

CITY OF LACONIA, NEW HAMPSHIRE

NATURAL RESOURCES INVENTORY

November 2009



**Report Prepared by:
Watershed to Wildlife, Inc.
John C. Severance and Elise J. Lawson
Natural Resource Consultants
42 Mill Street, Suite 3
Littleton, NH 03561**

ACKNOWLEDGEMENTS

This report has involved hard work by many people in Laconia. Involvement of volunteers has greatly increased the amount of data collected on natural resource features throughout city.

City of Laconia

Planning Board members, Conservation Commission members, Public Works
Department members

Funding for this Project Provided by:

Laconia City Council

Cover Photo of Pickerel Pond Wetland System, courtesy of Diane Hanley

TABLE OF CONTENTS

EXECUTIVE SUMMARY 4

INTRODUCTION AND OBJECTIVES..... 6

METHODOLOGY..... 9

 Field Work..... 9

 Gather Existing Digital Data..... 9

 Accuracies of Existing Maps..... 9

 Compile Existing Data into Autocad and Arcview..... 10

 GIS Training Workshop..... 12

 Public Information Presentation..... 12

RESULTS..... 12

 Rivers and Large Waterbodies..... 12

 Subwatersheds..... 18

 Riparian Zones and Floodplains..... 18

 Wetlands and Hydric Soils..... 21

 Permanent Wildlife Openings..... 29

 Forested Lands..... 31

 Bedrock Geology..... 35

 Soils..... 37

 Farmland Soils..... 39

 Stratified Drift Aquifers..... 41

 Slope..... 42

 Rare Species and Exemplary Natural Communities..... 43

 Wildlife Action Plan..... 47

 Scenic Resources..... 48

 Conservation Land..... 50

 Unfragmented Lands..... 52

 Cultural Resources..... 52

 Invasive Plant Species..... 55

 Habitat Area Summary Table..... 58

DISCUSSION – FUTURE APPLICATIONS AND BENEFITS..... 60

REFERENCES..... 64

MAPS..... 65

 Wetlands, Hydric Soils, Aquifers, and Conservation Lands

 Dense Softwoods and Permanent wildlife openings

 Farmland Soils and Conservation Lands

 Steep Slopes and Conservation Lands

 Subwatersheds – Level 12

 Bedrock Geology

 Unfragmented Lands

EXECUTIVE SUMMARY

The City of Laconia is committed to protecting and sustaining the quality of life offered by the rich natural resources within Laconia by sustainable use of its natural resources. One of the goals of this project is to provide a natural resource inventory with recommendations for future studies and management of the natural resources throughout the City. Another goal of the project is to integrate all existing data for the City, with new data created and field verified from this project, including wetlands, dense softwood stands and permanent openings. This produces a seamless overlay of natural resources over the comprehensive City-wide composite, and provides an educational and planning tool.

This project has compiled natural resource data into a digital database in GIS format and produced a written report for use in the City of Laconia. It contains a database with a comprehensive, updatable, digital inventory of the entire City. The data from this project is compatible for integration with the existing City GIS. Efforts from this project will aid in future work and inventories, as well as provide data to guide future development decisions in Laconia.

Based on results from this study, Watershed to Wildlife, Inc. and the Laconia Conservation Commission offer the following additional recommendations:

1. **Wetland Identification and Protection** - There are several wetland complexes adjacent to brooks, ponds and lakes, and along some hillsides. The importance of conserving these wetlands cannot be over emphasized. It is hoped that the City will continue to pursue ways to further inventory the functionality and vulnerability of these wetlands with a ranking system, and a long-term goal of Prime Wetland designations. Several wetland studies have been completed in the past and there are data on several key wetlands throughout Laconia, all of which could be updated, integrated, and strengthened.
2. **Shoreline Protection** - Many shoreline areas along the large lakes and bays in Laconia have been developed. The Comprehensive Shoreland Protection Act, originally enacted in 1991 has been recently updated. Based on results from a commission of multidisciplinary professionals, sixteen of their recommendations for change were enacted into law and became effective July 1, 2008. The changes are broad in scope and include impervious surface allowances, a provision for a waterfront buffer in which vegetation removal is restricted, shoreland protection along rivers designated under RSA 483-B (Designated Rivers and Fourth Order Streams), and the establishment of a permit requirement for many construction, excavation or filling activities within the Protected Shoreland. These updated rules would apply to the large lakes and bays in Laconia.
3. **Surface Water Protection** - Many of Laconia's residents obtain drinking water from Paugus Bay. Moreover, Laconia is in the heart of the "NH Lakes Region", where people from near and far enjoy recreation in the largest lakes in New Hampshire. Maintaining good water quality is the highest priority for the Laconia Conservation Commission. Fortunately, water quality in these lakes and bays has improved over the last few decades. However, water quality issues should be addressed not only in the large lakes themselves, but also in the headwater streams and brooks that feed into the lakes, ponds and rivers throughout the city.
4. **Aquifer Protection** - Based on the locations and relatively small size of the underlying aquifers in Laconia, it is important that steps be taken to protect the groundwater, brooks, ponds and aquifers in city. Future water supplies are a very valuable natural resource, for

Natural Resource Inventory for Laconia, NH

Laconia and the abutting municipalities; proven by the drinking water systems already in use.

5. **Hillside and Viewshed Protection** - Laconia's hilly topography, lakes and ponds, and open fields are directly related to the City's tourism industry, scenic beauty, and assortment of natural resources (wetlands, streams and rivers, wildlife, plants, soils, etc.). Research and considerations should be made towards evaluating and possibly updating the zoning ordinance in Laconia to conserve viewsheds as an important feature and tourist attraction to the area, while continuing to consider landowner rights. Several areas with scenic views have been identified in the City of Laconia Master Plan 2007. Many of these viewsheds overlap into abutting towns and are part of regional importance (e.g. The Lakes Region Tour Scenic Byway). The City might want to consider verifying and adding to an inventory of Scenic Viewsheds.
6. **Dense Softwood Stand Protection** - Based on results from this project, there are a few areas that contain adequate acreage of dense softwood stands scattered throughout City. These areas are beneficial to many wildlife species.
7. **Land Conservation and Maintaining Unfragmented Roadless Areas** – Just over 6.7% of Laconia's land is officially classified as conserved land. It is recommended that the City continue to explore lands to potentially conserve. This will further benefit the City's natural resources. Focus should be on connectivity between existing conserved parcels as well as minimizing future fragmentation. Habitat types that are not currently well represented in conservation lands such as wetland complexes, permanent wildlife openings, and dense softwood areas should be considered. Laconia should continue to encourage landowners to place land into conservation easements.
8. **Interagency Cooperation** - It is recommended that Laconia will continue to work with neighboring towns, organizations, and agencies throughout the region to share future data as it becomes available. This will avoid an all too common problem of separate entities replicating work. Natural resource features do not end at town or city boundaries. A watershed approach to conserving them is recommended. All of the surrounding towns have completed or are in the process of completing a Natural Resource Inventory and all of the data between the towns and Laconia should be compatible in GIS format.

Long-term uses of this project could include, but are not limited to:

- assisting the City and others in determining “least-impact” sites for future development
- locate ideal locations for telecommunication towers or wind farms
- Refining future Master Plan updates based on natural resource features
- promoting protection plans for water quality, wetlands, and aquifers under portions of the City
- continuing identification of land for purchase or easements for protection into the future

Furthermore, the City is in a position to request that all future development plans be delivered in digital format, which would build upon the existing database (including assist in updating tax maps for assessment) at little cost to the City.

INTRODUCTION, HISTORY, AND OBJECTIVES

The City of Laconia, New Hampshire contains approximately 26.1 square miles (16,712 acres) which includes 6 square miles (3,862 acres) of inland waters according to GRANIT data. The average elevation is 506 feet above sea level. Out of 20.1 square miles of land, approximately 1.71 square miles are conserved lands, leaving roughly 18.39 square miles or 91.5% of the land that is already developed or available for future growth or development. The average elevation is 506 feet above sea level.

The land within the City of Laconia has a long and rich history based on natural resources, dating back to use by Native Americans who utilized the diverse natural resources. The earliest single radiocarbon date (9,615 years ago in 1995) for any Paleo-Indian site in NH comes from Weirs Beach (formerly called Aquadoctan). This was a great meeting place [of several tribes] for miles around. (Mulligan, pg. 27) Anadromous fish such as alewife would “run” (often during the last two weeks of May) bringing many tribes from afar to Weirs Beach. (Mulligan, pg. 29)

In 1620 King James I of England allowed a council to form of which Sir Fernandino Gorges and Captain John Mason were members. A large section of land (portions of Maine, New Hampshire, and Vermont) was granted to them in 1622. Seven years later, Gorges and Mason split the granted land with John Mason getting “Laconia”, which was still a large area. Mason died without ever setting foot on the land and it went to the Masonian Heirs, specifically, a daughter. For over 150 years no one knew just where this New Hampshire land was. Once the estate was settled, a group called the Masonian Proprietors purchased the land and became the first New Hampshire real estate developers. Part of the purchase settlement gave quit-claim to squatters who had improved their lands (Mulligan, pg. 43).

In 1727 six inland townships were granted. Settlement in the area was delayed by the wars with the French and Indians and settlement did not occur until early 1760’s. Settlers sought the deeper agricultural soils and water power afforded in the ‘Upper Parish’ at Meredith Bridge (now Laconia) (Mulligan, pg. xvii). By 1794 settlements in Meredith Bridge, Lake Village, and Aquadoctan, later became Laconia, Lakeport, and Weirs Beach (Mulligan, P. xviii). By the late eighteenth century, Lakeport, Laconia, and Belmont were increasingly known as Gunstock Parish with Belmont known as Upper Parish (Mulligan, P. xviii). This changed in 1855 when Laconia annexed some of Gilford and in 1893 with further annexation that separated Gilford and Laconia forever (Mulligan, P. xix).

Dramatic changes occurred when dams built in 1781 and 1851 at Lake Village raised the water level 2 feet, flooding Paugus Bay, the shoreline, and reducing the number of islands from an estimated 365 to only 153, (153 - newest computer mapping - 1995) (Mulligan, P.12). In 1848 the Boston, Concord, and Montreal Railroad line reached Meredith Bridge stimulating commercial vitality of the village and area. This stimulated shoreline development including hotels, summer cottages, boarding houses, and camps. People began taking summer vacations (Mulligan, P. xix). As happened throughout the state and country, the invention of the automobile killed the railroad and the last run of the ‘Lake Shore’ took place in 1934 (Mulligan, P. xxi).

Industry flourished in Laconia with knitting mills and machine shops, and the City boasted that it was the largest manufacturer of streetcars in the US. Between 1930 and 1940 the population in Laconia increased by 22% (Mulligan, P. xx). The effects on natural resources were dramatic with development and recreational use increases. These land uses continue to this day.

Natural Resource Inventory for Laconia, NH



Most of Laconia is displayed as it was 102 years ago on this 1907 Historic USGS topographic map.

Recognizing the need to protect and sustain the quality of life offered by the rich natural resources within the City of Laconia, Lake Associations have formed, the City Planning Board, Conservation Commission, and several private individuals have devoted effort, time, and money towards maintaining and improving management of the City's natural resources. One of the major components of these actions is the fact that the City's drinking water supply is Paugus Bay; demanding that high water quality be maintained now and into the foreseeable future. The intertwined matrix of waterbodies, wetlands, forests, streams, wildlife, vegetation, and effects of human use demands has caused City officials to better assess its natural resources and take action to ensure wise, sustainable use of these treasures. One tool toward accomplishing this goal is the creation, implementation, and upkeep of a natural resource inventory.

This project provides a base Natural Resource Inventory (NRI) with the addition of data to the existing Laconia GIS database that can integrate other studies, and future data. For

Natural Resource Inventory for Laconia, NH

example, newly digitized data from this project, such as permanent wildlife openings and dense softwood cover, is projected in NH State Plane Coordinates, NAD 83, and compatible with existing GRANIT Laconia GIS data.

One of the goals of this project is to provide an inventory, management recommendations, and planning tools for the City of Laconia. Another goal of the project is to integrate all existing data for the City, with new data created and field verified from this project, including wetlands, dense softwood stands and permanent wildlife openings. This produces a seamless overlay of natural resources over the comprehensive City-wide composite, and provides an educational and planning tool. It promotes conservation of riparian habitat, wetlands, and unique co-existing natural resource features throughout the City.

Measurable objectives of this project include the following:

1. Provide the City of Laconia with new accurate, standardized coverages that can be integrated into the existing GIS database.
2. Incorporate natural resources, scenic vistas, cultural/historical resources, and other related elements for comprehensive planning.
3. Create a document that can be incorporated into future updates of Laconia's Master Plan.
4. Increase awareness of the values of the characteristics of Laconia including scenic view areas, recreation areas, riparian buffer habitat, and wetlands with associated wildlife habitat through a public presentation and discussion.
5. Provide the City with the ability to continue to build upon and update the natural resources digital database.



A large meadow formed from an abandoned beaver pond with lush abrupt edges. In 2003, this area contained an extensive pond maintained by beavers. The dam breached sometime in 2006 by heavy rains. Wetland is on the north side of Hilliard Road.

METHODOLOGY

Diane Hanley of the Laconia Conservation Commission was the contact person for Watershed to Wildlife, Inc. (WTW). An initial meeting with the Laconia Conservation Commission and City Conservation Technician, Greg Jones was conducted early on in the project for an exchange of ideas on locations for fieldwork. (This Natural Resource Inventory was written so that it may be incorporated into future Master Plan updates.)

Field Work

Five days of fieldwork were conducted to get an overall view of Laconia, with a focus on previously identified target areas. Greg Jones contacted landowners, where applicable, to obtain permission before field work was conducted on private property. This work included inventories and assessments on several wetland complexes, beaver ponds, lake shoreline and ponds, forested habitats, rock outcrops and overlooks, and agricultural uses of the land throughout the City. Existing roads and trails were followed to access most field sites, while in some cases compass-based orienteering and topographic maps were used. All five days of field work were completed between May and October 2008. Photographs were taken with a digital camera at points of interest throughout the City. During fieldwork sessions any unique habitat co-occurrences were noted in field books and located on a map. Observed invasive plant species were also documented. Diane Hanley, Greg Jones, and Dean Anson assisted WTW during field work and helped guide to areas of interest.

Gather Existing Digital Data

Existing maps and data for the City of Laconia were collected. The following table shows which maps were obtained, their scale, and the national mapping standard accuracy measure. Since many decisions are based on parcels as they relate to rivers, roads, trails, ponds, wetlands and other features, it is important to point out the working accuracies of these data sources. Combining these sources in various overlays provides an excellent overview and planning tool, but does not replace the need to perform site-specific investigations for many subdivision requests. Please refer to the table below to better understand some of these accuracy issues.

Accuracies of Existing Maps

| Data | Source | Ratio | Scale | National Mapping Standard Accuracy |
|---|-----------------------|--------------|--------------|---|
| 1998 and 2003 Digital Orthophoto Quadrangle (DOQ) | GRANIT - .sid version | 1:5,000 | 1" = 416.7' | Acceptable accuracy within 12.48 feet |
| Topographic Maps (DRGs) | GRANIT | 1:24,000 | 1" = 2,000' | Acceptable accuracy within 60 feet |
| Roads and Trails, Power Lines, Railroads, Watershed Boundaries, Hydrology, and Conservation Lands | GRANIT | 1:24,000 | 1" = 2,000' | Acceptable accuracy within 60 feet |

Natural Resource Inventory for Laconia, NH

| Data | Source | Ratio | Scale | National Mapping Standard Accuracy |
|----------------------------|--|--------------|--------------|---|
| Soils | Natural Resource Conservation Service (NRCS) | 1:20,000 | 1" = 1,667' | Acceptable accuracy within 50 feet |
| Geology & Aquifers | USGS & NH –Dept. of Environ. Services | 1:24,000 | 1" = 2,000' | Acceptable accuracy within 60 feet |
| National Wetland Inventory | U.S. Fish and Wildlife Service | 1:24,000 | 1" = 2,000' | Acceptable accuracy within 60 feet |
| GPS Points | Garmin GPSMAP 76CSx | N/A | N/A | Generally within 30' but dependent upon satellite availability, PDOP, refraction, and topology. |
| Tax Maps (Parcel overlay) | Cartographic Associates, Inc. | | | Planimetric Features – within 5 feet |

Compile Existing Data into Arcview and ArcGIS

GIS analyses were conducted by WTW. Digital data were gathered from the City of Laconia, GRANIT, Natural Resource Conservation Service (NRCS), the US Fish and Wildlife Service, and the NH Natural Heritage Bureau. These data include the following:

1. DOQs – Aerial photography
2. Topographic maps
3. Hydrology (rivers, streams, lakes and ponds)
4. Roads and trails
5. Power lines and rail roads
6. Conservation lands
7. National Wetlands Inventory
8. Soil Information
9. Aquifers and Subwatersheds
10. Documented Rare or Endangered Plant and/or animal species
11. Geology
12. City tax map parcel overlay

Existing available maps were then integrated using ArcMAP software. Using the 1998 Digital Orthographic Quadrants (DOQ), USDA 2003 aerial photography, topographic maps, and soils maps features were digitized and overlaid onto a base map. These include: permanent wildlife openings, dense softwood stands, and field verified wetlands. Potentially significant wildlife habitat areas were noted.

Wetlands – Wetlands were reviewed and analyzed using the Digital Orthophoto Quadrangles (DOQs), National Wetland Inventory (NWI), Natural Resource Conservation Service (NRCS) soils maps (displaying hydric soil map units), and fieldwork notes. New Hampshire state laws require that three parameters be met for classification as a jurisdictional

wetland: the presence of hydric soil (very poorly and poorly drained soils); sufficient hydrology; and hydrophytic¹ vegetation. When soils maps alone are used, they could potentially over-estimate the number of wetlands throughout the City. This is particularly true given that up to 35% of a soil classification can be inclusions (for example, upland areas within NRCS hydric soil units or wetland areas within NRCS upland units). On the other hand, examining the NWI data alone would under-represent the number of wetlands, due to the U.S. Fish and Wildlife Service's method of using aerial photography to identify wetlands. Open water, emergent, and scrub-shrub wetlands can readily be identified using aerial photography alone, but forested wetlands are often missed. Some types of wetland delineations require extensive fieldwork beyond the scope of this project. Despite differences and potential errors, data provided from these sources are important tools, and can be built-upon in future studies.

Farmland Soils – Prime farmland, farmland of statewide importance, and farmland of local importance throughout Laconia were determined using the NRCS soils map data. Data were displayed in ArcView and queried so only those soils classified as important farmland were displayed in the City. Much of the prime farmland, farmland of statewide importance and some of the farmland of local importance are now used for production of hayland. Land utilized for pasture, forestry, recreation, or land uses other than urban, built or disturbed areas can still qualify as prime farmland, farmland of statewide importance, or farmland of local importance. The rationale for this approach is that land not already committed to irreversible (urban) uses is still available for cropping. Three categories of important farmlands have been described by the NRCS and they are:

1. Prime Farmland Soils as defined by the U.S. Department of Agriculture is the land that is best suited for food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained yield of crops in an economic manner. These soils are generally flat and relatively free of stones.
2. Farmland soils of statewide importance are lands, in addition to prime farmland, that are of statewide importance for the production of food, fiber, forage and oilseed crops. Criteria used to define this agricultural land were determined by State and local agencies in New Hampshire. The soils on the list are important to agriculture in New Hampshire, yet they exhibit some properties that exclude them from prime farmland. These soils can be farmed satisfactorily by greater inputs of fertilizer, soils amendments and erosion control practices than those necessary for prime agricultural farmland. They produce fair to good crop yields when managed properly.
3. Farmland of local importance is land, in addition to prime and statewide farmland, that is of local importance for the production of food, fiber, forage and oilseed crops. The criteria used to define this farmland were determined by local agencies in Belknap County. Relative values from 100 to 0 were assigned to each of the county's soils based on each soil's potential to grow corn silage or grass-legume hay. The local agencies then determined that soils with relative value of 54 or greater would qualify as farmland of local importance.

Permanent Wildlife Openings & Dense Softwoods – Permanent wildlife openings (areas dominated by grasses, forbs², brambles, or shrubs) were digitized from the 2003 DOQs with additional field verification. With the ability to utilize smaller map scale compilation and

¹ Hydrophytic vegetation are plants that grow in water or on a substrate that is at least partially deficient in oxygen as a result of excess water; plants typically found in and adapted to wet habitats.

² A forb is a non-woody, broad-leaved plant other than a grass, especially one growing in a field or meadow.

field verification, these data are more accurate than the coarser LandSat data often used in GRANIT analysis. The regions digitized include only those openings managed as permanent opening habitat, often farmland with active agricultural practices, or former farmland maintained as openings for wildlife purposes. They do not include clear-cuts where the intent is for timber harvesting and regeneration for future logging. Dense softwood (or conifer) cover areas were also digitized from the DOQs and fieldwork notes. These areas have been recognized as significant wildlife habitat and could be deer and moose wintering areas. Steep slopes were determined using the NRCS soils maps. Data were displayed in ArcView and queried so only those soils map units with 15% slope and greater were displayed in ArcView. A similar query provided areas of 25% and greater slopes as a further analysis.

Unfragmented Roadless Areas – Unfragmented or roadless areas were determined using ArcMap-ArcView. Five hundred foot offset analysis was done on all roads Class I to V, based on GRANIT road system classification. Roads that were Class VI were excluded from analyses since their presence would not negatively impact wildlife or their travel corridors. The roadless analysis shows unfragmented blocks of land throughout Laconia.

Maps were created at the end of this project with the features described above. All information gathered, compiled, and mapped for this report was delivered to the City of Laconia in digital format.

GIS Training Workshop and Installation of Project Data

A two-hour ‘hands on’ training session in accessing and viewing the data, and plotting maps will be conducted in November 2009 as part of this project for Conservation Commission, City Council, and Planning Board members that have an interest in providing GIS access for the City of Laconia.

All digital information belongs to Laconia and was delivered on CD-ROM(s) with hardcopy formats where appropriate.

Public Information Presentation

At the completion of the fieldwork, and GIS analyses for the natural resources, a public information meeting will be held in November 2009 to explain results from the NRI. The goal of this meeting is to increase public awareness of the importance of the natural resource inventory including; scenic and recreation areas, riparian habitat, dense softwood stands, wetlands, and associated wildlife habitat. In addition, work done for this project will be displayed for public viewing at the meeting.

RESULTS

Rivers, Streams, Ponds and Lakes (Maps #1 to #6 at end of report)

Laconia is in the heart of the Lakes Region in New Hampshire. These waters provide a significant recreational economy as well as the city’s water supply. The City of Laconia contains 3,862.17 acres of inland waters which comprise 23.1% of its total area. The four largest waterbodies are a portion of Lake Winnepesaukee – Meredith Bay/Weirs Beach portion - with approximately 765.8 acres of open water, and all of Paugus Bay containing 1,234 acres of open water; Opechee Bay containing 449 acres of open water; and a large portion of Winnisquam Lake (roughly the eastern half) with approximately 1,301 acres of open water. These large waterbodies are listed in order of drainage in a downstream direction, eventually flowing into the Winnepesaukee River.

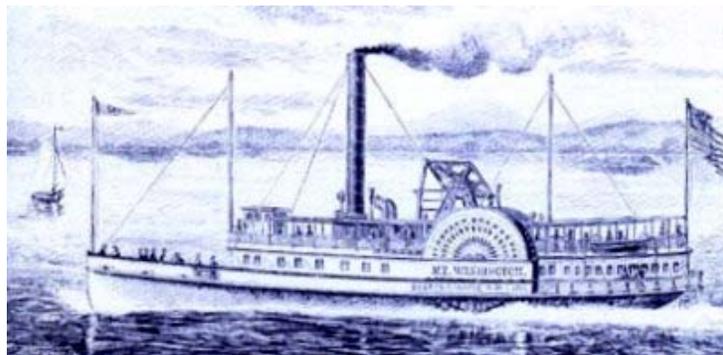
Natural Resource Inventory for Laconia, NH

Lake Winnepesaukee is a glacial lake, the largest lake that is entirely within New Hampshire. There is some controversy as to historic drainage patterns of this lake. Several sources state that the flow of Winnepesaukee Lake was once southeast, draining through Alton Bay toward the Atlantic Ocean. Its waters reversed when glacial debris blocked this path, shifting the flow westward through Paugus Bay into the Winnepesaukee River. Other sources discount this theory and claim that the lake levels and drainage channel were always as they exist today.

In 1811 a charter was granted for a canal from Alton Bay to the Sea by way of Merrymeeting, Cocheco, and Piscataqua rivers. Though the Little Pequakit Canal Co. [was incorporated] in 1819, no work was done on a proposed project that was intended to eventually extend from the Atlantic Ocean through our Lake, to Squam Lake, and the Connecticut River, and on to Lake Champlain and the St. Lawrence” (Lake Winnepesaukee Historic Society, 2009).

The shoreline of Lake Winnepesaukee is between 183 to 240 miles long depending on whether you count the 300+ islands, and which source you refer to, with over 4.6 miles of this shoreline located in Laconia. Additionally, Paugus Bay has 9.8 miles of shoreline and Opechee Bay has 7.5 miles of shoreline. The shoreline of Winnisquam Lake is approximately 28 miles long with nearly 10 miles of shoreline in Laconia. This calculates to a total of 31.9 miles of shoreline with additional shoreline footage around some of the islands. Interestingly, though Lake Winnepesaukee has many islands, none are located within the City of Laconia boundary, while Paugus Bay and Winnisquam Lake contain several islands.

These large waterbodies offer many recreational opportunities in Laconia and include fishing, boating, marinas, and beaches (Bartlett, Ahern, Opechee Park, Bond Beach, Weirs Beach and private beaches). The 230 foot long M/S Mount Washington ship offers tours in season on Lake Winnepesaukee. Though its home port is in Center Harbor, a popular stop and loading location is at Weirs Beach. Ice is a natural resource that was once a valuable commodity prior to modern refrigeration, and has now shifted to more of a recreational relationship with the community, e.g. ice-fishing, skating, cross-country skiing, ‘ice out’ contests. “Lake Winnepesaukee is well known for its annual Ice-Out Contest, in which people try to guess the date that the Mount Washington can safely leave her port at Center Harbor and motor to four other ports. Since records began being kept in 1851 ice-out has happened as early as March 29 and as late as May 12, although 90 percent of the time it is declared during April.” (Lake Winnepesaukee Historic Society, 2009). Large yachts, power boats, sailboats, and smaller crafts enjoy the vastness of these large waterbodies and the deep waters (up to 213 feet) found within the lakes.



Steamer *Mount Washington*. The famous side-wheeler, seen in this 1890s artist's rendering, was constructed by the Boston and Maine Railroad Line to accommodate the growing need of travel on Lake Winnepesaukee (Lake Winnepesaukee Historical Society, 2009).

Natural Resource Inventory for Laconia, NH

The deeper waters have cold water even in the summer heat, and provide habitats for species of fish not able to survive in smaller, shallow lakes and ponds (e.g. lake trout, landlocked salmon, rainbow trout, brown trout, whitefish). The shallower portions of these waters provide habitat for many warm-water species of fish such as eastern chain pickerel, small and largemouth bass, yellow and white perch, bullheads, common white suckers, and the American eel. The fishery value of these waters dates back to pre-European Settlement when the Native Americans relied on anadromous species “runs” as a source of food. The name “Weirs” comes from the type of fish traps used by Native Americans at the outlet of Lake Winnepesaukee. Fishing in open water during warmer months and ice fishing during winter months continues to be very popular in these large waterbodies.



Weirs Beach is a very popular recreational area on Lake Winnepesaukee in Laconia.

In the 1930's the lakes were showing signs of degradation due to sewage and other pollutants being dumped directly into the lakes. By the 1970's closed sewage systems with treatment plants were implemented and water quality studies showed improvements. "The water quality in the Lake has been investigated three times by the New Hampshire Department of Environmental Services (DES): 1979, 1984, and 1990. DES sampled 8 water quality stations around Lake [Winnepesaukee] and found all of them to be oligotrophic³." (Lobdell Associates, 2000).

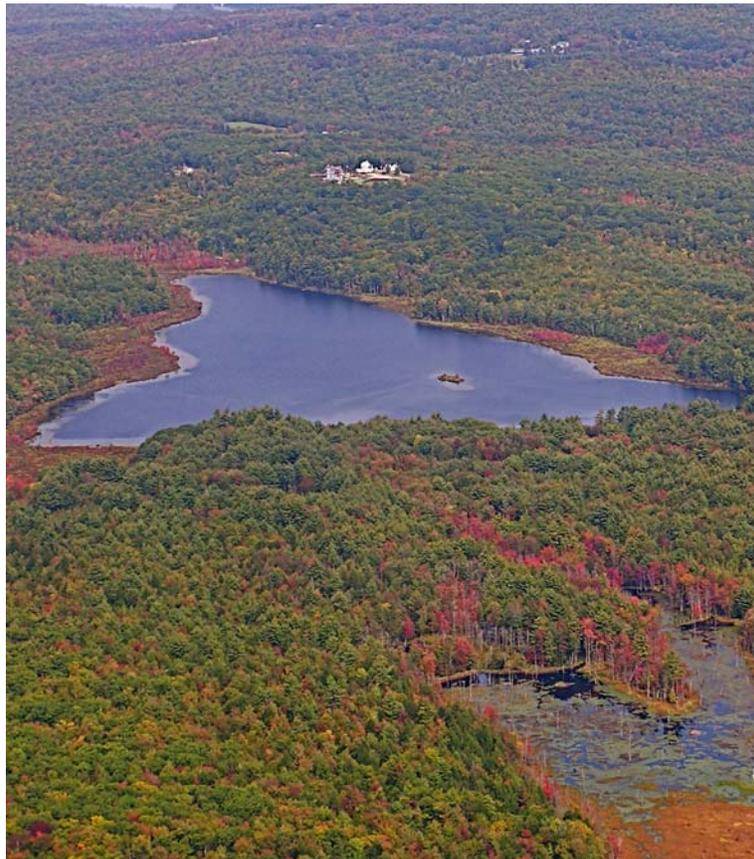
Challenges today are related to the attraction of people to the open water, particularly in the summer months. This can conflict with maintaining the natural resources in these areas with

³ An oligotrophic lake is a lake with low primary productivity, the result of low nutrient content. These lakes have low algal production, and consequently, often have very clear waters, with high drinking-water quality. The bottom waters of such lakes typically have ample oxygen; thus, such lakes often support many fish species, like lake trout, which require cold, well-oxygenated waters. The oxygen content is likely to be higher in deep lakes, owing to their larger hypolimnetic volume.

Natural Resource Inventory for Laconia, NH

development and recreation. Some issues include erosion, loss of shoreline, fuel in the water, road runoffs and spills, and fertilizer runoff. Of further concern is the fact that the City of Laconia's drinking water supply is drawn from two intake pipes located approximately 15 feet deep in Paugus Bay. Presently the water quality of these lakes continues to be good, but will require sound management and diligence; not only on the part of Laconia, but of the entire Lakes Region given the extents of the watershed area.

There are some named small ponds within Laconia such as Pickerel Pond, most of which is in Laconia (approximately 69.3 acres), Footes Pond, and Perley Pond. There are several unnamed ponds, many of which are influenced by the dynamic activities of beaver (*Castor canadensis*) with fluctuating water levels. With few exceptions, these smaller waterbodies are surrounded by a diversity of wetland/wildlife habitats with travel corridors and nesting or denning areas of high ecological value. An exceptionally rich habitat is located south of Pickerel Pond. Along an unnamed stream where beaver activities have enhanced a large fen wetland, there are over 40 acres of open water with adjacent riparian areas including emergent, scrub-shrub, and forested wetlands. This wide diversity of wildlife habitat contains a Great Blue Heron (*Ardea Herodias*) rookery, a nesting pair of osprey (*Pandion haliaetus*), numerous ducks, and many additional wildlife and plant species.



Pickerel Pond is relatively undeveloped along its shoreline with good buffers. (Photo by Diane Hanley)

Pickerel Pond, which is approximately 72 acres, is in the northwestern portion of Laconia (approximately 1.5 miles west of Pickerel Cove). Though close in name and proximity, Pickerel Pond and its associated wetlands are in the Winnisquam Lake sub-watershed while Pickerel Cove and associated wetlands are in the Paugus Bay sub-watershed. Most of this pond is located in the City of Laconia with approximately 12 contiguous acres in the town of Meredith. Though

Natural Resource Inventory for Laconia, NH

there are town roads paralleling the shoreline of Pickerel Pond to the west and south, this pond is relatively undeveloped with wide forested buffers,⁴ which in turn offer good wildlife habitat. Moreover, a portion of Pickerel Pond in Meredith is under a conservation easement.

The upper portion of the Winnepesaukee River, which at one time flowed free out of Lake Winnepesaukee through Laconia, is now incorporated into Paugus Bay due to dams constructed in the Lakeport village section of Laconia at 504 feet above sea level. Another downstream dam at City Hall, known as Avery Dam results in a similar situation with Opechee Bay at an elevation of 492 feet above sea level. Though debatable as to its association with either the Winnepesaukee River or Winnisquam Lake, the Winnepesaukee River contains Eager Island, which is located approximately 1,500 feet upstream from Winnisquam Lake and 1,200 feet below the Avery Dam behind City Hall. Flooding and erosion are experienced on an annual basis. Due to this harsh floodplain environment, the plant life is challenged with mostly scrub-shrub and herbaceous species. Eager Island is a unique feature in Laconia used by a variety of wildlife species. Beaver activities were observed on Eager Island, as were ducks, sandpipers, and songbirds. Bald Eagle sightings are common just downstream of Eager Island, adjacent to the former sewage treatment plant. During the winter, the open water below the Lakeport Dam and along the Winnepesaukee River between Avery Dam and the outlet to Lake Winnisquam provides important winter feeding areas and habitat for a variety of waterfowl and bald eagles.

Although Eager Island (center of photograph) is located in the middle of Laconia, this portion of the Winnepesaukee River contains some areas where open water remains throughout the winter. It is an important habitat for a diversity of waterfowl and bald eagles during the winter months. (Photo taken by Diane Hanley)



The waters contained in Winnepesaukee Lake flowing down the Winnepesaukee River through Laconia have a long history of supplying water power. Avery Dam still produces electric

⁴ Forested buffers are crucial to the protection and enhancement of water resources. They are complex ecosystems that help provide optimum food and habitat for stream, pond and wetland communities as well as being useful in mitigating or controlling pollution or contamination. Forested buffers can produce a number of beneficial effects on the quality of water resources. Buffers can be effective in removing excess nutrients and sediment from surface runoff and shallow groundwater and in shading streams to optimize light and temperature conditions for aquatic plants and animals. Forested buffers also ameliorate the effects of some pesticides, and directly provide dissolved and particulate organic food needed to maintain high biological productivity and diversity in the adjoining waterbody.

Natural Resource Inventory for Laconia, NH

power. Perley Canal, a concrete tunnel that runs under portions of the City, was built in the early 1800's to supply water power to a number of industrial mills, and continues to flow today. These features are highlighted by Laconia along the River Walk, a 1.03 mile loop

Several streams are found in Laconia adding yet another valuable connection and riparian habitat between many of the ponds, lakes, and wetlands of Laconia. Durkee Brook is located in the southeastern portion of Laconia with its headwaters near Rte 107 and the City boundary with Belmont. It flows in a northwesterly direction for approximately 2.2 miles, through residential and industrial areas, to its confluence in Winnisquam Lake. There are beaver activities along this brook that enhance the riparian floodplain zones, providing habitat for a diversity of wildlife. Black bear, whitetail deer, mink, river otter, weasel, fox, coyote, and raccoon depend on these areas for cover, feed, and travel corridors. The rich deep soils in these areas also provide lush plant growth and the potential for threatened or endangered species.

Durkee Brook has been degraded in several areas due to residential yard waste dumping and removal of stabilizing shoreline vegetation. In addition, urbanization has led to increased runoff causing more frequent flooding and erosion.



Beaver activities have influenced this portion of Durkee Brook in southern Laconia.

Jewett Brook, with its headwaters in Gilford, enters central Laconia crossing the eastern border about 570 feet south of Route 11A, flowing in a westerly direction. Its confluence with the Winnepesaukee River in the southern part of Opechee Bay, is approximately 1,700 feet upstream from Avery Dam.

Black Brook, located in the central eastern portion of Laconia, has its confluence in Paugus Bay flowing approximately 1,500 feet in a westerly direction, from the City boundary roughly paralleling, and 200-300 feet south of Route 3. Though it contains a small floodplain wetland area, a few songbirds, and fish (Eastern chain pickerel), much of its ecological value appears to be compromised due to impervious surfaces, lack of buffers, and development. There

is also a large area of sawdust fill immediately upslope and adjacent to the east side of this stream, containing wetlands and seeps.

There are many unnamed small streams located throughout Laconia with high value habitat where adequate to good buffers have been retained. These areas provide high value plant and wildlife habitat and connectivity to forest, wetlands, and other habitat types.

Sub-Watersheds (Map #5 at end of report)

The ability to view the landscape from a watershed or sub-watershed perspective helps to understand drainages, flows, and associated habitat throughout the city. Sub-watersheds do not stop at municipal boundaries; highlighting the fact that all things downstream are affected by land management upstream, particularly in the headwaters. The State of NH does not breakdown the watershed beyond the HUC 12 level, but most towns and cities contain more than one subwatershed determined by topography and ridgelines.

Laconia contains pieces of four sub-watersheds when broken down to the level 12 hydrologic unit code (HUC) listings. The largest subwatershed in Laconia is Winnisquam Lake subwatershed which covers most of the southern and west-central half of Laconia and contains 9,169 acres. Paugus Bay subwatershed is the next largest in Laconia covering 5,544 acres and is located in the north-central portion. The third and fourth subwatersheds are both part of the Lake Winnepesaukee: Meredith Bay/Lake Winnepesaukee located in the northwest, containing 1,664 acres and Sanders Bay located in the northeast containing 335 acres. It is important to realize that all four of these subwatersheds extend beyond the Laconia City boundaries and are listed as the Winnepesaukee River when viewed at the HUC 8 level, highlighting the need for a regional approach with cooperation from several abutting towns needed to maintain water quality standards.

Please refer to the subwatershed map at the back of this report to view these catchments.

Riparian Zones and Floodplains

A riparian zone or riparian area is the interface between land and a stream. Riparian zones are important habitat because of their role in soil conservation, their biodiversity, and the influence they have on aquatic ecosystems. Riparian habitats occur in many forms including grassland, woodland, wetland, floodplains, or a combination of features. A floodplain is flat or nearly level land adjacent to a stream or river that experiences occasional, seasonal, or periodic flooding. Floodplains are a category of riparian zones and can support rich, diverse ecosystems. With miles of developed shoreland and lake edges, and a limited number of streams, Laconia contains a limited amount of riparian and flood plain areas. Though some portions of several Laconia streams have been impacted, many portions have not, and there are some opportunities for maintenance of adjacent riparian habitat and creation of additional buffers.

Natural Resource Inventory for Laconia, NH



A rich, lush floodplain area along Durkee Brook.



Black Brook near southern Paugus Bay has sections that contain wetlands and riparian habitat, but also has been degraded by development.

Riparian areas are extremely significant and beneficial habitat types. They also reduce flooding by absorbing runoff and then releasing it slowly. By leaving them in their natural state, they attenuate floodwaters and erosion. Riparian lands are rich in bird species; songbirds, raptors, ducks, herons, and others are commonly found utilizing the scrub-shrub, grasslands, meadows, and forests that make up these areas. Aquatic and terrestrial mammals such as muskrat (*Ondatra zibethicus*), beaver (*Castor canadensis*), river otter (*Lutra canadensis*) and other weasel species,

Natural Resource Inventory for Laconia, NH

moose (*Alces alces*), white-tailed deer (*Odocoileus virginianus*), black bear (*Ursus americanus*), raccoons (*Procyon lotor*), bats, red fox (*Vulpes vulpes*) and gray fox (*Urocyon cinereoargenteus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), and many others rely heavily upon these habitats. Riparian areas provide important birthing, mating, feeding, and resting sites for these species. They are also commonly used as travel corridors. In many cases wildlife species may not linger within these habitats, but they are a relatively well protected mode for travel linking various upland habitat types.

As stated earlier, floodplain forests are relatively narrow strips of land, particularly found along streams and wetlands in Laconia. They are diverse and dynamic ecosystems affected by periodic, temporary flooding. Sediments are transported from upstream and deposited where water slows and spreads out across the floodplain terraces. Red maple and silver maple (*Acer saccharinum*) floodplains are found along several wetland and stream complexes in Laconia, including portions of Black Brook, Jewett Brook, Durkee Brook, and several unnamed streams. The lushness of species found in these areas include red maple, black cherry, nanny berry, northern arrowwood, cinnamon, royal, and sensitive fern. (Additional species lists are found in the Forestland Section of this report.)



When floodplains are canalized the waters increase in velocity and can cause flooding and erosion downstream.

Intact riparian areas are essential for creating and maintaining a healthy aquatic system. Overhanging vegetation such as shrubs and trees provide important shade to aquatic habitats allowing them to maintain cooler water temperatures and adequate amounts of dissolved oxygen. These conditions were observed even in downtown City areas, along sections of the Winnepesaukee River, Black-Durkee-Jewett Brooks, and sections of lake shoreline between developed sections. This is particularly important for trout and other salmonid species. The root systems of the riparian vegetation are also important for reducing the amount of erosion that the constant moving water and flooding situations could potentially cause. By reducing erosion, relative stream bank stabilization and sedimentation are controlled. Riparian habitats also slow

and hold floodwaters reducing shoreline damage, and can work as a filtration system removing nutrients and toxins from the water, assisting in maintenance of water quality. Riparian vegetation can also provide habitat structure to aquatic systems through dead or broken limbs (or sometimes whole trees) that fall into the water.

For all these reasons and more, conserving or expanding riparian areas and shoreland buffers is a vital part of conserving Laconia natural resources. Adherence to New Hampshire's Shoreland Protect Program will help maintain existing riparian habitat, providing wildlife travel corridors and good water quality.

Wetlands and Hydric Soils (Maps #1 and #5 at end of report)

Wetlands are an essential habitat type for the majority of plant and animal species in New Hampshire. As a whole, wetlands are extremely diverse depending on the hydrology, soils, topography, and climate of an area. In addition to the rivers, lakes, and ponds, there are four general types of Palustrine⁵ wetlands: marsh, swamp, bog, and fen, with additional sub-types within each of these categories. This diversity extends into each individual wetland where diverse plant and wildlife species and water regimes co-exist. This creates edge habitats within and around wetlands which are frequently used by a great deal of wildlife species. It is estimated that riparian areas and wetlands are used by over 90% of the region's wildlife species and provide preferred habitat for over 40% of local species. For these reasons wetlands provide plentiful wildlife viewing and hunting opportunities.



These photos illustrate the abundant water resources in Laconia, containing several different types of Lacustrine, Palustrine, and Riverine wetlands. There is a network of wildlife trails found throughout these areas, particularly along the edges of the wetland and ponds in the heavily forested areas. The left photo is of Pickerel Pond Wetland System and the one to the right is of Pickerel Pond (Photos taken by Diane Hanley in October 2008).



Along with providing important plant, wildlife, and fish habitat, wetlands are also an important protector of water sources. Because they often contain hydrophytic vegetation (plants adapted to living in water and/or wet conditions) and poorly drained soils, wetlands are able to store significant amounts flood and/or run-off water, minimizing serious damage in times of high water. They are important contributors to groundwater recharge. This ability to retain water allows wetlands to act as a filtration source. As moving water is slowed and stored in wetlands, suspended sediments and particles settle to the mucky substrate and plant roots are given a

⁵ Palustrine wetlands are a group of vegetated wetlands traditionally called marshes, swamps, bogs, fens. They also include the small, shallow, permanent or intermittent water bodies often called ponds.

Natural Resource Inventory for Laconia, NH

chance to absorb excess nutrients, toxicants, pollutants, and contaminants. These functions make wetlands an important source for maintaining the health of aquatic systems.

Wetland areas are dynamic and constantly changing. The general trend without severe weather or other outside influences is for wetlands to slowly fill in over time. The process begins with open water and as time passes, submerged plants appear. Floating-leaved plants, such as water lilies, eventually follow. Then further emergent plants such as reeds, sedges, and wetland grasses begin to flourish. Shrubs such as high bush cranberry (*Viburnum trilobum*), sweet gale (*Myrica gale*), and bog rosemary (*Andromeda glaucophylla*) begin to appear and heaths such as leatherleaf (*Chamaedaphne calyculata*) and labrador tea (*Ledum groenlandicum*) surface among the shrubs. Trees such as red maple (*Acer rubrum*) and gray birch (*Betula populifolia*) subsequently emerge. This natural successional process is often referred to as lakefill.

On the other hand, there are several environmental and human-induced reasons for wetlands to actually increase in size. Some examples of these follow:

- Human development including damming or excavation such as the mining of gravel and sand could increase wetland sizes and often create new wetlands
- Severe weather changes – an increase in rain will increase the wetland area, whereas a drought may diminish the area
- The cyclic movements of beaver as hardwood saplings regenerate in early succession. In Laconia there is abundant sign of beaver activities in most of the wetland complexes
- Human activities such as logging and landscape alteration can dredge out wetland areas or increase the amount of runoff into wetlands



Recent beaver activities have enhanced the area around Foote's Pond, including this series of maintained dams on the inlet into the pond. A diversity of wildlife species use the area including bald eagles, osprey, black bear, and painted turtles.

Of the hydric soils in Laconia, 720.8 acres are classified as poorly drained and nearly 492.2 acres are very poorly drained. Poorly drained soils are defined as soils where water is

Natural Resource Inventory for Laconia, NH

removed from the soil so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. In very poorly drained soils, water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Hydric soils are scattered throughout the city with some of the larger areas listed below.

1. 152.37 acres of very poorly drained soil plus 124.66 of poorly drained soils are found along the Pickerel Pond Wetland System
2. 80.20 acres of very poorly drained soil and 104.65 acres of poorly drained soil are located in an unnamed wetland complex to the east of Paugus Bay and White Oaks Road
3. 46.47 acres of very poorly drained soil is found north of Pickerel Cove



Several colonies of sundews (*Drosera rotundifolia*) were found among the sphagnum in the Pickerel Pond Wetland System. The leaves are covered with gland-tipped hairs whose secretion of sticky fluid traps insects, which are then digested by enzymes. This flower's ability to extract nutrition from insects helps it survive in nutrient-poor bogs and marshes.

National Wetland Inventory (NWI) GIS analyses indicate there are just over 4,427.67 (26.5%) acres of wetlands. Of these mapped wetlands, 3,935.92 acres (23.55%) include the large lakes and ponds in the City. These large open water lakes and ponds are described in more detail in the Lakes and Ponds section of this report. An additional 25.17 acres include the wide rivers flowing through Laconia. Remaining wetlands are Palustrine wetlands totaling 466.58 acres (2.8%). On the other hand the NRCS hydric soils data indicates there are 1,212.96 acres of poorly drained soils, and thus potential wetlands in Laconia. GIS mapping analysis and field verification by WTW has determined that there are at least 493 acres (2.9%) of Palustrine wetlands in Laconia, adding approximately 26.44 acres of field-verified wetlands to the more conservative NWI acreage. Lacustrine⁶, Riverine⁷ and Palustrine wetlands contain a significant

⁶ Lacustrine wetlands include permanently flooded lakes and reservoirs (e.g. Lake Winnepesaukee). Typically, there are extensive areas of deep water and there is considerable wave action.

⁷ Riverine wetland mapped in Laconia by NWI is the Winnepesaukee River between Opechee Bay and Winnisquam Lake

Natural Resource Inventory for Laconia, NH

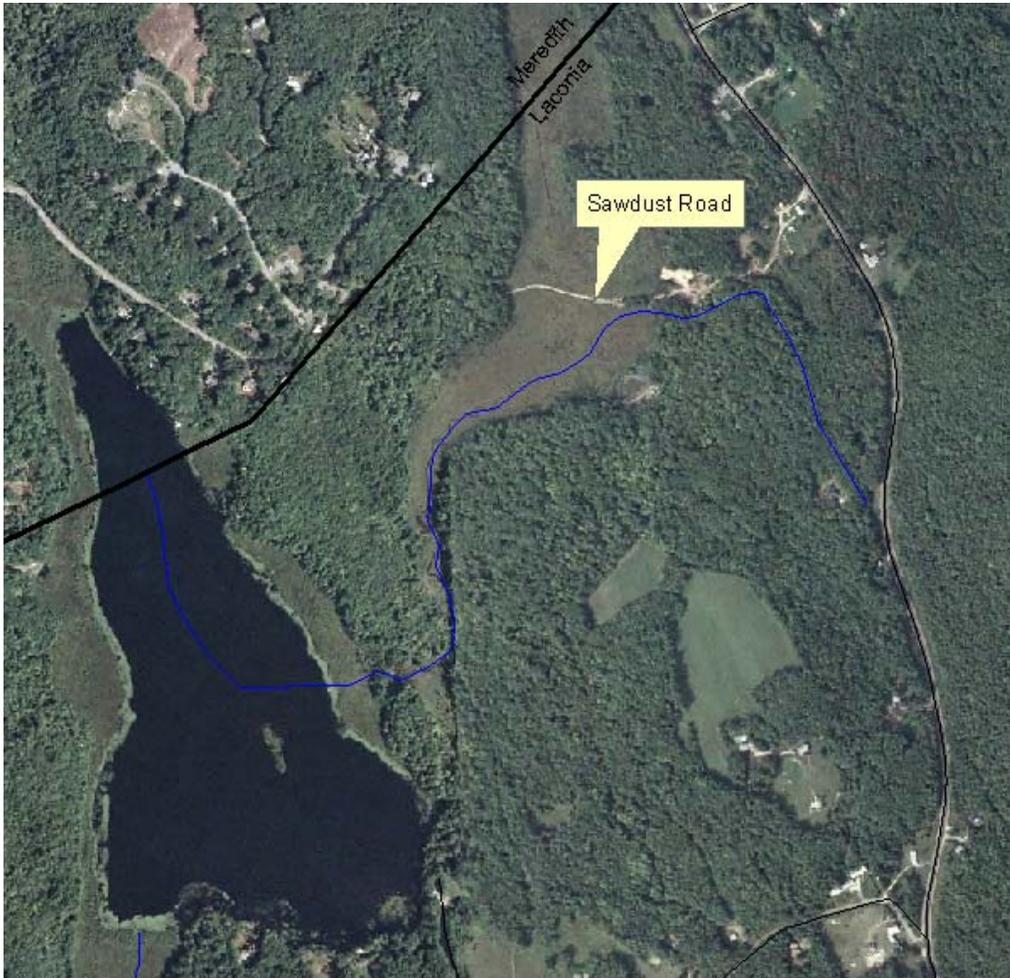
amount of diversity. NWI data illustrates a diversity of wetland types including lakes, ponds, emergent, scrub-shrub, forested, and riverine wetlands. Of the 493 acres, only 39.56 (8%) are protected in conservation land.

With maintaining and enhancing water quality being a priority for Laconia, working to protect and maintain all types of wetlands throughout the City should continue to be a high priority.

The 493 acres of wetlands from NWI data and WTW field work, under-represents the actual amount of Palustrine wetlands that exist in Laconia. On the other hand, NRCS classified hydric soils tend to over-represent the amount of wetlands throughout city. Hydric soils are one of three parameters required by the State to document a wetland (hydric soils, wetland hydrology, and wetland plants are all required). This project was not designed to focus solely on wetlands; therefore complete field delineation of all the wetlands present in Laconia was not conducted. Several potential wetlands, some new areas and other extensions of existing NWI areas, were observed in the field where at least two of the required New Hampshire wetland parameters were met, but could not be included in the City's wetlands acreage because they were not field delineated. Their locations are provided to the City through map and GPS locations in order for future field verification or wetland delineations to be conducted if desired. Most of these potential wetlands are forested wetlands making them difficult to verify and delineate through offsite mapping techniques alone. Hillside wetlands play an important ecological role because of the functions they provide for the waterbodies, wetlands, and communities that exist in the adjacent valleys below. They are important wetlands for Laconia to be aware of due to the potential of residential development occurring on the City's hillsides. Future field determinations would be necessary to comprehensively delineate all wetlands in Laconia. These can be incorporated over time with additional field verification.



Water from this large wetland complex eventually flows into Pickerel Pond. The road has been used for at least 40 years for logging access. It is easily recognized on aerial photos such as the one on the following page. Even this type of organic filling can be detrimental to a wetland and effect water quality and waterbodies downstream.



This 2003 aerial photograph shows Pickerel Pond as well as the large wetland complex to its east. The light colored line through the wetland is called “Sawdust Road” by many Laconia residents.

The City of Laconia has a Wetland Conservation and Water Quality Overlay District (Article IV: 235-17) which is intended to protect and regulate the land adjacent to water bodies, the use of wetlands and their buffer areas. The purpose is to ensure the protection of water and wetland resources from activities that would adversely affect their functions and values. The ordinance calls for maintenance of wetland buffers in their natural condition. Buffer distances include the following:

1. 100 feet buffer around any prime wetland (none have been established at the time of this report)
2. 75 feet buffer from any non-prime wetland contiguous to public waters including:
 - a. Durkee Brook
 - b. Jewett Brook
 - c. Black Brook
 - d. Langley Brook
 - e. Mellinger Brook
 - f. Any unnamed brook designated A through I on the Official Zoning Map
3. 50 feet buffer around any other wetland

Refer to the Zoning Ordinance for further details and definitions.

Natural Resource Inventory for Laconia, NH

In addition to the zoning ordinances, several years of data have been gathered on specific wetlands throughout the City. The Laconia Conservation Commission working with the University of New Hampshire, the Lakes Region Planning Commission, the Lake Winnepesaukee Association Lake and River AmeriCorps Team produced a binder full of information on several different wetlands throughout the City. Data was collected between 1992 and 2002 and summarized in 2003. The wetland areas were summarized and categorized by the following criteria:

1. Major Wetlands with Multiple Values (include in this are Hamel State Forest, Pickerel Pond, Lily Pond, and Pickerel Cove)
2. Wetlands Important for Pollution Attenuation (Old North Main Street, Lily Pond, Black Brook, Maiden Lady Cove, Pickerel Cove)
3. Wetland Important to Laconia's Water Supply (Lily Pond, Black Brook, Pickerel Cove)
4. Wetland Important to Developed Areas for flood control and visual aesthetics (Durkee Brook, South Down, and Pleasant Street School)
5. Wetland Important for their Educational Potential (Pickerel Pond, Pleasant Street School, and Maiden Lady Cove)



This lush forested wetland is found near a wetland and perennial stream which drains into Pickerel Cove. Cinnamon ferns dominate the forest floor and are strong indicators of a wetland.

One wetland that stood out during the 2008 field inventory was the Pickerel Pond Wetland System (called the Hamel State Forest Wetland in the 1998 wetland evaluation study). This wetland has 76.21 acres of NWI and WTW digitized wetlands, including many different types. Wetland types noted during field work included open water habitat (ponds) emergent wetlands, scrub-shrub wetlands, and forested wetlands (containing hardwood and softwood species). The ecological integrity and use by a diversity of wildlife is further enhanced by excellent upland buffers surrounding the wetland complex. During field inventory, a series of beaver ponds were noted, some dams being actively worked by the beaver, and other dams abandoned. It is clear that beaver have used this wetland for many years, and have enhanced its

Natural Resource Inventory for Laconia, NH

use for other wildlife species. While beavers are considered to be pests by some, scientists have proven that beavers are a "Keystone" species in North America. This means that beavers play a crucial role in biodiversity. Innumerable species rely either partly or entirely on beaver ponds, many of them threatened or endangered. In the Pickerel Pond Wetland System, osprey nested in 2008, and raised young successfully in the past as well. There were also several great blue heron nests throughout the wetland. Whenever we can coexist with beavers, we are providing the habitat necessary for supporting many other species, and protecting the web of life upon which we depend.



Great blue herons in a nest next to an active beaver lodge. Sixteen great blue heron nests were documented in this wetland complex, 13 of which were actively used in 2008. An osprey nest was also documented. This wetland has been enhanced by beaver for many years.

Vernal Pools – Unique often isolated and important wetland types are vernal pools. Vernal pools provide essential breeding habitat for certain amphibians and invertebrates such as wood frogs (*Rana sylvatica*), spring peepers (*Pseudacris crucifer*), spotted salamanders (*Ambystoma maculatum*), marbled salamanders (*A. opacum*), and fairy shrimp (*Branchinecta lynchi*). These creatures depend on vernal pools as breeding sites because they are only temporary water bodies preventing fish and other aquatic predators from taking up residency. Reptiles such as Blanding's turtles (*Emydoidea blandingi*) and spotted turtles (*Clemmys guttata*) also rely on vernal pools as important feeding areas in early spring. Vernal pools fill annually from precipitation, runoff, and rising groundwater, typically in the spring and fall. By mid-summer, however, these wetlands are typically dry, making them a dynamic system inhabitable to specifically adapted plant and wildlife species. For this reason many unique, rare, threatened, and endangered species are linked to this wetland type. The State of New Hampshire (Fish and Game Department and Wetlands Bureau) recognizes their value as important habitat and give them special attention. Fourteen vernal pools were documented in Laconia during this study, and eight others have been documented in previous years; totaling 22 documented vernal pools throughout Laconia. Of that, four vernal pools are located in conserved or protected land. Undoubtedly there are many more throughout city. Refer to the "Wetlands, Hydric Soil, and Aquifer" map at the end of the report for locations of known vernal pools throughout the City.

Natural Resource Inventory for Laconia, NH



A vernal pool found in the northwestern corner of Laconia in May 2008 east of Leighton Ave N. Wood frog tadpoles and yellow spotted salamander egg masses were noted along with deer tracks, and porcupine sign. This pool is located within a dense softwood stand (eastern hemlock) and contains a network of wildlife trails.



A probable vernal pool was noted in the southern part of Laconia in the City's 2-acre conservation easement at the Taylor Community. Although no obligate species were documented at the end of July 2008, it is recommended that the area be inventoried in May or early June when obligate vernal pool species are active.

Permanent wildlife openings⁸ (Map #2 at the end of report)

As farming was found to be more productive in areas such as the mid-west, it became increasingly less popular in Northern New England. As a result, most of New Hampshire has experienced a loss of working farms. With its abundant sources of water, large areas of gently sloping topography, and soils such as Marlow, Henniker, and Metacomet, much of the land mass in Laconia was cleared for farmland. There are a few remaining active agricultural practices, tree farms, hayland, equine, vegetable crops, on a smaller scale involving less of the potential farmland acreage. Much of the former farmland has reverted back to forest, and many areas have been developed. This overall loss of working farms has caused a significant decrease in the percentage of permanent wildlife openings over the past 50 years, and New Hampshire is encouraging landowners to create or maintain permanent wildlife openings as important wildlife habitat. For further discussion of farming practices and land use in Laconia, please refer to the Farmland Soils section.

Permanent wildlife openings are dominated by grasses, forbs, wild flowers, brambles and fruiting shrubs. These include hay land, pastureland, cropland, brush-hogged fields, and mechanically maintained transmission lines. It is estimated that they provide required habitat for about 22% of New England's wildlife species and are seasonally important for nearly 70% of species. Insects are not accurately incorporated into these figures, but a large number of these species occupy or use openings. White-tailed deer (*Odocoileus virginianus*), black bears (*Ursus americanus*), numerous rodents, such as deer mice (*Peromyscus maniculatus*), meadow voles (*Microtus pennsylvanicus*), shrews (*Soricidae* spp), and woodchucks (*Marmota monax*), commonly feed on the vegetation present in these habitats, and carnivores from weasels to coyotes in turn feed on these species. Permanent wildlife openings are heavily used by bird species as feeding and nesting sites, specifically by the eastern bluebird (*Sialia sialis*), Bobolink (*Dolichonyx oryzivorus*), and northern harrier (*Circus cyaneus*), which are species of concern in New Hampshire. They also create important edge habitat. Wherever an open area meets the forest, the area of transition will attract the largest diversity of species, both plant and animal. Generally, there will be species adapted to permanent wildlife openings, those adapted to forested habitat, and those who specialize in the transition zone area, who will frequent these edge habitats. For example, many bird species that feed in openings are known to nest within the edge habitat because there is typically more structural diversity and cover.

Though the positives of former farming landscapes far outweigh the negatives, it is often overlooked that vestigial unused fencing can be prohibitive to some wildlife travel and occasionally cause harm to wildlife. ***When possible it is a good practice to remove non-functioning fencing, such as barb wire and woven sheep fence.***

Agricultural fields are not the only source of permanent wildlife openings in Laconia. Some landowners are routinely brush-hogging former pastureland and hayfields to maintain them as permanent wildlife openings. This is done to enhance views and/or wildlife habitat. Transmission lines are now maintained by mechanical methods, rather than chemical methods as in the past, allowing them to be included as wildlife used permanent wildlife openings with miles of edge habitat. Meadows created from beaver activities are another source of permanent opening but are typically dynamic, and in various stages of succession as the long-term cyclic movements of beaver occur. These areas provide the characteristics of an open area and are surrounded by forested and wetland habitats, making them attractive for many wildlife species.

⁸ Permanent wildlife openings are those that are and will continue to be maintained as herbaceous openings (grass and legumes). They are valuable for many wildlife species in a landscape dominated by forested areas.



Permanent wildlife openings like this hayfield in the Paugus Bay State Forest provide special habitats and edge cover.

Currently, Laconia has 578.7 acres of permanent wildlife openings which make up 3.4% of the City's area. This percentage is less than the New Hampshire's State average of 10% permanent wildlife openings. A total of 95 different openings were documented during this project ranging in size from just over 0.5 acres to approximately 34.76 acres. Diversity in sizes is a good feature to maintain in permanent wildlife openings because varying sizes are preferred by different species. For example, northern harriers (*Circus cyaneus*) – a predatory bird or raptor - prefer larger openings while feeding, yet snowshoe hare (*Lepus americanus*) are more likely to feed in smaller openings where cover is more readily available. There are other permanent wildlife openings throughout Laconia that are too small to be mapped into the City's overall acreage of permanent wildlife openings, such as lawns near homes and seeded woods roads. These openings, especially those in more isolated parts of the City, are still important habitat and help maintain Laconia's plant and wildlife diversity. ***A goal to retain, and ideally increase, permanent wildlife openings would be beneficial to the diversity of wildlife and vegetation throughout the City.***



This field at the Opechee State Forest Tract offers an excellent grassland habitat for wildlife species. Several bobolink were observed here. Maintaining permanent wildlife openings also creates scenic vistas.

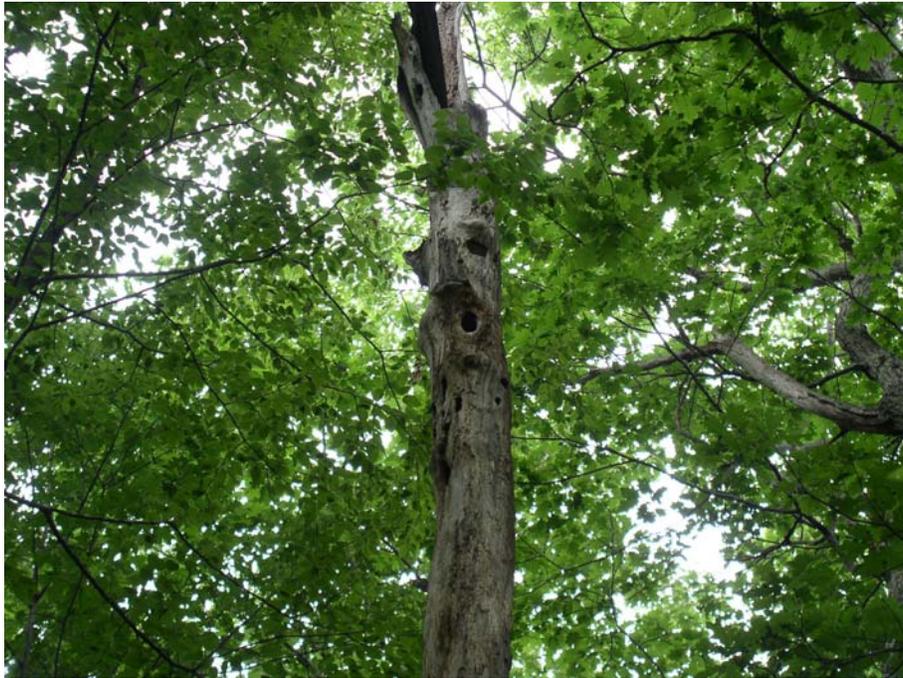
Natural Resource Inventory for Laconia, NH

Approximately 111.43 acres or 19.3% of permanent wildlife openings are located in conserved or protected land. The City of Laconia maintains the following areas as conserved permanent wildlife openings.

1. Paugus Bay State Forest
2. Opechee State Forest Tract
3. Huston-Morgan State Forest
4. Harrington, 21 acre, off White Oaks Road

Forested Lands (Map #2 at the end of report)

Based on digitization of the USDA 2003 aerial photography, an estimated 40.5% of the 16,712.2 acres of Laconia is forested lands. This calculation is a compromise between lands that might be under timber management, or could be sustainably harvested, and thick tree cover areas valued for their carbon content and carbon sequestering capabilities. Common tree species that make up these forested lands are white pine (*Pinus strobes*), eastern hemlock (*Tsuga canadensis*), red oak (*Quercus rubra*), white oak (*Quercus alba*), black oak (*Quercus velutina*), yellow birch (*Betula lutea*), white birch (*Betula papyrifera*), black birch (*Betula lenta*), red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), white ash (*Fraxinus americana*), black cherry (*Prunus serotina*), poplar (*Populus spp.*), red spruce (*Picea rubens*), American basswood (*Tilia americana*), balsam fir (*Abies balsamea*), and red spruce (*Picea rubens*).



Cavity trees such as this, offer excellent habitat for many wildlife species: wood peckers forage for insects; flickers, owls, and song birds and many small mammals nest/den in cavities in the tree; bats will roost behind loose bark. Once fallen, ruffed grouse will use the tree as a drumming log to attract a mate.

Forested areas include hardwood stands, white pine stands, hemlock stands, and mixed hardwood and softwood stands. Approximately 614.73 acres of forested land, approximately 3.7% of Laconia are dense softwood stands, primarily eastern hemlock and/or balsam fir. These stands range in size from 0.62 acres to nearly 34.76 acres. Of all dense softwood stands in the City, 110.67 acres or 18% are found within conserved or protected land. The largest density of

Natural Resource Inventory for Laconia, NH

softwood stands are in the central and northwest portion of the City, although a cluster is also found in the northeast of Laconia. Throughout the City, softwood stands are found in a variety of soil types ranging from the flat, very poorly drained soils such as Peacham Muck, to a well drained, upland forest with Marlow soils on hillsides. Some of these dense softwood stands are found along wetland complexes offering proximity to good cover and a diversity of habitat types. Many of the softwoods stands in Laconia are isolated, but a few are connected allowing for excellent winter cover and travel corridors for wildlife. Dense softwood stands are an important habitat type to many wildlife species. They provide important cover and foraging habitat during harsh winter conditions by reducing snow accumulations and wind speeds. Therefore animals such as red squirrels (*Tamiasciurus hudsonicus*), snowshoe hare, ruffed grouse (*Bonasa umbellus*), and white-tailed deer are often found utilizing them during the winter months. White-tailed deer are not well adapted for traveling in and dealing with deep snow conditions and hence require dense softwood stands in order to survive New Hampshire's harsher winters. When they congregate in these stands they are referred to as winter deer yards. For the stand to be considered a deer yard two basic elements must be met: (1) A core area is identified by concentrations of dense softwoods, and; (2) Mixed hardwood and softwoods adjacent to, or within the core area will provide accessible forage. ***Deer yards cover only about 3% of the land base in New Hampshire so their identification and management is an important part of conserving the entire State's natural resources.***



This eastern hemlock dominate stand near a wetland north of Pickerel Cove in north central Laconia provides good cover for wildlife. A network of deer trails was observed throughout this stand.

Laconia has several species of trees that are considered important because of their mast production. These include red and white oak, beech, maple, hickory, hemlock, black cherry, juneberries (*Amelanchier* spp), white ash (*Fraxinus americana*), and pine. Mast are the fruits produced by woody stemmed plants and can be either hard (seeds and nuts) or soft (fruits and berries). Wildlife species from nuthatches (*Sitta* spp.), chickadees (*Parus* spp.), squirrels, and eastern chipmunks (*Tamias striatus*) to white-tailed deer, black bears, turkeys (*Meleagris*

Natural Resource Inventory for Laconia, NH

gallopavo), and wood ducks (*Aix sponsa*) rely heavily on mast as a source of feed. Hard mast produced by oaks, beech, and some shrubs such as beaked hazelnut (*Corylus cornuta*), is considered extremely important because it is able to persist for a longer amount of time than soft mast and therefore is accessible to wildlife during times of the year when other food sources are limited.

A historic tree found in Laconia is a very large and old white oak (*Quercus alba*) at the Perley Pond conservation area located on the western side of Rte. 106. This oak is estimated to be 400 years old with a circumference of 20 feet (with a calculated diameter of over 6 feet). It is still alive, though there is some deadwood within the limbs.



The Perley Pond Oak has witnessed over 400 years of history in Laconia
Photo by Russell Tibault



Water color painting of the Perley Pond Oak by Russell Tibault

Natural Resource Inventory for Laconia, NH

As with much of New Hampshire, Laconia had American chestnut (*Castanea dentata*) trees, in the past. Unfortunately, this much valued tree species was nearly wiped out by an Asian bark fungal disease, chestnut blight, and their recovery through restoration efforts has been very slow. A species similar in name only, the horse-chestnut (*Aesculus hippocastanum*), is unrelated to the American chestnut family and its seeds are poisonous if not properly prepared. There is a large horse-chestnut in Lakeport Square in the Walter Torrey Park.



Walter Torrey Park in Lakeport Square is centered around this magnificent horse-chestnut tree.



This large healthy red oak in downtown Laconia is “multi-tasking” with one of those tasks being the sequestering and retention of carbon.

There are three Tree Farms listed in Laconia totaling 281 acres of managed forest and several State Forests: Paugus Bay, Swain, Huston Morgan, Prescott, and Hamel totaling 516 acres of managed forestland according to the City of Laconia Master Plan, 2007.

Bedrock Geology (Map #6 at the end of report)

The familiar pattern of a general southwest to northeast direction of the receding glaciers of over 12,000 years ago can be seen in Laconia as well as most all of New England. This process formed the rivers, lakes, stratified drift aquifers, and wetlands that we see today. Soil variations found throughout a given area exist because of the parent material (or bedrock) that lies beneath the surface and the deposits of materials left by the retreating glaciers. These parent materials influence land formations, hydrology, and vegetation occurring above them.

Surficial and Bedrock Geology studies of New Hampshire have shown that prior to the Ice Age, Lake Winnepesaukee did not exist as we know it today. The quartz diorite (primary rock of the Winnepesaukee basin) was decomposed in place before and during the glacial period, and the power of the ice toward the end of the Pleistocene Epoch gouged out the loosened rock leaving hills which are the islands and the water that makes up the lake. In addition, since the last glaciation, water flow in and out of the lake changed directions. Draining the central portion of New Hampshire, it once flowed southeast, leaving via what is now Alton Bay toward the Atlantic Ocean. When glacial debris blocked this path, flow was redirected westward through Paugus Bay into the Winnepesaukee River. The latter flows west from the lake and joins the Pemigewasset River in Franklin to form the Merrimack River, which flows south to Massachusetts and into the Atlantic.

Six types of bedrock geology have been mapped for Laconia by the US Geologic Survey. They are:

1. **Dclm** – Concord Granite – a gray two-mica granite, locally grading to tonalite
 - A small pocked found just southeast of Opechee Bay
2. **Dk2x** – Kinsman Granodiorite – foliated granite, granodiorite, tonalite and minor quartzdiorite; Large megacrysts of potassium feldspar characteristic; garnet locally abundant
 - The largest area found in the northern and western half of the City
3. **Dw3a** – Winnepesaukee Tonalite – gray massive to foliated tonalite and minor quartz diorite, granodiorite and granite
 - The Lake Winnepesaukee basin in Laconia
4. **Sp** – Perry Mountain formation, undivided – sharply interbedded quartzites, light-gray nographitic metapelite, and “fast-graded” metaturbidites. Cortical layer common
 - a small unit found half way between Paugus Bay and the Laconia town line...nearly 4,000 feet east of Plummer Point
5. **Srl** – Lower part of the Rangeley Formation – gray, thinly laminated metapelite containing local lentils of turbidites and thin quartz conglomerates in western NH. Sparce calc-silicate pods and corticule
 - A unit as part of the Winnisquam Lake basin and adjacent land to the east of the lake
6. **Sru** – Upper part of the Rangeley Formation – rusty-weathering peltic schist metasandstone, and local coarsed-grained metasandstone lentils; calc-silicate pods common; minor corticule.
 - The majority of the southern and eastern half of Laconia



The exposed ledge shown here is mostly granite and is located in the northern part of Laconia, nearly 1 mile west of Lake Winnepesaukee. The exposed granite offers not only scenic views, but also a glimpse at the bedrock geology underlying this region of the City.

Although the mapping was done at a large scale and is coarse, it provides a tool for location of these shifts in bedrock types and may suggest small inclusions of calcium or alkalis where higher pH soils and water may provide unique habitat for rare or unusual species. In terms of bedrock, the name ‘The Granite State’ aptly suggests an abundance of granite and acidic soils. According to the available mapping data, there are two bedrock types in the southern and eastern part of Laconia which contain pockets of higher pH parent material. These include: **Sr1 – Lower part of the Rangeley Formation; Sru – Upper part of the Rangeley Formation**. Both mapped bedrock geology units contain pods of calcium rich areas. From weathering of this rock type, and the potential presence of calcium deposits, the soils could have a higher pH, which could result in the presence of some rare plant species and communities.

New Hampshire Bedrock Geology data is available for download from the GRANIT data system. Further details about NH geology are available through the State Geologist – www.des.nh.state.us/geology/ and www.nhgeology.org. Please refer to the Geology Map at the back of this report for a complete list of these symbols found in Laconia.

Laconia has a mesic temperature regime indicating that the mean annual temperature ranges from 45 to 52 degrees Fahrenheit – the frost free season ranges from 105 to 180 days. The highest elevation in Laconia is an unnamed 960-foot (290 meters) hill in the northern part of the city, southwest of Weirs Beach. It is in the corner of Hilliard Road and Parade Road. The lowest elevation is in Winnisquam Lake where the Winnepesaukee River enters it in the southern portion of the City (500 feet or 150 meters).



A view from Weirs Beach looking towards the inlet of Paugus Bay. The last glaciation created this new drainage from Lake Winnepesaukee.

Soils

The nature of soil has a profound effect on plant growth. Whether it is rich with organic material, very poorly drained, or sandy, these characteristics will affect the type of vegetation adapted to grow in those conditions, and thus affecting the type of wildlife in the area. Scientists can learn much about the soil type by examining the vegetation. At the same time, examining the soil will predict the type of vegetation that can grow in the area. Because soils affect the vegetation that will grow in an area they also influence the habitat types and therefore the wildlife species that will occur in particular areas. As a result, understanding soil conditions and characteristics can be indicators of critical areas such as wetlands, agricultural lands, forestlands, and wildlife habitat. In descriptions of soil types, the NRCS evaluates soils according to their capacity for agriculture, woodland, community development, recreation, and wildlife habitat. Certain soils are better suited for certain land uses such as agriculture or residential development. For example, residential development should be located away from areas with unstable soil conditions such as high water tables, and slow percolation rates, due to constraints for building foundations and septic system placement.

Several factors exert a major influence on soil development. These include climate, time, topography, parent material, biota, and human activities. Studying soil can also lead to an understanding of how that soil was formed. For example, deep, rich, organic soils found in many wetlands were formed by lack of oxygen and slow decaying of plant and animal material.

Throughout the forested areas of Laconia, spodosol soils continue to develop under the organic litter. These soils take many years to develop identifiable horizons and typically have an albic or “E” horizon just under the organic or “O” horizon. The “E” horizon is generally 1 to 3 inches thick and is described as looking similar to wood ash. The phenomenon is caused by the actions of water and acidic decomposition or fallen needles and leaves stripping off the normal coatings of clay and or iron oxides. The spodosols are relatively young soils.

Natural Resource Inventory for Laconia, NH

One of the common soils in Laconia is the Marlow series (167). It consists of fairly deep, well drained soils that are fertile and moist on moderately steep slopes, good for high quality hardwood forests. This soil is also considered to be a prime farmland soil if the slope is not too steep. The presence of hard pan (acting as a restrictive layer) might limit development and building uses but proper timing and implementation of Best Management Practices (BMPs) for logging should provide a continuum of use as productive forestland and wildlife habitat.



Henniker fine sandy loam is classified as a farmland soil of statewide importance. It is well suited for blueberry and grape crops as shown here on the Foote property.

Another common soil is Henniker fine sandy loam (46). This soil series consists of well drained soils that formed in a loamy mantle overlying sandy dense till or loamy dense till characterized by a sandy component on drumlins and glaciated uplands. They are very deep to bedrock. Henniker soils are mostly forested and generally contain tree species including sugar maple, red oak, white oak, yellow birch, paper birch, white pine, and eastern hemlock. Areas cleared of trees and stones are used primarily for hay and pasture as well as apple orchards and cultivated crops.

A parameter sometimes overlooked in soils is that of pH. New Hampshire soils are commonly slightly acidic due to the influence of granite, thus NH being called “The Granite State”. There are some areas in Laconia where there are calcareous soils with higher pH due to small pockets of calcium within the bedrock. They tend to be near wet areas, often seeps. Such areas might contain unique habitat and rare plant life. Unusual or rare plant species in an area sometimes suggests higher pH soils. Some of the rare plant and plant communities located in Laconia are in these higher pH soils.

ArcGIS compatible shape files of the NRCS soils map and the USGS geologic bedrock of the City of Laconia have been included with the digital data. It is important to recognize that these delineations are limited in detail as they are Category II and III Levels derived from large grid fieldwork done in 1983 and USGS Quadrant maps at 1:24,000 scales. These soil

delineations are also limited for site-specific use in that minimum area polygons are three acres in size and can contain up to 35% inclusions or different soil types.

Farmland Soils (Map #3 at the end of report)

As true with many New England towns and cities, Laconia had several family farms in the 1800's and early 1900s. During the mid 1900s, small family farms were caught in the struggle of adjusting to a transition to commercial dairy activities within the larger regional markets. Laconia is considered to be in the center of one of the most fertile farming regions in the State, and was the trading center for the surrounding farms, villages, and towns.



The Prescott Farm Audubon Center is historic family farm on 160 acres of land. The open fields allow for scenic views. This farm is designated as an official NH wildlife viewing area and offers a variety of environmental educational opportunities for all ages.

As stated in the methodology section, prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It is land that still has the potential to serve agricultural uses and can be cultivated land, pasture, or woodland. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well-managed soil to produce the highest sustainable yields with minimal inputs of resources while at the same time generating the least possible damage to the environment. Farmlands that hold state and local importance may not be as ideal for producing the highest possible sustainable yield as prime farmlands, but these soil types have been determined to be of agricultural importance on a more localized scale.

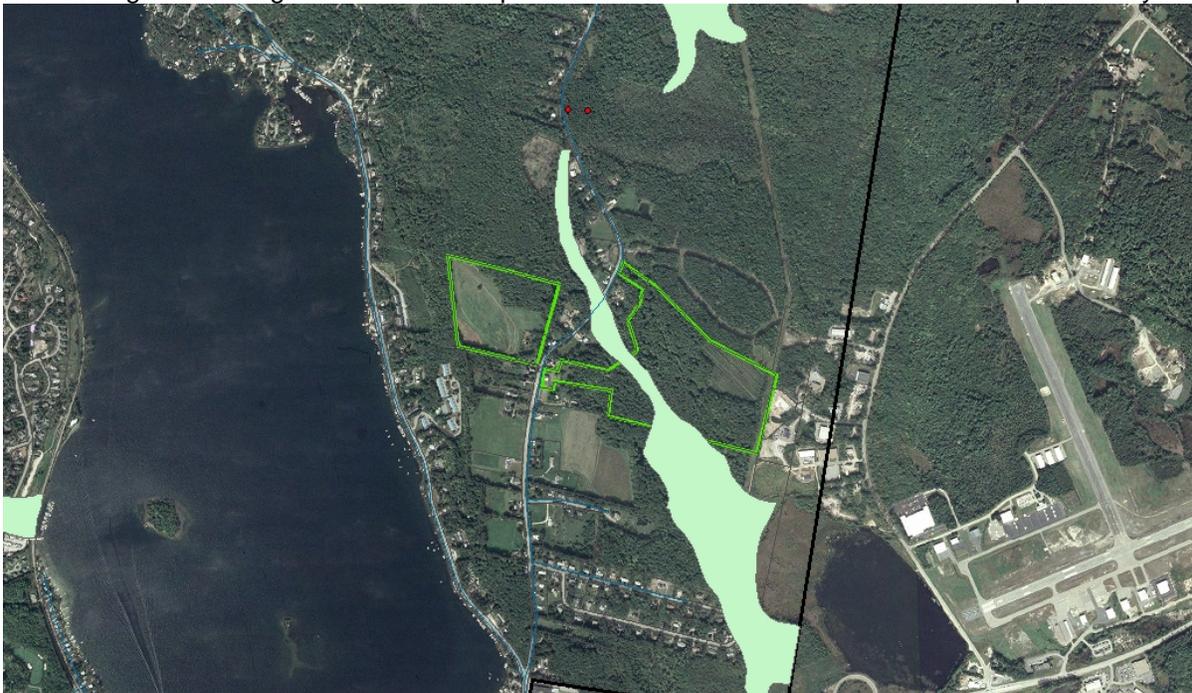
Out of the 16,712.2 acres of land within Laconia 601.4 acres (3.6%) of land have been classified as USDA prime farmland soils, 372.5 acres (2.2%) have been classified as farmland soils of statewide importance, and 7,235 acres (43.3%) have been classified as farmland soils of local importance. Most of the soils that make up the prime and state importance categories are located in the northern half of City, with fewer towards the northeast. Local important farmland soils are evenly spread throughout City. Some area of prime and state farmland has been lost to development, but most has not been developed yet. Other areas have reverted back to forested land. Of 601.4 acres of prime farmland that exists in Laconia, 28.5 acres or 4.7% are within

Natural Resource Inventory for Laconia, NH

conservation land boundaries, and of 372.5 acres of farmland of statewide importance, 5.7 or 1.5% are within conservation lands.



This field in Opechee State Forest contains prime farmland soils. It is a productive hay field and is co-leased by the Belknap Conservation District for public gardens. Several pairs of bobolinks were observed breeding and nesting in this field. The open fields also offer scenic views towards Opechee Bay.



The Harrington Easements (roughly outlined in green) contain an old apple orchard and fields as well as being hydraulically connected to Lily Pond by hydric soils and wetlands as displayed by the light green polygon.

As mentioned in the Permanent Wildlife Openings section, areas which had been used for agriculture, but are now abandoned, could be maintained as permanent opening habitat to benefit many wildlife species.

Many locations of rolling hills and knolls in Laconia have high potential for building sites with views. Decision makers must be aware of the long term implications of various land use options for the production of food, fiber, forage and oilseed crop, and the trade-offs involved; including carbon sequestration and storage.

Stratified-Drift Aquifers (Maps #1 and #5 at the end of report)

An aquifer is an underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt, or clay) from which groundwater can be pumped for drinking. Groundwater is a critical natural resource for the State of New Hampshire. Approximately 98% of public water systems rely on groundwater. There are three types of groundwater aquifers: stratified-drift, till, and bedrock. The basic difference is that stratified drift and till aquifers are composed of unconsolidated glacial deposits (loose earth materials), while bedrock aquifers are fractured rock. In stratified drift aquifers, the materials are sorted sand and gravel. In till aquifers, the material is a gravel, sand, silt and clay mixture. In bedrock aquifers, the material is rock with fractures.

Stratified-drift aquifers are an important source of groundwater for commercial, industrial, domestic, and public-water supplies in the State of New Hampshire. They typically are the most productive sources of groundwater and therefore the most high yielding public water supply wells tap these aquifers. Stratified-drift or overburden aquifers are most directly influenced by surface waters and land-use activities. They are therefore, perhaps most susceptible to contamination. Approximately 14% of land surface in the State is underlain with stratified-drift aquifers. In Laconia most of the aquifers are in the eastern (south and north) portions of the City, directly related to Lake Winnepesaukee, the Winnepesaukee River, Paugus Bay, and Winnisquam Lake.



Overlooking Paugus Bay (Laconia's Drinking Water source) - highlighting the interrelationship of vegetative buffers, development, infrastructure, and the need to maintain high water quality. (Photo provided by Diane Hanley)

Approximately 1,597 acres or about 9.6% of Laconia is underlain with stratified-drift aquifers. These aquifers are comprised of both coarse gravel and fine gravel materials. In all cases, the aquifers extend into abutting towns and are associated with waterbodies. The largest aquifer (778.5 acres) is in the southern part of the City along Durkee Brook, the Winnepesaukee River, including approximately 5,330 lineal feet along Winnisquam Lake (north and south of the Winnepesaukee River inlet), and Eager Island. Additionally, much of this aquifer lies to the east in the Town of Gilford. Another large aquifer in Laconia (345.6 acres) is just north of the previously described aquifer and is part of Jewett Brook and eastern shoreline of Opechee Bay area, extending north to include approximately 850 feet of shoreline along the southeastern outlet of Paugus Bay in Lakeport. This aquifer also extends into the town of Gilford. A third aquifer (274 acres) located in northern Laconia along approximately 9,392 feet of Winnepesaukee Lake shoreline traveling from Pendleton Point, past the bridge to Governors Island, and ending at the City/town line near Rte. 11. This is a portion of a very large aquifer which is mostly in Gilford.

Two other aquifers have portions that are mapped in Laconia: approximately 130.5 acres on the west and east shorelines of Pickerel Pond in northern Laconia extending into the Town of Meredith; and approximately 67.1 acres located in east central Laconia near the City line, including approximately one mile of eastern Paugus Bay shoreline and portions of Black Brook extending into the Town of Gilford.

Stratified drift aquifers consisting of sand and gravel materials, such as those in Laconia tend to be more porous and have a higher potential for quicker transmissivity and recharge. This also raises the risk of contamination with sources that require a region approach, working with neighboring towns. ***Although most people in Laconia get water from Paugus Bay and bedrock wells, these aquifers could be important water sources for use in the future. Whenever possible, these aquifers should be protected from contamination (impervious surfaces, point and non-point source pollution sources, development) to insure their future water quality and availability for the City.***

Slope

Slope is an important component of an area's landform and influences the plants and animals living there. Soils tend to be shallower on steeper slopes, the volume and velocity of surface water runoff is higher, and the erosion potential is greater than on flatter areas. These conditions create a unique habitat where in some cases plants and wildlife have special adaptations for dealing with the limitations associated with steep slopes.

Slopes provide opportunities for panoramic views and for this reason tend to be sought for residential development. Slope has several limitations for building such as structural problems and a greater chance of erosion. The consequences of erosion are loss of soil resulting in sedimentation of surface waters, loss of the productive capacity of the land, and in severe cases visual scars that can be seen from even long distances. Slope is traditionally expressed as a percent and represents the amount of rise or fall in feet for a given horizontal distance. For example a 15% slope means that for a 100 foot horizontal distance, the rise or fall in height is 15 feet. As slope becomes steeper the expenses associated with building increase. In general, slopes between 15% and 25% are considered areas where development would be restrictive and slopes greater than 25% are considered too steep to provide adequate sites for structures such as roads, homes, and septic systems.

Natural Resource Inventory for Laconia, NH

Laconia has development regulations which require that slopes over 25% be protected from development. *New Hampshire towns which have steep slope ordinances generally choose between 15% and 25%, so 20% slope documentation is a reasonable compromise.*

NRCS soil data was used to determine areas in Laconia with slopes equal to and greater than 15%. Using this method, 1,506 acres or 9.0% of the land in Laconia contains slopes that are over 15%. Of that 153.56 acres or about 0.9% of Laconia's land mass contains slopes over 25%. These are fairly low percentages of land mass and suggest that unique habitats for Laconia exist within these areas. Steep slope areas often provide special habitat for plant and wildlife species. They also contribute to the Town's tourism industry create hiking opportunities, and enhance several viewsheds.



The Eastman Road meanders down a relatively steep slope overlooking Winnisquam Lake.

Rare Species and Exemplary Natural Communities

The City of Laconia has some occurrences of rare species and communities documented. They are listed by the NH Natural Heritage Bureau (NHB), the State agency that houses all reported occurrences. It is highly likely that future studies would document additional rare species and communities.

With its many acres of lakes and ponds, as well as streams and rivers, Laconia has breeding bald eagles, osprey and loon.

New Hampshire is home to more than 500 species of vertebrate animals. Many of these animals live in Laconia and the surrounding towns. The number would be considerably larger if a complete list of invertebrates (insects, crustaceans, clams and snails) were included. About 75% are nongame wildlife species – not hunted, fished or trapped. Twenty-one species are endangered and thirteen are threatened in the state. The New Hampshire Fish and Game Department maintains a list of Endangered or Threatened animal species in New Hampshire, which is shown on the next page. Minimal information is available relative to their occurrence in Laconia, but their habitats, when identified should be protected.

Despite being a city, Laconia has some large tracts of land that are unfragmented by development. These contain a diversity of habitat types and thus, Laconia has potential for containing many rare and endangered plant and wildlife species, beyond those currently recorded.

Natural Resource Inventory for Laconia, NH



In 2008, a pair of osprey nested on the other side of this wetland. They successfully raised a chick. NH Audubon carefully monitors the nesting of Osprey in this wetland (Pickerel Pond Wetland System) each year.



Although not considered endangered or threatened habitat in NH, the habitat found in northwestern Laconia is valuable wildlife habitat. As the photos shows, there are a series of vernal pools. The forest is primarily a dense softwood stand (eastern hemlock) and contains a network of deer trails. Furthermore, there are large boulders scattered throughout the area which are used by porcupines.

NH Natural Heritage Bureau Listing for Laconia

| Species or Community Name | Listed? | | # Reported last 20 years | |
|---|---------|-------|--------------------------|-------|
| | Federal | State | City | State |
| Plants | | | | |
| Arethusa (Arethusa bulbosa) | -- | T | Historical | 21 |
| Fringed Gentian (Gentianopsis crinita) | -- | T | Historical | 25 |
| Ram's-head Lady's Slipper (Cypripedium arietinum) | -- | E | Historical | 14 |
| Sago Pondweed (Stuckenia pectinata) | -- | E | Historical | 8 |
| ***Small Whorled Pogonia (Triphora trianthophora) | T | T | 1 | 49 |
| Three-birds Orchid (Triphora trianthophora) | -- | T | Historical | 23 |
| Water Marigold (Megalodonta beckii) | -- | E | Historical | 11 |
| Vertebrates – Birds | | | | |
| **Bald Eagle (Haliaeetus leucocephalus) | M | T | 1 | 21 |
| **Common Loon (Gavia immer) | -- | T | 1 | 236 |
| **Osprey (Pandion haliaetus) | -- | - | 2 | 76 |
| **Purple Martin (Progne subis) | -- | - | 1 | 18 |
| Vertebrates – Fish | | | | |
| Lake Whitefish (Coregonus clupeaformis) | -- | - | Historical | 8 |

Listed? E = Endangered T = Threatened W = Species of concern (watch list) M = Monitored

Flags **** = Highest importance
 *** = Extremely high importance
 ** = Very high importance
 * = High importance

(These flags are based on a combination of (1) how rare the species or community is and (2) how large or healthy its examples are in that city. Please contact the Natural Heritage Bureau (603) 271-2214 to learn more about approaches to setting priorities.)

**Endangered and Threatened Wildlife in New Hampshire
 (list effective on September 20, 2008)**

ENDANGERED

| Common Name | Scientific Name |
|------------------------|----------------------------------|
| MAMMALS | |
| Canada lynx* | <i>Lynx canadensis</i> |
| Gray wolf** | <i>Canis lupus</i> |
| New England cottontail | <i>Sylvilagus transitionalis</i> |
| Small-footed bat | <i>Myotis leibii</i> |
| BIRDS | |
| Northern harrier | <i>Circus cyaneus</i> |
| Golden eagle | <i>Aquila chrysaetos</i> |
| Common nighthawk | <i>Chordeiles minor</i> |
| Piping plover* | <i>Charadrius melodus</i> |
| Upland sandpiper | <i>Bartramia longicauda</i> |
| Roseate tern** | <i>Sterna dougallii</i> |
| Least tern | <i>Sterna antillarum</i> |
| Sedge wren | <i>Cistothorus platensis</i> |
| FISH | |

Natural Resource Inventory for Laconia, NH

| Common Name | Scientific Name |
|----------------------------|-----------------------------------|
| American brook lamprey | <i>Lampetra bifrenatus</i> |
| Shortnose sturgeon** | <i>Acipenser brevirostrum</i> |
| REPTILES | |
| Blanding's turtle | <i>Emydoidea blandingii</i> |
| Eastern hognose snake | <i>Heterodon platirhinus</i> |
| Timber rattlesnake | <i>Crotalus horridus</i> |
| AMPHIBIANS | |
| Marbled salamander | <i>Ambystoma opacum</i> |
| INVERTEBRATES | |
| Dwarf wedge mussel | <i>Alasmidonta heterodon</i> |
| Brook floater | <i>Alasmidonta varicose</i> |
| Frosted elfin butterfly | <i>Incisalia irus</i> |
| Karner blue butterfly* | <i>Lycaeides Melissa samuelis</i> |
| Persius dusky wing skipper | <i>Erynnis persius persius</i> |
| Ringed boghauter dragonfly | <i>Williamsonia lintneri</i> |
| Cobblestone tiger beetle | <i>Cicindela marginipennis</i> |
| Puritan tiger beetle | <i>Cicindela puritana*</i> |
| White Mountain fritillary | <i>Erynnis persius</i> |

* = Federally Threatened

** = Federally Endangered

THREATENED

| Common Name | Scientific Name |
|--------------------------------|---------------------------------|
| MAMMALS | |
| American marten | <i>Martes Americana</i> |
| BIRDS | |
| Common loon | <i>Gavia immer</i> |
| Pied-billed grebe | <i>Podilymbus podiceps</i> |
| Bald Eagle | <i>Haliaeetus leucocephalus</i> |
| Peregrine falcon | <i>Falco peregrinus</i> |
| Common tern | <i>Sterna hirundo</i> |
| American three-toed woodpecker | <i>Picooides tridactylus</i> |
| Grasshopper sparrow | <i>Ammodramus savannarum</i> |
| REPTILES | |
| Spotted turtle | <i>Clemmys guttata</i> |
| Black racer | <i>Coluber constrictor</i> |
| INVERTEBRATES | |
| Pine pinion moth | <i>Lithophane lepida lepida</i> |
| White Mountain arctic | <i>Oeneis Melissa semidea</i> |
| FISH | |
| Bridle shiner | <i>Notropis bifrenatus</i> |

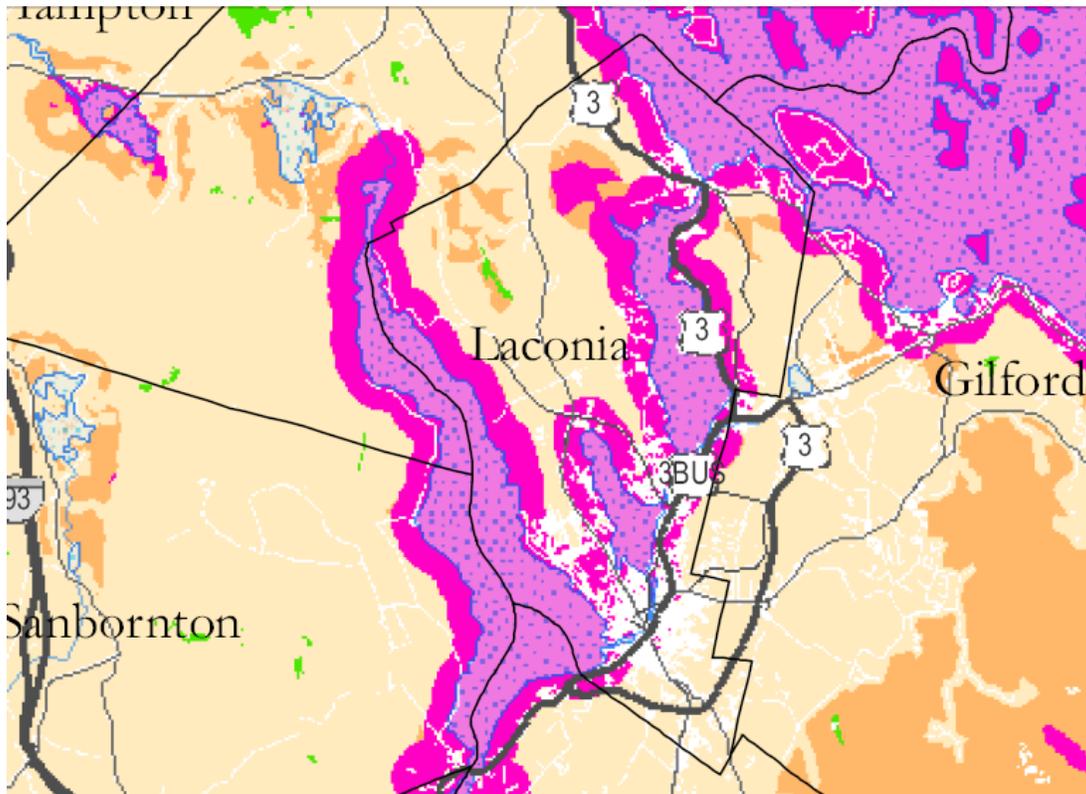
The State of NH defines endangered wildlife as those native species that are in danger of extinction in New Hampshire because of a loss or change in habitat, over-exploitation, predation, competition, disease, disturbance or contamination. Assistance is needed to ensure these species'

continued existence. Threatened wildlife are those native species that are likely to become endangered in the near future, if conditions surrounding them begin, or continue, to decline. To learn more about threatened or endangered species or unique communities, contact the New Hampshire Natural Heritage Bureau office of NH Division of Forest and Lands for plant species 603-271-2214 website – www.dred.state.nh.us/divisions/forestandlands/bureaus/naturalheritage/index.htm), or the Nongame and Endangered Species Program of the NH Fish and Game Department (603-271-2461 website – www.wildlife.state.nh.us/Wildlife/nongame_and_endangered_wildlife.htm).

Wildlife Action Plan

The New Hampshire Fish and Game Department worked together with select partners in the conservation community to create the state’s first Wildlife Action Plan (WAP). The plan, which was mandated and funded by the federal government through the State Wildlife Grants program, provides a base tool for restoring and maintaining critical habitats and populations of the state’s species of concern and their habitat. New Hampshire Fish and Game claims it to be a first step on a statewide scale to work towards helping keep species off the rare species lists. The NH Wildlife Action Plan was submitted to the U.S. Fish and Wildlife Service on October 1, 2005, and was approved in the spring of 2006.

In the GIS phase of the Wildlife Action Plan, biologists and GIS technicians conducted co-occurrence analyses using a variety of digitized natural resource features such as wetlands, riparian habitat, unique rock outcrops, dense softwood stands, alpine areas, etc. This analysis identified and ranked areas of conservation priorities throughout the state and at a statewide level.



The large lakes and bays with upland buffers surrounding them in Laconia are classified by the Wildlife Action Plan as “Highest Rank Habitat by Condition”. This further demonstrates the need to protect and enhance water quality.

As analyzed by this process, Laconia contains quite a bit of water and land that was classified as “Highest Rank Habitat by Condition in NH”. Most of those areas classified as “Highest Rank Habitat by Condition” are found along the large lakes and bays in the city. The Action Plan demonstrates that buffers to lakes are critical to maintain water quality and quality wildlife habitat. The small “green” area in Laconia is part of the Pickerel Pond Wetland System (described above in the Wetlands Section). This area contains a diverse, productive wetland, with beaver, nesting osprey, a great blue heron rookery, wildlife trails, song birds, ducks, amphibians and reptiles.

Because the Wildlife Action Plan was done at a broad scale, not all areas containing important wildlife habitat were identified in Laconia. It is also important to note that this analysis focused on 123 species and 27 habitats in greatest need of conservation throughout the State, which contains over 1,300 known species. Nevertheless, it is an important starting point for municipalities, including Laconia. Future work, including this NRI, can be shared with Fish and Game, and incorporated into the Wildlife Action Plan to build upon and improve data and habitat analyses.

For more details on the Wildlife Action Plan visit the NH Fish and Game’s website at: http://www.wildlife.state.nh.us/Wildlife/wildlife_plan.htm. The plan and associated maps can be downloaded and viewed. Fish and Game also keeps record of updates and on how the Plan is being used and updated. There is also a spot to sign up for regular WAP e-mails.

Scenic Resources

With its large amount of shoreline and gentle sloping topography, Laconia has many scenic views and viewsheds throughout the City. There are currently several designated scenic roads in Laconia, most offer scenic views overlooking waterbodies, knolls, ridgelines, and mountains. Many of these views extend into abutting towns. The Lakes Region Tour Scenic Byway which includes all the area around Lake Winnepesaukee, includes routes in Laconia:

1. NH Rte. 3, from the Meredith Town line to Downtown Laconia
2. New Hampshire Rte. 106 (also known as Parade Road) from the Meredith Town line to Downtown Laconia;
3. Rollercoaster Road
4. Scenic Drive
5. White Oaks Road
6. New Hampshire Route 11B from Weirs Beach to the Gilford Town line (2007 City of Laconia Master Plan).

At the time of this report, no Laconia City roads have been designated as Scenic Roads.

There are many roads and vistas that are valuable to the City for the views they provide maintaining the character of Laconia. White Oaks Road, Parade Road, Meredith Center Road, Rollercoaster Road, and Hilliard Road are some examples of potential Scenic Roads (City of Laconia Master Plan, 2007). *Laconia residents should continue to consider designating scenic roads.*

Forests, and wetland complexes such as the Pickerel Pond area, and the large wetland complex north of Pickerel Cove have scenic views from a different perspective compared to hill tops. In all cases, wildlife and plant observations are rich and diverse. Weirs Beach, Opechee Bay, Paugus Bay, and smaller areas such as the Perley Pond Conservation Area and the Prescott Farm Audubon Center have scenic areas, some with roadside pull-offs or trail access.



Scenic views in the Pickerel Pond area may not be as spectacular as some of the larger waterbodies, but have the advantage of less developed shorelines with plant and wildlife species in abundance.

Closely associated to scenic views are the fields and permanent wildlife openings in Laconia. People experience scenic views in all directions while driving, biking or walking along the roads in the City, particularly where fields and permanent wildlife openings are maintained.

Continuing to maintain permanent wildlife openings will retain views throughout Laconia.

In recent years, development and population growth throughout the State and region have caused people to increase their appreciation of the natural scenery New Hampshire has to offer. As with many other towns and cities in NH, there are potential threats to viewsheds. Several communities are struggling with the concern of future development on the ridgelines and top of hills. In many communities there have been extensive debates over wind towers, cell towers, and houses built on ridgelines because of their detrimental effect on viewsheds.



This recent clearing on the Foote property in Laconia not only enhances wildlife habitat, but also allows for scenic views.

Conservation Land (Map #2 at the end of report)

Approximately 1,115.2 acres equaling 6.7% of Laconia is land conserved by governmental ownership or conservation easements, and is protected as conserved land. There are several abutting protected parcels located in the central portion of Laconia between Winnisquam Lake and Paugus Bay, and the same is true further south between Winnisquam Lake and Opechee Bay. There are 74.6 acres of conserved land in a parcel located approximately 2,200 feet east of northern Paugus Bay along the east side of White Oaks Road, and several smaller abutting parcels of conserved land in northern Laconia west of Lake Winnepesaukee, south of Maiden Lady Cove. A few smaller parcels are scattered within the City in southern Laconia such as Perley Pond Conservation Area and Eager Island. See table below for details of conservation land throughout Laconia.

| Parcel Number | NAME | ACRES | Conservation status, ownership |
|---|---|----------------|---|
| Portions of lots 127-191-02 & 127-191-01 | Charland Easement | 5.0 | Permanent, Conservation Easement with City of Laconia |
| 20-153-6 | Hamel State Forest | 41.2 | Permanent, Protected by State law Title XIX-A, Chapter 227-H:5 |
| 28-155-1 | Paugus Bay State Forest | 253.0 | Permanent, Protected by State law Title XIX-A, Chapter 227-H:5 |
| 26-155-1 | Prescott State Forest | 116.0 | Permanent, Protected by State law Title XIX-A, Chapter 227-H:5 |
| 30-85-1 & 31-85-26 | Swain State Forest | 102.9 | Permanent, Protected by State law Title XIX-A, Chapter 227-H:5 |
| 30-154-4 & 35-153-10 | Huston-Morgan State Forest | 165 | Permanent, Protected by State law Title XIX-A, Chapter 227-H:5 |
| 332-404-2 | Opechee Bay State Forest | 48.1 | Permanent, Protected by State law Title XIX-A, Chapter 227-H:5 |
| 333-310-3 | Ahern State Park | 129.4 | State Owned Park |
| 29-155-5 | Puleo Easement | 65 | Permanent, private easement with NH DRED |
| 321-71-1 | Bond Beach Park | 38 | City Owned Park |
| 441-15 | Eager Island | 2.4 | Permanent, City Owned Land |
| Portion of 391-220-18 | Taylor Retirement Home | Approx 10 | Permanent, Easement with the City |
| 385-142-2 | Perley's Pond | 1.6 | Permanent, City owned land |
| 353-404-2 | Tardif | 11 | Permanent, City Owned Land |
| Wetland crossing lots 244-414-18, 244-413-17 & 244- 412-20 | Wilkins - SouthDown | Approx 0.25 | Permanent, Easement with the City |
| 266-272-1.1 | Bonum - SouthDown | 2.5 | Permanent, Easement with the City |
| Portion of 141-484-5 | Akwavista | 13 | Permanent, Easement with the City |
| 375-324-7 | Fuller | 3,100 sq ft | Permanent, Easement with the City |
| 191-241-2 & 191-241-3 | Prescott Farm- Environmental Education Center | 160 | Prescott Conservancy Inc. |
| 240-241-10 | Harrington | 53 | Easement with the City |
| 240-241-3 | Harrington | 23 | Easement with U.S. NRCS |



Although Perley Pond is located by a busy road within the City limits, and visited by many people, portions of this small pond and wetland area are well wooded with good wildlife habitat. In fact, this portion of Perley Pond is a probable vernal pool and could be visited in May to check for obligate species.



An aerial overview of the White Oaks wetland complex courtesy of Diane Hanley.

There are several ways to conserve land. Many lands are owned by federal, state, and local governments (national forests, state parks, and state/town forests for example). A conservation easement on private land is another means to protect property. It creates a legally enforceable land preservation agreement between a landowner and a municipality or a qualified land protection organization or trust. It restricts real estate development, commercial and industrial uses, and certain other activities on a property to a mutually agreed upon level. The

decision to place a conservation easement on a property is strictly a voluntary one where the easement is sold or donated. The restrictions, once set in place, are binding on all future landowners. The restrictions are spelled out in a legal document that is recorded in the local land records, and the easement becomes a part of the chain of title for the property. The landowner who gives up these development rights continues to privately own and manage the land and may receive significant state and federal tax advantages with their land for future generations. The easement holder has a responsibility to monitor future uses of the land to ensure compliance with the terms of the easement and to enforce the terms if a violation occurs.

The City of Laconia has a conservation fund of up to \$250,000 in place to facilitate land conservation projects.

Unfragmented Roadless Areas (Map #4 at the end of report)

With increasing development, the number of roadless areas or unfragmented blocks of land has been steadily decreasing in many towns in New Hampshire. The increasing number of roads has affected wildlife both directly and indirectly: directly through road kills; and indirectly through loss of habitat and cutting off travel corridors. Fortunately, Laconia has several large tracts of land which are not impacted by roads. The City contains unfragmented blocks ranging from just over 20 acres to over 1,765 acres. The largest block of unfragmented land is in the northcentral part of Laconia between Parade Road and Endicott Street North. The second largest block is on the west side of Parade Road adjacent to the largest unfragmented block and contains nearly 853 acres of land. The Pickerel Pond Wetland System is found within this large block of roadless areas. Overall there are 14 blocks of unfragmented land listed below and displayed on the “Unfragmented, Roadless Area” map at the end of this report.

- 1 area is over 1,000 acres
- 2 between 500 and 1,000 acres,
- 5 between 250 and 500 acres
- 2 areas between 100 and 250 acres
- 2 between 50 and 100 acres
- 2 less than 50 acres.

It is recommended that the City works to promote conservation of some of these large unfragmented tracts for wildlife habitat, wildlife travel corridors, and recreation. These larger tracts of unfragmented lands are the most valuable for wildlife and its associated habitat. Other tracts to consider protecting are those adjacent to Lake Winnepesaukee, Winnisquam Lake, and Paugus Bay. Maintaining unfragmented blocks adjacent to large water bodies will also help maintain good water quality for Laconia.

Cultural Resources

The City of Laconia has an exceptionally rich history of land use changes and cultural features from its original settlement to current times. Settlers and later entrepreneurs were drawn to Laconia due to its gentle knolls, large waterbodies, and the powerful flow of the Winnepesaukee River as a source of power. Laconia was, and still is, a land of abundant opportunity because of its natural resources. Laconia has had diverse changes from farming to logging to industry, with associated upgrades in road and railroad systems, water powered mills, water transportation, and tourism. All of these economies and ways of life can be found throughout the landscape.

Natural Resource Inventory for Laconia, NH

Several community initiatives exist that highlight some of the cultural features in Laconia such as the River Walk and the Lakes Region Tour Scenic Byway. There are walking and hiking trails, a proposed city-wide recreation trail (the WOW trail), and historic parks. Other cultural efforts include designation of several buildings to the National Register of Historical Places, and archeological sites predating modern settlement such as Weirs Beach. Laconia has a “Historic Preservation Plan” written by the Lakes Region Planning Commission in 1982.

Evidence of old farms and miles of stonewalls can be found in areas which reverted back to forest. Abandoned Class VI roads within Laconia are further evidence of former farms and dwellings.



This stone archway at the start of a trail in Weirs Beach Community Park is an example of past activities.



Granite slabs cut and broken by hand tools in an abandoned quarry near Lakeport Village.

Natural Resource Inventory for Laconia, NH



Avery dam on the Winnepesaukee River, behind City Hall, continues to supply power to the City.



Jewett Brook flows beneath the city road and former Scott and Williams mill building in Laconia.



These apple trees once in pastures are still producing fruit, but now must compete with vines & other tree species as the former field reverts back to forest. Photo taken on the Prescott State Forest.

Invasive Plant Species

There is an increase in public awareness and concern about the rapid growth of invasive species in NH and throughout New England. Invasive species are plant and wildlife species that are not native to an area, but take up residency and can out-compete native species. These species tend to be more common in wet areas such as lakes, wetlands, riparian habitats, and areas of recent disturbance including roadsides. They can also be found at old farm sites where people have planted various fruiting and ornamental plants for agricultural purposes.

During field work several areas containing invasive species were documented. A list of a few of these species follow:

- Japanese barberry (*Berberis thunbergii*) was documented at the end of Water Street near Winnisquam Lake and along Durkee Brook.
- Japanese knotweed (*Polygonum cuspidatum*) was noted in several areas in Laconia, particularly along many of the roadsides and along Durkee Brook.
- Reed phragmites (*Phragmites australis*) was documented on Pickerel Pond, along Durkee Brook and on the Tardiff Conservation Easement along Parade Road.
- Purple loosestrife (*Lythrum salicaria*) was noted in several roadside wetlands and disturbed areas. A few plants were noted in a wetland, which is part of Black Brook
- Multiflora rose (*Rosa multiflora*) was found near Black Brook.



A colony of Japanese knotweed in full flower is shown in the middle of the photograph, and found between the City's recreation field and Durkee Brook.



An area of reed phragmites was documented at a public boat landing on Pickerel Pond. It was also documented along Durkee Brook and the Tardiff Conservation Easement on Parade Road.

Variable-leaf milfoil (*Myriophyllum heterophyllum*) is a major nuisance non-native plant in New Hampshire's lakes. This plant is more robust than the native water-milfoil species. It has a very thick stem, and studies at the University of New Hampshire suggest that it can grow an inch per day. It is very difficult to control once it becomes fully established. Milfoil spreads rapidly and displaces beneficial native plant life. It makes swimming difficult and may devalue waterfront property. Periodic dock checks are made throughout Laconia to help avoid infestation and spreading of this invasive plant.

This NRI was not designed to be an all inclusive search and documentation of invasive species in Laconia. Undoubtedly, other species and locations where invasive species occur in Laconia have been or will be documented. The City of Laconia should continue their efforts to help identify and eradicate these invasive species, and may want to seek assistance from the Invasive Plant Atlas of New England (IPANE), New England Wild Flower Society, and other organizations that have begun programs to control or eradicate invasive species. For further information on invasive species, and an update of the list of these species, review the IPANE website: <http://nbii-nin.ciesin.columbia.edu/ipane/>

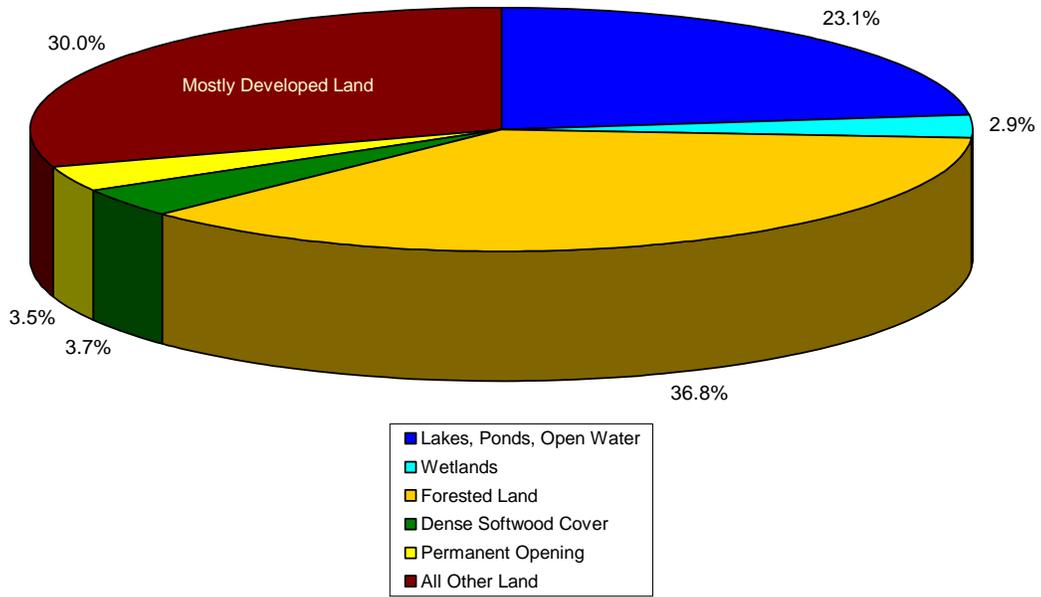
Habitat Area Summary Table

The table displayed below is a summary of different habitat areas in acres and square miles.

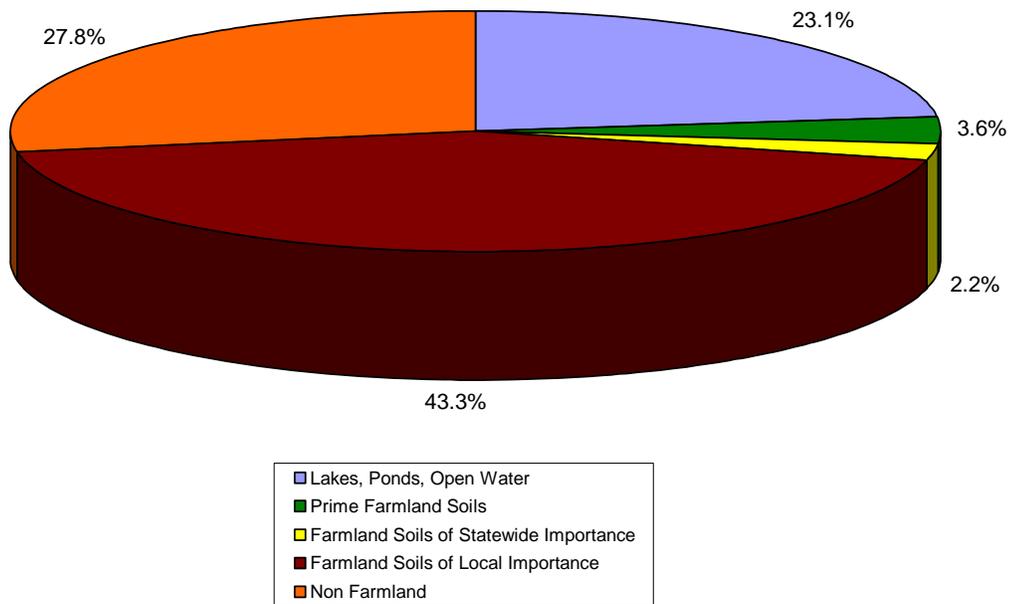
| Habitat Type | Number of Acres | Number of Square Miles | Percentage of City Land Mass |
|--|------------------------|-------------------------------|-------------------------------------|
| Laconia City Boundary | 16,712.2 | 26.11 | 100% |
| Lakes, Ponds, Open Water | 3,862.17 | 6.03 | 23.1% |
| Wetland Complexes (from National Wetland Inventory data & WTW fieldwork) | 493.0 | 0.77 | 2.9% |
| Hydric Soils | 1,212.96 | 1.90 | 7.3% |
| Aquifers | 1,596.96 | 2.50 | 9.6% |
| Forested Land | 6,770.0 | 10.58 | 40.5% |
| Dense Softwood Cover | 614.73 | 0.96 | 3.7% |
| Permanent Wildlife Openings | 578.73 | 0.90 | 3.4% |
| Prime Farmland Soils | 601.41 | 0.94 | 3.6% |
| Farmland Soils of Statewide Importance | 372.50 | 0.58 | 2.2% |
| Farmland Soils of Local Importance | 7,235.00 | 11.30 | 43.3% |
| Steep slopes – 15% and greater | 1,506.03 | 2.35 | 9.0% |
| Steep slopes – 25% and greater | 153.56 | 0.24 | 0.9% |
| Conservation Lands | 1,115.2 | 1.74 | 6.7% |

Natural Resource Inventory for Laconia, NH

Laconia Natural Resources 2009



Laconia Farmland Soils 2009



DISCUSSION – FUTURE APPLICATIONS AND BENEFITS

This project has compiled natural resource data into a digital database in GIS format and produced a written report for use in the City of Laconia. It contains a database with a comprehensive, updatable, digital inventory of the entire City. The data from this project is compatible for integration with the existing City GIS. Efforts from this project will aid in future work and inventories, as well as provide data to guide future development decisions in Laconia.

It is anticipated that results from this study will help the City of Laconia in many ways. City-wide zones based on habitat and vegetation can be assessed and modified. Data gathered from this work will also assist the Conservation Commission, Planning and Zoning Boards, and City Council, in foreseeing possible conflicts with future development. Perhaps the most powerful advantage of this project is that future studies and work can be easily integrated to build upon this database indefinitely.

Based on results from this study, Watershed to Wildlife, Inc. and the Laconia Conservation Commission offer the following additional recommendations:

9. **Wetland Identification and Protection** - There are several wetland complexes adjacent to brooks, ponds and lakes, and along some hillsides. The importance of conserving these wetlands cannot be over emphasized. It is hoped that the City will continue to pursue ways to further inventory the functionality and vulnerability of these wetlands with a ranking system, and a long-term goal of Prime Wetland designations. Several wetland studies have been completed in the past and there are data on several key wetlands throughout Laconia, all of which could be updated, integrated, and strengthened.
 - a. An in-depth inventory of vernal pools throughout Laconia would also enable the Conservation Commission, Planning Board, and City Council to critique and adjust future subdivision proposals if vernal pools are likely to be impacted.
 - b. Laconia currently has city-wide ordinances to help protect wetlands and vernal pools, or at least minimize detrimental effects to them and the groundwater. The Laconia Conservation Commission has also compiled volumes of data on the functionality of wetlands throughout the municipality. The City should consider increasing the current 50 foot wetland buffers in situations where wetland functionality values are high.
 - c. The Conservation Commission should continue to work towards designating Prime Wetlands for some of the more valuable wetland complexes. This would offer more protection through city ordinances as well as State regulations (through the NH DES Wetlands Bureau)
10. **Shoreline Protection** - Many shoreline areas along the large lakes and bays in Laconia have been developed. The Comprehensive Shoreland Protection Act, originally enacted in 1991 has been recently updated. Based on results from a commission of multidisciplinary professionals, sixteen of their recommendations for change were enacted into law and became effective July 1, 2008. The changes are broad in scope and include impervious surface allowances, a provision for a waterfront buffer in which vegetation removal is restricted, shoreland protection along rivers designated under RSA 483-B (Designated Rivers and Fourth Order Streams), and the establishment of a permit requirement for many construction, excavation or filling activities within the Protected Shoreland. These updated rules would apply to the large lakes and bays in Laconia
 - a. The shoreline along the miles of streams, ponds, and lakes has a range from excellent to no vegetative buffers. There are many sections in Laconia where

Natural Resource Inventory for Laconia, NH

enhancement of the buffer by plantings would help maintain and improve water quality; particularly along Durkee Brook, Black Brook, and sections of Jewett Brook.

- b. Stormwater runoff and associated drainage should be monitored immediately after storm events whenever possible. Treatment devices for stormwater structures should be installed and maintained; particularly within 150 feet of the shoreline.



Durkee Brook: The photo on the left shows very poor vegetative buffer with attempts to stabilize the bank using pieces of scrap metal and rocks. The photo on the right is taken further downstream and shows excellent riparian buffer, within a small floodplain forest.

11. **Surface Water Protection** - Many of Laconia's residents obtain drinking water from Paugus Bay. Moreover, Laconia is in the heart of the "NH Lakes Region", where people from near and far enjoy recreation in the largest lakes in New Hampshire. Maintaining good water quality is the highest priority for the Laconia Conservation Commission. Fortunately, water quality in these lakes and bays has improved over the last few decades. However, water quality issues should be addressed not only in the large lakes themselves, but also in the headwater streams and brooks that feed into the lakes, ponds and rivers throughout the city.

- a. Where possible work to conserve riparian habitat adjacent to headwater streams and brook. The wetland setback should also apply to all Riverine wetlands including perennial and intermittent streams.
- b. Continue to monitor water quality not only in the large lakes and bays throughout the City, but also in the streams such as Durkee, Jewett and Black Brooks.
- c. The City should update potential contamination source (PCS) location inventory at least on an annual basis and ensure that compliance (secondary contain structures, and spill kits) are in place.

12. **Aquifer Protection** - Based on the locations and relatively small size of the underlying aquifers in Laconia, it is important that steps be taken to protect the groundwater, brooks, ponds and aquifers in city. Future water supplies are a very valuable natural resource, for Laconia and the abutting municipalities; proven by the drinking water systems already in use. They are:

- a. Implement Best Management Practices (BMPs) within aquifer areas.

Natural Resource Inventory for Laconia, NH

- b. Monitor septic system plumes with a focus on parcels adjacent to brooks, wetlands, and aquifers.
 - c. Monitor the placement of future septic systems keeping in mind the typically high permeability of many of Laconia's soils.
 - d. Develop city-wide ordinances to help protect aquifers, including restriction of impervious surface development and dumping of waste on top of aquifers, particularly those with high productivity and flow.
13. **Hillside and Viewshed Protection** - Laconia's hilly topography, lakes and ponds, and open fields are directly related to the City's tourism industry, scenic beauty, and assortment of natural resources (wetlands, streams and rivers, wildlife, plants, soils, etc.). Research and considerations should be made towards evaluating and possibly updating the zoning ordinance in Laconia to conserve viewsheds as an important feature and tourist attraction to the area, while continuing to consider landowner rights. Several areas with scenic views have been identified in the City of Laconia Master Plan 2007. Many of these viewsheds overlap into abutting towns and are part of regional importance (e.g. The Lakes Region Tour Scenic Byway). The City might want to consider verifying and adding to an inventory of Scenic Viewsheds.
- a. Scenic View Conservation - The potential for a continued population increase throughout the City makes it wise for landowners to sustainably conserve their land. By taking a proactive approach to deal with future development pressures, the scenic vistas and beauty will remain as impressive (or even better) tomorrow as they are today. Scenic easements are types of conservation easements that make protection of scenic resources possible.
 - b. Ridge-line Development Criteria - Several municipalities throughout the State have developed ridge-line ordinances to protect ridgeline views. Laconia may want to review some of these and explore the possibility of implementation.
 - c. Steep Slope Development Criteria - Develop city-wide ordinances to restrict future development and road construction at sites with over 25% slopes and limit development on slopes between 15% and 25%.
14. **Dense Softwood Stand Protection** - Based on results from this project, there are a few areas that contain adequate acreage of dense softwood stands scattered throughout City. These areas are beneficial to many wildlife species.
- a. Connectivity to each other and travel corridors could be improved.
 - b. Maintaining the existing stands for the benefit of the deer, moose and other wildlife populations is very important.
 - c. Where possible, extend the existing softwood areas and connect patches of softwood in a continuum should be further investigated and willing landowners should be encouraged to do so, particularly those with abutting wetlands and riparian buffers. One area that stands out is the dense softwood stand adjacent to the Pickerel Pond Wetland System, just south of Pickerel Pond. It is one of the largest dense softwood stands (nearly 68 acres), and contains a network of wildlife trails. It is used as a deer wintering area. Maintaining or increasing this softwood stand will be beneficial to many wildlife species.
15. **Land Conservation and Maintaining Unfragmented Roadless Areas** - Just over 6.7% of Laconia's land is officially classified as conserved land. It is recommended that the City continue to explore lands to potentially conserve. This will further benefit the City's

Natural Resource Inventory for Laconia, NH

natural resources. Focus should be on connectivity between existing conserved parcels as well as minimizing future fragmentation. Habitat types that are not currently well represented in conservation lands such as wetland complexes, permanent wildlife openings, and dense softwood areas should be considered. Laconia should continue to encourage landowners to place land into conservation easements.

- a. Stewardship planning of these properties is recommended.
- b. A high priority should be placed on conservation of lands along the shores of Lakes Winnepesaukee, Winnisquam Lake, Paugus Bay, Opechee Bay, and Pickerel Pond. Conservation of land to prevent runoff erosion, sedimentation, and impervious surfaces will help maintain good water quality.
- c. Investigating the purchase of adjacent parcels to current conservation lands would increase and maintain existing wildlife travel corridors, particularly in large unfragmented areas. The City would benefit by maintaining the connectivity of forestlands, wetland complexes, and open space habitat.
- d. Stewardship and protection of prime agricultural land and farmland of statewide importance should be considered, to retain these lands and protect them from irreversible development. The Opechee Bay State Forest is an example of one parcel (48 acres) on prime farmland soils. It is co-leased by the Belknap Conservation District, maintained as a hay field, and also used by bobolinks for breeding.

16. **Interagency Cooperation** - It is recommended that Laconia will continue to work with neighboring towns, organizations, and agencies throughout the region to share future data as it becomes available. This will avoid an all too common problem of separate entities replicating work. Natural resource features do not end at town or city boundaries. A watershed approach to conserving them is recommended. All of the surrounding towns have completed or are in the process of completing a Natural Resource Inventory and all of the data between the towns and Laconia should be compatible in GIS format.

- a. Work with regional planning commissions, who have developed several templates for town-wide and city-wide ordinances in areas from wetland and shoreline setbacks, to restrictions on steep slopes, to ridgeline development.

Long-term uses of this project could include, but are not limited to:

- assisting the City and others in determining “least-impact” sites for future development
- locate ideal locations for telecommunication towers or wind farms
- Refining future Master Plan updates based on natural resource features
- promoting protection plans for water quality, wetlands, and aquifers under portions of the City
- continuing identification of land for purchase or easements for protection into the future

Furthermore, the City is in a position to request that all future development plans be delivered in digital format, which would build upon the existing database (including assist in updating tax maps for assessment) at little cost to the City.

REFERENCES

- City of Laconia. 2009. City of Laconia, NH Ordinances. Retrieved from the worldwide web on March 19, 2009: <http://www.city.laconia.nh.us/>
- Laconia Conservation Commission. 2002. *Laconia Wetland Evaluations*. Data compiled from 1992 to 2002 on several wetland complexes throughout Laconia. City of Laconia, Laconia, NH.
- Laconia Planning Board. 2007. *City of Laconia Master Plan*. City of Laconia, NH.
- Lake Winnepesaukee Historical Society. 2009. Information retrieved from the worldwide web on April 2009. (<http://www.lwhs.us/>).
- Lobdell Associates Inc. February 2000. *Planning Study For Weirs, Paugus Bay, Opechee Bay, and Winnepesaukee River Watersheds* for City of Laconia Planning and Community Development Department.
- Mulligan, Adair D., 1995. *The Gunstock Parish – A History of Gilford, NH*, Published for the Thompson-Ames Historical Society, Gilford, NH. By Phoenix Publishing, West Kennebunk, Maine.
- New Hampshire Department of Environmental Services. 2009. Information retrieved from the worldwide web on August 2009. (<http://des.nh.gov/organization/divisions/water/wetlands/cspa/index.htm>)
- State of New Hampshire. 2007. *Economic & Labor Information Bureau, NH Employment Security*. Updated 06/23/06.
- University of New Hampshire. 2005. *Natural Resource Inventory for the City of Laconia*. NR775, Department of Natural Resources, UNH. Consulting team: Kendra Gurney, Erin Milling, Julie Barber, and Kristen Lamb.

MAPS

Map #1: Wetlands, Hydric Soils, Aquifers, and Parcel Overlay

Map Data Sources:

- City Boundary, Roads, Aquifers, Railroads, Open Water, Streams, obtained from GRANIT
- Vernal Pool locations taken using a handheld GPS unit (Garmin GPSmap 76CSx) during field work by Watershed to Wildlife, Inc.
- National Wetlands Inventory wetlands obtained from U.S. Fish and Wildlife Service and GRANIT
- Additional Wetlands were field verified by Watershed to Wildlife, Inc. and/or digitized using 2003 DOQs (obtained from GRANIT)
- Poorly and Very Poorly Drained Soils obtained from the Natural Resource Conservation Service
- City Parcels obtained July 2008 from Cartographic Associates, Inc.

Map #2: Dense Softwoods, Permanent wildlife openings, Conservation Land, and Parcel Overlay

Map Data Sources:

- City Boundary, Roads, Railroads, Aquifers, Open Water, and Streams obtained from GRANIT
- Dense Softwood Stands and Permanent wildlife openings digitized by Watershed to Wildlife, Inc. 2008 using the 1998 and 2003 aerial photographs
- Conservation Lands obtained from GRANIT and the City of Laconia
- City Parcels obtained July 2008 from Cartographic Associates, Inc.

Map #3: Steep Slopes and Farmland Soil

Map Data Sources:

- City Boundary, Roads, Railroads, Open Water, Streams obtained from GRANIT
- Soil data obtained from Natural Resource Conservation Service and queried to display farmland soils and soils with steep slopes

Map #4: Unfragmented Roadless Areas

Map Data Sources:

- City Boundary, Roads, Railroads, Open Water, Streams obtained from GRANIT
- Unfragmented Roadless Areas were determined by Watershed to Wildlife, Inc. via a multi-step analysis in ArcMap-ArcView.
 1. A 250-foot buffer was drawn around Class I to V roads in Laconia
 2. Unfragmented areas were verified using 2003 DOQs (obtained from GRANIT)
 3. The blocks of land were digitized and queried so only those over 20 acres were displayed

Map #5: Subwatersheds, Wetlands, Hydric Soils, and Aquifers

Map Data Sources:

- City Boundary, Roads, Railroads, Open Water, Streams obtained from GRANIT
- Subwatershed Units (NH DES HUC 12 Names) obtained from GRANIT

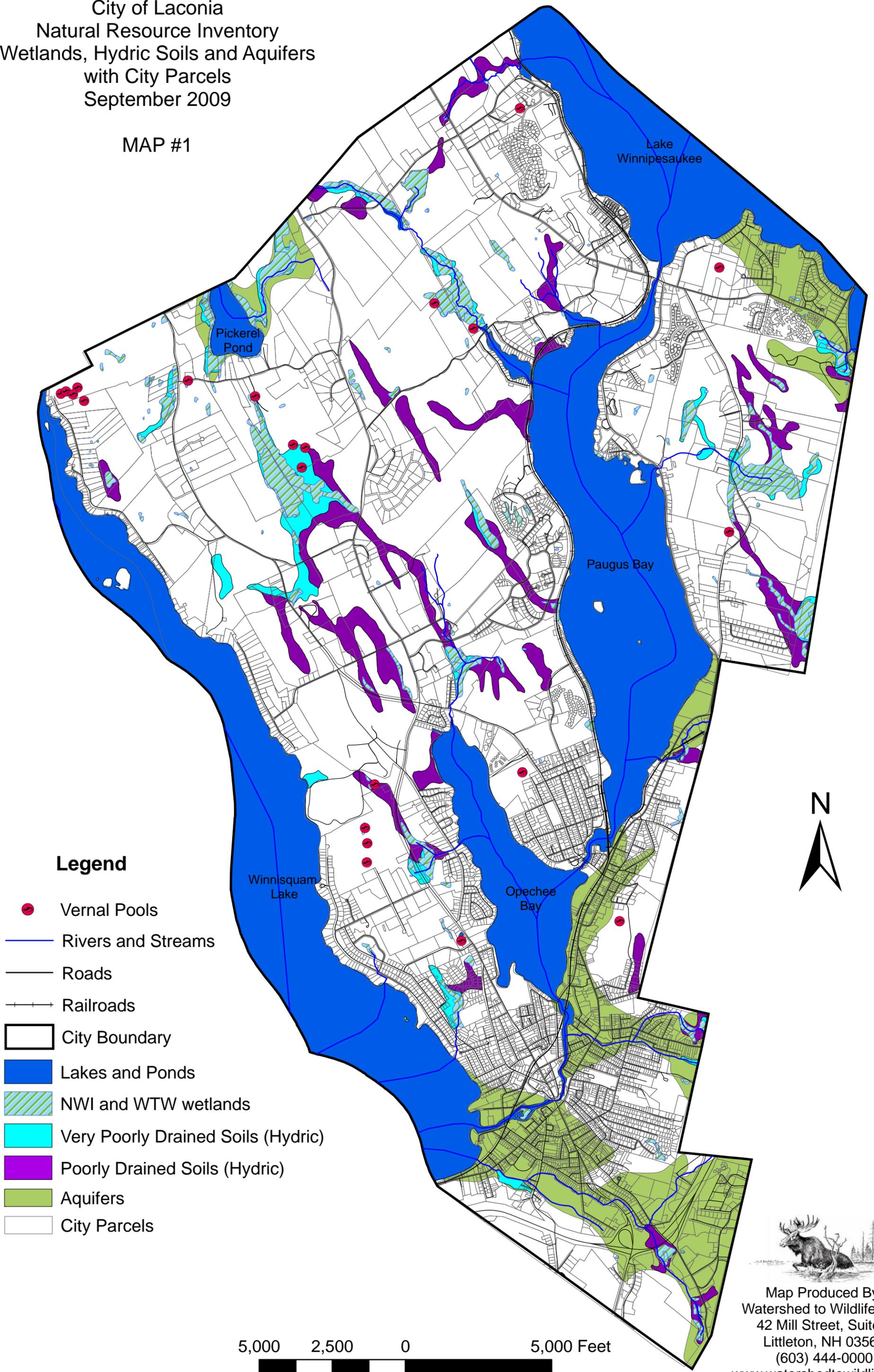
Map #6: Bedrock Geology

Map Data Sources:

- City Boundary, Roads, Open Water, Streams obtained from GRANIT
- Bedrock Geology data obtained from United States Geologic Survey and New Hampshire Department of Environmental Services
- National Wetlands Inventory wetlands obtained from U.S. Fish and Wildlife Service and GRANIT
- Additional Wetlands were field verified by Watershed to Wildlife, Inc. and/or digitized using 2003 DOQs (obtained from GRANIT)
- Poorly and Very Poorly Drained Soils obtained from the Natural Resource Conservation Service

City of Laconia
 Natural Resource Inventory
 Wetlands, Hydric Soils and Aquifers
 with City Parcels
 September 2009

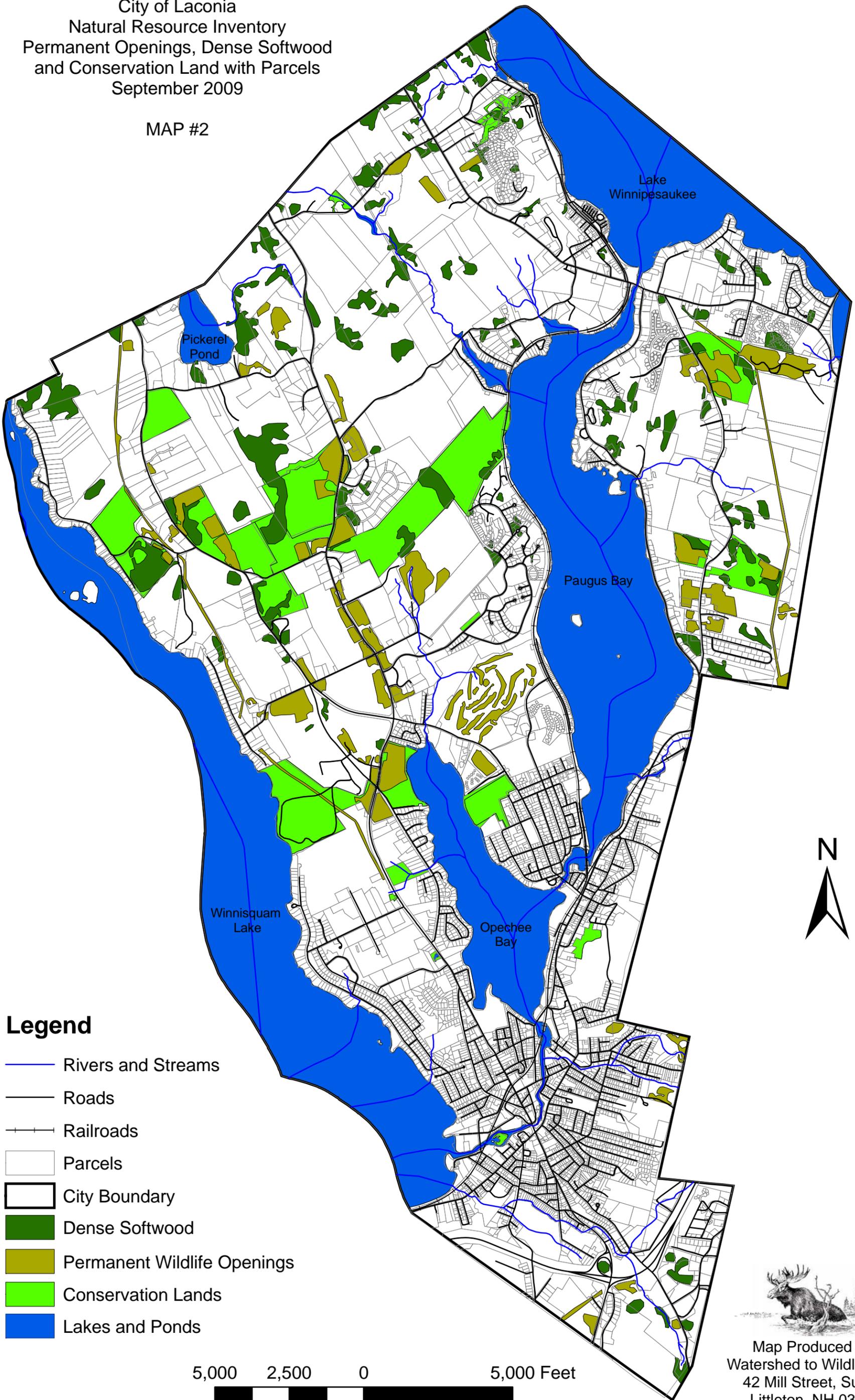
MAP #1



Map Produced By:
 Watershed to Wildlife, Inc.
 42 Mill Street, Suite 3
 Littleton, NH 03561
 (603) 444-0000
www.watershedtowildlife.com

City of Laconia
 Natural Resource Inventory
 Permanent Openings, Dense Softwood
 and Conservation Land with Parcels
 September 2009

MAP #2



Legend

-  Rivers and Streams
-  Roads
-  Railroads
-  Parcels
-  City Boundary
-  Dense Softwood
-  Permanent Wildlife Openings
-  Conservation Lands
-  Lakes and Ponds

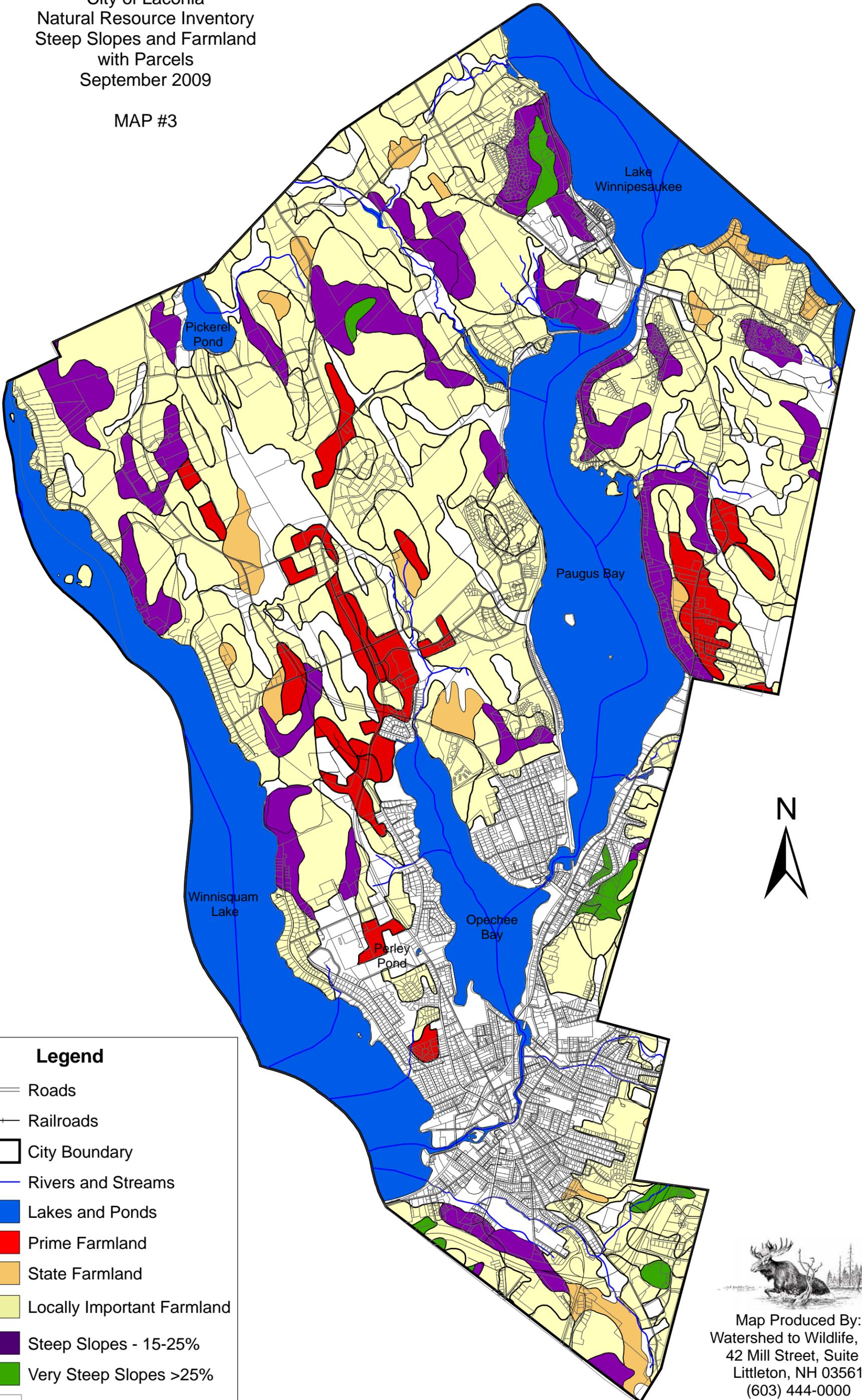
5,000 2,500 0 5,000 Feet




Map Produced By:
 Watershed to Wildlife, Inc.
 42 Mill Street, Suite 3
 Littleton, NH 03561
 (603) 444-0000
www.watershedtowildlife.com

City of Laconia
 Natural Resource Inventory
 Steep Slopes and Farmland
 with Parcels
 September 2009

MAP #3



Legend

-  Roads
-  Railroads
-  City Boundary
-  Rivers and Streams
-  Lakes and Ponds
-  Prime Farmland
-  State Farmland
-  Locally Important Farmland
-  Steep Slopes - 15-25%
-  Very Steep Slopes >25%
-  City Parcels

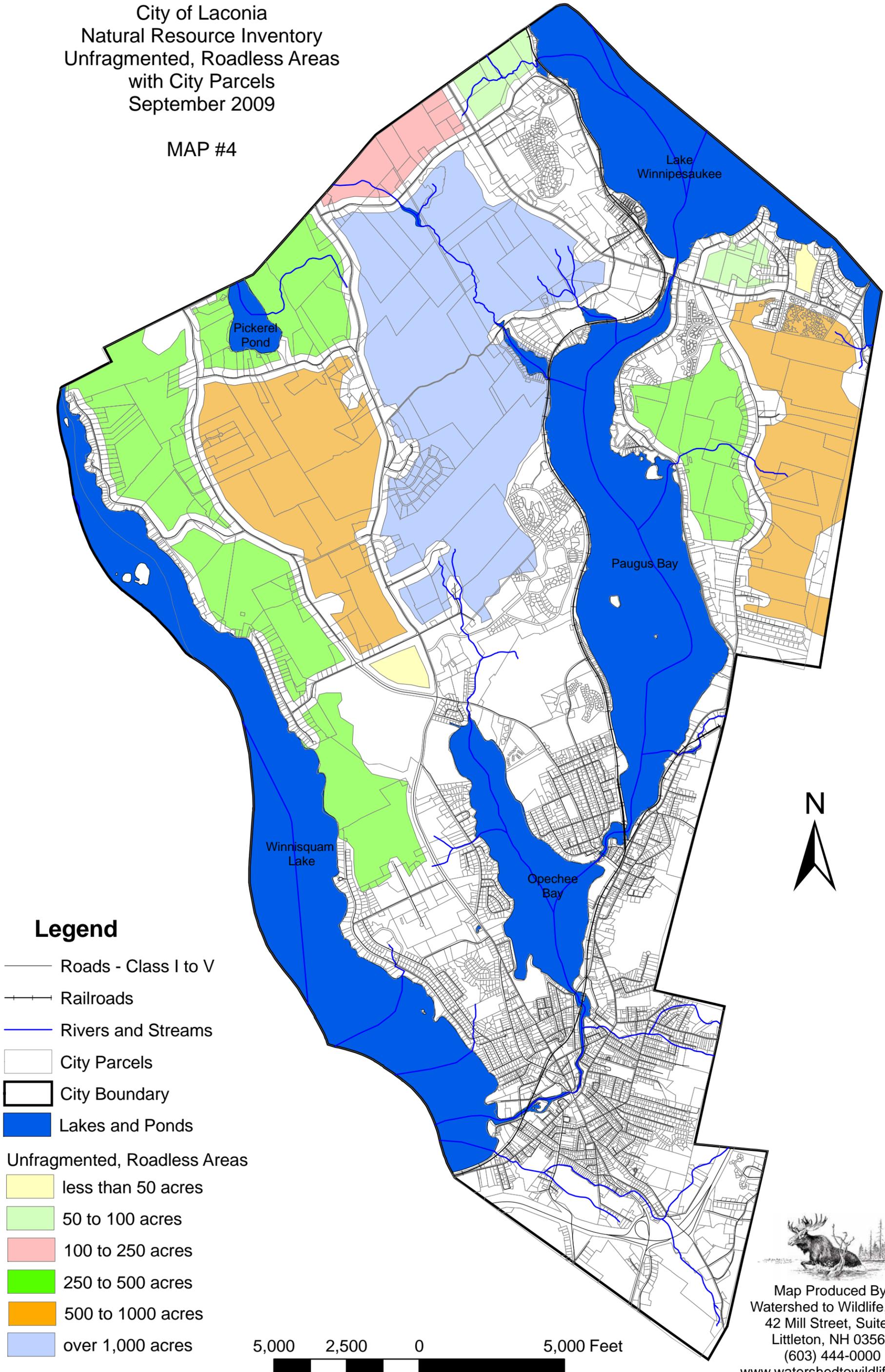
5,000 2,500 0 5,000 Feet



Map Produced By:
 Watershed to Wildlife, Inc.
 42 Mill Street, Suite 3
 Littleton, NH 03561
 (603) 444-0000
www.watershedtowildlife.com

City of Laconia
 Natural Resource Inventory
 Unfragmented, Roadless Areas
 with City Parcels
 September 2009

MAP #4



Legend

- Roads - Class I to V
- Railroads
- Rivers and Streams
- City Parcels
- City Boundary
- Lakes and Ponds

Unfragmented, Roadless Areas

- less than 50 acres
- 50 to 100 acres
- 100 to 250 acres
- 250 to 500 acres
- 500 to 1000 acres
- over 1,000 acres

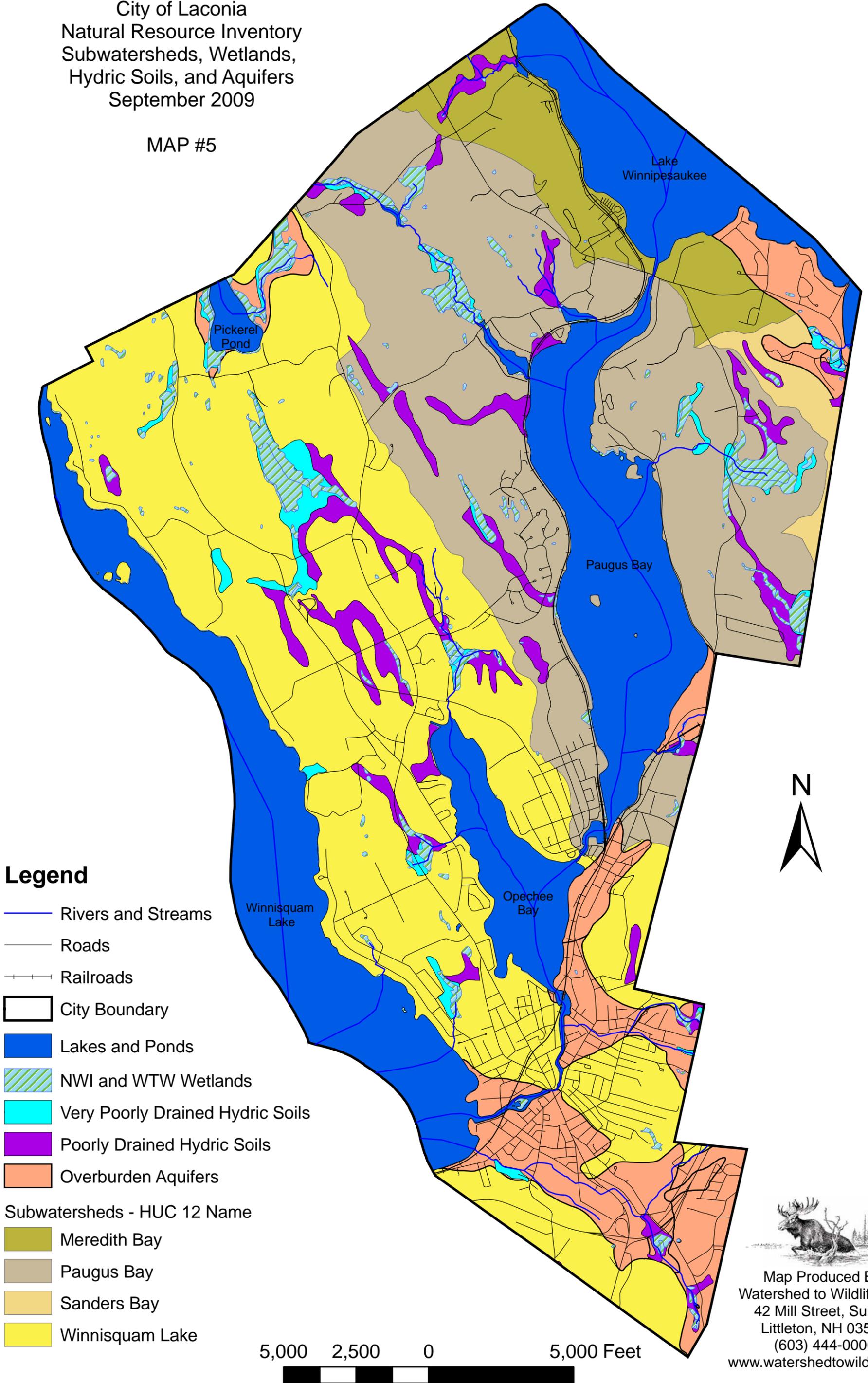
5,000 2,500 0 5,000 Feet



Map Produced By:
 Watershed to Wildlife, Inc.
 42 Mill Street, Suite 3
 Littleton, NH 03561
 (603) 444-0000
www.watershedtowildlife.com

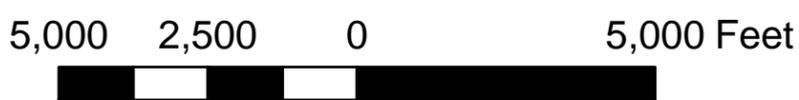
City of Laconia
 Natural Resource Inventory
 Subwatersheds, Wetlands,
 Hydric Soils, and Aquifers
 September 2009

MAP #5



Legend

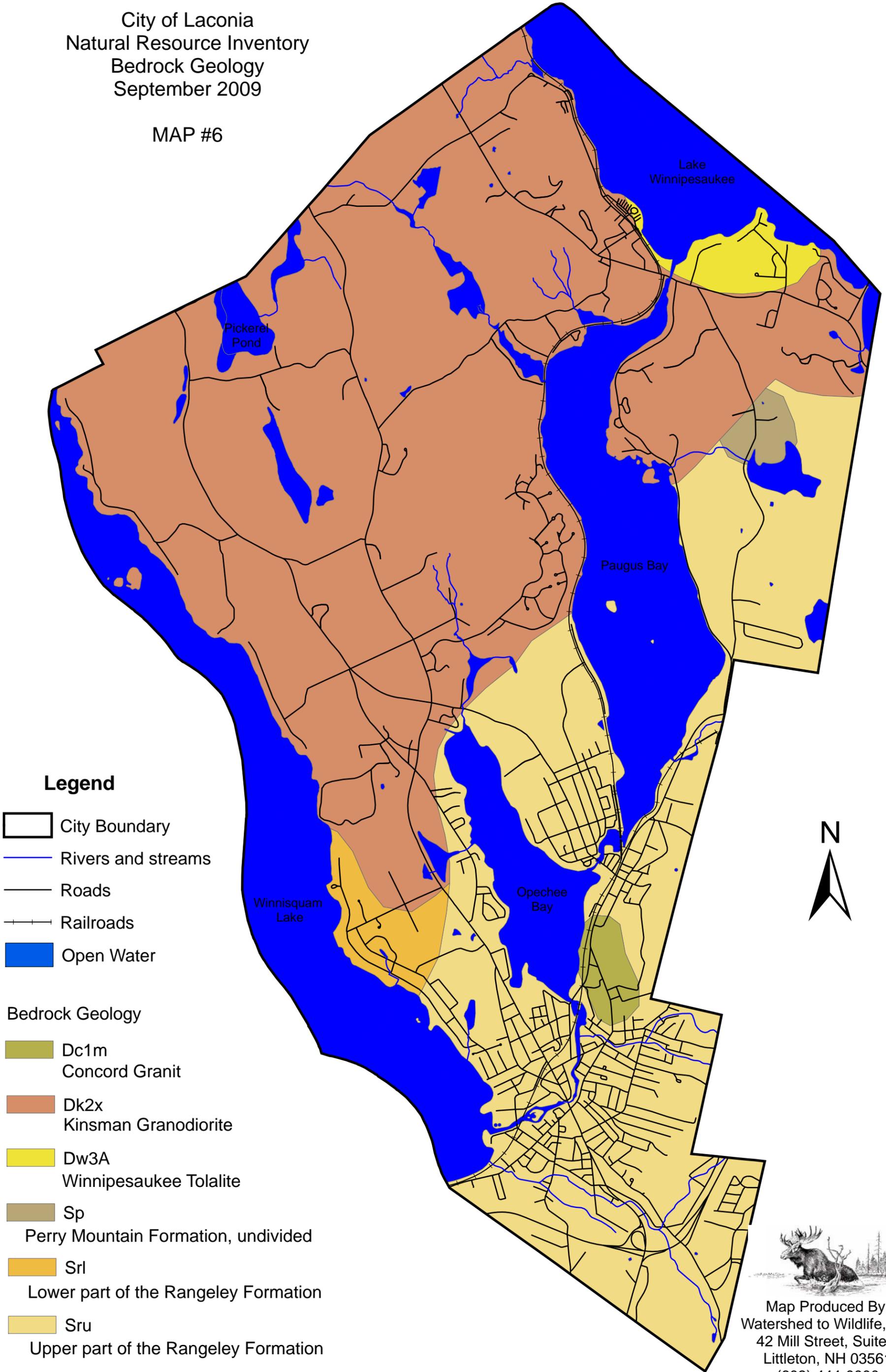
-  Rivers and Streams
 -  Roads
 -  Railroads
 -  City Boundary
 -  Lakes and Ponds
 -  NWI and WTW Wetlands
 -  Very Poorly Drained Hydric Soils
 -  Poorly Drained Hydric Soils
 -  Overburden Aquifers
- Subwatersheds - HUC 12 Name
-  Meredith Bay
 -  Paugus Bay
 -  Sanders Bay
 -  Winnisquam Lake



Map Produced By:
 Watershed to Wildlife, Inc.
 42 Mill Street, Suite 3
 Littleton, NH 03561
 (603) 444-0000
www.watershedtowildlife.com

City of Laconia
 Natural Resource Inventory
 Bedrock Geology
 September 2009

MAP #6



Legend

-  City Boundary
-  Rivers and streams
-  Roads
-  Railroads
-  Open Water

Bedrock Geology

-  Dc1m
Concord Granit
-  Dk2x
Kinsman Granodiorite
-  Dw3A
Winnepesaukee Tonalite
-  Sp
Perry Mountain Formation, undivided
-  Srl
Lower part of the Rangeley Formation
-  Sru
Upper part of the Rangeley Formation

5,000 2,500 0 5,000 Feet



Map Produced By:
 Watershed to Wildlife, Inc.
 42 Mill Street, Suite 3
 Littleton, NH 03561
 (603) 444-0000
www.watershedtowildlife.com