TOWN OF MARLOW
NATURAL RESOURCES INVENTORY
AND
CONSERVATION PRIORITIES

Prepared for:
Town of Marlow Conservation Commission

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With contributions from the Southwest Region Planning Commission for preparation of the Housing and Demographics study and Build-out Analysis mapping

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NEW HAMPSHIRE OEP OFFICE OF ENERGY AND PLANNING

The majority of this project was graciously funded by the NH Office of Energy and Planning Housing and Conservation Planning Program. The Town of Marlow Conservation Commission provided funding to distribute community outreach materials. Members of the Marlow Conservation Commission, Marlow Historical Society, and other community members, as well as the Cheshire County Conservation District and Cheshire County Cooperative Extension, provided in-kind voluntary hours in support of the project as well.

Cover photograph – A stretch of the Ashuelot River in the Kinson State Wildlife Management Area; a favorite fishing spot for the a great blue heron.

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INTRODUCTION

Population Growth and Development

Currently, New Hampshire's population is growing at a rate that is twofold that of the other New England states. The population has doubled in the forty years leading up to the turn of the century in 2000, and there was a rise in population of 17.2% between 1990 and 2004 alone. This rate of growth is followed by VT (10.4%), RI (7.7%), ME (7.3%), MA (6.7%), and CT (6.7%). New Hampshire's development pressure will tax the state's natural resources if not managed with diligence.

The bulk of population growth is in the southern third of the state; however 75% of conservation lands are located in the northern regions. This entrusts towns in the southern half of New Hampshire with a great responsibility with managing its natural resources and biological diversity, and establishes citizens as stewards of the land if we are to use informed decision making to promote a more sustainable approach at land use planning.

Although quite rural, Marlow is not without exception to these changes. To better understand this increase in population and development pressure the Southwest Region Planning Commission prepared a study on housing and demographics of Marlow. This report helps to illustrate *actual* and *projected* population trends and what this means for future housing needs.

From 2000 to 2007, Marlow increased its population by 2.9%, while Cheshire County had an increase of 4.4% (Figure 1, p.2). This would indicate that the overall population in Marlow is increasing at a slower rate than Cheshire County. However, projections through 2010 tell a different story. Based on data from NH Office of Energy and Planning (NH OEP) and the U.S. Census, the Town of Marlow is projected to increase by 6.6% over this ten year period. The population projection for Cheshire County is 78,624, which is an increase of 4,799 people, or a 6.1 % increase over the ten year period. This indicates that the projected population of Marlow will increase at a slightly faster rate than the population of Cheshire County during the same period. It is important to acknowledge that the 2007 figures are *estimates* and the 2010 figures are *projections.* Neither of these figures are actual counts. The upcoming census in 2010 will

provide us with *actual* population data that can better reflect the changes for both the Town of Marlow and Cheshire County.

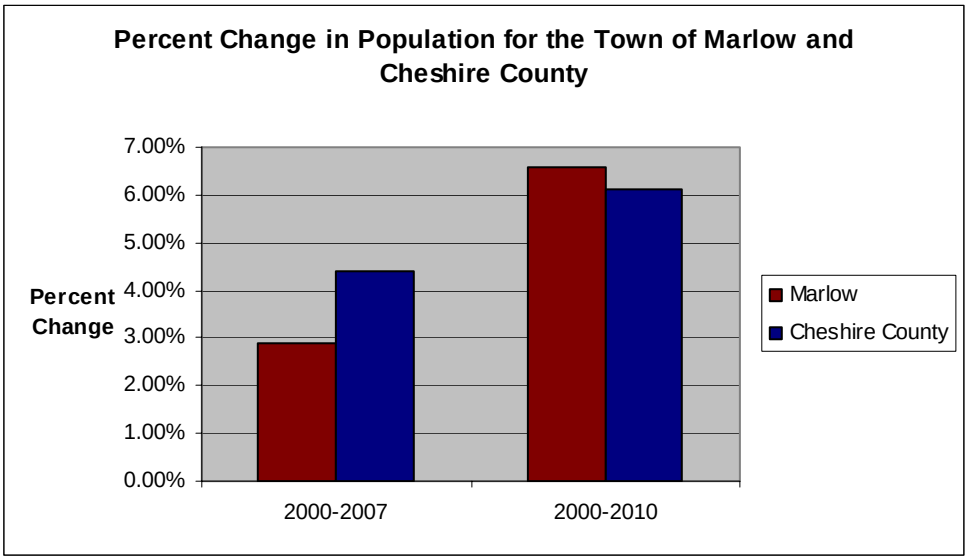


Figure 1. Percent estimated and projected population change from 2000-2007 and 2000-2010, respectively. Source: U.S. Census

In any population analysis it is important to understand how the town compares in a sub-regional context. This includes a comparison to the surrounding towns - Stoddard, Gilsum, Alstead, Acworth, Lempster, and Washington. Table 1 (p.3) and Figure 2 (p.3) help to illustrate this perspective of population change and comparison from 1980 - 2007. The results indicate that the towns within this sub-region experienced the largest growth in population during the housing boom of the 1980's (with the exception of Stoddard). For all of these towns, the slowest rate of growth occurred during the 2000 - 2007 period, with very little change in the population. Since this period only covers a seven year period and not a ten year period like the other categories, one might conclude that the numbers are not reflective of a true analysis. However, any changes that have occurred since then, and any population projections for the remainder of this period are expected to remain minor.

Table 1. Sub-regional comparison of percentage of population change for Marlow and surrounding towns.

	Marlow	Acworth	Alstead	Gilsum	Lempster	Stoddard	Washington
1980 - 1990	19.90%	31.50%	17.80%	14.30%	48.70%	29.00%	52.80%
1990 - 2000	14.90%	7.70%	13.00%	4.30%	2.50%	49.20%	42.50%
2000 - 2007	2.90%	6.90%	4%	4.00%	13.30%	10.20%	9.50%

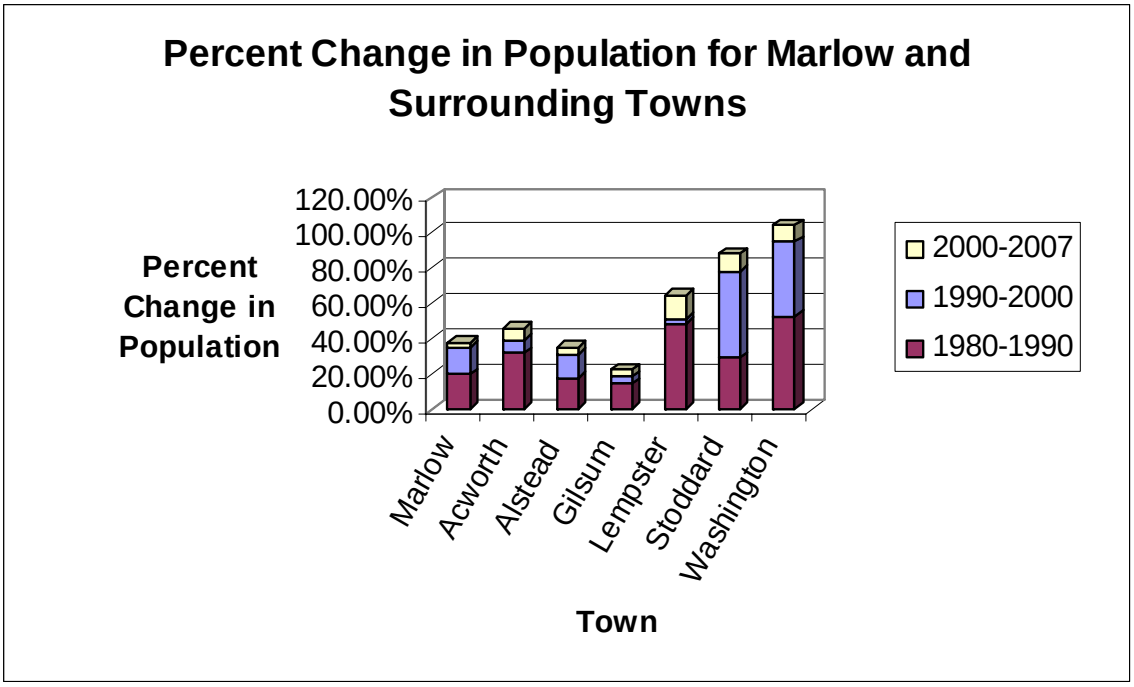


Figure 2. Sub-regional comparison of percentage of population change of Marlow and surrounding towns. Source: U.S. Census

So, how does this population growth affect land use? For Marlow, it is expected to be mainly in the form of residential housing as opposed to business and commercial developments. This is partly due to the rural nature of the town, distance to more populated business centers (i.e., Keene, Charlestown, Claremont, and Newport), and the increase in home businesses and telecommuting as a result of communication technologies.

The changes in real estate prices and availability have fluctuated drastically over the last twenty years. The housing boom in the late 1980's ended with an overstock of residential units throughout the country. Housing prices nearly tripled form 1980 to 1990. During the next decade, new house construction dropped off sharply to allow the housing need to catch up to the availability and prices remained stable. Prices began to rise again near the end of the 1990's as the need for housing began to rise. This rise continued into the 21st century but has seen a decline once again due to the effects of the latest recession. As such, the number of housing permits issued in Marlow from 2000-2007 was among the lowest when compared to the surrounding towns (Table 2, p.4 and Figure 3, p.4).

Table 2. Housing units authorized by permit in the sub-region.

Housing Units	2000	2001	2002	2003	2004	2005	2006	2007	2008
Marlow	6	7	2	4	6	3	-1	2	-
Acworth	1	4	6	13	12	10	10	18	-
Alstead	7	6	12	4	8	-5	36	9	-
Gilsum	4	4	2	1	2	2	5	3	-
Lempster	13	11	14	11	23	16	14	13	-
Stoddard	12	10	12	20	24	22	31	18	-
Washington	9	11	15	25	32	30	18	25	-

Source: NH Housing Finance Authority

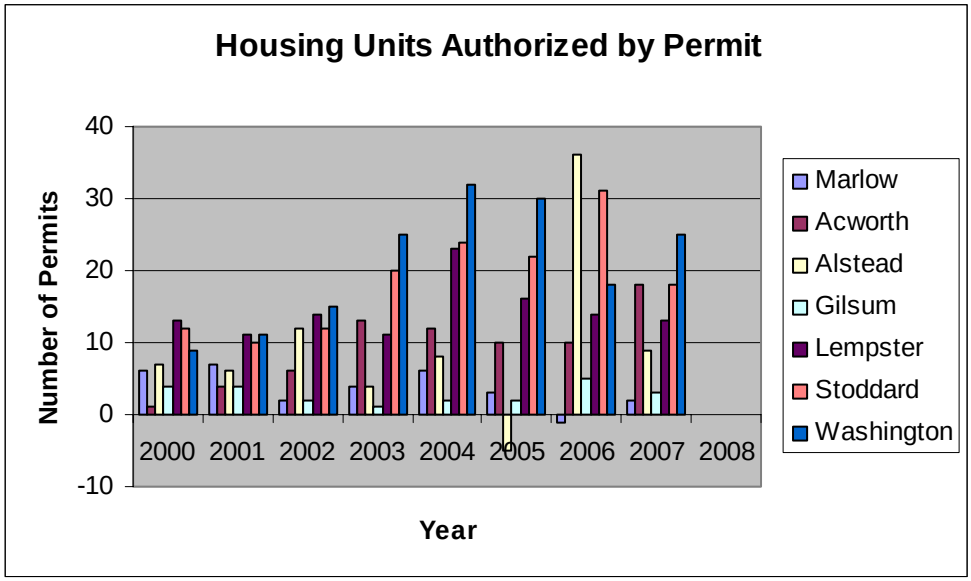


Figure 3. Housing units authorized by permit in the sub-region.
Source: NH Housing Finance Authority

In 2000, the number of housing units in Marlow totaled 396 units, which was an increase of 32 units from the 1990 census. The occupancy or use of these units in 2000 was 292 occupied homes and 104 vacant units, of which 86 were seasonal vacation units. This represents a 12.3% increase in owner-occupied units. However, the change in the number of rental units experienced a significantly larger increase. In 1990, there were 24 rental units, and by 2000 there were a total of 46 units, which represents a 91.7% change during the ten year period. These trends in combination with population growth projections can help to better understand the needs for future housing.

Future housing needs can be estimated from the NH OEP population projections or from the past population change trends for the 20 year period 1980 - 2000. The future population values are then divided by an average person per unit estimate, resulting in a total housing estimate. Tables 3 (p.5) and 4 (p.5) exemplify these trends and projection for Marlow.

Table 3. Marlow population growth trends from 1980-2000.

Population			# Increase	% Change	# Increase	% Change
1980	1990	2000	1980-1990	1980-1990	1990-2000	1990-2000
542	650	747	108	20%	97	14.9%

Source: U.S. Census

Table 4. Marlow population projections.

Population Projections							# Increase	% Change
2000	2005	2010	2015	2020	2025	2030	2000-2030	2000-2030
747	780	800	840	880	910	940	193	25.8%

Source: NH Office of Energy and Planning

The average growth for each 10 year period using the historical census data (Trends method) was 17.5%. Projecting this to the period from 2000 - 2030, there could be an increase in population to 1,213 by 2030 (an increase of 466). The methodology utilizing NH OEP population projections using a 25.8% increase shows that there could be an increase in population to 940 by 2030 (an increase of 193). To calculate housing need, a reasonable *person per unit* figure for the future must be assumed. The accepted *person per unit* figure used is 2.59, the value reported in the 2000 census. The results are found in Tables 5 (p.6) and 6 (p.6).

Table 5. Growth projections using past trends.

Population Increase	2000 Population	Additional Persons using 17.5% x 3 decades	Total Population	Persons/Unit	=Total Increase in Units
17.5%/decade	747	466	1213	2.59	468 (180 more units than in 2000)

Source: U.S. Census

Table 6. Growth projection for 2030 using NH OEP projections.

Population Increase	2000 Population	Additional Persons using 25.8% increase	Total Population	Persons/Unit	=Total Increase in Units
25.8%	747	193	940	2.59	363 (75 more units than in 2000)

Source: NH Office of Energy and Planning

The observations and projections indicate that, if Marlow were to experience the same level of population growth until the year 2030 as it did from 1980 - 2000, the need for housing units would increase from 288 units in 2000, to 468 units in 2030, which is an increase of 180 units. This would mean approximately 6 units per year. If the NH OEP projections are more accurate, the town would expect an increase of 2.5 units per year during the period from 2000 - 2030.

For a more detailed account on the housing and demographics study, including methods and sources of information, see the full report in Appendix A (p.86).

Biological Diversity and Conservation Planning

Biological diversity, or biodiversity, refers to the variety, variability, and complexity of life in all its forms and includes various ecological processes (e.g., nutrient cycling, flooding, fires, wind events, and succession) that have helped to shape them over time. Biodiversity includes various levels of ecological organization such as individual species and their genes that have evolved over time, as well as the many intricate plant and wildlife populations. It refers to even higher levels of organization including the

assemblage of ecological communities and even entire ecosystems, such as wetlands, woodlands, and rivers. Therefore, the concept of biodiversity engenders all levels of biological organization and the interactions of all living organisms within their physical environments (e.g., bedrock, soil, and water). It is at the heart of this understanding of the dynamics of biodiversity that we seek to develop protection strategies, helping to ensure a healthy environment for humans, as well as all other life forms.

Planning for the conservation of biodiversity is not a new concept altogether. It has helped in such efforts as the recovery of the American bald eagle; assisted in building preserves and managing other lands for species of conservation concern, as well as our most common species; aided in the identification of biodiversity hot spots; and helped to identify and protect critical wildlife habitats within our landscape. It has been a center piece for natural resources protection, restoration, and adaptive management for the past four decades.

This form of land use planning is not a static directory but one that is ever-changing. It is a vision that should be based on the principles of conservation biology and incorporates the current ecological structure of a given area (e.g., a town, a watershed, or an entire region). Thus, biodiversity conservation planning strives to incorporate the socio-economic fabric of our world with that of the ecological structure. This effort can help build more sustainable, more resilient New Hampshire communities into the future as a result of implementing comprehensive land use planning that includes our natural environment and built infrastructure.

The need for this type of informed land use planning is becoming more evident. Ecosystems and their constituents have long been susceptible to long-term degradation from overexploitation and misuse of natural resources. This has led to a precipitous decline in several species, some even resulting in extinction altogether. It has also led to the loss of critical habitats. While the past few decades certainly have seen a positive change in resource management and protection, there has been a distinct rise in conservation planning efforts within this past decade, especially in New Hampshire.

Statement of Purpose

The Marlow Conservation and Community Planning (MCCP) project was initiated in October 2008. The purpose of this project was to conduct research, mapping and data analyses on housing and natural resources. The overall scope was to craft a proactive planning project that incorporated the guiding principles of smart growth, affording an opportunity to blend our local and regional socio-economic fabrics with that of its ecological structure. Attention to these aspects provided the public with knowledge of our vast natural resources, historically sensitive areas, and opportunities for growth, aiding future planning efforts to help establish land use regulations, including those that can promote inclusionary housing. In addition, it can provide our educators with tools to teach our children about balancing regional and local resource protection with housing issues, which in turn can help to ensure our community's future.

The main goals of the MCCP project were to 1) solicit community involvement through outreach and engage residents in three open forum to address issues of growth and development (see pp.9-11), 2) map and analyze natural resources to determine priorities for conservation (see pp.20-70 and 77-81), 3) develop a basic inventory of historical resources (see the Town of Marlow Historical Resources Inventory document[1]), 4) analyze local and regional housing needs and demographics (see Appendix A, pp.86-92), and 5) conduct a build-out analysis based on current local zoning (see pp.71-76). These goals represent a process that promoted community participation and input into the planning process as a means to stimulate the future development of a community-based growth and development strategy. This can then be used to update the town's Master Plan and to identify regulatory ordinances that adhere to Marlow's community vision.

Marlow's Natural Resources Inventory (NRI) was a major component of the MCCP project. As such, it was incorporated into all three community forums and outreach efforts. It also included the housing needs and demographics analysis, as well as the build-out analysis. The NRI was prepared to provide general guidance for land use planning and community education. Its goals were to: 1) identify and map some of the most significant natural resources in Marlow using existing data sources in combination

[1] The Town of Marlow Historical Resources Inventory was prepared by Moosewood Ecological in cooperation with the members of the Marlow Historical Society. It was prepared as a separate document.

with limited site assessments, 2) identify priorities for conservation, and 3) prepare basic recommendations for future conservation planning initiatives.

Community Outreach and Education

As part of the MCCP project, the Town of Marlow began to act on its goal of community outreach and education by involving the residents into the conservation planning process. This effort involved two basic areas of concentration, including community mailings and forums, and a workshop on data collection for the NRI.

Community Mailings and Forums

In 2005, a community survey was developed and distributed to residents that solicited information regarding various aspects of growth and development. This survey was part of the Marlow Land Use Study by Jason Little (2005). A well-attended presentation highlighted the results of this study. As such, an initial mailing was sent to all households in Marlow to promote and encourage community support for the NRI as a way of invigorating the community's interest and building upon this land use study. This mailing packet included 1) an invitation to the first of a series of community forums and presentations, 2) a topographical base map of Marlow, and 3) a newsletter prepared by Moosewood Ecological and the Cheshire County Conservation District that provided the following:

- a background of the NH OEP Housing and Conservation Planning Program and its guiding principles,
- the scope, goals, and objectives of the Marlow Conservation and Community Planning project,
- highlighted results of the 2005 Land Use Study developed by Jason Little and the Franklin Pierce College Small Business Advisory Group, and
- a list of upcoming events, including workshops, forums, and presentations

The Town of Marlow in cooperation with Moosewood Ecological, the Cheshire County Conservation District and Southwest Region Planning Commission held a series

of community forums to engage the town's residents into the public planning process. The first was held on December 11, 2008. This forum introduced the overall project to the community, including the goals of each of the components, and solicited volunteers to assist with the project. It also facilitated a discussion on growth and natural resources protection. This discussion focused on identifying the strengths and challenges of Marlow's natural resources and its working landscape.

The second forum, held on May 21, 2009, provided an update of the project, including the natural and historical resources inventories, and the results of the housing and demographics study, as well as the results of the first community forum. The evening then continued with the theme of growth and natural resources protection. This included discussions that centered on identifying the natural resources that are most important to Marlow and which natural resource topics would participants like to learn more about. This discussion was then followed by an exercise that ranked natural resources for protection. The results of the ranking exercise were used in the co-occurrence analysis to assist with prioritizing areas for conservation.

On November 19, 2009, the third and final forum was held to present the results of the NRI and build-out analysis, including conservation focus areas. Results of the second forum were also shared. The results of the NRI and build-out analysis were then used as a spring board to facilitate a discussion on housing and conservation needs within the community, as well as drafting topics and ideas for Marlow's vision of growth and development.

The results from all three community forums can be found in Appendix B (p.93).

Global Positioning Systems (GPS) Workshop

In a continued effort to solicit volunteers for the MCCP project, the Marlow Conservation Commission, in cooperation with Moosewood Ecological and the Cheshire County Cooperative Extension, sponsored a Global Position System (GPS) workshop on April 23, 2009. The workshop trained volunteers on how to use GPS units to collect locational data for various natural resources on participant-owned or public properties. A

volunteer packet was created to facilitate data collection by volunteers. GPS units were provided by Cooperative Extension for volunteer use during April and May.

METHODOLOGY

Study Area

Marlow is part of the Sunapee Uplands, a subsection of the U.S. Forest Service's Vermont-New Hampshire Upland ecoregion that spans the western portion of New Hampshire and continues into Vermont (Figure 4, p.11). This ecoregional classification system is based on natural divisions defined by physical (climate and landforms) and biological attributes. The natural divisions that define ecoregions and their associated subsections are useful in synthesizing information regarding plant distributions and ecosystems. Simply stated, it represents a systematic approach of understanding and classifying the ecological structure on a large scale.

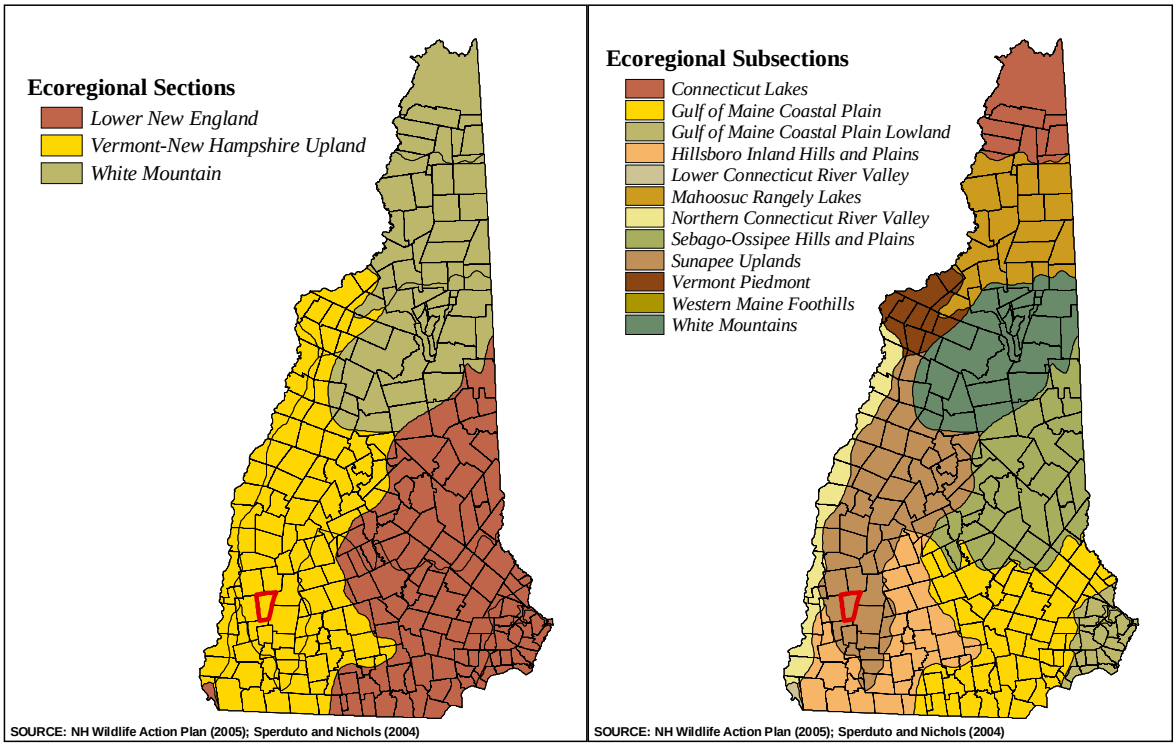


Figure 4. Ecoregions of New Hampshire. These maps show the distribution of ecoregional sections (*left*) and subsections (*right*) and how the town of Marlow (outlined in red) fits into this big picture. Moosewood Ecological LLC.

The Sunapee Uplands subsection is typically associated with shallow and stony soils, and is characterized as foothills of the White Mountains. Narrow valley streams and small waterbodies are numerous throughout. Bedrock geology that typifies this ecoregion mostly includes granite, except for the western edge that is characterized as phyllites and schists, which are known for producing soils enriched with higher nutrients.

The town of Marlow can be viewed from a watershed perspective as well. It lies within the greater Connecticut River basin. This large watershed has been divided into two distinct units by the NH Fish and Game Wildlife Action Plan, including the Southern Upland watershed associated with Marlow, as well as the Connecticut River mainstem watershed (Figure 5, p.12). These were delineated in such a manner as to provide a broad-scale, comprehensive assessment of and approach for the protection of aquatic ecosystems and the biodiversity associated with each.

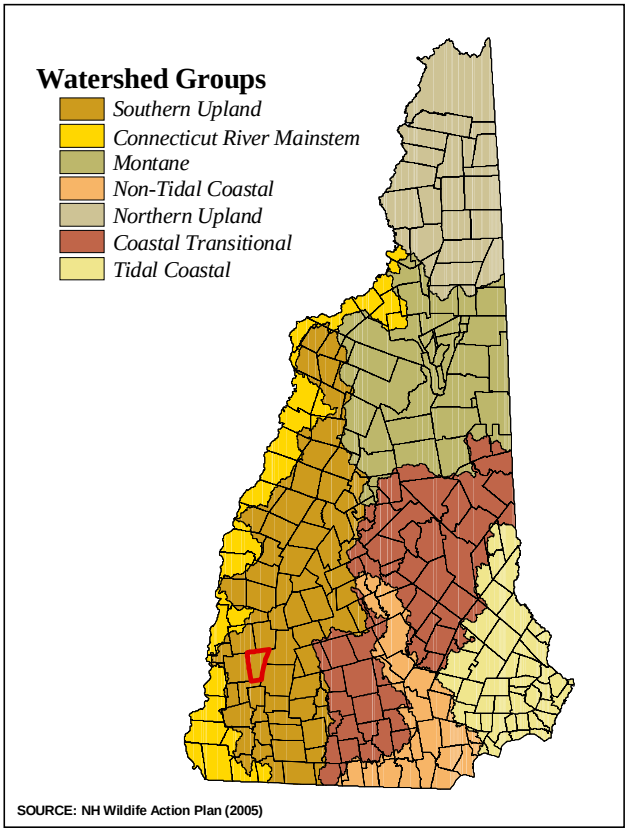
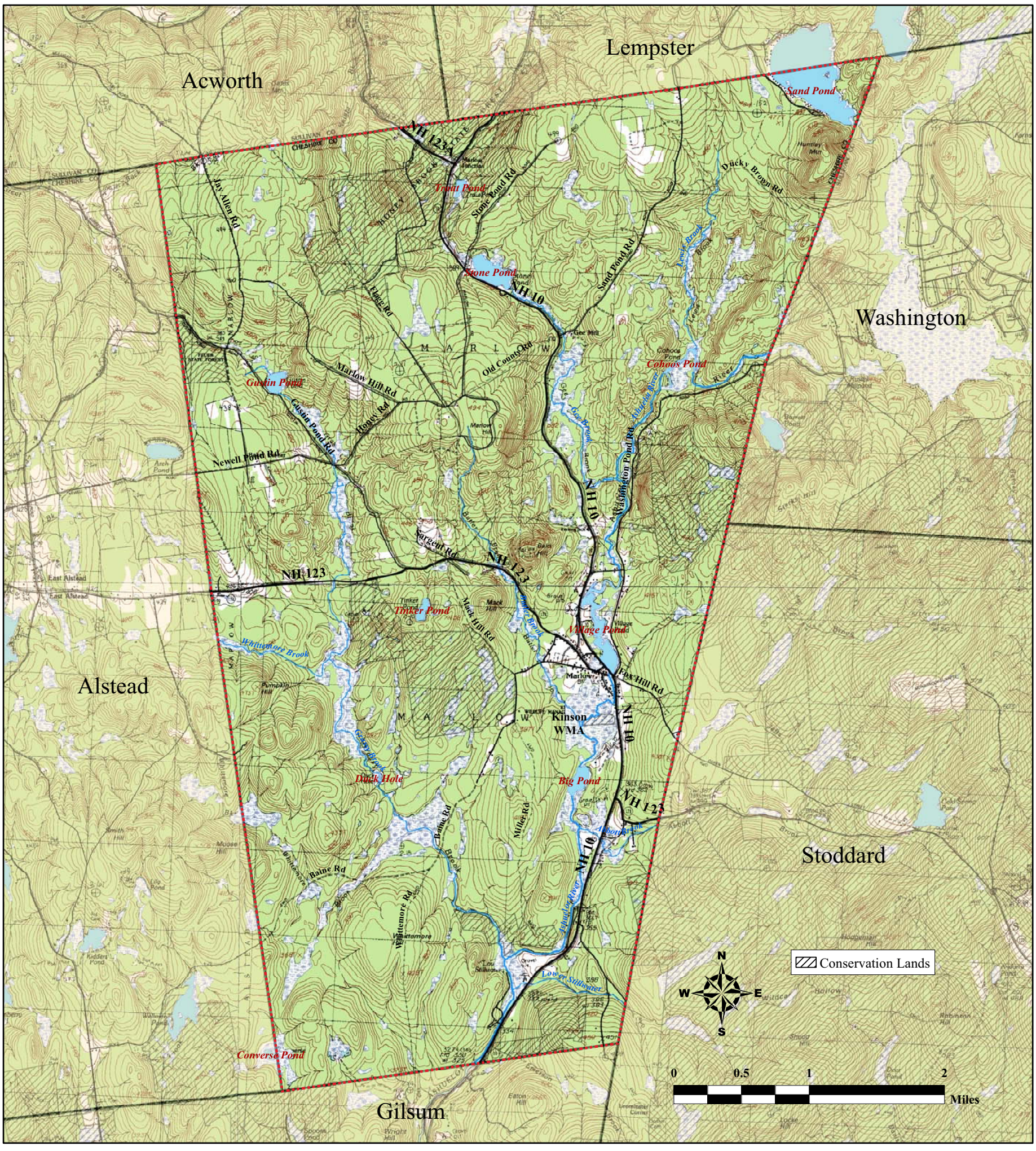


Figure 5. Major watershed units of New Hampshire. This map shows the distribution of main watershed units and Marlow's relationship to the Southern Uplands watershed. Moosewood Ecological LLC.

Marlow covers approximately 26.4 square miles, or 16,922 acres, of mostly forested and hilly terrain (Figure 6, p.14 and Figure 7, p.15). Its topography is highly variable, ranging from approximately 1,050 feet at the Ashuelot River along the southern town boundary to nearly 2,000 feet atop Huntley Mountain. The most densely populated center is found in the Village at the intersection of NH Routes 10 and 123 along the Ashuelot River. The landscape is further characterized by lowland river floodplains along the Ashuelot River and rolling hills of Whittemore Hill, Marlow Hill, Bald Hill, Mack Hill, Pumpkin Hill, and Huntley Mountain to extensive wetland systems along Grassy Brook, Gee Brook, and Ashuelot River. Other surface water resources include Gee Brook, Lewis Brook, Grassy Brook, Whittemore Brook, Butler Brook, and Ashuelot River, as well as Sand Pond, Gustin Pond, Village Pond, Tinker Pond, and Stone Pond. These varying landforms offer great diversity for wildlife and plant communities alike.

Marlow Natural Resources Inventory
Topological Map [2002]



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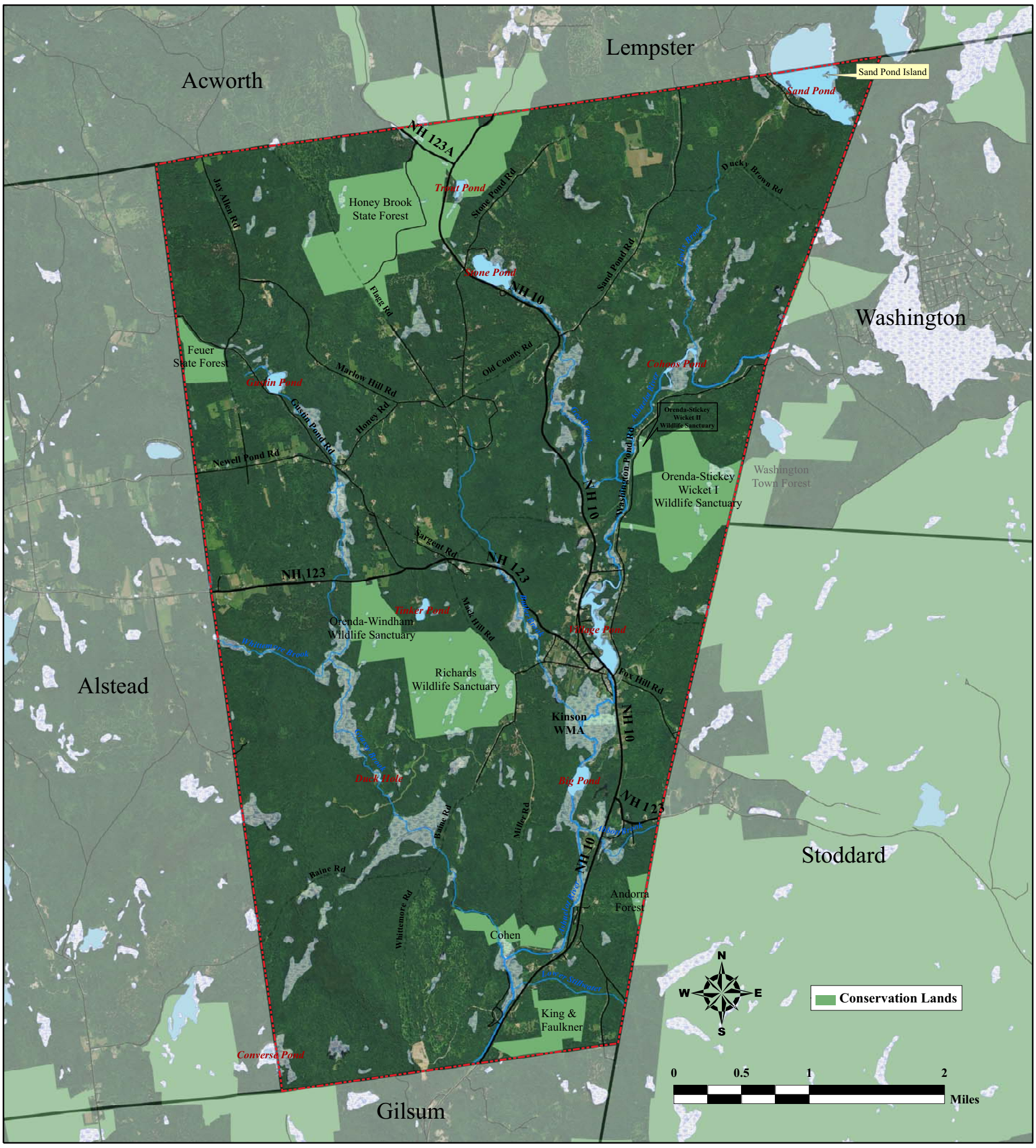
Latest Map Revision: November 2, 2009

Figure 6. U.S. Geological Survey topological map (2002) of Marlow, NH. This map demonstrates the general topography and distribution of transportation systems, general developed areas, conserved lands, ponds, lakes, rivers, streams and larger wetland systems. Moosewood Ecological LLC

Marlow Natural Resources Inventory
Aerial Map [NAIP 2008]



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Map is to be used for planning purposes only. Accuracy of data to be verified by end user. Use of this map constitutes agreement with terms of the Moosewood Ecological GIS Data Disclaimer.This map was created using ArcView 9.3.1 from ESRI with data supplied by NH GRANIT.

Latest Map Revision: November 2, 2009

Figure 7. Aerial photography (2008) of Marlow, NH. This map demonstrates the distribution of transportation systems, developed areas, conserved lands, utility right-of-ways, fields, forested areas, ponds, lakes, rivers, streams and larger wetland systems. Moosewood Ecological LLC

Methods for Natural Resources Inventory (NRI)

A variety of spatial data was incorporated into a series of natural resources maps using a geographical information system (GIS). These data were then assembled into the following themes:

Water Resources

Ecological Resources

Agricultural Resources

Forest Resources

Conserved Lands

The majority of the data were gathered from a variety of existing sources, while a few data layers were developed specifically for this project (Appendix C, p.97). All data were analyzed and manipulated for integration into a total of eight natural resources maps using ArcGIS (Version 9.3).

A total of three data layers were created or corrected for this project. These include steep south-facing slopes, riparian buffers, and unfragmented lands. Steep south-facing slopes were created using digital elevation models (DEMs). Slopes greater than 15% slopes and those with southeast, south, and southwest aspects were analyzed and selected from the dataset. These two data layers were then combined to determine the locations where they co-occur, resulting in steep, south-facing slopes. Riparian buffers were selected by buffering all wetlands and surface water resources by 200 feet. Each of the riparian buffers was then combined into one data layer to represent riparian areas. The unfragmented lands data prepared by the NH Wildlife Action Plan (WAP) was corrected. The area along NH route 123 from the Village to the western boundary with Alstead was recalculated to reflect the 500-foot development zone that was used in the original analysis.

Roadside surveys and limited site visits were conducted to verify a variety of ecological data and record new rare or unusual observations. This included selected WAP

data and known natural communities, as well as observations of species of conservation concern and additional rare natural communities.

Methods for Build-out Analysis

The build-out analysis was conducted using a geographic information system (GIS). In using a GIS the analysis of existing zoning, parcel boundaries and environmental constraints were entered into the build-out analysis software (CommunityViz). Environmental constraints were defined as hydric soils, wetlands and surface waters, steep slopes (slopes greater than 15%), conserved lands, areas that are shallow to water table (less than 36") and 100-year flood zone. Two analyses were conducted in CommunityViz to demonstrate 100% build-out capacity using the current zoning and 150% build-out using a modified version of the zoning to allow for such capacity for development.

Methods for Conservation Priorities

A simple weighted co-occurrence model was created in a GIS to aid in prioritizing areas for conservation. Twenty-one sets of data were grouped together into fifteen classes of natural resources. These data represent the four main themes outlined above, including *Water Resources*, *Ecological Resources*, *Agricultural Resources*, and *Forest Resources*, and were ranked according to their importance during the second Marlow Conservation and Community Planning forum (Table 7, p.18). The ranking used a numeric system of 1 or 2 to score natural resources, whereas natural resources ranked with a 2 were perceived as having a higher priority for protection in Marlow.

Once the data sets were prepared and ranked accordingly a co-occurrence analysis was performed. This analysis demonstrates "hotspots" where natural resources co-occur or overlap. The resulting data was then combined with an ecological interpretation of various landscape-level attributes to identify general Conservation Focus Areas (CFAs). This process evaluated the distribution of "hotspots," especially those concentrated within close proximity to one another, with the distribution of unfragmented lands, general locations of rare species and exemplary natural communities, high quality

examples of ecologically significant habitats, proximity to conservation lands, wildlife movement and habitat connectivity, and current land use, including degree of land parcelization and general development pressure.

Table 7. Natural resources ranking for inclusion in the co-occurrence analysis.

Natural Resource Data	Ranking
Surface Waters (ponds, lakes, streams)	2
Important Forest Soils (IA, IB, IC)	2
Unfragmented Lands	2
Agricultural Soils	1
Peatlands (WAP)	1
Marshes (WAP)	1
Forest Floodplains (WAP)	1
Grasslands (WAP)	1
Hemlock-Hardwood-Pine Forest (WAP)	1
Lowland Spruce-Fir Forest (WAP)	1
Northern Hardwood-Conifer Forest (WAP)	1
Wetlands Composite (NWI and Hydric Soils)	1
Stratified Drift Aquifers	1
200-foot Stream and Wetlands Buffer	1
South-facing Steep Slopes	1

Limitations of Data and GIS Disclaimer

One of the major limitations of a coarse-filter analysis is the use of existing digital data. A variety of data layers were used to create the natural resources maps found herein, and most data were developed by numerous governmental agencies and other sources. Much of the existing spatial data were produced using *remote data* such as the interpretation of satellite imagery and aerial photography. In addition, these data were produced at various scales and hence represent different degrees of errors, omissions, and inaccuracies.

While these limitations do represent some uncertainties, this type of mapping and analyses is the most cost-effective first phase of developing an understanding of Marlow's natural resources in an effort to assist with innovative conservation planning.

In the ideal world, all data would be accurate, precise, and up-to-date. However, to produce such a level of accuracy would be very time-consuming and thus a costly effort.

The scope of this project included the use of existing data and limited development of new data. Additional research and data development would be needed to produce more exact data. Every effort has been put forth to maintain high quality data for the mapping of Marlow's natural resources. As such, Moosewood Ecological refined some existing data and developed new data based on aerial photography interpretation, limited site visits, and roadside surveys. Areas assessed represent only a small sample of the town. As such, it does not include a comprehensive ecological inventory and should not be construed as such. Nor should it relieve the need to continue to conduct additional ecological inventories and biological monitoring efforts in the future to build upon the collective knowledge gathered to date.

The maps contained herein are for information and planning purposes only. They are suitable for general land use planning. However, they are not suitable for detailed site planning and design, including, but not limited to, wetlands delineations and other jurisdictional determinations, as well as defining legal property boundaries. These data are approximate and should be field verified. The accuracy of the data is the end user's responsibility. Moosewood Ecological LLC and the Town of Marlow make no warranty, expressed or implied, as to the accuracy or completeness of the GIS data, and do not assume any liability with the use and/or misuse of this data. Furthermore, Moosewood Ecological LLC and the Town of Marlow shall assume no responsibility for any errors, omissions, or inaccuracies in the information provided.

RESULTS AND DISCUSSION

Natural Resources Inventory

Water Resources

Water resources represent some of our most fragile ecosystems and are particularly sensitive to certain types of land use. Water resources comprise a variety of natural features, which include both surface and groundwater elements. Such features include our streams and rivers, ponds and lakes, wetlands, and groundwater aquifers. In terms of their importance for conservation, these resources provide a variety of ecological functions and societal values, including:

- Water quality maintenance
- Flood control
- Wildlife and fisheries habitat
- Drinking water sources
- Recreation
- Visual quality and aesthetics
- Rare and endangered species habitat and natural communities
- Groundwater recharge and discharge
- Sediment and shoreline stabilization
- Educational and scientific value
- Overall biological diversity of Marlow

Water resources, as with all natural resources, do not adhere to political units, such as parcels, towns, and state boundaries. Instead, they are dictated by the physical features of our landscape that form watersheds. Watersheds can be mapped at various scales and are dependant upon the stream or drainage basin that is in question. These can include large rivers such as the Connecticut River basin down to even the smallest tributary. As such, one can create a series of nested subwatersheds that express various scales of information found within each. For example, a small drainage on Pumpkin Hill forms its own subwatershed and is contained within the Whittemore Brook subwatershed,

which is part of the Grassy Brook subwatershed. Grassy Brook is a subwatershed of the larger Ashuelot River watershed, which is yet a smaller watershed unit of the much larger Connecticut River basin that covers many towns in western New Hampshire and eastern Vermont, as well as other states to the south.

Watersheds typically form reasonable ecological units from which management and land use planning can be most beneficial. They can be very effective in better understanding land use impacts on our natural resources, including water quality and quantity, flooding, soil erosion, wildlife habitats, natural communities, rare species, and aquatic wildlife, including fisheries. As such, they form easily identifiable units that can be used in various types of conservation planning efforts.

Watersheds have been classified by their Hydrologic Unit Code (HUC), as defined by the U.S. Geological Survey. These are codes given to a particular hydrologic unit, or watershed, and identify the scale at which it was mapped. The higher the HUC number the smaller the watershed unit and hence represents a finer scale of mapping. For example HUC 12 has been mapped at a finer scale than HUC 10. The USDA Natural Resources and Conservation Service and the NH Department of Environmental Services have mapped the hydrologic units for New Hampshire, including HUC 10 and HUC 12 watersheds that were used for this project (Figure 8, p.22 and Table 8, p.22).

As noted earlier, Marlow is located within the Southern Upland watershed of the greater Connecticut River (HUC 6) basin (Figure 5, p.12). Within this hydrologic unit are two distinct and well-known watersheds (HUC 10): the Ashuelot River and Cold River. The majority of Marlow lies within the Upper Ashuelot River watershed, whereas the northwestern highlands form part of the upper portion of the Cold River watershed. The Water Resources maps that follow use the HUC 10 watersheds for easier interpretation of surface and groundwater resources in Marlow. However, HUC 12 units have been mapped to provide an understanding of how watersheds can be nested within one another in order to achieve a finer scale of analyses and interpretations of natural resources within each hydrologic unit. These subwatersheds can then be further refined to delineate even smaller hydrologic units if the need should arise.

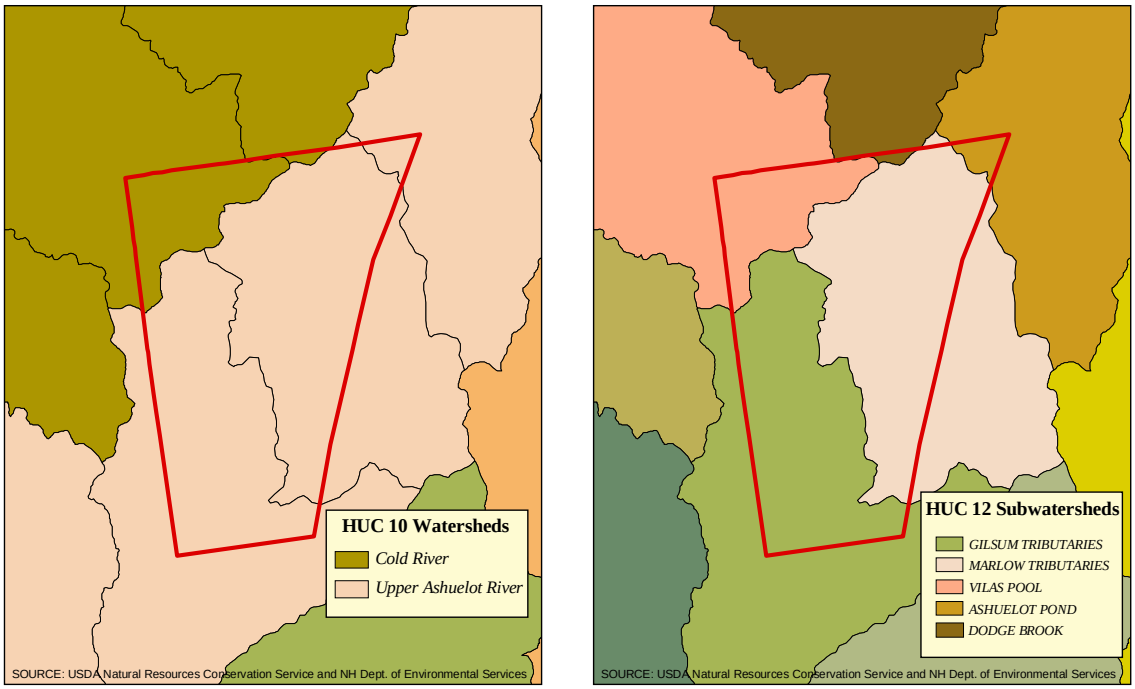


Figure 8. Watersheds of Marlow, NH. This map shows the locations and names of HUC 10 watersheds and HUC 12 subwatersheds that form part of the Connecticut River basin. Moosewood Ecological LLC

Table 8. Summary of watersheds (HUC 10) and subwatersheds (HUC 12).

Watersheds and Subwatersheds	**Area in Marlow (acres)**
Upper Ashuelot River Watershed	
Gilsum Tributaries Subwatershed	6,507
Marlow Tributaries Subwatershed	7,713
Ashuelot Pond Subwatershed	311
	Total 14,531
Cold River Watershed	
Vilas Pool Subwatershed	2,294
Dodge Brook Subwatershed	98
	Total 2,392

SOURCE: US Geological Survey hydrologic watershed units (HUC 10 and 12) from GRANIT

Wetlands and Surface Water Resources

The Wetlands and Surface Waters Resources map demonstrates the distribution of wetlands, watercourses (rivers and streams), and waterbodies (ponds and other surface water impoundments) in Marlow (Figure 9, p.30). This map also shows which watershed these resources reside, as well as those areas that are permanently protected.

Wetlands generally include familiar places such as marshes, wet meadows, beaver impoundments, swamps, fens, bogs, streams, ponds, and lakes. As noted above, they perform a variety of ecological functions and values that benefit humans. They also serve as ecologically significant habitats for wildlife and plants, which is discussed in the *Ecological Resources* section below. In New Hampshire, wetlands are defined by RSA 482-A:2 as "an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and under normal conditions does support, a prevalence of vegetation typically adapted for life in saturated soils conditions." They are further defined by three particular elements, including hydrophytic vegetation, hydric soils, and wetlands hydrology. As such, wetlands are regulated by the New Hampshire Department of Environmental Services' Wetlands Bureau as defined in RSA-A:2.

To better understand the potential extent of wetlands within Marlow, the US Fish and Wildlife Service's National Wetlands Inventory (NWI) and US Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) hydric soils were mapped. These combined datasets provide for a more balanced approach at wetlands mapping. The NWI is a hierarchal system of classification that was designed to map wetlands throughout the conterminous United States as a means to determine wetlands loss over time. It also serves a systematic method for comparing wetlands within a defined geographic location (i.e., town or watershed). The NWI provides some very useful information including the type of wetland as well as its hydrology, associated plant communities, water chemistry, and other modifiers such as human dams and beaver influence.

There are two main wetland systems that have been mapped by the NWI that comprise about 1,297 acres or 8% of the total area of Marlow. These include lacustrine and palustrine wetlands (Table 9, p.25). A third NWI wetland system (riverine) also

exists in Marlow and includes all rivers and smaller stream drainages. However, only larger riverine wetland systems (i.e., Connecticut River and the lower Ashuelot River) have been mapped by NWI. As such, rivers and streams are discussed below.

Lacustrine wetlands generally refer to ponds and lakes greater than 20 acres that are located in a topographic depression (with or without an existing dam) or along a dammed river. These wetlands systems lack a substantial cover (<30%) of trees, shrubs, and herbaceous plants (i.e., grasses, sedges, and wildflowers). Lacustrine systems may include other smaller waterbodies if the shoreline is formed by wave action or lined with bedrock, or if the water depth exceeds 6.6 feet. Marlow's lacustrine wetlands are estimated to cover approximately 177 acres and include Sand Pond, Stone Pond, and Village Pond, as well as two other sites including a portion of the large wetland complex along Grassy Brook between Route 123 and Gustin Pond Road and the large wetland complex along Gee Brook south of Sand Pond Road.

Palustrine systems make up the majority of wetlands distributed throughout New Hampshire. As such, Marlow typifies this general trend. Palustrine systems are primarily wetlands that are dominated by vegetation and do not meet the criteria as a lacustrine system. These are, for practical purposes, wetlands that most people recognize as marshes, swamps, beaver impoundments, and bogs. These can even include vernal pool complexes.

Four main classes of palustrine wetlands are located in Marlow. These include:

1. *emergent marshes* - dominated by herbaceous plants such as grasses, sedges, rushes, and wildflowers;
2. *scrub-shrub swamps* - dominated by shrubs such as highbush blueberry, winterberry, northern wild raisin, arrowood, and alder as well as small trees;
3. *forested swamps* - dominated by mature trees such as red maple, hemlock, spruce, and fir; and
4. *unconsolidated bottom* - open waterbodies with mucky or sandy substrates and less than 30% vegetative cover.

Table 9. Summary of National Wetlands Inventory and hydric soils in Marlow.

Wetlands Description		Size (acres)
National Wetlands Inventory		
Palustrine Emergent Marsh		121
Palustrine Scrub-Shrub Swamp		533
Palustrine Forested Swamp		270
Palustrine Unconsolidated Bottom		196
Lacustrine		177
	Total	*1,297*
Hydric Soils		
Very Poorly Drained		1,428
Poorly Drained		1,056
	Total	*2,484*
Wetlands Composite		
NWI and Hydric Soils		*3,115**

SOURCE: USDA Natural Resources Conservation Service soils and US Fish and Wildife Service National Wetlands Inventory datasets from GRANIT

*Total estimated acreage of wetlands when combining hydric soils and National Wetlands Inventory together into one data layer.

The majority of the palustrine wetlands are represented by scrub-shrub swamps (41%) followed by forested swamps (21%). Together, palustrine systems make up approximately 1,120 acres or 86% of NWI in Marlow. The largest and most structurally diverse wetland complexes can be found along the various river and stream drainages, including Ashuelot River, Grassy Brook, and Gee Brook. However, many smaller wetlands are found in isolated basins and may represent some unique plant communities and wildlife assemblages.

Hydric soils are essentially wetland-related soil types and represent those that take on anaerobic (oxygen-deprived) conditions as a result of seasonal saturation, flooding, or ponded water. These have been mapped by the USDA NRCS and when combined with

the NWI provide a more complete perspective of the potential array of wetlands in Marlow. Included are poorly drained soils and very poorly drained soils.

Poorly drained soils are those that drain water very slowly. For this reason the soil is wet for extended lengths of time and is periodically saturated during the growing season. Poorly drained soils are not always associated with jurisdictional wetlands and need field verification. In comparison, very poorly drained soils include soils that also drain water very slowly, but result in free water at or on the surface during the majority of the growing season. Generally, very poorly drained soils are associated with jurisdictional wetlands of the state. It is important to display both NWI and hydric soils data to help understand potential gaps that may exist, especially as it pertains to forested wetlands that can be difficult to map using aerial photography interpretation alone.

Hydric soils are widely distributed throughout Marlow, accounting for approximately 2,484 acres or 15% of the town (Table 9, p.25). Very poorly drained soils comprise nearly 58% of hydric soils. These are mostly found in association with palustrine wetlands and as a result are mapped beneath the NWI. In contrast, poorly drained soils represent about 42% of the hydric soils in Marlow. They are mostly found in association with palustrine wetlands, extending into areas of slow drainage due to broad topographic relief.

When these two wetland datasets are combined into a single wetland composite, it was estimated that Marlow contains approximately 3,115 acres of wetlands, or 18% of the town. This estimate provides a better representation of wetlands coverage across the town. However, it should be noted that NWI can typically underestimate wetlands acreage while hydric soils, and in particular poorly drained soils, can tend to overestimate total coverage.

The remaining surface water resources include areas that are typically known as waterbodies and watercourses. In Marlow, these represent the various ponds and streams distributed throughout the town. Not only do they provide a multitude of human benefits such as fishing, hunting, boating, swimming, and nature watching, they are also extremely significant for diverse wildlife and plants that depend upon these resources for part or all of their life cycle needs. Generally, major threats to surface water resources

include potential water quality degradation and habitat loss due to adjacent land uses, including unsustainable forestry and agricultural practices and land conversion associated with residential, commercial, and industrial development.

Marlow has 11 waterbodies scattered throughout the town, representing 213 acres (Table 10, p.27). These waterbodies have been recognized and labeled as such by the state of New Hampshire and/or the US Geological Survey. They range in size from roughly ½-acre (Duck Hole) to 155 acres (Sand Pond), and the majority of these are less than 20 acres each. As such, Sand Pond, Village Pond and Stone Pond are the largest waterbodies, respectively, and Sand Pond and Stone Pond have state-designated recreational access via boat ramps. Overall, residential developments along the shoreline of these waterbodies have been relatively minor, whereas Sand Pond exhibits a moderate level of shoreline development in Marlow as well as Lempster. Eight out of the 11 waterbodies are included on the NH Department of Environmental Services (NH DES) Consolidated List of Waterbodies subject to the Comprehensive Shoreland Protection Act under RSA 483-B.

Table 10. Summary of waterbodies in Marlow.

Name	Size (acres)
Sand Pond	159.1*
Trout Pond	4.2
Stone Pond	25.8
Gustin Pond	11.1
Cohoos Pond	17
Tinker Pond	5.8
Village Pond	35
Big Pond (Upper Stillwater)	11
Lower Stillwater	14
Wildife Pond	>10
Duck Hole	0.6

SOURCE: USGS topography and GRANIT hydrogrpahy datasets and NH DES RSA 483-B.

*Total acres of Sand Pond; about 78.6 acres is located in Marlow.
Waterbodies in **bold type** are jurisdictional designations by NH DES and subject to the Comprehensive Shoreland Protection Act under RSA 483-B.

Watercourses include all perennial and intermittent streams. There are approximately 103 miles of streams in Marlow (Table 11, p.28), and much of this length is in nearly pristine conditions due to relatively low levels of residential and commercial developments and roadway crossings within their respective watersheds. In fact, many stretches of Marlow's streams have no development associated with them. Most of the watercourses are unnamed. However, nine are recognized by the US Geological Survey and two of which are included on the NH Department of Environmental Services (NH DES) Consolidated List of Waterbodies subject to the Comprehensive Shoreland Protection Act under RSA 483-B, including Grassy Brook and Ashuelot River.

The entire length of the Ashuelot River from the dam at Butterfield Pond in Washington to the confluence with the Connecticut River in Hinsdale has been declared a State Designated River under the New Hampshire River Management and Protection Program (RSA 483), which is administered by the NH DES. This designation is in recognition of its outstanding natural and cultural resources. The intent of the Program is to complement and reinforce existing water quality laws (state and federal), maintain in-stream flows, restore and maintain scenic beauty and recreational opportunities, and respect riparian interests.

Table 11. Summary of watercourses in Marlow.

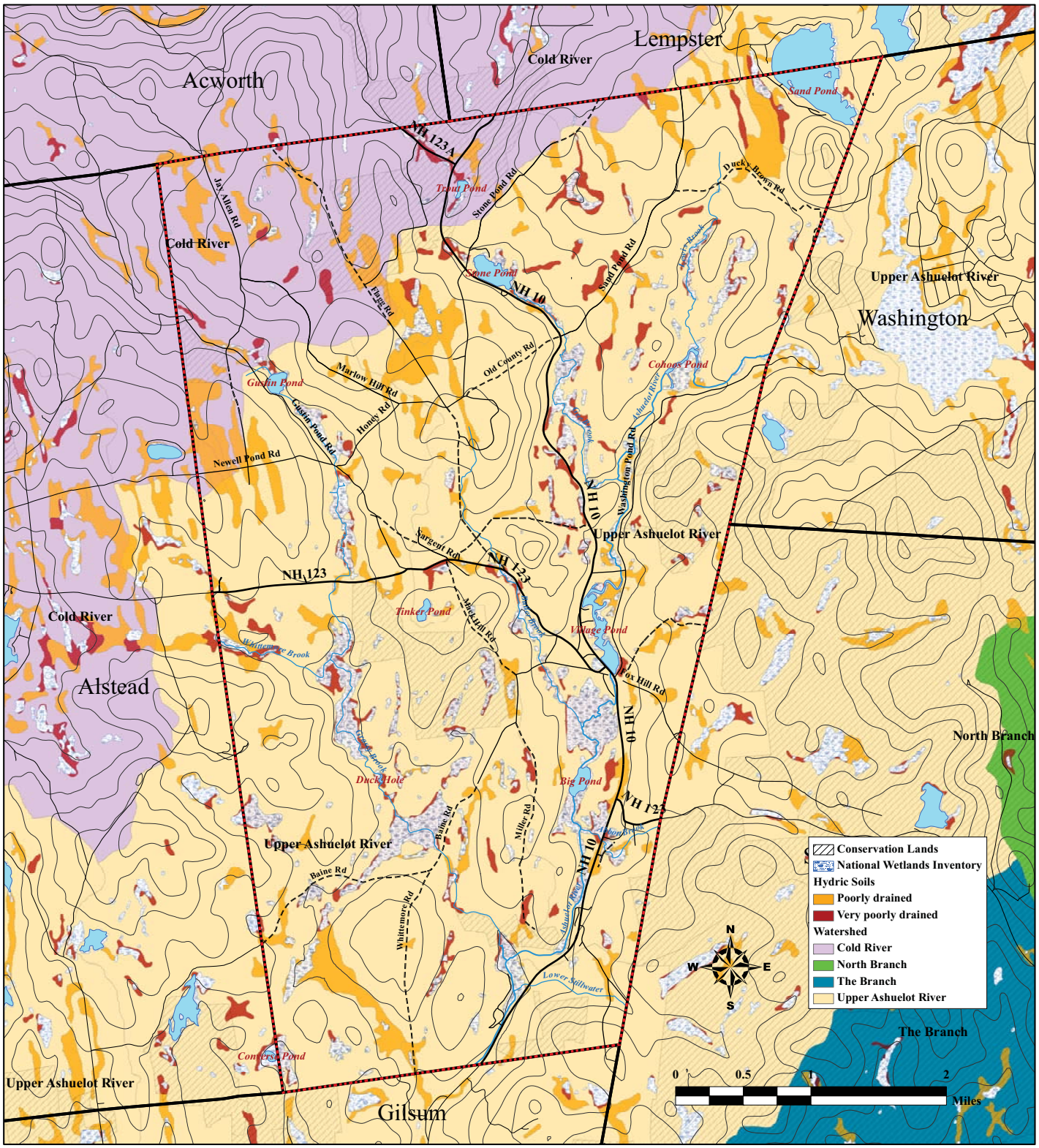
Name	Length (miles)
Ashuelot River	8.5
Grassy Brook	6.4
Lewis Brook	2.4
Gee Brook	4.6
Butler Brook	2.8
Whittemore Brook	2.1
Abbott Brook	0.8
Honey Brook	1.1
Knight Brook	0.5

SOURCE: USGS topography and GRANIT hydrogrpahy datasets.

Watercourses in **bold type** are jurisdictional designations by NH DES and subject to the Comprehensive Shoreland Protection Act under RSA 483-B.

The Comprehensive Shoreland Protection Act (RSA 483-B) is a state statute that was prepared to protect water quality for designated public waters. The Act establishes minimum standards for various setbacks from the reference line based on land use within the designated 250-foot buffer. For most new construction, as well as land excavating and filling, a state permit is required (certain exemptions apply). As such, all great ponds (waterbodies >10 acres), fourth order streams or higher, and state designated rivers have been identified by the NH DES as those waterbodies and watercourses that are subject to the Act. For more details on the Act, as well as certified administrative rules, refer to the NH DES at http://des.nh.gov/organization/divisions/water/wetlands/cspa/index.htm.

Marlow Natural Resources Inventory
Wetlands and Surface Waters Resources Map



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Latest Map Revision: March 01, 2010

Figure 9. Wetlands and surface waters of Marlow, NH. This map demonstrates the distribution of waterbodies (ponds), watercourses (streams and rivers), wetlands (National Wetlands Inventory and hydric soils), and watersheds, as well as those areas that are conserved.

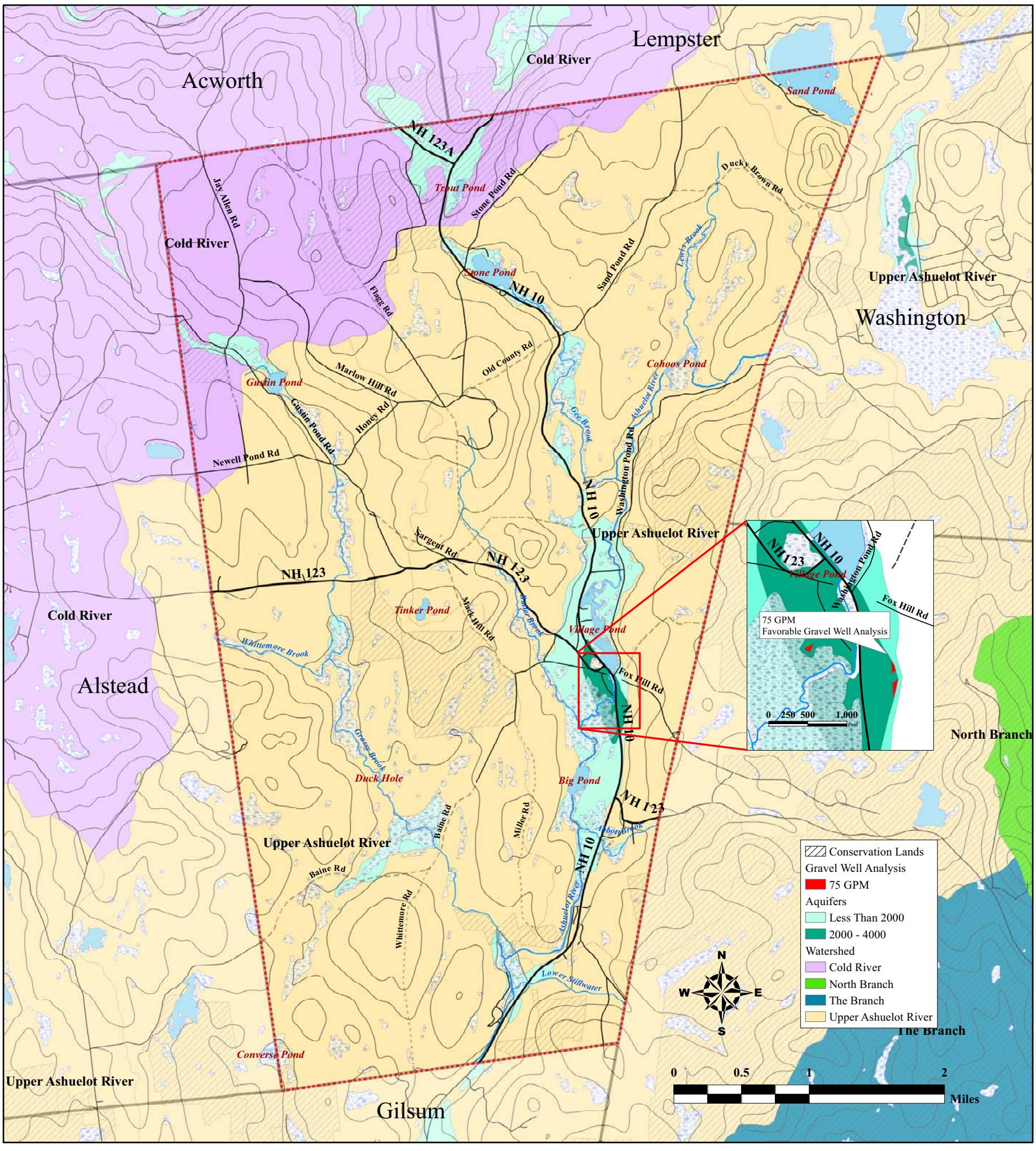
Groundwater Resources

Groundwater resources are stored in two main types of aquifers and can serve as sources for drinking water. Aquifers can be located within saturated areas of sand and gravel deposits or in fractured bedrock. In the past as glaciers melted they left behind layers of coarse sediments including sand and gravel. The space between these sediments provides opportunity for groundwater storage and flow. Groundwater stored in *stratified drift aquifers* of this kind can serve as an excellent source for drinking water. Locating and protecting these geologic features can help to ensure a supply of clean drinking water for the community as these areas are vulnerable to contamination.

Marlow contains approximately 1,027 acres of stratified drift aquifers in various locations (Figure 10, p.32). The largest contiguous aquifer is located along the Ashuelot River. Other stratified drift aquifers are located along Gee Brook, Grassy Brook, and Honey Brook State Forest and Trout Pond. These aquifers are divided into two categories based on *transmissivity*, or the rate at which water moves through an aquifer and is measured in square feet per day (ft^2/day). Therefore, higher rates of transmissivity correspond to a potentially higher yield of groundwater. Most of the aquifers in Marlow have a transmissivity rate less than 2,000 ft^2/day. However, a small area located along the Ashuelot River aquifer is estimated to conduct 2,000-4,000 ft^2/day.

While transmissivity takes into account the quantity of water moving through an aquifer system its does not reflect the quality of the source. To assist in addressing this issue and to identify potential future public water supplies for communities, the NH DES prepared a Potential Favorable Gravel Well Analysis (PFGWA). This technique analyzed stratified drift aquifers, affording the opportunity for town planners and water suppliers to determine quantity and quality constraints on aquifers. In doing so, NH DES buffers out all known and potential contamination sources and examines potential well yield to identify the most suitable areas for potential community wells. Thus, NH DES is encouraging communities to take proactive measures at protecting their most significant groundwater resources. As such, three sites within the highest yield area of the Ashuelot River aquifer system have been identified by the PFGWA. It was estimated that these sites could produce 75 gallons per minute.

Marlow Natural Resources Inventory
Groundwater Resources Map



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Map is to be used for planning purposes only. Accuracy of data to be verified by end user. Use of this map constitutes agreement with terms of the Moosewood Ecological GIS Data Disclaimer.This map was created using ArcView 9.3.1 from ESRI with data supplied by NH GRANIT.

Latest Map Revision: November 2, 2009

Figure 10. Groundwater resources of Marlow, NH. This map demonstrates the distribution of stratified drift aquifers by transmissivity rates and the locations of potentially favorable gravel well analysis (PFGWA) identified by the NH Dept. of Environmental Services. Also included are watersheds and conservation lands. Moosewood Ecological

Ecological Resources

In general, ecology is the field of science that studies organisms and their environments. This includes interactions within and between species, within habitats (i.e., for mating, breeding, and feeding) and even at the cellular level. Therefore, developing a better understanding of ecological resources is accomplished on several levels, or scales. These include genes, species, populations, communities, ecosystems, and even the larger landscape that includes human land use within the natural environment.

For effective conservation planning and protection of human health and welfare, it is essential to better understand the distribution, composition, structure and function of various ecological attributes on many scales. Having this foundation of knowledge can greatly inform us on how land use can affect our natural resources and better prepare us for the application of the principles of smart growth for more sustainable community planning. This section attempts to develop a basic understanding of these concepts in relation to Marlow and build upon the current foundation of knowledge on critical wildlife habitats, natural communities, wildlife, plants, and species of conservation concern, and the unfragmented landscape.

Marlow with its diverse terrain is characterized by a variety of ecologically significant habitats (ESHs) that provide much needed resources to help maintain the town's biodiversity. In turn, this diverse landscape supports a wide range of wildlife and plants, including common and infrequent species and a variety of species of conservation concern, as well as uncommon habitat types.

ESHs include *critical wildlife habitats* and rare, uncommon, and exemplary *natural communities*. These areas function as 1) habitats for rare species and other species of conservation concern; 2) rare or declining habitats and natural communities in New Hampshire; and 3) connectivity to other habitats within a largely undisturbed forested landscape. For the purposes of this report, the following ESHs were considered as significantly important for the protection and maintenance of biodiversity:

1. wildlife habitats as mapped by the NH Fish and Game Wildlife Action Plan, including marshes, peatlands, open waterbodies, grasslands, floodplain forests, hemlock-hardwood-pine forests, lowland spruce-fir forests, and northern hardwood-conifer forests;
2. additional wildlife habitats including rivers and smaller streams, riparian buffers, heron rookeries, forested swamps, vernal pools, other active agricultural lands (hayfields/pastures and row crops), shrublands, abandoned mines, and steep south-facing slopes;
3. rare and uncommon natural communities as defined by the NH Natural Heritage Bureau;
4. large unfragmented forest blocks with embedded wetlands and other habitats lumped in close proximity to one another; and
5. critical wildlife habitats and natural communities supporting rare species

Critical Wildlife Habitats

The NH Fish and Game Department, in cooperation with several other agencies, organizations, and individuals, produced the NH Wildlife Action Plan (WAP) in 2005. This document was designed as a planning and educational tool for federal, state, and municipal governing bodies, conservation commissions, land trusts, other conservation organizations, and private landowners, as well as the general public. Its purpose was to promote the conservation and management of NH's biological diversity. This includes providing strategies for informed land use decisions and land management planning. This can help to ensure that an adequate representation of various wildlife habitats are maintained across our landscape, whereby keeping common species common in NH and working to prevent the loss of our rare species.

The following descriptions represent critical habitats that were mapped for the WAP (noted with an asterisk*), as well as other fine-scale habitats observed during site assessments or predicted to occur based on analysis of remote data. Species listed in **bold type** have been identified by the NH WAP as species of concern conservation. A total of 12 critical wildlife habitats have been mapped and summarized for Marlow (Table 12,

p.35 and Figure 11, p.50). Three additional critical habitats have also been described below but have not been mapped.

Table 12. Summary of critical wildlife habitats of Marlow.

Wildife Habitat Type	Size	% of Town
Marsh and Shrub Wetlands*	888 acres	5.2
Peatlands*	79 acres	0.5
Floodplain Forests*	648 acres	3.8
Forested Swamps	270 acres	1.6
Ponds	175 acres	1.0
Rivers and Streams	101 miles	n/a
Riparian Areas	4,836 acres	28.6
Hemlock-Hardwood-Pine Forests*	7,359 acres	43.5
Northern Hardwood-Conifer Forests*	3,855 acres	22.8
Lowland Spruce-Fir Forests*	4,685 acres	27.7
Grasslands*	647 acres	3.8
Steep South-facing Slopes	58 acres	0.3

Source: GIS Slope and Riparian Buffer Analysis (Moosewood Ecological 2009); NH Fish and Game Department Wildlife Action Plan (2005); USGS topography, NH hydrography and US Fish and Wildife Service National Wetlands Inventory datasets from GRANIT.

*Wildlife habitats mapped as part of the NH Fish and Game Wildlife Action Plan (2005).

Marsh and Shrub Wetlands*

Marsh and shrub wetlands can offer some dramatic variations in plant community structure. Various grasses, sedges, and rushes, dwarf shrubs, pond lilies, pickerel weed, wild flowers, and other herbaceous plants, as well as open water, typify Marlow's marshes. In contrast, shrub swamps are dominated by common shrubs such as highbush blueberry, maleberry, winterberry, mountain holly, wild raison, arrowood, chokeberry and speckled alder. They will usually also contain a mixture of herbaceous plants and sparse sapling trees, depending upon the density of the shrub layer and degree of wetness.

These critical habitats perform significant ecological functions and hold great value to humans and wildlife alike. Functions include storage of floodwaters, wildlife habitats, water quality maintenance of surface and groundwater resources, sediment

trapping, reducing impacts of excess nutrients and toxicants, shoreline stabilization, erosion control, and habitat for rare species and natural communities. Societal values also can be attributed to our wetlands such as education and scientific research, visual aesthetics, recreation (i.e., fishing, hunting, and boating), and historical value.

Wetlands are widely known to have diverse plant and animal communities. This is mainly due to the fact that wetland ecosystems contain a wide variety of smaller habitats. This in turn provides many organisms with all or part of their life cycle needs. Robust bird communities can be found in marsh and shrub wetlands. Waterfowl (i.e., wood duck, **American black duck**, mallard, common merganser, and Canada goose), **American bittern**, **least bittern, great blue heron**, **American woodcock,** red-winged blackbird, northern kingbird, tree swallow, belted kingfisher, song sparrow, swamp sparrow, gray catbird, and common grackle, as well as various warblers such as common yellowthroat and yellow warbler, commonly breed and nest in wetlands or along the wetland edge. Many waterfowl also use wetlands and open waterbodies extensively during spring and fall migration.

Mammals such as river otter, mink, beaver, and muskrat rely heavily upon marsh and shrub wetlands for feeding and denning sites within or adjacent to the wetland. Other mammals known to use these wetlands include raccoon, state endangered **New England cottontail**, ermine, long-tailed weasel, coyote, **bobcat**, white-tail deer, **moose**, and **bear**. Many amphibians are common to marsh and shrub wetlands. Green frog, bullfrog, pickerel frog, spring peeper, wood frog, American toad, spotted salamander, and red-spotted newt can be frequently observed in these wetland habitats. Common reptiles include painted and snapping turtles. However, marsh and shrub wetlands also provide critical habitat for more secretive and less abundant species such as **northern leopard frog, Jefferson salamander, ribbon snake**, **eastern smooth green snake**, and northern water snake. Aquatic wildlife such as fish and macroinvertebrates are also integral of and dependant upon these wetland ecosystems and represent a significant part of the complex food cycle.

The interface between wetlands and their adjacent uplands form the riparian zone, which further adds complexity and diversity to the both ecological structure and

composition. This zone is used by a wide range of semi-aquatic and terrestrial species for breeding, nesting, and feeding, or as connectivity to other significant habitats. The riparian zone can also be very beneficial for aquatic species such as fish and macroinvertebrates that benefit from the shading characteristic of overhanging tree canopies. These trees help to maintain cooler streams temperatures upon which many species need for long term survival.

It has been estimated that approximately 53% of wetland acreage in the contiguous forty eight states was lost between 1780 and 1980[1]. The widespread devastation of loss and conversion has left a substantial mark; 117 million acres were filled, drained, or flooded. New Hampshire is fortunate to have had a conservative history of wetland loss.

Between 1780 and 1980 it was estimated that approximately nine percent of the New Hampshire's wetlands have been lost through destruction and/or alteration. The level of loss during these two centuries was the second lowest of the fifty states. However, marsh and shrub wetlands are still vulnerable to human alterations through direct disturbance within the wetland or more often within the adjacent uplands. Threats include habitat loss and conversion, fragmentation, introduction of non-native invasive plants, haphazard use of off-highway recreational vehicles (OHRV), and compromised water quality due to ineffective riparian buffers.

The marsh and shrub wetland complexes are composed of three main wetland classes originally mapped by the NWI (see Water Resources section above for description), including emergent marshes, unconsolidated bottoms, and shrub swamps. Each of these wetland classes are dictated by topographic setting, hydrologic regimes, soil development, nutrient availability, wildlife influence (e.g., beaver damming), and plant community composition. The only major wetlands not included in this habitat type are peatlands and forested swamps. These are described below as their own distinct habitat types.

The marsh and shrub wetlands comprise approximately 888 acres in Marlow. They are widely distributed along the Ashuelot River and other major streams, including

[1] Dahl (1990). Wetlands losses in the U.S. from 1780-1980.

Grassy Brook, Gee Brook, and Whittemore Brook. Some of the most significant examples of this habitat are located on the Richards Wildlife Sanctuary and along the Ashuelot River, as well as the Grassy Brook area.

Peatlands*

Wetlands can be lumped into two categories: peatlands and non-peatlands. The marsh and shrub habitats previously discussed are considered non-peatlands. Peatlands have been separated as a distinct habitat type due to its unique species composition, sensitivities to changes in pH (level of acidity), and potential to contain rare species and natural communities.

Peatlands are a type of wetland that is generally characterized by acidic conditions with little groundwater input and limiting nutrients, which dramatically slows down decomposition rates of plant material. This slow decomposition results in the accumulation of peat over time. Most of the peatlands in New Hampshire are technically defined as fens. Many of these open fens have been traditionally referred to as bogs, however. Peatlands are classified into three wetland classes, including open emergent peatlands, shrub thickets, and forested wetlands.

The WAP has estimated that approximately 79 acres of peatland habitat are found throughout Marlow. The largest and most significant is located along the Ashuelot River south of the Village. The large open emergent and shrub thicket peatland associated with and adjacent to the Kinson Wildlife Management Area provides a mosaic of habitats for many aquatic and semi-aquatic wildlife. Other smaller peatlands can be found along this slow meandering stretch of the Ashuelot River.

Peatlands are significant mostly in terms of their rare plants and natural community diversity. However, the state endangered **ringed boghaunter**, a type of dragonfly, is strongly associated with peatland habitats. Many of the same species that are associated with the marsh and shrub wetlands can also be found in association with open and shrub peatlands, including **eastern smooth green snake**, **ribbon snake**, **Jefferson's salamander**, **northern leopard frog**, state endangered **New England cottontail**, and **bobcat**. Peatlands and non-peatlands can often be part of the same mosaic

of plant communities within large wetland complexes, especially those associated with slow moving streams.

Peatlands are sensitive to excess loading of nutrients, sedimentation, and toxicants associated with certain adjacent land uses such as development, which can change their water chemistry, altering both plant and animal communities. Excess flooding as a result of incompatible adjacent land use planning, as well as damming by beavers, can also dramatically alter peatland habitats. As such, threats to these habitats include fragmentation, habitat loss and conversion, altered hydrology, nonpoint source pollution, unsustainable forestry and agricultural practices, haphazard use of off highway recreational vehicles (OHRV), and introduction of non-native, invasive plants.

Forested Swamps

Forested swamps were not mapped as part of the WAP but have been considered as ecologically significant habitats due to sensitivities associated with wetland ecosystems, their relationship with marsh and shrub wetlands, and their associated wildlife. Some forested swamps function as vernal pools thus providing critical habitat for such obligate species as wood frogs, spotted salamander, **Jefferson's salamander**, **blue-spotted salamander,** and invertebrates such as fingernail clams, caddis fly, and other aquatic insects. Other species that use forested swamps for feeding and nesting are **red-shouldered hawk**, **Cooper's hawk**, barred owl, northern waterthrush, and **Canada warbler**.

Forested wetlands face many of the same threats associated with other wetland habitats. These include habitat loss and conversion, fragmentation, introduction of non-native invasive plants, haphazard use of off-highway recreational vehicles (OHRV), and compromised water quality due to ineffective riparian buffers.

Forested swamps represent another major class of wetland habitats, covering approximately 270 acres in Marlow. Forested swamps may be hydrologically connected to marsh and shrub wetlands or exist as isolated basin swamps. In Marlow, these isolated basins are commonly represented as red maple- or hemlock-dominated swamps or even found within parts of the lowland spruce-fir forests described below.

Floodplain Forests*

Floodplain forests perform a variety of significant ecological functions. They help to store floodwaters and reduce overall flow rates that can reduce potential flooding downstream; maintain water quality by buffering adjacent land uses associated with excess nutrients, sedimentation, and toxicants; control erosion; and host many habitat types. Floodplains can be characterized as a mosaic of habitats that can greatly vary in structure, owing to its rich biological makeup. They can include both upland and wetland communities such as forests and less dense open woodlands, meadows, oxbow marshes, shrub thickets, vernal pools, and seeps. This interaction between wetland and upland communities forms the riparian zone. These habitats in turn support wonderfully diverse wildlife communities for breeding, nesting, feeding, and migration.

Floodplain forests provide habitat for many migratory and year-round resident birds. Waterfowl (i.e., wood ducks and mallards using vernal pools), American redstart, Baltimore oriole, **red-shouldered hawk**, **Cooper's hawk**, **American woodcock**, **veery**, and **wood thrush** use these dynamic habitats. Amphibians include spring peeper, wood frog, spotted salamander, green frog, pickerel frog, gray tree frog, and American toad. More importantly, floodplains are critical for **Jefferson's salamanders** and **northern leopard frog**, as well as some reptiles considered as species of conservation concern, including **wood turtle** and **ribbon snake**. Semi-aquatic mammals using river systems readily depend upon these riparian forests. Signs of river otter, muskrat, beaver, and mink can typically be observed using intact floodplain forests.

Many of New Hampshire's major and minor floodplain forests have been converted to other land uses such as agriculture or residential, commercial, and industrial developments. This fact exemplifies the great significance of protecting the remaining intact examples if we are going to conserve the various wildlife and plant communities that reside within these habitats. As such, threats to the long term stability and ecological integrity of floodplains include fragmentation, habitat loss and conversion, altered natural disturbance due to damming, and the introduction of non-native invasive plants that can out-compete native species, potentially altering wildlife communities as well.

Marlow's major floodplains are found along the Ashuelot River, spanning roughly 648 acres over the majority of its length through the town. Other minor floodplain forests may also be found along smaller streams, such as Grassy Brook and Gee Brook, especially where the topography becomes broader and streams segments meander.

Waterbodies and Watercourses*

The waterbodies and watercourses of Marlow have been discussed above in terms of their importance as surface water resources for humans mainly. However, these natural resources also have great significance for providing critical habitats for diverse wildlife. The WAP has identified a variety of important wildlife for the Southern Upland watershed. These include **Atlantic salmon**, state threatened **bald eagle**, **banded sunfish**, state endangered **brook floater**, **burbot**, common loon, state endangered **dwarf wedgemussel**, **eastern brook trout**, **eastern pond mussel**, **lake trout**, **Northern redbelly dace**, state threatened **osprey**, **round whitefish**, slimy sculpin, spotted turtle, state endangered **Sunapee trout**, **tessellated darter**, **wood turtle**, migrating/wintering birds, birds, and **rainbow smelt**.

Threats to the ponds and streams of the Southern Upland watershed generally include altered natural flow regimes as a result of dams that can inhibit migration of semi-aquatic and aquatic species (particularly fish), nonpoint source pollution (especially sedimentation and stormwater runoff) from land development and unsustainable forestry and agricultural practices within or adjacent to the resources, and the spread of invasive species.

Riparian Areas

Riparian areas form the interface between uplands and wetlands, including ponds rivers, and streams. They provide a wide range of natural services that are essential in maintaining biodiversity and proper ecological functions. These include services such as:

- various biogeochemical processes that result in the breakdown of living and non-living materials that support a thriving soil community, providing food web support and nutrients for plant growth;
- buffering properties for point and nonpoint source pollution (i.e., sedimentation, excess nutrients, toxicants) from upland land use;
- providing optimal shading by the tree canopy that is required for streams to maintain cold temperatures needed by fish and aquatic macroinvertebrates (large water bugs);
- contribution of organic debris (i.e., large woody debris or downed trees, smaller woody limbs and twigs, and leaf litter) within the riparian area and adjacent wetland ecosystems;
- reducing the effects of downstream flooding by storing rising floodwaters in floodplains;
- wildlife corridors for safe movement between various habitats for mammals, birds, reptiles, and amphibians; and
- important breeding, feeding, and nesting habitats for terrestrial, aquatic, and semi-aquatic wildlife.

Riparian areas have been mapped using a 200-foot buffer around all NWI wetlands (including ponds) and on either side of intermittent and perennial streams. The total riparian area of Marlow was estimated to be 4,836 acres or roughly 29% of the town. This estimate helps to provide insights into the distribution and coverage that this critical area represents in Marlow.

Vernal Pools

Vernal pools are listed in the WAP as a critical habitat type but have not been mapped at the state level. These habitats are more easily mapped at the town or site-specific level. It is expected that a significant number of vernal pools exist throughout Marlow. Sites where these critical habitats can often occur include saddles along ridges

and tops of hills and mountains, headwaters of drainages, floodplains, and broad areas of generally flattened topography.

Vernal pools are typically referred to as temporary or seasonal woodland pools that are found within upland or floodplain forests. These woodland pools fill with water in the spring and fall, and generally dry partially or even completely in the summer, which prevents fish populations from persisting. They are isolated in small basins and are not associated with a permanent inflow or outflow of water.

Vernal pools are critical for the long-term survival of many obligate species of amphibians, reptiles, and macroinvertebrates. Species considered as obligate or strongly associated with vernal pools include **ribbon snake**, **Jefferson's salamander**, **blue-spotted salamander**, spotted salamander, wood frog, fingernail clams, and fairy shrimp. **Bobcat** and state endangered **New England cottontail** can also be found using this habitat for feeding and/or cover from predation.

The main threats to vernal pools are those associated with residential, commercial, and industrial development activities within and adjacent to this habitat, resulting in habitat loss and conversion. Fragmentation created by roadways can bisect a complex of vernal pools within close proximity from one another. This effect can result in high road mortality and lower genetic diversity, essentially isolating populations of amphibians. Unsustainable forestry practices adjacent to vernal pools can have negative effects within upland habitats, as well as alterations in hydrology from the removal of the forest canopy. This can result in increased transpiration rates that can effectively cause the pools to dry out more rapidly and consequently desiccating egg masses before they can fully develop to maturity.

Heron Rookeries

Beaver impoundments and other wetlands can provide critical nesting habitat for **great blue herons**, which typically nest in colonies referred to as heron rookeries. Nests are generally found in dead trees (or snags) within or adjacent to the wetland. However, white pines along the edge of wetlands have been known to provide adequate nesting

sites as well. Great blue heron habitats can also function as breeding and nesting habitat for **osprey**.

Two known locations of heron rookeries have been reported in Marlow: one along Grassy Brook south of Gustin Pond Road and one along the Ashuelot River. At least one of these locations was known to be active in 2009. Herons are known to exhibit sensitivities to habitat loss and human disturbance, especially during the breeding and nesting season. Other major threats to heron rookery health include those cited for the marsh and shrub wetland habitat discussed above.

Hemlock-Hardwood-Pine Forest*

The hemlock-hardwood-pine forest ecosystem is often considered to be a northern transitional hardwood forest situated between the northern hardwood-conifer forests typical of the northern half of New Hampshire and the Appalachian oak-pine forests that reside in the southern most portion of the state. Coniferous and mixed forests typify this ecosystem and are composed of various mixtures of eastern hemlock, American beech, red oak, white pine, and red maple. Other hardwoods are present but less abundant include sugar maple, white ash, hop-hornbeam, and black cherry. These forests consist of approximately 7,359 acres, or nearly half of Marlow.

Species diversity for the hemlock-hardwood-pine forest totals 140 vertebrates throughout New Hampshire, including 15 amphibians, 73 birds, 39 mammals, and 13 reptiles. These include a variety of important wildlife such as **American woodcock**, **bald eagle**, **northern goshawk**, **Canada warbler**, **cerulean warbler**, **Cooper's hawk**, **eastern towhee**, **purple finch**, **red-shouldered hawk**, **ruffed grouse**, **veery**, **wood thrush**, **blue-spotted salamander**, **Jefferson's salamander**, **ribbon snake**, **smooth green snake**, **wood turtle**, **eastern pipistrelle**, **eastern red bat**, **northern myotis**, **silver-haired bat**, **bear**, **moose**, and **bobcat,** as well as many migratory and wintering birds. Historically, gray wolf and mountain lion inhabited these forests as well.

Some of the major direct threats to these forests include the construction of new roadways that fragment the remaining forested blocks, exposing wildlife to increased road mortality and decreasing core forest habitat needed by certain area sensitive species,

such as **bobcat**, ovenbird, scarlet tanager, and some raptors. Other threats are associated with habitat loss and conversion due to land use planning, leading to new roadways and associated forest fragmentation. These elements also lend themselves to exposure pathways for the colonization of non-native, invasive plants that can alter species composition and diversity of native trees, shrubs, and other plants. Lastly, non-native forest pests such as the hemlock wooly adelgid and the Asian long-horned beetle poses serious risks to forest health as can other introduced pathogens.

Northern Hardwood-Conifer Forest*

The northern hardwood-conifer forests stretches from the Monadnock highlands through the foothills of the White Mountains and beyond, increasing in distribution as one moves north in the state. In Marlow, they are mainly restricted to hilltops such as Mack Hill, Pumpkin Hill, Marlow Hill, and Bald Hill. These forests consist of approximately 3,855 acres, or nearly 23% of Marlow.

Species diversity for the northern hardwood-conifer forest is very similar to the hemlock-hardwood-pine forest, totaling 137 vertebrates throughout New Hampshire, including 14 amphibians, 73 birds, 42 mammals, and 8 reptiles. These include a variety of important wildlife such as **American woodcock**, **bald eagle**, **northern goshawk**, **Canada warbler**, **cerulean warbler**, **Cooper's hawk**, **purple finch**, **red-shouldered hawk**, **ruffed grouse**, **veery**, **wood thrush**, **blue-spotted salamander**, **Jefferson's salamander**, **ribbon snake**, **smooth green snake**, **wood turtle**, **eastern pipistrelle**, **eastern red bat**, **northern myotis**, **silver-haired bat**, **bear**, **moose**, **bobcat**, and **Canada lynx,** as well as many migratory and wintering birds. Historically, wolf and mountain lion inhabited these forests as well.

The same threats listed for the hemlock-hardwood-pine forests also apply to the northern hardwood-conifer forests.

Lowland Spruce-Fir Forest*

Lowland spruce-fir forests have a similar range in New Hampshire as the northern hardwood-conifer forests. They can represent upland forests with well-drained soils or

forested spruce swamps. In Marlow, they are mainly restricted to lowlands and drainages, as well as some north-facing slopes such as Huntley Mountain and Marlow Hill. These forests consist of approximately 4,685 acres, or nearly 28% of Marlow.

Species diversity for the northern hardwood-conifer forest is very similar to the two previously described forest types, totaling 101 vertebrates throughout New Hampshire, including 9 amphibians, 53 birds, 37 mammals, and 2 reptiles. These include a variety of important species such as **bald eagle**, **bay-breasted warbler**, **northern goshawk**, **Canada warbler**, **Cooper's hawk**, **purple finch**, **wood turtle**, **hoary bat**, **American marten**, **bear**, **moose**, **bobcat**, and **Canada lynx,** as well as many migratory and wintering birds. Historically, wolf and mountain lion inhabited these forests as well.

The same threats listed for the hemlock-hardwood-pine forests also apply to the northern hardwood-conifer forests.

Grasslands*

Typical plant composition for upland grasslands includes various grasses and sedges, goldenrods, asters, meadowsweet, and milkweeds. Medium- to large-sized shrubs and young trees may also be present but are in very low abundance. Management within each type of grassland habitat varies depending upon the type of land use but all must be maintained in a fashion that prevents the establishment of shrubs and trees. If not regularly maintained grasslands will succeed into shrublands, and eventually develop into a forest, as did most of New Hampshire's grasslands when agricultural lands were abandoned.

These extensive grasslands provide critical open habitat for both common and uncommon wildlife that can greatly contribute to Marlow's diversity, particularly birds, insects, and reptiles. Species of conservation concern associated with grassland habitats include **eastern meadowlark**, **vesper sparrow**, **grasshopper sparrow**, **northern harrier**, **American kestrel**, **American woodcock**, **upland sandpiper**, **horned lark**, **wood turtle**, and **eastern smooth green snake**. Also associated with grasslands is the northern leopard frog, especially grasslands in close proximity with floodplain forest complexes.

Grasslands and their associated wildlife have been in decline due to the mass abandonment of agriculture within the last 100-150 years. When farming and open land was more prevalent grassland species thrived in the state. However, grassland bird populations are declining more rapidly than any others in the northeast[2]. Other threats to grasslands are habitat loss and conversion due to land use planning. Without the presence of grassland habitats certain species would not remain a part of Marlow's landscape, resulting in lower biodiversity overall.

Grasslands mapped by the WAP were estimated to account for approximately 647 acres. They are distributed widely throughout the town, including Marlow Village. Grasslands range in size from about 2 acres to nearly 65 acres. These upland habitats may include hayfields, pastures, cropland, and/or other types open fields (i.e., landfill, athletic fields).

Shrublands*

Shrublands are typically characterized by a combination of shrubs and young shrub-like trees that dominate this habitat. Mixed grasses, sedges, and forbs are generally present and interspersed throughout but less abundant overall. These upland areas may include utility right-of-ways, reverting sand and gravel pits (i.e., along the Ashuelot River), old farmlands, and patch cuts created by forestry projects. Certain shrub swamps may also function as critical shrubland habitat for a subset of wildlife. As noted above, grasslands will naturally succeed into shrublands if not maintained, and likewise, shrublands will eventually revert to forests. Each of these areas (except shrub swamps) must be managed appropriately in order to maintain this habitat structure and support its various wildlife communities.

As with grasslands, upland shrubland habitats are significant for many types of birds and reptiles. They serve as primary and secondary habitats for breeding, nesting, and feeding for many animals. Species of conservation concern that use shrublands include **golden-winged warbler**, **eastern towhee**, **ruffed grouse**, **whip-poor-will**, **American woodcock**, **eastern smooth green snake**, **wood turtle**, **bobcat**, and the state

[2] Sauer et al. (2003)

endangered **New England cottontail**. The latter three species can also be associated with certain shrub swamps as well.

Similar to grasslands, shrubland habitats have been declining in the state. During the abandonment of farms, grasslands succeeded into shrublands and were once widespread throughout the state. However, most of these shrublands have succeeded into forests or were cleared for developments, which rapidly reduced the size and distribution of this critical habitat that negatively impacted its wildlife communities. Other threats to this habitat type include fragmentation, habitat loss and habitat conversion due to land use planning; haphazard use of off-highway recreational vehicle (OHRV) activities; and establishment of non-native, invasive plants, including honeysuckles, buckthorn, autumn olive, Asian bittersweet, and swalloworts. Invasive species can be quite aggressive, resulting in a change in plant composition from native species to one dominated more with invasive species.

Abandoned Mines

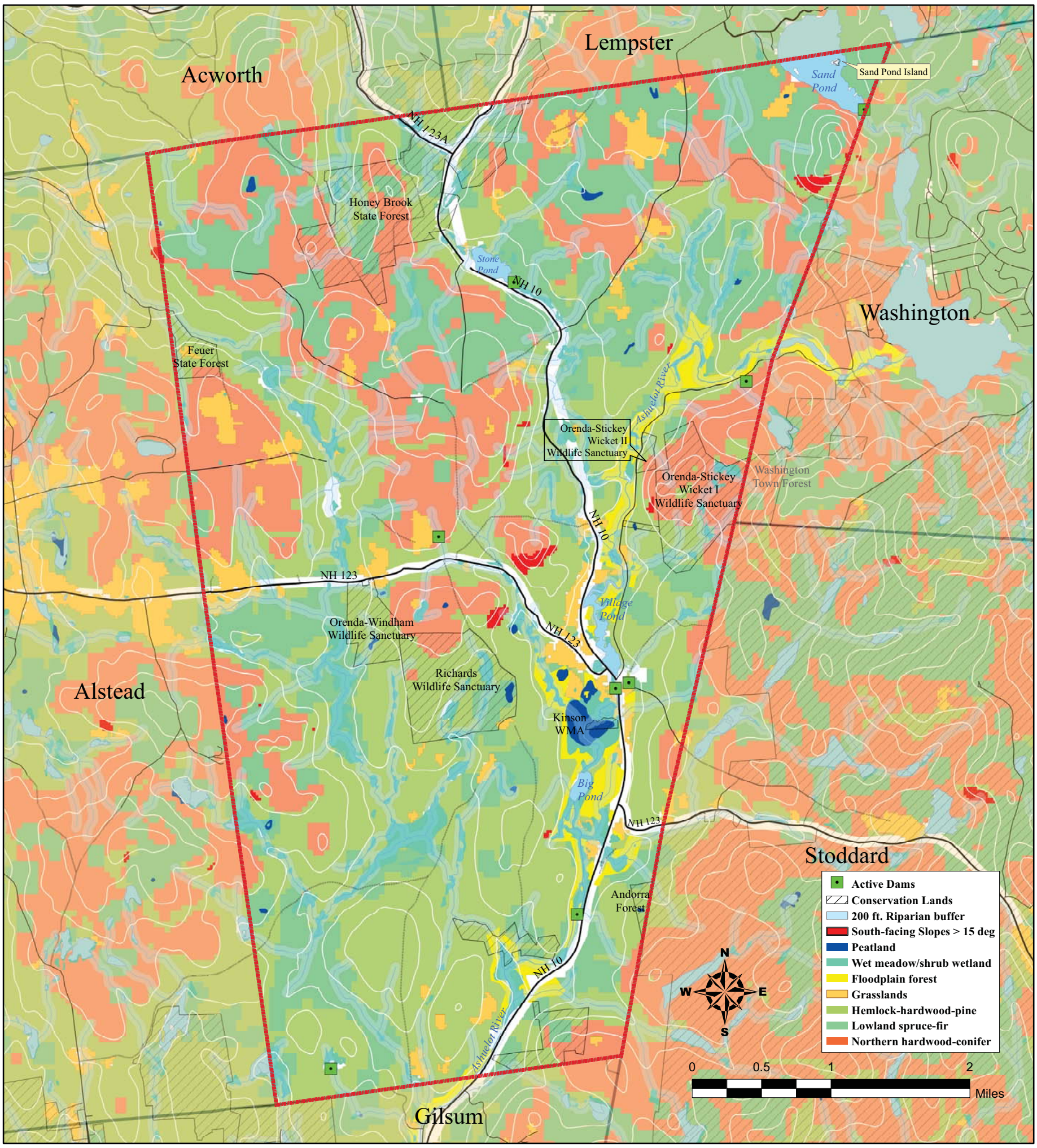
Abandoned mines serve as significant winter hibernacula for many bats, including **northern myotis**, state endangered **eastern small-footed bat**, **eastern pipistrelle**, and federally endangered **Indiana bat**. Presently, there are only seven known sites in New Hampshire that are functioning as winter hibernacula. These are mainly distributed in Grafton County (five known sites) but are also found in Coos and Merrimack Counties. However, other potential sites exist throughout the state, including Marlow. While abandoned mines are known to exist in Marlow they have not been confirmed by the NH Fish and Game to be active hibernacula and thus are considered as potential sites. Due to the sensitivity of this habitat they have not been included on the critical wildlife habitats map.

Steep South-facing Slopes

Ledge outcropping and talus slopes can serve as primary habitat for snake hibernacula, **bobcat** sunning sites during the winter months, and denning sites for other species, especially those associated with south-facing slopes. This habitat was estimated

to cover approximately 58 acres. Potential sites include Huntley Mountain, Pumpkin Hill, and Mack Hill. The Marlow Profile and especially the south face of Bald Hill provide good examples of ledge outcropping. These sites may also be associated with rare natural communities.

Marlow Natural Resource Inventory
NH Wildlife Action Plan Wildlife Habitats



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Current map revision date is: November 21, 2010.

Figure 11. Critical wildlife habitats of Marlow, NH. This map demonstrates the distribution of upland and wetland habitats that express especially high and/or unique biodiversity attributes, including rare species and rare or declining habitats. Moosewood Ecological LLC

Natural Communities

Natural communities, as defined by the New Hampshire Natural Heritage Bureau (NH NHB), are combinations of distinct plant assemblages, their physical environments, and the ecological processes that affect them. Essentially, they are ecological units that are repeated on the landscape. Natural communities include both uplands and wetlands such as forests and woodlands, talus slopes, shorelines, marshes, forested swamps, peatlands, floodplains, and aquatic systems. Natural communities act as the compliment to wildlife habitats but from a plant perspective. It is a way of providing more detail regarding the various plant communities that form a broader habitat type (e.g., many types of natural communities can make up the marsh and shrub wetland habitat).

These communities provide scientists and resource managers with an ecological understanding of the land and its inhabitants to make informed decisions regarding land management options. Therefore, natural community classifications provide a powerful tool to guide strategic land use planning. Equally as important, they provide a basis from which inventory and monitoring programs can be developed, and a means to document and track rare species and rare and exemplary natural communities.

The NH NHB, a bureau within the Department of Resource and Economic Development's Division of Forest and Lands, is responsible for locating, tracking, and facilitating the protection of rare and imperiled plants and rare and exemplary natural communities. They have developed an extensive classification system for natural communities in New Hampshire and have ranked each according to rarity in the state, as well as globally. As such, the NH NHB maintains a list of known rare elemental occurrences (i.e., rare species and rare and exemplary natural communities) for each town in the state and provides locational data for such occurrences that are documented for public conservation lands. However, data on rare elemental occurrences on private properties are not released by the NH NHNB unless permission has been granted by the landowner to release such data.

Marlow potentially contains 91 different natural community types, including 29 uplands and 62 wetland and riparian varieties (Appendix D, p.99; see Appendix E for an explanation of State Ranking, p.105). Of these, the NH NHB has documented four known

exemplary natural communities, two of which are located on public conservation lands (Table 13, p.52 and Figure 12, p.55). While these are not considered rare they are regarded by the NH NHB to represent excellent examples of more common natural community types, and thus are considered to be deserving of conservation protection strategies. As such, the NH NHB considers the hemlock forest, semi-rich mesic sugar maple forest, and emergent marsh-shrub swamp system to be of very high importance for conservation.

The emergent marsh-shrub swamp system was observed on the Orenda-Windham Wildlife Sanctuary and the Richards Wildlife Sanctuary, and extends along Grassy Brook and Whittemore Brook. This wetland system has great significance due to its remote landscape context but also is further exemplified by other adjacent elemental occurrences. Within the Converse Pond watershed (Alstead and Gilsum) lays another exemplary wetland system and northeast of Converse Pond located in Marlow are the two exemplary upland forest communities listed in Table 13 (p.52).

The medium level fen system was observed within the Kinson Wildlife Management Area (WMA) located along the Ashuelot River south of Marlow Village. This natural community system most likely extends beyond the boundary of the WMA but its extent was not fully documented by the NH NHB.

Table 13. List of known exemplary natural communities in Marlow.

Natural Community Types	**Associated Critical Wildlife Habitat**
Wooded Uplands	
Northern and transition hardwood - conifer zone	
Hemlock forest	Hemlock hardwood pine forest
Semi-rich mesic sugar maple forest	Hemlock hardwood pine forest
Open Wetlands and Riparian Communities	
Open emergent marshes, shrub thickets, and aquatic beds	
Emergent marsh-shrub swamp system	Marsh and shrub wetlands
Open peatlands	
Medium level fen system*	Peatlands

Source: Sperduto and Nichols (2004); NHNHB (2009)

*****Indicates historical observation of greater than 20 years.

This list of communities has been cross-referenced to their associated critical wildlife habitat for direct comparisons. This affords the opportunity to view Marlow in a more ecological perspective, integrating biological diversity and conservation planning with considerations for both wildlife habitats and natural communities that together form ecologically significant habitats.

Rare and Uncommon Wildlife

Using the various ecologically significant habitats as a guide, Marlow can potentially support 39 species of conservation concern (Appendix F, p.107). These include birds, mammals, reptiles, amphibians, and fish. The NH NHB has seven documented rare and uncommon species (Table 14, p.53 and Figure 12, p.55). Six birds, including the state threatened **common loon**, and one mammal (**bobcat**) have been reported for Marlow. As such, the NH NHB considers the **common loon** to be of very high importance for conservation. Lastly, mountain lion has been reported by residents of Marlow but evidence has not been confirmed by the state.

Table 14. List of known wildlife species of conservation concern.

Species	Rarity Rank
Birds	
American woodcock*	
Common loon	S2
Cooper's hawk*	
Great blue heron (rookery)^	
Ruffed grouse*	
Veery*	
Mammals	
Bobcat^	
Canada Lynx^#	S1;FT
Gray wolf^#	FE
Mountain lion^#	FE

Source: Site Inventory Data by Moosewood Ecological (Littleton 2009) and NH Natural Heritage Bureau database (January 2009)
*****Observed in 2009
^Reported by Marlow resident(s).
^#Reported by Marlow resident(s) but have not been confirmed by the state.
S1 - State Endangered
S2 - State Threatened
FE - Federally Endangered
FT - Federally Threatened

Rare and Uncommon Plants

Two rare plants have been documented by the NH NHB to occur in Marlow (Table 15, p.54 and Figure 12, p.55). These are both listed as state endangered species but are considered as historical observations since the latest record was more than 20 years ago. However, it is likely that these two species still remain and other rare plants exist in Marlow.

Table 15. List of known rare plants in Marlow.

Species	Rarity Rank
Bailey's sedge (*Carex baileyi)**	S1
satin willow (*Salix pellita)**	S1

Source: NH Natural Heritage Bureau database (January 2009)

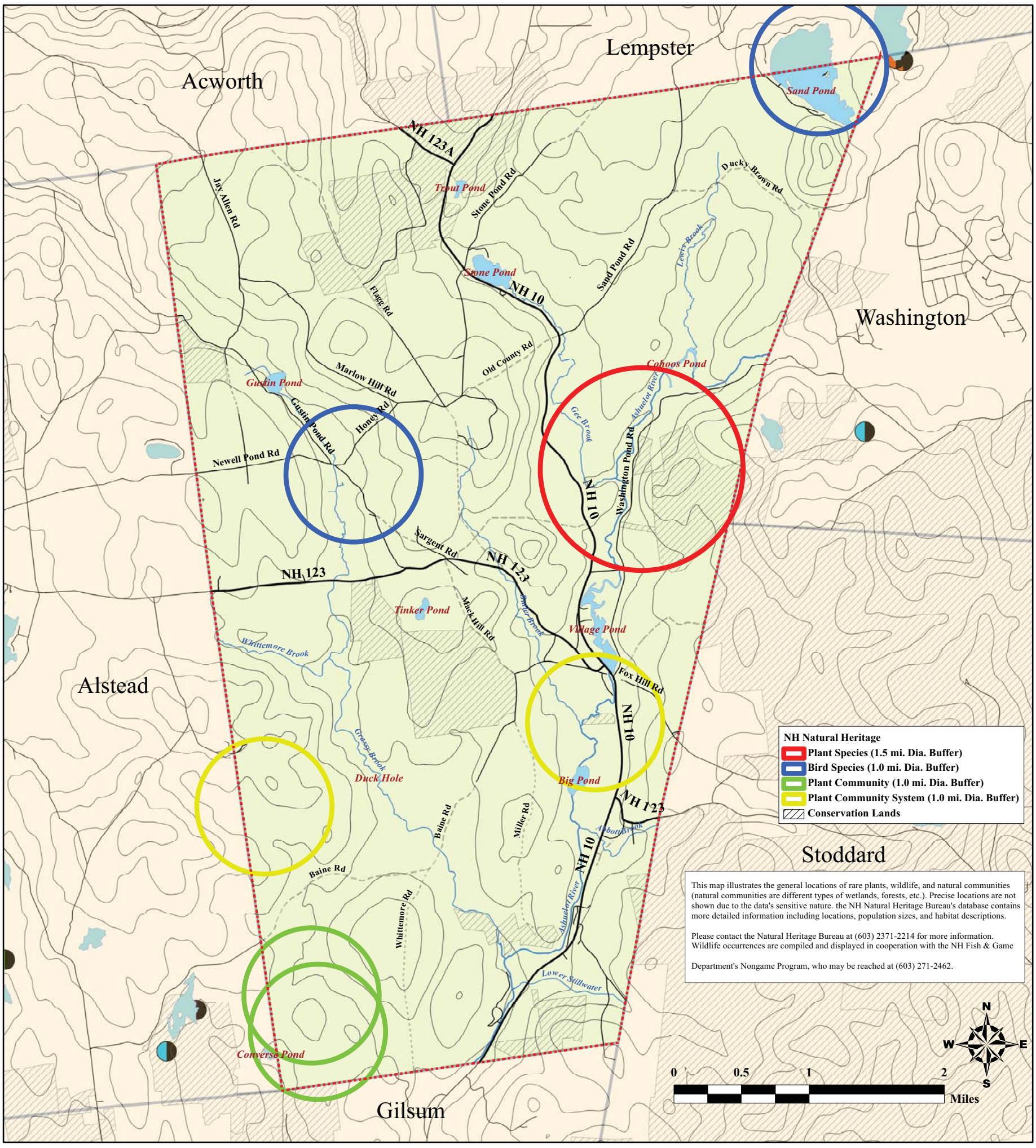
*****Historical observation of greater than 20 years.
S1 - State Endangered

Invasive Species

Invasive species include plants and animals that are not native to the region and pose a threat to native species through competitive strategies that can greatly alter habitats and ecosystems. While there are hundreds of non-native species that have become naturalized in our region only a few are considered invasive. As such, these species are often the target for management activities that seek to remove the species altogether or at the least keep it to a manageable level.

Some of the most noxious invasive plants in New Hampshire include Japanese knotweed, Japanese barberry, purple loosestrife, common buckthorn, glossy buckthorn, multiflora rose, honeysuckles, common reed, garlic mustard, Eurasian water milfoil, and burning bush (a.k.a. winged *Euonymus*). Many of these species have been observed in Marlow and continued management efforts should be exercised, as well as public outreach to assist landowners and residents learn how to identify and prevent their spread. For a complete list of invasives see publications by the NH Department of Agriculture and the NH Department of Environmental Services.

Marlow Natural Resources Inventory
Rare Wildlife, Plants, and Natural Communities



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Latest Map Revision: December 6, 2010.

Figure 12. Rare species and exemplary natural communities of Marlow, NH. This map demonstrates the approximate location of rare wildlife and plants and exemplary natural communities that are known to exist. This

Unfragmented Landscape

Fragmentation is an effect of human land use that divides our landscape into discrete blocks of land. This division of land occurs when roadways are created to support our built infrastructure (i.e., residential, commercial, and industrial developments). The continuous development of new roadways and fragmentation into large forested blocks can eventually create a mosaic of smaller unfragmented forest blocks that can no longer support robust biological communities. Furthermore, many types of wildlife need large unfragmented lands in order to survive and successfully reproduce, including bear, bobcat, gray wolf, mountain lion, and even small warblers such as the ovenbird.

When discussing fragmentation it is important to look at the big picture. Since our natural resources do not observe our political boundaries we must take into account the pattern and distribution of unfragmented blocks within Marlow as well as the adjacent communities. This approach provides a better perspective for understanding species presence and ecological integrity of our landscape in light of our development patterns.

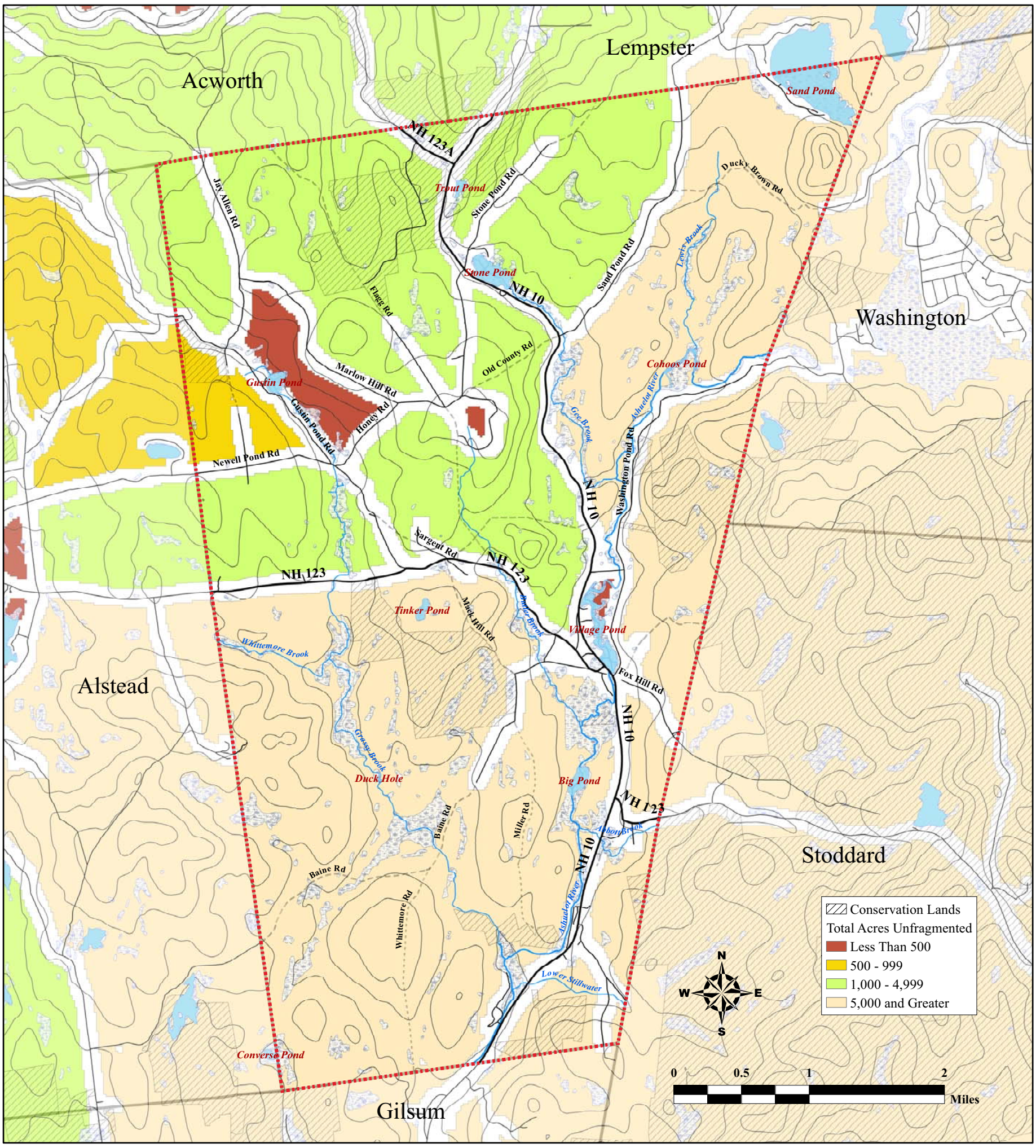
For the purposes of this project, fragmenting features were defined as 500 feet on either side of existing roadways, including all state and town roads but excluding Class VI roads and trails, as well as private driveways. This is the area where most developments occur in relation to roadways. Unfragmented blocks of land includes a variety of natural habitats such as forests, wetlands, streams, and ponds but also can include human-modified areas such as agricultural lands and shrublands.

Due to its rural nature, Marlow is characterized by large unfragmented blocks of land (Figure 13, p.58). All but three of these blocks extend into adjacent towns. The smallest block is associated with the Marlow Town Common Park on Marlow Hill and was estimated to be about 15 acres. The next smallest unfragmented block located east of Gustin Pond was approximately 243 acres. All other forested blocks were greater than 700 acres.

The largest unfragmented block is associated with the Grassy Brook area. In Marlow, this area was approximately 5,270 acres. However, it continues into Alstead and Gilsum, resulting in roughly 9,700 acres of unfragmented forests with embedded

wetlands and other critical habitats. Other large blocks within Marlow include areas associated with Lewis Brook and Sand Pond, northeast of Stone Pond and Trout Pond, Bald Hill north to Marlow Hill, and Honey Brook State Forest. Each of these are greater than 1,000 acres and all, except the Bald Hill block, are even larger since they extend into Acworth, Lempster, Washington, and/or Stoddard. To better understand the significance of the unfragmented landscape and associated wildlife, see Appendix G (p.111).

Marlow Natural Resources Inventory
NH WAP Unfragmented Lands Map



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Latest Map Revision: November 2, 2009

Figure 13. Unfragmented lands of Marlow, NH. This map shows the distribution and size range of unfragmented, contiguous forest patches with embedded wetlands. Roads, excluding Class VI, and private driveways serve as fragmenting features. Moosewood Ecological LLC

Agricultural Resources

Agricultural resources include current farmlands and soils determined to be the most productive for agricultural activities. Not only are these resources important for food production for humans and livestock alike, but they also provide an aesthetic quality that helps to define the rural character of New Hampshire; a characteristic that many communities revere and seek to preserve.

These elements have been recently reinforced with the local foods movement across America that seeks to promote and support local farming activities. One such effort that has been underway for the past two years is the Monadnock Farm and Community Connection (MFCC), a program that is administered by the Cheshire County Conservation District. This program seeks to increase community awareness about the importance of local agriculture, which can in turn stimulate agricultural production in the region. To this end MFCC has engaged community volunteers, farmers, service providers and other professionals to better understand the mechanisms needed to help achieve this vision. One method in which this is being accomplished is through the volunteer-based work of three committees, including the Agricultural Inventory Committee, Infrastructure Committee, and Education Committee, that are working together with the MFCC Steering Committee.

In particular, the Agricultural Inventory Committee (AIC) has been working to gather baseline documentation on Cheshire County's existing and potential agriculturally-based activities using existing coarse-filter data. The Agricultural Resources and Land Use Mapping project was designed to better understand the distribution and type of current farmlands in the County, as well as areas of productive farmland soils and their current land use (i.e., active farmland, fallow farmland, managed grassland, forested, developed, protected open space). As such, this effort has focused on maintaining an ongoing list of active farms in each of the 23 towns in Cheshire County. The results of this work may be used in a variety of formats, including:

- assisting towns and Agricultural Commissions with town-specific farmland data;
- informing our regional community on where to purchase local farm-related products;
- prioritizing the best agricultural lands on a town- and county-wide basis for conservation
- incorporating agricultural information into the master planning process; and
- developing innovative land use planning techniques for agricultural lands on a local level.

It is estimated that Marlow has roughly 609 acres of active farmland classified into two broad categories: pastures/hayfields and row crops (Table 16, p.63 and Figure 14, p.64). These are distributed throughout the town in roughly 108 patches with an average size of 5.6 acres (maximum size of 59.5 acres and minimum size of 0.2 acres). This is no means an exhaustive list of current agricultural-based land uses and should be further refined in conjunction with the Marlow Agricultural Commission, MFCC AIC, and other interested town boards and community members.

In response to the Farmland Protection Policy Act of 1981[1], agricultural soils were mapped by the US Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Based on a variety of physical and chemical properties (i.e., drainage, texture, hydric regime, pH, erodibility factor), these soils have been identified as being among the most productive lands for many types of farming practices. These include prime farmland soils, farmland soils of statewide significance, and farmland soils of local significance. Each is defined below by the USDA NRCS:

[1] As defined by the USDA NRCS: "The Farmland Protection Policy Act of 1981 was established to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses, and to assure that Federal programs are administered in a manner that, to the extent practicable, will be compatible with state, unit of local government, and private programs and policies to protect farmland."

Prime Farmland

- Soils that have an aquic or udic moisture regime and sufficient available water capacity within a depth of 40 inches to produce the commonly grown cultivated crops adapted to New Hampshire in 7 or more years out of 10.
- Soils that are in the frigid or mesic temperature regime.
- Soils that have a pH between 4.5 and 8.4 in all horizons within a depth of 40 inches.
- Soils that have either no water table or have a water table that is maintained at a sufficient depth during the cropping season to allow cultivated crops common to New Hampshire to be grown.
- Soils that have a saturation extract less than 4 mmhoc/cm and the exchangeable sodium percentage is less than 15 in all horizons within a depth of 40 inches.
- Soils that are not frequently flooded during the growing season (less than a 50% chance in any year or the soil floods less than 50 years out of 100.)
- The product of the erodibility factor times the percent slope is less than 2.0 and the product of soil erodibility and the climate factor does not exceed 60.
- Soils that have a permeability rate of at least 0.06 inches per hour in the upper 20 inches.
- Soils, that have less than 10 percent of the upper 6 inches consisting of, rock fragments larger than 3 inches in diameter.

Farmland of Statewide Importance

Land that is not prime or unique but is considered farmland of statewide importance for the production of food, feed, fiber, forage and oilseed crops. Criteria for defining and delineating farmland of statewide importance are determined by a state committee chaired by the Commissioner, New Hampshire Department of Agriculture, Markets and Food, with members representing the University of New Hampshire Cooperative Extension, New Hampshire Association of Conservation Districts and the New Hampshire Office of State Planning. The NRCS State Soil Scientist serves on this committee in an advisory capacity. The original criteria were established on June 20, 1983. It was updated on December 7, 2000.

Soils of statewide importance are soils that are not prime or unique and:

- Have slopes of less than 15 percent
- Are not stony, very stony or bouldery
- Are not somewhat poorly, poorly or very poorly drained
- Includes soil complexes comprised of less than 30 percent shallow soils and rock outcrop and slopes do not exceed 8 percent.
- Are not excessively drained soils developed in stratified glacial drift, generally having low available water holding capacity.

Farmland of Local Importance

Farmland of local importance is farmland that is not prime, unique or of statewide importance, but has local significance for the production of food, feed, fiber and forage. Criteria for the identification and delineation of local farmland are determined on a county-wide basis by the individual County Conservation District Boards. The original criteria were established on June 20, 1983. Updates are noted according to the county initiating the update. The criteria for soils of local importance in Cheshire County are as follows:

- Soils that are poorly drained, have artificial drainage established and are being farmed.
- Specific soil map units identified from the NRCS county soil survey legend, as determined by the Conservation District Board.

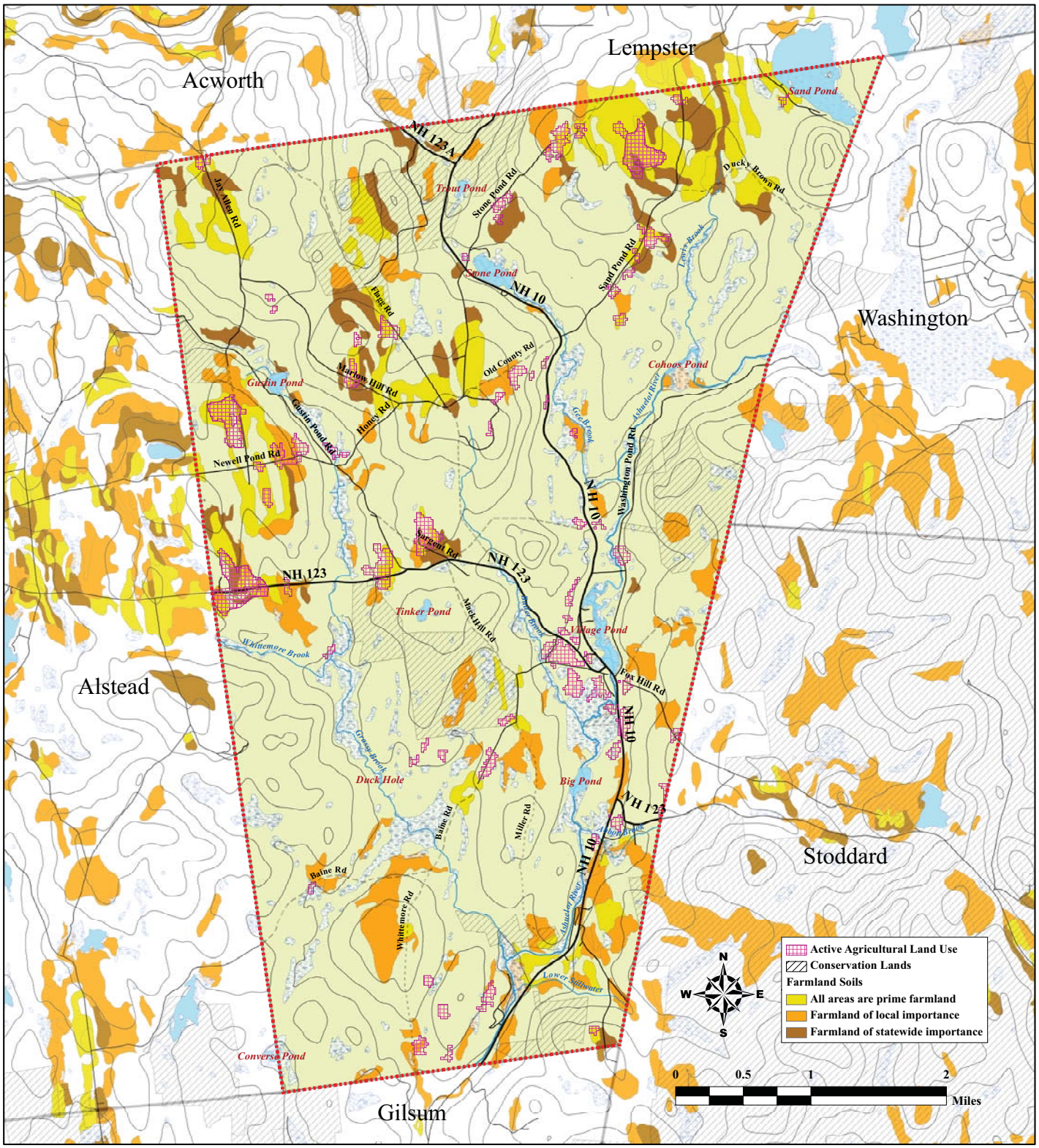
Agricultural soils cover approximately 2,825 acres, or 17%, of Marlow (Table 16, p.63 and Figure 14, p.64). These soils are widely distributed throughout the town but are more strongly associated with the northern half. Prime farmland soils make up about 40% of the total acreage of agricultural soils. From the map one can begin to understand which of these soils are in current farmland practices and which are currently conserved. These data can provide a first phase in agriculturally-based land use planning.

Table 16. Summary of agricultural land use and soils in Marlow.

Agricultural Resource Type	Size	% of Town
Agricultural Soils		
Prime Farmlands	1,115 acres	6.6
Farmlands of Statewide Signficance	557 acres	3.3
Farmlands of Local Signficance	1,153 acres	6.8
Agricultural Land Use		
Pastures and Hayfields	604 acres	3.6
Row Crops	5 acres	0.03

SOURCE: GIS Analysis (Moosewood Ecological 2010) of USDA Natural Resources Conservation Service soils, Land Cover, and NH Wildlife Action Plan grasslands datasets from GRANIT

Marlow Natural Resources Inventory
Agricultural Resources Map



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Latest Map Revision: March 01, 2010

Figure 14. Agricultural resources of Marlow, NH. This map shows the distribution of prime farmland soils and other significant farmland soils and which of these soils are actively farmed and which are conservation lands. Active farmlands include hayfields/pastures and row crops. Moosewood Ecological LLC

Forest Resources

Forest resources within New Hampshire are significant for many reasons. They provide sources of employment, a multitude of forest products, promote local economies, recreation and tourism, and provide substantial habitats for wildlife and plants, as well as diverse ecological functions (i.e., nutrient cycling, carbon sequestration, water quality maintenance through sediment trapping). For these reasons, it is important to maintain large tracts of forest lands and to better understand where some of the best forest soils exist in Marlow.

The USDA NRCS has mapped the distribution of important forest soils and have classified them according to their capacity to grow trees. These soils signify areas as providing the most productive lands for timber production. The NRCS has identified three soils groups within this category and have described each as follows:

Forest Soil Class IA

This group consists of the deeper, loamy textured, moderately well, and well-drained soils. Generally, these soils are more fertile and have the most favorable soil moisture relationships. The successional trends on these soils are toward stands of shade tolerant hardwoods, i.e., beech and sugar maple. Successional stands frequently contain a variety of hardwoods such as red oak, beech, sugar maple, red maple, white birch, yellow birch, aspen, and white ash in varying combinations with red spruce, hemlock, and white pine. Hardwood competition is severe on these soils. Softwood regeneration is usually dependent upon persistent hardwood control efforts.

Forest Soil Class IB

The soils in this group are generally sandy or loamy over sandy textures and slightly less fertile than those in group IA. These soils are moderately well and well drained. Soil moisture is adequate for good tree growth, but may not be quite as abundant as in group IA soils. Soils in this group have successional trends toward a climax of tolerant hardwoods, predominantly beech. Successional stands, especially those which are heavily cutover, are commonly composed of a variety of hardwood

species such as red oak, red maple, aspen, paper birch, yellow birch, sugar maple, and beech, in combinations with white pine, red spruce, balsam fir, and hemlock. Hardwood competition is moderate to severe on these soils. Successful softwood regeneration is dependent upon hardwood control.

Forest Soil Class IC

The soils in this group are outwash sands and gravels. Soil drainage is somewhat excessively to excessively drained and moderately well drained. Soil moisture is adequate for good softwood growth, but is limited for hardwoods. White pine, red maple, aspen, and paper birch are common in early and mid-successional stands. Successional trends on these coarse textured, somewhat droughty and less fertile soils are toward stands of shade tolerant softwoods, i.e., hemlock and red spruce. Hardwood competition is moderate to slight on these soils. Due to less hardwood competition, these soils are ideally suited for softwood production. With modest levels of management, white pine can be maintained and reproduced on these soils. Because these soils are highly responsive to softwood production, especially white pine, they are ideally suited for forest management.

Important forest soils cover approximately 6,095 acres, or 36% of Marlow (Table 17, p.66 and Figure 15, p.67). Groups IA and IB make up the majority of the area (92%) and are most ideally suited for hardwoods. Group IC appear to be more restricted to stream drainages where outwash sands and gravels were deposited by glacial activity. These areas include stretches along Ashuelot River, Gee Brook, Knight Brook, and Honey Brook. These soils types are suited for softwood production, mainly white pine.

Table 17. Summary of important forest soil resources.

Forest Soil Type	Size	% of Town	Primary Productivity
Group IA	5,326 acres	31.5	northern hardwoods
Group IB	275 acres	1.6	hardwoods
Group IC	493 acres	2.9	pine, spruce, and hemlock

SOURCE: GIS Analysis (Moosewood Ecological 2010) of USDA Natural Resources Conservation Service soils dataset from GRANIT

Marlow Natural Resources Inventory
Forest Resources Map

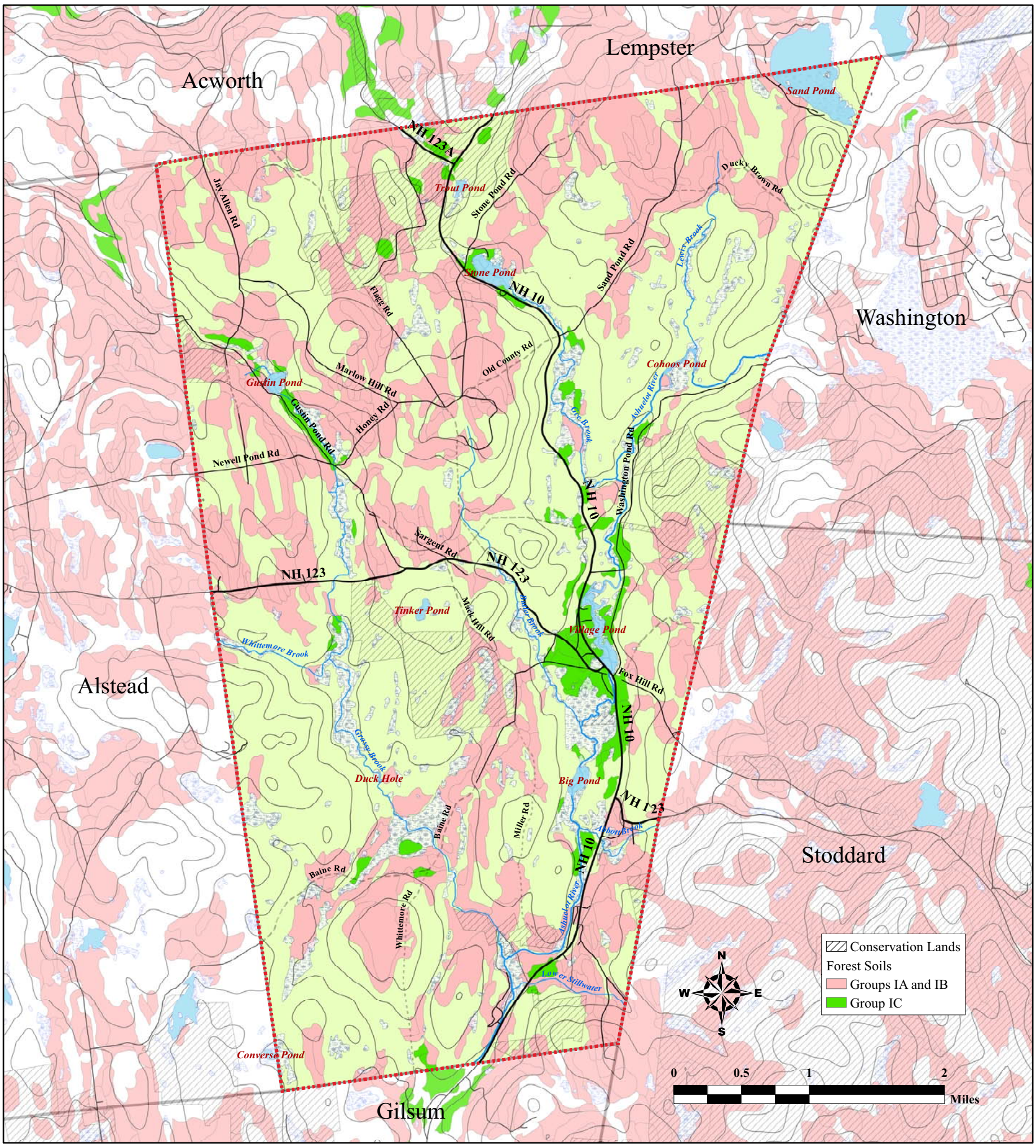

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Figure 15. Forest resources of Marlow, NH. This map shows the distribution of important forest soils, including those best suited for hardwood and softwood production, and those areas currently conserved. Moosewood

Conservation Lands

Marlow has a total of 11 permanently conserved tracts of land, totaling 1,681 acres (Table 18, p.69 and Figure 16, p.70). This covers approximately 10% of the town. The majority of this land (56%) is still under private ownership while the remaining tracts are public properties under the management of the NH Fish and Game and the DRED Division of Forest Lands. As such, it should be noted that all conservation lands may not be open for public use and therefore landowner property rights should be respected.

Honey Brook State Forest represents the largest tract of contiguously conserved lands, which is located in the northern part of Marlow. This area covers approximately 660 acres in the town but extends into Acworth and Lempster for a total of 937 acres. Honey Brook State Forest is managed by the DRED Division of Forest Lands and is open for public use. The next largest conservation land includes the Richards Wildlife Sanctuary (339 acres). It's located just to the west of Marlow Village along Baine Road and is adjacent to the Orenda-Windham Wildlife Sanctuary (113 acres) that is located along NH Route 123. As such, this contiguously conserved block totals 425 acres. The third largest tract of conserved lands includes the Orenda-Stickey Wicket I and II Wildlife Sanctuaries located along the eastern town boundary adjacent to Washington. These two tracts of land total more than 300 acres in Marlow but their conservation value is greatly enhanced as it abuts an additional block of conserved lands of more than 11,600 acres, which includes the Washington Town Forest and Andora Forest.

Table 18. Summary of conserved lands in Marlow.

Conservation Lands	Acres in Marlow	Land Ownership	Primary Protecting Agency	Agency Type	Protection Level	Protection Type
Richards Wildife Sanctuary	339	Private	Humane Society of US	Private	Permanent Conservation Land	Conservation Easement
Orenda-Windham Wildife Sanctuary	113	Private	Humane Society of US	Private	Permanent Conservation Land	Fee Ownership
Orenda-Stickey Wicket I Wildlife Sanctuary	285	Private	Humane Society of US	Private	Permanent Conservation Land	Fee Ownership
Orenda-Stickey Wicket II Wildlife Sanctuary	20	Private	Humane Society of US	Private	Permanent Conservation Land	Fee Ownership
Andorra Forest	21	Private	SPNHF	Private	Permanent Conservation Land	Conservation Easement
Cohen	68	Private	SPNHF	Private	Permanent Conservation Land	Conservation Easement
Faulkner and King	101	Private	SPNHF	Private	Permanent Conservation Land	Conservation Easement
Kinson Wildlife Management Area	9	State	NH Fish and Game	State	Permanent Conservation Land	Fee Ownership
Sand Pond Island	0.8	State	DRED	State	Permanent Conservation Land	Fee Ownership
Honey Brook State Forest	660	State	DRED	State	Permanent Conservation Land	Fee Ownership
Feuer State Forest	64	State	DRED	State	Permanent Conservation Land	Fee Ownership

SOURCE: GRANIT Conservation Lands database (2009).

SPNHF = Society for the Protection of New Hampshire's Forests (a.k.a., the Forest Society)
DRED = NH Department of Resources and Economic Development
* = Size of entire tract of conserved lands, including area extending into adjacent towns; See text for acreage located solely in Marlow.

Fee Ownership is largest and most common form of land ownership giving the owner complete control, including the development of the property unless expressed otherwise in the property deed.

Conservation Easements place a legal limit on the use of a property and generally includes a transfer of usage rights (i.e., development, commercial and industrial uses, as well as other uses mutually agreed upon by the parties involved). It is a legally enforceable land preservation agreement between a landowner and a government agency or land trust for conservation purposes. The property remains with the current landowner or subsequent landowners, whereas the use restrictions remain in place for perpetuity.

Marlow Natural Resources Inventory
Conserved Lands Map

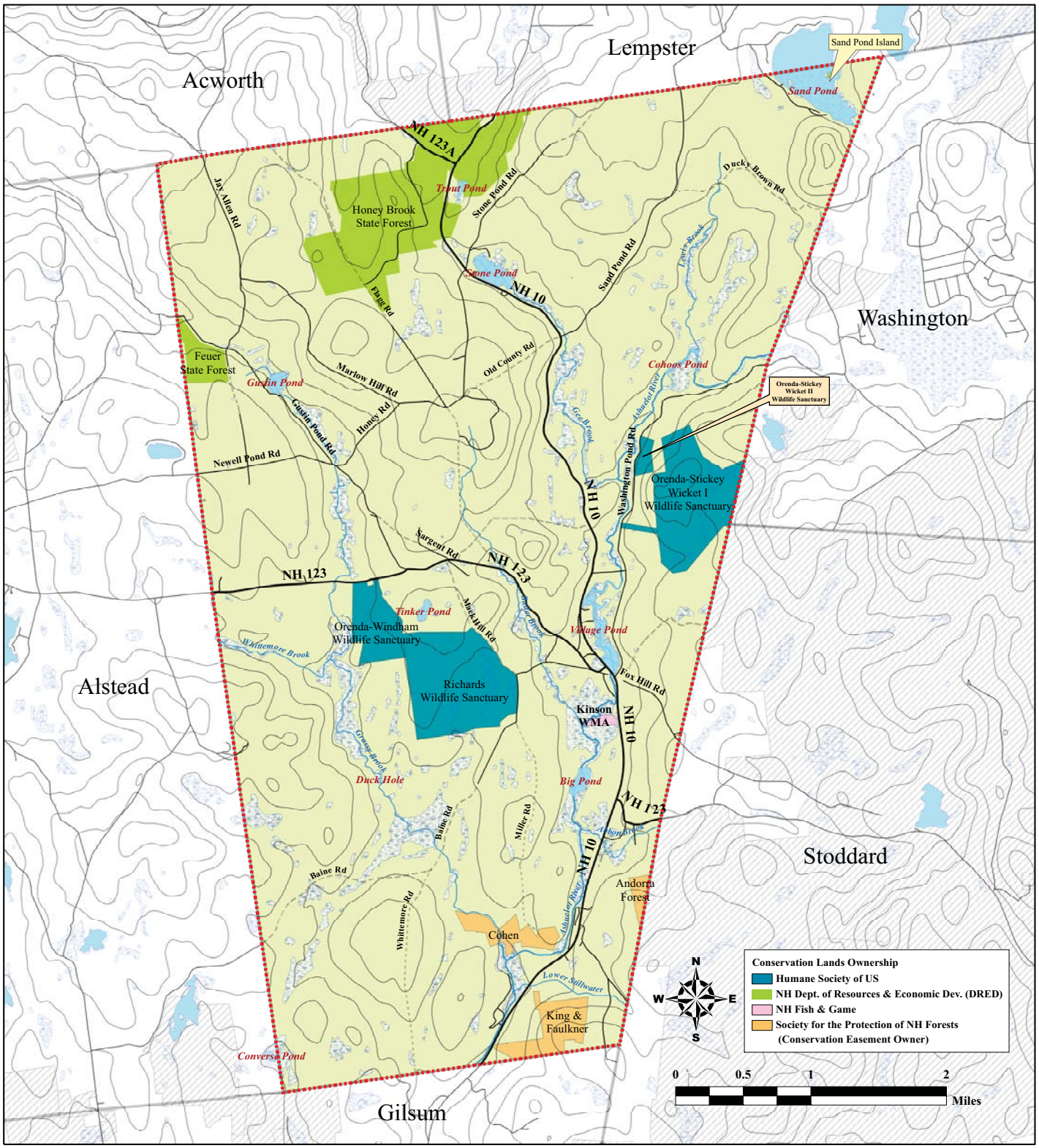

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Figure 16. Conservation lands of Marlow, NH. This map shows the distribution of permanently conserved lands by conservation easement or fee ownership. Moosewood Ecological LLC

Build-out Analysis

To better understand Marlow's built infrastructure with that of the natural environment it is important to incorporate patterns of past land use to get a sense of the town's build-out potential. To do so, the Southwest Region Planning Commission conducted a phase one build-out analysis. This analysis is an estimation of the amount and location of potential development for an area, essentially identifying the holding capacity of the land. The evaluation of current zoning, degree of land parcelization, existing development, and environmental constraints for development are generally taken into consideration. When conducting a build-out analysis various calculations about current development and future land growth are also taken into consideration.

Marlow's landscape has been divided into approximately 768 parcels, representing five zoning districts (Figure 17, p.73). These districts have various lot size requirements within each and help to dictate how parcels may be developed in the town. This base map defines Marlow's current existing conditions.

To this base map a variety of environmental constraints for development were mapped using existing data sources (Figure 18, p.74). These constraints included conservation lands, public open space and recreation, hydric soils, areas that are shallow to the water table, floodplains, lakes, ponds, wetlands, and steep slopes. This provides a course-filter view to better understand where issues may exist for future land development. It is important to note that all of these constraints may not necessarily preclude the possibility of land development, especially in light of technical advances in engineering.

Next, phase one build-out analyses were conducted using the existing conditions of the base map in combination with Marlow's current zoning. The first analysis evaluated what the town could look like under existing zoning and if each parcel was built to 100% of its capacity (Figure 19, p.75). The second analysis evaluated if the town's existing zoning ordinance was modified to allow properties to be built to 150% of its capacity, such as reducing the minimum lot size within zoning districts (Figure 20, p.76).

These two build-out maps demonstrate the potential density of development if the town were built-out as outlined above. They do not necessarily reflect the actual location of each development but rather the number of houses and/or businesses per parcel. In the build out analysis, development constraints were not taken into consideration when evaluating the carrying capacity of each parcel under current zoning. This was due in part to the project being a phased approach and in subsequent analyses analytics would be need to be conducted to identify priorities regarding development constraints.

A build-out analysis is a very useful analytical tool that can be used for town-wide land use planning. It can provide various land use scenarios for communities regarding how the town views itself into the future. It provides an avenue to evaluate how the current zoning is or is not reflective of community values and its vision of future development patterns. Finally, it can serve as a source for promoting innovative land use planning that is reflective of the principles of smart growth as a means to development Marlow in a more sustainable manner.

The Town of Marlow should consider using the build-out analysis maps to help develop a growth and development strategy plan. Does the Town wish to consider alternative subdivision regulations that would promote a more compact style of development that encourages conservation of natural resources as opposed to regulations that may promote sprawl over time? Does it wish to incorporate more innovative land use planning techniques that could help guide the growth and development strategy plan?

Marlow should also consider developing a phase two build-out analysis that incorporates environmental constraints and current developed areas into the analysis. This would include constraints identified by their current zoning ordinances and those at the state level (i.e., Comprehensive Shoreland Protection Act: RSA 483-B), as well as constraints identified in Figure 18 (p.74). Phase two should provide a more detailed build-out analysis and include various land use scenarios from which future informed decision making can be more accurately based. As such, the build-out analysis can be used to test how future land use decisions could change or help to maintain the rural nature of Marlow.

Housing and Conservation Planning Program (HCPP)
Town of Marlow, NH - Base Map

Towns Boundaries

Tax Parcel Boundaries

Zoning

- Residential District -10
- Residential District-2
- Residential District-5
- Rural Lands District
- Village District

Conservation Land

Public Open Space or Recreation (unprotected)

Roads

- Class I and II
- Class III, IV, and V
- Class VI
- Class VII

Lakes, and Ponds

Wetlands

Rivers and Streams

Intermittent Streams

N W E S

1:15,000

0.25 0 0.25 Miles

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Digital base information provided by the New Hampshire Geographically Referenced Analysis and Information Transfer System (GRANIT)

MAP NOT INTENDED FOR SITE SPECIFIC WORK

NOVEMBER 2009
Y:\Projects2009\HCPP\Marlow_Basemap_2009.mxd

Figure 17. Base map of Marlow, NH. This map shows the distribution and relative size of tax parcels and the five zoning districts in town. Southwest Region Planning Commission

Housing and Conservation Planning Program (HCPP)
Town of Marlow, NH - Development Constraints

Towns Boundaries

Tax Parcel Boundaries

Zoning

- Residential District -10
- Residential District-2
- Residential District-5
- Rural Lands District
- Village District

Roads

- Class I and II
- Class III, IV, and V
- Class VI
- Class VII

- Conservation Land
- Public Open Space or Recreation (unprotected)
- Hydric Soils*
- Shallow to Water Table (less than 36")*

Steep Slopes

- 15-25%
- Greater than 25%

- Flood Zone
- Lakes, and Ponds
- Wetlands
- Rivers and Streams
- Intermittent Streams

*USDA Soil Survey of Cheshire County

N W E S

1:15,000

0.25 0 0.25 Miles

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NOVEMBER 2009
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Figure 18. Development constraints in Marlow, NH. These constraints include conservation lands, public open space and recreation, hydric soils, areas shallow to the water table, floodplains, lakes, ponds, and wetlands, and steep slopes. Southwest Region Planning Commission

Housing and Conservation Planning Program (HCPP)
Town of Marlow, NH - 100% Built-Out

Towns Boundaries

Tax Parcel Boundaries

Zoning

- Residential District -10
- Residential District-2
- Residential District-5
- Rural Lands District
- Village District

Build-Out Estimated Buildings

- Single Family Residential
- Multi-Family Residential
- Mixed Use
- Non-Residential

Conservation Land

Public Open Space or Recreation (unprotected)

Roads

- Class I and II
- Class III, IV, and V
- Class VI
- Class VII

Lakes, and Ponds

Wetlands

Rivers and Streams

Intermittent Streams

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MAP NOT INTENDED FOR SITE SPECIFIC WORK

NOVEMBER 2009
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Figure 19. Build-out analysis at 100%. The first analysis evaluated what the town could look like under existing zoning and if each parcel was built to 100% of its capacity. Southwest Region Planning Commission

Housing and Conservation Planning Program (HCPP)
Town of Marlow, NH - 150% Built-Out

Towns Boundaries

Tax Parcel Boundaries

Zoning

- Residential District -10
- Residential District-2
- Residential District-5
- Rural Lands District
- Village District

Build-Out Estimated Buildings

- Single Family Residential
- Multi-Family Residential
- Mixed Use
- Non-Residential

Conservation Land

Public Open Space or Recreation (unprotected)

Roads

- Class I and II
- Class III, IV, and V
- Class VI
- Class VII

Lakes, and Ponds

Wetlands

Rivers and Streams

Intermittent Streams

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MAP NOT INTENDED FOR SITE SPECIFIC WORK

NOVEMBER 2009
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Figure 20. Build-out analysis at 150%. The second analysis evaluated what the town could look like under modified zoning and if each parcel was built to 150% of its capacity. Southwest Region Planning Commission

Conservation Priorities

Co-occurrence Analysis and Landscape-level Considerations

To continue the process of identifying Marlow's most significant areas in town, a co-occurrence model was generated in a GIS (Figure 21, p.80). A co-occurrence model is an analytical tool that uses spatial data to determine where various levels of natural resources occur in unison, or where they overlap. This analysis, in its simplest form, demonstrates low, medium, and high levels of co-occurring resources to assist in the identification of "hotspots" for conservation. Essentially, it helps to prioritize conservation planning efforts to help maximize economic, social, and ecological benefits.

While the co-occurrence model is an effective tool for an initial analysis it should be used in combination with ecological interpretations of Marlow's landscape to aid in the identification of conservation focus areas (CFAs). It should consider many landscape-level attributes, including wildlife movement and habitat connectivity, ecological reserve design and proximity to protected lands, unfragmented lands, development pressure, land parcelization, and current land use, as well as the presence and distribution of rare species and clustering effect of ecologically significant habitats (ESHs) that occur in close proximity to one another.

These landscape-level considerations aid in a more comprehensive approach that recognizes large-scale habitats and ecological processes within the built and natural environments. When these elements are considered in combination with the distribution of currently protected lands then a more successful conservation plan can be prepared that incorporates the concepts of biological conservation and ecosystem reserve design to help maximize and sustain biodiversity protection for the long-term.

One major landscape-level consideration includes the size and distribution of unfragmented lands in Marlow (Figure 13, p.58). These areas are defined by the surrounding human infrastructure (roads and developed areas) and can negatively affect species survival rates, including mortality or lowered rates of breeding success. The degree of severity of fragmentation depends upon many aspects, such as the size and shape of unfragmented block, the species or community in question, the extent of loss of natural habitats, intensity of human use, and colonization of invasive species.

Large blocks of unfragmented areas are widely known to support greater biodiversity than smaller blocks. As forest blocks become smaller due to the construction of roadways and developments their biodiversity will generally be reduced. This fragmentation affect provides greater benefits for generalist species or those with small home ranges (i.e., gray squirrels, raccoon, many amphibians and reptiles, and small rodents) while affecting and potentially eliminating area-sensitive specialists that need large forested blocks in order to maintain their home ranges and for long-term survival (i.e., bear, bobcat, moose, some reptiles, wood thrush, and goshawk). Appendix G (p.111) provides a general list for habitat block size requirements for wildlife.

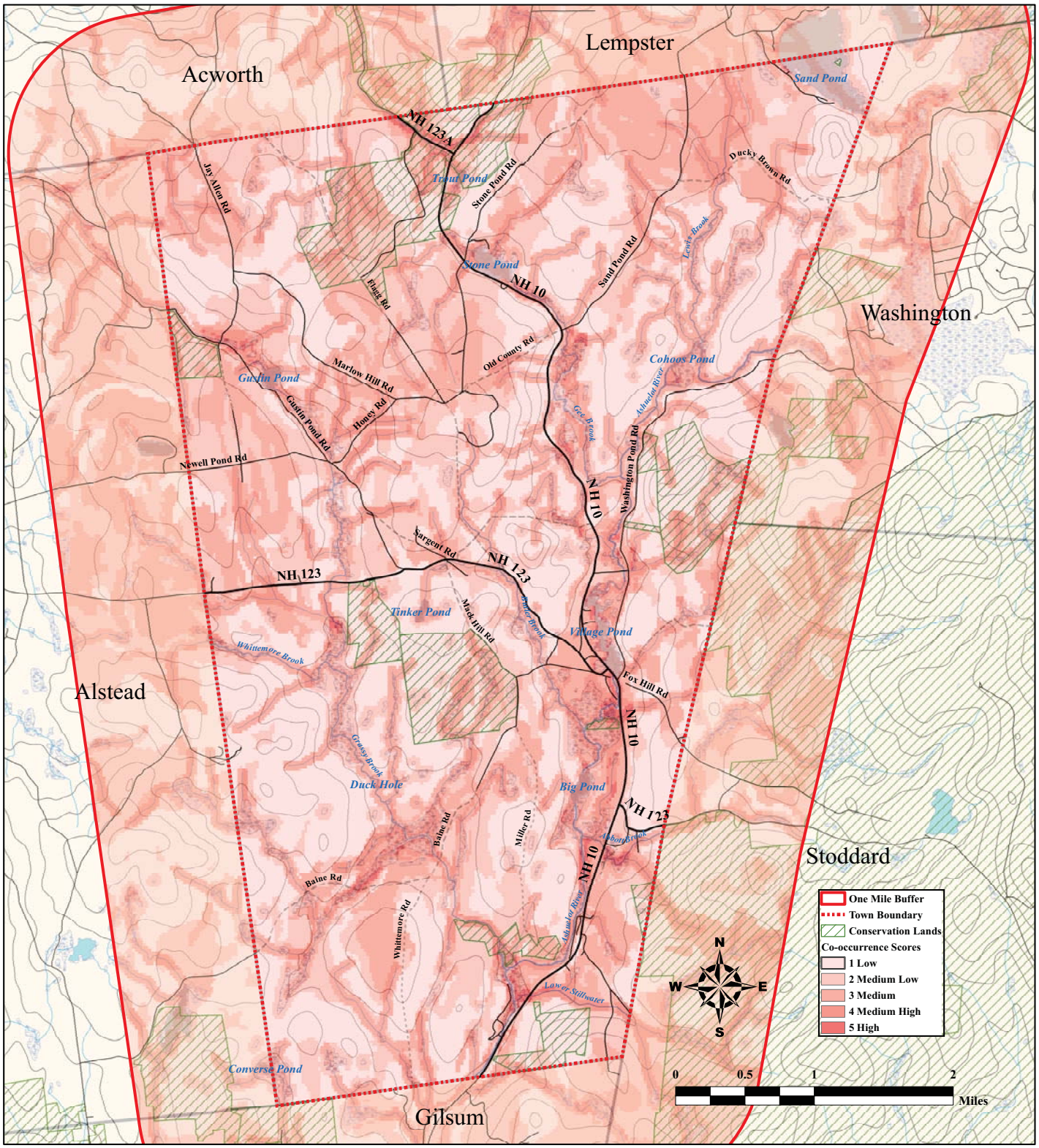
Another function of large landscapes considers wildlife movement and habitat connectivity. By maintaining connectivity between critical habitats it may be possible to provide permanent wildlife corridors within the built environment. Wildlife travel corridors function as areas that one or many species may use to move from one habitat to another. This movement can be based on traveling to various areas for feeding, breeding, nesting, or shelter. Wildlife must be able to travel safely throughout the landscape in order to meet their biological needs. Many depend upon a variety of habitats for their survival and may utilize many natural features for travel. These may include features such as riparian zones of wetlands, ponds, and streams, ridgelines, utility right-of-ways, and forest patches acting as a safe route between two or more habitats. A variety of wildlife can be associated with these corridors, including otter, muskrat, fox, coyote, bobcat, deer, moose, fisher, mink, beaver, and bear.

Corridors are not only significant for mammals but equally as important for amphibians, reptiles and migratory birds. Both amphibians and reptiles begin to move from their wintering habitats to their respective breeding and nesting grounds in the spring. This is the time of year that most mortality can be noticed as these species travel across roadways in search of suitable habitats. This affect can often be exacerbated as the same individuals must return back to their wintering habitats. Thus, there is a great significance in maintaining habitat connectivity, as well as understanding where these patterns of movement are taking place. This latter point can be a very important educational tool for community education and awareness about corridors across

roadways. It can provide a means to adjust transportation patterns to help eliminate potential road mortality. Potential sites for amphibian crossings were identified to begin assisting the town of Marlow in this effort (Appendix H, p.113).

Another consideration to take into account when developing priorities for conservation is the distribution of currently protected lands (Figure 16, p.70). This affords the opportunity to understand how various fine- and large-scale ecological attributes are arranged on the landscape and how they coincide with protected areas to best prioritize for conservation initiatives. This informed land use planning effort helps to determine how Marlow can link significant areas with those parcels that have development constraints, as well as how and where to create larger reserves. These are the basic ideas of ecological reserve design that helps to maximize conservation values and ensure that representative ESHs are included for protection strategies.

Marlow Natural Resources Inventory
Co-occurence Analysis



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Latest Map Revision: March 01, 2010

Figure 21. Co-occurrence analysis of ecological data for Marlow, NH. This map shows hotspots where ecological attributes overlap. The darker red coloration indicates greater overlap, or co-occurrence, of these resources. Conversely, the lighter the shade of red indicates fewer co-occurrences. Moosewood Ecological

Conservation Focus Areas (CFAs)

In consideration of the co-occurrence analysis and landscape-level attributes, a total of six large-scale CFAs have been identified as having high priorities for conservation. These include:

- Grassy Brook watershed; particularly the unfragmented block bound by NH Route 123 and Route 10, and the stream riparian corridor north of NH Route 123 including Gustin Pond and tributaries
- Lewis Brook watershed
- Ashuelot River corridor, including Village Pond and its adjacent undeveloped uplands
- Gee Brook riparian corridor, including Stone Pond and its tributaries
- Sand Pond riparian corridor and its tributaries
- Bald Hill
- Knight Brook and tributaries adjacent to Honey Brook State Forest

RECOMMENDATIONS

The information provided herein, including the various maps, should be used when considering the adoption of various land use planning techniques. The data used to develop such information represents the most current, readily available data to better understand Marlow's natural resources. As such, there are some general guidelines that the town can use to promote innovative and informed land use planning.

- protect large unfragmented blocks, especially those with high quality habitats located within close proximity of one another and with limited barriers for wildlife movement;
- protect known rare species populations;
- protect representative examples of critical habitats for known rare species;
- protect rare and representative examples of natural communities;

- protect intact wetland and stream riparian buffers and promote the restoration of degraded areas;
- support voluntary and regulatory approaches at natural resources protection;
- build upon existing contiguous protected lands;
- connect protected lands and other critical habitats with upland, aquatic, and/or riparian corridors;
- better understand wildlife movement patterns to identify and design the most effective conservation corridors; and
- promote community education and outreach regarding Marlow's biodiversity and the importance of long-term protection strategies

The following general recommendations have been provided based on the findings of the natural resources inventory. These are considered as the next actions steps that the town of Marlow should consider as they proceed with community land use planning.

1. Develop an Open Space Committee as part of the Conservation Commission to help oversee conservation planning efforts in the Town
2. Conduct field-based surveys of CFAs to verify WAP habitats and to document species presence (with an emphasis on species of conservation concern), rare and exemplary natural communities, and fine-scale critical wildlife habitats (i.e., vernal pools).
3. Complete the parcel-based GIS ecological assessment model.
4. Prepare site-specific rapid ecological assessments of high priority parcels as determined by recommendation #2.
5. Develop a comprehensive Conservation Plan that incorporates recommendations for land conservation, regulatory and voluntary actions, and community outreach. This plan should build upon the priorities described above, incorporating more detailed and refined data.
6. Incorporate the NRI into the town's Master Plan.

7. Develop a Growth and Development Strategy Plan that includes the data collected during the Marlow Conservation and Community Planning project that identifies ways to use land more efficiently, encourages more compact development, and specific areas for conservation and development.
8. Refine active agricultural lands mapping.
9. Conduct an audit of current zoning regulations to better understand if and how they incorporate principles of smart growth (Appendix I, p.115) and how they align with current housing needs. This effort can illuminate certain land use planning techniques that the Town might want to consider adopting in an effort to develop informed land use decisions for a more sustainable future. This could identify ways to use land more efficiently, encourage more compact development, and allocate specific areas for conservation and development.
10. Continue to work with adjacent communities on similar conservation initiatives of common interest. It would be helpful to meet with the Conservation Commission within each of the adjacent communities to build strong relationships and create open lines so communication, as well as to inform these communities about Marlow's conservation planning efforts.
11. Continue with community outreach and education regarding Marlow's natural resources and conservation planning. Topics could include and expand upon those identified during the second community forum as outlined above.

SOURCE DOCUMENTS

Brunkhurst, E. 2009. Personal communications. Conservation Biologist, NH Fish and Game, Concord, New Hampshire.

Coppola, M.L. 2010. Request for rare elemental occurrences on conservation lands. Environmental Information Specialist, NH Natural Heritage Bureau, Concord, New Hampshire.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. US Dept. of Interior, Fish and Wildlife Service, Washington D.C. 131 pp.

Dahl, T.E. 1990. Wetlands losses in the United States 1780s to 1980s. Department of the Interior, U.S. Fish and Wildlife Service, Washington, D.C. 21 p.

Gries, G. 2009. Personal communications. Fisheries Biologist, NH Fish and Game Department, Region 4, Keene, NH.

Hunt, P. 2009. Personal communications. Senior Conservation Biologist, NH Audubon Society, Concord, NH.

Little, J. 2005. Marlow Land Use Study. Franklin Pierce College, Rindge, NH.

Marchand, M. 2009. Personal communications. Conservation Biologist, NH Fish and Game Department, Concord, New Hampshire.

Littleton, J.N. 2009-2010. Ecological Assessment: sites visits conducted for inclusion in the Marlow NRI. Moosewood Ecological LLC, Chesterfield, NH.

Littleton, J.N. 2010. Town of Marlow Historical Resources Inventory. Moosewood Ecological LLC, Chesterfield, NH.

New Hampshire Department of Employment Security. http://www.nh.gov/nhes/

New Hampshire Department of Environmental Services. 2008. Innovative Land Use Planning Techniques. Concord, NH.

New Hampshire Fish and Game Department. 2005. New Hampshire Wildlife Action Plan. New Hampshire Fish and Game Department, Concord, New Hampshire.

New Hampshire Housing Finance Authority. http://www.nhhfa.org/rl_demographic.cfm

New Hampshire Natural Heritage Bureau. 2009. Rare Plants, Rare Animals, and Exemplary Natural Communities in New Hampshire Towns. Concord, NH.

New Hampshire Office of Energy and Planning. 2007. Municipal Population Projections 2010 to 2030. Concord, NH.

New Hampshire Office of Energy and Planning. 2009. 2008 Population Estimates of NH Cities and Towns. Concord, NH.

Murphy, L. 2009. Housing and demographics study of Marlow. Southwest Region Planning Commission, Keene, NH.

Rosenberg, G.L. 1989. Soil Survey of Cheshire County, NH. U.S. Department of Agriculture Natural Resources Conservation Service in cooperation with NH Agricultural Experiment Station.

Sauer, J.R., J.E. Hines, and J. Fallon. 2004. The North American breeding bird survey, results, and analysis 1966-2003. Version 2004.1. U.S. Pautuxent Wildlife Research Station Center, Laurel, Maryland.

Society for the Protection of New Hampshire Forests. 2005. New Hampshire's Changing Landscape - Population Growth and Land Use Changes: What They Mean for the Granite State. SPNHF, Concord, NH.

Sperduto, D.D. 2005. Natural Community Systems of New Hampshire. New Hampshire Natural Heritage Bureau, Concord, New Hampshire.

Sperduto, D.D. and William F. Nichols. 2004. Natural Communities of New Hampshire. NH Natural Heritage Bureau, Concord, NH. Pub. UNH Cooperative Extension, Durham, New Hampshire.

Stone, A.J.L. 2001. Natural Resources Inventory – A Guide for New Hampshire Communities and Conservation Groups. University of NH Cooperative Extension.

U.S. Census Bureau. 1998. National Population Projections. Washington D.C.

APPENDIX A

HOUSING AND DEMOGRAPHICS STUDY

Town of Marlow - Current Population and Population Projections

Population growth is a product of two factors - births over deaths, and migration of people moving into the community.

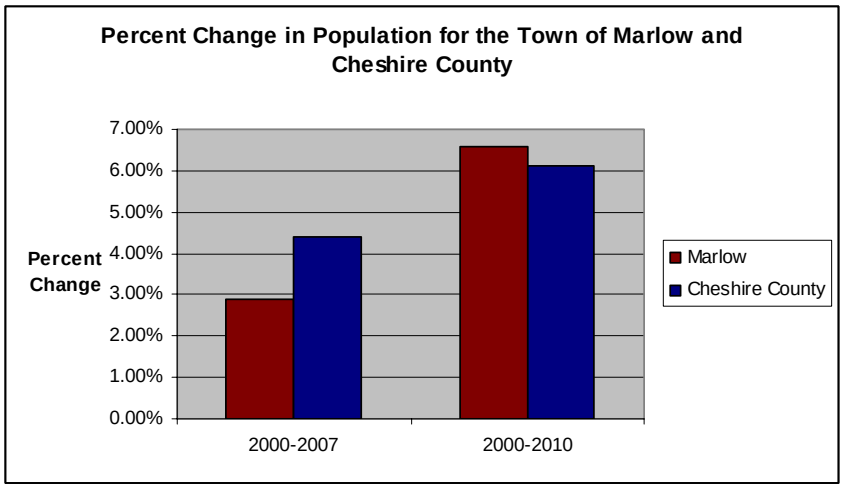
The last census was taken in 2000 and the next census will begin within the next year (2010). However, the data collected from that census must be analyzed and will likely be available in 2011. In the meantime, the latest population data has been obtained from the New Hampshire Housing & Finance Authority, New Hampshire Office of Energy and Planning (NH OEP), and U.S. Census estimates. The figure shows that the population in Marlow increased from 747 people in 2000 to 769 people in 2007. This indicates an increase of 22 people in a seven year period or a 2.9% increase.

The population projection for 2010, based on data from NH OEP and the U.S. Census is 800 people for the Town of Marlow. This represents an increase of 53 people since the 2000 census or a 6.6% increase over a ten year period.

Comparing change in population of Marlow to change of population in Cheshire County

The U.S. Census figures show that Cheshire County has experienced a slightly different population growth trend than the Town of Marlow. The population estimates for Cheshire County show an increase in population from 73,825 in 2000 to 77,235 in 2007. This represents an estimated increase of 3,410 people or a 4.4 % increase. This indicates that the population in Marlow is increasing at a slower rate than Cheshire County.

The projection for 2010, however, is quite different. The population projection for Cheshire County is 78,624 which is an increase of 4,799 people, or a 6.1 % increase over the ten year period. This indicates that the projected population of Marlow will increase at a slightly faster rate than the population of Cheshire County during the same period. It is important to acknowledge that the 2007 figures are *estimates* and the 2010 figures are *projections.* Neither of these figures are actual counts. The upcoming census in 2010 will provide us with *actual* population data that can better reflect the changes for both the Town of Marlow and Cheshire County.

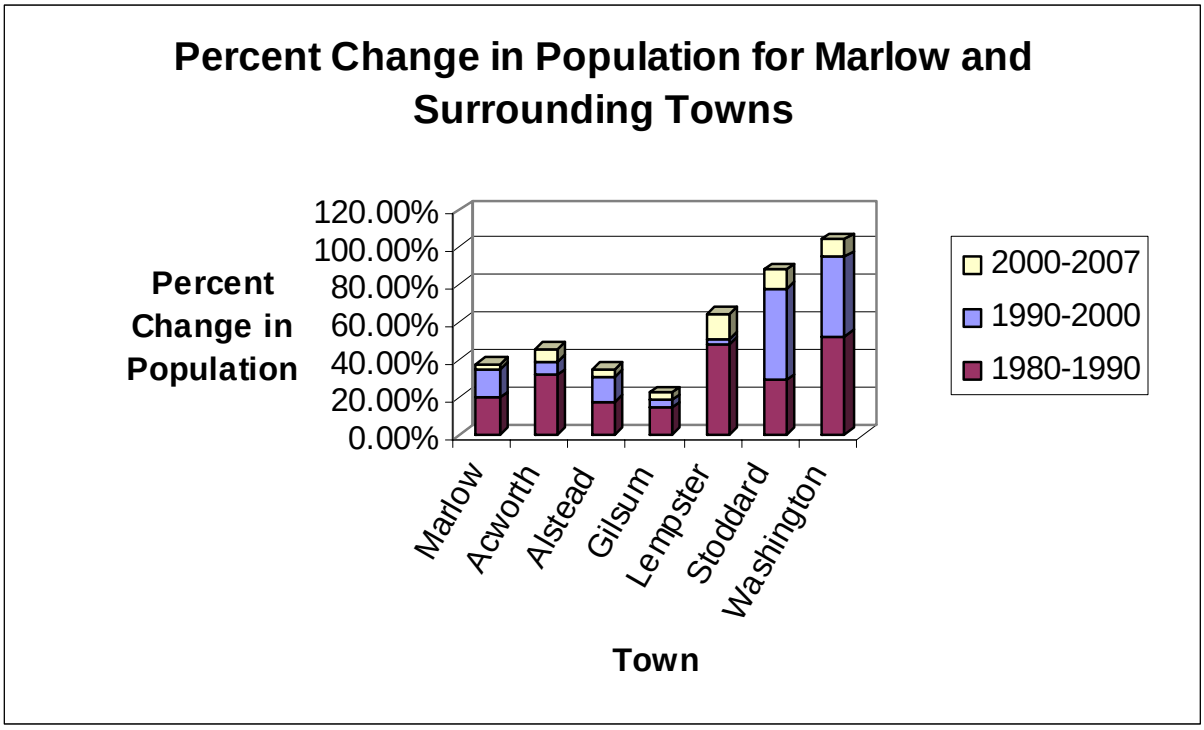


Source: U.S. Census

Sub-Regional Population Comparisons

An important comparison to make in any population analysis is a comparison to the surrounding towns - Stoddard, Gilsum, Alstead, Acworth, Lempster, and Washington. The following tables represent the population change and comparison for Marlow and the surrounding towns from 1980 - 2007. These charts indicate that the towns within this subregion experienced the largest growth in population during the housing boom of the 1980's (with the exception of Stoddard). For all of these towns, the slowest rate of growth occurred during the 2000 - 2007 period, with very little change in the population. Since this period only covers a seven year period and not a ten year period like the other categories, one might conclude that the numbers are not reflective of a true analysis. However, any changes that have occurred since then, and any population projections for the remainder of this period are expected to remain minor.

	Marlow	Acworth	Alstead	Gilsum	Lempster	Stoddard	Washington
1980 - 1990	19.90%	31.50%	17.80%	14.30%	48.70%	29.00%	52.80%
1990 - 2000	14.90%	7.70%	13.00%	4.30%	2.50%	49.20%	42.50%
2000 - 2007	2.90%	6.90%	4%	4.00%	13.30%	10.20%	9.50%



Source: U.S. Census

Population Distribution by Age

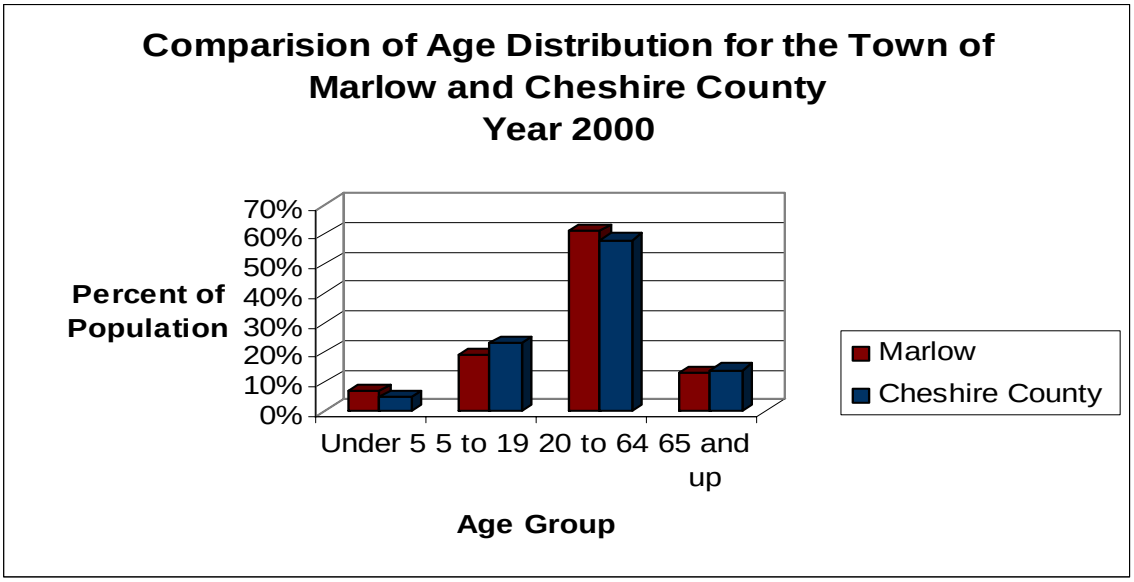
Age distribution can be broken down into various categories depending on the expected use of the data. In many instances, for municipal planning purposes, age is divided into categories that correspond with services that will be provided by the municipality. Therefore, there are three main groups: school age, work force, and retirement age. The largest category is the workforce age group because it spans the greatest range of ages (ages 20 - 64). This age group includes 452 people or 61% of Marlow's population. The second largest category in Marlow is the school age group (ages 5 - 19). This category includes 145 people or 19% of the population.

The age distribution for Cheshire County during the same time period has slightly different numbers, although the categories are consistent. The largest category for the county is also the work force age group. This age group includes 43,408 people or 58% of the county's population. The second largest category is the school-age group which has 16,509 people or 23% of the county population.

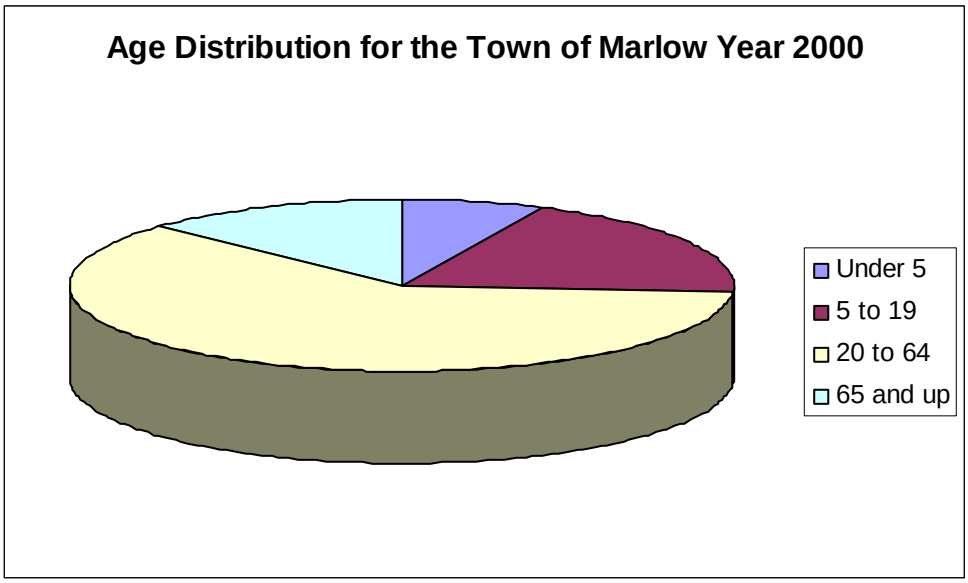
This indicates that the Town of Marlow has a 3% higher population distribution in the work force age group than Cheshire County. It also shows that Marlow has a slightly lower percentage of school-age residents (4% less) than that of Cheshire County.

The median age is useful data to have for planning the needs of a community. In the Town of Marlow, the median age is 39.6 years. The median age in the State of New Hampshire is 37.1 years.

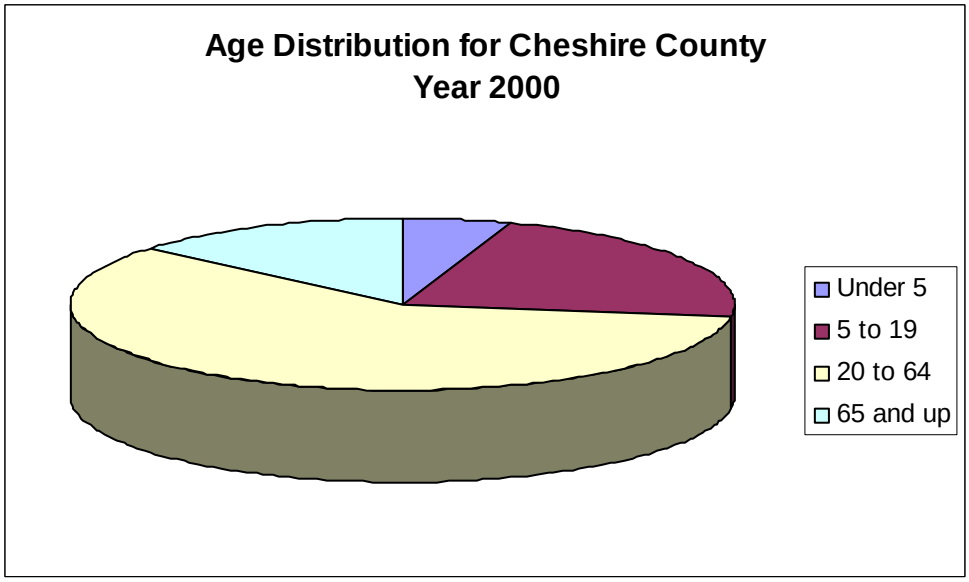
The following graph shows the age distribution in the Town of Marlow and Cheshire County according to the 2000 census.



Source: US Census



Source: U.S. Census



Source: U.S. Census

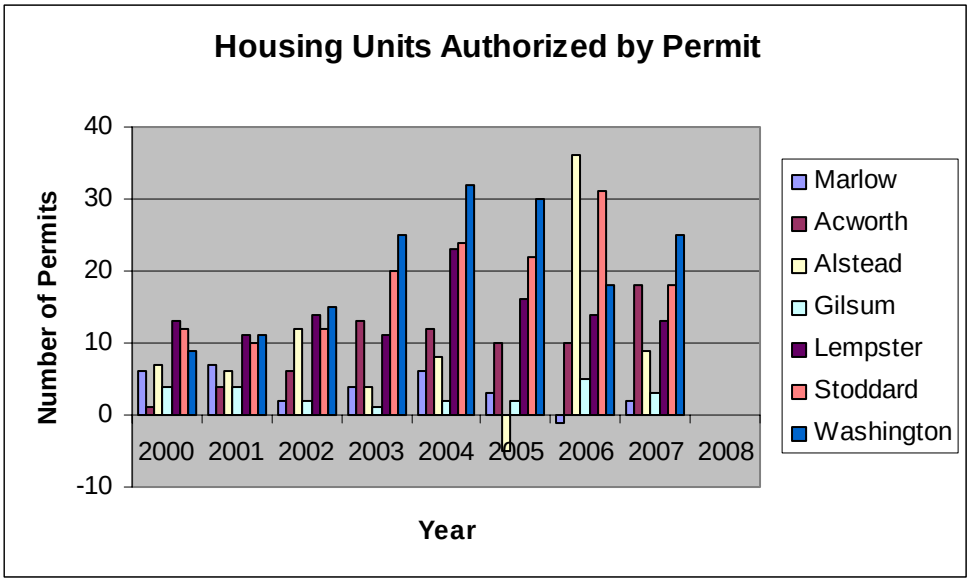
Housing Analysis

The changes in real estate prices and availability have changed drastically over the last twenty years. The housing boom in the late 1980's ended with an overstock of residential units throughout the country. Housing prices nearly tripled form 1980 to 1990. During the next decade, new house construction dropped off sharply to allow the housing need to catch up to the availability and prices remained stable. Prices began to rise again near the end of the 1990's as the need for housing began to rise.

Housing Units Authorized by Permit

Housing Units	2000	2001	2002	2003	2004	2005	2006	2007	2008
Marlow	6	7	2	4	6	3	-1	2	-
Acworth	1	4	6	13	12	10	10	18	-
Alstead	7	6	12	4	8	-5	36	9	-
Gilsum	4	4	2	1	2	2	5	3	-
Lempster	13	11	14	11	23	16	14	13	-
Stoddard	12	10	12	20	24	22	31	18	-
Washington	9	11	15	25	32	30	18	25	-

Source: NH Housing Finance Authority



Source: NH Housing Finance Authority

Median Purchase Price of Homes in Marlow

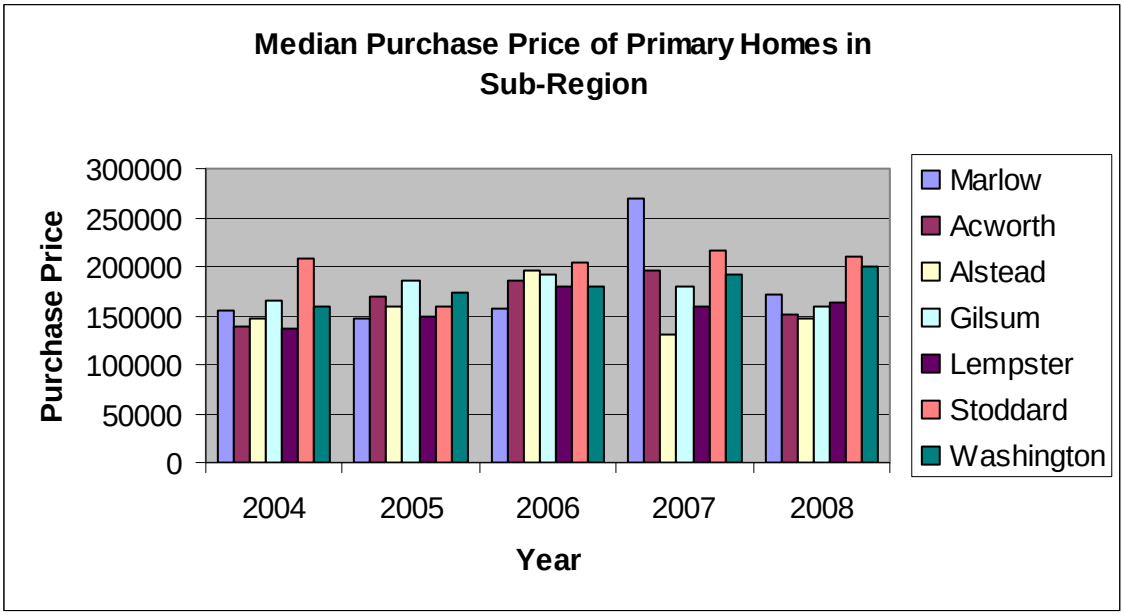
The current market has taken a sharp decline as the banking industry has changed lending policies and procedures. The change in the labor market has further affected the ability for people to secure mortgages or maintain their existing ones, thus leading to an unusually high rate of foreclosures and vacancies. As a result, real estate prices have dropped and the number of houses on the market is increasing.

The following chart provides information regarding the average purchase price of homes in Marlow. It indicates that the cost of purchasing a home in Marlow between the years of 2000 - 2008 has risen each year except for 2008 (which only reflects the first half of the year). Prices increased sharply during the periods of 2001-2002, 2002-2003, and again in 2006-2007. It declined significantly during the first six months of 2008.

Median Purchase Price of Primary Homes in Sub-Region

	2004	2005	2006	2007	2008
Marlow	$155,000	$146,000	$157,000	$270,000	$172,000
Acworth	$139,000	$170,000	$186,500	$195,000	$151,700
Alstead	$147,500	$160,000	$195,000	$131,250	$146,000
Gilsum	$165,000	$185,250	$191,000	$180,000	$159,500
Lempster	$137,000	$148,000	$179,000	$159,000	$163,000
Stoddard	$208,000	$160,000	$205,000	$216,000	$210,000
Washington	$160,000	$174,115	$179,900	$191,000	$200,000

Source: NH Housing and Finance Authority.



Source: NH Housing Finance Authority

Median Rental Costs

Contrary to the sharp decline in housing prices, there has been little or no change in monthly rental fees. In a changing market, rental fees may increase as the change in home ownership shifts. With fewer people qualifying for mortgages, the need for rental housing increases and available rental units become more difficult to find.

The following tables show the 2008 gross rent according to the number of bedrooms per unit. The comparison used here is Cheshire County and the State of New Hampshire. These tables show that the average rent for units with 2 bedrooms or greater are slightly higher in Cheshire County than those for the State of New Hampshire.

Cheshire County 2008 Gross Rent (including utilities)

Unit Size	Sample Size	Rent Range	Median
0	9	$400-$864	-
1	176	$488-$1,226	$787
2	301	$557-$2,260	$1,052
3	67	$746-$1,725	$1,297
4+	21	$1360-$2,700	$1,710
ALL	574	$400-$2,700	$970

Source: NH Housing and Finance Authority

State of New Hampshire 2008 Gross Rent (including utilities)

Unit Size	Sample Size	Rent Range	Median
0	642	$250-$1,439	$615
1	4,005	$377-$1,926	$800
2	6,473	$427-$2,342	$1,044
3	1,752	$540-$2,925	$1,200
4+	256	$621-$3,310	$1,466
ALL	13,128	$250-$3,310	

Source: NH Housing and Finance Authority

Housing units by Tenure

In 2000, the number of housing units in Marlow totaled 396 units which was an increase of 32 units from the 1990 census count of housing units. The occupancy/use of these units is 292 occupied homes, 104 vacant units, and 84 vacation units. The table indicates a 12.3% increase in owner occupied units and a significantly larger increase in rental units. The number of rental units was 24 units in 1990 and 46 units in 2000, a 91.7% change during the ten year period.

Units by Tenure & Vacancy for the Town of Marlow

Housing Units	1990	%	2000	%	% Change
Total Units	364	-	396	-	8.8%
Occupied Units	243	66.8% of Total	292	73.7% of Total	20.2%
Owner Occupied	219	90.1% of Occ.	246	84.2% of Occ.	12.3%
Renter Occupied	24	9.9% of Occ.	46	15.8% of Occ.	91.7%
Vacant Units	121	33.2% of Total	104	26.3% of Total	-14%
Vacant for Sale	6	5% of Vac.	5	4.8% of Vac.	-16.7%
Vacant for Rent	9	7.4% of Vac.	1	1% of Vac.	-88.9%
Vacant Seasonal	84	69.4% of Vac.	86	82.7% of Vac.	2.4%

Source: U.S. Census

Future Housing Needs

Future housing needs can be estimated from the NH OEP population projections or from the past population change trends for the 20 year period 1980 - 2000. The future population values are then divided by an average person per unit estimate, resulting in a total housing estimate.

Marlow Population Growth Trends 1980-2000

Population			# Increase	% Change	# Increase	% Change
1980	1990	2000	1980-1990	1980-1990	1990-2000	1990-2000
542	650	747	108	20%	97	14.9%

Source: U.S. Census

Marlow Population Projections

Population Projections							# Increase	% Change
2000	2005	2010	2015	2020	2025	2030	2000-2030	2000-2030
747	780	800	840	880	910	940	193	25.8%

Source: NH Office of Energy and Planning

The average growth for each 10 year period using the historical census data (Trends method) was 17.5%. Projecting this to the period from 2000 - 2030, there could be an increase in population to 1,213 by 2030 (an increase of 466).

The methodology utilizing NH OEP population projections using a 25.8% increase shows that there could be an increase in population to 940 by 2030 (an increase of 193).

To calculate housing need, a reasonable *person per unit* figure for the future must be assumed. The accepted *person per unit* figure used is 2.59, the value reported in the 2000 census.

Growth Projections Using Past Trends

Population Increase	2000 Population	Additional Persons using 17.5% x 3 decades	Total Population	Persons/Unit	=Total Increase in Units
17.5%/decade	747	466	1213	2.59	468 (180 more units than in 2000)

Source: U.S. Census

Growth Projection for 2030 Using NH OEP Projections

Population Increase	2000 Population	Additional Persons using 25.8% increase	Total Population	Persons/Unit	=Total Increase in Units
25.8%	747	193	940	2.59	363 (75 more units than in 2000)

Source: NH Office of Energy and Planning

The observations and projections indicate that, if Marlow were to experience the same level of population growth until the year 2030 as it did from 1980 - 2000, the need for housing units would increase from 288 units in 2000, to 468 units in 2030, which is an increase of 180 units. This would mean approximately 6 units per year.

If the NH OEP projections are more accurate, the town would expect an increase of 2.5 units per year during the period from 2000 - 2030.

Median Household Income

The median household income is important data to have for providing programs to households that may need assistance with general needs such as food, shelter and health care. Studying the change in income levels along with other demographical information can be useful in projecting budget requirements and preparing for grants.

The median household income for the Town of Marlow has increased at a higher percentage than Cheshire County and the State of New Hampshire levels. The table below shows that Marlow experienced a 39.7% increase in the median household income over the 10 year period compared to 34% for Cheshire County and 36% for New Hampshire.

Median Household Income 1990-2000

	1990	2000
Marlow	$32,212	$45,000
Cheshire County	$31,648	$42,382
New Hampshire	$36,329	$49,467

Source: U.S. Census

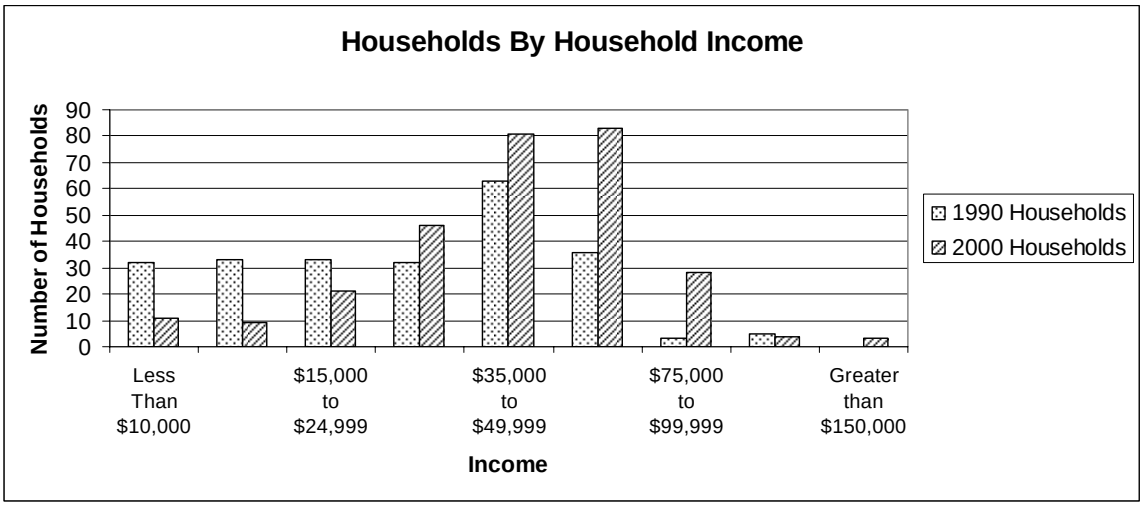
Household Income Distribution

The following table and chart show the distribution of income levels in Marlow during 1990 and 2000 based on U.S. Census information. The figures indicate that the household income levels jumped significantly which is probably due to the number of workers per household (i.e. two incomes instead of one).

Household Income Distribution

Household Income		1990 Households	% of Total	2000 Households	% of Total
	Less Than $10,000	32	13.50%	11	4%
	$10,000 to $14,999	33	13.90%	9	3.30%
	$15,000 to $24,999	33	13.90%	21	7.60%
	$25,000 to $34,999	32	13.50%	46	16.70%
	$35,000 to $49,999	63	26.60%	81	29.50%
	$50,000 to $74,999	36	15.20%	83	30.20%
	$75,000 to $99,999	3	1.30%	28	10.20%
	$100,000 to $149,999	5	2.10%	4	1.50%
	Greater than $150,000	0	0%	3	1.10%
Median HH Income		$32,212		$45,000	

Source: U.S. Census



Source: U.S. Census

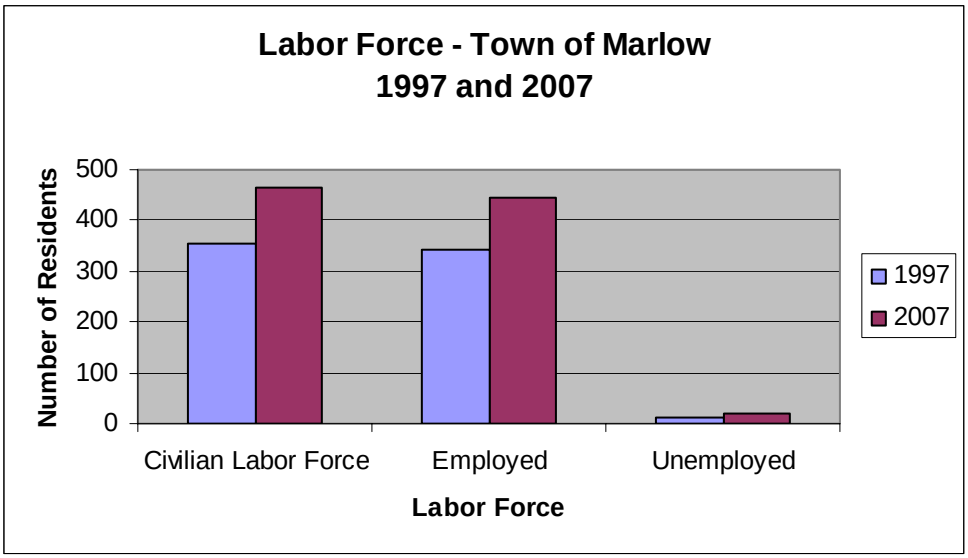
Labor Force

During the 10 year period between 1997 and 2007, the Town of Marlow experienced an increase in unemployment. In 1997, there were 341 residents of the town with jobs and 13 residents (within the workforce age) that were unemployed, resulting in an unemployment rate of 3.7%. The figures in 2007 showed that 444 residents held jobs and 19 residents (within the workforce age) were not working, resulting in an unemployment rate of 4.1%. Therefore the unemployment rate rose by 10.8 % in Marlow.

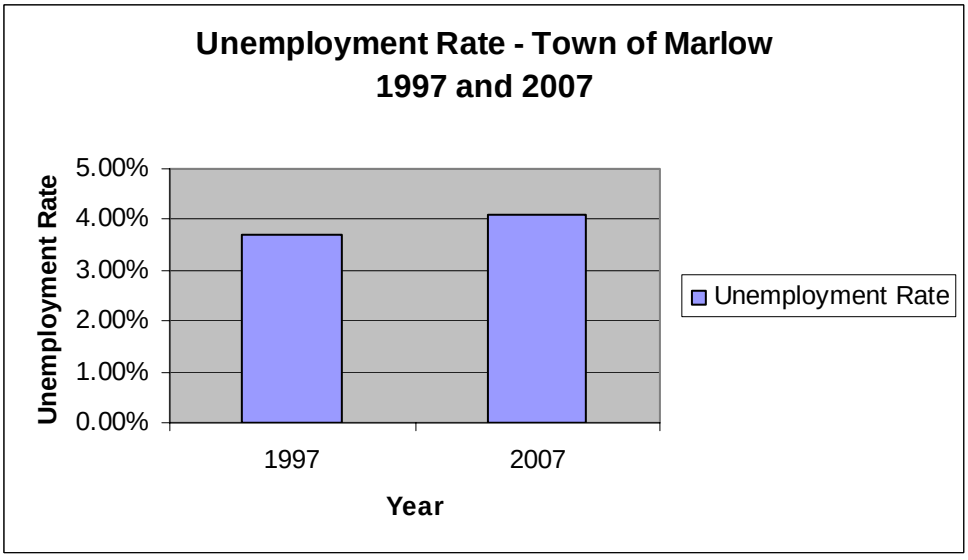
Labor Force - Town of Marlow 1997 and 2007

	1997	2007
Civilian Labor Force	354	463
Employed	341	444
Unemployed	13	19
Unemployment Rate	3.70%	4.10%

Source: NH Employment Security



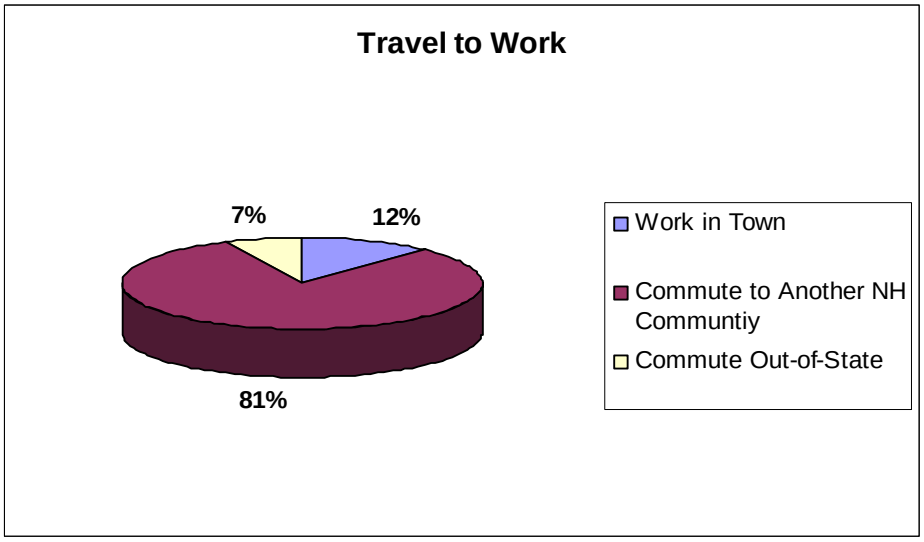
Source: NH Employment Security



Source: U.S. Employment Security

Commuting Patterns

The information found in the chart below is an important factor in the overall analysis of understanding the labor force of the Town of Marlow. A large portion of employment for residents is occurring outside of the Town and causing a great number of workers to commute to and from their place of employment. The chart shows that 81% of Marlow's workers commute to another New Hampshire community to get to work. In addition, another 7% travel out of state to work, which means that 88% of all workers that live in Marlow are commuting to their jobs. This is an indicator of the available job opportunities that exist in town. Marlow is predominantly a residential community with little commercial or industrial businesses.



Source: NH Employment Security

APPENDIX B

COMMUNITY FORUMS RESULTS

Marlow Conservation and Community Planning Forum I
December 2008

Attendees: 15

Natural Resources Strengths and Challenges for the town of Marlow
As identified by forum attendees of the town of Marlow

Strengths

- Farms
- Agriculture
- Horses
- High quality water
- Lots of water
- Grassy Brook – undeveloped
- Much undeveloped land
- Rural
- Sense of community, helping and checking in on one another
- Wind farm possibilities
- PC Connection community Center and their support
- Great working forests*
- Unfragmented land – wildlife
- Outdoor recreation
- Community Spirit
- Ashuelot
- Lot of land in current use
- Zoning laws
- Rural character*
- Nature – Wildlife
- Rural – no large towns nearby
- Lots of "hermits"
- Friendly town
- Population low
- Keep small, rural character
- Keene is nearby – arts, business, etc.
- Odd Fellows/ other orgs. meet regularly
- Taxes good/ taxes low
- Beauty, mountains, water, snow, state parks, forests, wildlife, and wildlife sanctuaries
- Rivers, marshes, kayaking
- Good drinking water
- Mainly clean businesses and services
- Unfragmented lands for the Quabbin to Cardigan corridor

Challenges

- How to preserve water quality
- How to develop more farming
- How to manage forestry
- No high speed DSL
- What kinds of businesses do we want to avoid: "big box stores"
- Better roads for encouraging farming and forestry
- 1/3 of landowners live out of town
- Apathy*
- Zoning laws*
- Class 6 roads
- Master Plan 2008-2013
- Do we want a commercial tax base?
- Stay a bedroom community?
- Lack of business opportunities
- Zoning – cluster and business zoning
- Rural – how to get help in floods, ice and major snow storms
- Everyone like rural character but people have property rights to change/build
- Don't want "dirty" industry

***** *denotes the top strengths or challenges as identified during the natural resources group activity by town of Marlow attendees*

Significant Wildlife Habitat/Sighting Locations

- Mack Hill (significant oak)
- Bald Hill (Marlow Profile)
- Marlow Hill (original site of town)
- Village Grasslands (one of the largest areas of grasslands in town, great habitat)
- Ashuelot River (heron rookeries, corridor)
- Osprey (nesting near Linda's house)
- Grassy Brook region
- Gould Pond (pristine, undeveloped wetland, unfragmented, contiguous forests)
- Mines, feldspar
- Mines/Caves
- Northwest corner adjacent to Honey Brook (unfragmented, wild)
- Grassy Brook (wildlife path and undeveloped area)
- Ashuelot River (recreational and biological, lack of pollution in the headwaters)
- Sand Pond (recreational, potable water, nesting loons, reclaimed trout pond, bass, natural fish – hornpout, eel, no invasive milfoil)
- Mica Mines (hiking)
- Profile – off 123 hiking trail
- Kroka School (education of the outdoors)
- Huntley Mountain (Windmill site)

Marlow Conservation and Community Planning
Forum II Activity Results

May 21, 2009 at 7:00pm
John D. Perkins, Sr. Elementary School
Marlow, NH

Evening activities hosted by the Marlow Conservation Commission, Moosewood Ecological LLC, the Cheshire County Conservation District, and Southwest Region Planning Commission

Natural Resources Discussion
Guiding Questions:

- **Which natural resources are most important to Marlow? Why are they most important?**
- **Which natural resources issues would you like to learn more about? What specific tools and additional information would be helpful for residents in the Town of Marlow?**

Results:

Resources most important to Marlow:

Group 1

- Ashuelot River, protecting the watershed
- Wetlands, rivers, ponds, lakes for recreation and tourism
- Aquifers, for health and property values, considered to be often undervalued
- Rural Character, concerned about protecting this through efficient use of land. There are housing and zoning concerns. An expressed need for smaller lots, conservation land, cluster development
- Contiguous tracts of land for wildlife habitat/biodiversity/game
- Forest Resources – Working Lands for income, habitat, sustainability
- Air Quality for sanity and health, consideration for future industry, many individual community members commute to out or town jobs
- Agricultural Resources

Group 2

- Water resources for recreation and wildlife
- Flood control
- Agriculture and forestry – working lands
- Productive soils – for forestry and agriculture
- Creating/maintaining biodiversity through land management
- Wildlife habitat

Group 3

- Great hiking, outdoor recreation, skiing, canoeing, etc.
- All unfragmented lands near water and higher elevations for wildlife corridors and raptors
- Wildlife habitat variety, grasslands, vernal pools, high elevations
- Renewable resources – timber and timber tax, fuel, wood, wind, etc.
- Rare pockets – oak forest, rare plants, mushrooms, old growth
- Ashuelot River and clean water is “Blue Gold” for drinking water
- Need to save historic, archaeological sites
- Agriculture, buy local foods
- Rural character in the town

Resources and information citizens would like to learn more about:

Group 1

- Education on value of the community's resources for individuals to show folks what is at stake.
- Education through recreational activities
- Workshops on natural resources to help community members overcome apathy
- Workshops that target interest groups (including but not limited to mountain bikers, snowmobilers, birders, fishers, hunters, etc.) and bring different groups together over common interests
- Technical knowledge and Best Management Practices for Forest Management
- Gardening for wildlife, habitat enhancement with native plantings
- Technical information on conservation easements and information on where to go. There is a desire for a simplified process with conservation easements
- More info is needed on where the good agricultural soils are for more potential agricultural sites.
- More education on the value of open space and wildlife habitat

Group 2

- Flood control
- Quality and quantity of water
- Exotic pests (forest management)
- Open space protection vs. business development
- Energy needs
- Loss of farms
- Encouragement of new farms

Group 3

- Wildlife Inventory
- Education for landowners on soils – fertility and types
- Mapping of wind potential
- Mapping of hydro and aquifer potential
- Sustainability, composting
- Good forest management practices
- Forest service talks to towns
- Map where the rare plants are
- State wildlife plans talks
- Fisheries
- Insects
- Helping people with gardening
- Invasive species
- Mapping agricultural lands
- Mapping grasslands

Natural resources ranking activity - ranked in order of importance (1 being the highest):

1.) Lakes, Ponds & Rivers
2.) Forest Resources
3.) Unfragmented Lands
4.) Agricultural Resources (Active and Potential Farmland) (equal to #5)
5.) Groundwater/Drinking Water Resources (Aquifers) (equal to #4)
6.) Wildlife Habitats
7.) Wetlands
8.) Rare Elements (Plants, Wildlife, & Ecological Communities)
9.) Historic Sites/Archeological Sites

Marlow Conservation and Community Planning
Forum III Activity Results

November 19, 2009 at 7:00pm
John D. Perkins, Sr. Elementary School
Marlow, NH

Evening activities hosted by the Marlow Conservation Commission, Moosewood Ecological LLC, the Cheshire County Conservation District, and Southwest Region Planning Commission

Natural Resources Discussion
Guiding Questions:

- **Based on the findings of the NRI and Build-out Analyses what is your vision of Marlow?**
- **Where would you like to see growth and development planning address?**

Participants were asked to think about these questions within the scope of four major themes, including Historical and Cultural Resources, Significant Natural Resources and Working Lands, Housing and Business Development Patterns, and Future Opportunities (i.e., Energy, Climate, Transportation, Telecommunications, etc.)

Below provides a list of ideas, visions, and discussion points for each of the four themes.

Housing and Business Development Patterns:

- No big malls
- Small grocery/pharmacy/general store desirable
- Affordable housing for young and older people
    - Don't want to burn out with age
    - Communal options
    - Centrally located villages
    - Compact development/ cluster housing
- 20 acre zoning is a positive feature
- Encourage small local businesses
- Signage to remain moderate to keep heritage
- Flexibility with zoning for cluster development and natural resources development (protection through conservation easement
- Infill development
- Utilize existing buildings
- Encourage bed and breakfast – keep small town uniqueness
- Use historic district for commercial
- Walkable community
- Marlow Hill as another center for activity
- Compact development has social benefits

Significant Natural Resources and Working Lands

- Conservation Subdivision zoning desirable to set aside significant areas for conservation
- Develop trail maps for hiking
- Conduct state programs in Honey Brook on sustainable forestry practices
- Create a camping area
- Promote local agriculture (i.e., community supported agriculture)

Historical and Cultural Resources

- Create community fairgrounds
- Create a farmer's market in town
- Create and build upon a community center for various activities for social interactions
- Encourage bed and breakfast businesses
- Maintain historical buildings

Future Opportunities

- Broadband expansion desirable
- Expansion of hiking, biking, horse trails to encourage different modes of transportation within community
- Develop roadway bike lanes
- Village centers using solar energy
- Promote wood for heat
- Hydro-power desirable
- Look into possibilities for wind energy based on previous study by a Keene State College class directed by a Marlow resident
- Multi-use developments desirable
- Conduct an energy audit for Town

APPENDIX C

GIS DATA SOURCES

Appendix. Basic GIS Data and Sources for Marlow NRI Maps.

Basic Data Layer	Source(s)	NRI Theme Maps
Town Boundaries	United States Geological Survey	all
Roads	NH Deptartment of Transportation	all
Conservation Lands	Society for the Protection of NH Forests	all
Watersheds (HUC 10)	US Dept. of Agriculture Natural Resources Conservation Service and NH Dept. of Environmental Services	Water Resources
Surface Waters (ponds and streams)	United States Geological Survey	all
National Wetlands Inventory (NWI)	US Fish and Wildlife Service	all
Hydric Soils	US Dept. of Agriculture Natural Resources Conservation Service	Water Resources
Stratified Drift Aquifers	United States Geological Survey	Water Resources
Potentially Favorable Gravel Well Analysis	NH Dept. of Environmental Services	Water Resources
WAP Wildlife Habitats	NH Fish and Game Dept.	Ecological Resources
Riparian Areas	Moosewood Ecological	Ecological Resources
Steep, South-facing Slopes	Moosewood Ecological	Ecological Resources
Active Dams	NH Dept. of Environmental Services	Ecological Resources
Rare Species and Natural Communities	NH Natural Heritage Bureau	Ecological Resources
Unfragmented Lands	NH Fish and Game Dept.	Ecological Resources
Agricultural Land Use	Landsat Satellite Imagery	Agricultural Resources
Agricultural Soils	US Dept. of Agriculture Natural Resources Conservation Service	Agricultural Resources
Forest Soils	US Dept. of Agriculture Natural Resources Conservation Service	Forest Resources

APPENDIX D

POTENTIAL NATURAL COMMUNITIES

Natural Community	Distribution Status	State Ranking	Associated Critical Wildlife Habitat
Open Uplands			
Landslides and talus barrens			
Montane lichen talus barren	3	S3	Talus slopes
Temperate lichen talus barren	1	S2S3	Talus slopes
Cliffs			
Montane acidic cliff	1	S5	Cliffs
Montane circumneutral cliff	3	S2S3	Cliffs
Lowland acidic cliff	1	S4	Cliffs
Lowland circumneutral cliff	3	S2	Cliffs
Wooded Uplands			
Spruce - fir zone			
High-elevation spruce - fir forest	2	S4	High-elevation spruce - fir forest
Lowland spruce - fir forest	2	S3	Lowland spruce - fir forest
Spruce - birch - mountain maple wooded talus	1	S3	Talus slopes
Red spruce - heath - cinquefoil rocky ridge	1	S3S4	Rocky ridges
Red pine rocky ridge	1	S2	Rocky ridges
Northern and transition hardwood - conifer zone			
Northern hardwood - spruce - fir forest	1	S4	Northern hardwood - conifer forest
Sugar maple - beech - yellow birch forest	1	S5	Northern hardwood - conifer forest
Hemlock - spruce - northern hardwood forest	2	S3S4	Northern hardwood - conifer forest
Hemlock forest	1	S4	Northern hardwood - conifer forest
Beech forest	1	S4	Northern hardwood - conifer forest
Hemlock - white pine forest	3	S4	Hemlock hardwood pine forest
Hemlock - beech - northern hardwood forest	1	S4	Northern hardwood - conifer forest

Natural Community	Distribution Status	State Ranking	Associated Critical Wildlife Habitat
Northern and transition hardwood - conifer zone (cont'd.)			
Hemlock - beech - oak - pine forest	1	S5	Hemlock hardwood pine forest
Semi-rich mesic sugar maple forest	1	S3S4	Matrix forest - inclusion
Rich mesic forest	1	S3	Matrix forest - inclusion
Oak - pine zone			
Dry red oak - white pine forest	1	S3S4	Hemlock hardwood pine forest
Dry Appalachian oak - hickory forest	3	S1S3	Appalachian oak pine forest
Red oak - pine rocky ridge	1	S3S4	Rocky ridges
Appalachian oak - pine rocky ridge	3	S3	Rocky ridges
Appalachian oak - mountain laurel forest	1	S3	Appalachian oak pine forest
Red oak - black birch wooded talus	1	S3S4	Talus slopes
Rich red oak rocky woods	2	S2S3	Talus slopes
Red oak - ironwood - Pennsylvania sedge woodland	2	S2	Talus slopes and rocky ridges
Wooded Wetlands and Floodplain Forests			
Floodplain forests			
Red maple floodplain forests	2	S2S3	Floodplain forests
Boggy nutrient-poor swamps			
Inland Atlantic white cedar swamp	1	S1	Peatlands
Red maple - *Sphagnum* basin swamp	1	S4	Peatlands
Black gum - red maple basin swamp	2	S1S2	Peatlands
Black spruce - larch swamp	1	S3	Peatlands
Minerotrophic swamps			
Red maple - black ash - swamp saxifrage swamp	3	S2	Matrix forest - inclusion
Red maple - lake sedge swamp	1	S3	Matrix forest - inclusion

Natural Community	Distribution Status	State Ranking	Associated Critical Wildlife Habitat
Minerotrophic swamps (cont'd.)			
Red maple - sensitive fern swamp	1	S3S4	Matrix forest - inclusion
Seasonally flooded Atlantic white cedar swamp	2	S2	Peatlands
Seasonally flooded red maple swamp	1	S4S5	Marsh and shrub wetlands
Northern hardwood - black ash - conifer swamp	2	S2	Peatland - forested
Red spruce swamp	1	S3	Lowland spruce - fir forest, Peatlands
Seasonally flooded boreal swamp	2	SU	Marsh and shrub wetlands
Northern hardwood seepage forest	3	S3	Matrix forest - inclusion
Hemlock - cinnamon fern forest	1	S4	Peatland - forested
Red maple - red oak - cinnamon fern forest	2	S3S4	Matrix forest - inclusion
Forest seeps			
Acidic *Sphagnum* forest seep	1	S3S4	Matrix forest - inclusion
Subacid forest seep	1	S3S4	Matrix forest - inclusion
Circumneutral hardwood forest seep	1	S3	Matrix forest - inclusion
Vernal pools			
Vernal woodland pool	1	S3	Vernal pools
Vernal floodplain pool	1	S2	Vernal pools
Open Wetlands and Riparian Communities			
Open river channels, riverbanks, and floodplains			
Dwarf cherry river channel	1	S2	Southern upland watershed
Boulder - cobble river channel	1	S3	Southern upland watershed
Cobble - sand river channel	1	S3S4	Southern upland watershed
Herbaceous sandy river channel	1	S4	Southern upland watershed
Willow low riverbank	1	S3	Southern upland watershed

Natural Community	Distribution Status	State Ranking	Associated Critical Wildlife Habitat
Open river channels, riverbanks, and floodplains (cont'd.)			
Twisted sedge low riverbank	1	S3S4	Southern upland watershed
Herbaceous low riverbank	1	S3S4	Southern upland watershed
Herbaceous riverbank/floodplain	1	S2S4	Floodplain forests
Herbaceous - wooded riverbank/floodplain	1	S4	Floodplain forests
Blue joint - goldenrod - virgin's bower riverbank/floodplain	1	S3S4	Floodplain forests
Alder alluvial shrubland	2	S3	Floodplain forests, Marsh & shrub wetlands
Alder - dogwood - arrowood alluvial thicket	1	S4	Floodplain forests, Marsh & shrub wetlands
Meadowsweet alluvial thicket	1	S3?	Floodplain forests, Marsh & shrub wetlands
Alluvial mixed shrub thicket	1	S4	Floodplain forests, Marsh & shrub wetlands
Acidic riverbank outcrop	1	S3	Southern upland watershed
Acidic riverside seep	3	S1	Southern upland watershed
Open emergent marshes, shrub thickets, and aquatic beds			
Tall graminoid emergent marsh	1	S4	Marsh and shrub wetlands
Mixed tall graminoid - scrub shrub marsh	1	S4S5	Marsh and shrub wetlands
Short graminoid - forb emergent marsh/mud flat	1	S4	Marsh and shrub wetlands
Medium-depth emergent marsh	1	S4	Marsh and shrub wetlands
Cattail marsh	1	S4	Marsh and shrub wetlands
Deep emergent marsh - aquatic bed	1	S4S5	Marsh and shrub wetlands
Aquatic bed	1	S4S5	Floodplain forests, Marsh & shrub wetlands
Herbaceous seepage marsh	1	S3	Marsh and shrub wetlands
Highbush blueberry - winterberry shrub thicket	1	S4	Marsh and shrub wetlands, Peatlands
Buttonbush basin swamp	3	S4	Marsh and shrub wetlands

Natural Community	Distribution Status	State Ranking	Associated Critical Wildlife Habitat
Cliff seeps			
Cliff seep	1	S3S4	Cliffs
Open peatlands			
Liverwort - horned bladderwort mud-bottom	1	S3	Peatlands
Sphagnum rubellum - small cranberry moss carpet	1	S3	Peatlands
Large cranberry - short sedge moss lawn	1	S3	Peatlands
Leather-leaf - sheep laurel dwarf shrub bog	1	S1S3	Peatlands
Leather-leaf - black spruce bog	1	S3	Peatlands
Bog rosemary - sweet gale - sedge fen	1	S3	Peatlands
Sweet gale - meadowsweet - tussock sedge fen	1	S4	Peatlands
Hairy-fruited sedge - sweet gale fen	1	S3	Peatlands
Highbush blueberry - mountain holly wooded fen	1	S3S4	Peatlands
Winterberry - cinnamon fern wooded fen	1	S4	Peatlands
Speckled alder wooded fen	1	S3S4	Peatlands
Highbush blueberry - sweet gale - meadowsweet shrub thicket	1	S4	Peatlands
Floating marshy peat mat	1	S3S4	Peatlands
Marshy moat	1	S4	Peatlands

SOURCE: Sperduto and Nichols (2004)

Distribution Status code: 1 = natural community's primary distribution, 2 = natural community is occasional and relatively less abundant than its primary distribution, 3 = natural community may be present, but occurrence is currently undocumented

State Ranking codes: see Appendix E.

APPENDIX E

RARE ELEMENTAL OCCURRENCES RANKING EXPLANATIONS

Appendix 1. Explanation of global and state rank codes.

Ranks describe rarity both throughout a species' range (globally, or "G" rank) and within New Hampshire (statewide, or "S" rank). The rarity of sub-species and varieties is indicated with a taxon ("T") rank. For example, a G5T1 rank shows that the species is globally secure (G5) but the sub-species is critically imperiled (T1).

Code	*Examples*		*Description*
1	G1	S1	Critically imperiled because extreme rarity (generally one to five occurrences) or some factor of its biology makes it particularly vulnerable to extinction.
2	G2	S2	Imperiled because rarity (generally six to 20 occurrences) or other factors demonstrably make it very vulnerable to extinction.
3	G3	S3	Either very rare and local throughout its range (generally 21 to 100 occurrences), or found locally (even abundantly at some of its locations) in a restricted range, or vulnerable to extinction because of other factors.
4	G4	S4	Widespread and apparently secure, although the species may be quite rare in parts of its range, especially at the periphery.
5	G5	S5	Demonstrably widespread and secure, although the species may be quite rare in parts of its range, particularly at the periphery.
U	GU	SU	Status uncertain, but possibly in peril. More information needed.
H	GH	SH	Known only from historical records, but may be rediscovered. A G5 SH species is widespread throughout its range (G5), but considered historical in New Hampshire (SH).
X	GX	SX	Believed to be extinct. May be rediscovered, but evidence indicates that this is less likely than for historical species. A G5 SX species is widespread throughout its range (G5), but extirpated from New Hampshire (SX).

Modifiers are used as follows.

Code	*Examples*		*Description*
Q	G5Q	GHQ	Questions or problems may exist with the species' or sub-species' taxonomy, so more information is needed.
?	G3?	3?	The rank is uncertain due to insufficient information at the state or global level, so more inventories are needed. When no rank has been proposed the global rank may be "G?" or "G5T?"

When ranks are somewhat uncertain or the species' status appears to fall between two ranks, the ranks may be combined. For example:

G4G5	The species may be globally secure (G5), but appears to be at some risk (G4).
G5T2T3	The species is globally secure (G5), but the sub-species is somewhat imperiled (T2T3).
G4?Q	The species appears to be relatively secure (G4), but more information is needed to confirm this (?). Further, there are questions or problems with the species' taxonomy (Q).
G3G4Q S1S2	The species is globally uncommon (G3G4), and there are questions about its taxonomy (Q). In New Hampshire, the species is very imperiled (S1S2).

APPENDIX F

POTENTIAL WILDLIFE OF CONSERVATION CONCERN

Species of Conservation Concern	Ranking	Associated Critical Wildlife Habitats		
Amphibians				
blue-spotted salamander	RC	Hemlock - hardwood - pine forest	Northern hardwood-conifer forest	Floodplain forest
		Vernal pools	Marsh and shrub wetlands	
Jefferson salamander	SC,RC	Hemlock - hardwood - pine forest	Northern hardwood-conifer forest	Floodplain forest
		Vernal pools	Marsh and shrub wetlands	
Reptiles				
ribbon snake	RC	Hemlock - hardwood - pine forest	Northern hardwood-conifer forest	Floodplain forest
		Marsh and shrub wetlands	Peatlands	Vernal pools
smooth green snake	SC	Hemlock - hardwood - pine forest	Northern hardwood-conifer forest	Grasslands
		Shrublands	Marsh and shrub wetlands	
wood turtle	SC,RC	Hemlock - hardwood - pine forest	Northern hardwood-conifer forest	Lowland spruce-fir forest
		Grasslands	Floodplains	Streams
		Shrublands		
Birds				
American bittern	RC	Grasslands	Shrublands	Marsh and shrub wetlands
American black duck		Marsh and shrub wetlands		
American woodcock		Hemlock - hardwood - pine forest	Northern hardwood-conifer forest	Grasslands
		Shrublands	Floodplain forest	Marsh and shrub wetlands
bald eagle	T	Hemlock - hardwood - pine forest	Streams, Rivers, Ponds, Lakes	
common moorhen		Marsh and shrub wetlands		
common loon	T	Ponds and lakes		
Canada warbler	RC	Hemlock - hardwood - pine forest	Northern hardwood-conifer forest	Floodplain forest
		Forested swamps		
Cooper's hawk	T	Hemlock - hardwood - pine forest	Northern hardwood-conifer forest	Lowland spruce-fir forest
		Floodplain forest		
eastern towhee		Hemlock - hardwood - pine forest	Shrublands	Peatlands
great blue heron (rookery)		Marsh and shrub wetlands		
least bittern	SC	Marsh and shrub wetlands	Peatlands	

Species of Conservation Concern	Ranking	Associated Critical Wildlife Habitats		
Birds (continued)				
northern goshawk		Hemlock - hardwood - pine forest	Northern hardwood-conifer forest	Lowland spruce-fir forest
pied-billed grebe	E	Marsh and shrub wetlands		
purple finch		Hemlock - hardwood - pine forest	Northern hardwood-conifer forest	Lowland spruce-fir forest
red-shouldered hawk		Hemlock - hardwood - pine forest	Floodplains	Marsh and shrub wetlands
		Forested swamps		
ruffed grouse		Hemlock - hardwood - pine forest	Northern hardwood-conifer forest	Shrublands
veery		Hemlock - hardwood - pine forest	Northern hardwood-conifer forest	Floodplain forest
vesper sparrow		Grasslands		
wild turkey	BGP	Hemlock - hardwood - pine forest	Northern hardwood-conifer forest	
wood thrush		Hemlock - hardwood - pine forest	Northern hardwood-conifer forest	Floodplain forest
Fish				
American eel		SurfaceWaters		
Atlantic salmon		SurfaceWaters		
banded sunfish	RC	Marsh and shrub wetlands	SurfaceWaters	
burbot		SurfaceWaters		
eastern brook trout		SurfaceWaters		
northern redbelly dace		SurfaceWaters		
rainbow smelt (stocked but self-sustaining)		SurfaceWaters		
round whitefish		SurfaceWaters		
slimy sculpin		SurfaceWaters		
tessellated darter		SurfaceWaters		
Mammals				
bear	BGP	Hemlock - hardwood - pine forest	Northern hardwood-conifer forest	Lowland spruce-fir forest
		Shrublands	Floodplain forests	Marsh and shrub wetlands
		Peatlands	Rocky ridges and talus slopes	
bobcat	SC	Hemlock - hardwood - pine forest	Northern hardwood-conifer forest	Lowland spruce-fir forest
		Shrublands	Floodplain forests	Marsh and shrub wetlands
		Peatlands	Rocky ridges and talus slopes	

Species of Conservation Concern	Ranking	Associated Critical Wildlife Habitats		
Mammals (continued)				
lynx	E	Talus slopes/rocky ridges	Lowland spruce-fir forests	
mountain lion*	FE	nearly all habitat types		
moose	BGP	Hemlock - hardwood - pine forest	Northern hardwood-conifer forest	Lowland spruce-fir forest
		Shrublands	Marsh and shrub wetlands	
white-tailed deer	BGP	Hemlock - hardwood - pine forest	Northern hardwood-conifer forest	Lowland spruce-fir forest
		Shrublands	Grasslands	Marsh and shrub wetlands
		Floodplain forests	Peatlands	

SOURCE: New Hampshire Wildlife Action Plan (2005); Littleton (2009)

Ranking: E = NH endangered, T = NH threatened, SC = NH species of special concern, RC = regional conservation concern
FE = Federally endangered, FT = Federally threatened, BGP = Only included in the New Hampshire Big Game Management Plan.

Species in **bold type** have been observed in Marlow.

*** =** The NH Fish and Game Dept. does not list the mountain lion as occurring in the state but may potentially exist. It has been reported by Marlow residents but has not been confirmed by the state.

APPENDIX G

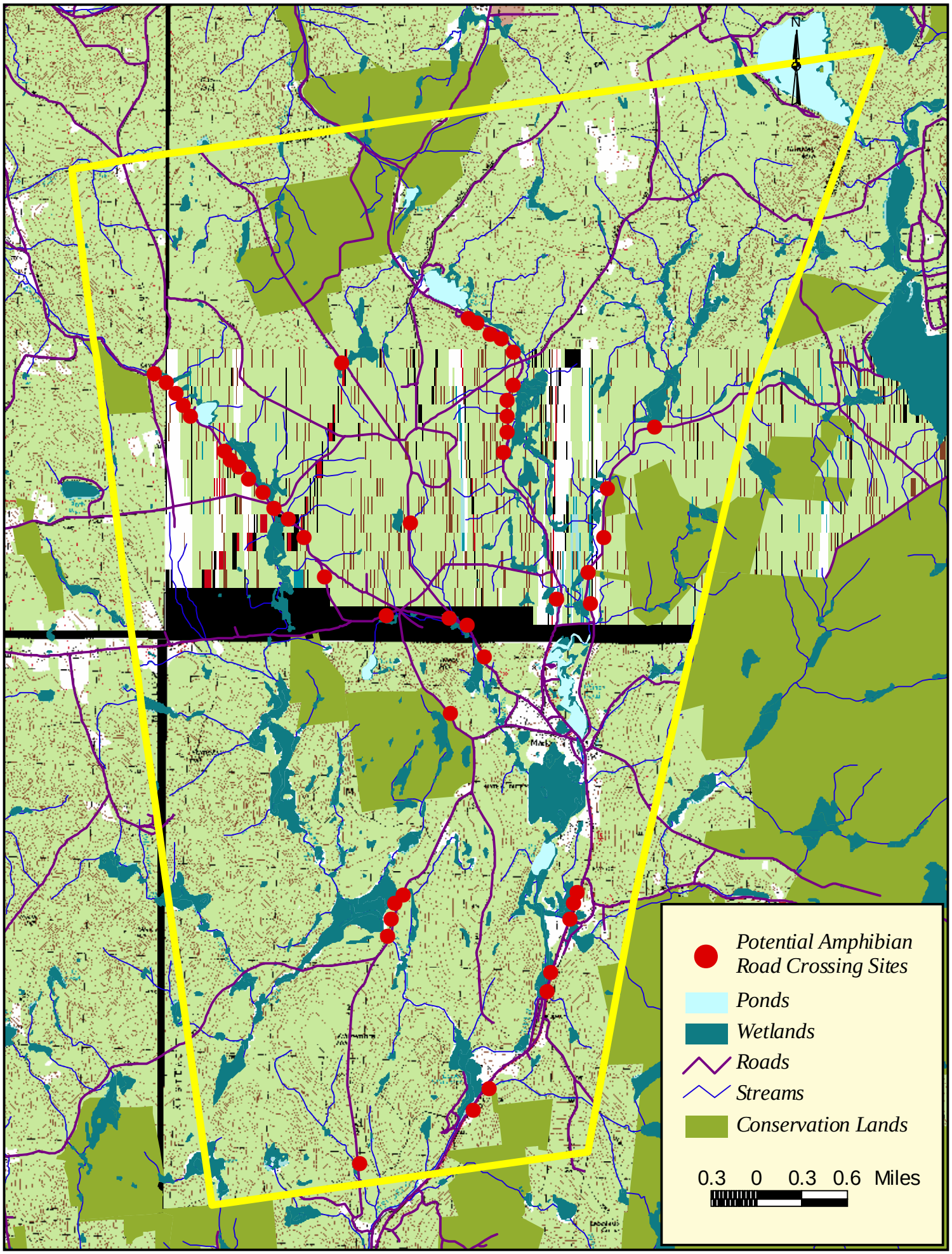
HABITAT BLOCK SIZE REQUIREMENTS FOR WILDLIFE

Habitat Block Size Requirements For Wildlife

1-19 Acres	20-99 Acres	100-499 Acres	500-2,500 Acres	>2,500 Acres
raccoon	raccoon	raccoon	raccoon	raccoon
	hare	hare	hare	hare
				coyote
small rodent	small rodent	small rodent	small rodent	small rodent
	porcupine	porcupine	porcupine	porcupine
				bobcat
cottontail	cottontail	cottontail	cottontail	cottontail
	beaver	beaver	beaver	beaver
				black bear
squirrel	squirrel	squirrel	squirrel	squirrel
	weasel	weasel	weasel	weasel
		mink	mink	mink
				fisher
	woodchuck	woodchuck	woodchuck	woodchuck
		deer	deer	deer
muskrat	muskrat	muskrat	muskrat	muskrat
			moose	moose
red fox	red fox	red fox	red fox	red fox
songbirds	songbirds	songbirds	songbirds	songbirds
		sharp-shinned hawk	sharp-shinned hawk	sharp-shinned hawk
			bald eagle	bald eagle
skunk	skunk	skunk	skunk	skunk
		Cooper's hawk	Cooper's hawk	Cooper's hawk
		harrier	harrier	harrier
		broad-winged hawk	broad-winged hawk	broad-winged hawk
			goshawk	goshawk
		kestrel	kestrel	kestrel
			red-tailed hawk	red-tailed hawk
		great-horned owl	great-horned owl	great-horned owl
			raven	raven
		barred owl	barred owl	barred owl
		osprey	osprey	osprey
		turkey vulture	turkey vulture	turkey vulture
		turkey	turkey	turkey
most reptiles	most reptiles	reptiles	reptiles	reptiles
	garter snake	garter snake	garter snake	garter snake
	ring-necked snake	ring-necked snake	ring-necked snake	ring-necked snake
most amphibians	most amphibians	most amphibians	amphibians	amphibians
		wood frog	wood frog	wood frog

APPENDIX H

POTENTIAL AMPHIBIAN ROAD CROSSING SITES


N
Potential Amphibian Road Crossing Sites
Ponds
Wetlands
Roads
Streams
Conservation Lands
0.3 0 0.3 0.6 Miles

APPENDIX I

PRINCIPLES OF SMART GROWTH

Ten Principles of Smart Growth RSA 9-B:3

1. **Vibrant commercial activity within cities and towns.**

2. **Strong sense of community identity.**

3. **Adherence to traditional settlement patterns when siting municipal and public buildings and services.**

4. **Ample alternate transportation modes.**

5. **Uncongested roads.**

6. **Decreased water and air pollution.**

7. **Clean aquifer recharge areas.**

8. **Viable wildlife habitat.**

9. **Attractive views of the landscape.**

10. **Preservation of historic village centers.**