SECTION 4

A former minister in Montague, David Cronyn, was asked what salary he got. "Fifteen hundred dollars," was the reply, a very substantial sum in those days. Surprise was expressed, whereupon the minister explained: "I get five hundred dollars in money and a thousand in scenery." (Pressey, 1910).

ENVIRONMENTAL INVENTORY AND ANALYSIS

The scenic landscape of the Town of Montague has been cherished by its residents for generations. This Open Space and Recreation Plan is intended to help residents protect the Town's scenic value and natural resources in the face of increased development pressure, while recognizing that people need places to live, learn, work and play. These needs require infrastructure: homes, roads, power, water, wastewater systems, etc. Infrastructure, in turn, both depends upon and impacts critical natural systems like the water cycle. One way to understand the impact of development on natural resources is to study the *ecosystems* of the town and the region.

One way to understand the impact of development on natural resources is to study the ecosystems of the town and the region.

An ecosystem is a concept that describes how a group of living organisms (plants, animals and microorganisms) interact with each other and their physical environment (soil, climate, water, air, light, etc.). Ecosystems exist at different scales. A large forest can be an ecosystem; so can a decayed tree trunk. The integrity of ecosystems depends on the relationship between living beings and their environment. Wetlands, for example, are ecosystems consisting of plants and animals that depend on water from the surface and the ground. Wetland vegetation grows where soils are saturated by water for at least several weeks a year. This vegetation provides shade, food and habitat for a wide variety of insects, birds, fish, reptiles and amphibians.

Ecosystems provide a variety of "services" that are very important to human communities. Wetlands, for example, trap and remove sediments, nutrients and toxic substances from surface water. They store floodwaters during and after storms, preventing damage to public and private property, recharge water to the ground, and retain it during droughts. These functions are

vulnerable to the impacts of land development. Construction in and around wetlands not only displaces the animals that depend on this ecosystem. It may also result in increased flooding, storm damage, and reduction in the quality and quantity of drinking water. Montague residents need to understand the impact of their actions and land uses on the environment and their quality of life.

The information provided in this section explores the biological and physical components of the town's ecosystems. These components include air, surface and ground water, soils, vegetation, fisheries and wildlife. *Topography, Geology, and Soils* 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. Montague's forest, farmland and wetland vegetation types are documented including rare, threatened, and endangered species. In *Fisheries and Wildlife*, wildlife, habitat, special corridors, and rare, threatened, and endangered species are discussed. Montague's *Scenic Resources and Unique Environments* are identified and described. Finally, *Environmental Challenges* addresses current and potential problems or issues that may influence open space or recreation planning.

A. TOPOGRAPHY, GEOLOGY, AND SOILS

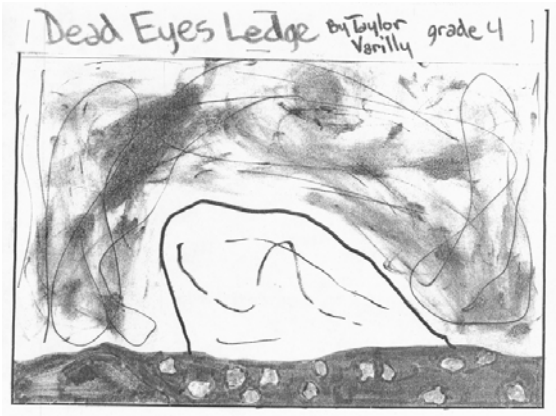
Decisions about land use must take into consideration the inherent suitability of a site for different kinds of development. Geology, soils, and topography are essential to determining potential sites for future residential, commercial and industrial development and for new parks, hiking trails and open space.

A.1 Topography

The topography of the Town of Montague is one of sharp contrast. The Connecticut River Valley in western Montague is broad and flat and encompasses much of the prime agricultural land in town. The Montague Plains, which spans the western and central portions of Montague, is also an area of flat terrain. Moving east, the land formation begins to change to rolling hillsides. Although steep slopes can be found throughout the town, the eastern half of Montague is significantly higher than the rest of town, with an average height of 900 feet above sea level, and a high point of 1400 feet at Dry Hill.

A.2 Geology

The Town of Montague 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 Montague's current landscape requires a brief journey back in time and a review of some basic geological concepts (University of Massachusetts Amherst,Department of Landscape Architecture and Regional Planning, 1996).



A.2.1. Mountain Building: 700 Million Years to 190 Million Years Ago

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 schist rock metamorphosed from lava flows and volcanic ash.

A.2.2. Earthquakes and Dinosaurs: 190 Million to 65 Million Years Ago

Hundreds of millions of years ago, a great continent, known as Pangaea, formed through the collisions of plates. Pangaea 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 to the east brought alluvium, including gravels, sand and silt. At the time, the area that is now the town of Montague 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 Montague 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. Greylock, and Mt. Monadnock in New Hampshire.

As the peneplain eroded, the less resistant rock 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 Westfield, Deerfield, and Farmington Rivers continued to meander eastward. The Millers River and other westward-flowing streams would become more significant later on.

A.2.3. Cenozoic Era and the Ice Age, to the Present: 65 Million Years Ago to Today

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. The plain rose one more time, and the Millers River, once a slowly meandering westward stream, now carved its course through the sediment and bedrock. Today, the visible remnants of the peneplain are the area's schist-bearing hilltops, all at about the same one thousand 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 huge 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* (University of Massachusetts Cooperative Extension, 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

Montague Plains is formed of these delta sands, and bands of silts and clays are found on its western edge.

The Millers River probably first formed prior to the glacial period, but most of Montague's hydrological system is a remnant of that time. Smaller streams flow from uplands feeding the extensive wetlands formed by sedimentation that filled drainage points when the glacier receded.

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 (University of Massachusetts Cooperative Extension, 1976). Soils are classified and grouped into associations that are commonly found together. These soil associations are named for the dominant or prevalent soils they contain.

There are four main soil associations in the Town of Montague. The Hadley-Winooski-Podunk Association accounts for 842 acres, approximately 4 percent of the Town's land area. Ridgebury-Walpole and Wareham-Scarboro soils account for 1,153 acres, 6 percent of Town. The most prevalent soils are the Shapleigh-Gloucester-Scituate Association (8,779 acres, 43 percent of town) and the Hinckley-Carver-Merrimac Association (9,732 acres, 47 percent of town) (U.S. Department of Agriculture Soil Conservation Service, 1967).

As Montague plans for the long-term use of its land, residents should ask: 1) Which soils constrain development given current technologies? 2) Which soils are particularly suited for recreational opportunities and wildlife habitat? 3) What is the relationship between soils and current and future drinking water supplies? 4) Which soils are best for agriculture? The answers to these questions can help lay a foundation for open space and recreation planning in Montague. The following sub-section provides a description of the soils in Montague based on their impact on agriculture, drinking water, wastewater disposal, recreational opportunities, erosion and wildlife habitat.

Which soils constrain development given current technologies?
The entire southeastern quadrant of the Town of Montague, generally east of Route 63 and including Dry Hill, Harvey Hill and Quarry Hill, as well as the Taylor Hill area in the southwestern section of Town, consists of Shapleigh-Essex-Gloucester association soils. Shapleigh soils are shallow and are located on very steep slopes, from 15 percent to 60 percent, and many areas have ledge outcrops of schist bedrock. Depth to bedrock is generally less than eighteen inches. These soils may severely limit the installation of on-site sewage disposal systems and construction of house foundations. Essex soils are often found on the steep terrain. These soils have a slowly permeable hardpan within two and a half feet of the surface. Development constraints within this association vary considerably.

Soils in Montague that have only slight to moderate limitations for development are Gloucester soils occurring on flat to moderately steep slopes, and Hinckley, Windsor, Carver and Merrimac soils on flat to moderate slopes. Gloucester soils tend to be extremely stony, with boulders common on the surface. Permeability is rapid to moderately rapid. Hinckley, Windsor and Merrimac soils are primarily located in the northwest quadrant of Montague, bounded by Route 63 to the east, and Ferry and Swamp Roads to the south. These soils consist of excessively drained, shallow, gravelly soils. Carver soils consist of excessively drained, loamy coarse sand and are found in wooded areas on nearly level to moderate slopes.

Which soils are particularly suited for recreational opportunities 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 mountain biking and hiking enthusiasts. The level topography of the Plains makes it well suited for walking, birding and mountain biking, as well as appealing to users of all-terrain vehicles and snowmobiles.

Erosion due to use of unauthorized, illegal use of ATVs on the Montague Plains has been particularly severe.

Erodability of soils has important implications for the impact of recreational uses. Erodable soils include those that are shallow, wet, sandy, or sloped, or those with a combination of these characteristics. Hikers, mountain bikers and ATVs can create and exacerbate erosion on steep slopes and in sandy soils. Erosion due to use of unauthorized, illegal use of ATVs on the Montague Plains has been particularly severe.

The sandy, well-drained, nutrient-poor soils of the Montague Plains are typical of Pitch Pine-Scrub Oak ecosystems across the northeastern United States. Ecological studies of vegetation on the Plains have demonstrated that vegetation differs based on how soils were used in the past: Pitch pine is more common on tracts of the Plains that were cultivated for agriculture in the nineteenth or twentieth century, while scrub oak is more common on tracts that were never plowed (Motzkin et al., 1996). Plant diversity is

higher on unplowed sections, and these areas are believed to provide important habitat for rare species of moths and butterflies (Motzkin et al., 1996, and Glenn Motzkin, personal communication). Some of these unplowed sections of the Plains are part of the protected Montague Plains Wildlife Management Area, while others are owned by Northeast Utilities and are zoned and planned for future industrial use.

In other areas of town, there is a good correlation between soils that support wildlife habitat and soils that present the most constraints to development. These soils include the shallow and fine, sandy Shapleigh soils, and the Ridgebury, Muck and Walpole soils found in depressions and saddles in the hills and the areas bordering the streams in the valleys primarily in the southwestern quadrant of Montague. These soils have high water tables during all or most of the year. Montague might consider identifying and protecting the areas surrounding such wet soils. It is likely that these soils support habitat for a diverse array of species. In addition, protecting ridge tops would also provide for the protection of large mammal habitat and scenic views.

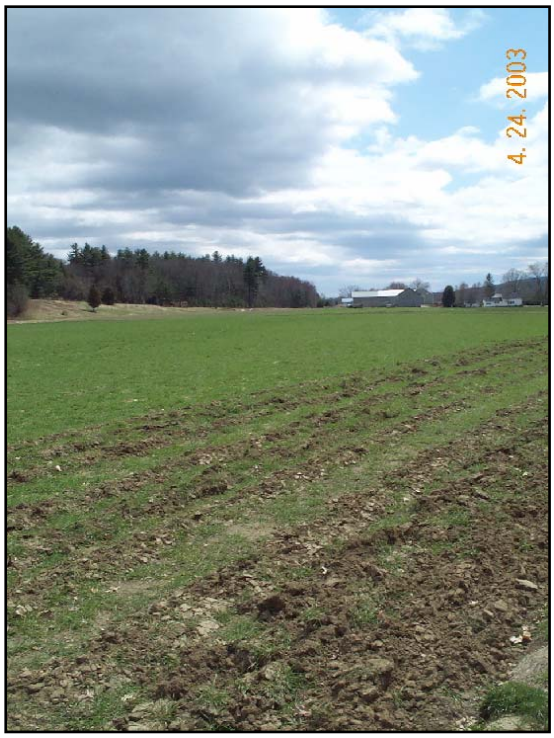
What is the relationship between soils and current and future drinking water supplies? Hinckley and Gloucester association soils generally have high filtration rates and low runoff potential. The more easily drained Hinckley association forms in valleys on stratified drift. The Gloucester association forms on gently sloping and steep upland areas on sandy till. Both of these associations provide high recharge to aquifers.

Soils with high rates of filtration, including Carver, Gloucester, Hinckley, and Merrimack soils, are typical of aquifers. In Montague, these soils are located in the southwestern half of the town and coincide with a high-yield aquifer bounded by the Connecticut River as far north as Ferry Road; South Ferry Road, Swamp Road and Green Pond to the north; along Route 63 to the east; and the Sawmill River to south. These easy-to-develop soils provide little filtration of septic leachate, as water passes through very quickly. Development could pollute the groundwater in these areas if care is not taken to protect the aquifer.

<u>Which are the best soils for agriculture?</u>
The Natural Resources Conservation Service (NRCS), formerly known as the Soil Conservation Service, of the U.S. Department of Agriculture (USDA) is responsible for

classification of soils according to their suitability for agriculture. NRCS maintains detailed information on soils and maps of where they are located.

NRCS defines prime farmland as the 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, 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.



Prime farmland soils have contributed to the Town's economic stability throughout its history. The more common soils that constitute Montague's prime and unique agricultural land include those of the Hadley - Winooski - Limerick association and the Hinckley - Windsor - Merrimac association. These prime farmland soils are primarily located in the southwestern section of the town along the Connecticut River as far west as Greenfield Road; in the Sawmill River and Goddard Brook floodplains; and along Route 63. Another pocket of prime farmland also exists to the east of West Mineral Road in Millers Falls.

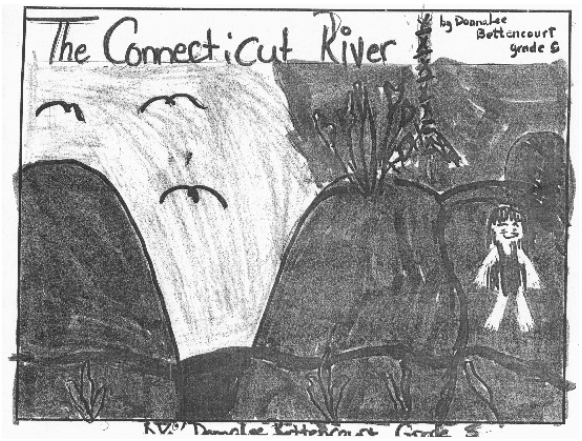
The characteristics that make prime farmland soils suitable for agricultural use also make them easy to develop. Large tracts of level, well-drained farmland are attractive to developers because the cost of installing roads and other infrastructure is relatively low. It would behoove residents interested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

B. LANDSCAPE CHARACTER

The Town of Montague has a diverse landscape that distinguishes it from surrounding communities. The Connecticut River defines the western border of the town, and the farm fields and farmhouses along the river give the town its rural, agricultural character. The hilly, forested landscape east of Route 63 is still very sparsely populated. Walk a few hundred feet from the road in this section of town and it is easy to become lost in the

wilderness. Surprisingly, Montague's wilderness is only five miles from the densely populated urban center of Turners Falls. Turners Falls and Millers Falls resemble other nineteenth century mill towns, while Montague Center is a typical nineteenth century rural village. The sights, sounds and fragrances of the Montague Plains resemble the pine barrens of the Cape and Islands more than any other landscape in the western region of the state, and the village of Lake Pleasant on the edge of the Montague Plains with its tightly clustered Victorian homes is reminiscent of a freshwater Oak Bluffs.

C. WATER RESOURCES



C.1 Watersheds

Montague is rich in water resources, including brooks, streams, ponds, vernal pools, wetlands, and aquifers *(See the Water Resources Map).* As described in Section 3, land in the town drains into two main watersheds: the Connecticut River and the Millers River. Most of Montague lies in the Connecticut River Watershed. The Sawmill River is an important sub-watershed within the Connecticut River Watershed.

The Connecticut River watershed is the largest river ecosystem in New England. It encompasses approximately 11,000 square miles and flows from its headwaters of Fourth Connecticut Lake in New Hampshire at the Canadian border to Long Island Sound at Old Saybrook Connecticut. Although wholly in New Hampshire, it forms the border with Vermont. The River travels through Massachusetts entering the Commonwealth at Gill and Northfield, draining all or part of forty-five (45) municipalities before entering the State of Connecticut. The watershed is 80 percent forested, 12 percent agricultural, 3 percent developed and 5 percent wetlands and water.

According to the US Fish and Wildlife Service, the watershed is home to many species including fifty-nine (59) species of mammals, 250 species of birds, twenty-two (22) species of reptiles, twenty-three (23) species of amphibians, 142 species of fish, 1,500 of invertebrates and 3,000 species of plants. Eight (8) federally listed endangered or threatened species occur in the watershed –piping plover, shortnose sturgeon, dwarf wedge mussel, puritan tiger beetle, Jesup's milk-vetch, Robbin's cinquefoil, small whorled pogonia, and the northeastern bullrush. (The bald eagle (2007)and the peregrine falcon (1999), have been de-listed due to recovery of the species.)

The Connecticut River 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 – 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 Millers River is one of the Connecticut River's 38 major tributaries and a large river of statewide importance and historical significance in Massachusetts. Its headwaters are located in Winchendon, New Hampshire. Montague is located in the western portion of the Millers River Watershed, which includes portions of sixteen Massachusetts communities and four towns in New Hampshire.

This section focuses on waters within the Town of Montague, but it is important to keep in mind that improvements in water quality in the Millers River, Sawmill River, and other brooks and streams in town have impacts beyond town borders. By "drinking locally" and thinking regionally, Montague residents can ensure the future of their own water supplies while contributing to recovery of the Connecticut River.

C.2 Surface Waters

C.2.1 Connecticut River

Fifty years ago the Connecticut River was described as "the best landscaped sewer in the Nation" however, today it is classified as swimmable and fishable (Class B) and in some areas drinkable (Class A). This is a result of the Federal Clean Water Act and the investment of more than $600 million in wastewater treatment.

The Connecticut River and its watershed are 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 in four states. Seven years later, in 1998, the Connecticut River became one of only fourteen rivers in the country to earn Presidential designation as an American Heritage River.

The priorities of the Massachusetts Executive Office of Energy and Environmental Affairs for the Connecticut River watershed include: promote the protection and/or creation of riparian buffer zones along its waterways; reducing the negative effects of non-point source pollution, primarily storm runoff; restore aquatic diversity by removing barriers to fish and eel passage on the tributaries to the Connecticut; and improving upon the limited amount of water quality data available within the Watershed.

Years of deforestation, industrialization, and widespread dumping took their toll on the river's water quality causing a mass disruption of ecological processes. The effects were more pronounced in the urban sections of the river, although pollution and erosion are concerns in all areas of Franklin County (US Fish and Wildlife Service, 1995). In recent years, the water quality of the Connecticut River has improved. Fish and wildlife that virtually disappeared from the region twenty years ago have begun to return including the Atlantic salmon, American shad, the peregrine falcon, and the bald eagle. However, present threats to the river are many. They include increased development resulting in nutrient and heavy metals loading, hydroelectric generation as it relates to fisheries and documented toxic and bioaccumulations effects on fisheries resulting from historic discharges or waste sites (Massachusetts Department of Environmental Protection, March 1995).

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. 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. The water should also be suitable for irrigation and other agricultural uses. The classification of rivers and streams in Massachusetts does not necessarily mean that the river meets that classification, rather, classifications represent the State's goal for each river.

According to the "Connecticut River Basin 2003 Water Quality Assessment Report" published by the Massachusetts Department of Environmental Protection, the Connecticut River is impaired by polychlorinated biphenyls (PCBs) along its total length and by fecal coliform from its confluence with the Deerfield River to the Montague town line.

Pregnant women and nursing mothers are advised not to eat any fish from the Connecticut River.

A report published in January 1998 by the New England Interstate Water Pollution Control Commission (NEIWPCC) listed bioaccumulation and toxicity as water quality issues for the entire length of the Connecticut River in Massachusetts. Bioaccumulation refers to the concentration of toxins in organisms at higher levels in the food chain. The report specifically identified PCBs in fish. The general public is warned not to eat any affected fish species, which include channel and white catfish, American eel and yellow perch. Pregnant women and nursing mothers are advised not to eat any fish from the Connecticut River (Department of Environmental Protection, 1998).

Published water quality information for the Connecticut River is limited. There are numerous point sources of pollution along the Connecticut River such as wastewater treatment plants and industries with National Pollution Discharge Elimination System (NPDES) permits. While a listing of NPDES permit holders exists, there is no published analysis of the water quality testing required to be conducted by the permit holders and many point sources have permits which have expired (Massachusetts Department of Environmental Protection, March 1995). Clearly additional water quality testing and an

evaluation of existing NPDES permits is needed to determine the health of the Connecticut River ecosystem and to clearly identify which uses the river supports.

A 1998 publication issued by the U. S. Geological Survey as part of the National Water Quality Assessment Program (Water Quality in the Connecticut, Housatonic, and Thames River Basins; USGS Circular 1155; 1998) identified various pesticides used by agricultural operations as pollutants in the Connecticut River in Franklin County. While drinking water standards were not exceeded, the report noted that existing drinking water standards did not include some pesticides detected or their breakdown products. In addition, the drinking water standards did not consider the cumulative impacts of more than one pesticide in the water. As a result, the actual health concern posed by these results is uncertain.

Table 4-1 summarizes water quality information available from the Department of Environmental Protection on the Connecticut River in Massachusetts. While the information presented on aquatic life and fish consumption may appear to be in conflict, it is possible for a river segment to be interpreted as having a "non-support" rating for fish consumption and a "full support" status for aquatic life use. The two interpretations are the results of different testing methods and assumptions made by the United States Environmental Protection Agency (EPA). For example, when fish flesh is measured for contamination, many species of fish are tested, and not all are found to contain mercury or PCBs. It is assumed that because PCBs are not found in all fish species, the presence of PCBs in any fish does not necessarily mean that all aquatic life is threatened. Therefore, the Massachusetts Department of Public Health's fish advisories are very specific. The fish advisory identifies only the species that are likely contaminated, and suggests consumption limits for the most sensitive segments of the citizenry (i.e. pregnant women and children).

Although wastewater treatment facilities constructed throughout the watershed have been treating major pollution discharges for more than twenty years, the Connecticut River is still plagued by pollution from PCBs, chlorine, heavy metals, erosion, landfill leachate, storm water runoff and acid rain. These pollutants come from both point sources, like wastewater treatment plants and manufacturing plants, and non-point sources, including failed residential septic systems, improperly managed manure pits and stormwater runoff carrying herbicides.

Table 4-1: Summary Table of Testing Results for the Connecticut River – Massachusetts Segments

Location	Aquatic Life	Fish Consumption	Primary Contact (e.g. Swimming)	Secondary Contact (e.g. Boating)	Overall Ranking of Segment
NH/VT/MA state line to Rt. 10 Bridge, Northfield **(3.5 mi.)** (Segment MA34-01)	**Support** *This use is identified with an Alert Status due to the regulated flow regime, the severe bank erosion issues, and the risk that fish tissue contaminants pose to fish-eating wildlife.*	**Impaired** *The following site specific fish consumption advisory is recommended by MA DPH for the mainstem Connecticut River:* *"(All towns between Northfield and Longmeadow) Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from the Connecticut River and the general public should not consume channel catfish, white catfish, American eel, or yellow perch because of elevated levels of PCB" (MA DPH 2007).*	**Support** *The Primary Contact use is assessed as support based upon the low bacteria counts and the lack of objectionable deposits, odors, or oils. However this use is identified with an Alert Status due to the highly turbid conditions, regulated flow regime and severe bank erosion issues.*	**Support** *The Secondary Contact use is assessed as support based upon the low bacteria counts and the lack of objectionable deposits, odors, or oils. However this use is identified with an Alert Status due to the highly turbid conditions, regulated flow regime and severe bank erosion issues.*	**Class B** *This segment is on the 2006 Integrated List of Waters in "Category 5"- Waters Requiring a TMDL because of priority organics, flow alteration, other habitat alterations, and pathogens (MassDEP 2007).*
Rt. 10 Bridge, Northfield to Turners Falls Dam, Gill/Montague **(11.2 mi.)** (Segment MA34-02)	**Support** *This use is identified with an Alert Status due to the regulated flow regime, the severe bank erosion issues, and the risk that fish tissue contaminants pose to fish-eating wildlife."*	**Impaired** *Because of the site-specific fish consumption advisory for the Connecticut River due to PCB contamination (see above), the Fish Consumption Use is assessed as impaired.*	**Support** *This use is identified with an Alert Status due to the highly turbid conditions, regulated flow regime and severe bank erosion issues.*	**Support** *This use is identified with an Alert Status due to the highly turbid conditions, regulated flow regime and severe bank erosion issues.*	**Class B** *This segment is on the 2006 Integrated List of Waters in "Category 5"- Waters Requiring a TMDL because of priority organics, flow alteration, and other habitat alterations (MassDEP 2007).*

Location	Aquatic Life	Fish Consumption	Primary Contact (e.g. Swimming)	Secondary Contact (e.g. Boating)	Overall Ranking of Segment
Turners Falls Dam, Gill/Montague to the confluence with the Deerfield River, Gill/Montague/ Deerfield **(3.6 mi.)** (Segment MA34-03)	**Impaired – upper 2.3 mi.** *Due to diversion of water to the power canal causing dry streambed part of the year.* **Not Assessed– lower 0.7 mi.** *The* Aquatic Life Use *is identified with an Alert Status due to the risk that fish tissue contaminants pose to fish-eating wildlife.*	**Impaired** *PCB in fish tissue.*	**Not Assessed**	**Not Assessed**	**Class B** *This segment is on the 2008 Integrated List of Waters in "Category 5"- Waters Requiring a TMDL because of priority organics, flow alteration and suspended solids*
Confluence with the Deerfield, Gill/Montague/ Deerfield to Holyoke Dam, Holyoke/So. Hadley **(34.4 mi.)** (Segment MA34-04)	**Support** *This use is identified with an Alert Status due to the isolated occurrences of Trapa natans found in Cove Island Cove and at the mouth of the Mill River in Northampton and the risk that fish tissue contaminants pose to fish-eating wildlife.*	**Impaired** *PCB in fish tissue.*	**Support**	**Support**	**Class B** *This segment is on the 2008 Integrated List of Waters in "Category 5"- Waters Requiring a TMDL because of priority organics and pathogens*
Holyoke Dam, Holyoke/So. Hadley to the Ct. State Line, Longmeadow/ Agawam **(15.9 miles)** (Segment MA34-05)	**Not Assessed**	**Impaired** *PCB in fish tissue.*	**Impaired** *Elevated E. coli bacteria counts, noted particularly during wet weather periods.*	**Support**	**Class B** *This segment is on the 2008 Integrated List of Waters in "Category 5"- Waters Requiring a TMDL because of priority organics, pathogens and suspended solids.*

Source: MA Department of Environmental Protection, "Connecticut River Basin 2003 Water Quality Assessment Report," 2008; Massachusetts Year 2008 Integrated List of Waters (EOEEA, Division of Watershed Management, Watershed Planning Program).

C.2.2 Millers River

The Millers River is located in north central Massachusetts and southwestern New Hampshire. From its headwaters in New Hampshire, the Millers River flows south, then gradually west, ultimately flowing into the Connecticut River along the northeastern border of the Town of Montague. According to the US Fish and Wildlife Service, it is one of 38 major tributaries to the Connecticut River, New England's longest river and largest watershed.

Although the Millers River fluctuates between sluggish and rapid flows, there is an average drop of twenty-two (22) feet per mile. The River and its tributaries powered industrial development in the region since the late 1700s. Over time, serious water pollution problems resulted from industrial and human uses of the river as a sewer.

Today, the Millers River is valued for its recreational and natural resources. The Millers provides opportunities for fishing, wildlife and scenic viewing, whitewater boating and swimming. There are many public access sites to the Millers River in Erving, the most popular of which is at its confluence with the Connecticut River. It supports a variety of species including freshwater mussels. Freshwater mussels are particularly good indicators of water quality and therefore their presence may indicate improving conditions along the Millers River.

The Millers River has an appallingly colorful history of industrial pollution—literally. In the late 1950s, paper mills in the towns of Erving and Baldwinville switched from using virgin white pulp as a primary raw material to using recycled paper. The recycled paper's chemical coatings and colored inks had to be removed in order to make new paper. As there were no wastewater treatment plants at the paper factories, these inks and coatings went directly into the river as waste from the water-intensive paper making process. The volume of chemical discharges increased as paper production expanded, causing the river to flow in different colors (Showers, 2000).

During the late 1960s, citizen activists began meeting to discuss strategies to clean up the river. Montague farmer Henry Waidlich was one of the founding members of Millers River Watershed Council (MRWC), a nonprofit organization founded in 1970 to address industrial pollution in the watershed (Showers, 2000).

The continued presence of dangerous levels of mercury and PCBs buried in sediments has prevented the Millers from achieving its classification as "swimmable and fishable."

Regulation of industrial discharges under the Clean Water Act beginning in the early 1970s and advocacy by the MRWC resulted in substantial improvements in water quality in the Millers River. In 1983 the Millers River was stocked with fish for the first time in 20 years. Along with the regular sport fish, 20,000 juvenile salmon were released as part of the salmon restoration program. The Millers River no longer smelled or looked dirty, but fishing was on a catch-and-release basis only (Showers, 2000).

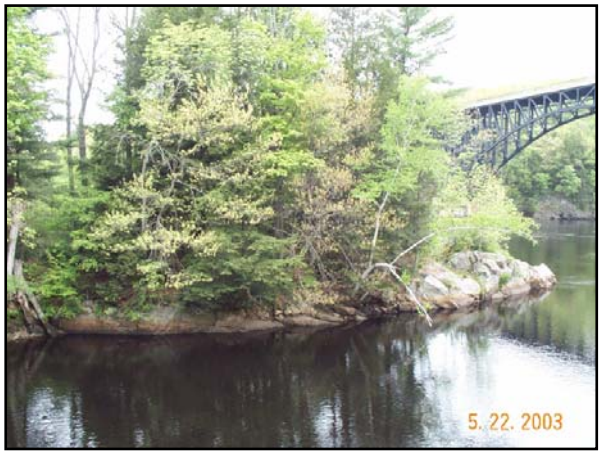
Although the river is considered Class "B" (appropriate for fishing and swimming), consumption of fish caught there is not advisable. The stated class for a particular river is in fact only the State's goal for that river and does not necessarily mean that the river meets the standards for that classification. Hence there are public health warnings against eating native fish species caught in the Millers River. The given classification also implies that the future recreational potential for the Millers River may in part depend on continued water quality improvements.

According to the Executive Office of Energy and Environmental Affairs (EOEEA), the "top three" watershed priorities for the Millers River are: perform hydrologic assessment and water supply forecasts to identify flow and yields throughout the watershed and stressed sub-watersheds; develop a non-point source assessment to identify existing and potential sources of water quality problems; and work with the Coordinator of the North Quabbin Regional Landscape Partnership (NQRLP) to protect biodiversity and open space in the region.

The continued presence of dangerous levels of mercury and PCBs buried in sediments has prevented the Millers from achieving its classification as "swimmable and fishable." Fish in the river have been found to contain these chemicals at levels resulting public health warnings prohibiting their consumption. The full extent of PCB contamination of the sediments is under continued study by the Massachusetts Department of Environmental Protection. The contamination will undoubtedly have a negative long-term impact on the recreational potential of the Millers River for the Town of Montague and surrounding communities.

Area municipal officials and residents have worked hard to improve the water quality of the Millers River since the days when raw sewage was discharged from area homes and industries directly into the river. Water quality information is included in this section because the future recreational potential for the Millers River depends in part on continued improvements.

The water quality of the Millers River is much higher than it used to be due to more than fifty years of research and effort to clean the river by state and private institutions. Federal legislation, passed in the 1960s and 1970s, greatly affected the treatment wastewater received before it was discharged into rivers and streams. The Massachusetts Clean Water Act enacted in 1966 specified laws, standards, and procedures for the implementation of federal legislation at the state level. It contained provisions for the regulation of discharge



to surface waters, ground waters, and sewer systems, and provisions for state technical assistance to communities for construction of public treatment plants.

The Federal Water Pollution Control Act of 1972 (Public Law 92-500), as amended by the Clean Water Act of 1977, sought to eliminate discharge of pollutants into navigable waters by 1985. Public Law 92-500 also provided for federal grants for construction of public sewage treatment facilities. Between 1973 and 1977, eight wastewater treatment plants were constructed at sites along the Millers River. In spite of this, toxicity tests in 1987 found that four of the eight (Athol, Orange, South Royalston, and Winchendon) demonstrated acute toxicity, which DEP thought to be chlorine. In addition, testing of fish caught in the Millers River basin between 1995 and 1997 identified problems of polychlorinated biphenyls or PCB contamination resulting in fish advisories by the Massachusetts Department of Public Health.

In 2001, the Millers River Watershed Team also began implementing a Strategic Monitoring and Assessment for River Basin Teams (SMART) monitoring program in conjunction with the Department of Environmental Protection, the Division of Watershed Management and the Wall Experiment Station. This program provided important information on long-term on-going water quality trends in the watershed. Although the Watershed Team has since been disbanded, DEP staff have continued the SMART monitoring at five locations on the Millers River, which are sampled every other month. The DEP now has raw data on water quality in the Millers River going back over ten years, which is used in part to develop the Millers River Watershed Assessment report that is updated approximately every five years.

Table 4-2: Summary Table of Testing Results for the Western Millers River

Location	Aquatic Life	Fish Consumption	Primary Contact (e.g. swimming)	Secondary Contact (e.g. Boating)	Overall Ranking of Segment
Millers River From the USGS gage station in South Royalston to the Erving Paper Company **(18.5 miles)** (Segment MA35-04)	**Impaired** (upper 6.6 miles) **Support** (lower 11.3 miles) *The upper 6.6 mile reach of this segment (from South Royalston USGS Gage downstream to the dam at the Cresticon Upper FERC Project) because of PCB contamination in sediment. The downstream 11.3 mile reach of this segment is identified with an Alert Status because of flow fluctuations resulting from hydromodification, which appear to be*	**Impaired** *High levels of mercury and polychlorinated biphenyls (PCBs). MA Dept. of Health recommends the following advisory for all towns from Erving to Winchendon because of mercury and PCBs:* *1. "Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from this waterbody and its tributaries,"* *2. "the general public should not consume any brown trout or American eel taken from this*	**Not Assessed**	**Not Assessed**	**Class B** *This segment is on the 2008 Integrated List of Waters in "Category 5"- Waters Requiring a TMDL based on Dept. of Health Fish Advisory*

Location	Aquatic Life	Fish Consumption	Primary Contact (e.g. swimming)	Secondary Contact (e.g. Boating)	Overall Ranking of Segment
	influencing the fish community and potential PCB contamination problems documented upstream. Slightly elevated levels of total phosphorus and the algal growth in this segment of the Millers River are also of concern.	*waterbody downstream from its confluence with the Otter River," and* *3. "the general public should limit consumption of all non-affected fish from this waterbody and its tributaries to two meals per month."*			
Millers River from Erving Paper Company to confluence with the Connecticut River **(9.2 miles)** (Segment MA35-05)	**Support** *This use is identified with an Alert Status because of the documented aberrant flow fluctuations (pulsing twice per day) and potential PCB contamination problems from upstream sources. Additionally, whole effluent toxicity at the Erving Center WWTP discharge is of concern as is slightly elevated levels of total phosphorus.*	**Impaired** *High levels of mercury and polychlorinated biphenyls (PCBs). See Dept. of Health Advisory above.*	**Not Assessed**	**Not Assessed**	**Class B** *This segment is on the 2008 Integrated List of Waters in "Category 5"- Waters Requiring a TMDL based on Dept. of Health Fish Advisory*

Source: 2000 Millers River Watershed Assessment Report; Massachusetts Department of Environmental Protection; Massachusetts Year 2008 Integrated List of Waters (EOEEA, Division of Watershed Management, Watershed Planning Program)

C.2.3 Sawmill River

The Sawmill River is a sub-watershed of the Connecticut River Watershed that drains approximately thirty-two square miles of land located in the towns of Montague, Wendell, Leverett and Shutesbury. From its headwaters at Lake Wyola in Shutesbury, the Sawmill River flows westerly for approximately fourteen miles to its confluence with the Connecticut River in the Town of Montague. The Sawmill River has been part of the Atlantic Salmon Restoration Program sponsored by the Massachusetts Division of Fisheries and Wildlife.

The upper reaches of the watershed are forested and steep, accounting for approximately 85 percent of the total watershed area. The valley in the upper watershed is narrow, with the floodplain limited in most locations. Housing density in this section is low, with most homes located adjacent to North Leverett Road, close to the river. Downstream from Route 63, the watershed characteristics change. The topography flattens and the floodplain widens. The land use is a mixture of cropland, pasture, forest and other open land. Development is generally scattered, with the exception of the densely-populated village of Montague Center.

As its name implies, the Sawmill River was harnessed for power by early settlers in Montague. Beginning in the eighteenth century, the river was dammed to provide power to many mills along its length. Most of the mills are gone, but several dams remain, serving no commercial function but restricting passage of migratory fish. In the lower reaches of the watershed, the floodplain of the Sawmill has been farmed for centuries. The river closely parallels North Leverett Road and Main Street, and passes under North Leverett Road, Route 63, South Street, Center Street, Main Street, Meadow Road and South Ferry Road on its way to the Connecticut, with bridge abutments located in the floodplain. There are more than a dozen homes and businesses located in the riparian zone within two hundred feet of the river.

Economic use of the Sawmill River and the proximity of buildings and infrastructure to its banks and floodplain has resulted in conflict in the lower watershed as the course of the river has threatened public and private property over the past century. The Town of Montague sponsored dredging attempts to increase flow capacity under bridges during the second half of the twentieth century. Spoil piles were left on the banks. These have acted as dikes, containing higher flows rather than allowing the river to flow across its floodplain. Additional spoil piles from dredging were left along the channel in North Leverett downstream of the Sawmill Dam, and downstream of Route 63 on the north side of the river.

Dredging and the accumulated spoil piles in the floodplain caused the water to travel faster and cut deeper than it would have if allowed to enter the floodplain. Sand, gravel and cobbles moved down-river and collected under bridges filling in the previously dredged areas. Where the river was again able to access its floodplain, it flooded agricultural fields and town roads. Riprap was placed to deflect flows from these areas. These hardened banks forced the flow to the opposite bank, where erosion began anew.

Each time the town and its residents attempted to fix one problem, others emerged. Older residents of the town have stories about various projects to alter the course or flows of the river, and about how these efforts have affected fisheries and habitat.

Following the severe storm of June 1996, the town requested help from the Natural Resources Conservation Service in rebuilding infrastructure destroyed by flooding. In 2001, the town again contacted NRCS for assistance repairing a severely eroded section of the bank of the Sawmill River on Meadow Road. During the process of obtaining permits for this work, which cumulatively totaled more than $500,000, it became clear that state, federal and local environmental permitting authorities were concerned about the piecemeal approach to solving problems in the watershed. Town officials began working with NRCS and the Franklin Conservation District to research the problem. A preliminary assessment was released by the Conservation District in early 2002.

According to the assessment of the Sawmill River included in the "*Connecticut River Basin, 2003 Water Quality Assessment Report*", the most significant environmental issue in the watershed is the erosion of the stream banks with subsequent sedimentation, resulting in habitat destruction, flooding and bridge and roadway maintenance problems. In 2006, Vanase Hanagen Brustlin Inc.(VHB) outlined areas of excessive sediment deposition, bank erosion, and inadequate riparian buffer in the lower portion of the segment of the Sawmill River from Dudleyville Road in Leverett to the confluence with the Connecticut River in Montague. Also of concern is the degradation of fish habitat along the river. Sedimentation can negatively impact the spawning habitat in the streambed. The erosion along the stream banks removes overhanging vegetative cover and increases water temperature, which also affects habitat. In addition, dredging has resulted in widening of the stream channel, reducing the depth of the streambed, thereby increasing water temperature. The removal of trees to create pastureland and the grazing of livestock along the banks of the river has had a negative impact on the aquatic life in the Sawmill River.

The typical land cover along riparian corridor is composed of mature trees, however, there are stream segments along the Sawmill River where this forested buffer is absent and is replaced by impervious surfaces, riprap, or mowed grass. Invasive species are also present and in some places have successfully taken over the understory. The decline in plant diversity has a negative impact on wildlife habitat.

In July 2002, the Town hosted a meeting of key stakeholders to discuss the findings of the preliminary assessment. Attendees included town officials, NRCS personnel, representatives of the Franklin Conservation District, Franklin Regional Council of Governments, Connecticut River Watershed Council, Trout Unlimited, Massachusetts Executive Office of Environmental Affairs and the office of State Representative Stephen Kulik, and regulatory staff from the Massachusetts Department of Environmental Protection, the Massachusetts Division of Fisheries, Wildlife and Environmental Law Enforcement, United States Fish & Wildlife Service, and the United States Army Corps of Engineers. The participation of so many high-level agency personnel was a good indication of concern about the problem, and interest in the report.

Attendees agreed on the need for more study of the river and on the concept of a comprehensive restoration plan. A working group was formed to involve stakeholders and the public in plans for further study and restoration. In December 2002, the working group proposed the Sawmill River Watershed Restoration Project, with three distinct but interrelated elements: 1) a study resulting in conceptual designs; 2) public education and participation; and, 3) regulatory involvement. NRCS made a major commitment of time and personnel to conduct further research in the watershed beginning in summer 2003. In April 2003, the Franklin Conservation District was awarded one of only four federal 604(b) grants in the state to support additional research, which resulted in the 2006 VHB report cited earlier. Additional funding has been obtained under the DEP s.319 nonpoint source pollution grant program to implement the recommendations of that report in regard to remediation of bank erosion and excessive sedimentation. A section of the Sawmill River just south of Route 63 will be diverted back to its original floodplain. The project is currently moving through the approval process (Franklin Conservation District, personal communication).

The Town has an important role to play in the restoration of the Sawmill River. While human impact in the lower reaches of the watershed is serious, the upper watershed is mostly forested, and the river continues to serve many valuable ecological functions. Given the opportunity, Atlantic salmon will spawn and salmon fry will grow in the river. Trout thrive in the Sawmill year-round, offering living proof that the quality of the water is still clean enough for even the most particular cold water fish. Protecting the riparian corridor and controlling development in the upper reaches of the Sawmill and its tributaries will help sustain fisheries, preserve wildlife habitat, improve water quality and prevent costly damage to public infrastructure and private property from flooding in the future.

C.2.4 Other Rivers and Brooks

Randall Brook

Randall Brook originates near the former town landfill between Turnpike Road and Greenfield Road and flows southwest to the Connecticut River. Leachate from the landfill is believed to have contaminated the brook.

Hatchery Brook

Hatchery Brook flows westerly from its origin at underground springs on the Montague Plains to the Bitzer State Fish Hatchery on Montague Road. The flow of approximately 1,000 gallons a minute of very clean groundwater is used at the hatchery to raise trout for stocking. From the hatchery, the brook flows southerly under Greenfield Road and South Ferry Road. The brook is dammed to form two small ponds at the historic Field Farm west of South Ferry Road. Downstream of the dams, the brook flows westerly into the Connecticut River.

Pond Brook

Pond Brook originates at the southern end of Lake Pleasant and flows southwesterly. North of Swamp Road, the brook is dammed, creating a body of water known as Clapp's pond. Due to its source at Lake Pleasant, the water entering the pond is very clean. The Town of Montague considered acquisition of this property for a public swimming area when it was for sale during the early 1990s. There was public support for the acquisition, but it was judged to be too expensive. The property on which the pond is located is currently privately owned. South of the pond, the brook joins Goddard Brook in an extensive wetland area in the North Street Wildlife Management Area.

Goddard Brook

Goddard Brook originates in the minimally populated Dry Hill area of eastern Montague. The brook then parallels Dry Hill Road, crosses Route 63 into the western half of the Town, where it joins the Sawmill River in Montague Center. A severe storm in June 1996 resulted in flooding along Goddard Brook and major damage to Dry Hill Road and Wonsey Road, including complete washouts at several sites where the river crosses the road. Residents should be aware that further development in the watershed to Goddard Brook has the potential to increase flooding during storm events.

Cranberry Pond Brook

Cranberry Pond Brook originates at the northern end of Cranberry Pond in the Town of Sunderland. The brook flows northwest through Montague farmland. The severe storm of June 1996 resulted in flooding that severely damaged Old Sunderland Road at the crossing of Cranberry Pond Brook. After crossing Old Sunderland Road, the brook drops sharply in elevation and supports an extensive wetland prior to crossing Meadow Road, where it joins the Connecticut River in Montague's southwestern corner.

Spaulding Brook

Originating in the forested upland of the Montague Wildlife Management Area in southeastern Montague, Spaulding Brook flows into the Sawmill River at Spaulding Brook Road near the Town's border with Leverett. The severe storm of June 1996 resulted in flooding at the confluence with the Sawmill, destroying the road at this location. The culvert and road were reconstructed to allow access from Spaulding Brook Road to the southern section of Ripley Road, but access to the northern section of Ripley Road was determined to be too expensive to repair, and the road was permanently closed at this location.

Chestnut Hill Brook

Chestnut Hill Brook originates in a wetland area in the portion of Montague Wildlife Management Area that borders the Town of Wendell. It flows southwesterly parallel to East Chestnut Hill Road, crossing the road twice before joining the Sawmill River in North Leverett. The severe storm of June 1996 resulted in flooding that washed out both of the road crossings on East Chestnut Hill Road. Recent construction of homes on roadside frontage lots along East Chestnut Hill Road may have contributed to flooding.

Hannegan Brook

Hannegan Brook originates in the uplands of northeastern Montague and flows into Lake Pleasant in central Montague. Virtually the entire watershed of Hannegan Brook—approximately 1300 acres—was purchased by the Turners Falls Fire District to protect the waters of Lake Pleasant, which was then the Town's primary water supply. As a result, the water in the brook is exceptionally pure.

Williams Brook

Williams Brook originates where several smaller streams join to form an extensive wetland on the border between Montague and Wendell in the southeastern corner of town. It flows south and west into North Leverett, eventually flowing into the Sawmill River.

Beaver Pond

Beaver Pond, also known as Beaver Hollow, is located between Millers Falls Road and the Millers River east of the village of Millers Falls. The pond is the remains of an oxbow in the Millers River. Residents of Millers Falls have long advocated for permanent protection and public access to this property, which is currently privately owned.

Lyons Brook

Lyons Brook begins at Ruggles Pond in Wendell State Forest and flows approximately two miles northwest to the Millers River, forming a portion of the boundary between Wendell and Montague. About three-quarters of a mile of Lyons Brook lies within the Wendell State Forest. The remainder flows through private land. Logging in the watershed has resulted in erosion and sedimentation of the brook.

C.2.5 Other Lakes and Ponds

Lake Pleasant and Green Pond

Lake Pleasant and Green Pond are located in central Montague. The lake was the focal point of a summer spiritual retreat developed in the 19th century, which evolved into the permanent settlement of the village of Lake Pleasant. The Turners Falls Fire District owns both Lake Pleasant and Green Pond, which were the Town's main sources of water until 1965. Lake Pleasant covers fifty-three acres and has a storage capacity of approximately 150 million gallons. It is connected to Green Pond, a 15-acre reservoir that holds approximately 40 million gallons. In 1994, the Lake Pleasant and Green Pond Reservoirs were downgraded to emergency water supplies by the Department of Environmental Protection. They cannot be used directly for water supply unless the District builds a filtration plant. While district voters have not to date been willing to approve the significant expenditure that filtration would require, the Turners Falls Water Commissioners believe that the Lake will supply residents of the Town with drinking water in the future.

Lake Pleasant and Green Pond are located in a high yield aquifer area, which covers a large portion of western Montague. The Turners Falls Water Department is currently developing a new well next to Lake Pleasant, scheduled to be completed in 2010. It is estimated that the well will have a 2 million gallon capacity, doubling the existing capacity (Turners Falls Water Department, personal communication). This new source is greatly needed, as the two existing wells at Tolan Farm are being pumped close to the maximum capacity.

"Podlenski's Pond"

Located at the intersection of Routes 63 and Gunn Road, "Podlenski's Pond" provides habitat for the Jefferson Salamander, a Massachusetts "Species of Special Concern."

West Pond

West Pond, located on the east side of Main Street south of Montague Center, is in the Zone I for the Montague Center well.

Montague Center School Pond
The Montague Center School pond is located south of the Montague Center School on School Street. The pond is used for ice skating in the winter and is stocked for a fishing derby in the spring. The depth of this pond has significantly decreased due to deposit of sediment.

"Lucas' Pond"
"Lucas' Pond" is located west of Greenfield Road and south of the Boston & Maine Railroad tracks just east of the Connecticut River. The pond was created by construction of a dam approximately fifty years ago, and has been privately managed for wildlife. Sediment flowing from the site of the old railroad bridge on Greenfield Road in 2001 reached the pond; the sedimentation of the pond is extensive.

C.3 Class A Waters

In the Town of Montague, both Green Pond and Lake Pleasant and their 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. They currently serve as emergency water supplies for the town. 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)

According to MassGIS and U.S. Geological Survey (USGS) documents, Montague contains a portion of a large high-yield aquifer …with the potential to provide a pumping volume of twenty-five (25) to 1,000 gallons per minute.

C.4 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 spaces 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, 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).

According to MassGIS and U.S. Geological Survey (USGS) documents, Montague contains a portion of a large high-yield aquifer, defined as an aquifer with the potential to provide a pumping volume of twenty-five (25) to 1,000 gallons per minute. In Montague, this aquifer is located along the Connecticut River from the Vermont border to Ervingside and Millers Falls. It extends from Millers Falls southwest to the Plains, surrounding Lake Pleasant and Green Pond, and west and east of Taylor Hill. Along the western slopes of Taylor Hill, the aquifer follows the Sawmill River to the Connecticut. Around its eastern slopes the aquifer stretches south to Cranberry Pond in Sunderland *(See Water Resources Map at end of Section 4)*.

In 2007, Nestle Waters North America conducted preliminary studies of conservation land on the Montague Plains owned by the state's Division of Fisheries and Wildlife to determine the suitability of the high-yield aquifer for use as a source of bottled drinking water. Although Nestle ultimately decided not to pursue the project further due to the complexity of complying with state statues, similar proposals could well be advanced in coming years as clean drinking water becomes an increasingly scarce resource. Many residents of Montague and surrounding towns sharing the aquifer raised concerns about corporate control of a natural resource and the potential for a project of that nature to drain water sources for towns in the Pioneer Valley and suggested the need to provide more secure protection for water resources.

Montague's surficial geology has characteristics that would support low to medium yield aquifers as well. A low-yield aquifer provides a potential yield of between 0 and 50 gallons per minute. According to MassGIS and the USGS, all areas of Montague other than the Dry Hill Area east of Rte. 63, Taylor Hill and Wills Hill have surficial geological characteristics that would support low to medium yield aquifers.

The areas that contribute to wells are known as recharge areas. The Massachusetts Department of Environmental Protection strictly regulates an area within a radius of 100 to 400 feet of public water supply wells, depending on the pumping rate. This area is known as the "Zone I," or primary recharge area. Secondary 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. A hydrological study done in the early 1990s delineated the Zone II recharge area to the Tolan Farm Wells for the Turners Falls Water District. This Zone II and the "Interim Wellhead Protection Area" indicating the Zone I for the Montague Center well make up the Town's Water Supply Protection Overlay Zoning District (WSPD).

The Turners Falls wells are located in a deep, pre-glacial sand and gravel aquifer that is confined in the immediate vicinity of the wells, partially confined in other portions of the aquifer, and possibly unconfined along the aquifer boundaries. The wells are considered to be highly vulnerable to contamination because the clay confining layer does not extend across the entire aquifer. (Massachusetts Department of Environmental Protection, 2003*).*

C.5 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, 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.

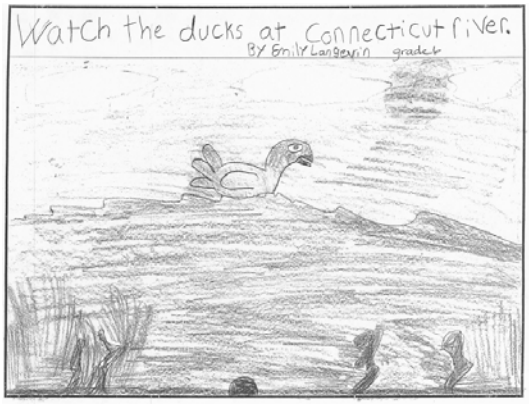
The 100- and 500-year floodplains are mapped by the National Flood Insurance Program (NFIP) after study of waterways. The 100-year floodplain is used for regulatory purposes. In Montague, floodplains for the Connecticut River, Millers River, Sawmill River, Pond Brook and Hatchery Brook were mapped in 1978. Comprehensive flood maps for the town were produced in 1982.

According to the NFIP, one hundred year flood plains in Montague occur along the Connecticut River at the Patterson Farm on Greenfield Road, and in the southern section of Town at the confluences with the Sawmill River and Cranberry Pond Brook. Beaver Hollow is in the 100-year floodplain of the Millers River. The Sawmill River floodplain crosses North Leverett and Spaulding Brook Roads at their intersection, then narrows as the river travels along North Leverett Road, broadening again as the river approaches Montague Center near South Main Street. The 100-year floodplain for Hatchery Brook crosses South Ferry and Greenfield Roads at their intersection. Hannegan Brook has a floodplain east of Route 63 and west of B & M Railroad before it joins Lake Pleasant, and the floodplain for Pond Brook extends from Lake Pleasant to Clapp's Pond. In a 100-year storm, Cranberry Pond Brook floods farm fields and Meadow Road before joining the Connecticut River. Detailed studies have not been performed for other waterways.

C.6 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 "wetlands" 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 traps 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 most 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 "interests" related to their function: public and private water supply, ground water supply, flood control, storm damage prevention, prevention of pollution, land containing shellfish, fisheries, and wildlife habitat. To this end, the law defines and protects "wetland resource areas," including banks of rivers, lakes, ponds and streams, wetlands bordering the banks, land under rivers, lakes and ponds, land 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.

Wetlands can be found along the banks of many of Montague's rivers, ponds and streams, as well as in isolated forested areas. Some of these wetlands are mapped by the National Wetlands Inventory (NWI). Others are not mapped, but are well-known to local residents and members of the Conservation Commission. The following list identifies

major wetland areas in Montague, but is by no means comprehensive. All wetland areas, mapped and unmapped, serve important functions and should be protected.

Sawmill River
There is extensive floodplain forest along the Sawmill River west of Meadow Road. East of South Ferry Road, the wet meadows in the Sawmill floodplain are used for hay and pasture. Floodplain forest is also found in the North Street Wildlife Management Area between Center Street and Swamp Road, and in the area of the Tolan Farm wells. Beavers have built several dams along the Sawmill in this area. There are smaller wetland areas mapped along the east side of the Sawmill west of Route 63 and south of the village of Montague Center, as well as along the river north of Ripley Road and east of Spaulding Brook Road.

Cranberry Pond Brook
There is mapped floodplain forest along Cranberry Pond Brook east and west of Old Sunderland Road. Extensive swamps characterize the area along the brook east of Meadow Road. Beavers are very active in this area.

Pond Brook
Forested wetlands coincide with the mapped floodplain along Pond Brook from Lake Pleasant Road to its confluence with the Sawmill River.

Goddard Brook
East of Route 63, the banks of Goddard Brook are bordered by forested wetlands as the river flows south to its confluence with the Sawmill in the North Street Wildlife Management Area.

Ponds in Montague Center
There are wetlands south of West Pond and the Montague Center School Pond and north of Four Corners Pond. Podlenski's pond is shallow and surrounded by wetland vegetation.

West Street
There is an extensive area of wetlands fed by streams at the southwest end of West Street. This area drains the eastern side of Taylor Hill and is mostly undeveloped. Any future development in this area should be designed to protect wetlands and accommodate natural drainage patterns.

Turners Falls Road and Greenfield Road
There are wetlands bordering several unnamed streams between Greenfield Road and Turners Falls Road.

Randall Brook
There is a small area of mapped wetlands along Randall Brook near its intersection with Greenfield Road. This area is proposed for creation of additional wetlands to compensate for wetlands to be destroyed when Greenfield Road is reconstructed.

Power Canal
Seepage from the Turners Falls Power Canal feeds a large wetland area in Montague City between Montague City Road and the Power Canal northeast of Depot Street. Beavers have been very active in this area in the past several years, creating conflicts with homes and utility company infrastructure.

Montague City Road
The stream that runs along the southeast side of Montague City Road is bordered by wetlands along much of its length. This stream drains a large section of the hill in Turners Falls and Montague City Road, and has become filled with sediment. Beavers have also been active in this area, resulting in flooding on the Thomas Memorial Golf Course.

Turners Falls Road & Gun Club
On the banks of the Connecticut River at the end of Deep Hole Drive, there is a shallow wetland area at the Turners Falls Rod & Gun Club.

West Mineral Road
There is an extensive area of wetland vegetation bordering an unnamed pond and stream east of West Mineral Road and west of the Turners Falls Airport. This is an area that has been identified for future industrial development. Any development in this area must be carefully planned to protect wetland resources.

Beaver Hollow
Floodplain forest characterizes the area between the Millers River and the old Oxbow known as Beaver Hollow.

Montague Plains Kettle Holes
There are several kettle hole ponds on the Montague Plains north of Greenfield Road and east of Lake Pleasant Road and Mineral Road. Kettle hole ponds are wet depressions formed by melting of isolated glacial icebergs. Two of these kettle hole ponds are state-certified vernal pools (see below for discussion of vernal pools), and at least one of them supports endangered plant species.

Chestnut Hill/Catamount Swamp
There are mapped forested wetlands along Chestnut Hill Brook on Montague's eastern border with Wendell. There is also an extensive section of Catamount Swamp east of

East Chestnut Hill Road in this area. South of Chestnut Hill Loop, there is another wetland area on the Town's southern border with Leverett. These areas are very sparsely populated and serve as extremely valuable habitat for wildlife.

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

A Source Water Assessment Program (SWAP) Report conducted for the Turners Falls Fire District by the Massachusetts Department of Environmental Protection in 2002 identified a variety of potential threats to groundwater in the recharge area for the Turners Falls Fire District Wells (see Table 4-3). Please note that the potential threats (H-high, M-medium, L-low) relate to the type of activity, not to any specific site in Montague. For example, an auto service station is considered to be a high threat due to the fact that petroleum products are handled and stored on-site. A specific station may be in full compliance with all state regulations concerning known contaminants to groundwater, but this would not change the rating for this use.

The activities listed in Table 4-3 are those that typically use, produce, or store contaminants of concern, which, if managed improperly, are potential sources of contamination (PSCs). When specific potential contaminants were not known for a facility, DEP identified typical potential contaminants or activities for that type of land use. Facilities within the watershed may not contain all of these potential contaminant sources, may contain other potential contaminant sources, and may use Best Management Practices (BMPs) to prevent contaminants from reaching drinking water supplies.

It is important to understand that an actual release may never occur from a potential source of contamination if the facility is using BMPs. The threat rankings (high, moderate or low) represent the relative threat of each land use compared to other PSCs. The ranking of a particular PSC is based on a number of factors, including the type and quantity of chemicals typically used or generated by the PSC; the characteristics of the contaminants (such as toxicity, environmental fate and transport); and the behavior and mobility of the pollutants in soils and groundwater. The threats shown in the table, therefore, are generic, rather than specific to a particular facility in Montague. If BMPs are in place, the actual risk may be lower than the threat ranking identified by DEP. Many potential sources of contamination are regulated at the federal, state and/or local levels to further reduce the risk (Massachusetts Department of Environmental Protection, 2003).

The SWAP report made a variety of recommendations to protect Montague's drinking water:

- Manage and control new residential development in water supply protection areas;
- Educate residents and local businesses, including farms, on best management practices for protecting water supplies;
- Develop local regulations to address use, storage and disposal of hazardous materials;
- Map stormwater discharges in water supply protection areas and develop a local stormwater control ordinance;

- Implement best management practices for road maintenance in water supply protection areas, including limited use of road salt and cleaning of catch basins; and;
- Develop wellhead protection plans.

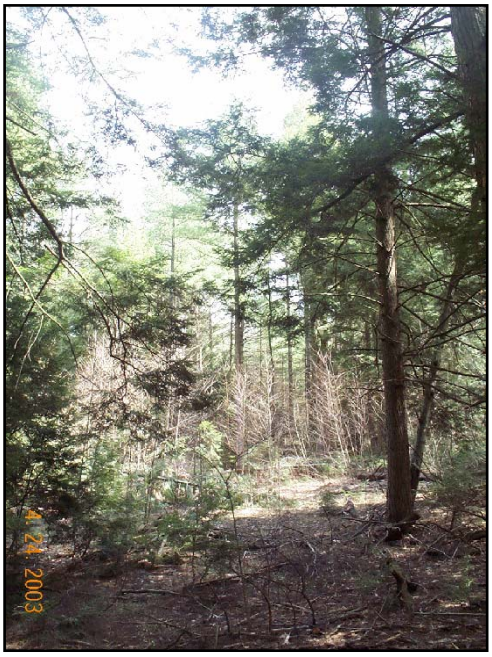
In 2005, the Turners Falls Water District conducted Source Water Assessment of Lake Pleasant, Green Pond and the Tolan wells under the auspices of the Massachusetts Rural Water Association. In 2005 the Turners Falls and Montague Center Water Districts collaborated on the purchase of 100 acres near the Montague City well that are also located in the Turners Falls recharge area.

Table 4-3: Potential Sources of Contamination in the Turners Falls Aquifer Recharge Area

Activities	Quantity	Threat	Potential Source of Contamination
Agricultural			
Fertilizer Storage or Use — Crop land	Numerous	M	Fertilizers: leaks, spills, improper handling, or over-application
Pesticide Storage or Use— Crop land	Numerous	H	Pesticides: leaks, spills, improper handling, or over-application
Livestock Operations	2	M	Manure (microbial contaminants): improper handling
Manure Storage or Spreading	Numerous	H	Manure (microbial contaminants): improper handling
Commercial			
Service Stations/ Auto Repair Shops	2	H	Automotive fluids and solvents: spills, leaks, or improper handling
Furniture Stripping and Refinishing/ Window refurbishing	1	H	Hazardous chemicals: spills, leaks, or improper handling
Bus and Truck Terminals	1	H	Fuels and maintenance chemicals: spills, leaks, or improper handling
Car/Truck/Bus Washes	1	L	Vehicle wash water, soaps, oils, greases, metals, and salts: improper management
Sand And Gravel Mining/Washing	3	M	Heavy equipment, fuel storage, clandestine dumping: spills or leaks
Residential			
Fuel Oil Storage (at residences)	Numerous	M	Fuel oil: spills, leaks, or improper handling
Lawn Care / Gardening	Numerous	M	Pesticides: over-application or improper storage and disposal
Septic Systems / Cesspools	Numerous	M	Hazardous chemicals: microbial contaminants, and improper disposal
Miscellaneous			
Aboveground Storage Tanks	Numerous	M	Materials stored in tanks: spills, leaks, or improper handling
Clandestine Dumping/junk piles	1	H	Debris containing hazardous materials or wastes
Clean Water Act permitted discharges	1	L	Various depending on discharge limits
Floor Drains/Dry Wells	2	—	Owners are currently conducting closure; contact the DEP regional coordinator for status and information.

Activities	Quantity	Threat	Potential Source of Contamination
Small quantity hazardous waste generators	Numerous	M	Hazardous materials and waste: spills, leaks, or improper handling or storage
Stormwater Drains/ Retention Basins	Numerous	L	Debris, pet waste, and chemicals in stormwater from roads, parking lots, and lawns
Transportation Corridors	Numerous	M	Fuels and other hazardous materials: accidental leaks or spills; pesticides: over-application or improper handling
Underground Storage Tanks	Unknown	H	Stored materials: spills, leaks, or improper handling

D. VEGETATION



Plants are a critical component of ecosystems in Montague. 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 make up 70 percent of the Montague's total land area and are the Town's most important natural resource. The town's forests are diverse, including hardwoods and conifers, pitch pine-scrub oak forest, and floodplain forest. Natural areas that are not forested are used for crops and pasture. This section describes vegetated areas in town and their ecological and economic significance.

D.1 Forests

Montague is located in the Transition Hardwoods-White Pine Forest Region (USDA, 1992). This forest type commonly occurs up to an elevation of 1,500 ft. above sea level in upland central Massachusetts and southern New Hampshire, northward through the Connecticut Valley.

Hardwood-White Pine Forest

The majority of Montague's forested land is located east of Route 63. This area is characterized by northern hardwoods including yellow and paper birch (*Betula alleghaniensis* and *Betula papyrifera*), beech (*Fagus grandifolia*) and sugar and red maple (*Acer saccharum* and *Acer rubrum*). In drier areas, red oak (*Quercus rubra*) is the most abundant deciduous species; other oaks and white pine can also be found. Hemlock (*Tsuga canadensis*) occurs in moist cool valleys, north and east slopes and sides of ravines.

White pine (*Pinus strobus*) is characteristic of well-drained sandy sites. It occurs as a scattered tree in hardwood forests, but is most common in southwest Montague in the area west of Route 47; west of Turners Falls Road in very sandy soils, and north of the state fish hatchery.

Pitch Pine-Scrub Oak Forest

The Montague Plains is the largest inland Pitch-Pine Scrub Oak (PPSO) community in southern New England, and the only large remnant of this ecosystem in the Connecticut River Valley. PPSO barrens are vegetative communities occurring on deep, coarse, well-drained sands derived from glacial outwash. The sands are acidic, poor in nutrients and prone to drought. Pitch pine-scrub oak barrens are maintained by fire, which increases the rate of cycling of nutrients to the soil. Without disturbance by fire, tree-sized oaks and white pine can take over. The main tree species of the barrens is pitch pine (*Pinus rigida*) and the dwarf chinquapin oak (*Q. prinoides*). Huckleberry (*Gaylussacia baccata*), and low bush blueberries (*Vaccinium angustifolium and V. pallidum)* are also common. The inland pitch pine-scrub oak communities have successional areas with trembling aspen (*Populus tremuloides*), gray birch (*Betula populifolia*), and black cherry (*Prunus serotina*).

Harvard Forest ecologist Glenn Motzkin has studied the Montague Plains intensively for the past decade. His work has shown that vegetative communities on the Plains today are both very diverse and dynamic, changing over time due to a variety of natural events and human influences. While there is little archaeological evidence of land use on the Plains

prior to European settlement, sources used by Motzkin suggest that Native Americans used fire to manage the land for hunting. It is believed that forest products were harvested from the Plains in the early 19th century, including timber, fuel and raw material for tar and turpentine. Much of the area was cleared for agriculture between the mid 19th and early 20th centuries (Motzkin et al., 1996).

Records from the 1930s suggest that the Plains was dominated by grasslands, open canopy forest, and scrub oak shrub lands, while in 1985, 73 percent of the area studied was forested, with pitch pine as the dominant species.

Fire was long believed to be the major force shaping patterns of vegetation in PPSO communities. Motzkin, however, believes that the history of soil disturbance for agriculture explains most of the variation in vegetation on the Plains today, with fires modifying the patterns of vegetation established as a result of prior land uses (Motzkin et al., 1996). As noted previously, his research has found that scrub oak/huckleberry/ lowbush blueberries and associated rare plant and insect species occur almost exclusively in areas that have never been plowed, while stands of pitch pine are found in plowed areas.

Motzkin's findings have important implications for conservation and management of this rare ecosystem. While intentional "controlled burns" are advocated by some ecologists to maintain historical PPSO communities, Motzkin cautions that the vegetation on the Plains today is different from historical patterns of vegetation. Controlled burns are unlikely to return the Plains to some pre-settlement "natural" condition. He recommends conserving areas of the Plains that have never been plowed and establishing connections between isolated unplowed areas to facilitate spread of rare species. He believes that some areas of the Plains should be allowed to mature without disturbance, and that other areas be maintained by a variety of methods, including controlled fires, cutting of hardwoods and soil disturbance to promote pitch pine regeneration (Motzkin et al., 1999).

Floodplain Forest

Floodplain forests are deciduous, forested wetland communities found along rivers and streams that flood on an annual or semi-annual basis. According to the Natural Heritage and Endangered Species Program of the Massachusetts Division of Fisheries and Wildlife, there are several types of floodplain forests in the Town of Montague: major river floodplain forests which occur along the Connecticut River; transitional floodplain forests such as those that are found along the lower Sawmill River; and the small-river floodplain forest found along tributaries of the Connecticut River.

All floodplain forests in Massachusetts have silver maple (*Acer saccharinum*) as the dominant tree species. Associated plant species vary depending upon location and degree and duration of flooding. In the major-river floodplain forest, silver maple covers more than 60 percent of the overstory with cottonwood (*Populus deltoides*) accounting for the remainder. There are no shrubs. The herbaceous vegetation includes stinging nettles (*Laportea canadensis*), ostrich fern (*Matteuccia struthiopteris*), whitegrass (*Leersia*

virginica), woodreed (*Cinna arundinacea*), and jack-in the- pulpit (*Arisaema triphyllum*). Major-river floodplain forests on islands have cottonwood, sycamore (*Platanus occidentalis*) and American ash (*Fraxinus americana*) in addition to the silver maple. Box elder (*Acer negundo*) is common in the understory of these floodplain forests, and the herbaceous vegetation is dominated by ostrich fern. Disturbed areas will also have staghorn sumac (*Rhus typhina*), bittersweet (*Celatrus orbiculata*), riverbank grape (*Vitis riparia*) and Virginia creeper (*Parthenocissus quinquefolia*).

Transitional floodplain forests have silver maple as the dominant species in the canopy, with green ash (*Fraxinus pennsylvanica*) also present. There are no shrubs and vines. Hog peanut (*Amphicarpaea bracteata*) is abundant. The herbaceous vegetation consists of a mixture of stinging nettle, ostrich fern, sensitive fern (*Onoclea sensibilis*) and false nettle (*Boehmeria cylindrica*).

Shrub vegetation in small-river floodplain forest consists of silky dogwood (*Cornus amomum*) and buttonbush (*Cephalanthus occidentalis*). The herbaceous vegetation is most diverse in these areas. Sensitive fern and false nettle are most common, with water hemlock (*Cicuta maculata*), swamp candles (*Lysimachia terrestris*) and water parsnip (*Sium suave*) also present.

Major owners of forestland in Montague include the state Department of Fish, Wildlife and Environmental Law Enforcement, the state Department of Conservation and Recreation, the Turners Falls Fire District and Northeast Utilities. These public and quasi-public forests provide for many of Montague's available recreational opportunities including walking, hiking, fishing, skiing, snowshoeing, hunting, snowmobiling, picnicking and nature study.

The remaining forest lands in Montague fit into a category called non-industrial private forestlands, or NIPF's. A 1998 article in the Journal of Forestry, "Ecosystem Management: Capturing the Concept for Woodland Owners" described the results of a survey of Franklin County NIPF owners. The results of the survey indicated that the top five reasons for forestland ownership are privacy, personal use of wood products, aesthetics and beauty, part of residence and recreation. The survey also provides selective information on a sample of woodland owners: most live less than a mile from the land; 60 percent have owned the land for at least fifteen years; 60 percent own less than fifty acres; 62 percent have annual household incomes of less than $55,000; and 48 percent are over fifty-five years of age (Rickenback et al., 1998)

Approximately 39 percent of the town's privately owned forest is enrolled in Chapter 61.

The results of the study suggest that Franklin County NIPF owners may hold attitudes that are favorable

towards three concepts of ecosystem management: small parcels of land fit into a larger ecosystem; individual parcels have conservation value in themselves and as part of the larger landscape; and that land should be managed both for today's use and for future generations. The results of this study also suggest that Montague NIPF owners may be open to participating in cooperative conservation measures that would seek to protect natural resources that cross property lines including drinking water supplies and biodiversity.

An analysis of private forest ownership in Montague suggests a somewhat more complex picture than the NIPF study describes. Forest landowners in town fall into five main categories: forest residence, farm woodlot, family land, commercial woodlot, and investment property. In some cases, the categories may overlap.

Approximately 39 percent of the town's privately owned forest is enrolled in Chapter 61. This provision of state law, also known as the Forestland Act, allows for reduced property tax assessment in exchange for a commitment for maintaining land in active forestry use. Chapter 61 also grants the Town the right of first refusal to purchase land enrolled in the program at its fair market value when it is sold for or converted to residential, commercial or industrial purposes. To qualify for Chapter 61, a landowner must have at least 10 acres of contiguous forestland and a 10-year forest management plan. Property taxes are assessed at valuations based on forest production purposes, as determined by the Farmland Valuation Advisory Committee. If the land is sold for or converted to an ineligible use within ten years the owner must notify the Town, triggering a 120-day right of first refusal period, and must pay the higher of either a Conveyance Tax or a Roll-Back tax (but not both). The Conveyance Tax is a percentage of the sale price of the property or a percentage of the land value in the case of a conversion of use. No Conveyance tax is assessed if the land leaves the Chapter program at the end of the enrollment period and there is no conversion or change of use from forestry. In addition, there is no penalty if the land leaves the program and is then converted to a use covered in Chapter 61A (agriculture) or 61B (open space and recreation). Rollback taxes are the amount of the difference between what the landowner paid in taxes under Chapter 61 and what would have been paid over the last five years had the land been paid had the land been taxed at its fair market value, plus 5% interest. (Mt. Grace Land Conservation Trust, 2007).

Commercial harvest of forest products is subject to the Massachusetts Forest Cutting Practices Act. Landowners who harvest 25,000 board feet of timber or more from forestland at any one time must file a "forest cutting plan," unless trees are cut for conversion to another land use such as agriculture. The plan is reviewed and approved by the Department of Conservation and Recreation (DCR). DCR publishes a "Best

Management Practices" manual for timber harvesting that is designed to help landowners prevent erosion and protect wetlands and water bodies and the animals that rely on wetland habitat during a timber harvest. Local conservation commissions receive a copy of all forest cutting plans, which is one way that a town can monitor use and management of privately owned forest land.

An analysis of records on file in the Montague Planning & Conservation Department Office indicates that approximately 1,689 thousand board feet of lumber has been harvested subject to forest cutting plans between 1996 and 2002. Of this total, approximately 60 percent was white pine, followed by red oak (11.8 percent), hemlock (7.65 percent), pitch pine (4.46 percent) and red maple (3.33 percent). In addition, 211 cords of hardwood were harvested for fuelwood, and 326 cords of softwood for pulp during this period. Between 2005 and 2010, 790 board feet of lumber was harvested, and 443 cords of wood were harvested for fuel. Due to the fact that records are incomplete, and there are many timber harvests not subject to forest cutting plans, these statistics should not be considered to be definitive, but they are probably a good indication of the species of timber being cut in town.

Forest residences consist of homes on large forested lots. These homes are principally located east of Route 63 on Chestnut Hill Road, East Chestnut Hill Road, Dry Hill Road and Wendell Road, with a few scattered residences in the Taylor Hill area, East Mineral Hill and Greenfield Road. Most of the owners in this category fit the profile described by the NIPF survey. Many are senior citizens who have inherited land and/or owned and managed it for its natural values for decades. It is important to note that these properties may be at risk for development if the heirs of the current owners are not interested in living on the land and maintaining it as forest. The town should consider offering resources on estate planning for owners of forestland who wish to conserve it.

Another type of forest residence is wealthier, middle-aged new residents of town who have built very large homes on secluded forest lots. This may be a growing trend with mixed implications for forest conservation. These residences are being built at very low densities. Owners of these homes value the aesthetic beauty and privacy of the forest,

and can be expected to support conservation efforts. On the other hand, this type of development has the potential to fragment the town's large blocks of forestland.

The second category of private owners of forest is farmers whose land includes working woodlots. Most of the active farms in Montague include land in this category. Farm woodlots produce income outside of the growing season from sales of cordwood, and in some case, maple syrup. With few exceptions, land in this category has been in the same families for generations. However, most of the current owners are over the age of fifty and are starting to scale back their agricultural operations. Many do not have heirs that intend to continue farming. These lands may be at risk of development when the current owners retire or pass away. The Town should consider offering assistance to farm woodlot owners who wish to plan for conservation of their land.

There are some large forest properties in Montague owned by non-residents of Town. This land is not enrolled in Chapter 61, and the Town has no information on the plans of these absentee owners. There are a few large tracts of forestland in Montague that are owned by people who live elsewhere, and are managed for cordwood and timber. This land is enrolled in Chapter 61.

The Town should consider zoning changes to allow for clustering of homes on smaller lots, in exchange for permanent preservation of the remaining land through conservation restrictions.

Finally, there are a number of large forest properties in Town that are being held for their development value. Land in this category includes properties in the Wills Hill region of Hillside Road and Millers Falls Road and land between Greenfield Road and Turners Falls Road north of Hatchery Road. On the east side of Route 63, a tract of approximately 100 acres between East and West Chestnut Hill Roads on the border with Leverett and a 100-acre property off South Prospect Street and Grout Circle in Millers Falls were recently purchased for development. Large-lot zoning in the eastern half of town has the potential to create forest sprawl if these parcels are developed at full density. The Town should consider zoning changes to allow for clustering of homes on smaller lots, in exchange for permanent preservation of the remaining land through conservation restrictions. Such "conservation subdivisions" could help protect large blocks of forestland. Developments should be designed so that protected land abuts land that is already conserved and in public ownership.

D.2 Shade Trees

Public shade trees live along Montague's roads and in its villages, parks, and cemeteries. These trees promote both environmental quality and quality of life for residents. In downtown Turners Falls, Cherry and Apple trees were planted along Avenue A as part of streetscape improvements in the 1980s**.** These ornamental trees make the downtown more attractive to residents and visitors, helping to support the local shops and restaurants

by creating a vibrant urban space. The street trees provide shade in the summer months, and act as a beautiful backdrop for the annual Arts and Bloom open studios and walking tour in the spring. Streetscape improvements in Millers Falls, completed in 2006, included the addition of new street trees as well. These trees are maintained by the Department of Public Works**.**

The Town of Montague owns public parks in Turners Falls, Millers Falls, Montague Center, and Lake Pleasant. Unity Park, Highland Park, Montague Center Park, and Rutter's Park are maintained by the Town and managed by the Town Parks & Recreation Department. Peskeomskut Park in Turners Falls is managed by the Board of Selectmen. The Town owns seven cemeteries which are maintained by the Cemetery Commission. A Downtown Streetscape Committee, made up of volunteers, maintains the planters along Avenue A in Turners Falls with assistance from the Department of Public Works.

D.3 Agricultural Land

According to MassGIS, in 2005, agricultural land in Montague comprised 8 percent of the Town's total land area. The U.S. Census of Agriculture does not provide municipal-level data for the amount of land in farms. An inventory of farmland conducted for Section 5 of this plan estimates that there are approximately 2736 acres of farmland in town, roughly 14 percent of the Town's land area. This figure includes agricultural land and farm woodlots enrolled in Chapter 61A, land protected by an Agricultural Preservation Restriction and/or a Conservation Restriction, and unprotected land in agricultural use. Montague's agricultural land is located primarily along the Connecticut River, Sawmill River and Greenfield Road, between East and West Mineral Roads, and along Routes 63 and 47.

Chapter 61A (the Farmland Assessment Act) is a reduced tax assessment program similar to Chapter 61, but is applied to land used primarily for agriculture or horticulture. To qualify for the program, the landowner must own a minimum of 5 acres; must have been devoted to agricultural or horticultural use for at least two prior years; and must demonstrate annual sales of farm products of $500 per acre for the first five acres, plus $5 per additional acre of farmland, and $0.50 per acre for forestland or wetland. Landowners must reapply annually to the Board of Assessors. Property taxes are assessed at valuations based on agricultural or horticultural purposes, as determined by the Farmland Valuation Advisory Committee. If a sale or change of use of the land occurs, the owner must notify the Town, triggering a 120-day period when the Town has the right of first refusal to purchase the property for fair market value. The owner may be subject to Conveyance or Rollback Taxes, depending on factors such as when the sale or conversion occurs and when it was purchased. An owner farming the land for more than ten years under Chapter 61A can sell the land at any time without paying the Conveyance Tax. No Rollback Tax is assessed if the land continues to meet the definitions of forest,

agriculture, horticulture or recreational land under Chapter 61, 61A, or 61B within five years after the land leaves the Chapter 61A program. (Mt. Grace Land Conservation Trust, 2007). There are approximately 983 acres enrolled in Chapter 61A in Montague.

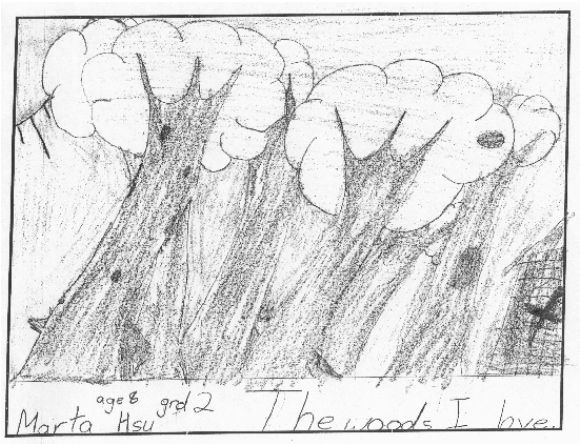
The Agricultural Preservation Restriction Program is a voluntary state program that permanently protects farmland from development by paying farmers the difference between the "fair market value" and the "agricultural value" of the land. Land enrolled in the program is privately owned and managed and remains on the tax rolls, but cannot be developed for houses or any other use that would interfere with its viability for agriculture. The Agricultural Preservation Restriction (APR) must be formally recorded at the Registry of Deeds. Generally, the APR is owned or "held" by the state Department of Food and Agriculture, but it may also be held by the Town, and/or a private land trust. Public access is generally not permitted to land protected by an APR, but specific provisions in the covenant are negotiated based on the landowner's wishes. Conservation Restrictions (CRs) are similar to APRs, except that they are usually held by the state Department of Conservation and Recreation or a land trust, they may include additional restrictions on the land, and more often permit public access. There are 1227 acres of farmland in Montague protected by an APR or CR.

Average farm size in Montague is approximately 114 acres; this is larger than the average farm size for Massachusetts (67 acres), and the average farm size for Franklin County (107 acres) (USDA National Agricultural Statistics Service, 2007 Census of Agriculture). Median farm size in Montague is approximately 80 acres.

Nineteen percent, or approximately 526 acres, of farmland in Montague is not protected from development. These lands may be particularly vulnerable to development if the heirs of the current owners are not interested in or able to continue farming. The Town should consider offering technical assistance to farmers who wish to plan for conservation of their land.

D.4 Rare, Threatened and Endangered Plant Species

The Natural Heritage and Endangered Species Program (NHESP) of the Massachusetts Division of Fish, Wildlife and Environmental Law Enforcement has designated several



"Priority Habitat" areas in the Town of Montague. A Priority Habitat is an area where plant and animal populations protected by the Massachusetts Endangered Species Act Regulations (MESA; 321 CMR 10.00) may occur. Rare species habitat is located in the following areas in Montague:

- Along the banks of the Connecticut and Millers Rivers;
- Most of the Montague Plains State Wildlife Management Area;
- A~~n~~ large area surrounding the confluence of Goddard Brook and the Sawmill River and continuing south to encompass Taylor Hill and its environs;
- An area on Route 63 south of the intersection of Sunderland Street and North Leverett Road (where Podlenski's Pond, Cranberry Pond Brook, and the Trout Hatchery is located) which extends south into Leverett;
- The Turners Falls Airport; and
- An area between Green Pond and Millers Falls (NHESP, 2008).

(See Open Space Map at end of Section 5).

The 13th edition of the Natural Heritage Atlas (effective October 1, 2008) displays the boundaries of the MESA-protected Priority Habitats and Estimated Habitats throughout the Commonwealth. Estimated Habitats are a sub-set of the Priority Habitats, and are based on the geographical extent of habitat of state-listed rare wetlands wildlife as codified under the Wetlands Protection Act, which does not protect plants. The 2008 Atlas is the product of a statewide revision of Priority Habitat and Estimated Habitats to reflect the latest state-listed species data, understanding of species biology and habitat requirements, and GIS technology and data. These revisions represent the last phase of implementing the revised Massachusetts Endangered Species Act (MESA) regulations, which took effect July 1, 2005. Maps are updated every two years by NHESP and it should be noted that the updated 2006 mapping resulted in a 30% increase in land designated as Priority Habitat in the Town of Montague. The designated Priority Habitats in Montague may change again when the 2010 revisions are complete, though they may be unlikely to change as much as when the 2005 MESA regulations were incorporated.

The Massachusetts Environmental Policy Act (MEPA; M.G.L. c.30, secs. 61-62H and regulations 301 CMR 11.00) provides the public an opportunity to review proposed projects for environmental impacts, including potential impacts to state-listed rare species. Projects resulting in a "take" of state-listed rare species and disturbing two or more acres of Priority Habitat of Rare Species may be required to file an Environmental Notification Form (ENF) with the MEPA office (301 CMR 11.03(2)).

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 Montague. These plants occur in some of the Priority Habitats identified above, including the Plains and floodplain forests. 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 their 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). Rare plant species in the Town of Montague are listed in Table 4.4.

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

Common Name	Scientific Name	State Status
Cat-Tail Sedge	*Carex typhina*	Threatened
Dwarf Scouring-Rush	*Equistum scirpoides*	Special Concern
Green Rock-Cress	*Arabis missouriensis*	Threatened
Houghton's Flatsedge	*Cyperus houghtonii*	Endangered
Many-Fruited False-Loosestrife	*Ludwigia polycarpa*	Endangered
Muskflower	*Mimulus moschatus*	Endangered
Mountain Alder	*Alnus viridis* Spp. *Crispa*	Threatened
Nantucket Shadbush	*Amelanchier nantucketensis*	Special Concern
Northeastern Bulrush	*Scirpus ancistrochaetus*	Endangered
Roundleaf Shadbush	*Amelanchier sanguinea*	Special Concern
Sandbar Cherry	*Prunus pumila var Depressa*	Threatened
Sandbar Willow	*Salix exigua*	Threatened
Tradescant's Aster	*Aster tradescantii*	Threatened
Tufted Hairgrass	*Deschampsia cespitosa ssp. glauca*	Endangered
Upland White Aster	*Solidago ptarmicoides*	Endangered

Source: Natural Heritage and Endangered Species Program, Mass. Division of Fisheries and Wildlife, 2009, http://www.mass.gov/dfwele/dfw/nhesp/nhesp.htm.

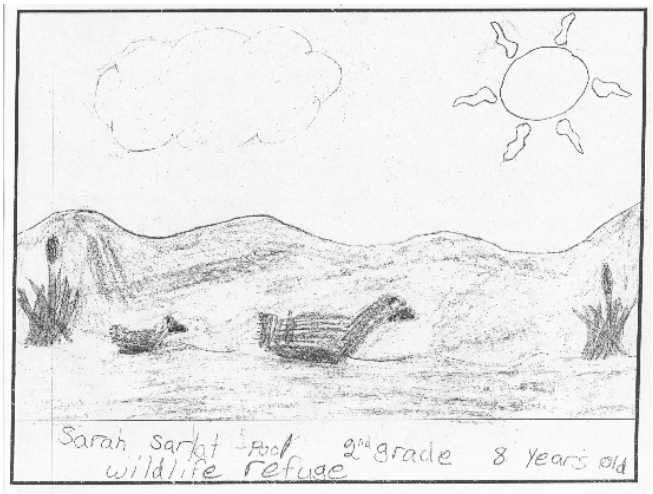
Farm fields are relatively rare in Montague and are valued for a multitude of reasons: economic, scenic beauty, wildlife habitat, and as a source of locally grown food. Forests, on the other hand, are widespread and easy to take for granted. However, it is important to remember that landscapes are dynamic. The forests that blanket 70 percent of Montague today were virtually absent at the beginning of the twentieth century. Everything that is discussed in this Open Space and Recreation Plan points to the importance of forests: they protect aquifers, streams and wildlife habitat; they clean the air and the water and they provide us with raw materials to support our community. Forested wetlands are unique sites where the greatest level of biodiversity occurs. In summary, all of Montague's vegetation can be considered part of an extensive life support system and should not be taken for granted.

E. FISHERIES AND WILDLIFE

Montague's forests, sand plains, rivers, wetlands and open farmland 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.

The BioMap Project of the Natural Heritage & Endangered Species Program 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 Habitat" and "Supporting Natural Landscape." Core Habitat areas include the most viable habitat for rare plants and animals and exemplary natural communities. Supporting Natural Landscape includes buffer areas around Core Habitat, large undeveloped patches of vegetation, large areas without roads and undeveloped watersheds. As previously noted, Montague spans two ecological regions—the Connecticut River Valley and the Worcester Monadnock Plateau. Core habitat designated by the BioMap is found in both regions—along the banks of the river and on the Montague Plains in the Connecticut River Valley, and large, unfragmented blocks of forest east of Route 63 in the Worcester Monadnock Plateau.



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

E.1.1 Connecticut River Valley

The Connecticut River Watershed is home to a diversity of animal life, including 59 species of mammals, 250 species of birds, 22 species of reptiles, 23 species of

amphibians, 142 species of fish, 1,500 species of invertebrates and 3,000 species of plants. The main stem of the Connecticut River includes riparian habitats for various fisheries. American shad, blueback herring, and shortnose sturgeon spawn within this stretch of the river (U.S. Fish & Wildlife Service, 1995).

A comprehensive inventory conducted by the Massachusetts Natural Heritage and Endangered Species Program in 1997 found that eight of the ten highest quality floodplain forests in the state are found along the Connecticut River (Barbour et al., 1998). High-quality floodplain forest is also found along the Sawmill River in Montague. Floodplain forest provides habitat for a wide variety of insects, which in turn attract warblers, thrushes and other songbirds (NHESP, BioMap, 2001). Vernal pools, a specialized habitat discussed separately below, are also found in floodplain forest.

Eight federally listed endangered or threatened species occur within the Connecticut River Watershed. Long-term efforts to restore two of the River's most well-known species that were long absent from the area—bald eagles and Atlantic salmon—are starting to bear fruit.

By the 1960s, bald eagles had virtually disappeared from the continental United States, their populations decimated by use of the pesticide DDT. Banning of DDT and efforts to restore eagles to their old habitat have been very successful. Bald eagles now nest in dead trees along the Connecticut, and can frequently be seen fishing in the river. The neighboring town of Gill, in fact, may be home to the Nation's most famous pair of our national birds—for the past several years, Northeast Utilities has maintained a live "Eagle Cam" focused on nesting bald eagles in Barton's Cove in the Spring. Live images of the eagles can be viewed on Montague's cable access television station, and on the utility's web site at www.nu.com. In a successful year, viewers can watch the eagles warming and feeding their chicks. This program has helped to publicize the importance of habitat and interest in the wildlife of the Connecticut River Valley, and should be continued.

Atlantic salmon are believed to have been abundant in the Connecticut River prior to European settlement. Salmon are anadromous fish, meaning that hatch in fresh water, travel to the ocean for most of their adult life, and return to fresh water to spawn.

Construction of the dam at Turners Falls in 1798 blocked the passage of the salmon, and the species disappeared from the Connecticut shortly thereafter. The interagency Atlantic Salmon Restoration Program began its effort to restore salmon to the River in 1967. Schoolchildren in Montague and surrounding communities participate in this effort by raising juvenile salmon from eggs, and releasing them in local streams to begin their journey. Success of the restoration effort has been mixed. Between 1998 and 2000, a total of only 531 salmon traveled back to the river from the ocean (Pioneer Valley Planning Commission, 2001). However, at least one salmon has been observed in the Sawmill River, indicating that there is still viable habitat for this species in the area (John O'Leary, personal communication).

E.1.2 Montague Plains

The Montague Plains falls within the Connecticut River Valley ecological region, but its drought-prone soils and pitch pine-scrub oak communities are dramatically different from the lush floodplain forests along the banks of the Connecticut and its tributaries.
The rare vegetation of the Plains, discussed in the previous section, provides habitat for a variety of species, including several rare moths (see below). Little is known about these species beyond their affinity for pine barrens habitat, and their larval diet based on scrub oak leaves, pine and other plans found in PPSO communities (Barbour et al., 1998). These rare populations can be severely threatened by aerial spraying for pests such as gypsy moths and disease-bearing mosquitoes. The impact of herbicides on the rare plants and moths of the Plains has not been studied. Use of chemicals with the potential to impact wildlife habitat on the Plains should be extremely limited.

E.1.3 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 (NHESP, 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 Town of Montague has a total of ten certified vernal pools.

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 Montague, NHESP has identified more than 60 potential vernal pools. "Hot spots" of likely locations of vernal pools include the floodplain forest along the Sawmill River west of Meadow Road, and in forested areas east of Route 63 (NHESP, Spring 2001).

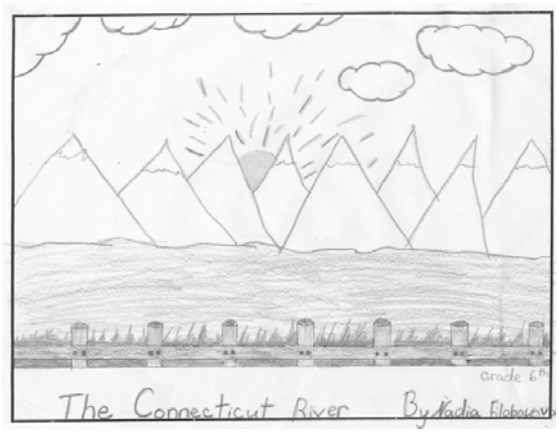
In Spring 2002, the Town worked with Antioch graduate student and resident Annemarie Averill to identify owners of land with potential vernal pools mapped by the NHESP. Averill visited approximately a dozen potential pools between March and May of 2002. Several landowners attended the vernal pool workshop held in April 2002.

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. Certified vernal pools are protected by the Massachusetts Wetlands Protection Act and by additional state and federal regulations. According to the Natural Heritage Atlas (13th Edition, 2008), the Town of Montague has a total of ten certified vernal pools. See the *Water Resources Map* at the end of this section for the locations of these certified vernal pools.

Vernal pools are magical places in early spring. They are easiest to find by listening for the mating choruses of frogs and toads. The pools teem with life, and are wonderful places to teach children about the natural world. The Town should continue its efforts to identify vernal pools, provide landowners with information on their ecological importance, and encourage certification to protect these unique ecosystems.

E.1.4 Upland Forest

As discussed previously, Montague's extensive forests east of Route 63 provide habitat for a wide range of wildlife species. Interior forest, which when combined with forest edges, fields, early successional tree growth, wetlands and vegetated river banks, helps maximize regional biodiversity. Large contiguous patches provide more deep interior forest for species that require areas without excessive disturbances from humans, and that rely on other interior species for food. For example, bobcat are not normally observed along the field edges. The interior areas provide habitat for specialist predators and for mammals that require larger home



ranges. Wetland areas within interior forest provide habitat for increasing populations of moose.

E.2 Corridors for Wildlife Migration

Many species of wildlife in Montague 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 that is experiencing development pressure to ensure that animals have the ability to travel across vegetated areas between large blocks of habitat.

Montague is located within several regional belts of protected open space that contribute to the value of protected land in Town. One of the largest Core Habitat areas identified by the BioMap is land within the Quabbin Watershed. West of the Quabbin are three smaller but significant Core Habitats areas around the Holyoke Range, Mt. Toby and the Montague Plains. There is only a third of a mile gap between the Quabbin Watershed and the Mt. Toby Core Habitat via a Core Habitat area and Supporting Natural Landscape in Shutesbury. In addition, Supporting Natural Landscapes in Shutesbury and Wendell are connected to the Montague Plains Core Habitat via the Montague Wildlife Management Area parcels and the Turners Falls Fire District lands in the Dry Hill area. Wildlife probably moves from and into the Quabbin area by way of sparsely or undeveloped open space in Montague and abutting towns, crossing roads when necessary. Ensuring that these forested areas between habitats are protected from development would support the viability of rare plant and animal populations and facilitate the movement of some species between core habitat areas (*See Open Space Map at the end of Section 5*).

Connections between bodies of water and sub-watersheds are also important for wildlife and fish. 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 Montague.

E.3 Rare, Threatened and Endangered Wildlife Species

NHESP has identified 176 wildlife species as rare in the Commonwealth, and a number of rare wildlife species have been documented in the Town of Montague. NHESP has mapped several "Priority Habitats of Rare Species" and "Estimated Habitats of Rare Wildlife" in the Town of Montague. (These areas are identified above in Section D.3: Rare, Threatened and Endangered Plant Species; see also the Open Space Map at the end of Section 5.)

These habitats provide for wildlife species that are endangered, threatened and of special concern. Montague's rare, threatened and endangered wildlife species are listed in Table 4-5.

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

Common Name	Scientific Name	State Status
Invertebrates		
Arrow Clubtail	*Stylurus spiniceps*	Threatened
Brook Snaketail (dragonfly)	*Ophiogomphus aspersus*	Special Concern
Barrens Buckmoth (moth)	*Hemileuca maia*	Special Concern
Barrens Metarranthis Moth	*Metarranthis apiciaria*	Endangered
Cobra Clubtail (dragonfly)	*Gomphus vastus*	Special Concern
Cobblestone Tiger Beetle	*Cicindela marginipennis*	Endangered
Creeper (mussel)	*Strophitus undulatus*	Special Concern
Frosted Elfin (butterfly/moth)	*Callophrys irus*	Special Concern
Intricate Fairy Shrimp	*Eubranchipus intricatus*	Special Concern
New Jersey Tea Inchworm	*Apodrepanulatrix liberaria*	Endangered
Oak Hairstreak (butterfly/moth)	*Satyrium favonius*	Special Concern
Pine Barrens Itame (moth)	*Itame* spp..	Special Concern
Pine Barrens Zale (moth)	*Zale sp. 1 nr. lunifera*	Special Concern
Pine Barrens Zanclognatha (moth)	*Zanclogantha martha*	Threatened
Pink Sallow (moth)	*Psectraglaea carnosa*	Special Concern
Riverine Clubtail	*Stylurus amnicola*	Endangered
Sandplain Euchlaena (butterfly/moth)	*Euchlaena madusaria*	Special Concern
Slender Clearwing Sphinx Moth	*Hemaris gracilis*	Special Concern
Spatterdock Darner (dragonfly)	*Rhionaeschna mutata*	Special Concern
Spine-crowned Clubtail (dragonfly)	*Gomphus abbreviatus*	Endangered
Stygian Shadowdragon	*Neurocordulia yamaskanensis*	Special Concern
Triangle Floater (mussel)	*Alasmidonta undulata*	Special Concern
Tule Bluet dragonfly	*Enallagma carunculatum*	Special Concern
Yellow Lampmussel	*Lampsilis cariosa*	Endangered
Zebra Clubtail (dragonfly)	*Stylurus scudderi*	Special Concern
Vertebrates		
Bald Eagle	*Haliaeetus leucocephalus*	Endangered
Blue-Spotted Salamander	*Ambystoma laterale*	Special Concern

Common Name	Scientific Name	State Status
Eastern Box Turtle	*Terrapene carolina*	Special Concern
Grasshopper Sparrow	*Ammodramus savannarum*	Threatened
Jefferson Salamander	*Ambystoma jeffersonianum*	Special Concern
Longnose Sucker	*Catostomus catostomus*	Special Concern
Shortnose Sturgeon	*Acipenser brevirostrum*	Endangered
Vesper Sparrow	*Pooecetes gramineus*	Threatened
Water Shrew	*Sorex palustris*	Special Concern
Wood Turtle	*Clemmys insculpta*	Special Concern

Source: Natural Heritage and Endangered Species Program, Mass. Division of Fisheries and Wildlife, 2009, http://www.mass.gov/dfwele/dfw/nhesp/nhesp.htm.

The good news is that several species that were once extirpated from Montague thrive here today, including the bald eagle, wild turkey, beaver and moose. With conservation of remaining wildlife and restoration efforts, Montague's diversity of wildlife can be maintained, and populations of rare species stabilized, and hopefully increased over time.

E.4 Conserving Montague's Biodiversity

There are two concepts that can be used to help explain Montague's options for pursuing the conservation of the Town's biodiversity: island biogeography and landscape ecology. 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, 1995). This model is reflected in Montague in that the five villages as well as the main highways concentrate development, agriculture is concentrated where prime farmland soils occur along river corridors, and large blocks of forest remain intact. Montague's 1999 Comprehensive Plan recognizes these historical patterns of land use in town, and recommends that they be maintained.

Individual animals move within a landscape. When and where wildlife and fish species move is not well understood by wildlife biologists. However, we do know that animals ignore 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 land within Montague 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 that conflicts between the needs of wildlife and residents will become more common.

How will the Town of Montague determine the most appropriate conservation strategies for wildlife habitat? There are several paths to follow in conserving the health of wildlife populations. One is to protect and, where necessary, restore 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 and restore 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 Montague 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 (*see Open Space Map*); the continued protection and linkage of large blocks of contiguous forestland; the retention of early successional habitats like fields and grasslands; the protection of vernal pools, wetlands, and riparian corridors that sustain the greatest diversity of life in Montague, and the restoration of resources damaged by use, development or natural events, such as eroded riverbanks.

F. FAVORITE PLACES: SCENIC RESOURCES AND UNIQUE ENVIRONMENTS

The characteristics that allow a stranger to distinguish Montague 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 Montague residents would agree represent the essence of Montague's character.

In many ways the history of Montague—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. Some of the town's most scenic views include old farm buildings, fields cleared long ago and undeveloped hillsides. Historic homes, meeting halls and churches provide us with a sense of our culture and the work of our ancestors and predecessors.

The unique environments in Montague 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 location relative to other landscape features. The purpose of an

inventory of scenic resources and unique natural environments in Montague 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. The following inventory is based 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 criteria including area of significance, period of significance and historical integrity. 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).

Table 4-6 lists significant scenic, historic, recreational and ecological landscapes in Montague. This table is just one way to express the multitude of special places in the town. Recognizing that individual residents have their own favorite places in Montague, the Open Space and Recreation Plan committee asked schoolchildren to draw pictures of their favorite place in Town. Selections from these drawings are printed on the front and back covers of the plan, on chapter covers, and interspersed throughout the text.

Table 4-6: Scenic Resources and Unique Environments

MAP #	SCENIC RESOURCES	ECOLOGICAL/ GEOLOGICAL RESOURCES	RECREATIONAL VALUE	HISTORICAL VALUE
	Stream Corridors			
1	Connecticut River	Yes	Yes	Yes
2	Millers River	Yes	Yes	Yes
3	Sawmill River	Yes	Yes	Yes
4	Pond Brook	Yes	Yes	
5	Goddard Brook	Yes	Yes	
6	Spaulding Brook	Yes	Yes	Yes

MAP #	SCENIC RESOURCES	ECOLOGICAL/ GEOLOGICAL RESOURCES	RECREATIONAL VALUE	HISTORICAL VALUE
7	Chestnut Hill Brook	Yes		
8	Cranberry Pond Brook	Very High-Floodplain Forest		
9	Hannegan Brook	Very High-Recharge Area for Lake Pleasant		
10	Lyons Brook	Yes	Yes-Falls	
Ponds and Lakes				
11	Lake Pleasant	Yes		Yes
12	Green Pond	Yes		Yes
13	Podlenski's Pond/MassWildlife	Yes		
Wetlands				
14	Catamount Swamp (shared with Wendell)	Yes		
15	Beaver Pond (shared with Leverett)			
16	Plains Kettle holes	Yes		
17	Vernal Pools	Yes		
Recreation Areas				
18	Montague State Forest	Yes	Yes	Yes
19	Montague Wildlife Management Area	Yes	Yes	
20	Montague Plains Wildlife Management Area	Yes	Yes	
Historical Agricultural Landscapes				
21	Connecticut River Scenic Farm Byway along Route 63			Yes
22	Along Greenfield Road			Yes
22	Along Chestnut Hill Road			Yes
24	Along Chestnut Hill Loop			Yes
25	Along Ferry and Meadow Roads	Yes		Yes
Historical Community Development Landscape				
26	Montague Center; Village Center			Yes
Historical Recreation Landscape				
27	Cabot Camp, East Mineral Road		Yes	Yes
28	Turners Falls Road and Gun Club, Norman Circle		Yes	Yes
Historical Religious Landscape				
29	Lake Pleasant Area, Lake Pleasant Road, Late Industrial early recreational cottage settlement, spiritualist camp			Yes
Historical Conservation/Science/ Industrial Landscape				
30	State Fish Hatchery, Hatchery Road	Yes	Yes	Yes
31	Turners Falls Water Works, Lake Pleasant, Green Pond Road			Yes
32	Turners Falls industrial settlement,			Yes

MAP #	SCENIC RESOURCES	ECOLOGICAL/ GEOLOGICAL RESOURCES	RECREATIONAL VALUE	HISTORICAL VALUE
	Avenue A and Route 2A			
	Unusual Geologic Features			
33	Deep Hole	Yes	Yes	
34	King Phillip's Abyss	Yes	Yes	
35	Bartons Cove	Yes	Yes	
36	Rock Falls	Yes		
	Unusual Natural Communities			
20	Montague Plains Pitch Pine /Scrub Oak Barrens	Yes	Yes	Yes
	Scenic Views			
37	South from CT River			
38	South from East Taylor Rd.			
39	West from Montague WMA			
40	West from Dry Hill Rd.			
41	Northeast from Lake Pleasant Rd.			
42	Northeast from East Mineral Hill			
43	Northeast from Carlisle Avenue			
44	East from Unity Park			
45	South from the Montague/Gill Bridge			
46	Northeast from Highland Park			
47	Mason's Wildlife Viewing Area			
48	Industrial Park Pedestrian Bridge Falls Viewing Area			
	Other Recreational Resources			
49	North Street Conservation Area	Yes	Yes	
50	Poplar Street Canoe Access		Yes	
51	Unity Park			
52	Highland Park			
53	Norma's Park			
54	Rutter's Park			
55	Montague Center Park			
56	Canalside Trail Bike Path	Yes	Yes	Yes
57	Great Falls Discovery Center	Yes	Yes	Yes
58	Turners Falls Fishway	Yes	Yes	

Note: TFFD= Turners Falls Fire District; WMA=Wildlife Management Area

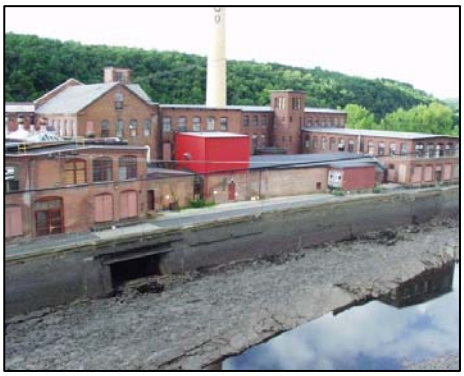
G. ENVIRONMENTAL CHALLENGES

Residents canvassed at public meetings held in each of Montague's five villages in the Fall of 2002 identified a variety of challenges associated with natural resources in Montague. The most frequently-mentioned problems included:

- Urban blight in Turners Falls and Millers Falls;

- Lack of access to recreational opportunities offered by the Connecticut River, especially swimming; and
- Management of the Montague Plains.

G.1. Urban Blight



Urban blight and the need to improve the health of downtown areas were identified as one of four major themes of Montague's 1999 Comprehensive Plan. In a 1998 survey of elected Town Meeting Members, more than half of the respondents identified the entire downtown area of Turners Falls or specific locations in the downtown as areas that they would be ashamed to show visitors.

At the meetings held in each of the villages for the Open Space and Recreation Plan in fall 2002, Montague residents made it clear that they view the rundown condition of downtown areas in Turners Falls and Millers Falls as a serious problem for the Town. Poorly maintained residential buildings and storefronts, drug-related activities and the unsightly condition of the Power Canal were identified as specific concerns in Turners Falls. Dilapidated buildings, trash dumping in the Millers River, a neglected bridge, and the poor condition of the rail yard and the sidewalks in Millers Falls are reasons why residents feel their immediate built environments require attention. While fewer residents addressed problems in Montague City, the "Rod Shop" area is also clearly in need of revitalization and redevelopment.

The Town of Montague has an active downtown revitalization program to address the problem of urban blight in downtown areas. The Crocker Bank and Cutlery Buildings in downtown Turners Falls were fully renovated in 2001-2002, and renovation of the historic Colle Opera House was completed in 2003. Efforts have also been undertaken in recent years to reconstruct the streetscape in downtown Millers Falls and to restore privately-owned façades in Turners Falls and Millers Falls. Town Meeting has approved zoning changes for both villages designed to encourage pedestrian-oriented commercial development.

Cleanup and redevelopment of abandoned industrial sites known as "brownfields" is an important element of restoring economic viability and environmental health of the town's urban villages. The Town has worked with the Franklin Regional Council of Governments to assess the extent of pollution at several old industrial sites in downtown Turners Falls.

The success of efforts to address urban blight and promote revitalization in urban areas is critical to the future of the town's open space and natural resources. Montague's villages have many natural and cultural resources that make them attractive places to live: historic buildings, a mix of residential and commercial spaces, parks, proximity to rivers and

forests. Improving infrastructure and the quality of life in the villages can help draw people to these historic settlements, and possibly reduce some of the pressure to develop more rural areas of town.

G.2. Lack of Safe Swimming Areas

The Connecticut River surrounds Montague to the north and west and represents the single largest body of water in Montague. Unfortunately, while there are many areas in Town that look like good places to swim, legal and safety considerations put swimmers at risk of breaking the law or serious injury at every one of them. The lack of a safe public swimming area is a very common complaint among Montague residents.

In 1998, two teenage boys drowned while swimming in the "Rock Dam" area of the Connecticut River in Montague City. The fact that the boys had been warned repeatedly and recently about the extreme danger of swimming in that specific location sent a message to many Town residents that the only way to stop teens from swimming in dangerous locations would be to provide them with a safe place to swim. Toward this end, the Board of Selectmen appointed a committee of residents, town employees and a representative of Northeast Utilities to investigate options for public swimming areas.

The group evaluated the potential of virtually every water body in town. Possibilities discussed included:

- Three sites along the Connecticut River:
  - The grassy area above southeast of the old bridge abutment across from Unity Park
  - The Turners Falls Rod & Gun Club
  - The "Rock Dam" in Cabot Woods
- Lake Pleasant
- Green Pond
- The Sawmill River where it runs through the North Street Wildlife Management Area in Montague Center
- Clapp's Pond north of Swamp Road
- The existing non-functional pool at the Thomas Memorial Golf Course

The "Rock Dam" site was unanimously rejected as being unsafe. There was strong interest in the other Connecticut River sites, both of which are owned by Northeast Utilities (now SUEZ Energy). The company does not permit swimming on its property, maintaining that unpredictable changes in volume and flow along the entire reach of the river in Montague make it unsafe for swimmers. The Turners Falls Rod & Gun club leases its site from SUEZ Energy and is not interested in opening the property up for public swimming even if the company would permit it.

There was also very strong interest in Lake Pleasant and Green Pond, both of which are owned by the Turners Falls Water District. There was consensus that Lake Pleasant

would be an ideal public swimming area; and many older residents of the Town have fond memories of swimming in Green Pond. The Lake was the Town's main source of drinking water until 1994 when changes in drinking water regulations required filtering. There is a hydrologic connection between the lake and the pond, and both are currently designated as backup drinking water supplies. State regulations unequivocally prohibit swimming.

The group investigated the possibility of abandoning Lake Pleasant and/or Green Pond as drinking water supplies so that they could be used for swimming. Massachusetts regulations state that:

> *No supplier of water may remove a public water system source from service or abandon a public water system source without the prior written approval of the Department [of Environmental Protection]. The Department will not approve any such action unless the supplier of water demonstrates to the Department's satisfaction that such action will have no significant adverse impact upon the supplier of water's present and future ability to provide continuous adequate service to consumers under routine and emergency operating conditions, including emergencies concerning the contamination of sources of supply, failure of the distribution system and shortage of supply.* [310 CMR 22.25]

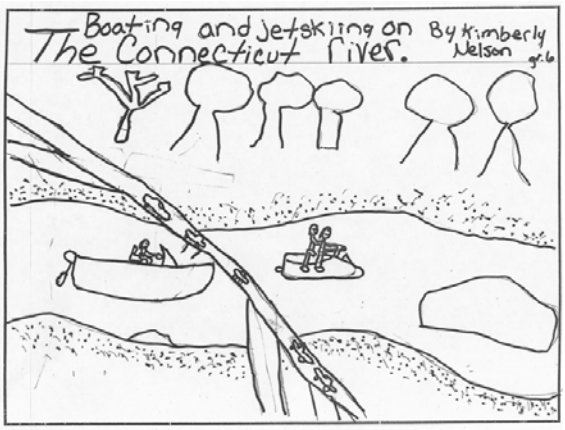
In addition, a 2/3 vote of the Massachusetts Legislature may be required to transfer or change the use of land acquired for water supply purposes. The Turners Falls Fire District believes that filtration of Lake Pleasant will be the most cost-effective and practical option to meet the Town's future water needs. The Water Commissioners have been consistently opposed to the abandonment of either the lake or the pond as water supplies for the sake of creating a swimming area.

The Sawmill River sites in the North Street Wildlife Management Area are owned by the state Division of Fish, Wildlife and Environmental Law Enforcement, which prohibits swimming on its property.

Clapp's Pond is privately owned and the owners are not interested in selling the property to the Town. Creation of a public swimming area at that site would likely require the use of eminent domain.

With no consensus on whether, where and how to create a safe outdoor swimming facility in the Town of Montague, residents continue to swim illegally, and to rely on swimming facilities in other towns, including the Greenfield municipal swimming area on the Green River, Lake Wyola in Shutesbury and Laurel Lake in Erving. The Montague Parks & Recreation Department provides weekly trips to Laurel Lake through its Summer Playground Program (ages 5 - 12). Children must be registered through this program to take advantage of this opportunity. A better solution is still needed for teens and adults, as well as low-income residents who cannot pay the fees for the trips or afford to travel out of town on their own.

Limited access for boating is another frequent complaint of residents. The only public boat access in town is the Poplar Street canoe access, owned by Northeast Utilities and leased by the Department of Conservation and Recreation (DCR). This site is too steep for many seniors and residents who enjoy canoeing but have limited mobility. Given the generally steep topography along the banks of the Connecticut River in Montague, it is not clear where an alternative access point could be located.



G.3 Montague Plains

Guiding the future of the Montague Plains was another one of the four major planning challenges identified in the 1999 Comprehensive Plan. Residences appreciate trails and wildlife habitat on the Montague Plains. More than 48 percent of residents surveyed for the Open Space & Recreation Plan in 2009 take advantage of the recreational opportunities offered by the Plains. Problems associated with the Plains include rampant illegal dumping, noise and erosion caused by all-terrain vehicles, and the lack of parking. Both major landowners on the Plains—the Massachusetts Department of Fish and Wildlife and Suez Energy—prohibit use of their property by ATVs. There is also some concern about safety issues caused by hunting in proximity to residences.

More than 48% of residents surveyed for the Open Space & Recreation Plan in 2009 take advantage of the recreational opportunities offered by the Plains.

Since a large section of the Plains was purchased by the Commonwealth in 1999, the state has made an effort to discourage illegal dumping and ATV use by blocking roads. However, due to the size of the Plains Wildlife Management Area and state budget cuts, it is not possible for the state to monitor the entire area effectively. One strategy to address the persistent problems in the area would be to form a "Friends of the Montague

Plains" group to do regular patrols, organize cleanups, volunteer to help with restoration, and educate other residents about the unique ecology and beauty of the Plains.

G.4 Other Environmental Challenges

Wildlife Habitat

Residents who participated in the Open Space & Recreation Planning process value the abundance of wildlife habitat in Montague and are concerned about the threats posed by development. Specific areas of concern identified during the village meetings include the vernal pools north of Green Pond and the forested area east of Route 63.

Dry Hill

Residents identified several problems in the Dry Hill region of Town. There is some concern that recent residential development at higher altitudes is causing erosion. Above the existing houses, the road is in extremely poor condition. It is severely eroded and impassible in sections. Access to the historic town cemetery at the north end of the road needs to be restored. The Town should carefully consider the future of Dry Hill Road. Continued development in this area has the potential to fragment large blocks of forest and may result in costly expenditures on infrastructure and road maintenance. If repair of the deteriorated sections of the road to standards required for general use is determined to be too costly, the Town should consider stabilizing eroding areas and formally abandoning the road.

Sawmill River Watershed

As discussed previously, erosion and sedimentation, invasive plant species, and barriers to fish passage are important problems in the Sawmill River Watershed.

Connecticut River

Streambank erosion is also an important ongoing issue for the Connecticut River, especially in the "Turners Falls Pool," which encompasses the length of the river from the Northfield Mountain Pumped Storage Facility to the Turners Falls Dam. Erosion is discussed in more detail in Section 7-Analysis of Needs.

Greenfield Road

Pavement on Greenfield Road is badly deteriorated, and drainage in many areas is inadequate. Plans for reconstruction of the road, including the addition of bicycle lanes, have been in progress for nearly twenty years. While there is consensus that the road needs improvement, proposals to widen it have been controversial. Some residents favor a wider road, which they believe will be safer for cars and trucks, farm equipment, bicycles and pedestrians. Others oppose widening, on the basis that it will result in the loss of trees, encroachment on wetland buffer areas and negative impacts on farmland. A committee appointed by the Selectmen to review the issue in 2001 and a public meeting facilitated by State Representative Steve Kulik in May of that year failed to come to a consensus. As of the fall of 2009, design for the reconstruction of Greenfield Road is 75 percent complete. While the state has recently developed a policy of "context-sensitive" road design to protect and enhance community character and landscape, it is late in the process to make changes in the design for Greenfield Road.

Hatchery Road

The bridge that was removed on Greenfield Road near Hatchery Road is expected to be rebuilt as a bicycle bridge. Meanwhile, the area surrounding the former route continues to pose environmental challenges.

The "Burn Dump" off Turnpike Road

An abandoned dump site, located off Turnpike Road, still needs to be capped even though the landfill nearby was properly closed in the 1990s. The dump site is located upstream of a tributary to the Connecticut River. It is therefore important to monitor any water draining from this site for potential contaminants.

An abandoned dump site, located off Turnpike Road, still needs to be capped even though the landfill nearby was properly closed in the 1990s.

Illegal Dumping

Illegal dumping is a noted concern in some of Montague's most environmentally sensitive lands including the Montague Plains and on banks of the Connecticut and Millers Rivers. Typically, the sites are cleaned annually by the Connecticut River Watershed Council. These locations are mostly on public lands, but are owned by different entities. These lands require increased stewardship and management.

Hazardous Waste and Brownfield Sites

As defined by the U.S. Environmental Protection Agency (EPA), "brownfields" are properties that the expansion, redevelopment, or reuse of may be complicated by the actual presence or perceived potential presence of a hazardous substance, pollutant, or contaminant. Montague has been working with the Franklin Regional Council of Governments and property owners to assess the extent of contamination and promote industrial or commercial redevelopment of identified brownfield sites in Town. Table 4-7 lists the sites and the extent of the work that has been done thus far.

Table 4-7: Brownfield Sites in Montague

Property Name	Address	Further Action Required	No Further Action	Cleaned Up	Site Acreage
151 Third Street LLC	151 Third Street		1		0.36
31 Turnpike Road/Duda Property	31 Turnpike Road		1		0.34
Beauchesne Property	97 Main Street			1	0.37
Griswold Cotton Mill/ Railroad Salvage	11-15 Power Street	1			3.38
Strathmore Mill	20 Canal Road	1			2.05
Former Sweeny Ford/ Dubois Property	2 Third Street			1	0.41
15 Rod Shop Road	15 Rod Shop Road	1			1.50
25 Rod Shop Road	25 Rod Shop Road	1			0.42

Source: Franklin Regional Council of Governments Brownfields Program, January 2011.

In addition to the brownfields identified in Table 4-7, the Massachusetts Department of Environmental Protection (DEP) maintains a list of brownfield sites where known contamination has occurred. In Montague, 41 sites have been reported to the DEP as of January 2011, most of which have either been cleaned up or determined to pose no significant risk to public health.[1]

On July 12, 2010 DEP received notice from the Montague Board of Health of potential petroleum-contaminated soil at Parcel ID map 44 Lot 61 on Center Street in Montague - land known as Jiang farm. As described by Town of Montague officials, the property has been undeveloped for several years but was formerly utilized as a fueling station for buses. During recent excavation of soil at the site for the foundation of a barn, petroleum odors and stained soils were observed. The site has been subject to the release of oil/hazardous materials. The cleanup is governed by the M.G.L. c 21E and the Massachusetts Contingency Plan. The Town and property owners are currently seeking funding for the cleanup. The site is located in the Zone II aquifer of the Tolan well - the primary water source for the Turners Falls Water District.

Chronic Flooding

According to the 2004 Montague Local Natural Hazards Mitigation Plan, landowners on the northwest side of Montague City Road have experienced high groundwater and

[1] The full list of sites can be found by searching the DEP database at http://db.state.ma.us/dep/cleanup/sites/search.asp.

periodic flooding, which Town officials have attributed to seepage from the Turners Falls Power Canal. In response to concerns expressed by the Town, the Federal Energy Regulatory Commission commissioned a review of the structural integrity of the canal's left embankment in 2000, which determined that the integrity of the canal was sound and that the elevated groundwater levels and periodic flooding are likely due to the growing beaver population.

Forestry Issues

As discussed previously, the Montague Plains is the largest inland Pitch-Pine Scrub Oak (PPSO) community in southern New England, and the only large remnant of this ecosystem in the Connecticut River Valley. Pitch pine-scrub oak barrens are maintained by fire, which increases the rate of cycling of nutrients to the soil. Without disturbance by fire, tree-sized oaks and white pine can take over. According to Harvard Forest ecologist Glenn Motzkin, much of the area was cleared for agriculture between the mid 19th and early 20th centuries, resulting in differing vegetative communities between areas that had formerly been cleared and those that remained untouched. Motzkin recommends conserving areas of the Plains that have never been plowed and establishing connections between isolated unplowed areas to facilitate the spread of rare species. He believes that some areas of the Plains should be allowed to mature without disturbance, and that other areas be maintained by a variety of methods, including controlled fires, cutting of hardwoods and soil disturbance to promote pitch pine regeneration (Motzkin et al., 1999).

APPENDIX

INDIVIDUAL WILDLIFE SPECIES FOUND IN MONTAGUE

Individuals of the following species of wildlife have been observed in Montague at least once as members of migrating, wintering, or breeding populations. The lists are based on information presented in New England Wildlife: Management of Forested Habitats by R.M. DeGraaf et. al., published in 1992, which correlates wildlife with the major forest type in the area. The species are listed by category (amphibians, reptiles, birds, or mammals), then by type of habitat and by size of home range. This source has been augmented with information provided by members of the Montague Open Space Planning Committee and the general public. It is by no means a complete inventory of all species that may be found in Montague.

AMPHIBIANS

These species are found in forest, wetland, and open upland habitats and require a home range 1-10 acres in size:

Red-spotted Newt, Four-toed Salamander, Red-backed Salamander, Eastern American Toad, Northern Spring Peeper, Bullfrog, Green Frog, Wood Frog, Gray Tree Frog, Northern Leopard Frog, and Pickerel Frog.

This species is found in forest habitats and requires a home range 11-50 acres in size:

Spotted Salamander

REPTILES

These species are found in forest, wetland, and open upland habitats and require a home range 1-10 acres in size:

Wood Turtle, Spotted Turtle, Eastern Painted Turtle, Eastern Box Turtle, Eastern Garter Snake, Northern Redbelly Snake, Eastern Ribbon Snake, Northern Ribbon Snake, Eastern Hognose Snake, Northern Ring-neck Snake, Eastern Smooth Green Snake

This species is found in forest, wetland, and open upland habitats and requires a home range 11-50 acres in size:

Common Snapping Turtle

This species is found in forest, wetland, and open upland habitats and requires a home range >50 acres in size:

Eastern Milk Snake, Black Rat Snake

BIRDS

These species are found in forest /nonforested habitats and require a home range 1-10 acres in size:

Common Goldeneye, Hooded Merganser, Common Merganser, Ruby-throated Hummingbird, Yellow-bellied Sapsucker, Downy Woodpecker, Hairy Woodpecker, Northern Flicker, Eastern Wood-Pewee, Yellow-bellied Flycatcher, Willow Flycatcher, Least Flycatcher, Eastern Phoebe, Black-capped Chickadee, Tufted Titmouse, House Wren, Carolina Wren, Winter Wren, Golden Crowned Kinglet, Ruby Crowned Kinglet, Blue-gray Gnatcatcher, Eastern Bluebird, Bobolink, Veery, Hermit Thrush, Wood Thrush, American Robin, Brown Thrasher, Cedar Waxwing, Solitary Vireo, Yellow-throated Vireo, Warbling Vireo, Philadelphia Vireo, Red-eyed Vireo, Blue-winged Warbler, Tennessee Warbler, Nashville Warbler, Northern Parula, Yellow Warbler, Chestnut-sided Warbler, Black-throated Blue Warbler, Yellow-rumped Warbler, Black-throated Green Warbler, Blackburnian Warbler, Prairie Warbler, Blackpoll Warbler, Black-and-White Warbler, American Redstart, Worm-eating Warbler, Ovenbird, Louisiana Waterthrush, Northern Waterthrush, Song Sparrow, Lincoln Sparrow, White-throated Sparrow, Dark-eyed Junco, Common Grackle, Brown-headed Cowbird, Northern Oriole, Rufous-sided Towhee, Purple Finch, Scarlet Tanager, Northern Cardinal, Rose-breasted Grosbeak, Indigo Bunting, Great Crested Flycatcher, Eastern Kingbird, Tree Swallow, Blue Jay, Mourning Warbler, Common Yellowthroat, Wilson's Warbler, Canada Warbler, Chipping Sparrow, Field Sparrow, Grasshopper Sparrow, Henslow's Sparrow, American Goldfinch, Gray Catbird, Great Blue Heron, Green-backed Heron, Wood Duck, American Black Duck, Green-winged Teal, Mallard, Northern Pintail, Blue-winged Teal, Northern Shoveler, Common Egret, American Wigeon, Canvasback, Ring-necked Duck, American Goldfinch, Evening Grosbeak, American Redstart, Red Crossbill, European Starling, Sora, Killdeer, Spotted Sandpiper, Common Snipe,

Northern Mockingbird, Eastern Pheoebe, Mourning Dove, Pine Siskin, Northern Waterthrush, Virginia Rail, Eastern Kingbird, Pine Siskin.

These species are found in forest/nonforested habitats and require a home range 11-50 acres in size:

Ring-necked Pheasant, Ruffed Grouse, Upland Sandpiper, Black-billed Cuckoo, Yellow-billed Cuckoo, Common Nighthawk, Whip-poor-will, Northern Rough-winged Swallow, Bank Swallow, Barn Swallow, Purple Martin, Red-breasted Nuthatch, White-breasted Nuthatch, Brown Creeper, American Woodcock, Horned Lark, Muted Swan, Canada Goose.

These species are found in forest/nonforested habitats and require a home range >50 acres in size:

Turkey Vulture, Bald Eagle, Sharp-shinned Hawk, Cooper's Hawk, Northern Goshawk, Red-shouldered Hawk, Broad-winged Hawk, Red-tailed Hawk, Golden Eagle, American Kestral, Peregrine Falcon, Wild Turkey, Great Horned Owl, Eastern

Screech-Owl, Great Gray Owl, Barred Owl, Northern Saw-whet Owl, Pileated Woodpecker, American Crow, Common Raven, Chimney Swift, Belted Kingfisher, Northern Harrier.

These species are found in forest/nonforested habitats with unknown home ranges:
American Tree Sparrow, Bohemian Waxwing, Northern Shrike, Common Redpoll.

MAMMALS

These species are found in forest habitats and require a home range 1-10 acres in size:
Eastern Cottontail, Snowshoe Hare, Eastern Chipmunk, Gray Squirrel, Red Squirrel, Northern Flying Squirrel, Beaver, Deer Mouse, White-footed Mouse, Shrew, Northern Short-tailed Shrew, Hairy-tailed Mole, White-footed Mouse, Meadow Vole, Star-nosed mole, Eastern Mole, Muskrat.

These species are found in forest habitats and require a home range 11-50 acres in size:
Virginia Opossum, Porcupine, Ermine.

These species are found in forest habitats and require a home range >50 acres in size:
Woodchuck, Coyote, Red Fox, Grey Fox, Black Bear, Raccoon, Marten, Fisher, Striped Skunk, River Otter, Lynx, Bobcat, White-tailed Deer, Moose.

These species are found in forest/nonforested habitats with unknown home ranges:
Little Brown Myotis, Big Brown Bat.