Appendix 16

Buildout Analysis Report & Memo from Study Committee

Eightmile River Watershed Management Plan
Draft Aug. 25, 2005

TO: Whom it may concern
FROM: Eightmile River Wild and Scenic Study Committee
RE: Planimetrics Report dated October 22, 2005
DATE: 6/14/06

The Eightmile River Wild and Scenic Study Committee studied the Eightmile River and its watershed for possible designation as a federal Wild and Scenic River. As part of that study, the Study Committee commissioned Planimetrics of Avon, Connecticut, to prepare an analysis of potential future development in the watershed. That report, the "Eightmile River Wild and Scenic River Buildout Analysis" provides a brief historical review of development in the watershed, an analysis of growth trends in the three towns which comprise the watershed, and offers recommendations for municipal management activities to protect the outstanding resource values of the watershed.

While the report contains information that contributes to the discussion of the future of the watershed, the Study Committee does not (necessarily) endorse the report's conclusions relating to the possible impact of completion of the Route 11 expressway on population growth in the watershed. The time frame of the report's preparation and the level of resources dedicated to that effort did not allow for a comprehensive analysis at a level that justifies the report's conclusions.

The committee's specific concern is based on the relatively limited assumptions used to predict population growth. The writer did not find a positive correlation between highway construction and population growth based on a very broad examination of this issue. In the opinion of the Study Committee, the data used was too broad and did not account for important variables which would influence population growth, such as the amount of vacant land available, the level and density of existing development, and the generation of non-residential growth in place of population growth. No distinction was made among rural, suburban and urban settings.

In addition, the section entitled "Tools for Protecting the Watershed" includes a large "menu" of possible tools that might be considered in any review of watershed protection. While some tools might be appropriate for the Eightmile River Watershed, others are not practical or feasible in this area. This report in no way represents the actual recommendations of the Study Committee.

THIS REPORT IS SUBJECT TO STUDY COMMITTEE COMMENTS - SEE PREVIOUS PAGE

October 22, 2005

EIGHTMILE RIVER WILD & SCENIC RIVER BUILDOUT ANALYSIS

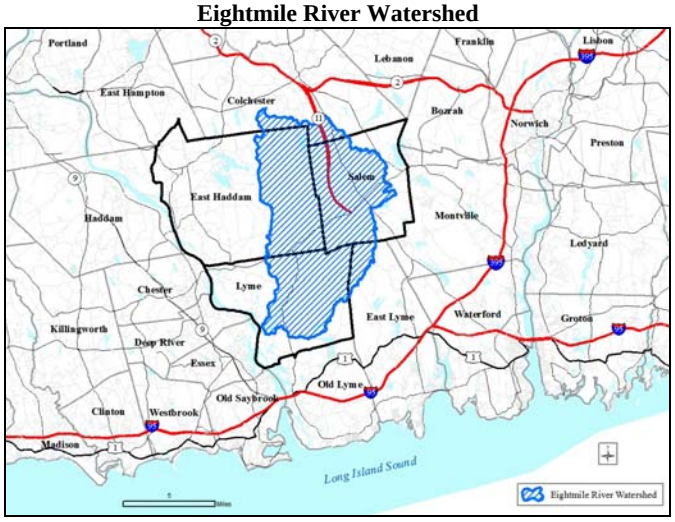
INTRODUCTION

The Eightmile River is a tributary of the Connecticut River, located in the rural towns of East Haddam, Lyme, and Salem, CT. Despite Connecticut possessing the highest population density in the nation, the Eightmile River Watershed is fortunate to be located in a relatively undeveloped area of the State, allowing much of the River and surrounding landscape to remain in its natural state.

To protect the wild and scenic character of the River, the Eightmile River Wild & Scenic Study Committee, in association with the Connecticut River Estuary Regional Planning Agency, the Connecticut Nonpoint Education for Municipal Officials Project (NEMO), the Nature Conservancy, and the National Park Service, is studying the River and its watershed for designation as a federal Wild and Scenic River. The purpose of this report is the supplement the work of these agencies by providing the following:

- a brief historical overview of development trends in southeastern Connecticut and the State as a whole;
- an analysis of growth trends in the three towns that comprise the Watershed;
- future growth projection scenarios for the Watershed, including the effect of a completed Route 11; and
- detailed recommendations on municipal regulatory and non-regulatory tools for achieving the management goals for protecting the outstanding resource values of the Watershed.

Eightmile River Watershed



STATE & REGIONAL DEVELOPMENT TRENDS

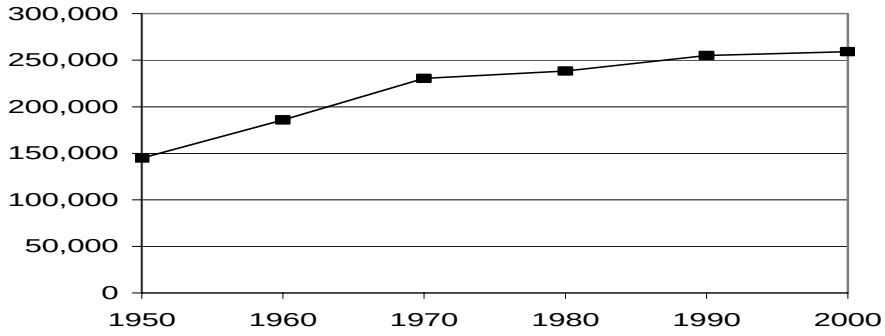
Prior to World War II, development in Connecticut was concentrated in densely populated villages and cities, where residents could live a short distance from daily activities. Employment was typically found in factories and mills that initially relied upon water for power and railroads to bring in raw materials and transport finished products to market. The 1955 Flood proved too much for many of these firms that had already been in a state of decline due to competition in the southern United States and abroad, sending some villages and cities into decline as well.

The years shortly after the end of World War II marked a dramatic shift in development patterns within southeast Connecticut and the State as a whole as suburban expansion began in the towns immediately surrounding central cities. The advent of the Interstate Highway System in the mid to late 1950s further fueled suburban expansion by allowing workers to commute further distances.

Coastal towns experienced significant growth to serve the growing demands of summer residents and tourists. Many cottages would later be converted to year-round use by residents commuting to jobs in coastal communities such as Bridgeport, New Haven, Groton, and New London.

Several military installations including the Groton Submarine Base and the Coast Guard Academy continue to play significant roles in the region. Industries such as Electric Boat and Pratt & Whitney, that had provided war materials during World War II, thrived during the Cold War, making defense manufacturing a primary component of Connecticut's economy. The collapse of the Soviet Union coincided with the collapse of the real estate market in the late 1980s and early 1990s, dealing Connecticut a double blow with a subsequent decline in defense spending, affecting defense contractors throughout the State.

New London County Population Growth 1950-2000



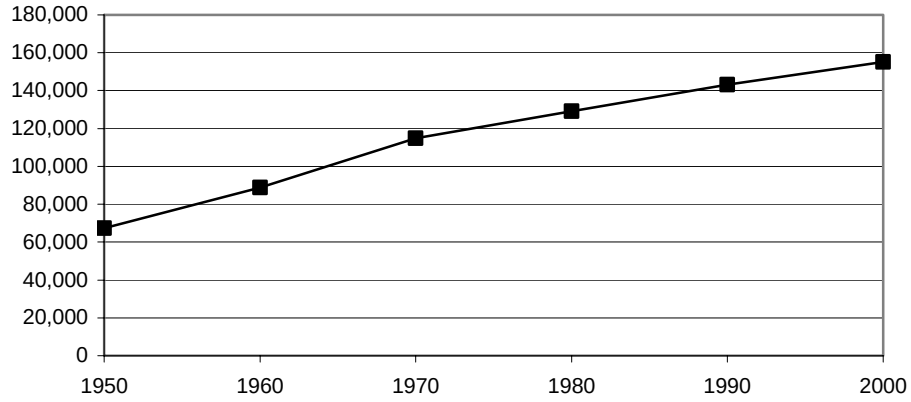
U.S. Census Bureau

During the 1950s and 1960s, New London County experienced an average annual population growth rate of 2.3%, comparable to statewide growth rates during that period. The 1970s and 1980s marked a decline to a 0.5% average annual growth rate that also closely mirrored statewide growth rates. Growth during the 1990s was virtually flat with an average annual growth rate of 0.2%, marking the first time in 50 years that statewide growth outpaced the County.

Growth in the insurance industry would spark significant suburban expansion in the Capitol Region that would peak during the late 1980s before a collapse in the real estate and banking industries would impact insurance investments, leading to restructuring and nearly a decade of stagnant growth.

Middlesex County, while predominantly outside the Capitol Region, plays a significant role in the Hartford Labor Market and is influenced by the fortunes of the insurance industry. During the 1950s and 1960s, Middlesex County experienced an average annual population growth rate ranging from 2.6% to 2.8%, exceeding statewide growth rates during that period. The 1970s through the 1990s marked a decline in average annual growth rates from 1.2 % in the 1970s down to 0.8% during the 1990s, closing the gap between statewide growth rates.

Middlesex County Population Growth 1950-2000



While tourism has always been a component of the Connecticut economy with attractions such as Hammonasset Beach, Mystic Seaport, and Mystic Aquarium attracting visitors from throughout the Northeast, it was not until the opening of the Foxwoods Casino in the early 1990s that tourism played a major role in the State economy. Foxwoods Casino, and later the Mohegan Sun Casino, would fill voids in both jobs and State revenues, employing an estimated 21,000 workers in southeastern Connecticut and paying over $300 million in slot machine revenue to the State by 2000. The lower wage casino and other service sector jobs in the region would lead to a high demand for affordable housing, placing pressure on older housing stock in region towns, where workers engage in a practice known as ‘hot bunking’ or taking turns sharing a single bed among workers on different shifts.

Biotechnology is another growing sector of the State economy, led by firms such as Bayer, Pfizer, and U.S. Surgical. Pfizer is playing an increasingly significant role in the economy of southeastern Connecticut, constructing nearly two-million square feet of research and development space in Groton and New London that will add thousands of jobs in the Region. Unlike casino employees, Pfizer employees will likely seek out moderate to luxury housing options within the Region.

WATERSHED DEVELOPMENT TRENDS

The Eightmile River Watershed is comprised of nearly 40,000 acres or approximately 62 square miles, spread across five towns. The bulk of the Watershed, or over 36,000 acres, is concentrated in the three towns of East Haddam, Lyme and Salem, which are located on the fringes between the steep terrain of the Eastern Uplands, that had been the focus of early industrialization in Connecticut, and the gently sloping Eastern Coastal Slope, that is the center of Connecticut's maritime economy. The Watershed's isolation relative to major employment centers in the region, such as Groton, New London, and Norwich, has allowed the Watershed to escape the brunt of post-war suburban expansion.

In recent years, open space preservation has also played a significant role in curbing potential residential development by taking available land off the market before it becomes available for development. Since 1998, 2,777 acres or nearly seven percent of the land within the Watershed has been conserved as open space or farmland, displacing as many as 777 new houses.

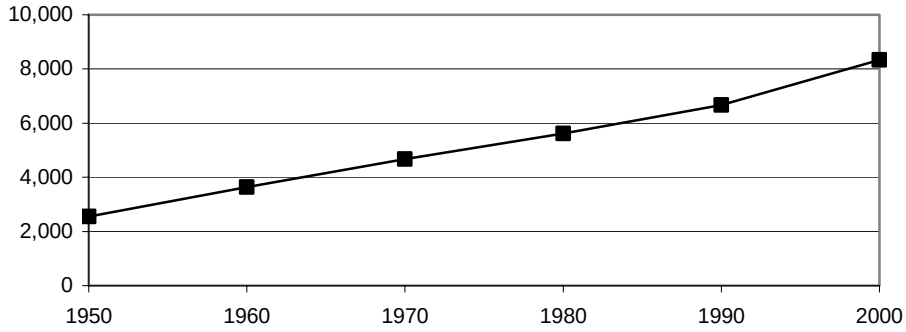
The Connecticut Turnpike (I-95), I-395 (originally Route 52), Route 2, and Route 9 have all served as avenues for both suburban expansion and new economic growth within the region. However, none of these expressways provides convenient access to significant portions of the Watershed for regional commuters or industry. The incomplete Route 11 expressway penetrates the Watershed but its sole connection to Route 2 in Colchester may be too remote from the Hartford Labor Market to have a significant effect on development. The impact of connecting Route 11 to I-95 in Waterford will be a subject of discussion later in this report.

East Haddam

East Haddam is the most populous of the three towns that comprise the Watershed, due initially to the industrialization and immigration of the 19th Century, and later due to the abundance of recreation opportunities and its access to jobs both inside and outside the region via Route 9.

During the later half of the 20th Century, East Haddam consistently outpaced State and regional growth, with average annual population growth rates ranging from 1.7% to 3.6% (see chart on opposite page. A continually decreasing average household size in East Haddam over the last 50 years often drove the rate of housing construction higher than the rate of population growth.

East Haddam Population Growth 1950-2000



U.S. Census Bureau

The Center for Land Use Education and Research (CLEAR) has conducted a series of land cover analyses between 1985 and 2002, based on satellite imagery, to document changes in land cover over time. While land cover data does not always provide a clear indication of use (barren land, tall grasses and turf can be attributed to either agricultural uses or various stages of development), it does reveal that between 1985 and 2002, 1,051 acres or four percent of East Haddam's forested land was cleared for various purposes. During that same period, an additional 327 "developed" acres were created (an 11% increase) and an additional 803 acres of "barren", "turf and grass" and "other grasses and agriculture" land cover were created (a 26% increase).

While not all of the 1,051-acre loss of forestland can be attributed to housing development, the 920 building permits issued for new housing units during that time likely account for much of the clearing activity. For each housing unit constructed, East Haddam lost 1.14 acres of forestland and added 1.23 acres of developed, barren, and grassed land capable of increasing stormwater runoff, erosion, and the application of fertilizers and pesticides.

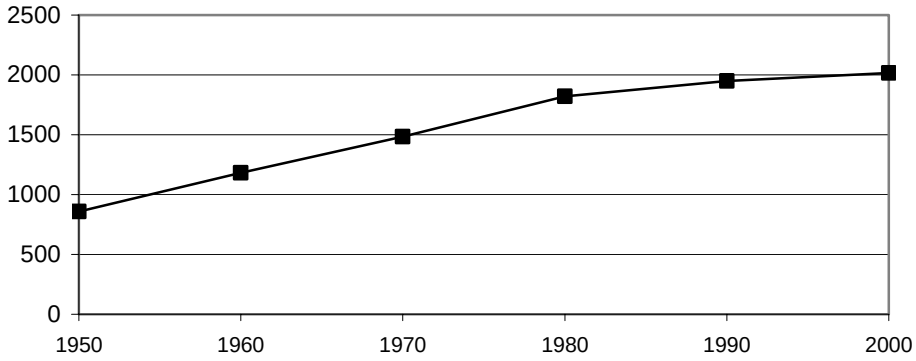
Open space preservation efforts since 1998 have conserved 892 acres of land in East Haddam. Given current zoning regulations and known environmental constraints, this land could have supported between 200 and 300 additional housing units if developed.

Lyme

Lyme is the least populous of the three Watershed towns. The Town's population actually peaked in 1800 on the strength of its maritime industries and would steadily decline to only 546 residents by 1930 before beginning a 70-year trend of slow growth. Lyme is the most isolated of the Watershed towns in terms of expressway access and is more than three towns removed from the regional employment centers of Groton, New London, and Norwich.

Lyme experienced average annual population growth rates ranging from 3.3% in the 1950s down to 0.3% during the 1990s, more than doubling in size during the last 50 years due to its small population. Like East Haddam, Lyme's rate of housing growth outpaced population growth between 1970 and 1990, due in part to decreasing average household size.

Lyme Population Growth 1950-2000



U.S. Census Bureau

The CLEAR land cover analysis reveals that between 1985 and 2002, 586 acres or four percent of Lyme's forested land was cleared for various purposes. During that same period, an additional 116 developed acres were created (an 11% increase) and an additional 512 acres of land cover were created in the "barren", "turf and grass" and "other grasses and agriculture" (a 44% increase).

During that 17-year period, Lyme issued 192 building permits for new housing units. Disturbingly, the ratio of cleared forestland relative to new housing is nearly triple that of East Haddam at 3.05 acres per new housing unit. Similarly, the ratio of newly created "developed", "barren", and "grassed" acreage is more than double that of East Haddam at 2.67 acres per new household, significantly increasing the potential for additional stormwater runoff, erosion, and attendant pollutants.

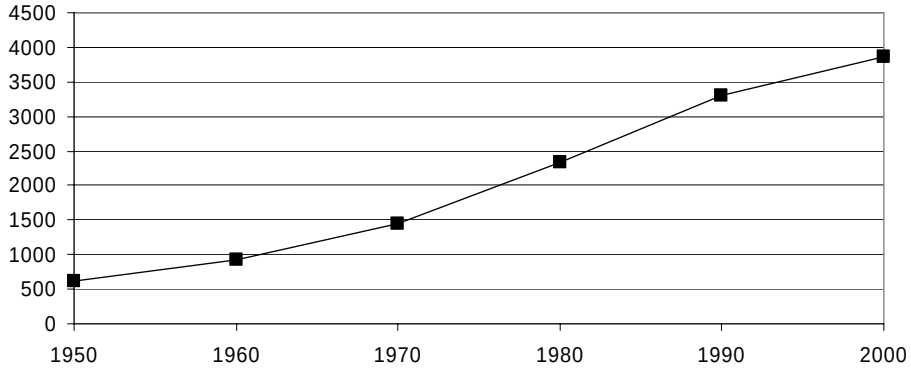
Since 1998, Lyme was the most aggressive of the three main watershed towns with respect to open space protection, conserving a phenomenal 1,724 acres or nearly eight percent of the entire Town in only seven years. If developed, this acreage could have supported over 400 new homes under current environmental and regulatory conditions.

Salem

Salem is the fastest growing of the three Watershed towns due to its location closest to employment opportunities in Norwich, Groton and New London as well as its direct access to Colchester and Hartford via Routes 11 and 2.

Salem experienced average annual population growth rates ranging from a peak of 4.9% during the 1970s down to a low of 1.5% during the 1990s. Salem is considered one of the fastest growing communities in the region and by 2000 its population had grown to more than six times its 1950 population. Typical of the other towns in the Watershed, the rate of housing growth in Salem outpaced population growth between 1970 and 2000, due in part to decreasing average household size.

Salem Population Growth 1950-2000



U.S. Census Bureau

The CLEAR land cover analysis for Salem reveals that between 1985 and 2002, 788 acres or six percent of Salem's forested land was cleared for various purposes. During that same 17-year period, an additional 286 "developed" acres were created (a 23% increase) and an additional 569 acres of "barren", "turf and grass" and "other grasses and agriculture" were created (a 27% increase).

Like Lyme, Salem's ratio of cleared land per new housing unit (334 building permits for new housing) during the 17 years covered by the CLEAR Study is significantly higher than East Haddam's at 2.35 acres of forestland lost per new housing unit. Similarly, there were 2.56 acres of "developed", "barren", and "grassed" acreage created per new housing unit.

Salem was the least aggressive of the three main Watershed towns in terms of conserving open space over the last seven years. Salem's 161 acres of open space conserved since 1998 represents less than one percent of Salem's total land area but nonetheless potentially displaced more than 70 additional housing units.

GROWTH PROJECTION SCENARIOS

According to the buildout analysis provided by the Study Committee, there is significant potential for additional housing units ranging from 157% to 260% growth.

Buildout Analysis Results

	Housing Units			Percent Growth Potential
	Current	**Potential**	**Total**	
East Haddam	3,967	7,611	11,578	192%
Lyme	1,051	2,733	3,784	260%
Salem	1,453	2,279	3,732	157%
Total	6,471	12,623	19,094	195%

Eightmile River Wild & Scenic Study Committee

These projections indicate that Salem is only 39% developed in terms of housing potential, given its current zoning and the amount and condition of developable land, while East Haddam and Lyme are 34% and 28% developed respectively.

Housing Growth Projections

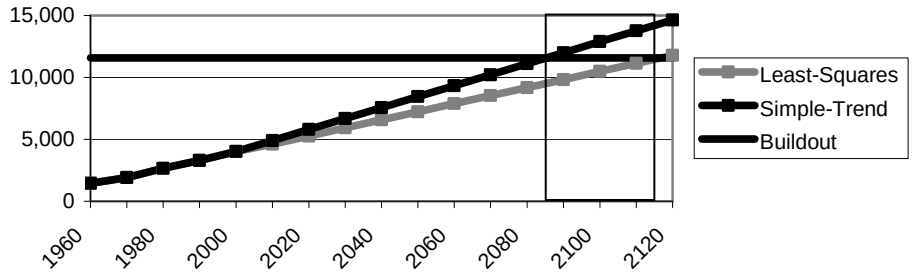
East Haddam

Several projection methods were used to offer a range of possible growth scenarios for each of the towns in the study. The first projection method used is the simple-trend method, which takes the growth trends of the last decade and extrapolates or projects those trends into the future until growth reaches the total housing buildout of 11,578 dwellings projected above.

Another method for projecting growth called the least-squares method looks at growth trends between 1960 and 2000 and minimizes fluctuations in growth over time to project an average or smoothed trend into the future.

To determine when total buildout might be reached, the trends produced using these two methods were plotted over time. The results depicted below reflect a range of 75 years to 110 years before the total buildout of 11,578 dwelling units is reached in East Haddam.

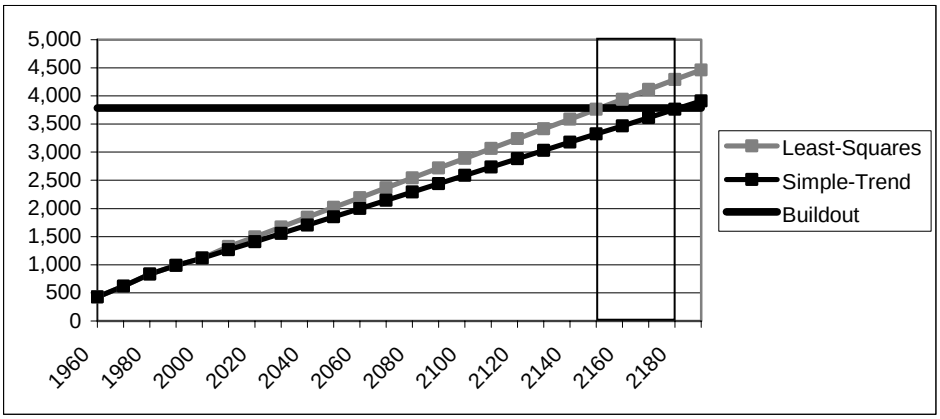
East Haddam Housing Growth Projections



Lyme

As stated earlier, Lyme has the smallest population and slowest population growth of the three towns in this analysis. While some of the slow growth can be explained by the aggressive acquisition of open space during the last decade, we believe that the Census Bureau undercounted housing units in Lyme during the 2000 Census (only three additional units accounted for over ten years) and have substituted data obtained from the Department of Housing and Urban Development (130 building permits for new dwellings over the same ten years).

Lyme Housing Growth Projections

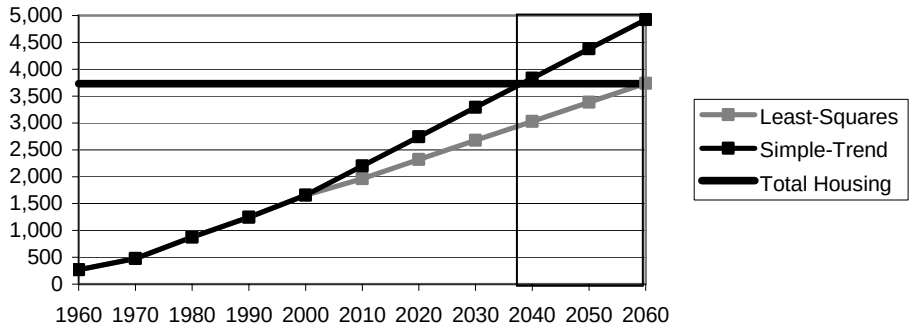


The results of the two projection methods produced a range of possible buildout dates from approximately 145 years for the least-squares projection method to 175 years for the simple-trend projection method.

Salem

As the fastest growing of the three towns, Salem's results are dramatically different. Based on the two trend analyses, Salem could reach its buildout potential of 3,732 dwellings in approximately 30 to 55 years. If these projections hold true, Salem would have to move quickly to implement some of the strategies outlined later in this report if they are to have any significant impact on protecting the Watershed and the overall character of the Town.

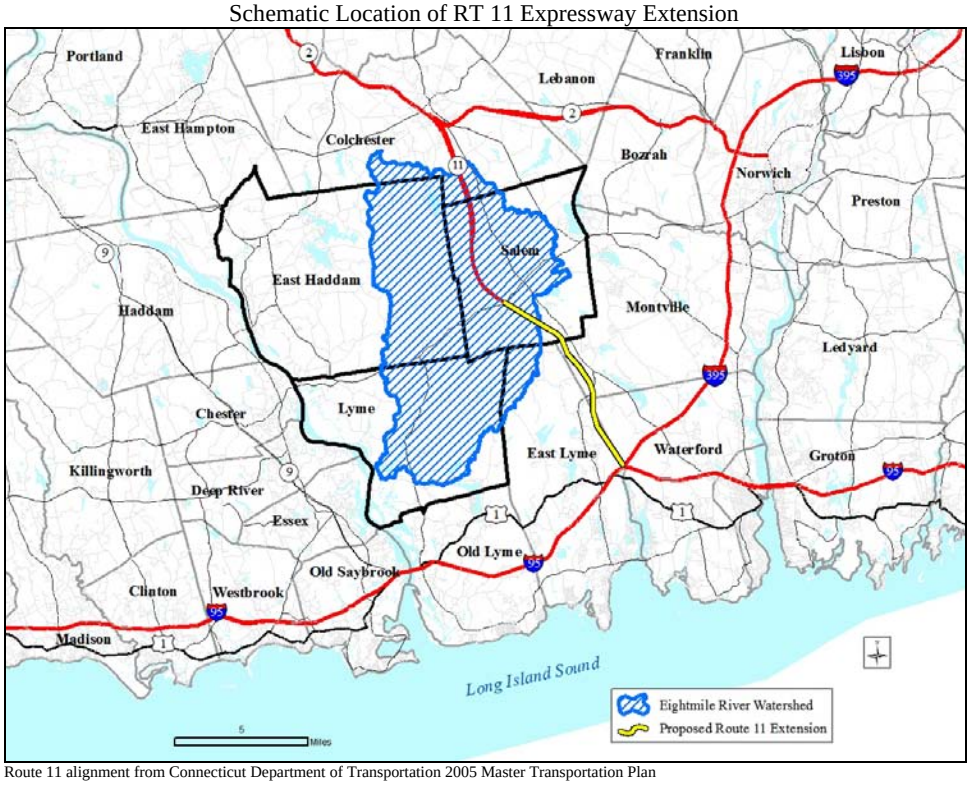
Salem Housing Growth Projections



ROUTE 11 IMPACT ASSESSMENT

The final leg of the Route 11 expressway between Route 82 in Salem and I-95/I-395 in Waterford has been fast-tracked by the Federal Highway Administration and right-of-way acquisition has begun. The following map illustrates the general routing of the expressway.

Schematic Location of RT 11 Expressway Extension



Route 11 alignment from Connecticut Department of Transportation 2005 Master Transportation Plan

Correlation Coefficient

A correlation coefficient can vary between zero and one with a value of zero meaning that there is no correlation between variables and a value of one representing a perfect correlation. A negative number implies a negative correlation in which two variables behave oppositely.

Correlation Analysis

To determine whether the completion of Route 11 would have an impact on development within the Watershed, an analysis was performed utilizing population data for all 169 towns in Connecticut between 1950 and 2000 to determine if there was any correlation between population growth (both in terms of the rate of growth and actual population counts) and direct access to an expressway of four or more lanes.

Correlation coefficients (see sidebar) were calculated for several statewide data sets, comparing the presence or lack of an expressway to total population growth between 1950 and 2000, and the average annual population growth rate between 1950 and 2000. In this analysis, a correlation coefficient was used to measure how closely these two attributes (the presence of an expressway and population growth) relate to one another in communities across the State.

Assuming that the presence of an expressway in a community would have a strong positive influence on the rate of growth in that community, when the presence or lack of an expressway in communities across the State was compared

to their average annual population growth rate between 1950 and 2000, one would expect a close correlation between the two factors. Comparing these factors across every community in Connecticut actually results in a correlation coefficient of -0.256, meaning that there is a weak negative correlation between these factors. Squaring this value produces a coefficient of determination of 0.06 meaning that only 6% of the variation in population growth rates in Connecticut communities can be explained by the presence or lack of an expressway. This leaves 94% of the variation in population growth left unexplained and possibly due to factors such as the price and availability of land, the quality of schools, employment opportunities, etc.

Coefficient of Determination

Squaring the correlation coefficient produces a coefficient of determination, which in this analysis represents the percent of the variation in population growth that can be explained by the presence or lack of an expressway.

Since the rate of growth is also a function of the size of a community (ex. 1,000 new residents in a town of 10,000 would represent 10% growth while 1,000 new residents in a city of 100,000 would represent only 1% growth), the actual number of residents added to a community over time provides a more standardized measure of growth. When total population growth between 1950 and 2000 is compared to the presence or lack of an expressway in communities across the State, a positive correlation coefficient of 0.177 and a coefficient of determination of 0.0313 results, indicating that only 3% of the variation in total population growth in Connecticut communities can be explained by the presence or lack of an expressway.

To better understand the impact of the presence of an expressway on communities of different sizes, all 169 communities were sorted into discrete population groupings and average annual population growth rates were calculated for each group over time. The results presented below illustrate that while there are differences between communities with and without expressways, there is no consistent pattern to those differences over time.

Average Annual Population Growth Rates for Connecticut Communities 1950-2000

1950 Population	1950s	1960s	1970s	1980s	1990s	1950-2000
Under 1000						
No Expressway	3.6%	3.0%	2.3%	1.7%	1.4%	2.4%
Expressway	5.2%	4.2%	4.0%	1.9%	0.8%	3.2%
1000-1999						
No Expressway	6.1%	4.4%	1.3%	1.2%	0.8%	2.7%
Expressway	4.7%	5.9%	2.1%	1.4%	1.1%	3.0%
2000-2999						
No Expressway	5.1%	4.0%	1.6%	1.3%	1.0%	2.6%
Expressway	4.8%	5.5%	1.4%	1.0%	0.6%	2.6%
3000-3999						
No Expressway	5.3%	3.4%	1.5%	1.2%	1.0%	2.5%
Expressway	5.0%	4.4%	2.2%	1.1%	1.5%	0.4%
4000-4999						
No Expressway	5.3%	5.0%	1.3%	0.9%	1.3%	2.7%
Expressway	4.6%	3.4%	0.9%	1.4%	0.6%	2.2%
5000+						
No Expressway	3.8%	2.7%	1.0%	0.6%	0.5%	1.7%
Expressway	1.9%	1.3%	-0.2%	0.4%	0.2%	0.7%

TOOLS FOR PROTECTING THE WATERSHED

There are numerous regulatory and non-regulatory tools available to communities within the Watershed that can be used not only to protect the outstanding resource values of the Watershed, but also:

- increase the quantity and quality open space,
- improve the pattern of residential development,
- reduce development pressure on other environmentally sensitive areas,
- adjust the residential development potential, and
- protect the overall character of the towns.

Some of these tools may already be in place in some form within the Watershed but may benefit from minor adjustments or a more comprehensive approach in concert with additional tools.

Increase the Quantity and Quality Open Space

Increase Open Space Set-asides

The Connecticut General Statutes (CGS) allow communities to require a portion of the undeveloped land within a new subdivision to be set aside for open space and indeed, there are few communities in Connecticut (if any) that do not take advantage of this provision. Where most communities differ is in the quantity and quality of open space that is actually preserved through this process. Many communities are increasing their open space requirements to as much as 15% to 20% of the overall development. At this early stage of residential development within the Watershed, such significant set-aside requirements can have a dramatic impact on the amount of open space preserved.

Plan for Open Space

The most effective tool for ensuring the quality of open space is an open space plan that identifies the most desirable open space for achieving the community's open space goals, such as providing parks or greenways, protecting wildlife habitat or important natural resources, buffering incompatible land uses, etc. Absent a plan that identifies specific parcels, a simple set of guidelines for use, access, ownership, and quality can guide Planning Commissions as they consider the value of proposed open space.

Require Equivalent Quality Open Space

To ensure that the quality of open space is representative of the development as a whole, Commissions can require that the percentage of wetlands, watercourses, floodplain, and steep slopes contained within the open space is no greater than the parcel as a whole. Since these areas are for the most part self-preserving, the protection of open space designation is not always necessary. For those instances where floodplain or similarly constrained land achieves an open space goal, such as providing a link in a greenway system, the commission should be able to waive this requirement to ensure public access or resource protection through appropriate ownership.

Accept Fees in-lieu-of Open Space

In those instances where the amount, quality, or location of proposed open space does not achieve a desired open space or other community goal, communities can accept a fee or combination of land and a fee in-lieu of open space equal to ten percent of the fair market value of the undeveloped land. The limit of ten percent applies regardless of whether a community normally requires a 15 to 20 percent open space set-aside. The discretion to offer a fee lies with the developer while the discretion to accept a fee lies with the Planning Commission.

Open space fees must be placed in a separate open space fund to be used to purchase more appropriate open space that meets community open space goals or needs. Through bonding and/or annual town contributions, a more effective open space fund can be created to leverage state and federal open space grants when desirable open space parcels become available.

Accept Alternative Open Space

One approach that might be particularly appropriate for protecting the Watershed would be to allow developers to substitute alternative open space within the Watershed in-lieu-of open space in developments located outside of the Watershed. In doing so, development within the Watershed is reduced in return for fully developing parcels located outside of the Watershed. Communities could also purchase critical open space within the Watershed and allow developers to "buy" their equivalent portions from the Town and offset the purchase price. This ensures that the Towns make the most effective use of their limited open space funds

Encourage Open Space Donation

One final open space tool that costs communities almost nothing to implement is to promote the benefits of open space donation. Many residents are emotionally attached to their land and communities and would rather see their land preserved in its natural state than developed into housing after they are gone. There are also a number of tax benefits to donating open space that can make such a donation easier on the owner or their estate.

Preserve Undeveloped Land

Implement Public Act 490

Towns can take several steps to forestall or prevent the development of undeveloped farmland, forest and privately held open space. Public Act 490 (PA 490) allows communities to offer reduced tax rates on designated farmland, forest and private open space in return for the land remaining undeveloped for ten years. Land that is developed while designated under the program is subject to a penalty until ten years have elapsed, making this only a temporary measure.
Purchase Development Rights

A more permanent program that can also be more cost effective than purchasing open space is to purchase development rights. In Connecticut, fee-simple ownership of land includes a package of rights including water, mineral, air and development rights that can be purchased separately from the land. Development rights are the right to develop according to the zoning regulations governing a parcel of land. They can be purchased at a fraction of the total cost of the property, preventing all or a portion of the land from being developed in the future. The owner is free to continue living on or farming the land utilizing whatever development already exists on the property. Like open space, there are matching grant programs available for purchasing development rights and preserving farmland.

Several studies have shown that purchasing open space or development rights can be cost effective for communities over the long term. While preserving open space or purchasing development rights can be initially costly and reduce tax revenues, approximately two-thirds of most municipal budgets are devoted to educational costs and the cost of educating children of new development would eventually exceed the purchase price.

As noted earlier in this report, the Towns of East Haddam, Lyme, and Salem have conserved 2,777 acres of open space in the last seven years alone, displacing as many as 777 new housing units. If developed, these houses would add 3,163 residents to the Watershed and the potential for over 500 new schoolchildren.

Improve the Pattern of Residential Development

Around the country, people are beginning to realize that the traditional zoning patterns of inflexible, large-lot zoning regulations have resulted in what people perceive as residential sprawl. This is an unflattering name for what has been recognized as the systematic consumption of rural land into similar characterless subdivisions.

Encourage Conservation Subdivisions

A simple step that many communities can take is to permit conservation or cluster subdivisions that allow reductions in minimum lot requirements such as area, frontage, and lot coverage. The benefits of this flexibility can include: more open space, less disturbance of the environment, less infrastructure to construct and maintain, and less stormwater runoff.

One deterrent to this approach is that the developer is often required to perform soil testing and design a conventional subdivision at additional expense that he/she has no intention of building, simply to determine the number of dwelling units that can be built in a clustered development.

Adopt Density-Based Zoning

Faced with the prospect of significant housing growth that threatens a town's rural character or its ability to provide necessary services, many communities' "knee-jerk" reaction is to try to increase rural minimum lot sizes in an attempt to reduce rate of growth and the total buildout of the community.

While effectively reducing buildout potential, such a measure will also:

- consume raw land at a much faster rate,
- increase the amount of road surface and lawn,
- increase stormwater runoff and non-point pollutants such as oil, salt, fertilizer, and pesticides, and
- encourage larger homes to justify the cost of the larger lots, making the community less affordable.

In the end, it may also have little if not the opposite effect on the rate of growth in the community.

Density-based zoning allows residential density and buildout potential to be tailored to meet community goals and objectives, such as protecting the Eightmile River Watershed, without the negative side effects noted above. Rather than use a minimum lot size to determine the development potential of land, density-based zoning replaces conventional minimum lot size requirements with a simple density factor

A comparable density factor for a one-acre minimum lot size zone might be anywhere from 0.6 to 0.8 dwelling units per acre after factoring out:

- any mandatory open space set-aside,
- the area consumed by roads, and
- an efficiency loss factor that accounts for irregularities in the land that affect the layout of parcels.

Assuming a density factor of 0.7 units per acre, a 100 acre parcel would allow 70 dwellings.

The chief benefit of density-based zoning over conventional zoning, or even conventional zoning with clustering provisions, is the simple flexibility that it provides. Under conventional zoning, minimum lot size and frontage requirements dictate the pattern of development and the location of infrastructure, leaving open space and protection of important resources as almost an afterthought. Under density-based zoning, sensitive areas and desirable open space can be identified and set aside at the beginning of the design process, with housing arranged to avoid these areas and take maximum advantage of access to open space, scenic views, water features, etc. The design of roads, and not the location of open space, becomes the final step in the process.

Other benefits of density-based zoning over conventional minimum lot area regulations include:

- total growth can be anticipated and planned for;
- lot sizes can be reduced without increasing the number of housing units;
- the total buildout potential can be moderated through adjustments in density;
- densities can be adjusted without creating non-conforming lots (there is no minimum lot size to judge small, older lots by);
- the amount of infrastructure to be constructed and maintained can be reduced, thus reducing stormwater to be collected and treated;
- sensitive areas within a subdivision can be avoided and the impacts on larger sensitive areas such as aquifers and watersheds can be reduced;
- the amount of raw land consumed can be reduced as much as soil conditions will allow; and
- residents and wildlife are able to enjoy all of the benefits of the larger open spaces surrounding the homes.

To adjust the density and buildout potential of a one-acre zone within a Watershed community, the 0.7 dwelling units per acre density can simply be reduced. A reduction from 0.7 to 0.5 units per acre would result in nearly a 30% reduction in density without requiring an increase in lot size. In our 100-acre example above, 70 lots would be reduced to 50 lots. A developer could conceivably develop 50 homes on 70 acres of land but would likely develop one-acre or smaller lots to reduce infrastructure costs, leaving the balance as open space.

Reduce Pressure on Sensitive Areas

Adopt a Buildable Area Regulation

When property is developed under conventional zoning regulations, developers will typically attempt to fit as many building lots onto a parcel as possible, often incorporating wetlands, steep slopes, and floodplains into lots in order to maximize the return on their investment in land and infrastructure. To ensure the ability to construct a home, many communities have instituted "buildable area" regulations that require that each lot contain a minimum buildable area that is free of steep slopes, floodplain, etc. The result is that lot sizes are increased to meet the buildable area requirements and overall development potential is reduced. This approach encourages these sensitive areas to remain under private ownership and provides them with little protection after development.

Adopt a Developable Area Regulation

A similar approach to a buildable area regulation is a "developable area" regulation, which may sound like a subtle distinction but the benefits are significantly greater. A developable area regulation is used in conjunction with density-based zoning and discounts wetlands, floodplains, and steep slopes before the density factor is applied to the land to be developed. In doing so, the development potential is determined up front and there is no incentive for the developer to incorporate these sensitive areas into building lots in order to maximize the number of dwelling units.

Building on the earlier example, if the equivalent density factor for a one-acre zone is 0.7 units per acre and 20% of our 100-acre property is constrained by wetlands and steep slopes, the development would result in a maximum of 56 dwellings.

$$(100 - 20) \times 0.7 = 56$$

Benefits of the developable area approach include:

- total growth can be anticipated and planned for;
- buildout potential is tailored to the ability of the land to support development;
- the expense of soil testing and designing conventional subdivisions for the sake of determining density becomes unnecessary;
- lot sizes and the amount of infrastructure to be constructed and maintained can be further reduced;
- development pressure on sensitive areas is reduced;
- more open space can be preserved; and
- conventional development patterns become the exception and not the norm.

Protect Water Quality

Adopt Stringent Coverage Requirements

Many towns adopt standards to regulate the density, bulk, and appearance of development but do not consider the impact of lot coverage on surface and groundwater resources. Impervious surfaces such as pavement and buildings prevent stormwater from penetrating into the ground, creating stormwater runoff that can lead to a host of problems including: increased erosion, flooding, non-point source pollution, and the need for unsightly storm drainage facilities that can detract from the character of the community.

Maximum impervious coverage requirements can be tailored to the character and purpose of each zone to place fixed limits on the amount of building coverage, pavement, and other impervious surfaces, thus reducing the amount of stormwater runoff. Flexibility in impervious coverage can be provided in exchange for meeting prescribed best management practices for stormwater management such as creating rain gardens, infiltrating clean stormwater into the ground, and creating bio-filtration systems to reduce non-point source pollution such as pesticides and fertilizers entering wetlands.

Adopt More Stringent Stormwater Management Requirements

In addition to coverage requirements that reduce the amount of runoff, measures can be taken to improve the quality and quantity of stormwater leaving a development. Stormwater collected from paved surfaces used by motor vehicles can contain many surface water contaminants such as oils, salt, sand and silt. Stormwater that is collected and discharged from a property without regard for downstream conditions can lead to flooding and property damage.

To improve the quality of stormwater leaving a site, regulations can require the renovation of stormwater through natural means such as bio-filtration through wetland vegetation and/or mechanical means such as oil separators and mechanical sand/silt separators.

Zero increase in runoff regulations can limit the rate of post-development stormwater runoff from a site to pre-development rates through infiltration of roof stormwater, and the storage, renovation, infiltration, and metered release of pavement runoff. In doing so, the effects of increased stormwater runoff volume and velocity can be mitigated.

Create Overlay Protection Zones

An Eightmile River Overlay Zone or similarly named zone could be a special purpose "floating zone" that applies on top of underlying residential, commercial, and industrial zones, placing more restrictive standards on activities within the River's riparian zone. Such a zone could establish more stringent buffer standards adjacent to the River, limit clearing and other activities that would encourage erosion and alter the wild & scenic character of the River.

Floodplain Overlay Zones could similarly overlay underlying zoning and limit activities within floodplains that would increase flooding (and erosion), place additional property in harms way, allow sewage to contaminate floodwaters and/or infiltrate drinking water systems, or create floating debris that could lead to downstream stream channel obstructions or collision damage.

A much broader Eightmile River Watershed Overlay Zone could encompass the entire Watershed within a given town and apply not only more restrictive coverage requirements, but could also reduce residential densities and strictly regulate uses with the potential to create surface water pollution such as gas stations or outdoor storage of hazardous materials.

Surface and Groundwater Protection Ordinances

Septic System Management and Underground Storage Tank Ordinances, while typically considered groundwater protection tools, can also be beneficial for surface water protection in cases of extreme failure. For many residents, septic systems and underground oil tanks are often overlooked until a problem occurs or the sale or refinancing of the property warrants their inspection or removal.

A Septic System Management Ordinance can require the periodic inspection and cleanout of septic systems to ensure their functionality and longevity. Septic system contractors can submit required proof of inspection and cleanout as required, and those property owners that do not comply can be issued warnings followed by fines. The septic system contractors can be willing participants in such a program by sending out reminders to their customers.

An Underground Storage Tank Ordinance is intended to prevent groundwater contamination by residential fuel oil leaks but can also protect surface water in locations where groundwater seeps occur on steep terrain. Such an ordinance can

take many forms ranging from a simple registration and testing program to a ban on all residential underground fuel tanks. Typically, an ordinance will allow for the amortization of existing tanks, depending on their age and potential threat to groundwater. A documented steel tank might be allowed to remain for a fixed period from its installation (short of its designed life expectancy) while an undocumented tank would have to be removed immediately due to its unknown age. Double walled fiberglass tanks with monitoring equipment might be allowed to remain longer with regular testing.

These strategies are by no means the only measures capable of protecting important resources within the Watershed. Other partners in the Eightmile River Wild & Scenic Study, such as NEMO and the Nature Conservancy, are renowned for their knowledge on protecting water quality, wildlife habitat and other important resources. However, we believe that these strategies represent the most effective means of mitigating development impacts on communities in a manner that is both practical and defensible.

To chose one comprehensive strategy that would have the greatest positive impact on development within the Watershed with the least amount of committed resources, adopting density-based zoning in combination with a developable land regulation and conservation subdivision provisions would be the preferable choice. This simple approach costs communities almost nothing to implement and can have far reaching impacts on community character, development potential, natural resources, open space, water quality, wildlife habitat and overall quality of life.

To illustrate the impact of just one aspect of this approach, if each of the three towns had conventional one-acre zoning and adopted density-based zoning while reducing the density from 0.7 units per acre to 0.5 units per acre (as in the hypothetical 100-acre subdivision), the buildout potential within the three towns would be reduced by over 3,600 new dwelling units, potentially saving up to 5.6 square miles of additional open space at buildout.

Adjusted Buildout Results

Housing Units

	Current	Potential	Total	Unadjusted Total*	Reduction in Units
East Haddam	3,967	5,436	9,403	11,578	2,175
Lyme	1,051	1,952	3,003	3,784	781
Salem	1,453	1,628	3,081	3,732	651
Total	6,471	9,016	15,487	19,094	3,607

*Unadjusted totals from the chart on Page 8.

With or without an adjustment to current densities, adding a developable land regulation alone could significantly reduce densities by removing wetlands, steep slopes, and floodplains from the density equation. As illustrated by the estimated 777 housing units displaced by the acquisition of 2,777 acres of open space within the Watershed between 1998 and 2005, additional open space acquisition beyond that required during the subdivision process can further reduce the potential for additional housing units and their attendant impacts on the Watershed.

Because it would displace housing, additional open space acquisition will also hasten the projected buildout dates presented in this report for each of the three communities but this is a positive outcome as it would protect natural resources and community character in the process.

SUMMARY

While we are unable to anticipate changes in many factors affecting growth, we can project past trends into the future to offer several possible growth scenarios. The results provide a different sense of urgency for each community with respect to protecting the quality of resources within both the Watershed and the remainder of each community.

The one factor that barring legal obstacles is within our ability to foresee, the completion of Route 11, cannot be proven to be a significant indicator of future growth. In the absence of a clearly discernable trend that can be applied to account for Route 11's impact on future growth within the Watershed, we are left to speculate on what its impact may ultimately be.

It would be wise to caution on the side of Route 11 having a positive impact on future growth and take many of the steps outlined in this report that are necessary to protect the Watershed. Growth is inevitable and Route 11 only has the potential to accelerate (or hinder) that growth. Having these measures in place will ensure that no matter how fast development occurs, it will be done in a manner that minimizes impacts on the Watershed, increases open space, protects surface and groundwater resources for future generations, protects overall community character, and enhances quality of life for all residents.

Notes & Comments

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