WATER CONSERVATION PLAN

For the Town of Southwick




Prepared by the Pioneer Valley Planning Commission
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EXECUTIVE SUMMARY

The need to conserve water is often obscured by the seemingly abundant water resources enjoyed in Western Massachusetts. Water is fundamental to our survival, as important as the air we breathe. Perhaps that is another reason why it is so easy to take for granted. Southwick is fortunate to be able to draw water from the Great Brook Aquifer and the Springfield Water and Sewer Commission's (SWSC) system as needed. Although the arrangement with SWSC services the communities' water needs well, it costs valuable money that could be spent on many other programs and infrastructure needs.

The generally fortunate circumstances in Southwick and throughout Western Massachusetts are not shared across the Commonwealth. Many communities in eastern Massachusetts, particularly along the I-495 corridor are facing extreme, year-round water shortages. These water shortages are the result of a growing population, loss of recharge to impervious surfaces, and diminishing source alternatives due to widespread contamination. In addition to the hardships water shortages place on communities, there is also a severe ecological impact observed through low-base flows in streams or in rivers that are reduced to mud flats for several months of the year. This situation is not unique to eastern Massachusetts but is the hard reality for many regions across our nation and around the globe. These circumstances not only dictate how much water will be available but how affordable it will be in the future.

Massachusetts has adopted water conservation standards and guidelines with the goal of fostering policies and practical recommendations that will assist public and private water utilities in achieving the maximum possible efficiency in their water supply systems and in encouraging increasing efficiency by consumers. There is no doubt that water efficiency can achieve significant benefits for water suppliers and citizens. Of equal importance, achieving water efficiency can provide a measure of protection to the natural resources that depend on ground and surface water.

The purpose of this document is to outline many water conservation and demand management strategies and tools that the Town of Southwick can implement to further its efforts toward water conservation at the municipal level and by consumers. These recommendations for effective efficiency technologies and practices can achieve substantial water savings and benefits in our homes, on lawns and landscapes, at businesses, institutions, factories, and farms.

The format of this report is designed to fulfill the Commonwealth's requirements for a Water Conservation and Demand Management Plan as outlined in the Water Resource Commission's *Water Conservation Plan for Public Water Suppliers* dated July 13, 2000. The Commonwealth requires that a Water Conservation Plan be completed by:

- water suppliers interested in planning for demand management;
- water suppliers planning a new water source;
- those applying for a Water Management permit application, permit amendment or permit transfer with the Department of Environmental Protection (DEP);

- those undergoing a 5 Year Review of their existing Water Management Act permit by the DEP;
- those requesting new or updated water needs forecasts from the DEP, Office of Water Resources; and,
- those applying for Interbasin Transfer Approval with the MA Water Resources Commission.

As a water supplier interested in planning for demand management and the development of a new well, the Town of Southwick has completed this Water Conservation and Demand Management Plan for its municipal well and the Zone II, considered to part of the larger Great Brook Aquifer.

Section 1 of this report discusses Southwick's water supply system based on information provided in their 2004 Annual Statistics Report. Section 1 describes water conservation and demand management measures already in place in Southwick as well as recommendations for continued efficiency and demand management. This information has been used to complete the M*assachusetts Water Resources Commission's Water Conservation Plan for Public Water Suppliers* form and is included in the Appendices. Section 2 discusses the structure of the Great Brook Aquifer and its importance to West Springfield and Southwick.

Section 3 provides an in depth discussion of many tools and strategies useful for a regional water conservation program throughout the Zone II. Section 3 also provides model bylaws that would provide the regulatory backbone for implementing several of the measures related to outdoor water use. Last, the case study about the Massachusetts Water Resources Authority (MWRA) talks about the successful demand management program implemented by this water district over the past twenty years and why the MWRA has become a national model for water conservation programming.

This project was funded by the Executive Office of Environmental Affairs through a Smart Growth Technical Assistance Grant to the Pioneer Valley Planning Commission in Fiscal Year 2005. Through a regional application, PVPC assisted 15 communities located in Hampshire and Hampden counties in Western Massachusetts. Work included comprehensive reviews of local zoning bylaws, development of smart growth zoning bylaws, public outreach and education about smart growth and smart growth land use tools, formation of local agriculture commissions, and facilitation of water conservation plans.

SECTION 1 SOUTHWICK WATER SOURCE AND USE

The Town of Southwick is a growing rural residential community in south western Massachusetts along the Connecticut border. Southwick has recreational activities in the Congamond Lakes region and increased pressure in residential, light industry and commercial development. The Southwick Water Department is served by a single source, Well #1. During times of peak demand, Southwick purchases water from the Springfield Water & Sewer Commission. Southwick's public well is located in the northeastern section of town near Feeding Hills Road. The Zone I for the well is a 400 foot radial area and the Zone II recharge area was delineated using empirical data, analytical modeling and geologic mapping. The aquifer is an extensive, very productive, inconfined sand and gravel buried valley aquifer with no evidence of a confining clay layer. Groundwater flows north to the Westfield River and two other community supplies withdraw from the same aquifer. The well has an approved maximum daily withdrawal rate of 1.02 MGD and a Water Management Act Registration and Permit to withdraw .69 mgd based on historic and projected demand. The aquifer has a high vulnerability to contamination due to the absence of hydrogeologic barriers that can prevent contaminant migration. Well water does not now receive treatment. The Zone II is a mixture of forest, residential and agricultural land uses; therefore the well is threatened by contamination from agricultural uses such as fertilizers, livestock operations and pesticides, sand and gravel operations, and residential uses such as fuel oil storage, septic systems, and persticide use. Recommendations for this and other water conservation issues will follow at the end of this report.

There are four other public, non-community wells in Southwick. Two serve the Sodom Mountain Campground and two serve the Ranch Golf Club. The Zone II areas for these range from 400 to 600 feet and recommendations for their protection are similar to those for Well #1.

Southwick's municipal water supply system services a residential population of 4,695, with 2,436 total service connections. Just over 75% of the service connections are residential, with 7.9% commercial, 1.4% municipal, and just under 1% each for agricultural and industrial. Unaccounted-for water is below 10% at 9.5%. The system uses 81.9 residential gallons per capita per day (RGCD).

The Great Brook Well (Well #1; 1279000-01G) referred to above is a 12-inch diameter well approximately 112 feet deep. This source supplies water to the entire distribution system during all but peak demand periods. The operation of the well is telemetrically controlled by the level of the system's one million gallon storage tank. During periods of peak demand, Springfield Water & Sewer supplies water to the system via interconnections on College Highway and North Longyard Road. Pump stations are located at both interconnections.

Southwick is actively seeking permitting for construction of a redundant well within 250 feet of Well 01G to increase well capacity and withdrawal. The capacity of Well 01G is

currently half of the 1 MGD for which it is permitted. There are no interconnections planned with other communities.

During a water audit performed in 2004, 40 of the 51 total miles of water mains were surveyed. Of those miles surveyed, 7 leaks were found and 21 repairs were made for an estimated 1.5 million gallons of water saved annually.

Although Southwick has not distributed residential retrofit or water saving devices and does not have a water savings device rebate program, they plan to increase water fees to encourage reduction of water use to below 80 residential gallons per capita per day (rgpd). Southwick is currently just under 82 rgpd. Public buildings have water-saving devices installed such as low-flow toilets and auto-shut-off faucets.

UNACCOUNTED-FOR WATER USE

The percentage of un-accounted for water in Southwick is 9.5 percent, below the ten percent cap placed by DEP. In efforts to lower this rate, adjustments, including lightning and surge protection, were made to the water storage tank. A past lightning strike took out tank controls over a 3-day weekend resulting in tank overflows.

In addition to the regular leak detection performed by the Water Department, ongoing efforts are made to prioritize and replace aging water mains to prevent future breaks. The Water Department has also contacted the 16 un-metered residential and seasonal buildings about installing meters. The Water Department has offered to meter these connections to help the homeowners avoid being charged a sewer flat rate fee of $600 on top of their water rates.

PUBLIC EDUCATION PROGRAM

Southwick typically provides information about residential leak detection in bill stuffers on an annual basis. When requested, the DPW has sent staff to talk about Southwick's water supply in the schools and to the Eastern States Exposition to staff a New England Water Works Association booth about water supplies. Information on lawn care, gardening, and outdoor water use is being distributed to homeowners in cooperation with the Conservation Commission. In 2004, the Town of Southwick, in partnership with Pioneer Valley Planning Commission, received a S.319 Grant from DEP. A part of this grant included outreach to homeowners, specifically those in the Congamond Lakes watershed, about organic landscape practices, techniques for controlling erosion, and the use of rain barrels for outdoor irrigation. Southwick plans to continue this outreach program and is applying for a second round of S.319 funds. As a result of the S.319 grant, nine rain barrels were installed and two homeowners installed drywells for infiltrating roof runoff. Both of the drywell sites are in the Zone II. Although these successes are small, both the Conservation Commission and the DPW have been provided with some tools with which they can continue this program.

The Water Department performs cross-connection inspections annually and at new installations. Although the focus of this program is not water conservation, the inspector does discuss potential water saving measures at each of the facilities. Occasionally the cross-connection inspection results in leak detection and repair.

Prior to the development of this plan and report, Southwick DPW and the Pioneer Valley Planning Commission sent out a survey to all commercial and industrial users in Southwick to better understand how water was being used a the commercial level and if any conservation measures had been implemented. Although the survey had return envelopes included, none of the targeted users returned it. PVPC staff followed up with several businesses by telephone. One of the businesses did use an outdoor irrigation system, but none had water conservation education programs, and few knew their annual water use or what they paid for water. Unless the business was expanding, they also did not have updated water saving devices.

LEAK DETECTION AND REPAIR

The Water Department conducts an on-going leak detection program. This program involves visual inspections and the use of sounding devices. Main surveys are prioritized based on the age of the pipes, pipe material and construction, and location of the main. Approximately 20 percent of the water mains are in areas that are not readily accessible and therefore do not receive regular inspection and monitoring.

The Water Department is not an Enterprise Fund. Maintenance and emergency repairs occur within the general operating budget. If an emergency necessitates, the Board of Water Commissioners will authorize additional spending to rectify a situation.

METERING

Ninety-eight percent of Southwick is metered. All meters are operable. Public buildings are metered but not billed for their use. There are six un-metered residential buildings that are charged a flat rate of $275 per six months or $550 per year. There are also ten un-metered seasonal dwellings that are charged a flat rate of $250 per year, which includes a $25 fee to turn the water service on/off. Most of these service connections will become metered in the next year as a result of an offer by the DPW to meter these connections to avoid being charged a sewer flat rate fee of $600 per year, on top of their water rates. Testing, calibration, repair and replacement is performed on an as needed basis. While taking meter reads, if something looks out of place, maintenance is performed to correct the problem. Master meters are calibrated annually. The community does not allow the installation of a second meter for outside water use only.

Contractors using hydrants for construction or pipe flushing are charged for this use; $100 fee for meter installation and removal plus the $4 per 1,000 gallon rate for water usage. Southwick uses a touchpad meter reading systems and is transitioning to radio-read on new meters.

PRICING

Water supply operations are not fully funded by revenues. Bills are sent twice a year and at a flat rate of $4 per 1,000 gallons for water and $4.40 per 1,000 gallons for sewer. This was a two-tiered increase over the past year from $3.50 per 1,000 gallons. The Board of Water Commissioners has recommended another rate increase for 2005. Additionally, the Water Commission is investigating a tiered rate structure to encourage water conservation for large users.

DEMAND MANAGEMENT AND EMERGENCY PLANNING

Southwick adopted an outside water use restriction bylaw in 2003, but the bylaw has never been implemented. The Town relies on the provisions of their Water Restriction Bylaw as a drought management plan and procedure for water emergencies. Additionally, the Water Department submits an Emergency Response Directory each year with their Annual Statistics Report. In June of 2004, the Water Department completed a Vulnerability Assessment that was submitted to U.S. EPA headquarters in Washington D.C..

SOUTHWICK WATER CONSERVATION AND DEMAND MANAGEMENT RECOMMENDATIONS

The following recommendations are to assist Southwick in maximizing their water conservation efforts. Section 3 of this report includes more detailed information on specific residential and commercial water saving tools and strategies to be implemented throughout the Great Brook Aquifer for a comprehensive regional water conservation and demand management program.

1. Complete a leak detection survey every two years;

2. Continue to retrofit public buildings with water saving devices;

3. Expand public outreach program to include information on xeriscaping;

4. Switch from a flat rate to a progressive rate for large water users; and,

5. Distribute information about water conservation to large water users.

SECTION 2 REGIONAL DEMAND MANAGEMENT STRATEGIES FOR THE GREAT BROOK AQUIFER

The Great Brook Aquifer contains municipal supply wells for the City of West Springfield, City of Westfield and the Town of Southwick. The aquifer trends north-south across the Town of Southwick and underlies the valley of Great Brook. The aquifer underlies approximately 7,000 acres within Southwick. It extends form the northern to nearly the southern borders of town. On the east the aquifer is bordered by Provin Mountain, and on the west by the till-covered hills which range from 300 to 500 feet in elevation. Saturated thicknesses of over 100 feet have been documented at many locations within the aquifer. Transmissibility in the northern portion of the aquifer has been calculated between 150,000 to 430,000 gpd/ft in various studies (Tighe and Bond, 1983 as referenced in Wehran, 1988). Groundwater flows of the Great Brook Aquifer are generally south to north. There is localized flow from east to west where groundwater flows from the sides of the valley toward Great Brook (Wehran, 1988).

Nearly the entire Town of Southwick is underlain by Upper Triassic-aged sedimentary rocks referred to as the New Haven Arkose. This formation consists of light to dark reddish brown siltstone, sandstone, and conglomerate which is approximately 5,000 feet thick (Schnabel, 1974 and Colton and Hartshorn, 1966 as referenced in Wehran, 1988). The New Haven Arkose is a small-yield aquifer and is the only practical source of groundwater in the hilly parts of Town (Maevsky and Johnson, 1988 as referenced in Wehran, 1988). Wells completed in this formation have yields ranging from 1 to 300 gallons per minute.

Unconsolidated deposits overlying bedrock in Southwick consist primarily of glacially-derived unstratified till and stratified drift. In general, till is located directly above bedrock, and is in turn overlain by the stratified drift deposits. The stratified drift deposits have large variations in thickness across Southwick, ranging from a few feet to more than 100 feet thick. These deposits consist of stratified silts, sands and gravels. Stratified drift deposits are the most productive source of groundwater in the area, with well yields reported as high as 2,000 gallons per minute in the coarser grained deposits. It is these deposits which form the Great Brook Aquifer (Wehran, 1988).

SECTION 3 WATER CONSERVATION AND DEMAND MANAGEMENT STRATEGIES

Efficient water use helps reduce the need for costly water supply and wastewater treatment facilities, helps maintain stream flows and healthy aquatic habitats, and reduces the energy used to pump, heat and treat water. Section 3 of this report provides tools and strategies for a regional demand management program for the Great Brook Aquifer. In order for demand management to be effective at protecting the capacity of an aquifer, it must address all sources of withdrawal. In approaching demand management regionally, this program offers the communities of West Springfield, Westfield and Southwick a more sustainable water conservation program.

POLICY

Water management policy is an important tool for regulating water usage. In Massachusetts, water policy is administered at the federal, state and local level. The following is a discussion of the state and local policy mechanisms that a municipality can utilize as part of a demand management program.

Municipal Regulations and Groundwater Recharge

Encouraging on-site groundwater recharge to the maximum extent possible is an important component in a municipalities' water conservation program. DEP's Stormwater Policy Standard #3 Recharge to Groundwater requires this of all projects reviewed under the Policy. Standard #3 states: "Loss of annual recharge to groundwater should be minimized through the use of infiltration measures to the maximum extent practicable. The annual recharge from the post-development site should approximate the annual recharge from the pre-development or existing site conditions, based on soil types."

Forested areas, open spaces, and other naturally vegetated areas are often permanently lost through clearing and grading activities associated with land development. Clearing and grading activities also impact both water quality and quantity. Loss of ground cover coupled with grading, smoothing, and compaction of the land contributes to decreased groundwater infiltration, increased stormwater flow and erosion and increased sediment runoff into streams and other water bodies. This in turn results in decreased water quality in aquatic habitats and breeding grounds. Erosion and sedimentation often results in environmental damage to abutting properties.

Local bylaws may address the issues of clearing and grading to varying degrees, ranging from limits on clearing prior to the issuance of development permits to earthmoving regulations. However, most bylaws do not address the issues of combined clearing and grading activities. In addition, while most municipalities require erosion and sediment control for projects within 100 feet of wetlands through the Wetlands Protection Act and local bylaws and regulations, they do not have authority beyond the 100 foot buffer until after erosion has resulted in damage to wetlands and waterways.

Under the National Pollutant Discharge Elimination System (NPDES) Phase II program, communities must implement and enforce regulatory mechanisms for pre- and post-construction stormwater management. Compliance with NPDES Phase II is one other way in which communities can implement mechanisms for encouraging on-site infiltration of stormwater, and subsequently groundwater recharge, to the maximum extent possible. When dealing with stormwater recharge, pre-treatment for removal of contaminants is important for protecting groundwater quality and should be a requirement of any stormwater management ordinace.

Through a combination of Site Plan Review Standards and Special Permit requirements, regulations can aim to minimize the loss of natural vegetation and topography and to protect specimen trees, significant forest types, and the most valuable wildlife habitat when developing a site. Minimizing the loss of natural vegetation provides for a cost-effective means of controlling erosion, flooding, and managing stormwater runoff from nonpoint sources such as development sites, streets and parking lots and encouraging on-site recharge of groundwater.

Emergency Water Ban Bylaws

This is the most common type of water conservation bylaw, generally used during droughts or in response to an emergency caused by a water main break or contamination event. Outdoor and indoor water use is generally prohibited during specific hours of the day, certain days of the week or entirely. Most bylaws include provisions for voluntary measures and mandatory requirements. Water Ban Bylaws may also restrict certain activities such as filling swimming pools or using lawn irrigation systems. Fines are imposed for violations. A Right-of Entry clause is an important component of this bylaw and gives the enforcement authority some means for investigating violations.

Although considered a reasonably effective tool for conserving water during times of drought or other emergencies, this type of bylaw is difficult to enforce. Outdoor water use is easy to spot when it is occurring. Violations on indoor water use restrictions are nearly impossible to identify and therefore, enforce.

Massachusetts Plumbing Code

The Massachusetts Plumbing Code includes provisions for Ultra Low Flush (ULF) toilets and urinals which use 1.6 gallons per flush (GPF) and 1.0 gpf respectively. Plumbing activities more than ten feet from a residence are exempt from needing a plumbing permit issued by the town under the provisions of the State Plumbing Code. Therefore, private wells used solely for irrigation and any irrigation systems connected to them do not need installation by a licensed plumber or a permit under the State Plumbing Code. Where an irrigation system is connected to the public water supply via a spigot on the exterior of the house, installation of the spigot does require a permit, however, the irrigation system connected to it does not.

Rebate Programs and Other Financial Incentives

Offering financial incentives such as rebates can encourage some water users to purchase and install water efficient appliances, devices, and other measures. For example, the Metropolitan Water District (MWD) of Southern California, in partnership with its member agencies, offers financial incentives for:

- Replacing high flush-volume, pre-1994 toilets with new, water-efficient 1.6 gallon-per-flush toilets.
- Purchasing a new generation of high-efficiency clothes washers that use much less water and energy than conventional washers.
- Installation of dual-flush toilets.

MWD provides a $60 rebate per toilet. Often the local water agency provides additional program funding, so the combined rebates range between $60 to $100. Rebates on high-efficiency clothes washers are part of a partnership program shared by MWD and energy utilities. Rebate amounts, which normally range between $85 to $150, are based on the combined water and energy savings. The Los Angeles Department of Water and Power, the San Diego County Water Authority, and Southern California Edison have all sponsored programs with Metropolitan Water District of Southern California.

MWD has also given away low-flow toilets, working in partnership with a local high school as a fund raiser. The schools served as the distribution center for the toilets on designated Saturdays. The customers were required to return their old toilets to the school for recycling once they installed the low-flow toilets. The schools were given $15 per returned toilet.

Other rebate programs for water efficient devices include:

Louisville, Kentucky

- Up to $50 towards purchase and installation of soil moisture sensors for irrigation systems
- 50% off purchase price or $50 off drip irrigation system installation

Alberquerque, New Mexico

- Free residential water audit and retrofit kit
- $100 rebate for low water use (Energy Star) washing machines
- $25 rebate on water bill for rain barrel purchase
- $125 rebate on water bills per low-flow toilet installation

Las Vegas, Nevada

- The Southern Nevada Water Authority rebates customers $1 for each square foot of grass removed and replaced with xeriscape.

More details about water efficient appliances and devices for incorporation in a rebate program are discussed at length later in this report.

RECOMMENDATIONS

1. Implement an Erosion and Sediment Control Bylaw that meets the requirements of NPDES Phase II.
2. Use site plan review processes and Special Permits to encourage groundwater recharge to the maximum extent possible.
3. Seek grant funding, or other funding mechanism, to offer a rebate program for water efficient devices.

RESIDENTIAL WATER EFFICIENCY

Toilets are the greatest water user in the house and the most common source of wasted water through leaks. Leaky toilets can waste as much as 200 gallons of water per day! Inefficient and leaky toilets not only waste water but cost homeowners hundreds of dollars. Implementing a water conservation program at the residential level should involve leak detection, particularly in the bathroom. Testing a toilet for leaks is as easy as dropping a dye tablet into the toilet tank and seeing if the dye seeps into the bowl before flushing. Dye tablets cost only a few cents and are generally available from the Water Department.

Effectively implementing a water conservation program at the residential level can be very difficult because it involves behavior modification. Asking someone to flush the toilet every other time or turn the water off while they are brushing their teeth instead of letting it run requires someone to not only think about their actions but make a conscious decision to change their pattern of behavior. Although these are seemingly simple actions, there are very complicated factors influencing them such as consciousness or forethought, convenience, desire to participate, commitment to water quantity issues, and cost. Therefore, for the purposes of this report, residential water efficiency will focus on water saving appliances and devices for inside the home including low-flush toilets, dual-flush toilets, toilet water displacement dams, low flow shower heads, faucet aerators, dishwashers and washing machines. Water saving techniques for the home garden and landscape are discussed later under Garden and Landscape. The appliances and devices discussed in these chapters are the types of products would be eligible to participate in a municipal rebate program as described above.

Domestic Water Saving Appliances and Devices

Low-flush Toilets

In 1992 the Department of Energy mandated the sale of low-flush toilets. Toilets now must use 1.6 gallons per flush as opposed to the 3.5 gallon toilets made prior to 1992. An EPA study finds that the new residential 1.6 gpf toilets reduce water use by 23 to 46 percent, a savings of about 21,130 gallons of water per year per household. Generally this equates to about $130 of annual household savings.

Some towns and cities have established rebate programs to replace pre-1992 toilets with the newer models. Since toilets account for over a third of the water used in most homes, installing a new ultra low-flush toilet will save thousands of gallons each year per household and can reduce bathroom water use by more than half.

Dual-flush Toilets

Dual-flush toilets, common in other countries and recently approved for sale in the United States, allow people to be even more water efficient. These toilets have two levers -- one lever to flush for liquids and the other for solids. The liquid-lever option uses half the water used in today's standard low-flush toilet. Using these new types of efficient toilets can save an average of 2,250 gallons a year.

Toilet Water Displacement Devices

These reduce the amount of water used per flush. There are several commercially available retrofit devices that are inexpensive and eliminate the need to replace old toilets. A toilet displacement bag is essentially just a bag that is filled with water, sealed, and hung inside the tank. All water bags come with metal or plastic clips for hanging the bag inside the tank.

Toilet dams are another excellent device. Toilet dams are flexible plastic rectangles that are place on the bottom of the toilet tank. They work by damming the water behind them. Toilet dams are recommended only for older toilets. In newer toilets, which are designed for lower-volume flushes, toilet dams can force people to have to flush twice, thereby canceling any benefit. Toilet dams and displacement bags range from $5 to $10.

Low-flow Showerheads

The shower is one of the easiest and most cost-effective places to decrease your water use. Some showerheads may still use over 5 gallons per minute. A low-flow showerhead uses 2.5 gallons or less and can save you over 20 gallons per 10 minute shower. In one year, that's over 7000 gallons!

Aside from the environmental benefits of a low-flow showerhead such as lower water use and decreased wastewater volume, significant savings are possible on water and energy bills as well. In particular, households with electric hot water may reduce their energy bill by a third by switching to a low-flow, AAA-rated showerhead. A top-quality, low-flow showerhead will cost $10 to $20 and pay for itself in energy saved within 4 months. Lower quality showerheads may simply restrict water flow, which often results in poor performance. These devices are widely available where plumbing supplies are sold.

Faucet Aerators

Installing a low-flow aerator on a kitchen or bathroom faucet can reduce the flow by about 25 percent. Most standard aerators simply screw onto a faucet thread and can be cheaply purchased at any hardware or home improvement store for between 1-2 dollars. Another popular type of faucet aerator is equipped with an on/off tap saver and costs between 6 to7 dollars. The fingertip control lever temporarily reduces the flow of water without disturbing the original temperature setting. This feature allows the user to reduce the flow of water while shaving, washing dishes, brushing teeth, etc. to save water without having to remix the hot and cold water. Faucet aerators range in price from $1 to 7.

Washing Machines

Most full-sized Energy Star™ certified washers use 18-25 gallons of water per load, compared to the 40 gallons used by a standard machine. Research shows that families with water-efficient clothes washers (25 gallons per load) compared to non-conserving families' homes with less efficient washers (40 gallons per load) save astronomical amounts of water. High-efficiency clothes washers use 30-50 percent less water- about 5,000 gallons less per year- and require one third less detergent. Compared to a model

manufactured before 1994, an Energy Star™ machine can save up to $110 a year on utility bills.

Dishwashers

Replacing a dishwasher manufactured before 1994 with an Energy Star™ qualified dishwasher can save you more than $25 a year in energy costs. Energy Star™ qualified dishwashers use 25% less energy than the federal minimum standard for energy consumption. Because they use less hot water compared to conventional models, an Energy Star™ qualified dishwasher is both environmentally conscious and cost-effective.

RECOMMENDATIONS

1. Distribute information about water efficient appliances and devices to water users via bill stuffers.
2. Seek grant funding, or other funding mechanism, to offer a rebate program for water efficient appliances.
3. Offer residential water audits to residential water users with high usage.

COMMERCIAL, INDUSTRIAL, AND INSTITUTIONAL WATER EFFICIENCY

Commercial water use can generally be broken down into heating and cooling, domestic usage and kitchen usage. For domestic water efficiency, any of the appliances and devices described above are applicable. The Metropolitan Water Resources Authority (MWRA) has instituted an Industrial, Commercial and Institutional (ICI) Water Management Program. The program offers water audits and the development of water efficiency plans for interested facilities. Through this program, one Boston facility was able to take advantage of renovations to replace 126 existing 3.5 gpf toilets with 1.6 gpf toilets. When completed, the change reduced the total water usage by 15%. With an implementation cost of $32,000 and estimated annual savings of $22,800, their payback occurred in 1.4 years. A second facility in Brookline installed 30 faucet aerators reducing water consumption by 190,000 gallons per year. The cost for the devices and labor was $300 and the estimated annual saving was $1,250 per year, a payback in 3 months.

RESTAURANT KITCHENS AND CAFETERIAS

Water efficiency in restaurant kitchens and cafeterias is also based in many of the water saving appliances and devices discussed above. In addition, MWRA's ICI Water Management Program identified several areas for increasing water efficiency with little or no capital investment:

- Operate dishwashers with full loads only, ensure that water shuts off when no dishware or utensils are in the washer.
- Reduce the flow of water to the minimum necessary in scrapper troughs, food prep, wash down and frozen food thawing.
- Install high pressure/low flow spray rinsers with automatic shut off for pot washing.
- Adjust ice machines to produce only the amount of ice needed.
- Control flow of water to garbage disposal or eliminate garbage disposal altogether.
- Consider using rinse water from dishwasher for garbage disposal.

Heating and Cooling

Below are some suggestions from successful retrofits performed through MWRA's ICI Water Management Program for heating and cooling systems:

- Avoid excessive cooling tower blowdown, check with chemical vendor to increase concentration ratio of cooling tower.
- Make-up water and blowdown should be submetered and recorded regularly to address any anomalous usage patterns that could indicate leaks or problems in the system.
- Discuss cooling tower sewer abatements.
- Utilize sidestream filtration to reduce concentration of solids.
- Consider ozone treatment for cooling tower.
- Check steam traps and ensure return of steam condensate to boiler for reuse.
- Limit boiler blowdown, check continuous blowdown systems and adjust if necessary.
- Minimize the water used in cooling equipment, such as compressors, in accordance with manufacturer's recommendations. Utilize solenoid controls and timers to match cooling water to duty cycle of equipment.
- Employ an expansion tank for boiler blow down and drainage rather than cold water mixing.
- Replacement of water cooled equipment with air cooled units.
- Utilize recirculating water-cooled refrigeration loops instead of once-through systems.

RECOMMENDATIONS

1. Offer water audits to commercial and industrial users to identify possible leaks and to make recommendations for conversion to water efficient appliances and devices.

GARDENS AND LANDSCAPES

Gardens and landscapes are some of the biggest water users at a time in the year when water supplies are the most stressed. Water efficient garden and landscape practices include xeriscaping, water wise lawn care, water efficient outdoor irrigation, and reuse systems for outdoor irrigation. Local regulations pertaining to outdoor irrigation systems provide legal authority for implementing water efficient garden and landscape protocols.

Xeriscaping

Xeriscape is a word derived from the combination of a Greek word "Xeros" meaning dry and scape from "landscape". It is a water-conserving landscape design that utilizes water-efficient plants and natural vegetation. Properly maintained, xeriscapes can easily use less than one-half the water of a traditional landscape.

Typical xeriscapes uses native grasses, flowers, and woody plants that are well adapted to the local climate. Using these types of vegetation will mean that no additional water, fertilizer or pesticides will be required in the long-term. Often during the first year, most plants require regular watering to encourage good root growth, germination and establishment. The following table includes a list of plants native to New England that are easy to grow in drier soils.

Xeriscaping is based on seven principles:

1. Proper Planning and Design

Whether starting with an old landscape or planning a new one, a good design is a must. The plan should take into consideration the exposures of the site. As a rule, south and west exposures result in the greatest water loses, especially near buildings and paved surfaces. Extensive use of rock in these locations can raise temperatures and result in wasteful water loss. Water can be saved in these areas by using plants adapted to reduced water use.

2. Soil Analysis and Improvement

A soil sample should be analyzed by a lab to provide some basic information about pH and nutrients. These factors will influence what types of plants are selected for the site and whether or not you need to add soil amendments. If the soil is very sandy, water and valuable nutrients will be lost to leaching below the root zone. If the soil is heavy clay, water will be lost to runoff. Most soils need added organic matter to create optimum conditions for water retention and subsequent plant growth.

3. Appropriate Plant Selection

Appropriate plant selection should be based on the results of a soil lab analysis and sun exposure. A list of easy to grow plants for drier conditions is listed below. The focus of a xeriscaping program should be on preserving as many existing trees and shrubs as possible because established plants usually require less water and maintenance. Choose plants native to New England. Native plants require very little to no additional water beyond normal rainfall outside of the first year. Once established, drought-tolerant species maintain their beauty and resilience during the hottest days of summer.

4. Practical Turf Areas
Narrow strips of turf should be avoided. Not only is maintenance more costly but watering becomes difficult and often wasteful as water spills onto sidewalks and roads.

5. Efficient Irrigation
Proper irrigation practices can lead to a 30 to 80 percent water savings around the home. Water efficient outdoor irrigation systems are discussed at length below along with water-wise lawn care practices.

6. Use of Mulches
Properly selected and applied mulches in flower, shrub and tree beds reduce water use by decreasing soil temperatures and the amount of soil exposed to wind. Mulches also discourage weeds and can improve soil condition and fertility.

7. Appropriate Maintenance
A landscape is a growing, living, changing environment affected by temperature, light conditions, precipitation, and many other factors. Similarly, a landscape care program should also change and evolve with season. This means that irrigation systems should be calibrated for weather conditions, lawns should be kept slightly longer in late summer to prevent burning and water loss, and soil fertility should be evaluated annually for optimal plant growth.

Table 1 Drought Tolerant Native Plants	
Perennials	
Allium cernuum - Nodding Onion	Amsonia species - Blue Star
Anemone (Pulsatilla) patens ssp. Multifida - Pasque Flower	Antennaria species - Pussy-toes
Asclepias tuberosa - Butterfly Weed	Aquilegia species - Columbine
Aster (Eurybia) divaricatus - White Wood Aster	Aster (Symphyotrichum) cordifolius - Blue Wood Aster
Aster (Symphyotrichum) ericoides - Heath Aster	Aster (Symphyotrichum) laevis - Smooth Aster
Baptisia species - False Indigo	Callirhoe species - Wine Cups
Campanula species - Harebell	Chrysogonum virginianum - Golden Star
Echinacea pallida - Narrow Coneflower	Echinacea paradoxa - Yellow Purple Coneflower
Eupatorium rugosum 'Chocolate' - White Snakeroot	Gaultheria procumbens - Wintergreen
Helianthus maximiliani - Maximilian Sunflower	Heuchera cultivars - Alumroot, Coralbells
Houstonia caerulea - Bluets, Quaker Ladies	Hypoxis hirsuta - Star Grass
Iris verna v. smalliana - Clumping Dwarf Iris	Liatris graminifolia - Blazing Star
Liatris scariosa v. novae-angliae - New England Blazing Star	Maianthemum canadense - Canada Mayflower
Panicum virgatum - Switch Grass	Porteranthus trifoliatus - Bowman's Root
Potentilla tridentata - Three-toothed Cinquefoil	Pycnanthemum muticum - Showy Mountain Mint
Rudbeckia fulgida v. sullivantii - Black-eyed Susan	Ruellia humilis - Wild Petunia
Schizachyrium scoparium - Little Bluestem	Sisyrinchium species - Blue-eyed Grass
Solidago caesia - Wreath Goldenrod	Tradescantia hirsuticaulis - Hairy Spiderwort
Verbena stricta - Hoary Vervain	Vernonia missurica - Missouri Ironweed
Viola brittoniana - Britton's Violet	Waldsteinia fragarioides - Barren Strawberry
Zizia aptera - Heart-leaved Alexanders	
Ferns	
Dennstaedtia punctilobula - Hayscented Fern	Polystichum acrostichoides - Christmas Fern
Trees, Shrubs, and Vines	
Amelanchier species - Serviceberry	Ceanothus americanus - New Jersey Tea
Cornus racemosa - Gray Dogwood	Diervilla sessilifolia - Southern Bush Honeysuckle
Halesia tetraptera (carolina) - Silver-bell	Hydrangea quercifolia - Oak-leaved Hydrangea
Hypericum frondosum - Golden St. John's-wort	Ilex glabra - Inkberry Holly
Kalmia angustifolia - Sheep Laurel	Leucothoe fontanesiana (catesbaei) - Dog Hobble
Myrica pennsylvanica (Morella carolinensis) - Bayberry	Oxydendrum arboreum - Sourwood
Parthenocissus quinquefolia - Virginia Creeper	Rhododendron vaseyi - Pink-shell Azalea
Rosa virginiana - Virginia Rose	Sassafras albidum - Sassafras
Spiraea alba var latifolia - Meadowsweet	Vaccinium angustifolium - Lowbush Blueberry

Source: New England Wildflower Society, 2005 Plant Catalog

Water Wise Lawn Care

A lawn's water needs are site specific, influenced by soil type, drainage, sun and shade. Established lawns with dense turf and deep roots are drought tolerant and do not need regular irrigation. Grass naturally goes dormant in late August. A slightly brown lawn at the end of summer is resting and will green up again in the cooler fall weather.

If a lawn must be watered, a general rule of thumb (depending on the amount of natural precipitation) is one time weekly for 3 to 4 hours to a depth of 2 inches. Early morning is the best time of day to water. Frequent light watering can actually weaken a lawn by encouraging shallow roots that are less tolerant of dry periods and more susceptible to insect damage. Wet grass can also burn in the hot sun and is vulnerable to disease from mildew and fungus.

Soil should be tested for dryness by digging below the surface. Lawn should only be watered when the soil is dry to a depth of 1 ½ inches. During irrigation, water should soak down 3 to 4 inches to encourage deep root growth.

In addition to watering your lawn wisely, mower blades should be kept at 2 to 3 inches or more to help the lawn retain moisture. Leaving grass clippings on the lawn allows for nutrients to return to the soil and helps maintain good organic composition in the soil.

Water Efficient Outdoor Irrigation Systems

If for some reason, a property owner or landscape manager feels that irrigation is necessary, water efficient devices for outdoor irrigation systems must be used. There are two primary water efficient technologies for outdoor irrigation systems: drip irrigation and rain sensors. In addition, backflow prevention devices are also important components of any irrigation system to prevent cross-contamination with the public water supply. These technologies are summarized below.

Drip Irrigation

Drip irrigation (sometimes called trickle irrigation) works by applying water slowly and directly to the soil. The high efficiency of drip irrigation results from two primary factors. The first is that the water soaks into the soil before it can evaporate or run off. The second is that the water is only applied where it is needed, (at the plant's roots) rather than sprayed everywhere. While sprinkler systems are around 75-85% efficient, drip systems typically are 90% or higher. There are a wide range of drip systems which vary in complexity and price. Generally they require a higher initial investment than standard sprinkler systems.

Rain Sensors

This device, which contains a piece of floating cork, alerts the automatic sprinkler when rainfall has reached a certain level and tells the sprinkler not to turn on, preventing unnecessary watering. Rain sensors should be attached to a rain gutter or along a flat, unobstructed surface and wired to a 24-volt irrigation timer. Rain sensors can be adjusted

to prevent the watering system from beginning or continuing after rainfall amounts of 1/8, ¼, ½, ¾ or 1-inch. Rain sensors range in price from a few dollars up to $100.

Tensiometers

Tensiometers are soil water measuring devices that are sensitive to soil water change and usefull for irrigation scheduling. A tensiometer is a sealed, water filled tube equipped with a vacuum gauge on the upper end and a porous ceramic tip on the lower end. As water is added to the soil from rainfall or irrigation, the soil suction is reduced. The higher vacuum in the tensiometer causes soil water to be drawn into the tensiometer, and the vacuum will be reduced until a balance in tension in tension is reached.

Backflow Prevention Devices

The backflow prevention device fits between an outdoor spigot and a hose to keep the water from flowing backwards and sucking fertilizer, pesticides and other products into the water supply. Backflow happens when the pressure in water pipes decreases suddenly, like when firefighters open a hydrant to fight a fire.

Rain Barrels and Cisterns

Collecting rainwater is a great way to reduce water bills and conserve water. One inch of rain falling on a 1,000 square foot roof adds up to 623 gallons of water. Residential irrigation for gardens (and lawns if a pump is used) can easily be done with recycled rainwater. Typically, it takes only a ¼ inch of rainfall runoff from the average roof to completely fill a rain barrel. This free “soft water” contains no chlorine, lime, or calcium. It also tends to have less sediment and dissolved salts than municipal water making it ideal for a multitude of applications including organic vegetable gardens, indoor tropical plants and orchids, car washing, and cleaning windows.

Rain barrels generally come in 55-gallon drum sizes, equipped with a spigot, short hose, and screen to cover the opening. The barrel is placed at a roof gutter downspout where it collects water. Most garden supply stores carry rain barrels and they range in price from $80-120.

Cisterns, often made of concrete, store large amounts of water, but can be expensive and time-consuming to construct. Cisterns are generally stored underground or in a basement. These larger cisterns are used in many rural areas of the country that lack public water supply infrastructure or where a well is not feasible.

Water Re-use Systems for Irrigation

On-site wastewater re-use provides numerous opportunities to reduce water use for irrigation purposes. There are two types of wastewater, each of which can be treated and used in various ways. Blackwater is water that has been mixed with waste from the toilet. Blackwater requires biological or chemical treatment and disinfection before re-use. Greywater is wastewater from non-toilet plumbing fixtures such as showers, basins and tubs. Depending on its use, greywater can require less treatment than blackwater and generally contains fewer pathogens.

A groundwater discharge permit issued by DEP is required in Massachusetts in order to implement a water re-use system. In 2000, DEP issued Interim Guidelines on Reclaimed Water to guide the permitting and operation of water reuse facilities. In 2004, DEP began a comprehensive review of its Guidelines as well as incorporation of the 2004 published EPA Guidelines for Water Re-Use. DEP's intent in the near future is to develop a new set of regulations to encourage water re-use in Massachusetts while continuing to protect public health.

One example of a successful water reuse system for irrigation is in the Town of Yarmouth, Massachusetts. The municipally owned Bayberry Hills Golf Course was seeking a nine-hole expansion. The golf course needed to find an alternative source of irrigation water since the town's already stressed water supply could not meet the 18 million gallon annual water demand needed for the additional holes. Adjacent to the golf course was the Dennis-Yarmouth Septage Treatment Plant. The treatment plant had a 21 MG treatment and effluent disposal capacity and a10.5 MG onsite storage tank. The treatment plant was currently discharging treated water to land three miles away from the plant. After a lengthy five year permitting process with DEP (this project was the impetus for DEP's Interim Guidelines issued in 2000), the reclaimed water project was given the go ahead to proceed via a Groundwater Discharge Permit.

Regulating Automatic Irrigation Systems, Private Irrigation Wells in Zone IIs, and Private Wells during Water Supply Emergencies

The growing demand for water to irrigate suburban landscapes is becoming an increasing problem for water suppliers and water resources alike. Summertime water demand in these communities can increase 75 to 100 percent. Although the technology exists to make automatic irrigation systems more water efficient, residential and commercial users generally opt out of purchasing these mechanisms unless required to do so by local regulations.

Often times the high cost of using municipal water for outdoor irrigation provides great incentive for residents and businesses to install private wells for this purpose. While the installation of a private well carries with it great initial investment, the water provided is virtually free, just the cost of the electricity to pump it. Private wells are also exempt from water bans enacted by the Massachusetts DEP or a municipality. One exception to this is in the Town of Falmouth where the town's bylaw states that a water ban enacted by the Board of Selectmen applies to both private and public water supplies.

In many situations, private irrigation wells are drawing on the same groundwater reserves as the public water supply, which also help sustain water levels in rivers, streams, ponds, and wetlands. While some water suppliers encourage their customers to shift to private irrigation wells in to reduce peak demands on the public system, the private wells are still contributing to the overall hydrologic stress within the watershed.

Several communities in Massachusetts and elsewhere have developed by-laws or ordinances for the purpose of regulating in-ground irrigation systems. Table 1

summarizes the regulatory provisions of 15 Massachusetts communities. Key elements of some of these bylaws are described below.

The Water Supply District of Acton, Massachusetts requires automatic lawn watering systems, connected to the public water supply, to be equipped with a timing device that can be set to make the system conform to local odd/even outdoor watering restrictions. All automatic lawn watering systems must be equipped with a moisture-sensing device that will prevent the system from starting automatically when not needed. Systems must also be installed with an approved backflow prevention device that has been inspected initially by the plumbing inspector, and may be inspected periodically thereafter by water district employees. The Acton ordinance requires any person who now has, or who intends to install an automatic lawn watering system in the future, to notify the Water Department of the existence of their system, or of their intention to install a new system prior to the actual installation. Finally, the ordinance provides for the disconnection of any automatic lawn watering system from the public water supply system that is not in conformance with these standards.

The town of North Andover, Massachusetts has similar provisions. Their automatic lawn irrigation system bylaw requires residents to register their automatic sprinklers with the town and purchase specified equipment to make their sprinklers more water efficient including a backflow prevention device and rain sensor. North Andover's by-law also assesses a fee for the connection of an automatic lawn irrigation system to the municipal water supply.

Other noteworthy provisions in municipal bylaws include the town of Sharon, Massachusetts' prohibition on the installation of underground piped irrigation systems to a percentage of the total lot coverage.

Table 2 Summary of Existing Municipal Regulation of Private Wells and Irrigation Systems

AGENCY	ISSUES	ENACTED BY	SUMMARY
Acton Water Supply District	Irrigation Systems	Regulation	Requires moisture sensor, backflow prevention, pre-installation notification, applies to new and existing systems
Bridgewater Water Department	Irrigation Systems	Regulation	No irrigation systems on public water
Dedham Board of Health	Irrigation Wells	Town Bylaw	New irrigation wells prohibited in water resource district
Falmouth	Irrigation Systems	Zoning Bylaw	Xeriscape required unless private well or drip/mist irrigation used
Falmouth	Private Well Water Bans	Town Bylaw	Bans apply to private well irrigators when Selectmen declare groundwater emergency
Holliston Water Department	Irrigation Systems	Regulation	No irrigation systems on public water
Mashpee Water district	Irrigation Systems	Regulation	No new automatic outside irrigation systems on public water, existing systems may not be enlarged and require rain sensor, low flow heads and max 0.5 inches per week
Northborough Water and Sewer Commission	Irrigation Systems	Regulation	No new irrigation systems on public water, enacted 1985
North Andover	Irrigation Systems	Town Bylaw	Irrigation systems on public water require backflow preventer, rain sensor and second meter
Norfolk Water Department	Irrigation Systems	Regulation	No new underground sprinklers on public water, enacted 1991
Sharon	Irrigation systems	Town Bylaw	Underground piped irrigation systems restricted to a percentage of the total lot coverage
Sterling Water Department	Irrigation Systems	Regulation	Irrigation systems require rain sensor
Stoughton Board of Health	Private Well Irrigation Systems	Regulation	Requires detailed design and pump test information before allowing irrigation system on private well
Sudbury	Irrigation systems	Town Bylaw	No new or expanded in ground irrigation system on public water, permit for irrigation system from Board of Health, 100' wetland setback for wells, moisture sensor and IPM plan required
Walpole Water and Sewer Commission	Irrigation Systems	Regulation	No new outside irrigation systems on public water, xeriscaping required
Westborough	Irrigation Systems	Town Bylaw	No new underground sprinklers on public water, existing commercial systems must move to private well in one year, enacted 1996

SOURCE: Dawson, Alexandra and Neponset River Watershed Association. *Options for Managing the Impact of Private Irrigation Wells and Surface Diversions on Wetlands, Waterways and Public Water Supplies*. June 30, 2003.

Communities considering by-laws that limit the use of irrigation systems or restricting watering or irrigation should include an exception to protect commercial agricultural operations. This exception should exempt all the various water uses of the various forms of agriculture, as defined at General Laws Chapter 128, Section 1A.

RECOMMENDATIONS

1. Implement a demonstration landscape at a public building that utilizes the principles of xeriscape. Include interpretive signage that informs users about the specific elements of the landscape and their functions.
2. Include information about xeriscaping, water-wise lawn care, water efficient outdoor irrigation devices, and rain barrels as bill stuffers with water and sewer bills.
3. Work with commercial, industrial, and institutional facilities with outdoor irrigation systems to retrofit their systems with water efficient devices. Seek grant funding to offer rebates for these retrofits. Utilize interpretive signage at the sites to promote the use of these devices.
4. Seek grant funding, or other funding mechanism, to offer rain barrels to residential water users.
5. Adopt a bylaw to regulate automatic irrigation systems, including provisions for water efficient devices.
6. Adopt a bylaw restricting the use of private wells for irrigation within the municipal Zone II.
7. Adopt bylaw requiring private wells to abide by Water Emergency Bans.
8. Seek a commercial or industrial facility to implement a water re-use system for outdoor irrigation.

REGIONAL WATER CONSERVATION AND DEMAND MANAGEMENT STRATEGIES

Policy Recommendations

1. Implement an Erosion and Sediment Control Bylaw that meets the requirements of NPDES Phase II.
2. Use site plan review processes and Special Permits to encourage groundwater recharge to the maximum extent possible.
3. Seek grant funding, or other funding mechanism, to offer a rebate program for water efficient devices.

Residential Efficiency Recommendations

4. Distribute information about water efficient appliances and devices to water users via bill stuffers.
5. Seek grant funding, or other funding mechanism, to offer a rebate program for water efficient appliances.
6. Offer residential water audits to residential water users with high usage.

Commercial and Industrial Efficiency Recommendations

7. Offer water audits to commercial and industrial users to identify possible leaks and to make recommendations for conversion to water efficient appliances and devices.

Lawn and Garden Recommendations

8. Implement a demonstration landscape at a public building that utilizes the principles of xeriscape. Include interpretive signage that informs users about the specific elements of the landscape and their functions.
9. Include information about xeriscaping, water-wise lawn care, water efficient outdoor irrigation devices, and rain barrels as bill stuffers with water and sewer bills.
10. Work with commercial, industrial, and institutional facilities with outdoor irrigation systems to retrofit their systems with water efficient devices. Seek grant funding to offer rebates for these retrofits. Utilize interpretive signage at the sites to promote the use of these devices.
11. Seek grant funding, or other funding mechanism, to offer rain barrels to residential water users.
12. Adopt a bylaw to regulate automatic irrigation systems, including provisions for water efficient devices.
13. Adopt a bylaw restricting the use of private wells for irrigation within the municipal Zone II.
14. Adopt bylaw requiring private wells to abide by Water Emergency Bans.
15. Seek a commercial or industrial facility to implement a water re-use system for outdoor irrigation.

CASE STUDY: METROPOLITAN WATER RESOURCES AUTHORITY

The Massachusetts Water Resources Administration (MWRA), since its inception in 1985, has developed a local and national reputation for innovative and successful water conservation policies in the Boston Metropolitan area. The agency was established not only to manage the region's water system but to also promote water conservation and environmental quality in the process.

At the time of its birth, the MWRA inherited a system that had been exceeding its safe yield of 300 million gallons per day (mgd) for nearly 20 years. Several studies undertaken by the MWRA's predecessor agency, the Metropolitan District Commission, called for developing 70 mgd of additional supply by 2020 above a base demand of 340 mgd. These plans examined supply options, such as the potential for diverting a portion of the Connecticut River flow, as well as some demand management considerations.

In 1986, the MWRA Board of Directors opted to pursue a demand management strategy rather than explore new supply options. The Long Range Water Supply Program (LRWSP) became the long-term plan to carry out this new objective. From leak detection to public outreach, this plan aimed for water conservation strategies to reduce water at every step of the water system, from the reservoir to the user.

The MWRA's demand management strategy quickly showed results. Conservation programs for residences and businesses included leak detection, retrofitting of older devices with water efficient fixtures and plumbing equipment, and educational outreach programs to teach residents the importance of conservation. In 1989, the MWRA sponsored plumbing code changes leading to state legislation mandating the installation of 1.6 gallon/flush toilets for new construction and renovations. By 1990 the average water demand in Massachusetts dropped to 285 mgd, down from 326 mgd only three years earlier.

Due to the initial successes of the MWRA's long-term conservation plan, the agency began the process of initiating conservation measures system-wide. One of the first initiatives in this regard was to reduce "unaccounted-for-water" system-wide. Unaccounted-for water refers to water withdrawn from the source but not accounted for as sold or otherwise used. It includes leaks, unmetered uses and other losses. MWRA approached this problem based on two different strategies: the first was to identify and reduce the number of leaks and the second was to establish an accurate accounting system for water usage.

In helping communities identify water main leaks, the MWRA surveyed 6,085 miles of municipal water mains and detected 2,374 leaks representing 30 mgd of unaccounted-for water, which were eventually repaired by each community. Based on these findings, the MWRA decided to push for local leak detection regulations in 1991. Under these regulations municipalities are required to complete leak detection surveys of their distribution system every two years.

The MWRA demand management program established strategies appropriate for dealing with the various users of the system. Its residential water user strategy, dubbed "Operation Watersense", focused on the installation of water-saving devices in the home as well as an extensive outreach and educational program. Overall, Operation Watersense's teams installed 1.3 million water-saving fixtures in 348,871 households in 42 communities throughout the early 1990s. In dealing with commercial, industrial, and institutional users, the MWRA tailored strategies that could be implemented by each specific user. These included water-saving technologies, a water audit program, and numerous workshops to provide general conservation information and technical assistance.

Perhaps the most important tool the MWRA has used to achieve its demand management agenda has been short and long-range planning. The management and planning programs of the LRWSP were designed to make the MWRA less reactive and more proactive by emphasizing long-term thinking about water-supply planning. For those communities that receive water on a contractual basis, MWRA policy requires that each community have aggressive demand management programs in place, protect and use any local water resources, and provide for specific peak and average flow limitations. In the early 1990s, MWRA instituted a concept of water supply planning called Trigger Planning, which focuses on ways of dealing with future water problems. With this plan, the first step is to identify parameters (leading indicators that can be monitored over time and act to "trigger" a response by the agency. The second step is to analyze what can be done in advance to reduce the time for implementation of the projects. Short-term planning has primarily taken the form of drought-management plans and policies. The MWRA has also developed a model that calls for different demand management strategies (emergency stages 1, 2, and 3) based on the drought status of the Quabbin Reservoir. Fortunately these plans have not had to be implemented in recent years as the reservoir has been at or above normal operating levels.

The MWRA continues to advance its demand management agenda today. Since the year 2000, water demand (withdrawal) has steadily fallen within the MWRA service area. In 2003, water demand reached its lowest point at 231 mgd. A comprehensive review of water supply and demand in the MWRA service area was performed by the MWRA in 2002 and presented in a report entitled "MWRA Water System Supply and Demand", May 8, 2002. The report concluded that the MWRA water supply system is sufficient to meet both current and future demand for the existing service area. The projections of growth in the service area are modest; the incremental water demand from new homes and businesses in the service area is projected to be less than 13 mgd. The report concluded that further conservation, increased efficiencies in water use, and response to price increases could temper demand, so that demand in the year 2025 could conceivably be less than current levels.

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Web Resources:

Colorado State Cooperative Extension
http://www.ext.colostate.edu/pubs/Garden/07228.html

Living Organics
http://www.greenedge.org/livingorganics/grey_water.html

Metropolitan Water Resources Authority
http://www.mwra.com

APPENDICES

Southwick Wellhead Protection District

185-22. Southwick Wellhead Protection District.

[Added STM 11-21-1991 by Art. 13; amended ATM 5-18-1999 by Art. 20; STM 10-15-2002 by Art. 7]

A. Purpose. The purpose of the Wellhead Protection District shall be to promote the health, safety and welfare of Southwick and neighboring communities by protecting and preserving the surface and ground water resources located in Southwick for any use of land and/or buildings which may reduce the quality or quantity of its public drinking water supply.

B. Definitions.

AQUIFER - A geological formation composed of rock or sand and gravel that contains significant amounts of potentially recovering potable water.

GROUNDWATER - All water found beneath the surface of the ground.

HAZARDOUS WASTE OR HAZARDOUS MATERIAL - Any material or waste which is potentially hazardous to human health or to the environment, including, but not limited to, such hazardous wastes and materials which have been designated as such by the United States Environmental Protection Agency under 40 CFR 250, as amended, or which have been designated as such under regulations promulgated pursuant to the Massachusetts Hazardous Waste Management Act, Massachusetts General Laws, Chapter 21C and 310 CMR 30.00, as amended.

IMPERVIOUS SURFACES - Materials or structures on or above the ground that do not allow precipitation to infiltrate the underlying soil.

LEACHABLE WASTES - Waste materials, including solid wastes, sludge and pesticide and fertilizer wastes, capable of releasing waterborne contaminant to the environment.

PRIMARY AQUIFER RECHARGE AREA - Areas which are underlain by surficial geologic deposits, including glaciofluvial or lacustrine stratified drift deposits or alluvium or swamp deposits, and in which the prevailing direction of groundwater flow is toward the area of influence of public water supply wells. These areas are also

designated as Zone I, Zone II, and Zone III areas under regulations promulgated by the Massachusetts Department of Environmental Protection as shown on the Wellhead Protection District Map (as Zones 1, 2, and 3) referred to in Article III, § 185-5E, of this chapter.

TRUCK TERMINAL - A business which services or repairs commercial trucks which are not owned by the business.

WASTEWATER TREATMENT WORKS SUBJECT TO 314 CMR 5.00 - Any wastewater treatment plant or works, including community septic systems, which require a permit from the Massachusetts Department of Environmental Protection.

WATERSHED - Lands lying adjacent to watercourses and surface water bodies which create the catchment or drainage areas of such water courses and bodies.

ZONE I RECHARGE AREA - That circle of a four-hundred-foot radius extending around the wellhead of a drinking water well, with the wellhead at its center and including all land within the boundaries of said circle.

ZONE II RECHARGE AREA - That area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can realistically be anticipated (180 days of pumping at a safe yield with no recharge from precipitation). It is bounded by groundwater divides which result from pumping the well and by the contact of the aquifer with less permeable materials such as till or bedrock. In some cases, streams or lakes may act as recharge boundaries. In all cases, Zone II shall extend up gradient to its point of intersection with prevailing hydrogeologic boundaries (a groundwater flow divide, a contact with till or bedrock, or a recharge boundary).

ZONE III RECHARGE AREA - That land area which is up gradient of the Zone II and represents the well's drainage basin.

C. Scope of authority. The Wellhead Protection District is an overlay district and shall be superimposed on the other districts established by this chapter. All regulations of the Town of Southwick Zoning Bylaw applicable to such underlying districts shall remain in effect, except that where the Wellhead Protection District imposes additional regulations, such regulations shall prevail.

D. District delineation.

(1) The Wellhead Protection District is herein established to include all lands within the Town of Southwick lying within the primary aquifer recharge areas of groundwater aquifers which now or may in future provide public water supply. The map entitled "Town of Southwick Commonwealth of Massachusetts Wellhead Protection District Zone I - Wellhead Protection Area Zone 2 & 3 - Zone of Contribution," dated May 21, 2002, referenced in Article III, § 185-5E, of this chapter which is on file with the Town Clerk, delineates the boundaries of the district.

(2) Where the bounds delineated are in doubt or in dispute, the burden of proof shall be upon the owner(s) of the land in question to show where they should properly be located. At the request of the owner(s), the Town may engage a professional hydrogeologist to determine more accurately the location and extent of an aquifer or primary aquifer recharge area, and may charge the owner(s) for all or part of the cost of the investigation.

E. Permitted uses. The following uses are permitted within the Wellhead Protection District, provided that they comply with all the applicable restrictions in this bylaw, including but not limited to Subsections F through J, and provided that all necessary permits or approvals required by local, state or federal law are also obtained:

(1) Single-family residences;

(2) Residential accessory uses, including garages, driveways, private roads, utility rights-of-way and on-site wastewater disposal systems;

(3) Foot, bicycle and/or horse paths and bridges;

(4) Normal operation and maintenance of existing water bodies and dams, splash boards, and other water control, supply and conservation devices;

(5) Maintenance, repair, and enlargement of any existing structure;

(6) Conservation of soil, water, plants and wildlife;

(7) Farming, gardening, nursery, conservation, forestry, harvesting and grazing;

(8) Outdoor recreation, nature study, boating, fishing and hunting where otherwise legally permitted;

(9) Construction, maintenance, repair, and enlargement of drinking water supply related facilities such as, but not limited to, wells, pipelines, aqueducts and tunnels;

(10) Day-care centers, family day-care homes and school age child care programs;

(11) Structures for educational and religious purposes.

Underground storage tanks related to these activities are not categorically permitted.

F. Prohibited uses.

(1)Business or industrial uses, or facilities, not agricultural, which generate, treat, store or dispose of hazardous materials or wastes, including, but not limited to, metal plating, chemical manufacturing, wood preserving, furniture stripping, dry cleaning, metal fabrication or manufacturing, foundries, petroleum refining, photographic processing, leather tanning, electrical circuit manufacturing, degreasing operations, plastics processing, fuel oil sales and auto body repair, or which involve on-site disposal of process waste waters, except for the following:

(a) Very small quantity generators as defined under 310 CMR 30.000 as amended, which generate less than 20 kilograms or 6 gallons of hazardous waste per month may be allowed by special permit in accordance with Subsection J;

(b) Household hazardous waste centers and events under 310 CMR 30.390;

(c) Waste oil retention facilities required by MGL c. 21, § 52A;

(d) Treatment works for remediation of contaminated water supplies, which are approved by the Department of Environmental Protection and designed in accordance with 314 CMR 5.00, as amended.

(2) Trucking terminals, motor vehicle gasoline sales, motor vehicle and boat service and repair shops, tractor-trailer cab and trailer storage, car washes, automotive body and repair shops.

(3) Solid waste landfills, dumps, auto recycling, junk and salvage yards, landfilling or storage of sludge and septage, with the exception of the disposal of brush or stumps. Transfer waste stations operated by the Town of Southwick are

specifically exempted herefrom.

(4) Petroleum, fuel oil, and heating oil bulk stations and terminals including, but not limited to, those listed under Standard Industrial Classification (SIC) Codes 5171 and 5983. SIC Codes are established by the U.S. Office of Management and Budget and may be determined by referring to the publication, Standard Industrial Classification Manual, and any subsequent amendments thereto.

(5) Storage of liquid petroleum products and/or liquid hazardous materials, as defined in MGL c. 21E, except for the following:

(a) Storage which is incidental to:

[1] Normal household use, outdoor maintenance, or heating of a structure;

[2] Emergency generators required by statute, rule or regulation;

[3] Waste oil retention facilities required by statute, rule or regulation;

[4] Treatment works approved by the Massachusetts Department of Environmental Protection designed in accordance with 314 CMR 5.00 for treatment of contaminated ground or surface waters, provided that such storage shall be in a freestanding container, located on an impervious surface within a structure, or within the basement of a structure, with secondary containment adequate to contain a spill the size of the container's total storage capacity. The storage tank and piping must comply with all applicable provisions of 527 CMR 9.00, the Massachusetts Board of Fire Prevention regulations;

(b) Replacement of storage tanks or systems for gasoline, which existed at the time of the adoption of this bylaw, provided that:

[1] All such replacement gasoline storage tanks or systems shall be located underground as required by Massachusetts Board of Fire Prevention regulation 527 CMR 9;

[2] All such storage systems shall be protected by one of the secondary containment systems specified in Massachusetts Board of Fire Prevention regulations 527 CMR 9;

[3] The head of the Fire Department may deny an application for tank replacement, or approve it subject to conditions if he or she determines that it constitutes a danger to public or private water supplies.

Replacement of all other storage tanks for liquid petroleum products other than gasoline must be above ground.

(6) Outdoor storage of pesticides or herbicides.

(7) Storage of de-icing chemicals unless such storage, including loading areas, is within a structure designed to prevent the generation and escape of contaminated runoff or leachate;

(8) Storage of animal manure, unless covered or contained in accordance with the specifications of the Natural Resource Conservation Service;

(9) Dumping or disposal of any hazardous material or hazardous waste on the ground, in water bodies, in septic systems, or in other drainage systems. This shall include septic system cleaners which contain toxic chemicals such as methylene chloride and 1-1-1 trichlorethane.

(10) Wastewater treatment works subject to a groundwater discharge permit under 314 CMR 5.00, except the following:

(a) The replacement or repair of all existing treatment works that will not result in a design capacity greater than the design capacity of the existing treatment works;

(b) Treatment works approved by the Department of Environmental Protection designed for the treatment of contaminated ground or surface water and operating in compliance with 314 CMR 5.05(3) or 5.05(13);

(c) Publicly owned treatment works;

(11) Stockpiling and disposal of snow and ice containing de-icing chemicals brought in from outside the district;

(12) Storage of commercial fertilizers, as defined in MGL c. 128, § 64, unless such storage is within a structure designed to prevent the generation and escape of

contaminated runoff or leachate.

(13) Residential, commercial and industrial uses within Zone I of any municipal water supply well. Only water supply activities are allowed within Zone I.

(14) Multifamily residential uses which are not served by the municipal sewer system.

G. Performance standards. All uses, whether allowed by special permit or by right, must meet the performance standards herein:

(1) Sodium chloride for ice control shall be used at the minimum salt to sand ratio which is consistent with the public highway safety requirements, and its use shall be eliminated on roads closed to the public in winter.

(2) Storage areas for road de-icing chemicals shall be covered and be located on a paved surface, with berms to prevent runoff from leaving the site.

(3) Aboveground storage tanks for oil, gasoline or other petroleum products shall be placed in a building on a diked, impermeable surface sufficient to contain 1 1/2 the volume of the tank to prevent spills or leaks from reaching groundwater.

(4) In accordance with the State Plumbing Code, all vehicle maintenance facilities must have floor drains, unless they receive a variance from the State Plumbing Board, which must be connected to a municipal sewer system or to a state holding tank in unsewered areas. All other facilities which use, store, maintain hazardous materials or wastes must, with state approval, seal floor drains or connect them to .a sewer system or holding tank.

(5) For commercial, residential and industrial uses, to the extent feasible, all runoff from impervious surfaces shall be recharged on the site by stormwater infiltration basins, infiltration trenches or similar systems covered with vegetation. Such runoff shall not be discharged directly to rivers, streams, or other surface water bodies. Dry wells shall be used only when other methods are unfeasible, and for commercial and industrial uses a permit is required from the Massachusetts Department of Environmental Protection. All such basins and wells shall be preceded by oil, grease and sediment traps to facilitate removal of contamination. All recharge areas shall be permanently maintained in full working order by the owner. Infiltration systems greater than three feet deep shall be located at least 100 feet from drinking water wells, and shall be situated at least 10 feet down gradient and 100 feet up gradient from buildings to avoid seepage problems. Infiltration basins and trenches shall be constructed with a three-foot minimum separation

between the bottom of the structure and the maximum groundwater elevation.

H. Area regulations. Within the Wellhead Protection District the minimum allowable lot size shall be 60,000 square feet in areas not served by municipal or quasi-public sewage treatment plants, except for Flexible Residential Developments, where the minimum lot size shall be 40,000 square feet in compliance with the standards in Table 1 of this chapter. A Flexible Residential Development may occur within the primary recharge area, provided that no development occurs within the Zone I area designated for any public well. All aspects of any such Flexible Residential Development Overlay Zone (FRD) Bylaw 2 relative to health and environmental impact which may be hereinafter enacted by the Town of Southwick must be met before any FRI) development is to be allowed in the Wellhead Protection District.

I. Special permit uses.

(1) The following uses are permitted only upon the issuance of a special permit by the Planning Board under such conditions as they may require:

(a) Commercial and industrial uses not prohibited in § 185-22F which are allowed in the underlying district;

(b) Enlargement, intensification or alteration of existing uses that do not conform to the Wellhead Protection District;

(c) Those activities that involve the handling of toxic or hazardous materials in quantities greater than those associated with normal household use, permitted in the underlying district (except as prohibited under Subsection F). Such activities shall require a special permit to prevent contaminating groundwater;

(d) Any use that will render impervious more than 15% or 2,500 square feet of any lot, whichever is greater. A system for artificial groundwater recharge of precipitation must be provided which shall be by storm water infiltration basins or similar systems covered with natural vegetation, and dry wells shall be used only where other methods are unfeasible. For all nonresidential uses, all such basins and wells shall be preceded by oil, grease, and sediment traps to facilitate removal of contamination. Any and all recharge areas shall be permanently maintained in full working order by the owner.

(e) Excavation for removal of earth, sand, gravel and other soils, which shall not extend closer than 10 feet above the annual high groundwater table. A monitoring well shall be installed by the property owner to verify groundwater elevations. This section shall not apply to excavations incidental to permitted uses, including but not limited to providing for the installation or maintenance of structural foundations, freshwater ponds, utility conduits or on-site sewage disposal. This section shall apply to all commercial earth removal operations, including extensions of existing operations.

[1] Access road(s) to extractive operation sites shall include a gate or other secure mechanism to restrict public access to the site.

[2] As soon as possible after earth removal is completed, the land shall be restored and stabilized with topsoil and plantings of trees and natural vegetation. All fine materials such as clays and silts shall be disposed of off-site to prevent damage to aquifer recharge characteristics.

(2) Requirements for a special permit in the Wellhead Protection District. The applicant shall file six copies of a site plan prepared by a qualified professional with the Planning Board. The site plan shall at a minimum include the information required under Article VI, § 185-37, of this chapter as well as, the following in pertinent.

(a) A complete list of chemicals, pesticides, herbicides, fertilizers, potentially hazardous materials to be used or stored on the premises in quantities greater than those associated with normal household use.

(b) Those businesses using or storing such hazardous materials shall file a hazardous materials management plan with the Planning Board, Fire Department, Police Department and Board of Health which shall include:

[1] Provisions to protect against the discharge of petroleum products, hazardous materials or wastes to the environment due to spillage, accidental damage, corrosion, leakage or vandalism, including spill containment and clean-up -procedures

[2] Provisions for indoor, secured storage of hazardous materials and wastes with impervious floor surfaces.

[3] Evidence of compliance with the regulations of the Hazardous Waste Management Act, 310 CMR 30, including obtaining an Environmental

Protection Agency (EPA) identification number from the Massachusetts Department of Environmental Protection.

(c) Drainage recharge features and provisions to prevent loss of recharge.

(d) Provisions to control soil erosion and sedimentation and soil compaction, and to prevent seepage from sewer pipes.

(e) Proposed down gradient locations for groundwater monitoring well(s), should the Planning Board deem the activity a potential groundwater threat.

(3) Additional procedures for a special permit in the Wellhead Protection District.

(a) The Planning Board shall follow all special permit procedures specified in Massachusetts General Laws, Chapter 40A, and in this chapter.

(b) The Planning Board may grant the requested special permit only upon finding that the proposed use meets the following standards.

[1] The proposed use must in no way, during construction or thereafter, adversely affect the existing or potential quality or quantity of water that is available in the Wellhead Protection District; and

[2] The proposed use must be designed to avoid substantial disturbance of the soils, topography, characteristics of the site to be developed.

(c) The Planning Board shall not grant a special permit under this section unless the petitioner's application materials include, in the Board's opinion, sufficiently detailed, definite and credible information to support position findings in relation to the standards given in Subsection I(3)(b) of this section.

(4) Nonconforming use. Nonconforming uses which were lawfully existing, begun or in receipt of a building or special permit prior to the first publication of notice of public hearing for this chapter may be continued. Such nonconforming uses may be extended or altered only as permitted in these Zoning Bylaws and only if there is a finding by the Planning Board pursuant hereto that such change does not increase the danger of surface or ground water pollution from such use.

Automatic Lawn Irrigation System Bylaw, Andover, Massachusetts

CHAPTER 177 – WATER – ARTICLE II

177-11. Registration

All automatic lawn irrigation systems connected to the municipal water system of the Town of North Andover shall be registered with the Division of Public Works (DPW). A fee may be charged for this registration. The Board of Selectmen shall set registration fees.

177-12. Backflow Prevention

The Town of North Andover shall be protected from a backflow condition from all automatic lawn irrigation systems connected to the municipal water system by the installation of a backflow prevention device approved by the Division of Public Works. Each backflow prevention device shall be registered with the Division of Public Works.

All new or existing residential, municipal, commercial and industrial property owners are required to install or have in place, a backflow prevention device on their automatic lawn irrigation system. The installation shall be in compliance with 310 CMR 22.22. These devices must be installed on the discharge side of the water meter, preferably indoors, but can be located outside provided they can easily be removed to protect them from damage by freezing.

Reduced Pressure Zone and Pressure Vacuum Breaker type devices shall be tested upon initial installation and thereafter in accordance with 310 CMR 22.22

177-13. Rain Sensors

Installation of new automatic lawn irrigation systems connected to the municipal water supply in the Town of North Andover shall be equipped with a rain sensor approved by the Division of Public Works so that watering will be automatically prevented during or after a rain storm.
Any upgrade or repair of an existing automatic lawn irrigation system shall include the installation of an approved rain sensor if the same is not already installed and in good working condition.

The Division of Public Works shall maintain a list, available to the Public, of approved rain sensors.

177-14. Violations and Penalties

Any person violating this bylaw shall be subject to a warning for the first offense and thereafter shall be liable to the Town in the amount of $50.00 for the second violation, and $100 for each subsequent violation, which shall inure to the Town for such uses as the Board of Selectmen may direct. Fines shall be recovered by indictment, or on

complaint before the District Court, or by non-criminal disposition in accordance with Section 21D of Chapter 40 of the provisions of the Massachusetts General Laws. For purposes of non-criminal disposition, the enforcing person(s) shall be any police officer of the Town. Each day of violation shall constitute a separate offense.

177-15. Severability

The invalidity of any portion or provision of the Bylaw shall not invalidate any other portion or provision thereof.

Water Resources Commission Water Conservation Plan for Public Water Suppliers

THE COMMONWEALTH OF MASSACHUSETTS
WATER RESOURCES COMMISSION

Water Conservation Plan for Public Water Suppliers

Water Supply Agency/Company Name: Southwick Water Department

Street: 454 College Highway City/Town: Southwick Zip Code: 01077

Contact person/Title: Jeff Neece, DPW Director Telephone number: (413) 569-3040

PWS ID#: Great Brook Well 1279000 – 01G Date completed: March 2005

Please answer each of the following questions by
- circling **Yes** or **No**
- checking items that apply
- making comments in the space provided, or on attached documentation where referenced

NOTE: The data and information provided in this report is based on the town of Southwick's 2004 Annual Statistics Report, and Tighe and Bond, Inc. Review of Water Supply Needs (November 16, 2004).

A. General Information:

1. Residential Population served: 4,695 (Town Annual Population Record)
Number of service connections: 2,436 total (2,309 residential service connections)

2. Please give the volume and percentage of total water used by each type of customer.
The following calculations are based on 257 MG pumped and purchased in 2004.

	MGY	%	
a.	2.3	0.9 (8 Service Connections)	Agriculture
b.	20.4	7.9 (96 service connections)	Commercial/Business
c.	2.3	0.9 (4 service connections)	Industrial
d.	3.6	1.4 (14 Service Connections)	Municipal
e.	193.5	75.3 (2,309 Service Connections)	Residential
f.		0	Sales to other public water suppliers
g.		0	Process water, including bleeders, water main flushing, filter backwash, etc. where these uses can be confidently estimated. In the case of water use that is "confidently estimated", documentation of how the estimate was arrived at will need to be provided.
h.		0	Institutional/tax exempt
i.	24.6	9.5	Unaccounted-for* See Section B for definition
j.	2.8	1.4 (5 Service Connections)	Other: please specify:

3. Are the percentages shown above estimates or based on actual meter readings?
Both

4. What is the residential gallons per capita per day (gpcd) for your system? 81.9

Yes **No** 5. Do you maintain interconnections with other communities?

Which communities and what is your arrangement (i.e., emergency only, on request, at any time…) with that community?
Community: Springfield Water and Sewer Commission (SWSC) Arrangement: Automatic withdrawal based on telemetry reading of water level in storage tank on Bonnie View Road. Two interconnections with SWSC located at College Highway (Routes 10 and 202) and North Longyard Road.
Community: N/A Arrangement:

Yes **No** 6. Do you have interconnections planned with other communities? Southwick is developing a replacement well for mechanical redundancy in close proximity to Well #1 to increase withdrawal rates.
a. With which community(ies)? N/A
b. When will interconnections be completed for each? N/A
c. What is the planned arrangement with that community(ies)?
N/A

Yes **No** 7. Do you regularly conduct a water audit***** of your system to determine where water can be saved and the effectiveness of existing water conservation practices?
How often? Periodically
If yes, **describe in detail**, the tasks and results of your most recent audit, including dates the audit began and finished.
If no, **provide a schedule** for implementing such an effort. Your schedule should describe who will conduct the audit, a plan for conducting the audit, and a start and end date for the audit. Use additional pages as needed.

****** As defined by American Water Works Association, "A water audit identifies how much water is lost and what that loss costs the utility. Records and system–control equipment (such as meters) are thoroughly checked for accuracy. The overall system goal of the audit is to help the utility select and implement programs to reduce the distribution-system losses." For more information on conducting a water audit refer to AWWA Manual M36, "Water Audits and Leak Detection- Manual of Water Supply Practices".)*

In 2004, of the 51 total miles of water mains, 40 miles were surveyed. Of those miles surveyed, 7 leaks were found and 21 repairs were made for an estimated 1.5 million gallons of water saved annually.

Yes **No** 8. Have you distributed residential retrofit or water saving devices, or do you have a water savings device rebate program?

If yes, and residential consumption exceeds 80 gallons per capita day, **describe your efforts to reduce residential consumption,** including the total number and type(s) of devices retrofitted.

If no, and your residential gallons per capita day exceeds 80 gpcd, **provide a plan** describing the immediate implementation of such a residential retrofit or rebate program. The plan should include dates for implementation and the expected cost per year of the program. (Please note that projects requiring interbasin transfer approval will be subject to more rigorous review.)

Water Commission increasing water fees, news articles on possible progressive rate structure to promote conservation.

Yes **No** 9. Have water saving devices been installed in public buildings?

Describe your efforts, including location(s), and the number and type of devices replaced, and a **plan and schedule** for installing those devices in any buildings not currently retrofitted. If no, **describe in detail a plan and schedule** for installing such devices, including the dates proposed for each facility
Low-flow toilets, faucets with auto shut-off

10. Describe any other conservation efforts you are undertaking or planning to undertake: See Section 8

11. What is approximate cost per year of your conservation efforts, including personnel costs unknown

What is the funding source(s) for these efforts?

B. Unaccounted-for Water Use:

Unaccounted-for water *is the difference between water pumped or purchased and water that is metered or confidently estimated. Unaccounted-for water should include master meter inaccuracies, domestic and non-domestic meter underregistration, errors in estimating for stopped meters, overregistration revenue meters, unauthorized hydrant openings, unavoidable leakage, recoverable leakage, illegal connections, standpipe overflows, data processing errors.*

Calculation of unaccounted-for water use should be based upon the volumes reported on your Annual Statistical Report filed with The Department of Environmental Protection.

1. Based on the information concerning the percentage of total water used by each type of customer described in Section A, unaccounted-for water is 9.5 %.

2. Describe the "unaccounted-for" water in your system for the last three years, and how you determined it. Un-accounted for water is based on the following calculation: Source Pumped Total minus Adjusted Annual Gallons (Distribution Annual Gallons plus Known Adjustments)

3. Describe your current and ongoing efforts to lower the Town's unaccounted-for water use. 1) Adjustments were made to the Water Storage Tank including lightning and surge protection. A lightning strike took out tank controls over a 3-day weekend resulting in overflows; 2) The Town has a program in place to replace aging water mains to prevent future breaks; 3) There are 6 un-metered residential buildings charged a flat rate of $275 per six months or $550 per year. There are also 10 un-metered seasonal dwellings that are charged a flat rate of $250 per year, which includes a $25 fee to turn the water service on/off. Most of these service connections will become metered in the next year as a result of an offer by the DPW to meter these connections to avoid being charged a sewer flat rate fee of $600 per year, on top of their water rates.

4. Please estimate the percentage of raw water that is lost in treatment, that is: (raw water – finished water)/raw water). 0%; water flows untreated from the well to customers.

Yes **No** Is this lost raw water the same as, or counted as, unaccounted-for water?

C. Public Education Program:

Yes **No** 1. Do you have a public education program for your customers?

2. Please check which items are included in your public education program:

a. v Bill stuffers. How often mailed? Annually

b.____ Public service announcements (Please circle those used: cable TV radio newspapers, others: _____)

c.____ School materials

d. v Speakers for community groups

e.____ Conservation information center

f. ____ Public space advertising

g. v Information on lawn care, gardening, and outdoor water use

h. ____ Demonstration gardens for xeriscaping

i. ____ Industrial or Commercial Conservation

j. ____ Bills which compare current use with use during the same period last year

k. ____Comments/Other:

3. Describe in detail your efforts to implement each of the above checked items.
How often does each item get implemented?:

a) Information about residential leak detection is included as bill stuffers roughly annually. It is difficult to quantify whether or not his has been effective at reducing residential water consumption.

d) When requested, the DPW has sent staff to talk about Southwick's water supply in the schools and also to the Eastern States Exposition to staff a New England Water Works Association booth about water supplies.

g) Information on lawn care, gardening, and outdoor water use is being distributed to homeowners in cooperation with the Conservation Commission. In 2004, the Town of Southwick in partnership with Pioneer Valley planning Commission, received a s,319 grant from the DEP. A part of this grant included outreach to homeowners, specifically those in the Congamond Lakes watershed, about organic landscape practices, techniques for controlling erosion, and the use of rain barrels for outdoor irrigation. The Conservation Commission distributes literature about these topics . the Town of Southwick plans to continue this outreach program and is applying for a second round of s.319 funds.

4. Describe what you perceive as the successes and/or failures of your public education program:

The technical assistance provided through the above mentioned s.319 grant resulted in three homeowners utilizing rain barrels, and two homeowners installing drywells for infiltrating roof runoff. Both of the sites where the drywells were installed are in the Zone II. Although these successes are small, both the Conservation Commission and the DPW have been provided with some tools with which they can continue this program.

Yes **No** 5. Do you regularly contact large industrial, commercial, institutional users to encourage conservation? Describe your efforts:

As part of the process to develop this plan, the Water Department sent a survey to all commercial water users to better understand how water was being used at the commercial level and if any conservation measures had been implemented.
The Water Department performs cross-connection inspections annually and at new installations. Although the focus of this program is not water conservation, the inspector does discuss potential water saving measures at each of the facilities. Occasionally the cross-connection inspection results in leak detection and repair. New large users such as car washes now recycle 90% of water.

D. Leak Detection and Repair:

Yes **No** 1. Do you have a full leak detection program for your distribution system every two years?

a. *If yes,* when was the last full survey completed? _____

Attach the results or a summary of that survey which includes: who conducted the survey, miles of main surveyed, # of leaks found, estimated water loss, leaks repaired, date repaired, and the estimated water savings;

b. When is the next full survey scheduled? _____

c. If no survey is scheduled, how often is a 100% leak detection survey of the distribution system completed?

_____

d. *If no*, have you ever conducted a full leak detection survey for your distribution system? When was the last survey completed?

The Water Department conducts an on-going leak detection program. This program involves visual inspections and the use of sounding devices. Main surveys are prioritized based on the age of the pipes, pipe material and construction, and location of the main. Roughly 20 percent of the water mains are in areas that are not readily accessible and therefore do not receive regular inspection and monitoring.

Yes **No** 2. Do you include leak detection/repair as an expense of the water system?

Yes **No** 3a. Do you have funds set aside for regular maintenance?

Yes **No** 3b. Do you have funds set aside for emergency repairs?

3c. Provide an estimate on how much is spent on leak detection and repairs annually or per survey? unknown

The Water Department is not an Enterprise Fund. Maintenance and emergency repairs occur within the general operating budget. If an emergency necessitates, the Board of Water Commissioners will authorize additional spending to rectify situation.

E. Metering:

1. What percent of your total service accounts are metered? 98 %.

2a. List the number of operable meters in your system? 100%

Yes **No** 2b. Does your community allow the installation of a second water meter for outside water use only?

Yes **No** 2c. If yes, does this above number reflect those meters?

Yes **No** 2d. Are these billed at a different rate? Explain: _____

_____

Yes **No** 3. Are meters easily accessible for water system personnel to read?

4. List the percentage of users metered by category:

Residential	99 %	Industrial	100 %	Commercial	100 %
Public	100 %	Other	N/A		

Yes **No** 5. Are all public buildings metered? If not, list those not metered.

_____

Yes **No** 6. Are public buildings billed for their water use?

7. If you are not 100% metered for all users (including public buildings), **develop a plan** for installing meters in 100% of your system within 2 years. Describe your installation plan, including the number of services remaining to be metered, public buildings remaining to be metered, and an annual schedule for metering those remaining services:

There are 6 un-metered residential buildings charged a flat rate of $275 per six months or $550 per year. There are also 10 un-metered seasonal dwellings that are charged a flat rate of $250 per year, which includes a $25 fee to turn the water service on/off. Most of these service connections will become metered in the next year as a result of an offer by the DPW to meter these connections to avoid being charged a sewer flat rate fee of $600 per year, on top of their water rates.

Yes **No** 8. Do you have a regular metering program? If yes, check which items you include:

a. v Repairs
b. v Testing
c. v Replacement
d. v Calibration
e. v Check for tampering
f. ____ Other

These items are performed on an as needed basis. While taking meter reads, if something looks out of place, then maintenance will be performed to correct the problem.

Yes **No** 9. Are your master meters calibrated annually?

a. *If yes,* by whom Erikson, Providence, Rhode Island

b. Provide the most recent date each master meter has been calibrated: 2003

c. *If no,* how often? _____

10. How often are residential meters read? 2 times per year – Spring and Fall replaced? As needed

11. How often are large user (2" or larger) meters tested or calibrated? As needed

Yes **No** 12. Do you meter water from hydrants used by contractors for pipe flushing and/or construction?

Yes **No** Do you bill for this use?

There is a $100 fee for meter installation and removal plus the $4 per 1,000 gal rate for water usage.

Yes **No** 13. Do you use an automatic meter reading system? touch pad; transitioning to a radio-read system on new meters.

Yes **No** a. *If not,* do you plan to install one?

b. *If yes,* by when? _____

Yes **No** 14. Do you have funds set aside for regular meter repair and replacement? Provide an estimate on how much is spent annually on meter repair and replacement? Have continued to meter any un-metered service connections.

F. Pricing:

Yes **No** 1. Are water supply system operations fully funded by water supply system revenues?
*If yes, w*hen did full funding become effective?

2. Which of the following items are covered by the price of water charged to customers?

a. v Watershed purchase/protection
b. ____ Well site purchase/protection
c. v Distribution system operation
d. ____ Capital depreciation account
e. ____ Aquifer land acquisition
f. ____ Capital replacement/depreciation fund
g. ____ Staff benefits package
h. ____ Treatment and associated treatment plant costs
i. ____ Purchase/installation of water conservation devices
j. ____ All aspects of the education program
k. ____ Staff training/professional development
l. v Leak detection
m. v Pumping
n. v Maintenance
o. ____ Hiring of staff
p. v Leak repairs
q. ____ Debt service
r. ____ Electricity/fuel
s. ____ All of the above

2. Please check the type of rate structure your system uses:
a. ___v___Flat rate b._____ Increasing block c.____ Decreasing block
d. _____ Seasonal e._____Other rate (please explain)

Yes **No** 3. Are bills based on actual meter readings?

Yes **No** 4. Do the bills compare current use with use during the previous period and the same period last year?

Yes **No** 5. Is the volume of water used stated on the bill in gallons?

6a. How often are bills sent to residential customers? Water 2 times per year (April and November)
Sewer 2 times per year
6b. How often are bills sent to large users (2" meters or larger)? Water 2 times per year
Sewer 2 times per year

Yes **No** 7. Is your rate structure regularly evaluated?
How often? As needed
When was your rate last changed? In the past year, the rate increased from $3.50 to $4.00 per 1,000 gallons. This was two-tiered increase of $.25 per six months. The Board of Water Commissioners has recommended a third rate increase to take effect in 2005.

8. Describe or attach a copy of your current pricing level(s) for water & sewer (price charged for a given volume of water and sewer)?

WATER			SEWER		
$ 4	per	1,000 gallons	$ 4.40	per	1,000 gallons of metered water

G. Demand Management and Emergency Planning:

Yes **No** 1. Do you have a written plan describing water use reduction targets? Is this for use only during water supply emergencies, or are there year-round goals? _____ Emergencies only _____ Year-Round

Yes **No** 2. Do you have an outside water use restriction bylaw? Adopted by the Town in 2003 but never been required

Yes **No** Is it based on the DEP model bylaw?
Yes **No** 3. Do you have any other bylaws or restrictions which may control water use (for example, a municipal bylaw which restricts installation of irrigation wells or automatic sprinkler systems). Please describe:

Detailed in Emergency Response Plan

Yes **No** 4. Do you have a plan describing procedures for handling water emergencies?
If yes, describe the existing emergency plans:

Yes **No** 5. Do you have a Drought Management Plan?
If yes, describe your plan: The Town relies on the provisions of their Water Restrictions Bylaw as a drought management plan.

Yes **No** 6. Do you have a written procedure which outlines which users will be cut back, what emergency measures will be implemented, which trigger points require action, and how much will be cut back in the event of a water emergency or Drought? *If yes,* please attach.
The Water Department submits Attachment 1 Emergency Response Directory each year with the Annual Statistics Report. In addition, the Water Department completed a Vulnerability Assessment in June of 2004 that was submitted to U.S. EPA headquarters in Washington D.C.. Additionally, the Water Department relies on the provisions outlined in their Water Restrictions bylaw for these purposes.

Yes **No** 7. Does your system currently have the ability to implement and enforce outside water use restrictions? If yes, briefly describe your ability to implement such restrictions, including the frequency with which such restrictions have been implemented the past five years, and the thresholds used to determine when such restrictions are implemented:
Outdoor water restrictions can be imposed and enforced through the town's Water Restrictions Bylaw. Adopted in 2003.

8. Describe any other efforts your system has taken to evaluate and control your long-term water supply needs or demand management planning you have done:

Installation of a redundant well, second water storage tank, rate increase for usage increase

9. When was the last time you needed to implement water restrictions or water bans?
Adopted in 2003, never implemented.

10. What actions were taken at that time? How long were these measures in place? N/A

Certification:

I certify, under penalty of law, that the responses provided and all attachments were prepared under my supervision, in accordance with a system designed to ensure that qualified personnel properly gathered and evaluated the information submitted. The information submitted is, to the best of my knowledge and belief, true, and accurate and complete.

Signature Title Date