Regional Natural Features Chapter

of the Central NH Regional Planning Commission Master Plan

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INTRODUCTION

Natural features play an important role in the historical, cultural, and economic development of an area. If a person were to look at an area of land from any civilization, present or past, places of development would be characteristically focused around natural resources and furthermore would be shaped by those natural features. As a region becomes increasingly more developed, the challenges to preserve the naturally occurring resources within that specific area also increase. Many times these challenges are a direct result of the decisions between economic, cultural, residential, and commercial growth and the natural features of the land that are undeniably invaluable to the areas inhabitants.

Factors such as topography and water resources have great potential to dictate the type and location of development that a given parcel of land is able to support. Residential development is most often times a function of the proximity to water resources, as these resources have been historically used for transportation, as well as being the vehicle for economic prosperity. Topography is a factor that limits the type of residential or agricultural development a parcel of land will support. Agriculture typically takes place on land that has fertile soil and is relatively flat. A farmer who plants a crop on a slope will experience seed loss due to rainfall runoff and soil erosion, which are only a few reasons why it is not advantageous to plant on a steep slope. Residential development is not as limited by slopes as agriculture is but soil erosion and rainfall runoff are still factors to be considered.

Topography and water resources are very important factors, as are the types of resources found in a given area, which influence the types of economic activities that occur in that area. For instance, historically the Central New Hampshire Region relied heavily on agriculture for economic gain as more and more people move to the interior of New Hampshire from the busy shipbuilding ports along the coast. Many of these settlers found agriculture difficult in the beginning since the soil was rocky and substandard and would be short-lived due to railroad development. Produce was more readily available and New Hampshire turned its attention to textile manufacturing, which soon became the states leading industry and its mark can be seen along the rivers that snake through the Central Region of New Hampshire. The most prevalent use of natural resources today is timber harvesting, with timber tax revenues totaling approximately $500,000 annually. Mining of rocks and minerals is also a valuable state industry, and according to a National Mining

Association 2000 survey, New Hampshire has seen a direct and indirect economic gain of $1.77 billion.

This brief history account illustrates that as the state undergoes developmental changes so does natural resource use and it is important to remember that the impacts of these changes influence the cultural and economic development of the people associated with these resources, and who live in these areas. Important decisions will continue to be made between the Region's natural resources and the Region's economic development, certainly there will be times when these decisions will conflict with each other and times when tough decisions will need to be made. Therefore, the identification and management of the natural features in this Region are important to everyone and will be important in influencing the types and locations of development that will occur in the Region.

PURPOSE

As people have become more aware of the importance and benefits of preserving the natural resources that surround them, the need to identify these resources has become more prevalent and imperative. The Regional Natural Features Chapter (RNFC) aims at identifying the many natural features found within the Central New Hampshire Region so a larger picture can be deliberated upon when decisions need to be made that address land, water, and air quality issues. The objectives of the RNFC are to:

1. Identify the natural features of the Central New Hampshire Region;
2. Track changes in natural resource use for the years 2001-2003;
3. Provide a tool for management of the Region's natural features;
4. Provide recommendations on how to conserve and protect the Region's natural features; and
5. Provide maps that illustrate areas of certain natural features.

REGIONAL OVERVIEW

The Central New Hampshire Region consists of the Towns of Allenstown, Boscawen, Bow, Bradford, Canterbury, Chichester, Concord, Deering, Dunbarton, Epsom, Henniker, Hillsborough, Hopkinton, Loudon, Pembroke, Pittsfield, Salisbury, Sutton, Warner, and Webster, as shown on the **Regional Base Map**. All of the Towns are part of the Merrimack County Conservation District with the exception of Deering and Hillsborough, which belong to the Hillsborough County Conservation District. The Central New Hampshire Region occupies approximately 470,000 acres of land, 8 % of New Hampshire's total land area.

The Region is dominated by the presence of five major rivers. Historically these rivers provided fertile soils for farmland and pastureland, while serving as early transportation corridors and sources of hydroelectric power. The early dependency on these rivers resulted in increased residential and commercial development along what is now known as the "Merrimack River Corridor," a relatively densely populated area along the Merrimack River and Route 3 which includes the City of Concord. Historically, the majority of the forest in the Region was cleared and, although difficult to work the rocky soil, agriculture became the predominant use of the land. As the population began to grow, most noticeable along the river shores and on the flatter lands east of the Merrimack River, agricultural use of the land began to subside. Eventually, as commercial and industrial development increased, the forest began to grow back, while natural resource use shifted from agriculture toward other economically prosperous uses, including timber harvesting and mining of rock and minerals. Though all of the natural resource uses still occur today, people are beginning to identify benefits to preserving the natural features of the region. Benefits include use of the land for recreation, utilization of resources for commercial and industrial production, agriculture, and conservation and protection of important environmental, cultural, and historical resources.

PHYSICAL CHARACTERISTICS

TOPOGRAPHY

The **Regional Topography and Wetlands Map** illustrates elevation changes, at 20-foot intervals, throughout the region as determined by US Geological Services. A brief overview of the map shows the Merrimack River running from North to South acting as a "natural" division in the terrain. East of the Merrimack River is relatively flat, most noticeably in the Towns of Pembroke and Chichester, while the more mountainous terrain is found to the northwest in the towns of Warner, Bradford, and Sutton. Other hilly areas in the Region include the towns of Epsom, Hillsborough, Henniker, and the western Salisbury.

SURFICIAL GEOLOGY

The **Regional Hills and Mountains Map** shows the distribution of hills and mountains in the Region. The three highest peaks in the region are found in the Town of Warner. The highest peak is Mount Kearsarge, with an elevation of 2,937 feet, followed by Black Mountain (2,560 ft), and Little Mountain (2,360 ft). Ragged Mountain (2,240 ft.), in Salisbury, and "Moon" Mountain (2,108 ft.), found in Bradford, also exceeds 2,000 feet in elevation. The mountains most noticeably used for various recreational opportunities are Mount Kearsarge and Ragged Mountain. Ragged Mountain is a popular ski resort with activities occurring throughout much of the year, while hikers frequent Mount Kearsarge during the warmer months. A list of the hills and mountains of the Region, along with their respective elevation are found in **Table 1**.

TABLE 1

Hills and Mountains of the Central New Hampshire Region.

TOWN	NAME	ELEVATION	TOWN	NAME	ELEVATION
Allenstown	Catamount Hill	700'	**Hillsborough**	Murdough Hill	1320'
	Pickney Hill	700'		Unnamed (N of Contention Pond)	1320'
	Bear Hill	800'		Unnamed (W to N from Kimball Hill)	1351'
	Hall Mountain	925'		Unnamed (W to N from Kimball Hill)	1382'
Boscawen	Dagody Hill	620'		Unnamed (W to N from Kimball Hill)	1394'
	Knowlton Hill	760'		Sulphur Hill	1395'
	Choate Hill	800'		Campbell Mountain	1408'
	Unnamed Hill (NE section ofTown)	940'		Unnamed (NE Hillsborough)	1428'
Bow	Line Hill	840'		Unnamed (NE Hillsborough)	1552'
	Brown Hill	900'		Stowe Hill	1572'
	Wood Hill	900'		Jones Hill	1604'
	Picked Hill	910'		Unnamed (W to N from Kimball Hill)	1604'
	Great Hill	920'		Thompson Hill	1768'
Bradford	Cedar Hill	1060'	**Hopkinton**	Rattlesnake Hill	640'
	Guild Hill	1140'		Dimond Hill	660'
	Hogg Hill	1140'		Mt. Hope	740'
	Goodwin Hill	1320'		Clement Hill	760'
	Pickett Hill	1560'		Beech Hill	780'
	Haystack Mountain	1700'		Irishmans Hill	780'
	Silver Hill	1760'		Putney Hill	780'
	Rowes Hill	1920'		Gould Hill	840'
	Avery Ledge	1921'	**Loudon**	Bear Hill	740'
	Knight's Hill	1940'		Clough Hill	800'
	"Moon" Mountain	2108'		Oak Hill	920'
Canterbury	Cogswell Hill	700'	**Pembroke**	Pembroke Hill	680'
	Zion Hill	940'		Plausawa Hill	1000
	Sunset Hill	U	**Pittsfield**	Leavitt Hill	700'
	Whitney Hill	U		Jenness Hill	840'
Chichester	Garvin Hill	978'		Nudds Hill	853'
Concord	Silver Hill	441'		Tilton Hill	1000'
	Rum Hill	520'		Catamount Mountain	1334'
	Horse Hill	720'	**Salisbury**	Boston Hill	960'
	Parsonage Hill	720'		Searles Hill	1040'
	Jerry Hill	728'		Taunton Hill	1160'
	Rattlesnake Hill	774'		Raccoon Hill	1260'
	Pine Hill	793'		Beech Hill	1400'
	Oak Hill (Peak in Loudon)	920'		Morey Hill	1440'
Deering	Gove Hill	883'		Ragged Mountain	2240'
	Locke Hill	1000'	**Sutton**	Burpee Hill	1100'
	Bartlett Hill	1120'		Nelson Hill	1140'
	Sodom Hill	1150'		Wadleigh Hill	1160'
	Goodale Hill	1160'		Wright Hill	1180'
	Gregg Hill	1320'		Dodge Hill	1180'
	Hedgehog Hill	1340'		Hedgehog Hill	1200'
	Wilson Hill	1400'		The Pinnacle	1240'
	Clark Summit (Wolf Hill)	1520'		Rowell Hill	1260'
Dunbarton	Kuncanowet Hills	650'		Dresser Hill	1300'
	Burnham Hill	825'		Meetinghouse Hill	1360'
	Quimby Mountain	850'		Fellows Hill	1660'
	Mills Hills	900'		King's Hill	1880'
Epsom	Lockes Hill	680'	**Warner**	Denny Hill	680'
	Barton Hill	800'		Tory Hill	820'
	Sanborn Hill	920'		Burnt Hill	854'
	Brush Hill	960'		Stanley Hill	860'
	Epsom Mountain	960'		Pumpkin Hill	940'
	Nat's Mountain	1180'		Waldron Hill	1040'
	McCoy Mountain	1260'		Couch Hill	1140'
	Fort Mountain	1410'		Clark Hill	1160'
Henniker	Shaker Hill	900'		Bible Hill	1260'
	Buck Hill	1020'		Gage Hill	1760'
	Morrill Hill	1040'		Stewart's Peak	1780'
	Mount Misery	1080'		Little Mountain	2360'
	Wadsworth Hill	1160'		Black Mountain	2560'
	Liberty Hill	1193'		Mount Kearsarge	2937'
	Colby Hill	1256'	**Webster**	Chase Hill	660'
	Mount Hunger	1350'		Ox Pond Hill	740'
	Bear Hill	1380'		Putney Hill	740
	Craney Hill	1402'		Littles Hill	800'
Hillsborough	Unnamed (N of Contention Pond)	1188		Corser Hill	840'
	Monroe Hill	1210		Round Hill	840
	Kimball Hill	1241			

Source: 1998 Natural, Cultural, and Historical Resources Inventory of the Central New Hampshire Region CNHRPC Updates from 2001 CNHRPC GIS data and USGS 7.5 Quadrangle Maps

BEDROCK GEOLOGY

United States Geological Services (USGS) is responsible for identifying and mapping the types and location of bedrock in the United States. The **Regional Bedrock Geology Map** illustrates the types and locations of the various bedrock found in the Region. Bedrock is defined as solid rock found underneath loose rock, soil, and vegetation. **Table 2** shows the acreage each bedrock type accounts for in the Region. A description of each type of bedrock is provided, as determined by USGS:

- "Dc1m" Concord Granite (Late Devonian) – Gray two –mica granite, locally grading to tonalite. This bedrock, the second most common type in the Region, occurs most heavily to the east, concentrated under the City of Concord (32,676 acres of the City's total area). In addition, "Dc1M" underlies the majority of Allenstown in the southeast. Other locations include northern Salisbury, Sutton, and Henniker continuing into Hopkinton, scattered throughout Pittsfield and the Towns immediately adjacent to Concord.

- "Dc3Am" Two-mica tonalite – Similar to Concord Granite; found in south - central New Hampshire. This bedrock type only underlies two Towns in the Central New Hampshire Region, underlying the border between Bradford, and Warner.

- "Ds1-6" Spaulding Tonalite (Early Devonian) (Spaulding Quartz Diorite of .Fowler-Billings, 1949) – Weakly foliated to nonfoliated, spotted biotite quartz diorite, tonalite, granodiorite, and granite; garnet and muscovite may or may not be present. Found throughout half of the Towns in the region, this bedrock is found most heavily underlying the Blackwater River and Contoocook River corridors. The largest area underlies the Towns of Hopkinton, Salisbury, Webster, Deering, and Boscawen.

- "Ds6-9B" Hypersthene-biotite quartz diorite and hornblende or actinolite diorite or gabbro – Spatially associated with Spaulding Tonalite plutons. Located in the Towns of Hopkinton and Warner, this bedrock only accounts less than 0.5% of the Region.

- "D3Ab" Biotite tonalite – Dark gray; found in southeastern and western New Hampshire. "D3Ab" underlies 98 acres of land under the western border of the Town of Sutton.

- "Dk2x" Kinsman Granodiotite (Early Devonian) (Kinsman Quartz Monzonite of Billings, 1955) – Foliated granite, granodiotite, tonalite, and minor quartz diotite; large megacrysts of potassium fedspar characteristics; garnet locally abundant. This Bedrock type is the most predominant in the Region, underlying an estimated 20 % of the total area. "Dk2x" is found in the western most third of the Region occupying areas in Sutton, Bradford, Hillsborough Henniker, and Warner along with smaller areas in Salisbury, Webster, Hopkinton, Canterbury, and Concord.

- "Dl" Littleton Formation, undivided (Lower Devonian; Siegenian) – Gray metapelite and metawacke and subordinate metavolcanic rocks; generally, but not everywhere, conformable with the underlying Fitch or Madrid Formations. Fossiliferous in New Hampshire. Most of this bedrock underlies The Towns of Deering, and Henniker. Other occurrences are found in Epsom, Warner Hillsborough, and Pittsfield.

- "Dlu" Upper unnamed member – Light gray metaturbidite, lithographically identical to, and probably correlative with, the Seboomook Formation of Maine. Coticule layers common. Only found in the northern part of Central New Hampshire, "Dlu" underlies Salisbury, Sutton, and Warner.

- "Dll" Lower unnamed member – Thinly or poorly bedded aluminous lower part, somewhat rusty, Rare quartzite lentils. Carrabassett Formation in northwestern Maine is probably correlative. "Dll" is found in the north in the Towns of Boscawen, Salisbury, Sutton, Warner, and Webster.

- "Sm" Madrid Formation (Upper Silurian?) – Massive to weakly foliated, purple biotite-feldspar granofels, layered calc-silicate, and dark pelitic-sulfidic schist containing calc-silicate pods in upper member; an eastern facies equivalent to the upper part of the Fitch Formation. Locally mapped as the Warner Formation of Nielson (1981) in Southern New Hampshire. Found throughout the Region, this bedrock occurs most heavily in the Towns of Warner, Deering, and Boscawen.

- "Ssf" Small Falls Formation, undivided (Upper to Middle Silurian; Ludluovian and Wenlockian) – Very rusty weathering, thinly bedded

sulfidic-graphitic schist and pyrrhotitic calc-sillicate granofels. Eastern facies equivalent to the lower part of the Fitch Formation. Locally mapped as Francestown Formation of Nielson (1981) in southern New Hampshire. "Ssf" occurs in two broken strips under the western half of the Region. The most prominent areas occur in the Towns of Hopkinton, Boscawen, Deering, and Salisbury.

- "Sp" Perry Mountain Formation, undivided (Middle? To Lower? Silurian) – Sharply interbedded quartzites, light-gray nongraphitic metapelite, and "fast-graded" metaturbidites. Coticule layers common. This bedrock is found along the east border of the Region in Epsom and Pittsfield, and in the center of the Region in the Towns of Boscawen, Salisbury, and Canterbury.

- "Sru" Upper part of Rangeley Formation – Rusty-weathering, pelitic schist, metasandstone, and local course-grained metasandstone lentils; calc-silicate pods common; minor coticule. Probably equivalent to member C of Rangeley Formation of Maine. "Sru" occurs inn all Towns of the Region except, Bradford, Chichester, Hillsborough, Sutton, Warner, and Webster. The largest area occurs under Canterbury at 8,581 acres.

- "Srl" Lower part of Rangeley Formation – Gray, thinly laminated (5-25 mm) metapelite containing local lentils of turbidites and thin quartz conglomerates in western New Hampshire. Sparse clac-silicate pods and coticule. Probably equivalent to member B of Rangeley Formation of Maine. This bedrock occurs under all Towns to the east of Concord, forming a large band around the City.

TABLE 2

Bedrock Type by Acres Found in the Central New Hampshire Region

TOWN	BEDROCK TYPE IN ACRES														TOTAL
	D3Ab	Dc1m	Dc3Am	Dk2x	Dl	Dll	Dlu	Ds1-6	Ds6-9B	Sm	Sp	Srl	Sru	Ssf	ACRES
Allenstown		9,296									597	769	2,506		13,168
Boscawen		33				244		7,885		1,138	4,224	155	1,024	1,550	16,252
Bow		5,768									2	8,581	3,859	59	18,269
Bradford			21,335	1,659											22,994
Canterbury		3,395		906				3,341		19	1,733	10,314	8,052	937	28,697
Chichester		4,262										9,366			13,628
Concord		32,676		1,468						640	1,160	3,161	2,284	1,611	43,000
Deering					6,329			9,028		1,489	1,539		33	1,570	19,988
Dunbarton		8,483						1,506			1,684	2,834	5,538		20,045
Epsom		310			3,607						7,247	6,961	3,962	66	22,153
Henniker		2,994		13,482	5,154			705		767	713	1,167	3,136	554	28,672
Hillsborough				25,875	111			2,625							28,612
Hopkinton		1,749		5,011				11,905	1,664	330	1,333	179	1,767	4,914	28,852
Loudon		7,729										21,719	448		29,897
Pembroke		2,478										10,935	1,184		14,597
Pittsfield		3,125			10						4,688	4,732	2,073	930	15,559
Salisbury		870		4,542		1,055	294	10,728		25	603	2,982	2,982	1,388	25,468
Sutton	98	2,842		22,086		2,006	261	443							27,735
Warner			1,147	14,532	3,595	1,504	1,310	7,924	57	5,434					35,502
Webster				6,000		305		11,215		665	242				18,426
REGION	98	86,011	22,482	95,560	18,806	5,113	1,865	67,305	1,721	10,507	25,764	83,855	38,850	13,577	471,514

Source: US Geological Services, CNHRPC 2003

LAND AND FOREST RESOURCES

LAND USE

As stated earlier, land use in the Region has changed throughout its history. The **Regional Land Use Map** shows the distribution of land use in the Central New Hampshire Region. The categories used to define land use are as follows:

- "Open Space" – Open Space accounts for all undeveloped lands, including lands that are set aside for open space, such as conservation easements, unmaintained fields, Town forests, and privately owned lands that are not developed. These lands provide riparian corridors in which animals and vegetation can survive as the land around them is developed. Refer to Appendix B for the Regional Open Space Element.

- "Agriculture" –Agricultural lands account for any lands that are maintained for such use as horticulture or pasturelands.

- "Residential" – Any land that contains a single or multifamily dwelling unit. Included in this category are areas of high-density development, and areas of residential development along roadways.

- "Institutional" – Institutional land includes state owned land such as Bear Brook State Park in Allenstown, the Hopkinton-Everett Reservoir, Hospitals, and schools.

- "Commercial" – Any developed lands utilized for the buying and selling of goods or services, such as golf courses and small and large businesses.

- "Industrial" – Any lands devoted to the production, processing, or excavation of raw goods. This includes sand and gravel pits, mining operations, and processing plants.

- "Utility" – All lands that are utilized for public services which include power-line corridors, waste water treatment plants, and similar types of land uses which involve public.

Methodology Used for Development of the Regional Land Use Map
The Regional Land Use Map was developed using 1998-satellite imagery, known as Digital Orthogonal Quads (DOQs). The DOQs show an overhead view of the Region. Land was then classified using ArcView according to the type of cover that was seen. Large tracts of wooded areas and fields were classified as "Open Space/ Agriculture," while areas with dwellings were labeled as "Residential." All areas that were known to be "Industrial," or appeared to be used for industrial purposes were classified as such. "Commercial" classification was based upon known locations and from analysis of the DOQs. Lastly, power-line corridors and wastewater treatment plants were identified and classified as "Utility," and areas known to be of "Institutional" use were identified.

The majority of the classification was determined through visual analysis of the DOQs, therefore, there are known inconsistencies with the classification. The reason for choosing this methodology was to assure that all areas of the Region were classified with the same system, to assure a less bias system. In addition, it is important to note that the last available data for the DOQs comes from 1998. Though changes have occurred from 1998 to 2003, development on a regional level has not drastically changed. Though the map is known not to be 100% accurate, it should be used as a tool to recognize the overall pattern of development in the Central New Hampshire Region.

According to the **Regional Land Use Map**, Open Space/Agriculture accounts for the majority of the land use (73.47%) with 346,261.03 acres of land. Residential use accounts for 19.21% of the land, while Commercial, Industrial, Institutional, and Utility lands account for a combine percentage of less than 10 % of the total land area. **Table 3** shows the number of acres dedicated to each use.

TABLE 3
Regional Land Use by Type

LAND USE BY TYPE		
Type	**Acreage**	**Percent**
Utility	4,415.16	0.94%
Industrial	5,025.26	1.07%
Commercial	11,832.42	2.51%
Institutional	13,660.49	2.90%
Residential	90,107.50	19.12%
Open Space/Agriculture	346,261.03	73.47%
Region	471,301.86	100.00

Source: CNHRPC Data, 2003

Presently, commercial and industrial development of land occurs most heavily in the eastern half of the Region, most notably along the Merrimack River from Bow to Boscawen with development centralized in the City of Concord. There are 11,832.42 acres devoted to commercial development, which is present in all twenty towns that comprise the central region. Industrial development is not common to all twenty towns as is commercial development with only 5,025.26 acres being used for industrial development. Industrial development is present in northern Allenstown, Boscawen, eastern Bow, Bradford, central Concord, and central Henniker. The most notable characteristic of this commercial and industrial development is its concentration along Interstates 89, 93, and 393, US Route 4, and New Hampshire Routes 9, 28, 106 and 114.

Residential development accounts for the majority of developed lands in the Region, with the population existing in greater numbers among eastern towns. Residential development can be classified in terms of high, medium and low density according to the area of development. High density residential development is present in the northern center of Hopkinton, Concord, and the intersection of the Loudon, Canterbury and Gilmanton borders. Medium residential density seems to be most common to this Region, most prevalent along the Hillsborough/Deering border, central Dunbarton and Henniker, in Sutton along New Hampshire Route 114, Hopkinton, Concord, along New Hampshire Routes in Warner and Salisbury, eastern Boscawen, southwest Canterbury, at the intersection of Bow, Pembroke, and Allenstown borders up to Concord along the Pembroke/Bow border. Lower density residential presence can be found as the majority of the towns in this Region with the exception of Allenstown, Chichester, and Concord.

Development patterns of residential dwellings indicate the presence of sprawl (a geographic area not containing a centralized pattern of development) in the Region. The resulting pattern is fragmented areas of open space with few areas of continuity. Sprawl has become a very important issue for environmentalists and city planners as it has adverse effects on environmental policies and efforts. The Environmental Protection Agency (EPA) cites sprawl as one of the major contributors to declining environmental quality. There are seven specific aspects that the EPA lists on their website as being the major concerns related to sprawl:

- AIR POLLUTION -- Not only are there more cars on the road, but sprawl forces us to drive each car further, increasing congestion and emissions of greenhouse gases and the precursors to ground level ozone (smog).

- WATER POLLUTION -- Through soil erosion, increased urban runoff, and destruction of wetlands, sprawl threatens the quality of both ground and surface waters.

- LOSS OF NATURAL AREAS -- Sprawl may destroy or degrade natural ecosystems and species, such as remaining woodland and savanna remnants and wetlands.

- BROWNFIELDS -- Environmental decay has occurred in the urban core leading to brownfields and abandoned contaminated sites (Superfund sites, spills, LUSTs) as industry moves farther out and commercial incentives for clean-up evaporate.

- COSTS OF INFRASTRUCTURE -- Sprawl significantly increases the costs of infrastructure such as sewers, stormwater retention, and drinking water treatment because of the need to provide services in the metropolitan periphery while having to maintain aging core infrastructure.

- FARMLAND -- Sprawl converts high quality farmland into impervious surfaces, thereby increasing flooding and runoff, and adding pressure to farm on marginal lands which formerly served as habitat.

- WATER QUANTITY -- Sprawl may lead to more flooding throughout the region because of the increase in impermeable surfaces such as roads and parking lots. Loss of wetlands that provide flood control is increasing the number and intensity of floods. Current development practices sometimes result in channelized streams and increased flows.

Though larger tracts of undeveloped land occurs west of the Merrimack River, such as in southern Warner and the eastern bank of the Blackwater River, there are relatively few of these areas that remain. The resulting effect has been the awareness of the importance of open space, and the recognition for the need to protect the remaining undeveloped lands from future development.

The **Regional Land Use Map** also illustrates that there are large tracts of land devoted for institutional purposes, such as Bear Brook State Park (refer to Land Resources section), Blackwater River reservoir, and the Hopkinton-Everett reservoir which is a system made up of two dams, the Hopkinton Dam

and the Everett Dam. The Blackwater River reservoir system includes the Blackwater Dam which was completed in 1941 by the US Army Corps of Engineers at a cost of $1.32. This reservoir provides protection to cities further down the river such as Concord, Manchester, and Nashua. The US Army Corps of Engineers states that the Blackwater dam, one of five flood control dams in the Merrimack River Basin, has prevented $15.3 million in damages since its establishment. The Hopkinton-Everett reservoir, much like the Blackwater reservoir, was built by the US Army Corps of Engineers who completed the Everett Dam and Hopkinton Dam in 1962 and 1963 respectively. The Hopkinton Dam is on the Contoocook River and the Everett Dam is located on the Piscataquog River. Both of these dams are part of the Merrimack River Basin flood control system. The US Army Corps of Engineers take on the responsibility

LAND RESOURCES

Conservation Lands

The **Regional Conservation Lands Map** shows the locations of conservation lands within the Central New Hampshire Region. Conservation lands are generally lands that are set aside with the intent to prevent future development, however not all conservation lands within the Region are protected from development or set aside for that purpose. Other uses of conservation lands include recreation, natural buffers to rivers, protection of environmentally sensitive areas, corridors, and greenways. For the purposes of this chapter, conservation lands include all lands that are currently restricted to development including but not limited to easements, fee owned lands, State and Federal parks, and Town forests.

Presently, 15% (71,555 acres) of the region's land is set aside as conservation land. Table 4 shows the total acreage of conservation lands in each of the municipalities that make up the Central New Hampshire Region. Approximately 51 % of Allenstown is classified as conservation land. This is due to the presence of Bear Brook State Park. Additionally, the Towns of Hopkinton (28%), Warner (25%), and Concord (21%) all have conservation lands that make up greater than 20% of the Town's total land area. Several Towns have less than 10% of their land classified as conservation land. They are Sutton (5%), Bradford (4%), Epsom (4%), Chichester (3%), and Pembroke (3%).

There are several potential landowners and several types of conservation lands. Owners include the state, town, private landowners, special interest groups,

and combinations of the aforementioned owners. Each landowner has different objectives for placing land in conservation. **Table 5** shows a breakdown of the amount of land owned by each landholder. Of the 71,555 acres of land presently in conservation, the NH Department of Resouces and Economic Development owns 20,000 acres, individual towns own 21,874 acres, and the US Army Corps of Engineers owns 12,101 acres of land. These three landowners account for 75% of the conservation lands in the Central New Hampshire Region.

TABLES 4 AND 5 NEED TO BE UPDATED TO AT LEAST 2001. SEE STEVE FOR REGIONAL 2001 CONS LAND COVERAGE INFO TO REPLACE 1998 #S

TABLE 4
Conservation Lands of Central New Hampshire Region by Town

TOWN	Total Acres in Conservation	Total Acreage of Town	% of Land in Conservation
Allenstown	6,740	13,184	51%
Boscawen	3,018	16,256	19%
Bow	2,806	19,264	15%
Bradford	1,011	22,784	4%
Canterbury	3,219	28,672	11%
Chichester	391	13,568	3%
Concord	8,783	41,920	21%
Deering	2,252	20,288	11%
Dunbarton	3,671	20,416	18%
Epsom	763	21,696	4%
Henniker	4,185	28,352	15%
Hillsborough	3,178	28,288	11%
Hopkinton	7,817	28,416	28%
Loudon	3,199	29,696	11%
Pembroke	373	14,528	3%
Pittsfield	1,529	15,488	10%
Salisbury	4,775	35,344	14%
Sutton	1,393	27,456	5%
Warner	8,702	35,392	25%
Webster	3,715	18,048	21%
Region	**71,555**	**479,056**	**15%**

Sources: 1998 Natural, Cultural, and Historical Resources Inventory, CNHRPC data, Town Master Plans

TABLE 5

Conservation Lands in Acres for Towns by Owner

TOWN	ASNH	LCIP	NH DA	NH DOT	NH DRED	NH Fish & Game	NH Water Res.	SPNHF	State	Private	Town	US Army Corps	Other
Allenstown					6,740	4	1				30		
Boscawen		174	861		945	156		149			733		
Bow					118	1				124	2,562		1
Bradford					722						289		
Canterbury		824	321		277			88	58	714	937		
Chichester		300									91		
Concord	20			84	851	404	94	431	751	1,993	3,792		363
Deering	692				239		6	1,043			263		9
Dunbarton		242			1			307			1,934	1,187	
Epsom				66			30				666		1
Henniker					781	18		258		193	504	2,415	16
Hillsborough				43	2,166	291		208			401		69
Hopkinton	721	93	479		599	1				40	966	4,918	
Loudon				1		1,083			8		1,979		128
Pembroke											373		
Pittsfield						738	1	27		412	351		
Salisbury			261		827					143	1,157	2,387	
Sutton				3	1	79		614			586		110
Warner					5,733			48			2,921		
Webster						1,090		92			1,339	1,194	
Region	**1,433**	**1,633**	**1,922**	**197**	**20,000**	**3,865**	**132**	**3,265**	**817**	**3,619**	**21,874**	**12,101**	**697**

Sources: CNHRPC, 1998 Natural, Cultural, and Historical Resources Inventory, Local Town Master Plans

Current Use

Current Use is a tool that landowners can use to reduce the amount of property tax that they pay on open space land that they own. Open space conservation is seen as in the public's interest as it preserves the natural beauty of the land as well as maintains the natural features of the state. Furthermore, Current Use is used by the state as an incentive for its landowners to preserve open space, as there is little cost to the government to maintain these areas and less loss of the state's natural resources. The Current Use value is the assessed valuation per acre of open space land based upon the income-producing capability of the land in its current use– not its real estate market value. This valuation shall be determined by the Town's assessor in accordance with the range of current use values established by the Current Use Board (CUB) and in accordance with the class, type, grade, and location of land. Property owners can file for reduced property taxes though the Current Use Taxation program. Owners of parcels of land which are not anticipated to be used for a different type of use in the future can apply at the Town Office, and in accordance with RSA 79-A:2 the definitions of land type are as follows:

> The Current Use classifications act as an incentive for landowners to classify large tracts of land as Current Use land. The benefit of classifying land under Current Use for the landowner is that the landowner will enjoy reduced land tax. The state will benefit from this

land classification as it ensures that this land will retain its natural features for as long as the land maintains this classification. It is important land is not protected or permanent, unlike conservation lands. Placing land under Current Use classification is an incentive for landowners not to develop.

- "Farm land" means any cleared land devoted to or capable of agricultural or horticultural use as determined and classified by criteria developed by the commissioner of agriculture, markets, and food and adopted by the board.

- "Forest land" means any land growing trees as determined and classified by criteria developed by the state forester and adopted by the board. For the purposes of this paragraph, the board shall recognize the cost of responsible land stewardship in the determination of assessment ranges.

- "Open space land" means any or all farm land, forest land, or unproductive land as defined by this section. However, "open space land" shall not include any property held by a city, town or district in another city or town for the purpose of a water supply or flood control, for which a payment in place of taxes is made in accordance with RSA 72:11.

- "Unproductive land" means land, including wetlands, which by its nature is incapable of producing agricultural or forest products due to poor soil or site characteristics, or the location of which renders it inaccessible or impractical to harvest agricultural or forest products, as determined and classified by criteria developed by the board. The board shall develop only one category for all unproductive land, setting its current use value equal to that of the lowest current use value established by the board for any other category.

- "Wetlands" means those areas of farm, forest and unproductive land that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Table 6 shows the total number of Acres and its Current Use Assessed Value, while **Table 7** shows the breakdown of the Current Use land categories.

Trends from 2001-2003 indicate a decrease in the amount of current use land, but show that due to an increase in the price of land, the assessed value is greater.

TABLE 6

Current Use Land Acreage and Assessed Value by Town

Current Land Use Total Acreage and Assessed Value ($)						
	2001		2002		2003	
Town	Total	Value	Total	Value	Total	Value
Allenstown	3,036.67	273,977.00	3,068.06	273,977.00	3,041.00	274,934.00
Bowscawen	10,121.46	1,029,452.00	10,251.43	869,828.00	10,178.21	1,234,710.00
Bow	5,044.00	444,469.00	U	U	5,292.00	606,455.00
Bradford	15,485.48	1,535,475.00	15,646.87	1,551,699.00	15,591.90	1,703,701.00
Canterbury	19,246.59	1,295,207.00	19,208.33	U	10,375.00	519,679.00
Chichester	7,248.58	716,028.00	7,505.50	714,711.00	7,324.00	863,086.00
Concord	10,712.00	1,303,600.00	U	U	U	U
Deeing	14,910.17	109,776.00	14,822.90	1,043,623.00	14,859.00	791,850.00
Dunbarton	9,957.60	1,057,950.00	U	U	8,750.00	707,950.00
Epsom	14,302.63	893,264.00	U	902,588.00	14,311.08	U
Henniker	16,512.80	1,103,175.00	16,473.71	U	16,854.00	1,011,660.00
Hillsborough	16,513.43	1,290,151.00	U	U	16,482.19	1,032,684.00
Hopkinton	15,753.34	2,441,010.00	15,866.06	U	15,989.00	2,892,230.00
Loudon	17,861.00	2,092,200.00	U	18,899,200.00	17,857.78	2,102,322.00
Pembroke	9,009.35	945,481.00	U	936,450.00	8,717.14	938,417.00
Pittsfield	9,574.51	1,019,715.00	U	U	9946.29	1,330,960.00
Salisbury	17,909.50	1,302,600.00	U	U	17,052.71	1,614,301.00
Sutton	17,339.02	1,732,365.00	17,543.46	1,521,135.00	17,451.75	1,787,871.00
Warner	22,792.80	1,448,000.00	22,708.40	1,445,500.00	22,841.23	1,921,530.00
Webster	11,485.03	1,097,784.00	U	U	11,490.48	U
TOTAL	264,815.96	23,131,679.00	143,094.72	28,158,711.00	244,404.76	21,334,340.00

Source: 2001-2003 Town Annual Reports

Table 7

Current Land Use Acreage By Type												
	2001				2002				2003			
Town	Farm Land	Forest Land	Unproductive Land	Wetland	Farm Land	Forest Land	Unproductive Land	Wetland	Farm Land	Forest Land	Unproductive Land	Wetland
Allenstown	138.16	2,016.84	204.67	677.00	138.16	2,049.23	204.67	676.00	138.16	2,060.69	200.37	642.00
Boscawen	151.12	5,952.54	105.50	664.64	1,546.75	5,877.61	71.50	706.04	1,526.73	5,899.84	63.50	709.04
Bow									826.00	2,901.00	915.00	5.00
Bradford	547.73	8,857.25	852.66	553.87	554.21	9,097.22	852.66	560.07	562.71	13,659.66	803.56	565.97
Canterbury									413.26	9,826.17	71.40	64.16
Chichester					959.95	5,642.05	19.60	424.40	878.78	6,004.80	19.60	421.50
Concord									U	U	U	U
Deering	764.28	13,025.22	1,115.87		766.88	12,965.35	1,085.87		828.71	12,958.45	1,071.87	0.00
Dunbarton									747.35	7,528.95	22.59	451.91
Epsom									1,615.26	12,266.29	42.55	386.98
Henniker	1,351.63	4,759.87	8.90	657.68	1,344.65	4,678.87	8.90	656.85	1,364.96	14,881.64	20.70	687.33
Hillsborough									U	U	U	U
Hopkinton	2,000.38	10,232.91							1,972.06	12,465.81	11.00	1,539.63
Loudon									2,315.69	13,456.00	416.52	1,669.57
Pembroke									1,105.12	7,465.39	136.43	10.20
Pittsfield	1,305.34		199.70	360.02					1,315.54	8,087.32	156.44	386.99
Salisbury									806.65	15,729.76	35.75	480.55
Sutton	505.16	12,944.14	4.00	527.57	511.47	13,723.13	25.15	780.97	511.47	16,121.81	31.15	787.32
Warner									854.75	20,698.96	1,287.52	0.00
Webster									635.65	11,097.71	71.09	671.81
Region	6,763.80	57,788.77	2,491.30	3,440.78	5,822.07	54,033.46	2,268.35	3,804.33	18,418.85	193,110.25	3,303.61	9,479.96

Source: 2001-2003 Town Annual Reports

In accordance with RSA 79-A:7, when land is removed from Current Use, 10% of the full and true value of the land, not the Current Use assessed value must be paid as a Current Use Land Change Tax. It is important to understand that the Current Use classification can be placed on, or removed from, land at the landowners discretion which is why these lands vary from conservation lands. **Table 8** shows the Current Use Change Tax collected for the years 2001-2003. From 2001-2003, there has been an increase in the amount of taxes collected for Current Use Change Tax.

TABLE 8

Land Use Change Tax by Town

LAND USE CHANGE TAX ($)			
Town	**2001**	**2002**	**2003**
Allenstown	2,500.00	2,500.00	17,400.00
Bowscawen	10,300.00	12,096.69	U
Bow	95,270.00	85,029.00	42,130.00
Bradford	5,500.00	6,000.00	U
Canterbury	24,211.00	U	34,169.56
Chichester	92,800.00	13,150.00	16,900.00
Concord	U	U	U
Deering	12,564.32	8,838.15	30,729.00
Dunbarton	23,009.00	34,409.00	84,980.00
Epsom	U	29,690.00	37,144.00
Henniker	52,488.00	48,970.00	10,810.00
Hillsborough	2,668.97	32,540.17	45,719.00
Hopkinton	28,852.00	37,896.57	65,827.00
Loudon	45,756.00	63,900.00	49,300.00
Pembroke	21,752.00	100,617.00	U
Pittsfield	5,378.00	U	23,250.00
Salisbury	14,800.00	1,950.00	14,665.00
Sutton	5,041.00	32,236.00	5,797.00
Warner	0.00	0.00	9,236.00
Webster	3,034.00	19,972.00	18,237.00
TOTAL	445,924.29	529,794.58	506,293.56

Source: 2001-2003 Town Annual Reports

According to Section IV of RSA 79-A:7,

> "For purposes of this section land use shall be considered changed and the land use change tax shall become payable when:
>
> (a) Actual construction begins on the site causing physical changes in the earth, such as building a road to serve existing or planned residential, commercial, industrial,

or institutional buildings; or installation of sewer, water, electrical or other utilities or services to serve existing or planned residential, commercial, industrial, institutional or commercial buildings; or excavating or grading the site for present or future construction of buildings; or any other act consistent with the construction of buildings on the site; except that roads for agricultural, recreational, watershed or forestry purposes are exempt.

(b) Topsoil, gravel or minerals are excavated or dug from the
site; except:

(1) Removal of topsoil in the process of harvesting a sod farm crop in amounts which will not deplete the topsoil; and

(2) Removal of gravel and other materials for construction and maintenance of roads and lands for agricultural and forestry purposes within the qualifying property of the owner or, with the approval of local authorities, to other qualifying property of the owner.

(c) By reason of size, the site no longer conforms to criteria established by the board under RSA 79-A:4, I."

FOREST RESOURCES

Forest resources play a vital role in the Region. With approximately 73% of the Region remaining as open space and agricultural land (refer to **Table 2**) the potential for timber harvesting is great. The history of timber harvesting goes back to the 1600's when timber was a valuable commodity in the shipbuilding coastal ports, and became even more of a booming industry with the expansion of the railroad which reduced the need for agriculture. Timber harvesting is the practice of felling trees, transporting them, or "yarding", to a central point, referred to as a "landing", at which time they are transported along roads built for hauling.

Timber harvesting lands should be protected from nonpoint pollution, pollution of surface and ground water caused by natural and human-made pollutants transported by rainfall runoff and snowmelt. Nonpoint pollution

from timber harvesting is the result of heavy machinery in these areas and along these hauling routes. The Environmental Protection Agency has a system of measures in place to reduce nonpoint source pollution. A summary of these measures are as follows:

> "PREHARVEST PLANNING -- The objective of this management measure is to ensure that silvicultural activities, including timber harvesting, site preparation, and associated road construction, are conducted in a way that takes into account potential nonpoint source pollutant delivery to surface waters. Preharvest planning has been demonstrated to play an important role in the control of nonpoint source pollution and efficient forest management operations. Components of this measure address key aspects of forestry operations relevant to water quality protection, including the timing, location, and design of harvesting and road construction, the identification of sensitive areas or high-erosion-hazard areas; and the potential for additional cumulative contributions to existing water quality impairments.
>
> STREAMSIDE MANAGEMENT AREAS (SMA) -- This management measure establishes areas along surface waters that are managed to protect the water quality of the adjacent waterbody. Streamside Management Areas (SMAs) protect against soil disturbance and reduce the delivery to waterbodies of sediment and nutrients from upslope activities. Canopy species in SMAs shade waterbodies, which moderates water temperature, and provide the detritus that often serves as an energy source for stream ecosystems. Trees in the SMA also provide a source of large, woody debris to waterbodies.
>
> ROAD CONSTRUCTION/RECONSTRUCTION -- Road construction is often the largest source of silviculture-produced sediment. The purpose of this management measure is to reduce the generation and delivery of sediment from road construction or reconstruction. This is to be accomplished by following the preharvest plan layouts and designs for the road system, incorporating adequate drainage structures, and properly installing stream crossings. Other components of this measure include avoiding constructing roads in SMAs, removing debris from streams, and stabilizing areas of disturbed soil such as road fills.

ROAD MANAGEMENT -- The objective of this management measure is to manage existing roads to prevent sedimentation and pollution from runoff-transported materials. This management measure describes how to manage existing roads to minimize erosion, maintain stability, and reduce the risk of failure or decreased effectiveness of drainage structures and stream crossings. Components of this measure include the use of inspections and maintenance actions to prevent erosion of road surfaces and ensure the continued effectiveness of stream crossing structures. The measure also addresses appropriate actions for closing roads that are no longer in use.

TIMBER HARVESTING -- This management measure is intended to reduce NPS pollution resulting from timber harvesting operations. The measure includes components for the location of landings, for the operation of groundskidding and cable yarding equipment, and for the prevention of pollution from petroleum products. Harvesting practices that protect water quality and soil productivity can also reduce total mileage of roads and skid trails, lower equipment maintenance costs, and provide better road protection and reduce road maintenance. Appropriate skid trail location and drainage and proper harvesting in SMAs are addressed by this measure. Erosion from the siting and operation of timber harvest operations can be reduced by conducting preharvest planning.

SITE PREPARATION AND FOREST REGENERATION -- In some areas mechanical site preparation is of great concern for potential impacts to water quality. This is especially true in areas that have steep slopes on highly erodible soils, or where the site is located in close proximity to a waterbody. Careful regeneration of harvested forest lands is important in providing water quality protection from disturbed soils. This management measure is intended to reduce the impacts of mechanical site preparation and regeneration operations and to confine on-site potential nonpoint source pollution. Components of this measure address keeping slash materials out of drainages, operating machinery on the contour and protecting the ground cover in ephemeral drainages and SMAs.

FIRE MANAGEMENT -- Prescribed burning is aimed at reducing slash and competition for nutrients among seedlings and protecting against wildfire. Prescribed fires that burn intensely on steep slopes in close proximity to streams and that remove most of the forest floor and litter down to the mineral soil, are most likely to adversely affect water quality. The purpose of this management measure is to reduce the potential nonpoint source pollution and erosion resulting from prescribed fire for site preparation and from methods for suppression of wildfire. Prescribed fires should be conducted under conditions to avoid the loss of litter and incorporated soil organic matter. Bladed firelines should be stabilized to prevent erosion, or practices such as handlines, firebreaks, or hose lays should be used where possible.

REVEGETATION OF DISTURBED AREAS -- Revegetation of areas of disturbed soil can successfully prevent sediment and pollutants associated with the sediment (such as nutrients) from entering nearby streams. The objective of this management measure is to reduce erosion and sedimentation by the rapid revegetation of areas of soil disturbance from harvesting and road construction. The disturbed areas to be revegetated are those localized areas within harvest units or road systems where mineral soil is exposed or agitated such as road cuts, fill slopes, landing surfaces, cable corridors, or skid trails.

FOREST CHEMICAL MANAGEMENT -- Chemicals used in forest management are generally pesticides (insecticides, herbicides, and fungicides) and fertilizers. Since pesticides may be toxic, they must be properly mixed, transported, loaded, and applied and their containers must be properly disposed of to prevent potential nonpoint source pollution. Fertilizers must also be properly handled and applied since they also may be toxic or may shift surface water energy dynamics, depending on the exposure and concentration. The objective of this management measure is to ensure that the application of pesticides and fertilizers does not lead to contamination of surface waters. Components of this measure include applications by skilled workers according to label instructions, careful prescription of the type and amount of chemical to be applied, and the use of buffer areas for surface waters to prevent direct application or deposition.

> WETLAND FOREST MANAGEMENT -- Forested wetlands provide many beneficial water quality functions and provide habitat for aquatic life. The purpose of this management measure is to protect the aquatic functions of forested wetlands."

Timber harvesting fluctuates from year to year, but has remained consistent throughout much of the Region. Several of the State and Town owned lands within the region are actively managed for harvesting timber, and one such example is Bear Brook State Park in Allenstown which is managed by the NH Department of Resource and Economic Development. It is important to not that the majority of forest land within this Region is privately owned. As a result of a large portion of forest land being privately owned, these lands are more susceptible to varying degrees of forest management.

Tree Farms

The American Tree Farm System® (ATFS), a program of the American Forest Society, is a national nonprofit organization that promotes healthy forests and environmental education. The ATFS' mission statement, per their website, indicates that the ATFS promotes, "the growing of renewable forest resources on private lands while protecting environmental benefits and increasing public understanding of all benefits of productive forestry." Since 1941, members of the Tree Farm program have been educated on topics such as wildlife habitat, watersheds, soil conservation, and forest resources. The State of New Hampshire has an estimated 1,625 active Tree Farms, which account for 850,538 acres of land of the total 33 million acres of privately owned land among 46 states. It is important to note that due to the requirements set forth by the program, this number fluctuates on a yearly basis. As of May 2003, the Central New Hampshire Region had 114 of the 1,625 active Tree Farms in the state that were occupying an estimated 19,620 acres, which accounts for 4% of the land in the central region. With the majority of land in private ownership, this program offers a means to manage land while meeting the needs of these private owners harvesting their forest resources.

The ATFS website indicates that to qualify for the program, landowners must:

- Dedicate at least 10 acres to growing and harvesting forest products;
- Have a written plan for the future management of their forest;
- Follow management recommendations prescribed by a licensed forester;
- Demonstrate a commitment to stewardship of their forest for multiple values.

Timber Tax

RSA 79 defines timber as real estate. Thus, timber is subject to a real estate tax at the time it is cut. Prior to harvesting, landowners must fill out an "Intent to Cut" form notifying town and state officials of the intended amount of timber to be harvested. This form is also used to assess the value of timber being harvested so that a tax can be determined. **Table 9** shows the timber tax collected for each of the Towns in the Region for the years 2001-2003. The Towns of Warner ($135,470.88), Loudon (148, 580.04), and Henniker ($124,442.32) all brought in over $100,000 over the three year period. Conversely, the towns of Allenstown ($32,947.82), Chichester ($31,993.52), and Epsom ($24,645) all have timber tax totals of less than $40,000 between 2001 and 2003.

Timber harvesting plays an important role in the economic development of the Region as **Table 9** illustrates. Region timber taxes brought revenue totals of $415,836.69, $501,543.50, and $332,825.95 for the years 2001, 2002, and 2003 respectively, making the combine three year total just under 1.3 million dollars.

TABLE 9

Timber Tax Collected by Town

TIMBER/YIELD TAX				
TOWN	**2001**	**2002**	**2003**	**TOTAL**
Allenstown	12,087.00	12,954.00	7,906.82	32,947.82
Boscawen	16,535.00	26,815.00	32,674.00	76,024.00
Bow	18,248.00	14,073.00	9,044.00	41,365.00
Bradford	26,526.00	26,526.00	U	53,052.00
Canterbury	18,218.40	30,264.42	19,105.53	67,588.35
Chichester	8,386.52	14,781.00	8,826.00	31,993.52
Concord**	U	U	U	U
Deering	16,435.73	30,747.78	20,726.60	67,910.11
Dunbarton	24,701.00	13,189.00	14,748.00	52,638.00
Epsom	U	19,062.00	5,583.00	24,645.00
Henniker	25,866.00	55,252.32	43,324.00	124,442.32
Hillsborough	49,038.61	12,021.77	30,074.00	91,134.38
Hopkinton	21,854.00	15,603.32	19,174.00	56,631.32
Loudon	15,877.70	113,202.34	19,500.00	148,580.04
Pembroke	9,684.00	2,662.00	33,604.00	45,950.00
Pittsfield	18,151.00	U	8,617.03	26,768.03
Salisbury	51,254.00	1,950.00	16,963.00	70,167.00
Sutton	27,374.40	32,236.00	11,466.00	71,076.40
Warner	39,880.33	60,231.55	35,359.00	135,470.88
Webster	15,719.00	19,972.00	4,748.00	40,439.00
Region	415,836.69	501,543.50	341,442.98	1,258,823.17

Source: 2001-2003 Town Annual Reports

** Excludes the City of Concord

According to the 2004 New Hampshire Revised Statutes Annotated and the NH Department of Revenue Administration, the procedures regarding the notice of intent to cut timber tax is as follows:

> **"The Notice of Intent to Cut: (RSA 79:10)**
> The State of New Hampshire has a real estate tax and by definition timber is considered to be real estate, therefore taxable. However, the method in which it is taxed is different from other real estate and is described in the State Constitution. Timber is only taxed at the time it is cut and at a rate which encourages the growing of timber. In order for the municipal assessing officials to be aware of cutting operations they must be notified of the cutting by the owner filing a notice of intent to cut timber. The Notice of Intent, which is required by law, notifies the assessing officials, NH Department of Revenue (DRA) and the NH Division of Forest & Lands. Timber on all land ownership is taxable at 10% of the stumpage value at the time of cutting. The only exceptions are as follows:
>
> - 10 MBF saw logs and 20 cords fuel wood for personal use by the owner. (RSA 79:1 II(b) 1&2)
> - 10 MBF saw logs and 20 cords of wood for land conversion purposes when all permits for the conversion have been received. (RSA 79:1 II (b) 5)
> - Shade and ornamental trees, usually considered to be trees within striking distance of a building. (RSA 79:2)
> - Christmas trees, fruit trees, and nursery stock and short rotation tree fiber. (RSA 79:2)
> - Any amount of firewood for maple syrup production. (RSA 79:1 II (b) 2)
> - Government and utilities not selling the wood.(RSA 79:1 II (b) 3 & 4)
>
> The Notice of Intent to Cut must be completed with a volume estimate and signed by the assessing officials before any cutting requiring a notice can start. The original volume estimate cannot be exceeded without filing a supplemental notice of Intent to cut for additional volumes. Notice of Intent to Cut forms are available from the DRA and the Town.

Town officials have 30 days to sign the Intent to cut form (RSA 79:3a III). They may withhold signing only for the following reasons:

- The form has been improperly filled out (RSA79:10);
- Land is enrolled in the unproductive current use category that does not allow timber harvesting. (RSA 79-A:2,XIII, Current Use Administrative Rule Cub 305.02 (b);
- A timber tax bond is required but has not been posted (RSA 79:3-a).
- All owners of record have not signed the intent to cut (RSA 79:1,II). All owners of record are listed on the property record card.

If town officials have not acted on the Intent to Cut within 30 days of receipt the landowner should contact DRA, which then inquires with the town as to the status of the paperwork. If municipal officials are withholding signing, the landowner should be notified in writing by the town as to the reasons within 30 days of receipt of the Notice of Intent to Cut by the town.

Tax Responsibility: (RSA 79:1 II(a))

The responsibility for the timber tax depends on the type of ownership and must be one of the following:

- Landowners with timber rights on their own land.
- Persons with deeded timber rights on land they previously owned
- Persons purchasing timber on public lands Federal, state, county, town, etc.
- Timber Tax Bond : (RSA 79:10-a)

Owners that own land within the town the cutting is to take place and are current on property taxes and timber taxes cannot be required to post a timber tax bond. All other owners must post a timber tax bond before the Notice of Intent to Cut is signed. Timber tax bonds are usually equal to the expected timber tax."

WILDLIFE AND PLANT SPECIES RESOURCES

The Central New Hampshire Region is home to a wide range of wildlife and plant species, along with numerous habitat communities. The presence of the many lakes, ponds, and rivers along with the many wooded and open space areas make the Region a popular area for a variety of wildlife and plant related activities, including fishing, hunting, and bird-watching. The rich diversity of the Region makes the recognition of this resource an important part of the Regional Natural Features Chapter.

NATURAL HERITAGE INVENTORY

The New Hampshire Natural Heritage Bureau, one of six bureaus within the Division of Forests & Lands, is responsible for finding, tracking, and inventorying rare wildlife species. Increasing development and pressure in the Region on the native flora and fauna has led to a greater necessity by the New Hampshire Natural Heritage Bureau in identifying and protecting threatened and endangered species in these natural communities while working in conjunction with the NH Fish & Game Department's Nongame & Endangered Wildlife Program. According to the New Hampshire General Court the Division of Forests and Lands derives its authority from Title XIX-A which states the Director of the Division shall,

> "(a) Execute all matters pertaining to forestry, forest management, and forestlands within the jurisdiction of the state, including cooperation with other state and federal agencies, with the approval of governor and council as required.
>
> (b) Be responsible for the forest management of all reservations and state-owned forestlands except those areas managed for special purposes. The director shall consult with the directors of all agencies responsible for such areas in regard to forest management.
>
> (c) Execute all matters pertaining to the use of state reservations, except matters pertaining to the recreational development, administration, and maintenance, which shall be done in cooperation with the director of the division of parks and recreation, department of resources and economic development, with the approval of governor and council as required.

(d) Gather information on the state's forest resources and plan for the multiple use and perpetuation of those resources.

(e) Enforce provisions on timber harvesting in RSA 227-J.

(f) Be responsible for overall forest health monitoring, reporting, and protection.

(g) Be responsible for the overall prevention and control of woodland fires throughout the state except within the boundaries of the White Mountain National Forest.

(h) Administer the funds in RSA 227-G:5.

(i) Prepare biennially a report to the governor on the activities and plans of the division. Such report shall contain an itemized statement of all expenses incurred or authorized by the director or by the commissioner.

(j) Carry out such other duties relating to forests, forest management, and forestlands as may be delegated by the commissioner lying within the jurisdiction of the department."

Appendix A shows a complete listing of the Region's Natural Heritage Inventory, broken down by Town, as of June 2003.

Presently, there are 195 listings within the Natural Heritage Inventory of the Region. Of these 195 listings, there are 81 different plant and wildlife species, 31 Natural Communities identified (19 different types), 1 Bat Hibernacula, and 7 Great Blue Heron Rookeries.

Each species listed by the Natural Heritage Inventory is given a rank of importance. This rank is based upon the distribution of that species within New Hampshire, and within the entirety of its range. The less frequent the species, the higher the ranking that is given and these ranks are as follows: Highest Importance (HI) -species is rare to nonexistent in New Hampshire and its known range. Extremely High Importance (EH) –species is rare in New Hampshire and in its range, though slightly more frequent than HI. Very High Importance (VH) –species is rare in New Hampshire, but may be more

common throughout its entire range. High Importance (H) –species is rare to infrequent in New Hampshire, but frequent in other areas of its range. No Importance Specified indicates that although the species may be listed on the State level, the species is not endangered in other areas of its known range.

There are several species and natural communities that were given the highest priority (HI) for protection. They are as follows:

- MOLLUSKS
  - Brook Floater (Alasmidonta varicosa) in Webster

- NATURAL COMMUNITIES (TERRESTRIAL)
  - New England Pine Pitch/Scrub Oak Barrens in Concord and Pembroke
  - New England Dry Riverbluff Opening in Concord

- PLANTS
  - Small Whorled Pogonia (Isotria medeoloides) in Warner

Several species of wildlife, plant species and natural communities were given an extremely high importance priority (EH) for protection and are as follows:

- INSECTS
  - A Noctuid Moth (Chaetaglaea cerata) in Concord
  - A Noctuid Moth (Zale curema) in Concord
  - Cobweb Skipper (Hesperia metea) in Concord
  - Frosted Elfin (Callophrys irus) in Concord
  - Graceful Clearwing (Hemaris gracilis) in Concord
  - Kerner Blue Butterfly (Lycaeides melissa samuelis) in Concord
  - Persius Duskywing (Erynnis persius persius) in Concord
  - The Cora Moth (Cerma cora) in Concord

- MOLLUSKS
  - Brook Floater (Alasmidonta varicosa) in Boscawen, Canterbury, Chichester, Concord, Loudon, Pittsfield, and Salisbury

- NATURAL COMMUNITIES (PALUSTRINE)
  - Atlantic White Cedard Basin Swamp in Bradford and Hillsborough
  - Blackgum/Red Maple Basin Swamp in Warner
  - Inland New England Acidic Pond Shore/Lake Shore Community in Bradford

- NATURAL COMMUNITIES (TERRESTRIAL)
  - SNE Floodplain Forest in Concord

- REPTILES
  - Spotted Turtle (Clemmys guttata) in Warner and Webster
  - Wood Turtle (Clemmys insculpta) in Salisbury

- PLANTS
  - Sclerolepis (Sclerolepis uniflora) in Bradford
  - Golden Heather (Husonia ericoides) in Concord
  - Wild Lupine (Lupinus perennis) in Concord

The majority of the species listed by the New Hampshire Natural Heritage Bureau fall under the Very High Importance (VH) and High Importance (H) priority echelon. Please refer to **Appendix A** for a comprehensive list of species with these priority classifications in the Natural Heritage Inventory.

Producing a natural resource inventory specific to an individual community will prove invaluable to forming the groundwork for a management plan that aims to protect natural communities and sensitive habitat areas. An inventory can be a quick assessment or be a very detailed evaluation and this is relative to the individual community and how invested they are at protecting their rare species and communities. Inventories can shed light on the quality of the wildlife habitat, potential repercussions of timber harvesting on native ecosystems, and other factors that will have some effect on the way of life of the species in that area. Most often inventories update older records and thus provide a more accurate picture of the diversity of species in a given area. Natural resource management plans and conservation decisions in individual communities that are based on natural resource inventories will lead to better preservation of rare or unique natural features common to those communities.

WATER RESOURCES

The Central New Hampshire Region is dominated by water sources, such as lakes, ponds, rivers and aquifers. Uses of these resources range from wildlife habitat, private and public drinking water supplies, to a source of summer and winter recreational activities. This section identifies the important elements of water resources.

WATERSHEDS

The New Hampshire Department of Environmental Services defines a watershed as "a geographic area in which all water [surface water and groundwater] drains to a given stream, lake, wetland, estuary, or ocean. Watersheds boundaries are defined by a line that connects the highest elevations around a water body." Thus, it is possible to have watersheds of various sizes. In addition, it is possible to have many smaller watersheds contained within one larger watershed. For this reason, it is important to move outside of the region and identify the five watersheds that encompass New Hampshire. They are as follows:

- Androscoggin
- Connecticut
- Piscataqua
- Merrimack
- Saco

The Androscoggin River Watershed to the northeast, the Saco River Watershed to the east, and the Piscataqua River Watershed to the southwest encompass both the States of Maine and New Hampshire. The Connecticut River Watershed encompasses Massachusetts, Connecticut, Vermont, and the entire Western border of New Hampshire. The largest Watershed (at approximately 3850 square miles) is the Merrimack River Watershed which encompasses Central and Southern New Hampshire as well as Massachusetts.

The three major watersheds are the Merrimack River Watershed (99.84% of the regions total land area), the Connecticut River Watershed (.15%), and the Piscataqua River Watershed (.0001 %). On the regional level, the Central New Hampshire Region contains 19 watersheds derived from the three larger watersheds. The majority of these watersheds are part of the Merrimack River watershed. The Cocheco River Watershed, part of the Piscataqua occupies 3.6 acres of the region on the eastern border of the Region, while the Sugar River

Watershed, part of the Connecticut River Watershed, in the northwest occupies 754.71 acres in the Region. **Table 10** provides a list of the watersheds in the Region.

TABLE 10
Regional Watersheds and Acreage

MAJOR WATERSHEDS	REGIONAL WATERSHEDS	ACRES	TOWNS INCLUDED IN WATERSHED
Connecticut	Sugar River	754.71	Sutton
Merrimack	Warner River	76,813.46	Bradford, Hopkinton, Salisbury, Sutton, Warner, Webster
	Lower Suncook River	69,124.28	Allenstown, Chichester, Epsom, Loudon, Pembroke, Pittsfield
	Concord Tributaries	66,149.77	Bow, Canterbury, Concord, Dunbarton, Hopkinton, Loudon
	Henniker Tributaries	61,926.00	Bradford, Deering, Dunbarton, Henniker, Hillsborough, Hopkinton, Warner
	Soucook River	47,590.62	Canterbury, Chichester, Concord, Loudon, Pembroke
	Blackwater River	28,440.88	Hopkinton, Salisbury, Sutton, Warner, Webster
	Upper Merrimack River	27,939.31	Boscawen, Canterbury, Concord, Salisbury
	Lower Contoocook River	25,535.10	Boscawen, Concord, Hopkinton, Salisbury, Webster
	Upper Piscataquog River	23,192.37	Deering, Henniker
	Beards Brook	23,022.20	Bradford, Hillsborough
	Manchester Tributaries	11,871.55	Allenstown, Bow, Dunbarton
	Upper Contoocook River	3,969.41	Deering, Hillsborough
	Upper Suncook River	2,164.02	Pittsfield
	Lower Piscataquog River	1,694.63	Dunbarton
	South Branch Piscataqoug River	1,305.49	Deering
	Franklin Tributaries	14.23	Salisbury
	Cohas River	0.03	Allenstown
Piscataqua	Cocheco River	3.60	Pittsfield

Sources: CNHRPC, USGS

Watersheds provide natural boundaries to the water that collects in the water bodies and streams contained within the respective boundaries. The need to recognize and identify the watersheds within the region is critical to monitoring and protecting the water resources within the Region. All activity within the respective watershed has the potential to impact the overall quantity and quality of the water found within the watershed boundaries.

LAKES AND PONDS

According to the New Hampshire Association of Regional Planning Commissions water bodies in the Central New Hampshire Region account for an estimated 14, 575 acres (3.1%) of land within the Region. Of this total, there are 115 named water bodies accounting for approximately 5,200 acres of the total. These water bodies are scattered throughout the Region and provide

residents and nonresidents with many benefits, including summer recreation such as boating and swimming, winter recreation such as ice fishing, and acts as habitat for the many plants and wildlife that rely on these water bodies for survival. **Table 11** provides a list of the named water bodies within the Region, though it is important to note that many other unnamed lakes and ponds exist in the Region.

The largest lakes and ponds occur to the west of the Merrimack River, including Lake Massasecum (403 acres) in Bradford and Long Pond (360 acres) in Concord. Many of the water bodies east of the Merrimack occur close to the Contoocook River, while the other large water bodies occur in the towns of Bradford, Hillsborough and Sutton. Water in these areas tend to collect in the many valleys of the mountainous terrain. There are fewer lakes and ponds to the east of the Merrimack River due in large part to the flatter terrain. The largest body of water east of the Merrimack River is Turtle Pond (121 acres) in the eastern half of Concord.

TABLE 11
Named Ponds and Lakes in the Central NH Region

TOWN	NAME	ACRES	TOWN	NAME	ACRES
Allenstown	Bear Hill Pond	33	**Henniker**	Long Pond	90
	Catamount Pond	16		Lower Pond	12
	Hall Mountain Pond	25		Upper Pond	25
	Smiths Pond	9		Pleasant Pond	92
Boscawen	Patenaude's Pond	70		Mud Pond	8
	Flander's Pond	15		French Pond	33
	Little Pond	5.8		Craney Pond	36
Bow	Turee Pond	52		Carr Pond	11
Bradford	Lake Todd	168		Keyser Pond	
	Lake Massasecum	403		Morrill Pond	
	Ayer Pond	28		Grassy Pond	
Canterbury	Forrest Pond	23	**Hopkinton**	Hopkinton-Everett Reservoir	
	Crane Neck Pond	11		Drew Lake	38
	Kimball Pond	10		Whittier Pond	14
	New Pond	30		Kimball Pond	75
	Lyford Pond	26		Clement Pond	100
	Horseshoe Pond			Carr Pond	11
	Rocky Pond	78		Gassey Pond	20
	Morrill Pond	19		Rolf Pond	30
	Morrill Pond #2	30	**Loudon**	Clough Pond	45
	Oxbow Pond			Crooked Pond	29
	Upper shaker Pond	5		Sanborn Pond	104
	Shaker Pond #2	3		Holt Pond	43
	Unnamed Pond	14	**Pembroke**	Bragfield Pond	5
Chichester	Lynxfield Pond	14	**Pittsfield**	Berry Pond	33
	Marsh Pond			Blake Pond	14
Concord	Long Pond	360		Eaton Pond	17
	Turkey Pond	339		Whites Pond	36
	Turtle Pond	121		Wild Goose Pond	78
	Hot Hole Pond	26.9	**Salisbury**	Stirrup Iron Pond	5
	Snow Pond	20		Wilder Pond	8
	Little Turkey Pond	114.6		Tucker Pond	83
	Upper Goodwin Point Pond	37.2		Blackwater Bay	68
	Sugar Ball Pond	12		Greenough Pond	
	Fort Eddy Pond	20		Duck Pond	
	Horseshoe Pond	44		Shaw Pond	
	Unnamed Oxbow #1	23.2	**Sutton**	Lock Lyndon Reservoir	127
	Little Pond	4		Kezar Lake	143
Deering	Dudley Pond	30		Gile Pond	57
	Lily Pond	15		Blaisdell Lake	158
	Clifton's Camp Pond	8		Russell Pond	15
	Mud Pond	8		Billings Pond	20
	Fulton Pond	5		Palmer Pond	
	Oxbow Campground Pond	5		Cornelius Pond	
	Frog Pond	1	**Warner**	Bagley Pond	9
	Deering Reservior	315		Bear Pond	49
Dunbarton	Gorham Pond	103		Cunningham pond	22
	Stark Pond	10.8		Tom Pond	31
	Kimball Pond	52		Pleasant Pond	16
	Long Pond	32		Simmons Pond	16
	Purgatory Pond	14		Mud Pond	3.5
Epsom	Seeley Pond	3	**Webster**	Blackwater Reservior	
	Chestnut Pond	30		Walker Pond	190
	Odiorne Pond	20		Ox Pond	8
	Bixby Pond			Trumbull Pond	83
	Northwood Lake			Lake Winnepocket	227
	Round Pond			Pillsbury Lake	
				Knight's Meadow Marsh	35

Sources: 1999 Natural, Cultural, and Historic Resources Inventory, Local Master Plans

RIVERS, STREAMS, and BROOKS

A river, as defined in the New Hampshire rivers management and protection program, is "a flowing body of water or a segment or tributary of such water body." Rivers are the result from run-off water that falls on impermeable land surfaces. Once falling water reaches the surface, it either soaks into the ground and becomes groundwater, evaporates, or becomes surface flow. Water that soaks into the ground passes through transport systems formed by bedrock or gravel underlying this Region. Water that becomes surface flow will flow to the lowest point on the land, and many times this water finds its way to aquifers or reservoirs through rivers, streams, and brooks.

There are five major rivers that run through the Central New Hampshire Region. They are the Merrimack River, Soucook River, Blackwater River, Contoocook River, and Warner River. All of these rivers are utilized for multiple purposes including a source of hydroelectric power, recreation, wildlife habitat, and for drinking water. Many of the larger rivers are monitored by local conservation and water advisory groups to assure that these natural features maintain their aesthetic and environmental values. Some of these groups monitor lakes and ponds as well. A list of several advisory groups is provided in **Appendix B**. Several smaller rivers also run through the Region, including the Turkey River, Punch and Stirrup Brooks, Mill Brook, Bela Brook, and Suncoock River.

Major Rivers

Merrimack River

The Merrimack River runs north to south, beginning in the White Mountains and ends in the Atlantic Ocean after entering Massachusetts. The Merrimack River begins in the White Mountains and ends in the Atlantic Ocean after entering Massachusetts. This River is the most prominent waterway in the region, stretching for approximately 300 miles. The Merrimack has played an important historical role, and the many uses of this River have helped shape the economic and cultural history of the Region. Additionally, the Merrimack River acts as a natural division between the Region's topographic characteristics.

Soucook River

The Soucook River forms in Gilmanton, and along the way, acts as the natural boundary between Concord and Pembroke before flowing into the Merrimack River in Bow.

Blackwater River

The Blackwater River, located in the Central New Hampshire Region, begins in Salisbury, NH before flowing south and joining the Contoocook River in Hopkinton. The River is approximately 14 miles long and has a federally-owned dam in Webster that is used for flood control purposes.

Contoocook River

The Contoocook River begins in Rindge, NH, at Poole Pond, then flows 71-miles northeast to the City of Concord and into the Merrimack River. Along the 71-mile stretch, the Contoocook River acts as a collector for the North River and its branch rivers. The North River begins in Stoddard, NH before joining the Contoocook River 16-miles later in Hillsborough. Collectively, these two rivers make up the second largest waterway in the Region.

Warner River

The Warner River, like the Blackwater River, joins the Contoocook River in Hopkinton and flows north through the Town of Warner. This river provides scenic views of historic covered bridges and old mill sites.

WETLANDS

Wetlands are areas that are permanently or periodically flooded by water. Wetlands serve many ecological and environmental roles, such as a valuable source of ecological habitat for wildlife, recharge areas for aquifers, water purification, and act as natural buffers for lakes and ponds. There are two types of wetlands, coastal and interior, which as their names suggest depend where they are to be found geographically on the lands surface. This Region has interior wetlands, areas which border lakes, rivers and those areas that experience raised groundwater levels. These areas are responsive to changes in surrounding terrestrial and aquatic systems, as they harbor many unique habitats and species from both environments. Wetlands are a vital part of the nutrient cycle, filtering out heavy metals and organic pollutants by the plants that these areas support. There is a continuous cycle of plant growth, decomposition, and release of nutrients into the soil. Due to the many benefits of wetlands, this natural feature is viewed as a sensitive natural resource.

The US Fish & Wildlife Service is responsible for identifying, classifying, and mapping the wetlands in the United States through the National Wetlands

Inventory. The National Wetlands Inventory was established to monitor the changes in wetlands due to natural and human development. The **Regional Topography and Wetlands Map** shows the locations of wetlands in the Central New Hampshire Region. The classification used by the National Wetlands Inventory, based on soil type, vegetative cover, and soil saturation, is as follows:

Lacustrine: Wetlands classified under this category are areas of tidal or nontidal water pooled by the natural features of the land, such as a depression, or is the result of human development. This category refers to any lake or pond that exceeds twenty acres in size, or has a water depth of greater than 6.6 ft at its low water level.

Palustrine: Wetlands classified under this category include nontidal lands characteristically dominated by shrubs, mosses, trees, and other vegetation. This category includes all wetlands with a total vegetation cover at a percentage greater to or equal to 30%. It is important to note that some lacustrine and riverine wetlands are vegetated, however this category contains the most vegetated wetlands.

Riverine: This category includes all wetlands that exist within a channel with constant moving water, or water that connects two static bodies of water. Bodies of water classified under this category are rivers, streams, and their associated saturated soils.

Palustrine wetlands account for the majority of the wetland types in the Region. There is a large concentration of these wetlands in the Towns of Bow, Canterbury, Deering, Loudon, and Salisbury. The majority of the high concentration areas exist in close proximity to lakes, ponds, and streams. Few of these wetlands exist, although there are large Lacustrine wetlands located north in the Town of Sutton and Hopkinton, by the Hopkinton-Everett Reservoir. Several smaller wetlands exist in the Towns of Allenstown, Boscawen, Concord, Dunbarton, and Epsom. All Riverine wetlands are associated with the many lakes and ponds of the region.

AQUIFERS

An aquifer is geological formation, or formations, that are able to transmit and store large quantities of subsurface water. The US Geological Services is responsible for identifying and mapping the locations of aquifers in the United States. The **Regional Aquifers and Watershed Boundary Map** shows the

location of the underlain aquifers in the Region that play a vital role in water resource management. Not only do they act as recharge sources for lakes, ponds, and rivers; aquifers are the number one source of drinking water in the Central New Hampshire Region, accommodating both private and municipal uses. Presently, 65% of the northeast is underlain by large aquifers that account for 19.04% of the Region being underlain by aquifers. Concentrated most heavily under the City of Concord, the largest contiguous aquifer occurs under the Merrimack River, Contoocook River, and Suncook River. While another large, contiguous aquifer occurs to the west underlying the Blackwater River. Many smaller aquifers exist throughout the remainder of the Region.

The US Geological Service states that crystalline rock lay in large areas throughout the northeast, which contribute to the aquifers found in New Hampshire. Crystalline rock is classified as igneous and metamorphic rock, which is formed from magma or lava cooling below and above the Earth's surface respectively. Crystalline rock is made up of tiny mineral crystals that are unconnected and have minimal permeability. An aquifer can consist of pockets in this rock or can be the result of glacial deposits, ice contact, and valleys filled with sand and gravel. These aquifers were formed during the movement of glaciers across the Earth's surface gouging large valleys into the igneous and metamorphic rock. The glaciers were at the same time cooling the rock coming from the core of the Earth as magma, which created cracks, joints, and faults. While these glaciers were producing these gouges and fractures in the bedrock, they were accumulating loose gravel and outwash, which would later settle into these valleys as the ice melted.

Aquifer Transmissivity

The transmissivity of the water through these aquifers consisting of crystalline rock is a function of the fractures within the rock. The mineral crystals within crystalline rock create granular pore spaces, spaces that are minuscule, and which are the main contributing factor to its minimal permeability. Due to the composition of this rock it would be virtually impossible to have a productive well if it only relied on the water being transported between these crystals. The reason that a crystalline rock aquifer can yield enough water to be productive is due to the fractures in the rock, providing a larger amount of water to be transported. These fractures occur in greater number and size the closer they are to the surface due to weathering and ice contact. Water often makes its way into these fracture systems by outcrops with such characteristics as cleavage planes.

In valley aquifers, sand and gravel create a system where groundwater can be transported in larger volumes than in the crystalline rock. The spaces between the gravel create pockets for groundwater to pool and are most often times interconnected providing the ability to recharge surrounding wells drawing from the same aquifer. Sand that has settled into the lowest point of these valleys or basins produces a non-porous level that inhibits water from seeping further down into the ground. This is an important feature for the reason that a well would have to be drilled a lot deeper to provide the same results if this sand didn't help in pool groundwater and keep it among the spaces between the gravel.

The average well in this Region receives between 1 and 10 gallons of groundwater per minute. Aquifer transmissivity is revealed on the **Regional Aquifers and Watershed Boundary Map** and illustrates transport systems areas in the Region. Some wells may produce more if there is a nearby river that is connected into these transport systems. The US Geological Service estimates that 100 to 500 gallons of water every minute is possible in circumstances where a well is tied into a transport system being fed by a river.

The majority of the stratified drift aquifers in the Region move between 0 and 1000 square feet of water per day. These aquifers of lower transmissivity occur most notably along the Merrimack River, Contoocook River, and Blackwater River, while areas around the Warner River and Soucook River contain aquifer transmissivities that exceed 8000 square feet per day.

RESERVOIRS

The term reservoir refers to any pond or lake, manmade or natural, which is used as a water supply or for irrigation. A reservoir consists of the Pool, Dam, and Diverted Outlets. The Pool refers to the often times deep basin behind the Dam where the water pools and from which water treatment plants draw through diverted outlets. Reservoirs vary in size, 100 acres or less to several square miles, and often provide surrounding towns and cities with their primary water supply. Other uses for reservoirs include flood water storage, flood water control, and hydroelectric generation. Some reservoirs restrict recreational activities to reduce the risk of contamination although others allow fishing, boating, swimming, etc. These water storage areas provide scenic views to those homes on real estate along their shores. The US Army Corps of Engineers manages and/or owns hundreds of reservoirs nationally.

There are three reservoirs located within the Central New Hampshire Region that are used for flood control, provide habitat for aquatic wildlife, or are utilized for recreational purposes. The Hopkinton-Everett Reservoir is located in Hopkinton and was authorized by Congress after a series of seasonal flood disasters in 1938. The Lock Lyndon Reservoir, located in Sutton, and Concord's reservoir, known as Penacook Lake, are also included in the list. The locations of these reservoirs can be seen on the **Regional Water Resources Map**.

CORRIDORS AND GREENWAYS

Corridors and Greenways are used for multiple purposes and support a multitude of organisms. Recreation, transportation, and utility lines all utilize these corridors and greenways. Both are used by wildlife to travel from one habitat to another, often being the only way wildlife can safely move amongst non-adjacent sections of land. Recent emphasis has been placed on the identification and protection of these important areas, due to their many uses most notably along the shorelines of rivers. Many nonprofit groups are in the process of identifying and conserving undeveloped lands to place in conservation. Entities aimed at protecting the loss of open space lands envision these lands as havens for important wildlife and an untouchable sanctuary that will preserve important habitats. The growing concern with protecting open space lands to conserve natural features has caused a shift toward using corridors and greenways to connect existing protected lands to nearby disconnected areas of land. Areas of land that can be connected by corridors and greenways will have positive effects on the survival chances for wildlife and plant life within these habitats.

Utility Corridors

The **Regional Land Use Map** shows some of the major utility corridors that exist in the Region. One of the most notable is the corridor running form the north to south entering Salisbury then exiting through Dunbarton as it slices through Webster, Concord, and Hopkinton. Another utility corridor exists along the Warner River, specifically stretching from Route 114 in Bradford along the Warner River and exiting through Hillsborough. There is also a utility corridor running north to South parallel to Interstate 93 entering Canterbury and running along eastern Concord, through Pembroke and Bow and exits through Dunbarton. An arm of this utility corridor exists through the center of Pembroke and circumnavigates Bear Brook State Park in

Allenstown. Lastly, there is a corridor that exists from western Loudon through Chichester and into Pittsfield towards Barnstead. Utility corridors serve many wildlife uses by accommodating many fruiting trees, providing early successional habitat, and by acting as travel corridors for the many wildlife species of the Region.

River Corridors

A river corridor, according to the New Hampshire rivers management and protection program, is defined as:

> "(RSA 483:4) …the river and the land area located within a distance of 1,320 feet of the normal high water mark or to the landward extent of the 100 year floodplain as designated by the Federal Emergency Management Agency, whichever distance is larger."

Each of the five major rivers in the Region, the Merrimack River, Contoocook River, Warner River, Blackwater River, and Soucook River have corridors associated with there banks.

- The Merrimack River Corridor has many natural communities, recognized by the New Hampshire Natural Heritage Inventory that are unique to the area. This has resulted in an area that is diverse in plant and wildlife species. People continue to use this river as a source of recreation for activities including boating, fishing, and wildlife observation. Presently, this corridor is the most heavily populated area in the region, and the development pressures will need to be addressed to maintain the quality of this corridor.

- The Contoocook River Corridor has spotted development along its banks, making it largely undeveloped. Several agricultural lands exist along the river allowing for relatively easy movement for wildlife. The heaviest development occurs in Contoocook Village in Hopkinton, Penacook Village in Concord, downtown Hillsborough, downtown Henniker, and downtown Deering.

- Though not as large as the other river corridors, The Warner River Corridor still maintains areas of low development. With the presence of Interstate 89 this corridor is in danger of becoming increasingly developed. There are only a few areas protected along this river in the Town of Warner.

- The Blackwater River Corridor, like the Merrimack River Corridor is diverse in its plants and wildlife species. The NH Department of Resources and Economic Development owns a portion of this land for use in the Blackwater Dam and Reservoir System. This land is actively managed to maintain a range of habitat types, thus making it a valuable source for wildlife habitat. In addition, there are a large number of recreational uses that occur along the river, including an annual canoe race, bird watching, and snowmobiling.

- The Soucook River Corridor is in relatively poor condition due to the presence of NH 106 along the majority of the river's banks, and the areas of heavy development. The patterns of fragmented forest make this area of little value to recreation and difficult for terrestrial mammals to move throughout the corridor. See **Regional Unfragmented Lands Map.**

RECOMMENDATIONS

RECOMMENDATIONS NEED TO BE ADDED NOW BASED UPON THE FINDINGS OF THE DOCUMENT

APPENDIX

APPENDIX A

Natural Heritage Inventory Goes Here

APPENDIX B

Open Space Element Goes Here

APPENDIX C

TOWN OFFICES

Allenstown Town Hall
16 School Street
Allenstown, NH 03275
Phone: 485-4276
Website: www.allenstown.org

Boscawen Town Offices
17 High Street
Boscawen, NH 03303
Phone: 796-2426

Bow Municipal Building
10 Grandview Road
Bow, NH 03304
Phone: 225-2683
Website: www.bow-nh.com

Bradford Town Hall
75 West Main Street
Bradford, NH 03221
Phone: 938-5900

Canterbury Town Hall
Hackleboro Road, PO Box 500
Canterbury, NH 03224
Phone: 783-9955

Chichester Town Hall
54 Main Street
Chichester, NH 03234
Phone: 798-5808
Website: www.chichesternh.org

Concord City Hall
41 Green Street
Concord, NH 03301
Phone: 225-8500
Website:
http://www.onconcord.com/

Deering Town Hall
762 Deering Center Road
Hillsborough, NH 03244
Phone: 464-3224
Website: www.deering.nh.us

Dunbarton Town Hall
1011 School Street
Dunbarton, NH 03046
Phone: 774-3547
Website: www.dunbartonnh.org

Epsom Town Offices
Blackhall Road, PO Box 10
Epsom, NH 03234
Phone: 736-9002

Henniker Town Hall
2 Depot Hill Road
Henniker, NH 03242
Phone: 428-3221

Hillsborough Town Hall
29 School Street, PO Box 7
Hillsboro, NH 03244
Phone: 464-3877

Hopkinton Town Hall
330 Main Street
Hopkinton, NH 03229
Phone: 746-3170
Website:
http://www.hopkintonnh.us/

Loudon Town Offices
29 South Village Road, PO Box 7837
Loudon, NH 03307
Phone: 798-4541

Pembroke Town Hall
311 Pembroke Street
Pembroke, NH 03275
Phone: 485-4747
Website: www.pembroke-nh.com

Pittsfield Town Hall
85 Main Street, PO Box 98
Pittsfield, NH 03263
Phone: 435-6773
Website: www.pittsfield-nh.com

Salisbury Town Hall
9 Old Church Road, PO Box 214
Salisbury, NH 03268

Sutton Town Hall
93 Main Street, PO Box 847
North Sutton, NH 03260
Phone: 927-4416

Warner Town Hall
5 East Main Street
PO Box 265
Warner, NH 03278
Phone: 456-2298
Website: www.warner.nh.us

Webster Town Hall
945 Battle Street
Webster, NH 03303
Phone: 648-227

LOCAL, STATE, AND FEDERAL AGENCIES

Central New Hampshire Regional Planning Commission
28 Commercial Street
Concord, NH 03301
Phone: 226-6020
Website: www.cnhrpc.org

NH Department of Environmental Services (NH DES)
Division of Parks and Recreation
172 Pembroke Road
PO Box 1856
Concord, NH 03302-1856
Phone: 271-3254
Website: www.nhparks.state.nh.us

New Hampshire Department of Environmental Services (NHDES)
6 Hazen Drive
PO Box 95
Concord, NH 03305
Phone: 271-3505
Website: www.des.state.nh.us

NH Department of Environmental Services
Wetlands Bureau
6 Hazen Drive
Concord, NH 03301
Phone: 271-2147
Website: www.des.state.nh.us/wetlands

NH Department of Environmental Services
Watershed Management Bureau
6 Hazen Drive, PO Box 95
Concord, NH 03302-0095
Phone: 271-3503
Website: www.des.state.nh.us/watersheds

NH Department of Resources and Economic Development (NH DRED)
Division of Lands and Forests
172 Pembroke Road
PO Box 1856
Concord, NH 03302-1856
Phone: 271-2215

NH Fish & Game
2 Hazen Drive
Concord, NH 03301
Phone: 271-3211
Website: www.wildlife.state.nh

NH Geographically Referenced Analysis Information Transfer
(NH GRANIT)
GRANIT Project
Complex Systems Research, Morse Hall
University of New Hampshire
Durham, NH 03824

Phone: 862-1792
Website: www.granit.sr.unh.edu
United States Census Bureau
Website: www.census.gov

NH Natural Heritage Bureau
Division of Forests and Lands - DRED
172 Pembroke Road
PO Box 1856
Concord, NH 03302-1856
Phone: 271-3623
Website: http://www.nhdfl.org/formgt/nhiweb/

WATER RESOURCES ADVISORY COMMITTES, GROUPS, AND AGENCIES

Center for Freshwater Biology
University of New Hampshire
224 Nesmith Hall
Durham, NH 03824
Phone: 862-3848

Contoocook and North Branch Rivers Local Advisory Committee
Rivers Coordinator
6 Hazen Drive, PO Box 95
Concord, NH 03302-0095
(603) 271-8801

Executive Office
New England District Army Corps of Engineers (Blackwater Dam and Reservoir System)
696 Virginia Road
Concord MA 01742-2751
Phone: (978) 318-8778

NH Rivers Council
54 Portsmouth Street
Concord, NH 03301
Phone: 226-2696

Rivers Protection and Management Program
NH Department of Environmental Services
6 Hazen Drive
PO Box 95
Concord, NH 03302-0095
Phone: 271-1152

Source Water Protection Program
NH Department of Environmental Services
6 Hazen Drive
PO Box 95
Concord, NH 03302-0095
Phone: 271-1168

Upper Merrimack River Local Advisory Committee
PO Box 3019
Boscawen, NH 03303-3019
Phone: 796-2615

FOREST AND LAND RESOURCE GROUPS AND AGENCIES

Audubon Society of New Hampshire
Silk Farm Road
PO Box 8200
Concord, NH 03301
Phone: 224-9909
Website: www.nhaudubon.org

Bearpaw Regional Greenways
PO Box 19
Deerfield, NH 03037
Phone: 463-7562
Website: www.bear-paw.org

Five Rivers Conservation Trust
54 Portsmouth St
Concord, NH 03301-5486
Phone: 225-7225

New Hampshire Timberland Owners Association
54 Portsmouth Street

Concord, NH 03301
Phone: 224-9699
Website: www.nhtoa.org

Society for the Protection of New Hampshire Forests
54 Portsmouth Street
Concord, NH 03301
Phone: 224-9945
Website: www.spnhf.org

RESOURCES

Local Town Annual Reports 2001-2003 (see Town contacts)

"1998 Natural, Cultural, and Historical Resources, Inventory." Central New Hampshire Regional Planning Commission. 1999.

"Draft Regional Open Space Element." Central New Hampshire Regional Planning Commission. Draft 2002.

"Bear Brook State Park Management Plan." NH Department of Resources & Economic Development. 1994.

"Master Plan: Blackwater Project." US Army Corps of Engineers. 1997.

"River Corridor Management Plan." Contoocook and North River Branch Rivers Local Advisory Committee. 1994

NH Natural Heritage Inventory. 2003

NH Fish & Game Significant Wildlife Habitat Course Filter Analysis, 2004.

Local Town Master Plans (see Town contacts)