WATER CONSERVATION PLAN

For the Town of Southampton

Prepared by the Pioneer Valley Planning Commission
Funding provided by the Smart Growth Technical Assistance Grant
Massachusetts Office of the Executive Office of Environmental Affairs

June 2005

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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 it is so easy to take for granted. Our generally fortunate circumstances in Southampton 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 demand management strategies and tools that the Town of Southampton can implement to further its efforts to implement water conservation measures 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 developing a new well (replacement well for the College Highway Well), the Town of Southampton has completed this Water Conservation and Demand Management Plan for the College Highway Well and its Zone II, considered to part of the larger Barnes Aquifer.

Section 1 of this report discusses Southampton'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 Southampton 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 Barnes Aquifer and its importance to the four communities that draw water from it.

Section 3 of this report 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 SOUTHAMPTON WATER SOURCE AND USE

Section 1 focuses on Southampton's water supply source, water usage, and the status of a number of conservation and demand management practices such as public education, leak detection and repair, metering, and pricing. This section concludes with several recommendations for continued efficiency and demand management throughout Southampton's water supply system.

Southampton is a small agricultural/residential town with a population of 5,387 people according to the 2000 census. The town's main water supply known as the College Highway Well (01G) draws water from a confined portion of the aquifer that is part of the Barnes Aquifer, an EPA designated Sole Source Aquifer. Southampton also has an agreement with Holyoke to draw from the Tighe-Carmody Reservoir for peak demands however this is very cost prohibitive and rarely used.

The Town is in the process of developing a replacement well as the well has been experiencing diminished capacity due to deterioration of the screen. The replacement well is located within 50 feet of 01G and the Zone II will be the same. The well has a Zone I protective radius of 400 feet and an approved withdrawal rate of .792 million gallons per day (MGD) to meet peak demands.

Southampton has a total of 1,110 service connections including both residential and business users. The residential population served is less than 2700 but the exact number is unknown since the service connection figure combines residential and commercial use together. The volume and percentage of total water used in gallons per day by each type of customer is listed as follows:

14,984	or	2%	Commercial
14,984	or	2%	Industrial
14,984	or	2%	Municipal
689,264	or	92%	Residential
15,982	or	2%	Other

These figures were based on estimates taken from the 2004 Annual Statistical Report. Exact numbers are unknown at this time since meters for the entire town were only installed in December of 2004. The water department will have more precise figures after the reading in June of 2005. The system pumps 127 gallons per capita per day (gcpd) which includes both residential and commercial use.

Emergency interconnections are maintained with Easthampton through a verbal agreement. There is a solid connection at County Road and a hose connection between College Highway hydrants and the Easthampton town line. There have been no definite plans for interconnections with other communities however there has been some discussion at the Barnes Aquifer Protection Advisory Committee (BAPAC) meetings about a future connection in the Hampton Ponds area in Westfield.

The town does not conduct regular water audits but does calibrate the master meter every 2 to 3 years. System losses are accounted for through the leak detection program which has been effective, leading to annual repairs.

Water saving devices have not been distributed for residences and being a small town, Southampton is not in the financial position to offer rebates. However, as a member of BAPAC, the Town might seek grants in the future to provide funding. Conservation efforts have instead been focused on the new metering program which encourages citizens to reduce water consumption through user fees. Despite the Town's conservation efforts, there has actually been an increase of about 400,000 more gallons than the previous year, in a year which received more than adequate recharge. The Water Department attributes this increase to the proliferation of irrigation systems. The cost of conservation efforts for 2004 has included $400,000 from the enterprise fund to cover installation of the meters and $300 per meter paid by homeowners. Meters were installed by a private company therefore the $400,000 is inclusive of all equipment and personnel costs.

Since residential gallons per capita per day exceeds 80, the town needs a plan to reduce residential consumption. The town currently does not retrofit existing public buildings with water saving devices however any new buildings, or building additions must have these devices in order to comply with the 248CMR: Uniform State Plumbing Code. The William E. Norris Elementary School, built in the mid 1950's, has expanded over the years and the new additions have been equipped with water saving devices.

UNACCOUNTED-FOR WATER USE

Since meters have only recently been installed the amount of unaccounted-for water use in unknown at this time. The town may have estimates after the June reading.

PUBLIC EDUCATION PROGRAM

Southampton does not have a public education program however the Consumer Confidence report is made available annually. Industrial and commercial users receive annual inspections of their check valve devices and when problems are detected, users are given 14 days to make repairs and are then rechecked. As a result devices have been shown to leak internally but there have been no actual backflows.

LEAK DETECTION AND REPAIR

The Town has a full leak detection program which was just completed in December of 2004. The Water Department surveyed half the town east of White Loaf Mountain in one year and then did the other half west of the mountain the next year. The survey checked valves, hydrants, service connections, hydrant valves and main line valves. Leak detection surveys are completed in the fall and in the evenings when there is less noise and less foliage on the trees. There has been a big effort to locate mains out of travel lanes since the vibration from traffic contributes to breaks in older mains.

Leak detection and repair are included as an expense of the water system. Funds are set aside for regular maintenance and capital improvements. There are no funds set aside for emergency repairs. Under $5,000 is spent annually on leak detection and repairs.

METERING

As mentioned previously, meters were recently installed for the entire town covering 100 percent of the service accounts. This includes residential, public, industrial, and commercial users and totals about 1,100 meters. The Town of Southampton does not allow installation of a second water meter for outside use, per Water Department Regulations. Water system personnel use radio and touchpad to read meters. All public buildings are metered and billed for their water use. The Town will begin a regular metering program to include repairs, testing, replacement, calibration, and check for tampering. The residential meters keep accuracy for 10+ years. Master meters are calibrated every 2-3 years by Harbor Controls. Residential meters will be read quarterly and none have been replaced since they are all new. All two-inch commercial meters are also new and therefore have not been calibrated. The Water Department will monitor for metering irregularities and perform calibrations or meter replacements if necessary. Hydrants used by contractors for pipe flushing and/or construction are metered and billed for their use. There is also a fee of $1,550 per house for new water service connection and meter installation. Currently there are no funds set aside for regular repair and replacement but allocations will be built into the budget in time.

PRICING

The rate structure is based on an increased block system. Users pay $42 for the first 12,000 gallons, $42 for the next 12,000 gallons and $3.50 for every 1,000 thereafter. The bills are based on actual meter readings and the volume of water used is stated on the bill in gallons however the bills do not compare water use with use during the previous period. Bills for residential customers and larger users (2" meter or larger) are both sent quarterly. Before the new system was in place the pricing was done on a flat rate of $142, billed twice a year.

DEMAND MANAGEMENT AND EMERGENCY PLANNING

The town has no written plan describing water use reduction targets although there is a Water Use Bylaw, based on the DEP model bylaw. This bylaw, adopted in 2002, gives the Board of Water Commissioners the authority to declare a State of Water Supply Conservation and can impose restrictions, conditions or requirements limiting the outdoor use of water as necessary to protect the water supply. During a state of Water Supply Conservation, under this bylaw, filling swimming pools and use of automatic sprinklers is prohibited and outdoor watering is limited to certain periods or can be banned.
The town had not needed to implement any water restrictions since the drought in 2002.

Southampton's Water Supply Protection District is an effective tool for controlling potentially threatening land uses within the recharge area but it is not effective at regulating water usage. The District is an overlay district covering the Zone II and the Tighe-Carmody Reservoir watershed. The bylaw includes lists of prohibited uses, restricted uses and special permit uses.

Procedures for handling water emergencies are described in the Town's Comprehensive Emergency Management (CEM) Plan which outlines measures for mitigation, prevention, response and recovery in the case of a natural disaster. According to the CEM plan the DPW is responsible for coordinating with public health on water testing services and purification in the event of flooding or a dam failure. The Town also has a verbal agreement with Easthampton for mutual aid in the event of an emergency and has received water from them the past.

SOUTHAMPTON WATER CONSERVATION AND DEMAND MANAGEMENT RECOMMENDATIONS

The following recommendations are to assist Southampton 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 for the Barnes Aquifer to develop a regional water conservation and demand management program.

1. Conduct regular water audits of your system to determine where water can be saved and the effectiveness of existing water conservation practices. 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".

2. Distribute water saving devices and implement a water savings device rebate program. Seek grants through BAPAC to provide funding. Residential users account for the highest percentage of water consumption in Easthampton and should be a primary target for conservation efforts.

3. Develop a plan for installing water saving devices in public buildings. By retrofitting buildings with low flush toilets and faucet aerators, water usage can be significantly reduced. A detailed list of water saving devices is included in Section 2 of this report.

4. Implement a public education program which could include bill stuffers, public service announcements, public space advertising and demonstration gardens for xeriscaping. Another effective measure is to provide information on bills to compare current use with use during the same period the in the previous year. This allows homeowners and businesses to monitor their usage and would cost little to implement.

5. As part of the metering program, separate out residential from commercial use. This will allow the Water Department to more accurately calculate the residential gallons per capita per day. This will allow the Water Department to more accurately determine if they are under the 80 residential gallons per day threshold set by DEP under the Water Management Act.

SECTION 2 THE BARNES AQUIFER

The Barnes Aquifer supplies water to four municipalities within the Connecticut Valley of western Massachusetts including the cities of Westfield and Holyoke as well as the towns of Easthampton and Southampton. Currently 11 municipal wells supply 5 million gallons of water per day to 60,000 people in these communities. Due to its importance to the municipal water supply, it is useful to understand about the makeup of the aquifer and its shared relevance in the region it serves.

The water is held within sand and gravel deposits which were layed down approximately 14,000 years ago by a retreating continental glacier. Meltwater streams flowing off the ice deposited sands and gravels into glacial Lake Hitchcock. This area has been covered by continental glaciers numerous times during the last 2 million years since the Pleistocene Epoch. The Laurentide ice sheet last covered the area approximately 15,000 years ago. This ice sheet was centered at Hudson Bay, Canada and extended south to Long Island, New York.

The Barnes Aquifer is made up of sediment deposited by meltwater streams flowing off the glacier of the Pleistocene Era. Melting of the continental glaciers produced huge quantities of water and sediment. Meltwater streams were effective in sorting the sediment eroded by the ice. The silt and clay material was transported into lakes or carried all the way to the sea while the sand and gravels were deposited within the channels and floodplains of the meltwater streams or in deltas at the margins of glacial lakes. When the glaciers left the area, the meltwater streams dried up and the sorted sands and gravels were left behind.

As the ice front retreated northward up the Connecticut River Valley, a large glacial lake formed at the ice front. This lake was dammed by glacial sediment filling the valley near New Britain, Connecticut. At its maximum, this lake, now known as Lake Hitchcock, extended from central Connecticut northward to St Johnsbury in Vermont. Meltwater streams emerging from the ice at the snout of the glacier deposited sands and gravels into the lake in the form of ice-contact deltas. The size of these deltas was controlled by the size of the meltwater stream and the amount of time the ice front remained at any one place.

The ice front paused or retreated very slowly as it moved across the Westfield, West Holyoke, Southampton and southern Easthampton area. This allowed the building of a large delta whose sediments form much of the Barnes Aquifer (Stage 1). The ice front began to retreat much more rapidly as it moved north of the Plains area of Easthampton. During the more rapid retreat of the ice, meltwater streams emerging from the ice into the lake did not have time to build a delta. Instead, sands and gravels were deposited as a relatively thin apron at the bottom of the lake (Stage 2). After the ice front retreated north of Easthampton, these sands and gravels were buried by glacial lake sediments composed of alternating bands of silty sand and clay (varves). These lake sediments extend up the sides but not over the tops of the deltas (Stage 3). Eventually the sediments which dammed Lake Hitchcock were eroded and the lake catastrophically drained exposing the

sediments which make up the Barnes Aquifer.

The Barnes Aquifer is an extensive, buried-valley outwash formation believed to lie along the course of the pre-glacial Connecticut River. These sand and gravel deposits form a highly transmissive aquifer favorable for development of well supplies. The Barnes Aquifer runs north-south through Southampton, Westfield, Easthampton, the southern end of Northampton, and the western edge of Holyoke. There is generally considered to be a groundwater flow divide in the area of the Hampton Ponds in Westfield such that groundwater north of the Hampton Ponds tends to flow north and groundwater to the south of the Hampton Ponds tends to flow south to the Westfield River. The aquifer is underlain by a nearly continuous sheet of till which overlies bedrock composed primarily of the sandstone formation New Haven Arkose. The aquifer ranges in thickness from 50 to 250 feet providing an abundant depth for well development (Dufresne-Henry, 1990). The saturated thickness of the aquifer decreases toward the western and eastern edges of the aquifer and to the south.

The Barnes Aquifer in Easthampton is combined of both confined and unconfined sections. In the northern half of Easthampton, fine grained lake bottom sediments deposited by Glacial Lake Hitchcock are most prevalent extending northerly from Plain Street towards Northampton and the Connecticut River (IEP, 1987). The finer deposits are characterized by thin beds of silt or fine sand alternating with variable thicknesses of clay. These varved clay layers, as they are called, form a major confining layer influencing the Nonotuck Park well site (IEP, 1987). Thickness of varved clays observed in boring logs performed by IEP in 1987 as part of the Aquifer Land Acquisition Study range between 61 and 100 feet. The unconfined southern portion of the aquifer in Easthampton is the major recharge zone for the confined aquifer in the central and northern portions of the aquifer in Easthampton.

The Town of Southampton operates one municipal well known as the College Highway Well. The hydrogeology of the aquifer in Southampton is also one of confined and unconfined substrates as identified in the 1987 Southampton Aquifer Protection Study performed in 1987 by Wehran Engineering. The lower sand and gravel aquifer is overlain by a lacustrine clay deposit which results in confined aquifer conditions throughout all of the College Highway Well Zone I and most of the Zone II. The majority of recharge to the Southampton's aquifer is from the west in the area overlain by glacial fluvial sands known as the Pomeroy Recharge Area, and possibly to a lesser extent other coarse grained glacial fluvial deposits located south and southeast of the well.

The City of Westfield has developed six wells in the Barnes Aquifer. Well yields in Westfield are estimated to range between 75,000 gpd/ft (10,000 ft^2/day) and 135,000 gpd/ft (18,000 ft^2/day) (Dufresne-Henry, 1989).

SECTION 3 WATER CONSERVATION STRATEGIES FOR THE BARNES AQUIFER

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. This section discusses many tools and strategies for implementing a comprehensive demand management program for consumers.

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 ordinance.

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 implement 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 that 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 (gpf) 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 plan 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 the 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. Table 1

includes a list of drought tolerant native perennials, shrubs, trees and vines that can be used as a planting palette.

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 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.

Tensiometer

A tensiometer is a soil water measuring device that is sensitive to soil water change and useful 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 2

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.

Garden and Landscape 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

Massachusetts Water Resources Commission Water Conservation Plan for Water Suppliers

THE COMMONWEALTH OF MASSACHUSETTS
WATER RESOURCES COMMISSION

Water Conservation Plan for Public Water Suppliers

PLEASE TYPE OR PRINT

Water Supply Agency/Company Name: Southampton Water Department

Street: 8 Fomer Road PO Box 379 City/Town: Southampton Zip Code: 01073

Contact person/Title : Joe Slattery / Ed Cauley Telephone number: (413)527-3666

PWS ID#: 1276000 Date completed _____

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

A. General Information:

1. Residential Population served: 1021 Number of service connections: 1,012
2. Please give the volume and percentage of total water used by each type of customer.

	MGD or MGY	%	
a.	_____	_____	Agriculture
b.	14,984	_____	Commercial
c.	14,984	_____	Industrial
d.	14,984	_____	Municipal
e.	689,264	_____	Residential
f.	_____	_____	Sales to other public water suppliers
g.	_____	_____	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.	_____	_____	Institutional/tax exempt
i.	not known	_____	Unaccounted-for* See Section B for definition
j.	14,984	_____	Other: please specify:

_____

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

4. What is the residential gallons per capita per day (gpcd) for your system? 127 – includes commercial

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: Easthampton Arrangement: 1 solid – pipes connected & 1 hose connection

Community: _____ Arrangement: _____

Yes **No** 6. Do you have interconnections planned with other communities?

a. With which community(ies)? Some discussion of about pipeline in Hampton Ponds area - Westfield

b. When will interconnections be completed for each? _____

c. What is the planned arrangement with that community(ies)?

_____

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? Calibrate master meter every 2-3 years

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".)*

Leak detection – 50% one year, 50 % the next year for valves, hydrants, service connections, hydrant valves, and mainline valves. Has been effective – leads to annual repairs.

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.)

Need a plan

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
William E Norris Elementary School, K-6 addition – complies with new plumbing codes

10. Describe any other conservation efforts you are undertaking or planning to undertake:
Meter installation completed in December 2004

11. What is approximate cost per year of your conservation efforts, including personnel costs $400,000 – installation of meters

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

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 unknown %.

2. Describe the "unaccounted-for" water in your system for the last three years, and how you determined it. _____
May have estimates after June reading

3. Describe your current and ongoing efforts to lower the Town's unaccounted-for water use. _____

4. Please estimate the percentage of raw water that is lost in treatment, that is: (raw water – finished water)/raw water).
_____.

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.____ Bill stuffers. How often mailed?

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

c.____ School materials

d.____ Speakers for community groups

e.____ Conservation information center

f. ____ Public space advertising

g. ____ 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

Comments/Other: _____

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

Consumer Confidence Report made available annually
Industrial and commercial users – backflow prevention, annual inspection of check devices

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

Detected device problems – given 14 days to repair, then rechecked
Devices leaked internally but no actual backflows

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

The goal with quarterly reading is to contact users with large jumps in usage in a given quarter to get a better handle on the system.

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? December 2004
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;
Conducted by water department - surveys half the town east of White Loaf Mtn and then the other half west of White Loaf. Done in the fall and in the evenings.

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?_____

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? Maintenance and capital improvements

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

3c. Provide an estimate on how much is spent on leak detection and repairs annually or per survey? Under $5,000 (per year or survey)

E. Metering:

1. What percent of your total service accounts are metered? 100 %.
2a. List the number of operable meters in your system? 1,100+/-

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? Radio and touchpad

4. List the percentage of users metered by category:

Residential 100 % Industrial 100 % Commercial 100 %
Public 100 % Other %

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:

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

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

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

a. *If yes*, by whom Harbor Controls

b. Provide the most recent date each master meter has been calibrated: every 2 -3 years

c. *If no*, how often? _____

10. How often are residential meters read? Quarterly replaced? _____

11. How often are large user (2" or larger) meters tested or calibrated? All new meters, not addressed yet – will look for irregularities

Yes **No** 12. Do you meter water from hydrants used by contractors for pipe flushing and/or construction? New house - $1,550
Yes **No** Do you bill for this use?

Yes **No** 13. Do you use an automatic meter reading system? Radio and touchpad

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? $ System brand new – will be built into budget in time.

F. Pricing:

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

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

a._____ Watershed purchase/protection
b._____ Well site purchase/protection
c._____ 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._____ Leak detection
m._____ Pumping
n._____ Maintenance
o._____ Hiring of staff
p._____ 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. _____ Flat rate b._____ Increasing block c._____ Decreasing block
d. _____ Seasonal e._____X___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 Quarterly
Sewer _____
6b. How often are bills sent to large users (2" meters or larger)? Water Quarterly
Sewer _____

Yes **No** 7. Is your rate structure regularly evaluated?
How often? New system – before $142 flat rate, semi-annually
When was your rate last changed?

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
$42 per 12,000 gal.	$ _____ per
$4 per next 12,000 gal. &	

	$3.50 every 1,000 gal thereafter	

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?

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:

Aquifer overlay district

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

Only a town-wide plan: First priority – establish power to Town Hall / second priority – water facilities- pump and treatment

Yes **No** 5. Do you have a Drought Management Plan?
If yes, describe your plan: Water use restriction bylaw

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.

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:

Water use restriction bylaw

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:

9. When was the last time you needed to implement water restrictions or water bans? 3 years ago

10. What actions were taken at that time? How long were these measures in place? Voluntary outdoor water reduction

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

Automatic Lawn Irrigation System Bylaw, Andover, MA

TOWN OF ANDOVER, MASSACHUSETTS
CHAPTER 177 – WATER – ARTICLE II
AUTOMATIC LAWN IRRIGATION SYSTEM BYLAW

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.

Southampton Water Supply District

WATER SUPPLY DISTRICT

A. Purpose of District

To promote the health, safety and welfare of the community by protecting and preserving the surface and groundwater resources of the Town and the region form any use of land or buildings which may reduce the quality of its water resources.

B. Definitions

1. **AQUIFER :** Geologic formation composed of rock or sand and gravel that contains significant amounts of potentially recoverable potable water.

2. **GROUNDWATER :** All water found beneath the surface of the ground.

3. **HAZARDOUS WASTE :** A waste which is hazardous to human health or the environment. Hazardous wastes have been designated by the U.S. Environmental Protection Agency under 40 CFR 250 and the Regulations of the Massachusetts Hazardous Waste Management Act, Massachusetts General Laws, Chapter 21C.

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

5. **LEACHABLE WASTES :** Waste materials including solid wastes, sludge and pesticide and fertilizer wastes capable of releasing water-borne contaminants to the environment.

6. **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 and private water wells.

7. **TRUCKING TERMINAL :** Business which services or repairs commercial trucks which are not owned by the business.

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

C. Scope of Authority

The Water Supply Protection District is an overlay district and shall be superimposed on the other districts established by this bylaw. All regulations of the Town of Southampton Zoning Bylaw applicable to such underlying districts shall remain in effect, except that where the Water Supply Protection District imposes additional regulations, such regulations shall prevail.

D. District Delineation

1. The Water Supply Protection District is herein established to include all lands within the town of Southampton lying within the primary recharge areas of groundwater aquifers and watershed area of the Manhan Reservoir which now or may in the future provide public water supply. The map entitled `Water Supply Protection District', Town of Southampton, 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 hydro geologist to determine more accurately the location and extent of an aquifer or primary recharge area, and may charge the owner(s) for all or part of the cost of the investigation.

E. Prohibited Uses

1. Business and industrial uses, not agricultural, which manufacture, use, process, store, or dispose of hazardous materials or wastes as a principal activity, including but not limited to metal plating, chemical manufacturing, wood preserving, furniture stripping, dry cleaning, and auto body repair, or which involve on-site disposal of process waste waters.

2. Trucking terminals, bus terminals, car washes, motor vehicle gasoline sales, automotive service and repair shops.

3. Solid waste landfills, dumps, auto recycling, junk and salvage yards, with the

exception of the disposal of brush or stumps.

4. Underground storage and/or transmission of petroleum products excluding liquefied petroleum gas.

5. Outdoor storage of salt, de-icing materials, pesticides or herbicides.

6. Dumping or disposal on the ground, in water bodies, or in residential septic systems of any toxic chemical, including but not limited to septic system cleaners which contain toxic chemicals such as methylene chloride and 1-1-1 trichlorethane, or other household hazardous wastes.

F. Restricted Uses

1. Excavation for removal of earth, sand, gravel and other soils shall not extend closer than five (5) 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.

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

2. The use of sodium chloride for ice control shall be minimized, consistent with the public highway safety requirements.

3. Salt storage areas shall be covered and be located on a paved surface, with berms to prevent run-off from leaving the site.

4. Commercial fertilizers, pesticides, herbicides, or other leachable materials shall be used with all necessary precautions to minimize adverse impacts on surface and groundwater, and shall not result in groundwater concentrations exceeding Massachusetts Drinking Water Standards.

5. Above-ground storage tanks for oil, gasoline or other petroleum products shall be placed in a building in a concrete basement or on a diked, impermeable surface sufficient to contain the volume of the tank plus 10% to prevent spills or leaks from reaching groundwater. Floor drains shall be plugged to prevent discharges of leaks.

G. Drainage

1. For commercial and industrial uses, to the extent feasible, run-off from impervious surfaces shall be recharged on the site by being diverted toward areas covered with vegetation for surface infiltration. Dry wells shall be used only where other methods are infeasible, and 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(s).

H. Special Permit Uses

1. Uses Allowed by Special Permit

The following uses may be allowed by Special Permit obtained from the Board of Appeals:

a. Commercial and industrial uses which are allowed in the underlying district;

b. Any enlargement, intensification or alteration of an existing commercial or industrial use;

c. The rendering impervious of more than 20% of any single residential lot.

2. Requirements for Special Permit in the Water Supply Protection District

The applicant shall file six (6) copies of a site plan prepared by a qualified professional with the Board of Appeals. The site plan shall at a minimum include the following information where pertinent.

a. A complete list of chemicals, pesticides, fuels and other 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 Board of Appeals, Hazardous Materials Coordinator, Fire Chief, and Board of Health which shall include:

(1) Provisions to protect against the discharge of 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 Massachusetts Hazardous Waste Management Act 310 CMR 30, including obtaining an EPA identification number from the Mass. Department of Environmental Quality Engineering.

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

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

3. Additional Procedures for Special Permit in the Water Supply Protection District

a. The Board of Appeals shall follow all special permit procedures contained in Section XI.

b. The Board of Appeals may grant the required special permit only upon finding that the proposed use meets the following standards and those specified in Section XI of this bylaw. The proposed use must:

(1) in no way, during construction or thereafter, adversely affect the existing or potential quality or quantity of water that is available in the Water Supply Protection District, and;

(2) be designed to avoid substantial disturbance of the soils, topography, drainage, vegetation and other water-related natural characteristics of the site to be developed.

c. The Board of Appeals 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 positive findings in relation to the standards given in Section VII-H-3(b).

I. Non-conforming Use

Non-conforming 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 bylaw may be continued. Such non-conforming uses may be extended or altered, as specified in M.G.L. Ch. 40a, Sec. 6, provided that there is a finding by the Board of Appeals that such change does not increase the danger of surface or groundwater pollution from such use.

Southampton Water Use Bylaw

Section 1 *Authority*

This Bylaw is adopted by the town of Southampton under its police powers to protect public health and welfare and its powers under MG.L. c.40, §§21 et seq. And implements the Town's authority to regulate water use pursuant to M.B.L. c. 41, §69B. This by-law also implements the Town's authority under M.G.L. c. 40 § *41A,* conditioned Upjohn a declaration of water supply emergency issued by the Department of Environmental Protection.

Section 2 *Purpose*

The purpose of this by-law is to protect, preserve and maintain the public health, safety and welfare whenever is in force a State of Water Supply conservation or State of Water Supply Emergency by providing for enforcement of any duly imposed restrictions, requirements, provisions or conditions imposed by the Town of Southampton or by the Department of Environmental Protection.

Section 3 *Definitions*

Person shall mean any individual, corporation trust, partnership or association, or other entity.

State of Water Supply Emergency shall mean a State of Water Supply Emergency declared by the Department of environmental Protection under M.G.L. c. 21G, § 1 5-17.

State of Water Supply Conservation shall mean a State of Water Supply Conservation declared by the Town pursuant to section 4 of this by-law.

Water Uses or Water Consumers shall mean all public ~d private users of the Town's public water system, irrespective of any person's responsibility for billing purposes for water used at any particular facility.

Section 4 *Declaration* of a *State* of *Water Supply Conservation*

The Town of Southampton. acting through its Board of Water Commissioners, may declare a State of Water Supply Conservation Upjohn a determination by a majority vote of the Board that a shortage of water exits and conservation measures are appropriate to ensure an adequate supply of water to all water consumers. Public notice of a State of Water conservation shall be given under section 6 of this by-law before it may be enforced.

Section 5 *Restricted Water Uses*

A declaration of a State of Water Supply Conservation shall include one or more of the fol1owing restriction, conditions, or requirements limiting the use of water as necessary to protect the water supply. The applicable restrictions, conditions or requirements shall be included in the public notice required under section 6.

a) Odd/Even Day Outdoor Watering: Outdoor watering by water users with odd numbered addresses is restricted to odd numbered days. Outdoor watering by water users with even numbered addresses is restricted to even numbered days.
b) Outdoor Water Ban: Outdoor watering is prohibited.

c) Outdoor Watering Hours: Outdoor watering is permitted only during daily periods of low demand, to be specified in the declaration of a State of Water Supply Conservation and public notice thereof.

d) Filling Swimming Pools: Filling of swimming pools is prohibited.

e) Automatic Sprinkler Use: The use of automatic lawn sprinkler system is prohibited.

Section 6 Public Notification of a State of Water Supply Conservation; Notification of DEP

Notification of any provision, restriction, requirement or condition imposed by the Town as part of a State of Water Supply Conservation shall be published in a newspaper of general circulation within the Town, or by such other means reasonably calculated to reach and inform all users of water of the State of Water Supply Conservation,. Any restriction imposed under section 5 shall not be effective until such notification is provided. Notification of the State of Water Supply Conservation shall also be simultaneously provided to the Massachusetts Department of Environmental Protection.

Section 7 Termination of a State of Water Supply Conservation; Notice

A State of Water Supply Conservation may be terminated by a majority vote of the Board of Water Commissioners, upon a determination that the water supply shortage no longer exists. Public notification of the termination of a State of Water supply conservation shall be given in the same manner required by section 6.

Section 8 State of Water Supply Emergency; Compliance with DEP Orders

Upon notification to the public that a declaration of a State of Water Supply Emergency has been issued by the Department of Environmental Protection, no person shall violate any provision, restriction, condition of any order approved or issued by the Department intended to bring about an end to the State of Emergency.

Section 9 Penalties

Any person violating this by-law shall be liable to the Town in the amount of $25.00 for the second violation and $50.00 for each subsequent violation which shall inure to the Southampton Water Department Enterprise Fund for such uses as the Board of Water Commissioners may direct. A warning shall be given for the first violation. Fines shall be recovered by non-criminal deposition in accordance with section 21 D of chapter 40 of the general laws. Each day of violation shall constitute a separate offense. On the forth violation the Water Department may throttle the offending water service to reduce flow of water to the water consumer until accommodation is reached.

Section 10 Severability

The invalidity of any portion or provision of this by-law shall not invalidate any other portion or provision thereof.