V. NATURAL RESOURCES

A. INTRODUCTION

Attitudes towards the value of land have changed dramatically over the past decades. Previously, land was viewed in terms of its development potential and marketability. If land was not suitable for development it was flattened, drained, or filled. Experience has taught us that land is a complicated resource and the market alone cannot be expected to provide adequate environmental protection. Proper planning should identify those areas that, because of their value as natural or cultural resources, serve a more important role than supporting development.

The purpose of this element is to identify and assess the extent of significant natural resources within the Town of Cumberland. In addition, it evaluates how development impacts each component of the natural environment. Finally, it establishes methods for protecting and managing natural resources belonging to the community and the State of Rhode Island.

State Planning Act Requirements

According to the R.I. Comprehensive Planning and Land Regulation Act, the Natural and Cultural Resource Element "shall provide an inventory of the significant natural resource areas such as water, soils, prime agricultural lands, natural vegetation systems, wildlife, wetlands, aquifers, coastal features, flood plains and other natural resources and the policies for the protection of and management of such areas. The policies and implementation techniques must be identified for inclusion in the implementation program element."

The Act also requires consistency with State Guide Plan Elements:

110 Goals & Policies
121 State Land Use Policies and Plan
131 Cultural Heritage & Land Management Plan
156 Urban and Community Forests
162 Rivers Policy & Classification Plan
731 Nonpoint Source Pollution Management Plan

B. INVENTORY

Cumberland's natural resources can be broken into three major categories: geologic, hydrologic, and ecologic resources. Geologic resources include surficial geology, topography, and soils. Hydrologic resources are surface and groundwater, wetlands, and floodplains. Ecologic resources include both individual species as well as specific habitats located in Cumberland. This section inventories each of these resources and documents potential threats stemming from human activities.

1. Geology

The geologic and topographic features of Cumberland were formed or modified by glacial processes. During the last continental glaciation a thick sheet of ice covered most of the region. This ice, moving slowly in a southeasterly direction, transported soil and rock fragments thereby obliterating existing landforms and creating a completely new landscape. New valleys were gouged out and drumloidal hills were formed by the ice. Deposits ranging from glacial till and drift containing large boulders to fine grained deposits of silt and clay were created by the moving ice and later modified by extensive meltwater and the wind. Glacial features have been further modified by post glacial geologic processes such as erosion, weathering, redeposition of soils by wind and water, and the effects of vegetation forming cumulose soils (peat and organic silts) in depressions and along water courses.

Surficial Deposits

The surficial geology of Cumberland was mapped in 1949 by the United States Geological Survey (USGS) and has not been updated since. The base topographic survey used for the mapping is the Pawtucket Quadrangle at a scale of one inch to the mile (fifteen minute series). The Pawtucket Quadrangle covers most of the Town of Cumberland. Characteristics of surficial geology in Cumberland include till, bedrock, outwash, and minerals.

Most of the Town of Cumberland is composed till, a material which was deposited with little or no sorting and compacted to form dense deposits not suited to groundwater storage. Till, typically 10 to 20 feet thick, mantles the bedrock surface in the upland areas of the Town. Most of this till forms an uneven mantle or ground moraine. This is found over large areas on Thompson Hill, and on both sides of Mendon Road on Cumberland Hill.

Bedrock outcrops are scattered throughout the Town, particularly evident north and south of Sneech Pond Road between Mendon and Diamond Hill Roads. Much of the bedrock is calcareous based, which reduces acidity of overlying soils. This unique chemical makeup supports plant communities found that are found exclusively within this region.

Outwash is material that was deposited by glacial meltwater with much sorting and stratification by grain size. Because of this stratification, outwash deposits often contain significant layers of coarse-grained material suited to groundwater storage. A major area of outwash is found in north Cumberland near the Pawtucket Reservoir. This area is mostly developed by the residential neighborhood of Diamond Hills.

The principal mineral resources in the Town of Cumberland are sand and gravel deposits. There are several sand and gravel excavations along Abbott Valley and Blackstone Valley. In addition, an investigation conducted in 1937 identified mine holes containing iron, copper, titanium, zinc and tungsten. The extent of these mineral deposits was quite small and would not be profitable to mine under present circumstances. In addition, the igneous rock Cumberlandite, can be found in Iron Hill. This black, heavy, magnetic rock is found nowhere else in the world, and has been designated as Rhode Island's State Rock.

Topography

Topography is the form of the earth's surface, in particular the changes in elevation of the surface. The topography of Cumberland includes landforms such as hills, valleys and plains. The Town's elevation ranges from a low elevation of 10 feet above mean sea level (MSL) near the Blackstone River to a height of over 547 feet above MSL at Beacon Pole Hill.

There are approximately 12,000 acres of steep slopes within the Town. The location of steep slopes (15 percent or greater) in the Town was determined from USGS maps by calculating the amount of rise in elevation over a given horizontal distance. The Soil Conservation Service maps were also used to identify steep slopes. Areas of steep are located throughout the Town and are illustrated in Figure V-1. The most extensive concentrations of steeply sloping land are in the central section of the Town and along the banks of the Blackstone River. Steep slopes are protected in Cumberland's Subdivision Regulations because their disturbance will result in soil erosion and other environmental problems.

Soils

Soils are the surface layers of the earth. They are usually created by modification of surficial geologic material by the weather and climatic conditions. Soils are composed of gaseous, water, organic, and rock constituents. Variations in these constituents give soil a set of physical characteristics. The physical characteristics of soil determine their ability to support weights, susceptibility to erosion and failure in sloping terrain, capacity to receive and transmit water, and economic value (particularly for agriculture).

Soil types within the Town were mapped and analyzed by the Soil Conservation Service (SCS). Figure V-2 is a map of soils with development constraints as well as farmland soils, those whose physical characteristics make them highly suitable for crop production. Farmland soils are important for their resource potential.

The Town of Cumberland has approximately 2,305 acres of prime agricultural soils, or about 13 percent of total land area. Some of these soils are currently being used for agricultural purposes; however, a much greater percentage of these soils have been lost to development. Table V-1 identifies the types of farmland soils within the Town and shows their extent of surface coverage.

Table V-1 Prime Agricultural Soils

Soil Name	Acreage
Agawam	230
Bridgehamton	10
Canton and Charlton	1,125
Paxton	940
TOTAL	**2,305**

Impact of Geology on Land Use

Surficial geology - Characteristics of surficial geology impact land use planning because they affect land use suitability. For instance, bedrock can result in higher excavation costs if a large amount of drilling, blasting, and disposal or processing is required to excavate rock. Areas with shallow depths to bedrock indicate areas not suited to individual on-site sewerage disposal systems.

Areas of organic soil deposits on the other hand, may contain considerable depths of organic material that must be removed and replaced with gravel for construction. Deep foundations are generally required if structures are built in areas of swamp deposits. Deep foundations (consisting of piling, caissons, etc.) invariably cost more than shallow foundations. Organic soil deposits may also indicate areas of wetlands, which are also protected by the Town's Subdivision Regulations and by the Rhode Island Freshwater Wetland Act.

Topography - Steep slopes of 15 percent or more, can affect land use by increasing the amount of excavation and filling required for construction. This, in turn, can affect the stability of a development. Steep slopes are also very susceptible to erosion, particularly if vegetation is removed during construction.

Soils - Soils with severe limitations for supporting individual subsurface wastewater disposal systems (septic systems or ISDS) have important consequences for development. Development in these areas may lead to contamination of surface or groundwater resources if sanitary sewers are not available. However, providing sewerage can lead to denser development than is desired. According to the SCS mapping, there are over 5,670 acres of soils whose characteristics impose severe limitations for individual sewage disposal systems in Cumberland, this constitutes over 30 percent of the Town's total land area. As shown in Figure V-2 the majority of these soils are located in the northern portion of Town, where sanitary

Table V-2 Soils with Severe ISDS Limitations

Name	Acres	Characteristics
Adrian Muck	145	Wetness, Floods
Canton	1,725	Large Stones, slope
Carlisle	375	Floods, wetness
Canton & Charlton	405	Large Stones, Slope
Paxton	1,030	Severe, percs slowly
Ridgebury	285	Percs slowly, wetness
Ridgebury	905	Large stones, wetness
Rock Outcrop	285	
Walpole	505	Wetness
Total	**5,670**	

sewers are limited and the majority of recent development has taken place. Table V-2 identifies these soils and their limitations. The Town's recently approved Soil Erosion and Sediment Control Ordinance protects some soil resources, however, more can be done to further preserve important soils.

2. Hydrology

Hydrology consists of interactions between surface and groundwater. Wetlands usually occur as a transitional area between surface water and dry upland areas, or in areas where groundwater is near or at the land's surface. Floodplains also occur alongside surface water bodies. This section inventories the type, quality, and quantity of these resources. Potential threats to these natural resources are summarized in the final section.

Groundwater

Groundwater is water that saturates geologic or soil formations, generally in pore spaces between soil particles or fractures in bedrock. Groundwater aquifers are important as a source of drinking water. In addition groundwater discharges to the surface maintain baseflow in streams and rivers, and contributes water to lakes, ponds, and wetlands.

Aquifers - An aquifer is a formation of soils or rock with the capability of storing large volumes of water. An aquifer can be composed of consolidated material such as limestone rock or unconsolidated material such as sand and gravel. The Rhode Island Department of Environmental Management (DEM) has mapped the State's aquifers and their associated recharge areas. DEM's definition of a significant aquifer is one that has a saturated thickness (distance between water table and base of an aquifer) of greater then forty feet and a transmissivity (potential water yield) greater then 4000 square feet per day. Based on this definition, two significant aquifers are located in the Town of Cumberland: The Blackstone River Valley and Abbott Run Aquifers. The location of these aquifers is illustrated in Figure V-3.

- ***Blackstone River Valley Aquifer*** - From the Massachusetts line to Ashton, the Blackstone River aquifer is very narrow and averages 40 feet thick or more with an

average width of less than 500 feet. Much of the thickest and most transmissive part of the aquifer is located beneath the river. The maximum known thickness of the aquifer in this part of the river valley is 70 feet and the maximum transmissivity is 17,600 square feet per day (ft^2/d). From Ashton to Valley Falls Pond, the aquifer has a maximum known thickness and transmissivity of 165 feet and 44,000 ft^2/d, respectively. The saturated volume of about 4 billion cubic feet is estimated to contain 6 billion gallons of water. The Cumberland Water District has several wells located in this aquifer.

- **Abbott Run Valley Aquifer –** Downstream of the Abbott Run and Happy Hollow Pond Surface Water reservoirs, this stratified-drift aquifer covers 4.5 square miles and has a saturated thickness of as much as 80 feet. Saturated volume of the aquifer is about 4 billion cubic feet.

Groundwater Quality - DEM has classified the groundwater in Rhode Island based on its suitability for public drinking water purposes. The groundwater in Cumberland is classified as GAA, GA, and GB, this can be seen in Figure V-3. Areas classified as GAA are known to be suitable for drinking water use, and are afforded the highest level of protection by State regulations. In Cumberland these are areas of stratified drift alongside the Blackstone and Abbott Run River. The majority of Cumberland's groundwater is classified as GA, which is also assumed suitable for consumption. A small area in the southern tip of Cumberland is classified as GB, this classification is for groundwater that is known or presumed not to be suitable for drinking without prior treatment.

Part of the Blackstone River Valley Aquifer located under the 500-acre Peterson/Puritan, Inc. Superfund site is classified as non-attaining. This classification is given to areas were groundwater quality is known or presumed to be out of compliance with classification standards, and is assigned to specific locations where groundwater contamination has occurred. In this case, contamination is a result of 1974 railcar accident and the subsequent spill of 6,000 gallons of solvent. There are also other small areas of non-attaining groundwater associated with CERCLIS sites and LUSTs. The State's goal for non-attainment areas is for compliance with classification standards; the location of these non-attaining areas is shown in Figure V-3.

Groundwater Quantity -The level of a water table varies both over the course of a single year, as well as from one year to the next. Generally, the water table is at its highest in the

spring, and drops to its lowest point in the fall. The depth below the earth's surface to the water table is affected by groundwater recharge and discharge. Groundwater recharge generally occurs in areas of permeable soil, where there is a zone of aeration above the water table. Amount of recharge is based on amount of precipitation and permeability of soils. Volume of recharge to the groundwater supply is reduced by impervious surface, which allows precipitation to run directly in to surface water bodies without replenishing groundwater supplies. Discharge occurs in areas where groundwater becomes surface water, such as springs and seeps, as well as some ponds and rivers, where it maintains water levels. When groundwater is removed through the action of major wells discharge may be reduced or the water table lowered, thereby negatively impacting surface water bodies.

According to information obtained from the RI Water Resources Board, the majority of groundwater withdrawn from Cumberland's aquifers is subsequently sent out of the area. Between 1995 and 1999 an average of 14.5 MGD of groundwater was withdrawn from the Town's two aquifers. Only 24 percent of this amount (3.5MGD) was utilized in Cumberland; other municipalities used the remaining 75 percent. In addition to this exportation of groundwater, water is also lost in the form of sewage. An average of 2.543 MGD of sewage is sent to the Narragansett Bay Commission's Wastewater Treatment Center, where it is discharged into Narragansett Bay. This exportation of water reduces the amount of recharge available to Cumberland's aquifers, and may have a negative affect on the amount of water available in the future. The issue of water quantity must be further addressed through Cumberland's Growth Management Initiative.

Surface Water

Cumberland's surface water includes 1,026 acres of rivers, streams, lakes and ponds. These areas, and their tributary watersheds, were identified to assess potential impacts of land use on water quality. Identification of water resources was conducted using Rhode Island Geographic Information System (RIGIS), and maps. Watershed boundaries were plotted using the topographic information supplied on the USGS maps to interpret drainage area limits and were then compared with State's GIS watershed delineation. Figure V-4 illustrates the surface water areas and their watershed boundaries. The largest watershed involves the Blackstone River and Pawtucket Reservoirs. The Sneech Pond watershed is also identified, as it is the source of Cumberland's public water supply.

Surface Water Quality **-**The Rhode Island DEM has identified high quality surface waters throughout the State. These "special resource protection waters" are significant in terms of their ecological or recreational value. Several ponds, brooks, and rivers in Cumberland are included on DEMs list of special resource protection waters.

- **Reservoirs** - Diamond Hill and Pawtucket (Arnold Mills)
- **Ponds** -Happy Hollow, Robin Hollow, Sneech, and Valley Falls
- **Brooks –** Abbott Run, Ash Swamp, Crookfall, East Sneech, and Longbrook

Although these water resources are currently of high quality, they are at risk from a variety of pollution sources. Pathogens, nutrients, and heavy metals are all potential sources of contamination. Other surface water bodies, including the Blackstone River and Valley Falls Ponds, have already been negatively impacted by human activity.

Mandated by the Clean Water Act, the Total Maximum Daily Load (TMDL) program requires quantifiable goals to be set for water bodies not meeting water quality standards. No TMDLs have yet been developed for water bodies in Cumberland, however, impairments to several waterbodies have been identified by the State and priorities for TMDL development have been established; these can be seen in Table V-3.

Table V-3 Threats to Water Resources

Class	Resource	Cause	Priority Ranking
B1	Blackstone River	Biodiversity impacts, pathogens, Cu, Pb, hypoxia, nutrients, ammonia	Targeted (2002-2004)
B1	Valley Falls Pond	Biodiversity Impacts, Pb, Pathogens, algal growth/CHL-A, anoxia, Phosphorus	Targeted (2002-2004)
A	Ash Swamp Brook	Pathogens	High (2003-2005)
A	Abbot Run Brook	Biodiversity impacts, Pb, (Cd)	Medium (2008-2012)
A	Long Brook	Pathogens	Medium (2008-2012)
A	Robin Hollow Pond	Pathogens	Low (2012+)
A	East Sneech Brook	Pathogens (2002)	2012+

SOURCE: RI Department of Environmental Management

Wetlands

Wetlands are generally termed as the transitional lands area between terrestrial and aquatic environments. They are areas of poorly drained soils characterized by permanent or temporary soil saturation and occasionally standing water. These areas perform many functions, and are therefore an important resource for the overall environmental health of a community. Functions include:

- **Water Purification (Surface and Groundwater)** – Vegetation reduces water velocity, allowing particulate matter to settle out. Some vegetation function in denitrification, removal of phosphorus, and other toxin-removing chemical reactions.

- **Water Storage and Groundwater Recharge/Discharge –** Depending on its location, wetlands may store water, which allows for maintaining stream baseflow, or serve as an area of groundwater discharge.

- **Flood storage and control** – Depressional wetlands temporarily retain flood water and release it slowly, thereby preventing "flash floods".

- **Habitat and Biological Productivity** – Wetlands are some of the most productive ecosystems on earth. In addition, although they only make up approximately five percent of the land area in the United States, they provide habitat for a disproportionately high percentage of rare and threatened species. Fifty percent of nationally listed rate species are associated with wetlands; this number is much higher for some taxa such as birds and amphibians.

- **Erosion/Storm Damage Control** - Wetland vegetation slows down sheet flow along channels, reducing erosion and therefore the amount of sediment entering lakes and rivers.

Wetlands within the Town were identified using the RIGIS system. Figure V-4 shows the wetlands within the Town, these were mapped in 1988. At that time there were 1,942 acres of wetland identified in Cumberland. As of 1995, 21 acres of wetlands were lost, despite Rhode Island's stringent wetland regulations. Large concentrations of wetlands can still be found in northern Cumberland along Pine Swamp and Ash Swamp. Another

concentration is in the central section of Town associated with Little Pond, Scott Brook, and Long Brook. Both the Lonsdale Marshes and Ash Swamp have been identified by DEM as Special Resource Protection Waters. Location of wetlands in Cumberland is shown in Figure V-4.

Floodplain/Floodway

Floodplains are areas adjacent to rivers, streams, and surface water bodies which are susceptible to flooding during periods of excessive water runoff. During normal stream flow, water is carried within the channel; in times of high runoff, water overflows its banks and spills into the floodplain. The floodway is the central portion of the floodplain that contains the river and enough of the surrounding land to enable floodwaters to pass. No development should occur within the floodway.

The 100-year floodplain includes all the land area that will be flooded during a 100 year flood event. A 100-year flood is a base flood that has a one percent chance of occurring in any year. Over a long period of time, such a flood is projected to occur once every 100 years on the average. The 100-year flood boundary, or the 100-year floodplain, is usually the area identified for development restrictions. Within the Town of Cumberland floodplain areas are found adjacent to most large watercourses and water bodies. The largest floodplains within the Town are those associated with the Blackstone River. The floodplains within the Town have been mapped by the Federal Emergency Management Agency (FEMA), they can be seen in Figure V-5.

Threats to Water Resources

The Town's 2003 Stormwater Management Program Plan and 1999 Drinking Water Protection Plan document specific threats to Cumberland's Water Resources. These, along with more general causes of impairment from DEM's 2003 305(b) State of the State's Water Report, are identified below.

Groundwater **-** Sources of groundwater pollution include agriculture, construction, resource extraction and land disposal. Specific threats to groundwater in Cumberland include 44 Leaking Underground Storage Tanks (18 active, 7 inactive, 19 soil removal

only); septic systems (nitrates, bacteria, viruses, toxics); leachate from the (closed) Cumberland Municipal Landfill and 500-acre Peterson/Puritan, Inc. Superfund Site (solvents), storage and application of road salt, pesticides, and fertilizers (nitrogen).

Surface Water -Land use can affect both the quantity and quality of water resources. Quality impacts include the impacts of runoff carrying oil and grease, heavy metals, tire particles and de-icing compounds (salts) from driveways and parking areas to the water bodies. Quantity impacts include changes in local hydrology that can result from increases in impervious area and the resulting installation of drainage structures, as well as water withdrawals from public and private wells. Alterations in topography caused by cut and fill alternations undertaken for construction may also affect local hydrology.

Wetlands - The value of wetlands has not been fully appreciated until recent years. Conversion of wetlands to dry lands by draining, dredging, and filling was responsible for estimated loss of almost 40 percent of Rhode Island Wetlands between the 1880's and 1980's. In 1970 the Rhode Island Freshwater Wetland Act was passed, which afforded most of these areas protection against conversion. Other threats have become more important over recent years. One of these threats is modification of the hydrologic regime – either increasing or decreasing the length of time a wetland is saturated or flooded or the amount of flooding. Moderate changes in hydrology may change the vegetation of a wetland and therefore its suitability for specific wetland dependent wildlife. More drastic changes may convert wetland to upland or deepwater habitat. Another major threat to wetlands is changes in land use and associated pollution; runoff from impervious surface presents many of the same dangers to wetlands as to surface water bodies.

3. Ecology

Significant natural sites are areas in the State where unique or valuable natural resources exist. Figure V-6 "Areas of Critical Concern" identifies the natural areas of particular interest for rare species habitat and exemplary plant communities as well as wetland areas and surface water bodies. Table V-5 Lists rare species found in Cumberland. Significant natural sites in Cumberland include:

- **Ash Swamp Brook, Ash Swamp, Pine Swamp, Scott Brook, Lippitt Estates, and Long Brook –** Together, these areas constitute one of the most significant natural systems in Cumberland. The circumneutral (lime based) soils are highly unusual in Rhode Island, which has mostly acidic soils. These soils support exemplary plant communities and rare species habitat. Land in this area is owned by both the Town and private individuals. Areas surrounding Long Brook and Scott Brook areas have been recently acquired by the Town and the Cumberland Land Trust under the State's Open Space Grant Program.

- **Lonsdale Marsh (Valley Falls Pond) –** Considered one of the most valuable freshwater wetlands in Rhode Island according to the R.I. Natural Heritage Program. The area's habitat diversity, which includes several wetland types, support at least five state-listed species of birds. This site is owned in part by the State and the Town.

Several other sites in Cumberland contain rare plant species and are ecologically significant natural areas. If not already preserved in their entirety, these areas are top priorities for protection. Lands adjacent to these areas are equally important and every effort should be made to protect them as well. The sites and their locations are shown in Table V-4.

Table V-4 Significant Natural Areas

ID	Name	Location
	Pine Swamp	Lands south and north of Rte. 121, Cook Road to Wrentham
	Catamint Brook	Tower Hill Road to Diamond Hill State Park extension
	Diamond Hill Town Park	Both Sides of Diamond Hill Road
	Sneech Pond Reservoir	Lands and streams surrounding reservoir
	Long Brook	Diamond Hill Road west to Little Pond County Road
	Nate Whipple Wetlands	Pound Road to Nate Whipple Highway
	Scott Brook	Surrounding Area
	Millers Oak Conservation Area	Hines Road to North Attleboro line
	Valley Falls Marsh	Southern Cumberland – Blackstone River to Lonsdale marsh

A list of rare species found in Cumberland compiled by the Rhode Island Natural Heritage Program, and current as of 2003, is included in Table V-5. In addition to those rare species listed in Table V-5, there are many other birds and wildlife that can be commonly found in the Town. Table V-6 shows vertebrates found in Cumberland, Table V-7 shows birds that breed in Town, and Table V-8 lists migratory birds found in Cumberland.

Table V-5 Rare Species

Scientific Name	Common Name	Family	Last Ob
Agalinis acuta	Sandplain Gerardia		1941
Botaurus Lentiginosus	American Bittern	Ardeiadae	1978
Caulophyllum thalictroides	Blue Cohosh	Berberidaceae	1976
Caulophyllum thalictroides	Blue Cohosh	Berberidaceae	
Caulophyllum thalictroides	Blue Cohosh	Berberidaceae	1990
Caulophyllum thalictroides	Blue Cohosh	Berberidaceae	1990
Platanthera hookeri	Hooker's Orchid	Orchidacea	1885
Agalinis tenuifolia	Slender Gerardia	Scrophulariacea	1946
Agalinis tenuifolia	Slender Gerardia	Scrophulariacea	1871
Asclepias quadrifolia	Four-Leaved Milkweed	Asclpiadaceae	1979
Cypripedium pubescens	Large Yellow Lady's Slipper	Orchidacea	1985
Gentianopsis crinita	Fringed Gentian	Gentianacea	1854
Hypericum adpressum	Creeping St. John's-Wort	Clusiaceae	1914
Liparis loeselii	Yellow Twayblade	Orchidacea	1985
Penthorum sedoides	Ditch Stonecrop	Saxifragaceae	1900
Rhynchospora macrostachya	Tall Beaked Rush	Cyperaceae	1911
Rhynchospora macrostachya	Tall Beaked Rush	Cyperaceae	1856
Rhynchospora macrostachya	Tall Beaked Rush	Cyperaceae	1986
Ribes Hirtellum	Smooth Gooseberry	Grossulariaceae	1846
Saxifraga Pensylvanica	Swamp Saxifrage	Saxifragaceae	1985
Solidago flexicaulis	Zigzag Goldenrod	Asteracease	1985
Triosteum aurantiacum	Wild Coffee	Caprifoliaceae	1932
Tricstem Perfoliatum	Feverwort	Caprifoliaceae	1876
Lampetra appendix	American Brook Lamprey	Petromyzontidae	1981
Asclepias exaltata	Poke Milkweed	Asclepiadaceae	1878
Botrychium matricariifolium	Daiseyleaf Grape-Fern	Ophioglossaceae	1947
Corallorhiza Trifida	Early Coralroot	Orchidacea	1985
Eleocharis equisetoides	Horsetail Spike-rush	Cyperaceae	1877
Equisetum fluviatile	Wild Horsetail	Equisetaceae	1947
Hedeoma pulegioides	American Pennyroyal	Lamiaceae	1876
Hottonia inflata	Featherfoil	Primulaceae	1971
Isoetes echinospora ssp Muricata	Pontet Quillwort	Isoetaceae	1942
Isoetes engelmannii	Engelmann's Quillwort	Isoetaceae	1942
Isoetes riparia var. canadensis	River Quillwort	Isoetaceae	1942
Llilium canadense	Canada Lily	Liliaceae	1895
Ranunculus flabellarius	Yellow Water-Crowfoot	Ranunculaceae	1987
Sambucus racemosa ssp pubens	Red=Berried Elderberry	Caprifoliaceae	1878
Utricularia gibbba	Humped Bladderwort	Lentibulariacae	1981
Viola pubescens var. eriocarpa	Smooth Yellow Violet	Violaceae	1990

Table V-5 Rare Species

Scientific Name	Common Name	Family	Last Obs.
Acer pensylvanicum	Striped Maple	Aceraceae	1937
Arethusa bulbosa	Swamp Pink	Orchidacea	1907
Arethusa bulbosa	Swamp Pink	Orchidacea	1904
Arethusa bulbosa	Swamp Pink	Orchidacea	
Asclepias Amplexicaulis	Blunt-Leaved Milkweed	Asclepiadaceae	1905
Asplenium trichomanes	Maidenhair Spleenwort	Aspleniaceae	1947
Aster macrophyllus	Large-Leaved Aster	Asteraceae	1878
Aster macrophyllus		Asteraceae	1884
Conophilis americana	Squaw-Root	Orobanchaceae	1990
Equisetum sylvaticum	Woodland Horsetail	Equisetaceae	1947
Equisetum sylvaticum	Woodland Horsetail	Equisetaceae	1914
Lobelia dortmanna	Water Lobelia	Campanulaceae	1895
Lupinus Perennis	Wild Lupine		1878
Matteuccua struthiopteris	Ostrich Fern	Aspleniaceae	1990
Sorghastrum nutans	Indian Grass	Pcaceae	1903
Zizia aurea	Golden Alexanders	Apiaceae	1985
Zizia aurea	Golden Alexanders	Apiaceae	1879
Eriophorum alpinum	Northern Cotton-grass	Cyperaceae	1907
Eupatorium aromaticum	Snakeroot	Asteraceae	1941
Eupatorium aromaticum	Snakeroot	Asteraceae	1946
Gentiana andrewsii	Bottle Gentian	Gentianaceae	1914
Parnassia glauca	Grass-of-Parnassus	Saxifragaceae	1900's
Podostemum ceratophyllum	Riverweed	Pooostemaceae	
Woodsia ilvensis	Rusty Woodsia	Aspleniaceae	1908
Vermivora chrysoptera	Golden-Winked Warbler	Emserizidae	1956
Southern New England Circumneutral Seepage Swamp			1985
Panax quinquefolius	American Ginseng	Araliaceae	2002
Hattonia inflata	Featherfoil	Primulaceae	2002
Geranium bicknellii	Bicknell's Geranium	Geraniaceae	1995
Corydalis sempervirens	Pale Corydalis	Fumariaceae	2003
Cicindela rufiventris	Red-bellied Tiger Beetle	Cicindelidae	2000

Table V-6 Vertebrates

Amphibians	Reptiles	Mammals	Mammals (Cont)
Spotted Salamander	Snapping Turtle	White-tailed Deer	Meadow Vole
Marbled Salamander	Painted Turtle	Short-tailed Weasel	Muskrat
Dusky Salamander	Spotted Turtle	Meadow Jumping Mouse	Norway Rat
Two-lined Salamander	Stinkpot	Star-nosed Mole	House Mouse
Four-toed Salamander	Northern Black Racer	Little Brown Myotis	Coyote
Red-spotted Newt	Northern Ringneck Snake	Big Brown Bat	Red Fox
Redback Salamander	Eastern Milk Snake	Eastern Cottontail	Raccoon
American Toad	Northern Water Snake	New England Cottontail	Mink
Spring Peeper	Northern Brown Snake	Eastern Chipmunk	Striped Skunk
Gray Tree Frog	Eastern Garter Snake	Woodchuck	River Otter
Bullfrog	Eastern Smooth Green Snake	Gray Squirrel	Opossum
Green Frog		Red Squirrel	Masked Shrew
Pickerel Frog		Southern Flying Squirrel	Short-tailed Shrew
Wood Frog		White-footed Mouse	

Table V-7 Breeding Birds

Species	Species	Species	Species
Green-backed Heron	Hairy Woodpecker	Wood Thrush	Northern Oriole
Canada Goose	Downy Woodpecker	Hermit Thrush	Common Grackle
Mallard	Eastern Kingbird	Veery	Brown-headed Cowbird
American Black Duck	Great Crested Flycatcher	Eastern Bluebird	Scarlet Tanager
Wood Duck	Eastern Phoebe	Blue-Gray Gnatcatcher	Northern Cardinal
Turkey Vulture	Least Flycatcher	Cedar Waxwing	Rose-breasted Grosbeak
Red-tailed Hawk	Eastern Wood Pewee	European Starling	Indigo Bunting
Broad-winged Hawk	Tree Swallow	Yellow-throated Vireo	Purple Finch
American Kestrel	Bank Swallow	Red-Eyed Vireo	House Finch
Ruffed Grouse	Rough-winged Swallow	Warbling Vireo	American Goldfinch
Killdeer	Barn Swallow	Black-and-White Warbler	Rufus-sided Towhee
American Woodcock	Blue Jay	Yellow Warbler	Savannah Sparrow
Spotted Sandpiper	Common Crow	Pine Warbler	Chipping Sparrow
Rock Dove	Black-capped Chickadee	Prairie Warbler	Field Sparrow
Mourning Dove	Tufted Titmouse	Ovenbird	Swamp Sparrow
Yellow-billed Cuckoo	White-breasted Nuthatch	Louisiana Water thrush	Field Sparrow
Black-billed Cuckoo	Red-breasted Nuthatch	Common Yellowthroat	Swamp Sparrow
Eastern Screech Owl	Brown Creeper	American Redstart	Song Sparrow
Great Horned Owl	House Wren	House Sparrow	Mute Swan
Chimney Swift	Northern Mockingbird	Bobolink	Virginia Rail
Belted Kingfisher	Gray Catbird	Eastern Meadowlark	Sora
Northern Flicker	Brown Thrasher	Red-Winged Blackbird	Marsh Wren
Red-Bellied Woodpecker	American Robin	Orchard Oriole	

Table V-8 Migratory Birds

Species	**Species**
Pied-billed Grebe	Double-crested Cormorant
Great Blue Heron (w)	Great Egret
Black-crowned Night Heron	Canada Goose (w)
Green-winged Teal	Northern Pintail
Blue-winged Teal	American Pigeon
Ring-necked Duck	Common Goldenly
Bufflehead	Hooded merganser
Common Merganser (w)	Ruddy Duck
Osprey	Bald Eagle (w) – rare
Greater Yellowlegs	Common Snipe
Ring-billed Gull (w)	Herring Gull (w)
Great Black-backed Gull (w)	

w-Remain in area during winter as long as open water persists.

C. Findings

The analysis of natural resources within the Town was undertaken to identify the bountiful resources that need protection in order to maintain the Town's quality of life and character. Additionally, certain environmental constraints will limit particular types of development. It can also be used to identify where natural conditions are appropriate for particular kinds of activity. The long-range development plan must consider natural conditions as they relate to limiting or encouraging particular kinds of development. The following is a summary assessment of the natural resources within the Town of Cumberland. This summary provides a basis for identifying the specific goals and policies for natural resource management.

Geology - The surficial geology of the Town is a product of glaciation and consists primarily of till. There are also major areas of outwash containing sand and gravel; these areas are suitable for ground water resources.

Large areas of the Town have soil properties which severely limit the use of Individual Sewage Disposal Systems. High water tables, shallow depth to bedrock, and slow permeability are typical of these soil properties.

 careous bedrock called "greenstone" is located in the northern and central portions of the Town of Cumberland.

There are approximately 2,305 acres of prime agricultural soils in Cumberland. Approximately 1,000 of these acres are currently either vacant or being used for agricultural purposes.

Large areas of the Town are occupied by steep slopes. Prominent topographic features are associated with Diamond Hill, Brush Hill, Bear Hill, Copper Mine Hill, Thompson Hill and the bluffs along the banks of the Blackstone River.

Hydrology - Cumberland has extensive surface and ground water resources. Two highly productive, stratified drift ground water aquifers are located in the Town. These aquifers serve as a source for public water supply. The Blackstone Valley and Abbott Run Valley aquifers are used by the Pawtucket and Cumberland water supply systems. The Pawtucket Water Supply Board has its wells in the Abbott Run aquifer and the Cumberland Water system has its wells in both the Blackstone and Abbott Run aquifers.

The Blackstone River and the Pawtucket Reservoir systems are the largest watersheds within the Town. The Pawtucket Reservoir watershed contains many surface water bodies including Diamond Hill Reservoir, Arnold Mills Reservoir, Rawson Pond, Howard Pond, Robin Hollow Pond and Happy Hollow Pond. The entire northeast part of the Town drains to the Pawtucket Reservoir system.

Ecology - Several significant natural sites are located in Cumberland, these sites provide habitat for a variety of the State's rare native animals. These include State listed freshwater mollusks, odonates, tiger beetles, grebe, southern flying squirrel, northern leopard frog, the ringed boghaunter dragonfly, and the American brook lamprey. Other species found in the Town include the marbled and spotted salamander, wood frog, marsh wren, hermit and wood thrush, oriole, bluebird, wild turkey and herons. Occurring mammals include the coyote and fisher. Eagles have been identified at Diamond Hill Reservoir and undocumented bobcat and mountain lion sitings have been reported in Lippitt Estates.

D. GOALS, POLICIES, AND RECOMMENDATIONS

Goals and policies for natural resources management were formulated based on the inventory and analysis of the previous sections. In formulating the natural resource goals for the Town of Cumberland it is important to recognize the mutually compatible interest of the State and of the Town. The State has formulated natural resource goals which local plans should consider.

State Planning Act Goals

- To promote orderly growth and development that recognizes the natural characteristics of the land, its suitability for use, and the availability of existing and proposed public and/or private services and facilities.

- To promote the protection of the natural, historic and cultural resources of each municipality and the State.

- To promote the preservation of the open space and recreational resources of the municipality and state.

- To encourage the use of innovative development regulations and techniques that promote the development of land suitable for development while protecting our natural, cultural, historical and recreational resources and achieving a balanced pattern of land uses.

Cumberland Natural Resource Goals

Goal NR.1 Protect and preserve the Town's Natural Resources including unique environmental areas; surface and ground water quality and quantity; agricultural soils; trees; and rural character.

Policy NR.1.1 Continue working with the Blackstone River Valley National Heritage Corridor Commission in identifying preservation opportunities and complementary land use activities.

Action NR.1.1.1 Prepare and Adopt Blackstone River Valley National Heritage Corridor Overlay District in the Zoning Ordinance.

Policy NR.1.2 Preserve Cumberland's unique natural areas through land acquisition, conservation easements, transfer of development rights, and other creative methods to limit development.

Action NR.1.2.1 Acquire, through fee simple land purchase, conservation easements, or purchase of development rights unique ecological areas, watershed areas, and special natural resource areas.

Action NR.1.2.2 Encourage land owners to participate in the Town's Farm, Forest, and Open Space taxation program (see RIGL 44-3-32.2).

Action NR.1.2.3 Assist the Cumberland Conservation Commission and organizations such as The Cumberland Land Trust and the Nature Conservancy, in encouraging property owners to protect environmentally sensitive areas by easements or donations to the Town

Action NR.1.2.4 Adopt and enforce a Tree Ordinance regulating the planning, planting, maintenance and removal of trees on public property

Policy N.1.3 Protect surface water and ground water from contamination.

Action NR.1.3.1 Prepare, adopt and implement a Watershed Protection Ordinance.

Action NR.1.3.2 Identify and include a Water Quality Protection Zone in the Watershed Protection Ordinance.

Action NR.1.3.3 Establish a Waste Water Management District within the Cumberland and Pawtucket Reservoir Watershed

Action NR.1.3.4 Continue to acquire properties that are in close proximity to reservoirs and reservoir tributaries to protect public drinking water supplies for the future.

Policy NR.1.4 Relate the type and intensity of development to the capability of the land to support such development.

Action NR.1.4.1 Improve the Development Plan Review process (formerly known as Site Plan Review, administered by the Design Review Commission) which requires consideration of the impact of development on Natural Resources.

Action NR.1.4.2 Clarify the Town's Zoning Ordinance regarding Residential Cluster Subdivisions in order to encourage use of this land development technique; consider adopting the guidelines for Conservation Development as defined in the *Rhode Island Conservation Development Manual, June 2003;* consider the adoption of innovative forms of cluster development as new techniques emerge.

Policy NR.1.5 Encourage the preservation of prime agricultural soils and farmland for active agricultural use.

Action NR.1.5.1 Encourage land owners to participate in the Town's Farm, Forest, and Open Space taxation program (see RIGL 44-3-32.2). Partner with the State Agricultural Lands Preservation Commission for the purchase of development rights to agricultural land.

Policy NR.1.6 Cooperate with appropriate State agencies and encourage strict enforcement of regulations designed to protect environmentally sensitive areas.