WaterMarks 495

TRENDS AND TOOLS FOR A WATER-SMART REGION

A Product of the 495/MetroWest Corridor Water Resources Strategy

CURRENT WATER RESOURCE TRENDS

The 495/MetroWest Corridor is one of the fastest growing areas of Massachusetts. The Corridor's cities and towns are home to many high technology firms and are also experiencing rapid residential growth, according to the U.S. Census and MAPC projections. This growth brings challenges for the management and protection of water resources and provision of adequate water and sewer services. Increases in water demand, wastewater discharges, and stormwater runoff all affect regional water resources and, in turn, their capacity to support more development.

To address these issues, the Metropolitan Area Planning Council (MAPC) and the 495/MetroWest Corridor Partnership developed a comprehensive Water Resources Strategy for the 495/MetroWest Corridor. Funded by a grant from the Environmental Protection Agency, secured by Congressmen James McGovern, Martin Meehan, and Edward Markey, the project assessed water resource trends in the Corridor and created tools that communities can use to help protect and sustain their water resources.

WATER-SMART INDICATORS: A SNAPSHOT

This publication summarizes water resource trends in three categories: Water Supply, Wastewater, and Stormwater. A set of "Water-Smart Indicators" provides a snapshot of the region's impact on water resources and can be updated over time to assess whether policies and growth patterns reducing the impacts of development on water resources. More detailed information about all the indicators, including community-specific data, can be found in a full report available at www.mapc.org /495water or www.arc-of-innovation.org.

Water Marks 495 also describes three fundamental tools that communities can use to improve water resource management: Low Impact Development, Water Reuse, and Peak Demand Management. The last page of this publication presents recommendations for further action by municipalities, the Commonwealth, organizations, businesses, and individuals.

ABOUT THE 495/METROWEST CORRIDOR

The 495/MetroWest Corridor includes 32 communities along Route I-495 from Littleton to Foxborough. Most of the Corridor lies within the Charles River watershed or the watershed of the Sudbury, Assabet, and Concord Rivers (known as the SuAsCo watershed.) Portions of some towns are in the Blackstone, Merrimack, Nashua, Neponset, and Taunton watersheds.

Metropolitan Area Planning Council
495/MetroWest Corridor Partnership
April 2007

MAPC

arc of innovation
495/MetroWest Corridor

Municipal Water Supplies

OVERVIEW

Water is a limited natural resource, so managing supplies wisely is key to sustainable growth. Unsustainable water demand may result in low streamflows, depleted water tables, and unreliable supplies. Municipal water systems in the study area show some mixed progress in improving sustainable water use patterns over recent years. In the 495/MetroWest Corridor:

- 26 municipalities have municipal water systems (see map).
- 22 municipalities rely exclusively on local groundwater and/or surface water supplies.
- Two municipalities are partially supplied by the MWRA.
- Two municipalities receive all of their water from the MWRA.
- Of the 24 towns that rely on local supplies, six of them are currently over or near (within 10%) the withdrawal limits established by the Water Management Act.

AVERAGE DAY DEMAND

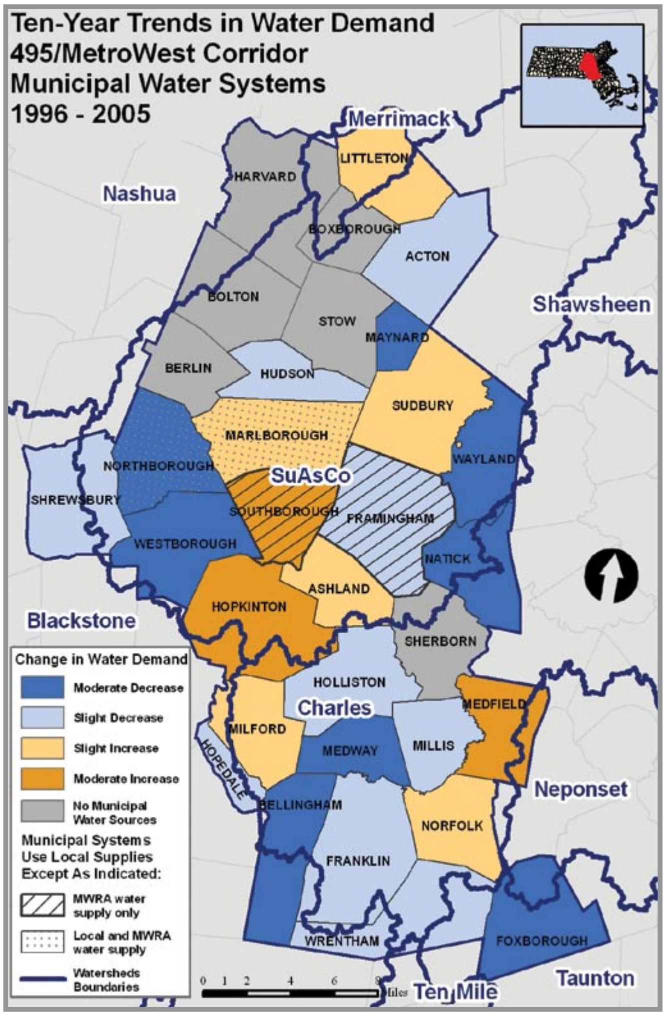
Many communities have increased efforts to promote conservation over recent years through peak demand management, leak detection, and other conservation methods.

- In 17 communities, there has been a decreasing trend in total average day demand over the decade (despite some year-to-year fluctuation).
- The total water demand in those 17 towns decreased from 38 million gallons per day (MGD) to 35 MGD over the period 1996 – 2005, a decrease of 8%. The median decrease in water use trends was 12%.
- In nine communities there has been an increasing trend in total water demand over the past decade.
- The total water demand in those nine communities increased from 15 MGD to 17 MGD, an increase of 13%. The median increase in water use trends was 10%.

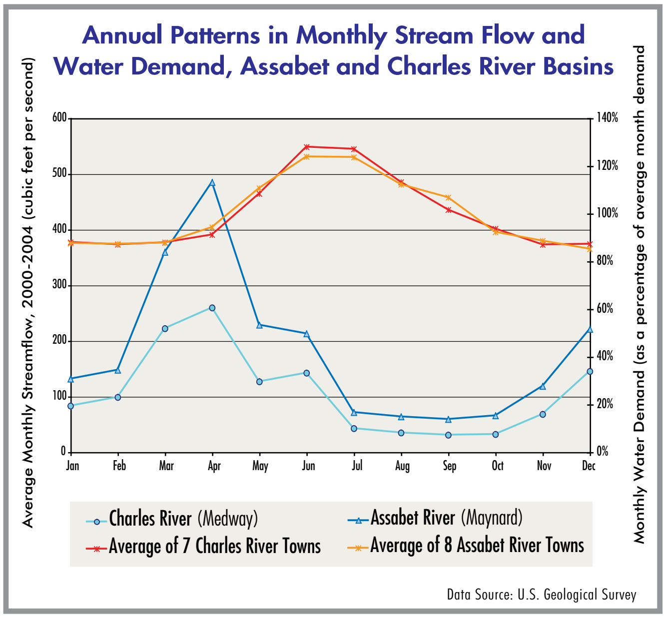
PEAK DEMAND

Summertime demand is important because it puts stress on water resources when supplies are at their lowest, and may force municipalities to make significant investments in new supplies that are only needed a few months of the year.

- In 11 towns, water demand during peak months averaged 40% higher than the rest of the year over the period 2000 – 2005.
- 12 municipalities had an increasing trend in peak demand ratios over the period 2000 – 2005, and in five of those communities, peak demand ratios increased by more than 10%.
- 14 communities had a decreasing trend in peak demand ratios over the period 2000 – 2005, and in six of those communities, peak demand decreased by more than 10%.
- Monthly data from all suppliers in each watersheds was combined and analyzed to assess peak demand in each basin. Aggregate peak demand ratios were comparable, averaging 1.35 in the Charles, and 1.39 in the SuAsCo. However, the trends were different; the peak demand trend in the Charles Basin increased by 4.5% during 2000 – 2005, while the trend in the SuAsCo decreased by 2.5% over the same time period.



Source: Massachusetts Department of Environmental Protection, MAPC analysis, MassGIS



Municipal Wastewater Systems

OVERVIEW

Municipal wastewater systems will experience continued pressure from population and employment growth, as well as new connections from existing properties with failing septic systems. Sixteen of the towns in the 495/MetroWest Corridor are served by 11 local municipal wastewater treatment facilities (WWTF). Eight of these WWTF discharge into the Charles or SuAsCo watersheds and are assessed here (see footnote for list).

CURRENT TRENDS

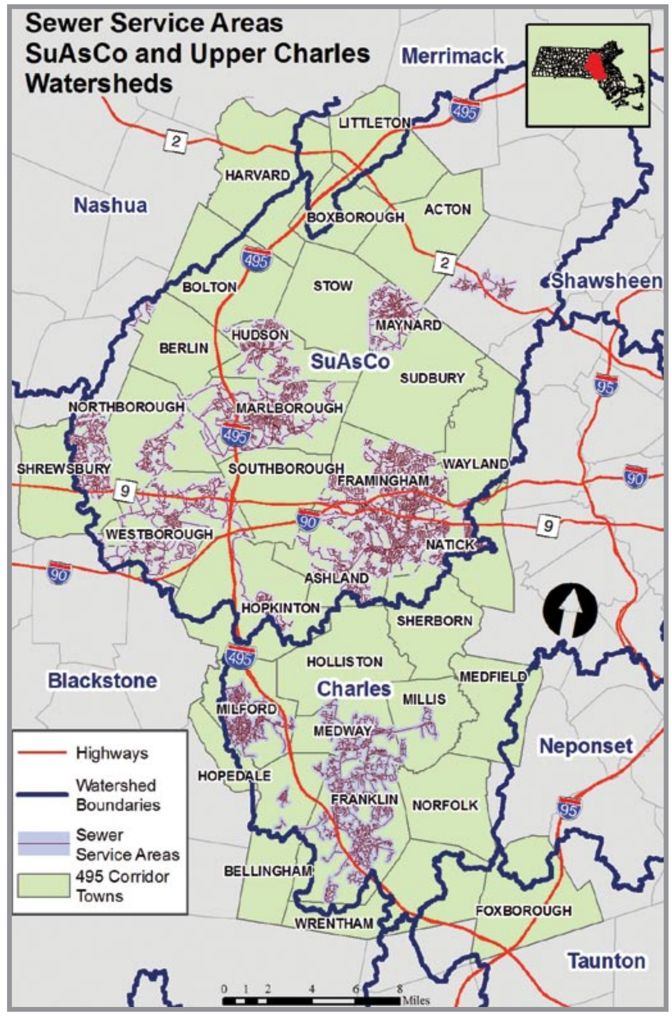
The volume of wastewater treated and discharged by municipal WWTF has been increasing steadily, and has been growing faster than population and employment growth:

- Over the years 2000 – 2006, seven of eight WWTF in the Charles and SuAsCo watersheds increased their discharge, and four of those increased by over 15%, even accounting for year-to-year fluctuation. Two facilities increased by over 25%.
- In the Charles River Watershed, total monthly discharge increased from 9.3 million gallons to 10.9 million gallons over the period 2000 – 2006, an increase of 18%. All three of the facilities in the Charles Watershed increased by over 15%.
- In the SuAsCo Watershed, total monthly discharge increased from 14.7 million gallons to 16.2 million gallons over the period 2000 – 2006, an increase of 10%. Hudson was the only facility where sewage discharges declined over the analysis period, and only very slightly (less than 3% decline).

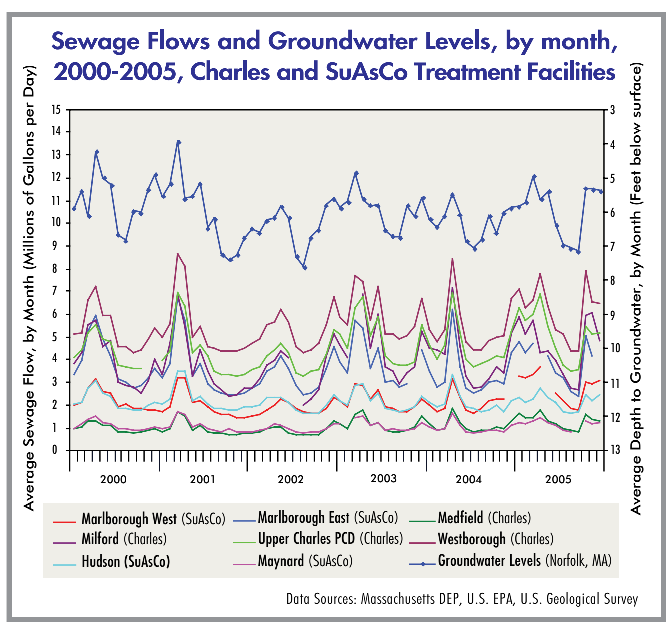
INFLOW AND INFILTRATION

Inflow and infiltration (I/I) continues to be a major challenge for public sewer systems. Inflow is rainwater that enters the sewer system through downspout and sump pump connections into sewer pipes, and infiltration is leakage of groundwater into sewer pipes that are below the water table. I/I is a problem because it introduces large amounts of clean water (rainwater or groundwater) that contribute to overflows and increase the overall amount that needs to be treated.

In the chart to the right, the strong correlation between groundwater levels (top line) and sewage discharges demonstrates that infiltration of high groundwater into sewer pipes is a major component of sewage. Over the years 2000 – 2005, I/I constituted an estimated 14% of total annual discharge and 35% of discharge during the month of April (when groundwater levels are high) for the eight systems in the Charles and SuAsCo. Over this time period, the amount of water lost to I/I increased from 1.2 to 1.9 million gallons per day (MGD) in the Charles River Watershed and from 1.9 to 2.6 MGD in the SuAsCo. Accounting for year-to-year fluctuations, the trend in I/I increased 40% in the Charles and 16% in the SuAsCo.



Source: U.S. Geological Survey (Sewer coverage data), MassGIS



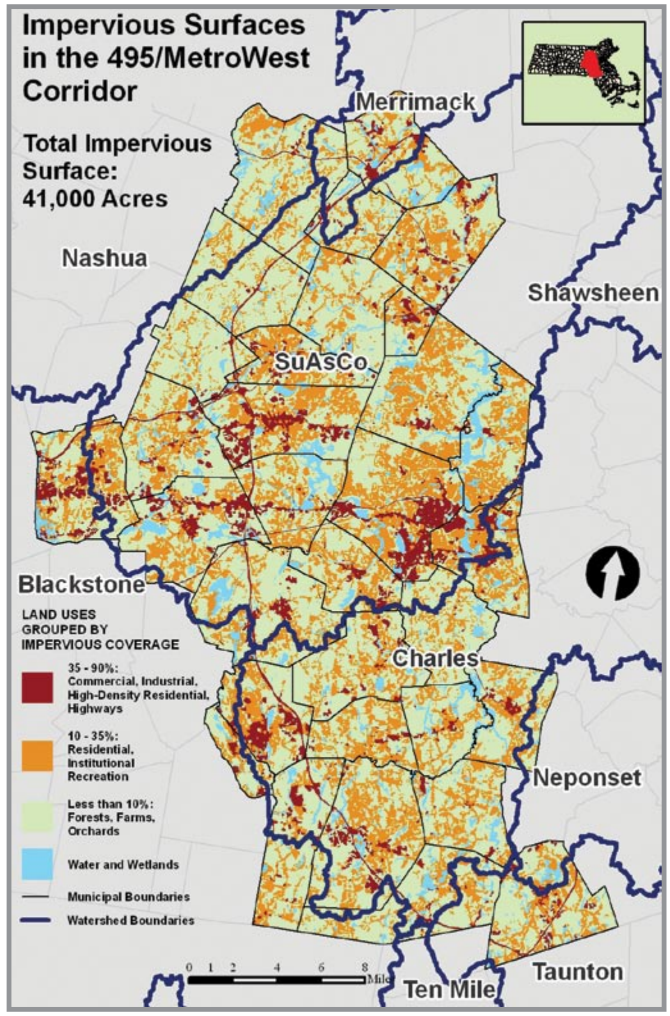
* The WWTF analyzed are as follows. Charles River Basin: Medfield, Milford, Upper Charles Pollution Control District. SuAsCo Basin: Hudson, Maynard, Marlborough (East and West), Westborough. The WWTF in Acton (SuAsCo) came on-line in 2002 and is not evaluated here. Hopedale and Foxborough discharge to the Blackstone and Three Mile Rivers, respectively. Ashland, Framingham, and Natick send their sewage to the MWRA facility at Deer Island. 13 towns do not have public sewer systems and rely on local on-site treatment.

Stormwater Runoff

OVERVIEW

Untreated stormwater runoff from impervious surfaces degrades the health of rivers and streams. Rainwater that falls onto roadways and parking areas transports oil, heavy metals, pathogens, and sand; and the increased volume of runoff from developed sites can increase the severity of flooding and decrease the amount of water recharged to local aquifers.

While stormwater management practices can help to manage the quality and quantity of stormwater runoff, stormwater standards have been applied to new development only in the last decade, and in most towns, do not apply outside of jurisdictional wetland areas. As a result, the acreage of impervious surface is a useful indicator for the impacts of stormwater runoff in the Corridor. For this analysis, MAPC applied a "percent impervious" coefficient to each of 21 land use types (determined by interpretation of aerial photographs) in order to estimate the amount of impervious surface. The map at right divides the Corridor into three categories of land uses. Research has demonstrated that watershed health is impacted when more than 10% of the land is impervious surfaces, and serious impacts occur when more than 25% of the land is impervious surfaces.



Source: MassGIS, MAPC analysis

KEY TRENDS

As of 1999, the 495/MetroWest Corridor included 41,000 acres of impervious surfaces, approximately 11% of the total land area. Residential development has the largest acreage of impervious surfaces among developed land use classes, accounting for 19,900 acres of impervious surfaces associated with roads, parking areas, and rooftops. Almost half of this impervious surface is attributed to low density residential uses (lot sizes larger than ½ acre).

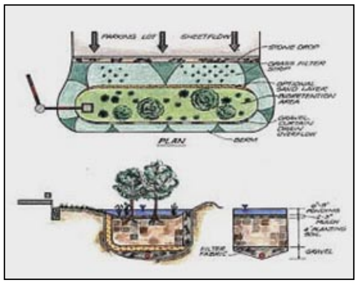
- While higher density residential uses have more pavement and rooftops per acre, they cover much less of the region than lower-density residential uses (see map).
- Industrial and commercial sites, while relatively limited in their extent, account for 10,600 acres of impervious surfaces due to the high proportions of impervious surfaces (>65%) associated with these land uses. Approximately 3,700 acres of impervious surfaces are associated with transportation facilities such as highways.
- Approximately 2,800 acres of impervious surfaces are attributed to other developed land uses (institutional uses, recreation areas); and 4,000 acres are paved areas smaller than the minimum mapping unit in undeveloped land.

Assessed on the watershed level, approximately 11% of the total land area in the SuAsCo and Charles River watersheds is impervious surface. Some subwatersheds are impacted more than others. For example, 15% of the Sudbury River watershed upstream of Hop Brook—an area of 75,000 acres—is estimated to be impervious surfaces. Approximately 12,000 acres of impervious surfaces have been created in the Corridor over the past 30 years, and some watersheds have been especially affected by recent development. In the headwaters of both the Charles River (above Chicken Brook) and the Assabet River (above North Brook), more than 5% of the total acreage was converted to impervious surface over the period 1971-1999.

Tools for a Water-Smart Region

LOW IMPACT DEVELOPMENT

Low Impact Development (LID) strategies use careful site design and decentralized stormwater management to reduce the environmental footprint of new growth. The idea is to minimize paved surfaces and to increase natural treatment and infiltration of stormwater runoff.

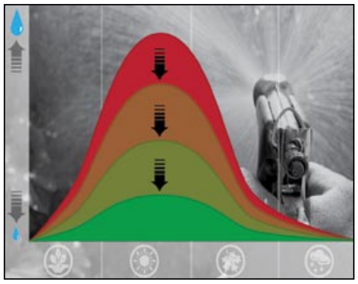


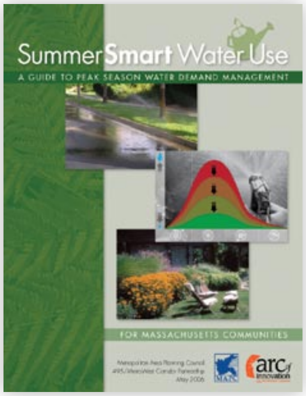
The Massachusetts Low Impact Development Toolkit includes brochures, fact sheets, and presentations that introduce LID concepts to public officials, developers, landowners, engineers, and citizens. Some important techniques identified in the *Toolkit:*

- **Low Impact Site Design** preserves natural areas and minimizes the amount of disturbance and runoff;
- **Narrow roadways and smaller parking areas** reduce the amount of stormwater runoff while also enhancing the appearance of a development;
- **Rain gardens (a.k.a. bioretention cells)** are vegetated areas that collect, treat, and infiltrate stormwater using natural processes;
- **Vegetated swales** are shallow drainage channels that slow runoff and filter it.

PEAK SEASON WATER DEMAND MANAGEMENT

Peak season water demand management programs use public education, pricing, and regulation to moderate water demand during those times when supplies are at their lowest. This can help save communities money while also protecting water resources.



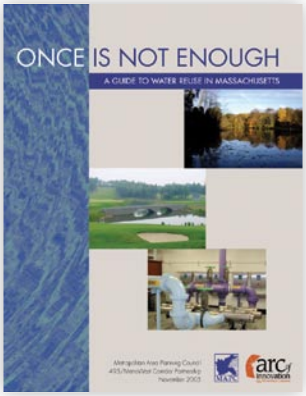


SummerSmart Water Use: A Guide to Peak Season Demand Management for Massachusetts Communities describes many strategies that water suppliers, municipal officials, and citizens can use to reduce peak demand on their water systems. SummerSmart includes information on:

- **Public education** can reduce water use by promoting native plants, low-water landscaping, and high-efficiency irrigation systems;
- **Water use regulation** can be used to control demand during high-demand periods and can require the use of the most efficient fixtures and systems;
- **Conservation pricing** can reduce demand by sending a strong signal through frequent billing, increasing block rates, and seasonal rates;
- **Alternative sources** such as cisterns, rain-barrels, and treated wastewater reduce the demand on public water supplies.

WATER REUSE

Highly treated wastewater can be an environmentally friendly and cost-efficient alternative to conventional sources for many non-consumptive water uses. As such, it provides an increment of supply for growing communities as well as alternative options for wastewater disposal.



Once is Not Enough: A Guide to Water Reuse in Massachusetts describes potential applications of highly treated wastewater, with descriptions of case studies in Massachusetts, discussion of cost considerations, and recommendations for increasing water reuse. Some potential applications for reclaimed water include:

- **Commercial uses**such as vehicle washing, dust control, fire protection, and toilet flushing (local example: Gillette Stadium in Foxborough, MA);
- **Industrial uses** such as manufacturing process water and industrial cooling (local example: Intel Corporation in Hudson, MA);
- **Agricultural irrigation,**especially on golf courses (local example: Bayberry Hills in Yarmouth, MA);
- **Groundwater recharge**of highly treated wastewater to augment aquifers in stressed watersheds (local example: Indian Pond Estate in Kingston, MA).

All materials are available at: www.mapc.org/495water and www.arc-of-innovation.org

Recommendations for a Water-Smart Region

STATE AGENCIES AND REGULATORS

- Review and revise Massachusetts state policies on the reuse of treated wastewater to expand the list of permitted uses. Review and revise MA Plumbing Code to include standards for use of separate transmission lines for reclaimed water distribution.
- Encourage water reuse through the Massachusetts Environmental Protection Act (MEPA) review process and state programs such as Massachusetts School Building Authority, state revolving loan fund (SRF), redevelopment of surplus land, and state building projects.
- Provide technical support (possibly through an expanded Office of Technical Assistance) to communities wishing to create or update local land use controls and other regulations affecting water demand, wastewater reuse, and stormwater.
- Provide additional credit for proactive local water policies in the Commonwealth Capital program and other discretionary local aid programs.
- Review and revise state wastewater policies to encourage the use of small private wastewater treatment facilities, to increase local groundwater recharge and minimize demand on conventional sewer systems.

MUNICIPAL GOVERNMENTS AND PUBLIC WATER SUPPLIERS

- Review municipal water system practices to ensure the use of full cost pricing, conservation pricing, and seasonal water rates.
- Enact a stormwater bylaw that applies performance standards to new development, with an emphasis on low-impact techniques. Review local land use controls to promote stormwater best practices such as clustering and narrow roadways.
- Enact a landscaping bylaw or integrate landscaping best practices into existing site plan guidelines, zoning bylaws, and subdivision rules and regulations.
- Create demonstration projects at municipal properties to demonstrate techniques such as green roofs, rain gardens, swales, rain barrels, permeable paving, and native landscaping.
- Create septic system maintenance programs to extend the useful life of existing septic systems, to increase local groundwater recharge and minimize demand on municipal sewer systems.
- Require new developments to mitigate new water and/or sewer demand through funding for leak detection, conservation, and I/I removal programs.

BUSINESSES, DEVELOPERS, AND PROPERTY OWNERS

- Increase the LEED rating of new developments by incorporating advanced water conservation practices, green roofs, low impact stormwater practices, and low water landscaping.
- Practice low impact property maintenance, including basic, low-cost measures such as frequent street/parking lot sweeping, catch basin cleaning, proper snow storage, and spill prevention.
- Evaluate the potential for the reuse of treated wastewater in new developments, for toilet flushing, landscape irrigation, or industrial processes.
- Educate local boards and regulators. Provide local officials and board members with information about sustainable water practices to help build capacity and expedite the permitting of innovative approaches.
- Conduct regular water audits to identify opportunities for water conservation and reduction of peak demand.
- Support program evaluation efforts at the municipal level to help public water suppliers and public sewer systems identify the most cost-effective strategies for conservation.

COMMUNITY GROUPS, WATERSHED GROUPS, AND INDIVIDUALS

- Educate local boards, regulators, municipal officials, and members of the public through presentations at municipal events and meetings. Organize workshops for homeowners to learn about sustainable landscaping practices.
- Apply for grants to support remediation and educational activities in conjunction with state agencies and municipalities.
- Work with local school systems to develop and implement water-related curricula for local high schools, addressing local water supply, wastewater, and stormwater issues.
- Ask developers to evaluate water reuse, low impact stormwater design, and low water landscaping designs during the regulatory process, whether through MEPA review, site plan review, or other regulatory approval mechanisms.

CREDITS

A product of the 495/MetroWest Corridor Water Resources Strategy conducted by MAPC and the 495/MetroWest Corridor Partnership. Financial assistance from the U.S. EPA. Water Resources Strategy Project Team: George Preble, P.E., Beals and Thomas, Inc.; Kristina Allen, Town of Westborough; David Begelfer, National Association of Industrial and Office Properties; Nancy Bryant, SuAsCo Watershed Community Council; Paul Matthews and Adam Ploetz, 495/MetroWest Corridor Partnership. MAPC Project Manager: Martin Pillsbury. Principal Author: Tim Reardon. Staff Contributors: Sam Cleaves, Rebecca Dann, David dosReis, Justin Sellars. Special thanks to U.S. Geological Survey Massachusetts-Rhode Island Water Science Center.