

## **VI. NATURAL RESOURCES**

The landscape of the Region is a mosaic of forest, field, wetland, and developed land. In order to maintain the diversity of plant and wildlife species that have existed in the Region for generations, land use planning should consider the health of the ecosystems needed to support a variety of species, including humans. Maintaining biodiversity within an ecosystem ensures that the system is in balance.

Changing land use patterns have resulted in ecosystems shifting and changing across our landscape, affecting the associated wildlife. In this Region and across much of Vermont, the landscape has undergone shifts from an original landscape of forested land to agricultural lands in the 19th and early 20th centuries and now back to primarily forest land. While the conversion of agricultural fields to forestland is beneficial to some species, those species that thrive in open fields and “edge habitat”, the area between field and forest, must subsist on declining habitat area. However, the re-establishment of forest land in the Region has significantly improved the water quality of our rivers, streams and lakes along with the species that depend on aquatic habitat. In addition, from a human perspective, the loss of agricultural land has made communities within the Region less self-sufficient, requiring many food products to be imported from other regions and states.

Piecemeal development over time often leads to fragmented forestlands and wildlife habitat areas. Land use regulations that require minimum lot sizes but do not allow for the flexibility of clustering development while protecting valuable resource lands can have negative effects on the ecosystem as a whole. Allowing development to encroach upon critical natural areas, such as floodplains, is not only detrimental to the habitat but also jeopardizes property and infrastructure. Just as we plan for the connection of economic and residential centers with roads, planners should provide for connectivity of wildlife habitat so that the nonhuman populations inhabiting the Region may be sustained through future generations. The following sections outline the diversity of resource lands in the Region while providing policies and recommendations that strive to connect and integrate the landscape types for balanced ecosystem sustainability.

### **A. Agricultural Lands**

The agriculture practices of the 19th and early 20th centuries factored heavily in the historical and cultural development of Vermont and the Region. Historically, Vermonters have always had an active, dynamic relationship with the land. Historical land use patterns emphasized densely settled village centers with farms outside of the villages. The villages provided a conduit for marketing supplies and services into and outside of the Region.

Beginning in the mid-19<sup>th</sup> century, agriculture slowly began to evolve from an institution that promoted self-sufficiency to one of specialization. Causes for this structural change can be traced to competition from the Midwest and West, the expansion of the railroad and the migration of young people from rural to more urban areas. In Vermont, as well as the Region, the 19<sup>th</sup> century saw the rise and fall of the sheep farm and woolen mill. Sheep farming dramatically changed the Vermont landscape and economy through the clearing of forestland and the resulting soil erosion. Approximately 80% of forested land in the state

was cleared for farming and grazing, and large woolen mills were built along Vermont's rivers. These changes to the landscape had lasting effects such as erosion and loss of topsoil to flooding. The loss of quality topsoil also contributed to the decline of agriculture statewide. To date, the mills still help define the character of many Vermont villages, including Ludlow and Cavendish.

The next agricultural trend in the state and Region was dairy farming, which dominated the landscape and economy for the first half of the 20th century. Since World War II, the decline in agriculture has been profound, with the loss of over three million acres of farmland and thirty thousand farms in the state. Currently, 21% (approximately 1.24 million acres) of total land in Vermont is devoted to agriculture. According to the Vermont Agency of Agriculture, there were only 1,406 dairy cow operations remaining in Vermont as of January 2003. Seventeen of these are located in our Region: Baltimore - 1, Cavendish - 2, Chester - 3, Reading - 2, Springfield - 5, Weathersfield - 1, and Windsor - 3. Underlying causes for the decrease include the dramatic drop in net income for farmers; the economic benefits of changing agricultural lands to other types of land use; tax policies; the expansion of the Interstate Highway System; and the increasingly international orientation of agriculture. Other major factors have included increased production through genetic engineering of plants and animals, increased reliance on chemicals to increase crop yields resulting in more productive farms on fewer acres of land, and dramatic changes in the regulation of the dairy industry.

The proximity of the Region to the Boston-New York corridor initially provided markets for agricultural products, but has now resulted in increased demand for the land to be used for more than agricultural uses. Increased recreational development and reduced profitability in agriculture have resulted in a near total decline of full-time farming in the Region, except for a few dairy and self-sufficient operations. During the past thirty to forty years, much of Vermont's farmland has converted to commercial and residential development, and much of it has reverted to forest cover. This forestland has allowed timber production which was prevalent across the state in the early 19th century to return as a significant factor in Vermont's agricultural economy. Unlike earlier times, however, properly applied modern forestry techniques and regulations help make logging a sustainable industry, ensuring healthy forests and a strong economic base well into the future.

Along with the decline in full-time agriculture operations has come an increase in the number of part-time farmers and specialty businesses that are trying to take advantage of markets located in the greater Upper Valley. As dairy production has become less profitable, many farmers have begun to diversify (or change altogether) their operations in an effort to increase net farm income. The means of diversification include the raising of exotic animals such as fallow deer, beefalo, llamas, alpacas, emus, and elk, and the development of specialty products such as organic vegetables, Christmas trees, turkeys, and sheep. Some of the more traditional Vermont products, like cheese, apples, and maple syrup, also benefit from Vermont's emergence in the national economy as a producer of high-quality, specialized farm products

Benefits of productive agricultural lands include:

- A more self-sufficient regional population;
- A local, stable and reliable supply of food products;
- Preserving regional heritage; and,
- Supporting the tourism economy.

Vermont is currently a net importer of food supplies. However, foreseeable changes may require increasing local food production in the future as transportation costs rise, the costs of petroleum and petroleum-based farm supplies increase, the western United States experience increasingly more severe water shortages and other factors.

### 1. Classification of Agricultural Soils

The Region has many areas identified as having prime agricultural soils (**Appendix A – Map 5**). As defined by the Natural Resource Conservation Service, prime agricultural soils are available for use and have a combination of the best characteristics for producing food, forage, fiber, and oilseed crops. The best suited land uses for prime agricultural soils includes forests, cropland, pasture, or other similar uses; but once developed, these soils lose their agricultural characteristics. Prime agricultural soils are valuable for their current and/or potential future farming uses.

Also located within the Region are many areas of agricultural soils of statewide importance. These soils exhibit many of the same characteristics of prime agricultural soils but are constrained by one or more of the following: slope, erosion potential, depth to bedrock, or location within a designated floodplain. Agricultural soils of statewide importance may also be valuable for their current and/or potential future farming uses.

When classifying agricultural soils, location and accessibility are not considered due to their physical and chemical makeup. In addition, NRCS definitions do not balance competing local and regional goals such as the locations of desirable local development in village and downtown areas.

### 2. Protection of Important Agricultural Soils

Over the past thirty years, Vermont has seen a marked increase in the conversion of prime agricultural lands to non-agricultural uses. These lands are a finite resource. Their use for non-agricultural purposes should be strongly discouraged. Communities, with the support of the RPC, should begin to develop a program that will locate, prioritize, monitor, and promote the protection of these valuable resources.

Protecting important agricultural soils, while also encouraging smart growth, is challenging. Many historic villages are located in river valley and are surrounded by areas of prime agricultural soils and/or agricultural soils of statewide significance, which restrict future growth in those areas. Agricultural soils that are rated by the NRCS as prime, statewide or locally important are regulated through Act 250 Criterion 9(b). A balance is necessary in order to protect agricultural soils, while allowing the flexibility to facilitate new growth within or adjacent to historic villages in accordance with the State Planning Goal in 24 V.S.A. §4302(c)(1).

There are tools available to help towns find that balance. The Land Evaluation Site Assessment (LESA) process can be used to reassess soil classifications within a town. A comprehensive study is undertaken in order to identify and rank important local agricultural soils based on soil characteristics and site considerations. The resulting designation of “locally important farm lands” typically differs from the “Prime” and “Statewide” classifications used by the state. Town officials can then develop and implement policies through local zoning and subdivision regulations, to protect these soils from transportation and development projects. Pursuant to 6 V.S.A. §8, the Secretary of the Agency of Agriculture established guidelines to assist the municipal and regional planning commissions of the state in identifying agricultural lands.

The Vermont growth center designation is another optional tool to achieve a balance between development and resource protection. Under 24 V.S.A., Chapter 76A, towns may apply for a growth center designation from the Vermont Downtown Board which reviews all applications. A benefit of the designation allows for lower ratios for off-site mitigation required of developments that impact agricultural soils within designated growth centers.

## **B. Forest Resources**

Forested land in the Region comprises approximately 75-80% of the total land area, and serves as a major asset to the Region. Forestlands provide a natural system of surface and groundwater filtration, air purification and soil stabilization, and provide critical habitat for many species of native wildlife. Vermont forests also are frequently home to a great diversity of significant natural communities along with many rare, threatened, and endangered species. They also serve as an important economic resource for the Region. They form the foundation for numerous outdoor recreational activities such as walking, hiking, skiing, hunting, and camping; provide timber for construction and woodworking industries; serve as a renewable resource for energy use through heat and power production; and provide the scenic qualities of an attractive natural setting for residents and visitors. Proper management of forested land takes into account all of these economically and environmentally beneficial values and balances them for the common good.

### **1. Forest Fragmentation**

The management and prevention of forest fragmentation is a key component in the long term health and productivity of Vermont forest land. The creation of smaller forest patches due to development of housing and associated components such as roads and power lines may create unusable forest for many of the original inhabitants. As discussed in the Wildlife Section of this chapter, species such as black bear and fisher need undeveloped blocks of forest land (over 2,500 acres) in order to sustain a healthy population. For smaller species, and many predatory birds, a habitat range of between 100 and 500 acres is needed for survival. Bald eagles, osprey, turkey, and even deer are unable to find the appropriate amount of food and forage in smaller blocks thus resulting in an overall decrease in biological diversity. As development increases, species that are more accustomed to human interaction such as raccoon, squirrels, and skunks will increase in population due to the increase in forest edge habitat where they thrive.

Most of the forested land in the Region is in private ownership. Vermont's Use Value Appraisal (or Current Use) Program has been successful in bringing a large amount of private forestland in the Region under sound management plans. (See **Table 6.1** summarizing enrollment in the Current Use Program.) Even if left forested, small lots in multiple ownerships can be difficult to effectively manage; recreation access and timber production can be reduced due to differing objectives of landowners.

Towns are encouraged to plan for the protection of large areas of important forested land. By developing open space plans, Forest Land Evaluation and Site Assessment (FLESA) or encouraging planned unit development that encourage higher density development while protecting valuable open space, municipalities can ensure that large tracts of forestland remain contiguous. Local planning and conservation commissions may also take advantage of state and nonprofit organizations that can assist with incorporating forest resource planning into comprehensive plans.

<b>Town</b>	<b>Total Acres</b>	<b>Forest</b>	<b>Non-Productive* Forest</b>	<b>Agricultural</b>	<b>Total Enrolled Acres</b>	<b>% of Total Acres</b>
Andover	18,432	2,995.7	45.75	316.03	3,357.48	18.2
Baltimore	3,002	997.8	4.0	146.7	1,148.50	38.3
Cavendish	24,832	2,934.03	67.26	390.2	3,391.49	13.7
Chester	23,040	11,463.11	140.59	1,101.61	12,705.31	55.1
Ludlow	21,704	2,458.52	20.55	194.89	2,673.96	12.3
Reading	26,624	8,187.88	147.10	705.41	9,040.39	34.0
Springfield	31,557	7,270.33	148.21	2,080.09	9,498.63	30.1
Weathersfield	29,292	5,189.71	113.95	1,519.63	6,823.29	23.3
West Windsor	15,808	1,318.59	39.9	362.47	1,720.96	10.9
Windsor	12,544	1,799.02	58.7	656.46	2,514.18	20.0

\* Conditions which cannot adequately support that use due to steep slopes, ledge, or wet soils.  
Source: State of Vermont, Division of Property Valuation and Review, 2002

In 2007-2008, as part of a Municipal Planning Grant (MPG), the Reading Planning Commission, with assistance from the RPC and in conjunction with a statewide effort sponsored by the Vermont Natural Resource Council (VNRC) and Vermont Forum on Sprawl (now Smart Growth Vermont), developed policies and regulations that could help control the fragmentation of their important forestlands. The final report documents the process of mapping priority lands, lays out issues associated with forest fragmentation, identifies a range of policy options, and recommends specific town plan and zoning changes for Reading that will inform a larger campaign of the VNRC. In addition to developing

planning strategies for towns to address the problem of forest fragmentation, VNRC's campaign looked at workable tax relief and other landowner incentive programs to reduce forest fragmentation and promote the ability of forest landowners to hold onto their land.

## 2. Timber Production

Managing privately owned forestland for timber production has become a more significant part of the state and regional economies as forest cover has increased over the past 20 to 30 years, and over 80% of the forest land in the state is privately owned. When done carefully, logging is the kind of natural resource-based industry that furthers regional goals concerning open space, wildlife habitat, air and water quality, scenic resources, access to recreation, and the tourism economy. Logging operations that are based on sound management plans, follow Vermont's Acceptable Management Practices, and help conserve valuable forest, air, water, wildlife, and recreation resources should be supported, especially when they contribute to regional forest products industries. Realizing an economic return on forestland through responsible timber harvesting is a legitimate tool for maintaining the integrity of large forested tracts. Owners of private forestland should be encouraged to continue the recreational opportunities they provide and to work together to manage contiguous wood lots and recreational trails.

## 3. Forest Legacy Program

Vermont participates in the Forest Legacy Program (FLP), a Federal program that supports State efforts to protect environmentally sensitive forest lands. Designed to encourage the protection of privately owned forest lands, FLP is an entirely voluntary program. To maximize the public benefits it achieves, the program focuses on the acquisition of partial interests in privately owned forest lands. FLP helps States to develop and carry out their forest conservation plans. It encourages and supports acquisition of conservation easements, legally binding agreements transferring a negotiated set of property rights from one party to another, without removing the property from private ownership. Most FLP conservation easements restrict development, require sustainable forestry practices, and protect other values. In Vermont, the Vermont Department of Forest, Parks and Recreation has conserved approximately 53,000 acres in Vermont through the FLP.

## 4. Public Forest Lands

The Region also has a substantial amount of publicly-owned forestland (see **Table 6.2**). In addition to several town forests and land owned by the U.S. Army Corps of Engineers, a large amount of forestland is owned by the State of Vermont. The state-owned forest in the Region is managed under the concept of integrated use, a strategy of land management that considers public needs and the capabilities of the land to meet those needs. There are two State parks with camping facilities and trail networks. There are seven Wildlife Management Areas (WMAs) in the Region: Hawks Mountain, Knapp Brook, Tiny Pond, Arthur Davis, Little Ascutney, Weathersfield, and Skitchewaug. While originally purchased specifically for hunting, today WMAs emphasize conservation of wildlife and fish habitat. Unlike Vermont State Parks which focus equally on recreation and conservation, WMAs attempt to provide visitors recreation opportunities through conservation. Some state land is leased to private companies for use as alpine ski trails. Most of the state forestland in the Region is managed for multiple uses, including hiking, snowmobiling, hunting, fishing, and skiing, and much of it is managed for timber production through controlled harvests as part of long-term

management plans. The Southeast State Correctional Facility in Windsor also includes a large tract of forest lands (**Appendix A – Map 3**).

<b>Table 6.2 State-owned Land in Southern Windsor County</b>			
<b>Town</b>	<b>Total Acres</b>	<b>State-owned</b>	<b>% of Total</b>
Andover	18,432	1,399.5	7.6
Baltimore	3,002	50.0	1.7
Cavendish	24,832	6774.0	27.3
Chester	23,040	118.3	.5
Ludlow	21,704	3,203.1	14.8
Reading	26,624	6,676	25.1
Springfield	31,557	431.25	1.4
Weathersfield	29,292	1,887.6	6.4
West Windsor	15,808	2,337.16	14.8
Windsor	12,544	4,359.59	34.8

Source: SWCRPC 2003  
 Note: Not necessarily forestland

Because it is not subject to the same development pressures as privately-owned forestland, public forestland is an especially valuable asset to the Region, and becomes more valuable as large tracts of private land are fragmented and developed. Public land can be a real asset not only to the Region’s natural environment, but also to its economy. When managed properly, the economic benefits of public land can offset, to some degree, losses of local property tax revenue inherent in public ownership through the use of effective forest management practices such as selective cuttings. Management of state land should take all resource values into account. Although the economic values of recreation, wildlife habitat, and aesthetics are difficult to measure, these are important values that state-owned forestland provides for the Region.

The Region and adjacent regions presently have several “secondary” wood product manufacturers. Secondary manufacturing refers to the creation of wood products other than raw lumber or paper, such as furniture and other specialty and value-added wood crafts. These types of industries tend to provide a large number of jobs relative to the amount of wood needed for harvest. Manufacturing of secondary wood and agricultural products also adds value to these resources, and provides a good way to expand the Region’s forestry economy without placing undue pressure on landowners to liquidate large amounts of timber

Productive forest soils, as defined in 10 V.S.A. §6001(8), are regulated through Act 250 Criterion 9(C).

## C. Invasive Exotic Species

Invasive exotic species are non-native plants and animals that invade and alter both natural and managed areas. When they are free from natural predators, invasive exotics persist and proliferate to the detriment of native plants and animals. Not all non-native plants are invasive and not all invasive plants are non-native.



**Fig. 6.1**

Invasive exotic species have come to the Region through a variety of sources including, ornamental plant trade, conservation plantings, and agricultural operations. The threat of invasive exotic species to forest and open land in the Region is ongoing. Exotic honeysuckles, barberries, and buckthorns are all invasive shrubs or small trees that monopolize the understory (the area of a forest which grows in the shade of the emergent or forest canopy) of forests, both along the streams and farther upland, especially where the ground has been disturbed, in logging. Buckthorn is considered to be a major threat to the survival of future timber stands. Invasive exotic insects, such as the Hemlock Woolly Adelgid (see **Fig. 6.1**), pose a serious threat to forested riparian zones that are often comprised of significant quantities of eastern hemlock.

Aquatic invasive exotic species include zebra mussels that are a problem throughout the region and can severely impact water resources. They alter habitats by displacing native species on which organisms depend, while being of little use to those organisms themselves. This can be particularly detrimental to rare, threatened, and endangered species, which often require specialized environments to ensure their survival. Recreational opportunities may also be impaired if certain aquatic invasive exotic species such as zebra mussels (*Dreissena polymorpha*) spread to the region. While some aquatic invasive exotic species have not yet reached this Region, preventing their spread is essential.

Eurasian water milfoil (see **Fig. 6.2**) is an aquatic species, which can be found in the Connecticut River, the Mill Pond in Windsor; Lake Rescue; and at the confluence of the Black River and the Connecticut River, above and below Hoyt's Landing in Springfield. Purple loosestrife, the familiar beautiful flowering perennial plant of wetlands, is invading cattail marshes along the Connecticut and elsewhere. On the streambanks and along roadsides, Japanese knotweed (see **Fig. 6.3**), commonly referred to as "false bamboo", is very widespread, notably along the Black River in the area of the North Springfield Dam and along Fletcher Fields in Ludlow.



**Fig. 6.2**

Since 1996, in an effort to control Eurasian water milfoil in Windsor's Mill Pond, the town has installed an impermeable barrier on the bottom of the pond at the public beach and has regularly made repairs to that barrier to make the beach more attractive for swimming. This treatment was undertaken with the help of the Water Quality Division, and is intended to become a part of a larger water milfoil control strategy as new technologies become available.



**Fig. 6.3**



The most recent threat is from Didymo (*Didymosphenia geminata*) also known as “Rock Snot” which has been found in the Connecticut and White Rivers. This freshwater diatom produces a fibrous stalk that can develop into visible mats several inches thick that can carpet a stream bottom. Didymo can have negative ecological, economic and aesthetic impacts in infested areas, but how it will affect Vermont waters is yet unknown. There are no known methods of eradicating Didymo once it has been established so spread prevention is essential.

## **D. Wildlife Resources**

The landscape of the Region includes a variety of natural resources such as rivers, lakes, forests, and wetlands that provide habitat for numerous wildlife and aquatic species. The abundance and diversity of wildlife provide both economic and recreational opportunities for residents in the Region and are an essential element of the Region’s natural heritage. According to a study by the U.S. Fish and Wildlife Service, total expenditures for fishing, hunting, and wildlife-associated recreation in Vermont were \$347 million in 2006.

Planning for the preservation of wildlife habitat is critically important for the continued survival of wildlife species in the Region and the economic benefits associated with them. In addition to providing habitat and creating economic opportunities, lands that are left undeveloped contribute to the rural character of the Region. A good planning resource for towns is *Conserving Vermont’s Natural Heritage*, published in 2004 by the Vermont Department of Fish and Wildlife (VFWD).

### **1. Mast**

Mast is high-energy food, including seeds, nuts and berries, produced by certain trees and shrubs, such as beech and oak. Mast production areas provide critical fall feeding areas for a number of mammals including black bear and turkey. A sufficient supply of these high-energy foods is necessary for pregnant female bears, prior to fall denning, to complete their gestation period and develop adequate milk for the cubs. In addition, mast areas are important for wild turkey, grouse, deer and a number of other birds and mammals. Mature oak and beech stands are the most important mast production areas for wildlife, and should be preserved whenever possible.

Natural events can also take a toll on wildlife food sources. Distribution of available hard mast was greatly influenced by the ice storm of January 1998. This storm’s freezing rain damaged several hundred thousand acres of forest in Vermont. Particularly affected were beech stands, with higher elevation stands experiencing severe damage. In many cases 80% of the trees had greater than 75% crown loss. Such a decrease in food supply requires wildlife to disperse more widely in search of new sources. In 2000, wildlife biologists noted various individual beech trees and some beech stands that had been climbed by bears for the first time, most likely due to storm damage to traditional higher elevation feeding areas. Though the ice storm did severely damage mast production areas, the beech stands have recovered through new growth.

## 2. Habitat

A diversity of habitat types is needed for the continued existence of the various fish and wildlife species that inhabit the Region. A major deterrent to their survival and proliferation is the impact of human development on the natural environment. Although most development in this Region is done on a relatively small scale, cumulative development efforts can have a major impact on wildlife habitat. As people move to the Region the development of new single-family housing outside of villages is increasing. This growth pressure in rural areas is having a detrimental effect on large, contiguous blocks of wildlife habitat, including forest land, fields and other open spaces. Scattered, small-scale development causes fragmentation of these habitat areas, potentially diminishing or eliminating the land needed to support some species. A diversity of healthy populations can only be achieved through maintaining variety in the types of habitat available. Conservation of a diverse mix of natural areas and attention to connections between large tracts of wildlife habitat is necessary in order for a diverse and healthy wildlife population to survive and flourish. The following sections describe some important habitat types that may be found in the Region.

Large mammals such as moose, bear, deer, bobcat, and a variety of other animals including wild turkeys and grouse, rely on large contiguous areas of forests, fields and other undeveloped lands for food, shelter, breeding grounds and migratory stop-overs. The fragmentation of such land can result in decreases in the number of species as well as the sizes of populations of many species. A variety of songbirds reside in wooded areas that are characterized by less intense human use. In the Region, species may include red-eyed vireo, scarlet tanager, rose-breasted grosbeak, warblers, thrushes, white-throated sparrows, wrens, and many others.

Through Act 250, some protection is available for wildlife habitat areas under Criterion 8(a) - Wildlife Habitat and Endangered Species, which provides a detailed system to weigh evidence for a project and determine if a permit can be allowed.

**Appendix A - Map 6** shows wildlife habitat areas identified by the VFWD and depicts blocks of undeveloped land that are likely to provide habitat for a variety of wildlife. Not only is minimizing the negative impacts of development on these large blocks of habitat important, but so is protecting wildlife travel corridors that connect these blocks. The boundaries of existing deer wintering areas and bear habitat have also been mapped, but are subject to change due to fluctuations in environmental conditions. These mapped areas are based on statewide data sources, so reviewing a development proposal for a specific site may require consultation with the VFWD or other qualified wildlife scientists to determine actual critical habitat areas and identify mitigation options.

### a. Deer Wintering Areas

In winter months, deer tend to congregate in certain coniferous woods on western and southern slopes where they are protected from the wind and cold temperatures, and where they are offered greater mobility when searching for food. The greatest limiting factor on the size of the deer herd in the state is the quality and availability of the winter habitat. As stated in the VFWD's publication, *White-tailed Deer Management Plan, 1997-2006*, Vermont nearly lost its white-tailed deer population in

the late 19th century when the landscape was transformed from one which was 85% forested to one which was nearly void of trees (30%). Lessons like these reinforce the need to plan for future use and the demands on habitat.

b. Bobcat

Bobcats rely on large, contiguous areas to survive. Recent studies conclude that bobcat habitat preference is driven almost entirely by the presence of prey species. Habitats are predominantly comprised of “mature mixed woods” with a dense understory providing food and cover for prey and stalking cover for the bobcat, which must compete with other predators such as coyotes and fisher for food and space. Bobcat numbers are often underestimated due to their nocturnal habits and wariness. They favor areas with scattered swamps and southerly exposed rocky cliffs and ledges, where they can rest and sun. Denning sites must be secluded and quiet, and can be located in ledges, fractured rock, brush piles, hollow trees, and timber slash. When young bobcats move out, they survive as transients looking for territories to take over when another bobcat dies. Studies from other states have determined that home ranges for an adult male bobcat can be extensive, up to 60-square-miles, depending on the constancy of the environment. In addition to large habitat blocks, bobcats also need the connecting lands that bridge developed areas. These connecting lands allow for species reproduction and the protection of a healthy gene pool. If these connecting lands are lost due to development pressure, isolated populations may begin inbreeding thus increasing the chance of health problems and species loss.

c. Bear

Bears range over very large tracts of land in search of food. An adult male will range over a 25- to 50-square-mile area, while a female will cover between 10 and 15 square miles. Since bears are naturally wary animals, they rely on undeveloped travel corridors to link and provide access to suitable habitat. If travel corridors are fragmented, the bear populations will be threatened.

According to the VFWD, black bears are found throughout Vermont and the entire state is considered bear range. Bears currently traverse the Green Mountain Range into the towns of Andover, Baltimore, Cavendish, Chester, Ludlow and Reading. For planning purposes, the State has mapped four categories of bear habitat:

1. Bear production habitat: Regions frequently used by bears, including densities of cub-producing females, and generally require contiguous and remote forestland. The long-term stability of Vermont’s bear population depends on these areas.
2. Seasonal bear habitat: Regions frequently used by bears, including some cub-producing females. These habitats often contain critical seasonal feeding areas.
3. Corridors: Regions often used by bears traveling between habitats.
4. Less-used areas: Regions that, in most years, are less frequently utilized by bears.

Black bears also need connecting lands and corridors to travel between habitats and breed grounds. As with the bobcat, bears must maintain a healthy genetic population to survive. In order to promote the stability of the multitude of animal species that rely on contiguous or interconnected wooded areas, local and regional planning should consider remoteness and connectivity as important environmental qualities. Such areas may host a number of compatible uses such as forestry and recreation.

## **E. Aquatic Habitat**

The type of aquatic habitat needed for a successful population varies by species. However, many fish species in Vermont have lost habitat due to increased development along the shorelines of rivers and lakes. Some of the greatest threats to water quality and fish habitat are nonpoint source pollutants such as sedimentation caused by stream and river bank erosion and road runoff. Buffer areas of natural vegetation next to waterways can mitigate some of these problems and provide shaded areas along banks to keep water temperatures cool. Development increases the amount of stormwater runoff and the loss of trees along the shoreline allows sunlight to warm the temperature of the water. Species such as trout and salmon require coldwater habitat to live and share the need for cool, well oxygenated, free-flowing water with few blockages, and gravel stream beds for spawning. The most productive habitat for wild trout are small upland streams where water temperatures remain cool throughout the summer season and stream habitat has been minimally altered by land and water development activities. In the Region, wild trout populate Branch Brook in Ludlow, Twenty-Mile Stream in Cavendish, the upper North Branch of the Black River in Reading, Mill Brook in Reading and West Windsor, Mill Brook in Weathersfield, the upper Williams River in the Smokeshire District of Chester, Seavers Brook in Springfield, as well as many other small streams. In addition, the Black and Williams Rivers have played an important role in the salmon restoration program in the Connecticut River basin.

Dams and hydroelectric facilities inhibit the movement of fish populations to spawning areas and increase water temperature and sedimentation. Mitigation measures may include the construction of fish ladders or elevators to allow upstream passage to spawning habitat. Smaller barriers to aquatic organism passage are far more common. Road culverts with the downstream end hanging above water level prevent movement upstream. Replacing these culverts with ones of the appropriate size installed at grade allow fish species such as trout, smelt, suckers and minnows along with other aquatic organisms to pass through to the upstream portion of the habitat. A good resource for towns is the *Vermont Better Back Roads Manual* which provides resources on rural road stormwater techniques and fish friendly culvert designs.

Sewage treatment plants can degrade water quality by not fully treating effluent or by not having adequate facilities to treat certain nutrients such as phosphorous. The ability of streams and rivers to assimilate the discharge from sewage treatment plants and provide food supply and necessary habitat for spawning is predicated on stream depth and flow. Water withdrawal from rivers and streams can have a negative impact on fish species and should be studied before permits to withdraw water are granted. For a more in-depth

discussion on water quality issues that affect fish habitat and the state and local regulations that control these issues, see the Surface Waters section in this Chapter.

## **F. Rare, Threatened and Endangered Species; and Significant Communities**

There are a number of rare, threatened and endangered plant and animal species and significant communities in the Region, including the peregrine falcon, dwarf wedge mussel, timber rattlesnake, and the cobblestone tiger beetle. The VFWD's Nongame and Natural Heritage Program has identified and mapped rare, threatened and endangered species, and significant natural communities throughout the State.

In order to protect these important natural areas, habitat areas or natural communities have been identified by points on the map but do not reveal which species reside in those areas (**Appendix A – Map 7**). In addition, the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Fish and Wildlife recognize the Connecticut River Rapids Macrosite area, stretching from the Wilder Dam in Hartford to Weathersfield Bow in Weathersfield, as an area of species and habitat richness. Endangered and threatened species are protected under 10 V.S.A., Chapter 123.

According to the U.S. EPA, threatened and endangered species are defined as:

**Endangered Species:** "...means any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to constitute a pest whose protection under the provisions of this Act would present an overwhelming and overriding risk to man."

**Threatened Species:** "...means any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range."

Vermont statute maintains that endangered species rules "shall [not] cause undue interference with normal agricultural or silvicultural practices", but does not exempt these practices from federal law protecting federally designated endangered species (10 V.S.A. §5408(d)).

The VFWD defines a rare species as:

**Rare Species:** "...one that has only a few populations in the state and that faces threats to its continued existence in Vermont."

Rare species face threats from development of their habitat, harassment, collection, and suppression of natural processes, such as fire. The VFWD uses a ranking scheme that describes the rarity of species in Vermont. The range is from very rare to common and widespread, based on the number of known occurrences, the population size, and the degree to which the populations are threatened.

A significant community, as defined by the VFWD's Nongame and Natural Heritage Program, is also shown on Map 6. These represent areas of land and/or water in which a natural community is, or was, present. VFWD should be consulted to determine if these areas have practical conservation value for the community, based on potential, continued or historical presence and/or regular recurrence at a given location.

## **G. Water Resources**

Healthy ponds, rivers, streams, wetlands, and clean drinking water are all important elements of healthy ecosystems. Rivers and streams provide habitat for fish and other aquatic species and are recreational resources for swimming, canoeing, kayaking, fishing, and sight-seeing. Many of the region's rivers serve as mixing areas for assimilation of treated wastewater, and some ponds and reservoirs provide secondary sources of drinking water for towns. River and stream corridors, including a buffer area of natural vegetation, also provide natural greenway corridors that can connect networks of wildlife or recreational corridors across the Region. Wetlands are important for habitat, recreation, pollution and flood control, and the recharge of surface and ground water. Groundwater is the primary source for most residential and municipal water supply systems and has many points of exchange both to and from surface water systems. Water resources can easily be damaged if not properly managed. Human activity can adversely affect surface water, groundwater, and wetlands through direct and indirect discharges caused by land use activities throughout the watersheds that supply these resources.

### **1. The Hydrologic Cycle**

The interrelation between the different water systems is clearly demonstrated by the hydrologic cycle - the way in which water moves through the environment. Generally, the cycle functions as follows: The sun causes water to evaporate from the ocean and other bodies of water, which is then carried by wind over land. The evaporated water falls to earth as snow, rain, or ice depending upon weather conditions. Vegetation catches and absorbs some of the precipitation. What is not used by vegetation falls directly to the ground or is evaporated back into the atmosphere. The water that falls to the ground without being absorbed or evaporated either percolates through the soil or runs off the land into depressions, lakes, streams, wetlands or other water bodies. The water that percolates through the soil slowly collects in pockets in the soil or fissures in rocks to become groundwater. Once the groundwater capacity of these spaces is filled, the water will migrate into surface water bodies. Once collected in water bodies, the groundwater and runoff water will again evaporate, thus completing the hydrologic cycle.

Land use activities can have a profound effect on the movement, storage, and transmission of water through the environment. The construction of impervious surfaces such as parking lots, driveways, and buildings can increase the velocity of runoff and inhibit the infiltration of water into the soil. The higher volume and velocity of water increases the potential for flooding and erosion and brings with it sediment and pollutants that wash over the land. Greater turbidity and pollutant levels caused by runoff damage habitat for fish and aquatic organisms, and impair the aesthetic and recreational values of the water body.

## 2. Basins and Watersheds

The Region is located in the Connecticut River Watershed, and sits within three basins, as defined by the State: the Black River (Basin 10), the Williams River (Basin 11), and the Lower Connecticut (Basin 13). Basins include a number of sub-basins, which are individual watersheds (Mill Brook) or sections of watersheds (Upper, Middle and Lower Black River). The State completes assessment reports for each basin about every five years. A more comprehensive “basin plan” is required for each basin under the Vermont Water Quality Standards (2000), and must be updated every five years. Assessment reports generally summarize monitoring data collected by the State and other projects conducted within the basin assessed. A Basin Plan summarizes current and past (within five years) assessment, planning, and implementation activities at the state and local level in the basin. It identifies topics or areas of special importance in the basin, identifies available management tools to address those topics, and makes specific recommendations on how to address key topics, including recommendations for continuing community based planning or implementation action. The basin planning process begins with any planning that has already been completed by organized watershed groups. The Mill Brook Watershed Association, the Connecticut River Watershed Council, the Connecticut River Joint Commissions, and its Mount Ascutney Region River Subcommittee, the Black River Action Team and the West River Alliance are all watershed groups working within our Region.

In June 2008, the Basin 11 plan was completed and signed by ANR’s Secretary. Basin 11 encompasses the Williams River watershed, which includes portions of Andover, Chester, Cavendish, and Springfield. ANR is currently working on the Basin 10 plan with a 2011 target date for completion of the Ottauquechee and Black River watersheds, which covers portions of Baltimore, Cavendish, Chester, Ludlow, Reading, Springfield and Weathersfield in this Region (**Appendix A – Map 8**).

## 3. Surface Waters

The Region’s surface water resources consist of ponds, lakes, rivers, and streams which offer a number of different uses, such as recreation; wildlife habitat; food supply; commercial, industrial, and domestic use; and public drinking water supplies. The major lakes and ponds in the Region are Lake Rescue, Stoughton Pond, Mill Pond, Knapp Ponds, North Springfield Reservoir, and Lake Runnemedede. The largest rivers in the Region are the Connecticut, Black, and Williams. Major streams include Mill Brook, Twenty-Mile Stream, Jewell Brook, and Tracer Brook. Like other waters in the state, the surface waters in the Region are impaired to varying degrees of severity.

Most point source pollution problems in the state have been addressed through the construction of publicly owned wastewater treatment facilities. However, nonpoint source pollution continues to be a problem in many areas. The most common sources of nonpoint pollution include agricultural runoff, streambank destabilization and erosion, removal of riparian (streamside) vegetation, flow regulations/modifications, land development, and highway maintenance/runoff. The problems caused by these sources include thermal modifications, organic enrichment or low dissolved oxygen, and excess nutrients.

The State is required to list waters that are “impaired” according to the most recently adopted Water Quality Standards (See **Table 6.3**). The State is required to address these

“303(d) listed” waters with a Total Maximum Daily Load plan, which will identify sources of pollutants and specify maximum amounts that will be regulated in order to bring the water back to state standards. In 2008, the Black River (from its mouth to 2.5 miles upstream in Springfield), and the Tributary to Jewell Brook in Ludlow were identified as “impaired” in our Region.

<b>Table 6.3 303(d) Listed Waters-Impaired (Do not meet VT Water Quality Standards)</b>				
Waterbody ID	Segment Name/Desc.	Pollutant	Use(s) Impaired	Problem(s)
VT10-11	Black River; from mouth to 2.5 miles upstream (Springfield)	E. Coli	Contact Recreation	Combined sewer overflows
VT10-14	Soapstone Brook, Ludlow	Iron, Arsenic, Sediment	Aesthetics, Aquatic Life Support	Aquatic habitat impairment, some effect likely from Talc mine drainage, needs upstream assessment
	Tributary to Jewell Brook, Ludlow	Iron	Aesthetics	Evidence of Ludlow landfill leachate

Source: Vermont DEC – Water Division; 2004

Three waters in the Region are also listed as “In Need of Further Assessment” in the “2008 List Of Priority Surface Waters Outside The Scope Of Clean Water Act Section 303(D)” (see **Table 6.4** below). Waters on this list are in need of further assessment due to some identified or suspected pollutant that may be impacting one or more designated use of the waterbody. If future assessment results indicate impairment, the waterbody will be included in the next 303(d) list.

The Connecticut River Joint Commissions, made up of the Vermont Connecticut River Watershed Advisory Commission and the New Hampshire Connecticut River Valley Resource Commission, developed the Connecticut River Corridor Management Plan (CRCMP) that lists problems and provides recommendations to address these problems throughout the Vermont and New Hampshire portions of the Connecticut River watershed. According to the CRCMP, bank erosion is one of the greatest problems along the Connecticut River. Both the Old Connecticut River Road in Springfield and Brook Road in Windsor are examples of the effects of erosion and streambank destabilization. In order to prevent erosion, the CRCMP recommends that towns and landowners avoid substantial investment and construction in the floodplain and protect floodplain areas and other lands in the corridor for open space, agriculture, and forestry.



<b>Table 6.4 Part C - Waters in Need of Further Assessment</b> <b>(May not meet VT Water Quality Standards)</b>				
Waterbody ID	Segment Name/Desc.	Possible Pollutant	Possible Use(s) Impaired	Possible Problem(s)
VT10-11	Black River, 2.5 To 7.5 Miles Above Mouth	Sediment, Nutrients, E. coli	Aesthetics, Aquatic Life Support, Contact Recreation	Contributions From Urban Runoff, Land Development
VT10-14	Jewell Brook	Arsenic	Aquatic Life Support, Contact Recreation, Secondary Contact Recreation	Arsenic In Sediment From Former Mill
VT10-16	No. Branch Black River Above Stoughton Pond	Sediment, Nutrients, E. Coli	Aesthetics, Aquatic Life Support, Contact Recreation	Source(s) Need Further Assessment; Notable Erosion

Erosion and road runoff are significant problems in many rivers and ponds throughout the Region. Increased flows that come from stormwater runoff can carry sediment and other pollutants into surface waters and cause an imbalance in flow dynamics. This imbalance can lead to flooding and sedimentation in rivers, streams, lakes and ponds into which they flow. The RPC, with assistance from the Mill Brook Watershed Association, completed an erosion study for the Mill Brook and its major tributaries in 2000. The study mapped out erosion sites and categorized them by type and potential for remediation. In most cases the erosion is caused by the natural movement of the stream channel over time (the geomorphology of the river). If the river has access to the floodplain, the natural meandering of the channel will eventually bring the river to a stable state. Rechannelization over time as well as ongoing development that bring higher flows have contributed to the changing channel. In order to slow the process of erosion and allow rivers to reach a stable state, the communities within the watershed should discourage development in the flood plain and work with property owners to establish vegetated buffers where there are none.

An ongoing study throughout Vermont has been a Fluvial Geomorphic Assessment of rivers and streams. Each assessment is broken into three distinct phases where differing aspects of the stream are studied. Within the Region, Phase I assessments were completed looking at the erosion, floodplain access and bridge or culvert condition on the Black River and associated tributaries along with Mill Brook in Windsor. Phase II studies were completed during the summer of 2008 on portions of the Black River and Twenty Mile Stream in Cavendish. The results of these studies will allow towns to better address water quality concerns. The anticipated final product from the Fluvial Erosion Hazard study is a corridor management plan that will provide guidance on restoration projects that will help remediate water quality concerns.

In addition to the threats to surface waters coming from the watersheds in which they are located, pollutants can be carried into rivers and streams in the rainwater itself. For several years, there have been statewide fish consumption advisories for mercury content. The advisory guidelines are more stringent for the consumption of lake trout and walleye, especially for women of childbearing age, but suggest limits on consumption of all fish for all segments of the population. Unfortunately, one of the major contributors to mercury contamination appears to be atmospheric deposition, which cannot be effectively controlled at the regional or state levels.

Water quality problems are exacerbated by human activities taking place not only along shorelines but throughout watersheds. These issues should be addressed through planning, education, land acquisition and regulatory programs. To be effective, these measures should encompass not only local needs but those of entire watersheds and the Region (**Appendix A – Map 7**).

#### 4. Wetlands and Vernal Pools

Wetlands and vernal pools serve as important feeding and breeding areas for a number of plant and animal species (**Appendix A – Map 7**). One-third of federally listed endangered species are dependent on these areas for survival. Upland wetlands provide an important early source of vegetation for bears that are emerging for springtime feeding. Many of these wetlands are fed by groundwater discharge and can produce vegetation earlier in the season because of the warmer groundwater.

Wetlands fulfill a variety of functions, including erosion control, flood storage, removal of pollutants, and wildlife habitat. The State of Vermont recognizes the importance of these functions in 10 V.S.A. §905. In 1990, the Water Resources Board issued the Vermont Wetlands Rules which classify all wetlands according to their functions. Wetlands in Vermont are classified by significance as either Class 1, 2 or 3. Class 1 wetlands are those that “are exceptional or irreplaceable in their contribution to Vermont’s natural heritage and are therefore so significant that they merit the highest level of protection under these rules.” Class 2 are those wetlands that “either taken alone or in conjunction with other wetlands, merit protection.” Class 3 wetlands have been determined to be not significant enough to be protected by the State. According to the Vermont Wetlands Rules, wetlands are:

“ . . . those areas of the state that are inundated by surface or ground water with a frequency sufficient to support significant vegetation or aquatic life that depend on saturated or seasonally saturated soil conditions for growth and reproduction. Such areas include but are not limited to marshes, swamps, sloughs, potholes, fens, river and lake overflows, mud flats, bogs, and ponds, but exclude such areas as grow food or crops in connection with farming activities.”

The major functional values of wetlands are:

- Storage of flood water and stormwater runoff;
- Protection of surface and groundwater through filtration of pollutants;

- Habitat for fish, wildlife, migratory birds, hydrophytic vegetation, and threatened/endangered species;
- Specialized, seasonal breeding habitat (such as vernal pools);
- Natural science education and research ;
- Recreational value; open space; aesthetics; and
- Erosion control through binding and stabilizing of the soil.

The degree to which a particular wetland fulfills the above functions, rather than size, determines its significance. In Vermont, 220,000 acres or 4% of the land area in the state have been identified as wetlands. The State's Wetlands Office estimates that over 80,000 additional acres of wetlands exist, and which still need to be identified on maps.

Development activity (other than certain agricultural/silvicultural activities and certain home maintenance activities) in or near a Class 1 or 2 wetland requires a Conditional Use Determination from the ANR to ensure no undue adverse effects on the protected functions. Zoning administrators in towns that have zoning are required to notify the Wetlands Office of activities proposed within wetlands prior to the issuance of a local zoning permit. The Wetlands Office has 30 days to provide comments on the project to the zoning administrator. This review mechanism protects zoning administrators from issuing local permits that might violate state and federal wetlands regulations.

Vermont wetlands are also protected under Act 250 and by some local bylaws. Federal protection is afforded by the U. S. Army Corps of Engineers and the U.S. Environmental Protection Agency through administration of Section 404 of the Clean Water Act. Section 404 regulates the dredging or placing of fill into any waters of the United States, including wetlands. The Clean Water Act also requires that regulated activities are certified by the states as being in compliance with applicable state water quality standards.

State and Federal regulations notwithstanding, the ANR's Water Quality Division estimates that between 200 and 400 acres of wetlands are lost each year in Vermont. This loss is offset by wetland restoration programs and natural reversion to wetland when land uses are abandoned, but clearly shows that existing regulations do not prevent all development in and around wetlands. The Vermont Wetlands Office has documented the loss of 118 acres and impairment of 265 acres of wetlands between 1990 and 1995 for projects that were reviewed under the Vermont Wetlands Rules. Smaller projects in Class 3 wetlands are not reviewed, and it is likely that development is still occurring in regulated wetlands without being reported to the Wetlands Office.

Vernal pools are temporary bodies of water which usually occur in woodland depressions and provide important breeding areas for a variety of amphibian and insect populations. Most vernal pools in Vermont are filled by spring rains and snow melt and are dry during the summer. The pools are typically shallow and may range in size from a few feet to 150 feet in width. They are safe breeding grounds for insects and amphibians because they do not support fish populations. Most vernal pools in the state occur in forested habitats, but they may also be found in meadows, sand flats, and river flood plains. Because of their small size and temporary nature, vernal pools are not protected under the Vermont Wetland Rules.

They are critical habitat areas for many species and should be identified and protected under municipal plans.

Vernal pools and Class 3 wetlands are not currently mapped in this Region. Vernal pools are not regulated by the State. Towns might consider creating a conservation commission to inventory vernal pools and Class 3 wetlands. Town plans and zoning bylaws could protect these resources if desired locally.

## 5. State and Local Efforts to Improve Water Quality

### a. Riparian Buffers

A riparian buffer is a band of vegetation located next to a body of water such as a brook or stream. Maintaining vegetated buffers of native trees and shrubs is the easiest and most cost effective way to improve water quality in streams, rivers, lakes, and ponds. Buffers filter runoff from roads, lawns, stables, farms, junkyards, and construction operations that may carry fine sediment, nutrients, oils, fertilizers or other pollutants. The roots of vegetated buffers can also help to hold stream banks in place preventing erosion. By reducing the speed of runoff, buffers allow water to infiltrate into the soil and therefore reduce the volume of runoff into the brook. This has the combined effect of preventing flooding and recharging the groundwater supply.

The effectiveness and functions of buffers vary according to a number of factors, including soil type, slope, and the type of vegetation. Generally, the wider the buffer, the more effective it is in filtering pollutants, protecting banks, and providing habitat areas for birds and other wildlife. Vegetated banks also provide shade which keeps waters cool for native fish populations. The State of Vermont has recently adopted policies for designating buffer widths on projects that come under State review. The policy will look at the intended functions of a buffer and make a scientific determination of the width according to the characteristics of the site. In most cases, the State will require a minimum 50-foot buffer, and in many cases a 100-foot buffer. Site visits will likely be made to projects proposing smaller buffers, and different standards will be developed for urbanized areas

Buffers can clearly provide benefits to water quality, fish and wildlife habitat, and can offer some protection against flood damage and erosion. However, some flexibility in buffer type, width and/or construction materials should be considered for projects that provide significant public benefits (such as bike paths, parks, and other recreational uses).

### b. Stormwater

Significant changes have been made in recent years to federal and state laws that regulate stormwater runoff. In 2005, the ANR adopted a new stormwater rule for stormwater runoff into water that is not primarily influenced by existing stormwater runoff. Permits from the Vermont Department of Environmental Conservation (DEC) are required for any development that disturbs 1 or more acres or is part of a larger development.

Under the rule, towns are responsible for ensuring that development plans have been stamped by a licensed engineer saying that they comply with the Vermont Stormwater Manual. Towns may also adopt local regulations for projects not covered by the State

regulations. To learn more about the new rules, visit this website: [www.vtwaterquality.org/stormwater.htm](http://www.vtwaterquality.org/stormwater.htm).

The *Vermont Erosion Prevention and Sediment Control Field Guide* and *The Low Risk Site Handbook for Erosion Prevention and Sediment Control* are resources for appropriate measures for erosion prevention and sedimentation control during construction. Several measures can be taken to prevent stormwater runoff during construction including:

- Laying gravel on the construction entrance to prevent soil from being transported from the site onto the pavement;
- Properly installing and maintaining a silt fence;
- Diverting and slowing the rate at which stormwater runoff from any surrounding hillsides passes through the site; and/or,
- Exposing only the soil on the area which will be worked on and then stabilizing the soil when finished with approved methods.

Low impact development (LID) is a technique used to control stormwater runoff at building sites. Techniques can range from utilizing the natural swales and hollows in the landscape for stormwater infiltration to collecting runoff from roofs on buildings for domestic reuse. The goal of LID is to return the development site back to its original hydrologic functions using designs to infiltrate, control, reduce and store runoff at the source and to maximize groundwater recharge on-site.

## 6. Groundwater

Groundwater is the Region's primary source of drinking water. It moves underground through aquifers, which are water-bearing strata of permeable rock, sand, or gravel. Due to Vermont's geology, groundwater is often unpredictable as it travels through a maze of cracks in bedrock formations. It can infiltrate rock fractures and travel in unknown directions for long distances or break out to the surface. Potential groundwater pollutants include septage from improperly designed or malfunctioning septic tanks and leaching fields for wastewater, leakage from underground gas and oil tanks, and improperly disposed of chemical or radioactive materials. Once contamination occurs, control and abatement are extremely difficult, if not impossible. The key is to prevent pollution from entering rock fractures in the first place.

Effective June 9, 2008, Section 1 of Vermont Act 199 sets forth the General Assembly's finding that it is the policy of the state to protect its groundwater resources in order to maintain high-quality drinking water, that the groundwater resources shall be managed to minimize the risk of groundwater quality deterioration by regulating human activities that pose a risk to those groundwaters, and that the groundwater resources of the state are held in trust for the public.

As such, Act 199 states that, "Beginning September 1, 2009, any person that withdraws more than 20,000 gallons per day, averaged over a calendar month at a single tract of land or place of business shall file a groundwater report with the secretary of natural resources on or before September 1 for the preceding calendar year." It further states that, "On and after July 1, 2010, no person, for commercial or industrial uses, shall make a new or increased

groundwater withdrawal of more than 57,600 gallons a day from any well or spring on a single tract of land or at a place of business without first receiving from the secretary of natural resources a groundwater withdrawal permit.”

In addition, a new Subchapter 6 was added to 10 V.S.A. Chapter 48, titled "Groundwater Withdrawal Program," covering matters such as groundwater withdrawal permits and reporting requirements, public input at hearings on permit applications, and the adoption of rules by the Secretary of the ANR implementing the new statutes. The rules shall include requirements for the mitigation of undue adverse effects on water systems and requirements for the renewal of permits.

The DEC's Water Supply Division has developed a groundwater protection strategy, including the identification and mapping of Public Water Source Protection Areas, for all communities in the Region. Vermont's Water Supply Rule (Environmental Protection Rules, Chapter 21; adopted April 25, 2005; [www.vermontdrinkingwater.org](http://www.vermontdrinkingwater.org)) defines a Source Protection Area/Public Water Source Protection Area as:

“...a surface and subsurface area from or through which contaminants are reasonably likely to reach a Public water system source.”

Delineation of Public Water Source Protection Areas is required for approval of each new Public Community water system source (as defined by Vermont's Water Supply Rule), and for increases in approved yield of an existing source. Groundwater sources require delineation of Wellhead Protection Areas, which are delineated using existing geologic and hydrogeologic data and pumping test data, and giving consideration to several factors, including topography, expected use, soil types, and hydrogeologic modeling.

A major issue confronting local communities is protection of Source Protection Areas. As development pressures increase, land uses can occur near these areas that threaten groundwater quality. A few areas of major concern are the storage of chemicals or other potential pollutants, the possibility for spills, or the use of materials by consumers that could leach into the public water supply. The severity of the potential problem is increased by the fact that few communities have secondary water supplies in case of contamination.

In response to the 1996 amendments to the federal Safe Drinking Water Act, which required states to develop and implement a Source Water Assessment Program (SWAP). Vermont's SWAP includes different requirements for the three different types of public water systems. In Vermont, a Source Protection Plan includes the delineation, inventory, and assessment required under the federal program, and also includes a management plan for the potential risks and a contingency plan.

On July 1, 2007 changes to the Vermont on-site sewage statute were put into effect giving the ANR universal jurisdiction over all on-site wastewater permits, superceding any existing town or local septic ordinances. These changes may have an effect on the quality of Vermont's groundwater in the near future. The changes ease the technical requirements for the installation of septic systems, making much more land available for residential development. Eliminated is the exemption from review of most systems installed on parcels of land greater than 10 acres in size. The changes also lifted many of the restrictions on the

use of land with steep slopes and shallow depth to bedrock, increasing the amount of land available for residential use by as much as 50%. Towns should address the land use implications in town plans and land use regulations, if they so choose. Much of the land that was recently off-limits to development solely because of physical constraints may now be suitable for supporting on-site septic systems.

## H. Soils

Composed of disintegrated rock, water, air, decaying organic matter, and microorganisms, soil is the critical link between rocks and plants. Soils vary greatly in their composition and determine where water impoundments occur, the kind and amount of vegetation that is available to wildlife as food and cover, and what types of land use are suitable. Potential uses include agriculture, forestry, earth resource and mineral extraction, and recreational and building site development.

The soils in Region occur in an orderly pattern that is related to geology, relief, climate, and the natural vegetation of the area. Individual soils on the landscape merge into one another as their characteristics gradually change. From the top of the Region’s highest peaks to the banks of the Connecticut River, soils differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use.

A major threat to soils is erosion, which is a process that occurs naturally but can be greatly accelerated through human activity. Most soils in their natural state are protected from wind and rain by vegetation, which may range from grasses to dense forests. When vegetation is removed, fertile topsoil, which may only be a few inches thick, is the first to erode. Topsoil generally has more capacity than the subsoil to hold the moisture necessary for plant growth, supplies more nutrients, and more readily allows plants to establish root systems. Erosion, construction, mining, logging, and other activities may also destroy protective vegetation.

Since 1935, the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) has provided leadership in a partnership effort to help America's private land owners and managers conserve their soil, water, and other natural resources. Slope is the inclination of the land surface and is one of a few important factors in determining suitability for development. **Table 6.5** identifies the various NRCS slope classifications and the associated development constraints. **Appendix A – Map 9** shows slopes over 25 percent.

<b>Table 6.5 Slope Classifications</b>	
% Slope	Classification
0-3%	Generally suitable for most types of development, may require drainage
3-8%	Most desirable for development, having least restrictions
11-15%	Suitable for low density development with particular attention given to erosion control, runoff, and septic design
15-25	Unsuitable for most types of development and septic systems, construction costly, erosion and runoff problems likely
>25	All types of construction should be avoided, careful land management for other uses needed

Source: Natural Resources Conservation Service

Generally, in Vermont, land in excess of 2,500 feet in elevation is considered a fragile environment and development should be strictly discouraged. The land tends to be predominantly steep with an extremely shallow soil depth to bedrock, low recovery rates of damaged vegetation, and high susceptibility to erosion. These highland areas are largely in forestland and contribute to the capture and filtration of clean water to lower elevation.

Ski areas may require construction in areas higher than 2,500 feet in elevation and with slopes greater than 25%. However, careful consideration must be given to any negative impacts new construction may have on the environment, such as degradation of water quality, erosion of topsoil, and encroachment on wildlife habitat.

Since most development outside of the Region's villages do not have access to a municipal sewer system, the suitability of soil for onsite wastewater treatment systems is important in evaluating where septic systems should be located and identifying the limitations of future development. Soils within the Region vary greatly with respect to suitability for private wastewater systems. **Appendix A – Map 10** shows the septic suitability of soils based on NRCS soils data.

## **I. Mineral Resources**

Mineral resources, such as sand, gravel, crushed rock and stone, talc, soapstone, granite and marble, are necessary commodities in the Region for road improvement, building construction, drainage, construction of septic systems, and for export. Historically, the towns of Cavendish, Chester, Ludlow, Weathersfield, and Windsor were sources for the export of granite and marble. However, due to a combination of capital costs and reduced consumer demand, the excavation of granite and marble has declined dramatically. There were extensive lime quarries and kilns in Weathersfield - primitive ones in the early to mid 1800s and a well developed commercial operation in Amsden until the 1930s. There was soapstone mining in Weathersfield until 1910 and in Chester until the 1980s for stone used by the Vermont Soapstone Company in Perkinsville. Presently, only Holden Quarry in Chester still extracts talc.

Sand and gravel for domestic use, and talc for export are the predominant mineral resources mined in the Region today. Sand and gravel deposits occur in abundance along the Connecticut River and its tributaries. However, many town-owned pits are close to being out of sand and gravel for local highway uses, and prices from private sand and gravel sources have increased dramatically in the last 15 years. Talc is currently mined and processed in Ludlow. The talc mining industry is expected to remain stable into the foreseeable future.

Excessive resource extraction can permanently damage natural and aesthetic resources with broad implications for water quality and availability, as well as the potential for destruction of archaeological sites. Sand and gravel deposits serve as areas for aquifer recharge and filtration, vital for high quality sources of drinking water. Disturbance of these areas can reduce their natural ability to retain and filter groundwater, resulting in degraded water



quality. On-site storage and disposal of materials at extraction sites contaminates underground water supplies through the leaching of hazardous materials into the water table.

Mineral and earth resources extraction requires an Act 250 permit under Criterion 9 (d) and (e). Such operations bring noise, dust, heavy truck traffic, and negative impacts on local aesthetics, which often trigger local challenges by neighboring property owners. Criterion 8(a) - Wildlife Habitat and Endangered Species must also be taken under consideration.

## **J. Air Quality**

Residents of the Region are fortunate to live in an area that has relatively clean air. However, threats to air quality do exist and may either be locally generated or transported from outside the State's borders. Local air quality problems may be generated through auto emissions, especially in congested areas; local industrial and manufacturing facilities, including mineral extraction; trash incineration; smoke from wood stoves; and illegal burning of garbage. Transported air pollution comes across state lines or from other regions of the country, as evidenced by acid rain and reduced visibility in the summer.

Air quality standards are set at the federal level, through the EPA. The Clean Air Act, which was last amended in 1990, requires EPA to set National Ambient Air Quality Standards (NAAQS) (40 C.F.R. part 50) for pollutants considered harmful to public health and the environment. It also established two types of national air quality standards: Primary standards (set limits to protect public health) and Secondary standards (set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.) The EPA Office of Air Quality and Standards set NAAQS standards for six principal or "criteria" pollutants: particulates, sulfur dioxide, carbon monoxide, nitrogen dioxide, lead, and ozone. Currently Vermont is "in attainment" for all standards set under NAAQS, however it is bordered by other states that are "in non-attainment" for some pollutants. It is important that development of new industrial or manufacturing facilities include approved emission control systems to stay in attainment, as well as preventing costly changes in the future. In addition, dust from mining operations and construction can cause local air quality problems if not properly controlled.

Noise may also be a side effect of mining and similar industrial activities that can negatively affect the quality of life of local residents and visitors, as well as wildlife. The Act 250 review process should prevent such negative effects; however, local planning commissions may want to address such issues when making land use decisions in their communities. The Noise Pollution Clearinghouse in Montpelier offers resources on this issue [www.nonoise.org](http://www.nonoise.org).

The greatest threat to air quality in the Region comes from motor vehicle emissions. Vermont requires that emission control devices be mounted on and in use in cars and requires that such devices be tested to ensure that emission standards are being met. Effective January 1, 2001, 1996 and newer gasoline powered vehicles, and 1997 and newer diesel powered vehicles of 8,500 pounds or less must pass an annual "On-board Diagnostic Inspection".

In addition, on September 12, 2007, the U.S. District Court for the District of Vermont decided against a group of automobile manufacturers challenging Vermont's vehicle emissions standards for greenhouse gases. In August of 2005, the Vermont Air Pollution Control Division introduced an amendment to Vermont's vehicle regulations. The amendment would require the State to adopt California's proposed greenhouse gas emissions standards for motor vehicles. The standards would be gradually phased in between model-years 2009 and 2016, and by model-year 2016, would require reductions of tailpipe greenhouse gas emissions from new motor vehicles of approximately 30 percent. Vermont and 13 other states are poised to adopt the California standards.

Regional and local planning commissions should address vehicle emissions problems through the planning of transportation networks to prevent congestion and through the promotion of public transportation and bicycle and pedestrian travel. Section 108(f) of the Clean Air Act lists Transportation Control Measures to reduce mobile source emissions (see Appendix C). States whose air quality fails to meet the NAAQS are required to implement various combinations of these measures in an attempt to improve air quality. See Volume 2: Southern Windsor County Regional Transportation Plan for additional discussion.

As discussed in the Energy Chapter, Vermont's primary energy sources produce very little air pollution as protected by the U.S. EPA. The contract for electricity from HydroQuebec expires in 2012, and the operating license for Vermont Yankee expires that same year. Any other potential new and/or replacement energy plants should strive to not negatively impact air quality.

By-products from woodstove combustion may cause poor air quality in some areas, depending on topography and weather patterns. Federal law requires that new woodstoves contain clean burning combustion systems or catalytic converters; however, older stoves and outdoor-burning woodstoves (mounted on the exterior of a building) are exempt from such requirements. The state is considering rules regarding outdoor-burning woodstoves; municipalities or regions that have noticeable air quality problems related to wood burning may wish to address such issues at the local level.

For additional discussion on air quality issues and climate change, please refer to the Energy Chapter.

## **AGRICULTURE & FOREST RESOURCE GOALS**

1. Encourage the conservation, wise use and management of the Region's agricultural and forestry resources, to maintain its environmental integrity, and to protect its unique and fragile natural features.
2. Expand the agricultural and forestry economies by coordinating planning, zoning, and economic development activities with member communities and organizations.
3. Protect the Region's rural character and working landscape.

4. Sustain agriculture and forestry in those areas of the region where they are predominant land uses, and where soils, and other conditions enable them to remain economically viable.
5. Reduce fragmentation of forest and agricultural lands.
6. Protect and preserve the character and integrity of both significant public and private forest lands.

## **AGRICULTURE & FOREST RESOURCE POLICIES**

1. Encourage measures that balance supporting land-based economies, protecting agricultural and large blocks of forested lands, with supporting development in or near town centers.
2. Work with landowners to create vegetated buffers between farmland and surface waters in the interest of protecting water quality as well as agricultural property.
3. Agricultural land and forested land form the separations between town centers, villages, and hamlets in the traditional regional settlement pattern. Tangible efforts shall be made to preserve this patchworked balance of open and forested space, to promote compact settlements through creative regional planning, municipal planning, private initiatives, purchases, leases and transfers of development rights and efficient site designs. Contiguous forest and significant agricultural areas shall remain largely in non-intensive uses unless no reasonable alternative exists to provide essential residential, commercial and industrial activities for the region's inhabitants.
4. The construction of utilities, roads or other land development should skirt tracts of productive agricultural and forest land rather than divide them.
5. Large tracts of economically viable Primary and/or Secondary Agricultural Soils located outside of downtowns, villages and other locally designated growth areas should be protected for current and/or future agricultural use. Development in these areas shall utilize innovative site designs (e.g. clustering, planned unit developments, etc.) in order to minimize negative impacts and preserve the agricultural viability of these soils.
6. Development within downtowns, villages and other locally designated growth areas should be allowed on areas of Primary and/or Secondary Agricultural Soils, if supported in the town plan, but shall use innovative site designs to minimize negative impacts and shall be required to maintain a small tract for future small-scale agricultural use or community garden.
7. State or federal programs and legislative efforts which protect and enhance the economic, cultural, environmental, and aesthetic values of agricultural and forest lands should be supported.

8. Support productive, sustainable forestry on large lots, contiguous blocks of forested lands, and forested corridors linking large tracts of forest lands, and maintain accessibility to those lands. Doing so will contribute to maintaining the ecological values and economic vitality of these forested areas.
9. Proposed roads or utilities should be sited to cause minimal negative impact to forest contiguity and aesthetics.
10. Where important natural features, soil conditions, or special resources including, but not limited to, agricultural and forested land are identified, clustered or peripheral development is required to protect such resources and prevent fragmentation and sprawling settlement patterns.
11. Encourage appropriately sited and designed businesses promoting the local processing, sale and distribution of native raw materials and products. Planning and regulatory review at the state and local level should not unduly restrict the development of “home cottage” industries which complement farm and forestry.
12. State-adopted Accepted Agricultural Practices and Acceptable Management Practices shall be used in agricultural and forestry activities, implementation of Best Management Practices (BMPs) are encouraged in such operations, and point and non-point source pollution shall be minimized.
13. Conservation of agricultural and forested lands through the use of public/private funds for the purchase of development rights, fee simple purchase, and other such measures is encouraged.
14. The RPC recognizes that certain local land development or subdivisions may conflict with policies to minimize the loss of existing or potential agricultural or forest resources. Furthermore, the RPC acknowledges that in certain areas agricultural or forestry uses may no longer be viable due to a variety of factors including:
  - (a) The existence of or planning for roads or sewers in the immediate area which dictate that involved land should be converted to more intensive uses; and.
  - (b) The presence of parcel sizes or site conditions which affirm that conservation efforts to minimize loss of the resource result in marginal public benefit.
15. It is the policy of the RPC to minimize or mitigate the loss of these resources to development. As an alternative to conventional methods, the RPC endorses use of off-site mitigation techniques to offset the loss of these resources. However, endorsement of off-site mitigation should be conditioned on finding that the project proposal is:
  - (a) Consistent with this Plan and the plans of affected municipalities; and
  - (b) Provides an equal or greater public benefit than conservation of the development site itself.

## **AGRICULTURE & FOREST RESOURCE RECOMMENDATIONS**

1. Inventory and prioritize agricultural lands using the Land Evaluation Site Assessment (LESA) and Forest Land Evaluation and Site Assessment (FLESA).
2. Provide planning advice and support to Planning Commissions, Conservation Commissions, non-profit conservation organizations, and other groups interested in sustaining agriculture and forestry.
3. The RPC will evaluate proposed developments involving Primary Agricultural Soils and forest lands, and their related industries. Where appropriate, it will provide information to federal and state agencies, town boards and commissions, and other parties regarding the probable impacts these resources have on the welfare of the region.
4. Encourage the location of local farm and forest product industries in the Region where such industries would benefit the community and the Region.
5. Assist in mediation efforts when disputes arise concerning regionally significant agricultural or forested lands.
6. Work with various federal, state, local and non-profit agencies to disseminate information related to agricultural and forest management and develop planning policies and regulations.

## **WILDLIFE GOALS**

1. Preserve or enhance the biodiversity and population of wildlife, including natural predators, by minimizing development impacts on large blocks of habitat and wildlife travel corridors.
2. Maintain or improve water quality necessary to sustain existing aquatic communities.
3. Support recreational activities, fishing and hunting done in an ecologically sound manner providing for the continued success of wildlife species and their habitat.
4. Combine recreation and wildlife corridor uses to develop a greenways network in the Region.
5. Encourage the use of the Region's forested land as both working landscapes along with wildlife habitat.
6. Protect rare, threatened, and endangered species and their habitats.

## **WILDLIFE POLICIES**

1. Support local efforts to inventory and map large contiguous blocks of wildlife habitat and associated connecting lands that serve as wildlife travel corridors.

2. Development should be designed and sited in a manner to preserve contiguous areas of active or potential wildlife habitat by clustering, building to the periphery of habitat areas and/or planned unit developments. Corridors connecting habitat areas for large mammals must be incorporated in plans for management and conservation of forested areas. Fragmentation of significant and necessary wildlife habitat should not be approved.
3. Large contiguous tracts of forest should be managed to maintain the diversity of ages and species of tree cover necessary for shelter and food supply for deer, black bear, and other large mammals, and birds.
4. Critical habitat types in the region that shall be considered during development planning include, but are not limited, to the following as identified by the Agency of Natural Resources:
  - (a) Forested corridors or “greenways” used by songbirds during migration;
  - (b) Open fields;
  - (c) Cliff areas or rock outcroppings identified as habitat for peregrine falcons, bobcats or other wildlife;
  - (d) Areas over 2,500 feet in elevation; and
  - (e) Large tracts of contiguous forest land.
5. Vegetated buffer areas along stream and river banks should be encouraged in development plans in order to provide shade and mitigate the negative impacts of sedimentation and nonpoint source pollution on aquatic habitat.
6. Efforts to monitor and, where necessary, to mitigate the effects of hydroelectric facilities, dams and sewage treatment plants on important aquatic species shall be encouraged.
7. Support federal, state and local governments and conservation group acquisition of land and/or conservation easements that protect critical wildlife habitats.
8. Support federal, state, regional and local programs and initiatives that educate and encourage private and public landowners to recognize the importance of protecting and enhancing fish and wildlife habitats and ecosystems.

## **WILDLIFE RECOMMENDATIONS**

1. Assist communities in addressing wildlife and habitat issues in town plans and implementation documents.
2. Coordinate with local communities and the Department of Fish and Wildlife, to ensure proper implementation of protective policies.
3. Develop significant wildlife habitat protection and water withdrawal policies that can be used as guidelines for communities and developers.

4. Review development proposals involving large tracts of forested land, and recommend developments to locate along existing road systems, and clustering of residential units along the perimeters of important habitat areas to avoid fragmentation and other negative impacts.
5. Support town planning commissions and/or conservation commissions to develop inventories of wildlife habitat and wildlife travel corridors in order to refine the Department of Fish and Wildlife's wildlife habitat suitability mapping information.

### **WATER RESOURCES GOALS**

1. To protect, and improve where necessary, the quality and quantity of the Region's surface waters and the land surrounding them so that they support a variety of uses and functions including contact recreation, habitat for native flora and fauna, and flood and erosion control.
2. To protect and preserve wetlands so that they may serve the functions defined in the Vermont Wetlands Rules.
3. To ensure that all towns in the Region have drinking water supplies that are safe and sufficient to meet the needs of future growth.
4. To protect groundwater as a public trust.

### **WATER RESOURCES POLICIES**

1. The RPC will assist towns in including a watershed planning component in their town plan in order to protect surface and groundwater resources.
2. Towns are encouraged to include "Best Management Practices" from the Connecticut River Corridor Management Plan (Volume V, Appendix E) in their town plans to minimize nonpoint pollution and improve water quality.
3. The RPC will work in cooperation with the state in developing watershed plans and/or basin plans for all of the Region's watersheds.
4. Local and regional organizations that provide educational, technical, and policy information on water-related issues to local communities shall be supported.
5. Headwater streams, gorges, waterfalls, and cascades and the land around these important resources should be protected.
6. Surface waters with minimum flows should be closely monitored to ensure that wildlife habitat and recreational values of these waters are not adversely impacted.
7. Development in flood hazard areas shall be in compliance with the municipal flood hazard regulations.

8. Continued assessment should be conducted on those water bodies that were “de-listed” on the State’s 303(d) report.
9. Towns are encouraged to implement land use policies and regulations that address wetlands protection in town plans, zoning bylaws and subdivision regulations; and to include the protection of smaller wetlands (not included on National Wetlands Inventory maps) in their wetlands protection planning.
10. Destruction of wetlands and construction in wetlands should be avoided.
11. Towns are encouraged to control exotic invasive species that impair, or have the potential to impair, aquatic resources; public education efforts are also encouraged.
12. Land uses within Public Water Supply Source Protection Areas should not threaten the quality of groundwater supplies.
13. The storage or use of chemicals that could contaminate groundwater within Source Protection Areas is discouraged.
14. Communities are encouraged to adopt regulatory and non-regulatory methods to protect municipal groundwater supplies.

#### **WATER RESOURCES RECOMMENDATIONS**

1. Assist towns in developing policies and recommendations to protect water resources.
2. Coordinate with towns and the Vermont Water Supply Division to identify and inventory Public Water Supply Source Protection Areas.
3. Assist towns in the identification and development of secondary sources for public drinking water.
4. Support water quality programs and encourage community participation with efforts of local organizations.
5. Work with towns to ensure the protection of regionally significant headwaters, streams, gorges, waterfalls, and cascades.
6. Work with towns, neighboring towns, and regional planning commissions to develop watershed management plans using the Connecticut River Corridor Management Plan as a model.
7. Seek legislation establishing adequate funding for upgrade and repair of sewage treatment facilities.
8. Work with local, state, and federal government officials to provide adequate funding to protect water quality.



9. Develop an education program for planning commissions concerning the assessment of the impacts of development on surface waters.
10. Coordinate with the Natural Resource Conservation District to provide education to land owners and local officials concerning the control of agricultural runoff and available expertise in nutrient management planning.
11. Assist towns in the implementation of programs that promote the protection of wetlands.
12. The RPC will continue to act as a conduit for funding to local organizations working on water quality protection.

### **SOIL AND TOPOGRAPHY GOALS**

1. Land uses and the intensity of land uses should be consistent with the suitabilities and limitations of the soils and topography of each site.

### **SOIL AND TOPOGRAPHY POLICIES**

1. Take special precautions on steep slopes to avoid environmental damage, such as erosion and landslides, including:
  - a. Minimize areas of earth disturbance, grading and clearing vegetation on slopes over 15%;
  - b. Developments on slopes over 15% shall be designed to appropriately to minimize the potential impacts of erosion and stormwater; and,
  - c. Avoid intensive development (other than appropriately designed recreational trails and ski lifts) in areas predominated by slopes exceeding 25% or above 2,500 feet in elevation.
2. Avoid developments on soils susceptible to flooding, erosion hazards and the failure of foundations and septic systems.
3. Avoid development on unstable soils that offer poor support for foundations or footings and are subject to slippage, or are poorly suited for road construction. Extensive site investigations may be required to determine the development suitability of such soils.
4. Ensure that all development proposals for shallow soils provide and conform to an erosion control plan for construction activities and a site drainage plan. Extensive site investigations may be required to determine the development suitability of such soils.

### **SOILS AND TOPOGRAPHY RECOMMENDATIONS**

1. Assist towns in the development of policies and ordinances that minimize the negative impacts of development on steep slopes, high elevation areas, highly erosive and shallow, unstable wet soil types.

## **MINERAL RESOURCE GOALS**

1. Encourage the well-managed extraction and utilization of mineral resources, which provide significant economic benefits to the Region.
2. Ensure that any extraction or recovery of mineral resources located below or adjacent to the surface of water bodies or impoundments is in accordance with appropriate state guidelines and any other applicable regulations.
3. Ensure that methods used for the extraction and utilization of mineral resources do not unduly impact surrounding land uses and minimize negative effects on the environment.

## **MINERAL RESOURCE POLICIES**

1. Development on lands with the high potential for extraction of mineral and earth resources should not interfere with subsequent resource extraction or processing.
2. Mineral extraction activity that may significantly degrade the quality and quantity of other existing and future land uses is discouraged.
3. Mineral extraction activity that may destroy or significantly imperil necessary wildlife habitat will be discouraged.
4. Where mineral extraction is determined to be appropriate, adequate measures to minimize adverse effects (e.g., visual, noise, groundwater, surface water, and air pollution) on the environment and its wildlife should be taken.
5. Ensure that effective site reclamation and revegetation plans are provided and implemented.
6. Mineral extraction and processing facilities should be planned, constructed, and managed:
  - (a) to provide direct access to Class III or better highways;
  - (b) to not unduly interfere with the function and safety of existing road systems serving the project site. Factors to be considered in determining impacts are:
    - (i) Extent of increase in heavy vehicular traffic;
    - (ii) Effects of weight loads on roadbeds and bridges;
    - (iii) Conflicts with pedestrians or bike users; and,
    - (iv) Numbers and frequency of heavy vehicles traveling through dense residential areas.
7. Mineral extraction and processing facilities should be planned and developed so as not to place an excessive or uneconomic burden on local and state highways and bridges.

## **MINERAL RESOURCE RECOMMENDATIONS**

1. Assist towns to address both the economic benefits and environmental impacts of mineral resource extraction and recovery in their town plans and implementation documents.

## **AIR QUALITY GOALS**

1. To maintain a consistently high level of air quality in the Region.

## **AIR QUALITY POLICIES**

1. Prohibit development or activities that significantly degrade air quality.
2. Support efforts to reduce locally and regionally generated air pollutants by encouraging the use of energy conservation guidelines as developed by the Vermont Department of Public Service.

## **AIR QUALITY RECOMMENDATIONS**

1. Work with towns to address air quality issues through the use of education, policies and regulations.