495/MetroWest Water Resources Strategy

THREE-TOWN ASSABET WATER SUPPLY PROJECT

Acton, Massachusetts: Final Report

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Foreword

As one of the state's most significant "economic engines," the 495/MetroWest corridor is home to many high technology firms, and is also experiencing rapid residential growth. This growth brings with it challenges for the management and protection of water resources and provision of adequate water and sewer infrastructure. To address these issues, the Metropolitan Area Planning Council (MAPC) and the 495/MetroWest Corridor Partnership are developing a Water Resources Strategy for the corridor. Funded by a grant from the Environmental Protection Agency that was secured by Congressman James McGovern, the project is developing innovative approaches to addressing water resources challenges facing the communities, businesses, and citizens in the 495/MetroWest corridor.

The strategy includes the following components:

WATER RESOURCES INDICATORS

MAPC is developing a database of key indicators of the status of the corridor's water resources, including:

Water Supply Indicators

- Trends in Average Day & Maximum Day Water Demand
- Unaccounted-for water & Per Capita use
- Projected 2030 water demand

Wastewater Indicators

- Wastewater flow trends & projected to 2030
- Effluent quality issues: discharge limitations
- Corridor-wide summary of local wastewater management plans.

Storm Water Indicators

- Impervious land use analysis for 1999 existing land use and projected for year 2030

HYDROLOGIC MODELING FOR THE ASSABET AND CHARLES RIVER

Working with the US Geologic Survey (USGS), the project is analyzing alternative water supply and storm water scenarios for communities in the upper Charles River and Assabet River watersheds.

BEST PRACTICES IMPLEMENTATION AND TECHNICAL ASSISTANCE

Low Impact Development Outreach / Technical Assistance
A *Low Impact Development Tool Kit* was published and is available at www.mapc.org/lid.

Leak Detection Technical Assistance
MAPC has developed a regional services contract to make leak detection services available to communities in the 495/MetroWest area at the lowest possible cost.

Water Reuse Outreach / Technical Assistance
A *Guide to Water Reuse in Massachusetts* was published and is online at www.mapc.org/waterreuse.

Water Supply Strategy for High-Growth Towns in the Assabet Watershed
MAPC has identified strategies for meeting future water demands in three towns in the Assabet River watershed that are experiencing growth of water demand.

Peak Water Use Reduction Program
SummerSmart Water Use: A Guide to Peak Season Water Demand Management for Massachusetts Communities was published and is online at www.mapc.org/peakdemand.

Acknowledgements

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Executive Summary

Community Profile

The Town of Acton is located entirely within the Assabet River watershed, with 8% of the Town in a high stress portion of the watershed and the remaining 92% in a medium stress portion of the watershed. The Town straddles several sub-basins, with most of the Town in the Nashoba Brook and Fort Pond Brook sub-basins, and smaller portions in the Spencer Brook sub-basin and the Assabet Lower Main Stem sub-basin.

Since World War II, Acton has been primarily a suburban bedroom community with nearly half of the town's land in residential use, and just 7 percent in commercial or industrial use. Acton's land use pattern today consists both highway-oriented commercial areas and traditional village centers in West and South Acton and a rural town common in the center. Single-family homes account for about 60 percent of all dwelling units, and more than 80 percent of residentially developed land, with new single-family homes increasing in both size and value in recent years. Acton has limited remaining land available for development. In 1998, the Town estimated the likely residential buildout at roughly 10,200 total dwelling units (an increase of 2520 from the year 2000). The non-residential buildout was estimated at a total of 8.38 million square feet (MSF) of floor area – an increase of 3.68 MSF (78%) over their existing total.

Acton's population doubled in the 1950s and again in the 1960s. Population growth slowed through the 1970s and 1980s, but picked up again in the 1990s, with the population reaching 20,331 in 2000. Projections from both the Metropolitan Area Planning Council and the Town show continued growth through 2030, adding roughly another 3000 residents in that time. Employment in the Town increased 18% from 1990-2000, but then decreased 16% from 2000-2004. The town's employment is projected to grow over the next several decades, adding almost 2,300 new jobs by 2030. Most of the growth is projected in the service sector, particularly financial and business services.

Town Plans, Policies, and Regulations

The Town's most recent Master Plan and Open Space and Recreation Plan list as top priorities slowing residential growth, encouraging economic development, protecting the environment, preserving the remaining elements of Acton's rural character, and improving recreational opportunities. The OSRP names water as the town's greatest environmental problem, because inadequate water supplies may limit growth. The Town wants to reduce residential water consumption to increase the capacity available for commercial uses and protect source water quality through preservation of open space and ecologically sensitive development.

The Town of Acton's regulations governing land use include several regulations intended specifically to protect water resources. A hazardous materials control by-law protects surface water and ground water by controlling handling and discharge of hazardous materials. The groundwater protection overlay district protects groundwater by regulating uses near water supplies and establishing landscape requirements for lots in Zones 1 and 2. Additionally, throughout the town, the bylaws state that levels of groundwater recharge and storm water runoff

must match pre-development levels for a 10-year storm, and runoff from impervious surfaces must be treated by gas trap catch basins and retention ponds to catch the first inch of rainfall.

In addition to the bylaws dealing directly with water resources, there are several other important town regulations that impact water resources, including minimum lot size requirements, provisions for Open Space Residential Development, commercial lot coverage regulations, and parking requirements. Over 40% of Acton's residential land is zoned for lots of close to 2 acres or more. Large lots tend to have large lawns, which produce a high peak water demand in summer. Acton also has two provisions for residential development that preserve open space and may reduce irrigation demand: Open Space Development and Planned Conservation Communities. Both are for residential developments and have requirements for common land of between 30% and 60% of the tract area. Acton's commercial lot coverage requirements are fairly low, and many commercial and industrial districts have requirements for open space. The Town's parking requirements are lower than those of many suburban communities, and provide for shared parking where there is a mix of uses and allow small car spaces for some uses and reductions for carpool/vanpool programs.

Acton's drainage and landscaping requirements show good intent, but may prevent the use of Low Impact Development (LID) techniques that can allow for infiltration, and in some cases treatment, of storm water. The Subdivision Rules and Regulations for Acton specify that drainage must be provided through a catch basin and manhole system. They also state, though, that street drainage may not be channeled into a wetland or water body without first passing through a vegetated detention basin to reduce pollution. There are landscaping requirements for some parking lots and for the center of cul-de-sacs. Both set standards for the depth of loam, which improves water retention, and for low-maintenance, climate-adapted plans, but prevent the use of LID techniques.

Water Supply System

Water System Profile

The Acton Water District is the public water supplier for roughly 95% of Acton residents. Approximately 500 parcels are served by private wells, which are required to be bedrock wells and must be permitted through the Board of Health. The Acton Water District obtains water from 21 groundwater wells, and has a total Water Management Act regulated annual withdrawal volume of 1.94 mgd for 2006. The District is proposing to reactivate an existing well on the W.R. Grace Superfund site and to build a replacement water treatment plant to treat the water from this well and two others. There are five existing treatment plants in the Water District system. The total pumping capacity of the system adds up to 4.13 mgd, but the physical capacity of the system to produce water is roughly 3.4 mgd if the whole system is running at its maximum. The District also has a total of 8.5 million gallons of finished water storage capacity, with an estimated usable storage capacity of 3.93 million gallons.

Water Rate Structures

Acton's water rates use a combination inclining block and seasonal rate structure, in which the price of water is higher at higher usage levels, with higher rates in the summer months. Currently, customers are billed biannually, but as of March 2007, the District will be increasing the rates and billing quarterly.

Current Water Use Trends
The District exceeded their authorized withdrawal once in 2001, although this was due to an open valve at the interconnection with Maynard. The average day demand has, on average, increased over the last 20 years, but it flattened out between 1997 and 2002 (except for 2001), and has dropped since. Recent reductions in total customer demand are likely attributable, at least in part, to water rate increases and continuing conservation efforts from the Acton Water District. The ratio of maximum day demand to average day demand has also decreased over time, though the maximum day demand has fluctuated significantly, reflecting the effort that the Water District has put into reducing summertime water use.

Projected Future Water Demand
Several efforts have been made recently to project the future water demand in the Town of Acton. The projections made for this project using town-specific data show that Acton's water consumption may surpass the currently permitted level between 2020 and 2025 if water consumption trends continue. If the Water District's conservation efforts and water efficient technology overcome the trend towards larger houses, lawns and irrigation systems and more affluent residents, water use could stay below the currently permitted amount through 2030.

Conservation and Demand Management
The Acton Water District has been aware for some time of the threat posed by growing water demand and high summer usage. To address these issues, the District has implemented a number of demand management initiatives, including:

- Water Impact Reports
- Outdoor Water Use Restrictions
- Irrigation System Regulations
- Promoting Sustainable Landscaping
- School Education Program
- Residential Water Audits
- Water Saving Devices
- New Resident Education
- Leak Detection
- Water Efficient Recreational Fields

The Water District credits these programs and the rate structure with recent decreases in water consumption.

Wastewater Treatment

The Town of Acton is served by a combination of onsite wastewater systems, cluster wastewater treatment systems, and public sewer. The majority (80%) of the Town's parcels use onsite wastewater treatment systems, 10% use cluster systems, and the remaining 10% are on public sewer. The Middle Fort Pond Brook Sewer System was brought online in February 2002, serving portions of South Acton. The Acton Wastewater Treatment Facility is located near the Assabet River mainstem in the southeast corner of the town; treated effluent is discharged to Rapid Infiltration Beds to recharge the underlying aquifer. The system is permitted for an average daily flow (ADF) of 299,000 (GPD), and a peak daily flow of 500,000 GPD. The 10% of the community not served by public sewer or onsite wastewater systems is served by a combination of privately owned package wastewater treatment facilities (WWTFs) and smaller common onsite wastewater systems.

The Town of Acton recently completed a Comprehensive Water Resources Management Plan, Phase II of which identified preferred and recommended solutions for 14 Needs Planning Areas.

Recommendations included connecting to existing sewers for small areas of West and South Acton, cluster or neighborhood systems for needs areas in East and North Acton, and Wastewater Management Districts for other Needs Planning Areas.

Storm Water Management Plan

Storm water management is critical to both water quality and water quantity issues, as runoff can contaminate surface waters and deplete groundwater. The Town of Acton completed a Storm Water Management Plan in 2003. The plan calls for implementation of certain Best Management Practices, and describes the Town's existing efforts, such as:

- Public outreach through the SuAsCo Watershed Association
- Surface water sampling
- Requirements for erosion control at construction sites, to be reviewed and updated
- Required treatment of first inch of runoff

The Plan recommends developing by-laws to maximize open space preservation and minimize impervious surfaces and direct runoff to wetlands; developing strategies to use structural BMPs to control runoff; inspecting storm water controls on private property; and incorporating MADEP standards regarding the discharge of untreated storm water from new developments into Acton's Subdivision Rules and Regulations.

Recommendations

Acton's water conservation programs already set a good example for surrounding towns, but because the water issues continue, particularly during the peak summer months, the Town and the Water District may need to implement more advanced conservation measures. The following recommendations provide some options that the Town or the Water District could pursue to further reduce their water consumption and improve groundwater recharge.

Conservation Incentives:

- Collect data on water use reductions due to water-efficient fixtures, audits, and other conservation programs as they are implemented.
- Send out seasonally appropriate water conservation tips to homeowners.
- Work more closely with commercial, industrial, and institutional users to reduce their water use. For example, develop an audit program for highest volume industrial and commercial users and/or for large non-residential landscapes; or assist in the development of water saving demonstration projects at private companies.
- Expand rebate programs to re-instate the washing machine rebate program and add rebates for water-efficient dishwashers, spray-rinse valves for restaurants, and toilet replacement. Offer installation assistance to the elderly and disabled through volunteers.

Rates and Metering:

- Convert water bill to gallons rather than cubic feet.
- Continue to gradually increase steepness of inclining block rates and/or increase summer rates on a regular schedule.
- Transition from quarterly to monthly billing.
- Implement selective irrigation sub-metering for automatic sprinklers connected to the public water supply.
- Meter and charge for water used by contractors for pipe flushing or construction.

Outdoor Water Use Restrictions:

- Reduce outdoor water use to one or two days per week during highest use periods.
- Set watering restrictions by neighborhood rather than by street number.
- Increase outdoor water use enforcement efforts.

Other Water District Actions:

- Make leak detection annual instead of bi-annual.
- Lower the threshold for Water Impact Reports and use them to require "water banking" – offsetting added demand through conservation measures elsewhere in the system.

Zoning and Bylaws:

- Implement a "retrofit-upon-sale" ordinance, requiring installation of water-efficient plumbing devices whenever any residential or commercial property is sold or transferred.
- Extend outdoor water use restrictions to private well users.
- Adjust requirements for cul-de-sac and parking lot island landscaping to allow bio-retention islands or other LID techniques, and alter drainage requirements in Subdivision Rules and Regulations to permit LID.
- Alter parking requirements to encourage shared parking for mixed uses; encourage use of small car spaces including for uses currently excluded; and encourage use of pervious paving materials for overflow parking areas where appropriate.
- In groundwater protection zones and near surface water bodies or other sensitive environmental resources, reduce minimum parking requirements and establish maximum parking allowances.
- Adjust Open Space Development bylaws to allow Open Space Development by right in residential zoning districts, offer at least a small density bonus, and allow flexible site design criteria.
- Implement regulations that promote water-efficient landscaping, such as requirements for loam or topsoil, encouraging the use of native plants, requiring a certain percentage of yard area be maintained with natural vegetation (for developments outside Zones 1 and 2), or limiting the allowable extent of automatic irrigation systems.

Other Municipal Actions:

- Incorporate Low Impact Development (LID) best practices for all municipal projects.
- Continue investigating the potential for reuse of highly treated wastewater and continue to prioritize groundwater recharge for future sewer expansions.

Conclusion

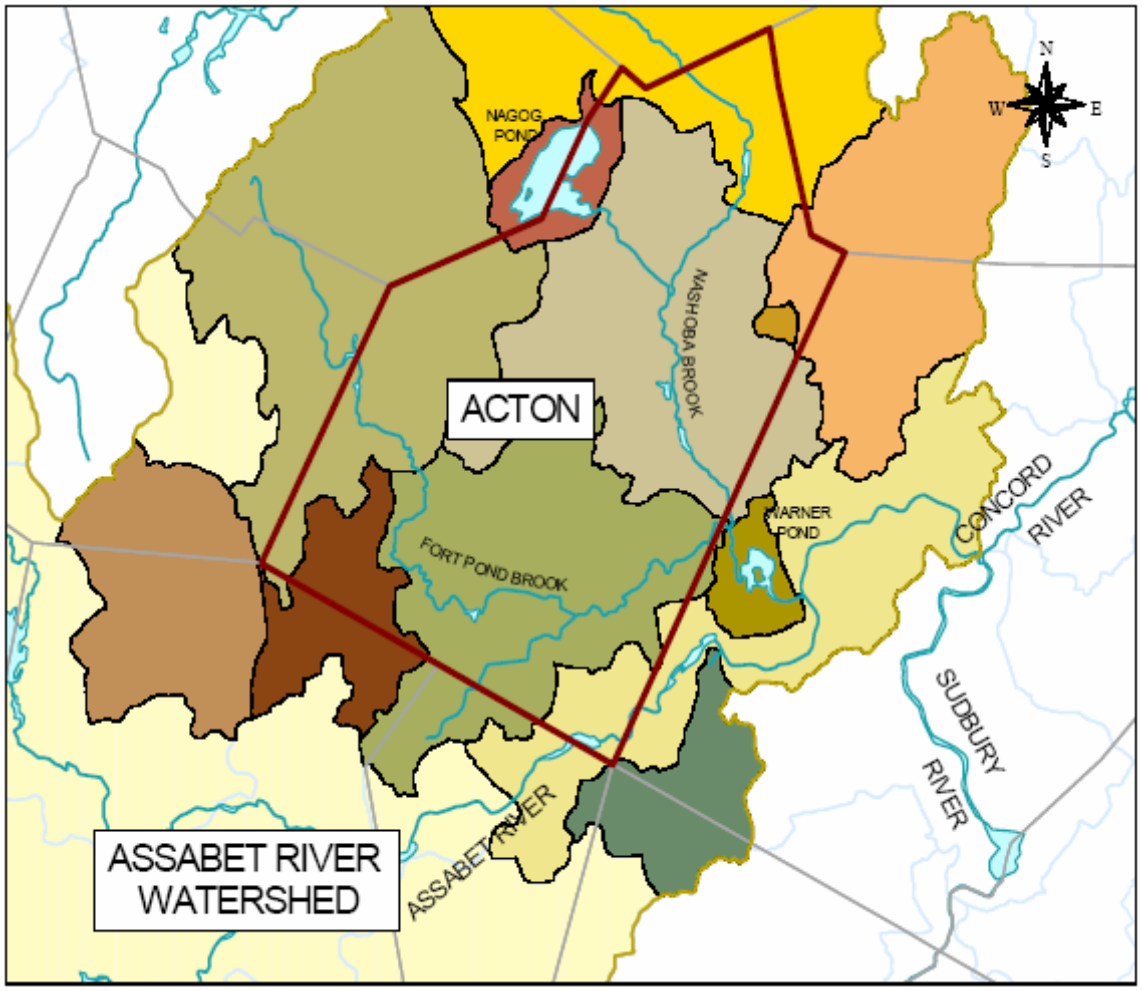
Due to the constraints on the water system in Acton, the Town and the Water District have already put a good deal of effort into reducing water consumption and ensuring adequate aquifer recharge. The effects of these efforts are visible in the lower water consumption in recent years. While both the Town and the Water District should celebrate and publicize their successes to date, they may need to go further in their conservation efforts in order to allow for continued growth, especially in the commercial sector. This may require implementing more advanced and challenging programs and regulations as the "low hanging fruit" begin to disappear, but their experience with public education and outreach efforts should help them move forward with community support.

I. Community Profile

A. Watershed context

The town of Acton is located entirely within the Assabet River watershed. Of the town's 20.3 square miles of land, 8% lies in a portion of the Sudbury-Assabet-Concord (SuAsCo) River Watershed that is classified as high stress by the Executive Office of Environmental Affairs, and the remaining 92% is in a medium stress portion of the watershed.[1] This designation reflects the relative quantity of stream flow within the SuAsCo watershed and its sub-basins in comparison to other watersheds in the state.

Figure 1: Assabet River Sub-basins. (Source: Woodard & Curran, Acton CWRMP Phase I, 2004)

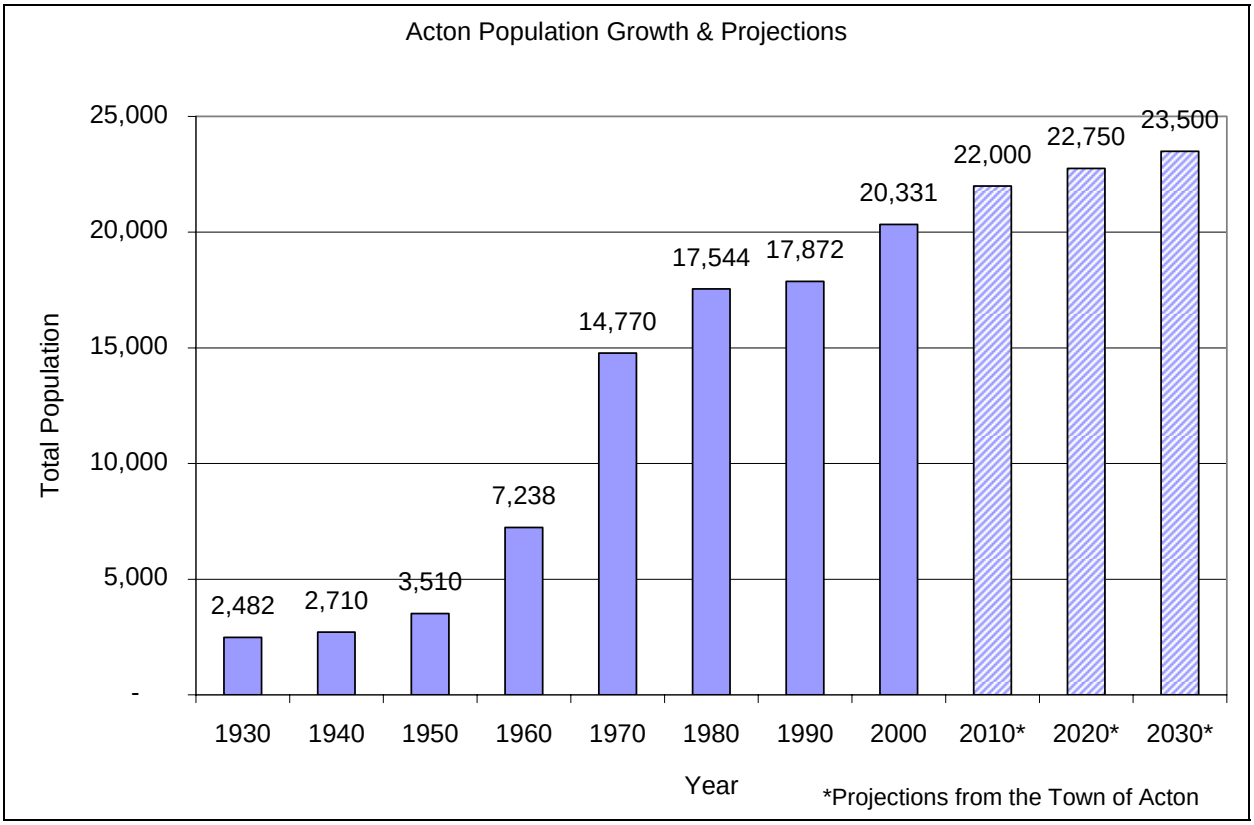


As shown in the map above, the town straddles several of the sub-basins, with somewhat less than half the town in each of the Nashoba Brook and Fort Pond Brook sub-basins, and smaller portions in the Spencer Brook sub-basin and the Assabet Main Stem Lower Sub-basin.

B. Population Trends and Projections

The town of Acton experienced rapid growth between 1950 and 1970, with the population doubling in 1950s and doubling again in the 1960s. The rate of growth slowed through the 1970s and 1980s, due in part to zoning changes that increased the minimum lot size.[2] The population increased by 18.7% from 1970 to 1980 and only 2% from 1980 to 1990. Residential development in town picked up again in the 1990s, with the population increasing 13.8% to 20,331 in 2000. The Metropolitan Area Planning Council (MAPC) is projecting continued but slowing population growth in Acton through 2030, with increases of 6.6% from 2000 to 2010 (to 21,663), 3.8% from 2010 to 2020 (to 22,487), and 2.9% from 2020 to 2030 (to 23,139). The town's own projections show Acton with a population of almost 22,000 by 2010, 22,750 by 2020 and 23,500 by 2030. These growth trends and the town's projections are shown in Figure 2.

Figure 2: Acton Population Growth and Projections.



The average household size decreased in the 1970s and 1980s as construction of apartments and condominiums, which generally have fewer bedrooms and attract smaller households than single-family homes, increased.[3] The household size increased slightly in the 1990s, but is projected to shrink again each decade from 2000 to 2030. This would mean that the number of housing units needed will continue to grow faster than the population, with MAPC projecting increases of 12.1% to 2010, 5.9% to 2020, and 4.6% to 2030 in housing units.

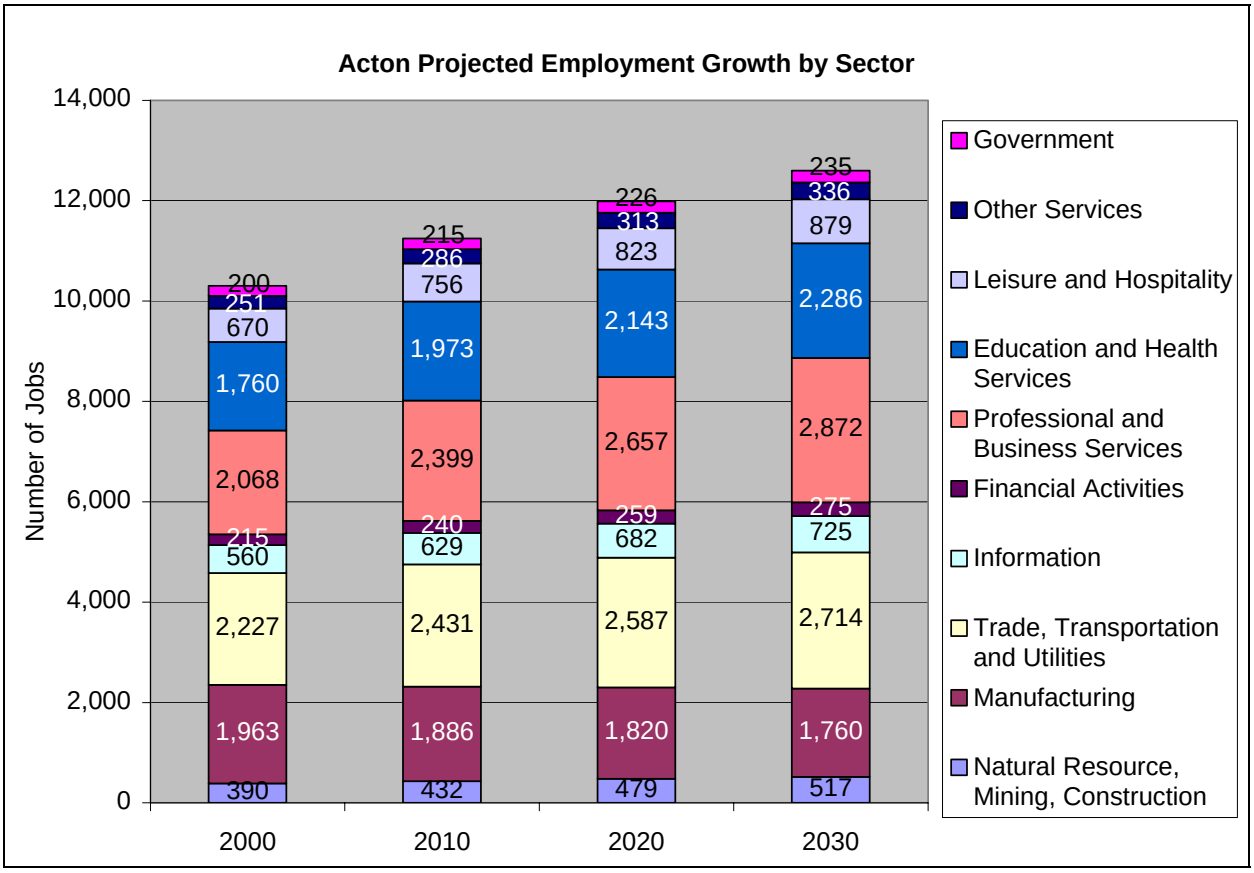
C. Employment Trends and Projections

Acton has been primarily a suburban bedroom community since after World War II, with a small employment base. The commercial and industrial sector made up 20% of the town's tax base from 1960s to the mid 1990s, and just 15% since the mid-1990s. Acton's employment increased 18.1% from 1990-2000, but then decreased 16.1% from 2000-2004. Employment trends from 1985 to 2004 are shown in Figure 3 below. [4]

Figure 3: Acton Total Employment 1985-2004.

MAPC is projecting the town's employment to grow over the next several decades, increasing from just over 10,300 to roughly 11,250 (an increase of 9.2%) between 2000 and 2010, growing another 6.6% to almost 12,000 in 2020, and an additional 5.2% to 12,600 in 2030. In total, Acton is expected to gain almost 2,300 new jobs by 2030. A graph illustrating projected employment growth by sector is shown in Figure 4.

Figure 4: Acton Projected Employment Growth by Sector



Most of the growth is projected in the service sector, particularly financial and business services, which are expected to add just over 800 new jobs by 2030. Education and health services jobs are also projected to increase significantly, from 1,760 in 2000 to almost 2,300 in 2030, an increase of roughly 30%. The only sector projected to decline is manufacturing.

D. Land Use summary

Acton is a suburban community with agricultural and village roots. Today it contains both highway-oriented commercial areas and traditional village centers in West and South Acton and a rural town common in the center. Acton is primarily a residential community, with nearly half of the town's land in residential use, compared to just 7 percent in commercial or industrial use. Single-family homes account for about 60 percent of all dwelling units, and more than 80 percent of the residentially developed land.

Acton's traditional land use pattern consists of clustered village center development surrounded by open spaces and residential neighborhoods. The historic village centers reinforce the town's link with it's past, and provide a mix of residential, commercial, public, and semi-public uses at a scale and density that create a strong pedestrian environment. West Acton Village in particular is a cohesive and active destination with a strong sense of place and a number of historic structures. The Town is working to maintain and strengthen the three remaining village centers

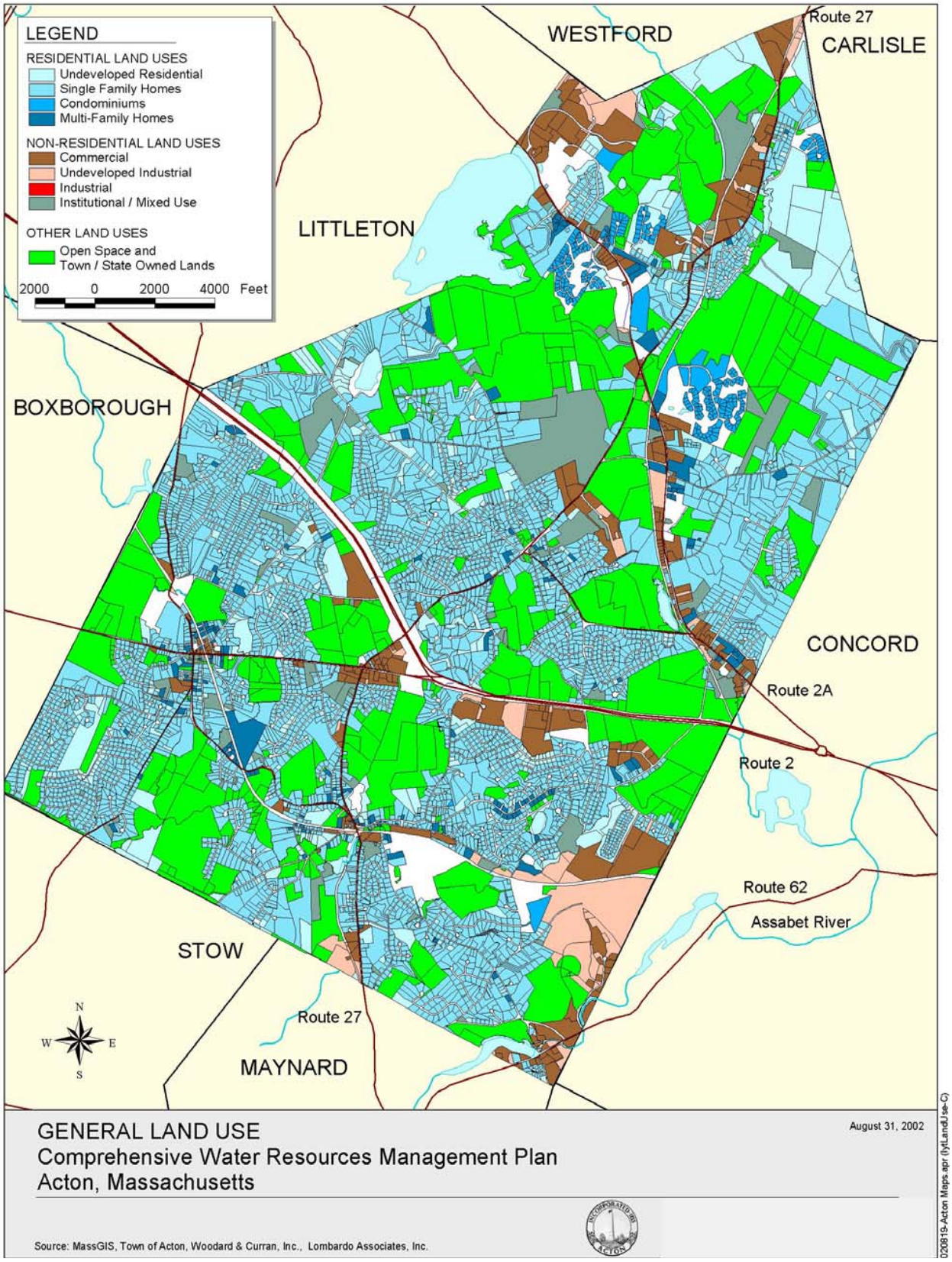
and reclaim a fourth in North Acton. During the 1970s and 1980s, highway-oriented development along I-495 and increasing development pressure transformed parts of Acton from farms and fields to subdivisions and shopping centers. Portions of Route 2A/119 in North Acton are intensively developed with commercial, office, and multi-family residential development. Despite the growth pressure, the village centers retain their historic character and the Town has protected significant open space.

Acton's village centers are surrounded by residential neighborhoods, predominantly single-family homes in subdivisions. This was the typical development pattern from the 1950s through the 1970s, with lot sizes ranging from half an acre to two acres, depending on the section of town. Construction of apartment buildings grew in the early 1970s, mostly along Route 2A in North Acton, but also scattered in parts of West and South Acton. Many of these units have since been converted to condominiums, either investor-owned or owner-occupied. In much of the town, frontage lots with older single-family homes from many time periods face the street, with gaps where newer roads ending in cul-de-sacs have been built. The newer roads are often long and wide and settled with newer, larger homes of a common design. Recent residential development has also included clustered developments in response to zoning that allows density bonuses and condominiums in return for preservation of open space in these developments. New single-family homes in Acton have increased in both size and value in recent years, with new homes typically valued between $500,000 and $750,000. The mean home value as of 2002 was $383,000, and the median home value was $350,000; both the mean and the median value increased by over $100,000 from the late 1990s to 2002.

Commercial development in Acton has changed from the mill industries of the 18th and 19th centuries to a wide range of modern industrial and commercial enterprises. Today, commercial development includes adaptive reuse in village centers as well as large scale developments such as Nagog Office Park. Commercial development is most dense in West and South Acton village centers, in Kelley's Corner, along Route 2A/119 in North Acton and along Route 2 in South Acton. Strip commercial development has proliferated along Route 2A and auto-oriented uses have come to dominate Kelley's Corner. The Town has been working to manage growth in Kelley's Corner more carefully since the 1991 Master Plan. [5]

A map illustrating land use as of 2002 is shown in Figure 5 on the following page. (Please note that some areas shown as "Institutional" are privately held lands, and may be vacant or developed for housing. Additionally, some parts of North Acton shown as undeveloped residential land are in fact developed or under development as of time of writing.)

Figure 5: Acton Land Use (Source: Woodard & Curran, Acton CWRMP Phase I, 2004)

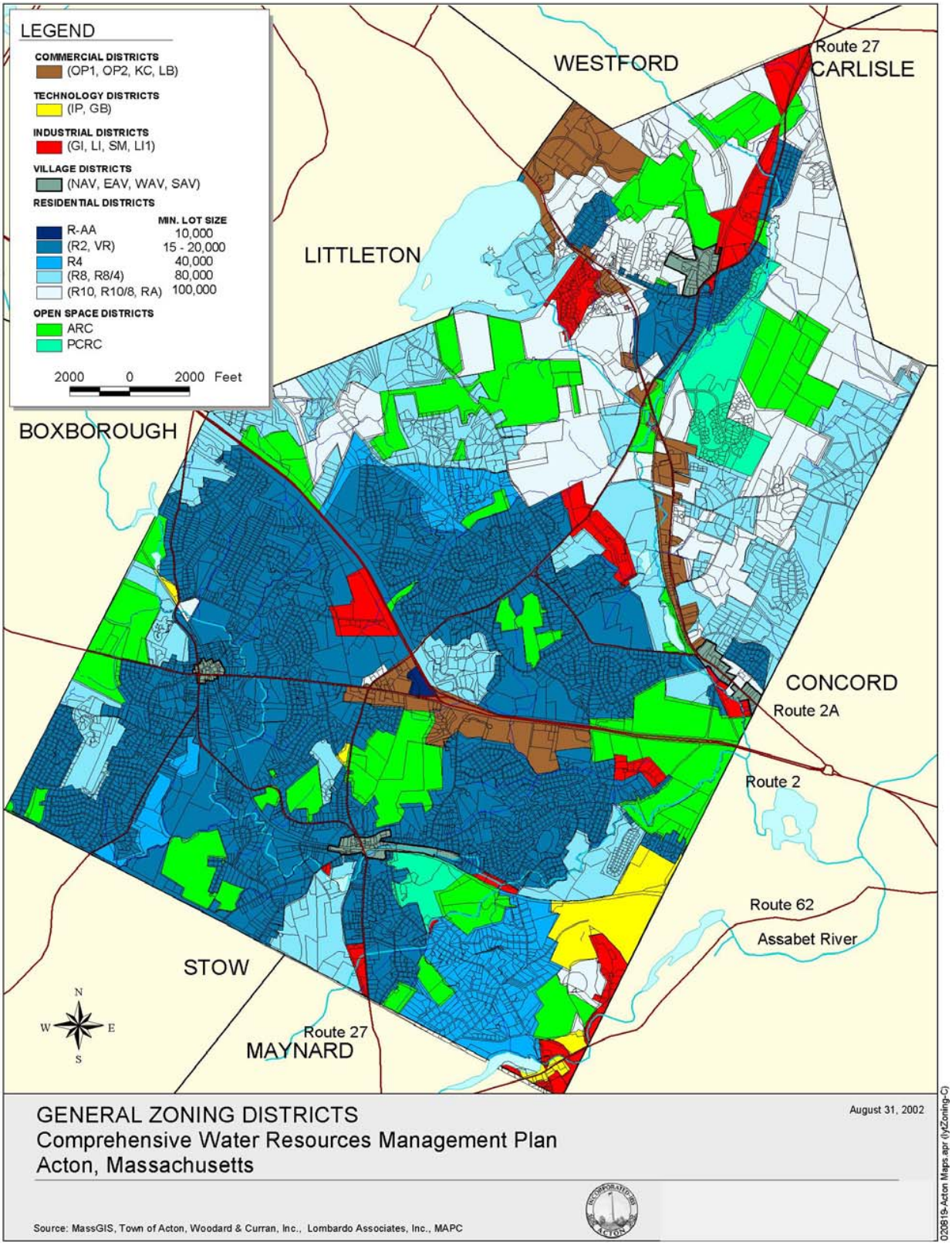


E. Potential future growth

The town of Acton has limited remaining land available for development, and is nearer to being built out to the level allowed by zoning than most of its neighbors. By 1998, when the Master Plan Update was written, the town had a total of 1,231 vacant acres (roughly 9.5% of the town's total acreage) zoned for residential use with a total capacity of roughly 1,100 housing units. The town estimated the "likely" residential buildout (assuming not all homeowners would be able to or choose to subdivide oversize lots) at roughly 10,200 total dwelling units, or 2520 more than there were in the year 2000. The non-residential buildout was estimated at a total of 8.38 million square feet (MSF) of floor area – an increase of 3.68 MSF (78%) over their existing total at the time of writing. Roughly 31% of the potential commercial growth is expected to come from development on open land, with the remainder coming from more intensive use of existing commercial and industrial sites, and conversion of some nonconforming residential uses to nonresidential use.[6]

Acton's zoning (as of 2002) is shown in the map in Figure 6 on the following page.

Figure 6: Acton Zoning (Source: Woodard & Curran, Acton CWRMP Phase I, 2004)



Please note that this map is not suitable for determining zoning applicability for a particular piece of property.

II. Town Plans, Policies, and Regulations

A. Summary of goals and recommendations from Master Plan

The top priorities expressed by the community in the 1998 Master Plan Update are to slow residential growth, encourage economic development, and protect the environment. Much of this stems from concerns over the rate and overall level of residential development, and its accompanying loss of open space, threats to natural resources, and increased demand for municipal services. Consequently, the goals laid out in Acton's Master Plan Update from 1998 show a desire to preserve the town's suburban character and rural roots while protecting the natural environment, expanding the commercial tax base, and diversifying the housing stock. Other town goals include providing high quality services, facilities, and recreational opportunities, and a safe, convenient transportation system that provides alternatives to the car. Some of the recommendations for accomplishing these goals include:

- Encourage residential open space development
- Encourage both residential and commercial development in the village centers
- Reduce the complexity and specificity of zoning regulations in commercial and industrial districts
- Promote affordable housing
- Encourage commercial development through revised zoning, incentives, marketing, construction of sewers, increasing the water withdrawal cap, etc.
- Improve wastewater treatment and integrate sewer system management with land use planning
- Continue and improve outreach and enforcement for environmental protection
- Promote groundwater protection and water conservation
- Acquire key open space parcels
- Plan for expansion of municipal facilities and services including public safety and schools
- Remove bottlenecks on major arterials to improve traffic flow
- Pursue traffic calming measures on local roadways
- Expand transportation choices through shuttles, sidewalks, bikeways, etc.

Many of the town's goals and recommendations have implications for water resources, whether explicit or implicit. The general goal seems to be to reduce the residential burden on water resources in order to increase the capacity available for commercial uses. It is important to note that the town foresees needing to increase the water withdrawal cap in order to allow for further commercial development. Thus the question of how much additional supply can be made available through further conservation measures is an important one.

Another important issue is the protection of source water quality through preservation of open space and ecologically sensitive development.

B. Summary of goals & recommendations from Open Space Plan

The goals outlined in Acton's Open Space and Recreation Plan for 2002 to 2007 are to preserve the remaining elements of Acton's rural character, protect the environment, and improve recreational opportunities. While the concerns and recommendations in the Plan are varied,

water is listed as the town's greatest environmental problem. The Plan notes that inadequate water supplies may limit growth, and that future growth should be tied to water supply availability. The plan also discusses other potential threats to water resources due to increasing development, including:

- increased impervious surfaces, with concomitant increases in runoff and decreases in groundwater recharge;
- flow reduction in streams leading to their reclassification from perennial to intermittent, with the associated reduction in the buffer subject to protection by the Conservation Commission;
- reduced groundwater recharge (but improved water quality) as septic systems are replaced with sewers; and
- increased pesticide and fertilizer use leading to non-point source pollution.

One positive step described in the plan is the installation of constructed wetlands in the North Acton Recreation Area for the purpose of treating runoff from parking lots, playing fields, and residential lawns to remove phosphorous and nitrogen, alleviating eutrophication in a nearby pond.

To address the growing water supply issue, the Open Space and Recreation Plan made several recommendations, including:

- implementing a town-wide planning effort around water supply protection and further controls on outdoor water use;
- establishing a Water Advisory group to address water use planning and to develop recommendations on managing both public and private wells in a sustainable manner;
- potentially prohibiting the use of potable water for lawn watering, or developing zoning controls to encourage water-conserving development through limits on lawn size or requirements on topsoil depth and retention of mature vegetation; and
- protection of several wildlife habitats anchored by wetlands or other bodies of water.

Clearly, water resources are recognized as a critical concern for the town, and one deserving of immediate and sustained attention.

C. Town Regulations

The Town of Acton's regulations include several regulations intended specifically to protect water resources, such as a hazardous materials control by-law, groundwater protection overlay districts and Conservation Commission protections for wetlands, vernal pools, and streams. Additionally, for all types of development throughout the town, the bylaws state that levels of groundwater recharge and stormwater runoff must match pre-development levels for a 10-year storm. In addition to the bylaws dealing directly with water resources, there are several other important town regulations that impact water resources. These include minimum lot size requirements, provisions for Open Space Residential Development, commercial lot coverage regulations, and parking requirements.

1. Hazardous Materials Control Bylaw

The purpose of this bylaw is to protect the Town's existing and potential groundwater supplies, recharge areas, surface waters, natural environment, and public health through the proper management of hazardous materials and waste. The bylaw states that no hazardous materials or wastes may be discharged without a permit or without a hearing from the Board of Health. No hazardous materials may be discharged within the aquifer protection Zones 1, 2, or 3 as delineated in the Zoning Bylaw. No underground storage tanks for hazardous materials or wastes are allowed within aquifer protection Zones 1 or 2 or within 500 feet of a surface water body, wetland, or private well. Floor drains leading to a storm drain or septic system are not allowed in areas where hazardous materials are used or stored. Floor drains in these areas must instead connect to a containment vessel. No residues or waste waters from the clean up of a hazardous material spill may be disposed of into drains leading to storm drains or septic systems, but instead must be contained for removal. Any user or generator of hazardous materials or waste in excess of the quantities specified must obtain a permit from the Board of Health and must meet the requirements for approval, including discharge prevention safeguards and a contingency plan. In case of a discharge of hazardous materials, the owners or operators must immediately contain the discharge and report it the incident to local officials, in addition to state and federal reporting requirements. A remediation plan must be submitted to the Fire Chief and the Board of Health.

Exceptions to the prohibitions above are made for applications of fertilizers, herbicides, and pesticides used according to applicable regulations; applications of deicing chemicals according to the Massachusetts Snow and Ice Control Program; and applications of swimming pool chemicals and water treatment chemicals by the Acton Water District. (Storage of these chemicals is not exempt from the storage requirements in the bylaw.) Discharge of ordinary sanitary wastewater to an approved septic system is not regulated under this bylaw.[7]

2. Groundwater Protection Overlay District

The location of groundwater protection zones in Acton is shown on the map in Figure 7 on the following page. The groundwater protection overlay district section of the zoning bylaws establishes landscape requirements for lots in Zones 1 and 2:

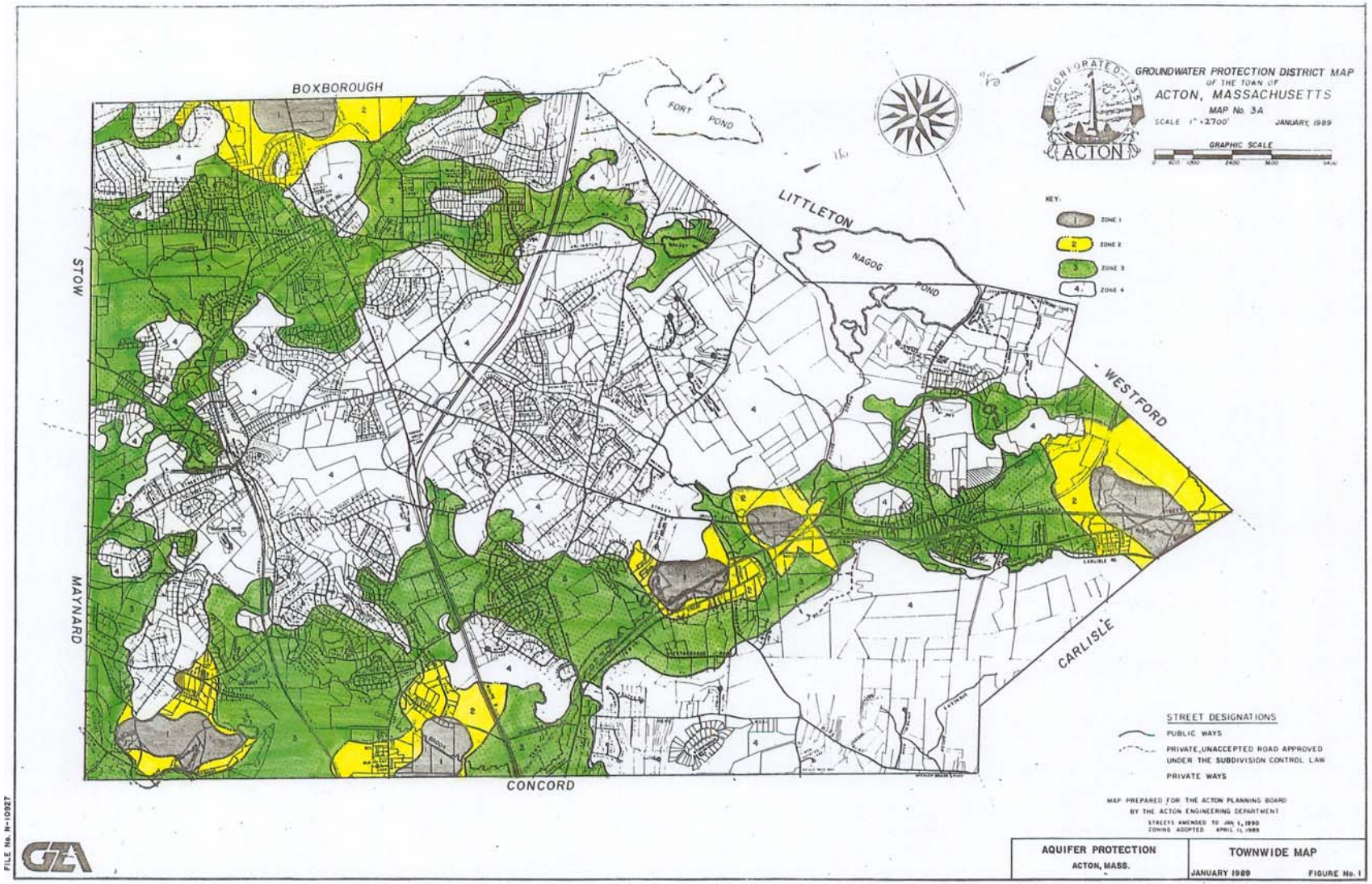
Table 1: Landscape Requirements in Groundwater Protection Overlay District

Zone 1:	**Zone 2:**
Open space[*]: minimum of 90% of lot	Open space: minimum of 70% of lot
Undisturbed open space[†]: 50% of lot	Undisturbed open space: 40% of lot
Impervious cover[‡]: no more than 10% of lot	Impervious cover: no more than 30% of lot

Stormwater runoff from impervious surfaces throughout town is required to be treated by gas trap catch basins and retention ponds to catch the first inch of rainfall (a Special Permit can be granted for an alternate means of treatment if the regulation's goals are met).[8]

[*] OPEN SPACE: Those areas of a LOT on which no BUILDING or STRUCTURE is permitted, except as otherwise provided by this Bylaw, and which is not to be used or devoted to STREETS, driveways, sidewalks, off-STREET parking, storage or display. (Section 1.3.9)
[†] UNDISTURBED OPEN SPACE – An area within the OPEN SPACE that lies outside of any disturbances due to clearing, grading, paving, building, landscaping or other site development activities. It may be subject to limited and selected cutting of trees, removal of dead wood, or yearly mowing of grass and brush. (Section 4.3.3.10)
[‡] IMPERVIOUS COVER – Refers to material covering the ground, with a coefficient of runoff greater than 0.7 (as defined in Data Book for Civil Engineers by Seelye; C = runoff/rainfall) including, but not limited to, macadam, concrete, pavement and BUILDINGS. (Section 4.3.3.8)

Figure 7: Groundwater Protection Zones



The groundwater protection overlay district also prohibits certain uses that could potentially contaminate the groundwater within some or all of Zones 1 through 3, as shown in Table 4.3.7.2, excerpted from the zoning bylaws, below.[9]

Table 2: Groundwater Protection District Use Regulations

TABLE 4.3.7.2 USE Regulations within the GROUNDWATER Protection District			
	ZONE 1 Well Protection Area	ZONE 2 Recharge Protection Area	ZONE 3 Aquifer Protection Area
1. Sanitary landfill/solid waste disposal site, refuse treatment and disposal facility, landfilling of sludge and septage, storage of sludge and septage except for municipal USES as defined in Section 3.4.1 of this Bylaw associated with the provision of public sewer services	N	N	N
2. GENERATOR OF HAZARDOUS MATERIALS OR WASTE, except for municipal USES as defined in Section 3.4.1 of this Bylaw associated with the provision of public water and sewer services	N	N	Y
3. Vehicle Repair or Vehicle Body Shop	N	N	Y
4. Vehicle STORAGE for the purposes of leasing, rental, sale, resale, parts recovery, or similar USES	N	N	Y
5. Car, truck and equipment washing facility	N	N	Y
6. STORAGE of petroleum products for purposes other than heating the premises on which it is located	N	N	Y
7. Underground STORAGE of fuel oil, gasoline, or other HAZARDOUS MATERIALS	N	N	N
8. Underground STORAGE of fuel oil, gasoline, or other HAZARDOUS MATERIALS associated with residential USE	N	N	N
9. Commercial Laundries	N	N	Y
10. Dry cleaners with on-site cleaning facilities	N	N	Y
11. Furniture/wood stripping, painting & refinishing	N	N	Y
12. Disposal of snow contaminated with deicing chemicals and originating from a protection ZONE further distant from a public well than the location of disposal	N	N	N
13. Outdoor STORAGE of fertilizer, animal manure, soil conditioner, pesticide, herbicide and deicing chemicals	N	N	Y
14. Chemical, bacteriological, biological or radiological laboratory or production facility	N	N	N
15. Subsurface disposal of wastewater effluent at a rate of less than 3.5gpd/1000sf of land area	Y	Y	Y
16. Subsurface disposal of wastewater effluent at a rate of 3.5gpd or more per 1000sf of land area but at a rate of less than 6gpd/1000sf of land area	N	Y	Y
17. Subsurface disposal of wastewater effluent at a rate of 6gpd or more per 1000sf of land area	N	N	Y
18. Subsurface disposal of wastewater effluent on a parcel of land which is not a buildable LOT as defined in footnote (**)	N	N	N
19. Subsurface disposal of wastewater effluent at a rate of less than 750gpd or more per buildable LOT(**)	Y	Y	Y
20. Subsurface disposal of wastewater effluent at a rate of 750gpd or more per buildable LOT(**) but at a rate of less than 2,000gpd per buildable LOT(**)	N	Y	Y
21. Subsurface disposal of wastewater effluent at a rate of 2,000gpd or more per buildable LOT(**) but at a rate of less than 6,000gpd per buildable LOT(**)	N	N	Y

22. Subsurface disposal of wastewater effluent at a rate of 6,000gpd or more per buildable LOT(**)	N	N	N
23. Subsurface disposal of TERTIARY TREATED wastewater EFFLUENT	Y	Y	Y
24. Any activity, construction or installation conducted solely for the purpose of environmental clean-up or remediation, and required or approved by the United States Environmental Protection Agency or the Massachusetts Department of Environmental Protection	Y	Y	Y
25. Treatment or disposal works for non-sanitary wastewater that are subject to 310 CMR 22.21 (2)(a)6 as amended, except the treatment and discharge of surface water runoff in compliance with section 4.3.6.3 of this bylaw	N	N	Y

(**) For the purpose of this table, buildable LOT shall mean: a) a LOT that is shown on a plan recorded in the Middlesex County Registry of Deeds or the Land Court, and that complies with all requirements of this bylaw pertaining to the LOT and the STRUCTURES thereon; and b) Common Land as provided for in sections 4.2, 4.4, 9, and 9B of this bylaw.

3. Conservation Commission Regulations

The Conservation Commission regulations protect wetland resource areas and buffer resource areas, including:

- Vegetated wetlands (marsh, swamp, wet meadow, bog, etc.)
- Rivers and streams (intermittent or perennial)
- Lakes and ponds
- Vernal pools
- A buffer area of 100 feet around any of the above resource areas
- A buffer area of 200 feet around a perennial river or stream

The regulations also set requirements for construction practices near protected areas.[10]

4. Residential Lot Size

Acton has ten different residential districts, with a variety of different minimum lot sizes. The minimum lot area, minimum frontage, minimum open space (where applicable), and allowable residential uses other than single family are summarized by residential district in Table 3.[11]

Table 3: Residential Lot Size Requirements

District	Minimum Lot Area in sq. ft.	Minimum Lot Frontage in feet	Minimum Open Space in percent	Two-Family Allowed	Multifamily Dwelling Allowed
Residence 2 (R2)	20,000	150	NR	N	N
Residence 4 (R4)	40,000	175	NR	N	N
Residence 8 (R8)	80,000	200	NR	N	N
Residence 8/4 (R8/4)	80,000	200	NR	N	N
Residence 10 (R10)	100,000	250	NR	N	N
Residence 10/8 (R10/8)	100,000	250	NR	N	N
Residence A (RA)	100,000	200	35%	Y	By Special Permit from the Board of Selectmen
Residence AA (R-AA)	10,000	100	35%	Y	Y
Village Residential (VR)	15,000	50	20%	Y	By Special Permit from the Board of Appeals

NR = No Requirement

Generally, the higher density districts (minimum lot sizes between 10,000 and 40,000 square feet) are located in the southern half of the Town and the lower density districts (with minimum lot sizes of 40,000 to 100,000 square feet) are located in the northern half of Town. Most condominium developments are in the northern half of the Town. A corridor of higher density residential zoning runs along Route 27 in North Acton. The approximate acreage in each of the zoning districts and the percent of the Town's land area in each type of zoning is shown in Table 4 (data from 2002).

Table 4: Land Area by Residential Zoning District

General Zoning Districts	Minimum Lot Size	Approximate Acreage	Percent of Total
R-AA	10,000 SF	13	0.1%
R2, VR	15,000-20,000 SF	4,532	36%
R4	40,000 SF	644	5.2%
R8, R8/4	80,000 SF	1,737	14%
R10, R10/8, RA	100,000 SF	1,996	16%
Total Residential Zoning		**8,922**	**71.3%**
Open		2,228	18%

Roughly half of Acton's residentially zoned land is zoned for lots of close to an acre or more, with roughly 42% zoned for lots of close to 2 acres or more. The 18% of the Town that is zoned for open space includes agricultural, recreational and conservation areas (ARC) as well as the Planned Conservation Residential Community (PCRC) district, discussed below.[12]

5. Open Space Development

Acton also has an Open Space Development by-law, which states that "Open Space Development shall be the preferred method of land development in the Residential Districts."[13] Open Space Development requires a Special Permit from the Planning Board and is limited to the construction of single family detached dwelling units in residential districts R-2, R-4, R-8/4, R-8, R-10, and R-10/8. The minimum tract size for such a development is 6 acres in the R-2 District or 8 acres in the other residential districts. An Open Space Development may not have more building lots than would be allowed under the under-lying zoning, and at least 70% of each lot must be yard area. Lot size requirements are as follows:

Table 5: Open Space Development Lot Size and Common Land Requirements

Residential Districts	**Minimum Average Lot Area (in sq. feet)**	**Minimum Lot Area (in sq. feet)**	**Minimum Common Land (percent of tract area)**
R-2	10,000	8,000	30
R-4, R-8/4	20,000	10,000	40
R-8, R-10, R-10/8	30,000	20,000	50

The Common Land must not contain a greater percentage of wetlands than does the tract of land as a whole, and must be laid out in large, contiguous parcels. If the tract abuts other undeveloped land, the Common Land should abut that undeveloped land. The Common Land may be used for conservation, historic preservation and education, outdoor education, recreation,

park purposes, agriculture, horticulture, forestry, or some combination of those uses. The designated uses must be specified in the common land's deed. No more than 5% of the common land can be paved or covered by accessory structures, but a portion may be used for pedestrian walks, bicycle paths, or access to the Open Space Development, or for leaching areas for the development's septic system. Common Land in addition to the minimum required amount may be used for storm water detention and retention. The common land must be conveyed in whole or in part to the Town of Acton or to an appropriate non-profit organization.[14]

In conventional subdivision developments, the Subdivision Rules and Regulations state that the Board may require one or more parks, generally including at least 500 square feet of dry, level, accessible land for active recreation per family.[15]

6. Planned Conservation Residential Community

A separate section of the zoning code provides for the development of a "Planned Conservation Residential Community" (PCRC). PCRC's are allowed by Special Permit in areas previously zoned for a PCRC or in residential districts R-2, R-4, R-8/4, R-8, R-10, and R-10/8.[16] The allowable uses are determined by the underlying zoning. These developments must have a minimum tract area of 8 acres. The maximum number of dwelling units allowed in a PCRC is 80% of the number calculated based on the square feet of tract area (including Common Land) per dwelling unit shown in the table below, rounded up to the nearest whole number:

Table 6: Planned Conservation Residential Community Lot Size Requirements

Residential District	Square feet of tract area per dwelling unit
R-2	20,000
R-4 and R-8/4	40,000
R-8 and R-8/10	80,000
R-10	100,000

At least 60% of the tract area must be set aside as Common Land, which must be laid out as one or more large, contiguous parcels, must not contain a greater percentage of wetlands than the tract as a whole, and should be laid out to abut any undeveloped land on adjacent tracts. The Common Land may be used for conservation, historic preservation and education, outdoor education, recreation, park purposes, agriculture, horticulture, forestry, or some combination of those uses. The designated uses must be specified in the common land's deed. A portion of the Common Land may be used for pedestrian walks, bicycle paths, or access to the Open Space Development, or for leaching areas for the development's septic system. Common Land in addition to the minimum required amount may be used for storm water detention and retention. The common land must be conveyed in whole or in part to the Town of Acton or to an appropriate non-profit organization.[17]

7. Commercial Lot Coverage Requirements

Commercial lot coverage requirements can impact storm water infiltration and runoff in commercial areas. Lot coverage and other relevant dimensional requirements for Acton's many commercial zoning districts are summarized in Table 7.[18]

Table 7: Commercial Lot Coverage and Open Space Requirements

District	Zoning Districts	Minimum Lot Area (in sq. ft.)	Minimum Lot Frontage (in feet)	Minimum Open Space (in percent)	Maximum Floor Area Ratio	Maximum Height (in feet)
Village Districts	EAV	NR	NR	25%	0.20	36
	EAV-2	15,000	50	35%	0.20	36
	NAV	10,000	100	35%	0.20	36
	SAV	NR	NR	NR	0.20	36
	WAV	NR	NR	NR	0.40	36
Office Districts	OP-1	80,000	200	50%	0.20	36
	OP-2	80,000	200	50%	0.20	40
Business Districts	KC	10,000	100	NR	0.40	36
	LB	20,000	200	50%	0.20	36
	PM	10,000	100	35%	0.20	40
Industrial Districts	GI	40,000	100	35%	0.20	40
	LI	80,000	200	35%	0.20	40
	LI-1	80,000	200	50%	0.10	40
	SM	40,000	100	35%	0.20	36
	TD	40,000	100	35%	0.20	40

NR = No Requirement

Acton's lot coverage requirements are fairly low, but the portion of the lot that is not covered by the building may be covered by parking. The open space requirements in many districts should help improve infiltration of stormwater, but these areas may also be landscaped and irrigated, adding to water demand during the peak season. Perhaps the more important aspect of commercial lot coverage is the parking coverage, which is addressed below.

8. Parking Requirements

Parking requirements impact stormwater infiltration because requiring more parking leads to larger paved surfaces, which prevent infiltration. Parking regulations by use are summarized in Table 8.[19]

Table 8: Minimum Parking Requirements by Use

Dwelling	2 spaces per dwelling unit, or 1 additional parking space in the case of accessory apartments
Home Occupation	3 spaces + additional spaces as determined by the Board of Appeals if non-residents are employed or retail sales are conducted
Educational (not including auditorium)	1 space per employee + 1 space per classroom + 1 space per 4 students above grade ten.
Nursing Home, Assisted Living Residence, or Full Service Retirement Community	2 spaces per independent living dwelling unit + 1 space per 3 additional beds
Child Care Facility	1 space per 10 children of rated facility capacity + 1 space per staff person on the largest shift
Retail Stores and Services not listed below; Repair Shop, Technical Shop, Studio; Restaurants without seating	One space per 300 square feet of net floor area (NFA)
Bank; Credit Union; Convenience Store; Shopping Center with two or more Retail Stores	3 spaces per 1000 s.f. of NFA
Furniture Store	1 space per 600 s.f. of NFA
Office	1 space per 250 s.f. of NFA
Restaurant (not otherwise listed); Funeral Home; Religious; Lodge or Club; Other Place of Assembly	1 space per 3 seats.
Fast Food Restaurants with seating but no table service	1 space per 100 s.f. of NFA
Hotel, Motel, Inn, Conference Center	1 space per bedroom + 1 space per 4 persons of rated capacity of conference rooms, banquet halls, restaurants, and other adjunct facilities.
Building Trade Shop	1 space per 1000 s.f. of NFA or 1 space per employee on the largest shift, whichever is greater.
Commercial Recreation; Commercial Entertainment; Auditorium	1 space per 4 seats or 1 space per 200 s.f. of NFA or 1 space per 4 persons of rated capacity, whichever is greater.
Vehicle Service Station; Vehicle Repair; Vehicle Body Shop	2 spaces + 3 spaces per service bay.
Industrial	1 space per 2,000 s.f. of NFA for the first 20,000. s.f. + 1 space per additional 10,000 s.f. of NFA, or 1 space per employee on the largest shift, whichever is greater.
Golf Courses	10 spaces per hole + 1 space per employee on the largest shift + 1 space per 3 persons of the capacity of all other accessory indoor and outdoor facilities

The Town's parking requirements are lower than those of many suburban communities, but they still rely on minimums by use, which often over-prescribe parking spaces. The Town's bylaws also provide for shared parking where there is a mix of uses if the parking needs occur at different times and for reduction in the number of required parking spaces when an effective employee carpool/vanpool program is provided and carpool/vanpool spaces are designated.[20] The bylaws also allow for 30% of spaces in parking facilities of more than 40 stalls to be small car stalls, except for retail store, personal service facility, general services, or restaurant uses.[21] These measures can help reduce pavement, but parking lots are still a major concern for groundwater recharge, and the Town may need to take additional steps to limit the paved area of the Town.

9. Drainage Requirements

The Subdivision Rules and Regulations for Acton require adequate drainage for surface and subsurface water of roadways and adjoining land. Street drainage must be provided through a catch basin and manhole system. This requirement prevents the use of Low Impact Development (LID) techniques that can allow for infiltration, and in some cases treatment, of storm water. The Regulations also state that street drainage may not be channeled into a wetland or water body without first passing through a vegetated detention basin.[22] This requirement should help protect wetlands and surface water bodies from polluted runoff.

10. Landscaping Requirements

The parking requirements include requirements for landscaping of the perimeter of parking lots with more than 5 spaces and interior landscaping requirements for lots with more than 25 parking spaces. The landscaping requirements include shrubs and shade trees, both of which must be tolerant of the climatic conditions of the Town, and ground surface cover with at least 4 inches of topsoil. Preference is given for retaining existing vegetation wherever possible.[23] These requirements should help mitigate some environmental impacts of parking lots and prevent landscaped islands from needing irrigation, but they do not incorporate or allow for LID techniques to be incorporated into the landscaping.

Landscaping is also required for the center of cul-de-sac streets and along the border of streets in certain cases in subdivisions. These must be convex in shape, planted with loam to a depth of 6 inches, and planted with a combination of turf grass or other low-maintenance ground cover, shade trees, and ornamental trees.[24] The requirement to have a landscaped center of the cul-de-sac reduces the paved area and increases the chances of infiltration, but as with the parking lot landscape requirements, prevents the use of LID to further increase infiltration.

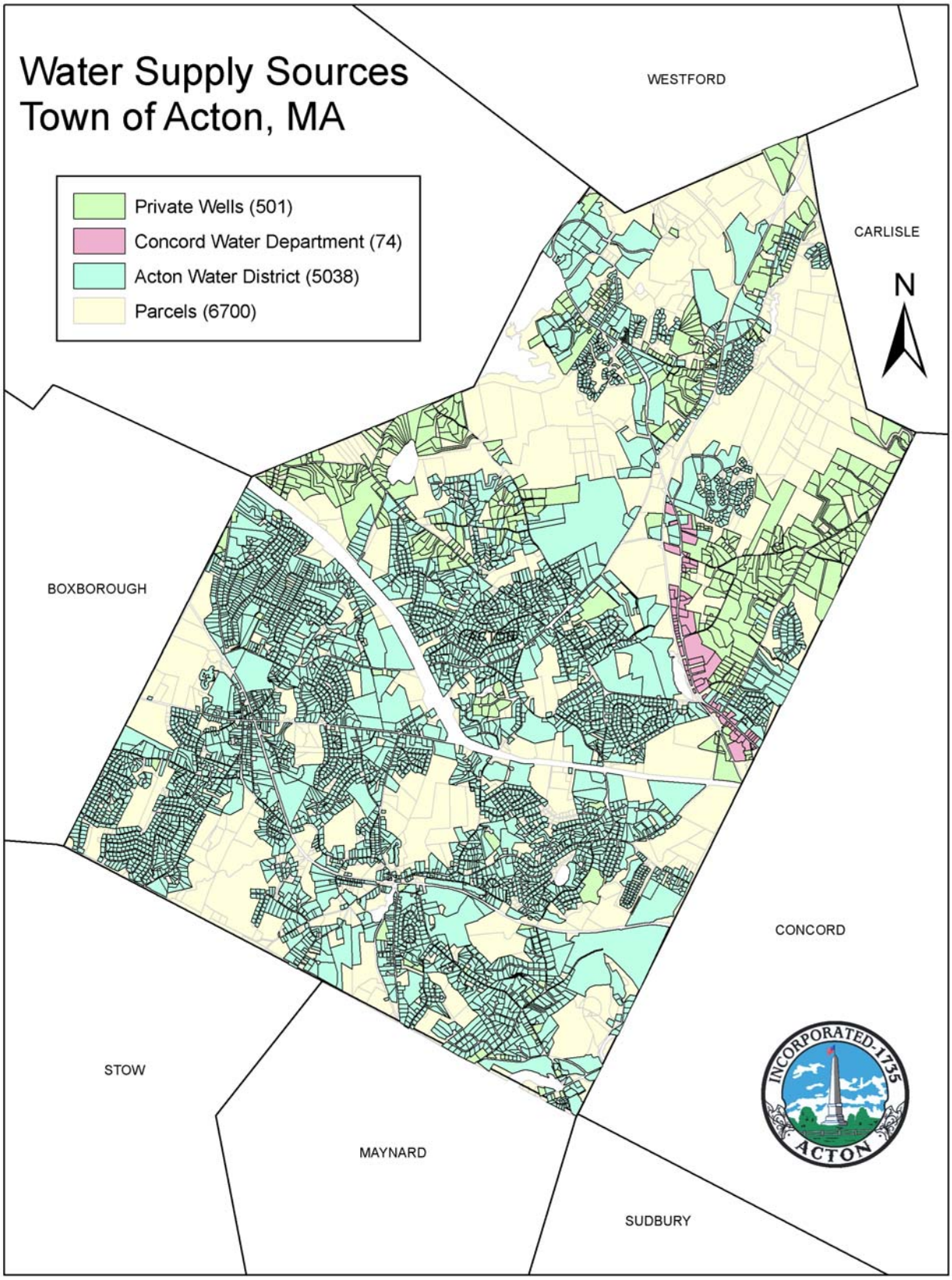
III. Water Supply System

A. Water System Profile

1. Water Service Area

The Acton Water District is the public water supplier for roughly 95% of Acton residents.[25] A map indicating parcels served by the Water District, by private wells, and by the Concord public water system is shown on the following page. A few parcels on the northwest side of Acton are served by Littleton Water. Article 9 of the Acton Board of Health Regulations requires that all private wells (water supply and irrigation) are bedrock wells and are registered/permitted through the Board of Health.

Figure 8: Water Suppliers in Acton (Source: Acton Health Department)



2. Water Sources

The Acton Water District obtains water from 21 groundwater wells within the town of Acton, 19 of which are treated for volatile organic compounds at five water treatment plants. A list of Acton Water District's groundwater sources with the total volume produced in 2005 is below.[26]

Table 9: Acton Water Sources

Source Name	Status	Gallons Produced 2005 (MG) *
Whitcomb Well	Active	26.3201
Conant Well #1	Active	41.2348
Lawsbrook Low Lift Well	Active	55.6652
Christofferson Well Low Lift Station	Active	54.0251
Assabet #1 Well Low Lift Station	Abandoned	0
Assabet #2 Well Low Lift Station	Active**	0
Clapp Well	Abandoned	0
Scribner Well Low Lift Station	Abandoned	0
Marshall Well	Active	0.9976
Kennedy GP Well #1	Active	12.2383
Kennedy GP Well #2	Active	12.2383
Kennedy GP Well #3	Active	12.2383
Kennedy GP Well #4	Active	12.2383
Conant II GP Well #1	Active	6.6772
Conant II GP Well #2	Active	6.6772
Conant II GP Well #3	Active	6.6772
Conant II GP Well #4	Active	6.6772
Conant II GP Well #5	Active	6.6772
Assabet Well #2 Replacement Well	Active	111.739
Scribner GP Well #79:1	Active	14.1775
Scribner GP Well #12	Active	14.1775
Scribner GP Well #23	Active	14.1775
Scribner GP Well #5	Active	14.1775
Clapp GP Well #1:02	Active	18.2467
Clapp GP Well #3:02	Active	18.2467
Assabet Well #1A Replacement	Active	120.9099

* For well fields, the 2005 Gallons Produced represents the total volume for the field, not for each individual well.
**Available only if Assabet Well #2 Replacement is not being run.

The Acton Water District is also proposing to reactivate an existing well, named WRG-3 on the W.R. Grace Superfund site. The well would be renamed Assabet 3. The District is also proposing to build a replacement water treatment plant to treat the water from this well, in addition to the water from the Assabet 1 and 2 wells. The groundwater remediation process for the W.R. Grace site combined with 20 years of natural attenuation has greatly improved water quality. The water will be treated by aeration before entering the distribution system as an additional precaution. The project would not increase permitted withdrawals, but would require an amendment to the WMA Withdrawal Permit to add an additional withdrawal point.[27]

3. Water Management Act Registration and Permits

Under the Water Management Act (WMA), each water supplier has a total annual withdrawal limit for all sources combined. This includes registered volumes (existing use in 1988) plus any additional permitted volumes approved since 1988. The total of both gives the WMA regulated annual withdrawal volume, expressed as average daily demand in millions of gallons per day (mgd).[28] As of 2005, the Acton Water District had a registered volume of 1.56 mgd and an additional 0.37 mgd of permitted volume, yielding a total WMA regulated annual withdrawal volume of 1.93 mgd.[29] This total increased to 1.94 mgd for 2006, and the permit will expire in August, 2011.[30] Five of the Acton Water District's 21 wells have additional daily restrictions on their use built into their WMA permits. The Conant II Wellfield #1-5 is allowed to pump up to a maximum of 216,000 gallons per day (gpd), and wetland monitoring is required.[31]

4. Treatment

There are five treatment plants in the Water District system, all of which use aeration to remove organics and add fluoride to the water; several use sequestration for iron and manganese removal or chlorination for disinfection; one uses pH adjustment for corrosion control, and one other uses granular activated carbon for natural organics removal. A summary of the treatment type and pumping capacity at each of the treatment facilities is given in the table below.[32]

Table 10: Treatment Plants and Pumping Capacity

Facility	Pumping Capacity (gpm)	Treatment
Assabet Treatment Plant	650	Aeration, Chlorine, Fluoride
Clapp Treatment Plant	500	Aeration, Carbon Filtration, Chlorine, Fluoride
School Street Treatment Plant	450	Aeration, Chlorine, Fluoride
Kennedy Treatment Plant	425	Aeration, Sequestration, Chlorine, Fluoride
Conant No. 2 Treatment Plant	300	Aeration, Sequestration, Chlorine, Fluoride
Conant No. 1 Pump Station	300	pH adjustment, Sequestration, Chlorine, Fluoride
Marshall Pump Station	170	Fluoride
TOTAL	2,795 gpm (4.13 mgd)	

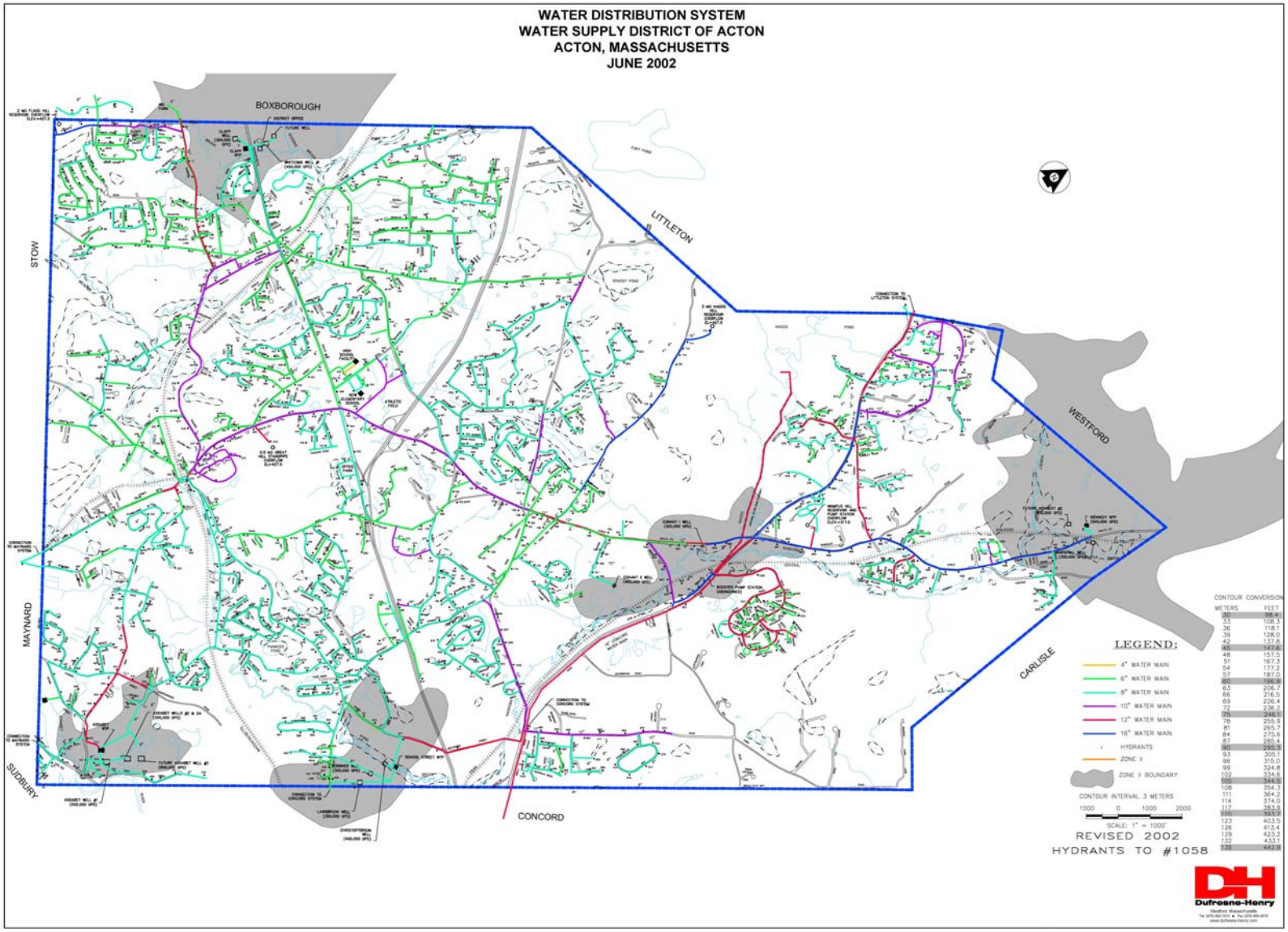
While the total pumping capacity of the system adds up to 4.13 mgd, the physical capacity of the system to produce water is roughly 3.4 mgd if the whole system were running at its maximum. This lower number takes into account constraints on treatment plants and reduced flow from individual wells when all 21 are running.[33]

5. Distribution and storage

The Acton Water District distribution system includes 120 miles of water main, covering most of the town, with the exceptions of Great Road (Route 2A) from Brook Street to Concord Street, the Strawberry Hill Road area and some areas of Newtown Road. The District also has a total of 8.5 million gallons of finished water storage capacity, with an estimated usable storage capacity of 3.93 million gallons.[34] A map of the water district, including well fields, Zone 2 boundaries and storage tanks, is shown in Figure 9. A map showing with Water District's distribution system is shown in Figure 10 on the following page.

Figure 9: Acton Water District Sources and Storage (Source: Acton Water District website)

Figure 10: Acton Water Supply District Distribution System (Source: Acton Water District)



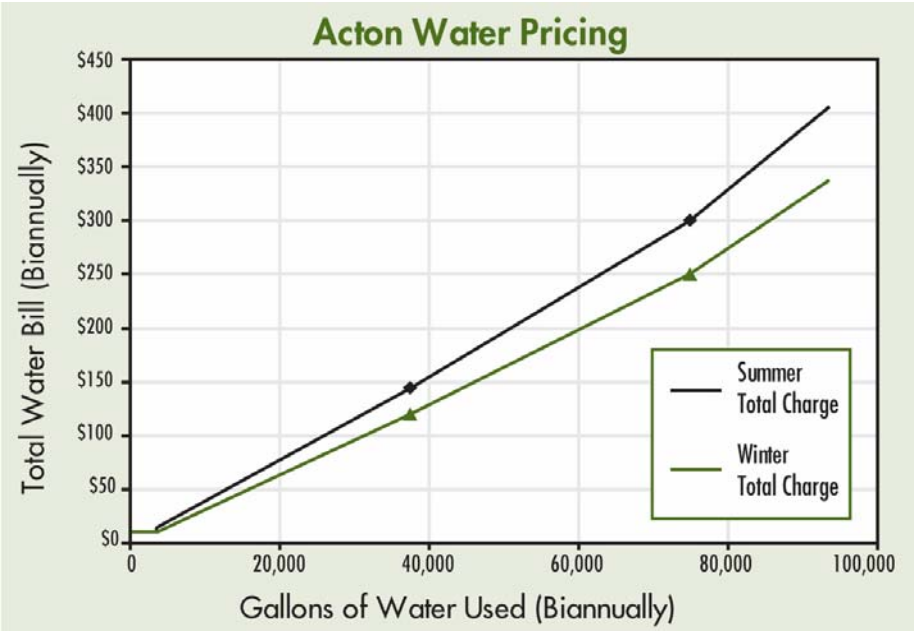
B. Water Rate Structures

Acton's water rates use a combination inclining block and seasonal rate structure, in which the price of water is higher at higher usage levels, with higher rates in the summer months. This type of rate structure is intended to discourage excessive use by penalizing higher usage levels, and to particularly target excessive summer use by raising the unit cost in summer. Currently, customers are billed biannually, once in April and once in October at the rates shown in Table 11 and illustrated in the graph in Figure 11.[35]

Table 11: Current Acton Water Rates – Until March 2007

Blocks	Summer Rate	Winter Rate
Up to 500 cubic feet	$10.00	$10.00
All usage between 1 and 5,000 cubic feet when 500 cubic feet has been exceeded	2.9 cents per cubic foot (0.39 cents per gallon)	2.4 cents per cubic foot (0.32 cents per gallon)
5,001 – 10,000 cubic feet	3.1 cents per cubic foot (0.41 cents per gallon)	2.6 cents per cubic foot (0.35 cents per gallon)
Over 10,000 cubic feet	4.2 cents per cubic foot (0.56 cents per gallon)	3.5 cents per cubic foot (0.47 cents per gallon)

Figure 11: Acton Water Prices



As of March 2007, the District will be increasing the rates and billing quarterly rather than biannually. The rate structure is still an inclining block with higher rates in summer. The incremental increases between blocks have been increased to encourage greater water conservation, especially during peak times. The new rates are shown in Table 12.[36]

Table 12: Acton New Water Rates – Starting March 2007

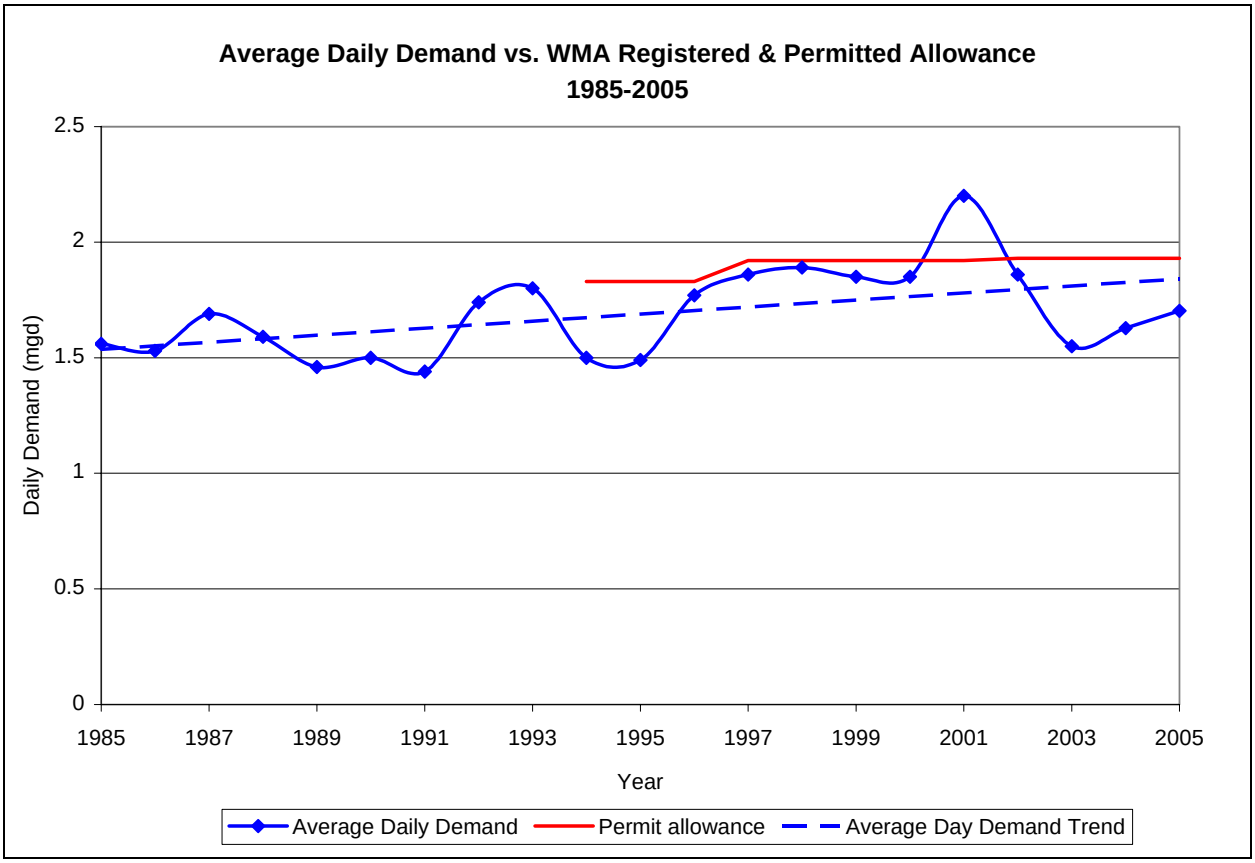
Inclining Block Rates in cubic feet	March Winter Rate	June Summer Rate	September Summer Rate	December Winter Rate
Up to 100	$5.00	$5.00	$5.00	$5.00
Between 101 and 2500	2.9¢ per cu. ft. (0.39¢ per gal.)	3.5¢ per cu. ft. (0.47¢ per gal.)	3.5¢ per cu. ft. (0.47¢ per gal.)	2.9¢ per cu. ft. (0.39¢ per gal.)
Between 2501 and 5000	3.1¢ per cu. ft. (0.41¢ per gal.)	3.9¢ per cu. ft. (0.52¢ per gal.)	3.9¢ per cu. ft. (0.52¢ per gal.)	3.1¢ per cu. ft. (0.41¢ per gal.)
Between 5002 and 10,000	4.2¢ per cu. ft. (0.56¢ per gal.)	5.0¢ per cu. ft. (0.67¢ per gal.)	5.0¢ per cu. ft. (0.67¢ per gal.)	4.2¢ per cu. ft. (0.56¢ per gal.)
Greater than 10,000	5.1¢ per cu. ft. (0.68¢ per gal.)	5.9¢ per cu. ft. (0.79¢ per gal.)	5.9¢ per cu. ft. (0.79¢ per gal.)	5.1¢ per cu. ft. (0.68¢ per gal.)
Municipal rate	3.2¢ per cu. ft. (0.43¢ per gal.)	3.2¢ per cu. ft. (0.43¢ per gal.)	3.2¢ per cu. ft. (0.43¢ per gal.)	3.2¢ per cu. ft. (0.43¢ per gal.)

C. Current Water Use Trends

The District exceeded their authorized withdrawal for the first and only time in 2001,[§] although this was mostly, if not wholly, due to an open valve at the interconnection with Maynard (after the valve was closed, the average daily demand dropped back down below the permitted level).[37] Average Daily Demand is shown in comparison with WMA permitted withdrawals for the years 1985-2005 in Figure 12.[38]

[§] Though over the amount listed on the WMA permit, the Water District was still within the 100,000 gallons above the permit amount that is allowed by DEP.

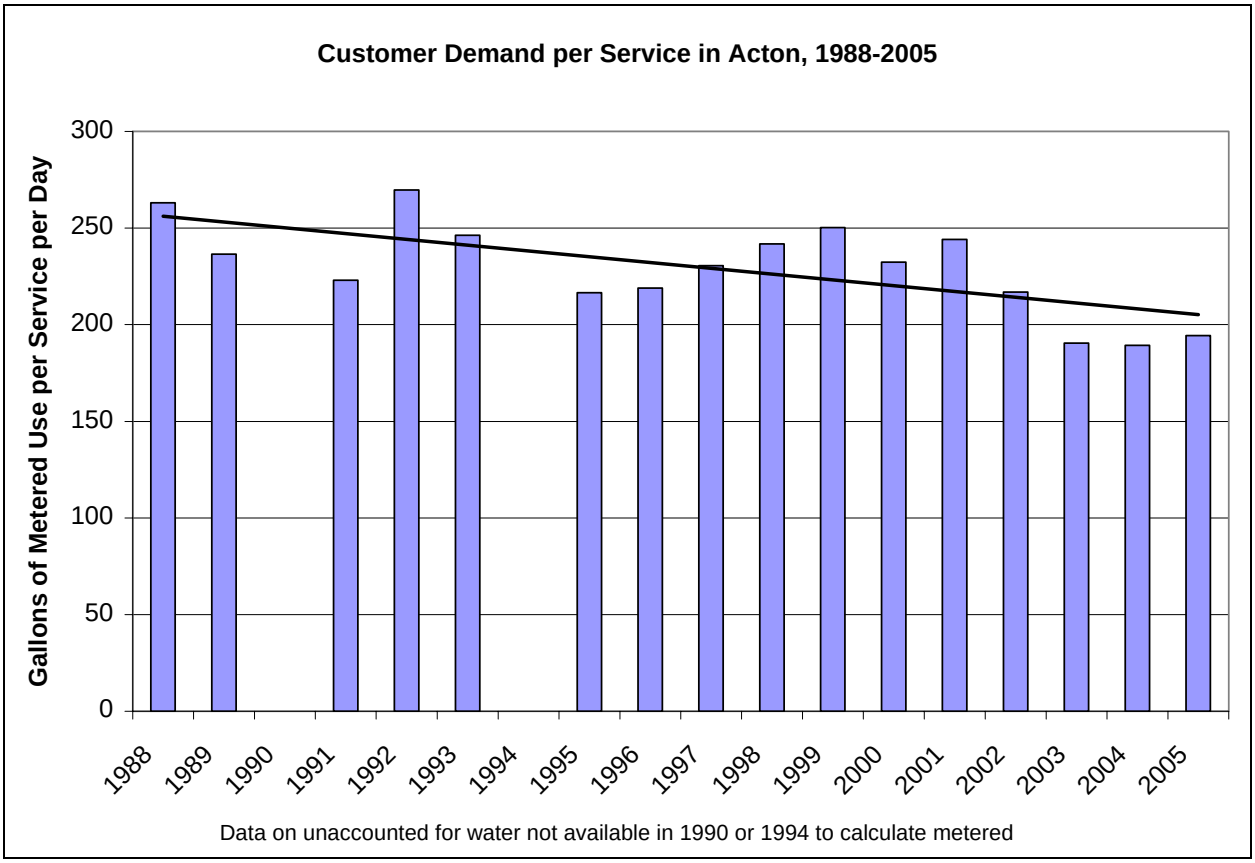
Figure 12: Average Daily Water Demand and WMA Allowance 1985-2005



While the average day demand has, on average, increased over the last 20 years, it flattened out between 1997 and 2002 (except for 2001), and has dropped since. The total demand also has not increased as fast as the number of services[**] connected to the District's system. The total number of services increased from just over 5,200 in 1985 to just under 7,600 in 2005. In the same period, the total yearly demand went from just over 570 million gallons in 1985 to just over 620 million gallons in 2005. This means that the average water consumption per service has declined, from 299 gallons per unit per day in 1985 to 224 gallons per unit per day in 2005, as shown in Figure 13.[39] Recent reductions in total customer demand and customer demand per unit per day are likely attributable, at least in part, to water rate increases and continuing conservation efforts from the Acton Water District. The conservation and demand management efforts are described in Section III-E.

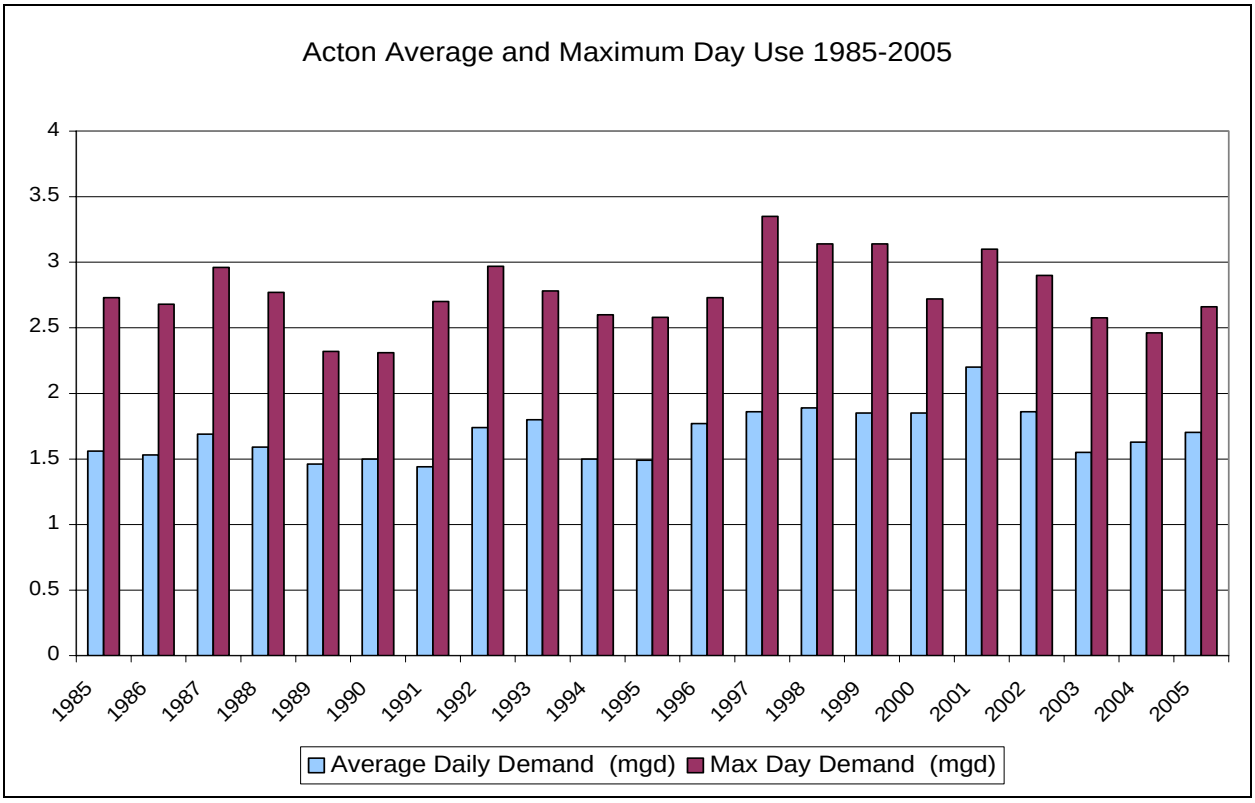
[**] Residential services represent the total number of residential units connected to the system, while commercial and municipal services represent the number of connections.

Figure 13: Customer Demand per Service, 1988-2005



The ratio of maximum day demand to average day demand has also decreased over time, though the maximum day demand has fluctuated significantly. The average max day to average day ratio between 1985 and 2005 was 1.65, but the average ratio from 1985-2000 was 1.69, while the average since 2000 has come down to 1.53. This again reflects the effort that the Water District has put into reducing summertime water use. The comparison between average day and max day since 1985 is shown in Figure 14.[40]

Figure 14: Average Day and Maximum Day Water Demand 1985-2005



D. Projected future water demand

Several efforts have been made recently to project the future water demand in the Town of Acton. The Acton Water District did projections through the year 2011 as part of the Master Plan Update. These projections are based on assumed consumption per service and assumed number of future services. The consumption per service is based on the average number of gallons consumed per service for the years 1996 to 2001, which was 269 gallons per service per day, including all customer demand and unaccounted for water. The future number of services was projected based on MAPC household forecasts available at that time.[41] The water demand projections have thus far been well above the actual demand levels, which may be due to climatic variation and/or to the Water District's conservation efforts.

MAPC has also done two sets of projections for Acton. The first was completed as part of a region-wide effort to project future water demand. This set of projections uses one set of assumptions about consumption per resident and per employee for the region as a whole. The residential consumption assumes 75 gallons per capita per day. The commercial consumption assumptions are based on per-employee factors for "basic", "retail", and "service" jobs. A more detailed explanation of the assumptions is included in Appendix A. Population and employment growth are projected using the standard projections methodology, an explanation of which can be found at:
http://www.mapc.org/data_gis/data_center/2006_Projections/2006ProjectionMethodologyFinal.doc.

The second set of MAPC projections was done specifically for this project, and incorporates data that has been tailored to the town. Population projections were revised based on updated input from the town of Acton. Water consumption projections for the commercial sector were calibrated to actual consumption by the commercial sector in 2005, which reduced the assumed consumption factors by nearly half. Assumptions about residential water consumption were derived from Water District data on usage by single-family and multi-family units between 2001 and 2005. Single-family consumption for existing households is estimated to be roughly 220 gallons per unit per day, based on this data, while multi-family consumption is estimated at just over 120 gallons per unit per day. Consumption from new single-family households is projected to be at least one and a half times the consumption from existing households, based on anecdotal evidence from the Water District. (A full explanation of the assumptions is included in Appendix A.) These projections show Acton's total water use remaining under the currently permitted level until 2030, though coming very close to the permit level in that year.

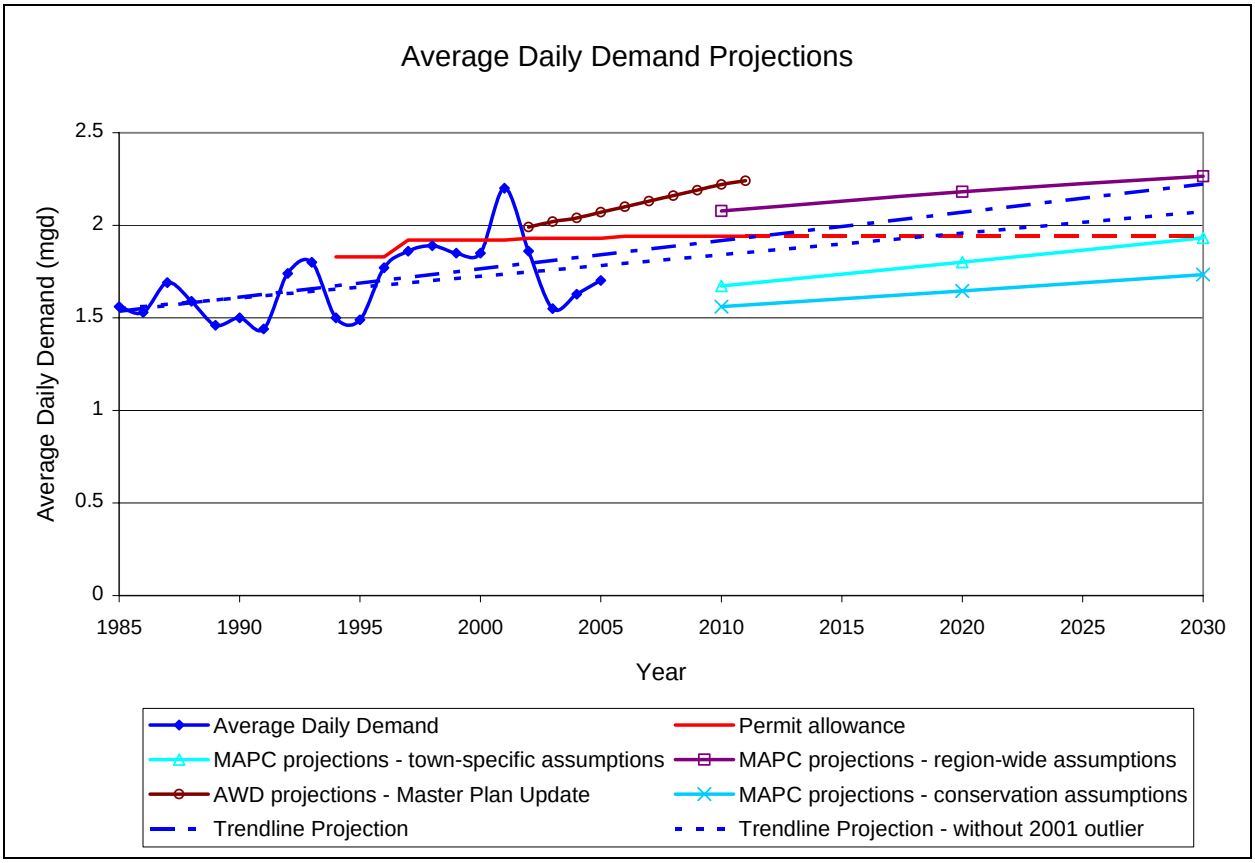
All projections described above are based on the fundamental assumption that current water consumption trends will continue. With the Water District's conservation efforts and more water efficient technology, this may not be the case. A third set of MAPC projections used assumptions about reductions in demand that the Acton Water District might be able to achieve in the future through conservation, particularly in the residential sector. These projections assume a 1% decrease in water consumption from existing households in each decade, and assume that new single-family homes use only as much water as existing single-family homes currently use. They also assume a slight reduction in unaccounted-for water, and a 2% decrease in municipal and other (such as commercial) water use. The difference in outcomes is significant, as shown in Figure 15. With the assumed improvements through conservation, the Acton Water District could theoretically stay well below their currently permitted withdrawals through 2030.

The projected values for Average Daily Demand in 2010, 2020, and 2030 under different sets of assumptions are shown in Table 13. Figure 15 on the following page shows historical and projected future average daily water demand for Acton in comparison to the amount allowed under the current WMA permit. Two linear projections from the historical data are also shown – one including the 2001 data (when there was a large leak that made water usage unusually high), and one without it.

Table 13: Average Daily Demand Projections 2010-2030

Type of Projection	Projected Average Daily Demand (mgd)		
	2010	**2020**	**2030**
MAPC projections - region-wide assumptions	2.08	2.18	2.26
MAPC projections - town-specific assumptions	1.67	1.80	1.93
MAPC projections - conservation assumptions	1.56	1.64	1.73
Trendline projections	2.01	2.16	2.32
Trendline projections (without 2001 outlier)	1.76	1.88	1.99

Figure 15: Average Daily Water Demand Projections



Max day demand was also projected for this project, based on the average daily demand and the peak demand ratio. If the max day to average day ratio remains at roughly 1.5, as it was in 2005, the max day volumes could reach 2.56 MGD in 2010, 2.75 MGD in 2020, and 2.96 MGD in 2030. This is higher than max day demand has been since 2001, but not as high as it was in the late 1990s, and does not pose a significant threat to the maximum capacity of the system (3.4 MGD, by the Water District's estimate).

Acton's eventual water consumption will depend on its ability to further its conservation efforts and contain the trend towards ever larger houses, ever larger lawns and irrigation systems, and ever more affluent residents. Acton's ability to control its own destiny and reduce future water demand is addressed in the recommendations section (Section VII).

E. Conservation and Demand Management

The Acton Water District has been aware for some time of the threat posed by growing water demand, and in particular the issue of high water usage in summer. The magnitude of the impact of outdoor water use is evident from the seasonal difference in overall consumption, which averaged 0.51 mgd between 1990 and 2001. The Water District's Master Plan Update in 2001 noted that "to put this amount in perspective, one of the District's wells must pump 24 hours per day during the summer months just to meet the demand caused by watering of lawns."[42] The District also found that in 1999 when outdoor water use was banned outright in late June after a

very dry spring and early summer, demand declined by 33%.[43] To address these issues, the District has implemented a number of demand management initiatives. These include:

Water Impact Reports – As of 2000, anyone applying for public water with a design demand of over 5,000 gallons per day must submit a concept plan that will enable the Water District to generate a Water Impact Report. The Report defines the impact that the project will have on the District's current and future demand, and stipulates conditions that the applicant will meet to mitigate the impact.

Outdoor Water Use Restrictions – During the peak water use period from May 1st to October 1st, lawn watering is restricted to even numbered houses on Tuesday, Thursdays, and Saturdays and odd numbered houses on Wednesdays, Fridays, and Sundays. No outdoor water use is allowed on Mondays, and no lawn watering is allowed between the hours of 7AM and 7PM. There is a fine of up to $200 for violating the restrictions.

Automatic Irrigation System Regulations – As of 1997, all underground lawn watering systems must be equipped with a timing device to conform with the District's watering restrictions and a moisture sensing device to prevent unnecessary operation. The regulation also stipulates that anyone intending to install an automatic lawn irrigation system must notify the District prior to installation.

Promotion of Sustainable Landscaping Practices – The Acton Water District installed and maintains a "water-wise" demonstration garden in front of its office that is designed to withstand summer drought conditions and not require any watering beyond the natural rainfall. The District has also sponsored or taught water-wise landscaping programs at a local community education center for several years. Other methods of outreach on sustainable landscaping include displays at gardening events and "Healthy Lawns" programs on local cable and with local nurseries and on-going collaboration with the Acton Garden Club on a "water-wise" gardening program.

School Education Program – The school education program has been running since the Fall of 1999. The program offers free field trips, drinking water related lesson plans, and a lending library of resource materials to all Acton public schools. Much of the school outreach is specifically aimed at conservation, as are many of the resource materials.[44]

Residential Water Audits – The District offered indoor home water use audits in the summers of 2002 and 2003 for high water users. Participating customers in 2002 averaged a 23.3% average reduction in water use after the audit. In the summer of 2004, the District offered irrigation system audits free to all customers with in-ground irrigation systems. The 21 participants saved a total of over 90,000 gallons (5.9%); adjusted for the weather conditions, the total savings was over 200,000 gallons (nearly 14%).[45]

Water Saving Devices – The Water District has been providing free water-saving devices to customers for several years. The District also offered a horizontal axis washing machine promotion and sponsors a rain barrel program every spring. The Town of Acton has retrofitted municipal buildings with water-saving devices.

New Resident Education and Orientation – The Water District provides a "Using Water Wisely" brochure and package to new residents, which includes information on conservation and on the watering restrictions. In 2004 and 2006, the District also partnered with the Acton Garden Club to offer a water conservation orientation program for new residents.

Leak Detection – The Water District undertakes a leak detection survey of all water mains every two years.

Water Efficient Recreational Fields – The Town of Acton has adopted the landscape water conservation measures recommended by the Executive Office of Environmental Affairs for all public recreational fields.

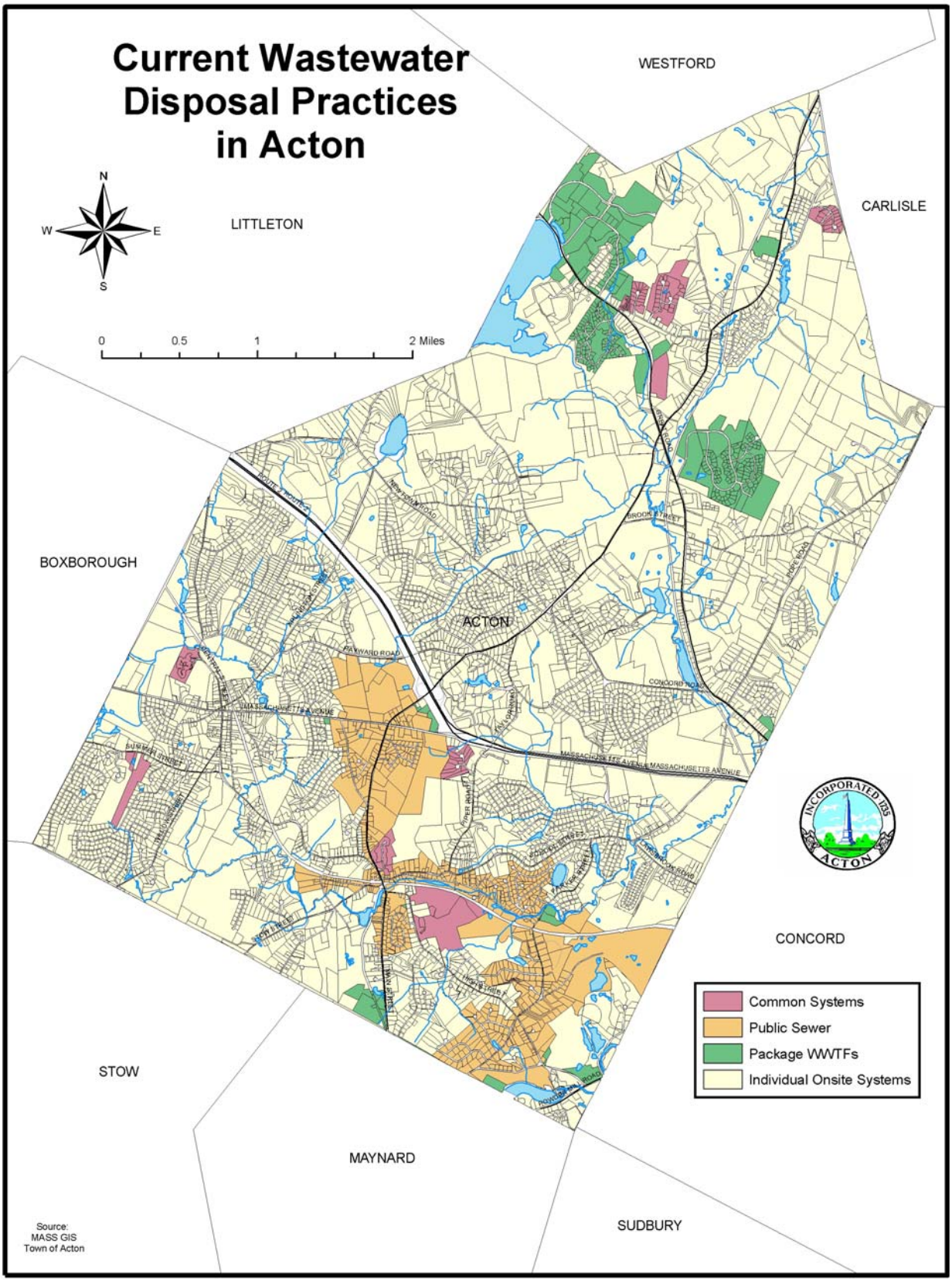
IV. Wastewater Treatment

A. Profile of existing system

The Town of Acton is served by a combination of onsite wastewater systems, cluster wastewater treatment systems, and public sewer. The majority (80%) of the Town's parcels use onsite wastewater treatment systems, 10% use cluster systems, and the remaining 10% are on public sewer.[46] A map illustrating where the different wastewater treatment practices are currently in use is shown in Figure 16.

The Middle Fort Pond Brook Sewer System was brought online in February 2002. Its service area includes 682 parcels of land in South Acton, of which 606 are developed. The wastewater from these properties is conveyed through a network of 10 miles of gravity sewer pipes and 10 pumping stations to the Acton Wastewater Treatment Facility, where it is treated and discharged. The Wastewater Treatment Facility is located on Adams Street, near the Assabet River mainstem, in the southeast corner of the town. The treated effluent is discharged to Rapid Infiltration Beds designed to recharge the underlying aquifer. The system was originally permitted for an average daily flow (ADF) of 250,000 gallons per day (GPD), and a peak daily flow (PDF) of 500,000 GPD, but in January of 2005, the Massachusetts Department of Environmental Protection upgraded the Acton WWTF Groundwater Discharge Permit to an ADF of 299,000 gallons per day. Operational and post-construction capital costs are borne entirely by the sewer system's users.[47]

Figure 16: Acton Wastewater Treatment (Source: Acton Health Department)



The 10% of the community not served by public sewer or onsite wastewater systems is served by a combination of nine privately owned package wastewater treatment facilities (WWTFs) and nine smaller common onsite wastewater systems. A summary of relevant information on the package WWTFs is included in Table 14.[48]

Table 14: Package Wastewater Treatment Facilities in Acton

WWTF	Permitted Flows (GPD)	Developed Parcels in Service Area	Developable Parcels in Service Area	Total Parcels in Service Area
Acorn Park	33,380	85	7	92
Brookside Apts*	11,000	2	0	2
Farmbrook	105,000	134	7	141
Great Road Condos*	27,720	1	0	1
North Acton	200,000	53	11	64
Powdermill*	12,000	1	0	1
Robin's Brook Assisted Living*	22,420	1	0	1
Suburban Manor	24,450	2	0	2
Woodvale*	12,400	1	0	1
Yankee Village*	4,400	1	0	1
TOTAL	**452,770**	**281**	**25**	**306**

*Some cluster systems serve condominium developments that are represented by a single parcel in the GIS database.

The nine common onsite wastewater treatment systems all have design flows of less than 10,000 gallons per day, and are maintained by condominium associations. They are normally constructed so that each dwelling or building has its own septic tank that discharges through an effluent sewer to a common disposal field.[49]

B. Plans for system expansion or alteration

The Town of Acton recently completed a 5 year Comprehensive Water Resources Management Plan (CWRMP). Phase I of the CWRMP included an environmental needs analysis, using GIS, which created a foundation of wastewater needs information. This was then further developed by more detailed analysis of environmental and many other factors into the Needs Planning Areas delineated as part of Phase II. A map of the Needs Planning Areas is shown in Figure 17 on the following page. The Areas are intentionally large to capture environmental similarities and encompass entire neighborhoods.

Phase II of the CWRMP also identified preferred and recommended solutions for the Needs Planning Areas based on both technical and non-technical criteria. The preferred alternatives by Needs Planning Area are shown in Figure 18. Preferred solutions included connecting to existing sewers for some needs areas in West and South Acton, Wastewater Management Districts for some needs areas in central and southwest Acton, and cluster or neighborhood systems for needs areas in East and North Acton.

Figure 17: Wastewater Needs Planning Areas (Source: Woodard & Curran, Acton CWRMP Phase II, 2006)

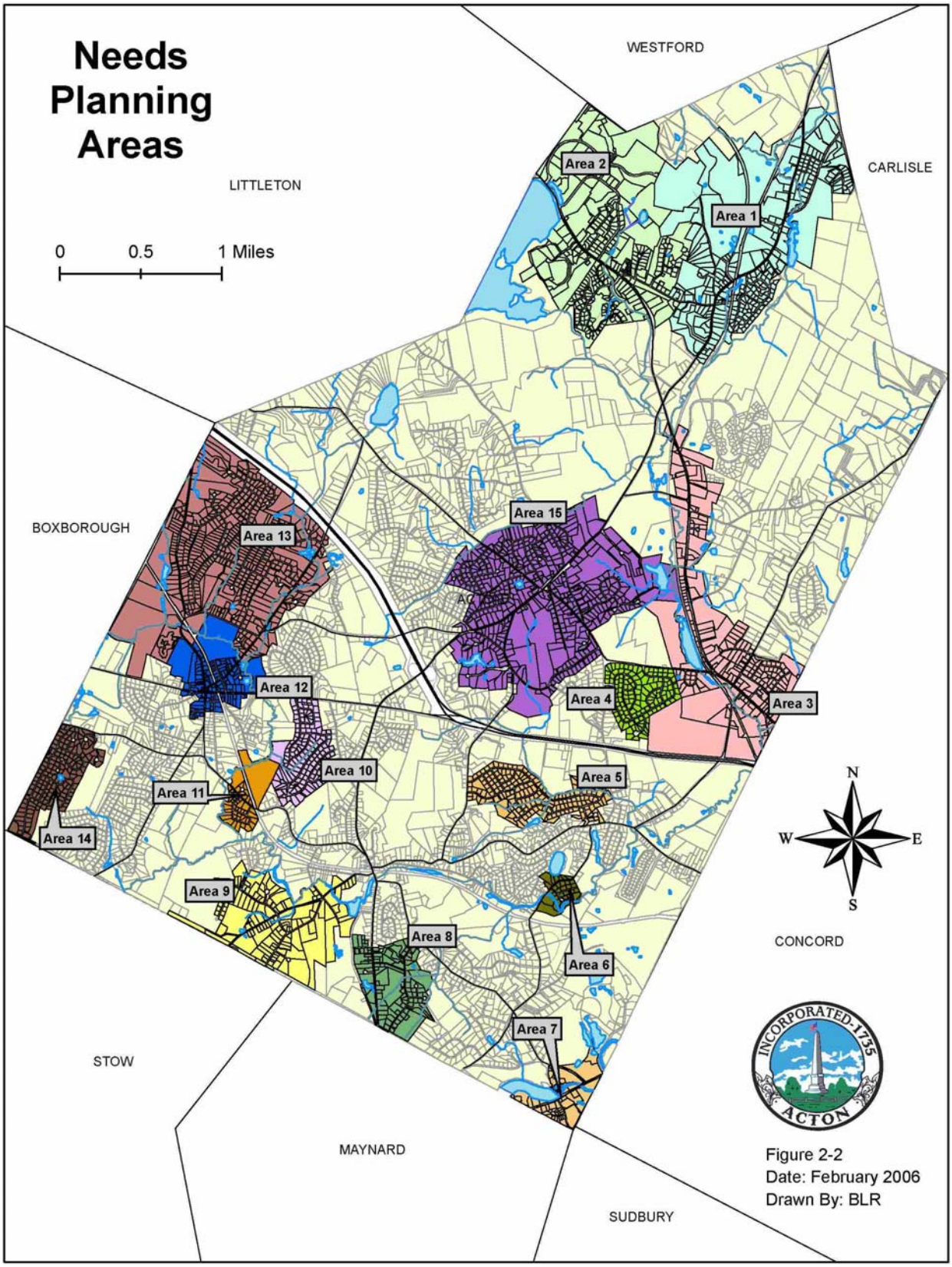
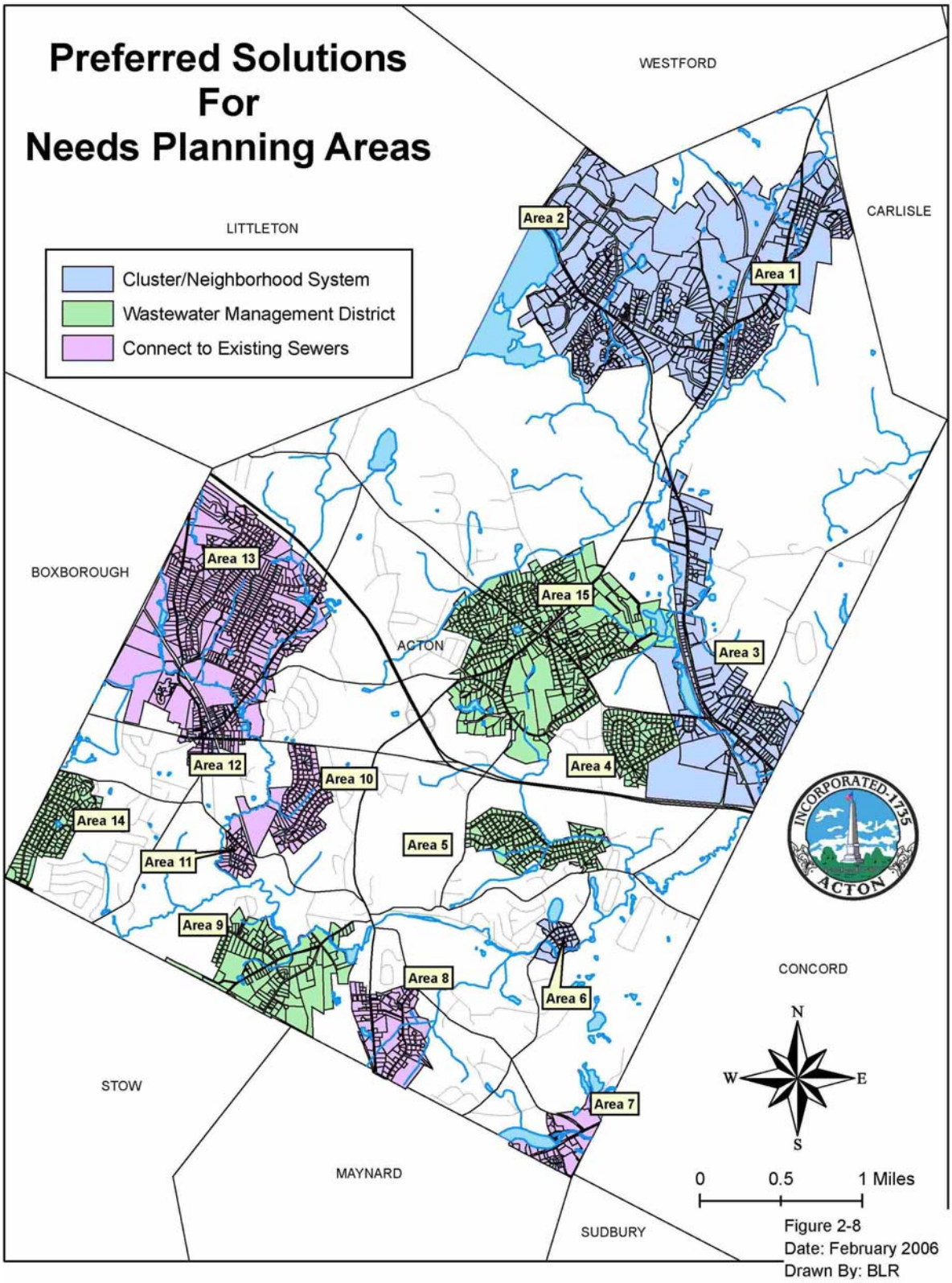


Figure 18: Preferred Solutions for Wastewater Needs Planning Areas (Source: Woodard & Curran., Acton CWRMP Phase II, 2006)



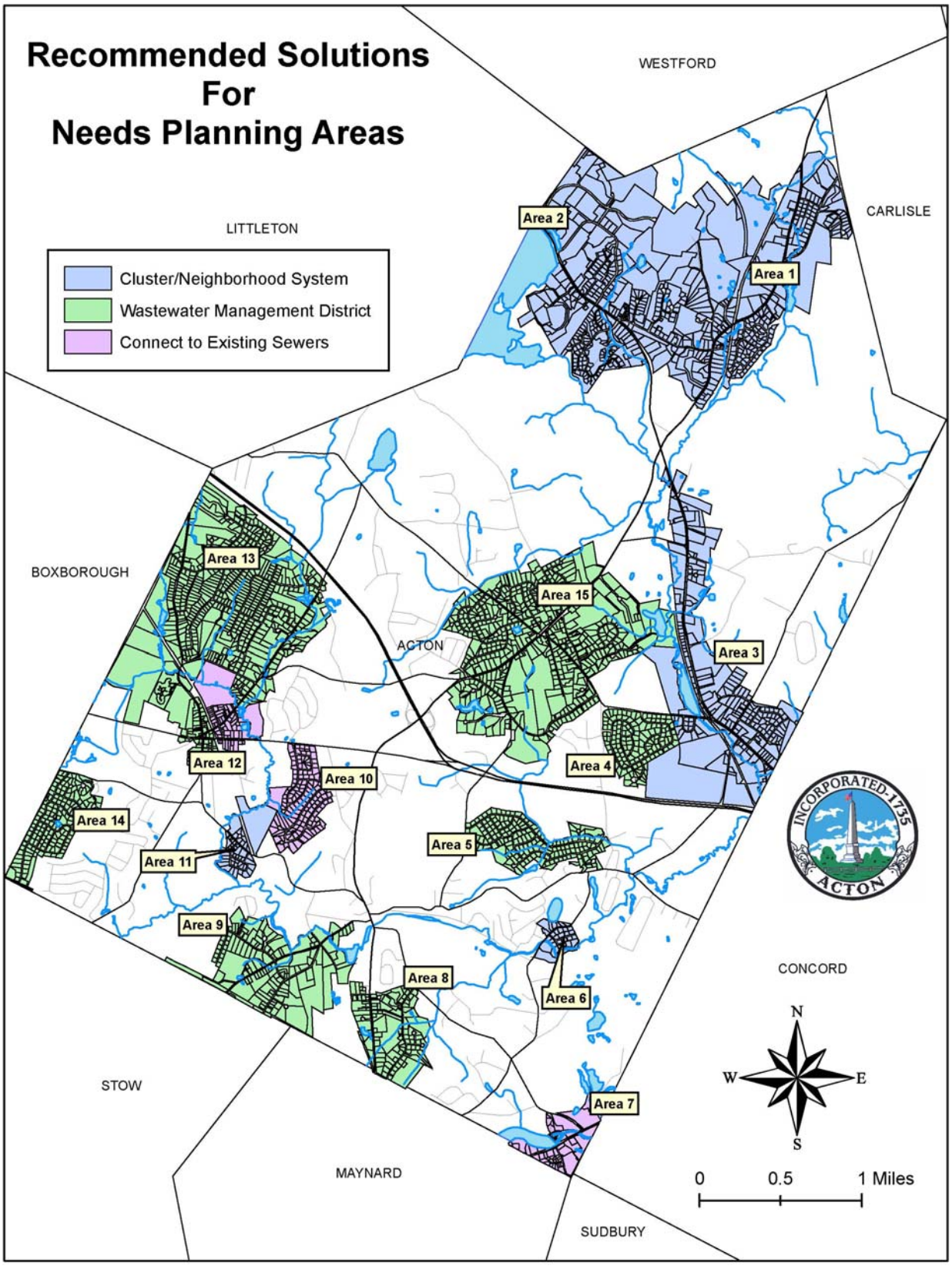
The CWRMP Phase II also developed a matrix of recommended solutions for each Needs Planning Area. That matrix is reproduced below.[50]

Table 15: Matrix of Recommended Solutions for Wastewater Needs Planning Areas

Rank (1-4) with 1 being the recommended choice (NA = Not Applicable)						
Needs Area #	Description	Current Priority Status	Connect to Existing Sewers	Construct New WWTF/Sewers	Cluster System	Wastewater Management District
1	North Acton Village Marshall Crossing Robbins Brook	Medium	NA	3	1	2
2	Nagog Woods Acorn Park North Acton Condos	Low	NA	2	1	NA
3	East Acton Village Route 2A	High	NA	2	1	3
4	Concord Road	Low	NA	2	3	1
	Robbins Park					
5	Brucewood Estates	Medium	3	NA	2	1
6	Brookside Circle	Low	3	NA	1	2
7	Powdermill Plaza	High	1	NA	NA	NA
8	Maynard Border	Medium	2 Maynard or Acton	NA	3	1
9	Heath Hen Meadow / Stow Street	Low	3	NA	2	1
10	Spencer / Tuttle / Flint	High	1	NA	NA	2
11	Nash / Downey / Dover Heights	Medium	NA	NA	1	2
12	West Acton Center - A	High	1	NA	2	3
12	West Acton Center - B	High	2	NA	3	1
13	Indian Village	High	NA	3	2	1
14	Flagg Hill	Medium	NA	NA	2	1
15	Acton Center	Low	NA	2 - East Acton	3	1

The recommendations for each of the Needs Planning Areas are also shown in the map on the following page. The recommended solutions were largely the same as the preferred solutions for most of the needs planning areas, but a large area in West Acton outside the West Acton Village and a smaller area in South Acton on the Maynard border were recommended for Wastewater Management Districts rather than connecting to the existing sewer.

Figure 19: Recommended Wastewater Treatment Solutions (Source: Woodard & Curran, Acton CWRMP Phase II, 2006)



Phase II of the CWRMP gives short term recommendations, including:

- Develop a feasibility study for creating Wastewater Management Districts;
- Conduct a small-scale pilot study of technologies for reclaimed water use once regulations provide guidance on treatment and discharge requirements;
- Proceed with plans for extending the sewer to the Spencer / Tuttle / Flint and West Acton Center-A areas, including appropriating funds for final study and design and applying for State Revolving Funds for construction;
- Pursue legislative changes to the betterment rules to allow redistribution of betterment assessments for funding of the sewer projects.[51]

V. Storm Water Management Plan

Storm water management is critical to both water quality and water quantity issues. Runoff can contaminate surface waters and deplete groundwater. The Town of Acton completed a Storm Water Management Plan in 2003 (Woodard & Curran, *Storm Water Management Plan: Acton, MA*, September 2003). The plan calls for implementation of certain Best Management Practices within a 5-year timeline. The Plan is organized into six categories, based around six Minimum Control Measures (MCMs):

MCM 1 – Public Education and Outreach
MCM 2 – Public Participation/Involvement
MCM 3 – Illicit Discharge Detection and Elimination
MCM 4 – Construction Site Runoff Control
MCM 5 - Post-Construction Runoff Control
MCM 6 - Pollution Prevention/Good Housekeeping

A summary of current programs and proposed BMPs in each category follows.

MCM 1 – Public Education and Outreach

In March 2003, Acton began a public education and outreach campaign through the Board of Health and the Conservation Commission. The work included the construction of a vegetated wetland at the Town's public beach in the North Acton Recreation Area. The wetland is being used to treat drainage outfall before it enters the pond, where there is a public beach, in order to reduce nutrient and sediment loading in the pond. The town will also distribute a survey to determine whether the educational component of the wetlands has had an impact on public awareness of the storm water issue. The Town also participates in the SuAsCo Storm Water Community Assistance Program, contracting with the SuAsCo Watershed Community Council for public outreach materials and programming.

Proposed BMPs for Acton include:

- distributing a storm water flyer to residents addressing issues such as lawn chemicals, water conservation, pet waste, car washing, and disposal of hazardous wastes;
- distributing a storm water flyer to local businesses addressing the impact of businesses on storm water;
- a media campaign to engage the local news media in raising public awareness on the issue and a cable access TV program; and
- educational materials to accompany structural BMPs, explaining their purpose.

MCM 2 – Public Participation/Involvement

In 1998, the Organization for the Assabet River Acton Stream Team conducted a stenciling program for Acton's storm drains and conducted shoreline surveys of the Nashoba Brook and Fort Pond Brook stream systems to identify sources of pollution and raise awareness. One of the proposed BMPs is to complete the storm drain stenciling program in areas not already covered. Other proposed BMPs include:

- creating a storm water traveling display to be used as an educational and motivational tool;

- holding a storm water poster contest and photo contest to engage youth groups; and
- discussing storm water issues at public meetings.

MCM 3 – Illicit Discharge Detection and Elimination

Acton has a surface water sampling program that provides data to assess potential point and non-point source pollution. The surface water sampling program began in 1982, providing a large database of historical water quality information. It will be expanded to include priority areas including sewer outfalls. Proposed BMPs include:

- generating a comprehensive storm drain map;
- implementing a by-law prohibiting non-storm water discharges into the storm drain system;
- monitoring and managing the town's watersheds to detect illicit discharges and contacting property owners to seek correction.

MCM 4 – Construction Site Runoff Control

Basic requirements for erosion control at construction sites are already included in the Town Subdivison Rules and Regulations and the Zoning By-Laws. These were to be reviewed and updated as a proposed BMP.

MCM 5 - Post-Construction Runoff Control

In the late 1980s, Acton implemented a regulation requiring any new commercial or residential development to construct retention basins designed to treat the first inch of rainwater falling on any impervious surface. Additionally, the engineering department in Acton inspects streets prior to acceptance and approval to construct and requires as-builts detailing the locations of new storm drain structures so that they can be added to a town-wide map. However, there are currently no requirements for operation and maintenance of private storm water systems except when a special permit is required, making it difficult to enforce these issues. The Plan recommends reviewing and updating as necessary the current rules and regulations. Specifically, it recommends developing by-laws to maximize open space preservation where appropriate and minimize impervious surfaces and direct runoff to wetlands; developing strategies to use structural BMPs (including storage, infiltration, and/or vegetative practices) to control runoff; and reviewing and inspecting storm water controls on private property. It also suggests incorporating MADEP standards regarding the discharge of untreated storm water from new developments into Acton's Subdivision Rules and Regulations, in addition to the requirement for recharging storm water at a rate similar to pre-development conditions and controlling the rate of discharge.

MCM 6 - Pollution Prevention/Good Housekeeping

Acton has rectified several Good Housekeeping issues at the DPW building and the Transfer Station in the last several years, including:

- DPW building: hazardous waste management, especially related to recycling waste oils
- DPW building: industrial wastewater discharge – the town no longer discharges from a drain to the groundwater, but is still assessing how to deal with operational issues from closing the drains

- DPW building: air quality control – the town plans to submit a permit for the fuel dispensing facility
- Transfer Station: solid waste – the Town's record keeping and inspection program is back on schedule

Current Town programs related to pollution prevention and good housekeeping include:

- The Town's DPW staff cleans all catch basins on publicly owned drains and the Highway Staff maintains outfalls.
- Street sweeping is performed on all Acton streets at least once per year.
- There are no areas where road salt use is restricted. Snow removed from Town streets is stored and allowed to melt and run off into Cole's Brook.
- Acton has a recycling program, a hazardous waste collection program, and collection of yard waste for compost.
- The Natural Resources Department is responsible for fertilizing playing fields and other public lands. While there is no control over citizens' lawn care, there is a by-law prohibiting use of pesticides within 40 feet of a wetland or other water body.
- The town fields near at the North Acton Recreation Area are irrigated automatically with water from bedrock wells on-site. There are no controls for shutoff due to rain. [This has probably been changed since the writing of the SWMP.]

The Town's Pollution Prevention Plan includes an auditing and reporting component for town facilities and operation and maintenance practices and employee training programs on pollution prevention.

VI. Evaluation of Impacts

The United States Geological Survey (USGS) will be modeling the hydrologic impacts of potential future water and wastewater scenarios in Acton. The model will evaluate four different scenarios:

1. Current water withdrawals, no public sewering (Base-Case scenario)
2. Future water withdrawals, current sewering
3. Future water withdrawals, "Recommended Alternative" sewering (additional 40,000 gpd)*
4. Future water withdrawals, "Preferred Alternative" sewering (additional 150,000 gpd)*

* In the model, all treated effluent will be directed to the existing discharge site.

The wastewater scenarios were defined with input from Acton's Board of Health. The Town does not anticipate any sewering will take place in the Nashoba Brook sub-basin.

The current water withdrawals for the base case model are based on average withdrawals between 1997 and 2001 (1.928 mgd). The future water withdrawals for the three future scenarios use MAPC's region-wide projections for Acton (2.265 mgd). This represents the high end of the estimates for Acton's future water consumption, so the USGS analysis will show the impact of the "worst-case scenario" water withdrawals combined with various sewering options.

The effects of these scenarios will be measured by their projected impact on streamflows at the mouth of Fort Pond Brook, where there is a streamflow gauge that allows USGS to calibrate the model to existing conditions. USGS will present an analysis of these impacts in their I-495 water resources modeling report to be published in 2007.

VII. Recommendations

Acton's water conservation programs already set a good example for surrounding towns, but because the water issues continue, particularly during the peak summer months, the Town and the Water District may need to implement more advanced conservation measures. As the Water District looks for additional ways to reduce water usage, moving beyond the "low-hanging fruit" to more challenging measures, tracking the costs and benefits of their conservation measures will become more important. The District should therefore make an effort to collect data on water use reductions due to water-efficient fixtures, audits, and other conservation programs as they are implemented. This will improve the District's ability to pursue the most effective programs and those that make the most of the available resources. The following recommendations provide some options that the Town or the Water District could pursue to further reduce their water consumption and improve groundwater recharge.

1. Public Education and Outreach

The Acton Water District already has an extensive residential public education program in place. This program could be extended somewhat in the residential sector, and programs could be developed for commercial, industrial and institutional users. Additional public education strategies could include:

- Convert water usage to gallons on the water bill and convert billing structure to bill by the gallon
- Send out seasonally appropriate water conservation tips to homeowners in a regular mailing or as an insert in their water bill, or potentially partner with the Acton Garden Club to create a newsletter, electronic or in print with landscape water conservation guidance and other news
- Work more closely with commercial, industrial, and institutional users to reduce their water use; for example:
    - Develop an audit program for highest volume industrial and commercial users and aim to reduce usage in this category by 10 % overall
    - Implement an audit program for large non-residential landscapes
    - Assist in the development of water saving demonstration projects at private companies

2. Rebates and Fixtures

In addition to providing water efficient fixtures to customers at no cost, the Water District has at various times implemented additional rebate programs. All existing rebate programs should be continued unless an evaluation of water savings indicates that they are not effective. They could also be expanded to include:

- Re-instating the washing machine rebate program
- Rebates for water-efficient dishwashers
- Rebates on water-efficient pre-rinse spray valves for restaurants
- Rebates for toilet replacement for residential and commercial customers
- Installation assistance provided by volunteers (e.g. high school students) for the elderly or disabled

The Town has also retrofitted municipal properties with water efficient fixtures, but it could go further by, for example, installing waterless urinals in municipal buildings. Another way that the

Town could potentially reinforce efforts to promote efficient fixtures would be to implement a "retrofit-upon-sale" ordinance, requiring installation of water-efficient plumbing devices whenever any residential or commercial property is sold or transferred. This regulation could have unintended consequences such as discouraging redevelopment in Village Centers, but if some funding were available through the Water District's conservation program (supplied through water rates), it might reduce the potential negative effects.

3. Water Impact Reports

The existing Water Impact Report program in the Water District is an important component of the District's planning and conservation efforts, but it could be adjusted and extended to have a greater impact for water conservation by:

- Lowering the threshold for Water Impact Reports
- Using Water Impact Reports to require "water banking" – offsetting additional demand through conservation measures elsewhere in the system

4. Unaccounted for Water

The Acton Water District's unaccounted for water has been mostly between 10% and 15% in the last several years, close to the 10% standard set by the state. To keep this figure consistently under 10%, the leak detection and repair program may need to be done annually instead of bi-annually. The additional cost should be funded by an increase in water rates if necessary.

5. Metering and Billing

The Water District is planning to move from bi-annual to quarterly billing in March, and has already installed radio-read water meters throughout the system. The rate structure already penalizes peak season use and the highest users, and the rates will be increasing in March. The District is definitely moving the right direction on billing, but they could go further. Some possibilities include:

- Continue to gradually increase steepness of inclining block rates and/or increase summer rates on a regular schedule
- Transition from quarterly to monthly billing
- Selective irrigation submetering for automatic sprinklers connected to the public water supply
- Meter and charge for water used by contractors for pipe flushing or construction

6. Outdoor Water Use Regulations

This is another area where the District is already off to a good start, but probably needs to take their existing outdoor water use regulations further. The District currently allows outdoor watering three days a week in summer. This should be reduced to one or two days per week either throughout the summer or during the highest use periods. As the regulations become more stringent, additional enforcement efforts may be necessary. Increasing regulation of outdoor water use for public water supply customers may also have the unintended consequence of increasing demand for private irrigation wells. Although these must be bedrock wells by Board of Health regulations, they still withdraw water from the watershed, and their impact is likely to be felt as their use increases. Although politically challenging, extending water use regulations to private well users is the only way to close this loophole. It also means that all town residents are subject to the same regulations, making enforcement easier and reducing resentment among

neighbors. Another way to use peer pressure and neighborhood enforcement to decrease water use is to set watering restrictions by neighborhood rather than by street number. Although this would require extensive outreach and establishment of neighborhood zones, it would make it easier for people to tell whether they were allowed to water their lawn on a given day, because their neighbors would all be on the same schedule.

7. Low Impact Development

The Town's bylaws currently all but prohibit the use of Low Impact Development (LID) techniques that can help maintain or restore groundwater recharge. The Town should study ways to allow and promote LID through the bylaws where appropriate. Some potential changes include:

- Incorporate Low Impact Development best practices for all municipal projects using models such as the Greenscapes program from the North and South Rivers Watershed Association
- Remove the requirement for cul-de-sac centers to be convex – allow concave design in the case of a bio-retention basin
- Allow use of bioretention islands or other LID techniques within landscaped islands in parking areas
- Alter drainage requirements in Subdivision Rules and Regulations to permit LID where appropriate
- Remove requirements for curbs on low traffic streets
- Establish design criteria for vegetated swales

8. Parking Requirements

The Town of Acton's parking requirements are not excessively high relative to other suburban communities, but the Town could make adjustments to them that would help reduce the amount of pavement in the town, with positive effects on the stormwater. Potential modifications include:

- Alter language to encourage rather than simply allow shared parking arrangements for mixed uses and provide a model shared parking agreement
- Extend small car parking spaces to uses currently excluded and change language to encourage the provision of small car spaces
- In groundwater protection zones and near surface water bodies or other sensitive environmental resources, reduce minimum parking requirements and establish maximum parking allowances
- Allow and encourage use of pervious paving materials for overflow parking areas where appropriate
- Allow pervious materials or "two track" design for single-family home driveways
- Allow shared driveways in residential developments

9. Open Space

The Town already allows and promotes Open Space Development and protects open space in Groundwater Protection Zones and through land acquisition. The regulations could go further, though, for example:

- Adjustments to Open Space Development bylaws:
    - Allow Open Space Development by right in residential zoning districts
    - Offer at least a small density bonus for Open Space Development

    - Allow flexible site design criteria for Open Space Development, including setbacks, road widths, and lot sizes
- Increase requirements for undisturbed open space in Zones 1 & 2
- Continue with open space preservation efforts through land acquisition, easements, etc.

10. Water Wise Landscaping

The Acton Water District has a Water Wise demonstration garden and other programs to encourage residents to use water-efficient landscaping practices in their own yards, but the Town of Acton could reinforce this message with regulations that promote water-efficient landscaping. Some possibilities include:

- Requiring a certain depth and quality of loam or topsoil
- Encouraging the use of native plants or requiring a certain percentage of yard area be maintained with natural vegetation / undisturbed open space for developments outside Zones 1 and 2
- Limiting the allowable extent of automatic irrigation systems

11. Reclaimed Water

The Town has already begun examining the potential for developing a system to use highly-treated wastewater in non-potable applications. This is an excellent start, and a thorough and comprehensive evaluation of the potential and challenges will be necessary. The Town should continue this work, but ensure that any use of reclaimed water does not take away from water which would otherwise have been recharged to the groundwater. The Town should also continue to prioritize groundwater recharge for future sewer expansions.

VIII. Appendix A

Assumptions used to calculate water demand through 2030 for MAPC study of water resources in Acton

A. Assumptions for "business as usual" scenario of water consumption

Single-Family (SF) Homes:

- Demand from existing SF homes for 2000 is based on average consumption by SF accounts between 2003 and 2005
    - summer: 222.9 gal/day per household
    - winter: 199.7 gal/day per household
    - annual: 195.6 gal/day per household
- For existing SF households, summer water demand assumed to increase by 1% each decade, winter demand assumed constant (daily demand on average for the year based on the average of the daily demand in summer & winter)
- Demand from new SF homes assumed to be 2 times the demand of existing SF households in summer, and 1.5 times the demand of existing SF households in winter
    - summer: 445.8 gal/day per household
    - winter: 252.5 gal/day per household
    - annual: 349.1 gal/day per household

Multi-Family (MF) Homes:

- Demand from existing MF homes for 2000 is based on average consumption by MF accounts between 2003 and 2005
    - summer: 125.5 gal/day per household
    - winter: 120.0 gal/day per household
    - annual: 122.2 gal/day per household
- Demand from existing MF households assumed constant through 2030
- Demand from new MF households assumed same as demand from existing MF households

Percent of households & jobs connected to the water system:

- Percent of existing households connected assumed to remain at 95% through 2020, increase to 96% in 2030
- Percent of new households connected assumed to be 100%
- 100% of new jobs also assumed to be connected to the water system

Unaccounted-for Water:

- Percent unaccounted-for water assumed to remain at 2005 levels (10.7%)

B. Assumptions for "conservation" scenario of water consumption

Single-Family (SF) Homes:

- Demand from existing SF homes for 2000 is based on average consumption by SF accounts between 2003 and 2005
    - summer: 222.9 gal/day per household
    - winter: 168.3 gal/day per household
    - annual: 195.6 gal/day per household
- For existing SF households, summer water demand assumed to decrease 2% in each decade, winter demand assumed to decrease 1% each decade (daily demand on average for the year based on the average of the daily demand in summer & winter)
- Demand from new SF homes assumed to be 30% higher than the demand of existing SF households in summer, and 20% higher than the demand of existing SF households in winter
    - summer: 289.8 gal/day per household
    - winter: 202.0 gal/day per household
    - annual: 245.9
    - gal/day per household

Multi-Family (MF) Homes:

- Demand from existing MF homes for 2000 is based on average consumption by MF accounts between 2003 and 2005
    - summer: 125.5 gal/day per household
    - winter: 120.0 gal/day per household
    - annual: 122.2 gal/day per household
- Demand from existing MF households assumed to decrease 1% each decade in both summer and winter
- Demand from new MF households assumed to be 10% less than that of existing MF households

Percent of households & jobs connected to the water system:

- Percent of existing households connected assumed to remain at 95% through 2020, increase to 96% in 2030
- Percent of new households connected assumed to be 100%
- 100% of new jobs also assumed to be connected to the water system

Unaccounted-for Water:

- Percent unaccounted-for water assumed to drop to 9% due to repairs to water mains causing fewer leaks

Endnotes

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