STATE OF NEW HAMPSHIRE
SITE EVALUATION COMMITTEE

Docket No. 2015-06

Joint Application of Northern Pass Transmission, LLC
and Public Service Company of New Hampshire
d/b/a Eversource Energy for a Certificate of Site and Facility

PREFILED DIRECT TESTIMONY OF JAN McCLURE AND KRISTINE TARDIFF ON BEHALF OF THE CITY OF CONCORD CONSERVATION COMMISSION

November 15, 2016

Background and Qualifications – Kristine Tardiff

Q. Please state your name and address.

A. My name is Kristine Tardiff. My address is 41 Dunklee Street, Concord, NH. I have been a resident of the City of Concord since 1999.

Q. Please describe your official capacity in the City of Concord?

A. I am the Chair of the Conservation Commission for the City of Concord. I have been on the Conservation Commission since 2000, and was involved in the development of the City's Conservation and Open Space Master Plan, which was adopted in 2008 ("Open Space Plan").

Q. What is your professional background and experience?

A. I am a Senior Trial Attorney in the Natural Resources Section of the United States Department of Justice, Environmental and Natural Resources Division. I have been employed as a trial attorney for the Department of Justice for 21 years. Prior to that I served as a law clerk for two years to the late Honorable Shane Devine, Senior Judge for the United States District Court for the District of New Hampshire. I received a B.A. in Sociology from Keene State College in 1988, and a J.D. from Northeastern University School of Law in 1993. My testimony here is provided only in my personal capacity as a member of the Conservation Commission, and I am not representing the views of my employer.

Background and Qualifications – Jan McClure

Q. Please state your name and address.

A. My name is Jan McClure. My address is 54 District Five Road in Concord, NH. I have been a resident of the City of Concord since 1981.

Q. Please describe your official capacity in the City of Concord?

A. I am currently an alternate member of the Conservation Commission for the City of Concord. I was previously an elected member of the City Council for twelve years, and was the Council Representative assigned to the Conservation Commission between 2007 and 2015. I was involved in the development of the Open Space Plan.

Q. What is your professional background and experience?

A. I am the Director of Land Protection for the New Hampshire Chapter of the Nature Conservancy. I was also one of the incorporators of the Concord Conservation Trust, a local land trust, founded in 1988 and now known as Five Rivers Conservation Trust. I graduated from Williams College in 1976 with a B.A. in Religion and minor in Environmental Studies. I received a Master of Science in Plant Biology from the University of New Hampshire in 1991. My testimony here is provided only in my personal capacity as a member of the Conservation Commission, and I am not representing the views of my employer.

Purpose of Testimony

Q. What is the purpose of this prefiled direct testimony?

A. Our testimony is for the following purposes:

(1) **First**, our testimony provides an overview of the mission and responsibilities of the City of Concord Conservation Commission.

(2) **Second**, our testimony provides an overview of the experience and qualifications of the City of Concord Conservation Commission.

(3) **Third**, our testimony explains the Open Space Plan, a section of the Master Plan 2030.

(4) **Fourth**, our testimony discusses concerns relative to the impacts on priority areas for conservation identified in the Open Space Plan, as well as concerns about potential impacts to trails, wetlands and natural resources.

(5) **Fifth**, our testimony explains how it is the opinion of the City of Concord Conservation Commission that the proposed Northern Pass Project will unduly interfere with the orderly development of the City of Concord.

I would note that it is anticipated that further testimony on additional issues such as natural resources, historic sites, aesthetics and the public interest will be provided by the deadline of December 30, 2016.

Mission and Responsibilities of the City of Concord Conservation Commission

Q. What is the mission of the City of Concord Conservation Commission?

A. The City of Concord established the Conservation Commission in 1971. The mission of the Conservation Commission is to protect, promote, and develop the natural resources and protect the watershed resources of the City of Concord.

Q. What are the main responsibilities of the City of Concord Conservation Commission?

A. The main responsibilities of the Conservation Commission include:

(1) Land protection;

(2) Land stewardship;

(3) Management of the city's hiking trails;

(4) Management of the city forests;

(5) Stewardship of the city's urban trees;

(6) Review of wetland permits and conditional use permits related to disturbances of wetland buffers, shore land protection district, and buffers to bluffs;

(7) Conduct inventories and studies, and public outreach and education related to the city's natural resources

Qualifications and Experience of the City of Concord Conservation Commission

Q. What are the qualifications and experience of the City of Concord Conservation Commission?

A. The City of Concord Conservation Commission is comprised of experienced and qualified professionals who are fully capable of performing their duties as Conservation Commission members appropriately, fairly and efficiently. The Commission's members, who are residents appointed by the City Manager, have extensive knowledge of the lands and natural resources within the City of Concord and have a wide variety of professional expertise in areas that relate to the role and mission of the Conservation Commission.

Q. Please provide a summary of the experience and qualifications of the individual members?

A. Our experience and qualifications are described above. The Conservation Commission also includes the following current members:

- **Christopher Kane** is the Secretary of the Conservation Commission, and an active member since 2007. Mr. Kane was involved in the development of the Open Space Plan and was instrumental in the creation of the City's Sustainable Tree Program. Mr. Kane is a Conservation Biologist and owner of Kane Conservation with experience as a conservation planner, botanist, and stewardship specialist in several municipalities throughout NH.
- **James E. Owers** is the Vice Chair of Conservation Commission and has been an active member of the Commission since 1995. He was involved in the development of the Open Space Plan. Mr. Owers is a former attorney.
- **Tracey Boisvert** has been a member of the Conservation Commission since 2003 and was involved in the development of the Open Space Master Plan. Ms. Boisvert is the Director of the Conservation Land Stewardship Program for the NH Office of Energy and Planning. She was formerly a Compliance Supervisor for the Department of Environmental Services, with prior experience as a permitting specialist and land protection specialist.
- **Frederick Chormann, Jr.** has been a member of the Conservation Commission since 2003 and was involved in the development of the Open Space Master Plan. Mr.

Chormann is a hydrogeologist and is the State Geologist employed by the NH Department of Environmental Services, and the Director of the New Hampshire Geological Survey.

- **Councilor Mark Coen** has been the City Council representative on the Commission since early 2016. Mr. Coen is the president of Page Belting Company, Inc. and has been a City Councilor-at-Large since 2006.
- **Katherine Healy** has been a member of the Conservation Commission since 2015. Ms. Healy is a soil scientist and worked under the Natural Resource Conservation Service as a soil conservationist, major land resource area soil survey project leader, and soil database manager.
- **Jeffrey Lewis** has been a member of the Conservation Commission since early 2016. Mr. Lewis is a Professional Civil Engineer and principal owner of Northpoint Engineering. Mr. Lewis has worked on a wide range of civil and land planning projects throughout New Hampshire.

History of Conservation and Open Space Section of Master Plan 2030

Q. What is the history of the Conservation and Open Space Section of the Master Plan 2030?

A. The first Open Space Plan was adopted by the Planning Board and Conservation Commission in 1978. The Conservation and Open Space Section of the Master Plan was adopted in 1993 as part of the Year 2010 Master Plan Update, and amended in 2008. The current Open Space Plan was officially adopted on June 18, 2008 at a meeting of the City Planning

Board, after public hearings held on January 23 and 24, 2008, the subsequent receipt of written communications, and consideration of the testimony and communications received. That process is defined in the introduction of the 2030 Master Plan. The Commission established the priority areas for protection in April, May and June 2004 during noticed regular public meetings. Work began on the update to the Master Plan in 2006, and the Commission continued discussions on priorities for open space protection in the Master Plan at their March 8, April 12, May 10, 2006 regular meetings. A copy of the Open Space Plan is attached as Exhibit A.

Q. What is the Open Space Plan?

A. The Open Space Plan is used to identify areas and natural resources with the City of Concord that are already protected, as well other areas and natural resources targeted for protection. Exhibit VII-2 of the Open Space Plan depicts Concord's Future Open Space Plan with existing open space areas depicted along with the proposed future protected areas differentiated by means of existing and proposed protection.

Q. What are the specific conservation and open space goals of the Conservation and Open Space Section of the Master Plan?

A. The conservation and open space goals are to:

(1) Develop a coherent interconnected system of permanently protected open spaces designed to provide areas for recreation, public service and safety, resource production, and the protection of sensitive environmental features.

(2) Foster the wise and proper development and management of the City's land and water resources so as to ensure sustainable productive use of the same, while avoiding environmental degradation, personal injury, and property damage.

(3) Maximize the multiple use of open space to the extent that such use does not adversely affect the primary function of the open space.

(4) Maximize the opportunities for the citizens of Concord to have access to public open space through linkages between the City's villages and neighborhoods and the open space system.

(5) Protect and enhance surface and ground water quality, and maximize the potential for the use of these water resources as potable water supplies.

(6) Protect and enhance the air quality of the region.

(7) Preserve prime and significant agricultural soils for agricultural uses, and to encourage the retention and diversification of agricultural uses within the city.

(8) Encourage the use of best management practices of forest resources on both public and private land within the City in order to maintain a continuing, sustainable timber harvest from the same, and to encourage multiple use of this forest resource.

(9) Retain habitat for the City's indigenous species of wildlife, including migratory species and those species that have been identified as endangered, to provide adequate area that will foster the perpetuation of these species, and allow for their movement through and within the City.

(10) Protect and maintain exemplary natural communities and rare plant species that have been identified within the City.

(11) Maintain and enhance scenic views and natural vistas from the City's roads and public properties where possible.

(12) Preserve open space within the Urban Growth Boundary (UGB) to protect environmentally sensitive natural features, to provide non-structured recreational opportunities, and to serve as amenity features within neighborhoods.

Q. How does the Conservation Commission use the Open Space Plan?

A. The Open Space Plan is used by the Conservation Commission as a guide for its decisions and recommendations to the Concord City Council regarding the protection of the City's existing open space and the acquisition of additional lands or the protection of such lands through conservation easements.

Q. Does the proposed Northern Pass Project pass through or otherwise impact priority areas for conservation in the Open Space Plan?

A. Yes. The proposed Northern Pass Project is mapped out to pass through sections of the City of Concord where significant acreage is already conserved as open space and through sections that are considered priority areas for targeted conservation. These areas are the Soucook River Corridor, Broken Ground, Oak Hill- Snow Pond - Hot Hole Pond, and Northern East Concord. Properties within these areas have been conserved through acquisition or easement since the Conservation and Open Space Master Plan, including Broken Ground Conservation Area (270 acres), Unitil Broken Ground Easement (130 acres), and Warren Richards Community

Forest (113 acres). A map of the properties conserved by the Conservation Commission which are adjacent to the proposed Northern Pass Project is attached as Exhibit B.

In total, in addition to the Turtle Pond conservation area, the project crosses or abuts 12 other parcels of open space land protected either by easement or City ownership. This amounts to a significant area within or adjacent to conservation land, with major impacts on these properties. Most notable among these properties are Spear Park and the adjacent Richards Community Forest, both fee-owned and easement-protected land in the Broken Ground Conservation Area, and a portion of the Oak Hill City Forest. All of these are managed by the Conservation Commission for protection of natural resources, open space, and non-motorized recreation. The City recently acquired 270 acres of open space in the Broken Ground area at a cost of approximately $1 million (including $80,000 from the ARM fund).

The City of Concord has been proactive in conserving land in East Concord, a priority in the City's Master Plan since the 1970s, and the Commission is concerned that these efforts will be undermined by the project.

Q. Does the proposed Northern Pass Project pass through or otherwise impact areas that are have been identified as proposed linkages and connections for public access?

A. Yes. The City has been actively working to provide linkage among large open space areas with internal trail systems, and to connect large open space areas and trails from neighborhoods and villages inside the Urban Growth Boundary. One of the areas is Broken Ground. The City recently purchased 270 acres in fee and acquired an easement over an additional 130 acres in the Broken Ground area with the intent of gaining formal trail rights

throughout Broken Ground connecting east to Josiah Bartlett Road, and north to Appleton Street, Turtle Pond and Oak Hill Road. These acquisitions also provide open space protection for lands with extensive wetlands and recognized wildlife habitat values. There was significant public involvement in and support for the conservation and preservation of this area as open space.

Trail Networks – Construction Impacts

Q. Does the City of Concord Conservation Commission have concerns about the impacts of construction of the proposed Northern Pass Project to existing and proposed trail networks?

A. Yes. The City of Concord Conservation Commission's trail group recently completed construction of a trail network from Portsmouth Street to access trails in the Whispering Heights/Broken Ground areas. The proposed construction of the Northern Pass Project has a construction pad located in an area off of Portsmouth Street that was recently cleaned up to allow parking for the public to access the trail network. The Conservation Commission is concerned that the construction in this area will not only block public access to the trails, but will adversely impact the parking area used by the public.

Impacts to Wetlands

Q. What Concerns does the Conservation Commission have about wetlands impacts?

A. Based on information provided by Northern Pass to the Conservation Commission , in the City of Concord, the proposed project will impact 35 wetlands totaling 51.8 acres. Of these, 23 are emergent wetlands and are 10 scrub/shrub deciduous. Most notable of these is the

15.26 acres of wetland adjacent to Turtle Pond, which as stated in the application provides significant functions and values. These functions include groundwater discharge/recharge, finfish habitat, floodflow alteration, sediment/toxicant retention, nutrient removal, shoreline stabilization, production export, and wildlife habitat. As stated in the application, principal values include recreation, uniqueness and heritage, education/scientific value, and visual aesthetics. The proposed project will require construction of 4.5 miles of new access routes within the corridor in Concord, with impacts on wildlife habitat and wetlands/wetland buffers.

The proposed project will also impact 16 rivers and streams including intermittent streams, with a total of 88,115 square feet of impacts on these important water resources within the City of Concord.

While the permanent impact on these resources may be relatively minor, the project will have temporary impacts of more than 7 acres (319,701 square feet) within the City of Concord. This is a very significant impact, and the Conservation Commission believes the work needed to access these areas is likely to cause long-term damage; in fact, the impacts will not be temporary. The project application did not provide sufficient detail on the temporary impacts to address this concern. Of particular concern is damage to the Turtle Pond wetland, a conservation area under the jurisdiction of the Conservation Commission, where the project application indicates there will be 130 square feet of permanent impact and 85,266 feet of temporary impact.

Other impacts to wetlands may be addressed in our additional prefiled testimony on December 30, 2016.

Impacts to Natural Resources

Q. What Concerns does the Conservation Commission have about impacts to other natural resources?

A. An area of concern is the project's impact on threatened and endangered species. The application addressed 12 wildlife and seven plant species affected by the project. The Commission is especially concerned about the risk to the Federally endangered Karner blue butterfly. The residents of Concord have a strong interest in restoring this species in its only occurrence in New Hampshire, through land protection agreements, and active efforts for many years by school children and adult residents to raise and plant wild lupine.

Six structures are proposed in areas where wild lupine is present, as well as additional temporary impacts. The application states that there will be an unavoidable impact to the Karner blue butterfly through habitat loss and mortality attributable to project activity. The application proposes preservation of land but does not identify the likelihood that Karner blue populations can be successfully re-introduced and maintained in this area. This is not adequate mitigation for the certain loss of populations of a federally endangered species that has been painstakingly restored in the pine barrens of Concord.

The 2010 report, "Wildlife Habitats, Natural Communities, and Rare Species Analysis for Concord, NH," highlighted in Table 3 the pine barrens as a particularly vulnerable natural community in Concord. A copy is attached as Exhibit D. The 2015 Wildlife Action Plan indicates the pine barrens near Concord Airport are categorized as highest ranked habitat in New Hampshire. Most of the area within the City of Concord where the Northern Pass project is

proposed to passes through is characterized as highest ranked habitat either on a statewide or regionally basis.

We also note that the Shoreland Protection application for the proposed project describes significant impacts on both sides of the Soucook River (the Concord-Pembroke boundary), a total of over 58,000 square feet. This important water resource has highly erodible bluffs along many of its banks; the temporary impacts of construction activities have a strong potential to cause new erosion and should be prohibited. The shoreland impacts on Turtle Pond are also significant -- over two acres for multiple structures -- and should likewise be avoided. An additional transmission line in this waterbody should not be permitted.

Comments to the New Hampshire Department of Environmental Services

Q. Did the Conservation Commission submit comments to the New Hampshire Department of Environmental Services?

A. Yes. A letter was sent on July 25, 2016. A copy of the letter is attached as Exhibit C. The letter identified concerns about the wetland permit and the shoreland permit submitted for the proposed Northern Pass Project.

Undue Interference With Orderly Development

Q. Is the City of Concord Conservation Commission concerned that the proposed Northern Pass Project will unduly interfere with the orderly development of the City of Concord?

A. Yes. As of the result of the Open Space Plan, the City established the Residential Open Space ("RO") District which was established to accommodate agricultural, forestry, and

low impact outdoor recreational uses outside of the Urban Growth Boundary adjacent to environmentally sensitive areas. The proposed construction of the Northern Pass Project from the Canterbury-Concord town line to I-393 passes through the RO District. According to the Master Plan, the purpose of the RO District is to maximize the area devoted to open space and minimize the area converted to development. Restrictions in zoning for this district include building height (35 feet), density (not to exceed one-half dwelling per acre), and minimum width of landscape buffers to screen structures (25 to 100 feet). The height limitations within the zoning ordinance require that any adverse visual impacts of the height and appearance of an appurtenant structure shall be minimized where the structure is to be located within a scenic vista or a natural or pastoral view, and the design shall respect the surrounding vernacular architecture. The proposed Northern Pass Project exceeds the height limitation and visually impacts scenic vistas and natural and pastoral views in the RO District. Further, landscape buffers to residences in several locations will be reduced or eliminated by the construction of the Northern Pass project, as proposed.

Other Impacts

Q. Are there other concerns that the City of Concord Conservation Commission has about the impacts of the proposed Northern Pass Project?

A. Yes. In the City of Concord, the corridor proposed for Northern Pass extends for 8.1 miles, with an average width of 257 feet. This represents approximately 252 acres. Additional clearing within the right of way is estimated at 10 to 11 acres. This is a substantial

area that will have numerous significant impacts: fragmentation of wildlife corridors, loss of tree cover, risk of additional ATV use with attendant erosion, and other impacts.

The City of Concord Conservation Commission also has concerns about other issues, which includes impacts to natural resources (including the endangered Karner Blue Butterfly and its unique pine barrens habitat), historic sites, aesthetics and the public interest. It is anticipated that further testimony on these additional issues will be provided by the deadline of December 30, 2016.

Q. Does this end your testimony?

A. Yes.

EXHIBIT A

SECTION VII. CONSERVATION AND OPEN SPACE

A. INTRODUCTION

The Conservation and Open Space Section is intended to guide the protection of the City's natural resources and environment while promoting the appropriate and efficient use of land and water within the City of Concord in a manner consistent with the economic, physical, and social needs and desires of the citizens of Concord. Appropriate uses of open space have been identified as recreation, public service and safety, resource production, and environmental protection while providing the maximum and multi-purpose use of open space by the citizens of Concord. Open space in Concord is intended to be a system, interconnected and interrelated, and therefore, the links among major open space areas, as well as between the open areas and developed areas, must be defined

The Conservation and Open Space Use Section consists of a review of existing protected lands with a focus on additions to the protected land inventory that have occurred since the last Master Plan was adopted in December 1993. Conservation and open space goals are articulated, and applied to and interpreted upon the landscape of the City, and as displayed on maps that indicate how land in Concord should be preserved and protected. Policies and recommendations to guide the implementation of the Future Open Space Plan complete this Section of the Master Plan.

B. CONSERVATION AND OPEN SPACE GOALS

When the City Council established the Conservation Commission in 1971, it set forth for the Commission the goal of "protecting, promoting and developing the natural resources...and for protecting the watershed resource of the City" and mandated the Conservation Commission, in conjunction with the City Planning Board, to prepare "a conservation and open space plan" as the major objective in achieving this goal, noting that the plan shall be based "on the concept of multiple use of natural resources and open space".

Specific conservation and open space goals are as follows:

1. To develop a coherent interconnected system of permanently protected open spaces designed to provide areas for recreation, public service and safety, resource production, and to protect sensitive environmental features.

2. To foster the wise and proper development and management of the City's land and water resources so as to ensure sustainable productive use of the same, while avoiding environmental degradation, personal injury, and property damage.

3. To maximize the multiple use of open space to the extent that such use does not adversely affect the primary function of the open space.

4. To maximize the opportunities for the citizens of Concord to have access to public open space through linkages between the City's villages and neighborhoods and the open space system.

5. To protect and enhance surface and ground water quality, and maximize the potential for the use of these water resources as potable water supplies.

6. To protect and enhance the air quality of the region.

7. To preserve prime and significant agricultural soils for agricultural uses, and to encourage the retention and diversification of agricultural uses within the city.

8. To encourage the use of best management practices of forest resources on both public and private land within the City in order to maintain a continuing, sustainable timber harvest from the same, and to encourage multiple use of this forest resource.

9. To retain habitat for the City's indigenous species of wildlife, including migratory species and those species that have been identified as endangered, to provide adequate area that will foster the perpetuation of these species, and allow for their movement through and within the City.

10. To protect and maintain exemplary natural communities and rare plant species that have been identified within the City.

11. To maintain and enhance scenic views and natural vistas from the City's roads and public properties where possible.

12. To preserve open space within the Urban Growth Boundary (UGB) to protect environmentally sensitive natural features, to provide non-structured recreational opportunities, and to serve as amenity features within neighborhoods.

C. THE CITY'S NATURAL RESOURCES

1. Water Resources

Much of Concord's land and its use are influenced by the City's extensive water resources. Concord is located in the watershed of the Merrimack River, and the City's other major rivers, the Contoocook, Soucook, and Turkey Rivers), are all tributaries of the Merrimack. There are 14 Great Ponds (10 acres or more in size) within the City as well as several smaller private ponds and many brooks and streams.

In the citywide rezoning of 2001, a Shoreland Protection (SP) District was adopted, supplanting the former Streambank and Shoreline (SS) District, paralleling and expanding upon the protections offered in the NH Comprehensive Shoreland Protection Act (RSA 483-B). The SP District, which was recommended in the 1993 Open Space Plan, encumbers the area within 250 feet of the shoreline of the rivers and Great Ponds, and establishes two buffer zones with differing levels of permitted activities and including restrictions on the removal of trees and shrubs. The entire SP District has a list of prohibited land uses that apply therein.

Penacook Lake is the City's primary source of potable water, although it is augmented by water pumped from the Contoocook River. A Penacook Lake Watershed Protection District was created by the City Council in the 2001 rezoning of the City which increased the minimum lot size to 4 acres and imposed restrictions on certain land uses that were deemed to represent a hazard to the water quality.

2. Wetlands

In addition to extensive surface waters, the City has substantial areas of wetlands. A wetland delineation performed for this Master Plan by means of aerial photography interpretation (ref. Exhibit VII-1) indicates there are 6,678 acres of wetlands, slightly less than the wetland acreage identified from soil mapping for the 1993 Master Plan. This methodology provided accuracy to the nearest half acre so that there is additional wetland acreage unaccounted for in terms of small pockets of wetlands.

The citywide rezoning of 2001 added provisions for buffers to wetlands, supplanting the prior Wetland Overlay District which was based on soils mapping. The Ordinance requires a Conditional Use Permit to alter the buffer area within 50 feet of wetlands that are over 3.000 square feet in area.

3. Floodplains

The City has a long documented history of floods with substantial acreages subject to flooding, primarily in relation to the Merrimack River which meanders from north to south through on broad floodplain that runs through the center of the City. The floodway and floodplain of the Merrimack were mapped by U.S. Army Corps of Engineers (USACOE) in 1966, while similar features were mapped for the Contoocook, Soucook, and Turkey Rivers by the U.S. Department of Housing and Urban Development (HUD) in 1980, and the Federal Emergency Management Agency (FEMA) in 1999.

In the mid-1970's prior to the advent of the National Flood Insurance Program, Concord adopted floodplain regulations for the Merrimack River using mapping and guidelines prepared for the City by the USACOE. Subsequently, the HUD maps and then the FEMA maps were adopted for other areas of the City, but the City continues to use the USACOE maps for the Merrimack as they proved to be more detailed and conservative than subsequent mapping prepared under the National Flood Insurance Program. The current Flood Hazard (FH) District as established in the Zoning Ordinance protects health, safety and property by prohibiting residential uses and permitting structural uses in those areas developed prior to the adoption of the District. Limiting further development in areas subject to flooding insures against increased property damage and increased public expenditures to deal with flood-related problems.

The extensive flooding in the spring of 2007 caused substantial damage in the Turkey River basin. Because major portions of the Turkey River Watershed are located in the Towns of Hopkinton and Bow, the City will need to work with both Towns to ensure coordinated actions to protect the watershed resources and to address the impacts of flooding which have been exacerbated by upstream development.

4. Groundwater/Aquifers

The maps of stratified drift formations in Concord as prepared by the U.S. Geological Survey in 1995 and 1997, reveal that aquifers underlie vast areas of Concord, surrounding and following the City's major rivers including the Merrimack, Contoocook, Soucook, and Turkey Rivers. The City's own recent water supply studies have corroborated this and identified those areas where the City could develop the groundwater as a source for its municipal water supply.

A new regulatory measure is needed in Concord's Zoning Ordinance for an aquifer protection in order to preserve options for use of groundwater for both public and private water supplies.

5. Steep Slopes

With regard to the soils and surficial geology of the City, Concord has areas of steep terrain, underlain by both rock as well as sand and gravel. While each type of resource has historically been quarried or excavated for marketable materials including granite, sand and gravel, these formations also constrain land development due to accessibility, and erodibility. Though use of soil maps, the 1993 Master Plan identified 6,767 acres of slopes in excess of 15% in the City. The steep sandy bluffs that line the Merrimack and Soucook Rivers are particularly unique and fragile examples of one type of formation, while Rattlesnake Hill that rises above West Concord continues to be a source of granite.

Another new provision of the citywide rezoning of 2001 is a setback to the top and bottom of the erodible bluffs that rise above floodplains, which limit activities on or adjacent to erodible steep slopes, ensuring that landowners do not inadvertently cause erosion.

While in effect citywide, of particular relevance to the Soucook corridor are the City's earth material removal regulations, which were updated in the 2001 rezoning, and saw their first application to an excavation site on Route 106 adjacent to the River in 2002. These regulations provide reclamation procedures and standards for closure of pits that have been depleted.

6. Prime Agricultural Soils

Another soil-based resource in Concord is prime agricultural soils, located along the Merrimack River floodplain, in the Turkey River watershed, and in upland locations in East and West Concord. These soils support an active agricultural industry ranging from dairy farming to orchards.

While there are no specific local regulatory provisions relating to the protection of these soils, other regulations, such as those related to floodplains, help in the preservation of these lands. In a more direct effort to protect areas of these soils, the City has acquired farmlands or easements on these lands for open space purposes, with leasehold arrangements with local farmers in order to maintain the productivity of the agricultural soils.

7. Productive Forest Lands

Concord has an extensive inventory of productive forest lands, some of which were once owned and managed by lumber companies. Privately owned and managed woodlots are found throughout the City, and the City has a Town Forestry program under which all municipal lands, conservation or otherwise, are managed with revenues from periodic timber sales. There are eight State Forests in Concord which are managed by the Forest and Lands Division of the NH Department of Resources and Economic Development.

There are no specific local regulatory provisions relating to the protection of these productive forest lands. As new land is added to the open space inventory, the City evaluates the forest resource and as appropriate, adds the property to the forest management plan.

8. Wildlife Habitat

Concord is fortunate to have substantial undeveloped areas of forest, field, and wetlands with ample adjoining water resources, all of which create excellent wildlife habitat. Broken Ground, and the area between West Parish Road and Currier Road along the Hopkinton townline are both examples of unfragmented habitat.

Exhibit VII-1. Wetlands

Insert 11 x 17 graphic

In terms of endangered species, the Karner Blue butterfly has been identified by both the federal and State governments, endangered, two other butterflies, the Frosted Elfin and Persius Duskywing Skipper butterfly were identified by the State. The habitat for these butterflies is the pine barrens found on parts of Concord Heights on the easterly side of the Concord Airport. Some of the airport is subject to a Conservation Management Agreement with the US Fish and Wildlife Service and the NH Fish and Game Department to protect the butterfly habitat.

There are no specific local regulatory provisions relating to the protection of wildlife habitat. As additional open space lands are considered for acquisition, the City should evaluate the wildlife habitat characteristics among other factors.

D. THE OPEN SPACE PLAN

This description of the planned open space system specifies the elements of the system by natural and geographic sub-areas of the City, primarily outside of the Urban Growth Boundary. Those properties already protected as well as lands proposed for protection are identified in terms of ownership for each geographic sub-area. Exhibit VII-2 depicts Concord's Future Open Space Plan with existing open space depicted along with the proposed future open land, differentiated by means of existing and proposed protection.

1. The Merrimack River Corridor

a. Description

The Merrimack River corridor includes the river itself as well as the broad expanses of floodplains and the erodible, sandy bluffs surround it in certain areas, from the Canterbury and Boscawen town lines on the north to the Bow town line on the south. The oxbow ponds left from former river channels are part of the Corridor including at the Old River Channel in West Concord, Horseshoe Pond, Fort Eddy Pond and the Sugar Ball.

Fishing, boating, canoeing, and kayaking have all increased on the River with the improved water quality. The United States Fish and Wildlife Service is working to re-establish the anadromous fishery through its Atlantic Salmon and Shad Restoration Program. The Merrimack River corridor is also part of the Atlantic Flyway, the eastern corridor for migratory birds, and it also provides habitat for numerous species of resident wildlife. Agriculture continues to be one of the major open space uses of privately owned land in the Merrimack floodplains in Concord.

The New Hampshire Heritage Trail has been initiated under RSA 216-A:7 and a portion of the planned 230-mile north-south trail system will be in the Merrimack River Corridor from Nashua to Franklin for hikers and snowshoers, and in some areas, for bicyclists and cross country skiers. A section of the Heritage Trail has been established starting at the north end of North Main Street running easterly along the edge of Horseshoe Pond to through the NH Technical Institute, then turning northerly to East Concord Village, Locke Road and West Portsmouth Street.

b. Protected Open Space

For many years, the City has owned park lands in the Merrimack River Corridor which represent protected lands, although much has been altered to create recreational facilities. These parks include Kiwanis Park/Everett Arena, Beaver Meadow Golf Course, as well as Reed Playground, Merrill Park, Terrill Park, Healey Park, and a portion of Rolfe Park. Prior to the adoption of the

first Open Space Plan in 1978, the City's non-park open space lands in the corridor consisted of the South End Marsh and a nine-acre wetland abutting the north side of the upper pond at Goodwin's Point.

Since that time, the City has preserved a significant amount of open space in the corridor. In December of 1978, the City was gifted a 50 acre wetland westerly of Locke Road as part of the development of the adjacent industrial park. In 1987, as part of the dedicated open space of a Planned Unit Development on Second Street, the City was deeded the 47-acre Morono Park on the west side of the Old West Concord River Channel south of Sewalls Falls. In 1989, the City acquired the 14-acre Wendell Knight property which links Morono Park with the State Prison Farm holdings to the south, and includes part of Rattlesnake Brook. On the east shore of the River, the City, in 2005, acquired the 145-acre Gold Star Sod Farm property west of Locke Road, and the 200-acre West Portsmouth Street farmland immediately south of the Gold Star land. In 2007, the City received a donation of 48 acres together with a conservation easement on an additional 17 acres on the south shore of Goodwin's Point Lower Pond including the adjacent bluff, from the Oxbow Bluff cluster development. Also in 2007, the City purchased agricultural lands that belonged to Green Gold Farm north of Terrill Park.

The New Hampshire Fish and Game Department manages the State land along the west bank at Sewalls Falls for recreational purposes, and this property is the only State land in the corridor which is formally protected for open space purposes. The State owns four of the five public boat ramps and launch areas on the Merrimack (one off West Portsmouth Street, one at the Technical Institute and two at Sewalls Falls).

Privately held open spaces include the bluffs and floodplains surrounding the headquarters of the Society for Protection of NH Forests on Portsmouth Street which are privately protected by that organization as is the island at Horseshoe Pond. The Five Rivers Conservation Trust holds a conservation easement on the 14-acre Foss parcel adjacent to Rolfe Park.

c. Priorities for Open Space Protection

- The land belonging to Unitil (formerly the Concord Electric Company) below the Sewalls Falls Dam on the east bank of the River, is the focus of an on-going property transaction with the City that will extend protection to the tract abutting the Gold Star Sod Farm to the north.

- A portion of the Public Service of NH (PSNH) holdings on Garvins Falls Road is proposed to be protected, including land in the floodplains of the Merrimack as well as the adjacent erodible bluffs. Conservation easements should embrace environmental protection as well as trail access along the Merrimack floodplain.

- If the NH Department of Corrections abandons its interest in the NH State Prison's agricultural lands on the west shoreline, the City should seek to preserve this land for agricultural use and passive public recreational purposes. The City's recent water supply studies also identified this area as a potential source for a public water supply from the groundwater resource adjacent to the River, providing another reason for this land to be permanently protected.

- Easements or the purchase of development rights are proposed for current agricultural lands in the floodplain that are not otherwise protected so those currently farming may continue, and so the prime agricultural soils remain available for future agricultural use.

Exhibit VII-2, Future Open Space Plan

[Insert 11 x 17 graphic]

- Some additional easements or purchases of land are proposed to augment available public lands to foster the expansion of the Heritage Trail in order to reach its northerly and southerly termini at the City limits.

- Additional boat ramps and/or canoe launch areas should be acquired, one in the northern reach of the River closer to the Contoocook, and one in the southerly reach of the River, below the current boat ramp at Kiwanis Park.

- Conservation easements may be needed to augment regulatory protection of wetlands in the valley and the bluffs that surround it.

- In addition to the acquisition of land and easements by the City, the City should seek the participation and assistance of other public or private organizations in acquiring land and easements in the Merrimack corridor to maximize the amount of protected open space in the corridor.

2. The Contoocook River Corridor

a. Description

Entering from Hopkinton and flowing easterly to its confluence with the Merrimack River in Penacook, the Contoocook River occupies a much narrower corridor than the Merrimack. Several floodprone shelves border the River, but much of the surrounding land is rather steep, stony embankments. Upstream of the Island are many dwellings that were constructed as seasonal camps, the presence of which was fostered by the Edward York Dam which sustains a ponded water level in that section of the river allowing for swimming, boating, canoeing, and kayaking. One boat ramp on the Island provides access to the River for non-residents as well as residents. Located below the York Dam are three separate hydroelectric facilities constructed in the 1980's.

The entirety of the Contoocook River is included in the NH Rivers Management and Protection Program (RSA 483), and a Local Advisory Committee, composed of representatives of the communities along the River including the City, has prepared management recommendations for land adjacent to the River.

There are some prime farmland soils along the Contoocook's floodplain but little agricultural use. Some timber is cut in or adjacent to the corridor, including active forest management of City and State forests.

b. Protected Open Space

The City has protected a substantial amount of open space in the corridor having acquired, in the 1970's, extensive acreage surrounding the Mast Yard State Forest on both sides of the River just east of the municipal boundary with Hopkinton. This land is held for future recreational purposes and was named Lehtinen Park in honor of the City's first city planner. In 1993, Eunice Clark donated to the City 15 acres of floodplain and wetland off of Broad Cove Drive on the River opposite Lehtinen Park. Further downstream, the City reassembled most of the once-renowned Contoocook River Park on The Island in Penacook. To complement the Contoocook River Park, a 50-acre parcel directly across the River was acquired from B & M in 2006 to preserve the gorge below the Edward York Dam. The Hardy family donated 16 acres of

land south of Elm Street to the City in 2002. The City also owns several sections of the abandoned Concord to Claremont railroad right-of-way for future trail purposes.

The sole state owned parcel in the corridor is the Mast Yard State Forest which straddles the Concord/Hopkinton boundary.

The Five Rivers Conservation Trust holds an easement on the Clark property that was acquired by the City

c. Priorities for Open Space Protection

- Another boat ramp should be provided, the best location for which appears to be just upstream of Lehtinen Park next to the power lines. The New Hampshire Fish and Game Department's program for access to public waters should be approached to assist in acquiring the land and constructing the ramp and parking area.

- Acquisition is proposed for parcels for future trails, including acquisition of additional sections of the abandoned Concord to Claremont Railroad right-of-way.

- Acquisition is proposed for land abutting Lehtinen Park as such may come available.

3. The Soucook River Corridor

a. Description

Flowing southwesterly from Loudon easterly of Route 106 to its confluence with the Merrimack at the tri-town boundary of Concord, Pembroke, and Bow, the Soucook River, which is the eastern border of the City, occupies a very narrow and meandering corridor. Small stretches of floodplain are interspersed with and lined by steep sandy bluffs.

The Soucook River water is of high quality. Public water supply wells for both Concord and Pembroke are located next to the River in Pembroke and draw water of excellent quality from a high yield aquifer.

There are relatively few areas of public and private development within the immediate river corridor. However, there is extensive commercial and industrial development atop the bluffs above the corridor along Route 106 and Route 3 in both Concord and Pembroke. There are several sand and gravel pits located in both Concord and Pembroke adjacent to the River.

b. Protected Open Space

The City of Concord owns a majority of the Soucook River frontage between Routes 106 and 3 as a buffer area for the municipal airport, and while this land is not truly held for conservation purposes, it cannot be developed or sold. A 10-acre conservation easement was obtained in 1996 on the bluffs and floodplains below Sam's Club retail site, and another was 3.5 acre easement obtained in 2003 along the shoreline of a private excavation site just upstream of the Route 106 bridge to Pembroke.

The State of New Hampshire owns the Taylor State Forest between Route 106 and the Soucook north of I-393, as well as a wetland mitigation site just south of I-393.

There are no lands that are privately conserved within the Soucook River corridor.

c. Priorities for Open Space Protection

- Conservation easements are proposed for the PSNH and KeySpan lands in the floodplains of the Soucook River as well as the adjacent erodible bluffs.

- Shoreline protective easements should be obtained on property occupied by the State's Fire Academy and Emergency Management facilities easterly of the Route 106.

- Easements or the purchase of development rights are proposed to conserve a portion of a dairy farm that lies at the edge of Broken Ground near the Loudon townline.

- The Soucook River bluffs and floodplains should be protected with easements wherever possible along the corridor.

4. Broken Ground

a. Description

Mentioned in both the Bouton and Lyford histories of Concord, Broken Ground is considered to occupy about five square miles bounded on the north by Oak Hill, on the east by the Loudon town line, on the south by Route I-393, and on the west by the PSNH transmission line. Bouton described it as "a tract of hardwood and pine, of gravelly soils and not very productive". Lyford gives a hint of the historical uses of Broken Ground when he terms it "a locality best known to woodmen and hunters". Modern soil surveys reveal rugged terrain -- rocky, gravelly soils with steep slopes surrounding pockets of wetlands. Substantial wetland areas, the largest of which abuts Turtle Pond, together with the rugged terrain, renders Broken Ground unsuited to development.

In the Broken Ground are headwaters of streams that flow into two watersheds. Water from Turtle Pond flows southerly over the dam through Mill Brook which then turns westerly on its way to East Concord Village and the Merrimack. Easterly of a topographic divide, Cemetery Brook and another unnamed stream flow southeasterly to the Soucook River.

While most areas of the City that are now forested were once cleared for farming, the Broken Ground was not. Except for the land along Josiah Bartlett Road which was and continues to be farmed, timber production has been the most important land use; hunting, hiking, cross country skiing and snowmobiling on power line right-of-ways and logging roads have also been popular.

b. Protected Open Space

The City has acquired land as well as easements within the Broken Ground in the wetland areas both east and west of Turtle Pond as well as a parcel at the end of Curtisville Road. The City has also acquired land for an east side school and park complex adjacent to Broken Ground School, which creates a natural entrance to the area. Two contiguous parcels were acquired by the City between Portsmouth Street and Curtisville Road along the PSNH transmission line that runs just easterly of the edge of the neighborhood on Portsmouth Street. A property exchange is pending with Unitil such that Unitil may acquire these two lots subject to a conservation easement to the City. The 29-acre common open space in the Welcome Subdivision on Josiah Bartlett Road was deeded to the City in 2004 along with some related conservation easements.

The City's water storage tank is located on land that stretches easterly along I-393 from the overpass of Portsmouth Street, and this land is restricted to uses solely related to the City's water system.

The NH Fish and Game Department has acquired land within the Broken Ground in the wetlands east of Turtle Pond and also owns the boat ramp off Oak Hill Road which provides public access to the Pond.

The Five Rivers Conservation Trust holds an easement on the Lang properties on both sides of Josiah Bartlett Road.

c. Priorities for Open Space Protection

- The City should seek to acquire from NHDOT two parcels that were retained by the State as part of the of the I-393 right-of-way acquisition.

- Public acquisition is recommended for most of Broken Ground in recognition of its diverse environment, its value as a large unfragmented habitat for a wide range of wildlife, as well as the range of recreational uses it offers to the public.

- The acquisition of easements or the purchase of development rights are proposed for the large dairy farm at the very easterly edge of Broken Ground so that those currently farming may continue to do so, and that the farm remains available for future agricultural use.

5. Oak Hill - Snow Pond - Hot Hole Pond

a. Description

Oak Hill rises northerly of Broken Ground between Shaker Road and Oak Hill Roads. The fire tower at its peak just across the town line in Loudon commands a panoramic view of Concord and much of Merrimack County. Hot Hole Pond, which offers freshwater swimming and cold water fishing, lies at the northerly foot of the hill, straddling the Loudon town line. Snow Pond is just westerly of Oak Hill, across Shaker Road, and is surrounded by large wetland areas with the one to the south reputed to having been a peat bog.

b. Protected Open Space

The City's first Open Space Plan identified Oak Hill as an important area to protect and over the past 30 years the City has been acquiring parcels, managing the timber, and developing and maintaining trails thereon. A small trailhead parking lot has been developed on the Shaker Road frontage of the City holdings and access has been acquired on the Oak Hill Road side.

A trail easement was donated in 2005 as part of Phase II of the Juniper Fells Subdivision providing access from Shaker Road linking the Oak Hill trailhead to Snow Pond Road via Becky Lane.

In 1989, the City acquired some of the wetlands north of Snow Pond with frontage on Snow Pond Road using matching funds from the Land Conservation Investment Program (LCIP).

The boat ramp and adjacent parking area maintained by NH Fish and Game at Hot Hole Pond are the only State-owned, protected properties in the area.

c. Priorities for Open Space Protection

- The rest of the ridge of Oak Hill as well as several access points are proposed for public acquisition to capitalize on scenic, environmental, and recreational potentials. Conservation easements are proposed for the slopes so that the scenic and natural environment of the peak will not be compromised by some ill-conceived utilization of these slopes

- One parcel is designated for acquisition to provide additional public access on Hot Hole Pond.

- The remaining wetlands surrounding Snow Pond are proposed for public easements for environmental protection.

6. Northern East Concord and the Hoit Road Marsh

a. Description

Northern East Concord includes the area easterly of Sanborn Road and northerly of Snow Pond Road to the City borders with Loudon and Canterbury. The Hoit Road Marsh is adjacent to the tri-town boundary of Concord, Loudon, and Canterbury and drains under Hoit Road into Hackett Brook which then becomes Hayward Brook near the Canterbury line. Snow Pond outlet drains northeasterly and into Hayward Brook before the latter reaches the Merrimack. Agricultural activity includes pastureland and hay fields as well as an orchard on the Canterbury line.

b. Protected Open Space

In 1992, Paul Riley bequeathed approximately 66 acres to the City abutting Fish and Game's holdings at the marsh. The City and State are managing this area cooperatively. By gift of Lester Spear in 1999, the City received the 70-acre Spear Park off of Sanborn Road for which is the forest resource is managed and public recreational use is permitted including hiking, cross-country skiing, and snowshoeing. A 34-acre tax title parcel on Tallant Road was retained in 1995 and three parcels have been donated as part of subdivisions over the past three years as follows: 29 acres off of Graham Road as part of Juniper Fells Phase I, 14 acres at the intersection of Snow Pond and Shaker Roads as part of Juniper Fells Phase IV, and 51 acres adjacent to Spear Park as part of the Reserve at Stonehaven cluster development. In that same timeframe, a trail easement over the former Snaptown Road was donated as part of Juniper Fells Phase I, a conservation easement of 4.9 acres was donated as part of Juniper Fells Phase IV, and a 16.5-acre conservation easement was donated as part of the Emerald Abode Subdivision at the southwesterly corner of Hoit and Graham Roads together with a trail easement leading west from Graham Road.

The New Hampshire Fish and Game Department acquired the Hoit Road Marsh as a waterfowl management area, open for fishing, hunting, and trapping. The State also holds the development rights on the former Blood Farm on Mountain Road.

The Five Rivers Conservation Trust holds an easement on the Bois de Brodeur Trust land on Hoit Road just west of Tallant Road, and the Society for the Protection of NH Forests has an easement on the Richards Community Forest easterly of Sanborn which is adjacent to Spear Park.

c. Priorities for Open Space Protection

- The acquisition of a parcel is proposed to complete the connection between the trail easement over the former Snaptown Road with the trails on the Riley parcel and the Hoit Road Marsh.

7. The Horse Hill Area

a. Description of the Area

Horse Hill rises in the far northwest corner of the City, above the historic Mast Yard and Contoocook River corridor. The rocky, steep area runs from the Boscawen town line to Horse Hill Road and Blackwater Road. Also included for purposes of this plan is the area easterly to Weir Road and Elm Street as well as land to the west of Horse Hill enclosed by Blackwater and Warner Roads and the City limits. Little Pond, one of two water bodies bearing that name in the City, straddles the townline with Boscawen on the north side of Horse Hill. While much of this area is comprised of forests, there are wetlands, particularly west of Blackwater Road, and pastures from former farming activities. Some timber is cut from these lands, and there is evidence of recreational activities such as hunting, cross-country skiing, and snowmobiling.

b. Protected Open Space

In 1991, the City acquired approximately 56 acres east of Weir Road on the Boscawen town line. This parcel abuts a portion of Boscawen's Town Forest, which in turn abuts NH Fish and Game Department's Hirst Marsh also located in Boscawen. The City, the Town of Boscawen and Fish and Game are cooperating in the management of the more than 600 acres of conservation land.

A 46.5-acre parcel on the westerly slope of Horse Hill was acquired by the City in 1996, a conservation easement was acquired in 1996 west of Blackwater Road at the Webster townline, and another conservation easement was acquired in 2006 on 22 acres on the north side of Warner Road.

Allen State Forest is the sole State-owned parcel in this area, located westerly of Blackwater Road. As part of an adjacent land subdivision in 2006, the State received a 5 acre donation connecting the Allen State Forest to Warner Road.

The Five Rivers Conservation Trust holds an easement on 21 acres on the easterly side of Horse Hill off of Weir Road, and on two properties that had belonged to the Hardy family located off of Elm Street.

c. Priorities for Open Space Protection

- The peak of Horse Hill is proposed for acquisition together with the shoreline of Little Pond and access to both from both Blackwater Road and Elm Street.

- Easements are proposed for the remainder of the slopes on the sides of Horse Hill in order to protect the physical and visual character of the hill, and to provide for increased recreational use.

8. The Great Bog

a. Description

Lying westerly of Fisherville Road and southerly of River Road, the Great Bog lent its name to Bog Road which was constructed across the southerly portion of the Great Bog as a “corduroy road”, made of row of logs laid side by side and covered with gravel. Bog Road was paralleled to the south by the Concord to Claremont railroad line, now abandoned, and a portion of the bog lies south of the old railbed, in a bowl-like form below the former Spofford Farm at the end of Ferrin Road. This large classic type of wetland remains relatively pristine, although residential development along Fisherville, Bog, and Borough Roads has pressed against its easterly edges, and a fringe of development lies along River Road. Although the Great Bog is primarily privately owned, the principal use of the area is for wildlife habitat.

b. Protected Open Space

The only publicly owned parcels belong to the City and include parts of the former Concord and Claremont Railroad right-of-way, used in part for the piping of Contoocook River water to Penacook Lake, and held in part for a future trail linking West Concord to the Mast Yard and Horse Hill. The agricultural lands on the Spofford Farm that lie adjacent to the Bog, southerly of the former railroad right-of-way, are protected by conservation easements. The common open space associated with the Primrose Subdivision south of Borough Road is the only private open space.

c. Priorities for Open Space Protection

- The missing links of public ownership in the former railroad right-of-way are proposed to be acquired for trail purposes.

- Conservation easements for environmental protection purposes are proposed to be obtained for the majority of this vast wetland.

9. The Penacook Lake Watershed and Environs

a. Description

Penacook Lake, the City's chief source of potable water, is the focus of a 3.7 square mile watershed area that includes portions of Jerry, Pine, and Rattlesnake Hills as well as Russell Pond. Underlain with granite, the steep, thickly forested hillsides descend into the clear, long lake which runs northeasterly from the intersection of Little Pond Road, Long Pond Road, and Lake View Drive to a point just south of Hutchins Street in West Concord. Included within this segment of the open space system is another water body that is also known as Little Pond which is located to the north and east of the intersection of Little Pond Road and Via Tranquilla. Wetlands surround Little Pond, in contrast to the steep, stony soils which predominate within the adjacent watershed. The protection of the City’s water supply is the pre-eminent purpose of public land protection in this small watershed, to the extent of exclusion of other potential uses.

b. Protected Open Space

The largest landowner within the watershed is the City of Concord. The City began acquiring the land around the lake some 40 years ago, and today owns the entire shoreline as well as varying amounts of acreage surrounding the immediate shoreline. The primary purpose of these acquisitions was and is to provide protection for the major source of the municipal water supply. The timber resource on the City’s watershed has been managed under the City's forest management program which also maintains a network of fire roads.

The Carter Hill Orchard is located along its northern boundary of the watershed on Carter Hill Road and was protected in 2001 by a conservation easement to the Five Rivers Conservation Trust for which the City holds an executory interest. The Five Rivers Conservation Trust also holds an easement on a parcel near the end of Via Tranquilla.

The State of New Hampshire owns several parcels at the westerly edge of the watershed. The Abbott State Forest and District #5 State Forest lie, respectively, north and south of District #5 Road. The State also owns property at the easterly edge of the watershed in the Rattlesnake Hill Area which it holds in relation to the NH State Prison on North State Street.

c. Priorities for Open Space Protection

- Easements are proposed for the wetlands surrounding Little Pond in order to protect its fragile ecosystem.

- Private parcels within the Penacook Lake watershed which become available should be considered for public acquisition for water resource protection.

- If the State ever abandons its interest in the NH Prison lands on Rattlesnake Hill, the City should take steps to acquire protective interests in these properties.

10. West Parish, District #5, and Dimond Hill

a. Description

This area embraces land westerly and southwesterly of the Penacook Lake Watershed to the Hopkinton townline, focusing primarily on the drainage area of Ash Brook which starts near District #5 Road and runs southerly past Currier Road to Hopkinton Road. Ash Brook has numerous associated wetland areas, of varying sizes as it meanders its way into Little Turkey Pond. Agricultural activity has been maintained at the Rossview Farm on District #5 Road and at the Dimond Hill Farm on Hopkinton Roads. Hikers and snowshoers, and in some places, bicyclists and cross country skiers use both formal and informal trails in this area which is also traversed by a snowmobile trail.

b. Protected Open Space

An easement on 21 acres on the Hopkinton townline north of Currier Road was acquired by the City in 1992. In 2001, the City acquired the 68-acre Thirteen Hills property, northerly of Currier Road and abutting the District #5 State Forest. In 2002, a trail easement over the southerly end of the Old Dimond Road was granted to the City as part of the Abbott Hill Subdivision, and a conservation easement was provided to the City along Ash Brook as it flows through the Shenandoah Subdivision. In 2006, the City purchased an executory interest in a conservation easement on the 108-acre Dimond Hill Farm with the Five Rivers Trust holding the easement, and in 2007, a similar interest in the 545-acre Rossview Farm was purchased by the City, with the New Hampshire Department of Resources and Economic Development holding the easement.

District #5 State Forest is the sole State-owned parcel which lies at the easterly edge of this area.

The Five Rivers Conservation Trust holds an easement on the Dimond Hill Farm, while the Society for the Protection of NH Forests has an easement on the 61.5-acre Hale parcel at the end of Chestnut Pasture Road.

c. Priorities for Open Space Protection

- Acquisition of land as well as easements is proposed to protect the unfragmented habitat and to provide trail connections from the Rossview Farm northerly to West Parish Road, from the Rossview Farm southerly to Currier Road along Ash Brook, as well as southerly from the Dimond Hill Farm to I-89, west of Little Turkey Pond.

- Protection should be legally formalized for the institutional lands of St. Paul's School including Jerry Hill as well as land on both sides of Long Pond Road at the intersection of Hopkinton Road, together with the trails thereon.

11. The Turkey Ponds and Turkey River Area

a. Description

The Turkey Ponds and Turkey River occupy a large area in the southwestern quadrant of Concord. Starting at the Bow town line, Bela Brook enters Concord and flows easterly under Hooksett Turnpike, while further east, White and Turee Brooks flow north into Concord toward Clinton Street. All three of these brooks drain into Great Turkey Pond, which in turn drains northerly through a dredged channel under I-89 into Little Turkey Pond. The St. Paul's School pond is the next link in the circuitous waterway system that ultimately finds its way southeasterly via the Turkey River back into Bow and its confluence with the Merrimack River. The dominant feature of this sector of the City is its flat, wetland character. Some agricultural uses remain along Stickney Hill Road and Silk Farm Road. In addition to recreational uses associated with the surface waters and the trails in the area, wildlife habitat is the predominant use of the open space.

b. Protected Open Space

The City itself is a major landowner south of Clinton Street. The City acquired properties along Bela, White, and Turee Brooks through tax title deeds and has held them, originally for an ambitious plan to create a "Concord Lake". While that plan has since been relegated to a historic novelty, the land is extremely valuable wetland and wildlife habitat. A donation of 90.8 acres from the Bela Brook cluster development was made to the City in 2004.

A portion of the White Farm on Clinton Street abutting the Turkey River was acquired from the State by the Concord School District for purposes of environmental education.

The State owns major parcels to the northeast of I-89 along the Turkey River. These include the Cilley, Russell-Shea, Upton-Morgan, and West Iron Works Road State Forests as well as the former New Hampshire Hospital farmlands northerly of Clinton Street which are used as part of substantial trail network between Memorial Field and the Turkey River.

The Audubon Society of New Hampshire maintains its headquarters on Silk Farm Road with a trail system on its premises as well as on adjacent property of St. Paul's School.

c. Priorities for Open Space Protection

- Additional easements are proposed to complete protection of the river, streams, floodplains, and wetlands within this area, as well as to protect the remaining farmlands on Stickney Hill.

- Acquisition is proposed for a parking area on the south side of Clinton Street now used for public access to the Turkey Ponds.

- Acquisition of the parcel between Memorial Field and State land is proposed to link these two public properties for trail and access purposes.

- Should the State abandon its interest in the lands west of Memorial Field, these tracts should be preserved by the City for agricultural use and passive public recreational purposes.

- Conservation easements should be sought on the entire shoreline around the Turkey Ponds as well as on the associated wetlands, all of which are in the institutional ownership of St. Paul's School, in order to formalize the protection of these valuable environmental resources and to preserve the flood storage capacity.

12. Fisk Hill

a. Description

Fisk Hill rises above Pleasant Street westerly of Concord Hospital and includes the land area westerly of Fisk Road and northerly toward Little Pond Road where the watershed of Penacook Lake begins to carry runoff to the north. Within this area lie the headwaters of Bow Brook and Miller's Brook together with some related wetlands, as well as the fields and pastures along Fisk Road which create a classic pastoral landscape. Some residential development has occurred in this area, and agricultural activity is limited to haying of the fields. There are both formal and informal recreational trails, primarily east of Fisk Road, used for hiking, snowshoeing, and cross country skiing. A rope-tow ski facility was once maintained by St. Paul's School from Pleasant Street to the height of land east of Fisk Road.

b. Protected Open Space

As part of the mitigation for the Northwest Bypass (Langley Parkway), the City acquired a 25-acre conservation easement in 1994 on the large wetland area north of Concord Hospital abutting Bow Brook. A conservation easement on the 47.8-acre common open space in the Walkers Reserve cluster development was given to the City in 2002, expanding the trails system from the adjacent Walker State Forest. In 2003, the City purchased 28 acres south of the Walker State Forest with the assistance of funds raised by supportive citizens.

Walker State Forest off of Little Pond Road is the only parcel of protected open space that is in State ownership. A trail network is maintained within the Forest.

The Five Rivers Conservation Trust holds an easement on the 28 acres the City acquired south of the Walker State Forest. The fields and forests of the Fisk Hill Farm subdivision are protected by private easements among the lot owners that bind those owners to maintaining the fields as such and not allowing their reversion to forest.

c. Priorities for Open Space Protection

- Acquisition by the City of the land between the protected wetland behind Concord Hospital westerly and northerly to the permanent open spaces surrounding Walker State Forest is proposed for both environmental protection purposes as well as for the expansion of existing trail systems.

- Protection of the institutional lands of St. Paul's School and the Unitarian Church and the public access to the trails thereon should be legally formalized.

13. Open Space inside the Urban Growth Boundary

a. Description

There are some open space lands inside the Urban Growth Boundary, and while these lands provide open space on a smaller scale, they are far more intensively used by the public due to proximity to residential development and places of employment. These parcels are mostly in public ownership and require little further action for preservation and protection.

b. Protected Open Space

The City's major parks all function as open space within or immediately adjacent to the Urban Growth Boundary, including White Park, Rollins Park, Martin Park, Memorial Field, Kimball Park, Garrison Park, Morono Park, Contoocook River Park, Rolfe Park, Merrill Park, Keach Park, Kiwanis Park, Terrill Park, and Healey Park, as well as Beaver Meadow Golf Course. The future park/school site adjacent to Broken Ground School will be added to this inventory as the park is formalized, and other recreation sites may be acquired and developed as parks to serve as urban open space for developing areas of the City.

The South End Marsh has long been held by the City as an urban open space. The City's cemeteries also function as formal, landscaped open spaces that provide open space both visually, and functionally, for walking within these special spaces.

Some subdivisions and all cluster developments within the Urban Growth Boundary have protected open spaces, some of which is held in condominium ownership as common land, some of which has been deeded as proportionate undivided interests among all of the owners, and some of which has had conservation easements conveyed to the City as a means of protection. These subdivisions and developments include the Primrose Subdivision, West Village, Millstream Estates, Brookwood, Freedom Acres, Haywood Brook, Bly Farm, Cardinal Builders Subdivision, and Woodcrest Heights.

c. Priorities for Open Space Protection

- The acquisition of easements around the South End Marsh is proposed to provide a buffer for the Marsh.

- While some specific recommendations for access to public waters are included in this plan, expanded public use of surface waters may result in the need for additional access points for purposes of recreation and safety.

14. Linkages and Connections

a. Description

Open space becomes a system when its components are linked together, and the system becomes more viable and useful to the citizens of Concord when these linked components are connected to and accessible from the villages and neighborhoods where the citizens reside. The linkage devices may include utility rights-of-way, railroad rights-of-way, and streambanks, but where no rights-of-way or streams exist, linkages will need to be acquired as corridors between open space parcels. Rights-of-way are generally traversable, being fairly free of substantial growth and having either relatively flat or at least passable terrain; however, streambanks vary in grade and are sometimes surrounded by wetlands, requiring culverts and small bridges make them valuable and viable as linkages and connections. A connected open space system will provide recreational opportunities for hiking, cross-country skiing, snowmobiling, horseback riding, bicycling and the like.

Trails and connections used by the public may also serve as wildlife corridors, linking large areas of unfragmented habitat as well as providing access for wildlife to sources of water. However, there may be need to acquire corridors for wildlife where the trail systems do not otherwise serve that need.

b. Existing Trails

Over the past thirty years, the Conservation Commission has developed trails on most of the City's public open spaces except where public access is prohibited, such as around Penacook Lake. Trail maps are available to the public (ref. Exhibit VII-3), and with the advent of computerized mapping, these maps have become available on the City's website. Informational kiosks have been constructed at many of these areas stocked with maps, and several sites have trailhead parking lots. Public trails are also available on the State land at Sewalls Falls, at the Forest Society's headquarters, and at the Audubon Society's headquarters.

c. Proposed Linkages and Connections for Public Access

While trails exist on many open space sites, only a few are connected to each other, such as Sewalls Falls, Morono Park, and Beaver Meadow Golf Course with cross country skiing trails. What is proposed to be accomplished herein is a more universal linkage among these large open space areas with their internal trail systems, and the provision of connections to these open space areas and trails from the neighborhoods and villages inside the Urban Growth Boundary. The following is a description of these linkages and connections throughout the City:

i. West Concord Village/Concord Manor to Riverhill/Board Cove/Mast Yard: The City owns or holds easements on sections of the abandoned Concord to Claremont railroad right-of-way from North State Street to the Contoocook River at the Riverhill Bridge. The missing links need to be acquired or easements obtained thereon in this stretch. There are also sections of the railroad right-of-way along Horse Hill Road that should be acquired which would connect from the O'Reilly-Fleetham Trail at Riverhill to the existing trail system in Lehtinen Park. A bridge over the Contoocook River using the old railroad bridge abutments has been proposed by local snowmobile clubs which will provide a connection to Mast Yard trails which lead into Hopkinton.

ii. Riverhill to Weir Road/Horse Hill/Boscawen Town Forest: For trail users arriving at Riverhill, a short trip up Horse Hill Road onto Elm Street and Weir Road leads to existing trails at the townline that continue into the Boscawen Town Forest and the Hirst Wildlife Management area. As land is acquired on Horse Hill, trails should be laid out on and over Horse Hill to Blackwater Road and Lehtinen Park.

Exhibit VII-3. Trail Map
Insert 8 ½ x 11

iii. West Concord Village to West Parish/District #5/Currier Roads and Dimond Hill: Running southerly from the proposed trail along the abandoned Concord to Claremont railroad right-of-way paralleling Bog Road, a trail connection should be established along the water line easements to West Parish Road. This would require the acquisition of trail easements in addition to the utility easement the City now holds. By continuing westerly on West Parish Road, a hiker could then enter the Carter Hill Orchard trail system, which is planned to be expanded westerly and southerly throughout Rossview Farm crossing District #5 Road. At the southerly end of the Rossview Farm, a trail needs to be laid out to continue southerly through the Thirteen Hills parcel and along an easement over the Old Dimond Road to Timberline Drive and Currier Road. Other connections from the Rossview Farm to Currier Road should be sought. Currier Road provides access to the northern edge of the Dimond Hill Farm which continues southerly across Hopkinton Road.

iv. Memorial Field through the White Farm to the Turkey River Watershed: The South End is connected to the Turkey River Watershed via trails leading westerly from Memorial Field through the White Farm under a license agreement between the Commission and NHDRED. The Concord School District land is also utilized in reaching the Turkey River just north of Clinton Street, which must be utilized to reach trails at the Audubon Headquarters as well as trails in the Upton-Morgan State Forest on Silk Farm Road, respectively north and south of Clinton Street. Further west off of Clinton Street is a new trail system in the Bela Brook cluster development. Opportunities should be explored to link with trails maintained by the Bow Conservation Commission in the Town of Bow.

v. Pleasant Street to Walker State Forest over Fisk Hill: Formal trails exist at both ends of this area, in Walker State Forest and on the land of the Unitarian Church. The informal network in between needs to be formally protected and upgraded, providing access from the West End to this open space area.

vi. The Heritage Trail along the Merrimack: The Heritage Trail is intended to follow the Merrimack River from Bow to Boscawen and Canterbury, providing access to the river from all of the neighborhoods and villages in Concord. Begun in 1990, some sections follow sidewalks along City streets, and some have been established over pre-existing trails such as the bicycle lane on the I-93 bridge connecting the NH Technical Institute with East Concord Village. All of the recently acquired properties on the Merrimack floodplain will be used to expand this trail system but there are missing pieces that will need to be acquired to connect from the Gold Star Sod Farm to Sewalls Falls Road, and from Sewalls Falls Road to Hannah Dustin Drive. The trail along I-93 in the Downtown area will have to wait for the modifications to I-93 by NHDOT to connect from Healey Park to Loudon Road and provide for the “river connection” to the trail over I-93 from Downtown Concord. Non-public sections of the abandoned Concord to Claremont railroad right-of-way should be acquired from Horseshoe Pond continuing north to North State Street and West Concord.

vii. Broken Ground: Existing trails on the future school park site accessed by Batchelder Mill, North Curtisville, and Curtisville Roads lead east toward Broken Ground. Trails have also been laid out on the Nichols parcel at the dead-end of Curtisville Road, while other more informal trails run southerly from Curtisville Road to Portsmouth Street, where the East Sugarbell Road trail connects back to East Side Drive providing access from the Heights. The vast remainder of Broken Ground is laced with old logging roads that are well used by the public but no formal trail rights exist to these. The protection of Broken Ground will be

the key to gaining formal trail rights throughout Broken Ground connecting east to Josiah Bartlett Road, and north to Appleton Street, Turtle Pond, and Oak Hill Road.

viii. Oak Hill to the Hoit Road Marsh: The City has an extensive trail system on Oak Hill with access from Oak Hill Road and a trailhead with parking off of Shaker Road. Existing trail easements connect from Shaker Road through Becky Lane across Snow Pond Road to a trail easement on the former Snaptown Road from which trails can diverge in two directions. Heading westerly, a City owned parcel that can provide a connection to Graham Road from which another trail easement continues westerly toward the Richards Community Forest and Spear Park on Sanborn Road, with one easement connection needed to complete this connection. Heading northerly from the former Snaptown Road, one additional acquisition would fill a missing link to the Riley Trails on City land that cross Hoit Road to the Marsh.

The City should remain alert for and actively seek additional corridors and linkages to provide connections between areas of open space and the urban parts of the city.

d. Proposed Linkages and Connections for Environmental Protection and Wildlife Corridors

Easements are proposed whenever possible along all streams and brooks. Drainage rights, development rights, and in some cases, right of access, should be sought along the following brooks:

i. Bow Brook is proposed for easements in order to unify various urban open spaces and to provide access and a link to Little Pond in the north and the Turkey River in the south.

ii. Hayward Brook, Hackett Brook, and the Snow Pond Outlet link the Hoit Road Marsh and the Snow Pond/Oak Hill area and the Merrimack as they meander through a developing area in East Concord.

iii. Hoyt Brook rises in the Great Bog southwest of Borough Road and flows northerly under Borough Road and South Main Street in Penacook, down through the land of the Merrimack Valley School District to the Merrimack River.

iv. Beaver Meadow Brook rises east of Ferrin Road and adjacent to the Penacook Lake watershed, and flows down across the railroad right-of-way, under Fisherville Road, through Concord Manor and Beaver Meadow Golf Course to the Merrimack River.

While the shorelines of rivers, streams and ponds have been placed under a protective setback requirement in the City's Zoning Ordinance, easements should be obtained for land in the Shoreland Protection District whenever possible, both to reinforce the zoning and to alert future landowners to development restrictions. Where no rights-of-way or streams exist, linkages will need to be acquired as corridors between open space parcels to act as wildlife corridors.

E. CONSERVATION AND OPEN SPACE POLICIES AND RECOMMENDATIONS

1. Conservation and Open Space Policies

a. Open space protection and management policies

i. Acquire and manage open space lands where public access is desired, including lands which provide access to public waters.

ii. Acquire conservation easements in perpetuity or purchase development rights in areas proposed to remain as open space and where public access is not envisioned or not desirable due to environmental sensitivity.

iii. Provide adequate public funding, such as the proceeds from the Use Change Tax, that will sustain a program for the acquisition and protection, as well as the long term management of open space, and to leverage that public investment with other sources of funding

iv. Work with volunteers, private conservation groups, landowners, adjacent towns, and the agencies of the state and federal governments to protect, monitor and maintain the open space areas identified in this open space plan.

v. Encourage and support the continued maintenance of the quality and functions of private open space areas owned individuals and institutions.

vi. Evaluate each tax title property for consistency with the Open Space Plan, and if consistent, to determine if the title should be retained if public access is desired, or should be resold with conservation easements, if public access is not recommended.

vii. Accept donations of conservation easements and/or fee simple title to open space lands only after a determination that the donation is consistent with the open space plan, and the site has been evaluated for the presence of hazardous wastes.

viii. Utilize conservation organizations as secondary grantees in holding easements or executory interests on publicly owned open space, to ensure that the land is protected in perpetuity.

ix. Support the continuation of the Current Use Taxation (RSA 79-A) and the Conservation Restriction Assessment (RSA 79-B) Programs for privately held open space.

b. Policies related to the public use of, and access to, open space

i. Establish linkages between large open space areas both for public access and as corridors for wildlife migration along rivers and streams, major transmission line rights-of-way, and abandoned railroad rights-of-way.

ii. Develop trails, boat ramps, boardwalks, and other facilities for public access to Concord's open space where such access will not adversely impact natural resources and the ecology of the open space.

iii. Continue trail development and maintenance within open space areas throughout the City, and to encourage and coordinate volunteer efforts to develop and maintain these trails.

iv. Carefully consider and mitigate adverse impacts which may occur from the development of public and private recreational facilities within the open space system.

c. Environmental protection policies

i. Conserve large unfragmented areas that provide a variety of wildlife habitats and promote landscape connectivity to allow for the movement of wildlife within the City.

ii. Protect the habitat of endangered or threatened species through acquisitions and easements that ensure the continued existence of the natural habitats of these species.

iii. Maintain and improve the quality of ground and surface waters

d. Land Use Regulatory Policies

i. Wetlands:
   - Strive for no net loss of the functions and values of wetlands in the City and to seek mitigation for unavoidable impacts.
   - Require setbacks from wetlands for activities that may have an adverse impact upon the wetland.
   - Continue to add to the City's inventory of mapped wetlands so that wetlands are readily and easily identified when land is proposed to be developed.

ii. Floodway - Prohibit the placement of fill and/or obstructions in the floodway, and to prohibit the erection of buildings and structures in the floodway other than those which cannot be located elsewhere, such as bridges and boat ramps.

iii. Floodplain:
   - Use the best available information to establish the regulatory flood elevations and limits of flood hazard areas and to continue participation in the Federal Flood Insurance Program.
   - Continue to restrict development in the floodplain outside of existing urbanized areas to agricultural and recreational uses.
   - Prohibit new residential uses within the floodplain and encourage the removal of existing residences.

iv. Steep and Erodible Slopes - Perpetuate setbacks and use regulations intended to protect steep erodible slopes and bluffs from irreversible damage from clearing, grading, and excavation.

v. Shoreland Protection - Perpetuate setbacks, buffers, and use regulations intended to maintain surface water quality and protect the banks of the rivers, streams and ponds from damage by incompatible development.

vi. Penacook Lake Watershed – Continue to protect the Penacook Lake Watershed City's primary source of potable water through restrictions on incompatible uses and limitations on density of development.

vii. Aquifers - Prepare and adopt ground water protection regulations.

viii. Site Development**:**
   - Require site development to take into account the natural site conditions during the design process and, where appropriate, to preserve and promote such physical and natural features as rivers, streams, ponds, marshes, wetlands, scenic vistas, steep slopes, woodlands, wildlife habitat, and special geological features.
   - Require site development to minimize the destruction of natural vegetation and alteration of terrain.

ix. Cluster Development - Foster the use of cluster development and/or limited development techniques in rural residential areas to promote the preservation of open space and to reduce the economic and environmental costs associated with sprawl.

e. Policies related to the use and development of natural resources

i. Agriculture:
- Recognize that agriculture is the highest and best use of prime agricultural soils within open space areas.
- Support a diverse agricultural industry including but, not limited to, field crops, horticultural production, dairy farms, orchards and animal husbandry.
- Support the use of agricultural best management practices to protect water and soil resources and to maintain long term productivity.
- Recognize agriculture as an economic activity which should be supported through tax policy and land use regulation.

ii. Forestry:
- Support the use of forestry best management practices to protect water and soil resources, to prevent soil erosion and sedimentation, and to preserve and enhance wildlife habitat.
- Recognize forestry as an economic activity which should be supported through tax policy and land use regulation.
- Continue the forestry management program for the City's open space lands to provide for sustainable yield of timber and allow for multiple use which will not adversely impact the ecological functions of the open space.

iii. Potable Water

- Protect the quality of surface and groundwater to ensure availability of a potable water supply for both the City as well as for individual homeowners.

iv. Sand and Gravel Deposits

- Maintain regulations consistent with the authority of RSA 155-E for the establishment of new excavations as well as the closure and reclamation of depleted excavations.

2. Conservation and Open Space Recommendations

a. Regulatory Recommendations

i. Sustain and perpetuate the open space-related regulatory provisions adopted in 2001. The 2001 Zoning Ordinance included a Shoreland Protection Overlay District, a Flood Hazard Overlay District, and a Penacook Lake Watershed Protection Overlay District as well as requirements for wetland buffers and requirements for buffers to bluffs. The City's earth removal regulations were also reviewed and substantially revised to reflect amendments to RSA 155-E, "Local Regulation Excavations".

ii. Aquifer Protection District - An aquifer protection district should be prepared and adopted to safeguard the City's potable groundwater supplies for future use by both the City and private users. Available models of such ordinances do not adequately address Concord's circumstances wherein the City possesses both municipal water and sewer

systems which serve the urban areas, and the land over the aquifers in these urban areas is substantially and heavily developed. At the same time, there are rural and undeveloped areas of Concord that are dependent on wells and septic systems. A Concord-specific ordinance should be prepared that will address requirements and standards for management practices such as for leak detection and spill containment, and will explore the legal means to apply these requirements retroactively to those existing uses that represent a hazard to groundwater.

iii. Maximize the open space benefits of Mandatory Cluster Development - While this was not included as a recommendation in the past editions of the Open Space Plan, the City Council adopted a zoning amendment making cluster development mandatory. Based on a tentative recommendation in the draft of this Master Plan, the amendment was promoted in part because the enabling statute was revised to allow the mandate, and in part because related research revealed that cluster developments had yielded about 600 acres of open space since the adoption of the citywide revision of the Zoning Ordinance in 2001. While the zoning amendment does not, and cannot require that the rights to the open space be granted to the public, it does require that a certain amount of land be kept open on a permanent basis. This represents a new opportunity to augment other more traditional means of protecting open space in Concord. The design of individual cluster developments should maximize the connectivity of the proposed open space to other existing as well as planned open spaces, for the benefit of both wildlife corridors as well as trails.

b. Public Acquisition Recommendations

All proposed open space acquisitions, whether the fee title or some lesser interest, should be judged by several criteria when establishing priorities. Perhaps the foremost is *vulnerability to development or other alteration*. Some open space is more susceptible to development by virtue of its location adjacent to an existing public highway or a waterbody. Since inaction would mean the loss of such open space, acquisition of interests in these properties should be of highest priority.

A second criterion would be the *potential for immediate public utilization* of the open space. Some parcels would require funding not only for acquisition but also for site development to render them useful to the public. Other lands can be utilized with minimal effort once they are acquired.

Other criteria include the following:

- maximizing the protection of multiple natural resources;
- providing linkages between and among existing protected open spaces and lands targeted for protection, or provision of connections between open spaces and the City's neighborhoods and villages;
- being located adjacent to existing open space such that there would be a complementary and beneficial relationship; and
- comprising a portion of an unfragmented area of open space.

The history of public acquisition of land indicates that opportunities will arise to acquire properties in a sequence unrelated to established priorities. Such opportunities should be carefully evaluated in light of available funding and the status of negotiations for parcels of higher priority. In some cases, non-sequential acquisitions will be warranted.

Some parcels of land may be offered to the City for open space purposes that are not included in this Plan. These properties should be evaluated on a case by case basis using the following criteria:

- the provision of possible linkages to or within the open space system,
- the potential to provide neighborhood "pockets" of open space,
- the level of difficulty of management of the property if acquired, and
- the potential for the resale or trade of the property, perhaps with the encumbrance of a conservation easement, for other more valuable or desirable property.

Finally, some consideration should be given to the timing of the various acquisitions. Based on past experience, in the case of acquisition by direct public purchase, at least one high priority or several lower priority acquisitions should occur each year. Receipt of gifts and retention of tax title land will periodically augment these purchases. The amount of remaining open land in the City is finite, and with development pressures and the passage of time, opportunities for protection of that open land that are lost, are likely lost forever.

i. Acquisition of Fee Title

All of the proposed acquisitions, with the possible exception of those around Penacook Lake, have the "potential for immediate public utilization", and there is some level of "vulnerability to development or other alteration" associated with each. However, of all of the proposed acquisitions, Broken Ground is the only one that meets all of the criteria for the acquisition of open space. The list of acquisitions presented below parallels that as presented in the description of the open space system in this Section and does not reflect a priority ordering of the same.

- Merrimack River Corridor - trail linkages; boat ramp/canoe launch sites
- Contoocook River Corridor - trail linkages; boat ramp/canoe launch site; expansion of Lehtinen Park
- Broken Ground – all land not already publicly owned or otherwise protected
- Oak Hill & Hot Hole Pond – additional access to, and remainder of ridgeline of, Oak Hill; frontage on Hot Hole Pond
- Northern E Concord & Hoit Road Marsh – one parcel linking the Snow Pond Road open space and trails to the Riley lot and the trails related to the Hoit Road Marsh
- Horse Hill - peak of Horse Hill; shoreline of Little Pond; access to both from Blackwater and Weir Roads
- The Great Bog – abandoned railroad rights-of-way to complete the trail connections
- Penacook Lake Watershed – additional land as may become available, evaluated on a case by case basis
- West Parish, District #5, and Dimond Hill – linkages from Rossview Farm to West Parish Road and to Currier Road
- Turkey Ponds and Turkey River – area for parking on Clinton Street for access to the Turkey Ponds; parcel between Memorial Field and State land

- Fisk Hill – the hillside between Pleasant Street and the Walker State Forest westerly of Langley Parkway

- Open Space inside the Urban Growth Boundary – future parks and cemeteries, access to public waters that may become available; common open spaces from cluster developments

ii. Acquisition of Interests-Less-Than-Fee

The list of acquisitions of interests-less-than-fee presented below parallels that as presented in the description of the open space system in this Section and does not reflect a priority ordering of the same.

- Merrimack River Corridor - agricultural lands; wetlands; bluffs

- Soucook River Corridor - agricultural lands; floodplains; bluffs

- Broken Ground - agricultural lands

- Oak Hill & Snow Pond – slopes of Oak Hill; wetlands around Snow Pond

- Northern E Concord & Hoit Road Marsh – trail easement to link Graham Road to open space along Sanborn Road

- Horse Hill – slopes

- The Great Bog – wetlands

- Penacook Lake Watershed – wetlands around Little Pond

- West Parish, District #5, and Dimond Hill – linkages from Rossview Farm to West Parish Road and to Currier Road; and from Dimond Hill Farm to Little Turkey Pond; wetlands and shoreline of Ash Brook

- Turkey Ponds and Turkey River – shorelines of the Ponds, River, and streams; floodplains and wetlands; agricultural lands

- Fisk Hill – trail easements

- Open Space inside the Urban Growth Boundary – easements over the currently privately owned sections of the Marsh and forming a buffer around its edges; shorelines of rivers, streams and ponds not otherwise mentioned to reinforce floodplain and shoreland zoning, as well as wetlands, and erodible slopes and bluffs.

c. Management of the City's Open Space

As the City accumulates more land and interests in land for permanent open space, the management of these lands becomes a more substantial matter that needs to be addressed. At present, much of the management undertaken under the aegis of the Conservation Commission is done through the Forestry Program. After starting the Forest Management Program rather modestly some thirty years ago with assistance from the NH Division of Forests and Lands as

well as employment of college interns, for the past twenty years Commission has maintained a contract with a consultant forester who oversees forest management practices, timber harvests, timber stand improvements including trail blazing though the forests. The City's Forest Management Plan is currently undergoing its third update which will recognize past work on existing lands and add new properties to the management schedule.

The City's consultant forester has provided a regular presence on these open space lands and a watchful eye for storm-related damage, illegal dumping activity, encroachment by neighboring owners, and other matters of concern in terms of land management. The trail volunteers who work under the forester's guidance and with his assistance also provide a public presence on these properties and public evidence of maintenance activities. Of course the trail users themselves, for whom the trail improvement efforts are expended, provide the best source for the reporting of management issues and concerns such as natural damages as well as acts of vandalism.

The addition to the City's open space inventory of agricultural lands has opened a new chapter in the City's open space management through formal lease agreements with farmers who plant various crops and provide a seasonal presence on these properties.

The terms of some of the easements acquired by the City as well as the terms of certain funding by which interests in land were acquired require stewardship on an annual basis by the City, which is generally performed by the Conservation Commission or a subcommittee thereof. As the number of these stewardship requirements increase, the responsibility will likely have to be shared or even shifted to an employee designated to serve the Commission to manage its land and its programs.

The private non-profit conservation organizations holding interests in open space land in the City are another major player in the management of open space land in the City. The Society for the Protection of NH Forests, and the Audubon Society of NH both own land as well as hold conservation easements, and the Five Rivers Conservation Trust holds a number of conservation easements. These organizations are all active stewards of the lands and are engaged in land management.

The other major land manager in the City's open space network is the State which includes the NH Division of Forests and Lands, NH Fish and Game, and the NH Department of Corrections, all of which manage major open space lands within the City.

As the open space system achieves its maximum limits, management planning should be a focus for the City in the future to provide for adequate and appropriate support and oversight of the system that will ensure the public's enjoyment and safety, as well as protect the public investment in this irreplaceable resource.

F. Supporting Studies

A Legacy for Future Generations – Open Space in Concord, New Hampshire: A Master Plan Report, Concord Conservation Commission, Concord, NH, 1978.

City of Concord Master Plan Year 2010 Update, Concord Planning Board & Concord Planning Department, Concord, NH, December 15, 1993.

Concord Wetland Mapping Study, prepared by James W. Sewall Company, 2004.

Concord Master Plan Community Survey, prepared by The NorthMark Group, 2004.

Endowment for the 21st Century, Conservation & Open Space Plan, Concord Conservation Commission, Concord, NH, December 15, 1993.

Floodplain Information, Merrimack River, City of Concord, New Hampshire, United States Army Corps of Engineers, 1972.

Geohydrology and Water Quality of Stratified-Drift Aquifers in the Contoocook River Basin, South Central New Hampshire; United States Geological Survey Water Resources Investigations Report 92-4154, 1995.

Geohydrology and Water Quality of Stratified-Drift Aquifers in the Upper Merrimack River Basin, South Central New Hampshire; United States Geological Survey Water Resources Investigations Report 95-4123, 1997.

Groundwater Exploration Program Phase I Report for the City of Concord Water System Master Plan, Emery & Garrett Groundwater, Inc., October 2005.

Merrimack River Greenway and Trail System, Concord Conservation Trust, Concord, NH, 1990.

Turkey River Basin Plan, prepared for the Turkey River Basin Trust by Margaret Watkins, 1993.

Water System Master Plan, Phase 1, for the City of Concord, New Hampshire, Wright-Pierce, September 2006.

Zoning Ordinance for the City of Concord, New Hampshire. Adopted November 29, 2001 together with zoning map, as revised through June 2007.

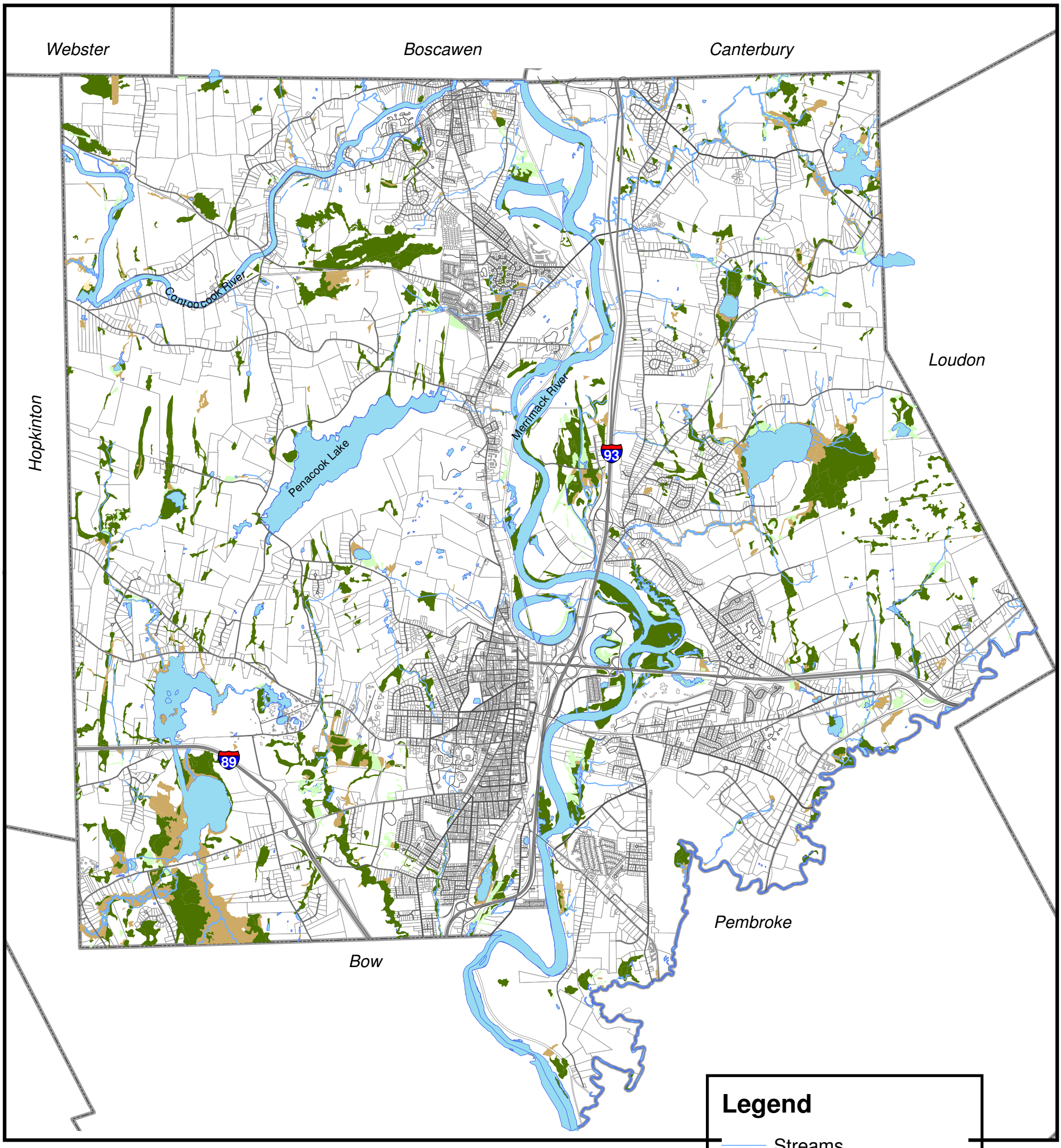

Exhibit VII-1
Wetlands Map
City of Concord, NH
Master Plan 2030

Prepared by the Planning Division: November 2007

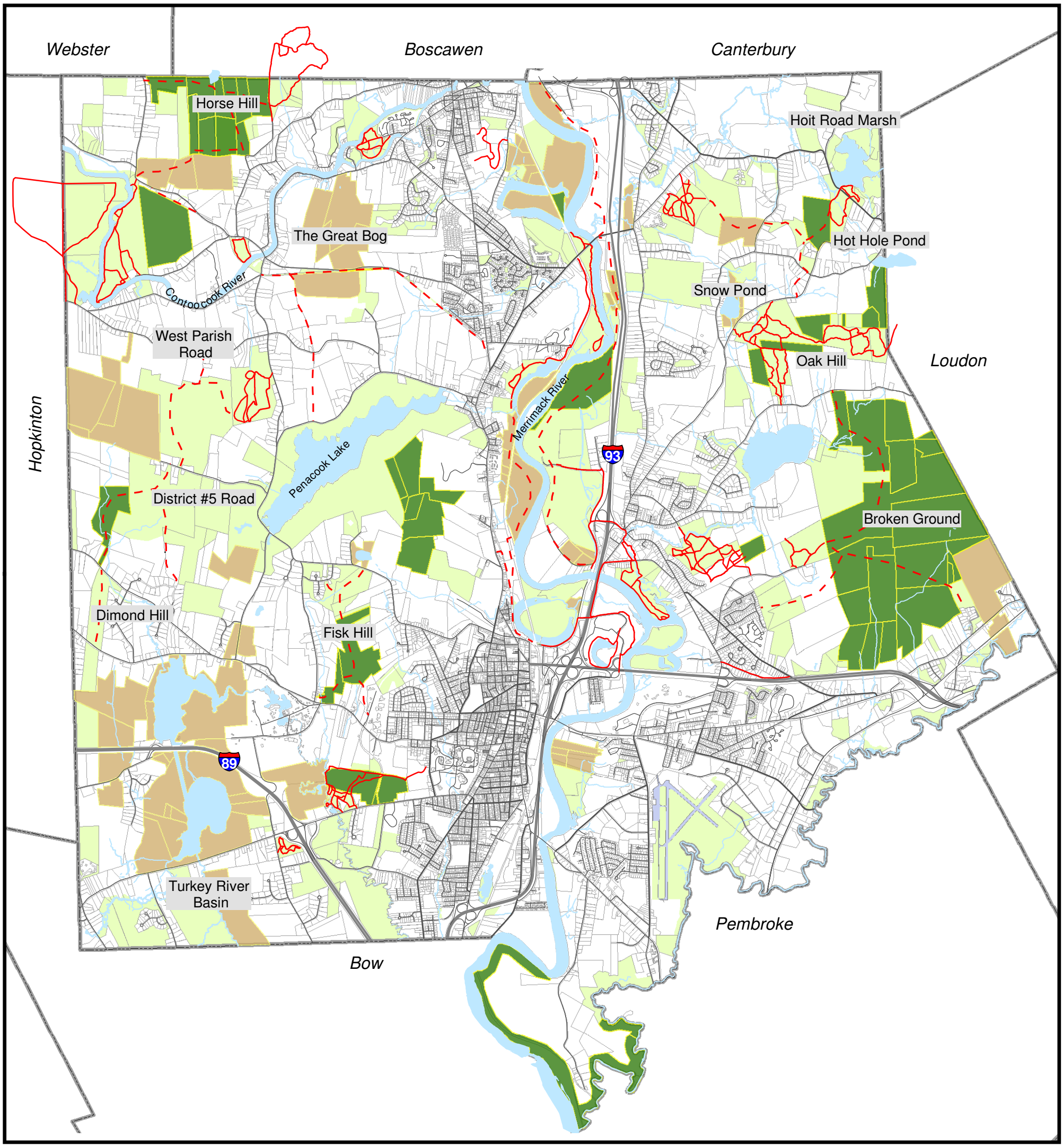

Exhibit VII-2
Future Open Space Plan
City of Concord, NH
Master Plan 2030

Legend

- Priority Acquisition - Fee Simple
- Priority Acquisition - Easement
- Existing Open Space
- Existing Trails
- Proposed Open Space Connections

N

Prepared by the Planning Division: November 2007

EXHIBIT B

East Street Vacant Lot
Penacook Park
Village Street Gazebo
Island Pond Estates
Brentwood Open Space
Rolfe Park - LWCF
Foss Easement
Rolfe Park - LWCF
Rolfe Park - LWCF
Rolfe Park - LWCF
Millstream Open Space
Woodland Cemetery
Millsteam Open Space
Merrimack Valley School District
Woodland Cemetery
Woodland Cemetery
Randall Property
Primrose at Penacook
Primrose at Penacook
Primrose at Penacook
Primrose Woods
Primrose Woods
Primrose Woods
Malinsky Easement
Penacook Street Lot
Fox Run Open Space
Freedom Acres Open Space
Freedom Acres Open Space
95 Hoit Road Easement
Pines at Hayward Brook
Hyland Property
Maxfield Lot
Maxfield Lot
Keller Easement
Glen Ellen Subdivision
Bois de Brodeur Trust
Riley Property
Hoit Road Marsh WMA
Hoit Road Marsh WMA
Hoit Road Marsh WMA
Emerald Abode
Acres of Wildlife
Hoit Road Marsh WMA
Hoit Road Marsh WMA
Emerald Abode Easement
Riley Property
Hoit and Shaker Road Easement
Riley Property
Spear Park
Richards Community Forest
Stonehaven
Manor Dump
Oxbow Bluffs or Rust Property
Oxbow Subdivision Open Space
Sewalls Falls State Recreation Area
Franklin Pierce Property
Swan Circle Subdivision
Hot Hole Pond Boat Access
Griffin Easement
Merullo Park - LCIP
Woodbine Ave Open Space
B&M Claremont Rail Road
West Village Open Space
Aversa & Mento Easement
Blood Agricultural Easement
Blood Agricultural Easement
Claremont & Concord RR Bed
Beaver Meadow Golf course
Sewalls Falls State Recreation Area
Sewalls Falls State Recreation Area
Blake Property
Piper Property
Shaker Road - Anderson Goodman Property
Oak Hill
Oak Hill
Susan Taylor Subdivision
Potter property
Bradley Easement
Maple Grove Cemetery
Morono Park
Foxcross Circle Open Space
Blye Farm Open Space
Paul Mack / Hugh Emerson Tract
Oak Hill Road
Unitil property
Estes Forest
Penacook Lake Watershed
Garrision Park
Knight Morono Park
State Prison Farm and Quarries
Goldstar Sod Farm
Penacook Lake Watershed
City Animal Pound
Goldstar Sod Farm
State of New Hampshire
Sewalls Falls Properties
State Prison Farm and Quarries
State Prison Farm
State Prison Farm and Quarries
State Prison Farm and Quarries
State Prison Farm and Quarries
State Prison Farm and Quarries
State Prison Farm and Quarries
State Prison Farm and Quarries
State Prison Farm and Quarries
State Prison Farm and Quarries
State Prison Farm and Quarries
Quarries
Quarries
Bainbridge Drive Easement
Turtle Pond Property
Fournier Easement
Oak Knoll Open Space
Oak Knoll Open Space
Turtletown Pond WMA
Turtletown Pond WMA
Corliss Property
Turtle Pond East - Potter Property
Fitzgerald Easement
West Portsmouth Street Conservation Area
West Portsmouth Street State Land
Merrill Park
Eastman Street Park
Merrimack River Access
SPNHF Conservation Center
SPNHF Conservation Center
SPNHF Conservation Center
Stevens Property
Concord School District
Reardon Subdivision
Chamberlin Property
Whispering Heights
Welcome Drive Open Space
Woodman Property
Delta Dental Easement
NHTI
Newell Property
Unitil Easement
Horseshoe Pond
Kimball Park - LWCF
Kimball Park - LWCF
Woodman Property
Whispering Heights
NHTI
Loudon Road State Land
Loudon Road State Land
Lang Property
Grappone Park
Little League Ball Field
Whispering Heights
Portsmouth Street Lot
West Sugarball Road Lot
Water Tower Access
Water Tower Access
Lang Property
Autum Drive Open Space
State of New Hampshire
Hazen Drive Land
393-State Land
Woodcrest Heights Open Space
Landfill Stump Dump
TDL Investments
Ladd Property
Ladd Property
Woodcrest Heights Open Space
Fish and Game Land
GGP Concord Land Co. Lot
Keach Park
Keach Park
Walmart Stores Inc. Easement
City of Concord - Dover Street
Airport Runway Protection Zone
Airport Runway Protection Zone
Concord School District
Concord School District
Landfill
Land Fill
Land Fill
Pembroke Well Fields
Karner Blue National Wildlife Refuge Area
Terrill Park Drive Vacant Lot
Airport Conservation Area
Sanel Field - Landfill
Sanel Field
Manchester Sand Gravel and Cement Co.

Northern Pass Information

- Conservation Easement
- Fee Simple - City of Concord and others
- Open State Land
- St Paul's School Property
- Concord School District

Easement Holder

- Audubon Society of New Hampshire
- City of Concord
- Five Rivers Conservation Trust
- Society for the Protection of NH Forests
- State of New Hampshire
- Trust for Public Land
- Final_Alt5c_Cleared_Area_merge
- Concord_Region_NP_towers_Oct2015

Prepared by: Planning Division
Information Provided by AMC
January 2016

0 2,200 4,400 8,800 Feet

EXHIBIT C

CITY OF CONCORD, NEW HAMPSHIRE
CONCORD CONSERVATION COMMISSION
CITY HALL · 41 GREEN STREET · 03301

July 25, 2016

Department of Environmental Services
Att: Craig D. Rennie, Darlene Forst

Re: Wetland File SEC 2-15-02817
Northern Pass LLC NHDES Wetlands Permit and Shoreland Permit

Dear Mr. Rennie and Ms. Forst,

The Concord Conservation Commission submits the following comments regarding the wetland permit and shoreland permit for the above project.

The Northern Pass project would carry electricity generated by Hydro Quebec to southern New England. Large-scale hydroelectric generation is not considered sustainable or "green" energy; it relies on the inundation of thousands of acres of boreal forest in Quebec -- by some estimates an area half the size of New Hampshire -- and construction of hundreds of miles of transmission lines from distant hydro dams. Such projects contribute to climate change through the release of methane gas from decomposing vegetation.

In addition, here in the United States we are actively removing dams, including those that generate hydro-electric power, and restoring the natural flow of rivers. This is occurring because we have learned -- with time -- that these dams have a significant negative impact on our nation's fisheries and the ecosystems of our rivers. American Rivers reports that in 2015 alone, 62 dams were removed in the United States to restore rivers, including 13 in New England.

The Concord Conservation Commission submits that because of the overall negative impacts of Northern Pass, coupled with major local impacts on open space properties, wetlands, and wildlife and plant species, the project should not be built.

The Commission believes that the applicant has failed to comply with the requirement that impacts be avoided "to the maximum extent practicable," [Env. Wt 302.03(a)(1)], that "unavoidable impacts have been minimized," [subsection 2], and that "the alternative proposed by the applicant is the one with the least impact to wetlands or surface waters on site." [Env. Wt.302.04(a)(2)] We note that the City of Concord has more than one-third of the population along the project corridor. Reflecting community concern and following public hearings, the Concord City Council issued a report on October 6, 2015 urging "that the Northern Pass bury its proposed line along the entire 8-mile route through Concord." To date the applicant has not fully examined this alternative, which is "practicable" within the meaning of the rules. Under public pressure the applicant has agreed to bury 60 miles of the proposed 192-mile line in the North Country. The New England Clean Power Link has agreed to bury all 154 miles of a

similar transmission line in Vermont -- a project which has obtained regulatory approval. The applicant has not offered an adequate explanation of why it has not considered burial of the line through Concord, or utilization of existing transportation corridors. These alternatives should be fully analyzed before the proposal in this application is considered.

The Concord Conservation Commission agrees with the comments of other communities that separate applications for each municipality should have been filed, in order to facilitate review of the tremendous volume of data in the application. Much of the mapping, aerial photography and data included in the application is now several years old and of questionable accuracy. This, along with the volume of data and the state-level discussion of some issues, has made it more difficult to evaluate the proposal.

In Concord, the corridor proposed for Northern Pass extends for 8.1 miles, with an average width of 257 feet. This represents approximately 252 acres. Additional clearing within the right of way is estimated at 10 to 11 acres. This is a substantial area that will have numerous significant impacts: fragmentation of wildlife corridors, loss of tree cover, risk of additional ATV use with attendant erosion, and other impacts.

In Concord, the project will impact 35 wetlands totaling 51.8 acres. Of these, 23 are emergent wetlands and are 10 scrub/shrub deciduous. Most notable of these is the 15.26 acres of wetland adjacent to Turtle Pond, which as stated in the application provides significant functions and values. These functions include groundwater discharge/recharge, finfish habitat, floodflow alteration, sediment/toxicant retention, nutrient removal, shoreline stabilization, production export, and wildlife habitat. As stated in the application, principal values include recreation, uniqueness and heritage, education/scientific value, and visual aesthetics. The project will require construction of 4.5 miles of new access routes within the corridor in Concord, with impacts on wildlife habitat and wetlands/wetland buffers.

The project will impact 16 rivers and streams including intermittent streams, with a total of 88,115 square feet.

While the permanent impact on these resources is relatively minor, the project will have temporary impacts of more than 7 acres (319,701 square feet) within Concord. This is a very significant impact, and the Commission believes the work needed to access these areas is likely to cause long-term damage; in fact, the impacts will not be temporary. The project application did not provide sufficient detail on the temporary impacts to address this concern. Of particular concern is damage to the Turtle Pond wetland, a conservation area under the jurisdiction of the Conservation Commission: 130 square feet of permanent impact and 85,266 feet of temporary impact.

In addition to the Turtle Pond conservation area, the project crosses or abuts 12 other parcels of open space land protected either by easement or City ownership. This amounts to a significant area within or adjacent to conservation land, with major impacts on these properties. Most notable among these properties are Spear Park and the adjacent Richards Community Forest, both fee-owned and easement-protected land in the Broken Ground Conservation Area, and a

portion of the Oak Hill City Forest. All of these are managed by the Conservation Commission for protection of natural resources, open space, and non-motorized recreation. The City recently acquired 270 acres of open space in the Broken Ground area at a cost of approximately $1 million (including $80,000 from the ARM fund). The City of Concord has been proactive in conserving land in East Concord, a priority in the City's Master Plan since the 1970s, and the Commission is concerned that these efforts will be undermined by the project.

Another area of concern is the project's impact on threatened and endangered species. The application addressed 12 wildlife and seven plant species affected by the project. The Commission is especially concerned about the risk to the Federally endangered Karner blue butterfly. The residents of Concord have a strong interest in restoring this species in its only occurrence in New Hampshire, through land protection agreements, and active efforts for many years by school children and adult residents to raise and plant wild lupine.

There are proposed six structures in areas where wild lupine is present, as well as additional temporary impacts. The application states that there will be an unavoidable impact to the Karner blue butterfly through habitat loss and mortality attributable to project activity. The application proposes preservation of land but does not identify which land or the likelihood that Karner blue populations can be successfully introduced and maintained in this area. This is not adequate mitigation for the certain loss of populations of a federally endangered species that has been painstakingly restored in the pine barrens of Concord.

The 2010 report, "Conservation Priorities, Concord, NH," highlighted the pine barrens as a particularly vulnerable natural community in Concord (see attached). The 2015 Wildlife Action Plan indicates the pine barrens near Concord Airport are categorized as highest ranked habitat in New Hampshire. Most of the region the project area passes through in Concord is either statewide or regionally highest ranked habitat.

We also note that the Shoreland Protection application describes significant impacts on both sides of the Soucook River (the Concord-Pembroke boundary), a total of over 58,000 square feet. This important water resource has highly erodible bluffs along many of its banks; the temporary impacts of construction activities have a strong potential to cause new erosion and should be prohibited. The shoreland impacts on Turtle Pond are also significant -- over two acres for multiple structures -- and should likewise be avoided. An additional transmission line in this waterbody should not be permitted.

For the reasons set forth in this letter, the Concord Conservation Commission recommends the wetland and shoreland permits be denied. Thank you for your consideration of these comments. We reserve the right to comment further at a later date.

Sincerely,

Christopher Morgan, Chair

EXHIBIT D

Wildlife Habitats, Natural Communities, and Rare Species Analysis for Concord, New Hampshire

Dan Sperduto

Sperduto Ecological Services, LLC

Canterbury, New Hampshire

with contributions from

Ellen Snyder

Ibis Wildlife Consulting

Newmarket, New Hampshire

October 2010

Sperduto Ecological Services, LLC

359 Baptist Road

Canterbury, New Hampshire 03224

sperdutoecological@gmail.com

Cover: Red maple floodplain forest along the Soucook River

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ACKNOWLEDGEMENTS

Ellen Snyder provided critical perspectives and input in the interpretation of wildlife data, identification of conservation priorities, and edits and additions to report text regarding wildlife. Many thanks to Pete Ingraham of Exeter, NH for production of all maps. Thanks to Peter Ellis for providing initial GIS support. I also thank Michael Tardiff, Becky Hebert, Vanessa Goold, and Chris Kane for their support during this project. Thanks to the NH Fish and Game Department and the NH Natural Heritage Bureau (DRED) for the use of their models and data.

This project was funded through the Central New Hampshire Planning Commission in support of CTAP planning efforts for the City of Concord.

OVERVIEW

This project contains a detailed analysis of wildlife habitats, natural communities, and rare species in Concord, New Hampshire. New Hampshire Fish and Game Wildlife Action Plan (WAP) habitat maps were refined based on GIS analysis and field work. Rare species and natural community data were obtained from NH Natural Heritage Bureau and interpreted to help identify important habitats and conservation areas. Other key ecological features of the landscape, such as ecological regions, large wetland complexes, unfragmented forest blocks, and wildlife corridors were considered along with the WAP and NHB data to identify conservation priorities for Concord, New Hampshire that are critical to biodiversity protection.

1 - METHODS

1.1 - WAP HABITAT MAP REFINEMENT

Data compilation: The 2010 release of New Hampshire Fish & Game's Wildlife Action Plan (WAP) habitat and assessment data were compiled, clipped to the bounds of Concord, and shape files set up for the purposes of validating and refining the WAP habitat polygons. Other GIS data were compiled from GRANIT and other sources to enable interpretation of the WAP and NHB data, including color and black and white ortho-photos, wetlands (Concord and NWI data), roads, hydrography, geology, soils, and public lands data from GRANIT and the City of Concord.

Seven habitats are mapped in Concord, including two "matrix" forest types (which cover large areas of the state and in Concord), and five smaller "patch" habitats (which typically cover areas on a scale of several to perhaps a hundred acres for most patches). The two matrix forest types are Hemlock - Hardwood - Pine Forest; and Appalachian Oak - Pine Forest. The five patch types are Pine Barrens, Floodplain Forests, Marshes, Peatlands, and Grasslands. Certain habitats were not predicted in Concord, such as Spruce – Fir Forest, Rocky Ridges, Dunes, and Cliffs.

Refinement prioritization: I prioritized the WAP habitat map refinements based on habitat rarity and importance for species diversity, as well consideration of time that would be required to complete a comprehensive and even refinement of the habitat. Pine Barrens and Floodplain Forests are relatively rare at a statewide scale, followed by Peatlands, which are uncommon; Marshes and Grasslands are more common statewide than the other three patch habitats. As such, I focused most of my revision efforts on Pine Barrens, Floodplain Forests, and Peatlands because they have a restricted statewide distribution, they contain important biological diversity (plants, animals, and natural communities), and therefore, represent potentially higher conservation significance than more common types. I made some modest but significant improvements to the marsh habitat layer. Relatively little effort was expended on improving or verifying the Grasslands habitat layer. In general, the Grasslands layer depicts open agricultural and field habitats reasonably well, and considerable time and effort would be required to modify the boundaries via air photos for improved gains in resolution and ultimately only modest improvement in conservation information.

As far as matrix forest types, Hemlock - Hardwood - Pine Forests are common in central and southern New Hampshire, whereas Appalachian Oak - Pine Forests are less common and restricted to southern portions of the state. I executed some large area changes to the matrix forest types, particularly the less common Appalachian Oak - Pine Forest layer, but these changes represent only a fraction of the improvements that could result from additional effort. Improvements to the matrix forest types are relatively more difficult than the patch types because they involve lots of polygons, cover much more area, and are more difficult to verify remotely via GIS scanning.

Refinement process: I validated and improved the habitat maps by an iterative process beginning with desktop scanning with air photos and other GIS layers, followed by field work, and finally additional desktop scanning. There were two broad types of refinements: 1) confirmation, rejection, or correction the identity of the habitat type; and 2) refinement of the boundaries of polygons to more accurately depict their extent on the ground (for example, in cases where the boundaries were inaccurate, or they over- or under-predicted the known or probable extent on the ground). Signatures evident from ortho-photos were universally useful for both validating identity and improving boundaries of all habitats. Soil types, surficial geology, wetland and hydrography layers, topographic maps, and personal familiarity with sites on the ground were also important collateral references. The combination of layers used varied with habitat type and the degree of uncertainty.

An initial GIS scan of the patch-habitat types yielded both identity and boundary improvements. During this initial scan, I identified both general areas and individual polygons to investigate in the field, including some of the many areas where WAP habitat types overlapped (i.e., more than one habitat predicted for one location). Field work was useful for determining general patterns of over- and under-prediction for the type, as well as a basis to validate and improve boundaries of individual polygons and correspondence with other GIS layers during the final scan. Ultimately, I made field observations at more than 150 locations, in addition to dozens of other locations observed prior to this project.

1.2 - PREDICTED EXEMPLARY NATURAL COMMUNITIES

Two limitations of NHB data are: 1) they do not represent a comprehensive inventory of most parts of the state, including Concord; and 2) the policies of NHB prevent potentially valuable conservation information in the Biotics database from reaching conservation entities in their most specific, useful form.

However, it is still useful to look at the WAP habitat polygons through the “lens” or approach used by NHB to identify exemplary natural communities or systems. Thus, I applied NH NHB exemplary natural community ranking criteria for natural communities associated with predicted WAP Floodplain Forest, Pine Barrens, peatland, and marsh habitat polygons. These criteria use a combination of rarity, size, ecological condition, and the surrounding landscape context to evaluate natural community systems. Using these criteria, I identified habitat polygons (or groups of them) that appear to meet the criteria for exemplary natural community or system status. Many of these areas are not presently identified as exemplary in the NHB database.

It should be emphasized that additional data would need to be compiled and submitted to NHB for validation and inclusion in the NHB data base. Some areas may not quite meet the specifications required. Regardless of which side of the fence these areas may ultimately fall, they do some of the more intact systems of natural communities and wildlife habitats apparent from the refined WAP habitat maps, and should help prioritize sites for additional data collection.

1.2 - Rare Species and Exemplary Natural Communities

Data compilation and interpretation: I attempted to obtain site- and species-specific data from the HH NHB for Concord. However, NHB was only willing to provide data according to one of their standard protocols involving "fuzzed" data. In this case, the data request was filled by GRANIT, and contained species and community ("elements") locations, randomly displaced by up to 500 feet, with the identity revealed only to broad group (plant, reptile, amphibian, bird, insect, mollusk, natural community, or natural community system). Any maps produced from these data are required to be buffered by one or 1-1/2 mile diameter circles around each dot (depending on mapping accuracy), which would be of limited utility for specific town level conservation planning.

I also obtained a list of all the known rare species and exemplary natural communities in Concord from the NHB website. This list is not location-specific. However, by considering this list together with the data from GRANIT, ranks of species, and various GIS layers, I was able to derive the species or type with a high degree of confidence for all reptile, amphibian, bird, mollusk, and natural community locations in Concord, and nearly all plant locations (a total of 93 element locations). It was not possible to interpolate the butterfly and moth data with as much success since there are so many species with similar rarity or legal status. However, all of the insects are pine barren species (59 occurrences) associated with pitch pine habitat remaining in Concord (mostly on the Concord Heights). These specific data will not be displayable or reportable in the report; however, their derivation had an important influence on recommendations in this report.

Next, I identified the broad habitats and groups of natural communities associated with each species (sandplain/pine barren, aquatic, Floodplain Forest, peatland, marsh, etc). I attributed each species and community type in GIS shape files as well as in the results section below. These species-habitats are either the same or very similar to the scale of WAP habitats and to broad groups of natural communities. Somewhat more specific habitats are listed in the results section when applicable for a particular species.

1.3 - Conservation Recommendations

A Word About the WAP Habitat Quality Assessment

The WAP contains a Habitat Quality Assessment for New Hampshire. This assessment represents an analysis of the statewide habitat maps and various indicators of habitat condition and diversity. The maps associated with this assessment break the state down into a prioritized scheme: "Tier 1" areas are the highest priority areas from a statewide perspective; "Tier 2" are important regionally within the

state; and “Supporting Landscapes” are those that buffer or provide additional biological support to the core Tier 1&2 landscapes. The remaining areas of the state are unranked.

I did not attempt to revise or modify the WAP habitat quality assessment maps directly. It would be difficult to determine the appropriate score adjustment for a given pixel, patch, or group of habitat patches that have been revised without re-running the analysis based on the revised data (a task only Fish & Game could perform). For example, if an area mapped as Pine Barrens in the 2010 WAP maps turned out to be a common matrix forest type, this would presumably result in a diminishment of the polygon score, and could potentially affect the score of the larger un-fragmented block the polygon occurs in. It is also difficult to determine the appropriate score adjustment in areas where a habitat patch was enlarged greatly, and whether the change was great enough to indicate a shift, for example, from Tier 2 to Tier 1.

I encourage the users of this report to consult the results and maps of both analyses, and to view them as complimentary pieces of information. The WAP analysis provides important statewide and regional perspective for the greater Concord area.

Conservation Priorities

The conservation recommendations in this report are based on a fresh, relatively straightforward interpretation of the revised data, in addition to other ecological inputs. This process did not attempt to replicate the methods and various factors used by F&G, which included a complex suite of data inputs to evaluate ecological condition. These methods are calibrated to the statewide scale and would be time intensive to replicate at a local scale.

Emphasis was placed on the following factors:

- Revised WAP polygons and predicted exemplary NCs
- Complexes of communities/habitats, including larger wetland complexes and diverse upland-wetland complexes
- Rare species and exemplary natural community locations
- Large un-fragmented forest blocks
- Degree of fragmentation and development (sources of stress to ecological integrity)
- Known and potential wildlife corridors between major areas of protected land (including consultation of Statewide Wildlife Connectivity Model for New Hampshire developed by NH Fish and Game and NH Audubon)
- Location of existing conservation lands

2 - Results

2.1 - Ecological Regions of Concord, New Hampshire

Concord is an amazingly diverse and interesting area ecologically. Physical features of the land have an important influence on the patterns of biological diversity in the landscape. Delineation of landscape scale patterns in Concord can help frame and interpret the ecological data and conservation priorities presented in this report. To this end, I submit a preliminary classification of ecological regions of Concord. Seven ecological regions are presented here (Figure 1) based on different combinations

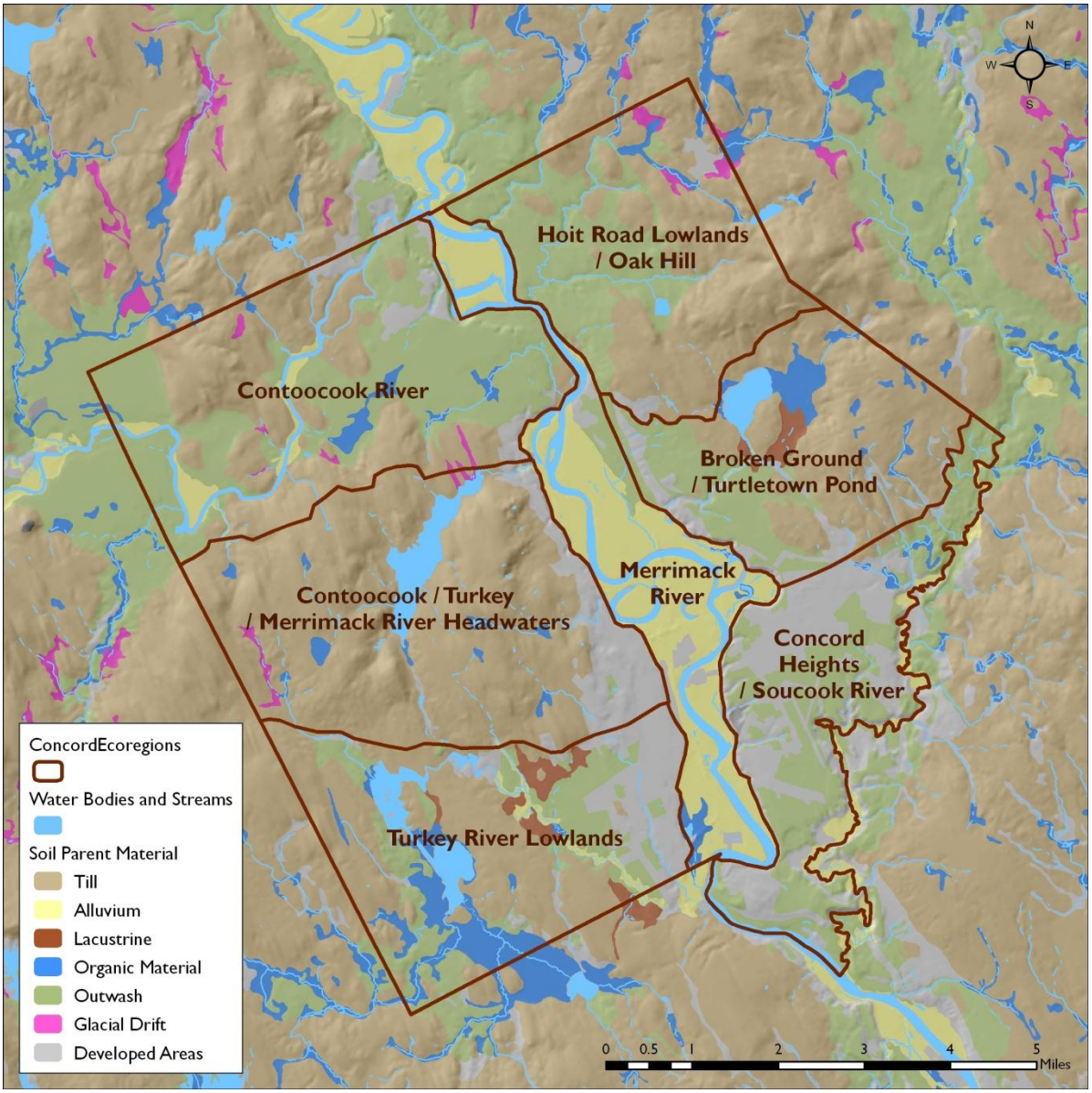

Figure 1. Ecological Regions of Concord, New Hampshire.

of surficial geology and landscape position, hydrography, and natural communities that occur in different parts of the City. Secondarily, I used roads that follow or approximate ecological transitions. Each of the regions can be broken down into subregions based on finer scale divisions of features. Most of these regions and subregions revolve around familiar landmarks of Concord. The delineation and naming of regions is certainly debatable. Different boundaries could be generated if different factors and patterns are emphasized over one another. However, the precise boundaries are less important than the landscape-level ecological patterns and systems they draw attention to. Table 2 describes the key features of these ecological regions.

The surficial deposits, or parent materials, depicted in Figure 1 are the raw material that soils developed from. These parent materials consist of different combinations of rock, gravel, sand, and silt that were deposited by glaciers or various meltwater environments. **Glacial till**, or simply till, consists of a an unruly mix of boulders, stones, gravel, sand, silt, and clay once trapped within or beneath a glacier. **Alluvium** consists of fine materials, typically sand or silt, that were deposited by moving water in former or current riverine environments. **Lacustrine** deposits are fine silts and clays laid down in quite-water environments of the former glacial Lake Merrimack that occupied the Merrimack Valley during glacial meltdown. **Organic materials** are poorly decomposed plant matter that has accumulated in saturated basins the over thousands of years since glacial retreat. **Outwash** consists of coarse sand and gravel deposited beyond the terminus of melting glaciers. The Concord Heights is a huge, former delta of a river that poured into Glacial Lake Merrimack. The term **sandplain** as used in this report refers to outwash or other relatively flat sandy soil areas. **Glacial drift** is a of rocky material deposited by glaciers, often mixed with finer sediments deposited by meltwater flowing from a glacier. These various parent materials can range from extremely dry to very wet, depending on the proximity of the water table to the surface.

Table 1. Attributes of Ecological Regions of Concord, including parent material, geologic setting, and key ecological features (wildlife habitats and natural communities).

Ecological Region & Subregions	Parent Material/Geologic Setting	Key Ecological Features
1) Merrimack River	Alluvium (Floodplains & high terraces)	Intact riparian river corridor: major migratory route for ducks, geese, and songbirds; roosting & foraging sites for bald eagle and osprey; exposed banks (bank swallow nest sites); associated backwaters, oxbows, and fields are potential or known habitats for wood and spotted turtles; wildlife corridor for otter, mink, & beaver; Floodplain Forest habitat for several uncommon songbirds such as blue-gray gnatcatcher and red-shouldered hawk; associated fields offer food sources for southbound migrating sparrows. The Merrimack River is a designated Important Bird Area
a) Hannah Dustin-Sewalls Falls	Alluvium	Agriculture, river, upland forest border
b) Sewalls Falls – Garvins Falls	Alluvium, floodplains	Extensive silver maple floodplain & terrace forests, agriculture, river
2) Contoocook River Valley	Outwash plains and till uplands	Large forest blocks embedded with wetlands and open lands and near river corridor: important to snakes and turtles susceptible to road mortality, including black racer, spotted turtle, wood turtle, Blanding's turtle; extensive sandplain peatland supports large population of the rare inflated sedge
a) Horse Hill	Till uplands	Large unfragmented forest block, Peatlands
b) Mast Yard outwash	Outwash (various drainage classes)	Pine Barrens, floodplain & terrace forest
c) Bog Road/Penacook Plains	Outwash (well to poorly drained), Organic materials	Extensive sandplain peatland/sedge meadow, swamp & upland forest on outwash
d) Contoocook River corridor	Aquatic, limited floodplain	River
3) Contoocook/Turkey/ Merrimack River Headwaters	Till uplands	Large forest blocks embedded with wetlands and open lands: important to snakes and turtles susceptible to road mortality, including known or potential habitat for black racer, spotted turtle, wood turtle, Blanding's turtle; provides connectivity to Turkey Ponds and Turkey River
a) Penacook Lake/Rattlesnake Hill	Till uplands, headwater drainages	Large unfragmented forest block, municipal water supply
b) Beech & Pine Hill headwaters	Till uplands	Large unfragmented forest block, headwaters & corridor between Contoocook & Turkey River watersheds, small pocket wetlands
4) Turkey River Lowland	Outwash, floodplain, lacustrine deposits, low till hills	Large, interconnected wetland complex critical to maintaining viable population of rare turtles; associated fields and other disturbed areas serve as turtle nest sites
a) Turee Brook/Turkey Ponds	Ponds & wetland complexes	Large ponds, large wetland complex

b) Turkey River Plains	Outwash & lacustrine deposits, floodplain (moderately well drained to poorly)	Floodplain Forest, agriculture, small river
5) Hoit Road Lowland/Oak Hill	Outwash and till uplands, marshes and organic material	Wetland complex within upland forest block: habitat and connectivity potential for Blanding's, spotted, and wood turtles
a) Oak Hill	Till uplands	Appalachian oak – pine and Hemlock - Hardwood - Pine Forests
b) Hoit Rd. Marsh/Hackard Bk.	Till uplands, large wetland complexes	Marshes & Peatlands along brooks
c) North Concord Plains	Outwash (somewhat excessively to moderately well drained)	Appalachian oak – pine and Hemlock - Hardwood - Pine Forests
6) Broken Ground/Turtletown Pond	Till uplands, large peatland complex and pond, lacustrine deposits	The largest unfragmented forest block, embedded with wetlands and open lands (powerline corridor): habitat and connectivity for wide-ranging species such as moose, black bear, bobcat, fisher, northern goshawk; Large forest blocks embedded with wetlands and open lands and near river corridor: important to snakes and turtles susceptible to road mortality, including black racer, spotted turtle, wood turtle, Blanding's turtle. Habitat potential for early successional species such as black racer, smooth green snake, American woodcock
a) Turtletown Pond	Large pond & wetlands, glacial lake deposits	Large pond and wetland (peatland, swamp, marsh)
b) East Concord Plains	Outwash (excessively to moderately well drained)	Appalachian Oak - Pine Forest on outwash, pitch pine fragments, river bluffs
c) Broken Ground Headwaters	Till uplands	Large unfragmented forest block, pocket wetlands (Peatlands and Marshes)
7) Concord Heights/Soucook River Valley	Outwash, minor river floodplain, sandy river bluffs and terrace slopes	Large grassland and Pine Barrens complex: supports nesting habitat for several uncommon bird species including state threatened grasshopper sparrow; known or potential habitat for state endangered eastern hognose snake, and the only habitat in NH for federally endangered Karner blue butterfly and many rare moths. Concord Airport Grasslands is a designated Important Bird Area
a) Concord Heights	Outwash (excessively drained)	Pitch Pine Barrens; Grasslands around airport
b) Soucook River Valley	Outwash (excessively drained), floodplain	Red maple floodplain & terrace forests, river bluffs, Pine Barrens
c) Garvins Falls Peninsula	Till upland, outwash	Appalachian Oak - Pine Forest, Pine Barrens, river corridor

2.2 - WAP Habitats and Natural Communities

Descriptions of WAP Habitats/Natural Communities

The WAP identified 19 different habitat types for NH (WAP 2005), seven of which occur in Concord NH: Grasslands, Pine Barrens, Peatlands, Floodplain Forest, Marsh and Shrub Wetlands, Appalachian Oak - Pine Forest, and Hemlock - Hardwood - Pine Forest. Most WAP habitats are naturally occurring, such as Marshes and various types of forest; a few, including Grasslands, require human intervention to maintain.The WAP list of 19 critical habitats was developed by NHFG based on the habitat requirements of associated wildlife species of conservation concern in the state. Many wildlife species require multiple habitat types, hence the importance of implementing wildlife habitat conservation at larger scales, such as at the ecological region and subregion scales described in this report. Other species, including many insects and other invertebrates, are specific to certain natural communities, micro-habitats within them, or plant species that occur in them.

Natural communities are recurring assemblages of plants and animals found in particular physical environments (Sperduto and Nichols 2004). WAP habitats consist of one or more types of natural communities. These habitats usually represent a broader range of vegetative and structural conditions than natural communities, which typically correspond to more specific plant species composition and physical conditions. Some natural communities correspond directly to habitats, while others are embedded features within a habitat type. Both habitats and their component natural communities occur in specific settings in the landscape. As physical settings change from one location to another, such as from a wind-exposed rocky summit to a forest below, there is a corresponding shift in the composition of plants and animals, producing different habitats and component natural communities that form predictable patterns across the landscape.

Below are abbreviated descriptions of the WAP habitats in Concord, key natural communities (or systems of natural communities) that correspond to them, and groups of species that occur in them, including rare species know to occur or that could potentially occur in Concord (see Table 2 for details).

WAP Patch types

These habitats typically occur in patches at a scale of tens to hundreds, or sometimes thousands of acres. Although collectively they cover a minority of the landscape, they contribute a great amount of biological diversity and critical habitat conditions within the larger landscape of upland forests and networks of streams, rivers, lakes and ponds.

Pine Barrens: Pine Barrens occur on excessively well drained sand soils with a history of frequent fire. Fire maintains pitch pine, scrub oak, wild lupine, and numerous other sandplain plants that require open conditions created by fire, or otherwise maintained by human activity in these areas. Pine Barrens also support a tremendous diversity of Lepidoptera (butterflies and moths) including the federally-endangered Karner blue butterfly, as well as vertebrate species such as Fowler's toad, eastern towhee, eastern hognose snake, and smooth green snake. Fire suppression and harvesting practices have eliminated pitch pine, scrub oak, and other Pine Barrens species in some areas, transforming former

Pine Barrens into either Appalachian Oak - Pine Forests or Hemlock - Hardwood - Pine Forests (see habitat descriptions below). Despite extensive development in and around the Concord Pine Barrens, many rare sandplain species persist, indicating the importance of remaining patches of Pine Barrens.

Examples of Pine Barrens natural communities that occur in Concord: pitch pine sand plain system; pitch pine - scrub oak woodland; dry river bluff.

Grasslands: Grasslands are created and maintained by human activity. They include mowed hayfields, pasture, croplands, and other maintained openings such as airport runways and capped landfills. A few natural communities contain small patches of native grasslands, such as riverwash gravel bars, but these are rare and form miniscule portions of the landscape.

Several breeding birds require large grassland habitat. Fifty to 75% of the statewide population of the threatened grasshopper sparrow is documented at the Concord Airport. Grassland management at the airport appears to be compatible with the sparrows' continued presence, and ongoing management related to restoration of the Karner blue butterfly may even create new habitat for sparrows as well. The shorter grass at the airport also supports several other species of conservation concern: vesper sparrow, eastern meadowlark, horned lark. The extensive Grasslands around the airport and smaller patches elsewhere in the Concord Heights are mapped as Pine Barrens habitat because of the many rare plant and invertebrate species rely on sand-soil grasslands openings.

Cropped fields can be important to migrating or wintering birds. In October 2002, hundreds of sparrows of a dozen species frequented the fields behind the Concord Post Office. These birds were joined by smaller numbers of indigo buntings, red-winged blackbirds, bobolinks, palm warblers, American pipits, and dickcissels. Other fields throughout the area regularly host small flocks of most of these species, in addition to horned larks.

Floodplain Forests: Floodplain Forests occupy the margins of streams and rivers throughout the state on flat terraces that flood regularly. The lowest Floodplain Forests flood every 1-2 years (or less frequently), with longer flood return intervals at higher elevations. They are generally better drained than swamps, but more poorly drained than upland forests. Tall trees and a dense layer of flood-tolerant herbs characterize Floodplain Forests. Non-native plants are abundant in many Floodplain Forests.

Several rare plants occur in Floodplain Forests. *Lygodium palmatum* (climbing fern) is one that occurs in Concord. Floodplain Forests along major rivers, such as the Merrimack River through Concord, provide some of the most critical wildlife habitat for spring and fall migrants and for aquatic-dependent species such as turtles and many amphibians. The complex of backwaters, oxbows, vernal pools, flooded forests, marshes, shrub wetlands, and nearby meadows and fields form suitable habitat for northern leopard frog, bald eagle, wood turtle, and dozens of species of migrating ducks, geese and songbirds. Floodplain Forests and open water along the Merrimack River provide roost and foraging sites for bald eagles and ospreys. Exposed banks offer nest sites for bank swallows.

Examples of Floodplain Forest natural communities that occur in Concord: major river silver maple floodplain system; silver maple - false nettle - sensitive fern floodplain forest; sugar maple - silver

maple - white ash floodplain forest; temperate minor river floodplain system; red maple floodplain forest; alder - dogwood - arrowwood alluvial thicket.

Peatlands: Peatlands are very poorly drained wetlands that occur in depressions or along sluggish drainage ways, where soils remain saturated throughout the year. As a result, organic matter decomposes slowly, eventually accumulating into thick deposits of organic soil (peat). Heath shrubs and peat mosses dominate in open bogs, which are extremely acidic types of peatlands. A more diverse mix of plants occurs in open fens, including non-heath shrubs, sedges, and other herbaceous plants. Fens are less acidic than bogs, but most are more acidic than marshes. Fens look similar to marshes superficially, but they are more nutrient-poor and have less pronounced water level fluctuations. WAP Peatlands also include conifer swamps. Large wetland complexes often contain both marsh and peatland habitats, with peatlands occurring in portions of a wetland with less overbank flow from streams and limited upland runoff.

Certain rare plants are restricted to peatlands, including several uncommon to rare orchids, and many sedges, such as *Carex bullata* (inflated sedge), a state endangered coastal plain plant recently discovered in Concord. Important wildlife that occur in peatlands (or peatlands and marshes) in Concord or have the potential to occur here include Blandings turtle, spotted turtle, eastern towhee, ribbon snake, and migrating songbirds including the palm warbler.

Examples of Peatland natural communities that occur in Concord: Poor level fen/bog system; medium level fen system; temperate peat swamp system; large cranberry – short sedge moss lawn; winterberry - cinnamon fern wooded fen; black spruce – larch swamp.

Marsh and Shrub Wetlands: Marsh and Shrub Wetlands (simplified as "Marshes" here) occupy wetland basins with broadly fluctuating seasonal water levels. Water remains near or above the surface for substantial portions of the growing season. Marshes are wetter than swamps, and better drained and more nutrient-rich than peatlands. Herbaceous plants and shrubs dominate Marshes. Trees are sparse or absent, but flood tolerant shrubs, grasses, sedges, forbs, and aquatic plants are common, depending on the range of hydrologic conditions within the wetland. Overall Marshes are more common than peatlands in the state. Large wetland complexes often contain both marsh and peatland habitats, with Marshes occurring in portions of a wetland with more influence of runoff from uplands and overbank flow from streams.

Wetlands complexes that are interconnected and unfragmented by roads are essential to maintaining viable populations of some species including Blanding's and spotted turtles. A diverse mix of wetland types and hydroperiods (length of time inundated with water) including emergent marsh, shrub wetland, vernal pools, and river corridors are particularly important. Larger wetlands with areas of open water mixed with emergent vegetation can support marsh birds such as common Moorhead, pied-billed grebe, herons, and rails. Rare plants historically documented in aquatic marsh habitats in Concord include *Sagittaria rigida* (sessile-fruited arrowhead) and *Potamogeton nodosus* (knotty pondweed).

Examples of Marsh natural communities that occur in Concord: emergent marsh - shrub swamp system; alder - dogwood - arrowwood alluvial thicket; cattail marsh; emergent marsh; aquatic

bed; meadowsweet – robust graminoid sand plain marsh; sedge meadow marsh; mixed tall graminoid - scrub-shrub marsh.

WAP Matrix Forest Types

Hemlock – Hardwood – Pine Forests: As defined in the WAP, this habitat includes a great diversity of upland forest and wetland swamp communities, and covers much of central and southern New Hampshire. The core upland forest types are characterized by combinations of hemlock, American beech, white pine, birches, red maple, and red oak. Appalachian oak species, such as white oak and black oak, are absent or sparse. As this type is so broadly defined and covers large areas of the state, it supports a wide diversity of plant and wildlife species. Large, unfragmented tracks of forest are important to wide-ranging species such as moose, black bear, fisher, bobcat, and northern goshawk. The larger the forest block, typically the greater the diversity of smaller patch habitats embedded within. Interior forest birds such a veery, wood thrush, scarlet tanager, and ovenbird are more successful breeders in larger forested areas. Patches of small openings, powerline corridors, and wetlands further diversify the forest habitat, offering potential habitat to black racer, American woodcock, migrating birds, turtles and amphibians.

Examples of Hemlock – Hardwood – Pine Forest natural communities that occur in Concord: hemlock - hardwood - pine forest system; hemlock - beech - oak - pine forest; hemlock - cinnamon fern forest; dry red oak - white pine forest; a wide variety of swamp natural communities.

Appalachian Oak - Pine Forests: Appalachian Oak - Pine Forests are uncommon statewide and restricted to southern and coastal New Hampshire, and approach their northern limit in the Concord area of the Merrimack River valley. They are indicated by the presence of oak trees other than red oak, such as white, black, and scarlet oak, as well as a variety of shrubs and understory plants that also reach their northern terminus in southern NH. These are relatively common types of forest in Concord. Some are oak and hardwood dominated with relatively little white pine, especially those on glacial till soils; others are dominated or co-dominated by white pine, particularly those on sandy outwash soils. This forest type offers similar wildlife benefits as the Hemlock - Hardwood - Pine Forests. The presence of diverse patches within the forest and other microhabitat features such as coarse woody debris, rock crevices, burrows, standing dead trees, determines the suitability of the larger forested landscape for many wildlife species.

Examples of Appalachian Oak – Pine Forest natural communities that occur in Concord: Appalachian oak - pine forest system; dry Appalachian oak forest; pitch pine - Appalachian oak - heath forest.

HABITAT POLYGON REFINEMENT

The refined habitat maps are depicted in Map 1 (pdf). This map also depicts the predicted exemplary natural community polygons.

Patch types

The refined WAP habitat polygons are illustrated in the attached pdf map (Map 1). The discussion below summarizes modifications to each layer.

Pine Barrens: I concluded that Pine Barrens were greatly over-predicted in Concord by the WAP habitat model. Their original WAP map predicted Pine Barrens included 90+ polygons totaling close to 5,000 acres. My refined pine barren layer contains 38 polygons, totaling roughly 1,000 acres.

Given the significance of these habitats, I refined the boundaries of all of the remaining areas in some detail to reflect apparent current extent using the NAIP 2008 color ortho photos. I included forest, woodland, and shrubby expressions of Pine Barrens, as well as adjacent areas of maintained Grasslands, such as the margins of runways at the Concord Airport. Many sandplain plants and animals require or utilize fire- or human-maintained openings such as these, and therefore these areas are important for the short and long-term maintenance of Pine Barrens species.

There is good reason to suspect that Pine Barrens were more extensive in pre-settlement and early-settlement periods. However, I found only scattered or no pitch pine trees in the areas investigated near Bog Road, north Concord, and East Concord, all areas with extensive patches of predicted Pine Barrens. Many of these areas supported stands of white pine with co-dominance or sub-canopies of white oak, black oak, red oak, and other hardwoods. These areas are more appropriately classified as Appalachian Oak - Pine Forests, and I changed the classification accordingly. In addition, while many of these areas contain outwash parent material, they are mostly poorly to moderately well drained or somewhat excessively drained – generally too mesic to sustain frequent fire return intervals. There may well be some small- to modest-sized patches of pitch pine still extant in these parts of Concord, but any formerly extensive areas of pitch pine have probably been eliminated by a combination of a) the absence of frequent fire, which is necessary to maintain pitch pine and scrub oak; b) forest management practices favoring white pine and hardwoods; and c) displacement by urban development. In addition, given the lack of local seed source of pitch pine, scrub oak, and other Pine Barrens plants, restoring these areas to Pine Barrens would be a substantial, expensive, and long-term prospect.

Floodplain Forests: Floodplain Forests were also over-predicted in Concord by a factor of approximately two. Many of the predicted Floodplain Forest polygons (or large portions of them) occupied high terraces adjacent to the Contoocook, Merrimack, and Soucook Rivers that apparently do not flood. I refined the boundaries of most of the Floodplain Forest polygons, based on interpretation of a combination of air photos, topographic maps, field work, and NRCS soils maps. Some of the polygons

may still contain some high terrace forests (i.e., that do not or only rarely flood) adjacent to floodplains, such as some of the Sunday sand soils along the Soucook River.

Peatlands: Most predicted Peatlands were fairly small, and those that were field-checked were reasonably good fits to the habitat type. One very large peatland along Bog Road was added (originally predicted as Hemlock - Hardwood - Pine Forest). This is one of two large Peatlands in Concord, both of which are dominated by tall shrub or sparse swamp peatland communities. The Bog Road example is a temperate peat swamp system, including various peatland communities such as basin swamp, tall shrub fen, and some large areas of sandplain sedge fen. The peatland contains what is apparently the largest population of *Carex bullata* (inflated sedge) in the state, a rare coastal plain sedge known currently from only a few sites.

Marshes (marsh and shrub wetlands): I made relatively few modifications to the marsh layer. Some polygons were changed to peatland habitat based on field work, and one very large marsh and shrub thicket system was added near Turkey Pond.

Grasslands: I made relatively few modifications to the Grasslands layer. For the most part, the habitat polygons reflected open fields, cropland, and Grasslands reasonably well at a coarse scale. Considerable time would be required to clean up the boundaries to match actual extent on the ground more closely, and to make meaningful distinctions between types of grassland openings.

Matrix forest types

The matrix forest types overlap considerably with the patch types. In general, the patch types should prevail in areas of overlap, and they are depicted this way in the maps associated with this report.

Hemlock - Hardwood - Pine Forests. This is the most common predicted habitat for Concord. While indeed common, I concluded that it is over-predicted. I encountered many areas of this mapped type that were better classified as Appalachian Oak - Pine Forest.

Appalachian Oak - Pine Forests: This type is mapped less extensively than Hemlock - Hardwood - Pine Forests. Field observations suggest that this type is under-predicted for Concord, and may even be as common as Hemlock - Hardwood - Pine Forests. Many of the originally predicted Pine Barrens in north and East Concord were re-classified as Appalachian Oak - Pine Forest. A large patch of predicted Hemlock - Hardwood - Pine Forest around Garvins Falls was also changed to Appalachian Oak - Pine Forest. These modifications are by no means complete: accurate corrections would require much more field work and/or refinements based on additional interpretation of soil types. Overall, Appalachian Oak - Pine Forests are less common in the state and therefore of somewhat higher conservation significance than Hemlock - Hardwood - Pine Forests.

2.3 - Rare Species and Exemplary Natural Communities

The interpreted rare species and exemplary natural communities data obtained from the NH NHB (July 2010) are presented in Table 2 (attached pdf). These data are supplemented with several newly discovered rare species found during the course of this project. The discovery of these species underscores the fact that there has not been a comprehensive inventory of rare species and communities in Concord. This is also reflected in the NHB database by numerous historical records (not confirmed within 20 years), and the bias towards Pine Barrens, certain riparian areas, and some large wetlands.

The data are organized to reflect the importance of certain systems and ecological regions, rather than taxonomic groups alone. In addition, while NHB could not allow me to reveal the ecological region for individual species or natural communities, they did permit me to identify the number of occurrences in ecological regions for groups of species (e.g., sandplain plants, riparian vertebrates). These numbers appear in the far right column and indicate some broad patterns of diversity of habitat-species groups across the City.

Exemplary natural communities represent the best or only remaining examples in the state for all types of natural communities. They include all examples of rare types, better examples of uncommon types, and the best examples of common types. NHB maintains criteria based on size, condition, and landscape context for each system or natural community type, which are applied to occurrences to determine if they are exemplary.

Predicted exemplary natural communities identified in this project are based on application of NH Natural Heritage Bureau (NHB) ranking specifications to refined WAP polygons, resulting in the identification of potentially exemplary natural communities or systems. Many of these areas are not presently verified as exemplary by NHB, nor do they represent NHB data directly.

2.4 - Conservation Recommendations

Proposed Conservation Priorities

The proposed conservation areas are summarized and framed within each of seven ecoregions in Table 3, and depicted in the pdf map attached with this report.

The selection of proposed conservation areas reflects consideration of the following factors:

- Revised WAP polygons
- Rare species and exemplary natural community locations
- Predicted exemplary natural communities
- Riparian zones
- Complexes of communities/habitats, including larger wetland complexes and diverse upland-wetland complexes
- Large un-fragmented forest blocks
- Degree of fragmentation and development
- Known and potential wildlife corridors between major areas of protected land
- Location of existing conservation lands

The information in Table 3 indicate the key important features of each area, and can help inform future discussions concerning modifications or alternative protection scenarios in these areas.

Although the specific areas of rare species and exemplary communities in the NHB database cannot be displayed on the attached map, it can be said that the combination of existing and proposed conservation lands would capture the actual locations or associated key habitats for the great majority of extant (observed in last 20 years) rare species and exemplary natural communities documented in Concord.

In addition, other worthy or alternative conservation areas not depicted in this map could be identified. Two examples involve the immediate corridors along the Contoocook River and the upper Soucook River (floodplain and terraces east of Route 106 and north of the Airport). The Contoocook River is clearly an important feature of northwest Concord. The reason the immediate Contoocook River corridor was not identified as a higher priority is because the floodplain riparian zone is less well developed than other Concord rivers, and because the upland forests on high terraces have lots of roads and houses close to the river. Similarly, the upper Soucook was not identified because of impacts from development on the patchy floodplain extent, and the narrow potential strip of conservation land available between Rt. 106 and the river. That said, the Loudon side of the river is more intact, and greater opportunities exist there to retain ecological values associated with the river.

Wildlife Corridors: The analysis of wildlife habitat and other ecological data to identify priority areas for conservation included an assessment of habitat connectivity and wildlife travel corridors. Protecting and maintaining these landscape linkages between key habitat patches is important to the long-term sustainability of wildlife populations. The assessment included use of the Connectivity Model for New Hampshire developed by NH Fish and Game and NH Audubon. This model was used to confirm potential

linkages identified through the analysis of WAP and other ecological data and knowledge of the habitat, range, and movement of species of concern known or thought to occur in the City of Concord. Land cover (i.e., habitat types), distance to roads and riparian areas, and proximity to existing conserved lands are key criteria used to identify potential pathways (and barriers) for wildlife movement.

Maintaining habitat connectivity and minimizing habitat fragmentation are particularly critical to turtles. Blanding's and spotted turtles are highly susceptible to road mortality and to predation by mid-sized predators such as raccoons and skunks, which thrive in fragmented landscapes. In addition, these turtles utilize a variety of wetland types throughout the year, requiring large wetland complexes unfragmented by roads. Wide-ranging species, such as fisher, black bear, and bobcat also require corridors as their ranges usually extend well beyond even the largest remaining habitat blocks. Migratory birds follow riverine-riparian corridors, such as the Merrimack River, during spring and fall migration.

OTHER RECOMMENDATIONS

- Comprehensive Inventory of species, habitats, and natural communities: Concord has not benefited from a recent, comprehensive inventory of species, habitats, and natural communities. The identification of several rare plants and probable exemplary natural communities during the conduct of model-verification field work underscores the limitations to current NHB data in the City. In the absence of comprehensive inventory, partial inventories can help fill information gaps: pursuit of targeted inventories of particular areas (for example, City owned properties), particular groups of species, or to refine or validate predicted exemplary natural communities or protection priorities. Good inventory information is also useful for evaluation of stressors and restoration needs (see below). Bats are an example of a group of species that we know relatively little about in Concord and other parts of the state. It is possible that the Merrimack River corridor and its Floodplain Forests, for example, could contain roost sites, foraging areas, migration routes for bats.
- Limitations of the WAP habitat model: While the WAP habitat maps represent a tremendous and useful effort to predict locations of important habitats across the state, the results of this study serve as a reminder that it is essentially a model of habitat that requires on-the-ground validation in many areas. Although many polygons were field checked during this study, most have not been, and additional field verification and refinement would improve accuracy and confidence in applied uses of the data. Future habitat mapping efforts would benefit from broadening the range of mapped categories to include natural communities or systems. One strategy would be to structure revisions hierarchically or at two levels, where more detailed natural community maps are produced to reflect important details where this information is available or desirable. For example, most swamps and some other wetlands are lumped into matrix forest habitat types, thereby potentially missing certain important biological resources in conservation planning exercises. Bog Road is a classic example of this: the original WAP model typed this large and significant peatland as a Hemlock - Hardwood - Pine Forest. Without delineation of this feature as a peatland, the area would be of equal value common forest types that are extremely common.
- Improve biological information and management planning on easement lands: Securing easements is an important strategy for land protection. Easement monitoring is critical, and protection is enhanced if good information on property resources is available, such as locations of rare species or special resources, and if landowners can be engaged as partners in land stewardship.

- Opportunities for conservation work across town boundaries and with partner conservation land holders: Many of the conservation priorities identified abut neighboring towns. Protection can be enhanced by engaging neighboring towns concerning each other's priorities, and by exploring possibilities for collaboration. The Pine Barrens habitat between the Soucook River and Route 106 in Pembroke, and the Broken Ground region adjacent to Loudon are good examples. Protection can also be enhanced by working with other large land owners, such as St. Pauls, to better understand management goals and the opportunities for securing long-term protection.

- Evaluation of stressors to natural areas: There are many stressors to natural systems, which threaten or disrupt their ecological integrity. Development, invasive species, pollution, heavy recreational use, inappropriate ATV use, harvesting in sensitive areas, poor forestry practices, and flood control policies of dams along rivers are a list of just a few. Some stressors can be mitigated by environmental regulations; others require on the ground management actions. Good information on the resources and threats on each property, and all conservation lands collectively, will help prioritize stressors and appropriate management and mitigation strategies. State and federal agencies and certain conservation organizations are concerned with these same issues, and there may be opportunities to partner with them to achieve common goals.

- Restoration Opportunities: Pine Barrens and floodplains are the primary systems that may require special management to maintain or restore ecological conditions necessary for the survival of component species, including certain rare species. These areas have considerable threats or stressors that are impacting or have the potential to impact species diversity and overall ecological integrity of the systems.

  Pine Barrens: the long term integrity of the Pine Barrens and its component species will depend on whether conservation partners can 1) combine efforts to secure additional remaining Pine Barrens fragments; and 2) commit to and institute a creative, long-term management strategy for the Pine Barrens restoration. Short of this, it may still be possible to retain and manage for certain species on smaller, isolated parcels, but it will not necessarily represent a fully functioning, diverse pine barrens system. For the pine barrens to be retained and restored to its fullest potential, management will need to involve a combination of mechanical vegetation management, prescribed fire, and other restoration efforts, such as nectar plant management and propagation. Such efforts would no doubt require considerable resources over the long term.

  Floodplain Forests: Invasives species are nowhere more prevalent in Concord than on floodplains and terraces of the Merrimack River, particularly in and along edges of Floodplain Forests and agricultural fields. Invasives species management is resource intensive, and given the scale of the problem, efforts should focus on priority Floodplain Forests or other riparian habitats that are most threatened, and where management efforts have the potential to succeed.

  Other stressors to Floodplain Forests are impacts of flood control dams. It is uncertain how the current and historic flood regimes have and continue to affect the dynamics and perpetuation of Floodplain Forests along the Merrimack Rivers. Other conservation organizations (including the Nature Conservancy) are involved in restoration of flood regimes appropriate for natural systems on some NH rivers, and they may be a good resource for the City.

  The agricultural fields and Floodplain Forests along the Merrimack are important resources in and of themselves. However, one resource lost from most of New Hampshire, including Concord, are infrequently- or un-flooded high river terraces on alluvial soils. Most of these areas are agricultural

soils of statewide importance, and it is no surprise that most of them are either developed or in agriculture. It might take a visionary to restore large and intact forests on high floodplains of the Merrimack River – areas that at one time grew what were probably some of the most beautiful, diverse, and impressive forests in the state.

REFERENCES

NH Fish and Game Department. 2005. New Hampshire Wildlife Action Plan. Concord, NH.

Sperduto, D.D. and W.F. Nichols. 2004. Natural Communities of New Hampshire. NH Natural Heritage Bureau, Concord, NH. Pub. UNH Cooperative Extension, Durham, NH. ISBN 0-9719675-3-9.

NH Fish and Game Department and NH Audubon. 2009. New Hampshire Wildlife Connectivity Model. Concord, NH.

Table 2. Rare Species and Exemplary Natural Communities of Concord, New Hampshire

Notes: NHB data as of July 2010, interpreted and supplemented by data collected by Sperduto Ecological Services LLC. **Yellow species** are newly discovered species or populations for Concord (not in NHB database yet). **Priority Scores** are rarity/quality combinations: 3=Highest (best or good examples of globally rare/regionally restricted types; 2=Very high (good/best examples of state rare/uncommon, best examples of common types); 1=High (fair examples of state rare). **Fed** = Federal status; **State**= State status; Ecological Region column indicates the region number followed by the number of occurrences in that region (in parentheses). **Ecological Region codes**: 1 = Merrimack River; 2 = Contoocook River; 3 = Contoocook/Turkey/Merrimack River Headwaters; 4 = Turkey River Lowlands; 5 = Hoit Road Lowlands/Oak Hill; 6 = Broken Ground; 7 = Concord Heights/Soucook River.

* Species know to occur on City of Concord fee-owned lands

Major Habitat and Type or Species	Priority Score	Fed	State	# Last 20 Years Concord	# Last 20 Years State	Habitat	Ecological Region (# of Occ.)
EXTANT (Observed within last 20 years in Concord)							
SANDPLAIN/PINE BARRENS and GRASSLANDS							
Natural Communities							7 (9)
Pitch pine - scrub oak woodland*	2			6	16	Sandplain/pine barrens	
Dry river bluff*	3			3	11	Sandplain/pine barrens	
Plants							6 (2); 7 (20)
Blunt-leaved Milkweed (Asclepias amplexicaulis)	2		T	3	15	Sandplain/pine barrens openings	
Golden Heather (Hudsonia ericoides)*	3		E	3	10	Sandplain/pine barrens openings	
Hay Sedge (Carex siccata)	2		E	1	5	Sandplain/pine barrens & river terrace	
Houghton's Umbrella Sedge (Cyperus houghtonii)	2		E	1	6	Sandplain/pine barrens openings	
Low Bindweed (Calystegia spithamaea)	2		E	1	8	Sandplain/pine barrens openings	
Spiked three-awn (Aristida longespica)	2		E	1	4	Sandplain/pine barrens openings	
Wild Lupine (Lupinus perennis)*	3		T	13	26	Sandplain/pine barrens openings	
Vertebrates - Birds							7 (3)
Grasshopper Sparrow (Ammodramus savannarum)*	2		T	1	12	Grassland (short grasslands)	
Horned Lark (Eremophila alpestris)*	2		SC	1	4	Grasslands (sparse vegetation)	
Vesper Sparrow (Pooecetes gramineus)*	2		SC	1	12	Grasslands (bare ground patches)	
Vertebrates - Reptiles and Amphibians							2(3); 6(2); 7(3)
Eastern Hognose Snake (Heterodon platirhinos)	2		E	3	30	Sandplain/pine barrens	
Northern Black Racer (Coluber constrictor constrictor)*	2		T	4	40	Grasslands (brushy areas)	
Smooth Green Snake (Opheodrys vernalis)	2		SC	1	38	Sandplain/pine barrens	
Fowler's Toad (Bufo fowleri)	2		SC	2	5	Sandplains/pine barrens (near water)	

Major Habitat and Type or Species	Priority Score	Fed	State	# Last 20 Years Concord	# Last 20 Years State	Habitat	Ecological Region (# of Occ.)
Invertebrates - Butterflies & Moths							
* 12 species of invertebrates occur on City-owned land							7 (44)
A Geometrid Moth (Euchlaena madusaria)	2			2	2	Sandplain/pine barrens	
A Geometrid Moth (Eumacaria latiferrugata)	2			1	2	Sandplain/pine barrens	
A Noctuid Moth (Acronicta hamamelis)	2			2	2	Sandplain/pine barrens	
A Noctuid Moth (Apharetra dentata)	2			1	3	Sandplain/pine barrens	
A Noctuid Moth (Chytonix sensilis)	2			1	3	Sandplain/pine barrens	
A Noctuid Moth (Eucoptocnemis fimbriaris)	2			1	3	Sandplain/pine barrens	
A Noctuid Moth (Euxoa pleuritica)	2			1	3	Sandplain/pine barrens	
A Noctuid Moth (Idia diminuendis)	2			1	5	Sandplain/pine barrens	
A Noctuid Moth (Platyperigea meralis)	2			1	2	Sandplain/pine barrens	
A Noctuid Moth (Zale obliqua)	2			1	2	Sandplain/pine barrens	
Apantesis carlotta	2			1	2	Sandplain/pine barrens	
Barrens Chaetaglaea (Chaetaglaea tremula)	2			1	1	Sandplain/pine barrens	
Barrens Xylotype (Xylotype capax)	2		SC	2	6	Sandplain/pine barrens	
Blueberry Gray (Glena cognataria)	2			1	2	Sandplain/pine barrens	
Dusted Skipper (Atrytonopsis hianna)	2			2	2	Sandplain/pine barrens	
Edwards' Hairstreak (Satyrium edwardsii)	2			1	2	Sandplain/pine barrens	
Karner Blue Butterfly (Lycaeides melissa samuelis)	2	E	E	2	5	Sandplain/pine barrens	
Little Bluet (Enallagma minusculum)	2			1	3	Sandplain/pine barrens	
No Common Name (Catocala sp. 1 nr. jair)	2			1	2	Sandplain/pine barrens	
Papaipema lysimachiae	2			2	2	Sandplain/pine barrens	
Phyllira Tiger Moth (Grammia phyllira)	2		SC	1	4	Sandplain/pine barrens	
Pine Barrens Zanclognatha Moth (Zanclognatha martha)	2		SC	2	4	Sandplain/pine barrens	
Plum Sphinx (Sphinx drupiferarum)	2			1	1	Sandplain/pine barrens	
Southern Pine Sphinx (Lapara coniferarum)	2			1	2	Sandplain/pine barrens	
Southern Variable Dart Moth (Xestia elimata)	2			1	2	Sandplain/pine barrens	
Wild Indigo Duskywing (Erynnis baptisiae)	2			1	3	Sandplain/pine barrens	
Cobweb Skipper (Hesperia metea)	3			3	5	Sandplain/pine barrens	
Frosted Elfin (Callophrys irus)	3		E	4	7	Sandplain/pine barrens	
Graceful Clearwing (Hemaris gracilis)	3			2	8	Sandplain/pine barrens	
New Jersey Tea Span Worm (Apodrepanulatrix liberaria)	3			1	2	Sandplain/pine barrens	
Persius Dusky Wing (Erynnis persius persius)	3		E	1	6	Sandplain/pine barrens	

Major Habitat and Type or Species	Priority Score	Fed	State	# Last 20 Years Concord	# Last 20 Years State	Habitat	Ecological Region (# of Occ.)
RIPARIAN - FLOODPLAIN AND RIVER							
Natural Communities							1(2); 7(1)
Acidic riverside seep	1			1	4	Riparian	
Sugar maple - silver maple - white ash floodplain forest*	2			1	3	Riparian - Floodplain forest	
Silver maple - false nettle - sensitive fern floodplain forest*	3			1	22	Riparian - Floodplain forest	
Plants							1(1)
Climbing Fern (Lygodium palmatum)	2		E	1	5	Riparian - Floodplain or terrace forest	
Vertebrates							1(8); 2(1); 6(1); 7(1)
Bald Eagle (Haliaeetus leucocephalus)	2	M	T	1	31	Riparian - river & terrace forest	
Wood turtle (Glyptemys insculpta)	2		SC	6	125	Riparian/shrubby/wetland-upland complexes	
Northern Leopard Frog (Rana pipiens)	2		SC	4	16	Riparian	
Invertebrates							1(1)
Brook Floater (Alasmidonta varicosa)	3		E	2	31	Riparian - river	
WETLANDS							
Natural Communities							4(1); 6(1)
Temperate peat swamp system	3			1	1	Peatland	
Emergent marsh - shrub swamp system	2			1	18	Marsh	
Plants							
Inflated sedge (Carex bullata)	3		E	1		Sandplain peatlands & sedge meadows	2 (1)
Vertebrates							1,2,3,4,5 (1 each); 6 (2)
Common Loon (Gavia immer)*	2		T	1	270	Aquatic - ponds and lakes	
Spotted Turtle (Clemmys guttata)	2		T	1	89	Large marsh or peatland complexes	
Blanding's Turtle (Emydoidea blandingii)	3		E	5	156	Large marsh or peatland complexes	
UPLAND FOREST							
Semi-rich oak - sugar maple forest	1			1	7	Rich woods/river terrace	6
OTHER							2,3,7 (1 each)
Common Nighthawk (Chordeiles minor)*	2		E	3	11	Urban - rooftops	

HISTORIC SPECIES - Last observed >20 years ago

Major Habitat and Type or Species	Priority Score	Fed	State	# Last 20 Years Concord	# Last 20 Years State	Habitat	Ecological Region (# of Occ.)
WETLANDS AND PONDS							
Plants							1(1); 2(1); 4(1)
Giant Rhododendron (Rhododendron maximum)	H		T		13	Peatland/Forest (poor swamp or forest)	Unknown
Knotty Pondweed (Potamogeton nodosus)	H		T		19	Aquatic	
Pale Duckweed (Lemna valdiviana)	H		E		4	Aquatic	
Sessile-fruited Arrowhead (Sagittaria rigida)	H		E		7	Aquatic	
Vertebrates							1(1); 4(1); 6(1)
Common Moorhen (Gallinula chloropus)*	H		SC		5	Marsh - emergent	
Great Blue Heron (Rookery) (Ardea herodias)*	H				39	Large marsh or peatland complexes	
Pied-billed Grebe (Podilymbus podiceps)*	H		T		28	Marsh - emergent	
SANDPLAIN/PINE BARRENS and GRASSLANDS							
Common Sandbur (Cenchrus longispinus)	H		E		11	Sandplain/pine barrens openings	Unknown
Invertebrates							All in 7
A Geometrid Moth (Metarranthis apiciaria)	H				2	Sandplain/pine barrens	
A Noctuid Moth (Acronicta lanceolaria)	H				1	Sandplain/pine barrens	
A Noctuid Moth (Chaetaglaea cerata)	H				5	Sandplain/pine barrens	
A Noctuid Moth (Cucullia speyeri)	H				1	Sandplain/pine barrens	
A Noctuid Moth (Lithophane thaxteri)	H				3	Sandplain/pine barrens	
A Noctuid Moth (Zale curema)	H				1	Sandplain/pine barrens	
Agrotis stigmosa	H				1	Sandplain/pine barrens	
Broad-lined Catopyrrha (Catopyrrha coloraria)	H		SC		1	Sandplain/pine barrens	
Noctuid Moth (Zale submediana)	H				2	Sandplain/pine barrens	
Pine Devil (Citheronia sepulcralis)	H				3	Sandplain/pine barrens	
Pinion Moth (Xylena thoracica)	H				3	Sandplain/pine barrens	
Sleepy Duskywing (Erynnis brizo brizo)	H		SC		3	Sandplain/pine barrens	
Spiny Oakworm (Anisota stigma)	H				2	Sandplain/pine barrens	
The Cora Moth (Cerma cora)	H		SC		2	Sandplain/pine barrens	
Twilight Moth (Lycia rachelae)	H				2	Sandplain/pine barrens	
Purple Martin (Progne subis)	H		SC		18	Grasslands (purple martin houses)	2(1)
Other							
Large Whorled Pogonia (Isotria verticillata)	H		E		4	Forest - Appalachian oak - pine forest	3(1)

Table 3. Key Attributes of Conservation Priority Areas. Y=yes; N=no; H=high; M=medium; L=low; U=unknown; S=small. Unfragmented forest blocks: H=>500 ac.; M=200-500 ac.; S=<200 ac.

Ecological Region	Cons Area #	Proposed Conservation Area	Key Geomorphic	Key WAP Habitats	Predicted Exemplary NCs?	Potential For Rare Species	Diverse Complex?	Unfrag-mented forest block	Known or potential wildlife corridor?	Adjacent Cons Land
Merrimack River	1.1	SW of Exit 16	Alluvium	Grassland; Floodplain Forest	Y	M	M	S	Y	Y
Merrimack River	1.2	Goodwin Point	Alluvium	Grassland; Floodplain Forest	Y	M	M	S	Y	Y
Merrimack River	1.3	Exit 17	Outwash	Riparian buffer	N	M	M	M	Y	Y
Merrimack River	1.4	South of Rt. 3	Alluvium	Riparian buffer; Floodplain Forest	N	H	M	N	Y	Y
Merrimack River	1.5	South of Rt. 9	Alluvium	Riparian buffer; Grassland	N	L	L	S	Y	Y
Contoocook River	2.1	Bog Road	Organic, Outwash	Peatland	Y	H	H	M	Y	Y
Contoocook River	2.2	Horse Hill	Till uplands	Matrix forest	Y	M	M	L	Y	Y
Contoocook River	2.3	Parish Road	Till uplands	Matrix forest	N	U	M	S	Y	Y
Contoocook River	2.4	Allen SF vicinity	Outwash; peat	Peatland; forest on outwash	Y	M	M	S	Y	Y
Contoocook/Turkey/Merrimack River Headwaters - W	3.1	Beech & Pine Hill Headwaters	Till uplands	Matrix forest	N	L	M	L	Y	Y
Contoocook/Turkey/Merrimack River Headwaters - E	3.2	Beech & Pine Hill Headwaters	Till uplands	Matrix forest	N	L	M	L	U	Y
Contoocook/Turkey/Merrimack River Headwaters	3.3	Little Pond	Till uplands; peat	Peatland; matrix forest	Y	M	M	S	Y	Y
Turkey River Lowlands	4.1	North of Turee Brook	Peat; outwash; till	Marsh; matrix forest	Y	H	H	M	Y	Y
Hoit Road Lowlands/Oak Hill	5.1	Hackett Brook/Hoit Rd.	Till upland	Marsh; peatland; matrix forest	Y	H	H	S	Y	Y
Hoit Road Lowlands/Oak Hill	5.2	Snow Pond	Outwash; peat	Peatland; matrix forest	Y	M	M	S	Y	Y
Hoit Road Lowlands/Oak Hill	5.3	Oak Hill	Till uplands	Matrix forest	N	L	L	M	U	Y
Broken Ground/Turtletown Pond	6.1	Broken Ground	Till uplands	Matrix forest; peatland	Y	H	M-H	L	Y	Y
Broken Ground/Turtletown Pond	6.2	Turtletown Pond/Mill Brook Headwater	Till; outwash; lacustrine; peat	Matrix forest; marsh; peatland	Y	H	H	L	Y	Y

Concord Heights/Soucook River	7.1	Garvins Falls to Rt. 3	Outwash	App oak; pine barrens; Floodplain forest	Y	H	H	L	Y	Y
Concord Heights/Soucook River	7.2	Steeplegate to KB Refuge	Outwash	Pine barrens	Y	H	H	S	Y	Y

NH WILDLIFE ACTION PLAN HABITATS

As refined by Sperduto Ecological Services, LLC for the City of Concord, NH

Concord, New Hampshire

Concord Boundary

Summits

Roads
- Highway
- Local Road
- Unmaintained Road

Railroad

Utility Lines

Water Body

River / Stream
- Perennial
- Intermittent

Developed Land

Patch Habitats
- Floodplain Forest
- Marsh and Shrub Wetlands
- Peatlands
- Pine Barrens (incl. sandplain grasslands)
- Grasslands (pasture, cropland, mowed fields)

Matrix Forest Habitat
- Appalachian - Oak - Pine Forest
- Hemlock - Hardwood - Pine Forest

Other Wetland Habitat (National Wetlands Inv.)

Predicted Exemplary Natural Communities
- Floodplain Forest
- Marsh and Shrub Wetlands
- Peatlands
- Pine Barrens (incl. sandplain grasslands)
- Appalachian - Oak - Pine Forest

DATA SOURCES:
NH GRANIT: All datasets displayed on this map are provided by NH GRANIT unless otherwise noted. Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center, under contract to the NH Office of Energy and Planning, and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. OEP, CSRC, and the cooperating agencies make no claim as to the validity or reliability or to any implied uses of these data.

Refined WAP Habitats and Predicted Exemplary Natural Communities:
Habitats displayed here are a modified version of the 2010 NH Fish and Game Department Wildllife Action Plan Habitat maps, based on field work and interpretation of air photos and other GIS data by Sperduto Ecological Services LLC. Predicted exemplary natural communities are based on application of NH Natural Heritage Bureau (NHB) ranking specifications to refined WAP polygons, resulting in the identification of potentially exemplary natural communities or systems. Many of these areas are not presently verified as exemplary by NHB, nor do they represent NHB data directly.

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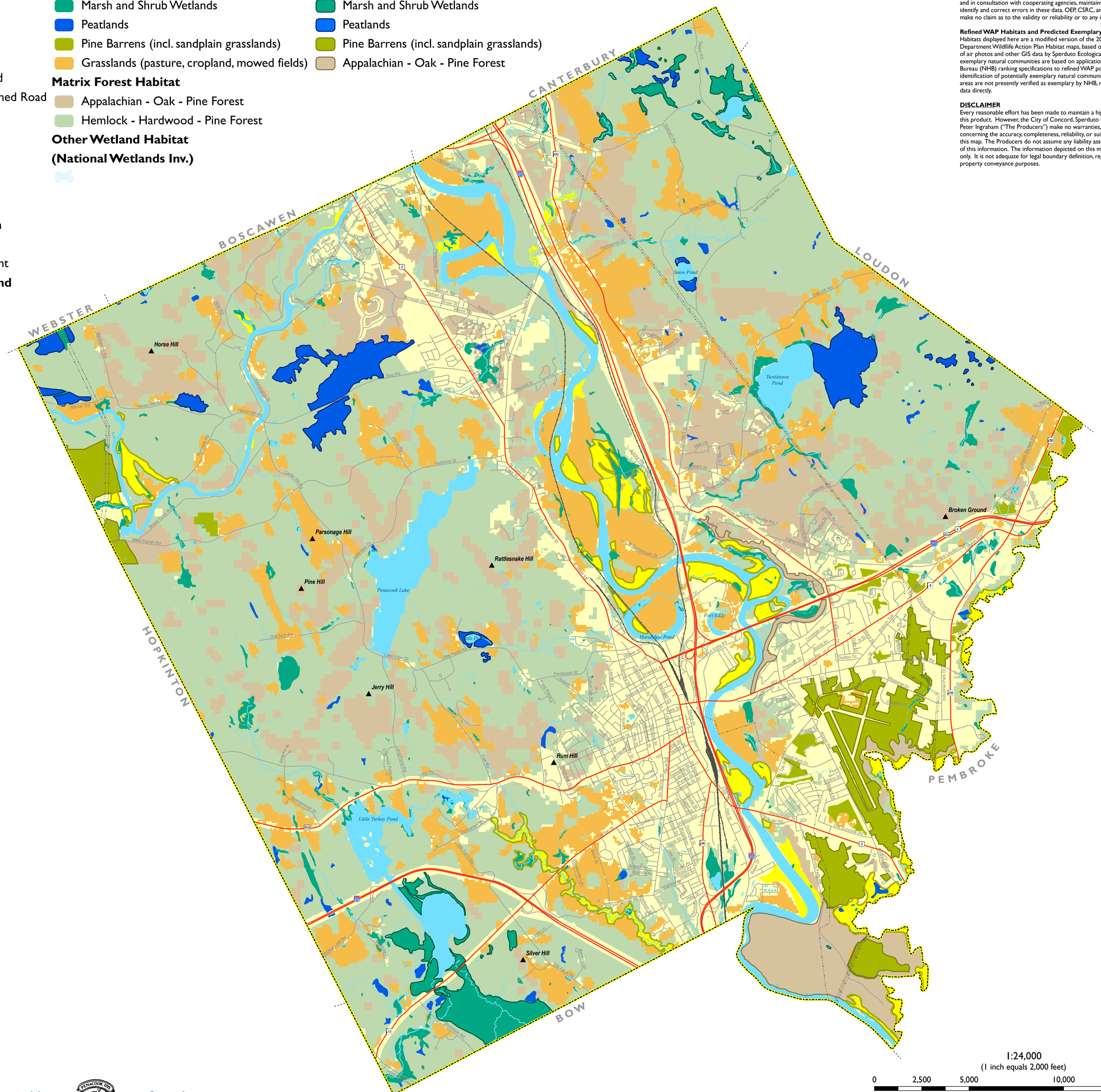

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1:24,000
(1 inch equals 2,000 feet)

0 2,500 5,000 10,000 15,000 Feet

0 0.5 1 2 3 Miles

Central New Hampshire Regional Planning Commission

Sperduto Ecological Services, LLC.

map production by: Pete Ingraham ecology. geography. cartography.

NH WILDLIFE ACTION PLAN HABITATS - *Concord, New Hampshire*
October, 2010

CONSERVATION PRIORITIES

Concord, New Hampshire

Concord Boundary

Conservation and Public Lands

Summits

Roads
- Highway
- Local Road
- Unmaintained Road

Railroad

Utility Lines

Water Body

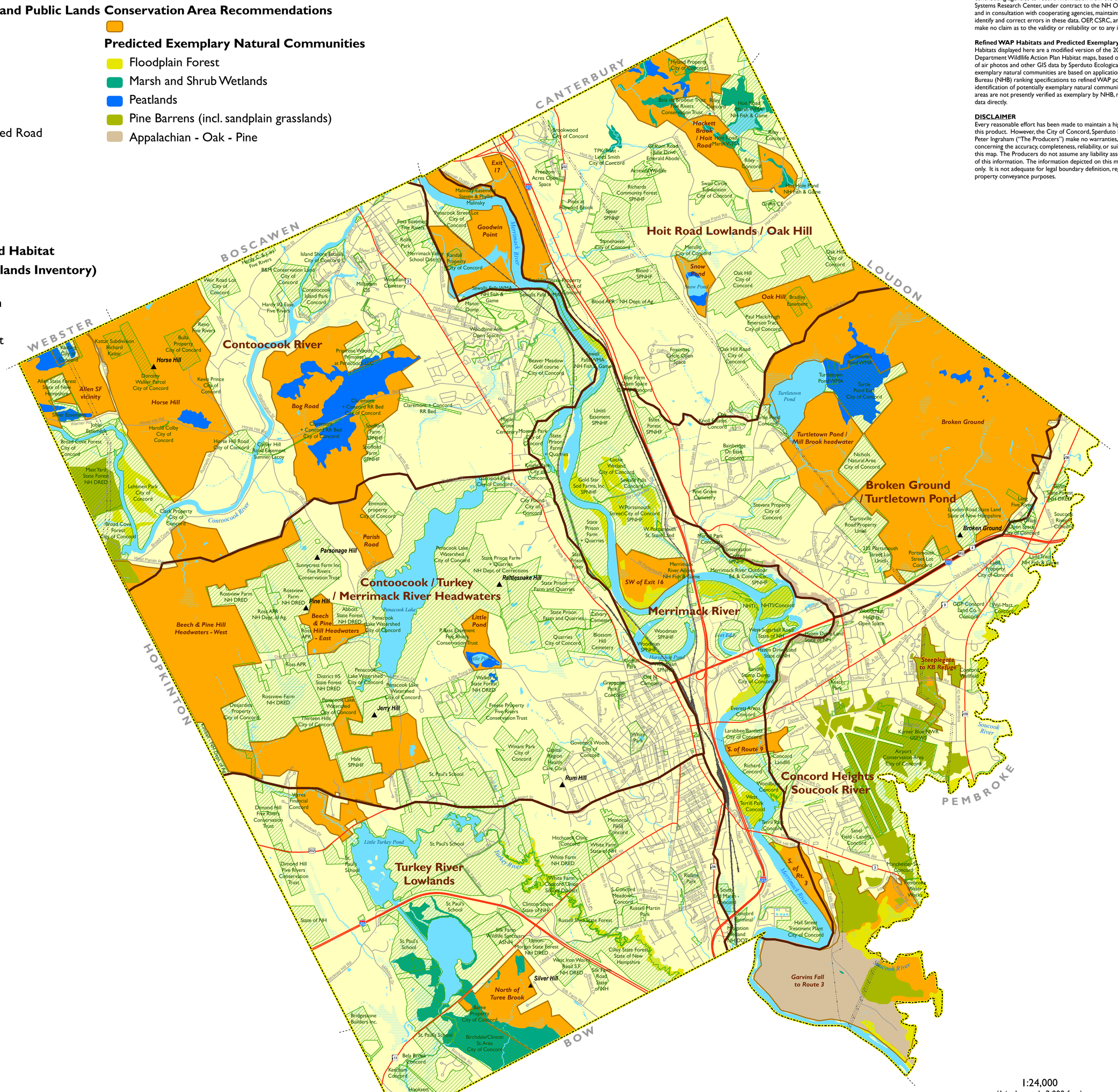
Other Wetland Habitat (National Wetlands Inventory)

River / Stream
- Perennial
- Intermittent

Ecological Regions

Conservation Area Recommendations

Predicted Exemplary Natural Communities
- Floodplain Forest
- Marsh and Shrub Wetlands
- Peatlands
- Pine Barrens (incl. sandplain grasslands)
- Appalachian - Oak - Pine



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CONSERVATION PRIORITIES - *Concord, New Hampshire*
October, 2010

Central New Hampshire Regional Planning Commission

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