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EXECUTIVE SUMMARY

A detailed Natural Resources Inventory was conducted by Daylor Consulting Group for the Town of New Ipswich Conservation Commission. The primary objective was to identify and locate naturally occurring resources within the Town. This inventory was based upon analysis of existing GIS information supplemented by additional data sources and field studies. The information and analysis in this report is intended to: provide a compiled summary of the Town's important natural resources; serve as the technical basis to support future comments or advocacy work related to the review of development projects; provide a framework for future conservation efforts; and provide a guide for future municipal planning.

Four general areas of natural resources were inventories in the study including: water resources, open lands, habitats and ecosystems, and an analysis of topographic slopes. Water resources included wetlands, which merged National Wetland Inventory data and hydric soils; water bodies; surficial aquifers; and watershed boundaries. Open space lands included conservation lands, recreation and trails, agriculture, important agricultural soils and unfragmented undeveloped lands. Topographic slope analysis involved computer analysis for delineating various slope classes and viewshed analysis focusing on steeper slope classes and summits. Habitats and ecosystems analysis mapped locations of rare plants and animals and exemplary communities, specific cover types, other significant wildlife habitat, such as deeryards, south facing south slopes, and wildlife corridors were also utilized.

These resource types were merged by GIS analysis into a composite map, and areas of over-lapping resource features, also called co-occurring resources were identified. The number of resources that over-lapped at a specific location was identified and colors assigned to each number. Merged resource overlay maps were developed separately for wildlife resources and non-wildlife resources. From these two maps a third composite was created for all inventoried natural resources within the Town of New Ipswich. From this final composite analysis, the areas with the greatest concentrations of natural resources and co-occurrences are shown to be located in the areas of Tophet Swamp, New Ipswich Mountain and extending along the Wapack Range, Whittemore Hill, the High Bridge area, the flood control reservoir areas, and Kidder Mountain.

This study has focused on identifying areas of selected natural resources and determining numbers and locations of co-occurrences in order to provide a basis for land use planning efforts, develop a conservation plan, and to initiate and support land protection efforts. Priorities for land acquisition or other forms of protection or management have not been established as the Conservation Commission members indicated time would be required to analyze the enclosed data and information before deciding upon a course of action. In further deliberations they may decide to take action on certain identified locations, introduce changes to town zoning regulations to better protect certain resources, work more closely with neighboring municipalities or NGO's or, to further study select resources or areas.

1.0 INTRODUCTION

1.1 Purpose of this Study

The purpose of this study is to provide a detailed inventory and analysis of natural resources in the environmentally sensitive area of New Ipswich, New Hampshire This area is approximately 32.5 square miles and includes land within the Souhegan, Squanacook, Millers, and Contoocook River watersheds. The information and analysis in this report is intended for four purposes:

1. To provide a compiled summary of the area's important natural resources.
2. To serve as the technical basis to support future comments or advocacy work related to the review of development projects in the area.
3. Provide a framework for future conservation efforts.
4. To provide a guide for future municipal planning.

1.2 Study Area

New Ipswich occupies approximately 32.5 square miles in southwestern Hillsboro County. It is located in two ecoregions, the Southern New England Coastal Plains and the Vermont-New Hampshire Upland. The town is mostly forested with scattered farmsteads and fields occupying flatter areas. New Ipswich is composed of a series of small villages, with several located along the banks of the Souhegan River. Development pressures have recently increased, with several new subdivisions as well as scattered individual houses constructed.

1.3 Scope of the Study

This report was prepared by Daylor Consulting Group, Inc. of Braintree, Massachusetts ("Daylor"), Daylor's scope of work for this project included four major components:

1. Compiling and synthesizing existing databases and new sources related to natural resources and open space in the study area. This information is presented in sections 2, 3, and 4 of this report.
2. Field verification of these data sources and field acquisition of new information.
3. Integrating these data into composites or overlays and producing a series of maps derived from these data.
4. Documenting the methodology and findings of the natural resource inventory in a report, with prioritization of undeveloped lands for conservation planning.

1.4 Data Sources

In preparing this report, Daylor consulted a wide variety of existing data sources, including water quality and hydrologic studies, habitat studies from the state and from non-profit conservation groups and other sources, and from discussions with knowledgeable persons in the area. In addition, Daylor obtained geographic data in electronic GIS format from the Southwest Regional Planning Office and GRANIT, New Hampshire's statewide GIS provider. Although numerous sources were consulted as part of this study, this report cannot be considered an exhaustive review of all data relevant to the study area. For more detailed information on the study area, the reader should consult the sources cited throughout this report and listed in **Appendix A: References.**

2.0 NATURAL HISTORY

New Ipswich is characterized by rugged, hilly terrain interspersed with gently rolling woodlands, open fields, stream corridors, and wetlands. At the western side of the town, the land rises abruptly along the north – south oriented Wapack Mountain range. The topography and consequential landscape of the town is controlled by the underlying bedrock and unconsolidated surficial geologic units. Fitted into this matrix of woods, fields, and wetlands is the community of New Ipswich, comprised of small villages.

2.1 Geology & Soils

2.1.1 Geology

Bedrock Geology

The bedrock in New Ipswich is comprised of three major geologic units, the metamorphic Littleton and Paxton Formations, and the igneous Fitchburg Plutonic Complex. The metamorphic bedrock types are silky-gray weathering feldspathic and sulfidic schists that have undergone only limited change from the original silt and mud sedimentary rocks from which they formed. The metamorphic bedrock was intruded by granites and tonolite, which was later deformed by uplift and folding. The more resistant of these rock types are responsible for the bedrock hills and outcrops in town.

Steep slopes, shallow water tables, shallow bedrock and hilly terrain used to be considered impediments to building. With modern equipment and current land prices, many parcels that were considered undevelopable in the past are now being developed by the introduction of large amounts of fill to provide separation for septic systems from ground water and deep cuts to facilitate roads and driveways. Septic outbreaks on these slopes may become more prevalent as building continues. Cut and fill operations may destabilize slopes resulting in increased bank failures with resultant erosion and sedimentation. These areas are becoming increasingly threatened as the demand for houses with scenic views of the Monadnock region overrides the higher costs of development.

Surficial (Glacial) Geology

During the Pleistocene Epoch, which began about 2 million years ago, glaciers advanced from the north. Evidence indicates that at least four advances and subsequent retreats occurred. The last glacial advance reached its maximum extent about 25,000 years ago, thereafter retreating to a position north of the Town 14,000 years ago. Most of the depositional and structural features were formed during the last glacial retreat.

There are three main classes of unconsolidated deposits in New Ipswich: glacial till, stratified drift, and alluvium. Most of the town is covered with varying depths of glacial till. Stratified drift deposits, where present, has been mined for sands and gravels.

Glacial till is a dense, heterogeneous, poorly sorted mixture of clay, silt, sand and subangular rocks and boulders that was smeared over bedrock by the overriding ice (dense till), or the same mix of particle sizes released from ice that melted in place (ablation till). This glacial till now forms a mantle over the bedrock averaging 20 feet in thickness on the uplands.

Stratified drift deposits are sorted, layered material deposited by glacial meltwater streams. Fine-grained deposits were deposited by low-energy, slower moving streams, and were generally carried further from the face of the receding glacier. Coarse sands and gravels were deposited by higher energy, fast flowing water near the face of the glacier. Most of the areas in town that are now borrow pits were formed as kames and kame terraces from sediments that flowed laterally across the melting ice lobes or outwash plains from materials deposited between the melting ice and bedrock hills or ice-dammed streams.

These sand and gravel deposits have great water storage capacity and have great potential as water yielding aquifers or recharge zones.

2.1.2 Soils

Soils form as the result of the interaction of five major factors: climate, parent material, plant and animal life, topography and time. The relative importance varies from place to place and one or more of the factors may dominate the kind of soil that forms in a particular area. In New Ipswich, the differences in parent material, drainage, topography and time have had the greatest influence in forming the various soils that have formed.

More than two-thirds of the soils in the study area formed in moderately coarse or coarse textured glacial till, but the characteristics of these soils differ greatly. Marlow, Monadnock, Becket, and Lyman soils formed in glacial till. Adams, Colton, and Naumburg soils formed in coarse textured glacial outwash. Ondawa, Podunk, and Rumney soils formed in alluvium on floodplains. These are medium and moderately coarse textured and have only slight profile development. Greenwood and other muck and peat soils formed in organic deposits that have accumulated in depressional areas since the retreat of the last ice sheet.

The predominant soil associations within the study area are the Monadnock-Lyme and Monadnock-Lyme-Tunbridge Associations. Both of these associations have loamy soils on uplands. The Monadnock-Lyme ranges from nearly level to steep topography, and has well drained to poorly drained drainage characteristics. The Monadnock-Lyme-Tunbridge association ranges from gently sloping to steep, and the drainage characteristics include well drained and somewhat excessively drained. The Marlow-Peru and Colton-Adams-Naumburg soil associations occupy lesser amounts of the town, but are of great importance. The Marlow-Peru association occurs from north to south near the center of the town. It has very deep soils, is nearly level to steep topographically, is well drained and moderately well drained, has loamy soils, and is located on uplands. The Colton-Adams-Naumburg association occurs at the northwestern corner of the town in the Tophet swamp area. This has very deep soils, ranges from moderately level to steep,

with drainage classes of excessively drained, somewhat poorly drained, and poorly drained. It contains sandy soils formed on outwash plains and terraces. For location-specific soil type information, the reader should consult the USDA Soil Conservation Service soils maps for Hillsborough County West.).

2.2 Climate

The climate in this area, characterized by warm summers and cold winters, is subject to occasional hot spells. The average annual temperature is about 44.2°F. Average long-term (1960-2001) annual precipitation at Peterborough is 44.68 inches. Precipitation averages slightly more than 3.7 inches per month throughout the year, with the driest month, February, averaging slightly less than 3 inches and the wettest, August, averaging about 4.1 inches, due to thunderstorm activity (http://www.erh.noaa.gov/er/gyx/climo/NH_STATS_NEW.htm). Annual snowfall is approximately 88 inches (NRCS, 1999).

2.3 Topography

Topography in New Ipswich ranges from 860 feet on the Souhegan River at the Greenville town line to 1881 feet at the summit of New Ipswich Mountain. Most of the rest of town is hilly, dissected with stream valleys and outwash plains. Slopes range from nearly flat to over 50 percent with much of the town being in the 8 to 25 percent slope range. The north-south oriented Wapack Range provides a dramatic change from the rolling hills and valleys located at the eastern side of the town.

2.4 Water Resources

The Town is rich in water resources. These provide a critical water source for natural communities such as the ponds, vernal pools, and wetlands formed as a result of glaciation. These same resources have been exploited and modified by past inhabitants of New Ipswich as expressed in the several dam sites, mills and villages that have sprung up around these sites. A relatively recent development of water resources was the PL-566 Flood Protection Program which funded construction of four flood-control dams in the town during the 1960's. The following is a discussion of the existing surface water resources in the study area:

2.4.1 Groundwater

The data set for stratified glacial deposit aquifers was obtained from GRANIT data sets. Currently there is no data set available for bedrock fracture aquifers. There are several aquifers underlying the study area consisting of glacial outwash and kame terraces. These aquifers are primarily located in the Souhegan and Gridley River valleys. Aquifer recharge and water quality is dependent upon the health and permeability of the watersheds supplying these aquifers. Figure 2 shows the location of these aquifers, which to this point has not been developed by a municipal system. However, the number of private wells has increased dramatically as a result of residential and commercial development.

It is foreseeable that new development, especially residential development, could grow to have a significant impact on water supply and quality over time. This is due to increased amounts of impermeable areas lowering the amount of water infiltrated into the ground, thus increasing surface runoff and nutrients in the water returned to the ground. By contrast, a public water system may distribute water up to a few miles from where it was pumped before it is returned to the environment by way of a septic system or wastewater treatment plant. During this transport, the water may be moved to a different sub-basin, or may be discharged directly to a surface water body rather than to the ground. For these reasons, pumping for agricultural usage generally has a smaller impact on an aquifer per volume pumped than pumping for public water supply systems.

2.4.2 Ponds

The ponds in the study area are of four primary types. These include: (1) Kettlehole ponds that were formed when blocks of ice from the retreating glaciers were buried in outwash sediments, subsequently melted and caused the surrounding sediments to collapse into round depressions. Many of these depressions remain filled with water today; (2) Bedrock controlled basins; (3) Through-flow; and (4) Dammed ponds, which may be a special case of through-flow, and includes both: A) manmade impoundments and B) beaver impoundments.

Water bodies have been classified into two size groups, less than ten acres and greater than ten acres. NH RSA Section 271:20 states: "All natural bodies of fresh water situated entirely in the state having an area of 10 acres or more are state-owned public waters, and are held in trust by the state for public use." Within the town there are approximately 14 ponds less than 10 acres in size and 9-ponds greater than 10 acres.

The New Hampshire Department of Fish and Game (NHF&G) has identified numerous streams and ponds within the town as fresh water fisheries. Several of these water bodies have all been stocked in the past with a variety of trout species. Although historical stocking data for all ponds is not available, the healthier ponds provide recreational fishing opportunities for game and panfish enthusiasts. Commonly observed species include smallmouth and largemouth bass, chain pickerel, bluegill, pumpkinseed sunfish, white perch, and yellow perch.

2.4.3 Streams

Streams in New Ipswich occur within the watersheds of the Contoocook, Squanacook, Souhegan, and Millers Rivers. Third order and other named streams are listed below providing information on stream order, watershed area and significance.

New Ipswich lies primarily within headwaters of the 430 square mile Souhegan River Watershed. The major river drainages in the study area include the Souhegan, Contoocook, and Squanacook Rivers, all of which flow into the Merrimack River. The Millers River, on the west side of the Wapack Mountains, flows to the Connecticut. Boundaries of named subwatersheds that comprise the study area are delineated on the water resources map. These streams historically provided significant habitat for

freshwater fishery species such as Atlantic salmon, shad, and eastern brook trout although the suitable habitat for these species has been significantly reduced as a result of dams, sedimentation and water pollution. Hydrologic alterations and temperature changes appear to be secondary factors in the local decline of these species.

Souhegan River

The West Branch of the Souhegan River originates in Fox Brook in New Ipswich. This tributary converges with the South Branch, which begins at Stodge Meadow Pond in Ashburnham, MA. These two third order tributaries converge at the head of Water Loom Pond, where the Souhegan becomes a fourth order stream. The river then flows easterly through the towns of Greenville, Wilton, Milford, Amherst, and Merrimack for 31 miles into the Merrimack River. Historically this river was used for waterpower to drive the numerous mills that were built along the stream as attested to by Water Loom Pond, the historic mills at High Bridge, and further downstream along the river. Four dams and reservoirs were built in New Ipswich as part of a program under PL-566, Watershed Protection and Flood Prevention Act, to alleviate flooding further downstream in the watershed. Portions of the impoundment areas are now conservation land under the auspices of the Conservation Commission.

The Souhegan has been designated as part of the NH Rivers Management and Protection Program. To be eligible for this program, a river must contain or represent either a significant statewide or local example of a natural, managed, cultural or recreational resource. The Rivers Management and Protection Program Act (RSA Ch. 483) lists nine river values and characteristics which may qualify a river for designation into the program. The resource values which qualify the rivers for designation are: geologic resources; wildlife, plant and fish resources; water quality; scenic values; historic and archaeological resources; community resources; managed resources; and recreational resources. The Souhegan supports many of these natural, managed, cultural, and recreational resource values and characteristics at a level of either statewide or local significance. The importance of the Souhegan to the Atlantic salmon restoration project has been recognized at the local, state, and federal levels. It is ranked as the best salmon nursery habitat in the region, and is key to the goal of the project. The river has also become an important educational tool as part of the Adopt-a-Salmon-Family program sponsored by the US Fish and Wildlife Service.

Squanacook River

The Squanacook River originates in Hoar Pond, the headwaters of Locke Brook, and Trapfall Brook on the flanks of Davis Hill, and flows into the Nashua River at the Shirley and Groton, Massachusetts town line. The headwaters have been ranked as "outstanding resource waters" and are ranked as coldwater fishery streams.

Contoocook River

The Gridley River flows northerly from the northwestern corner of New Ipswich into Sharon where it merges with the Contoocook. The Contoocook flows northeasterly to its confluence with the Merrimack at Penacook. A large wetland in a glacial outwash sand plain, regionally known as Tophet swamp, forms the headwaters of the Gridley. Within

the study area, it is a low gradient stream for an extended length with descriptive names such as Swamp road in Sharon signifying the hydrologic characteristics and vegetative cover.

Miller River

The headwaters of the North Branch of the Miller River begin on the westerly slopes of Pratt and New Ipswich mountains. This stream flows southwesterly to Winchendon, MA where it joins the main stem of the Millers. The Millers then flows westerly to meet the Connecticut River at Millers Falls. As with the Souhegan, all of these rivers have been harnessed for waterpower wherever hydraulic drops occurred. Two breached, rock faced earthen dams were observed between Island Pond and Mountain Pond.

2.4.4 Freshwater Wetlands

Wetlands have been difficult to define, as they are part of the continuous gradient between uplands and open water, and as such exhibit some of the characteristics of both. The most widely accepted definition is presented in the report entitled Classification of Wetland and Deepwater Habitats of the United States (Cowardin et al., 1979): Wetlands are lands transitional between terrestrial and aquatic systems where:

> "... water is usually at or near the surface or the land surface is covered by shallow water ... Wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominately hydrophytes, (2) the substrate is predominately undrained hydric soil, and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year."

The National Wetland Inventory classifies wetlands according to the Cowardin classification. The Federal and the New Hampshire definitions of wetlands are derived from the Cowardin document. There are numerous ways of classifying different types of wetlands. This classification divides waters into five ecological systems: estuarine, palustrine, riverine, lacustrine, and marine, three of which are included in the study area: palustrine, riverine, and lacustrine. These systems are subdivided into classes and subclasses defining the bottom or plant community with increasingly greater precision. There are also modifying terms related to water regime and water chemistry. Although this classification does not provide particulars about specific wetland vegetation, it does provide sufficient detail for community wide planning activity.

The New Hampshire Natural Heritage Inventory (NHNHI) has developed a landscape classification scheme based on natural communities. These are recurring assemblages of species founding particular physical environments. Each natural community type is distinguished by three characteristics: (1) a definite plant species composition; (2) a consistent physical structure and (3) a specific set of physical conditions.

2.4.5 Vernal Pools

Vernal pools are temporary bodies of freshwater that provide essential breeding and nursery habitat for many vertebrate and invertebrate wildlife species. Many vernal pools are filled by spring rains and snowmelt, only to dry up during the hot, dry months of summer. However, they may also be filled by the rains of autumn and may persist throughout the winter. Vernal pools are often very small and shallow. In fact, some that support rich communities of vertebrate and invertebrate animals may measure only a few yards across. Nevertheless, vernal pools up to several acres in size also occur throughout New Hampshire.

Vernal pools typically lack fish populations, making them excellent breeding habitat for many amphibian species and larval and adult habitat for many insect species, as well as other wildlife. The wood frog (*Rana sylvatica*) and all species of mole salamanders (*Ambystoma* spp.) that occur in New Hampshire breed exclusively in vernal pools. Areas in the immediate vicinity of the pool provide these species with important non-breeding habitat functions, such as feeding, shelter and overwintering sites.

Although vernal pools are not protected per se by the New Hampshire Wetland Protection Act, their significance is becoming increasingly recognized as important wildlife habitat.

2.4.6 Vegetated Wetlands

Most wetlands in the study area are associated within areas under forest cover. From available GIS data, this study has identified three significant types of wetland communities: deep and shallow marshes, shrub-scrub wetlands, and forested swamps. **Table 2-1: Characteristics of Wetland Communities by Type** summarizes the general characteristics of each community including the state rank, setting, dominant vegetation, habitat values associated with it, observed/associated rare animals, and potential threats (Sperduto, D.D.1994). The state rank, developed by The Nature Conservancy for the New Hampshire Natural Heritage Inventory (NHNHI), reflects the community's rarity and threat within New Hampshire as follows:

S1 = Typically 5 or fewer occurrences, very few remaining acres or miles of stream, or especially vulnerable to extirpation in Massachusetts for other reasons.

S2 = Typically 6-20 occurrences, few remaining acres or miles of stream, or very vulnerable to extirpation in New Hampshire for other reasons.

S3 = Typically 21-100 occurrences, limited acreage or miles of stream in New Hampshire.

S4 = Apparently secure in New Hampshire.

S5 = Demonstrably secure in New Hampshire.

Table 2-1: Characteristics of Wetland Communities by Type

Wetland Type	State Rank	Setting	Vegetation	Habitat Values	Associated Rare Animals	Threats
Bogs	S1-S3	Occur in bedrock and kettle depressions	Vegetation is in a ringed zonation pattern – outer ring of black spruce, tamarack, highbush blueberry and winterberry, and interior rings of leatherleaf and sedges and moss lawns. Sphagnum moss species.	May function as vernal pool habitat if open water remains standing for 2-3 months and no fish present; important amphibian breeding habitat	Spotted salamander, Jefferson Salamander, Blue-Spotted Salamander, Spotted Turtle, Pale Green Pinion Moth, Pitcher Plant Borer Moth and Bog Lemming.	Hydrologic alteration, nutrient enrichment from road and lawn runoff, and humans trampling on the peat mat.
Vernal Pools	S2, S3	Depressional settings in uplands and on floodplains	Sparsely vegetated to perennial or annual vegetation.	Obligate breeding habitat for several amphibian species.	Spotted salamander, Jefferson salamander, Blue-Spotted Salamander, pill clams, fairy shrimp, ringed boghaunter dragonfly.	Disturbance, altered hydrology, disturbance of vernal pool envelope (area within 100 feet of pool's edge)
Deep and Shallow Marshes (PEM)[1]	S3, S4	Occur in broad, flat areas bordering low-energy rivers and streams	Cattails, pickerel-weed, and wool-grass dominate deep marshes; tussock sedge and bluejoint dominate shallow marshes.	Deep marshes provide excellent habitat for waterfowl and shallow marshes for muskrats; both provide habitat for frogs and newts	Great Blue Heron, American Bittern, Northern Harrier, Marsh Wren, Spotted Turtle, Wood Turtle, Blanding's Turtle, Common Moorhen, American Bittern, Pied-Billed Grebe, King Rail, and Water Shrew	Filling and dredging; impoundments that alter natural water level fluctuations; nutrient inputs from roads, fields, or septic systems; invasive species (e.g., Purple Loosestrife and Phragmites)
Shrub Swamp (PSS)	S5	Occur in basin depressions, at pond margins, and along river and stream edges	Mixture of speckled alder, speckled alder, highbush blueberry, mountain holly, meadowsweet, buttonbush, winterberry, swamp azalea, silky dogwood, northern arrow-wood, and maleberry.	Function as vernal pool habitat in the absence of fish and provide important amphibian breeding habitat	Jefferson Salamander, Blue-Spotted Salamander, Marbled Salamander, Spotted Turtle, Wood Turtle, Elderberry Long-Horned Beetle, Blanding's Turtle, Four-Toed Salamander, Water-willow Stem Borer,	Urbanization, highway construction, impoundments and agriculture. Introduction of exotic species (e.g., Purple Loosestrife and Phragmites)
Wooded Swamp (PFO)	S5	Occur on flats where drainage or percolation is imperfect.	Includes all wetlands with at least 30% tree cover. The dominant species is red maple. With lesser amounts of black ash, green ash, American elm, black gum. Coniferous species include white pine, hemlock, spruces, and tamarack.	Pits of upturned trees may function as vernal pools. Hemlock and pine dominated areas may provide deer wintering areas.	Wood turtle, Jefferson salamander, Spotted salamander, Blue spotted salamander, Wood duck, Northern waterthrush, Wood frog	Urbanization, highway construction, impoundments and agriculture. Altered hydrology.

[1] Cowardin wetland classification abbreviations used: PEM – Palustrine emergent; PSS – Palustrine shrub-shrub; PFO – Palustrine forested.

2.5 Biodiversity & Significance of Habitats

New Ipswich is ecologically highly variable due to its physical location, the varied topographic and hydrologic features distributed within the town. The elevated topography of spine of the Wapack Range and the Souhegan River provide major travel corridors for migration of numerous species of flora and fauna.

2.5.1 Native Plant Communities

Classification of native plant communities has again resulted in several schemes being developed that are dependent upon use and classification methodology. The Society of American Foresters (SAF) has developed a classification based on forest cover types, which are categories of forest defined by its vegetation composition (particularly its composition) and/or locality (environmental) factors. SAF forest cover types found in New Ipswich include several red spruce types; several white pine and hemlock types; northern hardwoods; white oak – black oak – red oak; northern red oak; and gray birch – red maple.

The NHNHI has developed a landscape classification scheme based on natural communities. These communities are recurring assemblages of species occurring on particular physical environments. Each natural community type is distinguished by three characteristics: (1) a definite plant species composition, (2) a consistent physical structure, and (3) a specific set of physical conditions.

The GRANIT classification utilizes computer classification of spectral data sets and includes three coniferous classes, mixed forest, and three deciduous forest classes. These are displayed on the Land Cover map (Figure 8) and is the land cover classification typically used in this report.

2.6 Wildlife and Wildlife Habitat

The conservation areas delineated through this project were areas of core habitat for the rare and/or endangered species as well as supporting habitat areas. The study area hosts several rare and/or endangered species. For the rare species occurrences lists in the New Ipswich please refer to **Appendix B: NHNHI List of Rare Species Occurrences by Town** (source: NHNHI website). A summary of the species observed and their significance is described below.

2.6.1 Mammals, Birds, Reptiles and Amphibians

The physical characteristics and vegetation cover of the study area creates a unique environment that supports many rare or endangered species in addition to the more common species. Indigenous animals that are most dependent on the unique characteristics of this area include species such as the Blanding's turtle that requires densely vegetated shallow ponds and marshes; several frogs, toads, and salamanders such as the blue-spotted salamander, Jefferson salamander, marbled salamander, spotted turtle, and wood turtle, all of which depend on vernal pools for reproductive success.

- **Binney Pond:** Portions of this area are included in the Binney Pond State Forest. There are large undeveloped tracts on either side of the state forest. Parcels west and north of Binney Pond, which a portion of the Wapack Trail traverses, are owned by the Hampshire Country School. Recommended action would be to provide protection through purchase, conservation easement, or large lot zoning. Priority is rated as moderate as the pond itself is currently protected, but monitor activities of large landowners.

- **Dam Site 35:** A parcel is owned by the New Hampshire Water Resources Department, and administered by the Conservation Commission. There are several other parcels that have wetlands associated with the impoundment located on them. As flowage rights impact the development potential of these properties, they currently afford some protection to natural resources, and are considered low priority for further action. Streams and their buffers flowing into and out of this area have relatively low numbers of co-occurrences, but are important to maintain wildlife travel corridors and water quality.

- **Upper reaches of Fox Brook:** This area lies at the foot of New Ipswich Mountain and contains a large wetland complex and is mapped as a deer yard. Land parcels are relatively large, with no road frontage for most of them. Land to the west and south are owned by Forestland Preservation, whose name implies that they hold land for sustained management of forest products, and may provide some protection to these adjacent lands. The extensive area of wetland provides a moderate amount of protection from development or subdivision. Suggested priority for further conservation action on these lands is moderate.

- **Souhegan River Corridor**: This area contains aquifers along the West and South Branches, scattered wetlands of various types, and riparian habitat. Land adjacent to the South Branch near Flood control site 19 has been subdivided and developed with single-family houses, although the upper reaches of the pool score relatively high for natural resources co-occurrences. The river downstream of the confluence of the South and West Branches becomes a fourth order stream, and subject to Comprehensive Shoreline Protection Act provisions. The protection of this reach of the river is enhanced by the fourth order status that limits disturbances, coupled with New Ipswich zoning regulations that limit development within 100 feet of wetland boundaries provide control over development immediately adjacent to the stream corridor.

  The Town owns four parcels adjacent to the river, ranging in size from 0.2 to 5.05 acres. The Town of Greenville owns a parcel along the river in New Ipswich, located between the river and the highway. Two class VI roads near the western bank of Water Loom Pond, Whirlpool and Preston Hill Road, have recently been converted to trails. Water Loom pond, created by the damming of the Souhegan River, is used for recreational pursuits by townspeople including picnicking, swimming, and fishing. A short distance below High Bridge the river again

becomes a dead water stream, being backed up from the dam in downtown Greenville.

To maintain and improve the health of the stream and the riparian community through this area, several techniques can be employed. Road repairs or improvements should be required to utilize Best Management Practices (BMP's) for prevention of erosion and sedimentation. Recent innovations should be utilized for modification or replacement of bridges and culverts to minimize scour (Johnson, P.A. 2002) and facilitate travel corridors of wildlife (Jackson, S. 2002). Tree cover should be maintained to minimize thermal rise of the water.

5.1.2 Priority Analysis

The importance of the various resources varies from town to town, depending upon perceived needs. Multiple overlapping resource features, co-occurrences, can pinpoint "hot spots" with regard to protection strategies, however key single resource values should not be overlooked. Single resource, such as water, are becoming more important regionally as populations soar and increased demands for this resource become evident as recently expressed by the USA Springs Bottling plant proposed for Nottingham, and the proposed sale of the Pennichuck Water Works, which supplies Nashua, to an out-of-state company.

The New Ipswich Conservation Commission has opted not to establish priorities for resource protection at this time. Rather, they have made the wise decision to analyze the results of the Natural Resource Inventory and determine if further studies are needed, additional information required, and solicit input from other interested parties in Town to establish priorities and goals that will reflect the perceived needs and goals of New Ipswich.

To aid in establishing priorities for protection and conservation of New Ipswich's natural resources, answers to several questions must be pursued.

What are the locations in town that have the most important resource values, and where are resource co-occurrences?
The co-occurrences overlays provides detailed information where concentrations of natural resources occur, and can provide helpful information for land protection projects and land use planning measures. Important single resources, such as aquifers that may provide future water supplies, may receive high priority for protection.

Why is this resource valuable to the town?
The value of a resource to the town, be it a potential aquifer or critical habitat component, can help suggest an appropriate protection strategy. Water supply resources, for example, are important to the health and safety of the town and may appropriately protected through regulation. Others resources, such as recreational areas, may be more appropriately protected by purchase.

What are the threats to the continued availability of this resource or group of resources?

To assess the threats to resource availability and continuance involves evaluating the land use trends and current land use regulations as well as economic factors on that resource. To properly assess these threats to New Ipswich's natural resource base a build out analysis using current zoning regulations with various scenarios of economic factors.

What natural resources have been identified that are important to other towns or the region?

As natural resources are not contained by political boundaries, protection of important resources, such as the Wapack Range and Souhegan River will require cooperative efforts between adjacent communities.

6.0 CONSERVATION GUIDELINES

A goal of this study is to synthesize all of the factors discussed in Sections 1 through 5 to provide the Town of New Ipswich with specific recommendations for prioritizing their conservation efforts. These recommendations were developed based on three criteria described below.

The criteria for priority ranking and action recommendations were analyzed as follows:

- **Level of Protection:** Various weights can be assigned levels of protection currently in place on specific parcels..For example, the highest weight would be for properties owned fee simple by the conservation organizations or the Town; less weight would be given tor parcels that a conservation organization controls a conservation easement or other restrictive covenant; less protection is offered by active tree farms and properties that are enrolled in current use assessment; followed by parcels within a zoning conservation overlay zone; and finally other parcels that have no restrictions placed on them would be classified as unprotected.

  A caveat should be placed on ownership of a parcel of land by a town. To change the intended use of a parcel requires passage of a warrant article at a town meeting. This could be the change from conservation land to the site of a new school. To insure that such changes cannot occur, some towns have run ownership of conservation land through a land trust before taking title.

- **Value for On-Site Resources:** On-site resources include locations, habitats and ecosystems. "Critical" on-site resources include the Wapack Trail and environs, and the main stem of the Souhegan River. "Significant" on-site resources include the NHNHI designated rare species and exemplary plant community locations. These locations have been identified as "critical" on-site resources because it indicates the area may provide favorable habitat for the survival of that species. It is unclear whether these areas are more critical for biological conservation than adjacent areas with a similar habitat type or whether they are simply better sampled with regard to rare species.

- **Value of Off-Site Resources:** Off-site resources include viewsheds, catchment areas in a watershed as they contribute to the aquifer recharge, unspecified wildlife habitat and areas that contribute to wildlife travel corridors and all other open lands in the study area which are identified as "significant" for off-site resources.

6.1 Guidelines for Land Protection Activities

Land protection measures can utilize several basic techniques including: fee simple acquisition of land; conservation easements which separate the development rights to a property and place restrictions on its use; deed restrictions which are placed in a deed at the time of property transfer; mutual covenants which are similar to deed restrictions, and are often used by a group of landowners who share a resource; and zoning ordinances which can be tailored to adequately protect certain natural resources.

Based on the criteria discussed above, the highest priority lands for acquisition were determined to be unprotected areas that possess multiple co-occurrences of on-site resources, and face development pressures within the next few years. Most of these areas are privately owned. A few smaller areas of land are also identified as first priority for acquisition or other methods of protection.

Second priority lands for acquisition include areas that are unprotected and possess significant on-site and critical off-site resources. These lands are scattered throughout the study area and form the transition from first priority to third priority lands.

A land acquisition strategy for this area should balance the protection of first priority lands with the protection of second priority lands. Many of the first priority lands will likely be developed within the next 10 to 20 years if they are not acquired or otherwise protected. On the other hand, these lands may be more expensive to acquire because they are more imminently developable. Even though the second priority lands are less likely to developed in the near future, it may be a worthwhile use of land acquisition funds to purchase these lands before they increase further in value and before they are fragmented by development.

6.2 Guidelines for Advocacy and Project Review Activities

While it is not possible to acquire or permanently protect all of the significant lands within the study area, it may be possible to guide development and land management so as to preserve some resource values even on lands that will be developed in the future. Examples of such areas are lands that provide conservation value as connecting landscapes between critical habitat areas, areas with few natural resource co-occurrences, as well as areas contributing to the region's overall hydrologic system. In these areas, the New Ipswich Conservation Commission and their conservation partners should try to guide development away from areas of sensitive natural resources by participating in local and state project review and permitting processes.

Another type of land area are those parcels already protected from development, but contain critical resources that require appropriate land management practices. For example, bog communities require control of supplemental nutrients and sediments to prevent invasion by plants that require higher nutrient levels, and must not be used for most recreational purposes due to damage of the peat mat by trampling. In these areas the Town may want to work with neighboring local and state governments as well as other conservation groups to ensure that land management practices support natural resource values.

6.3 Detailed Natural Resources Studies

We recommend that additional studies be undertaken to gain further insight of the natural resources of New Ipswich. These studies can be expanded according to the Town's specific needs and goals. The purpose of these detailed studies is to collect additional information that supports the primary goals of the Natural Resource Inventory or to gain additional information about a specific site. These studies need not be done all at the same time, but could be spread out as time and resources allow. Specific additional studies might include such areas as:

1. Water resources evaluation:
    - Favorable Gravel Well Analysis
    - Water Quality Monitoring
    - Dam and impoundment/flowage rights
2. Wetland Studies:
    - NHNHI classification of wetlands
    - Vernal Pool Inventory
    - Prime Wetland Assessment
3. Agricultural Land Assessment
    - Agricultural types
    - Current Use Assessment Properties
    - Conservation Easements
4. Forest Resources:
    - Productive Forest Soils
    - Certified Tree Farm Locations
    - Unusual Forest Types
    - Current Use Assessment Properties
    - Conservation Easements
5. Undeveloped Shorelands
    - Great ponds
    - Fourth order streams
6. Cultural and Natural Resource Features
    - Archaeological and historic sites
    - Scenic areas and designated scenic roads
    - Recreation Areas
    - Unique geologic resources/waterfalls
7. Build-out Analysis
    - Perform analysis based upon current zoning regulations.
    - Perform analysis scenarios based on alternative proposed zoning changes.