems) are faced with uncertain costs due to pending federal requirements for stormwater mitigation.

In the coming decades, there is expected to be a dramatic increase in regulation and therefore, costs for stormwater management. Currently in Massachusetts, an MS4 permit is required of cities and towns within four districts, designated North Coastal, Merrimack, Interstate, and South Coastal. Although federal permits required that municipalities address basic storm water management needs related to municipal and industrial storm water by 2008, most cities and towns are still developing these programs. Despite the increasing regulatory and environmental requirements for storm water management, there are currently no dedicated federal or state resources for meeting this growing need.

An upgrade to the MS4 permits is currently under review by the EPA which will require ordinances and bylaws to regulate illicit connections and discharges to a municipal storm drain system and to address uncontrolled runoff, particularly during and after construction. Municipal Separated Storm Sewer Systems will ultimately be regulated to address contaminated discharges, and to address run off associated with impervious surfaces.

The most intensive storm water management effort to date in Massachusetts is focused on the upper Charles River watershed where the EPA has instituted a Residual Designation (RDA) pilot program. This effort requires that owners of commercial, industrial and multi-family residential properties 2 acres and larger in the towns of Milford, Bellingham and Franklin construct additional storm water facilities that reduce phosphorus pollution by 65% percent. The outcome of this pilot initiative may be the basis for future federal storm water requirements that will be instituted for municipalities state-wide. To a great extent, the outcome of this pilot and subsequent final federal regulations will be a significant driver of the total funding needs for storm water.

A few communities have created new "storm water utilities" which charge a fee based on an average impervious index for a residence and/or actual measurement of impervious acreage of commercial, industrial, and business uses. In these "model" communities, fees are initiated in concert with a capital, operational and maintenance and debt retirement cost plan associated with implementing storm water management best practices and a long term capital improvement program. An enterprise accounting system ensures that the fees in fact support the O & M, capital investment plan, and debt retirement plan.

Stormwater costs: The Town of Reading created an ad hoc **storm water management advisory committee** in 2002 to investigate funding options, identify program costs, and look at rate setting methodologies. A recommendation was made to create an **enterprise fund** to ensure a dedicated source of funds for storm water operation and maintenance. Reading's town meeting voted to establish this fund in 2006. The town raises approximately $430,000 annually, based on a residential fee of $40.00 per year for a single family or 2 family home and $40.00 per year for every 3210 square feet of other development. The town created an abatement process if residents can prove the presence of infiltration or storm water treatment systems. The revenue is used for labor to perform stream and detention basin maintenance activities, capital expenditures, drainage mapping, detection of illicit connections, drainage infrastructure improvements, and other activities. Any money that is left over at the end of the year is rolled over into the next year's enterprise fund budget. **http://www.ci.reading.ma.us/pages/ReadingMA_Engineering/faq**

Medway: *"We feel this proposed (MS4) Permit mandates stormwater requirements and best management practices that will prove too difficult for any town of Medway's size, with a limited budget and staff, to execute. We are concerned that the current economic climate presents the worst possible conditions in which to apply such strict requirements."* **--Dennis Crowley, Chair Medway Board of Selectmen- letter March 14, 2011**

SECURITY AND REDUNDANCY MUST BE ADDRESSED

Communities expect to invest significant dollars in security and redundancy in their systems, in order to protect the public during various emergency situations. Emergency preparedness requires both "operating" costs and capital costs. [41]

Redundancy is a concept that water system operators plan for. Redundancy generally means eliminating or managing potential points of failure within a system. Having redundancy in the system leads to a higher degree of reliability of the system in the event of an emergency, and also allows parts of the system to come off line for inspection or rehabilitation. [42] So for example, if a well is contaminated in one part of a town, another can be brought quickly on line. If a critical water main breaks, the affected area can be isolated and alternate routes utilized.

Redundancy planning may mean developing an additional water supply; alternate water mains; or treatment capacity. These redundancies have capital costs.

Emergency preparedness guidelines from the DEP[43] encourage towns to have safety protocols in the event of emergencies: to have standby power equipment for major pump stations, an adequate fuel supply for portable generators, an inventory of spare parts, an inventory of adequate treatment supplies, and to practice routines that keep vehicles in working order and fuel tanks filled. Provisions for staff training to make sure that all staff is familiar with emergency protocols are essential. These measures are prudent, and a wise use of resources.

As an example, the Massachusetts Water Resources Authority, which serves many cities and towns, in its 2012 financial report[44] has estimated that water system redundancy expenditures are projected to increase from 12.1% of spending through 2010, to 37.8% for the FY14-18 time period.

"Improving the security and resilience of our nation's drinking water and wastewater infrastructures is vital to ensure the provision of clean and safe water to all in the United States. Significant actions are underway to assess and reduce consequences, threats, and vulnerabilities to potential terrorist attacks; to plan for and practice response to natural disasters, emergencies, and incidents; and to develop new security technologies to detect and monitor contaminants and prevent security breaches."

"Dedicated resources are important to ensure a sustained focus on protective programs. In some circumstances, investment may be as simple as increasing the amount of time and attention that executives and managers give to protective programs. More resources should be invested where threat potential or potential consequences are greater. Utilities should identify specific protective program needs and set aside resources accordingly, through their annual capital, operations and maintenance, and staff resources plans."

"Utilities should encourage awareness and integration of a comprehensive protective posture into daily business operations to foster a protective culture throughout the organization and ensure continuity of utility services."
http://water.epa.gov/infrastructure/watersecurity/

THE STATE FACES CRITICAL ENVIRONMENTAL OR GROWTH ISSUES THAT MAY REQUIRE NEW INFRASTRUCTURE OR A NEW PARADIGM FOR WATER, WASTEWATER, AND STORMWATER SERVICES

Significant parts of the Commonwealth are struggling to plan for new or expanded water services to address a variety of emerging concerns including climate change, new demands for service due to growth or potential growth, and emerging contamination problems related to storm water, private wells, or septic systems. These communities need solutions that are cost-effective, supportive of the local economy, environmentally sustainable, and technologically reliable.

Some of these communities are starting with a small centralized water or sewer system but are facing demand to expand. Others have no centralized water or sewer systems but are attempting to deal with complex treatment challenges "from scratch" without a rate-payer base or existing facilities.

Some communities see the lack of water infrastructure as a drawback – others see an opportunity for new paradigms. Conventional centralized water systems have efficiencies of scale, but are difficult to start "from scratch" and have inherent built-in drawbacks including high energy use and transportation of water away from its sources.

Technologies that keep water local, replenish water closer to its source, and are more resilient in fluctuating climates, will offer sound investments for communities in the 21st century. This theme was struck by EEA's 2004 Water Policy, which stated: "Existing infrastructure often transports precipitation away from where it lands instead of letting it infiltrate. Transporting dirty water far from its source made sense historically, but today, with significant improvements in wastewater treatment techniques and standards, treatment levels often make the water available for reuse or recharge, thereby replenishing the natural stream flows and aquifers in the basin or sub-basin."

Addressing these challenges may offer opportunities for technologies and systems designs that meet the requirements of the triple bottom line- simultaneously optimizing economic, social, and ecological gains.

These technologies utilize "smart, clean, and green" ways to capture the value of assets in the process. These systems and technologies must be appropriately scaled and utilize low impact development techniques and green infrastructure designed to restore natural infiltration and evaporation cycles, which will reduce flooding, sewer overflows, and the severity of droughts.

> *"STAKEHOLDERS WHO NEED NEW INFRASTRUCTURE CAN BE SERVED WITH INTEGRATED WATER-CENTRIC SYSTEMS THAT SUPPLY AND TREAT WATER WITHIN A MORE RESILIENT AND EFFICIENT DECENTRALIZED DISTRICT AREA, AND MANAGE ALL OF THE RELATED NATURAL RESOURCES AS BENIGN BY-PRODUCTS THAT SERVE LOCAL NEEDS." "PRIVATE CAPITAL INVESTMENTS IN THESE INNOVATIVE PROJECTS ARE AN OPPORTUNITY FOR THE COMMUNITY TO BENEFIT WITHOUT NEEDING TO MAKE THE INITIAL PUBLIC INVESTMENTS OR CARRY RISKS. (…) IN THESE CASES, PRIVATE INVESTMENT WOULD BE TARGETED AT THE CREATIVE, LEADING-EDGE."* **--Edward Clerico and Dominic Kulik, Natural**

The vision is to utilize systems that integrate water resource considerations into all aspects of planning, building, and running communities and businesses, and that mimic natural designs and functions such as streams and wetlands. These approaches can also contribute significantly to green business development and job creation.

MUNICIPAL DEBT IS A GROWING BURDEN

Many municipalities have taken on increasing levels of debt in order to maintain their water infrastructure and meet their obligations for mandated improvement projects. As the cost of debt continues to rise, more of the available finances will be consumed by debt service and will be unavailable for needed maintenance and expansion projects. Many systems have raised rates to help cover the costs of debt.

Several examples paint a vivid picture.

First, consider the Massachusetts Water Resources Authority (MWRA) which serves 43 communities for sewerage and 51 communities for water service, for a net total of 61 communities. Since the MWRA was created in 1985, the Authority has completed nearly 7 billion dollars in upgrades to its water and sewer systems, including the Boston Harbor Project, the Metrowest Water Supply Tunnel, Rehabilitation of the Spot Pond Supply Mains, and mitigation of combined sewer outfalls. Nearly 80% of these capital improvements were mandated by state or federal regulations. Repayment of the borrowing (principal and interest payments on its bonds) now accounts for 58% of the annual MWRA budget. [45]

In the face of this debt, the MWRA has been able to operate by utilizing difficult budget cuts and rate increases, despite the fluctuation and elimination of state debt service assistance. However, the authority's estimates on future debt payments clearly show that without additional assistance, the authority will be facing serious challenges in meeting the $6b in debt payments that will be incurred over the next 20 years. Debt service payments are projected to peak by FY2022, when they are projected to total $550 million, almost as much as the proposed current expense budget for FY 2011.[46]

The Town of Holliston provides another example. Town officials testified before the Commission about the impact of debt on its ability to deal with current issues. The water department's annual budget already includes about 40% debt service for previous capital expenditures.

Beyond this existing debt, Holliston faces a DEP mandate to undertake a $1.5 million repair to an existing well site, and faces additional challenges in replacing asbestos-concrete pipes that have been in place for about 75 years – the average life of such pipes. Holliston maintains about 100 miles of pipe and serves 14,942 residents and 782 fire hydrants. Depending on circumstances, the average cost for pipe replacement has been estimated at about $800,000 per mile. Planning for a program of pipe replacement will be challenging to pay for, especially with the current debt load.

> *"MWRA REGARDS BOTH DEBT SERVICE ASSISTANCE (HB 242) AND ITS INFRASTRUCTURE ASSISTANCE PROGRAM (HB 241) AS CRITICALLY IMPORTANT COMPONENTS OF PROVIDING AID DIRECTLY TO CITIES AND TOWNS TO RELIEVE THE BURDENS OF FINANCING PAST AND ON-GOING WASTEWATER INFRASTRUCTURE IMPROVEMENTS WHICH BENEFIT THE COMMONWEALTH AS A WHOLE. THESE EXPENDITURES SERVE TO ASSURE THAT MASSACHUSETTS WILL ALWAYS POSSESS A CLEAN AND VIBRANT BOSTON HARBOR WHICH WILL SERVE AS AN ECONOMIC ENGINE TO BOTH ATTRACT AND RETAIN BUSINESS AND DEVELOPMENT IN THE COMMONWEALTH."*
> **Frederick A. Laskey; letter to Ioint Committee on**

Another city that testified about the debt burden is the City of Fall River. As outlined in the sidebar on Page 21 of this report, Fall River has a current annual debt service cost of $7,920,000 for its wastewater improvements, which is 45% of the entire Sewer Division budget. As a result, there has been a dramatic increase in sewer user fees and a new storm water fee.

In addition, the city has an annual debt service cost of $2,341,699 for its water system improvements, an amount that is 28% of the entire Water Division budget and the prime cause of the dramatic increase in water user fees. It is expected that new Massachusetts dam regulations and expanded federal storm water regulations will require the city to invest in millions more in capital improvements. To start, a $3.6 million dam improvement is underway using loans. Currently, the annual cost to a single family homeowner for water, sewer, and storm water is $816.

These three examples are illustrative of the debt pressures facing Massachusetts cities and towns.

The Commonwealth Sewer Rate Relief Fund (line item 1231-1000) was specifically designed to mitigate the escalating debt due to the costs of water and sewer service in Massachusetts. Instituted at a time (1993) when communities were experiencing double-digit rate increases as a result of federally mandated improvement projects, such as the Boston

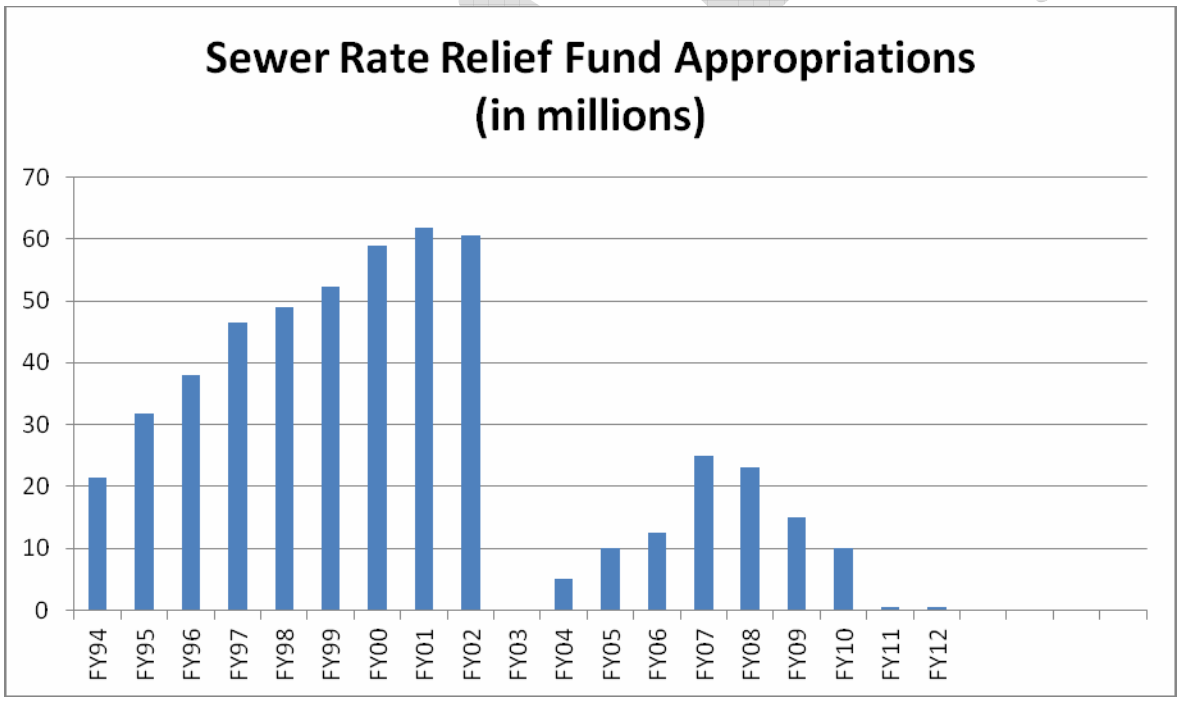
Harbor Cleanup, the fund historically helped communities cover their interest charges and also helped pay principal. At one time the account was funded at over 60 million dollars, and it was an important tool that helped residents in over 100 communities across the state. Eligibility for the fund is related to certain debt criteria.

Funding for the line item has fluctuated (see table below). The highest assistance was offered in FY00, FY01 and FY02, when the funding reached its highest point. In FY03, in response to a state-wide recession, debt service assistance was eliminated. Then, in response to a strengthening local economy, debt service assistance was restored but never regained its earlier levels. In light of the economic downturn in FY09, the Commonwealth was forced to eliminate the appropriation in October 2008. AWAITING FINAL NUMBERS FROM DOR for years 09-12.

Between FY 1994 and FY 2002 alone, these rate relief distributions totaled over $420,000,000 statewide.[47] Anecdotally, the Commission heard that erosion of this stream of revenue has had an impact on the willingness of municipalities to borrow for infrastructure programs, even at low interest rates.

As funding for the Rate Relief line item has fluctuated, many communities have been impacted. For the MWRA, which over the years received the highest share of support, reductions in debt service assistance have resulted in a combination of greater reliance on reserves and budget cuts which address short-term budget needs. For example, when the account went from over 60,000,000 in 2002 to zero funding in 2003, MWRA was forced to institute an unprecedented mid-year rate adjustment, increasing the rate increase from 2.9% to 6.9% as part of an overall strategy in response to cover required debt payments, while cutting $420.0 million from its capital improvement program and $47.2 million from the current expense budget through various budget cuts including layoffs. [48]

The following chart summarizes the history of assistance offered to communities through this critical fund:



THERE ARE UNANTICIPATED FINANCIAL EFFECTS OF WATER CONSERVATION

There has been a great deal of progress in water conservation in recent years, which is positive for the Commonwealth and the environment. However, current pricing structures used by many communities are putting conservation efforts in conflict with system maintenance. Because water is billed on a per gallon basis, fewer gallons used results in reduced revenues for maintaining water systems.

Town of Monson:

The Monson water system was established in 1894 and serves approximately $4000 customers. The town has worked diligently to maintain and upgrade their system. Since 1998 they have replaced approximately 12,000 feet of various sized water mains in six different projects, replaced a failed well with two new wells, build a new building around an existing well, added a concrete water storage tank and rehabbed an existing steel water tank. Monson completed these with grants and loans from several sources, including Community Development Block Grants, the United States Rural Development program, and the State Revolving Funds. The system now allocates 28% of its budget to debt service to pay off its borrowing.

To pay for these investments, Monson has raised its rates. One result of higher rates was that customers began to conserve water. Because less water was sold, Monson raised rates to maintain revenue. The continuing cycle of higher rates cause a manufacturing company in town to install a water recycling system to reduce their water use. The company is expected to save approximately 15 million gallons of water per year, which means the water department will see a decrease in revenue of $75,000 in FY 2012. **Based on testimony of Craig W. Jalbert Superintendent Monson Water and Sewer Department November 15, 2010**

STATE AND FEDERAL FUNDING IS TRENDING DOWNWARD

Since 1972, the federal government has spent billions of dollars in investments to drinking water and wastewater infrastructure nationwide. When leveraged with state and local contributions, over a trillion dollars has been spent across the country during these last forty years. However, the trend is that both federal and state funding available to municipalities has steadily decreased since the 1970s. [49]

For example, in the past, state and federal earmarks were utilized to subsidize water infrastructure projects in the Commonwealth. The recent economic downturn has virtually eliminated earmarks in the Massachusetts Legislature as well as in United States Congress.

In 2008, the Environmental Bond bill authorized $25 million for water infrastructure projects, but constraints on the bond cap have prevented this money from being appropriated.

Small but important streams of funding still do exist in such programs as the MWRA local pipeline assistance program, the MWRA infiltration and inflow local assistance program, the MassWorks Infrastructure program, the Drinking Water Supply Grant Program, and the United States Department of Agriculture (USDA) rural assistance programs. Clean Water Action has identified a number of funding streams that have been put to good use on diverse programs from schools to hospitals to pilot projects. [50]

By far the most important funding streams for Massachusetts are the Clean Water and Drinking Water State Revolving Fund Grants and the Massachusetts Contract Assistance Program that provides the match for them.

CLEAN WATER AND DRINKING WATER SRF GRANTS.

Each state participates in the state-federal partnership that uses federal dollars from the EPA combined with state dollars to create the State Revolving Funds (SRFs) that carefully loan the money at low interest rates to municipalities, water and wastewater districts, and public water suppliers to finance drinking water and wastewater infrastructure.

During the early years of the Clean Water and Drinking Water programs, federal money was disbursed in grant programs, offering 75% federal support for some programs. The state contributed a 15% match, and the municipality contributed the remaining 10%. These grants were critical to establishing our existing water infrastructure framework in many communities --- and were widely popular because municipalities paid only a fraction of the true costs of the systems.

The program was restructured and converted to today's low interest loan program in 1989 (Clean Water) and 1993 (Drinking Water). This restructuring had the intended impact of stretching the federal dollar to accomplish more projects, but it should be noted that the shift from grants to loans has had a substantial impact on municipalities. Unlike the earlier federal grant programs, SRF loans require that the municipality or local water district pay back principal and interest, either through rates or through the local general fund. This shift has resulted in an increasing reliance over the past thirty years on local water rates to fund infrastructure.

Massachusetts has one of the most highly leveraged SRF programs in the country, generating the most funding per dollar in federal grants for water infrastructure projects. The Clean Water and Drinking Water SRFs, managed by the Massachusetts Water Pollution Abatement Trust in the State Treasurer's Office, represent the most sustained and significant source of federal and state investment in water-related infrastructure in Massachusetts.

Each year, the Commonwealth contributes money to the fund, as does the federal government. For FY 2012, the anticipated **Contract Assistance** from the Commonwealth to keep the revolving funds running is $64,986,546.[51] This is Massachusetts' most consistent and important contribution to water infrastructure investments and represents an extraordinary commitment over the years of the program.

The leveraging capability of the Water Pollution Abatement Trust is based on its ability to leverage funds in the bond market through the use of a reserve fund, dedicated to each bond series in order to fund the projects and also to maintain the highest bond rating.

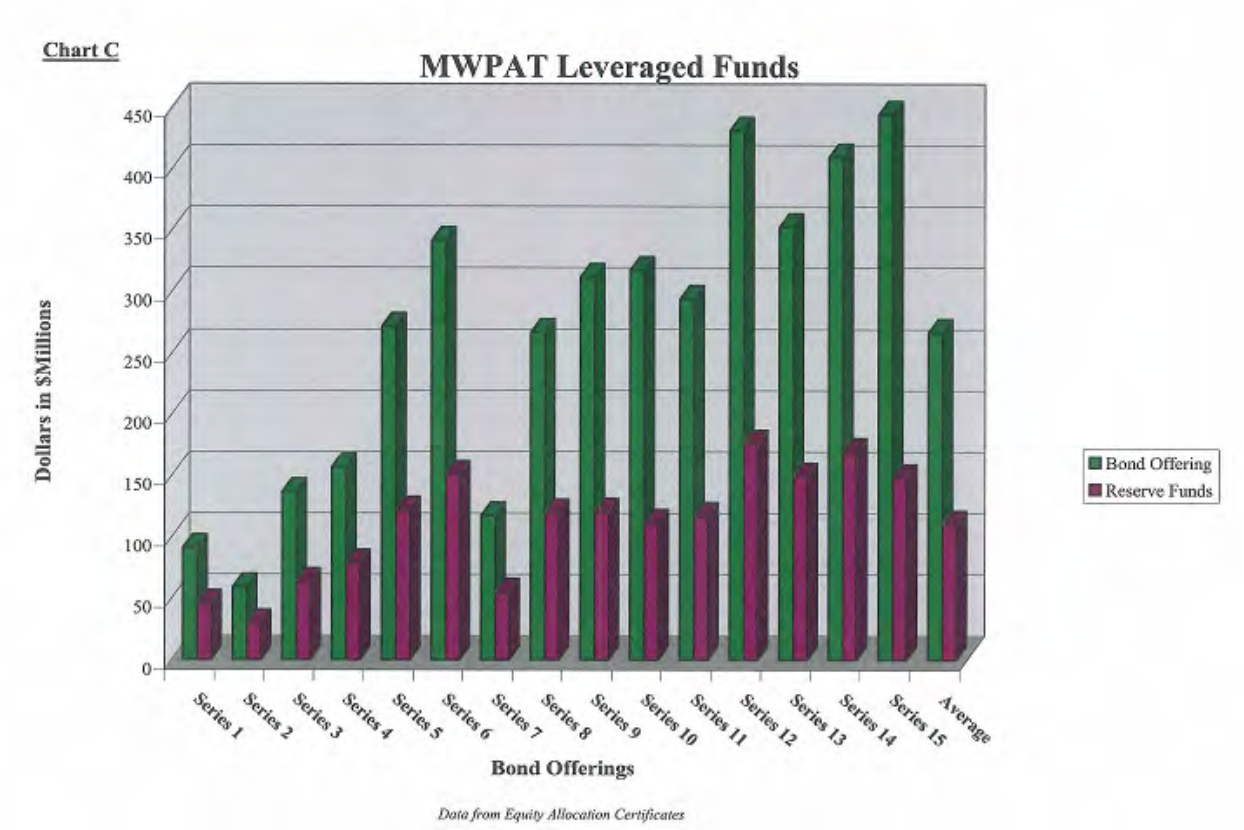
Over the life of the program, the MA Water Pollution Abatement Trust has leveraged the federal capitalization grants by an average factor of 2.4, translating the $1.59 billion in federal grants into $5.44 billion in project financing. The Trust has financed $4.3 billion in clean water projects and $1.1 billion in drinking water projects since the program began. In fact, the Commonwealth

With 97% of Massachusetts residents being served by one of the 292 entities that have borrowed funds through the Trust, MWPAT's SRF programs are critical to the Commonwealth's clean and drinking water initiatives.[52] The top borrowers include the MWRA, Fall River, Upper Blackstone Water Pollution Abatement District, New Bedford, Brockton, Lowell, South Essex Sewerage District, Taunton, Nantucket, Lynn Water and Sewer Commission, Chicopee, Gloucester, Chelmsford, Springfield Water and Sewer Commission, and the city of Fitchburg.

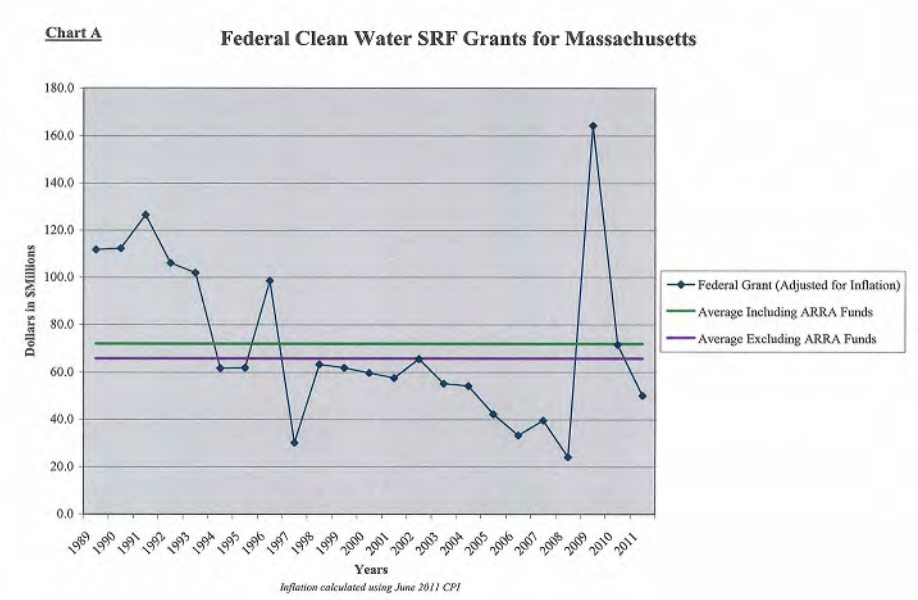
The chart below displays the leveraging capability of the Trust based on the bond series offering compared to the reserve fund needed to support the bonds. The reserve fund is the amount that the Trust has dedicated to each bond series in order to fund the project and also to ensure that the Trust will maintain the highest bond rating. Maintaining the AAA bond rating is crucial to the operation of the Trust because it reduces the cost of borrowing, thus reducing the cost incurred by the Commonwealth to subsidize the loans. The Trust has historically leveraged in between 2:1 to 3:1, with the last bond series leveraging just above 3:1. The success of the Massachusetts Water Pollution Abatement Trust is based on its ability to leverage funds in the bond market and fund more projects that possible with a direct loan system, a "non-leveraged" model that other States in the US have adopted.[53]

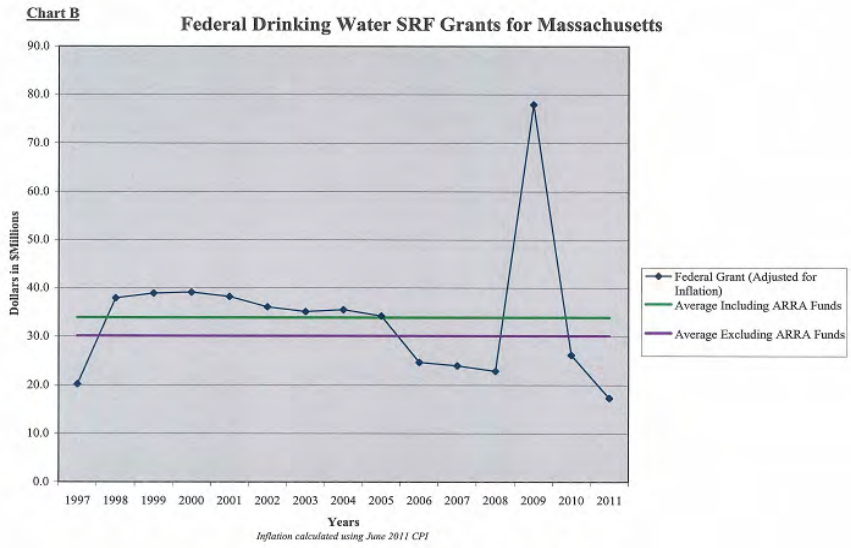
Currently, Massachusetts uses a 2% interest rate for its SRF loans. This rate allows the MWPAT to finance more projects through the leveraging of federal and state funds than would be possible if the loans were zero or one percent. It also provides subsidized financing to cities and towns, and provides a source of funding to support bond debt service payments. This leveraging can be seen in the chart below.[54]

In some years, the 2% SRF loans have compared favorably to what cities and towns could borrow on their own, and the Commission heard testimony that many communities have recently borrowed directly given the competitive rates currently available in the open market. With an improved economy, the current 2% rates will become more attractive and are very competitive with what other states are offering through their SRF programs.[55]



Overall federal spending provided to the states for the drinking water and clean water programs have decreased steadily in the last forty years. This has meant, and continues to mean less funding available through the SRF program, at a time when corresponding needs are expected to increase due to replacement of aging infrastructure and continually increasing regulatory requirements. There are several bills pending in Congress to reauthorize the federal Clean Water Act, which capitalizes the Clean Water SRF. However, given the current political climate on Capitol Hill, the Commission believes that it is more prudent to assume that there will be a continued decline in federal funding to the states for water infrastructure. In addition, new formulas could affect the proportion of the funding that comes to Massachusetts, increasing the uncertainty around federal funding sources. Downward trends in the federal Clean Water and Drinking Water funding can be seen in the following charts.[56]





Note: The spike in both of these charts in 2009 and 2010 is due to the American Recovery and Reinvestment Act (ARRA).

AFFORDABILITY IS AN IMPORTANT ISSUE FOR MANY COMMUNITIES

Rate payers are very concerned about the cost of service, and system managers must address affordability in setting their rates. Keeping water and sewer service affordable is of particular concern to individuals on low or fixed incomes. The American Association of Retired Persons has identified this issue as one if its public policy concerns. [57] If water infrastructure is to be paid for increasingly with user rates, it is important to recognize that different communities have different abilities to pay for necessary improvement.

For policy makers, the issue is finding ways to utilize full cost pricing in a way that doesn't make water rates unaffordable for low and moderate income individuals and communities.

While there is general agreement that affordability is a matter of important public policy, there is no national or widely accepted benchmark for what an individual household should expect to pay.[58]

Rather, the EPA has adopted benchmarks for system-wide rates for all customers of a water system relative to the median household income (MHI) in a service area (rates as a percentage of the community's median household income). The EPA uses these benchmarks to determine when waivers should be considered for small systems facing expensive water treatment regulations. The EPA benchmark was set at 2.0 percent each for wastewater and drinking water, and then was raised to 2.5%.[59] If the proposed treatment would result in rates higher than the benchmark, EPA could consider waiving the treatment.

Some policy makers are generalizing from this EPA waiver benchmark to suggest that keeping rates below some reasonable community-wide benchmark of around 1.5 to 2.0% of Median Household Income is reasonable. The benchmark should probably be considered in conjunction with other factors.

The State of Pennsylvania in its report used the factor of 1.5% to extrapolate a total charge of $1455 per year for water and sewer service to be affordable for communities with average or higher incomes. [60]

"Much of the nation's drinking water and wastewater infrastructure is at or near the end of its useful life. The expense of replacing the water infrastructure is contributing to a rapid increase in the cost of water service that is of concern for older, lower-income consumers, who pay a larger share of their income for utility services than other consumers. With water rates increasing at a much faster pace than inflation, finding ways to ensure that the necessary infrastructure repairs take place while supporting affordable water rates for consumers should be an important concern for policy makers." AARP Public Policy Institute. Replacing the Nation's Deteriorating Water Infrastructure While Maintaining Affordable Rates

WE WON'T MAKE PROGRESS UNTIL THE PUBLIC TRULY UNDERSTANDS THE FULL COSTS OF SERVICE AND THE CONSEQUENCES OF FAILURE TO INVEST

The public is often unaware of the true costs necessary to fully support, operate, maintain, and invest in the Commonwealth's water-related infrastructure. The costs of water include all the direct and indirect expenses of providing service (including such diverse items as labor, power, chemicals, benefits, taxes, pensions, retirement, administration, overhead, and capital costs including debt, depreciation, and replacement of assets).

At the same time, consumers generally underestimate the value of water for the protection of public health, fire protection, economic vitality, jobs, and environmental benefits -- and misunderstand the consequences of failing to invest.[61]

This lack of understanding – of both costs and value - makes it difficult for some municipalities to make the case for investment. Many communities cover only the "present" costs of operation, such as power, chemicals, labor, maintenance, debt service, and personnel-related costs. In paying only part of the full cost of service, utilities will postpone the replacement of assets and the funding of depreciation.

Thus, for a service that has a very high societal value, where failures will cause great inconveniences, loss of business, and jeopardize the public health, we sometimes fail to pay enough for the service.

Ironically, many of us see the value in high monthly fees for internet or cable service.

As a point of comparison, water rates on an annualized basis compare to the following rates paid for other commonly used utilities:

"The average citizen, who ultimately must vote for and pay for new water/nutrient infrastructure, needs a "big-Picture" overview of the water/waste situation and deserves a detailed comparison and analysis of ALL available options, in order to make an informed decision whether to pay for a particular technology."
--Earle Barnhart, The Green Center, Inc. Testimony at Water Infrastructure hearing November 10, 2010

"I am a fan of promoting education on the importance of drinking water utilities. The majority of Public Works Functions are generally downplayed and taken for granted. However, drinking water facilities are held to extremely high standards and regimens and are the best bargain in existence. (….) Educating the consumer to the excellence and value in drinking water utilities would provide the cornerstone for supporting infrastructure maintenance."
Irving A. Priest, Superintendent Town of Wrentham Department of Public Works – letter October 22, 2010

	Avg Monthly Pmt.	% MHI
Water rate	$39	0.72%
Sewer rate	$53-65	0.98%-1.19%
Cellular Phone	$50-60*	0.92%-1.10%
Cable television/Internet	$70**	1.28%
Electricity	$45-65†	0.83%-1.19%

Sources: *Kiplinger's May 2009; **Centris Research April 2009; †Mass. EOEEA website

What will it take to develop an understanding of the cost of infrastructure needed to bring clean water to our homes and businesses, 24 hours a day, 7 days a week? In 2010, the ITT Corporation conducted a survey of American voters regarding the value of water.[62] Sixty nine percent of those polled agreed with the statement: "I generally take my access to clean water for granted." A full 95% of American voters polled in the same survey value water over any other service they receive, including heat and electricity. Nearly one on four American voters is "very concerned" about the state of the nation's water infrastructure. Twenty nine percent of voters polled understand that water pipes and systems in America are "crumbling and approaching a state of crisis." Three out of four American voters polled in the survey stated that disruptions in the water system would have "direct and personal consequences."

The poll also found that voters are willing to pay more for their water service. This poll is important, because it suggests that efforts to educate the public on the actual and full costs of providing a reliable water supply can impact the willingness of ratepayers to pay for those services.

THE COMMISSION PROPOSES A ROAD MAP TO A SUSTAINABLE FUTURE

Over the past decade, many studies have confirmed the need for investment in the nation's drinking water, wastewater, and stormwater infrastructure. While estimates of the size of the gap may vary, the underlying message is clear. A significant increase in spending above current levels will be necessary to meet this investment need. And, while federal subsidies will continue at some level, it is clear that the states and local governments across the country will need to prepare integrated responses to this impending crisis. [63]

The Commission finds that Massachusetts, like other states, faces a substantial gap. The gap is not a static number – its size will depend on our actions and many other variables. We should continue to gather information about the size of that gap and the challenges facing each municipal, district, or authority in the Commonwealth. But we can't afford to wait for more precise information to act.

The Commonwealth needs to catch up with the rehabilitation of aging infrastructure, meet the challenges of environmental regulation, invest in a sustained asset management program, and integrate our infrastructure to be more energy efficient and more environmentally sustainable.

The challenge is to find a sustainable way of accomplishing these goals now and in the future. Today's financial backdrop is grim. But this challenge is too important to postpone for better times.

The Commission proposes that the Commonwealth undertake a variety of approaches to move our water-related utilities to a more sustainable future.

As we build on our many accomplishments, the Commonwealth has an opportunity to continue to bring the most modern, science-based understanding of water resources to future decisions and investments.

Closing the gap in Massachusetts will require a combination of strategies:

- Raise revenues
- Operate our water, clean water, and stormwater utilities more efficiently
- Assist Towns in Retiring Their Debt
- Address the issue of affordability
- Promote environmental sustainability
- Promote innovation
- Continue the work of the commission and educate the public

A New Path to Clean Water
"The vision outlined in the Clean Water Act – fishable, swimmable waters – has not changed. In fact, this strategy is about how we can achieve a leap forward in our nation's water quality to move us closer to realizing this vision."

"There is no silver bullet – no single program or regulation will allow us to accomplish our goal. Carrying out all of these principles is where the true "coming together" must happen to address the primary stressors from multiple angles: smarter regulations, stronger partnerships, more balanced and coordinated compliance and enforcement, more integrated approaches to capitalize on synergies, improved communication with a broader audience, and greater leveraging of programs. Just as EPA will have to employ all of its tools, so too must all our partners."
Coming Together for Clean Water: EPA's Strategy for Achieving Clean Water Public Discussion Draft, August 2010

STRATEGY #1: RAISING REVENUES

Closing the gap will be difficult without strong leadership in Congress and a national commitment to the issue of water infrastructure investment. We need increased spending at the federal level and Massachusetts must be a part of that conversation.

We should advocate with Congress for maximum funding for existing critical accounts, including particularly the State Revolving Funds for Safe Drinking Water Act and Clean Water Act, the USDA Rural Development Water Infrastructure Program, and key energy and sustainability accounts with impact on water-related infrastructure investments. The State should also advocate for new programs and funding that will stimulate jobs while addressing our water infrastructure needs, including new tax credits for research and development and innovation in water technology and innovative storm water solutions.

But Massachusetts can't afford to wait for Washington to solve the problem. We can and must take actions at the state and local level to reduce the Gap. The Commission recommends a three pronged approach.

THE STATE REVOLVING FUNDS ARE A CRITICAL FOUNDATION

First, we must at least hold steady on our existing state and federal funding programs, especially the State Revolving Funds (Water Pollution Abatement Trust Fund) that has contributed an average of 65.8 million dollars a year in low interest loans to clean water projects and 30.1 million a year in drinking water loans. [64] This will require our advocacy in Congress and a commitment by the Massachusetts Legislature to keep up the Contract Assistance line item in the state budget.

BOOST REVENUES AT THE STATE LEVEL THROUGH A NEW TRUST FUND

Second, the Commission recommends the creation of a new statewide trust fund, administered by the Water Pollution Abatement Trust but separate from State Revolving Fund. The Commission recommends that at least $200 million per year be deposited into the new trust.

The Commission has prepared two illustrative scenarios to demonstrate the potential power of this new trust fund. Each scenario assumes a new trust fund run by the WPAT and funded annually over 20 years at three different levels: $50 million, $100 million, or $200 million.

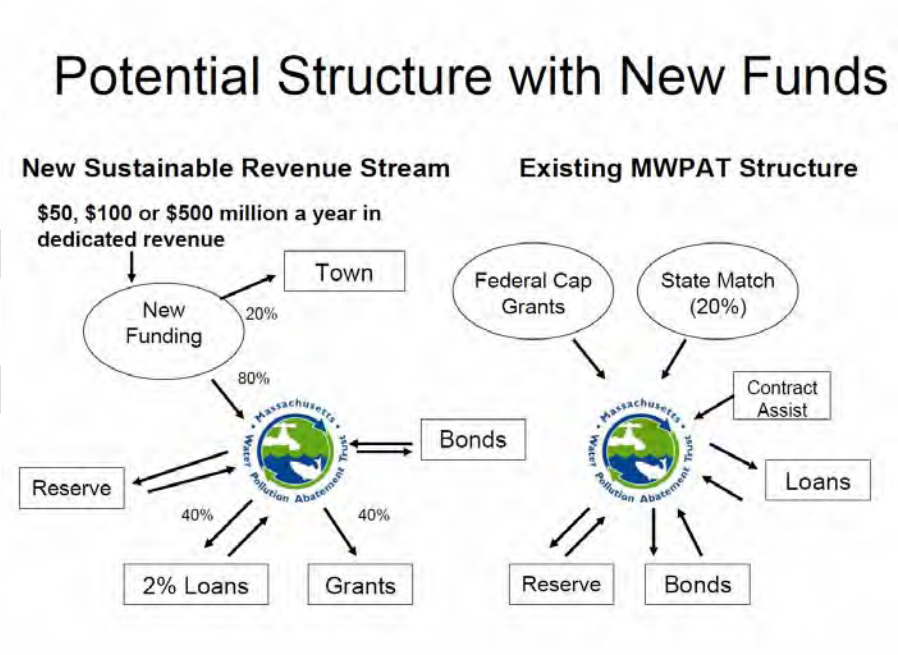
Mixed Disbursement Model

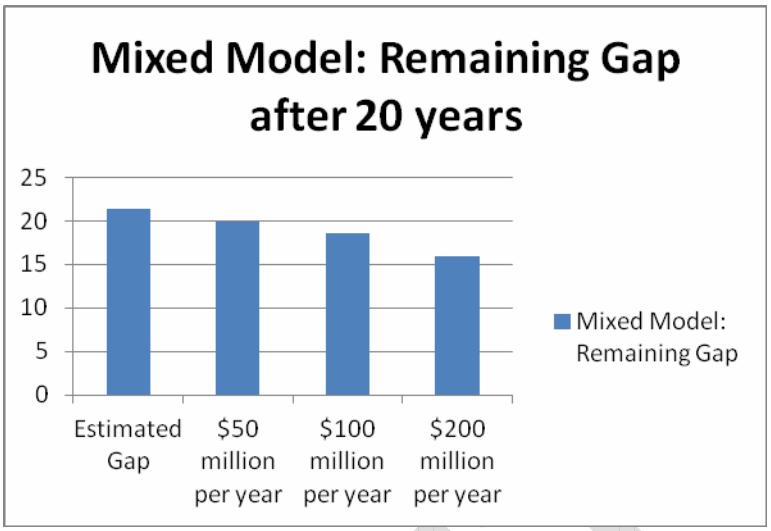
Under this scenario, 20% of the fund would go directly to cities and towns for infrastructure investments (much like Chapter 90 currently assists towns with highway infrastructure), with another 40% being offered as grants, additional debt relief, and principal forgiveness, and the final 40% going toward a 2% loan program leveraged similarly to the existing SRF loan program.

Assuming current interest rates and bond policy, and assuming that all grants and allocations are used for investments needed to reduce the gap, this "mixed model" scenario could reduce the anticipated gap by up to $5.707 billion dollars over 20 years.[65]

The advantage of this approach to cities and towns is that the grants and direct "Chapter 90-style" annual payment would not have to be repaid, so the State takes on some of the burden.

The model is demonstrated in the sketch below and estimated reductions in the gap over 20 years at the three funding levels are summarized on the chart below.



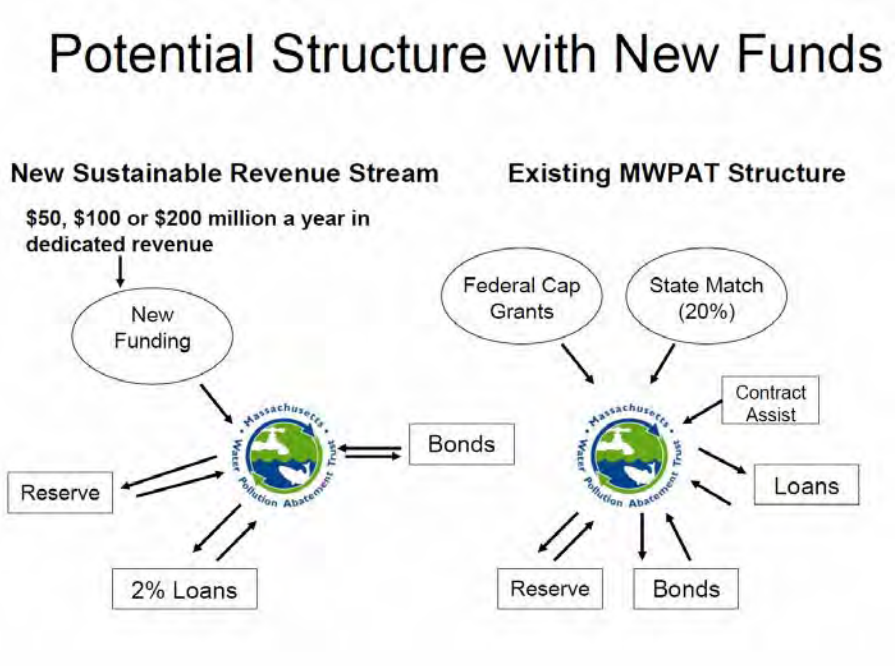


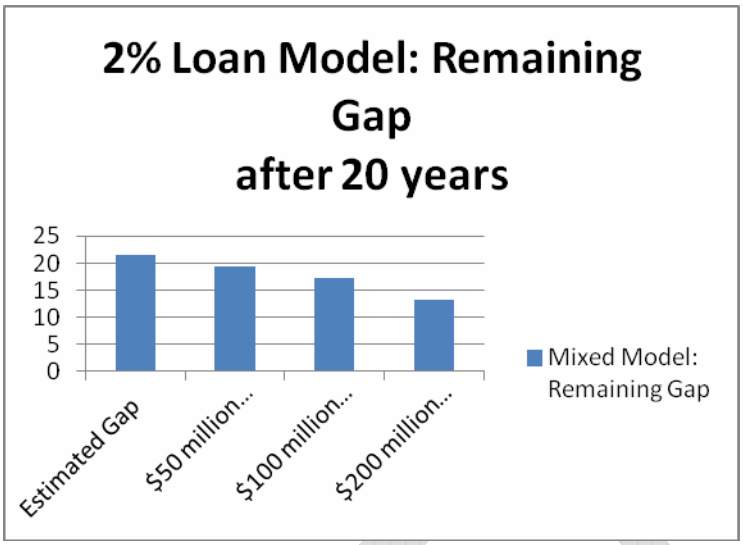
Two percent Loan Model

If the same $50, $100, or $200 million annual funding of the new trust was utilized solely for a 2% loan program, leveraged through a reserve trust, using current interest rate and bond policy assumptions, the gap reduction could be increased by up to $8,266 billion over that same 20 year period.[66]

The increased Gap reduction is important, but it should be noted that in this scenario, cities, towns, districts and authorities must ultimately pay back all the loan and interest, so the entire burden of infrastructure funding falls on the town and/or the ratepayer.

The second scenario is represented schematically on the following chart and estimated reductions in the gap are summarized on the chart that follows.





It should be noted that market conditions (such as interest rates, the differential between market and treasury bond rates, costs of borrowing, and potential changes to federal or state tax codes) could substantially alter the assumptions on which these estimates were made.[67] For example, if these same estimates had been made using 2007 market conditions, the conditions would have been more favorable and would have led to a more substantial reduction in the gap. (Insert same chart using 2007 market conditions). Conversely, if bond policy changes in the future to reduce the incentive for investment in bond offerings, the outlook could be LESS favorable.

Financing the New Trust: The Commission discussed a number of possible revenue sources that the Legislation might turn to in order to fund the new trust. In general, the Commission favors sources with a nexus to the water investment issue, such as revenue from a new Bottle Bill, new fees on pollutants such as fertilizers and pesticides, or charges on water-related fees such as port fees or building permits. There was considerable discussion by the Commission of imposing a state-wide surcharge on water and sewer rates to fund the new trust, but because the Commission also favors a strategy of full-cost pricing in the setting of rates, this could be an unfair reliance on local rate payers to address an issue that has national and state-wide implications. The use of such a surcharge would need further consideration. Other sources that do not have a direct nexus to the water issue, such as a share of gaming revenues, lottery funds, or the sales tax could also be considered.

Commit to the Trust: The success of the trust fund will depend on the assurance of long term sustainability of resources, so the Commission strongly recommends that all revenues be deposited into a dedicated trust fund. The program should reward municipalities, authorities, and districts that adopt best management practices in full cost pricing, financial management, asset management, and environmental sustainability, and use integrated water management planning, watershed-based solutions, and regional approaches.

Other provisions: Provisions should be included to assist communities without existing utilities or utilities that serve only a small fraction of the municipal population but that need to plan for new water systems.

COMMUNITIES SHOULD SET RATES TO RECOVER THE FULL COST OF SERVICE

Third, we must push municipal, district, and authority commissioners to utilize full cost pricing. Many Massachusetts communities are already doing this, thereby making steady progress on their needed investments. We must bring the rest into this more sustainable model.

There currently is no state-wide standard for rate structures for water infrastructure utilities, leaving room for variability of what gets paid for out of user rates. The state should adopt a policy to require or strongly encourage full cost pricing, setting firm guidelines as to what costs should be covered in a rate structure. The state should offer assistance to cities and towns to move them toward full cost pricing, and take other necessary steps to encourage or require communities to meet the guidelines.

User rates in Massachusetts are documented in the annual Tighe & Bond Water Rate and Sewer Rate surveys[68] and the annual Water & Sewer Retail Rate Survey published by the Massachusetts Water Resources Authority (MWRA). Each survey calculates an average water and sewer rate payment by household.

On one end of the spectrum, many well-run water supply systems and sewer systems set their rates based not only on their day- to-day costs --- such as electricity, chemicals, fuel, transportation, and personnel -- but also on careful capital improvement plans that make reasonable accommodation for the management and replacement of assets such as pipes, manholes, and pumps, and the protection of watershed land. Some of these systems use more sophisticated rate structures to encourage off-peak use or to encourage conservation. The money that is collected through rates is deposited into an enterprise fund, where it is used only for the purposes of paying term bills and for the careful replacement of longer term assets. Communities that set rates and manage their utilities in this fashion practice "full-cost pricing".

At the other end of the spectrum, there are public operating systems in Massachusetts that use a flat rate structure that may or may not be enough to cover the annual expenses of the utility – and many systems that do little to set aside money for more serious long-term asset investments. Some water systems are run by local volunteer Water Commissioners, who may be reluctant to raise rates for a variety of reasons, including the hardship to their customers. In some communities, the money collected in water or sewer rates is deposited not into a dedicated enterprise fund, but rather, into the municipality's general fund, where it might be used to fund other critical town priorities, unrelated to operation, maintenance and investment in water systems. In communities that have been charging rates below the cost of service, the public can dramatically underestimate or misunderstand the true cost of providing service, leading to lack of support for proactive system management, and objections when rates inevitably rise in response to emergency repairs or deferred maintenance.

Communities generally do better when they institute rates that are consistent with a long-term maintenance and management plan. There are a number of planning tools available to assist communities with water planning, however they are not consistently used across the state.

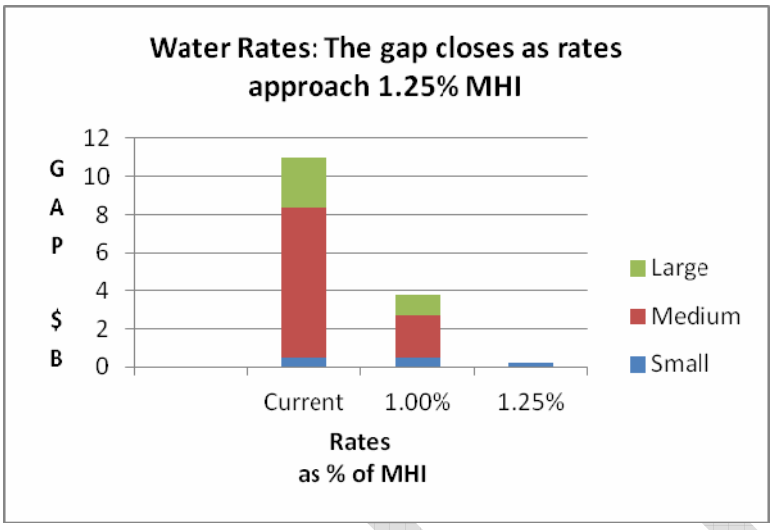
A review of Massachusetts water and sewer rates suggests that a significant portion of the infrastructure gap can be met by consistent, moderate rate increases over time, including set-asides for long-term capital investments.

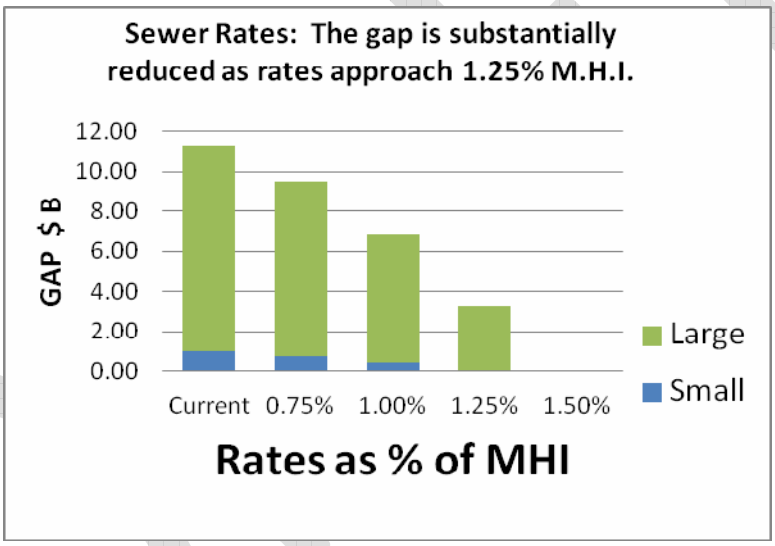
The Commission looked at the available data for water and sewer rates across the Commonwealth.[69] Given the variability in rates and rate structures, the Commission compared EACH town's rates and sewer rates to the median household index (M.H.I.)for its region. Marked against this yardstick, there was still good deal of variability, with some towns having high rates relative to their Median Household Index and others having much lower. A few exceeded 1.25% of M.H.I.

The Commission then projected how much revenue would be collected if all towns raised both water and sewer rates to either 1% of the median household income or to 1.25 percent of the median household income. By aggregating all these potential rate increases across the state, we can envision the general effect of such rate increases in reducing the gap (assuming that the new revenues would be used to reduce the gap for each community).

It should be noted that rate increases to these levels would cause proportionally dramatic rate increases in communities whose rates are currently well under the yardstick.

When aggregated, the data show a reduction in the infrastructure funding gap if rates are increased to either 1.0% or 1.25% of Median Household Income. Significantly, the data shows that as rates increase to those levels, future investment needs are met for large and medium-sized systems, with the gap significantly reduced for smaller systems.





COMBINED IMPACT OF RATE AND REVENUE STRATEGIES

The following chart suggests the combined impact on the estimated gap if the Commonwealth pursued both moderate rate increases and a new trust fund to assist towns with their water infrastructure. These estimates are illustrative only, and would vary with the specifics of rate increases, the amount set aside in the trust fund, the appropriation strategy, changes in market conditions, and any federal policy changes that may aide or hurt these efforts.

INSERT CHART showing gap reduction from rate increases and increased revenues

STRATEGY #2: OPERATE OUR WATER, CLEAN WATER, AND STORMWATER UTILITIES MORE EFFICIENTLY

ENCOURAGE MUNICIPALITIES, DISTRICTS, AND AUTHORITIES TO ADOPT FINANCIAL BEST PRACTICES

In addition to the inconsistencies in rate setting practices cited above, the Commission found that there is great inconsistency across the state in the application of other generally accepted Best Management Practices such as asset management, capital planning, and enterprise accounting. The Commission believes that there should be strong incentives and assistance to move communities toward adoption of those best practices. This suite of Best Management Practices will help bring all systems to financial habits that recognize and address the true costs of service.

Generally speaking, systems that use purposeful rate structures, capital improvement plans, asset management best practices, and enterprise fund accounting are able to make more progress toward a sustainable system. Like a wise homeowner who paints his home regularly, and who consistently invests in the maintenance and timely replacement of heating systems, roofs, and windows, a water or sewer system should work to maintain and replace assets.

The Environmental Protection Agency[70] recognizes that the renewal and replacement of assets that make up our water infrastructure is a "constant and ongoing task." To efficiently manage this ongoing responsibility, water management professionals nationwide utilize Best Management Practices in "asset management" wherein all the assets of a system are maintained at a defined level of service for the lowest life cycle cost. This concept is widely accepted and practiced.

A well-run utility will utilize a suite of Best Management Practices that does four things:

1. maintains up-do-date information about the history and condition of all assets
2. integrates renewal and replacement costs into a responsive long term capital plan
3. sets rates at a level adequate to provide steady and sustained investments toward asset replacement and upgrade
4. applies enterprise account principles to ensure that the revenues are dedicated to these purposes.

Asset management planning: A true asset management plan is based on a deep understanding of the condition of current assets and a planned timetable for maintenance and replacement. Assets are defined as "components of a facility with an independent physical and functional identity and age (for example, a pump, motor, sedimentation tank, or water main)."[71]

Rather than wait for failure, municipalities should create a maintenance and replacement program that minimizes failure and the costly disruptions caused by failure -- including flood mitigation, road repair, economic disruption and inconvenience. Age of an asset is one factor – but not the only one. Experts know that age is not always the best gauge for when maintenance is needed. Many new technologies, such as Geographic Information Service (GIS), enable municipalities to identify the location, condition and maintenance history of assets, which is especially useful for water infrastructure which is for the most part underground.

Capital Improvement Plan: A capital improvement plan is based on the asset management information – as well as any additional information about expected capital improvements the system will need such as upgrades to address regulatory requirements. The plan presents the public with a clear framework for what needs to be done, the timeframe for completion and the cost. This forward thinking approach is essential in gaining public acceptance and trust.

Enterprise funds: An enterprise fund gives communities the ability to separately account for financial activities associated directly with water infrastructure using a separate accounting and financial reporting mechanism. Enterprise accounting can be used when the service is provided for a fee, such as a water rate fee, as opposed to a general tax.

Because enterprise funds are managed separately from "general fund" municipal accounts, rates collected can be dedicated to the water, wastewater, or stormwater utility, allowing funding to be set aside, collecting interest, in preparation for long-term infrastructure repair and replacement. Information gathered via enterprise fund accounting also facilitates planning and data-driven decision making.

Utilities in communities that don't utilize enterprise fund accounts must fight for funds to be authorized from the General Fund.

The Commission was surprised to discover that many Massachusetts communities don't utilize these practices. When the Commission contacted a random sample of water and wastewater utilities, we found that 15% of those contacted lacked the basic information about the value of their assets.

Without information on the value of the system, it is difficult to recommend a budget target for annual reinvestment for replacement and rehabilitation and further increases the likelihood of reactive, rather than proactive, investment.

There are steps that the state could take to encourage more communities to adopt Best Management Practices, including:

1. technical assistance
2. grants to assist in asset inventories
3. incentives (e.g. requiring best management practices in order to qualify for state grants)
4. steps to help districts adopt enterprise fund accounting

Encourage Regional solutions where appropriate.

Regionalization may offer efficiencies in certain situations. Regionalization can include such practices as shared purchasing, shared staffing, regional planning, regional management of water systems or assets that may be owned and controlled by separate towns or districts, and, at its most comprehensive, regionalization can include the complete integration of a number of towns into one system.

Regionalization does not necessarily imply "centralized" solutions. Several towns might join together to provide management and monitoring of assets in different towns that may not be linked in any physical way. Or towns with septic tank issues might utilize a regionally administered "circuit rider" to handle Title V issues in several towns to address a common nutrient issue.

The Commonwealth already has a substantial regional approach to water supply delivery and sewer treatment. The largest regional authority is the MWRA, established by an act of the Legislature in 1984 to supply water and sewer treatment to 2.5 million people and more than 5,500 large industrial users in 61 metropolitan Boston Communities. Other multi-town water supply districts serve an additional 456,000 residents, and there are a number of multi-town sewer treatment districts, as well.

The Mattapoisett River Valley Water District includes water supply sources operated by the towns of Fairhaven, Marion, and Mattapoisett, also serving the Town of Rochester. Each town was experiencing elevated concentrations o iron and manganese in their wells, requiring several wells to be taken offline. Rather than constructing several treatment facilities for the eight wells, the towns team to construct a single advanced water treatment facility. This is the third ultrafiltration treatment facility in the state, and provides exceptional treatment, allowing the towns to meet and exceed current and future treatment standards. Construction was financed with a low interest loan obtained through the Drinking Water State Revolving Fund Program. These towns had a history of working together on water resources protection issues through the Mattapoisett River Valley Water Supply Protection Advisory Committee. For twenty years, the Committee had assessed annual fees to the members based on the amount of water pumped and used these fees for land purchase and other water resource protection measures. They met regularly regarding watershed planning, resource management and to review pumping data. Following town meeting votes in each town, special legislation, Chapter 367 of the Acts of 2004, was needed to create the district. The amount of water pumped and used these fees for land purchase and other water resource protection measures. They met regularly regarding watershed planning, resource management and to review pumping data. Following town meeting votes in each town, special legislation, Chapter 367 of the Acts of 2004, was needed to create the district.

Centralized management, operation, and monitoring of either decentralized or classic centralized assets could make a good deal of financial sense for smaller communities who lack the resources for full time support of a water-related utility. Regional entities can provide a management framework with sufficient resources to ensure proper operation and maintenance of either centralized or decentralized facilities, and may allow a region facing the need for new services to select the best mix of each.

Regional solutions may provide particularly compelling solutions in regions of the state facing court orders or looming costs for nutrient reduction and stormwater mitigation. Such creativity often takes extraordinary leadership in Massachusetts, where a strong sense of "home rule," makes regional planning and coordination challenging.

Regionalization offers the potential for cost savings and efficiencies when new or upgraded treatment is needed, but also requires the "buy-in" and careful coordination among member communities. Inter-municipal agreements can be used to help towns move toward regional agreements, or water districts can be created by acts of the legislature.

Regional approaches have been and continue to be a priority of the Commonwealth in recent years, with the Governor, the Lieutenant Governor, the Division of Local Services, Regional Planning Agencies, the Legislature, and many municipal groups working together to offer technical assistance, eliminate statutory barriers, and encourage regional agreements for all kinds of municipal matters. The Commission finds that the Commonwealth should continue to work to eliminate barriers to regionalization in water-related systems, and perhaps take a more central role in the planning and coordination of regional facilities.

Provide Guidance to Communities using public private partnerships, contracts, and project delivery.
Many communities in Massachusetts face difficult and complex choices about how to pay for services, particularly as the economy has worsened in the last few years. One option on the menu of solutions is the concept of public/private partnerships and/or contracts for private services.

These partnerships can be imagined in many different ways. On the extreme end of the scale would be the outright sale of public utility assets (land, wells, reservoirs, treatment facilities, pipes, mains) to a private, investor-owned company that takes responsibility for all operations, maintenance, and expansion of services for a community. The Commission strongly opposes such "privatization" for Massachusetts communities out of a concern for the undervaluing of the public assets and loss of local control. The importance of the municipal controlled asset to long and short term economic development cannot be overstated. It is critical that governmental units maintain fiscal control over the assets.

However, there is a broad range of "lesser" choices that offer the opportunity for efficiencies while preserving the public's interests. These include a simple "outsourcing" of various discrete services (such as provision of supplies and meter reading); or private contract operation and maintenance of existing plants; or contracts for the integrated design, construction, and subsequent operation of new facilities (Design-Build-Operate contracts).

Municipalities should weigh many factors before proceeding. It is important to consider all the costs and benefits of these arrangements, including the proposed savings and efficiencies, the potential impact on rates, the regulatory requirements facing the community, various environmental considerations, personnel implications, and more. Communities must weigh the implications of replacing existing employees and contracting out the control over day-to-day operations. They should consider the safeguards they need to have in place to assure the contractor performs as promised. It is crucial that all these deliberations be open and transparent.

Clearly, in some circumstances, these arrangements can offer advantages to communities. The largest gains are often in improved operations of water utilities. Private contractors can offer experience and expertise that would be expensive for many small to medium sized utilities to provide with their own employees. Contractual arrangements may offer savings in salaries and benefits, although some studies have shown that the savings may not be what they are often assumed.[72] Under some circumstances, private companies can provide needed capital, or share the risk for innovative technologies.

With a private operating contract, water and/or wastewater rates may be more likely to reflect the true cost of service. But it should be noted that rates can move in either direction, depending on the financial condition of the utility, the cost savings realized, and near-term improvements and investments called for under the contract.

Inter-municipal agreements in combination with private contracts can be used to consolidate the management of several small-to-medium sized utilities under a single private contract, and this holds great promise for improved performance. New management, communication, and monitoring technologies create opportunities for economies of scale and scope.

Private contracts are attractive because they promise a competitive environment with the attendant advantages of competitive markets. However, the "natural monopoly" attributes of water services (capital intensity, high costs of duplicating infrastructure) make competition tricky. Strong competition is likely to exist at the point in time when private proposals are submitted, and competition may continue along the boundaries of the service area. But during the contract period, conditions of the contract must substitute for active year-to year competition.

The state should protect the interests of municipalities and ratepayers by offering guidelines, model procurement agreements, and other assistance.

STRATEGY #3: ASSIST TOWNS IN RETIRING DEBT

The Commission recognizes that some communities face existing, staggering debt loads due to past infrastructure investments mandated by court orders, regulatory mandates, and other imperatives. In the past, the Commonwealth Sewer Relief Fund, pursuant to Section 22Z of Chapter 29 of the General Laws, offered meaningful assistance to many Commonwealth communities. In recent years the account has not been fully funded.

While the Commission strongly recommends that communities approach future debt within the concept of "full cost pricing," it recognizes that some communities will continue to need assistance in retiring their debt.

The Commission recommends that the Commonwealth make significant debt assistance funding available (optimally in the range of $50-60 million annually) through a line item in the annual budget, using a budgetary vehicle similar to the Commonwealth Sewer Rate Relief Fund but applicable to both water and sewer debt relief assistance. The enabling language for the account may need some updating to make sure that the communities that need assistance in debt relief can do so.

STRATEGY #4: ADDRESS THE ISSUE OF AFFORDABILITY

Full cost pricing is one of the foundations of the Commission's strategy to close the Gap. However, the Commission recognizes that some communities face particularly challenging and costly environmental problems. Others serve lower income populations who struggle to pay their utility bills. Others face significant debt or very large backlogs of investments. Full cost pricing may therefore result in rates that are unaffordable.

While there is general agreement that affordability is a matter of important public policy, there is no national or widely accepted benchmark for what an individual household should expect to pay.[73] Therefore, the Commission believes that Massachusetts should consider additional analysis to assist the state in setting a reasonable affordability benchmark, likely in the range of 1.5 to 2.0% of Median Household Income each for water and sewer.

Communities that utilize full cost rate structures but whose rates fall above the affordability benchmark should be given additional assistance, through priority consideration in allocating state and federal funding.

The state should also consider ways to assist low income individual households with water and sewer rates.

The Commonwealth should encourage federal subsidies to assist communities utilizing full cost rates that exceed the low income benchmarks.

The chart below shows the average current water rates in Massachusetts compared to Maximum Household Income (MHI), and what the average would rise to if systems were charging at a rate equal to 1.25% of average MHI.

	Drinking Water	%MHI	Clean Water	%MHI
Current Average Annual Household Cost*	$344	0.52%	$483	0.75%
Maximum Affordable Household Cost based on 1.25% MHI for the Average Household	$827	1.25%	$805	1.25%

STRATEGY #5: PROMOTE ENVIRONMENTAL SUSTAINABILITY

ENCOURAGE INVESTMENTS AND REGULATIONS THAT ARE ALIGNED WITH ENVIRONMENTALLY SUSTAINABLE PRINCIPLES

It is in the Commonwealth's interest to integrate science-based, sustainable principles into our water management to protect our water resources while using water wisely to support our economy and our residents.

Some of these principles are:

- Promote water conservation
- Reduce the release of nutrients in watersheds
- Encourage non-structural, decentralized solutions where appropriate and as part of integrated water management
- Prioritize solutions that keep water within its basin while protecting water quality
- Prioritize solutions that use technologies that are sustainable environmentally and financially over the lifetime of the assets
- Protect water sources through water shed protection programs
- Encourage more effective management of water resources through long term planning, optimization of resources, and management efficiencies.
- Encourage "integrated resource management", where "wastes" are viewed as "resources" from which revenues can be generated.

"EPA is firmly committed to helping local governments identify opportunities to achieve clean water using a comprehensive integrated planning approach. An integrated approach allows communities to prioritize their investments to address the most serious water issues first and provides flexibility to use innovative, cost-effective storm- and wastewater management solutions – including green infrastructure." EPA Develops New Planning Approach to Improve Water Quality in U.S. Cities: **Bob Perciasepe, EPA Deputy Administrator, press release October 28, 2011**

"Next generation designs come from a different engineering model: Use treat, store, and reuse water efficiently on a smaller scale, and blend these designs into restorative water hydrologies." "What will it take for our country to get on the path toward sustainable water infrastructure? For a start, we need to restore research funding so that we're leading the development of new technologies and capturing jobs and profits in the global marketplace. We should provide tax incentives that encourage builders, architects, and homeowners to adopt and implement these systems." "Viewpoint: Truly Sustainable Water Infrastructure" **Valerie Nelson in Water Environment Federation Magazine September**

Encourage Energy Efficiency:
According to the EPA, drinking water and wastewater systems account for approximately 3-4% of total energy use in the US, equivalent to approximately 56 billion kilowatts, or $4 billion each year to treat, pump, deliver, collect, and clean water and wastewater. This energy use is not only costly, it also adds considerably to the carbon emissions of the country. Assuming the average mix of energy sources, 56 billion kilowatts would add approximately 45 million tons of greenhouse gas to the atmosphere annually. [74] Energy use in future years is expected to increase due to increased populations and more stringent regulations.[75] As regulation evolves with respect to emerging contaminants like pharmaceuticals and personal care products in our water supplies, the treatment and associated energy use are expected to increase.

Energy costs have a huge impact on communities. EPA estimates that drinking water and wastewater plants are typically the largest energy consumers in a municipality – accounting for 30-40% of the total energy consumed by a municipality. Two studies in 2007 put that figure as high as 55%. [76] DEP estimates that in the state of Massachusetts, towns spend approximately $150 million per year in electrical costs to treat 662 billion gallons of wastewater and drinking water. The good news is that many studies have estimated potential savings in energy costs for these same utilities in the range of 15-30%.[77]

With the growth in renewable energy options and new and emerging water technologies that provide reduced energy usage, there are significant opportunities to upgrade existing facilities to be more energy efficient and generate long-term savings. The Consortium for Energy Efficiency as issued guidance for water and wastewater facilities, noting that some of

the best opportunities for energy efficiency (and cost efficiency) gains are present when a facility is upgraded, expanded, or being built new. These types of projects offer opportunities to thoroughly integrate energy efficiency into the operations of the plant.

The Massachusetts' DEP and local strategic partners are already working together to assist with the implementation of efficiency and renewable energy projects that will result in substantial energy savings for all the targeted facilities. In December of 2007, Massachusetts Executive Office of Energy & Environmental Affairs and the Department of Environmental Protection, in cooperation with the Dept. of Energy Resources, EPA, UMass, the Mass Renewable Energy Trust, the Consortium for Energy Efficiency and major gas and electric utilities, launched an energy management pilot for drinking water and wastewater treatment facilities with the goal of reducing the amount of energy consumed by water treatment by 20%; reducing greenhouse gas emissions; and saving communities money.

Seven wastewater treatment facilities and seven drinking water treatment facilities in Massachusetts were targeted in the pilot study, which guided the facilities through the assessment of their current energy performance, conducted energy audits, and assessed renewable energy generation potential. These audits identified over $3.7 million of potential annual energy savings, through energy efficiency and use of renewable energy sources at the 14 facilities. Each facility varied in estimated potential savings, from 5%-106% of annual energy costs, with an average of 33%.[78]

The first phase of the pilot program was funded by energy efficiency incentive programs and DOER. Using these and additional sources including the MTC Renewable Energy Trust, the State Revolving Fund, ARRA stimulus assistance, and energy efficiency funds from participating electric and gas partners, all original pilot projects at the 14 pilot locations and an additional seven green infrastructure projects totaling $68.6 million were fully funded with construction now underway. Once fully implemented, these projects are anticipated to generate annual energy savings of over $5 million per year through energy efficiency and on site clean energy power generation. Over 29 million kilowatts are estimated to be saved, and 22,000 tons of carbon dioxide emission reductions are expected. These savings include over 10,000 kilowatts of clean power generated by renewable energy projects such as solar photovoltaic, wind, combined heat and power, and hydroelectric. [79]

Encourage water efficiency. The concept of water efficiency is defined by the EPA as using "improved technologies and practices that deliver equal or better service with less water." Perhaps the leading example of these practices is the use of leak detection programs that can identify losses due to leakage, followed by water loss control strategies that "plug" or repair those leaks.[80]

National studies indicate that an average of 14 percent of the water treated by drinking water treatment systems is lost to leaks. Nationally, there are some egregious systems that lose up to 60% of treated water. [81] In a 2010 water rate survey conducted by the MWRA, over half of the respondents indicated that there is greater than 10% of unaccounted for water in their systems, largely the result of leaking pipes. [82] A 2008 study based on a review of Massachusetts Department of Environmental Protection Annual Statistical Reports (ASRs) filed by local water districts, suggests that Massachusetts drinking water utilities are losing over 1billion gallons of water per year due to leaking pipes and infrastructure, at a significant cost to the Commonwealth's ratepayers. This water loss is the result of over 2,300 leaks identified by water system during 2006.[83]

Town of Lee Drinking Water Treatment Facility "The Town of Lee operates a surface water treatment plant that treats and distributes more than 308 million gallons of drinking water for 2,055 customers annually. The facility currently utilizes an 80kw hydroelectric turbine at the plant that generates nearly 50% of its on-site electric power needs, saving the facility of $28,000 annually." The plant is installing various energy upgrades that are anticipated to result in approximately $34,000 in annual energy savings, and a reduction of 153 tons of carbon dioxide emission annually.

USEPA ARRA Achieving Zero-Net Energy
www.epa.gov.ow/eparecovery

City of Pittsfield, MA: Wastewater Treatment Facility
The City of Pittsfield operates an advanced nutrient –removal treatment facility that processes approximately 10.8 million gallons of wastewater per day. The facility treats municipal and industrial wastes. The plant is undertaking a number of zero net energy upgrades, including upgrde of the exisgint anaerobic biomass (sludge) digestion system by installing a 195kW biomass cogeneration system for on-site electric power generation and a new 1,575 kW solar photovoltaic system. The system anticipates approximately $647,000 in total annual energy savings and a reduction of 3,252 tons of carbon dioxide emission reductions.

USEPA ARRA Achieving Zero-Net Energy
www.epa.gov.ow/eparecovery

Treated water that leaks from pipes is water that the public has paid to treat, but for which it derives no value. This water is deemed "unaccounted for water". Reducing unaccounted for water can not only save water, it can also reduce water withdrawals from our aquifers and reduce energy, pumping, and treatment costs.

The EPA advocates for water-related utilities to use both "supply side best management practices" such as accurate meters, leak detection, and repair of leaks as well as "demand side best management practices" such as rates that encourage conservation and public education programs.

The problem is slightly different on the wastewater side of the equation. Sewer pipes are meant to transport wastewater from sanitary fixtures such as toilets, sinks, bathtubs, dishwashers, washing machines, and showers. Every gallon of water that enters a wastewater treatment plant must be treated, which costs money - money for energy, chemicals, personnel, transportation.

The term inflow and infiltration (" I & I") describes the flow of either storm water or groundwater into sewer mains and pipes. "Inflow" generally refers to stormwater that enters into sanitary sewer systems through drains, downspouts, pumps, and streams. During a rain event, stormwater entering a sewer system can fill it quickly above its capacity, leading to sewer backflows, flooding, or releases of contaminated water into surface water bodies. These issues are particularly common in older communities where combined sewer outfalls are an issue. "Infiltration" generally refers to groundwater that enters sanitary sewer systems through cracks and leaks in pipes and mains.

If a city wastewater plant experiences a doubling of the load on the system during a rainstorm, the plant must pay to treat double the normal capacity. These costs will be eventually paid by the ratepayers. Investments made to decrease inflow and infiltration will result in direct savings to the Commonwealth.

The reduction of unaccounted for water in water supply systems and I & I in sanitary sewer systems require sustained, long term strategies, but these strategies do work. The first step is to measure the problem, to monitor flow at various locations within the system. Technologies with dyes and/or remote monitoring devices can be used to look for cracks or damage.

Encourage water reuse

Because water supplies cannot be continuously expanded to accommodate new development, the challenges associated with stressed river basins, the expense of treating water, increasingly strict permitting standards and other challenges, the promotion of water reuse must be a significant policy priority. The reclamation of treated wastewater for non-potable uses such as landscaping, industrial processes and toilet flushing could offer water systems ways to both improve environmental and financial outcomes.

Reusing water can be helpful for a number of reasons. Reusing water can reduce environmental stress in sensitive river- and stream- basins, reduce the amount of wastewater that needs to be disposed of, provide industrial users with a low cost supply of water, reduce the community impact of larger developments, and reduce treated wastewater discharges into water bodies.

Water Reuse:

"In 2000, MassDEP issued Interim Guidelines on Reclaimed Water to guide the permitting and operation of water reuse facilities. In 2004, MassDEP began a comprehensive review of its Guidelines as well as national experience and the recently-published EPA guidelines. Our intent is to develop a new set of regulations to encourage water reuse in Massachusetts while continuing to protect public health. The controlling factor in water reuse is the protection of public health. For this reason, the water to be reused must be virtually pathogen- and contaminant-free.

MassDEP's Guidelines ensure that this standard is met, for example:

- The public must be told that reclaimed water is in use.
- Wastewater treatment plants producing reclaimed water are required to maintain a high level of treatment with redundant mechanical systems and backup power.
- Comprehensive monitoring of both the wastewater effluent and the groundwater is required to demonstrate that standards are met.
- For the most stringent uses, tests for fecal coliform must show a median of zero, with no test results greater than 14 parts per million.

MassDEP has approved about a dozen projects since issuing its Interim Guidelines in 2000, including Gillette Stadium, the Wrentham Village Premium Outlets, watering at golf courses, and reuse at manufacturing and office facilities."

Exerpts from the DEP webpage http://www.mass.gov/dep/water/wastewater/wrfaqs.htm

Reused water can be used for a number of purposes across a broad spectrum of interests. Reused water can be used for the irrigation of public parks and recreational centers, athletic fields and school yards, for vehicle washing facilities, fertilizer production, concrete production, fire protection, for industrial cooling systems, for agricultural purposes and for groundwater recharge. Many of these potential uses could become revenue positive endeavors for systems that approach water use holistically.

Encourage investments based on watershed-based resource allocation

Watershed-based planning and permitting is an approach that encourages a holistic watershed analysis to provide a framework for evaluating all stressors within a hydrologically-defined drainage basin, rather than viewing individual sources one at a time. EPA lists a number of positive outcomes from watershed-based permitting, including opportunities to achieve more environmentally effective results and to reduce the cost of improving the quality of the nation's waters.[84]

The Environmental Protection Agency strongly encourages watershed-based approaches in its NPDES permitting as an "innovative tool for achieving new efficiencies and environmental results." [85] The concept of utilizing a watershed or river basin approach to water resources management is not a new one. It is the principal basis for water resources management in the British Isles, and was recognized as a key concept for management of the Clean Water Act in Section 209 of the Act. Section 208 of the Act also encouraged regionalization and area-wide planning. Massachusetts had watershed based planning in the 1990s.

Unfortunately, under many of our current regulatory frameworks, enforcement and responsibility is directed at political boundaries (municipalities) rather than on watersheds, making it difficult to implement regional solutions which can be the most effective, and cost-effective. Lack of watershed planning can result in money being spent in ways that are not of the greatest value to either the public or the environment.

In 1972, when the Clean Water Act was passed, the tools available to planners were limited, as was our ability to model water quality and to scientifically determine the impacts of actions on the environment. As a result, in the early years of the Clean Water Act, water quality criteria were set based on broad concepts of what was considered necessary to improve our water resources. Principal water quality concerns were related to oxygen depletion, suspended solids, toxicity, and aesthetic issues such as color and turbidity.

As the Clean Water Act approaches its fortieth anniversary, these relatively simple concerns have been dealt with, and the issues before us are more complex ones – such as the need to control nutrients, and to address difficult water quality concerns through treatment. Concepts such as reuse of treated water, recharging water locally, and sustainable, decentralized treatment innovations are gaining importance, while permitting has expanded to include management and mitigation of storm water.

Today we have more direct access to environmental data, have made quantum leaps in our ability to model the science, and these advances allow us to evaluate a range of choices with more confidence than in the past. Our ability to measure the parameters of environmental concern and to determine their impacts has evolved. Methods for testing and monitoring water quality have been improved and detection levels for many contaminants have been reduced, so that we are able to identify minute quantities of substances that may or may not affect the aquatic environment. This tremendous surge in information must be evaluated carefully in order to avoid subjective conclusions and to hastily- drafted regulatory actions. In order to effectively manage our environment, data must be scientifically evaluated to identify whether impacts actually exist and how best to mitigate those that do.

The Commission believes that there is much to be gained in using watershed frameworks to determine the most effective ways to meet environmental and public health goals with our limited public dollars. The Commonwealth should return to the watershed based planning approach envisioned in the Clean Water Act.

There is a broad range of models for what a new Massachusetts watershed or river basin planning approach would look like. Many variables, such as the role of stakeholders in the process, the role of the DEP and EPA, the integration of planning into the existing regulatory and financing (SRF) structure, the integration of science, the collection and monitoring of data -- need to be determined.

From a financial perspective, river basin planning should be comprehensive and aimed toward setting affordable, prioritized, coordinated goals that follow a logical sequence. The planning should include area-wide management objectives that include all aspects of water quality needs within a framework that takes into account all stakeholders. Such integrated water planning should included all water infrastructure needs from water main and sewer repair and replacement to storm water management, agricultural requirements and new treatment facilities. Goals and priorities for

completion and management of these facilities should be realistically set based on science that shows direct contribution to water quality improvement and the financial capability of the communities they serve.

Utilize appropriate decentralized infrastructure:

There is a spectrum of decentralized infrastructure technologies and approaches – some with a proven track record and others that are emerging – that have the potential to play an important role in managing water in a financially and/or environmentally sustainable way. These technologies and approaches foster such sustainable goals as encouraging water conservation, or recharging of treated water to "keep water local".

Some of these approaches are scaled at the household level, such as urine diverting toilets, rain gardens, and semi-permeable surfaces -- and can be encouraged or incentivized through local building codes to reduce the amount of water entering the centralized storm water system in a community. Others are scaled at a neighborhood or large building level, setting up shared systems for on-site, rechargeable treatment of waste water or the reuse of treated water for certain purposes.

Across the country and the world, engineers and planners are using these decentralized technologies alone or to complement centralized systems, in order to meet local, statewide, and federal water policy goals. Examples of these kinds of technologies include urine-diverting toilets, waterless urinals, locally available composting services, permeable reactive barriers and applied aquaculture among others.

In some cases decentralized systems relying on home-based or small scale alternative technologies may achieve results comparable or better than traditional centralized systems and at reduced cost. For example, urine-diverting toilets can effectively remove 80% of nitrogen from a household's wastewater. The Commonwealth should encourage the adoption of technologies that can conserve water and protect the environment, particularly in fragile or at risk areas. The Commonwealth should work to help educate the public about what water conservation technologies are available by raising awareness about the US EPA's "water sense" partnership program, and perhaps offering state level evaluation and incentives for environmentally friendly products in the same way as the successful "energy star" program.

INCREASE REGULATORY FLEXIBILITY TO BETTER DIRECT FUNDING TO PROJECTS THAT DELIVER THE HIGHEST PUBLIC BENEFIT

The Commission believes that there is room for improvement in permitting and regulation so that we utilize our scarce resources to the projects and approaches that will yield the highest public benefit.

Prioritize and streamline types of applications:

Because different types of projects pose significantly greater or lesser potential environmental impacts, due to their size or type, it would be useful for DEP to consider different "tracks" for different types of projects. For example, repair, replacement and maintenance projects might be facilitated since it is often urgent to deal with these issues before a system failure or breakdown occurs, and since the potential environmental impacts may be significantly fewer than conditions required for new projects or significant expansion projects.

The DEP has established a fast-track permitting process geared toward private businesses to help promote economic growth, but it is not applied to municipalities and other public entities. The fast track process guarantees expedited reviews, negotiated permit schedules and fees, a single point of contact through the entire permitting process, protection of natural resources through smart growth.

Integrate green house gas policy (GHG):

In recent years, the adverse effects of greenhouse gas emissions on the environment have been acknowledged, however, the new GHG policy has not been fully integrated into the MEPA process and other permit reviews. Currently, EPA is pursuing GHG regulation independent of the state. Thus, when coordinated state and EPA approvals are required, the GHG standards may be in conflict.

Why is this important? Because an approach that might significantly benefit receiving water quality (for example, extremely low nutrient limits) could also require significant generation of GHG or production of chemical waste solids due to power and/or chemical use. Conversely, an approach that could eliminate the production of GHG (for example, the use

of gravity flow rather than a wastewater pump station) might result in impacts to a wetland resource due to the gravity pipeline alignment.

The Commission believes that these tradeoffs are neither simple nor insignificant. One possible solution is early collaboration to assess the pros and cons of solutions to a case-specific problem with the applicant and all regulators. Another possible solution is to utilize the watershed framework to review the wider implication of site-specific solutions.

Consider the length of Permit Duration:

Given the magnitude of many treatment facility upgrades, it is very difficult to plan, secure funding, design, bid, and construct a project within the 5 year permit term for a specific NPDES permit. If a permit extension is needed, time and resources must be expended to request terms. Often, types of long-duration projects can be identified "up front" by all stakeholders, based on the construction schedule.

Moreover, the term for the operational permits (NPDES permit issued to a publicly operated treatement works) could in fact be triggered at the time at which construction is completed to meet specific effluent standards rather than the current 5 year term.

The State could work more closely with DEP and EPA to see if some flexibility could be built into certain types of permits to address these issues.

STRATEGY#6: PROMOTE INNOVATION

Many cities and towns are working to adopt sustainable principles as they manage their water systems, encourage energy and water efficiency, and approach such problems as drought, seasonal flooding, climate-induced changes, low flows, nutrient loading, and mitigating combined sewer overflows. Increasing attention is being given to the design and development of innovative water technologies and approaches that reduce waste and are more consistent with environmental and fiscal sustainability. These technologies are rapidly evolving from an ideal into reality, and may offer solutions that optimize environmental goals, make economic sense, and address social inequities.

The Commission heard testimony about a wide range of state of the art management practices and innovative technologies that are emerging through entrepreneurial efforts, government support, and creative partnerships. These solutions are often hybrid approaches that optimize new and existing infrastructure. Some models are partnerships with private capital investments.

The best of these technologies protect the public health, are environmentally more effective than traditional systems, and also result in life cycle operating cost savings. Some highlight technologies and approaches that emphasize keeping water local. Others integrate wastewater reuse in large developments or building codes. Many mimic natural systems. Some convert waste products generated by water treatment processes into marketable products which generate income. Others are based on natural systems and processes that minimize water extraction and energy consumption, contribute to water and soil health, and support livable, healthy, and sustainable communities.

Many of these approaches and technologies are being tested "on the ground" at different scales. For example, the MWRA has been a leader in the use of innovative and cost saving technologies such as selling processed sewage waste as fertilizer and capturing energy through methane recapture and harnessing energy from the flow of wastewater.

Some innovation is being tested in targeted pilot studies. For example, the town of Grafton is piloting a bio-remediation technology to treat contaminated water and sediments in the Fisherville canal using mycelial and bacterial digestion.[86]

Other ideas are being successfully utilized in schools and commercial buildings as part of the emerging "green technologies" innovative effort. An intern at Clean Water Action has collected examples of large and small scale applications and how they were funded. For example, the Whitman-Hanson Regional High School included a 20,000 gallon underground storage tank to collect rainwater from the roof surfaces for use in flushing toilets. The Cape Cod Community College in West Barnstable utilized a system that combines water reduction and water reuse features. These sustainable practices were estimated to reduce overall water consumption at this public building by 85% compared to a standard system. [87]

Pilot project leads to a cost-saving operation.
The Town of Concord was aware that stringent new phosphorus limits were being considered that could require costly upgrades to its wastewater treatment plant. The town collaborated with Cambridge Water Technology, the developers of an innovative phosphorus reduction technology, (magnetically enhanced coagulation or *CoMag*). A pilot demonstration project was installed at the Concord treatment plant, treating 100 gallons per minute, achieving positive results. No operational costs were borne by the town during the demonstration project. Eventually the Town incorporated the technology into its 20 year old wastewater treatment facility-- the first full scale *CoMag* tertiary treatment installation in the world.

"As operation has continued, the system has reached low phosphorus levels at a wide range of flow rates and influent loads. The full-scale system is operating better than anticipated based on pre-design data. The CoMag system has immediately proven its ability to meet Concord's upcoming phosphorus limits as well as the lower limits required in many NPDES permits nationwide, while providing additional benefits relating to a variety of other effluent quality parameters."

Elena Proakis Ellis and Alan H. Cathcart: "Selection, Installation, Startup and Testing of the World's First Full Scale CoMag Phosphorus Reduction Tertiary Treatment System."

However, some communities find it difficult to take the plunge and invest scarce dollars into promising, but untested, approaches. The Commission recognizes that there are many barriers to the use of these approaches, and believes that more needs to be done to encourage and facilitate them.

Finding funding for the piloting of these emerging approaches can be challenging. Some communities have utilized funding sources dedicated to green design, water sustainability, or building construction and renovation projects. Clean Water Action submitted to the Commission a catalog listing numerous funding streams available for innovative, decentralized, site-level water infrastructure and building technologies through programs administered at the state and federal level.[88]

Nevertheless, the extraordinary pressures on the limited resources available for water infrastructure have the potential to squeeze out new ideas.

In order to reduce the risks associated with innovation, the Commission has made a number of recommendations to review regulatory, financial, and legal obstacles, including:

Allocate resources for programs that mitigate risk:

1. Pilot projects, case studies, demonstration projects
2. Proof of concept projects to support nascent technologies and new applications of current technologies
3. new technology vetting procedures
4. outreach and technical assistance programs, to advance innovative technologies and approaches, based on the Green Communities Act model
5. Conduct a study of regulatory barriers to innovation, including possible obstacles in procurement laws

Implement a more robust alternatives analysis for projects permitted through DEP to ensure that innovative solutions are considered

Manage regulatory compliance and third party litigation to eliminate economic risk to the regulated community in the instance of failure.

Invest in Massachusetts as a hub of innovation in the field of water, wastewater, and stormwater management and technology. Massachusetts is in an excellent position to be a leader in developing and utilizing innovative, sustainable solutions that improve water quality and provide cost effective ways to address our infrastructure needs. This is a sector with great promise for new jobs at different levels of expertise.

As a Commonwealth, we should build on our long tradition of leadership in technology, engineering, research, and development to keep Massachusetts in the forefront of innovation.

Harness the state's educational strengths to train engineers, scientists, researchers, and workers to be at the forefront of innovative water management across the country.

Finding solutions to today's water resources challenges opens doors for Massachusetts – whose academic, professional, and business leadership is poised to make our state a hub of innovation for water infrastructure. The state can play a major role in capturing the benefits of emerging technology.

In November of 1997, on the 25th Anniversary of the Clean Water Act, the Massachusetts Clean Water Council issued a report that summarized the extraordinary progress made in the Commonwealth over the 25 years since the passage of the Act in 1972. The report found that, through a combination of programs, including construction of municipal and regional wastewater plants, pretreatment programs for industrial dischargers, and the control of industrial wastes, millions of pounds of pollutants were prevented from reaching Massachusetts' rivers. Prior to 1972, large sections of rivers in Massachusetts were "virtually unusable". In 1972, only 28 percent of the monitored rivers and streams in the Commonwealth supported fishing and swimming. By 1997, that number was 70 percent. Similar improvements were gained in our lakes and coastal waters.

Just as twentieth century investments in water and sewer treatment technology made enormous progress in addressing the issues of the day, the Commission believes that Massachusetts is already working to meet the challenges of twenty first century water infrastructure.

The State of the Waters in Massachusetts: Assessing Progress and Setting Priorities; Massachusetts Clean Water Council November 1997

The Commission recommends that we build on existing professional and academic collaborations and encourage public/private partnerships with universities, colleges, and trade schools, NGOs, agencies, and the private sector. [89]

STRATEGY #7: CONTINUE THE WORK OF THE COMMISSION, EDUCATE THE PUBLIC,

With the filing of this report, the Commission's work will be done. But the task of addressing the problem is just beginning. The Commission recommends several initiatives to guide the Commonwealth in collecting necessary data, raising public awareness, and building a coalition of stakeholders.

RECOMMENDATIONS:

CONTINUE THE WORK OF THE COMMISSION

1. Create a coalition to continue advocacy for the recommendations of the Commission

2. Fund an asset-based analysis of the gap between projected needs and revenues.

The Commission recommends that the State supplement the current data available on water-related infrastructure funding by conducting an asset-based analysis based on a survey of a statistically significant and regionally diverse sample of Massachusetts communities in order to provide a baseline of information to evaluate the success of efforts to meet the water infrastructure needs of the Commonwealth. This study will provide a baseline of information on costs and investments in Massachusetts.

EDUCATE THE PUBLIC

3. Raise public awareness of the true value and cost of water-related services.

To gain and sustain public support for water infrastructure investments, and to convince voters and elected officials to raise appropriate revenues, it is important to communicate with stakeholders such as residents, businesses, community leaders, and institutions about the true cost of supplying water, wastewater, and stormwater services. The true cost includes not just direct costs, but also hidden costs and externalities over the lifetime of an asset.

a. Allocate funding to EOEEA for developing a campaign and educational program on the true cost of water infrastructure, and the implications of inaction. Audiences should include both residents and public officials. Materials should explain the need to support capital planning, asset management, wise investments, and adequate rates to support our water infrastructure. In developing the message, consult with appropriate agencies, trade organizations, advocates, environmental groups, local districts and authorities.

b. Charge EOEEA to work with all stakeholders, including municipalities, districts, and authorities to get out the message through appropriate media and public service outreach. Investigate and utilize opportunities for public/private partnerships for education and outreach.

c. Charge appropriate agencies to advocate for asset management, capital planning, and enterprise accounts for communities.

INCREASE FUNDING

A review of Massachusetts water and sewer rates suggests that a significant portion of the infrastructure gap can be met by consistent, moderate rate increases over time , including set-asides for long-term capital investments. However, additional state and federal subsidies, beyond those currently available, will still be needed to compensate for decreases in federal assistance, address escalating debt service, subsidize projects that would be otherwise unaffordable, such as wastewater projects on Cape Cod, and assist communities with limited revenue generating capacity due to lower household incomes.

4. Advocate for increased federal funding

It is critical to make sure that water infrastructure financing receives a growing share of the federal budget. All parties interested in sustainable investments in water infrastructure need to redouble their efforts at influencing the debate in Congress in order to maximize available funding to Massachusetts

a. Advocate with Congress for maximizing funding for existing critical accounts:
   - State Revolving Funds for Safe Drinking Water Act and Clean Water Act
   - USDA Rural Development Water Infrastructure Program
   - Key energy and Sustainability Accounts with impact on water-related infrastructure investments

b. Advocate with Congress to create new programs and funding*:*
   - New tax credits for research and development and innovation in water technology
   - New tax credits and accelerated depreciation for innovative storm water solutions
   - New subsidies to assist communities with full cost rates

5. Increase available resources at the state level

Massachusetts has had some successful programs to assist municipalities, authorities, and districts meet the high costs of water investments. Some of these sources have been cut in recent years and should be restored.

The Commonwealth has one of the most highly leveraged SRF programs in the country. It is critical that the Legislature continue to fund the state share of this crucial fund.

It is also important to find additional sources of revenues to address the identified gap in resources and the growing need for water-related infrastructure investment.

a. Maintain strong annual funding levels for the Commonwealth's share of the State Revolving Funds in the Water Pollution Abatement Trust

b. Maintain the leveraging capability of the Water Pollution Abatement Trust
   1. Maintain the leveraging capacity of the trust by utilizing the 2% interest rate as the standard interest rate for most loans
   2. Consider offering lower interest rates (under 2%) for projects that meet certain objectives for affordability, environmental sustainability, inter-municipal cooperation, nutrient reduction, etc.
   3. Consider expansion of nutrient deficiency 0% loan program (ten year sunset) for other priorities, particularly stormwater mitigation (CSO).
   4. Consider ways to fund design/engineering expenditures retroactively through the SRF if the project ultimately goes to construction.

c. Restore historic levels of funding ($50-60 million annually) to the Commonwealth Sewer Rate Relief Fund pursuant to Section 2Z of Chapter 29 of the General Laws. This funding should come from the General Fund.

d. Deposit all Safe Drinking Water Assessments into a dedicated fund in DEP for implementation of the Safe Drinking Water Act.

e. Institute new broad-based sources of funding at the state level. Raise revenues (at least $200 million per year) in new revenues from:

   Sources with a nexus to the water investment issue, including:
   1. New fees on pollutants such as fertilizers, pesticides
   2. New Bottle Bill revenue
   3. New Charges on water-related items such as port fees, building permits,
   4. The Commission has extensively discussed the possibility of instituting a statewide water surcharge ('the mil"). Given the absence of consensus on

whether or how the institution of such a surcharge might occur, we make no finding on such option at this time but instead recommend further consideration of the matter.

Other revenues from statewide sources that may or may not need legislative approval

Deposit all revenues into a dedicated trust to assure long term sustainability of resources

Include provisions for communities without existing utilities or with utilities that serve only a small fraction of the municipal population

New revenues should be used to support a mixed program of 1) "direct support for cities and towns (similar to the "Chapter 90 model" used to support highway investments); 2) leveraged loans; 3) grants

The program should reward municipalities, authorities, and districts that adopt best management practices in full cost pricing, financial management, asset management, and environmental sustainability, and use watershed-based solutions and regional approaches.

The grants and loans should be directed toward a diverse set of needs including assistance with cost-benefit analysis, planning, design, and construction; principal forgiveness, additional debt relief, and funding to encourage research and development.

f. Charge the Water Pollution Abatement Trust with finding additional ways to extend the capacity of the Trust

6. Encourage municipalities, districts, and authorities to cover reasonable costs of service (full cost pricing) when setting rates.

The Commonwealth should encourage full cost pricing by all municipal, authority, and district systems. With large needs for investments, communities will need to rely more on rates to cover the full costs of water, wastewater, and stormwater costs.

Transparency, stability, and predictability of rates will play an ever- increasing role in determining the availability and cost of capital for infrastructure needs. A consistent and purposeful rate structure builds credibility with customers and creditors. Encourage communities to adopt full cost pricing:

a. Charge DOR/Division of Local Services to adopt definitions, best management practices, and policies as needed for full cost pricing, delineating what direct and indirect costs should be covered by full cost pricing.

b. Give funding priority to municipalities, districts, and authorities that utilize full cost pricing

c. Provide funding for the appropriate agencies to provide technical assistance to communities interested in moving toward full cost pricing in rates and to provide rate structure studies

d. Encourage Water Pollution Abatement Trust, DEP, and other agencies to offer priority in grants and loans for municipalities, districts, and authorities utilizing full cost pricing

ADDRESS AFFORDABILITY

As we address the Water Infrastructure challenge, we recognize that there are some less affluent communities that may have more difficulty in paying their "fair share" of the costs. There has been much discussion at the national level as to what level of rates it is reasonable to ask a community to pay, and what happens if a community can't pay. We need to find ways to pay for water infrastructure investments in all communities while addressing the issue of affordability.

The EPA has never adopted a measure to indicate how much an individual household can pay for water services before they become unaffordable. Rather, EPA has adopted criteria that set benchmarks for system-wide rates collected from all

customers of a water system relative to the median household income (MHI) in a service area. The EPA benchmark is set at 2.0 to 2.5 percent of MHI each for wastewater and drinking water.

7. Institute measures to address affordability for low income rate payers and communities.

a. Direct WPAT to review SRF policies and identify ways to address affordability to municipalities and to individual ratepayers. Consider making SRF loan decisions more needs-based using the MHI index; offer more points on SRF applications to less affluent communities; use MHI benchmark as factor in setting level of funding, interest rate, or principal forgiveness.
b. Include Median Household Income in the selection criteria for SRF loans, grants, interest rates and principal forgiveness by setting a benchmark for water and sewer rates at no more than 1.25% each of median household income.
c. Seek new federal and state support for affordability issues

ENCOURAGE BEST PRACTICES

It is in the State's interest to encourage or require that water, wastewater, and stormwater utilities adopt best management practices that encourage financial and environmental sustainability.

8. Encourage Best Management Practices in asset management, capital improvement plans, and enterprise accounting

These practices encourage a municipality to plan, operate, and undertake infrastructure investments more effectively. These practices make it easier for rate payers and voters to understand the full, life cycle costs of water, sewer, and stormwater services. These practices can also reduce operating costs.

Specific Action items:

a. Provide funding for DOR/Division of Local Services to adopt definitions, best management practices, and policies as needed for enterprise funds, asset management, capital improvement plans,
b. Increase funding to relevant agencies to provide technical assistance to communities adopting or interested in adopting best management practices
c. Charge the WPAT to require these best management practices in any municipality, district, or authority that applies for SRF loans
d. Work with DEP and other agencies to require these best management practices prior to application for other state grants, subsidies, or loans
e. Offer certain presumptions in permitting to communities that have adopted minimum requirements
f. Create an even playing field for enterprise fund communities by passing legislation that provides for an income tax deduction for enterprise fund utility bills
g. Make it easier for communities, districts, and authorities to adopt enterprise funds by allowing local option without further legislative approval.
h. Allow municipalities that have adopted best management practices in asset management to utilize state procurement of GPS services

9. Encourage Best Management Practices in stormwater management

Encourage municipalities, districts, and authorities to adopt best practices in stormwater mitigation approaches and technology. Integrate stormwater mitigation best practices broadly into building codes, zoning bylaws, subdivision regulations, and other regulations, so that many stormwater impacts are dealt with on a site by site basis, and so that the costs of mitigation are shared with private owners.

Specific Action Items include:

a. Encourage municipalities, districts, and authorities to finance the public costs of stormwater mitigation through local stormwater utilities meeting state-specified minimum requirements. After consultation with EOEEA, Division of Local Services (DOR) should issue minimum accounting standards for stormwater utilities. These include:

1. enterprise fund accounting,
2. capital improvement plan;
3. integrated water management planning

b. Provide funding for technical assistance through appropriate agencies to assist communities wishing to establish stormwater utilities

c. Provide funding for DEP to review and adapt standards for the reuse of stormwater to best serve public health

d. DEP make available model bylaws for mitigating stormwater through building codes, zoning bylaws, subdivision regulations, and other appropriate regulations

e. DEP Encourage pilot projects for stormwater management

10. Improve energy efficiency in water infrastructure systems

a. Charge DEP, Mass Clean Energy Center and/or Green Communities Division to offer technical assistance to municipalities, districts, and authorities (particularly smaller systems) to help improve energy efficiency
b. Encourage DEP and other state agencies to prioritize state funding for energy best management practices

11. Encourage Regionalizing and Rightsizing

a. Find efficiencies by encouraging inter-municipal and regional agreements in situations where it will lead to more sustainable and natural use of water resources
b. In order to increase economies, consider the centralized management of decentralized infrastructure on a watershed or regional basis
c. Give funding priority to regional and watershed-based solutions
d. Offer technical assistance to municipalities, districts, and authorities wishing to explore such agreements. Provide funding as needed to Division of Local Services, RPAs, DEP, others.

12. View Water, Energy, and Nutrients as assets.

a. Encourage wastewater treatment plants to generate revenues through heating, cooling, the production of energy, and the possible sale of nutrient products
b. Encourage Water Re-Use

13. **Provide guidance for communities considering Public –Private Partnerships.**
Public-private partnerships can lead to important efficiencies, but need to protect public interests. Encourage safeguards for municipalities, districts, and authorities that are considering public/private partnerships and/or privatization. In so doing, find ways of standardizing procedures to reduce costs and protect local interests while not infringing on the freedom of municipalities to propose innovative approaches.

a. Communities should NOT be permitted to turn over the ownership of land and/or water rights to private investor owned entities. Pass legislation that would prohibit any public water supply source to be sold or leased to a private investor owned entity.

b. Adopt standardized procurement processes for public/private partnerships that reduce uncertainty on both the public and private side.

c. Charge the Inspector General's office with developing "model" agreements that protect the public's investment in the system, allow for oversight of the private operator, specify appropriate penalties, and encourage monitoring by the municipality.

d. Protect rate payers by requiring that any increase in fees for water/wastewater/stormwater services provided by a "private contractor" must be approved by the Massachusetts Department of Public Utilities.

14. Project Delivery: Consider changes to current procurement statues in order to reduce impediments to cost-effective water, wastewater, and stormwater management.

Municipalities, districts, and authorities must meet many objectives when contracting for planning, design, construction, and operating services from the private sector. They need to assure honest practices, cost-effective use of taxpayer funds, and a fair, open, and competitive process for procuring goods and services.

Some current procurement statutes may provide impediments to the most efficient and cost-effective implementation of complex water and sewer system improvements with anticipated project costs of over 5 million dollars. The Commission urges the Inspector General and the Legislature to update current laws in the following areas:

a. Alternative Delivery: Develop new tools to facilitate new forms of procurement for public design and construction contracts, including design/build (DB), construction manager at risk (CMR), multi-factor competitive procurement, and Qualification Based Selection (QBS).

b. Adopt standardized procurement processes for alternate project delivery models that reduce uncertainty on both the public and private side.

c. Develop procedures that assure a fair and objective review of competing proposals to seek the best outcome for the public, considering relevant factors such as performance, capital and operating cost, and risk allocation.

d. Provide that cost shall not be the only determining factor in the selection of an alternative delivery contractor.

e. Consider minimum requirements for labor agreements, project oversight, safety requirements, and project approval

f. Increase bid limit thresholds to save time and increase efficiency

g. Provide procurement training to municipal officials using model documents and procedures developed by the Inspector General.

h. In order to ensure a fair, open, and productive bidding for alternative project delivery methods, consider requiring municipalities to submit their proposed RFP packages and review procedures for approval by the Inspector General and the Attorney General.

STREAMLINE ADMINISTRATIVE AND REGULATORY PROCESSES

15. Facilitate Use of the State Revolving Fund.

Application process:

a. Charge WPAT and DEP to review and amend application process for reductions in paperwork

Loan Administration

b. Encourage WPAT to equalize and distribute payments throughout the year (monthly or quarterly for both principal and interest)
c. Charge WPAT to work with municipalities, districts, authorities, and engineering firms to increase "user friendliness"

16. Simplify permitting

a. Charge DEP with evaluating the usefulness of extended permit durations.
b. Charge DEP to conduct a regulatory review to identify ways to streamline permitting processes and identify possible areas where fast track permitting could be effective.
c. Encourage/Require early communication among applicants and regulatory parties

d. Allocate resources for a single project coordinator at DEP to provide assistance and coordination in the planning process of a project
e. Charge DEP with evaluating the usefulness of a joint application form among MADEP, USACE, and local conservation commission determinations

PROMOTE ENVIRONMENTAL SUSTAINABILITY

17. Encourage investments and regulations that are aligned with environmentally sustainable principles.

The Commonwealth must make strategic investments that make the best use of available resources and that address the "triple bottom line" – optimizing environmental goals, making economic sense, addressing social inequities. Cost benefit analyses should be utilized to determine how to achieve the maximum environmental benefit with the available resources. The cost of water treatment can be reduced by taking actions to preserve the quality and quantity of water resources in the Commonwealth.

The Commonwealth must encourage investments and regulations that are aligned with environmentally sustainable principles such as:

- Promote water conservation
- Reduce the release of nutrients in watersheds
- Encourage non-structural, decentralized solutions where appropriate and as part of integrated water management
- Prioritize solutions that keep water within its basin while protecting water quality
- Prioritize solutions that use technologies that are sustainable environmentally and financially over the lifetime of the assets
- Protect water sources through watershed protection programs
- Encourage more effective management of water resources through long term planning, optimization of resources, and management efficiencies.

Action Items:

a. Prioritize SRF funds toward projects that are aligned with environmentally sustainable principles.
b. Pass legislation to ban or limit the use of phosphorous in products, including fertilizers
c. Consider additional regulation to reduce the release of nutrients
d. Consider additional regulation of pharmaceutical product disposal and phosphorous disposal
e. Incorporate water sustainability into guidelines for schools, campuses, affordable housing, state and municipal facilities, hospitals, etc.
f. Review the interim DEP guidelines on reclaimed water to determine whether additional uses can be approved
g. Conduct a study of "decoupling" rates to better align regulatory conservation goals with consumer incentives
h. Provide technical assistance and grants to support these efforts

18. Encourage investments based on watershed-based resource allocation.

River basin planning should be comprehensive and aimed toward setting affordable, prioritized goals that follow a logical sequence. Use hydrologic based boundaries rather than political ones as the basis for coordinated investments and management. Use a cost/benefit approach as part of watershed-based planning to determine how to achieve the maximum environmental gain with the available resources.

a. Fund a study of what would be required to integrate watershed-based decision-making regarding land use, water infrastructure permitting, and investment as envisioned in the Clean Water Act
b. Require agencies to integrate watershed-based planning into decision making for land use, water infrastructure permitting, and investments
c. Encourage agencies to prioritize programs that recognize the values of natural systems and open space as assets
d. Provide funding for DEP and/or regional planning agencies to enhance watershed planning and environmental reviews, in order to direct scare resources to the regulations and projects that will deliver the highest public value.

e. Prioritize SRF funds toward projects with the greatest potential benefit for the watershed
f. Work with EPA to utilize watershed-based analysis, including cost benefit analysis, for NPDES permits to result in more efficient and more environmentally effective decisions.

19. Conduct an updated cost/benefit analysis on assuming primacy from the federal government over NPDES permitting. The study should evaluate whether the state can more effectively manage its resources and achieve better outcomes over the long run by assuming "primacy" over the administration of the federal Clean Water Act.

20. Increase regulatory flexibility to better direct funding to projects that deliver the highest public benefit

Such flexibility should include consideration of co-benefits, such as energy conservation and carbon reduction. Such flexibility should include optimization and integrated timing of construction, and the use of adaptive management models.

a. Integrate greenhouse gas and water policy so that all environmental costs and benefits are considered when permitting projects

PROMOTE WATER INNOVATION

21: Invest in Massachusetts as a hub of innovation in the field of water, wastewater, and stormwater management and technology.
Massachusetts is in an excellent position to be a leader in developing and utilizing innovative, sustainable solutions that improve water quality and provide cost effective ways to address our infrastructure needs. This is a sector with great promise for new jobs at different levels of expertise.

As a Commonwealth, we should build on our long tradition of leadership in technology, engineering, research, and development to keep Massachusetts in the forefront of innovation. Efforts should build on existing networks and collaborative efforts and utilize the academic, technical, and professional expertise of our universities, agencies, NGO's, and the private sector. The Commonwealth should invest in research and development.

a. Support innovative research and collaboration among agencies, corporations, academic institutions, NGO's, and others to promote water technology R&D.
b. Charge a task force within the Executive Branch to develop a plan for making Massachusetts a Hub of Innovation in Water Resources.

22. Reduce obstacles to adoption of innovative technologies

Consider ways to manage and address the regulatory and financial risks faced by municipalities, authorities and the private sector to encourage the adoption of innovative solutions.

a. Allocate resources for programs that mitigate risk:
   - Pilot projects, case studies, demonstration projects
   - Proof of concept projects to support nascent technologies and new applications of current technologies
   - new technology vetting procedures
   - outreach and technical assistance programs, to advance innovative technologies and approaches, based on the Green Communities model
   - Conduct a study of regulatory barriers to innovation, including possible obstacles in procurement laws
b. Implement a more robust alternatives analysis for projects permitted through DEP to ensure that innovative solutions are considered
c. Greater adoption of innovative technologies require managing regulatory compliance and third party litigation to eliminate economic risk to the regulated community in the instance of failure.

23. Harness the state's educational strengths to train engineers, scientists, researchers, and workers to be at the forefront of innovative water management across the country.

Build on existing professional and academic collaborations. Encourage public/private partnerships with universities, colleges, and trade schools, NGOs, agencies, and the private sector.

a. Create public private partnerships with universities, colleges, and trade schools to create training programs to "fill the pipeline" with future water management professionals.

b. Foster exchanges between industry, academia and regulators to increase awareness of developing technologies.

END NOTES

[1] Summary: Closing the Gap: Innovative Solutions for America's Water Infrastructure Forum; January 2003 http://water.epa.gov/infrastructure/sustain/upload/2009_05_26_waterinfrastructures_summary_si_waterinfrastructureforum-2003.pdf

[2] http://www.uli.org/~/media/Documents/ResearchAndPublications/Reports/Infrastructure/Infrastructure2011.ashx Urban Land Institute and Ernst and Young: Infrastructure 2011: A Strategic Priority

[3] USEPA Gap Analysis 2002 http://water.epa.gov/aboutow/ogwdw/upload/2005_02_03_gapreport.pdf

[4] http://www.mass.gov/dcr/watersupply/intbasin/stressed_basins.htm

[5] "Cranberry Water Use" information fact sheet; Cranberry Watershed Education Initiative; Plymouth County Conservation District in conjunction with the Cape Cod Cranberry Grower's Association http://www.cranberries.org/pdf/wateruse.pdf

[6] "Report on Clean Water Investment and Job Creation" National Utility Contractors Association (NUCA) 1992

[7] Source: DEP Drinking Water Program

[8] U.S. Census Bureau 2009 population estimate for Massachusetts (6,593,587) http://quickfacts.census.gov/qfd/states/25000.html

[9] Source: DEP Drinking Water Program

[10] Source: DEP Drinking Water Program

[11] Source: DEP Drinking Water Program

[12] Tighe and Bond 2010 Water rate survey http://rates.tighebond.com/(S(kphfco45z23ebd2v5zppaxus))/Downloads/2010%20MA%20Water%20Rates.pdf

[13] USEPA The Clean Water and Drinking Water Infrastructure Gap Analysis http://water.epa.gov/aboutow/ogwdw/upload/2005_02_03_gapreport.pdf

[14] USEPA Clean Water and Drinking Water Infrastructure Gap Analysis http://water.epa.gov/aboutow/ogwdw/upload/2005_02_03_gapreport.pdf

[15] http://www.mwra.state.ma.us/02org/html/whatis.htm

[16] http://www.mwra.state.ma.us/02org/html/whatis.htm

[17] http://www.mwra.state.ma.us/osu/osumain.html

[18] provide some examples

[19] Tighe and Bond 2010 Sewer Rate Survey http://rates.tighebond.com/(S(kphfco45z23ebd2v5zppaxus))/Downloads/2010%20MA%20Sewer%20Rates.pdf

[20] USEPA 2008 Clean Watersheds Survey http://water.epa.gov/scitech/datait/databases/cwns/2008reportdata.cfm

[21] USEPA Preliminary Data Summary of Urban Stormwater Best Management Practices (1999) Chapter 4 http://water.epa.gov/scitech/wastetech/guide/stormwater/index.cfm

[22] EPA Preliminary Data Summary of Urban Stormwater Best Management Practices (1999); EPA National Water Quality Inventory of 1996 Report to Congress (1998)

[23] EPA: Stormwater Phase II Final Rule Small MS4 Stormwater Program Overview http://cfpub.epa.gov/npdes/stormwater/swfinal.cfm

[24] National Pollutant Discharge Elimination System (NPDES) Stormwater Menu of Best Management Practices http://cfpub.epa.gov/npdes/stormwater/menuofbmps/

[25] http://www.mass.gov/dep/water/wastewater/csofaqs.htm

[26] Creating a Sustainable Solution for Pennsylvania: Report of the Governor's Sustainable Infrastructure Task Force Report November 2008 http://pa.gov/portal/server.pt/community/sustainable_water_infrastructure_task_force/10565

[27] USEPA Drinking Water Needs Survey http://water.epa.gov/infrastructure/drinkingwater/dwns/index.cfm

[28] USEPA 2008 Clean Watersheds Survey http://water.epa.gov/scitech/datait/databases/cwns/2008reportdata.cfm

[29] Estimate based on information provided by the Cape Cod Commission. Wastewater improvements on Cape Cod are necessary due to EPA requirements to address excess nitrogen from septic systems affecting coastal waterways.

[30] USEPA The Clean Water and Drinking Water Infrastructure Gap Analysis http://water.epa.gov/aboutow/ogwdw/upload/2005_02_03_gapreport.pdf

[31] This is a modified version of a chart in USEPA The Clean Water and Drinking Water Infrastructure Gap Analysis http://water.epa.gov/aboutow/ogwdw/upload/2005_02_03_gapreport.pdf

[32]http://water.epa.gov/infrastructure/drinkingwater/pws/affordability.cfmgov/npdes/stormwater/munic.cfm

[33] Need reference

[34] Bio mimicry is an emerging discipline that studies nature's best ideas and then imitates these designs and processes to solve human problems http://www.biomimicryguild.com/guild_biomimicry.html

[35] For example: Infrastructure 2011 A Strategic Priority Urban Land Institute and Ernst and Young 2011; and USEPA The Clean Water and Drinking Water Infrastructure Gap Analysis 2002

[36] [36] USEPA The Clean Water and Drinking Water Infrastructure Gap Analysis http://water.epa.gov/aboutow/ogwdw/upload/2005_02_03_gapreport.pdf

[37] John McNabb, *Analysis of the Massachusetts Drinking Water Infrastructure* Journal of the New England Water Works Association December 2010 http://www.southshorepcservices.com/Analysis_Mass_Water_Infrastructure-NEWWA-Dec2010.pdf

[38] American Society of Civil Engineers Report Card for American Infrastructure http://www.infrastructurereportcard.org/fact-sheet/drinking-water

[39] American Water Works Association, *Dawn of the Replacement Era: Reinvesting in Drinking Water Infrastructure* (May 2001) p6.

[40] http://www.epa.gov/region1/npdes/pwtfgp.html

[41] http://water.epa.gov/infrastructure/watersecurity/

[42] http://www.mwra.state.ma.us/finance/ceb/fy12proposed/CEB%20PFY12%20Document.pdf page 24

[43] Emergency Planning and Preparedness Tips for WWTP and WTP Operators DEP http://www.mass.gov/dep/water/laws/eprepwtp.htm

[44] http://www.mwra.state.ma.us/finance/ceb/fy12proposed/CEB%20PFY12%20Document.pdf page 24

[45]http://www.mwra.state.ma.us/finance/ratefacts.htm

[46] FY 2011 Integrated Comments and Recommendations on the MWRA's Proposed Capital Improvement Program and Current Expense Budget May 2010

[47] Utility Contractors Association of New England

[48] MWRA Source?

[49] "Asset Management – the U.S. Experience 10 Years and Counting" Presentation by Steve Albee, US EPA at the NEWEA Asset Management Conference April 26, 2011

[50] "Water Sustainability in Buildings and Sites: Federal and Massachusetts Funding Streams and Informational Resources" Clean Water Action - Water Alliance May 2011- submitted to Commission by Becky Smith

[51] Massachusetts Water Pollution Abatement Trust letter to the Commission dated August 2, 2011

[52] MWPAT Comprehensive Annual Finance Report June 2010 and the Independent Auditor's report

[53] Letter to Commission from Water Pollution Abatement Trust Executive Director, Enrique Zuniga, Executive Director, dated Sept 23, 2011

[54] Letter to Commission from Water Pollution Abatement Trust Executive Director, Enrique Zuniga, Executive Director, dated Sept 23, 2011

[55] Letter to Commission from Water Pollution Abatement Trust Executive Director, Enrique Zuniga, Executive Director, dated Sept 23, 2011

[56] Letter to Commission from Water Pollution Abatement Trust Executive Director, Enrique Zuniga, Executive Director, dated Sept 23, 2011

[57] http://www.aarp.org/content/dam/aarp/research/public_policy_institute/cons_prot/2011/insight56.pdf

[58] Congressional Budget office: Future Investment in Drinking Water and Wastewater Infrastructure 2002 http://www.cbo.gov/ftpdocs/39xx/doc3983/11-18-WaterSystems.pdf

[59] Congressional Budget office: Future Investment in Drinking Water and Wastewater Infrastructure 2002 http://www.cbo.gov/ftpdocs/39xx/doc3983/11-18-WaterSystems.pdf

[60] Creating a Sustainable Solution for Pennsylvania: Report of the Governor's Sustainable Infrastructure Task Force Report November 2008 http://pa.gov/portal/server.pt/community/sustainable_water_infrastructure_task_force/10565

[61] Christopher Woodcock presentation; Woodcock and Associates Northborough, MA

[62] "Value of Water Survey" ITT Corporation White Plains, NY 2010 http://www.itt.com/valueofwater/

[63] Summary: Closing the Gap: Innovative Solutions for America's Water Infrastructure Forum; January 2003 http://water.epa.gov/infrastructure/sustain/upload/2009_05_26_waterinfrastructures_summary_si_waterinfrastructureforum-2003.pdf

[64] Letter to Commission from Water Pollution Abatement Trust Executive Director, Enrique Zuniga, Executive Director, dated Sept 23, 2011

[65] Letter to Commission from Water Pollution Abatement Trust Executive Director, Enrique Zuniga, Executive Director, dated November 3, 2011

[66] WPAT calculations provided December 5, 2011

[67] Letter to Commission from Water Pollution Abatement Trust Executive Director, Enrique Zuniga, Executive Director, dated November 3, 2011

[68] Tighe and Bond

[69] Tighe and Bond water and sewer reports, MWRA rate report

[70] http://water.epa.gov/infrastructure/sustain/asset_management.cfm

[71] http://water.epa.gov/infrastructure/sustain/asset_management.cfm

[72] http://www.pogo.org/pogo-files/reports/contract-oversight/bad-business/co-gp-20110913.html#Table%201:%20Cost%20Analyses)

[73] Congressional Budget office: Future Investment in Drinking Water and Wastewater Infrastructure 2002 http://www.cbo.gov/ftpdocs/39xx/doc3983/11-18-WaterSystems.pdf

[74] Massachusetts Energy Management Pilot Program for Drinking Water and Wastewater Case Study http://water.epa.gov/aboutow/eparecovery/upload/2010_01_26_eparecovery_ARRA_Mass_EnergyCasyStudy_low-res_10-28-09.pdf

[75] http://www.epa.gov/owm/waterinfrastructure/pdfs/guidebook_si_energymanagement.pdf

[76] Consortium for Energy Efficiency Energy Efficiency RFP guidance quoting two studies by Dimitriou 2007 and MA DEP 2007). http://www.cee1.org/ind/mot-sys/ww/rfp/whattoknow.php3#Who

[77] http://www.epa.gov/owm/waterinfrastructure/pdfs/guidebook_si_energymanagement.pdf

[78] http://www.mass.gov/dep/water/wastewater/empilot.htm#sum

[79] Massachusetts Energy Management Pilot Program for Drinking Water and Wastewater Case Study http://water.epa.gov/aboutow/eparecovery/upload/2010_01_26_eparecovery_ARRA_Mass_EnergyCasyStudy_low-res_10-28-09.pdf

[80] http://water.epa.gov/infrastructure/sustain/wec_wp.cfm

[81] http://water.epa.gov/infrastructure/sustain/wec_wp.cfm

[82] Need MWRA reference

[83] John McNabb, *Analysis of the Massachusetts Drinking Water Infrastructure* Journal of the New England Water Works Association December 2010 http://www.southshorepcservices.com/Analysis_Mass_Water_Infrastructure-NEWWA-Dec2010.pdf

[84] USEPA Watershed-based National Pollutant Discharge Elimination System (NPDES) Permitting Policy Statement January 7, 2003 http://www.epa.gov/npdes/pubs/watershed-permitting-policy.pdf

[85] USEPA Watershed-based National Pollutant Discharge Elimination System (NPDES) Permitting Policy Statement January 7, 2003 http://www.epa.gov/npdes/pubs/watershed-permitting-policy.pdf

[86] John Todd Ecological Design, Inc. Woods Hole, Ma

[87] Clean Water Action: Case Studies of Innovatively Financed Green Facilities in Massachusetts.

[88] "Water Sustainability in Buildings and Sites: Federal and Massachusetts Funding Streams and Informational Resources" Clean Water Action - Water Alliance May 2011- submitted to Commission by Becky Smith

[89] Clean Water Action is currently working on an inventory of organizations in Massachusetts that are active in the water industry and the types of solutions they are working on – source: Becky Smith