

CHAPTER 3:

NATURAL RESOURCES—FRANKLIN COUNTY

Along the Route 112 Scenic Byway corridor lies a wealth of important natural resources. Among these resources are the Deerfield and North Rivers, as well as the East Branch of the North River and Clesson Brook, which contain important trout habitat; steep and rolling hills; fertile floodplains containing prime farmland soils; and thousands of acres of northern hardwood forests. The Byway also includes other geologic, flora and fauna, and water resources that help make the Route 112 Scenic Byway experience unique. The corridor's natural resources contribute to the dramatic scenery viewed from the Byway, and attract recreational tourists seeking to experience the corridor's wildness and its historic farm landscapes.

This chapter of the Corridor Management Plan provides a general inventory and overview of the Byway's natural resources, including its geology, soils, water resources, and rare species habitat areas. This inventory is not intended to provide an in-depth review or assessment of these resources. The purpose is to highlight the Byway's primary natural and environmental assets. The chapter also discusses potential issues that could affect the quality of these resources over time, especially if the Byway experiences an increase in tourist-related and vehicle traffic. The chapter closes with a series of recommendations for protecting, maintaining, and enhancing the Byway's natural resources.

Geologic Resources

The landscapes along the Route 112 Byway as we know them today are 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 region's water bodies, its soils and vegetation and its settlement patterns, both prior to and since colonial times. Understanding the region's current landscape requires a brief journey back in time and a review of some basic geological concepts.

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

The pressure of mountain building folded the earth, created faults, and produced the layers of metamorphosed rock typically found in New England. Collision stress also melted large areas of rock, which cooled and hardened into the granites that are found in some of the hill towns in Massachusetts today. Preceding the collisions, lines of

volcanoes sometimes formed, and Franklin County shows evidence of this in bands of dark rock schist metamorphosed from lava flows and volcanic ash.

Hundreds of millions of years ago, a great continent, known as 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. 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 in the 112 Scenic Byway corridor 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 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 Deerfield, Westfield and Farmington Rivers continued to meander eastward.

A long period of relative quiet in geologic terms followed the Dinosaur era. Then, as the Rocky Mountains were forming in the west eight million years ago, the eastern peneplain shifted upward a thousand feet. As a result of the new, steeper topography, stream flow accelerated, carving deep valleys into the plain. Today, the visible remnants of the peneplain are the area's schist-bearing hilltops, all at about the same 1,000-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* (Natural Resource Inventory for Franklin County, 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.

Soils

The characteristics of the different types of soils along the Route 112 Byway dictate the type of activity and development that can reasonably take place there. 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 such as soil structure, particle size, stoniness and depth of bedrock; drainage or permeability to water; depth to the water table and susceptibility to flooding; behavior or engineering properties; and biological characteristics such as presence of organic matter and fertility (Natural Resource Inventory for Franklin County, University of Massachusetts Cooperative Extension, May 1976).

Soils are classified and grouped into associations that are commonly found together. Soil associations found along the Route 112 Byway in Franklin County include the Merrimac-Ondawa, the Westminster-Colrain-Buckland, and the Westminster-Marlow, dark subsoil Peru associations. The Merrimac-Ondawa association soils are well-drained and somewhat excessively drained sandy and gravelly soils. These are typically found on terraces and floodplains in narrow, steep-sided valleys along major, fast-flowing mountain streams at elevations ranging from 500 to 1,000 feet above sea level. These soils are found along the rivers and streams that the Byway follows throughout the county. Activities that these soils are suitable for include dairying, production of maple products, recreation and tourism.

The soils of the Westminster-Colrain-Buckland association are shallow and well-drained and moderately well-drained. They tend to be forested, stony, rocky, and are found on rolling to steep hills and narrow valleys along fast flowing streams at elevations ranging from 300 to 1,300 feet above sea level. This association is located in the uplands above the streams and rivers all along the Byway. Westminster soils are shallow, are generally steep and have many rock ledges and outcrops. They develop in thin deposits of glacial till over bedrock. The bedrock is dark-gray schist interbedded with thin layers of limestone and many small veins of white quartzite. Colrain soils are deep and well-drained and are more gently sloping than the Westminster soils. Colrain soils are

limited in use due to their extreme stoniness and are found in loose to compact glacial till. Buckland soils are moderately well-drained and have a hard layer in the subsoil. They are considered wet and seepy because water moves slowly through the dense substratum. Minor soils in this association include well-drained Shelburne soils. The soils in this association support forestlands, dairy farms, apple orchards, maple products and Christmas trees.

The Westminster-Marlow, dark subsoil Peru association soils are shallow and deep, well-drained and moderately well-drained soils located on forested, rocky hills, high plateaus and narrow, steep-sided stream valleys at elevations ranging from 1,200 to 1,800 feet above sea level. These soils are located along the Byway primarily in a 4-mile section in the southern portion of Ashfield through which Route 112 runs. Activities that these soils are suitable for include dairy farming, growing potatoes, production of maple products, Christmas tree farming, and recreation.

The river and stream valleys along the Byway in Franklin County are formed of a mix of alluvial soils carried by erosion and flooding. Because of glacial activity, many small pockets of differing soil types are scattered throughout the region. These include pockets of Podunk, Agawam, and Sudbury sandy loams located near the Merrimac-Ondawa association soils described above. Many of these are considered to be prime farmland soils, unique farmland soils, or farmland of statewide importance.

The Natural Resources Conservation Service (NRCS), formerly known as the Soil Conservation Service of the U.S. Department of Agriculture, 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, National Soil Survey Handbook). Prime soils produce the highest yields with the fewest inputs, and farming in these areas results in the least damage to the environment. Prime farmland is located along the East Branch of the North River from the Vermont line to Colrain Center, from Foundry Village in Colrain down to Route 2 in Shelburne, and in Buckland along Clesson Brook to Buckland Four Corners. 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. Small pockets of unique farmland are located in Shelburne Falls and just south of Buckland Center in the Byway corridor. Additional farmland of statewide importance is located in small pockets spread all along the length of the Byway corridor. These farms are defined by the state and are nearly as productive as prime farmlands, capable of economically producing high yields if managed.

Prime farmland soils have contributed to the region's economic stability throughout its history. 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. It is important that

current farmland along the Route 112 Scenic Byway with prime farmland soils are identified and protected for future agricultural use.

The Agricultural Preservation Restriction (APR) program is one mechanism for protecting prime farmland from development. The APR Program is a statewide program run through the Massachusetts Division of Agricultural Resources that purchases the development rights of farmland on a voluntary basis. Under this program, landowners retain ownership of the land and the right to farm the land, while receiving payments for the difference between the “fair market value” and the “agricultural value” of their farmland in exchange for restricting the land from development in perpetuity. Another mechanism for protecting farmland is the statewide Chapter 61A program, which temporarily restricts development on farmland in the program in exchange for reduced property taxes. The APR and Chapter 61A programs, and the importance of protecting farmland from development, are discussed further in the Community Planning chapter.

Water Resources

The Route 112 Scenic Byway corridor contains a number of significant water resources that provide water for drinking and for energy production, and also offer communities a source of revenue by attracting outdoor recreational tourism. The Byway travels through both the Deerfield River and North River Watersheds, crossing these rivers and their tributaries several times and traveling alongside them for significant distances.



Going from north to south, the Byway first runs along the East Branch of the North River from the Vermont state line in Colrain to its confluence with the West Branch just south of Lyonsville, and then continues along the North River to its confluence with the Deerfield River just over the town line in Shelburne. The Byway follows the Deerfield River for just about a mile before crossing over it and entering Buckland. In Buckland, the Byway follows the Clesson Brook and the Smith Brook which flows north into it.

Most of the streams in the Route 112 Byway Corridor are identified as Living Waters Core Habitats by the Massachusetts Division of Fisheries and Wildlife’s Natural Heritage and Endangered Species Program. The goal of the Living Waters Project is to promote the strategic protection of freshwater biodiversity in Massachusetts. Core habitats represent the water bodies that should be the focus of proactive conservation activities in order to protect freshwater habitats. Nearly all of the Route 112 Byway Corridor in Franklin County is located within a “Living Waters Critical Supporting Watershed”, as defined by NHESP, with the exception of a few small areas in Ashfield.

Deerfield River Watershed

The Deerfield River Watershed is a sub-watershed of the Connecticut River Watershed that drains approximately 665 square miles of the Southern Green Mountains in Vermont and the Northern Berkshires in Massachusetts. Three hundred and forty-seven square miles of this land is located in all or part of twenty western Massachusetts towns. From its headwaters at Stratton Mountain in Vermont, the Deerfield River flows southeastward for approximately seventy miles through the steep terrain of the Berkshires to its confluence with the Connecticut River.

The northern portion of the watershed from Somerset to Route 2 in Massachusetts is primarily forested and steep, accounting for approximately 78 percent of the total watershed area. Much of the land along the remaining length of the river is open and agricultural land. The Route 112 Byway lies in this lower portion of the Deerfield River Watershed.

The Deerfield River drops 1,000 feet in elevation along its length in Massachusetts. This feature has resulted in the management of the Deerfield River for hydroelectric power generation with ten hydroelectric developments constructed on the river since 1911.

Despite the River's regulation by hydroelectric facilities, the Deerfield River's cold and clean waters makes it one of the best fisheries in the State. As part of the Connecticut River restoration project, the Massachusetts Department of Fish and Game is responsible for the Atlantic salmon restoration effort. The stocking program releases Atlantic salmon fry into tributaries of the Connecticut River. The Deerfield River Watershed (in twenty-one tributaries) is stocked with 700,000 Atlantic salmon fry each spring (Slater, Division of Fisheries and Wildlife; 2001). The River also supports native and stocked trout, making the Deerfield River one of the premier rivers for fishing in the New England.

Recreational opportunities within and along the Deerfield River abound. Whitewater sports, hiking, biking, hunting, fishing, cross-country skiing, and snowshoeing are some of the activities enjoyed by residents and visitors alike.

According to the Mass. Department of Environmental Protection (DEP), the Deerfield River from the Vermont-Massachusetts State Line to its confluence with the Connecticut River is given a Class B water quality designation. Given a Class B designation, a water body is considered suitable habitat for fish, other aquatic life and wildlife. It is also safe for primary and secondary contact recreation and has overall consistent aesthetic quality.

The Deerfield River is generally considered to be one of the most pristine rivers in Massachusetts, and is home to a large variety of aquatic and wildlife species. In addition to the Atlantic Salmon restoration program, a number of streams and stretches of river in the Deerfield River Watershed are known for their excellent trout fishing opportunities. All of the main streams and rivers crossed by the Byway are classified as

cold water fisheries. Trout require cold, clean water to survive and are especially sensitive to pollution. It is essential that the coldwater streams be protected from the negative impacts associated with development, roadway runoff and ill-managed woodland clearing. More generally, it is important that all activities along the Byway corridor, including recreation, tourism, and development, occur in a manner that minimizes any potentially adverse impacts of these activities on the Byway's natural resources.

Many of the recreational and fisheries resources of the Deerfield River are influenced by the ten hydro-power generating facilities located along the section of the river in northern Massachusetts. In 1994, an agreement was reached between the power company (that owned the facilities at the time) and twelve separate organizations, representing environmental, recreational, and government agencies. The agreement called for the power company to take a number of actions to enhance recreational activities and wildlife preservation along the Deerfield River. These actions include providing minimum flows below all of the dams and reservoir management to protect aquatic and shoreline habitats, installing fish passageways at various sites along the river, implementing a program to protect area wildlife, and scheduling water releases at agreed upon times for kayakers, canoeists, and other boaters. There are signs posted warning of the fluctuations in river flow but they are not in all locations along the river. Some people have complained that the water comes up too quickly, and creates a danger for boaters and fishermen.

The Deerfield River, from the confluence of the Cold River in the Town of Charlemont to its confluence with the North River at the Shelburne/Charlemont line is one of the water bodies in the state that the Massachusetts Department of Environmental Protection has placed on its list of Massachusetts Category 5 Waters, "Waters Requiring a TMDL". TMDL stands for "total maximum daily load" and is the greatest amount of a pollutant that a water body can accept and still meet water quality standards for protecting public health and maintaining the designated beneficial uses of those waters for drinking, swimming, recreation, and fishing. The TMDL reports reflect DEP's strategy for cleanup of all of the water bodies in Massachusetts.

The Deerfield River Watershed Association (DRWA) has been monitoring the Deerfield River and several of its tributaries in Massachusetts for water quality since 1990. The results of its 2003 Volunteer Monitoring Program note that the pH levels for all sites, with the exception of the West Branch Deerfield site, were above the state standard of 6.5. After a number of years of collecting bacteria data, the DRWA has concluded that dry spells in the watershed do not pose a bacterial threat to the Deerfield River and the tributaries it monitors and thus, these waters are safe for contact recreation during times of drought. Conversely, it was found that runoff, as a result of storms, does pose a bacterial threat at several of the monitored sites, making them unsafe for swimming at those times.

Clesson Brook Watershed (sub-watershed of the Deerfield River)

The Clesson Brook Watershed is located within the two towns of Hawley and Buckland, draining 21.2 square miles. It is comprised of numerous small streams, many of which originate in the uplands of eastern Hawley, as well as western Buckland. The headwaters of Clesson Brook originate at an unnamed pond in eastern Hawley and then flow through Cox Pond. From the outlet of Cox Pond, the brook flows toward the east through steep terrain as it enters Buckland. Cooley Brook and Ruddock Brook contribute their waters to the Clesson at this point. The brook then winds around Drake Hill and flows southeast until it reaches Route 112 at Buckland Four Corners. Smith Brook parallels Smith Branch Road and Route 112, flowing north until it converges with Clesson Brook just north of Four Corners. Historically, Clesson Brook was the site of seven sawmills in this area to harness the fast flowing brook for hydropower. From there, the Clesson flows northeast with a gentler gradient and the floodplain widens. The brook runs parallel with Route 112 until it reaches a small, unnamed pond where it joins Clark Brook. Clesson Brook then flows a short distance to its confluence with the Deerfield River in Buckland.

The Clesson is considered to be a Class B, cold-water fishery, with a high quality water designation, as are Clark and Smith Brooks. Forests predominate the upland slopes of the watershed while the floodplain areas in the valley are mostly agricultural. Residential development in the watershed is primarily concentrated within the river floodplain.

In 1996, the DEP noted that much of the floodplain in the lower sub-watershed had agricultural activities which could impair the quality of the lower 2.4 miles of the stream (MA DEP; 1996). Fields were plowed close to the stream edge, allowing for possible siltation and other habitat alterations. According to the Deerfield River Watershed 2000 Water Quality Assessment Report, between the 1995 and 2000 water quality surveys on the Clesson, the Natural Resource Conservation Service (NRCS) worked with several landowners to implement agricultural best management practices (BMPs) in the subwatershed. These activities may have contributed to the drop in coliform bacteria measured in the stream below the agricultural areas. The DEP recommended that the NRCS and the Department of Agricultural Resources (DAR) continue to work with landowners to maintain and expand the use of BMPs to protect riparian areas and prevent agricultural runoff and streambank erosion.

North River Watershed

The North River Watershed is located in northwestern Massachusetts and southern Vermont, draining 94.2 square miles (DRWA; 2002). It is formed by the confluence of the East Branch and the West Branch in Colrain. Below this confluence, the North River is impounded by a dam. The North River flows south and west, paralleling Route 112. Forests predominate the upland slopes of the watershed while the floodplain areas in

the valley are mostly used for agriculture. Residential and industrial development in the watershed is primarily concentrated within the river floodplain. The floodplain narrows as the North flows toward its confluence with the Deerfield River, just south of North River Road at the Shelburne, Charlemont and Buckland town lines. The North River has been designated a Class B, cold water fishery, high quality water from the confluence of the East and West Branches to the BBA Fiberweb Treatment Plant site in Colrain and Class B, cold water fishery for the remainder of the river to its confluence with the Deerfield River (Mass. DEP, 2000). The main stem of the North River to its confluence with the Deerfield River is on Massachusetts DEP's 1998 303(d) List of Waters for problems related to pathogens, taste, odor and color. However, the DEP's Deerfield River Watershed 2000 Water Quality Assessment Report recommends evaluating the possibility of removing it from the list since subsequent water quality monitoring observations do not indicate that the problem still exists.

Given its water quality and environmental factors providing for good cold water fishery habitat, the North River is a key component in the Connecticut River Atlantic Salmon restoration project. It is also stocked with trout on an annual basis.

Several key tributaries flow into the North River Watershed in the Byway region. These include the following waterways, going from north to south:

- East Branch of the North River—The East Branch originates at Ryder Pond in Whitingham, Vermont and flows southerly to its confluence with the main stem of the North River in Colrain.
- Spur Brook—Spur Brook originates in the hills of north-central Colrain near the Vermont border. It parallels Thompson Road for much of its length until it reaches its confluence with the East Branch.
- Foundry Brook—Foundry Brook originates near Christian Hill in the northern section of Colrain and joins the East Branch of the North River at Foundry Village.
- West Branch of the North River—The headwaters of the West Branch are in Whitingham, Vermont and the river flows southwesterly through the Town of Heath to the confluence with the East Branch at Griswoldville. The North River Flood Plain Management Study states the West Branch flows southeasterly to join the East Branch while the USGS topographical map shows both branches converging at the same place to create the main stem of the North River.
- McClellan Brook—McClellan Brook is located in south-central section of Colrain with its headwaters located southeast of Mount Hope. The brook flows southwesterly to its confluence with the North River south of the village of Griswoldville.
- Johnson Brook—Johnson Brook originates in the hills northeast of Houghton Hill. It flows southeasterly to its confluence with the North River northeast of the village of Shattuckville.

- Fox Brook—Fox Brook originates in north-central Shelburne and southwestern Colrain. It flows to its confluence with the North River in southwestern Colrain.
- Meadow Brook—Meadow Brook has its headwaters in the Catamount Hills with the main stem of the Brook flowing out of McLeod Pond in Catamount State Forest. Meadow Brook parallels Stacy Road for much of its length and eventually flows into the North River south of Shattuckville.
- Holden Brook—Holden Brook originates atop Pine Hill in Catamount State Forest. It converges with Houghton Brook near their confluence with the North River.
- Houghton Brook—Houghton Brook also has its headwaters in the Catamount Hills within the Catamount State Forest. Houghton Brook parallels Meadow Brook to its west and flows into the North River at the Shelburne town line.

Water Quality Issues

As stated earlier, most of the rivers and streams along the Route 112 Byway are cold water fisheries. These fisheries support trout, which require cold, clean water to survive and which are especially sensitive to pollution. It is therefore essential that the cold water streams be protected from the negative impacts associated with development and roadway runoff. In order to prevent degradation of water quality in these streams, the DEP recommends that land use planning techniques be applied to direct development, preserve sensitive areas, and maintain or reduce the levels of impervious cover (DEP; 2000).

One specific issue of concern is the pollution caused by stormwater runoff from the road surface of Route 112. “Country drainage,” where stormwater runoff is channeled through man-made ditches and culverts and discharged into the nearest waterway, may be the most prevalent drainage management system along the Byway. The main priority of these systems is to redirect stormwater off and away from the road in the quickest manner possible. These drainage systems were constructed in the early days of the Route 112, and continue to be used today. The good news is that these systems clear water off the road quickly to prevent crashes; the bad news is that they do not treat or remove the pollutants carried by the water before discharging it into nearby waterways. It is now known that non-point source pollution from roadways is similar to that of urban runoff (Barrett, et al; 1995), and is a major source of sediment, salt, petrochemicals, and heavy metals. Future roadway improvements should incorporate upgrades to the current stormwater management systems to treat or remove pollutants from stormwater runoff before it is discharged into nearby waterways.

To avoid degrading the quality of the water in these cold water streams, stormwater runoff should be directed away from waterways, not discharged directly into them. It should be treated or discharged into gently sloping fields or woodlands to allow sediment deposition and infiltration. Highway studies have shown that directing road runoff through grassy swales before discharge is an effective yet relatively simple and

inexpensive way to reduce the concentrations of most pollutants carried by the runoff. The mechanisms for removing pollutants in runoff are: 1) filtration of sediment by grass blades or other vegetation, 2) infiltration of water and attenuated pollutants into the soil, and 3) biological activity within the grass and soil media (Walsh, et al; 1997).

In areas where treatment is impossible and grassy swales or other mitigation measures are not appropriate (such as steeply sloped area), road “country drainage” systems can be redirected to discharge road runoff through heavily forested areas, allowing the water to filter through vegetation and duff layers and filtrate through the soil to mainly discharge into the receiving water as subsurface or groundwater flow. Runoff is collected through swales and diverted into a wooded area between the road and the river. As the stormwater is discharged into the forest floor, the roughness of the duff layer spreads the flow out and decreases the velocity, filtering out much of the sediment and sand. The cleaner stormwater then flows overland or infiltrates into the soil before it is discharged into the river. Although this stormwater management pattern is often seen in rural dirt roads, it is seldom used along paved roads. Where possible, it should be investigated as a passive stormwater pretreatment method. It should be noted that the sand that accumulates on the forest floor should be removed periodically to prohibit it from eventually reaching the river.

Aside from the environmental impacts of sand and salt, the velocity of the water can cause its own problems. Serious erosion can occur at the discharge end of stormwater pipes, culverts, and swales, carving deep gullies down the mountainside. These gullies eventually work their way back towards the road and can undermine the discharge system and eventually the stability of the stream bank. In addition, the soil that is eroded during the creation of these gullies is washed into the nearest waterway.

Future road maintenance and improvement projects are excellent opportunities to upgrade and/or improve stormwater control measures to protect the natural resources that exist in the waterways along the corridor. It is critical that state and local transportation agencies work to ensure that all road projects incorporate measures to minimize their potentially adverse impacts on the rivers’ water quality. Route 112 Scenic Byway advocacy groups should encourage best management practices to preserve and improve water quality of the rivers along the Byway. The PVPC and the FRCOG can support the use of best management practices through their roles in regional transportation planning activities. Future road maintenance and improvement projects are also excellent opportunities to upgrade and/or improve stormwater control measures to protect the natural resources that exist in the waterways along the corridor. In addition, the regional planning agencies can apply for grants to implement stormwater management improvements provided by the EPA and DEP through the s. 319 Nonpoint Source Pollution Grant Program.

Invasive species of plants, such as Japanese Knotweed, have been observed in and around Clesson Brook and in Ashfield Lake. Invasive plants are introduced species that can thrive in areas beyond their natural range of dispersal and which can cause

environmental harm, particularly in water bodies. These plants are characteristically adaptable, aggressive, and have a high reproductive capacity. Their vigor combined with a lack of natural enemies often leads to outbreak populations that can kill off native species. Environmental harm may be a result of direct effects of invasive species, leading to biologically significant decreases in native species populations.

Environmental harm also can be the result of an indirect effect of invasive species, such as the decreases in native waterfowl populations that may occur when an invasive wetland plant decreases the abundance of native plants, and thus decreases the seeds and other food that the waterfowl depend upon.

A final issue involving river water quality concerns the possibility of a hazardous materials spill along the Byway. The Byway is used by trucks that transport hazardous materials, and accidents and spills of these materials can occur. Hazardous spill management in Massachusetts is coordinated by the Massachusetts Department of Environmental Protection (DEP). In addition, recognizing the serious effects that a hazardous materials spill could have on water quality and animal and plant species in the area, the Massachusetts Executive Office of Environmental Affairs (EOEA) has made developing a regional Emergency Hazardous Materials Spill Plan one of its top priorities for the Deerfield River Watershed Association. A regional local emergency planning committee (LEPC) has developed an emergency response plan for Franklin County. The parties involved in this process include the Deerfield River Management Team, the FRCOG, and the local communities.

Public Drinking Water Resources

As with the quality of rivers and streams along the Scenic Byway, the public drinking water resources within the Byway corridor can also be threatened or degraded by nearby land uses, roadway runoff and the use of salt and sand for road maintenance during winter months. There are 12 public water systems located within one mile of the Byway in Franklin County. By definition, a public water system has fifteen (15) or more service connections, or regularly serves an average of at least twenty-five (25) individuals for sixty (60) days or more per year. Those systems can be publicly owned and maintained, such as city and town wells, or can be privately owned and maintained, such as those for mobile home parks, factories, rest stops, motels, and restaurants.

The public water systems within the Byway corridor are listed in Table 3.1 below and are shown on the Natural Resources Map at the end of this chapter. In the Franklin County portion of the Byway corridor study area, there are twelve public water systems. With the exception of the Mountain Spring Reservoir, which is an emergency surface water source, all other water systems in the Corridor are groundwater wells.

Table 3.1: Water Systems within the 112 Byway Corridor that Serve the Public

Well	Map ID	Private or Public	Town Location	County Location
Well #2	1	Public	Colrain	Franklin
Colrain Central Elem. School	2	Public	Colrain	Franklin
Mountain Spring Reservoir	3	Public	Colrain	Franklin
Well #1	4	Public	Colrain	Franklin
Well #1 Replacement	5	Public	Colrain	Franklin
Well #2	6	Public	Colrain	Franklin
Crab Apple White Water Rafting	7	Private	Charlemont	Franklin
Crab Apple White Water Rafting	8	Private	Charlemont	Franklin
Mohawk Trail Regional High School	9	Public	Buckland	Franklin
Buckland Recreation Facility	10	Public	Buckland	Franklin
Well #2	11	Public	Ashfield	Franklin
Sanderson Academy	12	Public	Ashfield	Franklin

Source: MassGIS, December 2006.

Plant and Animal Species

The Byway is graced with miles of forestlands that support a host of wildlife. Forests that were once cleared for farms, timber and charcoal have recovered and again grown into productive northern forests. Also, healthy populations of animals that were once diminishing in the area, such as black bear, bobcat, fisher, and turkey, have begun to return. There are even rumors that the elusive catamount, or mountain lion, has been seen roaming these forests once again.

The vegetation along the Byway varies distinctively as one travels from Colrain to Huntington. Generally, the Franklin County section of the Byway is characterized by a mixture of farmland and forests. Forests along the Byway are classified as Transition Hardwood Forests (USDA; 1992). The Transition Hardwood Forest consists of northern hardwoods such as yellow and paper birch (*Betula alleghaniensis* and *Betula papyrifera*), beech (*Fagus grandifolia*), and sugar and red maple (*Acer saccharum* and *Acer rubrum*). On the dryer sites, the Hardwood Forest consisting of oaks and hickories can be found with red oak (*Quercus rubra*) being the most abundant deciduous species. Hemlock (*Tsuga canadensis*) occurs in the moist cool valleys, north and east slopes, and sides of ravines of Shelburne. White pine (*Pinus strobus*) is characteristic of the well-drained sandy sites. These forest types commonly occur up to an elevation of 1,500 feet above sea level in upland central Massachusetts and southern New Hampshire, northward through the Connecticut Valley.

Many of these forests are considered Prime Forestland. As described by the Department of Forestry and Wildlife at the University of Massachusetts in their research bulletin entitled “Prime Forestland Classification for Forest Productivity in Massachusetts”, prime forestland are those soils that are able to support a production of wood fiber at a rate greater than eighty-five cubic feet per year. Only forestland with Prime 1, 2, and 3 soils is worthwhile to manage intensively for wood products.

These lush forestlands contribute to the local economy in a variety of ways, including revenues from timber production. They also support maple syrup production in a number of locations along the Byway corridor and outdoor recreational activities, such as hiking, camping, fishing, hunting, boating, skiing, snowshoeing, and snowmobiling.

Recreational opportunities along the Byway are further discussed in the Recreational Resources chapter. It is important that recreational activities and the harvesting of forest-based resources within the corridor occur in a sustainable way that ensures the long-term viability of the plant and animal species in the area.

Rare and Endangered Species and Significant Natural Communities

The Natural Heritage and Endangered Species Program (NHESP), which is administered by the Massachusetts Department of Fish & Game, collects and maintains information on over 400 rare and endangered species around the Commonwealth. The goal of the NHESP is to protect biological diversity in the state through biological research and the inventorying of species, data management, environmental impact review, restoration and management of rare species and their habitats, land acquisition, and education.

Approximately eighteen miles of the Byway travels through or is adjacent to habitat that has been documented by the NHESP as supporting some of the most important natural communities and state-listed rare species in Massachusetts. This constitutes virtually the entire length of the Byway, except for a short half-mile section just over the Deerfield River in Buckland where Route 112 and Route 2 follow the same roadway, and the final five and a half miles of the Byway in Ashfield. The Byway corridor contains extensive endangered species habitat, as well as important natural communities that are categorized as being moderately to highly significant. The NHESP reviews and comments on certain development proposals within these habitat areas on a case-by-case basis to ensure their protection.

NHESP’s BioMap identifies areas most in need of protection in order to protect the native biodiversity of the Commonwealth. In Colrain, Route 112 runs between BioMap Supporting Natural Landscapes for most of its length and near a Core Habitat in the southwestern section of Town. In Shelburne, the Byway passes near a Core Habitat in the northwestern section of Town. In Buckland, much of the Town east of Route 112 is Core Habitat and BioMap Supporting Natural Landscapes are located in the northwest and southeast sections of Town. In Ashfield, the Byway runs through a Supporting

Natural Landscape and a small Core Habitat Area in the section of Town south of the southern intersection of Routes 112 and 116.

The sites shown on the Natural Resources Map at the end of this chapter represent two distinct categories of habitats regulated under Massachusetts law. Estimated Habitat areas delineate the approximate geographical extent of the habitats of state-protected rare wildlife for use with the Wetlands Protection Act (M.G.L. Ch. 131, regulations at 310 CMR 10.00). Rare wildlife data for these areas were collected over the last 25 years. If a construction or development project is located within an Estimated Habitat and requires the filing of a Notice of Intent (NOI) under the Wetlands Protection Act, then the NOI and supporting materials must be forwarded to the NHESP for review before the project can proceed.

Priority Habitat areas delineate habitats for rare plant and animal populations protected under the Massachusetts Endangered Species Act (M.G.L. Ch. 131A, and its implementing regulations at 321 CMR 10.00). These areas indicate the approximated geographic extent of rare species populations taken from the NHESP database. These areas should also be used in conjunction with the Rare Species Threshold in the Massachusetts Environmental Policy Act (M.G.L. Ch. 30, sec. 61-62H, regulations at 301 CMR 11.03(2)). Under this review process, all projects two acres in size or larger and occurring in a Priority Habitat should be reviewed by the NHESP. Priority Habitat areas are also used in conjunction with the Forest Cutting Act Practices Act (M.G.L. Ch. 132, regulations at 304 CMR 11.00). It is important for decision-makers to understand the requirements of each NHESP designation as promotional and improvement projects for the Scenic Byway are developed.

NHESP has identified 264 native plant species and 178 species of vertebrate and invertebrate animals as rare in the Commonwealth, and a number of rare plants and animals have been documented in the Route 112 Byway Corridor. The NHESP has documented a total of forty-nine significant species within the Byway corridor, including thirty-four rare and endangered species of plants and fifteen rare and endangered species of animals. The identity of the rare and endangered species found within each specific habitat area is not publicized in order to protect the individual plants and animals living there.

Each of these species has been assigned a rating by the NHESP that reflects the rarity and threat of that species within Massachusetts. There are three categories for rare and endangered communities: Endangered, Threatened, and Species of Special Concern. Endangered species are native species that are in danger of extinction throughout all or part of its range, or which are in danger of extirpation from the state. Threatened species are native species that are likely to become endangered in the foreseeable future, or which are declining or rare. Special Concern species are native species that either have suffered a decline that could threaten the species if allowed to continue unchecked, or occur in such small numbers, or with such restricted distribution or specialized habitat requirements, that they could easily become threatened within the state. Table

3.2 and 3.3 list the 49 documented rare and endangered species within the Byway corridor and gives the NHESP sensitivity rating for each.

Table 3.2: Documented Rare Plants Along the 112 Scenic Byway in Franklin County

Common Name	Scientific Name	Taxonomic Group	Rating
Adder's Tongue-fern	<i>Ophioglossum pusillum</i>	Vascular Plant	Threatened
Autumn Coralroot	<i>Corallorhiza odontorhiza</i>	Vascular Plant	Special Concern
Back's Sedge	<i>Carex backii</i>	Vascular Plant	Endangered
Barren Strawberry	<i>Waldsteinia fragarioides</i>	Vascular Plant	Special Concern
Black Maple	<i>Acer nigrum</i>	Vascular Plant	Special Concern
Broad Waterleaf	<i>Hydrophyllum canadense</i>	Vascular Plant	Endangered
Canadian Sanicle	<i>Sanicula canadensis</i>	Vascular Plant	Threatened
Climbing Fumitory	<i>Adlumia fungosa</i>	Vascular Plant	Special Concern
Crooked-stem Aster	<i>Symphotrichum prenanthoides</i>	Vascular Plant	Threatened
Dwarf Rattlesnake-plantain	<i>Goodyera repens</i>	Vascular Plant	Endangered
Dwarf Scouring-rush	<i>Equisetum scirpoides</i>	Vascular Plant	Special Concern
Few-flowered Sedge	<i>Carex pauciflora</i>	Vascular Plant	Endangered
Fragile Rock-brake	<i>Cryptogramma stelleri</i>	Vascular Plant	Endangered
Giant St. John's-wort	<i>Hypericum ascyron</i>	Vascular Plant	Endangered
Hairy Beardtongue	<i>Penstemon hirsutus</i>	Vascular Plant	Endangered
Hitchcock's Sedge	<i>Carex hitchcockiana</i>	Vascular Plant	Special Concern
Hooded Ladies'-tresses	<i>Spiranthes romanzoffiana</i>	Vascular Plant	Endangered
Intermediate Spike-sedge	<i>Eleocharis intermedia</i>	Vascular Plant	Threatened
Leafy White Orchis	<i>Platanthera dilatata</i>	Vascular Plant	Threatened
Long-Styled Sanicle	<i>Sanicula odorata</i>	Vascular Plant	Threatened
Michaud's Sedge	<i>Carex michauxiana</i>	Vascular Plant	Endangered
Mountain Alder	<i>Alnus viridis spp. crispa</i>	Vascular Plant	Threatened
Mountain Firmoss	<i>Huperzia selago</i>	Vascular Plant	Endangered
Muskflower	<i>Mimulus moschatus</i>	Vascular Plant	Endangered
Pale Green Orchis	<i>Platanthera flava var. herbiola</i>	Vascular Plant	Threatened
Purple Clematis	<i>Clematis occidentalis</i>	Vascular Plant	Special Concern
Putty-Root	<i>Aplectrum hyemale</i>	Vascular Plant	Endangered
Roundleaf Shadbush	<i>Amelanchier sanguinea</i>	Vascular Plant	Special Concern
Sandbar Cherry	<i>Prunus pumila var. depressa</i>	Vascular Plant	Threatened
Spiked False Oats	<i>Trisetum spicatum</i>	Vascular Plant	Endangered
Tradescant's Aster	<i>Symphotrichum tradescantii</i>	Vascular Plant	Threatened
Tuckerman's Sedge	<i>Carex tuckermanii</i>	Vascular Plant	Endangered
Wild Sienna	<i>Senna hebecarpa</i>	Vascular Plant	Endangered
Woodland Millet	<i>Milium effusum</i>	Vascular Plant	Threatened

Source: Natural Heritage and Endangered Species Program, December 2006.

Table 3.3: Documented Rare Animals Along the 112 Scenic Byway in Franklin County

Common Name	Scientific Name	Taxonomic Group	Rating
American Bittern	<i>Botaurus lentiginosus</i>	Bird	Endangered
American Clam Shrimp	<i>Limnadia lenticularis</i>	Crustacean	Special Concern
Early Hairstreak	<i>Erora laeta</i>	Butterfly/Moth	Threatened
Harpoon Clubtail	<i>Gomphus descriptus</i>	Dragonfly/Damselfly	Endangered
Jefferson Salamander	<i>Ambystoma jeffersonianum</i>	Amphibian	Special Concern
Least Bittern	<i>Ixobrychus exilis</i>	Bird	Endangered
Longnose Sucker	<i>Catostomus catostomus</i>	Fish	Special Concern
Ocellated Darner	<i>Boyeria grafiana</i>	Dragonfly/Damselfly	Special Concern
Riffle Snaketail	<i>Ophiogomphus carolus</i>	Dragonfly/Damselfly	Threatened
Sedge Wren	<i>Cistothorus platensis</i>	Bird	Endangered
Spatterdock Darner	<i>Aeshna mutata</i>	Dragonfly/Damselfly	Special Concern
Spine-crowned Clubtail	<i>Gomphus abbreviatus</i>	Dragonfly/Damselfly	Endangered
Stygian Shadowdragon	<i>Neurocordulia yamaskanensis</i>	Dragonfly/Damselfly	Special Concern
Upland Sandpiper	<i>Bartramia longicauda</i>	Bird	Endangered
Wood Turtle	<i>Glyptemys insculpta</i>	Reptile	Special Concern

Source: Natural Heritage and Endangered Species Program, December 2006.

The NHESP has noted a number of uncommon ecologically significant natural communities within the borders of the towns included in the Route 112 Byway, which support a number of the state-listed rare and endangered species. These communities include:

- **High-Terrace Floodplain Forest**—High-terrace floodplain forests typically occur on raised banks adjacent to rivers and streams, on steep banks along high gradient rivers particularly in western Massachusetts, on high alluvial terraces and on raised areas within major-river and small-river floodplain forests. The high-terrace floodplain forest is not subjected to annual spring flooding as it is above the flood zone. The high-terrace floodplain forest in Massachusetts has a mixture of hardwoods generally associated with floodplains. The herbaceous layer is a mixture of forest ferns and upland herbs characteristic of floodplain forests. NHESP has noted that two rare plants and two rare vertebrates can be found in the high-terrace floodplain forests. These include the Black Maple (*Acer nigrum*) and the Barren Strawberry (*Waldsteinia fragarioides*), and the Jefferson Salamander (*Ambystoma jeffersonianum*) and the Wood Turtle (*Glyptemys insculpta*) (See Tables 3-2 and 3-3 above).

- **Rich, Mesic Forests**—Rich, mesic forests are one type of unusual natural community known to occur in the Franklin County. The rich, mesic forest is nutrient-rich, moderately moist (mesic) variant of the northern hardwood forest. It is found in areas of calcium-rich bedrock and alkaline groundwater. In the Northeast, these forests occur at low to moderate elevations below 2,400 feet and usually on the north or east-facing, concave, middle to lower slopes. Within the Commonwealth of Massachusetts only a limited number of rich, mesic forests can be found. Sugar maple (*Acer saccharum*) and/or basswood (*Tilia americana*) are the dominant species of this forest. Autumn Coralroot (*Corallorhiza odontorhiza*) and Barren Strawberry (*Waldsteinia fragariodes*) are two species of special concern identified by the NHESP that may be found in this forest type.
- **Riverside Seep**—Riverside Seeps occur at the base of steep riverbanks where groundwater seeps out of the bottom of the slope. These seepages are usually mineral rich leading to great plant diversity. Periodic flooding helps to prevent woody shrubs from establishing themselves. Riverside seeps are often associated with riverside outcrop communities and high-energy riverbanks. Vegetation is that of a mixed herbaceous community with the wettest spots being mossy with a mixture of herbs and sedge.
- **Riverside Rock Outcrop Community**—Riverside Rock Outcrop communities occur on flood scoured bedrock along rivers. The outcrops may be low or steep on the river's edge, or may extend into the river channel. Vegetation is sparse, mostly low and consists of scattered herbaceous vegetation limited to crevices where soil accumulates. The NHESP has identified two rare plants that utilize this outcrop community: Tradescant's aster (*Symphiodtrichum tradescantii*), a threatened species, and Roundleaf Shadbush (*Amelanchier sanguinea*), a species of special concern.
- **Rocky Summit/Rock Outcrop Community**—The Rocky Summit/Rock Outcrop community is found on the rocky summits of hills and mountains where bedrock is exposed or on rock outcrops of upper to mid-slope areas. Most of these communities are small in size, usually less than one-quarter acre. Grasses, sedges, herbaceous plants and shrubs dominate them. The Climbing Fumitory (*Adlumia fungosa*), a rare species known to occur in Colrain, may be found in this environment.
- **Black Ash-Red Maple-Tamarack Calcareous Seepage Swamp**—The Black Ash-Red Maple-Tamarack Calcareous Seepage Swamp is a mixed deciduous-coniferous forested swamp found in areas where there is calcareous (calcium-rich) groundwater seepage. Although the soils are mineral, there is a thin layer of peat at the surface. The more calcium-rich the seepage, the more rare plant species may be found. The Showy Lady's-Slipper (*Cypripedium reginae*) is a species of special concern that may be found in this community.
- **Acidic Graminoid Fen**—The Acidic Graminoid Fen is an uncommon natural community which forms along pond margins, slow-moving streams, and at the headwaters of streams or in isolated valley bottoms without inlet or outlet streams.

It is a wetland community composed of incompletely decomposed organic matter. The Slender Cottongrass (*Eriophorum gracile*), a rare species considered to be threatened in Massachusetts, can be found in the Acidic Gramminoid Fens.

- ***High-Energy Riverbank***—High-Energy Riverbank communities are rare in Massachusetts, however they are found in steep gradient, high flood areas on fast-flowing rivers. They typically occur on riverbends and the upstream ends of islands. These communities are created by cobbles, sand and silt being deposited during spring floods. Plants associated with this community vary depending upon the composition of the substrate and the severity of annual flooding. Due to the intense flooding, trees and/or tall shrubs are not able to establish themselves in the High-Energy Riverbank environment. However, short shrubs and mixed grasses can be found on the sandiest sections, which typically border floodplain forests.
- ***Cobble Bar Forest***—The Cobble Bar Forest is a variant of the high-energy riverbank community. It is characterized by open forests growing on sandy cobble bars on the upstream ends of islands. These open forests are dominated by sycamore (*Platanus occidentalis*) with associated cottonwood (*Populus deltoids*) and silver maple (*Acer saccharinum*). American elm (*Ulmus americana*) is also present. Exotic species usually dominate the understory. Cobble bar forests provide habitat for riverine odonates (dragonflies and damselflies).

The single greatest threat to these habitat areas along the roadway, and to the scenic values associated with the forested roadway in general, may be single-family residential development. The permitting process for single-family houses is relatively simple and proposals receive only limited local review. Most single family houses are permitted under the Approval Not Required, or “ANR” process, and outside of the building inspector, the local permitting authority has little review powers. This is the type of development that is most prominently “sprawling” out along rural roadways, and it can fragment sensitive environments, such as those identified in the Scenic Byway region. Because it receives little review from the local authorities, those developing the properties are almost certainly unaware of its ecological value. This concern could be addressed through the creation of a Corridor Overlay District, which would require that the developer provide a basic site sketch of the property. This procedure would allow the local permitting authority to alert the developers that the property is in rare species habitat and make suggestions on ways to lessen the impacts. This procedure will also give the town the opportunity to encourage property owners to maintain trees and other vegetation along the roadway to screen development.

Summary of Important Natural Resources and Features along the Scenic Byway Corridor

Of the natural and geologic resources along the Route 112 Scenic Byway that were discussed earlier in this chapter, there are several features that deserve specific mention

again. These sites of natural, environmental, and geological significance contribute considerably to the scenic value of the Byway, and also offer important recreation and tourism opportunities. However, at the same time, some of these resources are very sensitive, and could be degraded as development or tourism occurs along the corridor. Public access to areas that are particularly fragile should be managed to ensure the preservation of natural assets. The significant natural resource sites within or nearby the Scenic Byway corridor are listed below by county with a brief description of each location. Many of these sites are also described in greater detail in the Recreational Resources or Tourism chapters of the Corridor Management Plan.

The East Branch of the North River originates at Ryder Pond in Whitingham, Vermont and converges with the West Branch north of Griswoldville, in south-central Colrain. The East and West Branches have been designated as Class B, cold water fisheries with high quality water.

The Clesson Brook originates at an unnamed pond in eastern Hawley and then flows through Cox Pond and toward the east through steep terrain as it enters Buckland. The brook then winds around Drake Hill and flows southeast until it reaches Route 112 at Buckland Four Corners. Historically, Clesson Brook was the site of seven sawmills in this area to harness the fast flowing brook for hydropower. From there, the Clesson flows northeast with a gentler gradient and the floodplain widens to allow farming. The brook runs parallel with Route 112 until it reaches a small, unnamed pond where it joins Clark Brook. Clesson Brook then flows a short distance to its confluence with the Deerfield River in Buckland. The Clesson is considered to be a Class B, cold-water fishery, with a high quality water designation. Forests predominate the upland slopes of the watershed while the floodplain areas in the valley are mostly agricultural.

Prime farmland soils have been identified in some sections of the Byway corridor, particularly along the East Branch of the North River and Clesson Brook. (See the Agricultural Lands Map at the end of this chapter.) Prime farmland soils have the best combination of physical and chemical characteristics for economically and sustainably producing high crop yields. It is essential that farms be preserved in these areas and development limited.

Large blocks of forested land make up much of the Byway corridor, which gives the corridor a wild feel and provides critical habitat to many species of wildlife. As with farms, development pressures on forested properties is likely to increase over time and efforts to preserve these areas will be necessary to maintain the nature of the corridor.

Findings

- The broad floodplain regions of the corridor in Colrain and Buckland are prized for farmland, water supply protection areas, high scenic value, and as potential building sites.

- Although the Scenic Byway travels along several miles of cold water fisheries and sensitive habitat areas, few stormwater mitigation measures have been so far implemented to treat road runoff or direct it away from these sensitive areas.
- Invasive species of plants, such as Japanese Knotweed, have been observed in and around Clesson Brook and in Ashfield Lake. Invasive plants are introduced species that can thrive in areas beyond their natural range of dispersal and which can cause environmental harm, particularly in water bodies.

Recommendations

- Explore options that maximize opportunities for landowners to conserve their forests and agricultural land along the Byway. There are two main options which would result in the conservation of these landscapes: 1) economic development measures that result in sustaining agricultural businesses over time and 2) land protection efforts that result in the retention of forest and farmland in perpetuity.

Economic development measures can include efforts to reduce costs and sustain or increase profits associated with farming. Efforts that reduce excise and property taxes, lessen regulatory burdens, increase access to low-cost marketing, and support the transition to renewable methane or electric power, etc., can help lower some costs associated with farming. Profits can be affected by efforts that increase sales, or provide for a greater per unit price. Marketing efforts that result in greater traffic at retail establishments is one example of how economic development initiatives might positively impact agricultural businesses.

Options to conserve land through protection efforts include expanding the use of conservation restrictions, encouraging interested farmers to participate in the Agricultural Preservation Restriction (APR) program, identifying desirable properties for permanent land protection, and raising the funds necessary to purchase the development value of these parcels from willing landowners.

- As will be discussed in the Land Use and Zoning Section of this report, ANR development may be one of the most serious threats to the natural resources along the Byway corridor. Communities on the Byway may want to consider zoning changes to protect sensitive habitat, preserve natural and scenic resources, and to focus new development into existing village center areas.
- Cold water streams along the Byway should be protected to maintain water quality through the use of BMPs by farmers, highway commissions, and others.
 - Land use planning techniques should be applied to direct development to appropriate areas, preserve sensitive areas, and maintain or reduce the levels of impervious cover impacting cold water fisheries.

- Road improvement projects should comply with the Massachusetts Stormwater Policy and road runoff should be directed away from nearby waterways and sensitive habitats. In areas with endangered or rare species, additional pollutant removal may be warranted.
- Managers of state and local road improvement projects should work cooperatively with local Conservation Commissions, the Deerfield River Watershed Team, and the Natural Heritage and Endangered Species Program to ensure that priority habitat and sensitive waterways are properly identified and protected.
- Evaluate and promote the ways in which visitors can become more aware of the natural resources that can be enjoyed along the Byway. The Byway can become a vehicle to introduce the natural resources within the corridor region.
 - Develop an educational campaign to minimize the potential negative impacts of visiting the great outdoors, by respecting the land and “treading softly.” This is important if the Byway becomes a way to introduce nature to those who are not normally “the outdoor type” and may never have hiked, biked, or snowmobiled in forested areas before. It also must be recognized that much of the land along the Byway Corridor is privately owned and public access may be limited.
 - To minimize conflicts between humans and wildlife, remind visitors to control food waste and not to purposely feed the animals. Remind local residents to locate garbage bins and bird feeders so that bear, raccoons, skunks and other animals cannot get into them. Animals that become accustomed to people food can become pests and may need to be relocated or destroyed.
 - Establish educational signs reminding visitors to stay on marked trails.
 - Local conservation and recreational groups should coordinate recreational tourism efforts with the NHESP and the Department of Conservation and Recreation (DCR) to minimize negative impacts to the environment.
- Identify locations of invasive species of plants, particularly where they impact water quality, and undertake appropriate control measures to eliminate them or reduce their coverage.