TOWN OF LEYDEN
OPEN SPACE
AND RECREATION PLAN 2010

December 2010

Prepared by the
LEYDEN OPEN SPACE COMMITTEE

And the
FRANKLIN REGIONAL COUNCIL OF GOVERNMENTS
PLANNING DEPARTMENT

TOWN OF LEYDEN

OPEN SPACE AND RECREATION PLAN 2010

Prepared by the

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SECTION 1

PLAN SUMMARY

The Leyden Open Space and Recreation Plan (OSRP) coalesces the interest, effort, and motivation of community members towards the identification, prioritization, conservation and protection of Leyden's landscapes and ecosystems in the face of new residential development. Its purpose is to provide a framework for decisions dealing with land use, which may impact ecosystems and the lands that contain unique agricultural, historical, recreational, and scenic values.

The 2010 Leyden Open Space and Recreation Plan (OSRP) update is based on the community members' collective understanding of the interdependence of contiguous forests, open upland ridge line views, streams and wetlands, agricultural fields, scenic views, and significant historical structures and landscapes with the Town's rural character. The OSRP also illustrates the role that all undeveloped lands have in providing wildlife habitat, in ensuring the integrity of drinking water supplies, and at least in part, in providing for residents' livelihoods.

The Plan highlights the Town's natural and recreational resources, including:

- Large blocks of contiguous forest;
- Prime farmland and working agricultural businesses;
- Abundant supplies of high-quality ground and surface waters;
- Wetlands associated with the Green River, and Glen, Keets, and Beaver Meadow Brooks;
- High elevation open meadows; and,
- Other scenic and historic landscapes.

The Seven-Year Action Plan gives concrete substance to the goals and objectives, which were developed from the results of the 2009 Open Space and Recreation Survey and from community members' understanding of their town's vast yet vulnerable natural resource base. Including the Public Forum, which was held on October 27, 2010 and involved approximately 30 people, there were six public meetings of the Leyden Open Space Committee in 2009 and 2010.

The 2010 Leyden Open Space and Recreation Plan prioritizes the following actions, which are presented in order of priority from higher to lower. (Information in parentheses after each priority action item identifies the corresponding number of the item on Table 9-1 in Section 9: Seven-Year Action Plan.):

- Continue to implement a clear tracking procedure protocol for the Town to process conversions of Chapter 61, 61A, and 61B parcels to uses that

trigger the granting of right-of-first-refusal to the Town. (Action Item A3a)

- Work with local land trusts, nonprofit conservation agencies, and state and federal programs (such as MDAR's Agricultural Preservation Restriction Program and the USDA Forest Legacy Program) to protect local farm and forest landscapes. (Action Item A6a)
- Meet with Greenfield Water Department staff and representatives of the Deerfield River Watershed Association (DRWA) to discuss the potential for collaboration on water quality monitoring town-wide. (Action Item A4a)
- Revise zoning bylaws to continue adding components like a natural resource protection overlay district and an accessory apartment bylaw to help ensure that future development conserves the town's rural character and environmental quality where possible. (Action Item B2a)
- Review results of the 2009 Open Space and Recreation survey and determine which new programs and facilities are most needed and have the best chances of succeeding. Once the desirable programs and facilities are identified, seek to provide them. (Action Item B7a)
- Submit an annual article in the Town Newsletter that explains choices that landowners have in regards to the long-term stewardship of their land, which can include donating land in fee, donating money into the town's existing Land Acquisition Fund, or donating the development rights to the Town of Leyden. (Action Item A2b)
- Continue to implement procedures for the assignment to third parties (such as local land trusts), where appropriate, of the right of first refusal on conversions of Chapter 61, 61A, and 61B parcels. (Action Item A3b)
- Request the Town Clerk and local realtors to provide landowners with a packet of information that addresses land stewardship issues dealing with both development and conservation choices. (Action Item A7a)
- Encourage broad public participation in the local planning process to ensure that appropriate solutions for land use and growth management are identified. (Action Item B2b)
- Work with the Trustees of Reservation's Highland Communities Initiative (HCI) to fund or otherwise support a conference focusing on strategies to support farm and forest-based businesses and involve CISA, MWC, and NEFF.[1] (Action Item B4a)
- Include an occasional column on land use, open space, and cost of community services issues and information in the newsletter. (Action Item B6a)

[1] CISA=Community Involved in Sustaining Agriculture; MWC=Massachusetts Woodlands Cooperative; NEFF=New England Forestry Foundation.

- Identify areas with the greatest potential for providing public access to the Green River. (Action Item B8a)
- Meet with corresponding boards and committees in neighboring towns and consult with FRCOG staff to help identify opportunities for collaboration on events and recreational programming. (Action Item B11a)

SECTION 2

INTRODUCTION

The 2010 Leyden Open Space and Recreation Plan is an update of the 2004 Plan that was developed as part of project sponsored by the Deerfield River Basin team to foster open space and recreation planning in several towns within the watershed, including Leyden, Charlemont, and Colrain. This update has been developed with the aid of the Franklin Regional Council of Governments using local technical assistance funding. The 2010 plan builds on the strengths of the earlier plan, while providing updated information and revised priorities and objectives reflecting the many accomplishments that the Town has achieved in the intervening years in implementing the 2004 Action Plan.

A. STATEMENT OF PURPOSE

The purpose of this Open Space and Recreation Plan (OSRP) is to provide an accurate and thorough basis for decision-making involving the current and future open space and recreation needs of the residents of Leyden. This OSRP represents the results of consensus-building on the most important community and natural resource needs in town and on the best solutions for addressing them. The Seven-Year Action plan, when carried out by the Open Space Committee and other town boards and commissions, will successfully implement the town's open space and recreation goals and objectives.

B. PLANNING PROCESS AND PUBLIC PARTICIPATION

In the Fall of 2009, open space and recreation surveys were mailed in the Town newsletter to approximately 340 households in Leyden. Of these, 35 were returned and counted as responses, which represents an 11 percent rate of return (see Appendix A for a copy of the survey).

The Open Space Committee met six times between October 2009 and October 2010 to work on the updated Plan, including a very well-attended Public Forum that was held on October 27, 2010. All meetings of the Committee were posted and were open to the public. Draft maps were available in the Leyden Town Hall for review by interested parties throughout the year-long process. Special efforts were made to advertise the Public Forum, including a press release several days ahead of the event, a mini-ad in the local paper the day of the forum, and sandwich-board signs placed at key intersections in Town on the day of the forum. This resulted in an excellent turnout of approximately 30 residents of Town and a representative of a local land trust at the forum. (See Appendix B for copies of agendas, sign-in sheets, and advertising for the meetings and Public Forum.)

Overall, 35 residents participated in at least one meeting. Members represented town boards, committees, and stakeholders including:

- Selectboard
- Planning Board
- Conservation Commission
- Board of Assessors
- Historical Commission
- Agricultural Commission
- Franklin Land Trust
- Landowners and farmers

Any comments expressed at the public forum were recorded and included in Section 10 – Public Comments as well as in the final version of the Action Plan. Any ideas, comments, and corrections pertaining to different sections of the plan and the action steps have also been included in the final version of the Leyden Open Space and Recreation Plan.

SECTION 3

COMMUNITY SETTING

The Town of Leyden contains rural landscapes that have been established, developed, and formed by its human inhabitants over the past several hundred years. Planning for open space in Leyden must consider the complex relationships between people and the open spaces and natural resources upon which they depend. If growth continues without consideration for the natural systems that need to be protected, such as drinking water supplies, the quality of life for future generations will be diminished.

The information provided in this section, Community Setting, inventories and assesses the human and land use components of the landscape, moving from the present, to the past, and then to the potential future based on current development trends. The Regional Context presents an overview of Leyden today, and identifies the ways in which the location of the Town within the region has affected its growth and quality of open space and recreational resources. The History of the Community looks at the manner in which the human inhabitants settled and developed the landscapes in Leyden. Next, using statistical information and analysis, Population Characteristics reveals who the people of Leyden are today and how population and economic trends may affect the Town in the future. Finally, Growth and Development Patterns describes specifically how the Town of Leyden has developed over time and the potential impacts that the current zoning may have on open space, drinking water supplies, and municipal services.

A. REGIONAL CONTEXT

Regional Context concentrates on the location of the Town of Leyden relative to natural and socio-economic resources as well as conditions shared by communities in the region. It describes the significant influence a town's physical location can have on its characteristics, including the quality and quantity of open space in the Town as well as its recreational resources. Regional Context also considers the impact that different land uses have on regional open space and recreational resources, both within Leyden and in surrounding communities.

The Town of Leyden is located in northwestern Massachusetts, in central Franklin County. Leyden is bordered by Guilford, Vermont on the north; Bernardston on the east; Greenfield on the south; and Colrain on the west. (See the Regional Context Map at the end of this section.)

A.1 Natural Resources Context

In order to plan for the protection of open space and natural resources in the Town of Leyden, residents should consider the role natural resources play across the region. Two important regional landscape-level natural resource contexts important in both Leyden and in surrounding communities are abundant and contiguous forestland and watersheds (the Green River
Watershed and the Connecticut River Watershed). The presence and relatedness of these significant resources presents both opportunities and challenges to open space and recreation planning.

A.1.1 Large Blocks of Contiguous Forestland

Forests constitute one of the most important renewable natural resources in the Town of Leyden and the region. While 80 percent (9,215 acres)[1] of the Town's lands are forested, much of that land is privately owned. Less than five percent of Leyden's forestland (approximately 374 acres) is owned and protected by the Commonwealth of Massachusetts. These forestlands include Leyden State Forest (61 acres), which is located in north central Leyden and overseen by the Department of Conservation and Recreation. The Mass. Division of Fisheries and Wildlife (MassWildlife) owns and manages the Leyden Wildlife Management Area (WMA) located in southern Leyden. The Leyden WMA contains a total of 375 acres.

The Massachusetts Natural Heritage and Endangered Species Program's (NHESP) BioMap uses Estimated Habitats and other documentation to identify the areas most in need of protection in order to protect the native biodiversity of the Commonwealth. The BioMap focuses primarily on state-listed rare species and exemplary natural communities and was developed to promote strategic land protection of areas, which would provide suitable habitat over the long term for the maximum number of Massachusetts terrestrial and wetland plant and animal species and natural communities. The BioMap shows areas designated as Core Habitats and Supporting Natural Landscapes. The Core Habitat areas include the most viable habitat for rare plants and rare animals and exemplary natural communities. The Supporting Natural Landscapes includes buffer areas around the Core Habitats, large undeveloped patches of vegetation, large "roadless" areas, and undeveloped watersheds. The Core Habitat areas were identified, through field surveys, as supporting viable populations of rare plant and animal species while the Supporting Natural Landscape areas were determined through analyses using Geographic Information Systems (GIS) mapping programs.

Of the many large areas of contiguous forest in Leyden, three are considered by the NHESP BioMap to contain Supporting Natural Landscapes that buffer or link lands to Core Habitat areas:

- The northwestern forest block contains forests north of West Leyden Rd. It lies south of the largest Core Habitat area in Town and is part of a larger supporting forest block that stretches across the Green River into northeastern Colrain.

[1] MassGIS Land Use Data, 2005.

- The western forest block lies south of West Leyden and continues to below the western slopes of Katley Hill. These forests are contiguous to a Core Habitat area located along the Green River. Again, this forest block continues into Colrain.
- The southwestern block of forest that contains Supporting Natural Landscapes is located between Greenfield Road and the Green River, west of the Greenfield Reservoir. This forest block adjoins a Core Habitat in Colrain.

Two other large areas of contiguous forest are identified on the NHESP BioMap, although they are not surrounding known Core Habitat areas:

- The southern block of forest borders the east side of Greenfield Road and stretches north from Leyden's southern border to encompass the Greenfield Reservoirs and the Leyden WMA. Although a Core Habitat is not listed on the BioMap for this forest block, this area does contain a Priority Habitat for Rare Species and an Estimated Habitat of Rare Wildlife, shown in the 2008 13th edition of the Massachusetts Natural Heritage Atlas.
- The very large central forest block stretches from Greenfield Road, north from the Leyden WMA and the adjoining Leyden Glen Water and Fire District lands to Frizzell Hill Road along the north, and continues east into Bernardston. This area also contains a Priority Habitat for Rare Species and an Estimated Habitat of Rare Wildlife.

It is important to note that the NHESP BioMap program has not inventoried or mapped a large portion of land in the northeastern quadrant of Town, so the contiguous forest blocks in that area are not represented in this list. The NHESP recommends that Leyden focus on a biological inventory and study, as well as land acquisition and protection, in this area. The Priority Habitat of Rare Species and Estimated Habitat of Rare Wildlife inventories from the Natural Heritage Atlas cover the entire area of Leyden, and are up to date as of October 1, 2008. In addition to the areas already mentioned within Leyden's forested areas, land along the Green River and Glen Brook are identified as both Rare Species and Rare Wildlife habitats, and a small area surrounding the Thorne Brook in northwest Leyden is identified as a Rare Species habitat. Additionally, a certified vernal pool, a temporary body of water that provides critical habitat for many species, is located in the northern forested area near Gates Hill. (See the Plant and Wildlife Habitat Map for the locations of BioMap Supporting Natural Landscapes, NHESP Priority and Estimated Habitats, and blocks of contiguous forest as discussed below.)

Large blocks of contiguous forestland are important regional resources for several reasons. First, they represent an area with a low degree of fragmentation. Wildlife species that require a certain amount of deep forest cover separate from people's daily activities tend to migrate out of fragmenting landscapes. New frontage lots and subdivisions can often result in a widening of human activity, an increase in the populations of plants and animals that thrive alongside humans (i.e. raccoons and squirrels) and a reduction in the species that have larger home ranges and unique habitat needs. When these large blocks of forest are protected from development they help to protect and provide clean water, air, and healthy wildlife

populations. In addition, areas of unfragmented forest are more suitable for active forest management.

Large blocks of contiguous forestland are important for the preservation of water quality and quantity in Leyden. Forest soils have a high infiltration capacity, so they absorb moisture and permit very little surface runoff. The soil pores act like miniature reservoirs, storing water for later usage. Once absorbed, water is released gradually so flooding is reduced during large rain events and streamflow is maintained during low water months. Forests recycle nutrients, so the nutrients do not pass into waterways, and water quality is preserved. Because forest soils are absorptive, soil erosion is reduced. Brooks flowing through forests have a low turbidity, or cloudiness due to suspended sediments. Sediments in streams destroy fish habitat, reduce storage space in reservoirs, and cause increased treatment for water supplies. Forest trees also have a thermal impact on brooks. When trees are removed from stream banks, water temperatures rise. Warm water contains less oxygen than cool water, so cold water-dependent aquatic species like trout are adversely affected. Maintaining contiguous forestland for all of Leyden's waterways is important for the Town, particularly in Leyden's designated Outstanding Water Resource area, which is discussed in the following paragraphs.

A.1.2. Watersheds

Watersheds are the areas of land that drain to a single point along a stream or river. The Town of Leyden is located both within the northeastern portion of the Deerfield River Watershed and the central western portion of the Connecticut River Watershed. The Deerfield River Watershed encompasses all or part of twenty western Massachusetts communities and sixteen towns in Vermont. From Stratton Mountain in Vermont to the confluence with the Connecticut River in Greenfield, Massachusetts, the Deerfield River drains a regional landscape that is 665 square miles in size, of which 347 are in Massachusetts (Deerfield River Watershed Association website, 2009). The Deerfield's length is 70.2 miles, forty-four of which are in Massachusetts. The Deerfield River, one of the coldest and cleanest rivers in Massachusetts, has a steep gradient, dropping 46.8 feet per mile from its headwaters to the USGS gauge near West Deerfield, a distance of 69.5 river miles. This feature has made the Deerfield River a magnet for hydroelectric power generation, with ten hydroelectric developments constructed on the river since 1911. Given its gradient and excellent water quality, the Deerfield River has seen a long history of use by fishermen and whitewater enthusiasts. The Commonwealth of Massachusetts actively stocks the river to augment native populations in addition to stocking juvenile salmon, as part of the Connecticut River restoration project.

The northeastern portion of Leyden is located in the Connecticut River Watershed. Beaver Meadow, Keets, Shattuck, and Couch Brooks flow in an easterly direction to the Fall River in Bernardston, and through Greenfield before meeting with the main stem river. The Connecticut River Watershed is the largest river ecosystem in New England and spans four states, including Vermont, New Hampshire, Massachusetts, and Connecticut. From its beginnings on the Canadian border to its end in the Long Island Sound, the Connecticut River drains a landscape that is 11,000 square miles in size, 410 miles long, and flows

through 45 communities in Massachusetts. The river drops 2,400 feet from its source to the sea and is one of the most developed rivers in the Northeast. The Industrial Revolution flourished in this river valley, fueled by waterpower and stable communities. Because the Connecticut was dammed and used as a dumping area for over 150 years, the river became severely polluted before the Federal Clean Water Act was legislated in 1972.

Today, the Connecticut River has a "Class B" water quality designation from the New Hampshire-Vermont border to Holyoke and is classified as a warm water fishery (Massachusetts Department of Environmental Protection, 2007). Class B waters are supposed to provide suitable habitat for fish and other wildlife, and to support primary contact recreational activities such as fishing and swimming. However, due to heavy industrial use and wastewater treatment dumping, the Connecticut River is impaired by polychlorinated biphenals (PCBs) along its total length. Despite the river's pollution, the watershed has been designated an American Heritage River in recognition of its historical importance. In 1991 the watershed was designated the Silvio O. Conte National Fish and Wildlife Refuge with environmental priorities to reduce non-point source pollution, primarily storm water runoff, to reduce barriers to migratory fish, and to improve upon water quality data.

Subwatersheds contain first and second order stream tributaries. These are the most extensive component of any watershed. They are also the most sensitive to land use, both the negative impacts of runoff and the positive effects of forest cover. Fifty-one first order streams originate in Leyden, most of them flowing into second or third order streams within Town limits. The protection of forestland results in the long-term maintenance and integrity of wildlife habitats and water quality within the subwatershed's surface and ground waters.

The Green River Subwatershed is located in southern Vermont and northwestern Massachusetts. It has a drainage area of 89.9 square miles and is comprised of numerous small streams, many of which originate in the uplands of western Leyden. The river itself originates in southern Vermont and flows into Massachusetts in the Town of Leyden forming the Town's western border with the Town of Colrain. The Green River flows southeasterly through a steep narrow valley and, as it enters the Town of Greenfield, its gradient lessens. The segment of the river from the Vermont-Massachusetts border to the Greenfield Wastewater Treatment Plant is considered a Class B, cold-water fishery, with high quality water designations (Massachusetts Department of Environmental Protection, 2000). The Green River also provides drinking water to the Town of Greenfield (approximately 20 percent of its public water supply) to augment that town's pumped well and reservoir system.

The Glen Brook/Brandy Brook Subwatershed is located in central Leyden and drains into the Greenfield Reservoir, where it provides 30 percent of the drinking water for the Town of Greenfield. The brooks originate within northern Leyden and flow south into Greenfield. The entire subwatershed north of the reservoir is considered a Class A, cold water fishery and has been designated Outstanding Resource Waters (ORW) by Massachusetts for their "outstanding socioeconomic, recreational, ecological and/or aesthetic values." The state prizes the high quality of these waters enough to designate that they should be "protected and maintained" especially because they contribute to a public water supply.

The Beaver Meadow/Shattuck Brook Subwatershed is located in northeastern Leyden and drains toward the east into the Fall River through Bernardston and Greenfield, before flowing to the Connecticut River. The Beaver Meadow Brook has witnessed a long history of use by Leyden's settlers. Early farmers drained the silt-rich beaver bogs and cultivated hay to create the richest farmland found within the town's limits.

The degree of forest continuity, pattern of residential development, and the purity of the water in Leyden's watersheds are beyond the control of any one community. The Town of Leyden could promote the conservation of all its significant open space and natural resources, but if surrounding towns fail to protect land, plan growth, or continue to monitor and participate in the cleanup of brooks and rivers, their level of impact on the resources that disregard political boundaries (water, wildlife populations, scenic views, trails, etc.) will be less significant. Leyden needs to take an active role in the conservation of regionally important natural resources, whether they occur in town or not.

A.2 Socio-Economic Context

Agriculture, waterpower, and a remote upland location have all had an influence on the development and growth of the Town of Leyden as a small rural hill town. The historic community, located along the edge of the northern line of forts separating the settled areas from the northern "wilderness," was populated as part of Fall Town, now Bernardston. Because Anglo-Indian warfare remained a threat until fighting terminated, Leyden remained unoccupied except for sporadic settlement until the early 1760s. The Town was established as a separate district in 1784 and incorporated as a town in 1809. Development of a town center was fairly late in Leyden, as the Town's steep hills did not offer the rich farmland found in surrounding valley floodplains.

Even so, agriculture has played a prominent role in the Town of Leyden throughout its history. During the mid 1880s, Leyden ranked fourth in Franklin County in the production of Merino wool. While the (See the Plant and Wildlife Habitat Map for the locations own lacked extensive high quality cropland, pastureland covered many hillsides. Sheep, beef, pork, dairy, and poultry farming were important agricultural enterprises. In time, agriculture waned as the primary economic life style for Leyden, while residents sought employment and economic security outside of town boundaries.

Waterpower has had a less obvious influence on the Town's development, because large manufacturing enterprises were never built within Leyden. However, small saw and gristmills were powered by the Town's swiftly moving waters in a number of locations until the late 1800s. Water powered industry faded with the development of other energy sources.

After very low population numbers for over a century, the Town of Leyden's population expanded rapidly between 1970 and 2000, with growth estimated to taper to a modest rate through 2008. Median income levels among residents are significantly higher than the average for Franklin County. However the Town's unemployment rate in 2008 was higher than the County and State rates.

Unlike many of the communities on the western edges of Franklin County, Leyden has experienced a growth in population from 1970 to 2000 of 105.3 percent, from 376 residents in 1970, to 772 residents in 2000. This increase in population resulted in development pressures, as shown by the 42 building permits issued between 1994 and 2002, and the 63 certificates of occupancy issued during the same period. The community may consider protecting land in advance of further development. Development rights might be purchased at lower per acre rates now, than if the Town were to wait until conditions were more favorable.

Other socio-economic patterns reflect Leyden's recent growth and an aging population. While the population expanded rapidly in the Town through the 1990s, school enrollments began to decline by the end of the decade. Rapid expansion within the school system peaked in 1996 and then began to drop as the baby-boomer population aged. However, since 2004, a low point in enrollment, the number of students enrolled in the elementary school has begun to grow.

Tax rates in Leyden, currently at $16.40 per $1000, are among the highest in the State in 2009, with a rank of 341 out of 351 towns. This can be expected, as Leyden does not have an industrial or commercial base to offset residential taxes. .

A.3 Regional Strategies for the Protection of Open Space, Natural and Recreational Resources

A variety of state and regional studies have been done which can help the Town of Leyden further identify local recreation and land protection priorities. The Commonwealth has completed The Statewide Comprehensive Outdoor Recreation Plan (SCORP), *Massachusetts Outdoors 2006*, an update of the SCORP 2000, five-year plan. SCORP plans are developed by individual states to be eligible for federal Land and Water Conservation Fund (LWCF) grants and serve as a tool for states to use in planning for future needs and uses of outdoor resources for public recreation and relaxation. This plan notes the significance of forests and wildlife management areas as part of the protected land in the region.

The SCORP also provides information about use of and demand for outdoor recreational resources in the Connecticut River Valley region that may be relevant to Leyden's open space and recreational planning efforts. When assessing resource use in this region, the SCORP notes that rivers and streams, historic and cultural sites, lakes and ponds, forests, coastal beaches and shorelines, and mountains, all have 40% participation rates or greater. When reporting on satisfaction levels of users of resources in this region, residents report being most satisfied with historic and cultural sites, mountains, and trails and greenways resources. Somewhat lower than statewide levels of satisfaction were reported in this region for rivers and streams, and lakes and ponds. Rivers and streams were the area where Connecticut Valley Region residents who use these facilities were least satisfied overall. When considering new recreational projects, the Town may want to consider the following response from regional residents about future needs and interest from the SCORP:

"In contrast to demand (or present use patterns), respondents in this region place the highest priority for new facilities on road biking (14.5%), walking (13.9%), swimming (13.8%), playground (11.3%), hiking (10.0%), and mountain biking (10.3%)".

B. HISTORY OF THE COMMUNITY

Leyden's rivers, forests, and steep hills all had a significant role to play in the history of Leyden. Leyden's uphill terrain, coupled with the absence of large high quality agricultural tracts or large bodies of fresh water, suggest that this area probably only supported a small native population. However, members of local native communities were believed to have taken advantage of Leyden's fishing and hunting opportunities in small encampments along the Green River, the Glen Brook, and the Beaver Meadow Brook. The town was likely to have been a secondary resource area for the large native villages situated in Northfield and Gill, as a territory of the Squakheags. The development of the Anglo-Indian fur trade in the Connecticut River Valley during the 1600s probably encouraged increased hunting and trapping of fur animals, especially in Beaver Meadow.

The first Colonial settlers came to Leyden ca. 1741 as part of a land grant to soldier survivors of the 1676 "Falls Fight" near Turners Falls. The Falltown grant included land which later was incorporated into the towns of Bernardston and Leyden. Leyden was only sparsely and intermittently settled until the Anglo-Indian war ended in the early 1760s. In Leyden's first ten years, early colonial homes were restricted to the eastern portions of town, notably Frizzell Hill, East Hill, and Beaver Meadow. After that time, colonial settlement spread into western Leyden.

Early colonists focused their economic efforts on limited crop and livestock production, as Leyden lacked large fertile agricultural tracts. The town has always had more pastureland and associated croplands to feed its livestock, than it has had vegetable crops. During the Federal Period (1775-1830), Leyden saw only limited growth of its economy in small saw and gristmills, while upland farming continued as the town's chief economic resource. This era was Leyden's most populous, as the population peaked in 1800 with 1,095 residents.

As the Industrial Revolution grew in New England, many town residents left their agricultural beginnings to seek a future in areas with an industrial and commercial base. By 1830, Leyden had already lost over one quarter of its 1800 population. However, the town continued as an agricultural community with sheep production and several saw and grist mills that supplemented its economy. In 1837, there were 55,308 sheep in Franklin County, most of which were pastured in Ashfield, Conway, Colrain, Charlemont, and Leyden. The boom in sheep raising occurred with the introduction of merino sheep, which produced a quality of wool far superior to common sheep. In 1855, Leyden was one of several Franklin County towns that produced in sum 814,000 broom handles. Connecticut River valley towns like Deerfield, Sunderland, Whately, Leverett, Montague, Gill and Northfield all grew broom corn. The production of broom corn was a cash crop for many farmers during the period. Leyden's agricultural products in 1855 included mostly beef, pork, wool, butter, and poultry. In particular, wool production remained constant, even though most other towns in the county showed a decline. Four saw mills, three gristmills, and three broom handle

manufacturers took advantage of the town's waterpower. The last water-powered mills, at Beaver Meadow, closed in 1906. In modern times agriculture continues, but to a lesser degree.

The town's population continued to decline until the late1930s, when the automobile made commuting possible and Leyden began to experience growth as Greenfield grew. Today, despite the town's isolated location in the southern foothills of Vermont's Green Mountains, Leyden has become a suburban corridor between Greenfield and Vermont.

While Leyden has changed from a town where most residents earned their living locally through agriculture, to a place where most people commute to work outside of town, many residents continue to appreciate the nineteenth century agricultural landscapes that still exist. The rural small town character of Leyden is further defined by its historic structures and sites. These assets contribute to Leyden's "sense of place," the unique qualities of the town. Leyden's historical resources are listed in Table 3-1. (These assets also can be located on the Historic Community Map at the end of this section.) The Massachusetts Historical Commission notes in its 1982 Reconnaissance Survey Report that Leyden's historic inventory incorporates very little historical data and recommends that the town complete this information for structures, including use, construction date, and original owner. Detailed documentation of historic resources is often an important step for preservation.

Table 3-1: Inventory of Historic Structures and Sites in Leyden

Site #	Name	Location	Remarks
1	Leyden Methodist Church	West Leyden Road	Center of Town
2	Site of original Town Hall	West Leyden Road	East side of church
3	Magnan, Rita	868 Greenfield Road	Post Office
4	Clark, James & Sharon	67 West Leyden Road	Center School
5	Reid, Wallis & Cornelia	30 West Leyden Road	Judson Ewer
6	Leyden Town Hall	West Leyden Road	Center of Town
7	Blacksmith Shop	Greenfield Road	Center of Town
8	Mulligan, Patrick	859 Greenfield Road	Henry Glabach
9	Parsonage Site	Greenfield Road	Bob Saline property
10	Saline, Robert	838 Greenfield Road	Store & Post Office
12	Barton, Donna	832 Greenfield Road	Moved from old center
13	Breeden, Jeanne	752 Greenfield Road	
14	Tipping Rock	Greenfield Road	Across from Kummerle's
16	Swanson, Michael	646 Greenfield Road	Severence
17	Ainsworth, Katherine	8 Coates Road	
18	Zaveruha, Ann	45 Coates Road	
19	Yetter, William & Sandra	604 Greenfield Road	
20	Adams	164 Katley Hill Road	Steve Mukas Farm
21	Johnson, Carl & Martha	270 South County Road	
23	Troy, David	136 South County Road	Cobb Farm
24	Howarts, Bill & Sue	32 S. School Road	South School
26	Fuentes, Dean	South County Road	Charles F. Severence place
27	Maloney, Daniel	48 South County Road	
28A	Meeting House Rock	South County Road	Near 24 South County Road

Site #	Name	Location	Remarks
28	Granite Items	South County Road	On Doris Riley's property
28	Riley, Doris	32 South County Road	
31	Duprey, Mark	31 Glen Road	
32	Helbig, John & Jo-Ann	60 Glen Road	
33	Herron, Sidney	85 Glen Road	Ladder Look Farm
36	Croutsworst, Robert	404 Glenn Road	
37	Cayer, Roger & Catherine	18 Eden Trail Road	
38	Baker, Eva	42 East Hill Road	
39	Baker, Andrew & Linda	45 East Hill Road	
40	Saywood, Paula & Sims	119 East Hill Road	Oldest House
43	Fritz, Lance	228 East Hill Road	
45	Laudin, Ernest	East Hill Road	Newton Foster place
46	Rockwood, Jenney	96 Simon Keets Road	Ghosts
47	Apostoles, Peter & Cindy	92 Simon Keets Road	
49	Lund, Jerry	30 Simon Keets Road	
50	Neville, Harry & Margaret	19 W.S. Black Road	
53A	Henry Kirk's birthplace	North County Road	Across from Facey Farm; American sculptor
53	Hall, Violet	460 North County Road	Cloud Nine Farm
53	Slave Quarters	North County Road	Skip Hall / O'Neil property
55	Brown, Karyn, & Weeks, Jon	228 West Leyden Road	Beehive oven & large kettle w/ cooking fireplace
57	Yetter, Betsey	310 West Leyden Road	
58	Fish, Gilbert	341 West Leyden Road	
59	Spirit Fire Retreat	407 West Leyden Road	Robertson Farm
60	Peterson, Alan & Rebecca	41 Bell Road	
61	"Dorrilites"	Gates Road	Neipp Property
61	Neipp, Jeffrey	Gates Road	Rhodes Farm
63	Smith, Larry & Joan	234 West Leyden Road	School moved from corner on Bell Road School #5
65	Tusinski, Peter	265 River Road	Bert Whitney (Sage of Gore Hollow)
66	Beswick, Noel	349 River Road	
66	Thorn's Mill	River Road	Foundation along brook before Beswick's
67	Cormier, Matthew	346 River Road	
69	Vreeland, David	116 River Road	
71	Lynde Brothers Box Shop	Lyndes Road	Mill still standing
72	Spencer Mount	Greenfield Road	Behind Timmerman property
74	Emanuelli, Paul	16 River Road	
75	John Riddell's birthplace	West Leyden Road	Where Glen Call's is now; inventor of binocular microscope, Secretary of Agriculture and professor of Botany at Tulane University
75	Loomis, Robert & Karen	15 River Road	
76	Constantine, Craig	580 West Leyden Road	Moved across road
78	Lovely, Marie	486 West Leyden Road	Restored

Site #	Name	Location	Remarks
79	First Meeting House	Mid County Road	On Bob Snow's property / part of building located on Roland Johnson's barn
79	Snow, Robert & Valerie	200 Mid County Road	Matthew Severence / Ghosts
80	Feldman, Fred & Lois	187 Mid County Road	Carpenters Tavern
80	Feldman, Fred & Lois	187 Mid County Road	Town Pound
81	Pratt, Douglas & Ann	102 Mid County Road	Mink Farm
82	Glen Springs Cheese Factory	Greenfield Road	Center of Town
83	McCarthy, Jerry & Anne	200 Brattleboro Road	
84	Zimmerman, William	24 Zimmerman Hill Road	
86	Barton, Elwin	24 Frizzell Hill Road	Poor House
87	Catabia, Ron & Ellen	70 Frizzell Hill Road	
88	Snedeker, Robert & Lynette	170 Frizzell Road	Frizzell's Homestead
92	Timmerman, Laura	910 Greenfield Road	
95	Streeter, Ronald & Diane	1097 Greenfield Road	Foster Homestead
96	Heron, Sid	Wilson Road	Armstrong place
	Beaver Meadow Cemetery	Greenfield & Brattleboro Roads	
	Clark & Duffy	357 East Hill Road	
	Cohen, Susan Lee	41 Simon Keets Road	
	Copper Mine	River Road	Across from Rifle Range
	Dated Rock	East Hill Road	1471 inscribed upside down on granite boulder. Also drawings of a house and cross. Possibly inscribed by early settler Joh Lee, as a jest in 1741.
	Dobias, Austin	428 Brattleboro Road	Beaver Meadow School
	Dougherty	Greenfield Road	Plot along Pazmino's
	Family Cemetery Plots	Mid County Road	Pratt Property
	Glen Reservoir	Glen Road	Greenfield's water supply
	Johnson, Roland	95 South County Road	Remnants of First Meeting House
	Leyden Rifle Club	Mid County Road & River Road	
	Lone Grave	off Alexander Road	
	Monks Cave	Off River Road	Beehive Cave / possibly built by "Culdee" Monks
	Natural Cave	Greenfield Road	On east side half way between Center of Town and Ed Caron's.
	Paker Cemetery	North County Road	Davis Property
	Perry, Mitchell jr., /Okeefe	99 Simon Keets Road	
	Richter, Stephen & Little	210 Alexander Road	
	Robertson Library	Greenfield Road	Center of Town
	Simon Keets Sawmill	Simon Keets Road	
	South Cemetery	Greenfield Road	
	Sweethearts Chair	Glen Road	Croutworst Farm
	Town Vault	West Leyden Road	Center of Town
	West Leyden Cemetery	West Leyden Road	

Sources: *Leyden Open Space Plan*, 1986; *History of Leyden, MA*, 1959; *MHC Reconnaissance Survey Report*, 1982; Leyden Historical Commission, 2009.

C. POPULATION CHARACTERISTICS

In this section on Population Characteristics, Leyden's needs for open space and recreational resources are assessed based upon an analysis of demographic and employment statistics within Town. The demographic information includes changes in total population, changes in the relative importance of different age groups in Leyden, and measures of income. The employment statistics section covers labor force, and employment by industry sector.

C.1 Demographic Information

Demographics are useful for forecasting the need for open space and recreational resources that may be required by residents over time.

C.1.1 Population and Population Change

According to the U.S. Census, Leyden's population growth rate between 1970 and the year 2000 was far greater than County and State averages (See Table 3-2). During this time period, Leyden's population increased by 396 people , equal to a growth rate of 105.3 percent. This is in contrast to Franklin County as a whole, which saw a 20.8 percent increase in population from 1970-2000 and to the Commonwealth of Massachusetts, which saw an 11.6 percent increase in population during this time period.

Table 3-2: Population for Leyden, Franklin County and Massachusetts 1970-2000

	1970 Population	1980 Population	1990 Population	2000 Population	Population Change 1970-2000 (# of people)	% Population Change 1970-2000
Leyden	376	498	662	772	396	105.3%
Franklin County	59,233	64,317	70,092	71,535	12,302	20.8%
Massachusetts	5,689,377	5,737,037	6,016,425	6,349,097	659,720	11.6%

Source: U.S. Census, 1970, 1980, 1990, 2000.

Leyden is a rural community, with a population density in 2000 of 43 people per square mile. To compare with several neighboring Franklin County towns in the same year, Ashfield had 45 persons per square mile, Colrain had 42 per square mile, Conway had 48 per square mile, Charlemont had 52 per square mile, and Montague had 270 per square mile (which includes the densely populated village of Turners Falls).

Table 3-3 shows that Leyden's population continues to grow slightly faster than both the County and the State. However it is important to note that this population growth in Leyden is at a much more modest rate than in previous decades. According to the most recent U.S. Census estimates, between 2000 and 2008, Leyden's population grew 3.8 percent, compared to the County with flat population growth of .3 percent, and the State growth rate of 2.3 percent.

Table 3-3: Estimated Population Growth, 2000-2008

	2000 Population	2008 Estimated Population	% Population Change 2000-2008
Leyden	772	801	3.8%
Franklin County	71,535	71,735	0.3%
Massachusetts	6,349,097	6,497,967	2.3%

Source: U.S. Census, 2000, and U.S. Census Annual Population Estimates, 2008.

Increasing population, even at a modest rate, presents the need to plan for the protection of valuable resources that may be impacted by new development, as well as to reassess the recreational and open space needs of a growing community. It is also important to understand the age makeup of a community when planning for recreation and open space, as different age groups require different recreational opportunities. Table 3-4 displays the population of Leyden, the County, and the State by age cohorts for both 1990 and 2000, and the percent age change for each cohort during this time period.

According to the 2000 U.S. Census General Demographic Characteristics (see Table 3-4), during the last decade the Town of Leyden had an elementary school age (5-11 years old) population that declined by 41 percent (compared with a County decrease of only 4.5 percent), and a teenage (12-19 years old) population that has expanded by 85.7 percent (compared with a County increase of 17 percent). However, the 50-59 year age cohort experienced the largest growth, with a notable 162.5 percent increase over the ten-year period between 1990 and 2000 (compared with an 81 percent increase in the County). The 40-49 year age cohort also showed a 68.9 percent increase (more than twice the County increase of 31 percent during this time period). The change in these groups is driven by the aging of the baby boomer generation (born 1946-1964) who began turning 44 in 1990, as well as the aging of their children. The increase in the 70-79 year age cohort was the second highest increase from 1990 to 2000 at 135.7 percent, which is much greater than the County (.2 percent) and the State (7.3 percent) increases.. It is important to note that because Leyden has a relatively small population, any increase will result in a high percentage change compared to communities with larger populations. Therefore it is important to regard the number of residents in each age group, and how they have increased, in this analysis.

Table 3-4: Population by Age Cohort, 1990 and 2000 in Massachusetts, Franklin County, and Leyden

	Massachusetts Population		% Change	Franklin County Population		% Change	Leyden Population		% Change
Age Cohort	**1990**	**2000**		**1990**	**2000**		**1990**	**2000**	
0-4 years	410,674	394,848	-3.9%	5,081	3,657	-28.0%	51	39	-23.5%
5-11 years	523,626	608,825	16.3%	7,115	6,797	-4.5%	105	62	-41.0%
12-19 years	611,863	666,010	8.8%	6,819	7,993	17.2%	56	104	85.7%
20-29 years	1,063,844	835,277	-21.5%	9,835	7,853	-20.2%	53	76	43.4%
30-39 years	1,031,456	1,036,493	0.5%	12,918	9,852	-23.7%	159	90	-43.4%
40-49 years	775,172	995,375	28.4%	9,961	13,061	31.1%	106	179	68.9%
50-59 years	518,629	716,260	38.1%	5,302	9,590	80.9%	48	126	162.5%
60-69 years	515,995	453,683	-12.1%	5,908	4,867	-17.6%	63	52	-17.5%

	Massachusetts Population		% Change	Franklin County Population		% Change	Leyden Population		% Change
70-79 years	369,720	396,825	7.3%	4,672	4,680	0.2%	14	33	135.7%
80+ years	195,446	245,501	25.6%	2,481	3,185	28.4%	10	9	-10.0%

Source: U.S. Census Bureau, 1990 and 2000.

As of 2000, Leyden has a declining elementary school age group, a large number of teenage children (12-19 years old), and a growing number of residents in the 40-59 age groups, which typically earn higher incomes than younger workers, and a growing elderly population. If the relatively large cohort of older (40-59) working-aged residents continue to reside in Leyden, it could result in a significant population of individuals in the 60-79 age cohorts in ten to twenty years. The Town of Leyden should provide recreational facilities and services for all of its residents, but pay particular attention to the needs of specific age cohorts that have a higher concentration of residents. For example, teenagers may need sports or other recreational programs. The elderly may require services such as accessible walking paths, and arts and leisure programs. Residents of all ages may need facilities and programs that provide safe space for recreation, as well as access to open space.

If the current trend of older working adults moving to Leyden continues, then it might be logical to assume that enrollment in the elementary school will drop as the number of school-age children in Town declines. But the Census data also indicates that the 20-29 year old cohort has increased. Are these individuals returning home after college or new young residents being attracted to Town? If these are young families, then the school enrollments may increase some. However, even if young families move to Leyden, rising land prices might dictate that these families would be wealthier individuals. Will more affluent families desire to send their children to Leyden's elementary school or to a private school? Although the answers to these questions are beyond the scope of Leyden's Open Space and Recreation Plan, they are useful overall town and school planning and will affect the future makeup of Leyden's residents that should be served by recreational programming.

Table 3-5 tracks the enrollment of Leyden's elementary school across roughly four decades, between 1970 and 2008, when school numbers fluctuated between 39 and 101 students. Throughout the 1970s and most of the 1980s, total school numbers varied between the forties and the sixties, with the lowest enrollment in 1982 recording only 39 students. Beginning in 1988, and on into the 1990s, the school census jumped into the eighties and nineties and hit a high of 101 in 1994. These numbers were somewhat elevated by the addition of a pre-kindergarten class which began in 1988 with ten students. Not until the year 2000 did the numbers begin to decline, when they again dropped to 68 students. Enrollment fell to 44 students in 2004, the lowest number since 1982, before growing to 59, 57, and 58 from 2006 to 2008. Leyden may wish to compare numbers of pre-school children through the street census, to track potential incoming student numbers, before planning any major changes in the school system.

Table 3-5: Pearl Rhodes Elementary School Enrollment, 1970-2008

School Year Beginning	Number of Students Enrolled
1970	62
1971	64
1972	58
1973	55
1974	53
1975	50
1976	46
1977	53
1978	62
1979	57
1980	49
1981	46
1982	**39**
1983	48
1984	51
1985	51
1986	64
1987	65
1988	82
1989	97
1990	87
1991	89
1992	84
1993	94
1994	**101**
1995	87
1996	97
1997	81
1998	88
1999	87
2000	68
2001	68
2002	51
2003	50
2004	44
2005	48
2006	59
2007	57
2008	**58**

Sources: Massachusetts Department of Elementary and Secondary Education, 2009; Leyden Town Report 2000 & 2001.

Note: MA Department of Elementary and Secondary Education reports higher numbers of students for some of the years between 1990 and 1998. This may be due to differences in reporting methods and reporting times.

Identifying the best location for the development of new open space and recreation resources should consider where the concentration of population will occur and which parts of the local citizenry require specific needs. As will be seen in the fourth part of Section 3, Growth and Development Patterns, future growth depends in large part on zoning, slopes, soil and groundwater related constraints, and on which lands are permanently protected from

development. Town officials could identify key parcels in town that might be future parks and walking trails that are close to the current distinct villages and/or areas that could be later developed for residential uses. Officials could be looking for opportunities to conserve land in Leyden that protects valuable scenic and natural resources and provides public access to trail networks and open spaces.

C.1.2 Economic Wealth of Residents and Community

Measures of the income levels of Leyden residents as compared to the County and State are helpful in assessing the ability of the citizenry to pay for recreational resources and programs and access to open space. Table 3-6 describes the earning power of residents in Leyden as compared to the County and the State. Median income figures describe the middle income among residents, thus eliminating any extreme numbers (either the very wealthy or very poor) from influencing the overall figure. Median household figures include data for families, for households of non-related people, and for individuals living alone. In 1999, Leyden's median household income was $50,385, 23.6 percent above the median for the County ($40,768) and almost equal with the median for the State ($50,502). The per capita income for the Town (total income for all residents divided by the total population) was $26,076, higher than both the County ($20,672) and the State ($25,952). Leyden's higher per capita income figure may be partly due to a number of older work force professionals who have moved into Town. The percentage of people living below the poverty line in Leyden is significantly lower than both the County and the State at 4.7 percent (see Table 3-6). It appears that the financial well being of Leyden residents is on par with the average for households in the State, and higher than the average for Franklin County.

Table 3-6: Median Household Income, Per Capita Income, and Percentage Below Poverty Level in 1999 for Leyden compared to Franklin County and the State

	Median Household Income	Per Capita Income	Percentage Below Poverty Level*
Leyden	$50,385	$26,076	4.7%
Franklin County	$40,768	$20,672	9.4%
Massachusetts	$50,502	$25,952	9.3%

Source: 2000 U.S. Census.

*Individuals living below poverty level for whom the poverty status has been determined.

Although Leyden's resources today are clearly both its people and its natural landscapes, the status of its finances could be affected by an interdependent relationship that exists between the two. The costs of municipal services provided to residents are partially paid for with the tax revenues generated by different kinds of property, both developed and undeveloped. One reason that many towns encourage economic development is to have other types of property than just residential development to share the tax burden. Cost of Community Services Studies, developed by American Farmland Trust, show that in towns studied, commercial and industrial development, as well as farmland and open space, generally contribute more in tax revenues than they require in town services, generating a net fiscal benefit for the municipality. This relationship is explored in more detail in Subsection D. Growth and Development Patterns.

C.2 Employment Statistics

Employment statistics like labor force, unemployment rates, numbers of employees, and place of employment are used to describe the local economy. Labor force figures can reflect the ability of a community to provide workers to fuel incoming and expanding businesses. Unemployment rates can show how well residents are fairing in the larger economy while employment figures describe the number of employees in different types of businesses. Employment can be used as a measure of productivity to gauge economic health, which should be encouraged in Town. The Town may decide to encourage business development to supply local jobs and to build taxable value, which can help pay for municipal services and facilities including recreational parks and programming as well as protected open space.

C.2.1 Labor Force: Leyden residents that are able to work

In 2008 , the Town of Leyden had a labor force of 484 people with an unemployment rate of 5.2 percent, comparable to similar rates for the County (4.9 percent) and the State (5.3 percent) (See Table 3-7). The labor force is defined as the pool of individuals 16 years of age and older who are employed or who are actively seeking employment. Enrolled students, retirees, stay-at-home parents and other persons not actively seeking employment are excluded from the labor force. Labor force is available on an annual basis from the Massachusetts Executive Office of Labor and Workforce Development. Leyden's labor force has fluctuated slightly since 2000, when the labor force was made up of 471 residents, with an overall increase of 2.8 percent between 2000 and 2008. Leyden's unemployment rate on average has been below that of the County and the State, except for 2006 and 2008 when the rates in Town (4.4 and 5.2) were higher than the County rates (4.3 and 4.9), but still slightly lower than the State rates (4.8 and 5.3).

Table 3-7: Labor Force and Unemployment Rate in Leyden, 2000-2008

Year	Labor Force	Unemployment Rate		
		Leyden	Franklin County	Massachusetts
2000	471	2.5	2.5	2.7
2001	475	2.9	3.1	3.7
2002	490	3.3	4.0	5.3
2003	497	4	4.6	5.8
2004	495	4.2	4.3	5.2
2005	492	3	4.3	4.8
2006	498	4.4	4.3	4.8
2007	487	3.9	4.2	4.5
2008	484	5.2	4.9	5.3
% Change 2000-2008	2.8%	N/A	N/A	N/A

Source: Massachusetts Executive Office of Labor and Workforce Development.

Table 3-8 displays the top ten employment destinations for Leyden workers according to 2000 U.S. Census Journey to Work data. Roughly 32 percent of Leyden workers were employed in Greenfield, the top destination. Leyden was the second highest destination with

10.7 percent of workers employed within Town, followed by Bernardston (6.9 percent), Deerfield (6.2 percent), and Brattleboro, Vermont (4.7 percent). Employment was spread among a total of 36 different communities in Massachusetts, Vermont, and New Hampshire.

Table 3-8: Top Ten Employment Destinations for Leyden Workers, 2000

Rank	Leyden Resident Employment Destination	Number of Employees	Percent of All Employed Leyden Residents
1	Greenfield	142	31.6%
2	**Leyden**	**48**	**10.7%**
3	Bernardston	31	6.9%
4	Deerfield	28	6.2%
5	Brattleboro	21	4.7%
6	Montague	19	4.2%
7	Amherst	18	4.0%
8	Northfield	17	3.8%
9	Whately	12	2.7%
10	Hatfield	11	2.4%
	Other	103	22.9%
Total		450	100.0%

Source: 2000 U.S. Census Journey to Work Data.

Table 3-9 shows the travel time to work for Leyden residents in 1990 and 2000, compared to the County and the State. In 2000 the most frequent commute times were between 20 and 29 minutes (26.4 percent), and 10 to 19 minutes (24.9 percent). The percentage of residents commuting less than 10 minutes (10.4 percent), 10 to 19 minutes (24.9 percent), 30 to 39 minutes (16 percent), 40 to 59 minutes (15.6 percent), and 60-89 minutes (3.3 percent), all increased from 1990 to 2000, while the percentage of residents commuting between 20 and 29 minutes (26.4 percent), and over 90 minutes (.7 percent), both decreased from 1990 to 2000. The percentage of residents working from home decreased from 8.9 percent in 1990, to 2.7 percent in 2000. This is in contrast with the County and the State, where the percentage of work-at-home residents increased slightly between 1990 and 2000, from 4.7 percent to 5.1 percent in Franklin County, and from 2.5 percent to 3.1 percent in the State. However, it is important to note that the year 2000 is the most recent year of data available. Recent trends in telecommuting may be increasing the percentage of at-home workers in Leyden since 2000, with technological advances and changing workforce philosophies making it easier for employees to work from home.

Table 3-9: Travel Time to Work for Leyden, Franklin County, and Massachusetts Workers, 1990 and 2000

Geography	Total Workers*	Work at Home	Less than 10 Min.	10 - 19 Min.	20 - 29 Min.	30 - 39 Min.	40 - 59 Min.	60 - 89 Min.	90 + Min.
Leyden									
1990	**338**	**8.9%**	**7.4%**	**17.2%**	**39.1%**	**13.6%**	**9.5%**	**1.8%**	**2.7%**
2000	**450**	**2.7%**	**10.4%**	**24.9%**	**26.4%**	**16.0%**	**15.6%**	**3.3%**	**0.7%**
Franklin County									
1990	34,674	4.7%	21.8%	32.1%	17.8%	11.5%	7.7%	3.2%	1.1%
2000	37,053	5.1%	16.3%	30.0%	19.1%	14.2%	9.7%	3.3%	2.3%
Massachusetts									
1990	2,979,594	2.5%	15.6%	31.3%	18.7%	15.5%	10.7%	4.7%	1.0%
2000	3,102,837	3.1%	12.6%	27.4%	18.6%	16.3%	13.0%	6.5%	2.4%

*Employed workers 16 years and older.
Source: U.S. Census, 1990 Census STF3A and 2000 Census SF3.

C.2.2 Employment in Leyden: People who work in Town, whether they are residents or not

It is important to examine employment within the State and County, even though the number of employers currently in Leyden is limited. According to 2006 U.S. Census County Business Patterns data, the industry sector with the highest percentage of employment in Franklin County is manufacturing (19.9 percent), an industry with a long history in the region that is still strong when compared to the State, where only 9 percent of total employment is in manufacturing. Manufacturing's share of total employment in the County has been declining for several decades, however, and dropped by 10 percent since 2000, when it accounted for roughly 30 percent of the County's total employment. The sectors comprising the next highest percentages of employment in the County are health care and social assistance (16.0 percent), and retail trade (14.6 percent). It is important to note that County Business Patterns does not publish information for a sector when it would disclose the operations of any single business, and does not include the public administration sector.

Like most of the country, over the past few decades Franklin County has been transitioning from a "goods producing" based economy to a more diversified economic base with an expanded service sector. According to County Business Pattern data, three of the top five employment sectors in Franklin County are service industries: health care and social assistance services (16.0 percent), education services (7.2 percent), and food and accommodations services (8.1 percent). These three service sectors account for approximately 31% of the total employees in Franklin County (Greater Franklin County Comprehensive Economic Development Strategy – 2009 Annual Report).

Leyden's economy, while a part of the larger County and State economies, is different in many aspects, as the Town has very little employment or industry located within its borders. Table 3-10 displays the number of establishments and average monthly employment in Leyden from 2002 through 2008. This information comes from the Massachusetts Executive Office of Workforce Development ES202 data, which includes the public administration

sector, but does not include those who are self-employed, such as employees in the agriculture, forestry, and construction sectors. It is important to note that data is kept confidential if there are less than three reporting establishments for a given industry, or if with three or more units, one unit accounts for 80% or more of the total. For the years 2002, 2004 and 2005, data was only available for privately owned establishments, and for 2003 data was not available for any establishments, due to confidentiality reasons. From 2006 to 2008, data for both privately and publicly owned establishments was available, giving a more complete picture of current employment in Leyden. During these three years the number of establishments has remained the same at 7, while average monthly employment grew from 44 in 2006 to 70 in 2007, with a slight decline in 2008 to 65 employees.

Table 3-10: Establishments and Employment in Leyden, 2002-2008

Year	# of Establishments	Average Monthly Employment
2002*	4	9
2003**	ND	ND
2004*	5	11
2005*	5	13
2006	7	44
2007	7	70
2008	7	65

Source: Massachusetts Executive Office of Workforce Development, ES202 data
* Data only available for privately-owned establishments.
** ND = Data not disclosed.

If the Town should decide to continue to pursue economic development efforts, Leyden would be advised to encourage an industry sector that already has a strong base within the region, to help support the new endeavor. Certainly, the services and trade sectors are feasible and could be inserted within Leyden's rural residential character. While manufacturing may seem incompatible for Leyden's rural character, a small, green industry that was housed in a structure suited to the historic landscape could be a possibility for the Town. Expansion of businesses related to working land, such as Forestry and Agriculture, should also be supported by the Town as in line with the rural character of the community and open space goals. Business development of all kinds should be better supported now that most of the Town has access to high speed internet since the introduction of a DSL line in November 2008. Although there are still DSL-free blind spots in the extreme eastern, northern, and southern areas of Town, officials are looking to expand broadband service to all those areas to further promote economic development.

C.3 Analysis

Leyden's population growth is estimated to have slowed to a modest rate of 3.8 percent from 2000 to 2008. The overall population will continue to age if older working residents continue to reside in Town. A growing senior population will have implications for land use within the river valleys and villages. As Baby Boomers age, they may require different

housing options than are currently available in Town. This potential demand for new housing will impact the available open space in Leyden. The Town should proactively identify the types of housing this population group will need (including accessory apartments) and determine the best locations for development, taking into consideration the needs of an older population while also working to protect open space and natural resources. Planning for growth before it happens will help to protect open space and recreation resources into the future. All residents of Leyden should benefit from recreational programming. Therefore open space and recreation opportunities should be available to all age and income groups and should be evaluated as Leyden's population continues to grow and change.

The majority of residents will continue to depend on jobs in other communities and counties. However, creative economic development efforts could be explored to promote locally owned businesses that provide for the needs of residents of Leyden and the surrounding area, while increasing the tax base and the number of jobs in Town available to residents.

D. GROWTH AND DEVELOPMENT PATTERNS

D.1 Patterns and Trends

Over the past two hundred years, Leyden residents developed their community using the productivity of the area's forests and good grazing and forage crop soils. In the 20th century, Leyden's population declined as industrial development lured people away from rural areas, even though agriculture remained a significant part of the local economy. This movement resulted in a population decline that lasted for 135 years, from 1,095 in 1800 to 253 in 1935. After the late 1930s, improved roadways and the automobile made commuting possible so Leyden's population began to recover.

The land use figures presented in this section are based on data provided by MassGIS. MassGIS classifies land uses based on aerial photograph interpretation conducted by the Department of Forestry's Resource Mapping Project at the University of Massachusetts, Amherst. Statewide data including all municipalities are available for 2005,1999, 1985, and 1971.[2] Initially, analysis was conducted through manual interpretation of the aerial photos. In 2005, the land use data was created using semi-automated methods. MassGIS uses 38 land use classifications in the 2005 data, an increase from the 21 codes in the 1999 dataset. It is important to note that readers should exercise caution in comparing land use data over the years. Such comparisons can provide only an estimation of the trends in land use change over the years. Due to different data collection and analysis methodologies used over the decades, direct comparisons cannot be made with precision between the various datasets.

In 1971, the predominant land use in Leyden was forest (77%), although cropland and pasture (16%) could be found in contiguous north-south bands along County Road,

[2] The first statewide land use maps were created in 1953-54 from 1951-52 aerial photos. These maps were never digitized. They are available in the Map Collection Archives at the W.E.B. DuBois Library at the University of Massachusetts, Amherst.

Greenfield Road, Glen Road, East Hill Road, in Beaver Meadow, and in other scattered sites throughout Town. The most common residential development pattern in 1971 was single-family homes on open roadside lots at least two acres in size. Residential land represented just over 2% of all Town lands in 1971. Open undeveloped land and land used for recreation accounted for nearly 4% of the Town at that time.

Between 1971 and 1999, this pattern continued with forest as the predominant land use (76%), though the number of acres was slightly reduced. Over this period, the Town experienced an increase of residential land use (on lots greater than ½ acre) to nearly 5% of the Town's total acreage. The development of new single-family housing along existing public ways spread along many of Leyden's roads, but was most dense along West Leyden Road, East Hill Road, Alexander Road, Kately Hill Road, Eden Trail Road, Greenfield Road, South Schoolhouse Road, and River Road. By 1999, approximately 200 acres of cropland and pasture had been converted to residential use or reverted to forest, resulting in a reduction of agricultural land to just under 14% of the Town's total acreage. Open undeveloped land and recreation land declined to 3% of the Town during this period.

Between 1999 and 2005, forestland in Leyden increased to approximately 80% of the Town's total acres. Cropland and pasture declined further to just over 11% and residential land went down to approximately 3% of Town. Open undeveloped land and recreation land continued to decline to just over 2% of the total acreage in Town.

Most of the new residential construction over the years has continued to take place on lots larger than two acres in size. The Franklin County Cooperative Inspection Program maintains computer records of building permit information since 1994. Between that year and 2008, 64 building permits were issued for homes in Leyden**.** The majority, if not all, of the residential construction, has been for single-family housing development. The Inspection Program Fiscal Reports show progressively rising construction values that indicate the relative financial well being of new town residents.

Based on the current zoning in Town, large lot residential development is expected to continue to be the dominant pattern of land conversion in Leyden**.** Although the minimum lot size in the central village area surrounding the Town Hall is one acre, slope and depth to bedrock may limit development of septic systems, resulting in larger lots. Land conversion appears to be speeding up compared to the relatively slow rate of growth experienced since the late 1930s**.** In addition to losses in farmland and forestland, new residential development has other less obvious impacts, including increases in traffic congestion, school costs, and road maintenance expenditures. The loss of farmland and forestland along the edges of large blocks of woodland may seem to be unimportant. However, the impact on natural resources may go beyond simply the loss in acreage. As forest and remaining pastureland acres are converted to residential uses, the landscape becomes more fragmented.

Fragmentation of the landscape can negatively impact the quality of wildlife habitat, watershed protection, recreation opportunities, forest management opportunities, and ultimately, the municipal services budget. The more fragmented land uses become, the more expensive it becomes to manage and to provide services to residents or businesses, based on

additional travel time and fuel costs. Fragmentation of the landscape affects the viability of forest management operations. Development is limited to the road corridors in many rural communities in western Massachusetts. The roadways occur within a landscape of large blocks of contiguous forestland. When forestland is sold for residential development, the resulting lots, usually associated with single-family homes, are often too small to manage individually for forestry purposes. Similarly, the most inefficient method of providing municipal services such as police, fire, sewer, water, waste disposal, and snow plowing is associated with a fragmented landscape where residential development is spread sparsely across the town.

D.2 Infrastructure

D.2.1 Transportation Systems

Running parallel to the Glen Brook is the Town of Leyden's principle roadway, Greenfield Road. This is a north-south byway linking Leyden with Greenfield and Franklin County to the south. Greenfield Road intersects with Brattleboro Road near the Town Center and provides a northern link through Guilford, Vermont to Brattleboro, Vermont. Leyden residents gain access to Route 2 through Greenfield. Route 2 is a major east-west highway in northern Massachusetts, which intersects with Interstate 91, a major north-south route. Likewise, the Brattleboro connection offers access to Route 9, a major east-west Vermont state road, which links again to Interstate 91, the north-south route.

There is no regular public transportation in Leyden. The Franklin Regional Transportation Authority (FRTA) provides on-demand transportation for the elderly and people with disabilities.

D.2.2 Water Supply Systems

The Town of Leyden has one small public water system (PWS) in operation, at the Pearl E. Rhodes Elementary School. All of the residences and the Town's population are serviced by private wells. However, the Town also is the origin of two of Greenfield's principal drinking water sources, the Leyden Glen Reservoir and the Green River.

The Pearl Rhodes Elementary School water supply currently serves approximately 70 students and staff**.** A drilled 6" bedrock well, 150 feet deep, provides the water source and is located on Brattleboro Road, just east of the intersection with Greenfield Road. The well itself is located under the building, beneath the boiler room. The water storage system consists of three hydropneumatic tanks, each with a 30-gallon capacity. A pump test, performed during April of 1992, yielded an approved pumping rate of 3,240 gallons per day (GPD). This pumping rate produces a Zone I of 177 feet and an Interim Wellhead Protection Area (IWPA) of 472 feet.

Water quality regulations specify that only activities related to the water system and that are non-threatening to water quality occur within Zone I. The school has activities unrelated to

the protection of water, but the activities are grandfathered under its registration. As a consequence of these activities, the school must monitor for possible Volatile Organic Compounds (VOCs). Currently, the Town of Leyden does not own the entire Zone I protective radius around its wellhead. The sole land use within the Zone I is the school. The school is also the only land use within the IWPA. However, according to the Massachusetts Department of Environmental Protection (DEP), Brattleboro Road passes within the Zone I of the school's wellhead and poses a potential threat to the water supply, due to possible improper use of de-icing salts, or a vehicular accident, particularly, a fuel oil truck (Pendergast; 2003).

Following an evaluation conducted by the DEP in September of 2000, the DEP's Division of Water Supply issued a letter recommending the following protective measures for the school's well: location of vehicular parking away from Zone I, limited use of deicing salts in winter, routine pumping of the septic tank, elimination of herbicides, pesticides, or fertilizers on lawns or fields, education of staff of hazardous chemical use and disposal, and erection of source protection signs around the Zone I of the well.

In addition to the school's public water system, the Greenfield Water District maintains two surface water sources within Leyden, consisting of the five-acre Leyden Glen Reservoir off Greenfield Road and the pumping station intake at the Green River, located just south of the Leyden-Greenfield town line. The reservoir is designated as a Class A water body, due to its outstanding quality. In the year 2008, the Leyden Glen Reservoir water production was 226 million gallons with an average daily use of 620,000 gallons, and a storage capacity of 45 million gallons**.** The Green River provided 142 million gallons of drinking water to the Greenfield Water Department in 2008, with an average daily use of 389,000 gallons. Although the Town of Greenfield owns land immediately surrounding the Leyden Glen Reservoir, neither of these surface water sources is fully protected because the lands draining into the water bodies are not permanently protected from development, nor are they owned or controlled by the municipality using them.

The Massachusetts Department of Environmental Protection (DEP) completed a Source Water Assessment and Protection (SWAP) Report in January of 2003, which designates a Zone A area for critical protection of the reservoir water source. The Zone A is the area 400 feet from the edge of the reservoir and 200 feet from the edge of the streams and rivers draining into it. The watershed for the reservoir includes over 3,000 acres of land in Leyden. Approximately 70 percent of the watershed is forested and 56 percent is open space with at least limited protection.

The DEP recommended in the Deerfield River Watershed 2000 Water Quality Assessment Report that the section of the Green River that runs along Leyden's border to the Greenfield pumping station be reclassified from a Class B to a Class A water body in the next revision of the Massachusetts Water Quality Standards.. A Class B water body does not have a Zone A, B, or C protection area, as the Leyden Glen Reservoir does. For the SWAP Report, the Green River was assigned an Emergency Planning Zone of 400 feet on either side of the river and all the tributaries that feed it. The watershed for the Green River water source includes

over 4,000 acres, much of it in Leyden. Eighty percent of that land is forested and 50 percent is under temporary open space protection.

D.2.3 Sewer Systems

There are no public sewer systems in the Town of Leyden. All public and private facilities are served by septic systems.

D.3 Long-term Development Patterns

Long-term development patterns will be based on a combination of land use controls and population trends.

D.3.1 Land Use Controls

The Town of Leyden has five local land use controls: a single zoning district (with an overlay Village Center area), a Special Permit process, a Site Plan Review process, a subdivision control law, and an amendment to the Zoning Bylaws, Section 4.2.C Back Lot Development with Open Space Set-Aside.

Residential development of Approval Not Required (ANR) frontage lots on existing roads will likely be the dominant short-term development pattern given current zoning. Following historical precedent, Leyden's zoning recognizes only one use district throughout the entire town, the Residential-Agricultural District. However, an informal Village Center is depicted in the area within one-fourth mile of the Town Hall's front door, where residential minimum lot sizes are reduced. The Residential-Agricultural District allows single-family detached homes; religious, educational, or municipal uses; forestry, agricultural, and horticultural uses; and accessory uses incidental to an allowable use, such as home occupations and the leasing of rooms to boarders. Other uses, such as commercial businesses, are granted only by Special Permit from the Planning Board. Leyden has not designated any commercial or industrial districts. (See the Zoning Map at the end of this section.)

The Residential-Agricultural District requires housing lots to be two acres in size and have at least 200 feet of frontage on a roadway. The Village Center area allows lots to be one acre in size with 100 feet of frontage. A non-conforming lot size is also permitted if it has at least 5,000 square feet of area and at least 50 feet of road frontage.

A Site Plan Review Process is activated whenever a development over 10,000 square feet is anticipated, or when a parcel of land will be subdivided into more than three lots within one year. A detailed site plan, accompanied by an impact statement, must be reviewed before being approved by the Planning Board. Larger residential developments are subject to subdivision planning regulations.

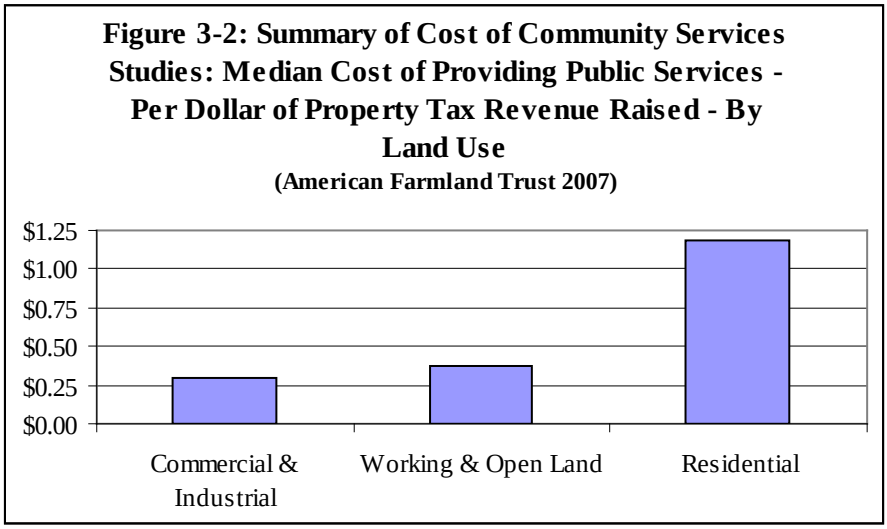
The Back-lot Development with Open Space Set-Aside bylaw is designed to allow for the development of up to four back lots, each at least two acres in size, which do not need the

required minimum road frontage. A deeded right-of-way serves as a common driveway for multiple lots. In exchange, the landowner or developer would have to place a permanent conservation restriction on land near the roadway (and restrict its future use to agriculture, forestry, conservation and/or recreation). At a minimum, an equal amount of land would have to be protected (at least 2 acres in size for each lot), with at least 200 feet of lot frontage and a minimum depth of 200 feet from the road, for every back lot developed.

The Town of Leyden has zoning that is designed to promote village, agricultural and rural residential uses. However, the predominant development pattern is that of residential development in all areas of Leyden. The Residential-Agricultural District, the rural district, is open to large lot residential use with few constraints. Planning is needed to identify key resources worthy of protection and the areas most suitable for development. Once completed, Open Space and Master Plans should be implemented by adopting zoning revisions and land protection programs to realize the balance desired by a community between natural resource protection and development.

The challenge for Leyden will be to plan for growth in a way that protects vital natural resource systems like aquifers and their recharge areas and prime farmland soils and at the same time promotes a stable property tax rate. In planning for future growth, it is important to understand the measurable fiscal impacts of different land uses. For instance, permanently protected open space (e.g. farmland/forest), residential, and commercial /industrial development each have a different fiscal impact depending on the relationship of property tax revenues generated to municipal services consumed. There is a process by which the fiscal value of these three different land uses are compared within a town to determine whether a use has a positive or negative fiscal impact. This process is called a Cost of Community Services (COCS) analysis. Figure 3-2 demonstrates the summary of more than 120 COCS studies.

Figure 3-2: Summary of Cost of Community Services Studies: Median Cost of Providing Public Services - Per Dollar of Property Tax Revenue Raised - By Land Use
(American Farmland Trust 2007)



Source: American Farmland Trust; 2007.

Although protected open space typically has a low assessed value and thus generates low gross tax revenues, municipal expenditures required to support this use are typically much

lower than the tax revenue generated. In 1991, the American Farmland Trust (AFT) conducted a Cost of Community Services (COCS) analysis for several towns in Franklin County. A COCS analysis is a process by which the fiscal impacts of different land uses within a town are compared to determine whether a use has a positive or negative net fiscal impact. The results of the 1991 AFT study showed that protection of open space is an effective strategy for promoting a stable tax base. It found that for every dollar generated by open space, the municipal services required by that land cost on average only 29 cents, resulting in a positive fiscal impact to the town. In 1995, the Southern New England Forest Consortium (SNEFC) commissioned a study of eleven southern New England towns that confirmed the findings of the earlier AFT study. These findings were confirmed by other COCS analyses across the country conducted over the last two decades. For every dollar of property tax revenues received from residential property, the amount of money expended by the town to support homeowners is over a dollar, while farm/forest and commercial/industrial property provide a positive fiscal impact.

To summarize the current situation within the Town, several issues should be reviewed. Leyden's population expanded rapidly from the 1970s through the 1990s, and new home construction has appeared along town roads as former forest and agricultural lands are converted to large, single-family residences. Most of Leyden's residents are better off financially than the average County resident. However, because there are no commercial or industrial properties to provide tax revenues, residential taxes are high, in order to support town services. Agricultural interests in Leyden are historic and provide the characteristic field/forest landscapes so valued by residents. It is critical for town boards, staff, and residents to continue to pursue avenues to protect the agricultural heritage of Leyden, including tax incentives and working with regional land trusts to pursue possible Agricultural Preservation Restrictions with willing landowners.

Since 2000, it is estimated that population growth has slowed in Leyden. The U.S. Census of 2000 indicates that the older adult population is increasing more rapidly than any other age group. This can be attributed to the aging of Baby Boomers and to an increase in new homes constructed by older working adults, who are beyond their child-rearing years. School enrollment has fluctuated over the last decade, with a general decline since the mid 1990s, but with signs of some recent growth since 2006. If population growth is desired to address issues such as decreasing school enrollment and increasing tax rates, there should be proactive planning for the Town as a whole to ensure that residential development is located in appropriate areas within Town, away from significant natural resources.

In conclusion, Leyden might consider some of these measures to preserve its resources and generate revenue for the Town:

- Small business development in the Services and Agricultural sectors to create taxable property for the long-term future wealth and financial security of the Town;

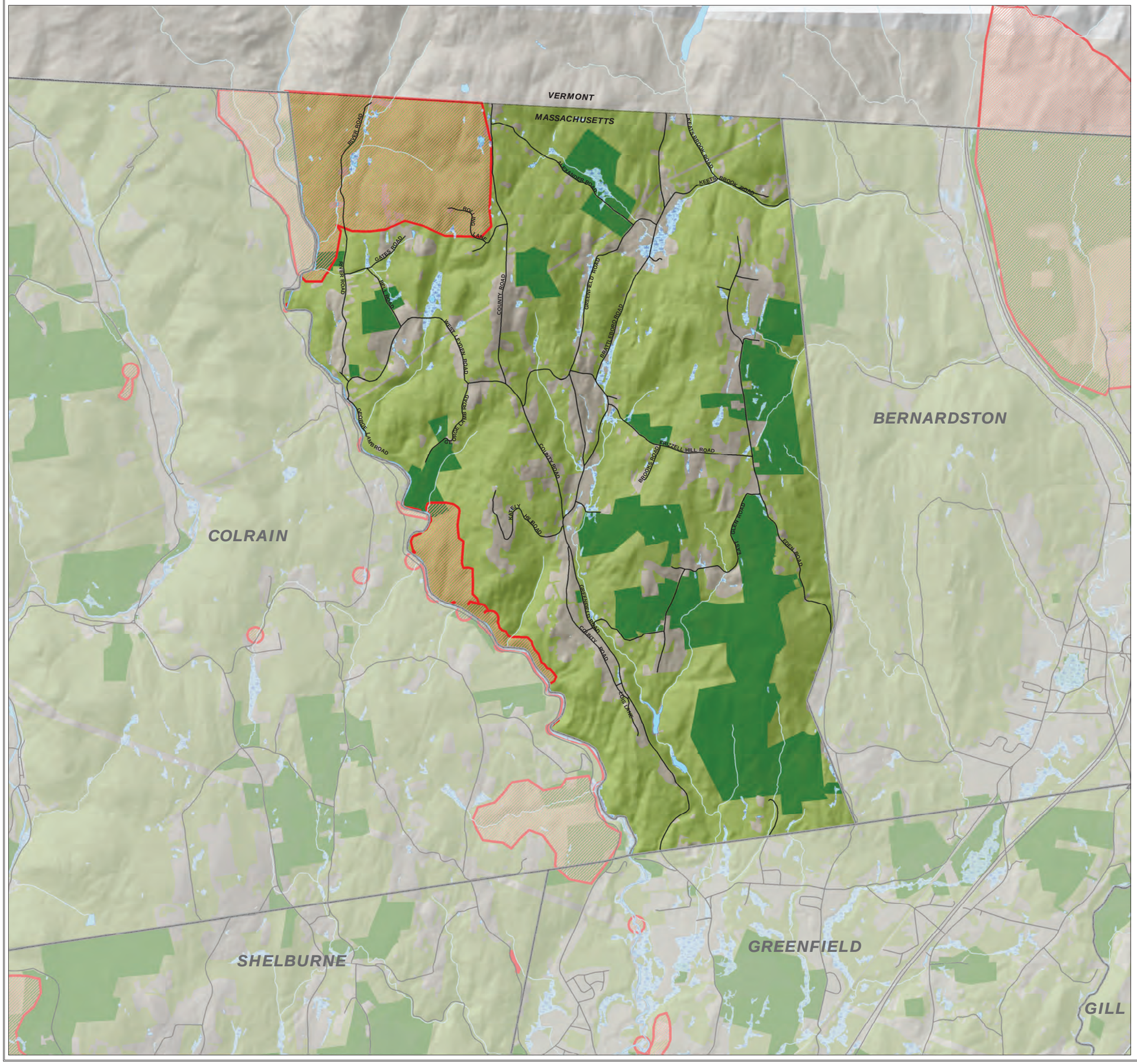
- Open space protection and historic preservation to ensure that Leyden's rural character and historic agricultural landscape is maintained; and,

- Development of a small amount of public and state supported affordable housing for elderly residents in a style appropriate to Leyden's rural heritage and adoption of a zoning bylaw allowing accessory apartments by right.

Town of Leyden

Regional Context Map

Open Space and Recreation Plan



Road

Permanently Protected Open Space

2005 Forest Land Use

BioCore Habitat Natural Heritage & Endangered Species

N
W E
S

0 0.3 0.6 1.2 Miles

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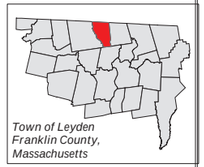
Main Office: 413-774-3167
425 Main Street
Greenfield, Massachusetts 01301

Map Sources:

Map Produced by the Franklin Regional Council of Governments Planning Department. GIS data sources include the FRCOG Planning Department, the Massachusetts Highway Department and MassGIS. Digital data obtained from MassGIS represent the efforts of the Massachusetts Executive Office of Environmental Affairs and its agencies to record information from the sources cited in the associated documentation. EOEA maintains an ongoing program to record and correct errors in the GIS data that are brought to or as to the implied validity of any uses of the GIS data. EOEA maintains records regarding all methods used to collect and process these digitaldata and will provide this information on request. Executive Office of Environmental Affairs, MassGIS EOEA Data Center, 251 Causeway St., Suite 900, Boston, MA, 617-626-1000.
Note: Depicted boundaries are approximate and are intended for planning purposes only.

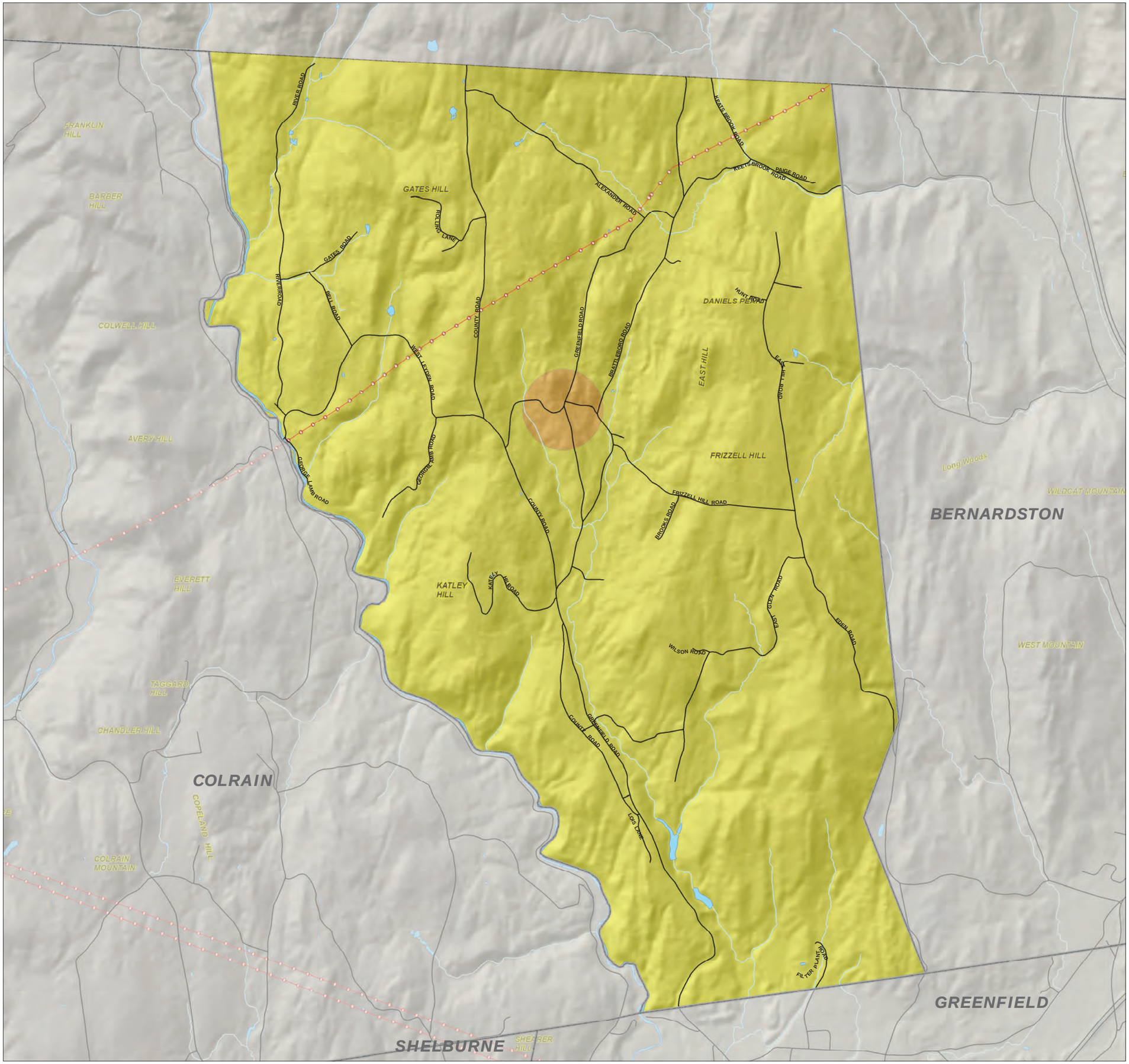


Town of Leyden
Franklin County, Massachusetts

Town of Leyden

Zoning

Open Space and Recreation Plan



Road
Transmission Lines

Zoning Districts

- Residential Agricultural
- Central Village Residential

N
W E
S

0 0.25 0.5 1 Miles

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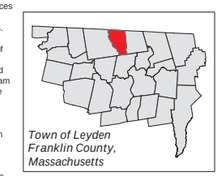
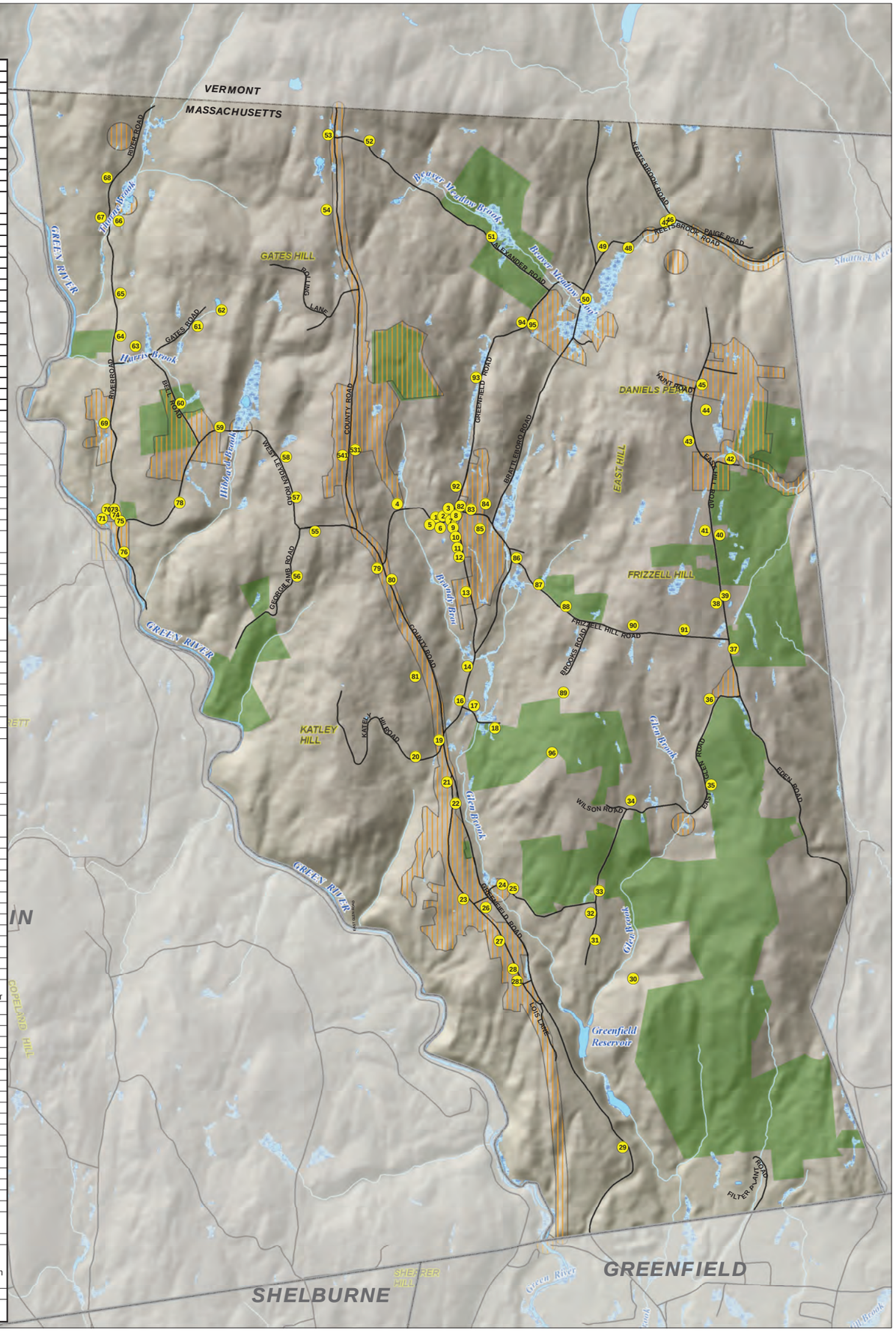


Town of Leyden
Franklin County, Massachusetts

Mapped Historic Houses and Sites

Site #	Name	Location	Remarks
1	Leyden Methodist Church	West Leyden Road	Center of Town
2	Site of original Town Hall	West Leyden Road	East side of church
3	Magnan, Rita	868 Greenfield Road	Post Office
4	Clark, James & Sharon	67 West Leyden Road	Center School
5	Reid, Wallis & Cornelia	30 West Leyden Road	Judson Ewer
6	Leyden Town Hall	West Leyden Road	Center of Town
7	Blacksmith Shop	Greenfield Road	Center of Town
8	Mulligan, Patrick	859 Greenfield Road	Henry Glabach
9	Parsonage Site	Greenfield Road	Bob Saline property
10	Saline, Robert	838 Greenfield Road	Store & Post Office
12	Barton, Donna	832 Greenfield Road	Moved from old center
13	Breeden, Jeanne	752 Greenfield Road	School moved from corner on Bell Road School #5
14	Tipping Rock	Greenfield Road	Across from Kummerle's
16	Swanson, Michael	646 Greenfield Road	Severence
17	Ainsworth, Katherine	8 Coates Road	
18	Zaveruha, Ann	45 Coates Road	
19	Yetter, William & Sandra	604 Greenfield Road	
20	Adams	164 Katley Hill Road	Steve Mukas Farm
21	Johnson, Carl & Martha	270 South County Road	
23	Troy, David	136 South County Road	Cobb Farm
24	Howarts, Bill & Sue	32 S. School Road	South School
26	Fuentes, Dean	South County Road	Charles F. Severence place
27	Maloney, Daniel	48 South County Road	
28	Riley, Doris	32 South County Road	
28	Granite Items	South County Road	On Doris Riley's property
31	Duprey, Mark	31 Glen Road	
32	Helbig, John & Jo-Ann	60 Glen Road	
33	Herron, Sidney	85 Glen Road	Ladder Look Farm
36	Croutsworst, Robert	404 Glenn Road	
37	Cayer, Roger & Catherine	18 Eden Trail Road	
38	Baker, Eva	42 East Hill Road	
39	Baker, Andrew & Linda	45 East Hill Road	
40	Saywood, Paula & Sims	119 East Hill Road	Oldest House
43	Fritz, Lance	228 East Hill Road	
45	Laudin, Ernest	East Hill Road	Newton Foster place
46	Rockwood, Jenney	96 Simon Keets Road	Ghosts
47	Apostoles, Peter & Cindy	92 Simon Keets Road	
49	Lund, Jerry	30 Simon Keets Road	
50	Neville, Harry & Margaret	19 W.S. Black Road	
53	Hall, Violet	460 North County Road	Cloud Nine Farm
53	Slave Quarters	North County Road	Skip Hall / O'neil property
55	Brown, Karyn, & Weeks, Jon	228 West Leyden Road	Behive oven & large kettle w/ cooking fireplace
57	Yetter, Betsey	310 West Leyden Road	
58	Fish, Gilbert	341 West Leyden Road	
59	Spirit Fire Retreat	407 West Leyden Road	Robertson Farm
60	Peterson, Alan & Rebecca	41 Bell Road	
61	Neipp, Jeffrey	Gates Road	Rhodes Farm
61	"Dorrilites"	Gates Road	Neipp Property
63	Smith, Larry & Joan	234 West Leyden Road	School moved from corner on Bell Road School #5
65	Tusinski, Peter	265 River Road	Bert Whitney (Sage of Gore Hollow)
66	Beswick, Noel	349 River Road	
66	Thorn's Mill	River Road	Foundation along brook before Beswick's
67	Cormier, Matthew	346 River Road	
69	Vreeland, David	116 River Road	
71	Lynde Brothers Box Shop	Lyndes Road	Mill still standing
72	Spencer Mount	Greenfield Road	Behind Timmerman property
74	Emanuelli, Paul	16 River Road	
75	Loomis, Robert & Karen	15 River Road	
75	John Riddell's birthplace	West Leyden Road	Where Glen Call's is now; inventor of binocular microscope, Secretary of Agriculture and professor of Botany at Tulane University
76	Constantine, Craig	580 West Leyden Road	Moved across road
78	Lovely, Marie	486 West Leyden Road	Restored
79	Snow, Robert & Valerie	200 Mid County Road	Matthew Severence / Ghosts
79	First Meeting House	Mid County Road	On Bob Snow's property / part of building located on Roland Johnson's barn
80	Feldman, Fred & Lois	187 Mid County Road	Carpenters Tavern
80	Feldman, Fred & Lois	187 Mid County Road	Town Pound
81	Pratt, Douglas & Ann	102 Mid County Road	Mink Farm
82	Glen Springs Cheese Factory	Greenfield Road	Center of Town
83	McCarthy, Jerry & Anne	200 Brattleboro Road	
84	Zimmerman, William	24 Zimmerman Hill Road	
86	Barton, Elwin	24 Frizzell Hill Road	Poor House
87	Catabia, Ron & Ellen	70 Frizzell Hill Road	
88	Snedeker, Robert & Lynette	170 Frizzell Road	Frizzell's Homestead
92	Timmerman, Laura	910 Greenfield Road	
95	Streeter, Ronald & Diane	1097 Greenfield Road	Foster Homestead
96	Heron, Sid	Wilson Road	Armstrong place
28A	Meeting House Rock	South County Road	Near 24 South County Road
53A	Henry Kirk's birthplace	North County Road	Across from Facey Farm; American sculptor
Additional Historic Houses and Sites			
	Clark & Duffy	357 East Hill Road	
	Cohen, Susan Lee	41 Simon Keets Road	
	Dobias, Austin	428 Brattleboro Road	Beaver Meadow School
	Johnson, Roland	95 South County Road	Remnants of First Meeting House
	Perry, Mitchell jr., /Okeefe	99 Simon Keets Road	
	Richter, Stephen & Little	210 Alexander Road	
	West Leyden Cemetery	West Leyden Road	
	Simon Keets Sawmill	Simon Keets Road	
	Leyden Rifle Club	Mid County Road & River Road	
	Robertson Library	Greenfield Road	Center of Town
	Town Vault	West Leyden Road	Center of Town
	South Cemetery	Greenfield Road	
	Family Cemetery Plots	Mid County Road	Pratt Property
	Paker Cemetery	North County Road	Davis Property
	Lone Grave	off Alexander Road	
	Dougherty	Greenfield Road	Plot along Pazmino's
	Glen Reservoir	Glen Road	Greenfield's water supply
	Beaver Meadow Cemetery	Greenfield & Brattleboro Roads	
	Monks Cave	Off River Road	Beehive Cave / possibly built by "Culdee" Monks
	Copper Mine	River Road	Across from Rifle Range
	Dated Rock	East Hill Road	1471 inscribed upside down on granite boulder. Also drawings of a house and cross. Possibly inscribed by early settler Joh Lee, as a jest in 1741.
	Sweethearts Chair	Glen Road	Croutworst Farm
	Natural Cave	Greenfield Road	On east side half way between Center of Town and Ed Caron's.



Town of Leyden

Historic Communities

Open Space and Recreation Plan

Permanently Protected Open Space

Road

Wetland

Scenic Resources

Historic Resource Area

Historic Resource

N
W E
S

0 0.25 0.5 1 Miles

FRANKLIN REGIONAL COUNCIL OF GOVERNMENTS
Main Office: 413-774-3167
425 Main Street
Greenfield, Massachusetts 01301

Historic information provided by the Leyden Historic Commission Bob Snow, Methodist Church

Map Sources:

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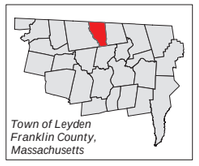


Town of Leyden Franklin County, Massachusetts

SECTION 4

ENVIRONMENTAL INVENTORY AND ANALYSIS

The natural resources and scenic landscapes of the Town of Leyden have been cherished by its residents for generations. This section of the Leyden Open Space and Recreation Plan provides a comprehensive inventory of the significant natural and cultural resources in Town. The purpose of the inventory is to provide a factual basis upon which assessments can be made. In this case, it identifies and qualifies the Town's soils, special landscape features, surface waters, aquifers, vegetation, fisheries and wildlife, and unique environments and scenic landscapes.

Each resource area is analyzed from two perspectives. First, the basic ecological services and cultural amenities the Town's natural resources provide the citizenry of Leyden. Ecological services include drinking water filtration, flood storage capacity, maintenance of species diversity, and soil nutrient levels. Cultural amenities include the recreational use of open spaces, the quality of life benefits that are maximized by maintaining the area's rural character and scenic beauty, and the direct and indirect benefits that well-conserved natural resources, such as good drinking water and open spaces, have on the local economy. Second, whether the resource should be conserved so that the quantity and quality required by residents is sustained.

The *Topography, Geology, and Soils* section provides a general understanding of the ways different soil characteristics can impact land use values. *Landscape Character* provides an overall scenic context. *Water Resources* describes all of the water bodies in town, above and below ground, including their recreational value, public access, and any current or potential quality or quantity issues. In the subsection *Vegetation*, Leyden's forest, farmland, and wetlands are documented and in *Fisheries and Wildlife*, wildlife, habitat, special corridors, and rare, threatened, and endangered species are discussed. Leyden's *Scenic Resources and Unique Environments* are identified and described. Finally, *Environmental Challenges* addresses current and potential problems that may influence open space or recreation planning.

A. TOPOGRAPHY, GEOLOGY, AND SOILS

Decisions relating to open space and recreation planning should take into consideration the inherent suitability of a site for different uses. Geology, soils, and topography are essential in determining potential sites for future residential, commercial, and industrial development and for new parks, hiking trails, and open space.

A.1 Topography

The Town of Leyden is composed primarily of three north-south upland ranges that are part of the eastern foothills of Vermont's Green Mountains. These uplands generally range between 1,000 and 1,300 feet in elevation, with the highest point being Frizzell Hill (1,310 feet). Because the town has high peaks located not far from open valleys, the topography in Leyden commands a number of extensive viewsheds. Ball Mountain, 1,250 feet above sea level, offers a view of the Connecticut Valley. From Gates Hill, on the west side of town, a view of the Green Mountains to the north and the Berkshire Mountains to the west can be seen. From North County Road, a view to the northeast includes Mt. Monadnock in New Hampshire.

Steep-walled valleys surround a number of Leyden's brooks and the Green River, along the town's western border with Colrain. Narrow fertile valleys are interspersed between the upland hills, most notably, Beaver Meadows and an agricultural tract along Glen Brook, south of the village center. The lowest point in town is only 240 feet in elevation, where the Green River crosses into Greenfield.

A.2 Geology

The Town of Leyden as we know it today is the result of millions of years of geologic history: great upheavals of the earth's crust and volcanics, and the sculpting power of moving water, ice and wind. This distinctive physical base has determined the distribution of the town's water bodies, its soils and vegetation and its settlement patterns, both prior to and since colonial times. Understanding Leyden's current landscape requires a brief journey back in time and a review of some basic geological concepts.

The earth's crust is a system of plates whose movements and collisions shape the surface. As the plates collide, the earth's crust is compressed and forced upward to form great mountain ranges. In the northeastern United States, the plates move in an east-west direction, thus the mountains formed by their collisions run north to south.

The pressure of mountain building folded the earth, created faults, and produced the layers of metamorphosed rock typically found in New England. Collision stress also melted large areas of rock, which cooled and hardened into the granites that are found in some of the hill towns in Massachusetts today. Preceding the collisions, lines of volcanoes sometimes formed, and Franklin County shows evidence of this in bands of dark rock schist metamorphosed from lava flows and volcanic ash.

Hundreds of millions of years ago, a great continent, known as Pangea, formed through the collisions of plates. Pangea began to break apart almost 200 million years ago, and continues to do so as the continents drift away from each other today. This "continental drift" caused earthquakes and formed large rift valleys, the largest of which became the Atlantic Ocean. The Connecticut Valley was one of many smaller rifts to develop. Streams flowing into the river from higher areas brought alluvium, including gravels, sand, and silt. At the time, the

area that is now the Town of Leyden was located south of the equator. The Dinosaur era had begun, and the footprints of these giant reptiles are still visible in the rock formed from sediments deposited on the valley floor millions of years ago.

By the close of the Dinosaur age, the entire eastern United States, including Leyden, was part of a large featureless plain, known as the peneplain. It had been leveled through erosion, with the exception of a few higher, resistant areas. Today, these granite mountaintops, called monadnocks, are still the high points in this region. Local examples include Mt. Wachusett, Mt. Grace, and Mt. Monadnock in New Hampshire.

As time passed, the less resistant rock of the peneplain eroded to form low-lying areas, while bands of schist remained to form upland ridges. By this time, the Connecticut Valley had been filled with sediment, while streams that would become the Deerfield, Westfield, and Farmington Rivers continued to meander eastward. Later, the westward-flowing streams would become more significant.

A long period of relative quiet in geologic terms followed the Dinosaur era. Then, as the Rocky Mountains were forming in the west eight million years ago, the eastern peneplain shifted upward a thousand feet. As a result of the new, steeper topography, stream flow accelerated, carving deep valleys into the plain. Today, the visible remnants of the peneplain are the area's schist-bearing hilltops, all at about the same one thousand (1000) foot elevation.

Mountain building, flowing water, and wind had roughly shaped the land; now the great glacial advances would shape the remaining peneplain into its current topography. Approximately two million years ago, accumulated snow and ice in glaciers to the far north began advancing under their own weight. A series of glaciations or “ice ages” followed, eroding mountains and displacing large amounts of rock and sediment. The final advance, known as the Wisconsin Glacial Period, completely covered New England before it began to recede about 13,000 years ago. This last glacier scoured and polished the land into its final form, leaving layers of debris and landforms that are still distinguishable.

The glacier picked up, mixed, disintegrated, transported and deposited material in its retreat. Material deposited by the ice is known as *glacial till*. Material transported by water, separated by size, and deposited in layers is called *stratified drift* (Natural Resource Inventory for Franklin County, University of Massachusetts Cooperative Extension; May 1976). The glacier left gravel and sand deposits in the lowlands and along stream terraces. Where deposits were left along hillsides, they formed kame terraces and eskers. Kames are short hills, ridges, or mounds of stratified drift, and eskers are long narrow ridges or mounds of sand, gravel, and boulders.

During the end of the last ice age, a great inland lake formed in the Connecticut River Valley. Fed by streams melting from the receding glacier, Lake Hitchcock covered an area approximately 150 miles long and twelve miles wide, stretching from St. Johnsbury, Vermont to Rocky Hill, Connecticut. Streams deposited sand and gravel in deltas as they entered the lake, while smaller silts and clays were carried into deeper waters.

The bedrock geology of Leyden is considered controversial as a debate ranges over the age of the underlying bedrock. According to information in U.S. Geologic Survey quadrangle maps, and covered well in Leyden's 1986 *Open Space Plan*, the oldest rock in Leyden is the Littleton formation of lower Devonian age. It is similar to the Leyden argillite, named when that rock type was encountered in the eastern part of town. The Littleton formation consists of dark-grey phyllite or phyllitic schist that contains quartzite layers. The rock begins as a narrow strip in the northwest corner of the town and widens as it extends south. It underlies the eastern border region and about a quarter of the total town area.

Several other bedrock types are also found within the town. The Gile Mountain formation, of lower Devonian age, is a coarse grey schist with garnets intermixed with quartzite and a few beds of marble. This rock type underlies the central portion of Leyden. The Waits River Amphibolite formation is schist with dark-green or black hornblende prisms lying in parallel planes. It also contains quartz grains, garnets, and a number of sparse minerals. This rock primarily underlies the northwest corner of the town. The Waits River formation is a predominately quartz-mica schist with garnets and is layered with beds of marble and gneiss. This rock type occurs in the western quarter of town and is associated with marble veins there. Although no rock outcrops of Sugarloaf formation have been discovered in the southeast section of Leyden, this rock type is presumed to underlie this area. It is a conglomerate-sandstone with a large quantity of red-colored feldspar.

As reported in the previous *Open Space Plan* and by the U.S.G.S. maps, the surficial geology of Leyden has been determined by the area's glacial activity. Most of Leyden is covered by glacial deposits. The hills are layered with till but many have bare rock exposures where glacial ice has scraped the surface, removing soil and wearing down bedrock. The valleys have many deposits of glacial outwash and alluvium that is more recent. Leyden's topography is due to stream erosion of rocks that have been significantly deformed. The area was uplifted at least twice, with increased stream gradients resulting in erosion and downward cutting of river bottom materials. This action resulted in the deep carving of the rocks on Leyden's valley floors. The till that covers most of Leyden is ground moraine produced when crushed soil and bedrock were deposited beneath glacial ice as it advanced and then receded. Glacial meltwater transported materials and resulted in varying deposits composed of sand, gravel, silt, and clay.

Leyden's surficial geology is an unsorted, unstratified mix of angular rocks and rock fragments. The two types of till found in Leyden both weather to a brown color and are distributed in thick layers occurring on the north sides of hills or as drumlins. An abundance of erratics, which are rocks transported by glacial ice, occur throughout Leyden. Post glacial activity has significantly altered Leyden's topography, as the steep slopes in town contribute to extensive erosion.

A.3 Soils

Soil is the layer of minerals and organic material that covers the rock of the earth's crust. All soils have characteristics that make them more or less appropriate for different land uses.

Scientists classify soils by these characteristics, including topography; physical properties including soil structure, particle size, stoniness and depth of bedrock; drainage or permeability to water, depth to the water table and susceptibility to flooding; behavior or engineering properties, and biological characteristics such as presence of organic matter and fertility (Natural Resource Inventory for Franklin County, University of Massachusetts Cooperative Extension; May 1976). Soils are classified and grouped into associations that are commonly found together.

The soils of Leyden fall into two broad soil group associations. The western and central regions of town, including the Green River and Glen Brook sub-watersheds, are located within the Westminster-Colrain-Buckland association. The eastern edge and southern portion lies within the Nassau-Bernardston-Dutchess association. Because of glacial activity, many small pockets of differing soil types are scattered throughout town.

As Leyden plans for the long-term use of its land, residents should ask the following questions. 1) Which soils constrain development given current technologies? 2) Which soils are particularly suited for recreational opportunities and wildlife habitat? 3) Which soils are best for agriculture? The answers to these questions can help lay a foundation for open space and recreation planning in Leyden. The following provides a description of the soils in Leyden and then examines their impact on agriculture, recreation opportunities, and wildlife habitat. (See also the Prime Farmland and Development Restraints Map at the end of this section.)

The Westminster soils are the predominant soils found on the moderate to steep slopes in Leyden. These soils are extremely rocky and are well to excessively drained. They developed in thin deposits of glacial till derived mainly from gray mica schist over bedrock. The Westminster series consists of well drained, slightly droughty, shallow loams with dull-colored subsoil. This soil is typically forested with a thin, crumbly, black loam surface layer about 4 inches thick, covered by 3 or 4 inches of forest litter in various stages of decomposition. At a depth of about 18 inches, it is underlain by dark gray schist bedrock. Outcrops of bedrock occur 10 to 150 feet apart and stones and boulders are scattered on the surface.

The Colrain soils can be found in nearly level to very steep slopes, but are limited in use due to their extreme stoniness. They are well drained fine sandy loams that are found in loose to compact glacial till. The Colrain soils have a moderate to high moisture holding capacity. If this soil has been tilled, it usually has an 8-inch surface layer of dark grayish-brown loam, thick and very crumbly. Stones 12 to 24 inches in diameter are scattered throughout the soil, with occasional boulders. In less sloping, nonstony areas, the Colrain soils are suitable for apple orchards, silage corn, and hay.

The Buckland soils consist of moderately well drained, fine sandy loams. These soils formed in compact glacial deposits. At a level of 20 inches, the Buckland soils have a hard layer that is difficult to dig. Although water passes through these soils rapidly, the Buckland soils are considered wet and seepy because water moves slowly through the dense substratum.

The Nassau soils consist of slightly droughty, shallow silt loams developed in thin deposits of glacial till derived from slate and phyllite. They are found on gently sloping to steep, rocky ridges. The texture is silt loam and heavy loam and in most places the soils are extremely rocky. The depth to bedrock is commonly about 15 inches, with rock outcrops usually about 50 feet apart.

The Bernardston soils consist of well-drained silt loams that formed in compact glacial deposits derived from phyllite. They have a hard layer at a depth of approximately 20 inches and are found in gently sloping and steep uplands in town. The soils retain moisture well, so they warm slowly in spring but seldom suffer from drought in summer heat.

The Dutchess Soils consists of well-drained silt loams that also formed in glacial deposits made of black slate and phyllite. They are extremely stony on the surface with large stones only 10-15 feet apart. Bedrock is commonly found at a depth of 36 inches. These soils have the ability to retain moisture and are not susceptible to drought during summer. The less sloped areas are well suited for silage and forage crops.

A. 3.1 Soils That Constrain Development

Of the six predominant soil types found in Leyden, the only two that are rated as having only a slight or moderate limitation for development of septic systems, if slopes are not over 15 percent, are the Colrain and Dutchess soils. The Bernardston and Buckland soils have hardpan within 30 inches of the surface, rendering them a severe limitation for septic installation, but acceptable for residential homesites if sewer lines are available. As Leyden has no wastewater treatment facilities and no plans to install any, these soils are also deemed unacceptable for development. The Nassau and Westminster soils have hardpan layers located at 18 inches and 24 inches depth respectively, contain bedrock ledge, and thus are not suitable for septic systems or residential homesites. As previously noted, the Westminster soils are the predominant soils found on the moderate to steep slopes in Leyden.

A.3.2 Soils Suited for Recreational Activities and Wildlife Habitat

Different recreational uses are constrained by different soil and topographical characteristics. Sports fields require well-drained soils and level topography, whereas lands with slopes greater than 25 percent are attractive to outdoor recreational users such as hikers, mountain bikers, and snowshoers. The soils in town, which support wildlife habitat, are those that are a constraint to development. Where soils prevent building or farming activity due to poor drainage, steep slopes, or bedrock ledge, forests can thrive and offer habitat for wildlife.

The only soils of the main six categories listed as well suited to recreational sports fields are the Colrain soils. These soils are rated as having only a moderate limitation for athletic fields if the slopes are less than 8 percent. All the other main types are a severe limitation to this type of development due to high water tables and slowly permeable hardpan.
The Westminster-Colrain-Buckland soils are found on forested, rocky, gently sloping to steep hills and in the narrow valleys along the town's fast flowing streams. The Westminster soils are shallow and have many rock ledges and outcrops, the Colrain soils are deep and

well drained and are more gently sloping, and the Buckland soils are moderately well drained and have a hard layer in the subsoil.

A.3.3 Soils for Agriculture

The Natural Resources Conservation Service (NRCS) of the U.S. Department of Agriculture classify soils according to their suitability for agriculture. NRCS maintains detailed information and maps on agricultural soils.

NRCS defines prime farmland as land with the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops and that is available for these uses (USDA, NRCS, *National Soil Survey Handbook*; 2001). Prime soils produce the highest yields with the fewest inputs, and farming in these areas results in the least damage to the environment. Unique farmland is land other than prime farmland used for the production of high-value food and fiber crops. Unique farmland has a special combination of soil quality, location, growing season, and moisture supply. These agricultural soils are a finite resource. If the soil is removed, or the land is converted to another use, the capacity for food and fiber production is lost.

Although Leyden has no large agricultural tracts of fertile soil like that found in the Connecticut River Valley, scattered prime farmland soils have contributed to the town's economy throughout its history and continue to be in use throughout the town today. The more common soils that constitute Leyden's prime and unique agricultural land include the Bernardston, Westminster, Colrain, and Buckland soils. The Colrain soils are deep and well drained and are found in gently sloping areas whereas the Buckland soils are moderately well drained fine sandy loams found in nearly level to moderately steep slopes. All of these soils are considered suitable for dairy farming and the Colrain-Buckland soils support apple orchards as well.

These prime farmland soils can be found along most of Leyden's north-south roadways: within Beaver Meadow; along East Hill Road; in the valley of East Glen Brook north of East Glen Road; at the intersection of Bell Road and West Leyden Road; along South County Road; in the lowlands of the southern part of town along the boundary with the Town of Greenfield; and in scattered sites throughout town.

The characteristics that make prime farmland soils suitable for agriculture also make them easy to develop. Large tracts of level, well-drained farmland are attractive to developers because the cost of installing roads and other infrastructure is relatively low. It would be appropriate for residents interested in conserving these lands to consider all farmland soils to be rare, valuable, and vulnerable to development.

A.4 Analysis

Overall, Leyden is a forested landscape with small, scattered farms, many rivers, brooks, and wetlands, and residential development. The scenic values come from forested hills, pastoral landscapes, both flat and fast running sections of the Green River and many brooks, and

views of the Connecticut River Valley. The value of the landscape for scenic views, wildlife habitat, and recreation could be diminished by development. Understanding the topography, geology and soils of Leyden will help the Town make decisions about protecting important natural resources and siting development in appropriate locations.

Leyden residents may want to develop a conservation plan to protect remaining prime forest and farmland soils for future wood fiber and food production while preventing the loss of these soils through development.

The ecological services and cultural amenities that Leyden's ridgelines, hills, and soils provide cannot be replaced. They will be diminished, however, with neglect and poor planning. Adopting ridge protection bylaws and exploring ways to facilitate the protection of prime farm and forest land soils will be required if the residents of Leyden want to sustain the Town's rural character and a local economy that includes recreational activities and agricultural and forestry operations.

B. LANDSCAPE CHARACTER

Leyden is located along three ranges of north-south uplands and the character of the landscape is rugged. The landscape is composed of high upland hills, steep slopes, fast flowing streams, hardwood forests and abundant wildlife. In addition to this ruggedness, the gentler lands found in Beaver Meadow and along upland ridges have historically afforded residents the opportunity for productive farming. The swift waters of the Green River and numerous brooks offered power for small grist and saw mills. The town's upland village center is located near the geographic center of town, affording radial connections along a north-south corridor between Greenfield and Vermont, and east-west connections between Leyden and Colrain. A secondary village in West Leyden is located next to the Green River, along the town's boundary with the Town of Colrain. For much of its length, the Green River boasts a steep and relatively undeveloped river corridor. The town is laced with a network of named and unnamed brooks. Glen Brook in particular offers an exceptional water resource for the town and for Greenfield as state-designated Outstanding Resource Waters for a drinking water supply.

The Town of Leyden is unique in the region because it combines a rugged rural landscape with a panoramic view shed, a low population density, little commerce, and no industry. Leyden's numerous brooks and the Green River drain this steep, rugged landscape and provide unique riparian habitat for several rare and endangered species. Woodland areas, some containing large tracts of unbroken forestland, surround the agricultural fields and pastures in town. The historic and fertile Beaver Meadows are a classic example of beaver dam-meadow creation. Leyden's upland location and lack of large fertile agricultural tracts contributed to the late development of the town. The town has one of the smallest land areas in the county and is situated within ten miles of Route 91 and Route 2, the two major north-south and east-west traffic corridors in western New England. Until recently, nineteenth century historical agricultural landscapes have remained largely undeveloped and intact. Old

yet active farms with their fields, farmhouses, barns, stonewalls and hedgerows represent one of Leyden's historical settlement patterns. Residential development of roadside lots built on once cultivated land is changing that pattern.

C. WATER RESOURCES

C.1 Watersheds

The Town of Leyden lies in the Connecticut River watershed which encompasses the Deerfield and Green River and Shattuck Brook Basins (sub-watersheds). The Green River, the boundary between Leyden and Colrain, is a major tributary to the Deerfield River which drains directly to the Connecticut River. Shattuck Brook flows east directly to the Falls River through the Town of Bernardston, where it enters the Connecticut River below the dam. (See the Water Resources Map at the end of this section.)

The Connecticut River is New England's largest watershed (11,260 square miles) and longest river (410 miles). The Connecticut is nationally significant. In 1991, Congress established the Silvio O. Conte National Fish and Wildlife Refuge, the only refuge in the country to encompass an entire watershed – the Connecticut River watershed is in New Hampshire, Vermont, Massachusetts and Connecticut. In 1998, the Connecticut River became one of only fourteen rivers in the country to earn Presidential designation as an American Heritage River.

The Green River is a major tributary of the Deerfield River, which in turn is one of the Connecticut River's 38 major tributaries and a river of statewide importance significance in Massachusetts. The headwaters of the Green River are located in Guilford, Vermont; the headwaters of the Deerfield River are in Searsburg, Vermont.

While this section focuses on waters within the Town of Leyden, it is important to remember that improvements in water quality in the Green River and other brooks and streams in Leyden have impacts beyond the Town's borders. By "drinking locally" and thinking regionally, Leyden residents can ensure the future of its own groundwater quality and of the drinking water supplies of neighboring Greenfield, while maintaining the quality of the Green and Deerfield Rivers and contributing to recovery of the Connecticut River.

C.2. Surface Water

The Town of Leyden has approximately 96 acres of fresh open water. The Green River is the Town's western border with Colrain.

The following is an inventory describing Leyden's rivers, streams, brooks, and ponds. It focuses on the extent of the public access and recreational value of these waters as well as

any water quality issues. The 2008 Massachusetts List of Integrated Waters prepared by the Division of Watershed Management, Department of Environmental Protection (DEP) for the Deerfield River is used as a source document for the Green River and all listed surface waters within the Town of Leyden.

C.2.1 Green River

The Green River watershed is located in southern Vermont and northwestern Massachusetts. It drains 82.8 square miles, which includes portions of Colrain, Leyden, Bernardston, Shelburne and Greenfield as well as five communities in Vermont. The total length of the Green River is 28.3 miles, 16.3 miles of which are in Massachusetts. The Green River forms the border between Colrain and Leyden for 8.5 miles. Many small brooks contribute to its flow along the way and at one time powered small grist and saw mills.

The River itself originates in southeastern Vermont on the south side of the Mt. Olga-Hogback Ridge in the Town of Marlboro, Vermont. The Green River enters Massachusetts in the Town of Leyden and forms the town's western border with the Town of Colrain. It flows south and east through a steep, narrow valley for much of its length and, as it enters the Town of Greenfield, its gradient lessens and the floodplain widens.

The Green River boasts an undeveloped river corridor, in part due to its steep terrain and geologic features. Most roads in the watershed remain unpaved, with minimal riverside development. Most of the watershed is forested, although along the Massachusetts section, agricultural and open land can be found as well. The drainage area of the Leyden/Colrain segment is approximately 14.8 square miles. Land-use estimates (top three) for the subwatershed are: Forest 80.2%, Agriculture 10%, and Residential 4.6%.

Only as the river reaches the Town of Greenfield does it begin to experience some urban development. Given this pristine character, it is the only river in the Deerfield River Watershed designated as an "Undeveloped River Corridor" by National Park Service standards for the purpose of a nationwide inventory of Wild and Scenic Rivers (Green River Preservation Alliance; 1996).

The Green River watershed provides many opportunities for recreational use. Swimming, fishing, whitewater boating, hiking, biking, horseback riding, hunting, cross country skiing and snowmobiling are popular and common in the watershed.

The Massachusetts Department of Environmental Protection has given the Green River a Class B, Cold Water Fishery, High Quality Water designation from the Vermont-Massachusetts border to the Greenfield Wastewater Treatment Plant. The Green River is part of Greenfield's water supply system and the MA DEP Drinking Water Program has recommended that the segment in Leyden/Colrain be reclassified as a Class A water body in the next revision of the Massachusetts Water Quality Standards. The Greenfield water supply dam is just downstream from the Colrain/Greenfield town line near the covered bridge on Eunice Williams Drive.

Area municipal officials and residents have worked hard to improve the water quality of the Green River. The Town of Greenfield Department of Public Works continues to work with the Town of Guilford, VT to address concerns regarding an auto junkyard located along the banks of the Green River in Guilford to insure that vehicles be removed from the flood plain and that stormwater BMPs be implemented at this site (Shields 2001). The 2003 Deerfield River Watershed Landfill Assessment Study by Fuss and O'Neill identified an area of chronic dumping in the Vermont to Greenfield segment along Green River Road in Colrain. Also, annual river cleanups by volunteers yield household appliances, household trash, construction debris, paint cans, and furniture to deal with illegal dumping in this reach of the River.

Once a river, brook or lake is identified as impaired, DEP is required by the Federal Clean Water Act to essentially develop a "pollution budget" designed to restore the health of the impaired water body. This process develops a Total Maximum Daily Load (TMDL) standard, the maximum amount of pollutant that can be discharged to the water and still meet water quality standards. Then the process identifies the pollution causes and sources, from both point and non-point sources, and develops a plan to meet the water quality goal.

Table 4-3: Summary of Data from MA DEP 2000 Water Quality Assessment Report

Location Segment ID #	Aquatic Life	Fish Consumption	Primary Contact (e.g. swimming)	Secondary Contact (e.g. boating)	Aesthetics	Overall Ranking of Segment
Vermont line, Colrain to Greenfield water supply dam (north of Eunice Williams Road), Greenfield. (formerly part of MA33-09) (8.5 miles) MA33-30_2008	**SUPPORT* 8.5 mile reach**	**Not Assessed**	**Not Assessed**	**Not Assessed**	**SUPPORT***	**Class B, Cold Water Fishery** The MA DEP Drinking Water Program recommends that the segment in Leyden/ Colrain be reclassified as a **Class A** water body in the next revision of the MA Water Quality Standards

* "Alert Status" issues identified, because of illegal dumping.
Source: Deerfield River Watershed 2000 Water Quality Assessment Report; Massachusetts Department of Environmental Protection (published in 2004).

Recommendations in the Deerfield River Watershed 2000 Water Quality Assessment Report include the following for the Leyden/Colrain reach of the Green River:

- Conduct water quality and biological monitoring in this segment of the Green River to more completely assess designated uses. In particular, fish population sampling should accompany the macroinvertebrate sampling effort. Due to the wide nature of this segment reach fish sampling should employ multiple crews or a barge-mounted electrofishing unit.
- Investigate possible impacts to aquatic life from potential nonpoint sources of pollution, including the large auto junkyard along the Green River in Guilford VT.
- Support the recommendations of the Army Corps of Engineers (ACOE) Green River Feasibility Study and assist the Town of Greenfield and others in securing funding to implement the recommendations of the study.
- Encourage local stewardship/resource protection efforts by supporting the Deerfield River Watershed Association (DRWA) volunteer water quality monitoring program and annual river clean-ups by Greenfield Community College, DRWA and Connecticut River Watershed Council (CRWC).
- Continue to address the trash dumping problem on Green River Road.
- The Towns of Leyden and Colrain should participate in the Deerfield River Watershed Regional Open Space Plan, which was funded by the Massachusetts Watershed Initiative/Deerfield River Watershed Team and conducted by the Franklin Regional Council of Governments. Through this plan the towns can work cooperatively with other watershed communities to prioritize regional open space and recreational land acquisitions and protection goals, including water resources.
- In order to prevent degradation of water quality in the Green River sub-watershed it is recommended that land use planning techniques be applied to direct development, preserve sensitive areas, and maintain or reduce the levels of impervious cover. The Towns of Leyden and Colrain should support recommendations of their recently developed individual municipal open space plans and/or Community Development Plans to protect important open space and maintain their communities' rural character.
- The rural roads that cross over and/or are in close proximity to watercourses should be identified. Field reconnaissance should be performed to evaluate their potential for impacting the water and habitat quality of these adjacent watercourses. Implementation of best management practices, as described in Unpaved Roads BMP Manual (BRPC 2001), should then be encouraged as appropriate.
- A study of Japanese knotweed infestations was conducted in 2003 by the DRWA. It identified small patches of knotweed upstream of West Leyden. Results of this study should be consulted and local efforts to help manage current and future infestations of this invasive plant should be encouraged (Serrentino 2003).

C.2.2 Other Rivers and Brooks

There are eight tributaries to the Green River in Leyden. From north to south, these include Thorne Brook, Harris, West Hollow Brook, Hibbard Brook, an un-named stream, Kately Brook, Brandy Brook, Glen Brook, and East Glen Brook.

Thorne Brook
Thorne Brook originates in Guilford, Vermont and flows parallel to River Road in the northwestern section of Leyden. One of its tributaries begins in the uplands north of Gates Hill. The Brook generally flows southwestward to its confluence with the Green River. Over the years, concerns have been raised regarding contamination with lead and copper from a nearby rifle range in a tributary to Thorne Brook. Initial testing showed levels exceeding allowances, but subsequent tests were within tolerance levels.

Harris Brook
Harris Brook originates at a pond in northwest Leyden, below Gates Hill, and runs along Gates Road. It flows westward before emptying into the Green River, approximately one third of a mile south of Thorne Brook.

West Hollow Brook
West Hollow Brook originates near the West Leyden Cemetery and parallels the West Leyden Road as it flows to its confluence with the Green River, near the site of the historic West Hollow Parish.

Hibbard Brook
Hibbard Brook originates near Pelog's Bog, in the uplands north of the West Leyden Cemetery. Surrounded on three sides by towering hillsides, it flows southwesterly to its confluence with the Green River.

Kately Brook
Kately Brook originates in Leyden's uplands on the east side of Kately Hill. It flows in a southeastern direction before changing its course to flow southwesterly to meet the Green River.

Brandy Brook
Brandy Brook is a tributary to Glen Brook. It originates in the highlands west of Leyden State Forest before traveling southward to meet with the Glen Brook near Pearl Rhodes Elementary School.

Glen Brook
Glen Brook begins in north-central Leyden in a wetlands area bordering Greenfield Road. It flows southeast, then south before connecting with Brandy Brook and running south to the Leyden Glen Reservoir. Eventually it flows to meet the Green River.

East Glen Brook
East Glen Brook originates south of Frizzell Hill Road and flows southeast, then southwest, before converging with the Glen Brook at the Leyden Glen Reservoir.

There are four brooks in Leyden that drain to the Connecticut River via Bernardston:

Beaver Meadow Brook
Beaver Meadow Brook drains northern Leyden in two wetland areas east of North County Road before it meanders across the historic and agriculturally rich Beaver Meadow. As part of the Connecticut River Watershed, the brook flows in an eastward direction to converge with the Keets Brook, before it enters the Shattuck Brook.

Keets Brook
Keets Brook originates in Guilford, Vermont and flows south before meeting with the Beaver Meadow Brook.

Shattuck Brook
Shattuck Brook begins in northeastern Leyden where the Keets Brook and Beaver Meadow Brook converge together. It drains eastward into Bernardston, eventually flowing into the Fall River.

Couch Brook
Couch Brook originates in the eastern highlands of Leyden, in a pond along East Hill Road, near the intersection with North Bernardston Road. The brook flows eastward into Bernardston where it drains into the Falls River.

C.2.3 Class A Waters

In the Town of Leyden, the Leyden Glen Reservoir and its tributaries have been designated as Class A water sources by the Massachusetts Department of Environmental Protection. As such, these waters can be used as public water supplies. The Leyden Glen Reservoir serves the Town of Greenfield as one of its three primary drinking water sources. Class A water sources are also considered excellent habitat for fish, other aquatic life and wildlife. They have aesthetic value and are suitable for recreation purposes compatible with their designation as drinking water supplies. These waters are designated for protection as Outstanding Resource Waters under Massachusetts 314 CMR 4.04 (Mass. DEP website; 2002).

C.3 Flood Hazard Areas

Flooding along rivers is a natural occurrence. Floods happen when the flow in the river exceeds the carrying capacity of the channel. Some areas along rivers flood every year during the spring, while other areas flood during years when spring runoff is especially high, or following severe storm events. The term "floodplain" refers to the land affected by flooding from a storm predicted to occur at a particular interval. For example, the "one hundred-year floodplain," is the area predicted to flood as the result of a very severe storm that has a one percent chance of occurring in any given year. Similarly, the 500-year floodplain is the area predicted to flood in a catastrophic storm with a 1 in 500 chance of occurring in any year.

Leyden is not part of the National Flood Insurance Program so detailed floodplain maps are unavailable. The Federal Insurance and Mitigation Administration (FIMA) last issued a map for Leyden in 1975 that denotes special flood hazard areas. According to the Natural Resource Conservation Service, the shaded areas approximate the one hundred-year floodplain found along designated waterways. As expected, the potential flood hazard sections are adjacent to Leyden's primary water resources; along the entire length of the Green River, especially at confluences with contributing tributaries; in Beaver Meadow for about 3,000 feet along Beaver Meadow Brook; and along the Glen Brook, from approximately 2,000 feet north of the Leyden Glen Reservoir to the Greenfield town line.

C.4 Wetlands

Wetlands are transitional areas where land-based and water-based ecosystems overlap. Inland wetlands are commonly referred to as swamps, marshes and bogs. Technically, wetlands are places where the water table is at or near the surface or the land is covered by shallow water. Sometimes, the term wetland is used to refer to surface water as well.

Historically, wetlands have been viewed as unproductive wastelands, to be drained, filled and "improved" for more productive uses. Over the past several decades, scientists have recognized that wetlands perform a variety of extremely important ecological functions. They absorb runoff and prevent flooding. Wetland vegetation stabilizes stream banks, preventing erosion, and trap sediments that are transported by runoff. Wetland plants absorb nutrients, such as nitrogen and phosphorus, which would be harmful if they entered lakes, ponds, rivers and streams. They also absorb heavy metals and other pollution. Finally, wetlands are extremely productive, providing food and habitat for fish and wildlife. Many plants, invertebrates, amphibians, reptiles and fish depend on wetlands to survive. Wetlands have economic significance related to their ecological functions: it is far more cost-effective to maintain wetlands than build treatment facilities to manage stormwater and purify drinking water, and wetlands are essential to supporting lucrative outdoor recreation industries including hunting, fishing and bird-watching.

In recognition of the ecological and economic importance of wetlands, the Massachusetts Wetlands Protection Act is designed to protect eight functional "interests:" public and private water supply, ground water supply, flood control, storm damage prevention, prevention of pollution, land containing shellfish, fisheries, and wildlife habitat. This law defines and protects wetland resource areas including: banks of rivers, lakes, ponds and streams and their associated wetlands, lakes and ponds, lands subject to flooding, and "riverfront areas" within two hundred feet of any stream that runs all year. Local Conservation Commissions are responsible for administering the Wetlands Protection Act. Some towns also have their own, local wetlands regulations.

The National Wetlands Inventory (NWI) maps many of Leyden's wetlands (*see Water Resources map*). Several wetlands can be found in uplands in isolated forested areas. They can be found in the forests along Thorne Brook, north of Beaver Meadow Brook, north of Frizzell Hill Road, west of Mid County Road, west of North County Road, and in scattered

sites throughout the town. The NWI also indicates that a number of the town's wetlands are adjacent to the town's roadways. Three well-known wetlands in this category are:

Pelog's Bog
Pelog's Bog, one of the most significant historic upland wetlands in the Town of Leyden, is located south of Gates Hill and north of West Leyden Road. It is surrounded on three sides by steep upland slopes.

Brattleboro Road Wetland
The Brattleboro Road wetland is adjacent to the upper reach of Glen Brook. It is approximately one half mile long and lies in the lowlands between two of Leyden's three upland hill ranges, at the intersection with Frizzell Hill Road.
Bell Road Wetlands
The Bell Road wetlands are located Gates Road intersects with Bell Road.

Also, East Hill Road is adjacent to several wetlands. Many of the town's wetlands exist in association with brooks or the Green River. NWI shows wetlands along the Green River south of Gates Road and at the conjunction with Workman Brook. Beaver Meadow Brook and its wetlands are another familiar example. Wetland areas also feed the headland waters of Glen Brook and Brandy Brook.

C.4.1 Vernal Pools

Vernal pools are temporary bodies of fresh water that provide critical breeding habitat for many vertebrate and invertebrate wildlife species. They are defined as "basin depressions where water is confined and persists for at least two months during the spring and early summer of most years, and where reproducing populations of fish do not survive." Vernal pools may be very shallow, holding only 5 or 6 inches of water, or they may be quite deep. They range in size from fewer than 100 square feet to several acres (Natural Heritage & Endangered Species Program, Massachusetts Division of Fisheries & Wildlife, *Massachusetts Aerial Photo Survey of Potential Vernal Pools*; Spring 2001). Vernal pools are found across the landscape, anywhere that small woodland depressions, swales or kettle holes collect spring runoff or intercept seasonal high groundwater, and along rivers in the floodplain. Many species of amphibians and vertebrates are completely dependent on vernal pools to reproduce. Loss of vernal pools can endanger entire populations of these species.

The state's Natural Heritage and Endangered Species Program (NHESP) has predicted the location of vernal pools statewide based on interpretation of aerial photographs. NHESP believes that its method correctly predicts the existence of vernal pools in 80 to 90 percent of cases. They acknowledge, however, that the method probably misses smaller pools. In Leyden, NHESP has identified 14 potential vernal pools.

In addition to identifying potential vernal pools, NHESP certifies the existence of actual vernal pools when evidence is submitted to document their location and the presence of breeding amphibians that depend on vernal pools to survive. At this date, the existence of two vernal pools has been certified by the State Natural Heritage Endangered Species

Program within the Town of Leyden (see the Water Resources Map at the end of this section). The first, certified in 2006, is located in the northwestern section of Leyden, off North County Road near Gates Hill. The second vernal pool was certified in 2009 and is located near the Green River at the intersection of River and West Leyden Roads. Certified vernal pools are protected by the Massachusetts Wetlands Protection Act and by additional state and federal regulations

Vernal pools are easiest to find by listening for the mating choruses of frogs and toads in early spring. The pools teem with life, and are wonderful places to teach children about the natural world. The town may want to identify vernal pools, provide landowners with information on their ecological importance, and encourage certification to protect these unique ecosystems. (See Appendix E for NHESP's *Guidelines for Certification of Vernal Pool Habitat*.)

C.5 Potential Aquifers and Recharge Areas

Aquifers are composed of water-bearing soil and minerals, which may be either unconsolidated (soil-like) deposits or consolidated rocks. Consolidated rocks, also known as bedrock, consist of rock and mineral particles that have been welded together by heat and pressure or chemical reaction. Water flows through fractures, pores and other openings. Unconsolidated deposits consist of material from the disintegrated consolidated rocks. Water flows through openings between particles.

As water travels through the cracks and openings in rock and soil, it passes through a region called the "unsaturated zone," which is characterized by the presence of both air and water in the spaces between soil particles. Water in this zone cannot be pumped. Below this layer, water fills all the pores in the "saturated zone." The water in this layer is referred to as "groundwater." The upper surface of the groundwater is called the "water table" (Masters, Gilbert. *Introduction to Environmental Engineering and Science, Second Edition*; 1998).

The route groundwater takes and the rate at which it moves through an aquifer is determined by the properties of the aquifer materials and the aquifer's width and depth. This information helps determine how best to extract the water for use, as well as determining how contaminants, which originate on the surface, will flow in the aquifer.

Aquifers are generally classified as either unconfined or confined (EPA and Purdue University; 1998). The top of an unconfined aquifer is identified by the water table. Above the water table, in the unsaturated zone, interconnected pore spaces are open to the atmosphere. Precipitation recharges the groundwater by soaking into the ground and percolating down to the water table. Confined aquifers are sandwiched between two impermeable layers (Masters; 1998). Almost all the public wells in Massachusetts, including those in Leyden, and many private wells tap unconfined aquifers (Mass. Audubon Society; 1985). Wells that rely on confined aquifers are referred to as "artesian wells."

According to MassGIS and US Geological Service (USGS) documents, Leyden does not contain any areas considered to be large high-yield aquifers, defined as an aquifer with the

potential to provide a pumping volume of 25 to 1,000 gallons per minute *(see Water Resources Map)*. However, Leyden's surficial geology does have characteristics that support low to medium yield aquifers. A low-yield aquifer provides a yield of between 0 and 50 gallons per minute. According to MassGIS and USGS, the following areas support low-yield aquifers:

- The entire Green River, especially the three-mile segment between the confluence with Thorne Brook and Kately Brook;
- Green River, from its confluence with Colrain's Browning Brook to the Greenfield town line;
- Thorne Brook northeast of River Road;
- An area approximately one mile long in Beaver Meadow;
- An area approximately one half mile long on Keets Brook, south of the town line with Guildford, Vermont; and
- An area about one and one half miles long on the town's southern border with Greenfield, which is part of the large Greenfield aquifer.

The areas that contribute to public water supply wells are known as recharge areas. The Massachusetts Department of Environmental Protection (DEP) strictly regulates an area within a 400-foot radius of public water supply wells, known as the "Zone I," and land uses in this area are restricted to water supply related activities only. Primary recharge areas are determined by hydrological studies involving pump tests and wells that monitor the level of groundwater in proximity to the public water supply well. The DEP also regulates an Interim Wellhead Protection Area (IWPA), although this area is less vulnerable and encompasses a larger area around a wellhead. An IWPA is that area of an aquifer, which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated, like a drought.

The Pearl Rhodes Elementary School water supply has a Zone I of 177 feet and an Interim Wellhead Protection Area (IWPA) of 472 feet. The Zone I has activities unrelated to the protection of water, but the school's activities are grandfathered under its registration. As a consequence of these activities, the school must monitor for possible Volatile Organic Compounds (VOCs). Currently, the Town of Leyden does not own the entire Zone I protective radius around this wellhead. The school and the recreation area behind it appear to be the only land uses within the IWPA, except for the roadway.

Following an evaluation conducted by the DEP in September of 2000, the DEP's Division of Water Supply issued a letter recommending protective measures for the Zone I of the school's well. Because a number of activities take place within this protective zone, the DEP recommended:

- Moving the location of vehicular parking away from the Zone I and monitoring it closely;
- Limiting use of deicing salts in winter;
- Maintaining a routine schedule to pump the septic tank regularly;
- Eliminating herbicides, pesticides, or fertilizers on adjacent lawns and fields;

- Educating all staff about the need to properly store and dispose of hazardous chemicals (petroleum products, paints and thinners, lawn and garden chemicals); and
- Erecting source protection signs around the Zone I of the well.

The Leyden Highway Department is no longer using deicing salts in the parking areas to reduce the threat of contamination of the Zone I area around the school wellhead. Also, lands across the street from the school were donated to the Town, which might help in the protection of the wellhead in the future.

According to the DEP, the roadway poses a potential threat as it is also within the Zone I. Deicing salts from highway maintenance could possibly percolate into the water table. In addition, the location of the school's well at the intersection of Brattleboro and Greenfield Roads may constitute a threat if a motor vehicle accident occurred within the Zone I, particularly if the vehicle was a truck transporting fuel.

C.6 Surface Water Reservoirs

The Greenfield Water District maintains the five-acre Leyden Glen Brook Reservoir off Greenfield Road as one of its five sources of drinking water for the Town of Greenfield. The reservoir and its entire watershed are designated as a Class A water body, due to its outstanding quality. In 2001, the Leyden Glen Brook Reservoir water production was 208 million gallons with an average daily use of 57,000 gallons, and a storage capacity of 45 million gallons. Although the Town of Greenfield owns land immediately surrounding the Leyden Glen Brook Reservoir, this surface water source is not considered to be fully protected because the land surrounding the brooks which drain into the reservoir are not owned or controlled by the municipality using them. Large tracts of land to the north of the reservoir are forested, most of which are permanently protected from future development.

The DEP completed a Source Water Assessment and Protection (SWAP) Report for Greenfield in 2003, which designates a Zone A area for critical protection of the reservoir water source. The Zone A is the area 400 feet from the edge of the reservoir and 200 feet from the edge of all the streams and rivers draining into it. The watershed for the reservoir includes over 3,000 acres of land in Leyden.

C.7 Potential Sources of Public and Private Drinking Water Supply Contamination

The DEP listed four broad categories of potential contamination in the SWAP Report for the Leyden Glen Brook Reservoir. Individual homeowners should be aware that these threats are also viable for the private drinking wells maintained by Leyden residents. Currently, no coordinated program exists to monitor or track water quality of private wells in Massachusetts, but could be done by the Board of Health in Leyden. It is important to note that these are potential sources of contamination only if the contaminants are managed improperly. The four categories are:

- Agricultural threats, which include the improper handling or storage of manure, fertilizer, pesticide, and forestry threats due to erosion caused by not following best management practices (BMPs), or spills due to equipment or materials leaks;
- Commercial activity threat, which in the watershed of the Leyden Glen Reservoir includes cemeteries and junk yards;
- Residential land use threats including possible fuel oil spills and the improper handling or storage of pesticides and hazardous chemicals; and,
- Miscellaneous threats including materials stored in aboveground and underground storage tanks, deicing materials, oils, and chemicals associated with roadways and vehicles, debris, pet waste, and chemicals in stormwater runoff.

The SWAP Report also notes the presence of two facilities that generate hazardous waste adjacent to the water supply protection area, the town's highway DPW site and a repair garage. While these facilities are not registered through a permitting process with the DEP as generators of hazardous waste, the DEP noted that both had very good hazardous materials management.

D. VEGETATION

Plants are a critical component of ecosystems in Leyden. Plants convert solar energy into food, which supports all animal life. Plants cycle energy through the ecosystem by decaying, by removing carbon from the atmosphere and by shedding oxygen. Plants help moderate temperatures and act as shelter and feeding surfaces for herbivores, omnivores, and carnivores.

Plants and animals together make up *natural communities*, defined as interacting groups of plants and animals that share a common environment and occur together in different places on the landscape (NHESP; 2001). Over the past decade, ecologists and conservationists in Massachusetts have devoted increasing effort to studying and protecting these natural communities, rather than focusing on individual species. This section and the following section will address both natural communities and their component species.

Forests are one of the town's most important natural resources. The town's forests are diverse, including Northern hardwood forest, high-terrace floodplain forests, rich mesic forests, and northern hardwood-hemlock-white pine forests. This section describes vegetated areas in town and their ecological and economic significance. (See also the Environmental Habitat Map at the end of this section.)

D.1 Forests

Forest areas comprise 9,215 acres or 80 percent of the Town's total land area as of 2005, an increase of approximately 423 acres since 1999, according to MassGIS. The Town includes large blocks of contiguous forest which provide critical habitat for many wildlife species as

well as providing for many of Leyden's available recreational opportunities. (See the inset on the Plant and Wildlife Habitat Map for the location of these large blocks of contiguous forest.)

Much of the Town's forestland is permanently protected, particularly in the southern and eastern areas of town. There are 511 acres of privately owned, permanently protected forestland in Leyden. In addition, there are 849 acres of publicly owned forestland protected by state conservation agencies. This state-owned land includes the Leyden Wildlife Management Area (WMA), consisting of 772 acres owned by the Department of Fish and Game that is located in the far southern area of Town. The WMA is accessible through a right of way at the Greenfield Reservoir off of Oak Hill Road, Glen Road, and Eden Trail Road. This area is well-maintained and has a high recreation value, including opportunities for hiking and hunting. In addition, the Department of Conservation and Recreation owns the Leyden State Forest, a 60-acre parcel located in the north central area of town off of North County Road. The State Forest offers opportunities for hunting, hiking, and nature observation. (See the Scenic Resources Map for the locations of these important forest resources.)

Leyden is located in the Northern Hardwoods Region (USDA; 1992). This forest type commonly occurs up to an elevation of 2,500 ft. above sea level and prefers fertile, loamy soils and good moisture conditions. In New England, the Northern Hardwoods can be found in Massachusetts in the glacial till soils west of the Connecticut River and in small portions of Maine and Connecticut, as well as most of the forested areas in New Hampshire and Vermont.

The predominant species of the Northern Hardwoods are sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), and American beech (*Fagus grandifolia*). Associated species include red maple (*Acer rubrum*), white ash (*Fraxinus americana*), eastern hemlock (*Tsuga canadensis*), paper birch (*Betula papyrifera*), quaking and big tooth aspen (*Populus tremuloides and P. grandidentata*), eastern white pine (*Pinus strobus*), red spruce (*Picea rubens*), grey birch (*Betula deltoides*), black birch (*Betula nigra*) and red oak (*Quercus rubra*).

D.2 Public Shade Trees, Stone Walls and Scenic Roads

Each of the surveys of town residents for Leyden's Open Space and Recreation Plans, conducted in 2003 and 2009, documented that maintaining the town's rural character is a top priority. In line with that desire, all of Leyden's roads were designated Scenic Roads under M.G.L. Chapter 40, Section 15C by a Special Town Meeting in the fall of 1993. Since that time, the Planning Board, as required by the Scenic Roads Act, has endeavored to ensure a best effort was made by Town officials (Planning Board, Selectboard, Tree Warden, and Highway Superintendent) and residents to maintain and protect public shade trees and stone walls along our public ways.

This effort has sometimes generated tension with various parties emphasizing competing objectives. These include, but are not limited to, dirt road improvements (widening), power line protection, utility pole placement, public safety concerns, etc. In addition only nominal appropriations ($400-500) for the work of the Tree Warden at Annual Town Meeting has meant that only emergency cases are able to be addressed. No planning or maintenance of trees along public ways is undertaken, leaving the town in a reactive posture towards one of its most prized quality of life resources—its public shade trees.

A more proactive approach to these issues, as well as related problems that have to date been totally ignored needs to be considered. Issues such as replacing removed road-side trees; spread of invasive species such as Japanese knotweed along public ways; effects of grading, salting and widening on existing healthy road-side trees need to be addressed in some manner. Establishment of a committee of volunteers to address the above issues and any other related pertinent problems should be considered. It might include representatives of the Highway Department, Selectboard, Tree Warden, Planning Board, Open Space Committee and interested residents. It would be tasked with producing a Scenic Roads Policy that, with public input, might be adopted as a Town Ordinance.

D.3 Unusual Natural Communities

The Natural Heritage and Endangered Species Program (NHESP) of the Massachusetts Division of Fisheries and Wildlife has noted that the Town of Leyden has a number of uncommon ecologically significant natural communities within its borders, which support a number of the state-listed rare and endangered species (NHESP correspondence; 2002). These communities include:

Rich, Mesic Forests

Rich, mesic forests are one type of unusual natural community known to occur in the Town of Leyden. The rich, mesic forest is a nutrient-*rich*, moderately moist (*mesic*) variant of the northern hardwood forest. In the rich, mesic forest the sugar maple is usually dominant and a diverse herbaceous layer is supported by abundant spring ephemerals. It is found in areas of calcium-rich bedrock and alkaline groundwater. In the Northeast, these forests occur at low to moderate elevations below 2,400 feet and usually on the north or east-facing, concave, middle to lower slopes.

Sugar maple (*Acer saccharum*) and/or basswood (*Tilia americana*) are the dominant species of this forest. White ash (*Fraxinus americana*), yellow birch (*Betula alleghaniensis*), butternut-hickory (*Carya cordiformis*), and sweet birch (*B. lenta*) also occur in small numbers.

Rare plants known to occur in Leyden's rich, mesic forests include the Barren Strawberry (*Waldsteinia fragarioides*), a member of the Rose family. It prefers rich wooded areas or semi-open banks, but also does well in cool, wooded areas and in sandy, dry soil. Woodland Millet or Millet Grass (*Milium effusum L.*) occurs on steep slopes within this plant community, where the soil has a high calcium content.

Acidic Graminoid Fen

The acidic graminoid fen is an uncommon high-ranked natural community found in Leyden, which forms along pond margins, slow-moving streams, and at the headwaters of streams or in isolated valley bottoms without inlet or outlet streams. It is a wetland community composed of incompletely decomposed organic matter. Acidic graminoid fens are sedge/sphagnum-dominated peatlands. Shrubs occur in clumps but are not dominant throughout the bogs. Peat mats are quaking and are often unstable.

The Slender Cottongrass (*Eriophorum gracile)*, a rare species considered to be threatened in Massachusetts, can be found in Leyden's acidic graminoid fens. Several rare plants, all native orchids, have not been seen in Leyden since the 1920s and 1930s. Threats to these native orchids include habitat destruction and the fact that only limited habitat is suitable for these species.

High-Energy Riverbank

High-energy riverbank communities are rare in Massachusetts, however they are found in steep gradient, high flood areas on fast-flowing rivers. They typically occur on riverbends and the upstream ends of islands. These communities are created by cobbles, sand and silt being deposited during spring floods. Plants associated with this community vary depending upon the composition of the substrate and the severity of annual flooding. On open cobbles, false dragonhead (*Physostegia virginiana*), cocklebur (*Xanthium strumarium*), beggar's ticks (*Bidens* spp.) and lady's thumb (*Polygonum persicaria*) are dominant. As the amount of sand increases, water horsetail (*Equisetum fluviatile*) and clasping dogbane (*Apocynum sibiricum*) occur. There is also a definitive band of switchgrass (*Panicum virgatum*). In the sandiest environments, mixed grasses of switchgrass, big and little bluestem (*Andropogon gerardii* and *Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*) and goldenrods (*Solidago* sp.) are found. Due to the intense flooding, trees and/or tall shrubs are not able to establish themselves in the high- energy riverbank environment. However, short shrubs such as shadbush (*Amelanchier sanguinea*), silky dogwood (*Cornus amomum*), sandbar willow (*Salix exigua*) and sandbar cherry (*Prunus pumila var. depressa*) can be found on the sandiest sections, which typically border floodplain forests. In Leyden, the high-energy riverbank community is found along the northern reach of the Green River.

Riverside Rock Outcrop

Riverside rock outcrop communities occur on flood-scoured bedrock along rivers. The outcrops may be low or steep along the river's edge, or extending into the river channel with soil accumulated in rock crevices. These areas are regularly disturbed by almost annual flooding and ice scouring, but proximity to the river's edge may alleviate some to the harsh conditions found on sand in open areas. The sparse, mostly herbaceous, vegetation is limited to crevices where soil accumulates. Typically, a mix of only a few plant species will be found per site. Examples are harebell (*Campanula rotundifolia)*, Canadian burnet (*Sanguisorba canadensis*), big blue stem (*Andropogon gerardii*), and goldenrods (*Solidago* spp.). Nonnative species that commonly occur in the Riverside rock outcrop communities are Purple loosestrife (*Lythrum salicaria*) and Canada bluegrass (*Poa compressa*). The riverside rock outcrop community is also found along the Green River.

Northern Hardwood-Hemlock-White Pine

Northern hardwood-hemlock-white pine communities have been inventoried surrounding the high ranked examples of rich, mesic forest, high-energy riverbank, and riverside rock outcrop communities along the Green River. A mix of evergreen and deciduous trees, with sparse shrub and herbaceous layers, dominates the closed canopy. Typically found on north facing slopes and ravines, the community type ranges from stands of pure hemlock to a mix of deciduous forest with scattered hemlocks. Hemlock (*Tsuga canadensis*) can be found in variable combinations with sugar maple (*Acer saccarum*), yellow birch, (*Betula alleghaniensis*), black cherry (*Prunus serotina*), and red oak (*Quercus rubra*). Often scattered among these trees are paper birch (*Betula papyrifera*), aspen (*Populus tremuloides*), and red maple (*Acer rubrum*).

High-Terrace Floodplain Forest

The high-terrace floodplain forest can also be found in Leyden, in the town's southern lowlands along Glen Brook and its tributaries, which drain the southern face of Ball Mountain. Typically, this plant community occurs on raised banks adjacent to rivers and streams, on steep banks along high gradient rivers – particularly in western Massachusetts, on high alluvial terraces, and on raised areas within major-river and small-river floodplain forests. The high-terrace floodplain forest is not subjected to annual spring flooding as it is above the flood zone. In Leyden, these forests are found adjacent to rich, mesic forest communities.

The high-terrace floodplain forest in Massachusetts has a mixture of hardwoods generally associated with floodplains. These include red and silver maple (*Acer rubrum* and *saccharinum*) as well as sugar maple (*Acer saccharum*), shagbark hickory (*Carya ovata*), black cherry (*Prunus serotina*), American elm (*Ulmus americana*), and basswood (*Tilia americana*). Ironwood (*Carpionus caroliniana*) is present in the sub-canopy and is a good indicator of this community. Within the shrub layer, one can find arrowwood (*Viburnum dentatum*), nannyberry (*Viburnum lentago*) and winterberry (*Ilex verticillata*). The herbaceous layer is a mixture of forest ferns and upland herbs characteristic of floodplain forests.

The Natural Heritage and Endangered Species Program (NHESP) has noted that three rare plants, one rare reptile, and one rare fish species can be found in Leyden. These include the Barren Strawberry (*Waldsteinia fragarioides*), and the Wood Turtle (*Clemmys insculpta*). (See Tables 4-4 and 4-5.)

D.4 Agricultural Land

According to MassGIS, in 2005 agricultural land in Leyden, which includes cropland (598 acres), pastureland (700 acres), and orchards and nurseries (59 acres), made up 11.8 percent (1,357) of the town's total land area of 11,505 acres,. Leyden's agricultural land is located primarily along town roads; within Beaver Meadow, along East Hill Road, in the valley along East Glen Road, along Greenfield/County Road, and along West Leyden Road. Numerous other agricultural sites are also scattered throughout town, wherever productive

soils were left by glacial activity or alluvial processes. According to the Community Involved in Sustaining Agriculture (CISA) website (http://buylocalfood.org/), there are three active farms in Leyden, including one dairy farm producing raw cow's milk, a vegetable farm, and one raising grass-fed lamb.

The Massachusetts Land Records website (www.masslandrecords.com) lists three farms in Leyden as participants in the Agricultural Preservation Program (APR), totaling approximately 115 acres. The Massachusetts Historic Commission notes in its *Reconnaissance Survey Report* of Leyden that the town still retains many of its historic Nineteenth Century agricultural landscapes and recommends that they be preserved (1982). The town may wish to encourage farmers to consider the APR program as one way of ensuring that their land remains in agriculture uses.

D.5 Rare, Threatened, and Endangered Plant Species

The Natural Heritage and Endangered Species Program of the Massachusetts Division of Fisheries and Wildlife has designated several "Priority Habitat" areas in the Town of Leyden. A Priority Habitat is an area where plant and animal populations protected by the Massachusetts Endangered Species Act Regulations (321 CMR 10.00) may occur. These areas include:

- Along the banks of the Green River from the Vermont border south to West Leyden Road;
- Along the banks of the Green River west of Katley Hill, south into Greenfield;
- Near an unnamed tributary to Thorne Brook, below the northwest face of Gates Hill;
- Along the banks of an unnamed tributary to Hibbard Brook, southeast of Pelog's Bog, where the power line crosses West Leyden Road;
- Along the banks of Glen Brook from the northern end of South County Road to Brattleboro Road west of East Hill;
- Along the banks of Glen Brook below the old south reservoir, east of Greenfield Road, south to the Greenfield town line and beyond (See the Open Space Map at the end of Section 5).

NHESP has identified 259 native plant species as rare in the Commonwealth, and a number of rare plants have been documented in the Town of Leyden (see Table 4-4). These plants occur in some of the Priority Habitats identified above. Plants (and animals) listed as *endangered* are at risk of extinction (total disappearance) or extirpation (disappearance of a distinct interbreeding population in a particular area). *Threatened* species are likely to become endangered in the foreseeable future. Species of *special concern* have been documented to have suffered a decline that could result in its becoming threatened, or occur in very small numbers and/or have very specialized habitat, the loss of which could result in their becoming threatened (NHESP, 2009). It is important to remember that the northeastern quadrant of Leyden has not yet been inventoried, thus many more endangered species may actually be present in town. The NHESP recommends that a focused biological inventory and study be conducted in this area, as well as land acquisition and protection of specified land areas after the study is completed.

Table 4-4: Rare Plant Species in the Town of Leyden

Common Name	Scientific Name	State Status	Most Recent Observation
Adder's-tongue Fern	Ophioglossum pusillum	T	1932
Barren Strawberry	Waldsteinia fragarioides	SC	2000
Black Maple	Acer nigrum	SC	2004
Canadian Sanicle	Sanicula canadensis	T	1972
Leafy White Orchis	Platanthera dilatata	T	1989
Slender Cottongrass	Eriophorum gracile	T	1989
Showy Lady's-slipper	Cypripedium reginae	SC	1928
Woodland Millet	Milium effusum	T	1987
White Adder's-mouth	Malaxis monophyllos var. brachypoda	E	1929

Source: Natural Heritage and Endangered Species Program (www.mass.gov/dfwele/dfw/nhesp/species_info/), Division of Fisheries and Wildlife, 2009.

(Fact sheets for each species listed in Table 4-4 can be found in Appendix D.)

D.6 Analysis

Plants and animals are the visible 'citizens' of the ecosystems in Leyden. Plants convert solar energy into food which supports all animal life. Plants cycle energy through the ecosystem by decaying, removing carbon, and shedding oxygen. Plants also help moderate temperatures and act as shelter and as feeding surfaces for herbivores, omnivores, and carnivores.

It is easy to take plants for granted because they are the backdrop for our daily activities. Fields, a maintained stage of human-caused vegetation, are rare in Leyden and thus valued. Forests on the other hand are plentiful and may appear as common. However, this Open Space and Recreation Plan points to the importance of forests: they protect aquifers, first and second order streams, and edge and interior habitats; they clean the air and cleanse the water; and they can provide materials, food, and medicines to support our human community. Forests of all types and habitats, densities, ages, and sizes, are what would predominate in our absence. Therefore, the multiple values of forest should be considered in land use decisions with a goal of maintaining as much forestland as possible.

E. FISHERIES AND WILDLIFE

Leyden's upland forests, rivers, wetlands, and open farmlands provide habitat for a variety of common and rare wildlife species. This section discusses wildlife species and their habitats from the perspective of natural communities, individual species, and patterns of wildlife distribution and movement across the landscape. (See also the Environmental Habitat Map at the end of this section.)

The BioMap Project of the Natural Heritage & Endangered Species Program has identified areas throughout the state that are critical to supporting the maximum number of terrestrial

and wetland plant and animal species and natural communities. The BioMap uses Estimated Habitat and other records to identify the areas most in need of protection to safeguard the native biodiversity of the Commonwealth. It focuses primarily on state-listed rare species and exemplary natural communities and was developed to promote strategic land protection. The BioMap divides the state into thirteen distinct ecological regions based on geology, soils and plant and animal communities. Within each region, scientists have designated "Core Habitats" and "Supporting Natural Landscapes" (SNL). Core Habitat areas include the most viable habitat for rare plants and animals and exemplary natural communities. Supporting Natural Landscapes include buffer areas around Core Habitats, large undeveloped patches of vegetation, large areas without roads and undeveloped watersheds.

In the Town of Leyden, there are two BioMap Core Habitat areas. A large Core Habitat area is located in the northwest corner of Leyden and includes Gates Hill, as well as land owned by the National Rifle Association and the Leyden Rifle Club. This Core Habitat area is also buffered by Supporting Natural Landscape (SNL) areas to the south and to the west, across the town line into Colrain. Most likely, the forested lands to the east will also be included as a SNL area when the northeastern quadrant of town is inventoried. Another Core Habitat area is located along the Green River to the west and south of Kately Hill. Again, this area is surrounded by forested SNLs on all sides. Much of the southern and central sections of Leyden are designated as Supporting Natural Landscapes.

E.1 General Description and Inventory of Wildlife and Wildlife Habitats

The Town of Leyden contains a significant amount of forested upland habitat. Many of the forests consist of large unbroken tracts of dense woodlands, sometimes interspersed with agricultural fields, allowing for good species movement within the town and the surrounding region. However, the north-south linear development of County/Brattleboro Road and East Hill Road may challenge the movement of species across those roads and agricultural tracts.

E.2 Rare, Threatened, and Endangered Wildlife Species

There are 176 rare wildlife species listed by NHESP in Massachusetts. NHESP has mapped several "Priority Habitats of Rare Species" and "Estimated Habitats of Rare Wildlife" in the Town of Leyden. The Estimated Habitats of Rare Wildlife are located in the same areas as noted for the Priority Habitats previously in this section. These habitats provide for wildlife species that are endangered, threatened and of special concern. Leyden's rare wildlife species are listed in Table 4-5. (Fact sheets for each species can be found in Appendix D.)

Table 4-5: Rare, Threatened, and Endangered Wildlife Species found in Leyden

Taxonomy Group	Common Name	Scientific Name	State Status	Most Recent Observation
Amphibian	Jefferson Salamander	Ambystoma jeffersonianum	SC	1997
Dragonfly	Harpoon Clubtail	Gomphus descriptus	E	2004
Dragonfly/Damselfly	Ocellated Darner	Boyeria grafiana	SC	2004
Reptile	Wood Turtle	Glyptemys insculpta	SC	2005

Source: Natural Heritage and Endangered Species Program, (www.mass.gov/dfwele/dfw/nhesp/species_info/), Division of Fisheries and Wildlife, 2009.

E.3 Conserving Leyden's Biodiversity

There are two concepts that can be used to help explain Leyden's options for pursuing the conservation of the town's biodiversity: Island Biogeography and landscape ecology.

The theory of Island Biogeography is based on observations that biodiversity is greater on large islands than on small ones, and greater on islands that are close to the mainland. The concept of islands surrounded by water has been applied to the idea of "islands" of protected open space surrounded by developed areas. Based on this theory, ecologists predict that increasing the size of a protected area increases its biodiversity (MacArthur and Wilson; 1967). Therefore, connecting two protected areas via a protected corridor to create one large area should also increase natural biodiversity (Wilson and Willis; 1975).

Another model for wildlife habitat protection, Landscape Ecology, aggregates similar land uses while allowing other uses in discrete areas (Forman; 1997). This model is reflected in Leyden in areas where agriculture is concentrated along river or stream corridors, as found along Glen Brook, Brandy Brook, East Glen Brook, and along Beaver Meadow Brook. This model allows large blocks of forest to remain intact.

Individual animals move within a landscape. When and where wildlife and fish species move is not completely understood by wildlife biologists. However, it is known that animals pay little attention to political boundaries. Wildlife seek natural cover for shelter and food, but some species willingly forage where human uses, such as farm fields, gardens and even trash cans, provide browse or food.

As the land within Leyden continues to be fragmented by development, it is reasonable to expect that remaining large blocks of undeveloped forest and the parcels of land connecting them will become more important to area wildlife and conflicts between the needs of wildlife and residents will become more common. Many species of wildlife in Leyden have home ranges greater than fifty acres in size. Even those species with smaller home ranges move across the landscape between sources of shelter, water, food and mating areas. Some animals, including white-tailed deer and black bear, seek both interior forest habitat and wetland edges where food sources may be more abundant.

Roads are a form of connection for humans but they can be an impediment to some wildlife movement. Wildlife benefit from having land to move within that is isolated from human

uses. Conservation planning that recognizes this need often focuses on the development of wildlife corridors. Permanently protected wildlife corridors are particularly critical in a landscape which is experiencing development pressures, to ensure that animals have the ability to travel across vegetated areas between large blocks of habitat.

Connections between bodies of water and sub-watersheds are also important for wildlife and fisheries species. Some of the more common animals that use river and stream corridors are beaver, muskrat, raccoon, green heron, kingfish, snapping turtle, and many species of ducks, amphibians, and fish. Since many species rely on a variety of habitats during different periods of their life cycle, species diversity is greatest in areas where several habitat types occur in proximity to each other. With this in mind, the protection of all habitat types is vital for maintaining and enhancing biodiversity in Leyden.

There are three general paths to follow in conserving the health of wildlife populations in Leyden. One is to protect the habitat of specific species that are rare, threatened, or endangered. It is thought that other species will also benefit from this strategy. A second path is to conserve landscape-level resources such as contiguous forest or riparian areas. This helps to protect the habitats of a large number of species, but it might not meet the needs of all rare and endangered species. The third method is a combination of the first two. Maintaining the biodiversity of Leyden over the long term will likely require the protection of both unique habitats for specific species and networks of habitat across the landscape. Conservation strategies for the town to consider include monitoring of species locations, numbers, and movements; the protection of core habitat areas as identified by the NHESP BioMap; the continued protection and linkage of large blocks of contiguous forestland; the retention of early successional habitats like fields and grasslands; and the protection of vernal pools, wetlands, and riparian corridors that sustain the greatest diversity of life in Leyden (see the Plant and Wildlife Habitat Map at the end of this section).

F. SCENIC RESOURCES AND UNIQUE ENVIRONMENTS

The characteristics that allow a stranger to distinguish Leyden from other towns in the region may be different than the unique qualities and special places that only residents can really know. This section identifies the scenic resources and unique environments that most town residents would agree represent the essence of Leyden's character. In many ways the history of Leyden – how people came to settle the land, use its resources, and enjoy its forests, streams, and bodies of water – can be seen in the landscapes that have retained a sense of the past. The unique environments in Leyden play a very important role in providing residents with a sense of place. Brooks, mountains, wetlands, and village centers provide markers on the landscape within which we navigate our lives.

Scenic landscapes often derive their importance from their location relative to other landscape features. The purpose of inventorying scenic resources and unique natural environments in Leyden is to provide a basis for setting resource protection priorities. To this end, the following section includes information about the different values associated with each scenic resource and natural environment, and indicates areas where multiple values are

represented in one landscape. Those landscapes that contain, for example, scenic, wildlife, and cultural values may be given higher priority for protection than a landscape that contains only one value.

These documented resources include historic landscapes and special places identified by the Open Space Committee in the course of preparing the 2004 Open Space and Recreation Plan and the 2010 Update. (See Table 4-6 below and also the Scenic Resources Map at the end of this section). This inventory is based in part on a formal survey done in 1992 for the Franklin County Rural Historic Landscape Preservation Plan Report. This document distinguishes between types of landscapes, identifies in general terms the locations of rural historic landscapes in each town, and provides examples of different preservation strategies. The methodology for identifying significant historical landscapes was based on National Park Service (NPS) criteria including area of significance, period of significance and historical integrity. The NPS classifies landscapes into four different categories: landscapes that reflect major patterns of a region's history (e.g. agricultural landscapes), landscapes that are associated with historically significant individuals (e.g. institutional grounds and buildings), landscapes that are important due to their design or physical characteristics (e.g. an 18th Century Colonial Period Connecticut Valley rural farm), and landscapes that yield or have the potential of yielding significant information on pre-history or history (e.g. a native American encampment site). Scenic landscapes identified in the 1992 report are marked with an asterisk (*) on Table 4-6.

There are also a number of unique geological features that warrant mentioning. These features include the following: Eden Trail crystal formations, Tipping Rock, Bear's Den, Shattuck Brook, Bear's Den, Greenfield Rd, Sweetheart's Chair (a legendary meeting place), Meeting House Rock (an early meeting place, before churches were built), Fossils of Coral and Crinoid stems, Copper & gold outcrop, Granite quarry (Monolithic dolmen-like rocks), and Rattlesnake's Den. In the future, the Leyden Open Space Committee might choose to use a GPS unit for identifying their exact locations for conservation purposes.

Table 4-6: Scenic Resources and Unique Environments

Map #	Scenic Resources	Ecological/ Geological Resources	Recreational Value	Historical Value
Stream Corridors				
1	Green River	Priority habitat of rare species, public water supply, low yield aquifer	Swimming, fishing, picnicking, and hiking	Dams, old mill sites, covered bridge (1808), and an old box factory
2	Glen Brook	Outstanding Water Resource	Fishing	Possible native encampments
3	Thorne Brook	Low yield aquifer		Thorne mill site
4	Harris Brook		Skating on beaver pond	
5	Hibbard Brook	Drain's Pelog's Bog		Historic mill site
6	Brandy Brook	Outstanding Water Resource		
7	East Glen Brook	Outstanding Water Resource	Fishing	Cellar holes and a mill site
8	Beaver Meadow Brook	Low yield aquifer and	Fishing	Two mill sites

Map #	Scenic Resources	Ecological/ Geological Resources	Recreational Value	Historical Value
		wildlife habitat		
9	Keets Brook	Low yield aquifer	Fishing	
10	Shattuck Brook		Fishing and swimming	Three mill sites
11	Couch Brook		Fishing	
Ponds				
12	Beaver Ponds, Beaver Meadow	Great wetland habitat for herons and salamanders	Snowmobiling and bird watching	Historic mill site, early home and early cemetery
Wetlands				
13	Pelog's Bog, West Leyden Road	Bog habitat		
14	Brattleboro Rd Wetland	Beaver pond		
15	Bell Road Wetland			
Recreation Areas				
16	Leyden State Forest*	Large block of forest	Hunting, hiking, nature observation	Historic Conservation/Recreation Landscape
17	Leyden Wildlife Management Area	Large block of forest	Hunting	
18	Camp Stonehenge		Girl Scout Camp, camping	
19	Leyden Common		Picnics, outdoor gatherings	
20	Leyden School Recreation Area		Baseball, tennis, playground, fishing, hiking, horseback riding	
Scenic Landscapes Along Roads and Trails				
21	H.H. Newton* East Hill Road			Historical Agricultural Landscape c. 1871
22	W.S. Black Farm* W.S. Black Road			Historical Agricultural Landscape
23	Bree-Z-Knoll Farm* North County Road			Historical Agricultural Landscape
24	Dobias Farm-Beaver Meadow			Historical Agricultural Landscape
25	Along Greenfield Road*			Historical Agricultural Landscape
26	Along South County Road*			Historical Agricultural Landscape
27	Brattleboro Road*			Historical Agricultural Landscape
28	Eden Trail Road*			Historical Agricultural Landscape and Indian trail and pack horse trail for early settlers
29	Leyden Road*			Historical Agricultural Landscape
30	River Road*			Historical Agricultural

Map #	Scenic Resources	Ecological/ Geological Resources	Recreational Value	Historical Value
				Landscape
31	Leyden Center, East Hill Road*		.	Dispersed village center
32	West Leyden, W. Leyden Rd & River Rd*			Secondary village; historic West Hollow Parish; early mill site, box factory
33	Beaver Meadow			Earliest settlement in Leyden, mill site and an Historical Agricultural Landscape
34	Hunt Hill Road/ East Hill Branch Road			Pioneer military road between northern forts 1744 to 1763
35	Deerfield Captives Trail/ Ethan Allen Highway			Old Indian trail followed by Deerfield captives in 1704/ Laid out by county in 1771, built 1778
36	North Bernardston Road (Couch Brook Road)			Improved from pack horse trail to road in 1766
Other Historical Landscapes				
37	Dorrilite settlement			Religious significance
38	Mill settlement, West Leyden on Green River			Early mill site, box factory
39	Box Shop			
40	Copper mine			
41	Home site of famous sculptor, Henry Kirk Brown			
Scenic Views From:				
42	West Leyden Road		Scenic view	
43	Greenfield Road (County Road)		Scenic view	Site of Old Town Pound
44	Kately Hill (looking south)		Scenic view	Pre 1781 historic homestead
45	East Glen Road (from hayfield to Holyoke Range)		Scenic view	
46	Blueberry Hill		Scenic view	
47	Frizzell Hill Road (toward Mt. Tom and toward Leyden Center)		Scenic view	
48	East Hill Road (toward Mt. Monadnock)		Scenic view	
49	Wilson Road (from Herron Farm)		Scenic view	
50	Bald Mountain (in all directions)		Scenic view	
51	East Hill Road (northern end) looking east		Scenic view	

Sources: Leyden Open Space and Recreation Planning Committee, *Leyden Open Space and Recreation Plan 2004*; *Franklin County Rural Landscape Preservation Plan Report*, Franklin County Commission, 1992; Town of Leyden Residents; *Open Space Plan*, 1986; *History of Leyden MA*; 1959.

Note: NA stands for Not Applicable.

Unusual Natural Communities are not shown on the Open Space and Recreation Plan maps to minimize risk from illegal collection of rare species.

G. ENVIRONMENTAL CHALLENGES

According to the Open Space Committee, there are three main types of environmental challenges in Leyden: non-point source pollution, invasive species, and other potential impacts of development.

Non-point source pollution occurs when pollutants are generated not by a single source like an outflow pipe from a factory but from improper land use across landscapes both suburban and rural. For example, Leyden residents can unknowingly contaminate groundwater by failing to update their private septic systems to limit leaching into rivers and streams and by improperly disposing of household hazardous materials like petroleum products, wood preservatives, and pesticides. Non-point source pollution can result in the contamination of both surface and groundwater and involve other types of pollution. Sources of pollution thought to be of greatest concern to residents include the improper use and disposal of hazardous chemicals, other hazardous wastes, road salt, siltation from new construction, gravel roads, and the use of herbicides along utility right-of-ways. Non-point source pollution is an even more significant environmental problem within the Glen Brook sub-watershed, which is designated as an Outstanding Resource Water area and is one of Greenfield's main sources of drinking water for over eighteen thousand people. One other problem mentioned is the over population of beavers, which apparently is getting worse.

G.1 Non-point Source Pollution Problems

Improper Use and Disposal of Hazardous Materials

Like many towns in the state, Leyden's residents get their drinking water from wells. These wells pump water from underground supplies called aquifers. Most of the aquifers in Franklin County are considered unconfined; there is no barrier between the top of the aquifer and the water table. This means that there is a potential for water supply contamination from pollutants allowed to permeate through the soils to the groundwater in Leyden. Many substances used in around the home are considered hazardous:

- Hobby materials: Adhesives (2 part), art/hobby paint, chemistry sets and photography supplies.
- Cleaning supplies: Disinfectants, drain cleaners, metal polish, spot removers/solvents, furniture polish and toilet bowl cleaners,
- Batteries: Button and rechargeable batteries.
- Automobile Supplies: Antifreeze, automotive fluids, car batteries, dry gas, engine degreasers, gasoline, lead acid batteries, and motor oil.
- Pest and Weed Control: Flea killers, insect pump sprays, moth balls, rodent killers, fertilizers with herbicides or pesticides, herbicides, pesticides, root killers, tree oils, weed killers, and DDT.
- Painting supplies: Varnishes, creosote, paint thinners/solvents, aerosol paint, lead paint, marine oil-based paints, stains & polyurethane, and wood preservatives.
- Other: epoxy, fluorescent bulbs, kerosene, septic tank cleaners, thermostats, and swimming pool chemicals.

Improper disposal of these materials can also lead to the contamination of local wetlands and harm to native wildlife, pets, and people. It is important that the town works to inform residents of the need to participate in hazardous materials drop off events that occur through the Town of Greenfield's Water Department.

Landfills and Hazardous Wastes

The Town of Leyden has no current or former landfill. Town officials express concerns regarding illegal dumping that may have occurred in specific locations in town, two former gas stations, and potential contamination with lead and copper of a tributary of Thorne Brook as a result of activities at a nearby rifle range over the years.

Roadside De-icing Materials

Another example of non-point source pollution of concern by residents is the use of road salt on area roadways. The use of wintertime de-icing materials can produce road salt runoff that can contaminate rivers, streams, and groundwater. For example, the Deerfield Fire District lost use of its Wapping Well due to sodium contamination from road salt use along Rte. 5/10. For this reason, Leyden residents may be interested in exploring the use of alternatives to road salt as a deicing material. According to Larry Salvatore, Maintenance Operations Engineer for MassHighway, District 1, some alternatives to road salt use include a lower salt/sand ratio, a low salt/calcium chloride mix, and the use of hops. Hops have been used in place of a straight salt and sand mix by some communities including Pittsfield. Although the type of hops used are a byproduct of the beer making process, they are thought to be more expensive than road salt. Even if hops do cost more than salt per unit volume, the benefits in reduced risk of groundwater and surface water contamination may be worth the price for special areas.

Runoff from New Home Construction

One type of non-point source pollution that is more common in an urbanizing landscape is the result of poor site management during new home construction. During a storm event, rainwater traveling over land can erode soil uncovered in the construction process. In addition, after construction, stormwater runoff from seeded and fertilized soils can load nearby streams and wetlands with excessive nitrogen and phosphorus. Fortunately, this is a well-recognized problem in the country and in the state. The Massachusetts DEP provides ample erosion and sediment control guidelines via their website (http://www.state.ma.us/dep/brp/stormwtr/files/esfull.pdf). The goals of construction site Best Management Practices (BMPs) can include:

- Maintain average volumes and peak runoff rates after construction at levels similar to predevelopment levels;
- Ensure that annual loadings of total suspended solids after construction are no greater than predevelopment rates;
- Retain sediment on-site during construction; and
- Reduce the amount of nitrogen, bacteria, and phosphorus that leave the site.

Some BMPs during construction including phased grading, seeding of stockpiles, vegetation of open space, cross-grading, and sediment detention swales can help to reduce runoff and

improve water quality. After construction, other BMPs can help to deter stormwater runoff using features such as pervious driveway surfaces, landscape plantings, reduced roadway widths, roadside swales, detention swales and a cul-de-sac detention basin.

Gravel Roads

Gravel roads and steep driveways, if not properly maintained, can produce impacts to local wetlands and surface waters due to erosion and sedimentation. There are no statewide standards for the design of gravel roads mainly because the Massachusetts Highway Department does not maintain any.

The DEP administers the Massachusetts Wetlands Protection Act to ensure that any wetlands within 100 feet of a gravel road project are protected. The Wetlands Protection Act protects these resource areas and typically a permit is required for any highway project that might impact them. If the impact, erosion and siltation for example, had been caused in the absence of a formal project, the Conservation Commission can still initiate action to protect the resource area.

Gravel driveways on steep slopes without swales can result in runoff of the road base and sedimentation of wetlands. A town can adopt grade limitations and require the use of swales where driveways intersect roads.

Herbicide Use Along Easements and Rights-of-way

According to Leyden residents, the use of herbicides for vegetation control along highways and easement right-of-ways is an important environmental problem. Pesticide use along right-of-ways is regulated by the Massachusetts Department of Agricultural Resources (DAR) using standards described in 333 CMR Standards for the Implementation of Integrated Pest Management Techniques and Rights of Way Maintenance Plans. A long-term Vegetation Management Plan (VMP) for easement and right-of-way pesticide use is developed prior to the first year of maintenance. The VMP is developed using a public review process. Each year the manager of the right-of-way must submit a Yearly Operational Plan (YOP) to the DAR. The applicant must send a copy of the YOP and an Environmental Monitor to the Board of Health, the Conservation Commission, and the Chairman of the Select Board after which there is a 45-day comment period. Leyden officials should continue to review the YOP's to ensure that the pesticides used in town are limited to those chemicals that break down into innocuous substances over a reasonable time period.

G.2 Invasive Species

The Massachusetts Invasive Plant Advisory Group, (MIPAG) a collaborative effort of state and federal government agencies and private organizations that serves the Commonwealth in an advisory capacity, defines invasive plants as "*non-native species that have spread into native or minimally managed plant systems in Massachusetts. These plants cause economic and environmental harm by developing self sustaining populations and becoming dominant and or disruptive to those systems*." Invasive plants can impact the Massachusetts environment by competing with native plants for natural resources, dominating habitats and

reducing food and shelter for native wildlife, according to *A Guide for Invasive Plants in Massachusetts,* a 2006 guide by members of MIPAG. Invasive plants can also eliminate the host plants of beneficial resident native insects and compete with native plants for pollinators. At times this can cause biologically diverse forests, wetlands and meadows to be dominated by one of several non-native invaders.

Japanese Knotweed *(Polygonum cuspidatum)*, an upright perennial herb, has become a problem in Leyden over the last decade. This plant, grows to ten feet tall with bamboo-like stems, large heart shaped green leaves, and white flowers. It is often found near water sources, along streams and roadsides and once established it is very difficult to eradicate and can regenerate from a small piece of root. It suppressed the growth of native plants and in the process and degrades wildlife habitat. The Deerfield River Watershed Council has been working to eradicate this plant in their watershed and produced a fact sheet on Knotweed including methods for controlling it without the use of herbicides (www.deerfieldriver.org/invasives). Some strategies include pulling for small patches, repeated mowing, cover with black plastic for an entire growing season. Grazing livestock may help to control the plant from spreading, but will not eradicate it. Proper disposal of plants that have cut is critical to prevent further infestations. They must either be buried ten feet deep or dried out completely and composted or burned.

Information on managing other invasive species can be found online at www.invasivespecies.net. The website for the National Invasive Species Information Center at www.invasivespeciesinfo.gov/unitedstates/ma/shmtl is a clearinghouse for information on the general topic. The Massachusetts Introduced Pests Outreach Project is a collaboration between the Massachusetts Department of Agricultural Resources and UMass Extension Agriculture and Landscape Program aimed at increasing awareness about introduced pests among professionals in agriculture, horticulture, and government. Their website (www.massrcn.org/pests) has fact sheets on pests including, insects, weeds, diseases affecting vegetables, flowers, fruits, landscaping, forestry and natural areas and offers pest alerts.

A pest of special concern since 2008 is the Asian longhorned beetle, a destructive wood boring pest of Maple, Birch, Willow, Polar, and other hardwood trees. State officials have been on alert for this pest, especially since the first sighting of this beetle in Massachusetts in Worcester in August 2008. The larva of this shiny black beetle with white spots damage the tree by eating away at the outer sapwood creating hollowed out sections in the wood. The beetles drill ½ inch round holes in trees and large amounts of course sawdust. Residents are encouraged to capture any beetles, freeze them to kill them, and contact state forest officials immediately. The Asian longhorned beetle was first discover in the United States in 1996 in Brooklyn, New York in 1996 and has since been seen in several counties in New York and New Jersey, and even as far away as Chicago and Toronto. Some of these counties have since been declared free of this pest, according to a North American Plant Protection Organization's pest alert report (www.pestalert.org).

Several invasive plant species have been occurring in increasing numbers in Town in recent years. Any attempts at effective containment of the spread of invasive species locally will

depend on the ability of the Open Space Committee and other local boards and committees to effectively educate local officials, highway department employees, and residents about these species and recommended management strategies. The same can be said regarding any introduced pests such as insects or diseases that may impact Leyden's forests and other local vegetation in coming years; effective public education will be essential to efforts to mitigate the impacts of such problems. Periods of rapid climate change, such as we are presently experiencing, are especially favorable for rapidly reproducing species such as insects and diseases and promote conditions that can enhance the spread of problematic species. By contrast species with longer life cycles, such as trees, are inherently less well equipped to adapt to rapid climate change. Thus the town would be wise to take a proactive approach to environmental problems related to the spread of introduced pests, including invasive species, and stay abreast of the latest information about related problems that may impact local vegetation, agriculture, and forestry and related strategies for sustainable management. Such efforts will require cooperation with state and regional efforts and may involve several Town boards and departments including the Open Space Committee, the Board of Health, the Agricultural Commission, the Tree Warden, and the Conservation Commission, as well.

G.3 Other Potential Impacts of Development

Although there may not be agreement as to its severity or solution, another environmental problem for Leyden is the potential for future growth in the region and the negative impacts of the development of approval-not-required frontage lots. In a growing community, the costs of community services including public education can be greater than the revenues generated through real estate taxes.

Some people argue that current development constraints, mainly related to soil characteristics, are sufficient to control development. The depth to the groundwater, depth to bedrock, and steep slopes are three characteristics which can restrict where people may build. Others would point to changes in technology and regulations, which have the potential for reducing those limitations on development.

New residential development across town would likely increase the prevalence of non-point source pollution, reduce the rural character and cause a reduction of remaining wildlife habitat. Sprawl would also increase runoff (potentially including contaminants such as road salt), decrease the recharge to ground water, decrease stream flow, and increase erosion. Increases in runoff would diminish biodiversity in first and second order streams. One solution to the problem could be a combination of zoning techniques to encourage development in suitable areas and open space protection to minimize development in areas with the greatest scenic, ecological, cultural, and historical values.

G.4 Chronic Flooding

There are no problems with chronic flooding in the Town of Leyden, with the occasional exception of flooding from beaver dams.

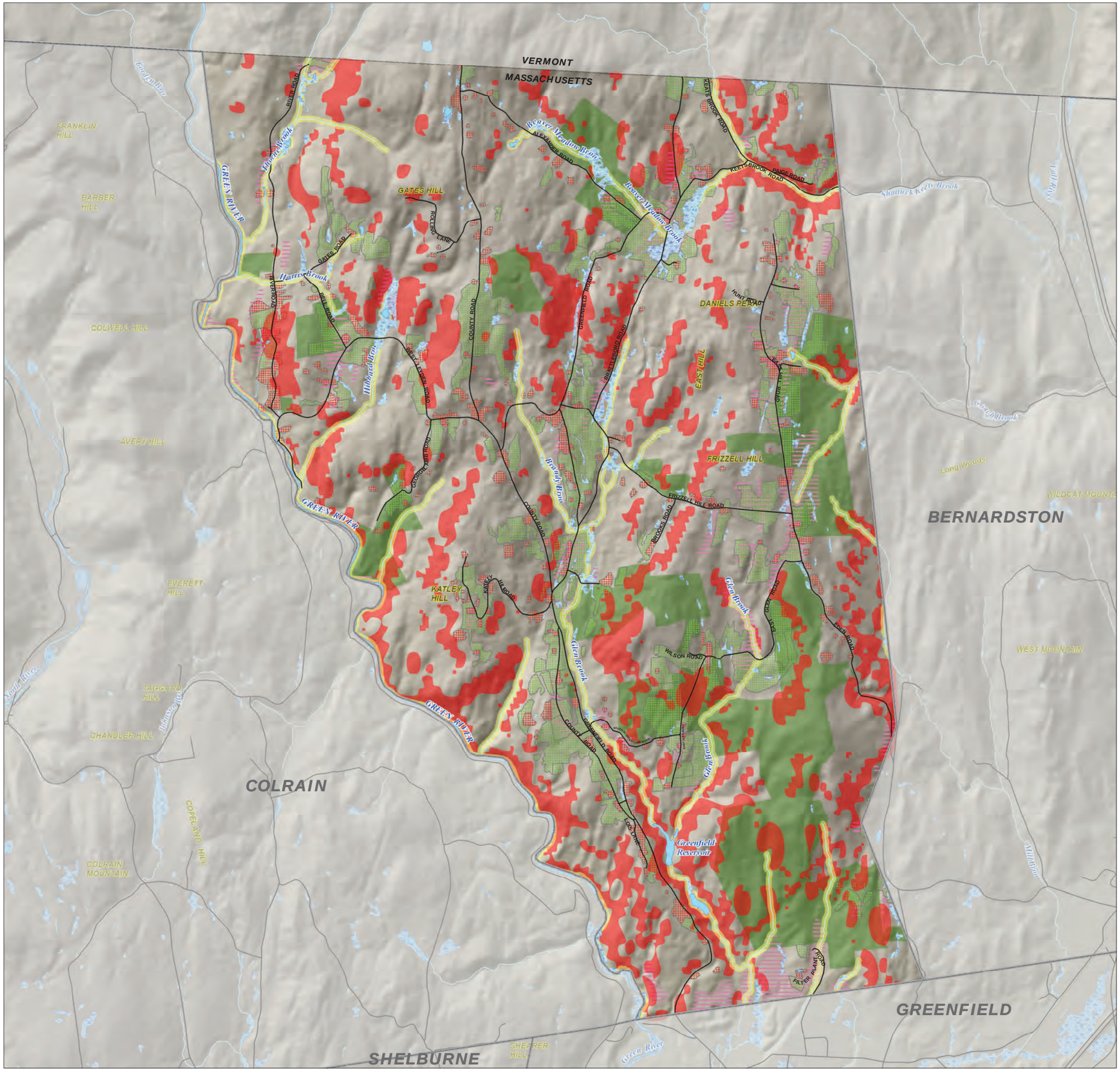
G.5 Forestry Issues

The Town of Leyden has not identified environmental challenges specifically related to the Town's forests.

Town of Leyden

Soils and Geographic Features

Open Space and Recreation Plan



Town Boundary

Road

Wetlands

Slopes > 25%

Prime Farmland Soils

Open Space

Permanently Protected

2005 Land Use

Cropland, Pasture

Residential

River Protection Act

100 ft from River Bank

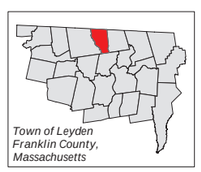
N
W E
S

0 0.125 0.25 0.5 Miles

FRANKLIN REGIONAL COUNCIL OF GOVERNMENTS
Main Office: 413-774-3167
425 Main Street
Greenfield, Massachusetts 01301

Map Sources:

Map Produced by the Franklin Regional Council of Governments Planning Department. GIS data sources include the FRCOG Planning Department, the Massachusetts Highway Department and MassGIS. Digital data obtained from MassGIS represent the efforts of the Massachusetts Executive Office of Environmental Affairs and its agencies to record information from the sources cited in the associated documentation. EOEA maintains an ongoing program to record and correct errors in the GIS data that are brought to or as to the implied validity of any uses of the GIS data. EOEA maintains records regarding all methods used to collect and process these digitaldata and will provide this information on request. Executive Office of Environmental Affairs, MassGIS EOEA Data Center, 251 Causeway St., Suite 900, Boston, MA, 617-626-1000.
Note: Depicted boundaries are approximate and are intended for planning purposes only.



Town of Leyden
Franklin County, Massachusetts

Town of Leyden

Water Resources

Open Space and Recreation Plan

Road

Public Water Supply

Certified Vernal Pool

Wetlands

Watershed Boundary

River Protection Act
0-200 ft from River Bank

Interim Wellhead Protection Area

Low Yield Aquifer

N
W E
S

0 0.25 0.5 1 Miles

FRANKLIN REGIONAL COUNCIL OF GOVERNMENTS
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Greenfield, Massachusetts 01301

Map Sources:

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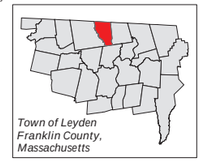
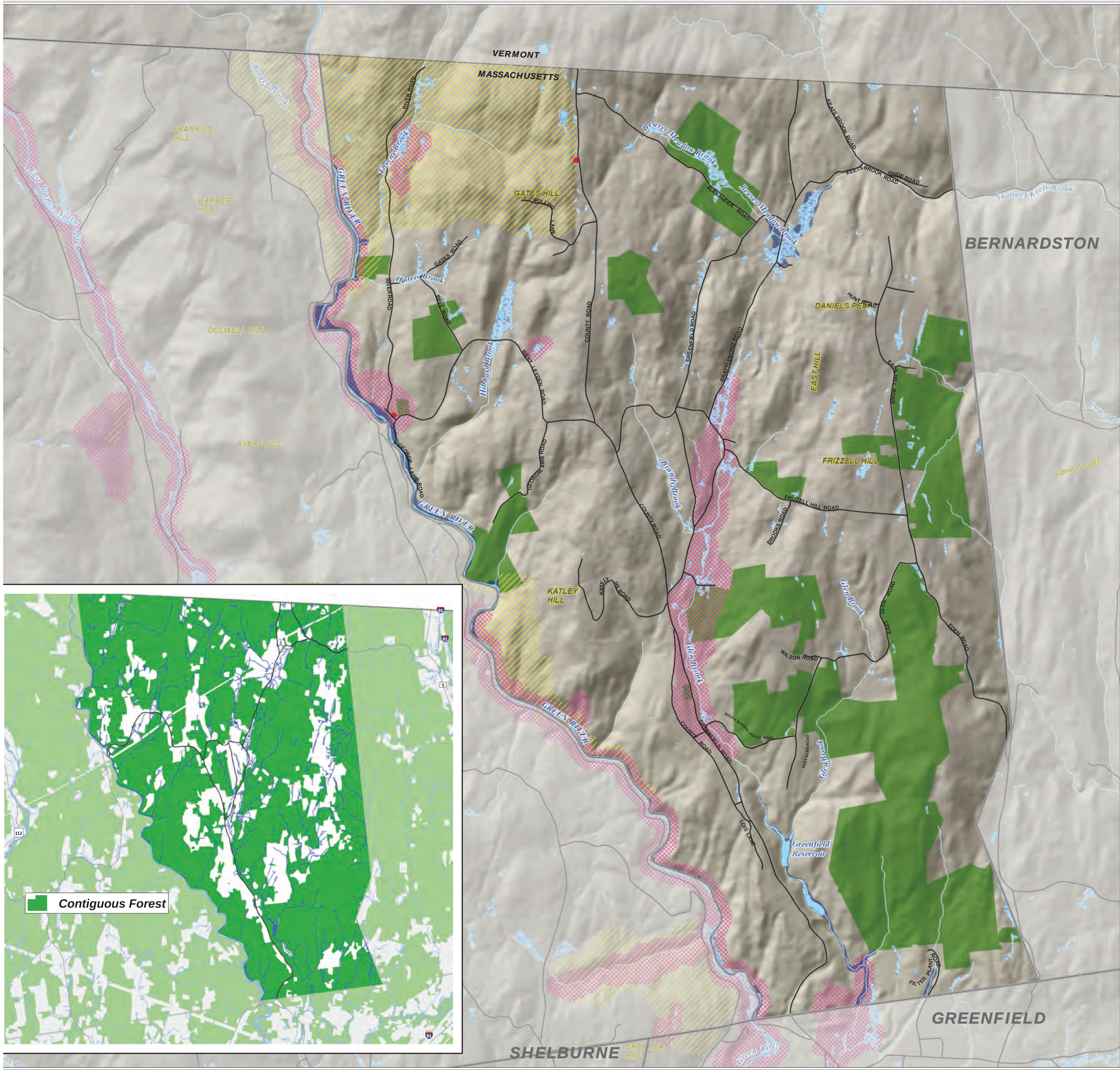


Town of Leyden
Franklin County, Massachusetts

Town of Leyden

Plant and Wildlife Habitat

Open Space and Recreation Plan



- Road
- Wetlands
- 100 Year Flood Plain (FEMA)

Open Space

- Permanently Protected

Natural Heritage & Endangered Species Program

- Priority Habitat of Rare Species
- BioMap Core Habitat
- Certified Vernal Pool

N W E S

0 0.125 0.25 0.5 Miles

FRANKLIN REGIONAL COUNCIL OF GOVERNMENTS
Main Office: 413-774-3167
425 Main Street
Greenfield, Massachusetts 01301

Map Sources:

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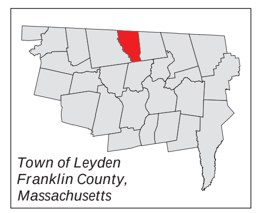

Town of Leyden

Scenic Resources

Open Space and Recreation Plan

Map #	Scenic Resources
	Stream Corridors
1	Green River
2	Glen Brook
3	Thorne Brook
4	Harris Brook
5	Hibbard Brook
6	Brandy Brook
7	East Glen Brook
8	Beaver Meadow Brook
9	Keets Brook
10	Shattuck Brook
11	Couch Brook
	Ponds
12	Beaver Ponds, Beaver Meadow
	Wetlands
13	Pelog's Bog, West Leyden Road
14	Brattleboro Rd Wetland
15	Bell Road Wetland
	Recreation Areas
16	Leyden State Forest
17	Leyden Wildlife Management Area
18	Camp Stonehenge
19	Leyden Common
20	Leyden School Recreation Area
	Scenic Landscapes Along Roads and Trails
21	H.H. Newton, East Hill Road
	Scenic Resources
22	W.S. Black Farm, W.S. Black Road
23	Bree-Z-Knoll Farm, County Road
24	Dobias Farm-Beaver Meadow
25	Along Greenfield Road
26	Along County Road
27	Brattleboro Road
28	Eden Trail Road
29	West Leyden Road
30	River Road
31	East Hill Road
32	West Leyden, W. Leyden Rd & River Rd
33	Beaver Meadow
34	Hunt Hill Road/East Hill Branch Road
35	Deerfield Captives Trail/Ethan Allen Highway
36	Haigis Road (Couch Brook Road)
	Other Historical Landscapes
37	Dorrilite settlement
38	Mill settlement, West Leyden on Green River
39	Box Shop
40	Copper mine
41	Home site of famous sculptor, Henry Kirk Brown
	Scenic Views From:
42	West Leyden Road
43	Greenfield Road (County Road)
44	Kately Hill (looking south)
45	East Glen Road (from hayfield to Holyoke Range)
46	Blueberry Hill
47	Frizzell Hill Road (toward Mt. Tom and toward Leyden Center)
48	East Hill Road (toward Mt. Monadnock)
49	Wilson Road (from Herron Farm)
50	Bald Mountain (in all directions)
51	Eden Trail, northern end

Permanently Protected Open Space

Road

Wetland

Scenic Resources

Ecological / Geological Resource

Recreational Resource

Scenic Resource

N W E S

0 0.125 0.25 0.5 Miles

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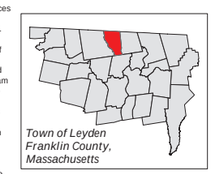


Town of Leyden Franklin County, Massachusetts

SECTION 5

INVENTORY OF LANDS OF CONSERVATION AND RECREATION INTEREST

Open space in the Town of Leyden consists of farms, forests, park, and recreation areas under both public and private ownership and management. This section provides a summary of all lands that provide open space, wildlife habitat, agricultural and forest products, watershed protection, scenic landscapes and recreational opportunities that have some level of protection from development.

In general terms, 'open space' is defined as undeveloped land. In an Open Space and Recreation Plan, the focus is on undeveloped land, which is valued by residents because of what it provides: actively managed farm and forestland; wildlife habitat; protection and recharge of groundwater; public access to recreational lands and trail systems; important plant communities; structures and landscapes that represent the community's heritage; flood control; and scenery. The term 'natural resource' describes the biological and physical components of an ecosystem that people depend on for their existence and for some, their livelihood. These components are air, surface and ground water, soil nutrients, vegetation, fisheries, and wildlife. Recreational facilities can include open space, parks, and developed areas like tennis courts and swimming pools. Open space and recreation plans typically identify areas of undeveloped land that contain precious natural and recreational resources and prioritize them for protection.

Open space can be protected from development in several ways that differ in the level of legal protection they provide, the method by which they are protected, and by the type of landowner. Section 5 will deal with open space under four levels of protection: permanently protected, temporarily protected, limited protection, and unprotected. These are briefly defined below:

- Land is considered to be **permanently protected** if it is 1) owned by a state conservation agency, a nonprofit conservation land trust or other conservation organization, or by the Town of Leyden under the care and control of the Conservation Commission; or 2) the land is subject to a conservation (or other) restriction in accordance with M.G.L. Ch. 184, section 31;
- Privately owned land is considered to be **temporarily protected** if it is enrolled in one or more of the state's Chapter 61, Chapter 61A or Chapter 61 B current use tax abatement programs;
- All land owned by the Town of Leyden except for cemeteries and land under the care and control of the Conservation Commission is considered to have **limited protection**; and finally
- All privately owned which is neither permanently nor temporarily protected, but in the opinion of the authors should be protected, is considered to be **unprotected**.

Land is considered to be "protected" from development when it is owned by the Commonwealth of Massachusetts and managed by a state conservation agency, including the Department of Fish and Game (DFG) or the Department of Conservation and Recreation (DCR). Land is also considered "protected" when it is owned by a town and is under the authority of the Conservation Commission, or when it is owned by a land trust for conservation purposes.

A conservation restriction is a legally binding agreement between a landowner (grantor) and a holder (grantee) - usually a public agency or a private land trust; whereby the grantor agrees to limit the use of his/her property by forfeiting interests in the land (development being one type of interest) for the purpose of protecting certain conservation values. The conservation restriction may run for a period of years or in perpetuity and is recorded at the Registry of Deeds. Certain income, estate or real estate tax benefits may be available to the grantor of a conservation restriction.

There are several types of conservation restrictions. Some protect specific resources, such as wildlife habitat, or farmland. Actively farmed land with Prime soils or soils of Statewide Importance may be eligible for enrollment in the state's Agricultural Preservation Restriction (APR) Program. The APR program purchases the development rights and attaches a restriction to the deed, which legally bars development, keeping land "permanently" available for agriculture.

The development of any parcel of land that is in the APR Program, protected with a conservation restriction, owned by a state conservation agency, or owned by a land trust or a town for conservation purposes, would require a vote by two thirds of the State Legislature as outlined in Article 97 of the Amendments to the Massachusetts State Constitution. For the purposes of this Open Space and Recreation Plan, cemeteries will also be considered to be protected from development.

This "protection" conveyed by Article 97 does have its limits. The state legislature has voted to release this protection at the request of local communities, so that conservation land can be used for schools, roads, economic development, or other public projects not related to resource protection. Reforms have been proposed to make this process more difficult. It is important for local advocates of conservation to be vigilant of attempts to remove the "protection" status from open space in the Town of Leyden.

Land in Massachusetts owned by towns or water districts may be considered to have "limited protection" from development. If a town-owned parcel of land is under the legal authority of the Select Board rather than the Conservation Commission, it is considered to have limited protection from development. The parcel could be called a wildlife sanctuary or a town forest, but not have the long-term protection afforded by Conservation Commission lands. In this case, converting a town forest to a soccer field or a school parking lot could be decided by the Select Board or at Town Meeting. A parcel of land used for the purposes of water supply protection is considered in much the same way. Unless there is a legal restriction attached to the deed or if the deed reads that the land was acquired expressly for water supply protection, the level of protection afforded these types of parcels varies depending on the policies of each community. In most cases, the water district would be required to show the Massachusetts Department of Environmental Protection just cause for converting the use of the land, but this is not an insurmountable hurdle.

Parcels enrolled in Massachusetts Chapter 61 tax abatement programs are considered to be "temporarily protected" from development. This program offers landowners reduced local property taxes in return for maintaining land in productive forestry, agricultural or recreational use for a period of time. These "chapter lands" provide many public benefits, from maintaining wildlife habitat and recreational open space to sustaining rural character, and local forest and farm-based economic activity. Another benefit of the Chapter 61 programs is that they offer towns the opportunity to protect land. When a parcel that has been enrolled in one of the Chapter programs is proposed for conversion to a use that would make it ineligible for the program, the town is guaranteed a 120-day waiting period during which it can exercise its right of first refusal to purchase the property.

Table 5-1: Summary Areas of Farmland and Forest Open Space by Ownership and Level of Protection from Development in Leyden

PRIVATELY OWNED OPEN SPACE	Acres	% Of Total Land Area in Leyden
Farmland		
Protected by Agricultural Preservation Restriction	312.0	2.7%
Temporarily Protected Farmland under Ch. 61A	2,126.6	18.5%
Forestland		
Protected by Conservation Restriction	510.9	4.4%
Temporarily Protected Forestland		
Chapter 61	791.1	6.9%
Chapter 61B	1,236.1	10.7%
TOTAL PRIVATELY OWNED OPEN SPACE WITH SOME LEVEL OF PROTECTION	**4,976.7**	**43.3%**
PUBLICLY OWNED OPEN SPACE		
Forestland		
Protected by State Conservation Agencies	849.3	7.3%
Division of Fisheries and Wildlife	17.3	<1%
Department of Fish and Game	772.4	6.7%
Department of Conservation and Recreation – Division of State Parks and Recreation	59.6	0.5%
Land with Limited Protection & Owned by Town of Leyden	21.4	<1%
Land with Limited Protection & Owned by the Inhabitants of the Town of Greenfield in Leyden	482.6	4.4%
Other Town-Owned Protected Land	11.3	<1%
Conservation Commission	6.2	<1%
Cemeteries	5.1	<1%
TOTAL PUBLICLY OWNED OPEN SPACE WITH SOME LEVEL OF PROTECTION	**1,364.6**	**11.9%**
TOTAL OPEN SPACE WITH SOME LEVEL OF PROTECTION	**6,341.3**	**55.1%**

Source: Leyden Assessors Records and Maps, 2010; and MassGIS Open Space data, 2010.

Approximately 55 percent of the total land area in Leyden is comprised of open space with some level of protection from development. The total land area of the town is 11,505 acres. The portion of the total land area that is protected as open space is summarized in Table 5-1. It is divided into two main sections based on type of ownership: private and public. Within each of these major categories, parcels are differentiated by use (farm or forestland), by ownership and

management, and by level of protection: "protected," limited, and temporary. (See also the Protected Open Space Map at the end of this section.)

A. PRIVATELY OWNED PARCELS

Approximately 43 percent of the undeveloped land with some degree of protection in Leyden is privately owned. Most of this land is owned by private individuals and is either forested or in use for agriculture. There are many advantages to private ownership of open space. Privately owned undeveloped land contributes to the town's tax base. When used for farming or forestry, land also generates revenue, jobs, food, and forest products. Some landowners allow access to their property for recreational purposes. Most take pride in their land, which favors good stewardship. Finally, owning land gives people a sense of place. This is particularly true of residents whose families have owned land in Leyden for generations. Land ownership encourages a sense of community and helps contribute to community stability over time.

One disadvantage of private ownership of undeveloped land, which is valued by residents for the public benefits it provides is that most privately owned land can easily be converted to other uses. According to Table 5-1, 823 acres or approximately 17 percent of the 4,977 acres of privately owned lands with conservation or recreation interests in Leyden have been protected from development. The remainder (83 percent) are only temporarily protected and are therefore considered to be vulnerable to development. Some landowners acquire land specifically for the purposes of development, but others are forced to sell their property due to circumstances beyond their control. Aging, the death of a parent or spouse, financial needs of family and rising costs or declining profits of farming and forestry are common reasons why landowners decide to put their property on the market. The high value of land for residential development is both a powerful incentive to sell property, and a formidable obstacle to people who might otherwise want to buy it for other purposes.

This section provides a detailed inventory of privately owned land in the Town of Leyden and discusses the value of this land for conservation and recreation. Privately owned land provides many public benefits, but it is important to respect the property rights of landowners. While many landowners choose to keep their property in farms and forests, and some allow public access, it is important that residents respect the rights of those who make different choices.

A.1 Privately Owned Agricultural Land

Farmland, including farm woodlots, orchards, and sugar maple stands, constitutes approximately 49 percent of the total amount of privately owned open space in Leyden with some level of protection from development, 38 percent of all open space and 21 percent of the town's total land base. Tables 5-2 and 5-3 display information on those farms in Leyden which have achieved a level of protection from development, including their ownership, management, and farm size.

Approximately 3 percent of Leyden's farm acreage with some level of protection includes land "protected" by the Agricultural Preservation Restriction (APR) Program. These restrictions are overseen by the Massachusetts Department of Agricultural Resources (MDAR). Information on "protected" farmland in Leyden is included in Table 5-2.

Table 5-2: Privately Owned Agricultural Land Protected from Development in Leyden

Owner/Manager	Holder of the Agricultural Preservation Restriction	Assessor's Map	Assessor's Lot	Acres	Value
Peterson	MDAR	3	8, 9, 12, 13	54.9	Prime Farmland Soils
Giard	MDAR	6	11.1, 12, 14.1, 17, 15	88.6	Prime Farmland Soils
Herron	MDAR	6 10	10 1.1, 1.2, 10, 13, 14	166.1	Prime Farmland Soils
Muka	Town of Leyden Conservation Commission	15	3.1	2.4	Prime Farmland Soils; future maple sugar lot
Total				**312.0**	

Source: Town of Leyden Assessor's Records and Maps; 2010; Franklin Land Trust, 2010.

Land enrolled in Chapter 61A is considered to be "temporarily protected." Approximately 87 percent of Leyden's open space farmland, including parcels with prime farmland soils, falls into this category (see Table 5-3). In some cases, farmland enrolled in Chapter 61A abuts "protected" land. Conversion of even a small percentage of this land to residential use could affect the viability of farming on the remainder. Location of new homes in proximity to active agricultural operations often results in conflict between new residents and farmers over the noise, dust, and odors that are part of normal agricultural practices. Increased commuter traffic on roads in agricultural areas also makes it difficult for farmers to move their equipment between fields.

Much of the land enrolled in Chapter 61A also abuts rivers and streams. While agriculture can have negative impacts on water quality, these impacts can be reduced or avoided through the use of best management practices. When best management practices are observed, agriculture is compatible with watershed protection, because it keeps the land open, while development results in conversion of land to impervious surfaces, with negative impacts on water quality.

Agricultural lands enrolled in the Chapter 61A program offer much value to the town, even if the farmlands are only "temporarily protected." Firstly, the agricultural parcels often contain prime farmland soils which should be preserved for continuing use. These privately owned open spaces also contribute to the town's tax base and generate revenue, employment, and food products. In addition, some landowners may allow access to their property for recreational purposes, like hiking or snowmobiling. Most Chapter 61A landowners take pride in their land, while practicing good stewardship. They help to define a sense of place for Leyden and contribute to community stability over time.

Table 5-3: Privately Owned Agricultural Land Enrolled in Chapter 61A in Leyden

Owner	Assessor's Map	Assessor's Lot	Acres
Clark, Donald	1	27.Q	45.42
Tusinski, Peter	1	45	16.40
Facey, Warren E.	1	30, 32, 57	15.30
Franklin, David	2	1	65.20
Bergeron, Robert	2	4.A	73.90

Owner	Assessor's Map	Assessor's Lot	Acres
Franklin, David	2	10	11.10
Glabach, Edward H.	2	28.A	6.05
Glabach, Edward H.	2	28.C	4.40
Dobias, Arthur J.	2	51, 57	102.20
Streeter, Ronald E.	2	54	42.40
Glabach, Edward	2	66.A	58.00
Lively, Daniel J	2	36.D	7.92
Rose-Fish, John & Jill	4	3	34.16
Damon, Edwin, Jr.	4	17	61.30
Facey, Warren Jr.	4	4, 6, 31	168.91
Christopher Morin	4	10	36.30
Spatcher, Kenneth	4	20	57.34
Facey, Warren Sr.	4	32	20.00
Butler, William, R.	6	6	102.00
Facey, Warren, Jr.	8	3, 14	71.68
Feldman, Fred	8	31	22.80
Johnson, Carl	8	36, 38	25.40
Brooks, D. & J.	9	46	57.90
Lotreck, Eric	10	4	69.90
Crapo, Patricia	10	6	17.30
Lotreck, Eric	10	7	31.00
Baker, Andrew	10	12	13.20
Johnson, Erik	11	46	8.49
Johnson, Carl	11	10	1.50
Herron, John & William	12	9,	68.20
Johnson, Carl	12	13, 22, 23	44.37
Zaveruha, Ann	12	29	53.58
Croutworst, Robert	13	1, 3	174.00
Herron, John & William	13	15	14.80
Troy, David	14	2, 3.1	135.20
Muka, James L.	14	4.3	36.40
Muka, Lewis	15	1, 2.1, 3, 3.1	39.30
Muka, James L.	15	2	21.90
Johnson, Carl	15	4	58.50
Herron, John, William, & Sidney	15	9.1	52.38
Herron, Sidney	15	27	.59
Herron, Sidney	15	28	13.20
Johnson, Roland	15	20	10.70
Troy, David	15	16, 18	3.82
Johnson, Roland N.	15	19	67.40
Helbig, Jo-Ann A.	15	30	17.30
Herron, John, William, & Sidney	16	1	2.35
Snyder, Alexa & Nola	17	2.1	10.79
Duprey, Mark	17	20	54.30
Total			**2,126.55**

Source: Town of Leyden Assessor's Records and Maps, 2010.

A.2 Privately Owned Forested Land

Table 5-4 includes the properties in Leyden that are privately owned and protected by the placement of a conservation restriction on the deed limiting future development. In the vast majority (84%) of the acres protected by conservation restrictions (CR), the CRs are held by the Franklin Land Trust. The Town of Leyden holds two CRs and the Massachusetts Audubon Society holds another. These properties consist of 511 acres, or 4.4 % of the Town's total land area.

Table 5-4: Privately Owned Forested Land Protected from Development with Conservation Restrictions

Owner/Location	Holder of the Conservation Restriction	Assessor's Map	Assessor's Lot	Acres
Freeley, David W., Beaver Meadow	Franklin Land Trust	2	49.1	88.58
Casale, C. & N., Beaver Meadow	Franklin Land Trust	2	49.2	26.93
Wallace, J. & B., Beaver Meadow	Franklin Land Trust	2	50	36.40
Sullivan, P. & Brandt, L., West Leyden Road	Town of Leyden/F&W	3	21.4, 21.5	4.64
Luck, T. & Kidder, E., George Lamb Road	Franklin Land Trust	8	20	12.90
Doyle, G., George Lamb Road	Franklin Land Trust	8	26, 27	24.94
Coty, E., Frizzell Hill Road	Franklin Land Trust	9	25.1, 25.2	32.60
Herron, S., Eden Trail Road	Franklin Land Trust	6 10	10 1.1, 1.2, 10, 13, 14	84.00
Kissling, C., George Lamb Road	MassAudubon Society	11	1	64.36
Tinker, J., East Glen, School House and Wilson Roads	Franklin Land Trust	12	11, 26	76.63
Zaveruha, Ann	Leyden Conservation Commission	12	29.1, 29.2	14.18
Tinker, J., East Glen, School House and Wilson Roads	Franklin Land Trust	15	5, 7	44.74
Herron, S., East Glen, School House and Wilson Roads	Franklin Land Trust	15	8	15.00
Dyer, Edwin	Franklin Land Trust	17 18	31 1	113.20
Total				**510.90**

Source: Town of Leyden Assessor's Records and Maps, 2010; Franklin Land Trust, 2010.

Approximately 32 percent of Leyden's open space with some level of protection is privately owned forest in one of the Chapter 61 tax abatement programs, accounting for approximately 2,027 acres, or 18 percent of the town's total land area. Privately owned forestland with temporary protection is shown in Tables 5-5 and 5-6. In addition, many of the temporarily protected farms shown in Table 5-3 include farm woodlots. Approximately 39 percent of privately owned forest with temporary protection in Leyden is enrolled in the Chapter 61 tax program for Forestry, while 61 percent is enrolled in the Chapter 61B program for Recreational Open Space.

Table 5-5: Privately Owned Forestlands with Temporary Protection from Development Enrolled in the Ch. 61 Forestland in Leyden

Owner	Assessor's Map	Assessor's Lot	Acres
Hall, Jeffrey	1	18.2	28.00
Harris, William S.	1	44.1, 50.1	67.32
Cohen, Martin L.	2	17	41.70
Kocot, P. & D.	2	69	32.80
Higginson, Robert W.	1	2	100.00
Loomis, Robert	3	19,22	16.50
Creamer, Anthony	4	7, 8	24.20
Creamer, Anthony	5	1	58.20
Provencher, Ronald	6	18	58.00
Romano, Anthony	8	21, 22, 41	28.42
Tomlinson, Martin, Porter	11	27.1, 38	184.16
Kicza, James	11	36,45	37.00
Klaus, Edmund	15	9.3	10.01
Adams, Richard J.	17	29	56.27
Fiske, Leon, Jr.	17	68	26.50
Andrews, Leon	18	2	22.00
Total			**791.08**

Source: Town of Leyden Assessor's Records and Maps, 2010.

All of the parcels in Tables 5-5 and 5-6 are temporarily protected in the Ch.61 Forestland and the Ch. 61B Recreational Open Space Classification and Taxation Programs and the degree of protection of these parcels is short term. There are no public grants awarded as a result of the Program, however, the owner agrees not to change the land's use for ten years while paying reduced property taxes during that time period.

Privately owned forestland offers many values to the community and are important resources for several reasons. First, many forestlands are large parcels with a low degree of fragmentation, so wildlife and plant habitats are preserved. When these forestlands are protected from development, they help to protect and provide clean water, air, and healthy wildlife populations. Forest soils have a high infiltration capacity, so they absorb moisture and permit very little surface runoff. Once absorbed, water is released gradually so flooding is reduced during large rain events and streamflow is maintained during low water months. Forests recycle nutrients, so the nutrients do not pass into waterways, and water quality is preserved. Because forest soils are absorptive, soil erosion is reduced and fish habitat is preserved. Chapter 61 lands are managed for forest products, which result in employment of loggers, foresters, and local mill workers, income for landowners, and the availability of locally grown wood for flooring, furniture making and firewood. Many forested lands also provide recreational value for Leyden residents. The Chapter 61 forests help to preserve the character of the wooded landscape prized in Leyden.

Table 5-6: Privately Owned Forestlands with Temporary Protection from Development Enrolled in the Ch. 61 B Recreational Open Space Taxation Program in Leyden

Owner	Assessor's Map	Assessor's Lot	Acres
Cersosimo Industries	1	1, 10, 12	220.6
Diskin, Patricia	1	47.2	15.75
Leyden Rifle	1	13, 14	46.00
Golosh, Ken & Richard	1	28	21.20
Tusinski, Peter	1	44.4, 46	47.60
Finney, James A.	2	4.B	21.36
Caffery, Glenn R.	2	26	45.00
Bates, Davis R.	2	61.1	96.00
Bates, Richard A.	2	61.2	4.29
Caffery, Glenn R.	2	28.E	11.33
Cersosimo Industries	3	1, 17	33.10
Vreeland, David A.	3	3, 4	50.90
Paris, Jennifer (Angel's Rest)	4	11, 26	20.70
Bates, Davis	5	22, 23	30.80
Moretti, Frances S.	7	8	59.00
Nielsen, James A.	8	29.2, 35	95.90
Lutz, George	9	47	52.00
Chaffee, Dennis	13	4	19.00
Muka, Michael	14	4.2	27.30
Cutting, John	17	2.2, 49	208.80
Cersosimo Industries	17	30	30.00
Provost, Marcia	17	51, 59	25.88
Webb, Ashley	17	62	53.60
Total			**1,236.11**

Source: Town of Leyden Assessor's Records and Maps, 2010.

B. PUBLICLY OWNED PARCELS

Publicly owned open space equals approximately 12 percent of the total land area in town. Two-thirds of the publicly-owned open space is state-owned land protected from development, most of which is located in the Leyden Wildlife Management Area owned by the Massachusetts Department of Fish and Game. Some of the town-owned parcels, representing 504 acres owned by the Town of Leyden and the Inhabitants of the Town of Greenfield, have a limited amount of protection. In addition, several properties owned by the Town are under the control of the Conservation Commission or are cemeteries, all of which are considered to be protected from development. The following inventory includes those parcels that are owned by the Commonwealth of Massachusetts and the Towns.

B.1 Publicly Owned Open Space

There are approximately 1,365 acres of publicly owned open space in Leyden, accounting for about 22 percent of the total amount of open space with some level of protection from development in town. In Leyden, publicly owned open space includes land owned by state conservation agencies, the Town of Leyden, and the Inhabitants of the Town of Greenfield on behalf of the Greenfield Fire District and Water Department. These lands are described in Tables 5-7, 5-8 and 5-9. For the purposes of this section, the town's publicly owned cemeteries are included in this category. Cemeteries are listed in Table 5-10. Most of the publicly owned open space in Leyden is forested or occupied by cemeteries.

Table 5-7: State-Owned Land Protected from Development in Leyden

Property Manager	Site Name	Acres	Assessor's Map	Assessor's Lot	Current Use	Condition	Recreation Value	Public Access
Division of Fisheries and Wildlife		17.25	1	47.1				
Dept. of Fish and Game	Leyden Wildlife Management Area	772.35	13 15 16 17	13.1 29 2, 3, 5 28, 32	Wildlife Management Area	Recently completed cutting fields and spraying invasives.	High	Good for walking; Through a right of way at Greenfield Reservoir off Oak Hill Rd., Glen Rd. and Eden Trail Rd.
Dept. of Conservation and Recreation	Leyden State Forest	59.63	1	64	State Forest	Currently inaccessible. Harvested in the 1950s but not since.	High	Right of way through Facey property on North County Rd.
Total		**849.23**						

Source: Town of Leyden Assessor's Records and Maps, 2010; Dept. of Fish and Game, 2010; Department of Conservation and Recreation, 2010; Sam Lovejoy, personal communication, July 2010.

The Massachusetts Department of Conservation and Recreation, Division of State Parks and Recreation manages the Leyden State Forest, a small parcel of approximately 60 acres located in the north-central sector of town. The Department of Fish and Game manages the Leyden Wildlife Management Area (WMA), consisting of approximately 772 acres located in the southeastern sector of Leyden. The WMA is comprised of several parcels and is open for hunting, walking, and nature study. In recent years, Fish and Game has acquired 5 parcels consisting of over 400 acres north of the WMA, formerly part of the Herron family holdings.

The Town of Leyden owns 21 acres of open space and the Town of Greenfield owns 483 acres of open space in Leyden all of which have limited protection (see Table 5-8 and 5-9). All of these Leyden-owned parcels are under the authority of the Select Board and are therefore considered to have limited protection from development (as are the parcels managed by the Greenfield Fire District and Water Department). If residents wanted to sell this town land for development, the Select Board or a Town Meeting vote could provide the authority. The Conservation Commission also holds 6 acres, which is considered to be protected from development because it

would take a majority vote by the Massachusetts State Legislature to convert the open space to a non-conservation use. Some of these open spaces may be set aside for municipal uses like schools, parks, or historic sites.

Table 5-8: Town-owned Land with Limited Protection from Development in Leyden

Owner / Property Manager	Site Name	Acres	Assessor's Map	Assessor's Lot	Current Use	Condition	Recreation Value	Public Access
Town of Leyden	Hemlock Forest	12.80	2	23	Wooded lot with a 20% slope	Steep and Unimproved	Low	No Access
Town of Leyden	Town Common	0.55	9	7	Park and Green	Good, well maintained	Picnicking, scenic views east	Parking at Town Hall
Town of Leyden	Elementary School grounds	8.00	9	44	About six acres of the eight-acre parcel are in playgrounds, fields, and forest	Good, well maintained	High	Access from Brattleboro Road
Total		**21.35**						

Source: Town of Leyden Assessor's Records and Maps, 2010.

Table 5-9: Land with Limited Protection from Development owned by Inhabitants of the Town of Greenfield in Leyden

Property Manager	Acres	Assessor's Map	Assessor's Lot
Greenfield Fire District	158.80	13	14,16
Greenfield Fire District	1.60	15	12
Greenfield Fire District	84.20	17	16, 17, 23-26, 36, 38-41, 64
Greenfield Water Dept.	238.03	17	15, 18, 21,22, 33-35, 37, 42, 46, 53, 66
Total	**482.63**		

Source: Town of Leyden Assessor's Records and Maps, 2010; Sam Lovejoy, personal communication, July 2010.

It is not unusual for a community to set aside land for future expansion of schools, sports fields, police and fire stations, and drinking water supplies. Open space planned for these purposes might be used as open space today and placed under the authority of the Select Board. It may also be sensible to place town-owned land that clearly contains wetlands or wildlife habitat, but which does not provide for easy development, under the authority and protection of the Conservation Commission.

Table 5-10 lists the properties in Leyden that are owned by the town and are permanently protected from development. All of these properties are located in the Town's Residential Agricultural Zoning District. They include properties owned by the Conservation Commission and cemeteries managed by individual cemetery committees. Most cemeteries represent well-maintained open space areas that are sometimes appropriate for walking and bird watching.

Table 5-10: Town-owned Land Permanently Protected from Development in Leyden

Site Name	Map	Lot	Acres	Current Use	Condition	Recreation Value	Public Access	Grants
CONSERVATION COMMISSION								
Church Sanctuary	6	1	0.94	A small wooded lot	No trail access	Low	A sign identifies the lot off of East Hill Rd.	N/A
	9	43.2, 43.3	3.26	Nature study	Steep & unimproved	Low	Access from both Brattleboro and Greenfield Roads	N/A
	11	12	1.99	Cow Pasture	Improved	Low	No access	N/A
Subtotal ConComm			6.19					
CEMETERIES								
Beaver Meadow Cemetery	2	46	2.0	Cemetery	Good	High	Access from Brattleboro Rd.	N/A
West Leyden Cemetery	3	11	0.66	Cemetery	Good	High	Access from West Leyden Rd.	N/A
East Hill Cemetery	10	11	0.47	Cemetery	Good	High	Off of Eden Trail Rd.	N/A
South Cemetery	12	21	2.00	Cemetery	Good	High	Access from Greenfield Rd.	N/A
Subtotal Cemeteries			5.13					
TOTAL PROTECTED TOWN-OWNED LAND			**11.32**					

Source: Town of Leyden Assessor's Records and Maps, 2010.

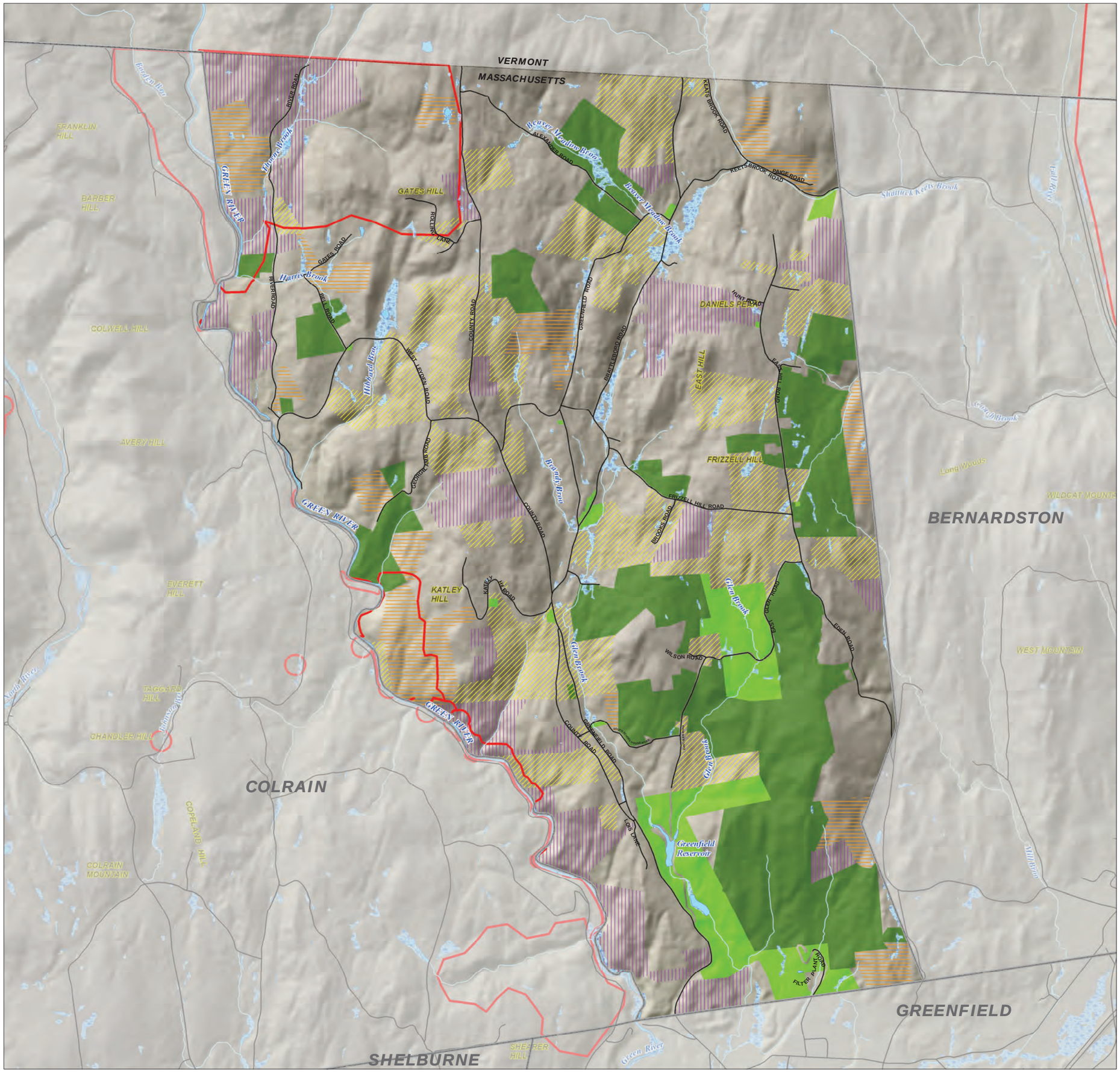
C. OPEN SPACE EQUITY

Open Space Equity means taking a look at conservation and recreation opportunities available in the town and determining if there are areas of the town that seem to be lacking resources. This is somewhat difficult to do in a town the size of Leyden, with only a few areas recognized by residents as discrete neighborhoods, such as the Town Center. Leyden has very few recreational facilities, which is not unique among rural western Massachusetts towns. There is a playground at the Pearl Rhodes Elementary School, ball fields and a basketball court at Avery Field, and people often use the Town Common for celebrations and fairs. Respondents to the 2009 Open Space Survey felt that the following facilities were at least adequate to meet their needs: library programming, Town Common areas, and Avery Ball Field. Basketball courts, hiking trails, and recreational programming are facilities that many respondents felt are in poor condition. The most popular activities according to the survey were walking, gardening, hiking, bird watching, and snowmobiling. These activities can all be done throughout the Town of Leyden. Given Leyden's community setting and traditions, there is no area of town that is deprived of recreational opportunities relative to other areas. (See Appendix A for the Town of Leyden's ADA Self-Evaluation Report.)

Town of Leyden

Protected Open Space

Open Space and Recreation Plan



BioMap Core Habitat
Road
Wetland

Open Space

- Permanently Protected
- Limited Protection
- Chapter 61A
- Chapter 61F
- Chapter 61B

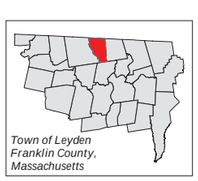
N
W E
S

0 0.125 0.25 0.5 Miles

FRANKLIN REGIONAL COUNCIL OF GOVERNMENTS
Main Office: 413-774-3167
425 Main Street
Greenfield, Massachusetts 01301

Map Sources:

Map Produced by the Franklin Regional Council of Governments Planning Department. GIS data sources include the FRCOG Planning Department, the Massachusetts Highway Department and MassGIS. Digital data obtained from MassGIS represent the efforts of the Massachusetts Executive Office of Environmental Affairs and its agencies to record information from the sources cited in the associated documentation. EOEA maintains an ongoing program to record and correct errors in the GIS data that are brought to or as to the implied validity of any uses of the GIS data. EOEA maintains records regarding all methods used to collect and process these digitaldata and will provide this information on request. Executive Office of Environmental Affairs, MassGIS EOEA Data Center, 251 Causeway St., Suite 900, Boston, MA, 617-626-1000.
Note: Depicted boundaries are approximate and are intended for planning purposes only.



Town of Leyden Franklin County, Massachusetts

SECTION 6

COMMUNITY VISION

A. DESCRIPTION OF PROCESS

The 2004 Leyden Open Space and Recreation Plan, of which this plan is an update, was developed between September 2002 and March 2004 using a comprehensive planning process. Public participation methods included: a survey mailed to all Leyden households; five public meetings held by the Open Space Committee; maps displayed in Town Hall; and a public forum. As an update to the 2004 plan, the 2010 Leyden Open Space and Recreation Plan builds on these past planning efforts while incorporating new information and public input. The Town of Leyden's 2010 open space and recreation goals were developed through the following planning process:

- In Fall of 2009, open space and recreation surveys were mailed to approximately 340 households in Leyden. Of these, 35 were returned and counted as responses, which represents an 11 percent rate of return. (See Appendix C for a copy of the survey results). Although the responses may not reflect the opinions of all residents, they do represent a significant source of community input, which was used to develop Section 7-Analysis of Needs and Section 8-Goals and Objectives.

- From Fall 2009 to December 2010, the Franklin Regional Council of Governments Planning Department staff developed the Leyden Open Space and Recreation Plan update with input from the Leyden Open Space Committee. The planning process used several methods for involving public participation:
    - The results of the 2009 Open Space and Recreation Survey were used as the basis for the development of goals and objectives as well as the overall open space and recreation vision.
    - Five public meetings were held by the Open Space Committee. (See Appendix B for copies of meeting agendas and sign-in sheets.)
    - Copies of the Open Space and Recreation Plan maps were displayed in the downstairs meeting room of the Town Hall.
    - A public forum was held on October 27, 2010 where residents reviewed and discussed the major findings and seven-year action plan. All public comments were recorded and considered for incorporation into the plan.

B. STATEMENT OF OPEN SPACE AND RECREATIONAL GOALS

Leyden's residents appreciate the Town's small town rural character, and expansive scenery. They value the town's diverse landscapes, which include a mix of working farms, extensive forests, steep hillsides and narrow floodplain corridors. They like living in a town with clean air and water, a dark night sky, and a great diversity of native plants and animals, that is relatively safe from crime, and all within minutes of Greenfield and Brattleboro, Vermont. Residents also appreciate and value the Town's terrain—long cleared hilltop vistas and old pastures.

Residents who responded to the Open Space and Recreation Survey and participated in the process of developing this plan have a vision for the future of Leyden's natural, historical, and recreational resources. In this ideal world, the Town's large blocks of forests and active farmland will be protected as a result of cooperative efforts between private landowners, the Leyden Conservation Commission, Leyden Planning Board, and local private non-profit organizations like Franklin Land Trust and Mount Grace Land Conservation Trust. Due to the methods used, these lands will remain in private hands and control, and continue to contribute property taxes. The Town's rivers and streams will be clean enough for fishing and swimming and the Green River and Glen Brook will continue to provide clean drinking water to the residents of Greenfield. In an ideal world, Leyden would be compensated financially for continuing to maintain land uses that contribute to the purity of the water consumed by Greenfield residents. Leyden would also continue to enjoy clean drinking water from sources and aquifers protected from contamination.

In an ideal Leyden there will be a diverse local economy, anchored by small home businesses and agricultural and forest-based businesses using farm stands that take advantage of the moderate flow of traffic between Brattleboro and Greenfield. The Agricultural Commission, created by the Town in 2007, is active in promoting farming in Leyden. As a result of supporting local agricultural and forestry businesses, Town residents will have access to fresh vegetables, dairy products, fruit and meat produced close to home, as well as the opportunity to buy forest products grown by neighbors. Promoting these renewable, natural resource-based enterprises helps farms and forestry businesses stay viable while maintaining open space.

Residents of all ages and abilities will continue to enjoy access to the Library, to Avery Ball Fields and to the Pearl Rhodes Playground as well as to a system of well-maintained trails. Trail enthusiasts will have been successful at organizing and facilitating trail access to only those private trails open to the public with the express permission of the landowners. Landowners interested in providing access might be offered incentives for providing public access to their land. Leyden will have acquired permanent public access to the Green River near the Ten-Mile Bridge. In addition, the Town will have been successful at attracting grants and assistance from local land trusts towards the development of landowner educational programs on land protection and estate planning and on the fiscal costs in community services of different types of development and open space in Town.

SECTION 7

ANALYSIS OF NEEDS

The Leyden Open Space and Recreation Plan incorporates the inventory of all the land-based natural, scenic, and cultural resources that are available in town (Section 4), identifies the areas that contain these resources (Section 5), and based on the community's general goals (Section 6), makes comparisons between the supply of resources and the demand (Section 7). In the following subsection, A. Summary of Natural Resource Protection Needs, the most important environmental issues are highlighted. In B. Summary of Community's Needs, the recreation and open space needs of the residents are discussed. Finally, in C. Management Needs, the obstacles to the effective resolution of these needs are addressed.

A. SUMMARY OF NATURAL RESOURCE PROTECTION NEEDS

Drinking Water, Clean Air, Wildlife Habitat, Rural Character, the Green River and its Watershed, and Farmland are the Natural Resources Most Important to Conserve

Leyden residents value their town's natural environment, clean drinking water and air, forests, diverse wildlife habitats, farmland, and short and long-range scenic views. They appreciate all of the ways their town still feels rural and want to keep it that way. According to the 2009 Open Space Survey, at least 91 percent of survey respondents stated that it was important to conserve clean drinking water, clean air, rural character, open fields, wildlife habitat, streams and ponds, scenic views, forests, and the Green River and its watershed. The 2009 survey was mailed with the Town newsletter in the fall of 2009 to 340 households in Leyden. (See Appendix A for an analysis of the Leyden Open Space and Recreation Survey Results, 2009.)

Public and privately owned forestland provides multiple public benefits to Leyden residents. Forests cover sub-watershed slopes and help replenish streams and wetlands over time. Forests provide habitat for wildlife and can provide public and private landowners periodic income if managed sustainably. In Leyden, forests also provide a context to farms within some of the most scenic short and long-range views in town.

Non-point Source Pollution and Unplanned Development Threaten Natural Resources in Leyden

The main environmental issues include non-point source pollution and the impacts of unplanned development. Generally speaking, people need to become more aware of how their actions may negatively impact water quality of rivers, streams, ponds, and groundwater. Non-point source pollution happens when organic and inorganic pollutants

enter soil or water from other than a single point, like a pipe. One example of a potential non-point source of pollution is home construction on a non-vegetated slope because rain can wash topsoil into abutting wetlands.

Unplanned development, which can increase the amount of stormwater runoff (another form of non-point source pollution), is a way of describing what can occur in a community that has minimal zoning, land use regulation, or protected land. With unplanned development, houses appear on building lots easiest to develop. Most residential development in this situation would likely be a combination of approval-not-required lots along Town roads and traditional, "cookie-cutter" subdivisions. Unplanned development can increase the threat, over time, to the natural resources most valued by Leyden residents.

Balancing Development and Conservation: Planned vs. Unplanned Development

The challenge for many rural towns in the Commonwealth is to grow in population without diminishing natural resources like clean drinking water and contiguous forests beyond the capacity of local ecosystems. Although exact capacity thresholds for water supplies and forest habitat acreage are not yet known, most Leyden residents would probably agree that poorly planned development can detract from their town's rural character and erode the quality of the environment over time.

Of course, some types of residential, commercial, and industrial development can be very beneficial to a community, especially if it is consistent with a town plan that balances growth with natural resource protection. Well-planned economic development, for example, could help provide jobs for low and moderate-income households and lower the expense per household for community services. In comparison, poorly planned economic development could result in higher costs than the revenues it generated via property taxes.

Promoting traditional economic development that attracts new residents to fill created jobs may not be the best strategy for Leyden. Generally, as more families move to Leyden, a greater level of municipal services would be required to serve the growing population, including schools and road infrastructure. Based on regional trends, the average residential tax bill will likely rise as the population of Leyden increases because service costs are greater than the revenues generated by residential property. In addition, residential development could reduce the number of acres in agricultural uses over time since active farmland often contains the most developable soils.

Not all development is undesirable, nor could the town over-control land development, even if this were the consensus of residents and officials. Most residents understand the need for balance and respect the rights of property owners, including the right to develop land. Through zoning and non-zoning techniques the town could provide incentives to developers so that development could contribute as much as possible to the residents' shared vision for their town. For example, by encouraging smaller lot sizes near historic village centers, forest or farmland could remain undeveloped.

Another way the town could promote and preserve active farmland, help stabilize local residential property tax bills, and create jobs, is by seeking to increase the market value of local agricultural and forest-based goods and services. Increasing revenue to farms and forest landowners via direct sales might create a small number of local jobs. A town with a greater number of its residents working locally feels different than a bedroom community. Local workers can support stores and other services with their purchases.

In summary, one of the most important natural resource needs is for a continuing discussion on how residents want their town to develop over time, and which areas should be protected from development so that water, forests, habitat, and farmland can be conserved for the next year, and the next 100 years.

B. SUMMARY OF COMMUNITY'S NEEDS

Planning for a community's open space and recreation needs must satisfy the present population's desires for new facilities, spaces, and services, and also must interpret and act on the available data to prepare for the future needs of Leyden residents. Although the Leyden Open Space and Recreation Plan will be updated in seven years, the types of actions identified in Section 9 will take into account the needs of the next generation as well.

The 2009 Open Space and Recreation Survey, and discussions at Open Space Planning Committee meetings, helped to identify several potential community needs relating to open space and recreation resources: recreational programming, community events and festivals; multi-user trails; and the support of existing library programming.

Recreational Programming

Over the years, the Leyden Recreation Committee has provided a menu of recreational and community-wide events: Rag Shag Parade for kids, Summer Youth Programs, The Steak Roast, and others. Which programs run in a particular year depends on demand and the availability of volunteers to supervise activities. For example, the summer programs, which focus on youth physical education activities, have not occurred in past years due to lack of participants. Demand for different types of recreational activities appears to go up and down over time.

Community Events and Library Programming

The 2009 Survey points to the important role that community events and library programs play in serving the recreation needs of residents. The town's library might be best funded through town appropriations and grants, while volunteers already organize and lead community events or programs. The recent loss of bookmobile service in the region poses a threat to the continued quality of library programming in Leyden. Groups such as the Cultural Council, Library Trustees, and the Friends of the Library may want

to consider joining with neighboring towns to share resources for community events, library programming and other recreational needs.

Hiking, Snowmobiling and Cross-country Skiing Trails

Residents reported in the 2009 Open Space and Recreation survey that walking and hiking were among the three most popular forms of recreation. Hiking trails were also identified as one of the most used recreational resources in Town. Many survey respondents felt that hiking trails in Leyden are in good condition (20%), however there were also a number of respondents who felt that hiking trails were in poor condition (17%).

Snowmobiling is also a popular form of recreation for Leyden residents, enjoyed by 53% of respondents to the 2009 survey (the 5th most popular activity out of 25). Forty-six percent of respondents said that snowmobiling trails are in excellent, good or adequate condition. Often these are the same trails used for hiking and for cross-country skiing, another activity enjoyed by 22% of Leyden residents.

Considering that trails for hiking, snowmobiling and cross-country skiing are so important to residents, town officials might consider ways of ensuring long-term public access to trails. The development of permanent trail systems on privately owned land can be a long-term project. Developing trails on publicly owned land might be a more reasonable short-term endeavor. In either case, success will be dependent in large part upon the presence of leadership. There needs to be a person or persons willing to move the project from beginning to end.

Special Populations

The Town of Leyden will need continue to address the recreational and other needs of special populations among its residents, such as the elderly and the handicapped. The Council of Aging currently runs programs for the elderly and more such programs will likely be necessary as the population overall ages. In addition, programs for handicapped residents will continue to be a critical need for those of all ages with mobility impairments. The Town has recently completed a $500,000 upgrade to Town Hall that has improved handicap access and should make it an attractive venue for programs for these residents in the future.

C. MANAGEMENT NEEDS

The most important management need for local officials and community leaders may very well be the importance of building consensus on a vision for the future of land use, development and conservation in town. This process has been initiated in earlier open space and recreation planning, through past zoning revisions, the community development planning process, and continues with this open space and recreation planning process. Consensus is needed to determine the land that should be protected

and the land that should be developed. Without consensus, the town will be less equipped to protect its water supplies, farmland, open meadow, and large blocks of forest habitats, as well as to develop future hiking trails. Another management-related issue that is common to communities with small populations is the relatively few people involved in oversight of town facilities, land, services and programs.

Conserving Drinking Water Resources

The Town of Leyden may consider working more proactively with the Town of Greenfield to develop strategies that protect against non-point source pollution within the Green River and Glen Brook sub-watersheds. Town officials might consider ways of enrolling Greenfield to seek Massachusetts Local Acquisitions for Natural Diversity (LAND) funds from the Division of Conservations Services to conserve open space and drinking water supplies in Leyden. In addition the Leyden Board of Health might consider ways to encourage and support residents for regular testing of their water supplies.

Supporting Farm Viability

Although farmland is at risk throughout New England, as market and other forces often work against small family farms, there are a multitude of strategies available to a town committed to preserving its local and regional agricultural industry. Local volunteer leadership must continue to work with regional land conservation and farm promotion efforts. The town may also need to continue to ensure that its policies are friendly to farm and forest-based businesses. In addition, farmers may need to be consulted in advance if the town is considering the development of strategies or zoning which might affect their bottom line.

Protecting Large Blocks of Forest from Fragmentation

To protect large blocks of forest from fragmentation might require both land protection efforts and strategies similar to those that would support farm viability. Land protection work may begin with providing landowners (residents and non-residents) with information about the benefits and risks of enrolling in the Chapter 61 programs, in protecting their land with a conservation restriction, and with estate planning in general. Leyden may consider developing a way for residents to learn about and support local forest-based businesses like sawmills and maple-syrup producers.

Hiking, Snowmobiling and Cross-country Skiing Trails

To develop a town-wide trail system that takes advantage of historical roads and paths, Leyden officials might begin by organizing a well-represented trails committee**.** The purpose of the committee would be to develop a coordinated plan for trail development, maintenance, and promotion in town. The plan could be a long-term action-based plan, which would require the collaboration of willing private landowners, and would focus on the trails they support the most.

It Appears that a Small Percentage of the Population is Involved with Community

Volunteer boards and committees of towns with relatively small populations, like Leyden, commonly experience a shortage of people willing to serve. In the year 2000, the Town of Leyden contained 770 residents, only 565 of whom were twenty years of age or older. Leyden officials cannot simply count on new volunteers simply showing up to serve on long-term boards and committees. Instead they might find a project or topic that people care about and create an easy way for volunteers to make a difference through their input and encourage town committees and community groups (such as the Cultural Council, Agricultural Commission, PTO, etc.) to continue to provide events that bring community members together face to face. People tend to take care of something if they feel ownership towards it. As people learn more about their town and their neighbors, they may feel more like a member of a community that wants to give back.

SECTION 8

GOALS AND OBJECTIVES

The following goals and objectives were formulated from the results of the 2009 Leyden Open Space and Recreation Planning Survey and the Analysis of Needs presented in Section 7. The goals and objectives have been reviewed and modified through the public meetings of the Open Space Committee, the public forum process, and associated public comment.

Goal A: Ensure that the Town of Leyden maintains the integrity of drinking water, clean air, streams and wetlands, working farms and forests, remaining contiguous forests, scenic views, and the diversity and integrity of native fauna and flora through the conservation of locally important natural and open space resources.

Objectives:

1. Encourage landowners interested in protecting their land from development to work with Franklin Land Trust, Mount Grace Land Conservation Trust, and state and federal conservation agencies.

2. Accept donated conservation open space and conservation restrictions from willing landowners that conserve working farms and forests, large blocks of contiguous forestland, drinking water supplies, streams and ponds, open fields, scenic views, and wildlife habitat.

3. Take advantage of the opportunity offered by the Town's right-of-first refusal with regards to the sale and or development of Chapter 61, 61A, and 61B parcels or assign the right to a third party.

4. Facilitate a program of water quality monitoring for the rivers, brooks, streams and ponds in Leyden in conjunction with the Deerfield River Watershed Association, the Greenfield Water Department, and other entities.

5. Consider ways to encourage and support residents' regular testing of their private water supplies.

6. Promote state and private investment to protect local farm and forest landscapes.

7. Develop a land protection education program for landowners to include estate planning, land protection options, and presentations by local land trusts.

Goal B: Ensure that Leyden maintains its rural, small-town character and a strong sense of community, including providing recreational opportunities to residents of all ages and abilities.

Objectives:

1. Support the continued development of festivals and events to provide residents with year-round opportunities to get to know each other and become more involved in their community.

2. Continue to explore changes to local zoning and subdivision regulations that would help to protect remaining farms, open fields, and large blocks of forest from adverse impacts by approval-not-required (ANR) and residential subdivision development.

3. Support and contribute to the efforts of the Massachusetts Zoning Reform Working Group and others working to revise the state's zoning act to provide towns better tools for controlling growth.

4. Encourage local cottage industries and farm and forest-based economic activities through the use of both zoning and non-zoning techniques.

5. Seek to increase the market value of local agricultural and forest-based goods and services by expanding opportunities for direct sales to consumers via farmers markets, roadside stands, etc.

6. Provide information to townspeople on the costs of services and benefits of residential, commercial, and industrial development through the newsletter and other methods.

7. Identify recreational needs of residents of all ages and abilities and develop new programs and facilities as appropriate.

8. Evaluate the feasibility of providing access to valued recreational resources.

9. Support the development of multi-user (walking/hiking, snowmobiling, cross-country skiing) trail systems that tie into existing ones, which can be accessed from publicly owned land or private lands with trail easements from willing landowners.

10. Continue to maintain Library programming, the Avery Ball Fields, and access to the Pearl Rhodes Playground at the level residents have come to expect.

11. Consider joining with neighboring towns to share resources for community events, library programming and other recreational needs.

12. Take a proactive approach to environmental problems related to the spread of introduced pests, including invasive species.

13. Maintain and protect public shade trees and stone walls along the Town's scenic roads.

SECTION 9

SEVEN-YEAR ACTION PLAN

The Seven-Year Action Plan is intended to provide concrete steps towards implementing the objectives of the Open Space and Recreation Plan. The Open Space Committee developed the action steps outlined below.

The goals and objectives are listed in the first two columns of Table 9-1 in the same order as they appear in Section 8. They are followed in the subsequent columns by recommended actions, the board or group responsible for implementation, start dates, and potential funding sources. By implementing the recommended actions, each of the objectives will begin to be realized. The Open Space Committee prioritized the action items to assist in the implementation process. Successful implementation will require the participation of existing town boards, committees and staff, including but not limited to the Selectboard, Planning Board, Conservation Commission, Agricultural Commission, Council on Aging, Board of Assessors and others.

The Open Space Committee established the following priority action items to assist in the successful implementation of the Plan. (Information in parentheses after each Priority Action Item identifies the corresponding number of the item on Table 9-1 in Section 9: Seven-Year Action Plan.) These Priority Action Items are also included on the Action Plan Map at the end of this section. Following are the Priority Action Items, presented in order of priority from higher to lower:

- Continue to implement a clear tracking procedure protocol for the Town to process conversions of Chapter 61, 61A, and 61B parcels to uses that trigger the granting of right-of-first-refusal to the Town. (Action Item A3a)
- Work with local land trusts, nonprofit conservation agencies, and state and federal programs (such as MDAR's Agricultural Preservation Restriction Program and the USDA Forest Legacy Program) to protect local farm and forest landscapes. (Action Item A6a)
- Meet with Greenfield Water Department staff and representatives of the Deerfield River Watershed Association (DRWA) to discuss the potential for collaboration on water quality monitoring town-wide. (Action Item A4a)
- Revise zoning bylaws to continue adding components like a natural resource protection overlay district and an accessory apartment bylaw to help ensure that future development conserves the town's rural character and environmental quality where possible. (Action Item B2a)

- Review results of the 2009 Open Space and Recreation survey and determine which new programs and facilities are most needed and have the best chances of succeeding. Once the desirable programs and facilities are identified, seek to provide them. (Action Item B7a)
- Submit an annual article in the Town Newsletter that explains choices that landowners have in regards to the long-term stewardship of their land, which can include donating land in fee, donating money into the town's existing Land Acquisition Fund, or donating the development rights to the Town of Leyden. (Action Item A2b)
- Continue to implement procedures for the assignment to third parties (such as local land trusts), where appropriate, of the right of first refusal on conversions of Chapter 61, 61A, and 61B parcels. (Action Item A3b)
- Request the Town Clerk and local realtors to provide landowners with a packet of information that addresses land stewardship issues dealing with both development and conservation choices. (Action Item A7a)
- Encourage broad public participation in the local planning process to ensure that appropriate solutions for land use and growth management are identified. (Action Item B2b)
- Work with the Trustees of Reservation's Highland Communities Initiative (HCI) to fund or otherwise support a conference focusing on strategies to support farm and forest-based businesses and involve CISA, MWC, and NEFF.[1] (Action Item B4a)
- Include an occasional column on land use, open space, and cost of community services issues and information in the newsletter. (Action Item B6a)
- Identify areas with the greatest potential for providing public access to the Green River. (Action Item B8a)
- Meet with corresponding boards and committees in neighboring towns and consult with FRCOG staff to help identify opportunities for collaboration on events and recreational programming. (Action Item B11a)

Accomplishing the actions identified in this section will require time and commitment from dedicated volunteers. Where money is required, it may be sought from state and federal governmental agencies, private non-profit conservation agencies, foundations, and individual donations in addition to municipal funds. A broad base of community support for the Open Space and Recreation Plan should facilitate fundraising to achieve its goals and objectives.

[1] CISA=Community Involved in Sustaining Agriculture; MWC=Massachusetts Woodlands Cooperative; NEFF=New England Forestry Foundation.

Table 9-1: Recommended Action Steps to Implement the Leyden Open Space and Recreation Plan

GOAL	OBJECTIVE	ACTION	RESPONSIBLE BOARD or GROUP	START DATE	POTENTIAL FUNDING SOURCES
A. Ensure that the Town of Leyden maintains the integrity of drinking water, clean air, streams and wetlands, working farms and forests, remaining contiguous forests, scenic views, and the diversity and integrity of native fauna and flora through the conservation of locally important natural and open space resources.					
	A1. Encourage landowners interested in protecting their land from development to work with Franklin Land Trust, Mount Grace Land Conservation Trust, and state and federal conservation agencies.	a. Produce a landowner workshop on estate planning and land protection options.	Open Space Committee	2011	Volunteer time; local land trusts; HCI
	A2. Accept donated conservation open space and conservation restrictions from willing landowners that conserve working farms and forests, large blocks of contiguous forestland, drinking water supplies, streams and ponds, open fields, scenic views, and wildlife habitat.	a. Accept donated conservation open space and conservation restrictions from willing landowners.	Conservation Commission	2011-2017	Volunteer time
		b. Submit an annual article in the Town Newsletter that explains choices that landowners have in regards to the long-term stewardship of their land, which can include donating land in fee, donating money into the town's existing Land Acquisition Fund, or donating the development rights to the Town of Leyden.	Open Space Committee; Conservation Commission; Newsletter Committee	2011-2017	Volunteer time

GOAL	OBJECTIVE	ACTION	RESPONSIBLE BOARD or GROUP	START DATE	POTENTIAL FUNDING SOURCES
	A3. Take advantage of the opportunity offered by the Town's right-of-first refusal with regards to the sale and or development of Chapter 61 parcels or assign the right to a third party.	a. Continue to implement a clear tracking procedure protocol for the Town to process conversions of Chapter 61, 61A, and 61B parcels to uses that trigger the granting of right-of-first-refusal to the Town.	Selectboard; Open Space Committee; Agricultural Commission; Board of Assessors; Tax Collector	2011-2017	Volunteer time
		b. Continue to implement procedures for the assignment to third parties (such as local land trusts), where appropriate, of the right of first refusal on conversions of Chapter 61, 61A, and 61B parcels.	Selectboard; Open Space Committee; Agricultural Commission; Board of Assessors; Planning Board	2011-2017	Volunteer time; local land trusts
		c. Determine whether the existing Land Acquisition Fund could be used for the purposes of receiving private donations for open space protection. If it can be used in that way, promote its use in the Newsletter.	Open Space Committee; Conservation Commission; Selectboard; Municipal Assistant	2011	Volunteer time

GOAL	OBJECTIVE	ACTION	RESPONSIBLE BOARD or GROUP	START DATE	POTENTIAL FUNDING SOURCES
	A4. Facilitate a program of water quality monitoring for the rivers, brooks, streams and ponds in Leyden in conjunction with the Deerfield River Watershed Association, the Greenfield Water Department, and other entities.	a. Meet with Greenfield Water Department staff and representatives of the Deerfield River Watershed Association (DRWA) to discuss the potential for collaboration on water quality monitoring town-wide.	Board of Health; Conservation Commission; Open Space Committee	2011-2017	Volunteer time; DEP 604b grants; DRWA volunteer monitors; Riverways Program stream teams; CT River Watershed Council; EPA equipment loans
	A5. Consider ways to encourage and support residents' regular testing of their private water supplies.	a. Disseminate information on appropriate tests and testing intervals and explore potential funding sources to assist private well owners.	Board of Health; Conservation Commission; Open Space Committee	2013	UMass Cooperative Extension Service; DEP staff services and grants
	A6. Promote state and private investment to protect local farm and forest landscapes.	a. Work with local land trusts, nonprofit conservation agencies, and state and federal programs (such as MDAR's Agricultural Preservation Restriction Program and the USDA Forest Legacy Program) to protect local farm and forest landscapes.	Open Space Committee; Conservation Commission; Agricultural Commission	2011-2017	Local land trusts; conservation agencies (such as MassAudubon and NEFF); MDAR APR Program; USDA Forest Legacy Program
	A7. Develop a land protection education program for landowners to include estate planning, land protection options, and presentations by local land trusts.	a. Request the Town Clerk and local realtors to provide landowners with a packet of information that addresses land stewardship issues dealing with both development and conservation choices.	Open Space Committee; Town Clerk	2014	Volunteer time; local land trusts

GOAL	OBJECTIVE	ACTION	RESPONSIBLE BOARD or GROUP	START DATE	POTENTIAL FUNDING SOURCES
B. Ensure that Leyden maintains its rural, small-town character and a strong sense of community, including providing recreational opportunities to residents of all ages and abilities.					
	B1. Support the continued development of festivals and events to provide residents with year-round opportunities to get to know each other and become more involved in their community.	a. Support an active Recreation Committee to create and supervise recreational programs and services for residents of all ages and abilities.	Selectboard; Agricultural Commission; Council on Aging; Library Trustees; Cultural Council; PTO	2011-2017	Volunteer time
		b. Develop and implement a year-round schedule of events, including a Leyden Maple Syrup Festival.	Selectboard; Agricultural Commission	2011-2017	Volunteer time; Cultural Council
	B2. Continue to explore changes to local zoning and subdivision regulations that would help to protect remaining farms, open fields, and large blocks of forest from adverse impacts by approval-not-required (ANR) and residential subdivision development.	a. Revise zoning bylaws to continue adding components like a natural resource protection overlay district and an accessory apartment bylaw to help ensure that future development conserves the town's rural character and environmental quality where possible.	Planning Board; Open Space Committee	2011-2017	Volunteer time; Smart Growth or other grants secured by FRCOG staff
		b. Encourage broad public participation in the local planning process to ensure that appropriate solutions for land use and growth management are identified.	Planning Board; Open Space Committee	2011-2017	Volunteer time
	B3. Support and contribute to the efforts of the Massachusetts Zoning Reform Working Group and others working to revise the state's zoning act to provide towns better tools for	a. Continue to provide ongoing support to the Zoning Reform Working Group and other reform advocates directly through the Franklin	Planning Board	2011-2017	Volunteer time

GOAL	OBJECTIVE	ACTION	RESPONSIBLE BOARD or GROUP	START DATE	POTENTIAL FUNDING SOURCES
	controlling growth.	Regional Council of Governments.			
	B4. Encourage local cottage industries and farm and forest-based economic activities through the use of both zoning and non-zoning techniques.	a. Work with the Trustees of Reservation's Highland Communities Initiative (HCI) to fund or otherwise support a conference focusing on strategies to support farm and forest-based businesses and involve CISA, MWC, and NEFF[2].	Open Space Committee; Agricultural Commission	2015	Volunteer time; HCI; Smart Growth, MDAR or other grants secured by FRCOG staff; CISA; MWC; NEFF
	B5. Seek to increase the market value of local agricultural and forest-based goods and services by expanding opportunities for direct sales to consumers via farmers markets, roadside stands, etc.	a. Consider establishing a seasonal farmers market to provide a venue for local farmers to market their products directly to the public.	Open Space Committee; Agricultural Commission	2015	Volunteer time; CISA
		b. Consider developing a list of local farms and farm stands that sell directly to the public to be published in the Newsletter and/or as a brochure.	Agricultural Commission	2011	Volunteer time; CISA
	B6. Provide information to townspeople on the costs of services and benefits of residential, commercial, and industrial development through the newsletter and other methods.	a. Include an occasional column on land use, open space, and cost of community services issues and information in the newsletter.	Open Space Committee; Planning Board	2011-2017	Volunteer time

[2] CISA=Community Involved in Sustaining Agriculture; MWC=Massachusetts Woodlands Cooperative; NEFF=New England Forestry Foundation

GOAL	OBJECTIVE	ACTION	RESPONSIBLE BOARD or GROUP	START DATE	POTENTIAL FUNDING SOURCES
	B7. Identify recreational needs of residents of all ages and abilities and develop new programs and facilities as appropriate.	a. Review results of the 2009 Open Space and Recreation survey and determine which new programs and facilities are most needed and have the best chances of succeeding.	Open Space Committee; Recreation Committee; Council on Aging	2011-2017	Volunteer time
		b. Once the desirable programs and facilities are identified, seek to provide them.	Open Space Committee; Recreation Committee; Council on Aging	2011-2017	Volunteer time
	B8. Evaluate the feasibility of providing access to existing valued recreational resources.	a. Identify areas with the greatest potential for providing public access to the Green River.	Open Space Committee; Recreation Committee	2016	Volunteer time; DCR Recreational Trails grant; DFG Office of Fishing and Boating Access funds
		b. Work with willing landowners to create access to trails in the Leyden State Forest.	Open Space Committee; Trails Committee	2011-2017	Volunteer time; DCR Recreational Trails grant
	B9. Support the development of multi-user (walking/hiking, snowmobiling, cross-country skiing) trail systems that tie into existing ones, which can be accessed from publicly owned land or private lands with trail easements from willing landowners.	a. Consider creating a Trails Committee to work with Town officials and willing landowners to identify potential locations for multi-user trails and then develop them.	Selectboard; Recreation Committee; Open Space Committee; Conservation Commission	2011	Volunteer time; DCR Recreational Trails grant
		b. Support the development of a trail system on the Leyden Wildlife Management Area.	DCR; Trails Committee; Open Space Committee; Conservation	2011-2017	Volunteer time; DCR Recreational Trails grant

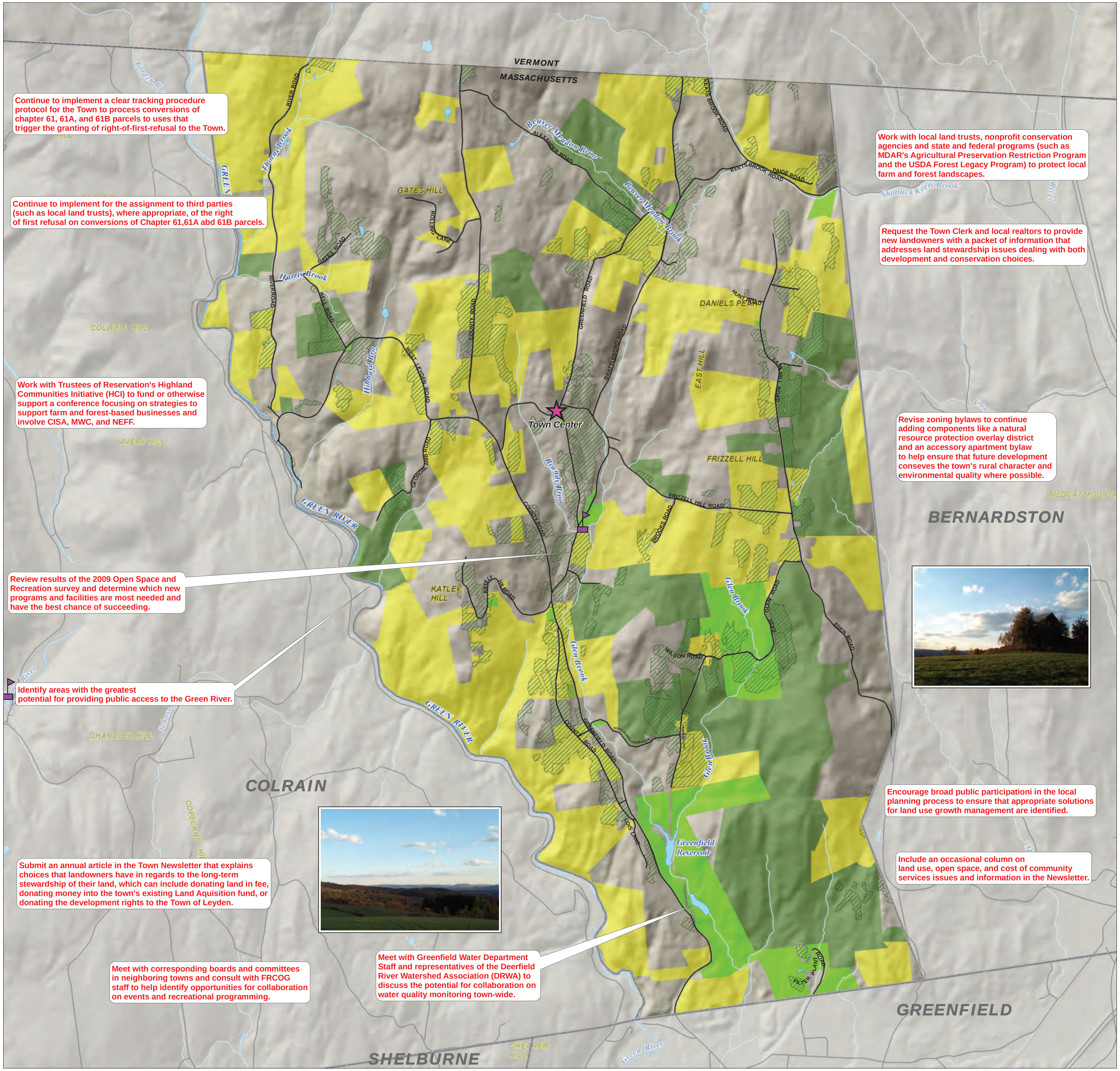
GOAL	OBJECTIVE	ACTION	RESPONSIBLE BOARD or GROUP	START DATE	POTENTIAL FUNDING SOURCES
			Commission		
		c. Prepare and disseminate a map and brochure showing public trails and private trails where willing landowners have provided public access.	Recreation Committee; Trails Committee; Open Space Committee	2013	Volunteer time; DCR Recreational Trails grant
	B10. Continue to maintain Library programming, the Avery Ball Fields, and access to the Pearl Rhodes Playground at the level residents have come to expect.	a. Develop clear guidelines for who is responsible for providing and maintaining existing programs and facilities.	Recreation Committee; Open Space Committee; Library Trustees; School Committee	2011-2017	Volunteer time
	B11. Consider joining with neighboring towns to share resources for community events, library programming and other recreational needs.	a. Meet with corresponding boards and committees in neighboring towns and consult with FRCOG staff to help identify opportunities for collaboration on events and recreational programming.	Selectboard; Recreation Committee; Open Space Committee; Library Trustees; FRCOG staff	2011-2017	Volunteer time; Cultural Council; grants secured by FRCOG
	B12. Take a proactive approach to environmental problems related to the spread of introduced pests, including invasive species.	a. Sponsor educational events and material for residents and the Highway Department regarding the management of invasive plant species.	Open Space Committee; Highway Department; Conservation Commission	2011-2017 (as needed)	Volunteer time
		b. Sponsor educational events and materials for residents concerning the management of invasive pests and diseases impacting vegetation, including food crops and trees.	Open Space Committee; Agricultural Commission; Tree Warden; Conservation Commission	2011-2017 (as needed)	Volunteer time; MDAR grants

GOAL	OBJECTIVE	ACTION	RESPONSIBLE BOARD or GROUP	START DATE	POTENTIAL FUNDING SOURCES
	B13. Maintain and protect public shade trees and stone walls along the Town's scenic roads.	a. Establish a Scenic Roads Committee.	Highway Department; Selectboard; Tree Warden; Planning Board; Open Space Committee	2011	Volunteer time
		b. Produce a Scenic Roads Policy to be adopted as a Town Ordinance and provide the funding necessary to implement it.	Scenic Roads Committee; Selectboard; Town Meeting	2012	Volunteer time; Tree Warden budget; Town Meeting appropriation

Town of Leyden

Action Plan

Open Space and Recreation Plan



VERMONT
MASSACHUSETTS
Continue to implement a clear tracking procedure protocol for the Town to process conversions of chapter 61, 61A, and 61B parcels to uses that trigger the granting of right-of-first-refusal to the Town.
Continue to implement for the assignment to third parties (such as local land trusts), where appropriate, of the right of first refusal on conversions of Chapter 61,61A abd 61B parcels.
Work with Trustees of Reservation's Highland Communities Initiative (HCI) to fund or otherwise support a conference focusing on strategies to support farm and forest-based businesses and involve CISA, MWC, and NEFF.
Review results of the 2009 Open Space and Recreation survey and determine which new programs and facilities are most needed and have the best chance of succeeding.
Identify areas with the greatest potential for providing public access to the Green River.
Submit an annual article in the Town Newsletter that explains choices that landowners have in regards to the long-term stewardship of their land, which can include donating land in fee, donating money into the town's existing Land Aquisition fund, or donating the development rights to the Town of Leyden.
Meet with corresponding boards and committees in neighboring towns and consult with FRCOG staff to help identify opportunities for collaboration on events and recreational programming.
Meet with Greenfield Water Department Staff and representatives of the Deerfield River Watershed Association (DRWA) to discuss the potential for collaboration on water quality monitoring town-wide.
Work with local land trusts, nonprofit conservation agencies and state and federal programs (such as MDAR's Agricultural Preservation Restriction Program and the USDA Forest Legacy Program) to protect local farm and forest landscapes.
Request the Town Clerk and local realtors to provide new landowners with a packet of information that addresses land stewardship issues dealing with both development and conservation choices.
Revise zoning bylaws to continue adding components like a natural resource protection overlay district and an accessory apartment bylaw to help ensure that future development conseves the town's rural character and environmental quality where possible.
Encourage broad public participationi in the local planning process to ensure that appropriate solutions for land use growth management are identified.
Include an occasional column on land use, open space, and cost of community services issues and information in the Newsletter.
Town Center
GATES HILL
DANIELS PEAK
EAST HILL
FRIZZELL HILL
KATLEY HILL
COLWELL HILL
AVERY HILL
CHANDLER HILL
BERNARDSTON
COLRAIN
SHELBURNE
GREENFIELD
GREEN RIVER
Greenfield Reservoir
RIVER ROAD
ALEXANDER ROAD
KEETS BROOK ROAD
PAIGE ROAD
GATES ROAD
ROLLING LANE
BELL ROAD
WEST LEYDEN ROAD
COUNTY ROAD
GREENFIELD ROAD
BRATTLEBORO ROAD
FRIZZELL HILL ROAD
BROOKS ROAD
GLEN ROAD
WILSON ROAD
EDEN ROAD
FILTER PLANT ROAD
Beaver Meadow Brook
Harris Brook
Hibbard Brook
Glen Brook

Road

School

Town Center

Open Space

Permanently Protected

Limited Protection

Temporary Protection Chapter 61, 61A, 61B

Land Use 2005

Agriculture

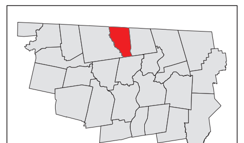
0 0.125 0.25 0.5 Miles

N W E S

FRANKLIN REGIONAL COUNCIL OF GOVERNMENTS
Main Office: 413-774-3167
425 Main Street
Greenfield, Massachusetts 01301

Map Sources:

Map Produced by the Franklin Regional Council of Governments Planning Department. GIS data sources include the FRCOG Planning Department, the Massachusetts Highway Department and MassGIS. Digital data obtained from MassGIS represent the efforts of the Massachusetts Executive Office of Environmental Affairs and its agencies to record information from the sources cited in the associated documentation. EOEA maintains an ongoing program to record and correct errors in the GIS data that are brought to or as to the implied validity of any uses of the GIS data. EOEA maintains records regarding all methods used to collect and process these digitaldata and will provide this information on request. Executive Office of Environmental Affairs, MassGIS EOEA Data Center, 251 Causeway St., Suite 900, Boston, MA, 617-626-1000.
Note: Depicted boundaries are approximate and are intended for planning purposes only.



Town of Leyden Franklin County, Massachusetts

SECTION 10

PUBLIC COMMENT

Public feedback, sought throughout the entire open space and recreation planning process, is difficult to document due to the fact that the draft plans constantly incorporated these changes and enhancements. A more direct request for feedback was presented in the Public Forum, which was held on October 27, 2010. Comments received during the Public Forum and the period prior to the forum have all been incorporated into the Plan. Participants were encouraged to mark any suggested revisions directly on the maps on display at the Public Forum and these revisions were incorporated in the final versions of the maps included in the plan.

Copies of the final version of the Leyden Open Space and Recreation Plan were sent to the Massachusetts Division of Conservation Services (DCS), the Franklin Regional Council of Governments, the Leyden Selectboard, Planning Board, Recreation Commission, and Conservation Commission for comment. Letters of support are inserted into the plan at the end of this section.

The following comments were recorded during the feedback session at the Leyden Open Space and Recreation Plan Public Forum held on October 27, 2010 at the Town Hall, beginning with map viewing and light refreshments followed by a presentation of highlights and discussion of the updated Plan. Thirty residents attended the forum, thanks to the press release and mini-ad placed in the local newspaper advertising it, as well as the sandwich board signs that were placed at the Town's two main intersections for several days prior to the event. Participants included local landowners, interested citizens, and members of the Selectboard, Planning Board, Open Space Committee, and Board of Assessors. A representative of the Franklin Land Trust was also in attendance.

Several of the comments led to discussions that supported the goals and actions of the plan. Residents were interested in the source of 2009 county population data, which are estimates developed by the U.S. Census based on birth, death, and net migration data. Participants questioned how the open space findings in Leyden compare with other Towns in the area, some of which have more open space and others of which have less. It was noted that open space under temporary or limited protection can be changed at any time and may be vulnerable to development. In regard to the goals and objectives outlined in Sections 8 and 9, it was suggested that the land protection education programs to be developed under Objective A7 should be for all landowners, not just new ones. Further, it was recommended that air quality monitoring should be added to the objectives (A4 and A5) that discuss water quality monitoring. One resident inquired whether the Town has the option to sell properties or donate development rights to the state, which it was explained it does. This led to a discussion of the role of land trusts in

such transactions and a suggestion to include this topic in the educational articles planned for the Town newsletter. Another resident asked about the reference in Objective B2 to adverse impacts by approval-not-required (ANR) and residential subdivision development and asked what an ANR lot is. It was explained that these are lots allowed under state law to be carved out along roadways without subdivision approval as long they have adequate frontage and access.

Residents were interested in how many goals of the previous plan had been met and the Chair of the Open Space Committee explained that it was about one-third of the previous action items that had been accomplished, but another member of the committee pointed out that some of the action items continue to be ongoing, not because they are not getting done but because they are recurring items. Participants also inquired what are the new items in the plan, and the Chair and FRCOG staff explained that, in addition to updating Census and other data throughout the plan, new sections were added on invasive species, public shade trees, open space equity, and hazardous wastes.

Open Space Committee members commented that the Open Space and Recreation Plan is valuable because it gets boards to work together to identify priorities and to implement the Action Plan. The importance of public information and involvement regarding the plan's implementation was also noted, and it was recommended that regular progress reports appear in the Town newsletter.

The Commonwealth of Massachusetts

Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Deval Patrick
GOVERNOR

Timothy Murray
LIEUTENANT GOVERNOR

Richard K. Sullivan, Jr.
SECRETARY

Tel: (617) 626-1000
Fax: (617) 626-1181

April 29, 2011

Patricia A. Smith
Franklin Regional Council of Governments
425 Main Street
Greenfield, MA 01301-3313

Re: Open Space and Recreation Plan

Dear Ms. Smith:

Thank you for submitting Leyden's Open Space and Recreation Plan to this office for review for compliance with the current Open Space and Recreation Plan Requirements. I am pleased to write that the plan is approved. This final approval will allow Leyden to participate in DCS grant rounds through December 2017.

Congratulations on a great job. Please call me at (617) 626-1171 if you have any questions or concerns about the plan.

Sincerely,

Melissa Cryan

Melissa Cryan
Grants Manager

cc: Jerry Lund, Chair, Open Space Committee

FRANKLIN REGIONAL COUNCIL OF GOVERNMENTS

425 Main Street · Greenfield, Massachusetts 01301-3313
Telephone 413-774-3167 · Fax 413-774-3169 · www.frcog.org
Executive Director · Linda Dunlavy

December 29, 2010

Melissa Cryan, Grants Manager
Division of Conservation Services
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Dear Ms. Cryan,

The Franklin Regional Council of Governments is extremely pleased to support the approval of the Leyden Open Space and Recreation Plan by the Massachusetts Division of Conservation Services.

As you know, the plan was developed by the Leyden Open Space and Recreation Planning Committee with technical assistance from the Franklin Regional Council of Governments Planning Department. It represents more than a year of consensus building on the most important natural, recreational, and scenic resources in Town and the most appropriate strategies for the long term conservation of Leyden. This process included significant public input. The updated Leyden Open Space and Recreation Plan meets all of the requirements of the Division of Conservation Services as laid out in the "Open Space and Recreation Planner's Workbook" (revised March 2008).

The Open Space and Recreation Plan will be used to help Town officials and other volunteers in their deliberations concerning land use and open space decisions. Once approved by the State, the Open Space and Recreation Plan will make Leyden eligible for land conservation and recreation project funding and more competitive for many other types of state grants. The Town will be better able to collaborate with neighboring towns, the Mount Grace Land Conservation Trust, the Franklin Land Trust, the Franklin Regional Council of Governments, and others to protect the natural, recreational, and cultural resources of the Town.

We look forward to your positive review and approval of the Leyden Open Space and Recreation Plan.

Sincerely,

Peggy Sloan
Director of Planning and Development

cc: Elizabeth Johnson, Leyden Municipal Assistant
William Glabach, Chair, Leyden Selectboard

March 3, 2011

Patricia A. Smith
Senior Land Use Planner
Franklin Regional Council of Governments
425 Main Street
Greenfield, MA 01301

Re: 2010 Leyden Open Space and Recreation Plan

Dear Ms. Smith:

The Leyden Selectboard have reviewed the latest revisions to the town's Open Space and Recreation Plan. At our meeting on Thursday, March 3rd we voted unanimously to support the plan as presented.

We would like to thank you, your staff and the Open Space and Recreation Committee for your dedication and hard work to complete the latest version of this plan.

Sincerely,

Lance H. Fritz, Chairman
William H. Glabach
Karen Sayword-Sims
Leyden Board of Selectmen

Office of The Board of Selectmen
TOWN OF LEYDEN
16 West Leyden Road, Leyden, Massachusetts 01337 / (413) 774-4111

February 9, 2011

Jerry Lund, Chair
Open Space and Recreation Committee
16 W. Leyden Rd.
Leyden, MA 01337

Dear Mr. Lund,

On behalf of the Leyden Planning Board I would like to express our appreciation for all your hard work along with the rest of the Committee and Patricia Smith of the Franklin Regional Council of Governments Planning Department in completing the revision of Leyden's 2010 Open Space Plan. The result of your efforts over the past two years is to be commended.

Thanks again, Jerry!

Sincerely, Robert Snow, Chair
and the Leyden Planning Board.

Office of The Board of Selectmen
TOWN OF LEYDEN
16 West Leyden Road, Leyden, Massachusetts 01337 / (413) 774-4111

SECTION 11

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APPENDIX A

Town of Leyden

ADA Self-Evaluation Report

Facility ADA Inventory **LOCATION: Town of Leyden**

ACTIVITY	EQUIPMENT	NOTES
Picnic Facility	Pavillion	Located adjacent to accessible paths
	Tables & Benches	Located under the Pavillion
		Located adjacent to accessible paths
		Access to Open Spaces
		Adequate number
	Grill	Located adjacent to accessible paths
	Trash Cans	Located adjacent to accessible paths
Play Areas	Playground at Elementary School	Same experience provided to all
	Access Routes	Located adjacent to accessible paths
		Enough space between equipment for wheelchair
Game Areas: ballfield basketball	Access Routes	Located adjacent to accessible paths
	Baseball Diamond	Fencing
		Spectator Seating
	Basketball Court	2 adjustable nets
		2 fixed position nets
	Equipment	basketballs
		kickballs
Services and Technical Assistance	Assistive Listening Devices available at Town Hall for public meetings.	
	TTY Service available at Town Offices to conduct town business.	

PUBLIC NOTICE

AMERICANS WITH DISABILITIES ACT REQUIREMENTS

THE TOWN OF LEYDEN ADVISES APPLICANTS, PARTICIPANTS AND THE PUBLIC THAT IT DOES NOT DISCRIMINATE ON THE BASIS OF DISABILITY IN ADMISSION OR ACCESS TO, OR TREATMENT OR EMPLOYMENT IN ITS PROGRAMS, SERVICES AND ACTIVITIES.

THE TOWN OF LEYDEN HAS DESIGNATED THE FOLLOWING PERSON TO COORDINATE EFFORTS TO COMPLY WITH THESE REQUIREMENTS. INQUIRIES AND COMPLAINTS SHOULD BE DIRECTED TO:

ELIZABETH JOHNSON, ADA COORDINATOR

LEYDEN TOWN HALL
16 WEST LEYDEN ROAD
LEYDEN, MA 01337
(413) 774-4111

The information contained in the notice must be communicated in a variety of formats that ensure access to persons with visual, cognitive, physical or hearing impairments. This may include the printing of information in brochures, program notifications and other municipal publications, sending notices to a variety of disability organizations including organizations that have telephone tapes for people who are blind, posting of notices in municipal facilities and printing notices in local newspapers.

Massachusetts Office on Disability (800) 322-2020 v/tty
One Ashburton Place (617) 727-7440 v/tty
Boston, MA 02108

Town of Leyden
Grievance Procedure

This Grievance Procedure is established to meet the requirements of the Americans with Disabilities Act of 1990 (ADA). It may be used by anyone who wishes to file a complaint alleging discrimination on the basis of disability in employment practices and policies, or in the provision of services, activities, programs, or benefits by the Town of Leyden.

The complaint should be in writing and should contain information about the alleged discrimination such as name, address, phone number of complainant and location, date and description of the program. Complaint forms are available in the Selectboard Office. Alternative means of filing complaints, such as personal interviews or a tape recording of the complaint will be available for persons with disabilities upon request.

For complaints received with respect to services, activities, programs, benefits and employment practices of the Town of Leyden, the complaint should be submitted by the grievant and/or his/her designee as soon as possible, but no later than 60 calendar days after the alleged violation to:

Name:	Elizabeth Johnson, ADA Coordinator
Address:	Leyden Town Hall 16 West Leyden Road Leyden, MA 01337
Phone:	(413) 774-4111
E-Mail:	leydenselectboard@live.com
Days Available:	Monday through Friday

Within 15 calendar days after receipt of the complaint, the ADA Coordinator will attempt to meet with the complainant to discuss the complaint and possible solutions. Within 15 calendar days after the meeting, the ADA Coordinator will respond in writing and, where appropriate, in a format accessible to the complainant. The response will explain the position of the Town of Leyden and where possible will offer options for substantive resolution of the complaint. If the response by the ADA Coordinator does not satisfactorily resolve the issue, the complainant and/or his/her designee may appeal the decision of the ADA Coordinator within 15 calendar days to the Leyden Selectboard.

Within 15 days of the appeal, the Leyden Selectboard will attempt to meet with the complainant to discuss the complaint and possible resolutions. Within 15 calendar days after the meeting, the Leyden Selectboard will respond in writing and, where appropriate, in a format accessible to the complainant, with a final attempt at resolution of the complaint.

All written complaints received by the ADA Coordinator, appeals to the Leyden Selectboard and responses will be kept by the Town of Leyden for a period of at least three years.

Approved: William H Glabach

William H. Glabach
Chair, Leyden Selectboard

November 22, 2010

Re: ADA Compliance of Employment Practices

The Town of Leyden's employment practices are in compliance with the American Disabilities Act of 1990.

Respectfully,

Elizabeth Johnson
ADA Coordinator
Town of Leyden

APPENDIX B

Leyden Open Space and Recreation Planning Committee Meeting Notices and Sign-in Sheets

PUBLIC FORUM

to discuss the

LEYDEN OPEN SPACE & RECREATION PLAN

Wednesday, October 27, 2010
Leyden Town Hall Upstairs Meeting Room

7:00 p.m. **Light Refreshments and Map Viewing**
7:30 p.m. **Presentation of Draft Plan and Comments**

The Leyden Open Space Committee values your input and looks forward to seeing you!

For more information contact Jerry Lund, Chair, at (413) 773-5766 or Pat Smith, FRCOG Senior Land Use Planner, at 413-774-1194 x111

HEAD COUNT = 30

Leyden Open Space Committee
PUBLIC FORUM
October 27, 2010
Sign-in Sheet
Please Print Clearly

Name	Affiliation	Mailing Address/ Email	Phone Number
Bill Glabach	Selectbd	289 E Hill Rd	774-7704
Jerry Lund	OSC, PB	30 Simon Keets	773 5766
PAT SMITH	FRCOG	psmith@frcog.org	
Regan Gorneault		292 River Rd.	624-0132
Cathy Gorneault		" "	" "
Barbara Francis		199 Eden Trail Rd / barbfran@yahoo.com	413-773-3522
Albert Woodhull		" " " "	" " "
Ruth Bellows		325 NORTH CTY RD.	413-772-6717
Don Clark		325 NORTH CTY RD	413-772-6717
ELWIN BARTON		24 OLD FRIZZELL HILL RD	413-773-3548
ED & RITA KLAUS		36 S. School House Rd	774-5218
Paul Gagnon	Franklin Land Trust	Shelburne Falls	508 885 4522
SAM BARRETT		83 RIVER RD	624-3963
Marie Bartlett		"	"
Ginny Rockwood		96 Simon Keets	774-2694
Sue Sojka		296 River Rd	624-3422
Bill + SUE HOWARTH		32 So. SchoolHouse RD	772-3118
Mary Praus		FRCOG	651 983 2043

★ BY YOUR NAME & MAILING ADDRESS IF YOU WANT A DRAFT COPY OF PLAN MAILED TO YOU

AGENDA

Town of Leyden
Open Space and Recreation Committee Meeting
Leyden Town Hall
16 West Leyden Road
September 22, 2010
6:30 – 8:30 p.m.

1. Introductions – Jerry Lund, Chair (6:30 p.m.)

2. Review of Final Draft of Section 8: Goals and Objectives (*see enclosed*) – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (6:35 p.m.)

3. Review of Final Draft of Section 9: Action Plan (*see enclosed*) – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (6:45 p.m.)

4. Review of Draft of Section 1: Plan Summary (*see enclosed*) – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (7:00 p.m.)

5. Review of Draft of Section 10: Public Comment (*see enclosed*) – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (7:15 p.m.)

6. Review of Draft of Section 11: References (*to be distributed at meeting*) – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (7:30 p.m.)

7. Review of Draft Maps – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (7:45 p.m.)
   - Regional Context
   - Soils and Geographic Features
   - Water Resources
   - Zoning
   - Open Space
   - Scenic Resources and Unique Environments
   - Plant and Wildlife Habitat
   - Historic Community
   - Action Plan

8. Public Forum/Next Steps (8:15 p.m.)

Leyden Open Space and Recreation Planning Committee
September 22, 2010
Sign-in Sheet
Please Print Clearly

Name	Affiliation	Mailing Address/ Email	Phone Number
Donald	RES AT Lg	325 No County Rd CLARKBELLOWS at YAHOO.COM	7726717
PAT SMITH	FRCOG		
Jerry Lund	Planning Bd	30 Simonkeets	7735766
ROBERT DEPALMA		152 S COUNTY RD	774-4594
WILLIAM GLABACH	SELECT BOARD	289 E. Hill Rd	774-7704

AGENDA

Town of Leyden
Open Space and Recreation Committee Meeting
Leyden Town Hall
16 West Leyden Road
August 12, 2010
6:30 – 8:30 p.m.

1. Introductions – Jerry Lund, Chair (6:30 p.m.)

2. Review of Draft of Section 8: Goals and Objectives (*see enclosed*) – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (6:35 p.m.)

3. Review of Draft of Section 9: Action Plan (*see enclosed*) – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (7:00 p.m.)

4. Review of Final Draft of Section 5: Inventory of Lands of Conservation and Recreation Interest (*to be distributed at the meeting)* – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (7:30 p.m.)

5. Review of Draft Maps – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (8:00 p.m.)
   - Regional Context
   - Soils and Geographic Features
   - Water Resources
   - Zoning
   - Open Space
   - Scenic Resources and Unique Environments
   - Plant and Wildlife Habitat
   - Historic Community
   - Action Plan

6. Next Steps (8:20 p.m.)

Leyden Open Space and Recreation Planning Committee

August 12, 2010

Sign-in Sheet

Please Print Clearly

Name	Affiliation	Mailing Address/ Email	Phone Number
Don Clark		325 N. County Rd Leyden	4137726717
Bill Glabach	Selectboard	289 East Hill Rd Leyden	413-774-7704
Jerry Lund	Plan Bd.	305 Simonkevits Rd, Leyden	4137755766
Pat Smith	FRCOG		
ED KLAUS	CONCOM	ed_klaus@yahoo.com	774-5218

AGENDA

Town of Leyden
Open Space and Recreation Committee Meeting
Leyden Town Hall
16 West Leyden Road
July 1, 2010
6:30 – 8:30 p.m.

1. Introductions – Jerry Lund, Chair (6:30 p.m.)

2. Review of Final Draft of Section 5: Inventory of Lands of Conservation and Recreation Interest* – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (6:35 p.m.)

3. Review of Draft of Section 2: Introduction* – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (7:15 p.m.)

4. Review of Draft of Section 6: Community Vision* – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (7:30 p.m.)

5. Review of Final Draft of Section 7: Analysis of Needs* – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (7:45 p.m.)

6. Review of Draft Maps – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (8:00 p.m.)
   - Regional Context
   - Soils and Geographic Features
   - Water Resources
   - Zoning
   - Open Space
   - Scenic Resources and Unique Environments
   - Plant and Wildlife Habitat
   - Historic Community

7. Next Steps (8:20 p.m.)

**Materials to be distributed at the meeting.*

Leyden Open Space and Recreation Planning Committee

July 1, 2010

Sign-in Sheet

Please Print Clearly

Name	Affiliation	Mailing Address/ Email	Phone Number
Paula Sayword	Town	119 East Hill Rd PSayword@yahoo.com	774 3897
Jerry Lund	Pl. Bd	jslundco@earthlink.net	7735766
Donald Clark		325 N County Rd. CLARKBELLOWS at YAHOO.com	772 6717
William Glabach		289 E. Hill Rd	774-7704
Pat Smith		FRCOG	
Ed Klaus		36 S. Schoolhouse ed_Klaus@yahoo.com	774-5218
John Rodgers		55 Lois Lane jlrventuraca@Aol.com	773-7394
Robert DePalma		DEPALMA-3@YHOO.com 152 S. County Rd	774-4594

AGENDA

Town of Leyden
Open Space and Recreation Committee Meeting
Leyden Town Hall
16 West Leyden Road
December 17, 2009
6:30 – 8:30 p.m.

1. Introductions – Jerry Lund, Chair (6:30 p.m.)

2. Review of Final Draft Section 3: Community Setting – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (6:35 p.m.)

3. Review of Final Draft Section 4: Environmental Inventory and Analysis – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (7:00 p.m.)

4. Review of Survey Results and Draft Section 7: Analysis of Needs – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (7:25 p.m.)

5. Review of Draft Maps – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (7:55 p.m.)
   - Regional Context
   - Soils and Geographic Features
   - Water Resources
   - Zoning
   - Open Space
   - Scenic Resources and Unique Environments
   - Plant and Wildlife Habitat
   - Historic Community

6. Status Update and Next Steps (8:20 p.m.)

Leyden Open Space and Recreation Planning Committee
December 17, 2009
Sign-in Sheet
Please Print Clearly

Name	Affiliation	Mailing Address/ Email	Phone Number
Liz Johnson	Town of Leyden	leydenselectboard@live.com 16 West Leyden Rd, Leyden MA 01337	(413)774-4111
Pat Smith	FRCOG	psmith@frcog.org	
Ed Klaus	con comm	ed_klaus@yahoo.com	774-5218
Jerry Lund	Leyden OSC	jslundco@earthlink.net	773 5766
William Glabach	OSC	Wglabach43@live.com	774-7704

AGENDA

Town of Leyden
Open Space and Recreation Committee Meeting
Leyden Town Hall
16 West Leyden Road
October 7, 2009
6:30 – 8:30 p.m.

1. Introductions – Liz Johnson, Municipal Assistant (6:30 p.m.)

2. Overview of Open Space and Recreation Plan Update process– Pat Smith, Land Use Planner, Franklin Regional Council of Governments (6:40 p.m.)
    - Purpose
    - Requirements
    - Timeline
    - Survey

3. Review of Draft Section 3: Community Setting – Pat Smith, Land Use Planner, Franklin Regional Council of Governments (7:00 p.m.)

4. Review of Draft Section 4: Environmental Inventory and Analysis – Whitty Sanford, Assistant Planner, Franklin Regional Council of Governments (7:30 p.m.)

5. Review of Draft Maps (Sections 3 & 4) - Pat Smith, Land Use Planner, Franklin Regional Council of Governments (8:00 p.m.)

6. Next Steps (8:20 p.m.)
    - Finalize Sections 3 & 4; Begin Section 5
    - Next Meeting (November?)

Leyden Open Space and Recreation Planning Committee
October 7, 2009
Sign-in Sheet
Please Print Clearly

Name	Affiliation	Mailing Address/ Email	Phone Number
PAT SMITH	FRCOG		
ED KLAUS	concom	ed_klaus@yahoo.com	
Liz Johnson	Leyden Staff	leydenselectboard@live.com	774-4111
Whit Sanford	FRCOG		
Jerry Lund	Leyden PB	jslundco@earthlink.net	773 5766
WILLIAM GLABACH	Leyden Selectboard	leydenselectboard@live.com	

APPENDIX C

2009 Open Space and Recreation Survey Results

Leyden Open Space and Recreation Survey Results, 2009

INTRODUCTION

The following paragraphs describe the results of the surveys distributed to Leyden town residents in 2009 with the purpose of learning public opinion on various issues related to open space and recreation. The answers from the survey will help guide the protection of open space and natural resources, and the development of recreational facilities and programs in Leyden.

Overall, the results of the survey show that Leyden residents place great value on the town's rural, small town character and the open fields, forests, and farmland which contribute to this character. The surveys also show that the town residents highly value the quality of the town's drinking water and clean air.

There were a total of 35 surveys returned to the Leyden Open Space Committee.

In this summary, each table below contains several columns of data. The first column, "Number," refers to the total *number* of people who selected each particular answer. The second column, "Freq" is the *percentage* of people that selected each answer. This percentage is based on the total number of people who actually answered each question, rather than the total number of surveys returned. For example: a total of 35 surveys were returned, but of these 35 surveys, not all of them answered each question on the survey. Some questions were left blank. If 33 of the 35 surveys had an answer for a particular question, then the percentage is based on these 33 responses. By using this methodology, potential bias from non-respondents is eliminated.

SURVEY RESULTS

Question 1

How important was each of the following in your decision to move to, and/or live in Leyden? ***Please circle a number for each item where 1=Very Important; 2=Important; and 3= Not Important.***

The five **most important** factors influencing people's decision to move to and or/or live in Leyden are:

1) Air/water quality (70% of respondents)
2) Rural or small town character (68%)
3) Peace and quiet (68%)
4) Open fields, forests, and trails (58%)
5) Safety from crime and vandalism (38%)

The table below shows how each of the factors influenced residents' decisions to move to and/or live in Leyden, and are listed in order of highest to lowest importance.

QUESTION 1	VERY IMPORTANT		IMPORTANT		NOT IMPORTANT	
	Number	*Freq.*	*Number*	*Freq.*	*Number*	*Freq.*
AIR/WATER QUALITY	23	70%	7	21%	3	9%
PEACE AND QUIET	23	68%	10	29%	1	3%
RURAL OR SMALL TOWN CHARACTER	23	68%	9	26%	2	6%
OPEN FIELDS, FORESTS, AND TRAILS	19	58%	12	36%	2	6%
SAFETY FROM CRIME AND VANDALISM	13	38%	14	41%	7	21%
PUBLIC SCHOOL SYSTEM	8	24%	11	33%	14	42%
FRIENDS OR RELATIVES HERE	6	19%	7	22%	19	59%
EASY COMMUTING	6	18%	14	42%	13	39%
LOCAL CLIMATE	5	16%	17	53%	10	31%
AFFORDABLE HOUSING	5	16%	14	44%	13	41%
ACCESS TO LEYDEN STATE FOREST	5	15%	9	27%	19	58%
FIVE COLLEGE AREA	4	13%	9	28%	19	59%
PUBLIC SERVICES	3	10%	14	45%	14	45%
JOB OPPORTUNITIES IN THE REGION	3	10%	10	32%	18	58%
RECREATIONAL OPPORTUNITIES	3	9%	17	53%	12	38%

9% of respondents noted the following:

- Beauty/Leyden is beautiful/Beauty and serenity

There was one response for each of the following:

- Good hunting from my house
- Cultural offerings
- Home
- Local ingenuity

The following comments were added:

- Public services: ? (2 responses)
- Access to Leyden State Forest: now important, didn't know then
- Job opportunities in the region: none
- Peace and quiet: gun club, rifle range!
- Affordable housing: taxes some of the highest in state?

Question 2

How important is it to conserve the following natural resources? ***Please circle a number for each item where 1=Very Important; 2=Important; and 3= Not important.***

According to survey results, the five **most important** natural resources to conserve are:

1) Clean drinking water (83%)
2) Clean air (76%)
3) Wildlife habitat (68%)

4) Rural character (68%)
5) Green River and its watershed; Farmland (both 66%)

The table below shows the level of importance placed on each of the natural resources.

QUESTION 2	VERY IMPORTANT		IMPORTANT		NOT IMPORTANT	
	Number	*Freq.*	*Number*	*Freq.*	*Number*	*Freq.*
CLEAN DRINKING WATER	29	83%	6	17%	0	0%
CLEAN AIR	25	76%	7	21%	1	3%
WILDLIFE HABITAT	23	68%	11	32%	0	0%
RURAL CHARACTER	23	68%	10	29%	1	3%
GREEN RIVER AND ITS WATERSHED	23	66%	9	26%	3	9%
FARMLAND	23	66%	8	23%	4	11%
STREAMS/PONDS	22	65%	12	35%	0	0%
OPEN FIELDS	22	65%	11	32%	1	3%
SCENIC VIEWS	21	62%	12	35%	1	3%
FORESTS	21	62%	11	32%	2	6%
WILDERNESS	18	53%	11	32%	5	15%
WETLANDS	16	46%	12	34%	7	20%
HISTORIC STRUCTURES	13	39%	14	42%	6	18%
STONE WALLS	12	34%	18	51%	5	14%
DIRT ROADS	10	29%	12	35%	12	35%

There was one response for the following:

- Structures with colonial character

The following comments were added:

- Streams/ponds: without beavers
- It would be wonderful if we could take back Leyden Glen and make it into a real accessible recreation area with a swimming beach and picnic area for all residents in Leyden. There also could be hiking trails and fishing further up stream.
- Important to conserve – but not at the expense of safety. Tree limbs need to be cut to keep trees healthy, preserve services to homes, and keep the dirt roads safe to walk on/drive on.
- Farms are some of the worst polluters (fact) not just mega farms.
- No wilderness in Massachusetts!

Question 3

Which actions do you support to protect/conserve open space and natural resources?
Please circle a number for each item where 1=Strongly Support; 2=Support; and 3=Don't Support.

The results of this question show that residents most strongly support actions that do not entail the expenditure of town money. However, over half of respondents felt that the town should take action towards the protection and conservation of open space and natural resources.

The top three **most strongly supported** actions to protect/conserve open space and natural resources are:

1) Acceptance of donated undeveloped land (68%)
2) Encourage land protection by private non-profits (66%)
3) Acceptance of donated development rights (62%)

QUESTION 3	STRONGLY SUPPORT		SUPPORT		DON'T SUPPORT	
	Number	*Freq.*	*Number*	*Freq.*	*Number*	*Freq.*
ACCEPTANCE OF DONATED UNDEVELOPED LAND	23	68%	9	26%	2	6%
ENCOURAGE LAND PROTECTION BY PRIVATE NON-PROFITS	21	66%	8	25%	3	9%
ACCEPTANCE OF DONATED DEVELOPMENT RIGHTS	21	62%	10	29%	3	9%
ENCOURAGE LAND PROTECTION BY A COMBINATION OF PARTIES	18	58%	7	23%	6	19%
ENCOURAGE LAND PROTECTION BY STATE AGENCIES	17	52%	8	24%	8	24%
TOWN PURCHASE OF DEVELOPMENT RIGHTS	15	44%	9	26%	10	29%
ZONING CHANGES FOR OPEN SPACE PROTECTION	12	38%	11	34%	9	28%
TOWN PURCHASE OF UNDEVELOPED LAND	12	36%	10	30%	11	33%
NO ADDITIONAL TOWN ACTIONS SHOULD BE TAKEN	6	21%	3	10%	20	69%

The following comments were added:

- Zoning changes for open space protection: minimum size lots/frontage should be greater i.e.: 5 acres
- Encourage land protection by state agencies: this is a trap
- There's a big danger in taking land out of private ownership. Do you want to live where all land is state owned?
- Town purchase of undeveloped land/development rights: if we had any money
- This needs to be decided case by case I think
- Again – it goes back to how much land do we want off the tax rolls?
- Zoning changes for open space protection: depends
- More taxes?!

Question 4

How has the quality of the following changed over time? ***Please circle a number for each item where 1=Changed for the better; 2=Changed for the worse; 3=Remained the same; and 4= No opinion/Unsure.***

The results for this question were fairly mixed – answers were distributed across the positive and negative opinions, with the majority of responses falling in the "remained the same" category. Twenty-two percent of respondents felt that local open space and undeveloped land has changed for the better, however 25% felt that it has changed for the worse. Thirty percent of respondents felt that Leyden's sense of community has changed for the worse, while 21% felt that the rural character in Town has changed for the worse.

QUESTION 4	CHANGED FOR BETTER		CHANGED FOR WORSE		REMAINED THE SAME		NO OPINION / UNSURE	
	Number	*Freq.*	*Number*	*Freq.*	*Number*	*Freq.*	*Number*	*Freq.*
LOCAL OPEN SPACE/UNDEVELOPED LAND	7	22%	8	25%	13	41%	4	13%
SENSE OF COMMUNITY	3	9%	10	30%	19	58%	1	3%
LEYDEN'S RURAL CHARACTER	3	9%	7	21%	23	70%	0	0%
RECREATIONAL FACILITIES	1	3%	3	9%	21	64%	8	24%
RECREATIONAL PROGRAMMING	3	9%	4	12%	14	41%	13	38%

Question 5

What are the two most significant threats to Leyden's sense of community and rural character? *Please circle two only.*

Eighty eight percent of survey respondents felt that the biggest threat to Leyden's sense of community of rural character is rising property taxes. This was followed by residential development at 54%. The following chart illustrates how town residents responded to this question.

QUESTION 5	*Frequency*
RISING PROPERTY TAXES	88%
RESIDENTIAL DEVELOPMENT	54%
ENVIRONMENTAL POLLUTION	19%
LACK OF DEVELOPMENT	12%

There was one response for each of the following:

- People who will not discuss differences civilly.
- People who are unwilling to compromise on issues of community importance (i.e. they who take a "my way or the highway" attitude).
- People thinking/feeling the owner of a property can do whatever they'd like with their property and they do not need to follow zoning bylaws, town bylaws or policies.
- High taxes so retirees cannot afford to live here on fixed incomes.
- Lack of thoughtful development.
- Viability of farming.
- Development of sense of community – small example is amount of trash on roads.
- The divide between new-comers and old-timers.
- Too many transplants from out of area trying to force agendas on others.
- New structures I.E.: Greenhouses, contemporary housing/retreat facilities, houses less than 1500 square feet of living space, trailers, solar panels, wind towers and radio towers. Also junk exposed to public view.
- Political rule making that is divisive and partisan in nature.
- These present different kinds of threats – residential development: if town takes a position of managing this is will be ok; lack of development: this could be a problem; environmental pollution: obviously a significant threat; rising property taxes: threat to those who can't afford and want to stay here.

- I think that small amount of town activities is not such a good idea – many of us don't know each other. And then we only show up when there is a conflict. It would be nice to see more opportunities to gather and get to know neighbors during the year – especially during the winter!
- The closing in of views of open space by roadside brush and saplings – we are losing our views of open space!
- Residential development: fine in this economy, but could be issue.
- Outspoken personal attacks in town meetings – against the rules!
- Residential development: not yet.
- Lack of vision for future of Leyden.
- Environmental pollution: because it would imply that Leyden citizens don't care enough about the community not to pollute it.
- A sense of community has no bearing on rural character. The sense of community I feel is in simply living in Leyden (though I volunteer in several ways). A sense of community is created by the community, not by the community's environment per se. Other than the church and library, there is no casual meeting place. A place like Elmers in Ashfield can create a sense of community because it is a meeting place. It's ok that we don't have an Elmers. But it would be nice...
- High prices of saleable homes.
- Poor attitude of Leyden Gun Club.
- The town becoming a "bedroom" community.
- Lack of development: no businesses in town to lower taxes.
- Rising taxes drive people out of town, sale of farmland parcels to meet rising cost.
- The gun range, shooting range.
- Recreational vehicles not respecting property lines.
- Environmental pollution: spreading of cow manure on fields/ archaic/ polluting Green River, streams, etc…groundwater.
- Rising property taxes: some of the highest in state.
- Gun Club/Rifle Range – River Road – Zero peace many evenings, enough said (police protect the rifle club members?) (what about taxpayers?).
- Right to Farm = Right to pollute!?

Question 6

How important are the following to you? ***Please circle a number for each item where 1=Very Important; 2=Important; and 3=Not Important.***

The results for this question show that the town residents value the protection of waterbodies and the maintenance of the quiet, rural and scenic character of Leyden.

The top five **most important** features to the survey respondents are:

1) Clean streams and water bodies (79%)
2) Quiet (75%)
3) Scenic views (72%)

4) Open fields (63%)
5) Lack of industrial/commercial strips (59%)

QUESTION 6	VERY IMPORTANT		IMPORTANT		NOT IMPORTANT	
	Number	*Freq.*	*Number*	*Freq.*	*Number*	*Freq.*
CLEAN STREAMS AND WATER BODIES	26	79%	7	21%	0	0%
QUIET	24	75%	5	16%	3	9%
SCENIC VIEWS	23	72%	8	25%	1	3%
OPEN FIELDS	20	63%	11	34%	1	3%
LACK OF INDUSTRIAL/COMMERCIAL STRIPS	19	59%	9	28%	4	13%
ABSENCE OF CITY LIGHTS	19	58%	9	27%	5	15%
LARGE FORESTED AREAS	18	55%	9	27%	6	18%
MOOSE, BOBCAT, DEER AND OTHER WILDLIFE	16	50%	14	44%	2	6%
FARM ANIMALS	15	47%	15	47%	2	6%
FARM HOUSES	14	44%	15	47%	3	9%
VERNAL POOLS	13	43%	12	40%	5	17%
LOWER HOUSING DENSITY	12	41%	11	38%	6	21%
LOW TRAFFIC VOLUME/TRAFFIC SPEEDS	12	39%	17	55%	2	6%
LARGE ROAD-SIDE TREES	9	29%	17	55%	5	16%
DIRT ROADS	9	27%	10	30%	14	42%
WALKING AND HIKING TRAILS	7	23%	16	52%	8	26%
LEYDEN STATE FOREST	7	23%	15	48%	9	29%
NARROW WINDY ROADS	6	19%	11	35%	14	45%
HISTORIC STRUCTURES	5	16%	20	63%	7	22%
HISTORIC CELLAR HOLES	2	6%	9	29%	20	65%

There was one response for each of the following:

- Snowmobile trails/ATV trails
- The aquifer

The following comments were added:

- Leyden State Forest: important - if accessible
- Large road-side trees: as long as they are alive; but if they are dying they should come down; only if healthy.
- Leyden State Forest: where is it?
- Low traffic volume/traffic speeds: doesn't happen.

Question 7

What is your opinion about the quality of the following open space and recreation facilities in the town of Leyden? ***Please circle a number for each item where 1=Excellent; 2=Good; 3=Adequate; 4=Poor; and 5=No Opinion/Unsure.***

This question shows that there are a few facilities that most people agree are in excellent condition – specifically the library programming and Town common areas. Basketball courts, hiking trails, and recreational programming are facilities that many respondents felt are in poor condition.

The top three facilities which survey respondents say are in **excellent or good condition** are:

1) Library programming (32% excellent; 39% good)
2) Town common areas (26% excellent; 45% good)
3) Pearl Rhodes Elementary School (PRES) playground (19% excellent; 22% good)

QUESTION 7	Excellent		Good		Adequate		Poor		No Opinion /Unsure	
	Number	*Freq.*	*Number*	*Freq.*	*Number*	*Freq.*	*Number*	*Freq.*	*Number*	*Freq.*
LIBRARY PROGRAMMING	10	32%	12	39%	3	10%	1	3%	5	16%
TOWN COMMON AREAS	8	26%	14	45%	5	16%	2	6%	2	6%
PEARL RHODES ELEMENTARY SCHOOL (PRES) PLAYGROUND	6	19%	7	22%	9	28%	2	6%	8	25%
AVERY BALL FIELDS	5	17%	7	23%	13	43%	0	0%	5	17%
COMMUNITY EVENTS	3	10%	8	26%	12	39%	5	16%	3	10%
CHURCH WOOD SANCTUARY (EAST HILL)	2	7%	3	10%	5	17%	2	7%	17	59%
LEYDEN STATE FOREST	2	7%	13	43%	3	10%	2	7%	10	33%
HIKING TRAILS	2	7%	4	13%	7	23%	5	17%	12	40%
SWIMMING HOLE AT 10 MILE BRIDGE	2	6%	10	32%	8	26%	3	10%	8	26%
SNOWMOBILING TRAILS	1	3%	6	20%	7	23%	0	0%	16	53%
RECREATIONAL PROGRAMMING	1	3%	5	17%	7	23%	6	20%	11	37%
MILLERS RIVER	0	0%	2	7%	4	14%	0	0%	22	79%
BASKETBALL COURT/AVERY FIELD	0	0%	2	7%	5	17%	11	37%	12	40%

The top three facilities in which survey respondents felt were in **poor condition** are:

1) Basketball court/Avery Field (37%)
2) Recreational Programming (20%)
3) Hiking trails (17%)

Question 8

Which of the following recreational activities do members of your household do in, or near Leyden? ***Please circle as many that apply.***

Question 8 reveals that Leyden town residents are very active. They participate in a lot of different recreational activities, many of which are outdoors. The top five most popular activities for survey respondents are:

1) Walking (94%)
2) Gardening (91%)
3) Hiking (56%)
4) Bird watching (56%)
5) Snowmobiling (53%)

QUESTION 8	*Number*	*Frequency**
WALKING	30	94%
GARDENING	29	91%
HIKING	18	56%
BIRD WATCHING	18	56%
SNOWMOBILING	17	53%
SLEDDING	15	47%
BICYCLING	14	44%
CANOEING	13	41%
SWIMMING	13	41%
PICKNICKING	8	25%
CROSS-COUNTRY SKIING	7	22%
FISHING	7	22%
GOLF	7	22%
BOATING	6	19%
CAMPING	6	19%
SNOWSHOEING	6	19%
BASEBALL	5	16%
HUNTING	5	16%
JOGGING	4	13%
ICE SKATING	3	9%
TENNIS	3	9%
BASKETBALL	2	6%
SOFTBALL	1	3%
ROCK CLIMBING	0	0%
ROLLERBLADING	0	0%

***NOTE: Frequency refers to the percentage of all respondents who acknowledged participation in the stated activity.**

Many of these recreational activities occur within the town of Leyden, including: walking, hiking, bird-watching, gardening, snowshoeing, and hunting. Many of the activities also take place in surrounding towns, such as Greenfield, Northfield, and Shelburne, or nearby states, such as Vermont and Maine. The following are the locations respondents noted for participating in different activities.

QUESTION 8 / ACTIVITY	LOCATIONS					
BASKETBALL	field at PRES	Greenfield	PVRS	Bernardston	New Hampshire	
BASEBALL	field	Bernardston				
BICYCLING	Greenfield Road (2)	Bike trail	Leyden (2)	All over Western Mass	S.County Rd.	Mostly other places
	Greenfield	Deerfield	New Hampshire			
BIRD WATCHING	Leyden (9)	everywhere I go	Beaver Meadow	other places	New Hampshire	
BOATING	Sweet Pond	Weatherhead Hollow (2)	Barton's Cove	other places	Connecticut River (2)	Gill

QUESTION 8 / ACTIVITY	LOCATIONS					
CAMPING	Vermont (2)	New Hampshire (2)	Maine	out of state	Gill	
CANOEING	Guilford Vermont (2)	other places	Weatherhead Pond/Hollow (3)	all over the region	Maine	Connecticut River
	Sweet Pond	Vermont	New Hampshire (2)			
CROSS COUNTRY SKIING	Snowmobile trail East Hill	Northfield	other places	Colrain		
DOWN-HILL SKIING	Vermont (3)					
FISHING	Keets Brook	Weatherhead Pond/Hollow (2)	Guilford Vermont	the Cape	Connecticut River	Green River
	Gill	Deerfield	Millers River (Wendell)	New Hampshire		
GARDENING	Coates Road	Leyden (16)				
GOLF	Greenfield (2)	Turners Falls	Bernardston	Northfield	Western MA	nearby towns
	Gill					
HIKING	All around/varies (2)	mostly other places	Vermont	New Hampshire	Maine	Massachusetts
	Leyden (4)	Keets Brook Rd.	East Hill	N. County Rd.		
HUNTING	Leyden (2)	Maine	surrounding towns	upstate N.Y.		
ICE SKATING	Weatherhead Hollow Pond	Greenfield: Collins Moylar Rink	Leyden			
JOGGING	Kately Hill Road	Leyden				
PICNICKING	Deerfield	New Hampshire				
ROCK CLIMBING						
ROLLERBLADING						

QUESTION 8 ACTIVITY	LOCATIONS					
SLEDDING	Coates Road	Leyden (5)	School (3)			
SNOWSHOEING	All around	Leyden (6)	Massachusetts	Vermont	New Hampshire	
SNOWMOBILING	Northern Vermont	local trails	Leyden (3)	Colrain (2)	Bernardston	
SOFTBALL	Greenfield					
SWIMMING	Ten Mile Bridge	Weatherhead Hollow Pond	Green River (3)	State Forest	Greenfield (2)	Laurel Lake
	Neighbors' pools	Gill	New Hampshire			
TENNIS	Greenfield (2)					
WALKING	Roads in Leyden (6)	Leyden (8)	Greenfield	All around/varies (2)	Shelburne	Bike/rail trail Amherst/Hadley /Northampton
	Keets Brook Rd.	East Hill	New Hampshire			

Other activities noted:

- Horseback
- Hang out in yard, listening to birds, enjoying the outdoors, play with pets.

Question 9

How often do you utilize the following open space and recreational resources? ***Please circle a number for each item where 1=Daily; 2=Weekly; 3=Monthly; 4=Every six months; 5=Once a year; and 6=Never.***

The results of this question reveal that library programming and hiking trails are well-used resources in Town. Community events are also frequently attended. The top five **most used** open space and outdoor recreational resources in the town are:

1) Library programming (19% weekly, 23% monthly)
2) Hiking trails (3% daily, 7% weekly, 17% monthly)
3) Community events (17% monthly)
4) Snowmobile trails (10% weekly, 3% monthly)
5) Pearl Rhodes Elementary School playground (6% daily, 3% weekly, 3% monthly)

(The following table was sorted by highest frequency of daily, weekly, and monthly answers combined.)

QUESTION 9	Daily		Weekly		Monthly		Every Six Months		Once a Year		Never	
	#	*Freq.*	#	*Freq.*	#	*Freq.*	#	*Freq.*	#	*Freq.*	#	*Freq.*
LIBRARY PROGRAMMING	0	0%	6	19%	7	23%	4	13%	1	3%	13	42%
HIKING TRAILS	1	3%	2	7%	5	17%	2	7%	3	10%	17	57%
COMMUNITY EVENTS	0	0%	0	0%	5	17%	14	47%	6	20%	5	17%
SNOWMOBILING TRAILS	0	0%	3	10%	1	3%	2	7%	1	3%	23	77%
PEARL RHODES ELEMENTARY SCHOOL (PRES) PLAYGROUND	2	6%	1	3%	1	3%	2	6%	7	23%	18	58%
AVERY BALL FIELDS	0	0%	2	7%	0	0%	5	17%	8	27%	15	50%
SWIMMING HOLE AT 10 MILE BRIDGE	0	0%	1	3%	1	3%	3	10%	5	16%	21	68%
BASKETBALL COURT/AVERY FIELD	0	0%	1	3%	0	0%	0	0%	2	7%	27	90%
TOWN COMMON AREAS	0	0%	0	0%	1	3%	7	23%	12	40%	10	33%
LEYDEN STATE FOREST	0	0%	0	0%	0	0%	1	3%	3	10%	26	87%
CHURCH WOOD SANCTUARY (EAST HILL)	0	0%	0	0%	0	0%	1	3%	2	7%	27	90%
MILLERS RIVER*	0	0%	0	0%	0	0%	0	0%	0	0%	26	100%
RECREATIONAL PROGRAMMING	0	0%	0	0%	0	0%	6	21%	8	28%	15	52%

* The Millers River is not within the Town of Leyden, and was therefore omitted from the survey analysis.

The following comments were added:

- Snowmobile trails: for hiking.
- Library programming: I don't know what is meant by programming. Scheduled hours?
- Leyden State Forest: Where is it? No access for public. Is it kept clear of brush for hiking? Who maintains it?
- Being handicapped these things are difficult.

Question 10

What is your opinion about the quantity and quality of the following recreational programming and facilities in the town of Leyden? ***Please circle a number for each item where 1=Excellent; 2=Good; 3=Adequate; 4=Poor and 5=No opinion/Unsure.***

This question provides insight into which programming and facilities in the town are currently in good condition and which would benefit from some improvement. There is some disagreement from survey respondents about the quality of certain programming and facilities, such as community events and hiking trails. Some respondents felt these things were of excellent or good quality, while others felt there was room for improvement.

The top three resources that survey respondents feel are **excellent or good**:

1) Community events/festivals (12% excellent, 26% good)
2) Playground/tot lots (9% excellent, 25% good)
3) Snowmobile Trails (3% excellent, 23% good)

The top three resources that survey respondents feel are **poor**:

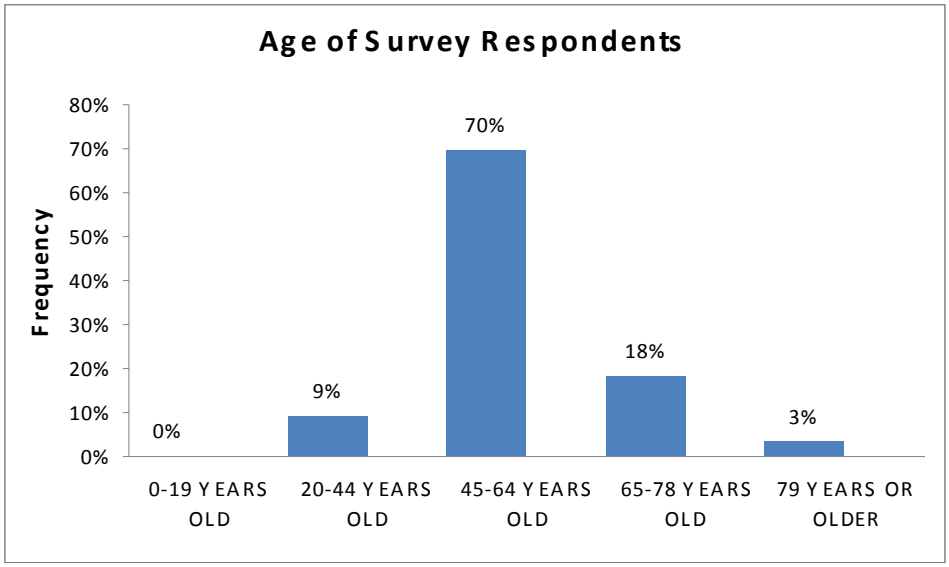
1) Tennis courts (32% poor)
2) Hiking trails (13% poor)
3) Horseback riding trails (10%)

(The following table was sorted by the highest frequency of excellent and good answers combined.)

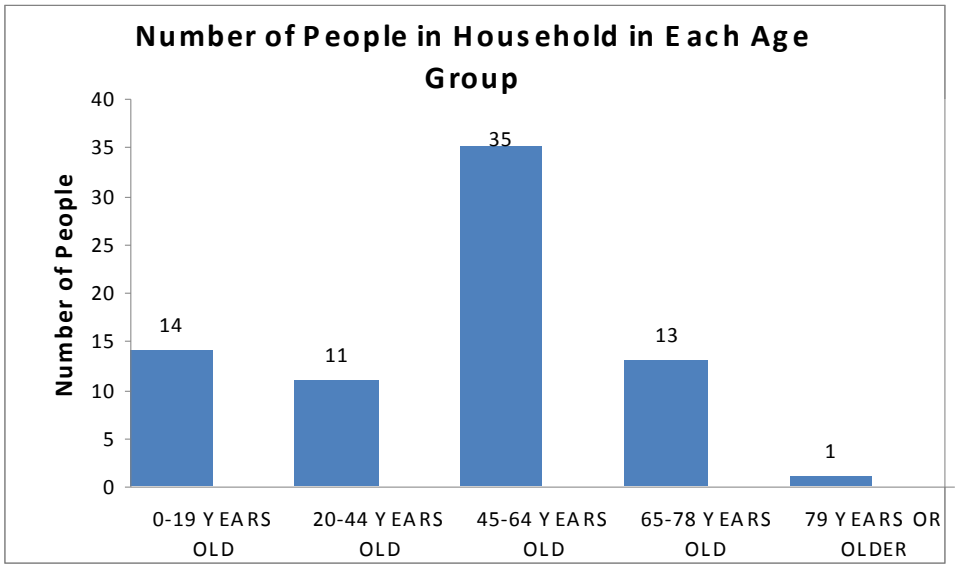
QUESTION 10	Excellent		Good		Adequate		Poor		No Opinion /Unsure	
	Number	*Resp.*	*Number*	*Resp.*	*Number*	*Resp.*	*Number*	*Resp.*	*Number*	*Resp.*
COMMUNITY EVENTS/FESTIVALS	4	12%	9	26%	16	47%	3	9%	2	6%
PLAYGROUND/TOTS LOTS	3	9%	8	25%	3	9%	1	3%	17	53%
SNOWMOBILE TRAILS	1	3%	7	23%	3	10%	0	0%	20	65%
HIKING TRAILS	1	3%	6	19%	9	29%	4	13%	11	35%
SPORTS FIELDS	1	3%	5	16%	12	38%	0	0%	14	44%
SWIMMING AREAS	0	0%	5	16%	11	34%	3	9%	13	41%
HORSEBACK RIDING TRAILS	1	3%	3	10%	2	6%	3	10%	22	71%
TENNIS COURTS	0	0%	2	6%	4	13%	10	32%	15	48%

Questions 11- 15: Demographic Statistics of Survey Respondents

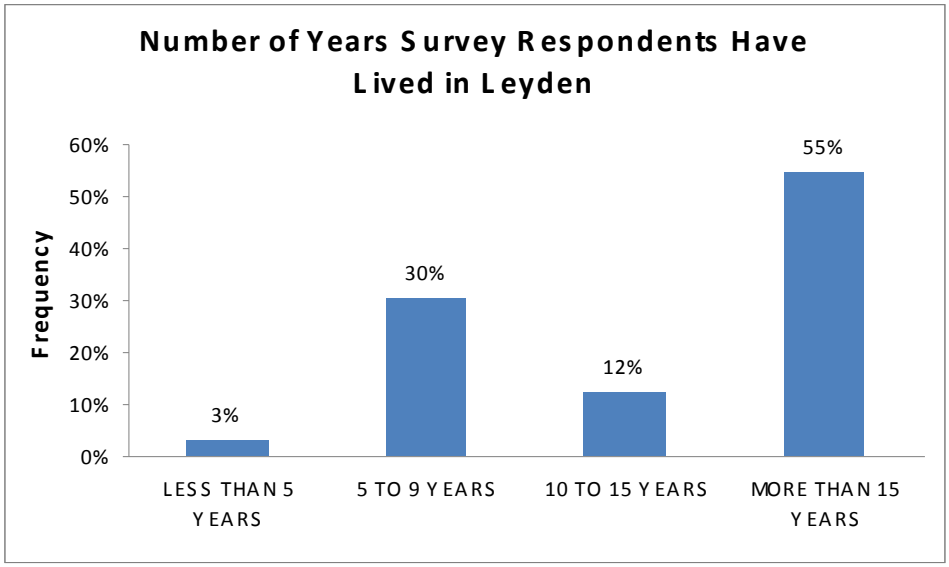
Question 11: What is your age?



Question 12: Please write the number of people in your household in each age group.



Question 13: How many years have you lived in Leyden?



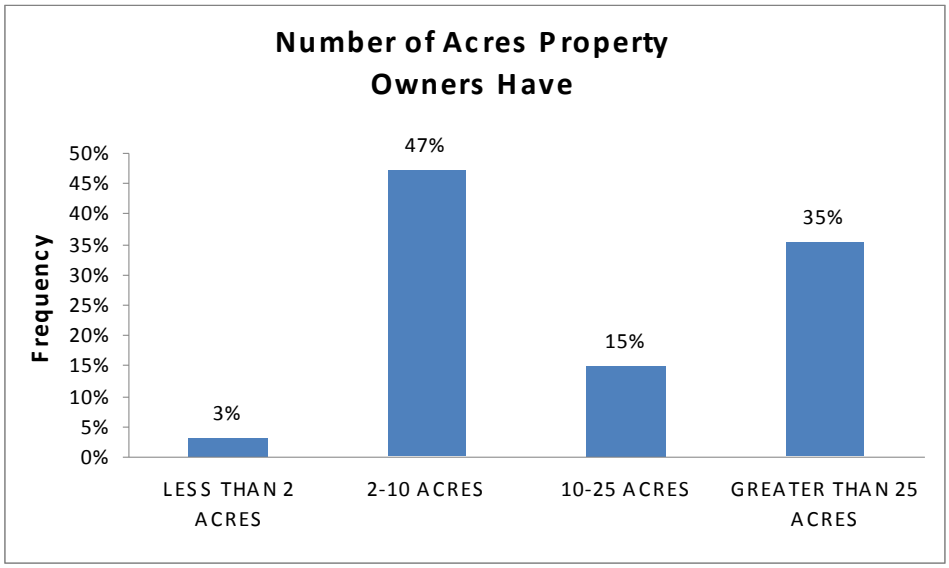
Question 14: How many months a year do you live in Leyden?

Ninety three percent of respondents live year-round in Leyden, while 3% live in Leyden 6 months a year, and 3% live in Leyden 10 months a year.

Question15: Do you own your property?

One hundred percent of survey respondents own their own property.

Question 15a: If you own your property, how many acres do you have?



APPENDIX D

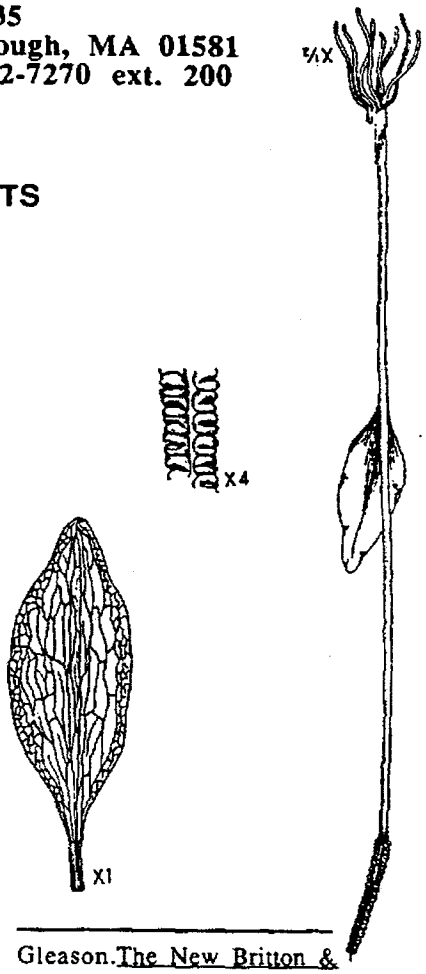
Rare Plant and Wildlife Species in Leyden

Natural Heritage & Endangered Species Program

Commonwealth of Massachusetts
Division of Fisheries & Wildlife
Route 135
Westborough, MA 01581
(508) 792-7270 ext. 200

MASSACHUSETTS THREATENED PLANTS

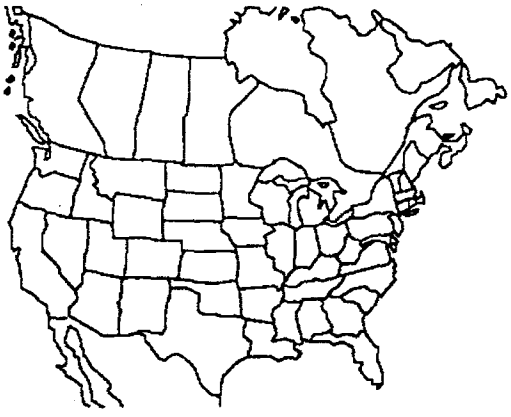
ADDER'S-TONGUE FERN
(Ophioglossum vulgatum L.)



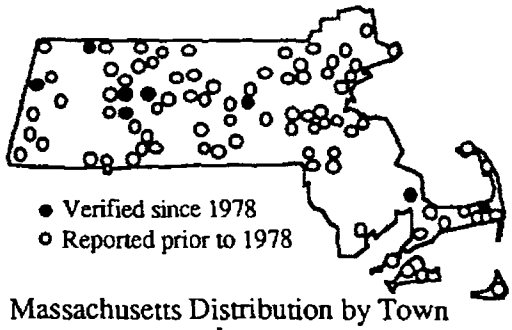
Gleason, The New Britton & Brown Illustrated Flora of the Northeastern U.S. and Adjacent Canada New York Botanical Garden, 1952.

Description

Adder's-tongue is a small, terrestrial fern, up to 30 cm (12 in) high, consisting of a single fleshy green stalk (stipe) bearing a simple leaf and a fertile spike. The stipe arises from fleshy, cord-like rhizomes and roots. About midway up the stipe is the pale green leaf, approximately 15 cm (6 in), narrowly oval to oblong. In var. pseudopodum (false foot), the widespread form, the blade gradually tapers for about 1/4 to 2/3 of its length to a narrow, 1-2 cm base that continues to run down the lower stipe. There is a finely indented network of interconnecting veins. The stipe extends well beyond the leaf blade and is terminated by a short, pale green, narrow fertile spike from 1-4 cm long and up to 5 mm wide, which consists of 2 tightly packed rows of rounded sporangia (spore cases) on the margins of the spike axis. There can be a large variation in the size, shape and position of the blade, as well as the fertile spike, and the occurrence of two fronds (leaves) per rootstalk has been observed. The plant appears anytime after early June.



Range of Adder's-tongue Fern



Massachusetts Distribution by Town

Similar Species

No other fern looks like the Adder's-tongue. Its closest relatives, the Grape Ferns (Botrychium) have dissected or lobed leaves. Several orchids and lilies may have similarly shaped fleshy basal leaves, such that non-flowering or juvenile individuals may at first glance be mistaken for Adder's-tongue Fern. However, all have parallel-veined leaves.

Habitat in Massachusetts

Boggy meadows, acidic fens (sphagnous areas with seeping groundwater), borders of marshes, wet fields, and moist woodland clearings provide suitable open and sunny habitat for Adder's-tongue Fern. Vegetation in these habitats is varied, composed predominantly of common grasses, bulrushes (Scirpus), sedges (Carex), and broadleaved herbs including Ragged, Small Purple Fringed, and White Fringed Orchis (Platanthera lacera, psycodes, and blephariglottis), and Swamp Milkweed (Asclepias incarnata var. pulchra). No common associate or indicator species particularly point to the presence of Adder's-tongue Fern.

Range

Adder's-tongue Fern (var. pseudopodum) is a very widespread, primarily northern fern occurring across North America from Prince Edward Island and southern Quebec to Washington; south to Virginia and west to Indiana, Nebraska, Arizona, and Mexico. A second variety (var. pycnostichum) occurs farther south to Florida and Tennessee.

Population Status

Adder's-tongue Fern was once a widespread species in Massachusetts during the century of extensive agricultural clearing. Records prior to 1978 are from over 90 locations! At present there are only 8 known occurrences. This elusive and easily overlooked species makes it difficult to determine whether individual populations are in decline or stable. Certainly, undiscovered populations still exist in Massachusetts, but the increasing rarity of appropriate open habitat appears to be a major factor in its decline in this state as well as most of its range. It is listed as rare in 20 states:CA, CT, DE, IA, IL, KS, MA, MI, MO, MT, ND, NE, NJ, OR, RI, SC, VA, WA, WI, and WY.

Natural Heritage & Endangered Species Program

Commonwealth of Massachusetts
Division of Fisheries & Wildlife
Route 135
Westborough, MA 01581
(508) 792-7270

THREATENED SPECIES OF MASSACHUSETTS

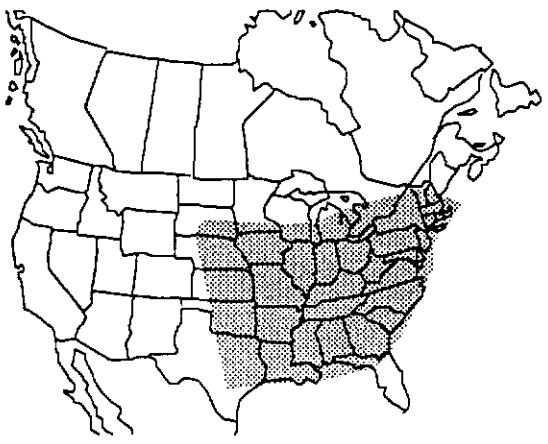
CANADIAN SANICLE
(*Sanicula canadensis* L.)

Gleason, H. A. The New Britton and Brown Illustrated Flora of the U.S. & Adjacent Canada. NY Botanical Garden, 1952.

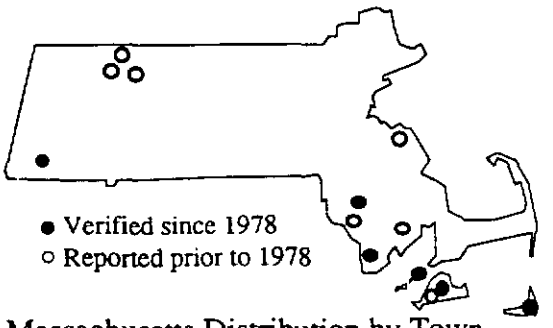
DESCRIPTION: Canadian sanicle is a fibrous-rooted, herbaceous biennial in the Parsley family (Apiaceae or Umbelliferae) found in deciduous forests. This species grows up to 7.5 dm (3 ft.) in height. Longer branches fork two to three times. The doubly serrate, palmately compound (with leaflets radiating out from a central point) leaves are three-parted but may appear five-parted due to deep lobing on the two lateral leaflets. Inconspicuous greenish or whitish flowers are arranged in umbels (rather flat-topped group of flowers in which all the flowers arise from a single point) with rays of differing lengths. The small, approximately globe-shaped fruits are borne in groups of three on 1–1.5 mm (1/25–2/25 in.) long pedicels (flower stalks). The styles (usually slender, stalk-like portions of the pistils) are shorter than the hooked bristles that cover the fruit, suggesting the plant's alternative common name of short-styled snakeroot. The plant's anthers (uppermost portions of the stamens) are white. Canadian sanicle fruits from June through September.

RANGE: The range of Canadian sanicle has been documented as occurring from southern Ontario, New Hampshire and Massachusetts to southern Minnesota and South Dakota, and south to Florida and Texas.

SIMILAR SPECIES IN MASSACHUSETTS: Similar species include the other snakeroots that occur in our area—black snakeroot (*Sanicula marilandica*), long-styled snakeroot (*S. gregaria*), and long-fruited snakeroot (*S. trifoliata*). Long-styled snakeroot differs in its bright yellow anthers (male pollen producing part of the plant), yellowish-green flowers, and the fact that its style exceeds its fruit bristles in length. Black snakeroot also has styles that are longer than the fruit bristles. The pistillate, or female, flowers of long-fruited snakeroot differ from those of Canadian snakeroot in having no stalks. In addition, the sepals (outer leaf covering of flower) of long-fruited snakeroot form a conspicuous beak at the top of the fruit.



Documented Range of Canadian Sanicle



Massachusetts Distribution by Town

HABITAT IN MASSACHUSETTS: Canadian sanicle is a plant of moist or dry, open woods. This species appears to occur in a variety of deciduous forest types, but it seems to prefer mesic slopes in stream valleys or lake margins. Habitats in Massachusetts include low knolls in a red maple swamp and a rocky, mesic hardwood forest. Among the plant species associated with Canadian sanicle are Indian cucumber root (*Medeola virginiana*) and various species of aster (*Aster* spp.), maple (*Acer* spp.), and hickory (*Carya* spp.). Rare Massachusetts plants that have been found with Canadian sanicle include gypsywort (*Lycopus rubellus*).

POPULATION STATUS: Canadian sanicle is presently listed as "Threatened" in Massachusetts. As with all species listed in Massachusetts, individuals of the species are protected from take (picking, collecting, killing...) and sale under the Massachusetts Endangered Species Act. There are seven current stations (discovered or relocated since 1978) in six towns and eight historical stations (unverified since 1978) in the Commonwealth. (Both a current and a historical station occur in Nantucket and are represented by a single, solid dot.) Canadian sanicle is also considered rare in Minnesota, New Hampshire, and Vermont.

MANAGEMENT RECOMMENDATIONS: As with most rare plants, exact needs for management of Canadian sanicle are not known. The following advice comes from observations of the populations in Massachusetts. Canadian sanicle prefers deep light sandy loam of high pH and is most vigorous where there are some sunny openings. The soil should be somewhat moist, but not wet or poorly drained. This sanicle is a biennial, producing two leaves the first year, and flowering the next. Preservation of large areas of its habitat is important as it relies on being able to seed into other appropriate suitable sites in order to survive.

1994

Partially funded by a grant from DEM Forest Stewardship Program

Natural Heritage
& Endangered Species
Program
Massachusetts Division of Fisheries & Wildlife
1 Rabbit Hill Road, Westborough, MA 01581
tel: (508) 389-6360 fax: (508) 389-7891
www.nhesp.org

Barren Strawberry

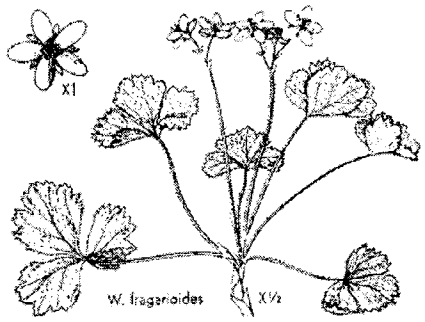
Waldsteinia fragarioides (Michx.) Tratt.

State Status: **Special Concern**
Federal Status: None

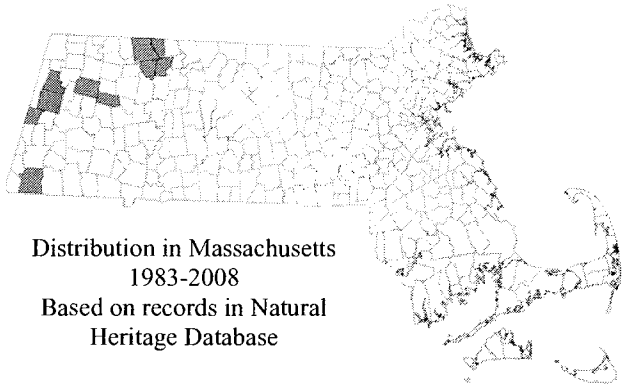
Description: Barren Strawberry (*Waldsteinia fragarioides*) is a low-growing, yellow woodland wildflower of the rose family (Rosaceae), known in Massachusetts from a variety of rich mesic habitats. A rhizomatous perennial herb, this species employs both sexual and asexual reproduction, and can form extensive colonies.

Aids to indentification: Barren Strawberry has a cluster of trifoliate compound basal leaves, 10 to 20 cm (4–8 in.) in height, which arise from tough, fibrous woody rhizomes. The leaves are evergreen, and long-petioled, with three wedge-shaped, shallowly lobed leaflets; the lateral leaflets are asymmetrical. The flowers are five lobed, with triangular sepals, yellow petals, and numerous stamens. The inflorescence is a cyme of few to many flowers on a long scape, approximately equal in height to the leaves. Typically 2 to 6 achenes (dry, single seeded fruits), are produced from each flower.

Similar species: Barren Strawberry somewhat resembles Wild Strawberry (*Fragaria virginiana*) and Woodland Strawberry (*F. vesca* ssp. *americana*). Both of these *Fragaria* species, however, have white flowers and fleshy edible fruits, and leaflets that are narrower than those of Barren Strawberry.



Holmgren, Noel H. The Illustrated Companion to Gleason and Cronquist's Manual. NY Botanical Garden. 1998.



Distribution in Massachusetts
1983-2008
Based on records in Natural Heritage Database

Habitat: Barren Strawberry inhabits a variety of habitat types in Massachusetts, yet it has few enough populations to be of conservation concern; this indicates that there are factors besides available habitat that limit the distribution of the species. Barren Strawberry is most typically found in rich, alluvial woodland terraces and seeps, but also in rich mesic forests, forested uplands bordering calcareous wetland communities, and old fields. Associated species vary greatly according to the habitat type, but often include Sugar Maple (*Acer saccharum*), White Ash (*Fraxinus americana*), Musclewood (*Carpinus caroliniana*), baneberries (*Actaea* spp.), False Solomon's Seal (*Maianthemum racemosum*), Cinnamon Fern (*Osmunda cinnamomea*), and Ostrich Fern (*Matteuccia struthiopteris*).

Flowering time in Massachusetts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
				■	■						

Please allow the Natural Heritage & Endangered Species Program to continue to conserve the biodiversity of Massachusetts with a contribution for 'endangered wildlife conservation' on your state income tax form as these donations comprise a significant portion of our operating budget.

Threats: Some populations of Barren Strawberry are threatened by invasion of exotic plant species such as Garlic Mustard (*Alliaria petiolata*), Japanese Barberry (*Berberis thunbergii*), Morrow's Honeysuckle (*Lonicera morrowii*), and Common Buckthorn (*Rhamnus cathartica*). These species can dominate the vegetation cover and effectively out-compete Barren Strawberry. Heavy recreational uses, such as hiking, mountain biking, and ORV use in Barren Strawberry habitat can cause physical damage to plants, and compaction or erosion of the soil.

Range: The documented range of Barren Strawberry encompasses most of eastern North America, from Quebec and New Brunswick, south to Georgia and Alabama, Minnesota, Missouri, and Arkansas.

Population in Massachusetts: Barren Strawberry is listed under the Massachusetts Endangered Species Act as a species of Special Concern. All listed species are legally protected from killing, collection, possession, or sale, and from activities that would destroy habitat and thus directly or indirectly cause mortality or disrupt critical behaviors. Barren Strawberry is currently known from Berkshire, Franklin, and Hampshire Counties, and is historically known from Worcester County.

Management recommendations: As with many rare species, the exact management needs of Barren Strawberry are not known. Sites should be monitored for invasions of exotic plants, particularly Garlic Mustard, Japanese Barberry, Morrow's Honeysuckle, and Common Buckthorn. If exotic plants are crowding and out-competing Barren Strawberry, a plan should be developed, in consultation with the Massachusetts Natural Heritage & Endangered Species Program, to remove the invaders. Barren Strawberry locations that receive heavy recreational use (e.g., hiking, ORV, rock climbing) should be carefully monitored for plant damage or soil disturbance; trails can sometimes be re-routed to protect the rare plant population. All active management of rare plant populations (including invasive species removal) is subject to review under the Massachusetts Endangered Species Act, and should be planned in close consultation with the Massachusetts Natural Heritage & Endangered Species Program.

Updated June 2008

Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife
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www.nhesp.org

Black Maple

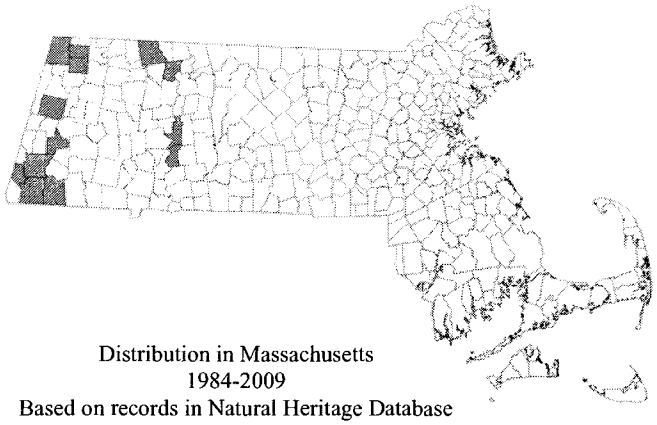
Acer nigrum Mich.

State Status: **Special Concern**
Federal Status: **None**

Description: Black Maple, also commonly known as Hard Maple and Rock Maple, reaches up to 40 meters (about 130 ft.) in height. It has a straight central trunk when growing in the forest and a widely spreading branch system when growing in the open. The bark on Black Maple trees is dark and thick, with narrow furrows. The leaves are deep green and, usually, densely pubescent beneath. Commonly, they have somewhat drooping sides. They are usually 3-lobed and rarely 5-lobed, with a few obtuse or rounded teeth. Black Maple's winged fruits (samaroid schizocarps) are similar to those of Sugar Maple (*Acer saccharum*), to which it is closely related and with which it hybridizes. Black Maple flowers from late May through early June.

Range: The documented range of Black Maple extends from Quebec and New Hampshire to Minnesota, south to northern Georgia and northern Louisiana. The species is more common in the western portion of its range than in the east.

Holmgren, Noel H. 1998. The Illustrated Companion to Gleason and Cronquist's Manual. *The New York Botanical Garden.*



Distribution in Massachusetts
1984-2009
Based on records in Natural Heritage Database

Habitat: Black Maple prefers rich, moist soil in association with alluvial hardwood forests. It does not grow in acidic soils. Black Maple is highly shade tolerant. All current sites in Massachusetts have mesic (moderately moist) soils, and most have either shade or filtered light conditions.

Among the specific habitats in Massachusetts are several floodplain forests, including one near a dolomitic limestone cobble; various types of forested rocky slopes and outcrops, including dolomitic cobbles, talus slopes and trap ledges; various rich wood communities, including ones near marble outcrops and on rocky slopes; and former floodplain forests, including a sunny hayfield. Species commonly found growing with Black Maple in Massachusetts include Sugar Maple (*Acer saccharum*), Basswood (*Tilia americana*), White and Green Ash (*Fraxinus americana* and *F. pennsylvanica*), Sycamore (*Platanus occidentalis*), American Elm (*Ulmus americana*), Bitternut Hickory (*Carya cordiformis*), Hop Hornbeam (*Ostrya virginiana*),

various species of birch (*Betula*), Leatherwood (*Dirca palustris*), and Wild Leek (*Allium tricoccum*). Rare Massachusetts species found with black maple include Autumn Coralroot (*Corallorhiza odontorhiza*), Downy Wood-Mint (*Blephilia ciliata*), Yellow Oak (*Quercus muhlenbergii*), Climbing Fumitory (*Adlumia fungosa*) and Crooked-Stem Aster (*Symphyotrichum prenanthoides*).

Similar Species: Black Maple is sometimes considered to be a variety of the Sugar Maple (*A. saccharum*) and often occurs in the same habitats. Black Maple differs in its darker, more furrowed bark and darker, densely hairy, 3-lobed leaves with characteristically drooping sides.

Population Status: Black Maple is currently listed as a Species of Special Concern in Massachusetts. Occurrences are found only in western Massachusetts, where populations are generally small in number (one population has about 100 individuals, however). Black Maple is also considered rare in Vermont, New Hampshire, New Jersey, North Carolina, Georgia, Arkansas, and Quebec.

Management Recommendations: Threats to Black Maple would include habitat destruction and logging.

Updated 12 January 2009

Natural Heritage & Endangered Species Program

Commonwealth of Massachusetts
Division of Fisheries & Wildlife
Route 135
Westborough, MA 01581
(508) 792-7270

THREATENED SPECIES OF MASSACHUSETTS

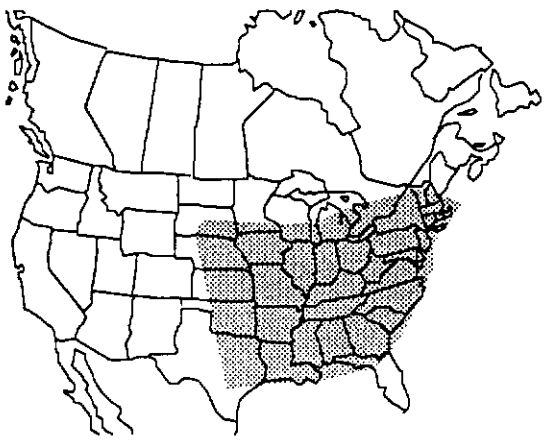
CANADIAN SANICLE
(*Sanicula canadensis* L.)

Gleason, H. A. The New Britton and Brown Illustrated Flora of the U.S. & Adjacent Canada. NY Botanical Garden, 1952.

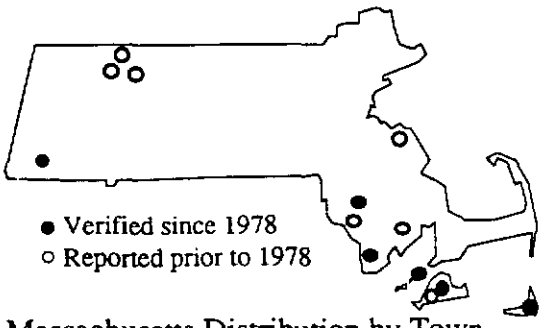
DESCRIPTION: Canadian sanicle is a fibrous-rooted, herbaceous biennial in the Parsley family (Apiaceae or Umbelliferae) found in deciduous forests. This species grows up to 7.5 dm (3 ft.) in height. Longer branches fork two to three times. The doubly serrate, palmately compound (with leaflets radiating out from a central point) leaves are three-parted but may appear five-parted due to deep lobing on the two lateral leaflets. Inconspicuous greenish or whitish flowers are arranged in umbels (rather flat-topped group of flowers in which all the flowers arise from a single point) with rays of differing lengths. The small, approximately globe-shaped fruits are borne in groups of three on 1–1.5 mm (1/25–2/25 in.) long pedicels (flower stalks). The styles (usually slender, stalk-like portions of the pistils) are shorter than the hooked bristles that cover the fruit, suggesting the plant's alternative common name of short-styled snakeroot. The plant's anthers (uppermost portions of the stamens) are white. Canadian sanicle fruits from June through September.

RANGE: The range of Canadian sanicle has been documented as occurring from southern Ontario, New Hampshire and Massachusetts to southern Minnesota and South Dakota, and south to Florida and Texas.

SIMILAR SPECIES IN MASSACHUSETTS: Similar species include the other snakeroots that occur in our area—black snakeroot (*Sanicula marilandica*), long-styled snakeroot (*S. gregaria*), and long-fruited snakeroot (*S. trifoliata*). Long-styled snakeroot differs in its bright yellow anthers (male pollen producing part of the plant), yellowish-green flowers, and the fact that its style exceeds its fruit bristles in length. Black snakeroot also has styles that are longer than the fruit bristles. The pistillate, or female, flowers of long-fruited snakeroot differ from those of Canadian snakeroot in having no stalks. In addition, the sepals (outer leaf covering of flower) of long-fruited snakeroot form a conspicuous beak at the top of the fruit.



Documented Range of Canadian Sanicle



Massachusetts Distribution by Town

HABITAT IN MASSACHUSETTS: Canadian sanicle is a plant of moist or dry, open woods. This species appears to occur in a variety of deciduous forest types, but it seems to prefer mesic slopes in stream valleys or lake margins. Habitats in Massachusetts include low knolls in a red maple swamp and a rocky, mesic hardwood forest. Among the plant species associated with Canadian sanicle are Indian cucumber root (*Medeola virginiana*) and various species of aster (*Aster* spp.), maple (*Acer* spp.), and hickory (*Carya* spp.). Rare Massachusetts plants that have been found with Canadian sanicle include gypsywort (*Lycopus rubellus*).

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MANAGEMENT RECOMMENDATIONS: As with most rare plants, exact needs for management of Canadian sanicle are not known. The following advice comes from observations of the populations in Massachusetts. Canadian sanicle prefers deep light sandy loam of high pH and is most vigorous where there are some sunny openings. The soil should be somewhat moist, but not wet or poorly drained. This sanicle is a biennial, producing two leaves the first year, and flowering the next. Preservation of large areas of its habitat is important as it relies on being able to seed into other appropriate suitable sites in order to survive.

1994

Partially funded by a grant from DEM Forest Stewardship Program

Natural Heritage & Endangered Species Program

Commonwealth of Massachusetts
Division of Fisheries & Wildlife
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MASSACHUSETTS THREATENED PLANTS

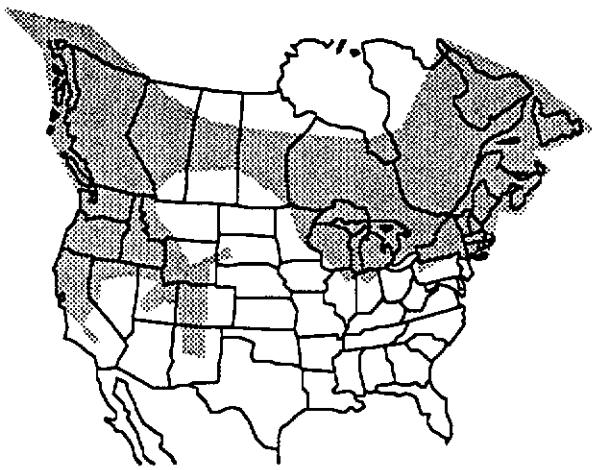
LEAFY WHITE ORCHIS

(*Platanthera dilatata* <Pursh> Lindl. ex Beck = *Habenaria dilatata* <Pursh> Hook)

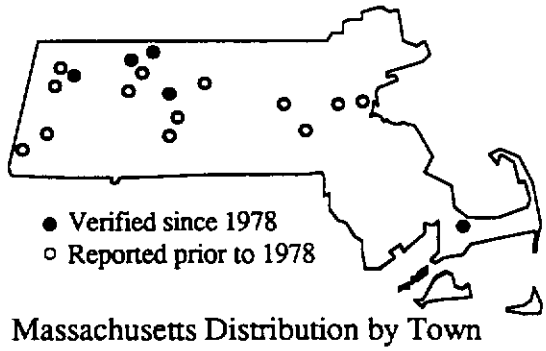
Newcomb, Lawrence. Newcomb's Wildflower Guide. Little, Brown and Company, Boston. 1977.

Description

Leafy white orchis--or bog candles--is a tall, leafy-stemmed, stout or slender perennial in the Orchid family (Orchidaceae) that rises from fleshy roots and ends in a slender spike of white flowers. It is erect, hairless, and reaches up to 1 m (3 1/3 ft.) in height. The lanceolate leaves number about 12 and become progressively smaller toward the top of the plant. Leafy white orchis's small flowers are generally bright white and are arranged in a 1-3 dm (1/3 to 1 ft.) long spike. Their delightful fragrance has been likened to cloves. The 5-10 mm (0.2 - 0.4 in.) long lip, or lowermost petal, widens near the base and has five to seven prominent veins. The spur (a hollow extension of the flower) is about as long as the lip. Leafy white orchis's fruit is a 12 x 6 mm (0.47 - 0.24 in.), ellipsoid capsule (a fruit that is formed from a compound pistil and that contains many seeds). In Massachusetts, the plant blooms from mid June through July.



Documented Range of Leafy White Orchis



Massachusetts Distribution by Town

Range

The North American range of leafy white orchis has been documented as extending across Labrador to Alaska and south to New Jersey, Wisconsin, South Dakota, New Mexico and California.

Similar Species

The white-fringed orchis (*Platanthera blephariglottis*) and the clubspur orchis (*Platanthera clavellata*)--two white to whitish-flowered orchids of somewhat similar habitats--could be confused with leafy white orchis. However, in our area, the lip of white-fringed orchis is deeply fringed. And the clubspur orchis is both shorter--1-4 dm (1/3 to 1 1/3 ft.)--and, generally, has only one well-developed leaf on its stem. Finally, northern green orchis (*Platanthera hyberborea*) is extremely hard to distinguish from leafy white orchis and often hybridizes with it. In contrast to leafy white orchis, it has green or greenish-white flowers. (Some authorities consider *Platanthera hyperborea* to be a green-flowered form of *Platanthera dilatata*.)

Habitat in Massachusetts

Leafy white orchis is a plant of sunny, wet areas, including bogs, seepage slopes and wet woods, especially where cold water surfaces to form springs. It prefers non-acid soil conditions. In Massachusetts, habitats include a cold, muddy and springy seep; a wet spot near a road; an area of sphagnum and rich muck, with springs and streamlets; a wet, sedgey open area; and an open, springy seep adjacent to a tributary. Plant species associated with leafy white orchis include sphagnum moss (*Sphagnum* spp.); various horsetails (*Equisetum* spp.), willows (*Salix* spp.) and alders (*Alnus* spp.); marsh fern (*Thelypteris palustris*); royal fern (*Osmunda regalis*); and yellow sedge (*Carex flava*).

Population Status

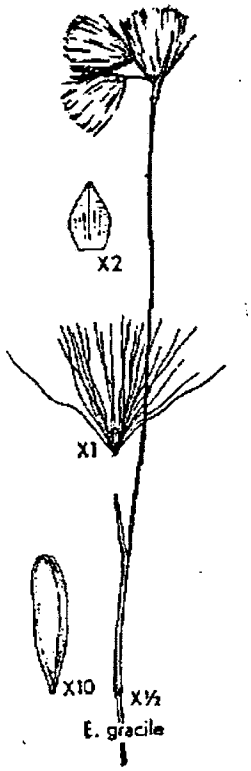
Leafy white orchis is presently listed as "Threatened" in Massachusetts. There are seven current stations (discovered or relocated since 1978) in five towns and 15 historical stations (unverified since 1978) in 14 towns. (One town has both an historical and a current station and is represented by one solid dot on the Massachusetts distribution map.) Reasons for the plant's rarity in Massachusetts include loss of habitat--due both to development and forest succession--and scarcity of suitable habitat. Leafy white orchis is also considered rare in Indiana, South Dakota and Wisconsin. It was present historically in Pennsylvania and Connecticut. The species is quite common in the far North, but becomes rare in the southern portions of its range.

Natural Heritage & Endangered Species Program

Natural Heritage & Endangered Species Program
MA Division of Fisheries & Wildlife
Route 135
Westborough, MA 01581-3337
508-792-7270 x 200

MASSACHUSETTS RARE AND ENDANGERED PLANTS

SLENDER COTTONGRASS
(*Eriophorum gracile* W. D. J. Koch ex Roth)

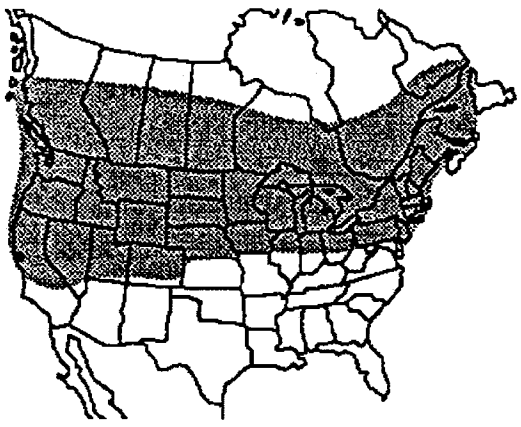


Gleason, H.A. The New Britton and Brown Illustrated Flora of the US & Adjacent Canada. NY Botanical Garden, 1952.

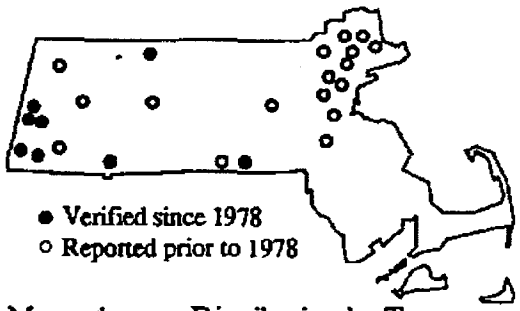
Description

Slender Cottongrass--a narrow-stemmed, grass-like perennial in the Sedge family (Cyperaceae)--is topped by a cluster of white, bristly inflorescences that resemble tufts of wool when seen from a distance. In fact, the genus name comes from the Greek words *erion* and *phorus*, meaning "wool" and "bearing" respectively. The weak, unbranched, 2-6 dm (8 - 24 in.) long stems are roughly circular in cross-section and rise from a creeping rhizome (underground horizontal stem).

Slender Cottongrass's narrow blades are 1-2 mm (1/25 - 2/25 in.) wide, and the uppermost is shorter than its sheath (the lower portion of a leaf that envelops the stem). There is one erect, foliaceous bract (modified leaf associated with an inflorescence), which is shorter than the inflorescence



Documented Range of Slender Cottongrass



Massachusetts Distribution by Town

and, usually, blackish at its base. Cotton-grass's wooly inflorescences occur as 2-5 spikelets (arrangements of reduced, stalkless flowers and bracts on an unbranched axis). Bristles are fully developed from early June to early July. The three-sided achenes (dry, one-seeded fruits) are brown and 2.5-3.5 mm (3/25 - 4/25 in.) long.

Range

The documented range of Slender Cottongrass in North America extends from Newfoundland to British Columbia, south to Pennsylvania, Indiana, Iowa, Colorado and California.

Similar Species

Plants that may be mistaken for Slender Cottongrass include various other species of *Eriophorum*. Rough Cottongrass (*E. tenellum*) can be distinguished by its uppermost leaf, the blade of which equals or exceeds its sheath in length. Both Virginia Cottongrass (*E. virginicum*) and Thin-leaved Cottongrass (*E. viridi-carinatum*) have two or three foliaceous bracts, in contrast to the one of Slender Cottongrass. Finally, Close-sheathed Cottongrass (*E. vaginatum*) has only one spikelet and no foliaceous bracts.

Habitats in Massachusetts

Slender Cottongrass is a plant of swamps and bogs. Habitats in Massachusetts include an acidic bog with no inflow or outflow, an alkaline fen (a peat-forming habitat where very cold, nutrient-poor water seeps through limey gravel to the surface) kept open by annual mowing, the open outlet channel of a freshwater lake, an abandoned beaver's pond dam, a wet fen near a streamlet, a shrubby section of a cedar swamp, and a wet basin with seepage swamp. Associated species include Shrubby Cinquefoil (*Potentilla fruticosa*), Leather-leaf (*Chamaedaphne calyculata*), Horsetail (*Equisetum fluviatile*), Sphagnum Moss, and various species of *Carex* (in the Sedge family). Rare Massachusetts plants that have been found with Slender Cottongrass include Fen Sedge (*Carex tetanica*) and Hoary Willow (*S. candida*).

Population Status

Slender Cottongrass is presently listed as "Threatened" in Massachusetts. There are nine current stations in eight towns (discovered or relocated since 1978) and nineteen historical stations (unverified since 1978) in eighteen towns. (One historical and one current station occur in one town and are represented by a single, solid dot on the town distribution map.) It is also considered rare in Vermont, Rhode Island, Indiana, Iowa, Nebraska, North Dakota, South Dakota, Wyoming and Colorado. Slender Cottongrass was present historically in Delaware, New Jersey and Ohio.

Massachusetts Natural Heritage Program

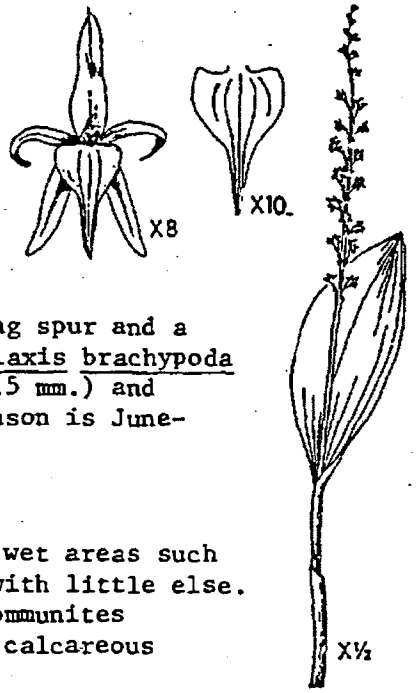
Natural Heritage & Endangered Species Program
Division of Fisheries & Wildlife
Route 135
Westborough, MA 01581
(508)792-7270, ext. 200

MASSACHUSETTS RARE AND ENDANGERED PLANTS

WHITE ADDER'S-MOUTH

(Malaxis brachypoda (Gray) Fern.)

DESCRIPTION



A slender herb, Malaxis brachypoda hardly appears to be a member of the Orchid family but close inspection of the tiny flowers reveals its kinship. This plant arises from solid tubers and has a stem height of 4-10 inches (1-2.5 dm.). A solitary, erect, basal leaf is oval to elliptic in shape, less than an inch to 3 1/2 inches (1.7-9 cm.) long and at least half as wide. Greenish-white flowers are produced along the upper part of the stem, each with a slender tapering spur and a heart-shaped lip situated lowermost in the flower. Malaxis brachypoda has ovate sepals which are less than an inch long (2-2.5 mm.) and lateral petals that spread horizontally. Flowering season is June-August.

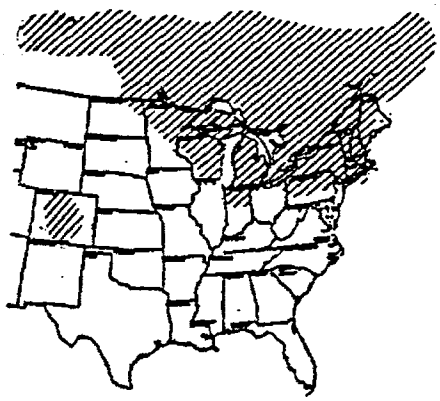
HABITAT IN MASSACHUSETTS

In Massachusetts, White Adder's-mouth occurs in shady, wet areas such as swamps and bogs, usually growing in sphagnum moss, with little else. It also favors coniferous forested fens and peatland communites dominated by coniferous trees and influenced by highly calcareous water.

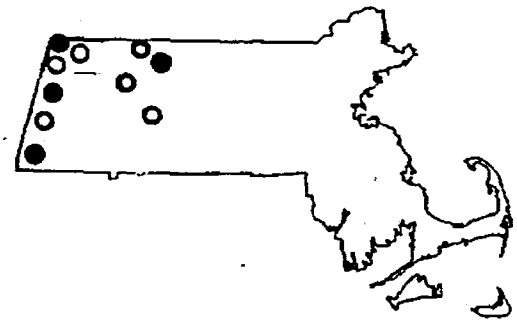
RANGE

Gleason, H.A. The New Britton and Brown Illustrated Flora of the Northeastern U.S. and Adjacent Canada. New York Botanical Garden, 1952.

Labradour to Alaska, south to Pennsylvania, northern Indiana, Minnesota, Alberta and British Columbia. Disjunct populations are located in the mountains of Colorado and southern California.



Distribution of White Adder's-mouth



● Verified since 1978
○ Reported prior to 1978

Distribution in Massachusetts by Town

(continued overleaf)

1985

POPULATION STATUS

Malaxis brachypoda is considered a "Threatened" species in Massachusetts. Currently (1978 to present) six occurrences have been sited and prior to 1978, seven historical occurrences have been recorded. The reasons for the rarity of this plant in Massachusetts include its natural occurrence in low numbers at a site and the possibility of it being overlooked in the limited amount of suitable habitat in the state.

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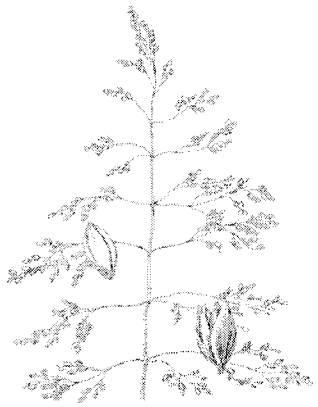
Woodland Millet

Milium effusum L.

State Status: **Threatened**
Federal Status: **None**

Description: *Milium effusum* is a perennial woodland grass. It has a smooth, somewhat succulent, slender stem that grows 3 ½-5 feet (1-1.5 m.) tall. The leaf blades are generally 4-8 inches (10-20 cm.) long and ½-1/2 inches (8-15 mm.) wide. The panicle (flowering part) is sparse-looking, 4-8 inches long with branches which extend outward and carry dropping spikelets. *Milium effusum* is notable for its delicate pastel green color and whitish bloom on the stem. Spikelets can be found from late May to September.

Habitat in Massachusetts: Woodland Millet is typically found on steep slopes in rich, mesic forest communities with calcareous soils. Its microhabitat often includes the drier, rocky upper slopes of the woodland. Commonly associated species include *Fagus grandifolia* (Beech), *Acer saccharum* (Sugar Maple), *Betula papyrifera* (White Birch), *Solidago macrophylla* (Broad-leaved Goldenrod), *Allium tricoccum* (Wild Leek), and *Carex platyphylla* (Broad-leaved Sedge).



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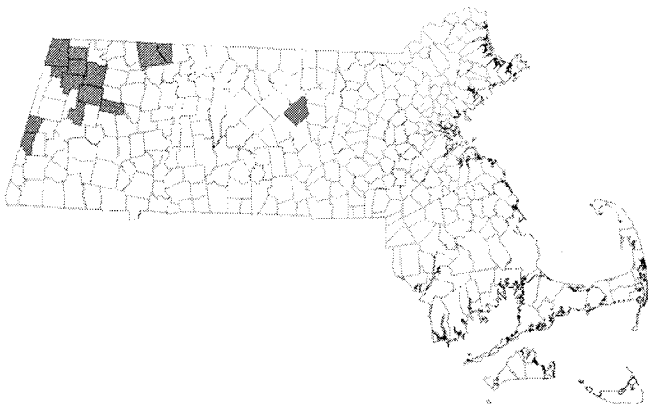

Distribution in Massachusetts
1984-2009
Based on records in Natural Heritage Database

Range: Woodland Millet is distributed from Nova Scotia and Quebec west to Minnesota and south to West Virginia and Illinois.

Population Status: Woodland Millet is currently considered Threatened in Massachusetts. It has probably never been very abundant in Massachusetts and its rarity is in part related to the relatively few steeply sloped mesic forest communities in the state. Except for one, all populations are small, scattered, and vulnerable to disturbance. Twenty-two current occurrences have been documented (1984 to present), and two historical occurrences (prior to 1984) have been recorded.

Updated 20 February 2009

Please allow the Natural Heritage & Endangered Species Program to continue to conserve the biodiversity of Massachusetts with a contribution for 'endangered wildlife conservation' on your state income tax form as these donations comprise a significant portion of our operating budget.

Natural Heritage & Endangered Species Program

Massachusetts Division of Fisheries & Wildlife
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Jefferson Salamander
Ambystoma jeffersonianum

State Status: **Species of Special Concern**
Federal Status: None

Description: Jefferson salamanders are long and slender salamanders with elongated limbs and toes. They are grayish brown to dark brown in color with a lighter bluish gray underside. Often there are pale bluish or silvery flecks on the limbs and lower sides of the body and tail.

Determining sex is easiest done during the breeding season, when males have conspicuously swollen vents and females appear less slender than males due to the burden of their eggs. Additionally, males are slightly smaller in length and range from 4.4 to 7.4 inches (11.0 to 18.5 cm) with a strongly laterally compressed tail that comprises approximately 50% of the total length; females range 5.1 to 7.8 inches (12.9 to 19.6 cm) in total length and have slightly shorter, non-compressed tails.

The larvae are difficult to distinguish from other *Ambystoma* species, but have short stubby bodies and very large heads with an unpigmented throat and chin. The backs of larvae are marked with pairs of black spots separated by a mid-dorsal black line, and the sides of their bodies are marked with a mid-lateral row of lighter spots.

Similar species: The Jefferson salamander is a member of the Jefferson / Blue-spotted complex salamander (*A. jeffersonianum / A. laterale* complex). Blue-spotted (*Ambystoma laterale*) and Jefferson salamanders were separated by ice age glaciation, but after the ice melted, the two species came into contact with each other and began interbreeding producing hybrid populations. The hybridization of these two species has led to the development of two completely female populations that are all polyploids – that is, they have multiple sets of chromosomes rather than the normal set of two (diploid). Although Jefferson salamanders and blue-spotted salamanders are fairly easy to differentiate from each other, the identification of the hybrid species is very difficult to distinguish on the basis of appearance alone; typically,

Photo by Bill Byrne

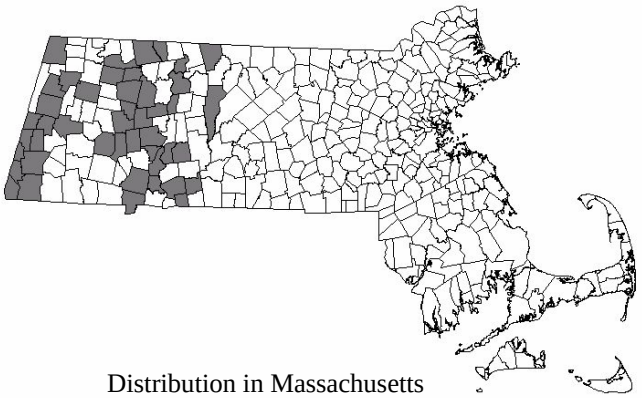
identification can only be completed through chromosome counts or size of red blood cells in conjunction with their external appearance. Even though, these two hybrid populations have been formally named as the Silvery salamander (*Ambystoma platineum*) and the Tremblay's salamander (*Ambystoma tremblayi*), the hybrid salamanders are simply referred to as the Jefferson / Blue-spotted complex salamander.

When the Jefferson / Blue-spotted complex hybrids are present in an area, they may outnumber the blue-spotted or Jefferson salamanders by a 2:1 margin. A population with many more females than males is a good indicator of the presence of hybridization of these species. The mode of reproduction of the female hybrids is gynogenesis: sperm is obtained from male diploids to stimulate egg division, but no genetic recombination occurs. However, additional hybrid forms such as triploid males and tetraploid and diploid females have been found, indicating that some offspring retain genetic material from two parents.

The members of the complex form a continuum in appearance from the grayish-brown coloration, pale blue flecks, and wide snout of the Jefferson salamander to the bluish-black coloration, prominent blue spots, and narrow snout of the blue-spotted salamander.

Range: The ranges of the Jefferson and blue-spotted salamanders overlap in New England. Populations of pure Jefferson salamanders therefore occur south of the hybridization zone with blue-spotted salamanders. The area of populations of pure Jefferson salamanders and hybrids extends from southern New York, northern New Jersey, and most of Pennsylvania to Ohio and southern Indiana. The range extends southward only as far as Kentucky, West Virginia and Virginia.

In Massachusetts, Jefferson salamanders occur predominantly within the western part of the state. In general, Jefferson - blue-spotted complex salamanders found west of the Connecticut River are more likely to be Jefferson salamanders.



Distribution in Massachusetts
1980 - 2006
Based on records in Natural Heritage Database

Habitat: Jefferson salamanders have a strong affinity for upland forests and prefer to reside most of the year in well drained deciduous or mixed forest, within 250 to 1600 meters of a small vernal pool or pond, commonly surrounded by alder, red maple, buttonbush, and dogwood. They hide beneath leaf litter, loose soil, and stones, or in rotting logs, rodent burrows, or subterranean burrows which they excavate. Vernal pools, or temporary ponds, are necessary for reproduction and need to be full of dead and decaying leaves for cover and overhanging bushes or grass for egg deposition. Abandoned, fishless farm ponds with cattails and other vegetation are good sites for breeding populations.

Life Cycle / Behavior: Jefferson salamanders hibernate underground in the winter months, usually near breeding sites. In March and April (sometimes as early as February), Jefferson salamanders begin to migrate to breeding ponds which is thought to be triggered by the first early warm spring rains or other conditions of high humidity and above-freezing temperatures. They congregate in large numbers at temporary ponds with males arriving to breeding sites a few days prior to females. An elaborate courtship, similar to the blue-spotted salamander, occurs including approach, contact, nudging, and tail-fanning routines that take place in the water between a single male and single female. Following a period of amplexus, the female will follow the male, pick up a deposited spermatophore, and store it in the cloaca for egg fertilization. (Normal sexual reproduction occurs in the diploid females, while no true fertilization or recombination of chromosomes takes place in the triploid hybrids). One to two days after mating, the females deposit their eggs at night (or during the day if cloudy and rainy) on submerged branches, aquatic plants, or tree limbs dipping into the water. The eggs are deposited in small masses which average 16 in number, but can vary from 1 to 60; 100 to 286 eggs are laid in all. The eggs hatch in 30 to 45 days, and the larval stage ranges from 56 to 125 days. Larvae are cannibalistic and are voracious eaters, preying on insect larvae and other small aquatic animals. No over wintering of larvae has been reported in Massachusetts, so by late August larvae have metamorphosed completely into air-breathing adults.

Jefferson salamanders have been found to migrate to and from breeding pools an average of 100 to 900 feet from their terrestrial habitat. The maximum known movement distance of an adult is 5249 feet (1600 m) in Ohio.

Adult Jefferson salamanders are rarely seen outside of the breeding season, but are presumed to eat earthworms and other invertebrates underground. They produce noxious skin secretions from specialized poison glands in their tail and are thus rarely preyed upon by native predators.

Population status in Massachusetts: The Jefferson salamander (including triploid and other polyploid forms within the *A. laterale/A. jeffersonianum* complex) is currently listed as a “Species of Special Concern” in Massachusetts. There are 47 towns in Massachusetts where Jefferson salamanders have been observed. Seventy-four occurrences have been documented since 1981, as well as 11 historic occurrences that were documented prior to 1981. The major threat to this species—and most salamanders in general—is the loss, degradation and fragmentation of both aquatic breeding pool habitat required for reproduction and terrestrial habitat needed for foraging, overwintering, growth and development to development and urbanization. Some

population declines may be attributed to over collection, heavy road traffic, and pesticides or other toxic chemicals polluting breeding pool water.

Studies on the effects of acid rain on salamander eggs and larvae have been contradictory, and further studies must be made to resolve this issue; however, it appears that Jefferson salamanders appear to be more vulnerable to acidic conditions than other salamanders in New England and have complete egg mortality at low pH levels and water of pH < 4.5 is often lethal to larvae.

Management Recommendations: In order to ensure the survival of this species in Massachusetts, the following recommendations regarding habitat preservation are suggested. There are two critical components in the life history of this species: vernal pool habitat required for reproduction and upland forest habitat required for foraging, hibernation, and other terrestrial and fossorial activities. Conservation of the Jefferson salamander—and all native members of the genus *Ambystoma*—must therefore focus on the preservation of vernal pools and small ponds known to be inhabited by this species, as well as a significant parcel (250–1600 meter radius) of upland habitat surrounding such breeding sites. Provided these habitats are not significantly degraded—and that the salamanders are not subject to illegal collection or high road mortality—the salamander populations should be capable of maintaining themselves indefinitely.

It should be kept in mind, however, that every population is unique. The majority of the population, for instance, may be concentrated in a relatively small and discrete upland habitat, which would safely allow carefully conducted development within some portions of the "uninhabited" habitat around the breeding pool without serious effects on the population. The only way to determine if such a case exists, however, is through a detailed environmental study conducted by a qualified researcher(s) over a series of years, charting the movements of the animals to and from the breeding site. Unless such a study is conducted, it should be assumed that the salamanders are relatively evenly distributed around the pool and development should be strongly discouraged within a minimum radius of 500–1,000 meters surrounding the breeding pool.

Vernal pools and breeding ponds must be protected not only from draining, filling, and development, but also from degradation in the form of road and lawn run-off. If forestry activities are conducted within surrounding areas, a no-cut buffer zone of 50–100 feet should be established around the pool depression, and no slash or other debris should be dumped in the depression. While vernal pools receive some protection under the Massachusetts Wetlands Protection Act, and several vernal pool species (including the blue-spotted salamander) are protected under the Massachusetts Endangered Species Act, efforts should be made to certify all vernal pools and to enhance and promote the enforcement of the laws mentioned above. Because of their ephemeral nature, vernal pools are often difficult to locate during dry periods and may be inadvertently damaged if their locations are not surveyed and marked prior to forestry or construction operations.

Citizens must be encouraged to recognize and report Jefferson salamanders and the locations of their breeding pools. Due to the rarity of this species, its ephemeral terrestrial occurrence, and its very specific habitat requirements, some populations undoubtedly remain undiscovered and therefore under protected.

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Originated: 1994
Updated: 2007

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Wood Turtle

Glyptemys insculpta

State Status: **Species of Special Concern**
Federal Status: None

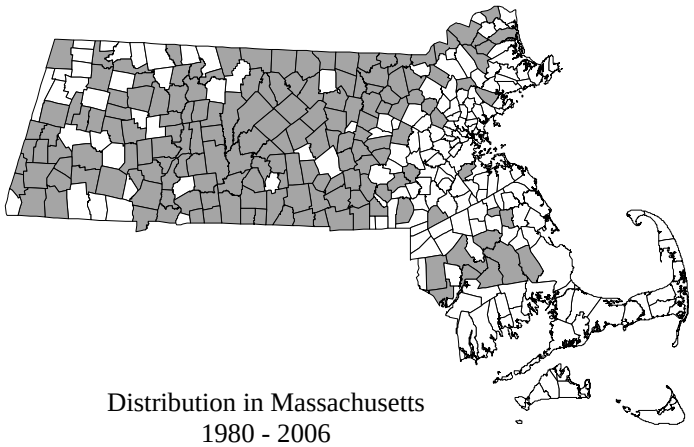
Photo by Mike Jones

DESCRIPTION: The Wood Turtle is a medium-sized turtle (14-20 cm; 5.5-8 in) that can be recognized by its sculpted shell and orange coloration on the legs and neck. The carapace (upper shell) is rough and each scale (scute) rises upwards in an irregularly shaped pyramid of grooves and ridges. The carapace is tan, grayish-brown or brown, has a mid-line ridge (keel) and often has a pattern of black or yellow lines on the larger scutes. The plastron (lower shell) is yellow with oblong dark patches on the outer, posterior corner of each scute. The head is black, but may be speckled with faint yellow spots. The legs, neck, and chin can have orange to reddish coloration. Males have a concave plastron, thick tail, long front claws, and a wider and more robust head than females. Hatchlings have a dull-colored shell that is broad and low, a tail that is almost as long as their carapace and they lack orange coloration on the neck and legs.

SIMILAR SPECIES: The habitat of the Eastern Box Turtle (*Terrapene carolina*) and the Blanding's Turtle (*Emydoidea blandingii*) may overlap that of the Wood Turtle, but neither has the Wood Turtle's pyramidal shell segments. Unlike the Wood Turtle, the Box and Blanding's Turtle have hinged plastrons into which they can withdraw or partially withdraw if threatened. The Northern Diamond-backed Terrapin (*Malaclemys terrapin*) has a shell similar to that of the Wood Turtle. However, its skin is grey and it lives only near brackish water, which the Wood Turtle avoids.

RANGE: The Wood Turtle can be found throughout New England, north to Nova Scotia, west to eastern Minnesota, and south to northern Virginia. The Wood Turtle appears to be widespread in Massachusetts. However, it should be kept in mind that little is known about the status of local populations associated with the majority of these sightings. Most of the towns have fewer than 5 known occurrences.

HABITAT IN MASSACHUSETTS: The preferred habitat of the Wood Turtle is riparian areas. Slower moving mid-sized streams are favored, with sandy bottoms and heavily vegetated stream banks. The stream bottom and muddy banks provide hibernating sites for overwintering, and open areas with sand or gravel substrate near the streams edge are used for nesting. Wood Turtles spend most of the spring and summer in mixed or deciduous forests, fields, hay-fields, riparian wetlands including wet meadows, bogs, and beaver ponds. Then they return to the streams in late summer or early fall to their favored overwintering location.



Distribution in Massachusetts
1980 - 2006
Based on records in Natural Heritage Database

LIFE CYCLE & BEHAVIOR: The Wood Turtle typically spends the winter in flowing rivers and perennial streams. Full-time submersion in the water begins in November, once freezing occurs regularly overnight, and continues until temperatures begin to increase in spring. It may hibernate alone or in large groups in community burrows in muddy banks, stream bottoms, deep pools, instream woody debris, and abandoned muskrat burrows. The Wood Turtle may make underwater movements in the stream during the winter; however, extended periods of activity and emergence from the water do not occur until mid-March or early April.

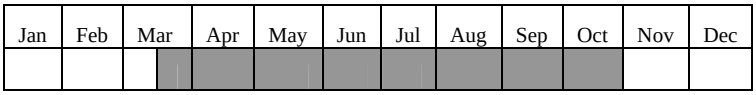
In spring, Wood Turtles are active during the day and are usually encountered within a few hundred meters from the stream banks. They have relatively linear home ranges that can be ½ a mile in length in Massachusetts (M. Jones, unpubl data). They will use emergent logs or grassy, sandy, and muddy banks to soak up the spring sun. During the summer months they feed in early successional fields, hayfields, and forests.

Wood Turtles are opportunistic omnivores; their diet consists of both plant and animal matter that is consumed on land and in the water. The Wood Turtle occasionally exhibits an unusual feeding behavior referred to as "stomping." In its search for food, this species will stomp on the ground alternating its front feet, creating vibrations in the ground resembling rainfall. Earthworms respond, rising to the ground's surface to keep from drowning. Instead of rain, the earthworm is met by the Wood Turtle, and is promptly devoured.

Although the peaks in mating activity occur in the spring and fall, Wood Turtles are known to mate opportunistically throughout their activity period. Males have been observed exhibiting aggressive behavior such as chasing, biting, and butting both during the mating season and at other times. A courtship ritual "dance" typically takes place at the edge of a stream or brook for several hours prior to mating. The dance involves the male and female approaching each other slowly with necks extended and their heads up. Before they actually touch noses, they lower their heads, and swing them from side to side. Copulation usually takes place within the water. Courting adults may produce a very subdued whistle that is rarely heard by observers. A female may mate with multiple individuals over the course of the active season.

In Massachusetts, most nesting occurs over a four-week period, primarily in June. Nesting sites may be a limited resource for Wood Turtles. Females are known to travel long distances in search of appropriate nesting habitat (average straight line distance of 244 m; 800 ft). Once they have arrived at a suitable nesting area, there may be multiple nesting attempts or false nests that occur over the course of several days, prior to laying eggs. They abort attempts when disturbed (e.g. by human activities) early in the process or hit a large rock while digging. Female Wood Turtles lay one clutch a year and often congregate in a good nesting area. Clutch size in Massachusetts averages 7 eggs (Jones, 2004, pers. comm.). Hatchling emergence occurs from August through September. The life span of the adult Wood Turtle is easily 46 years and may reach as much as 100 years.

ACTIVE PERIOD



THREATS: Hatchling and juvenile survival is very low and the time to sexual maturity is long. These characteristics are compensated by adults living a long time and reproducing for many years. Adult survivorship must be very high to sustain a viable population. These characteristics make Wood Turtles vulnerable to human disturbances. Population declines of Wood Turtles has likely been caused by hay-mowing operations, development of wooded stream banks, roadway casualties, incidental collection of specimens for pets, unnaturally inflated rates of predation in suburban and urban areas, forestry and agricultural activities and pollution of streams.

MANAGEMENT RECOMMENDATIONS: Using a turtle habitat model developed by UMass and NHESP records, Wood Turtle habitat needs to be assessed and prioritized for protection based on the extent, quality, and juxtaposition of habitats and their predicted ability to support self-sustaining populations of Wood Turtles. Other considerations should include the size and lack of fragmentation of both riverine and upland habitats and proximity and connectivity to other relatively unfragmented habitats, especially within existing protected open space. This information will be used to direct land acquisition and to target areas for Conservation Restrictions (CRs), Agricultural Preservation Restrictions (APRs) and Landowner Incentive Program (LIP) projects.

Mowing and nest site creation guidelines developed by NHESP should be followed on properties managed for Wood Turtles. These practices will be most practical on state-owned conservation lands. However, these materials are available to town land managers and private landowners.

Alternative wildlife corridor structures should be considered at strategic sites on existing roads. In particular, appropriate wildlife corridor structures should be considered for bridge and culvert upgrade and road-widening projects within or near Wood Turtle habitat. Efforts should be made to inform local regulatory agencies of key locations where these measures would be most effective for Wood Turtle conservation.

Educational materials are being developed and distributed to the public in reference to the detrimental effects of keeping our native Wood Turtles as pets (an illegal activity that reduces reproduction in the population), releasing pet store turtles (which could spread disease), leaving cats and dogs outdoors unattended (particularly during the nesting season), mowing of fields and shrubby areas, feeding suburban wildlife (which increases the number of natural predators to turtles), and driving ATVs in nesting areas from June-October. People should be encouraged, when safe to do so, to help Wood Turtles cross roads (always in the direction the animal was heading); however, turtles should never be transported to "better" locations. They will naturally want to return to their original location and likely need to traverse roads to do so.

Increased law enforcement is needed to protect our wild turtles, particularly during the nesting season when poaching is most frequent and ATV use is common and most damaging.

Forestry Conservation Management Practices should be applied on state and private lands to avoid direct turtle mortality. Seasonal timber harvesting restrictions apply to Wood Turtle habitat and to upland habitat that occurs up to 600 ft (183 m) beyond the stream edge. Motorized vehicle access to timber harvesting sites in Wood Turtle habitat is restricted to times when the Wood Turtle is overwintering. Bridges should be laid down across streams prior to any motorized equipment crossing the stream in order to maintain the structural integrity of overwintering sites.

Finally, a statewide monitoring program is needed to track long-term population trends in Wood Turtles.

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APPENDIX E

Guidelines for Certification of Vernal Pool Habitat

Commonwealth of Massachusetts

Division of Fisheries & Wildlife

Wayne F. MacCallum, *Director*

March 2009

Natural Heritage & Endangered Species Program's

Guidelines for the Certification of Vernal Pool Habitat

Table of Contents:

Background Information

The NHESP& Vernal Pool Certification:

The goal of the Natural Heritage & Endangered Species Program (NHESP) is to protect the state's native biological diversity with its highest priority being the protection of the state's roughly 435 native vertebrate, invertebrate, and plant species officially listed as Endangered, Threatened, or of Special Concern under the Massachusetts Endangered Species Act (M.G.L. c. 131A and implementing regulations 321 CMR 10.00).

The NHESP also administers the state's official vernal pool certification program. NHESP staff does not routinely survey and monitor vernal pools outside of rare species work and special vernal pool projects, but accepts certain biological and physical documentation submitted by outside scientists, resource managers, and other interested individuals and organizations as the basis for the possible certification of vernal pool habitat.

Why were the *Guidelines for the Certification of Vernal Pool Habitat* Revised in 2009?

Revisions to the *Guidelines* are designed to ensure consistency between the *NHESP certification criteria* and the *biological and physical criteria of 'vernal pool habitat'* in the WPA regulations (310 CMR 10.04, 10.57(1)(a)(3), 10.57(1)(b)(4), and 10.58(1)). The *Guidelines* have been modified to increase the confidence that pools that become certified provide essential breeding habitat for certain amphibians that require vernal pools. This is necessary, for example, because facultative vernal pool species use a variety of temporary and permanent wetlands and are not always reliable indicators of hydroperiod (two months inundation) or vernal pool habitat. The revised *Guidelines* address this by reducing the number of facultative species that can be used for certification. In addition, they enhance the requirements for documenting the physical and biological characteristics of a vernal pool (see sections II. and III. for specific changes). Overall, the revised *Guidelines* contribute to the defensible certification of vernal pool habitat in the variety of wetlands where they, in fact, occur.

Natural Heritage & Endangered Species Program

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Commonwealth of Massachusetts

Division of Fisheries & Wildlife

Wayne F. MacCallum, *Director* **March 2009**

NHESP Guidelines for the Certification of Vernal Pool Habitat

I. VERNAL POOL FACT SHEET

What Are Vernal Pools?

Vernal pools are temporary bodies of fresh water that provide important habitat for many vertebrate and invertebrate species. "Vernal" means spring, and indeed, many vernal pools are filled by spring rains and snowmelt, and then dry during the summer. However, many vernal pools are filled by autumn rains (i.e., "autumnal pools") and persist through the winter and others are semi-permanent and do not dry every year. Vernal pools are quite often very small and shallow; vernal pools that support rich communities of vertebrate and invertebrate animals may measure only a few yards across. However, vernal pools of several acres also occur throughout Massachusetts.

Where Are Vernal Pools Found?

Vernal pools are common in Massachusetts and occur in almost every town in the state. Vernal pools are found across the landscape where small woodland depressions, swales, or kettle holes collect spring runoff or intercept seasonally high groundwater tables. Although many people associate vernal pools with dry woodland areas, vernal pools also occur in meadows, river floodplains, interdunal swales, and large vegetated wetland complexes. Vernal pool habitat can occur where water is contained for more than two months in the spring and summer of most years and where no reproducing fish populations are present.

Why Are Vernal Pools Valuable?

Some state-listed species that may be found in vernal pools:

Species	Status[1]
Marbled salamander (*Ambystoma opacum*)	T
Blue-spotted salamander (*A. laterale*)	SC
Jefferson salamander (*A. jeffersonianum*)	SC
Eastern spadefoot toad (*Scaphiopus holbroookii*)	T
Blanding's turtle (*Emydoidea blandingii*)	T
Wood turtle (*Glyptemys insculpta*)	SC

[1]*Status pursuant to the MA Endangered Species Act: T = Threatened; SC = Special Concern.*

Vernal pools constitute a unique and increasingly vulnerable type of wetland. Vernal pools are inhabited by many species of wildlife, some of which are totally dependent on vernal pools for their survival. Vernal pools do not support fish because they dry out annually or at least periodically. Some may contain water year round, but are free of fish as a result of significant drawdowns that result in extremely low dissolved oxygen levels. The wood frog (*Lithobates sylvaticus*) and the four local species of mole salamander (*Ambystoma* spp.) have evolved breeding strategies intolerant of fish predation on their eggs and larvae; the lack of established reproducing fish populations is essential to the breeding success of these species.

Other amphibian species, including the American toad (*Anaxyrus americanus*), spring peeper (*Pseudacris crucifer*), and gray treefrog (*Hyla versicolor*), often exploit the fish-free waters of vernal pools but use a variety of different wetland types. Vernal pools also support rich and diverse invertebrate faunas. Some

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invertebrates, such as the fairy shrimp (*Eubranchipus* spp.), are also dependent upon vernal pools. Invertebrates are both important predators and prey in vernal pool ecosystems. Vernal pools are an important habitat resource for many birds, mammals, reptiles and amphibians, including many species listed under the MA Endangered Species Act (M.G.L c.131A).

Vernal Pool Protection

Vernal pools became eligible for protection when the **Massachusetts Wetlands Protection Act regulations (WPA)** (310 CMR 10.00) were revised in 1987 to include 'wildlife habitat' as an interest protected under the WPA. Vernal pools became protected not as a specific wetland type, but rather a wetland function that provides important 'wildlife habitat'. In accordance with the WPA, vernal pools are presumed present in jurisdictional wetland 'Resource Areas' only when mapped and certified by the Natural Heritage & Endangered Species Program (NHESP). Thus, the vernal pool certification program was established to register the locations of *all vernal pools, regardless of jurisdiction, that meet the biological and physical features of 'Vernal Pool Habitat' in the WPA*; i.e., those that provide essential breeding habitat for certain amphibians that require vernal pools (310 CMR 10.04, 10.57(1)(a)(3), 10.57(1)(b)(4), and 10.58(1)). Although the NHESP certifies vernal pool habitat, local conservation commissions and the Massachusetts Department of Environmental Protection (DEP) are responsible for the regulatory protection of vernal pools.

Other regulations have subsequently incorporated protections for *certified* vernal pools including: the **Massachusetts Surface Water Quality Standards** (314 CMR 4.00), **Massachusetts Environmental Code: Title 5** (310 CMR 15.00), **Massachusetts Forest Cutting Practices Act Regulations** (304 CMR 11.00), **Massachusetts 401 Water Quality Certification Regulations** (314 CMR 9.00), and some **local wetland bylaws**. These regulations extend protections to many certified vernal pools (CVPs) that may not be jurisdictional under the WPA. In addition, the WPA and Forest Cutting Practices Act regulations also provide protection to vernal pools that have not been certified if their occurrence is adequately documented during permit review.

The Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00) protect certified vernal pools and *up to* 100 feet beyond the pool boundary by preventing alterations which would result in impairment of the wildlife habitat function of the CVP. In order to receive protection through the WPA, however, CVPs **must occur within a jurisdictional wetland *'Resource Area'***. If in a 'Resource Area', protection extends to the CVP itself, as well as to the portion of the 100-foot zone surrounding the CVP (referred to as 'Vernal Pool Habitat') that is within a Resource Area. WPA protection of 'Vernal Pool Habitat' does not extend into non-jurisdictional upland or the buffer zone of a resource area. In summary, conservation commissions are empowered to prevent the impairment of the capacity of Vernal Pool Habitat to function as wildlife habitat.

Vernal pools that are not certified may also be protected by local conservation commissions or the DEP if credible scientific evidence is presented prior to the end of the appeals period for a Superseding Order of Conditions (OOC) issued by the DEP. A conservation commission, or the DEP on appeal, can incorporate protective conditions into an OOC that would prevent the impairment of the wildlife habitat value of the pool and its 100 foot 'Vernal Pool Habitat' if the pool is not certified.

The WPA is administered by local conservation commissions under the jurisdiction of the DEP, either of which **should be contacted** for all questions related to the regulatory protection of certified and potential vernal pools.

Each DEP Regional Office has Vernal Pool Liaison(s) who can be contacted at these locations:

NORTHEAST REGIONAL OFFICE	SOUTHEAST REGIONAL OFFICE	CENTRAL REGIONAL OFFICE	WESTERN REGIONAL OFFICE
Wayne Lozzi 203B Lowell Street Wilmington, MA 01887 (978) 694-3200	Daniel Gilmore OR Christopher Ross 20 Riverside Drive Lakeville, MA 02347 (508) 946-2700	Jennifer Gensel 627 Main Street Worcester, MA 01608 (508) 792-7650	Karen Hirschberg OR Tim McKenna 436 Dwight Street Springfield, MA 01103 (413) 748-1100

The Massachusetts Surface Water Quality Standards (SWQS) (314 CMR 4.00), administered by the DEP, implement Section 401 of the federal Clean Water Act at the state level. When a project proposes discharges of solid or liquid fill in a wetland under federal jurisdiction, a permit must be obtained from the Army Corps of Engineers. In accordance with the SWQS, the project proponent must first obtain a Water Quality Certification from the DEP, under the **Massachusetts 401 Water Quality Certification Regulations** (314 CMR 9.00), that states that the discharge complies with the federal Clean Water Act. The SWQS classify CVPs as Outstanding Resource Waters (ORW) for which no new or increased discharge of pollutants, including solid fill or storm water, is allowed, and any existing discharge must cease, or be treated with the highest and best practical methods. Generally, a CVP will be protected from the discharge of fill as an ORW, even if the CVP is not subject to WPA jurisdiction as a state wetland.

The Massachusetts Environmental Title 5 (310 CMR 15.00) regulates the siting and construction of subsurface sewage disposal (septic) systems in the state. A system's septic tank and distribution box must be located a minimum of 50 feet, and the leaching field a minimum of 100 feet, from the boundary of a CVP. The setback for the leach fields can be reduced if hydrogeologic data demonstrates the pool is hydraulically up-gradient from the proposed system.

The Massachusetts Forest Cutting Practices Act Regulations (304 CMR 11.00) protect CVPs from certain forestry impacts. Harvesting requirements limit cutting to no more than 50% of the trees within 50 feet of a CVP. They also require that trees or tree tops not be felled in CVPs, and restrict the use of pools as staging areas or skidder trails. Guidelines, similar to the regulations, are established for activities planned near uncertified vernal pools identified by consulting foresters.

Town Wetlands and Zoning By-laws are used by many municipalities to enhance protections to vernal pools. While the details of by-laws are town specific, they are generally intended to increase protection to vernal pools beyond that afforded by the WPA.

The Vernal Pool Boundary

The shallow edges of vernal pool habitat represent one of the most ecologically valuable portions of these habitats. These areas are generally the first to thaw in the spring and provide access to the pool for the earliest breeding species. These shallow water zones also tend to be significantly warmer than the deeper portions of a vernal pool throughout the spring. Egg masses of early breeding amphibians benefit from the warmer water temperatures at the pool edges that promote rapid egg development.

The boundary of vernal pool habitat must incorporate these shallowest reaches of the pool. When there is no distinct and clear topographic break at the edge of a pool, the maximum observed or recorded extent of flooding represents the ecological boundary of the vernal pool. This boundary is evident and should be delineated by leaf staining and other indicators of hydrology outside of the mean annual high water period (March through early April in most cases).

The NHESP does not establish a **physical, on-the-ground vernal pool boundary during the certification process.** The WPA allows a project proponent to submit an opinion as to the extent of a CVP that is based upon a total run-off from a statistical 2.6 inch rainfall in 24 hours, but it should also include groundwater inputs to the basin at the beginning of the spring amphibian breeding season (see DEP DWW Policy 85-2). The DEP has stated in its policies that groundwater inputs should not be overlooked in these calculations because otherwise it could result in a total volume considerably smaller than the basin holds in any given spring.

How Can Vernal Pools Be Certified?

The NHESP administers the official vernal pool certification program and accepts certain biological and physical documentation submitted by outside scientists, resource managers, and other interested

individuals and organizations as the basis for the possible certification of vernal pool habitat. People interested in vernal pool certification should:

The NHESP strongly recommends that landowner permission be obtained prior to collecting certification documentation. It is the sole responsibility of an individual providing vernal pool certification information to ensure that all activities associated with gathering said information comply with law.

1. Download the NHESP *Guidelines for the Certification of Vernal Pool Habitat, March 2009* and the Vernal Pool Field Observation Form from www.nhesp.org. Please *read and understand the Guidelines before* collecting data and completing the form.

   Certification is based on evidence that a pool provides important wildlife habitat consistent with 'Vernal Pool Habitat' in the WPA. Wildlife that use vernal pools are generally divided into two groups:

   Obligate Species: vertebrate and invertebrate species that require vernal pools for all or a portion of their life cycle and are unable to successfully complete their life cycle without vernal pools.

   Facultative Species: vertebrate and invertebrate species that frequently use vernal pools for all or a portion of their life cycle, but are able to successfully complete their life cycle in other types of wetlands.

   Obligate species serve as *direct* indicators of vernal pool habitat because they require at least two months of flooded conditions and the absence of established, reproducing fish populations. When breeding evidence of obligate species is documented, it is not necessary to prove there is no established fish population.

   Facultative amphibian species serve as *indirect* indicators of vernal pool habitat. Documentation of the appropriate facultative amphibian species does not ensure certification; evidence documenting there is no established, reproducing fish population must also be submitted. Additionally, the physical documentation (e.g., pool photos, descriptive notes) submitted must demonstrate the pool possesses the physical characteristics necessary to sustain a vernal pool environment (e.g., depth, size, vegetation).

2. Fill out a Vernal Pool Field Observation Form. Attach the physical and biological documentation and the maps as required by the *Guidelines*. Submit the packet to the NHESP for review.

   The NHESP does not field visit pools prior to certification but relies on the submittal of accurate information and clear documentation of both the biological and physical evidence. If the documentation is inconclusive additional documentation may be requested or the pool may not be certified. Once it is determined that a vernal pool meets the certification criteria in the *Guidelines*, it will be officially certified by NHESP and the observer, conservation commission, DEP regional office, and landowner (if known) are formally notified.

Certified Vernal Pool Maps

- **GIS Data layers** of Certified Vernal Pools (updated biannually) and Potential Vernal Pools are available through the MassGIS Online Data Viewer ('Oliver') at www.mass.gov/mgis/mapping.htm →"Oliver" - The MassGIS Online Data Viewer→Launch Oliver or Install Java→Login→Zoom to area of interest→Add Layers→Conservation/Recreation→Natural Heritage Data→NHESP Certified Vernal Pools→Potential Vernal Pools.
- NHESP's town-wide **'Prioirty Habitat & Estimated Habitat'** maps (published biennially) include CVPs and are available for public viewing at the offices of conservation commissions, planning boards, and building inspectors, and at MassGIS at www.mass.gov/mgis/cvp.htm.
- NHESP's **Massachusetts Natural Heritage Atlas** (updated biennially) is available at most town libraries and from NHESP at cost.

NHESP - Vernal Pool Certification
MA Division of Fisheries & Wildlife
1 Rabbit Hill Road
Westborough, MA 01581
For Certification Questions call 508-389-6360

Commonwealth of Massachusetts

Division of Fisheries & Wildlife

Wayne F. MacCallum, *Director* **March 2009**

NHESP Guidelines for the Certification of Vernal Pool Habitat

II. CERTIFICATION CRITERIA & DOCUMENTATION REQUIREMENTS

Please read and understand the **CERTIFICATION CRITERIA** and **DOCUMENTATION REQUIREMENTS** in the following sections before submitting Vernal Pool Field Observation Form(s) and supporting documentation.

Certification Criteria

Vernal pool certification is possible only after the appropriate **biological** AND **physical** criteria have been met and documented by one of the two certification methods described below:

A) OBLIGATE SPECIES METHOD

Biological Criteria

- Breeding evidence of obligate amphibian species OR the presence of fairy shrimp (see table on pg. II.2).

AND

Physical Criteria

- Evidence of a pool with no permanently flowing outlet (i.e., photo of the pool holding water).

B) FACULTATIVE AMPHIBIAN SPECIES METHOD

Biological Criteria

- Breeding evidence of 2 or more facultative amphibian species (see table on pg. II.2).

AND

Physical Criteria

- Evidence of a pool with no permanently flowing outlet (i.e., photo of the pool holding water).

AND

- Evidence that there is no established, reproducing fish population (i.e., photo of the pool dry).

The **Obligate Species Method** is the most direct way to certify a vernal pool. If documentation submitted is inconclusive, or if the physical documentation appears to show inappropriate habitat, the pool may not be certified or additional documentation may be requested. Since **facultative amphibians** can use a variety of wetland habitats it is especially important when using this method that the pool photos demonstrate the physical characteristics necessary to sustain a vernal pool environment (e.g., depth, size, vegetation). If there is any doubt, the NHESP may require additional evidence.

THE NHESP STRONGLY RECOMMENDS THAT LANDOWNER PERMISSION BE OBTAINED PRIOR TO COLLECTING CERTIFICATION DOCUMENTATION. IT IS THE SOLE RESPONSIBILITY OF AN INDIVIDUAL PROVIDING VERNAL POOL CERTIFICATION INFORMATION TO ENSURE THAT ALL ACTIVITIES ASSOCIATED WITH GATHERING SAID INFORMATION COMPLY WITH LAW.

Natural Heritage & Endangered Species Program

1 Rabbit Hill Road, Westborough, MA 01581 **Tel:** (508) 389-6360 **Fax:** (508) 389-7891

A. Obligate Species Method ~ Biological and Physical Criteria & Evidence Accepted for Certification:

BIOLOGICAL CRITERIA		PHYSICAL CRITERIA	
Obligate Species Accepted - one or more of the following	**Breeding Evidence Accepted** - one or more of the following from at least one obligate species must be documented by photos, video, or audio (chorusing)	**Physical Features Accepted**	**Physical Evidence Accepted**
Wood frog *(Lithobates sylvaticus)* **Spotted salamander** *(Ambystoma maculatum)* **Blue-spotted salamander** * *(A. laterale)* **Jefferson salamander** * *(A. jeffersonianum)* **Marbled salamander** * *(A. opacum)*	**Adult wood frogs -** • Full chorus (calls constant, continuous, & overlapping) - map location of chorus (pool) and site where recording was taken; **OR** • 5+ mated pairs **OR** **Adult salamanders -** • Congressing **OR** • Spermatophores **OR** • Marbled salamander attending a nest **OR** **Egg masses -** • TOTAL of 5 egg masses - any combination, regardless of species **OR** • 1 egg mass of a MESA-listed salamander or nest and eggs of marbled salamander **OR** **Larvae -** • Any number of larvae **OR** **Transforming juveniles -** • Still in pool with tail and/or gill remnants.	Pool with no permanently flowing outlet.	Good quality photos or video of the entire pool holding water including any inlets or outlets (e.g., any streams, culverts, etc). *See 'Tips for Photographing Evidence Required for Vernal Pool Certification' on page 4.*
Fairy shrimp *(Anostraca: Eubranchipus)*	Photo or video of adult specimen(s).	Same as above.	Same as above.

*Species listed under the Massachusetts Endangered Species Act Regulations (MESA) (321 CMR 10.90). If observed, please document and fill out a *Rare Animal Observation Form* (available at www.nhesp.org) to be submitted to the NHESP.

B. Facultative Amphibian Species Method ~ Biological and Physical Criteria & Evidence Accepted for Certification:

BIOLOGICAL CRITERIA		PHYSICAL CRITERIA	
Facultative Species Accepted - two or more of the following	**Breeding Evidence Accepted** - one or more of the following from at least two facultative species must be documented by photos, video, or audio (chorusing)	**Physical Features Accepted**	**Physical Evidence Accepted**
Spring peeper *(Pseudacris crucifer)* **Gray treefrog** *(Hyla versicolor)* **American toad** *(Anaxyrus americanus)* **Fowler's toad** *(Anaxyrus fowleri)*	**Adults –** • Full chorus (calls constant, continuous, & overlapping) - map location of chorus (pool) and site where recording was taken; **OR** • 5+ mated pairs **OR** **Egg masses –** • Any number of egg masses **OR** **Larvae –** • Any number of larvae **OR** **Transforming juveniles –** • Still in pool with tail remnants.	Pool with no permanently flowing outlet. **AND** Evidence that there is no established, reproducing fish population.	Good quality photos or video of the entire pool holding water including any inlets or outlets (e.g., any streams, culverts, etc.). **AND** Good quality photos or video of the entire pool dry. *See 'Tips for Photographing Evidence Required for Vernal Pool Certification' on page 4.*

Documentation Requirements

Documentation of the biological and physical evidence listed in the **CERTIFICATION CRITERIA** (pg. II.2, A and/or B) must be submitted for official certification of a vernal pool. Photographic prints are the preferred method of documentation but video of evidence or audio recording of chorusing frogs or toads are acceptable. Field notes are encouraged and helpful, but are not accepted as the sole source of evidence.

A. BIOLOGICAL DOCUMENTATION – Photos, Video, or Audio of Amphibian Breeding Evidence or Fairy Shrimp:

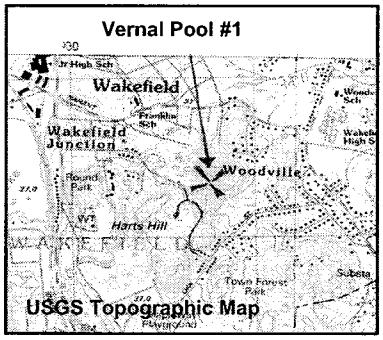
- Photos, video, or audio must be of suitable quality (resolution, focus, clarity, indicators of scale (e.g., coin, lens cap, ruler)) so species identification can be confirmed. Please see *"Tips for Photographing Evidence Required for Vernal Pool Certification"* (pg. II.4).
- Photos, video, or audio must be labeled with pool location (town), pool name or tracking # (e.g. VP#1, Elm St. VP), date taken, & observer's name.
- Each individual egg mass or mated pair required for certification (e.g., all 5 wood frog egg masses) must be photographed or videotaped. If more than the minimum required number is observed, photo the required number, and count or estimate the total number and indicate this on the Vernal Pool Field Observation Form.
- Only audio tapes of full amphibian choruses (calls are constant, continuous & overlapping) are accepted (see Protocol Description at: http://www.pwrc.usgs.gov/naamp/) provided the location of chorusing (i.e., exact pool location) and the location of your recording site are accurately mapped.
- Documentation must be collected within 3 years prior to submittal to NHESP.

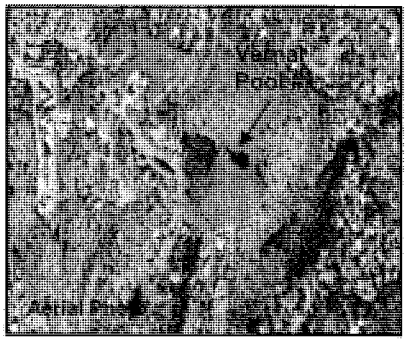
B. PHYSICAL DOCUMENTATION – Photos or Video of Pool Holding Water and Dry:

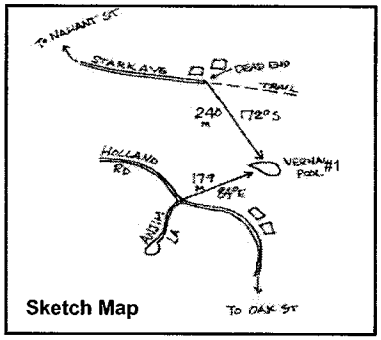
- Photograph(s) or video of the entire pool including any inlets or outlets (e.g., any streams, culverts) are required and must be of suitable quality (resolution, focus, scale) so pool features can be reliably assessed. One or more identifying landmarks (e.g., stand of trees, stumps, boulders, rock walls, etc.) to authenticate the pool location must be included. If unable to photograph the entire pool in a single photo, take a "panorama" series. Please see *"Tips for Photographing Evidence Required for Vernal Pool Certification"* (pg. II.4).
- Photo(s) or video must be labeled with pool location (town), pool name or tracking # (e.g. VP#1, Elm St. VP), date taken, & observer's name.
- Documentation must be collected within 3 years prior to submittal date to NHESP.

C. MAPPING REQUIREMENTS - THREE types of maps are required for certification and the pool locus must be clearly delineated and identified (your pool name or tracking #) on each map:

1. **U.S. Geological Survey topographic map** (copy) (1:24,000 or 1:25,000 scale) - topos can be downloaded from MassGIS at www.mass.gov/mgis/mapping.htm - scroll down to "Browser Based Mapping Applications", then to "Quick Links" and select "USGS Topographic Maps".
2. **Color orthophotos** (copy) (1:12,000 scale or better) - orthophotos can be downloaded from MassGIS at www.mass.gov/mgis/mapping.htm - scroll down as described above and select "Color Ortho Imagery 2005".
3. **One additional map or form of location data** to help clarify the pool's location, as follows:
   - **Sketch map -** directions and distances from landmark(s), readily identifiable in the field, should be marked and clearly described on the map; if submitting a breeding chorus, the location of the chorus (pool) and recording site can be delineated on this map, **OR**
   - **Assessors map -** available from local tax assessor's offices, include the map and parcel #'s, **OR**
   - **Professional survey, OR**
   - **GPS longitude/latitude coordinates.**







Tips for Photographing Evidence Required for Vernal Pool Certification[1]

The biological and physical evidence required for vernal pool certification must be documented by photos and/or video (or audio for frog/toad chorusing) of suitable quality (resolution, focus, indicators of scale) so species identification can be confirmed and pool features be reliably assessed. Because this often requires close-up photographs in generally poor lighting conditions, some general **"rules of thumb"** are included below to help you produce good photos/video:

- Cameras that compensate for low light conditions and close-up focusing provide the best photos; most digital cameras are capable of this but fixed focus cameras (i.e., "point and shoot") typically do not focus closer than 2-4 feet (if used carefully they usually produce suitable photos).
- Hold the camera as steady as possible or use a tripod to avoid blurred images.
- Take several photos, or extra photos using different backgrounds and light settings, to be certain you end up with a clear photo.
- Process or view your photos immediately so you can return to the pool for better photos, if needed.

POOL Photos (Physical Evidence)

Photographs of the vernal pool need to be clear and show as much of the pool as possible.

- They must include a landmark to authenticate the pool location (e.g., stand of trees, stump, a boulder, rock wall, etc.).
- If unable to photograph the entire pool in a single photo, try to photograph the pool in a "panorama" series.
- When photographing pools 'holding water', also include photos of any inlets or outlets (e.g., streams, culverts) observed entering or leaving the pool.

ORGANISM Photos (Biological Evidence)

Biological evidence from the pool needs to be documented by photographs/video that confirms **amphibian *breeding*** (i.e., mated pairs of frogs/toads, congressing salamanders, spermatophores, egg masses, larvae, or transforming juveniles) or the presence of **fairy shrimp** (see Certification Criteria for specific requirements).

- **Mated pairs** of wood frogs and **congressing salamanders** typically need to be photographed at night. A flash can sometimes illuminate the water surface, impeding the view underwater, so a flashlight can be used to illuminate subjects underwater.
- **Spermatophores** are found on the bottom of the pool. Reflections on the surface can sometimes block underwater images and can be eliminated in two ways: 1) position an object (or person) to cast a shadow over the area you are photographing, or 2) use a polarizing filter on your camera.
- To photograph **egg masses**, place a light-colored background (e.g., yellow foam meat tray, Frisbee, white board) behind the masses so they are clearly visible against the dark water and more easily identifiable; they should not be removed from the water and only minimally disturbed. Also try and include something in the photo for scale (e.g., backing tray with measurement markings, a hand, net, etc.).
- **Larvae** and **fairy shrimp** usually need to be briefly removed from the pool to be photographed. Place larvae or fairy shrimp in a small container (e.g., margarine tub, foam meat tray, clear plastic baggie) *filled with pool water* or photograph in your hand.
    a. **Salamander larvae** - place in container filled with pool water and photograph from above to clearly show the gills and, if possible, a side view of the body.
    b. **Wood frog tadpoles** - photograph in or out of water but positioned to show the belly (i.e., gut coiling) and gold flecking over the belly and sides.
    c. **Fairy shrimp** - place in white or clear container filled with pool water and photograph.
    d. **Transforming juveniles** – photograph so tail and/or gill remnants are visible; photos should be taken from above and/or a side view for proper identification.

[1]Based on *Wicked Big Puddles: A Guide to the Study and Certification of Vernal Pools*, 3rd Edition (March 2003) by Leo P. Kenney, Vernal Pool Association (www.vernalpool.org) and is used with permission.

Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife

III. Vernal Pool Field Observation Form

For use with the *Guidelines for the Certification of Vernal Pool Habitat, March 2009.*

For Office Use Only

THE NHESP STRONGLY RECOMMENDS THAT LANDOWNER PERMISSION BE OBTAINED PRIOR TO COLLECTING CERTIFICATION DOCUMENTATION. IT IS THE SOLE RESPONSIBILITY OF AN INDIVIDUAL PROVIDING VERNAL POOL CERTIFICATION INFORMATION TO ENSURE THAT ALL ACTIVITIES ASSOCIATED WITH GATHERING SAID INFORMATION COMPLY WITH THE LAW.

INSTRUCTIONS:
Please provide all information requested. Attach additional pages if needed. All required biological & physical evidence must be documented by photos, video, or audio of suitable quality (resolution, focus, indicators of scale) so species ID can be confirmed & pool features assessed. Documentation must be labeled. Sign/date the form; incomplete forms will be returned.

Additional Instructions for *Specific* Numbered Boxes:
1. Include an identifying name or tracking # for your pool & use it to label photos, maps, & any other documentation. If you used the Potential Vernal Pool (PVP) datalayer (available at MassGIS), include the PVP #. Written directions must be included with landmarks to help navigate to the pool.
3. 3A & 3B are for certification by the Obligate Species Method. Provide photos, video, or audio (chorusing) of the required breeding evidence or fairy shrimp **AND** photo(s) or video of the pool holding water.

1. Pool Location (Please complete a separate form for each pool).

Town_____ Potential Vernal Pool # (if known)_____

Pool Name or Tracking # (e.g., Elm St. VP, VP#1)_____

Written Directions to Pool (required):_____

2. Pool/Species Observation Dates (month/day/year):

First date pool observed_____ Last date pool observed _____

First date species observed _____ Last date species observed_____

3B. Biological Evidence: *Fairy Shrimp*

Date Observed (m/d/y)_____

3A. Biological Evidence: *Obligate Amphibians*

Indicate breeding evidence and date observed for each species. Evidence must include ≥1 of the following for certification: congressing salamanders **OR** ≥5 pairs wood frogs in amplexus **OR** salamander spermatophores **OR** a full wood frog chorus (calls constant, continuous, & overlapping) **OR** a total of ≥5 egg masses, regardless of species **OR** ≥1 MESA-listed salamander egg mass(es). Each individual egg mass or mated pair required for certification (e.g., all 5 wood frog egg masses) must be photographed or videotaped. If more than the minimum required number is observed, photo the required number, and count or estimate the total number and indicate in the table below.

SPECIES *State-listed species	Dates	COURTING ADULTS	Dates	SPERMATOPHORES	Dates	# EGG MASSES	Dates	SALAMANDER LARVAE	Dates	TRANSFORMING JUVENILES
Spotted salamander										
Blue-spotted salamander *										
Jefferson salamander *										
Marbled salamander *										
Unidentified Mole salamander										

SPECIES	Dates	# MATED PAIRS (≥ 5 pairs)	Dates	Full Chorus (calls continuous & overlapping)	Dates	# EGG MASSES	Dates	TADPOLES	Dates	TRANSFORMING JUVENILES
Wood frog										
TOTAL(S)										

Instructions (continued)

4. Certification by the Facultative Amphibian Method - provide photo, video, or audio (chorusing) of the required breeding evidence and photo(s) or video of the pool holding water **AND** dry.
6. Provide information to help distinguish the pool & assess its features.
7. All required biological & physical evidence must be documented by good quality photos, video, or audio.
8. Indicate the 3 required maps submitted.

4. Biological Evidence: *Facultative Amphibians*

Breeding evidence[1] of ≥ 2 species must be documented by photos, video, or audio.

BREEDING AMPHIBIANS	DATE OBSERVED month/day/year	BREEDING EVIDENCE[1] OBSERVED
Spring peeper		
Gray treefrog		
American toad		
Fowler's toad		

Breeding evidence[1] includes: full breeding choruses (call constant & overlapping), ≥ 5 adults in amplexus, any # of egg masses, tadpoles, and/or transforming juveniles in pool.

5. Rare Wetland Species

Were MESA-listed species observed using this pool?

☐ Yes ☐ No

If yes, please submit a Rare Animal Observation Form with photo & map to the NHESP (available at www.nhesp.org).

6. Description of Pool and Surroundings ~ Please describe to the best of your ability and knowledge.

Dimensions (please include measurements or estimates):

Approx. Length:_____ Approx. Width:_____ Approx. Maximum Depth:_____

Describe distinctive features (roads, structures, boulders, foot trails, vegetation types, etc.) which are visible from or near the pool that would help someone recognize it.

Origin of the pool (check): ☐ Natural depression ☐ Human-made pool/ditch ☐ Created wetland/pool ☐ Other or Unknown (describe)_____

The pool's hydroperiod is most likely: ☐ Seasonal (drying out in most years) ☐ Semi-permanent (drying partially in most years) ☐ Permanent

Describe any inlet or outlets to/from the pool and their permanence (e.g., streams, culverts, etc).

Land use in vicinity of pool (approx. 100 ft from pool edge – check all that apply): ☐ upland forest ☐ forested wetlands ☐ emergent marsh/scrub-shrub wetland ☐ agricultural/grassland/meadow ☐ residential/commercial ☐ other_____

7. Documentation Submitted – Label with pool name or tracking #, town, date taken, observer's name.

☐ Photo(s) ☐ Video ☐ Audio

☐ Obligate Species ☐ Facultative Species ☐ Pool Holding Water ☐ Dry Pool

8. Maps Submitted

Pool locus must be delineated & identified with your pool name or tracking #.

3 REQUIRED MAPS:

☐ USGS Topographic Map - 1:24,000 or 1:25,000 or better

☐ Color orthophoto - 1:12,000 or better

and ≥1 of the following:

☐ Assessor's map (Map and Plot #)

☐ Professional survey

☐ Sketch map - with directions and distances from permanent landmarks

☐ GPS longitude/latitude coordinates:

Latitude = _____

Longitude = _____

9. Property Owner Information - Landowner information is optional & is available from local tax assessor's offices.

Name_____

Address_____

Town_____ State_____ Zip_____ Assessors Map/Pcl#_____ (if known)

10. Observer Information & Signature – Must be filled out & signed.

Name_____

Address_____

Town_____ State_____ Zip_____

Telephone_____ E-mail_____

I hereby certify under the pains and penalties of perjury that the information contained in this report is true and complete to the best of my knowledge.

Signature_____ Date_____

Signature of Adult, if Observer is under 18 years of age_____

All submissions and supporting documents will be retained by the NHESP and, with the exception of information for MESA-listed species and the identity of minors, are available to interested parties under the Public Records Law.

SEND COMPLETED, SIGNED FORM & SUPPORTING DOCUMENTATION TO:

NHESP - Vernal Pool Certification
MA Division of
Fisheries & Wildlife
1 Rabbit Hill Rd.
Westborough, MA 01581

For questions call 508-389-6360