

# NATURAL RESOURCES

## For the Town of Hillsborough

---

This Chapter addresses Hillsborough’s physical features, including land, water and wildlife. These resources help to shape how residents view Hillsborough and where development and recreational activities take place. Hillsborough covers approximately 45 square miles, or 28,607 acres of mostly forested and hilly terrain, ranging in elevation from approximately 600 feet above sea level along the Contoocook River to 1,768 feet above sea level atop Thompson Hill. The landscape is further characterized by the rolling hills of Jones Hill, Murdough Hill, Stowe Hill, and Campbell Mountain. Major water bodies include Franklin Pierce Lake, Contention Pond, Loon Pond, Bagley Pond, Gould Pond (aka Emerald Lake), Contoocook River, North Branch River, Shedd Brook, Beard Brook, and Sand Brook. Extensive wetland systems grace many sections along rivers and streams, including the Town’s largest and notably most significant, Farrar Marsh. These varying landforms offer great diversity for wildlife and plant communities alike.

The Hillsborough Conservation Commission completed a Natural Resources Inventory (NRI) in March 2014. The NRI provides a foundation for much of this Chapter. Along with the community outreach results, identifying important ecological areas through the

NRI process provides documentation and support for the key recommendations developed in this Chapter.

Natural areas are highly valued by Hillsborough residents. Community feedback through the Community Survey and public visioning sessions support the preservation of natural resources. The majority of participants highly valued Hillsborough’s water resources, including lakes, ponds, streams, and rivers, and felt that these resources contribute significantly to the Town’s rural character. The survey results also demonstrated residents’ high appreciation of forested lands, including the conservation of Fox State Forest.

## OBJECTIVES OF THE CHAPTER

### OBJECTIVE 1:

Present information gathered from the survey and visioning session regarding the community's interest in conservation including the local environment, land preservation and water protection.

### OBJECTIVE 2:

Provide a review of the Town's initiatives and process on land and water conservation activities.

### OBJECTIVE 3:

Develop a guide for the Town's conservation actions over the next ten years.

- A) Educating citizens about the Town's natural resources and the importance they play to the Town's quality of life.
- B) Identify opportunities to enhance access to the Town's lands and water bodies.
- C) Use the identification of Ecologically Significant Areas to assist in the identification of priority areas for future acquisition and/or protection through regulatory and non-regulatory techniques.
- D) Identify opportunities to coordinate efforts with adjoining communities as well as within our own to protect watersheds and connect wildlife corridors.

## INCORPORATING THE NATURAL RESOURCE INVENTORY INTO A MASTER PLAN CHAPTER

In 2005, the NH Fish and Game Department, in cooperation with other agencies, organizations, and individuals, produced the NH Wildlife Action Plan (WAP) that was most recently revised in 2015. This plan identifies statewide habitats and species in greatest need of conservation, identifies threats to their continued existence, and offers strategies to address these threats statewide.

Using data from numerous sources, including the WAP, the Hillsborough Conservation Commission completed a Natural Resources Inventory (NRI) in March of 2014. An NRI is a list and description of the natural elements found within and adjacent to a town (or even a watershed or larger region). These data can include such elements as wetlands, aquifers, ponds, rivers, forests, plants, soils, and wildlife. These data can be created from existing sources or from field-based assessments to better reflect the extent of natural resources within a community.

The completed NRI provides much of the foundation for this Chapter. Along with the community survey and visioning session results, identifying important ecological areas through the NRI process provided documentation and support for the key recommendations developed at the end of this Chapter.

## COMMUNITY SURVEY RESULTS

The Community Survey yielded favorable results supporting the preservation of natural resources. Responses show that Hillsborough's water resources, including lakes, ponds, streams, and rivers, are one of the most highly valued resources within the community.

### WHAT WE HEARD...

*"Would like to see a community garden on unused town owned land"*

*"Natural Resources should all be protected, once it's gone, you can't get it back."*

*"I would not spend money to improve at this point, just maintain."*

*"Our history and small town rural NH picturesqueness is our draw."*

*"We need places for children and families to have fun."*

*"Our natural resources and natural beauty are our most valuable assets."*

*"If we don't have clean water, we have nothing."*

**Community Survey Question 19:**

What resources in Town do you think should be protected?

(Please check all that apply).

Q. 19	Total	Percent
Lakes/Ponds	280	93.3%
Streams/Rivers	257	85.7%
Forest	252	84.0%
Aquifers	242	80.7%
Natural Habitat	235	78.3%
Fish/Wildlife Management	228	76.0%
Wetlands	215	71.7%
Recreation	211	70.3%
Fields/Agriculture	203	67.7%

**Community Question 21:**

Do you use the Contoocook River for any of the following activities?

Q. 21	Total	Percent
Wildlife Watching	103	57.9%
Hiking	92	51.7%
Fishing	83	46.3%
Boating	69	38.8%
Swimming	39	21.9%
Other	17	9.6%

**Community Survey Question 22:**

Do you feel the Contoocook River is important to the character of Hillsborough?

Q. 22	Total	Percent
Yes	265	85.5%
No	13	4.2%
No Opinion	32	10.3%
Total	310	100.0%

**Community Survey Question 23:**

Do you feel the Town should invest in the development and improvement of access points to the Contoocook River?

Q. 23	Total	Percent
Yes	186	60.8%
No	47	15.4%
No Opinion	73	23.9%
Total	306	100.0%

**Community Survey Question 24:**

A greenway is a linear open space established along a natural corridor, usually designated to accommodate both wildlife and low-impact human recreational uses. A greenway can serve as a linkage between existing natural and historic sites. Should Hillsborough create a greenway along the Contoocook River?

Q. 24	Total	Percent
Yes	215	70.7%
No	39	12.8%
No Opinion	50	16.5%
Total	304	100.0%

**Community Question 25:**

How often do you use the following conservation, historical, or cultural areas?

Selected areas: *Fox State Forest, Historic Hillsborough Center, Gleason Falls, and Gould Pond (Emerald Lake).*

Q. 25	Often/Occasionally
Fox State Forest	74.0%
Historic Hillsborough Center	64.8%
Gleason Falls	60.5%
Gould Pond (Emerald Lake)	48.4%

**Community Survey Question 35:**

Should the Town invest in improving the following areas?

Selected areas: *Grimes Field, Manahan Park, Butler Park, and Kemp Park.*

Q. 35	Yes
Grimes Field	51.1%
Manahan Park	37.2%
Butler Park	26.1%
Kemp Park	20.5%

**Community Survey Question 36:**

Please indicate what recreational facilities you would like to see the Town develop:

Selected facilities: *Recreational trails, Canoe/Boat path, and Bike paths.*

Q.36	Yes
Recreational trails (all types)	53.1%
Canoe/Boat Path	48.3%
Bike Paths	53.1%

**Community Survey Question 43a:**

Please note how well you think the Town is performing with the following Town services.

Selected services: *Natural Resource Conservation.*

Q.43a	Natural Resource Conservation	
Good	85	37.0%
Fair	46	20.0%
Poor	9	3.9%
No Opinion	90	39.1%
Total	230	100.0%

**Community Survey Question 43a:**

How much money should the Town invest on each service?

Selected services: *Natural Resource Conservation*

Q. 43a	Natural Resource Conservation	
More	38	24.7%
Same	56	36.4%
Less	13	8.4%
No Opinion	47	30.5%
Total	154	100.0%

**HILLSBOROUGH VISIONING SESSION**

Residents who attended the Hillsborough visioning session highly value the Town's natural resources and conveyed the need for the resources to be protected. Attendees also felt that there was a lack of awareness and information on access points, which limited them from being able to use the Town's resources as much as they wished.

Attendees also demonstrated their support of multi-use trails within the community, as they would provide recreation opportunities for residents but also provide an opportunity for tourists to visit Hillsborough. The most common concern was the challenge of acquiring the funding needed for the creation of new trails and for maintenance and upkeep.

## COMMON THEMES

There are some common themes that emerged from the community's comments on natural resources and include:

- *Importance of natural resources to the overall quality of life that is enjoyed by residents.*
- *Support for maintenance of healthy watersheds with high quality ground and surface water resources.*
- *Continue to promote the protection and enhancement of the Town's natural systems.*
- *Recognition of the link between healthy ecosystems and Hillsborough's quality of life, rural character and the economy.*

### *NATURAL RESOURCES VISION STATEMENT*

---

*"Hillsborough supports environmental stewardship of our natural resources providing residents with a healthy natural environment that enhances a high quality of life."*

## WATER RESOURCES

Hillsborough contains a variety of surface water bodies, including rivers, streams, ponds, and lakes that are distributed throughout the Town. Not only do waterbodies provide a multitude of human benefits such as fishing, hunting, boating, swimming, and nature watching, but wildlife and plants also depend upon these resources for part or all of their life cycle needs. Water resources represent some of our most fragile ecosystems and are particularly sensitive to certain types of land use. Generally, major threats to water resources include potential water quality degradation and habitat loss due to unsustainable forestry and agricultural practices and land conversion associated with various types of developments.

Water resources comprise a variety of natural features, which include both surface water and groundwater resources. In terms of their importance, these resources provide a variety of ecological functions and societal values, including:

- Water quality maintenance
- Flood control
- Wildlife and fisheries habitat
- Drinking water sources
- Recreation
- Visual quality and aesthetics
- Rare and endangered species habitat and natural communities
- Groundwater recharge and discharge
- Shoreline stabilization
- Educational and scientific value
- Overall biological diversity of Hillsborough

**Table 8.1: Summary of Lakes and Ponds in Hillsborough**

Lakes and Ponds	Size (Acres)
Franklin Pierce Lake	*520
Loon Pond	155.1
Contention Pond	93.7
Gould Pond (Emerald Lake)	59.4
Bagley Pond	**32.5
Sand Brook Marsh (Farrar Marsh)	98.5
Possa Nissen Pond (Girls Camp Pond)	20
Other Lakes and Ponds	42.7

*Source: USGS topography, GRANIT hydrography datasets, NH DES RSA 483-B and Moosewood Ecological LLC.*

\* = 303.1 acres are located within Hillsborough

\*\* = 4.7 acres are located within Hillsborough

### **SURFACE WATER BODIES**

Lakes and ponds in Hillsborough cover approximately 777 acres, ranging in size from 0.1 acre to 303.1 acres (Table 8.1). Seven lakes and ponds are included on the NH Department of Environmental Services (NH DES) Consolidated List of Water Bodies subject to the Shoreland Water Quality Protection Act under RSA 483-B. An additional 75 ponds, totaling 42.7 acres, have also been identified, ranging in size from 0.1 acres to 8.1 acres. These lakes and ponds can be seen on **Map 8.1: Water Resources**.

Approximately 97.6 miles of rivers and streams have been mapped in Hillsborough (Table 8.2). Of the many rivers and streams, five are included on the NH DES Consolidated List of Water Bodies subject to the Shoreland Water Quality Protection Act under RSA 483-B.

## EMERALD LAKE (GOULD POND)

Emerald Lake, originally known as Campbell Pond and then later as Gould Pond, is located in eastern Hillsborough and is approximately 59 acres in size. During the 1960s, developers established a subdivision around the Lake, originally intended for seasonal vacation homes but have more commonly been developed into primary homes for residents. In 1979, this community surrounding the Lake was established as a formal governmental entity called the Emerald Lake Village District.

The Lake provides many recreational opportunities including swimming, boating, fishing, and other activities. The Lake contains several public beaches, including Hummingbird Beach, Emerald Beach, Eastman Park Beach, and a fourth along Gould Pond Road. Much of the Lake is surrounded by wetlands, as well as an aquifer, brook, and floodplains located to the western side of the Lake. Given the small lot sizes and the vast natural features present surrounding the lake, development patterns represent some of the Lake's biggest threats.

In 2014, the Emerald Lake Village District (ELVD) Source Water Protection Committee and Granite State Rural Water Association jointly prepared a source water protection plan for the District's community water system. The Plan outlines a multistage process to protect water quality and manage identified risks to source water in the District. Recommendations include acquisition of lands or easements on parcels within the Sand Brook Watershed, development of a groundwater protection ordinance, and public education on best management practices for septic system maintenance and other sources of potential contamination in the watershed.

Sources: Emerald Lake Village Plan 2010, <http://elvdnh.com/index.html>, [http://www.wildlife.state.nh.us/maps/bathymetry/gould\\_hillsborough.pdf](http://www.wildlife.state.nh.us/maps/bathymetry/gould_hillsborough.pdf)

**Table 8.2: Summary of Rivers and Streams in Hillsborough**

Rivers and Streams	Length (miles)
Contoocook River	10.9
North Branch River	2.9
Beard Brook	9.4
Shedd Brook	6.3
Black Pond Brook	2.3
Sand Brook	6.7
Nelson Brook	1.7
Other rivers and streams	57.4

Source: USGS topography, GRANIT hydrography datasets, NH DES RSA 483-B and Moosewood Ecological LLC.

Of the rivers and streams listed in Table 8.2, all except Sand Brook and Nelson Brook are jurisdictional designations by NH DES and subject to the Shoreland Water Quality Protection Act under RSA 483-B.

### WETLANDS

Wetlands include familiar places such as marshes, wet meadows, beaver impoundments, swamps, fens, bogs, and other surface water bodies. They perform a variety of ecological functions and values, such as providing significant habitats for wildlife and plants, maintaining good water quality, providing storage during flood events, and provide sources for recreation.

Hillsborough has roughly 1,586 acres of wetlands dispersed throughout the Town, with the largest and most extensive wetlands found along the various streams and rivers. However, the landscape provides pockets of isolated wetlands as well. Wetlands can be seen on **Map 8.1: Water Resources**. At this time the Town does not have a wetlands ordinance in place. There is one designated prime wetland located in the northwest corner of Hillsborough.



## WATERSHEDS

All of the water resources previously mentioned reside within a watershed. A watershed is the area that drains to a common water resource, such as a wetland, stream, or lake. As a watershed includes various water resources and typically covers a larger area of land, land use within a particular watershed can have a direct effect on the quality and quantity of surface waters and any underlying aquifers. Land use planning techniques that prioritize watershed protection can greatly benefit the town's water resources. These techniques are important as clean water is essential to sustaining life.

Hillsborough is divided into 6 major watersheds as shown in Table 8.3 and on **Map 8.1: Water Resources**.

### GROUNDWATER RESOURCES - STRATIFIED DRIFT AQUIFERS

Groundwater resources are stored in two main types of aquifers and can serve as sources for drinking water. Aquifers can be located within saturated areas of sand and gravel deposits or in fractured bedrock. As glaciers melted thousands of years ago, they left behind layers of coarse sediments including sand and gravel. The space between these sediments are often infiltrated with water, either as groundwater storage or flow. Groundwater stored in *stratified drift aquifers* can serve as an excellent source for drinking water. Locating and protecting these geologic features can help to ensure a supply of clean drinking water for the community as many of Hillsborough's natural resources are vulnerable to contamination.

Hillsborough contains approximately 3,721 acres of stratified drift aquifers as shown in Table 8.4 and on the **Map 8.1: Water Resources**. The largest and most significant aquifers are located along the Contoocook River, Shedd Brook, and Beard Brook. Smaller aquifers are associated with Gould Pond, Contention Pond, and the

**Table 8.3: Summary of Major Watersheds in Hillsborough**

Watershed	Area in Hillsborough (Acres)	Total Area (Acres)
Sand Brook	9,715.9	15,731.5
Beard Brook	11,222.7	21,911.0
Shedd Brook	4,401.0	14,026.4
Franklin Pierce Lake	3,063.1	22,959.1
Great Brook	50.3	23,721.7
Hopkinton Lake	153.7	16,703.4

Source: USGS HUC 12 watersheds from GRANIT

**Table 8.4: Summary of Aquifers and Favorable Gravel Well Analysis in Hillsborough**

Groundwater Attribute	Size (Acres)
<i>Stratified Drift Aquifer Transmissivity Rates</i>	
< 2,000 ft <sup>2</sup> /Day	3,490.2
2,000-4,000 ft <sup>2</sup> /Day	135.4
> 4,000 ft <sup>2</sup> /Day	95.0
<i>Favorable Gravel Well Analysis</i>	
> 75 Gallons/Minute	154.7

Source: USGS stratified drift aquifers (GRANIT 2000) and NH DES favorable gravel well analysis (2011).

wetland complex north of Route 31 along the western Town boundary.

Aquifers are divided into categories based on *transmissivity*, or the rate at which water moves through an aquifer and is measured in square feet per day (ft<sup>2</sup>/day). Therefore, higher rates of transmissivity correspond to a potentially higher yield of groundwater. Most of the aquifers in Hillsborough have a transmissivity rate of 1,000ft<sup>2</sup>/day or less, which corresponds to a potential yield of less than 75 gallons per minute. However, a few smaller areas are predicted to have a much higher yield.

## WATER QUALITY

The greatest threat to surface water quality is often nonpoint source pollution from a wide variety of sources – residential, commercial, agricultural and transportation. Development can disrupt natural hydrological systems through land clearing, grading and the building of structures and infrastructure, creating impervious surfaces. Since nonpoint source pollution, by its very name, means that there is not one single source, it is important to follow best management practices as well as stormwater management to reduce impacts.

Best management practices focus on retaining or re-introducing natural drainage systems to treat potential pollutants and on low-impact design and materials, while stormwater management looks for ways to reduce both the volume and velocity of runoff, erosion and potential downstream flooding.

## ECOLOGICAL RESOURCES

### SIGNIFICANT WILDLIFE HABITATS

To support a robust array of plants and wildlife a Town must possess high quality, healthy habitats for various species to coexist.

It is important to maintain large tracts of these habitats to support a wide diversity of wildlife, including large-roaming animals (such as bear and bobcat) as well as area-sensitive species (such as ovenbird and wood thrush). Protection of significant wildlife habitats also supports resident's quality of life by providing recreational resources for hiking, fishing, hunting, boating, and sightseeing.

The NH Fish and Game Department, in cooperation with other agencies, organizations, and individuals, produced the NH Wildlife Action Plan (WAP) in 2005 and revised it in 2015. This document was designed as a planning and educational tool for federal, state,

## LOON POND ORDINANCE

The Loon Pond Ordinance was adopted by the Town of Hillsborough in 1981 to protect the watershed of Loon Pond. As defined in the ordinance, a 200-foot buffer from the mean high-water mark surrounds the Pond, prohibiting new development along the immediate shoreline. The ordinance also prohibits clear-cutting, vegetation removal, and land disturbance within a 50-foot buffer of the mean-high water mark, with the exception of areas cleared before 2008. Although the purpose of the ordinance is to protect Loon Pond and its watershed, the ordinance is currently over thirty years old and may not fully address more recent threats.

*Source: Loon Pond Hillsborough, New Hampshire Source water Protection Plan, January 2015*

and municipal governing bodies, conservation commissions, land trusts and other conservation organizations, and private landowners, as well as the general public, to promote the conservation and management of NH's biological diversity. The WAP, in conjunction with the NRI, provides a resource for developing informed land use decisions and land management planning which, if enacted, ensures an adequate representation of various wildlife habitats. A total of fourteen wildlife habitats as recognized by the WAP were mapped for Hillsborough on **Map 8.2: Significant Wildlife Habitats**. They can also be seen listed in Table 8.5.

Another essential habitat is vernal pools, which are wetlands with a seasonal cycle of flooding and drying. Vernal pools provide key

breeding habitat for amphibians such as wood frogs, spotted, blue-spotted, and Jefferson’s salamanders whose tadpoles and larvae are especially vulnerable to fish predation. At least 116 vernal pools exist throughout Hillsborough and care should be taken to preserve this resource and the surrounding land.

#### UNFRAGMENTED LANDS

Unfragmented lands (see **Map 8.3: Unfragmented Lands**) are defined as large pieces of land that are not divided by human infrastructure, such as roads and developed areas. Fragmentation of land can negatively affect species’ survival rates by increasing mortality and lowering breeding success, it can even cause the loss of the species. The severity of fragmentation depends upon many aspects, such as the size and shape of unfragmented blocks, the species or community in question, the extent of loss of natural habitats, intensity of human use, the functional proximity of other fragmented lands, and the colonization of invasive species.

As forested blocks become smaller due to the construction of roadways and developments, their ability to support biodiversity will generally be reduced. This fragmentation effect has less immediate impact on generalist species or those with small home ranges, such as gray squirrels, raccoon, many amphibians, and small rodents. However, a much larger impact can occur on large game that regularly travel between habitats, such as bear, bobcat, moose, some reptiles, wood thrush, and goshawk, potentially eliminating these species from the area. This movement can be based on traveling to various areas for feeding, breeding, nesting or shelter and often include various features, such as riparian zones of wetlands, ponds and streams, ridgelines, utility right-of ways, and forested patches. Land use that continues to fragment Hillsborough’s landscape, especially those on the outskirts of town,

**Table 8.5: Summary of Wildlife Habitats in Hillsborough**

Wildlife Habitat Type	Percent of Town	Size/Count
Appalachian Oak-Pine	13.9%	3,997.0 Acres
Cliff and Talus	0.0%	16.5 Acres
Developed Land	7.6%	2,176.6 Acres
Floodplain Forest	0.6%	176.8 Acres
Grasslands	0.5%	157.4 Acres
Floodplain Forests	4.8%	1,387.3 Acres
Hemlock-Hardwood-Pine	63.1%	18,045.7 Acres
Northern Hardwood-Conifer	0.4%	122.4 Acres
Northern Swamp	0.2%	73.0 Acres
Open Water	2.4%	691.2 Acres
Peatland	0.5%	158.8 Acres
Rocky Ridge	0.7%	191.0 Acres
Temperate Swamp	1.3%	385.8 Acres
Wet Meadow/Shrub Wetland	3.6%	1,026.3 Acres

Source: NH Wildlife Action Plan data (2015)

decreases quality, connectivity and long-term viability of wildlife habitats and natural communities. Concentrating developments within the built environment and maintaining large unfragmented blocks can help to maintain connectivity, allowing species to continue to travel from habitat to habitat to meet their life cycle needs. Likewise, the use of appropriate culverts at stream crossings can help to maintain connectivity for aquatic-related species, such as otter, mink, turtles, and fish.

The urban areas of Hillsborough and NH Routes 9/202 act as major barriers for wildlife movement, inhibiting connectivity for many species moving north to south. Route 31 also appears to act as a fragmenting feature that can disrupt wildlife movement. However, the more rural areas of these roads do experience habitat connectivity although they also contribute to road mortality. Critical areas of connectivity include along and south of the Contoocook

River in the southeast part of Hillsborough, which connects the southern part of the Town to the east side of the River, and the area where Beard Brook and the North Branch River meet, which provides north-south connectivity.

#### RARE SPECIES AND EXEMPLARY NATURAL COMMUNITIES

The NH Natural Heritage Bureau, a bureau within the Department of Resource and Economic Development, is responsible for locating, tracking, and facilitating the protection of rare and imperiled plants and exemplary natural communities. In Hillsborough, the Bureau has identified 4 species of wildlife, 2 species of plants, and 5 types of exemplary natural communities (Table 8.6). Additional species of conservation concern include bobcat, osprey, and red-shouldered hawk.

#### AGRICULTURAL RESOURCES

While much of the Town's former farm land has reverted to forest, a significant number of fields north of Town running to the East Washington town line are maintained as hayfields by Eccardt's Farm (a dairy farm in East Washington). A few small livestock farms exist in town including those raising horses, cattle, sheep, llamas, and alpacas.

Small scale farming is promoted by the Town through its Farmers Market held at Butler Park during the summer months and by the privately run "Farmsteads of New England" with its farm stand located on Center Road.

Both the Elementary and Middle schools maintain gardens as part of their education services. In the Community Survey, at the Community Visioning Session, and independently, interest has been expressed about establishing a community garden.

**Table 8.6: Rare Species and Exemplary Natural Communities in Hillsborough**

Rare Elemental Occurrence Rarity Rank	
<i>Exemplary Natural Communities</i>	
Black gum swamp**	
Medium level fen system**	
Poor level fen/bog**	
Circumneutral riverbank outcrop**	
Silver maple-false nettle-sensitive fern floodplain forest**	
<i>Plants</i>	
American ginseng**	T
Sand blackberry*	E
<i>Birds</i>	
Common Loon**	T
<i>Reptiles</i>	
Eastern smooth green snake**	SC
Wood turtle**	SC
<i>Invertebrates- Dragonflies and Damselflies</i>	
Pygmy snaketail***	

Source: NH Natural Heritage Bureau database (2013) and Moosewood Ecological LLC (2012).

E – Endangered, T – Threatened, SC – Special Concern

\* - High Importance, \*\* - Very High Importance, \*\*\* - Extremely High Importance

#### IMPORTANT AGRICULTURAL SOILS

Important agricultural soils (see **Map 8.4: Important Agricultural Soils**) cover approximately 9,018 acres, or roughly 32% of Hillsborough (Table 8.7). Prime farmland soils are described nationally as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and are also available for these uses.

These soils are widely distributed throughout the Town and are categorized into three important soil types; prime farmland soils (4.7%), farmland soils of statewide significance (3.0%), and farmland soils of local significance (92.3%).

## FOREST RESOURCES

### IMPORTANT FOREST SOILS

Forest resources (see **Map 8.5: Important Forest Resources**) within New Hampshire are significant for many reasons. They provide sources of employment, a multitude of forest products, recreation and tourism, clean air, and substantial habitats for wildlife and plants, as well as diverse ecological functions (such as nutrient cycling, carbon sequestration, water quality maintenance through sediment trapping). For these reasons, it is important to maintain large tracts of forest lands and to better understand where important forest soils exist in Hillsborough.

Important forest soils represent nearly 16,000 acres, or approximately 57% of Hillsborough (Table 8.8). Forest soil groups IA and IB make up the majority of this resource and are most ideally suited for hardwood production. Soil group IC appears to be more restricted due to stream drainages where outwash sands and gravels were deposited by glacial activity about 11,000 years ago. Group IC soils types are best suited for softwood production, mainly white pine.

**Table 8.7: Summary of Important Soils for Farm Production in Hillsborough**

Important Soil Type	Acres	% of Important Agricultural Soils	% of Hillsborough Total Land Area
Prime Farmland Soils	420.7	4.7%	1.5%
Farmland Soils of Statewide Significance	274.6	3.0%	1.0%
Farmland Soils of Local Significance	8,322.9	92.3%	29.1%
Total Important Agricultural Soils	9,018.2	100.0%	31.6%

*Source: GIS Analysis (Moosewood Ecological 2012) of USDA Natural Resources Conservation Service soils.*

**Table 8.8: Summary of Important Forest Soils for Timber Production in Hillsborough**

Important Soil Type	Percent of Town	Size (Acres)
Hardwood Production (Groups 1A and 1B)	57.6%	16,486.1
Softwood Production (Group 1C)	6.2%	1,767.4

*Source: GIS Analysis (Moosewood Ecological 2012) of USDA Natural Resources Conservation Service soils.*

### CONSERVATION LANDS

Tracts of land under conservation easement can be permanently protected from future development as part of the parcel's deed restrictions. By the end of 2014, there were approximately 5,831 acres of conservation and Town-owned lands in Hillsborough (Table 8.9).

In Hillsborough, the largest single piece of protected property is Fox Forest (see insert on page 8.16) which was created through a donation to the State of New Hampshire. Likewise, the primary source of other protected lands has been through donation (of easements or the properties themselves) to the Town or conservation organizations. The Hillsborough Conservation Commission (HCC), through its limited resources, has facilitated some of those donations by contributing some of the costs of donation such as surveying or legal fees. In 2015, the HCC made its first outright purchase of a piece of conservation property. This lot is adjacent to Grimes Field and both expands the Town's River Walk on an adjoining town-owned property and adds to the de facto greenway along the Contoocook River.

**Table 8.9: Conservation Lands and Town-Owned Lands**

Primary Protecting Agency	Land Ownership	Size (Acres)
NH Dept. of Resources and Economic Development	Public	2,178.8
NH Dept. of Transportation	Public	8,037
NH Fish and Game	Public	484.5
Five Rivers Conservation Trust	Private	168.1
Society for the Protection of NH Forests	Private	2,486.3
The Nature Conservancy	Private	67.2
Town of Hillsborough	Public	367.4

Source: GRANIT Conservation Lands database (2013) and Hillsborough Conservation Commission.

#### ECOLOGICALLY SIGNIFICANT AREAS

One of the final outcomes of the NRI was the identification of Ecologically Significant Areas (ESAs). ESAs are often used in conservation/land use planning to establish priority areas for future acquisition and other regulatory/non-regulatory land protection techniques. These ESAs were identified using a combination of factors, including unfragmented lands, wildlife movement and habitat connectivity, clustering effect of significant habitats that occur in close proximity to one another, presence and distribution of focal species, wetlands of high value, presence and distribution of exemplary natural communities, priorities for conservation developed by the NH Fish and Game Wildlife Action Plan, as well as predicted high quality habitats, and a co-occurrence analysis of natural resources.

Six ecologically significant areas have been identified in Hillsborough and are shown in **Map 8.6: Ecologically Significant Areas**. They are:

##### 1. Shedd Brook and Black Pond Brook Vicinity

This area provides an important buffer from roadways and

development adjacent to two large (14,700 acre and 4,770 acre) blocks of unfragmented forest. It contains diverse habitats including floodplains, marshes, peatlands, swamps, grasslands, vernal pools and a mixture of different forest ecosystems which provides connectivity for wildlife. **This area is among some of the highest ranked habitats in New Hampshire.**

##### 2. Beard Brook Vicinity

This area provides a buffer from roads and development adjacent to unfragmented blocks of land ranging from 2,100 acres to over 22,000 acres in size. It contains excellent habitat connectivity for wildlife, having a diversity of upland forests, marshes, swamps, floodplains, peatlands, grassland and vernal pools. This area is among some of the highest ranked habitats in New Hampshire. The southern section of this ESA is associated with a fairly large aquifer having a high yield and good water quality.

##### 3. Contention Pond-Loon Pond Vicinity

This area is part of an extensive 21,842-acre block of unfragmented forest which is Hillsborough's largest self-contained unfragmented block. Home to a wide variety of habitats including vernal pools, marshes, peatlands, swamps, streams, south-facing slopes, open waterbodies and a variety of upland forest ecosystems. This area helps maintain wildlife connectivity to the south, east and west due to its remoteness and rural character. **Portions of this ESA are among some of the highest ranked habitats in New Hampshire.**

##### 4. Farrar Marsh-Sand Brook Vicinity

This ESA contains some of the headwater streams of Sand Brook and includes significant wetland and upland habitats. The presence of Farrar Marsh Wildlife Management Area and other extensive wetlands, combined with its location within Hillsborough's largest unfragmented block of land (which extends into Bradford and



Henniker), earned this area top ranking within the biological region and the State in the NH Fish and Game Wildlife Action Plan. It contains very diverse habitats, such as those noted in previous ESAs, with four significant wetlands, including two ranked as high value and two as medium value as defined in the NRI. At least five verified and two potential vernal pools are known to exist here. It contains very important wildlife habitat as well as serving as a wildlife corridor. Beaver, black bear, otter, moose, bobcat and mink are focal species using this area as is.

#### **5. Fox State Forest Vicinity**

This ESA is associated with two fairly large-sized blocks of unfragmented lands (933 acres and 1,515 acres) as well as two exemplary natural communities, including a red maple-black ash swamp and a fen/bog system (Mud Pond). These two communities are considered by the NH Natural Heritage Bureau to be of a very high level of importance for protection. This ESA contains diverse habitats including a heron rookery, marshes, peatlands, swamps, streams, vernal pools, grasslands and upland forest. It has three significant wetlands, one of which – Mud Pond – is ranked as high value. These wetlands serve as important feeding habitat for herons as well as supporting rookeries for great blue heron and green heron. The grasslands/hayfields provide important habitat for grassland birds, including bobolinks, and are among the highest quality agricultural resources in Hillsborough. Other important focal species of this area include red-shouldered hawk, beaver, mink, deer, and coyote.

#### **6. Contoocook River-North Branch River-Bear Hill Road Vicinity**

This ESA focuses on the entire stretch of the Contoocook River, the North Branch River (both considered NH Designated Rivers) and their associated upland and floodplain forests, as well as significant grasslands and pastures along Bear Hill Road. The western section

### **FOX FOREST**

Located in Hillsborough, Fox Forest covers approximately 1,445 acres of land and includes an array of trails used for hiking, snowshoeing, and cross-country skiing. In addition to its recreational opportunities, it has been the state's forest research station since 1933, after the land was given to New Hampshire from Miss Caroline Fox of Arlington, Massachusetts as a gift.

The Forest also is home to the Henry I. Baldwin Forestry Education Center, named after the first research forester at the forest. In the past, Fox Forest research has included growth studies, planting studies, forest recovery after the 1938 hurricane, pre-commercial thinning studies, charcoal making, herbicide research and investigations of unique forest areas. Current research includes an assessment of timber harvesting, forest sampling studies, regeneration research from white pine and red oaks, uneven-aged management research and growth and yield studies.

Fox Forest also contains black gum swamps, a rare wetland type found in New England that contains the highest concentration of black gum trees. These trees are the oldest known living hardwoods in New England and uncommon in New Hampshire. Several black gums can be observed from the Swamp Trail within Fox Forest, with some found to be over 500 years old.

For additional information on Fox Forest or black gum trees:

<http://www.nhdfi.org/new-hampshire-state-lands/state-owned-reservations/fox-state-forest.aspx>

<http://www.nhdfi.org/events-tours-and-programs/visit-nh-biodiversity/fox-state-forest-black-gum-images.aspx>

of this ESA is part of a 3,056-acre block of unfragmented forest containing tributaries of these rivers, unique floodplain forests, abundant vernal pools, upland forests and important grasslands. The forests and fields southwest of the Contoocook River serve as conduit for wildlife movement to and from the river. Significant floodplains grace various stretches along the river, rich in habitat and species diversity. These floodplains have been identified by the NH Wildlife Action Plan as highest ranked habitat for the state and the biological region. The eastern half of this ESA has a very high density of confirmed and potential vernal pools as well as a high density of focal species such as moose, mink, beaver, otter, osprey and bobolink. The grasslands and pastures along Bear Hill Road function as significant habitat for bobolinks, hosting the largest population of this focal species in Hillsborough, and have been identified by the NH Wildlife Action Plan as highest ranked habitat for the biological region. This ESA also contains some of the most significant stratified drift aquifers in Hillsborough. It has been identified as having some of the best spots for potential future drinking water sources based on water quantity and quality.

These ESAs can serve as a starting point for identifying overall conservation priorities. More detailed information about the attributes of each area can be found in the Natural Resource Inventory, a copy of which is available at the Town Library or on-line at the Town website. In addition, the Quabbin to Cardigan conservation initiative identifies most of the northern half of town as a core conservation focus area.

## OPEN SPACE AND RECREATION

Hillsborough's open spaces have a diversity of natural features, including forests, water resources and wildlife and aquatic species. Not only is preservation and stewardship essential to maintaining the health

of these resources, but they provide natural environments for residents to enjoy access to boating, fishing, hiking and other pursuits. Many residents responded to the Hillsborough survey as being in favor of greater and improved access, particularly to the Contoocook River. Fox State Forest is used most frequently by residents at 74%, with the downtown next at 65%, followed closely by Gleason Falls (61%) and Gould Pond (48%). Open space also provides scenic views from roads and trails that help define Hillsborough's identity and highlight natural and historical resources, such as the stone arch bridges, fields, and forests.

Like many communities, Hillsborough relies on volunteers for much of the maintenance and management of its network of open space and trails for public use. Equally important is the good stewardship of private land. Reaching out through educational events to not only recruit new volunteers for local committees and organizations, but to provide information for property owners on topics such as farm and forest management and wildlife habitat protection is an important consideration in continuing effective stewardship of natural resources. Looking for ways to partner with regional organizations is one strategy that Hillsborough can pursue as well as

### GLEASON FALLS

As one of a few historic stone arch masonry bridges remaining in Hillsborough, Gleason Falls Bridge dates back to the 1840s and crosses an impressive cascade of water.

Located near the junction of Gleason Falls Road and Beard Road, the area is conservation land and offers a place for picnicking, wading, and fishing.

Source: <http://livinghistoryeventnh.com/hillsboroughs-stone-arch-bridges/>



looking for opportunities to connect current trails into a larger network with adjacent communities.

## POTENTIAL RESOURCE PROTECTION EFFORTS

The following categories can be used to focus resource protection efforts and financial as well as volunteer and staff resources. The development of these categories is based on the results of the NRI study and important priorities that emerged from the public outreach efforts.

### CONSERVATION PLANNING

The conservation priorities maps in the NRI can be used to guide specific or general conservation planning efforts. This could include regulatory or voluntary methods. The Town may want to consider developing innovative land use techniques to help protect natural features, including rare species, critical habitats, rare natural communities, and large unfragmented lands. The *Innovative Land Use Planning Techniques: A Handbook for Sustainable Development* (NH DES, 2008) was designed to provide examples of various types of zoning regulations that could be implemented to promote more sustainable land use, including protective measures for various ecological attributes. This publication was developed for New Hampshire communities by the NH Department of Environmental Services in partnership with NH Association of Regional Planning Commissions, NH Office of Strategic Initiatives, and NH Local Government Center. It provides examples for various multi-density zoning options (i.e., density transfer credit, agricultural incentive zoning, and infill development), environmental characteristics zoning (i.e., permanent stormwater management, habitat protection, riparian protection) and site-level design (i.e., landscaping). Voluntary protection efforts could focus on working

with willing landowners within ESAs as a way to maximize the results of natural resources protection.

Another important aspect of conservation planning should be to minimize fragmentation and to develop appropriate wildlife corridors, a priority identified through the community survey.

### WORK WITH ADJACENT COMMUNITIES

Working with adjacent communities on similar conservation initiatives is an important aspect of natural resource protection, as watershed protection, water quality and greenway development goes beyond municipal boundaries. The Hillsborough Conservation Commission should reach out to adjacent communities to build strong relationships and create open lines of communication, as well as to inform these communities about Hillsborough's conservation planning efforts.

### COMMUNITY OUTREACH

Community outreach and landowner education is an important element of an overall plan to preserve and protect Hillsborough's natural resources and conservation planning. This can be accomplished in many ways, including workshops, hikes, printed materials such as brochures, water resource protection, and development of a citizen science program to monitor important natural resources (such as amphibian road crossings to vernal pools, culvert assessment to better understand issues with aquatic connectivity, invasive species management). Education and outreach can also be used as a mechanism to recruit volunteers to active participate in conserving and protecting Hillsborough's natural resources.

The Town should also develop incentives that encourage wetlands protection for proposed development projects. The Conservation Commission should distribute literature on the Town's natural

resources and engage landowners in wildlife and resource protection.

#### **WATER SOURCE PROTECTION**

Healthy watersheds with high-quality ground and surface water resources and aquatic habitats are important to residents as well as ecosystems. Further, protecting our drinking water supply from pollution, and any detrimental land use practices that would decrease the quality and availability of clean water, is critical. Hillsborough should protect high quality, high yielding aquifers that could serve as future public water supply areas. Hillsborough may want to use a variety of methods to protect its wetlands, including educational, regulatory, and voluntary efforts. These methods include:

- Consider strengthening the Loon Pond Ordinance.
- Secure future public water supply sources. Work with willing landowners on land protection efforts within and adjacent to these sources.
- Land use development should take into consideration the amount of impervious cover created by any development within aquifer recharge areas. Regulations should also consider storm water management, erosion and sedimentation control, and regulated substances.
- Identify and map aquifer recharge areas.
- Promote public education about the importance of aquifer protection. Topics could cover storm water management, proper septic system maintenance, erosion and sediment

control, and fertilizer use on lawns, as well as use of other chemicals.

- Periodically evaluate existing setbacks to minimize runoff from all sources (roads, parking lots, buildings, and home lots) into storm sewers and streams.

#### **GENERAL GUIDELINES AND PRIORITIES**

There are some basic guidelines identified below that the Town can use to promote innovative and informed land use planning. While these guidelines are comprehensive in nature, they are not intended to preclude the Town from pursuing other actions as opportunities arise. These recommendations are ranked in order of priority.

1. Protect large, unfragmented blocks, especially those with high quality habitats located within close proximity of one another and with limited barriers for wildlife movement.
2. Better understand wildlife movement patterns to identify and design the most effective conservation corridors.
3. Connect protected lands and other critical habitats with upland, aquatic and/or riparian corridors.
4. Protect intact wetland and stream riparian buffers and promote the restoration of degraded areas.
5. Build upon existing contiguous protected lands.
6. Promote community education and outreach regarding Hillsborough's biodiversity and the importance of long-term protection strategies.
7. Support voluntary approaches to natural resource protection.

8. Support regulatory approaches to natural resource protection.
9. Consider establishing a joint committee comprised of members from the Conservation Commission, Water Department and Planning Department.
10. Continue to support assessment, cleanup and redevelopment efforts to further reclaim the Woods Woolen Mill site.

## CHAPTER OBJECTIVES AND RECOMMENDATIONS

### OBJECTIVE 1:

Present information gathered from the survey and visioning session regarding the community's interest in conservation including the local environment, land preservation and water protection.

- The Community Survey yielded favorable results (see Pages 8.4 and 8.5) supporting the preservation of natural resources. Responses show that Hillsborough's water resources, including lakes, ponds, streams, and rivers, are one of the most highly valued resources within the community.

### OBJECTIVE 2:

Provide a review of the Town's initiatives and process on land and water conservation activities.

- The following initiatives and process related to Hillsborough's land and water conservation activities were reviewed:
  1. Ecologically Significant Areas (ESAs) as identified in the Conservation Commission's 2014 Natural Resources Inventory (NRI).

2. Hillsborough's important natural resources such as water resources, agricultural resources, forest resources and open space and recreation were outlined.
3. Existing Conservation Lands and Town-Owned Lands.
4. Existing protection measures such as the Loon Pond Ordinance.

### OBJECTIVE 3:

Develop a guide for the Town's conservation actions over the next ten years.

- A) Educating citizens about the Town's natural resources and the importance they play to the Town's quality of life.
  - Community outreach and landowner education are important elements of Hillsborough's natural resources and conservation planning.
- B) Identify opportunities to enhance access to the Town's lands and water bodies.
  - Potential future protection opportunities include:
    1. Strengthening the Loon Pond Ordinance.
    2. Reviewing and mapping aquifer recharge areas.
    3. Reviewing protection measures related to storm water management, erosion and sedimentation control, and regulated substances.
  - The general guidelines and priorities outlined in this chapter can assist in promoting innovative land use policies.
- C) Use the identification of Ecologically Significant Areas to assist

in the identification of priority areas for future acquisition and/or protection through regulatory and non-regulatory techniques.

→ The identification of ESAs can serve as a starting point for identifying overall conservation priorities and assist in protecting large, unfragmented blocks of natural habitat.

D) Identify opportunities to coordinate efforts with adjoining communities as well as within our own to protect watersheds and connect wildlife corridors.

→ As the protection of natural resources often reaches beyond municipal borders, the importance of outreach to adjacent communities by the Conservation Commission and the development of strong relationships is a key recommendation.

## SUMMARY

Natural resources are highly valued by Hillsborough residents with many voicing a desire to preserve the rural character through continued efforts to protect and manage water and land resources. The primary focus of this Chapter is to identify the natural resources in Town, recognize the role they play in giving Hillsborough its character, and propose strategies that best maintain that character. The Hillsborough Conservation Commission completed a Natural Resources Inventory (NRI) in 2014 that provides a foundation for much of this chapter. The NRI is a valuable tool in prioritizing critical habitats, greenways, and corridors that should be protected through purchase, easements, or other means. Along with the public outreach results, identifying important ecological areas through the NRI process provides documentation and support for the chapter's key recommendations.

Natural resources are part of a system and do not end at the Town's boundaries, affirming the importance of using a regional lens when addressing issues such as water quality and corridor protection. Community outreach and landowner education is also one of the most important elements of an overall plan to preserve and protect Hillsborough's natural resources and conservation planning.

Successful implementation of the chapter's recommendations requires communication, collaboration and coordinated activity from elected leaders, Town staff, public and private partners and residents. These recommendations can help to reduce land fragmentation, protect water quality, and help maintain the rural, cultural, and historic character of Hillsborough that residents value.