TOWN OF HOPKINTON, NEW HAMPSHIRE

NATURAL RESOURCES INVENTORY
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Commissioned and funded by the Hopkinton Conservation Commission

DEDICATION

The Hopkinton Conservation Commission dedicates this Natural Resources Inventory to the people of Hopkinton, which is built on N'dakinna**,** the traditional ancestral homeland of the Abenaki, Penacook and Wabanaki Peoples past and present. We honor with gratitude the land and waterways and the alnobak (people) who have stewarded N'dakinna throughout the generations. - ***Adapted from the Indigenous NH Collaborative Collective***

HOPKINTON CONSERVATION COMMISSION

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Cover Photo: Smith Pond in Hopkinton, NH

Photo on current page: Turtle head (*Chelone glabra*), a wildflower often found at the edge of wetlands and along streams and rivers – in this case on the bank of the Contoocook River.

Unless otherwise stated, all photos were taken by Elise Lawson / Watershed to Wildlife during field work for this NRI.

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INTRODUCTION BY THE HOPKINTON CONSERVATION COMMISSION

Why do Conservation Commissions Create Natural Resources Inventories?

Conservation commissions are tasked with many responsibilities, including environmental education, land protection, wetland evaluation and more. Although some of these are optional, creating an index of natural resources is a statutory requirement ((RSA 36-A:2) The contemporary interpretation of the word "index" in this instance is an NRI.

How is a Natural Resources Inventory (NRI) Used?

NRIs are essential to fulfilling the mission of conservation commissions. An NRI provides a clear picture of where a town's natural and cultural resources are located, which of them are significant and why.

Examples of how an NRI can be used include:

- Guiding the commission's goals and projects
- Advising the Planning Board and other government entities involved in making land use decisions
- Informing the town's Master Plan process and creation of Zoning Ordinances
- Assisting in the evaluation of wetland permit applications
- Creating a foundation for a Conservation Plan
- Providing background for public forums on natural resources and environmental topics
- Integrating information into environmental education curricula in schools

The application of the NRI to land use planning is perhaps its most critical purpose. Land use planning must constantly seek to balance future growth and development with protection of natural resources. The Hopkinton Conservation Commission (HCC) completed this report to give Hopkinton data on these resources, so the town can make informed and balanced decisions. This NRI provides Hopkinton with a foundation for proactive planning, rather than the all-too-common reactive approach.

Goals of the Natural Resources Inventory

In 2022 the HCC used the Conservation Fund to hire natural resources consultant and wetland scientist Elise Lawson, owner of Watershed to Wildlife, to prepare this NRI. The following goals, created by the HCC, guided its development, and resulted in the maps, data and narrative herein:

- Create a document that can be incorporated into future updates of Hopkinton's Master Plan
- Identify areas for future conservation efforts, and areas of contiguous open space and wildlife corridors

- Maintain inventories of natural and scenic resources, including aquifers, open water, steep slopes and hilltops
- Provide the Town of Hopkinton with new accurate, standardized coverages that can be integrated into the existing GIS database
- Increase awareness of the values of the characteristics of Hopkinton including forest and water resources, scenic view areas, recreation areas, riparian buffer habitat, and wetlands with associated wildlife habitat through public presentations and discussions.
- Promote conservation of water, forested land, wildlife habitat, wetlands and unique co-existing natural resource features throughout the town.

Summary of Recommendations

Based on the results of this study, the Hopkinton Conservation Commission offers recommendations in the eight categories below. For a full discussion of each recommendation, see the "SUMMARY AND HOW TO USE THIS REPORT" section that follows this introduction.

- Climate Change
- Surface Water Protection
- Aquifer Protection
- Forest Land Protection
- Wetland Conservation
- Land Conservation
- Hillside and Viewshed Protection
- Cooperation

SUMMARY AND HOW TO USE THIS REPORT

Based on the results of this study, Elise Lawson of Watershed to Wildlife and the Hopkinton Conservation Commission offer the following observations and recommendations:

1. **Climate Change** - The most significant threat to the existing natural resources in Hopkinton is climate change. The predictions of impacts as described in the 2021 NH Climate Assessment Report should be considered by all town departments and committees in planning for Hopkinton's future. It is recommended that land use planning incorporate actions to minimize, mitigate and adapt to climate change impacts. A town energy use plan should be developed to reduce municipal and residential activities that create greenhouse gases.

2. **Surface Water Protection** – **82.6 miles of streams/rivers – 1,492.61 acres of open water** Hopkinton's many water bodies, including rivers, lakes and streams, provide recreational opportunities such as swimming, fishing and boating. Some are also critical sources of drinking water for our residents and neighboring communities. Bear Pond, which is located in Warner, is the source of water for the Contoocook Village Precinct. **Maintaining good water quality is one of the highest priorities of the Hopkinton Conservation Commission.** Currently, water quality is in very good to excellent condition. We should continue to maintain this high standard not only in the Contoocook River, but also in smaller rivers, streams, and headwater brooks that feed the Contoocook River and/or the Merrimack River outside of Hopkinton. Recent challenges in achieving this include new knowledge of the threat and extent of PFAS contamination and the increasing occurrence of cyanobacteria, both of which are toxic to humans and animals.

3. **Aquifer Protection** – **7,272.9 acres – 25.2% of town -** Future water supplies are a vital natural resource for Hopkinton and the abutting municipalities as demonstrated by the drinking water systems already in use. Hopkinton residents who live outside the two precincts with a municipal water supply, depend on drilled or dug wells that draw from the groundwater or aquifer below. Land use planning should include consideration of what is built and disposed of on the land surface of this important underground resource.

4. **Importance of Forested lands – 70% Forested in Hopkinton**

    a. **Dense Softwood Protection**- **948.0 acres – 3.3% of Town -** Dense softwood stands (not including white pine stands) are beneficial to wildlife for cover particularly in the winter. Although many of these stands are scattered and small, there are a few areas that contain adequate acreage for deer wintering

habitat throughout the town. These should be identified on both public and private property to avoid cutting where possible.

b. **Carbon Sequestration** – Recent research indicates that forests and natural vegetation provide up to 37% of the emission reductions needed to keep global temperature increases under 2 degrees Celsius. Older trees and woody debris hold carbon in their structure, while the rapid growth of younger trees can sequester carbon at a faster rate. Thus, there is recognition of the carbon sequestering value of forests. Furthermore, sustainable forestry practices can enhance this function. There are opportunities to generate income from carbon offset programs, and revenue from the sale of these offsets can be used to purchase additional forested land for conservation. Funds can also be used to help private landowners put forested properties into conservation easements.

5. **Continued Wetland Conservation – 2,883.95 acres wetlands – 10% of town** - The Hopkinton Conservation Commission recognizes the many functions and values of wetlands including: excellent fish and wildlife habitats, higher water quality, flood storage, shoreline erosion protection, and recreation/observation/education opportunities (US EPA, 2023). This NRI report recommends that the Town continue to pursue ways to further conserve the functionality and diversity of these wetlands. An overall wetland study would help Hopkinton to work with willing landowners to conserve some of these valuable wetland resources. Hopkinton should continue to work towards establishing protective buffers around wetlands in town.
6. **Land Conservation** – **5,075 acres of conserved land -** As Hopkinton faces increasing development pressure, this NRI recommends strengthening efforts to secure for future generations the open spaces that help define the character and quality of life that residents have repeatedly listed as priorities for our town. The Hopkinton Open Space Committee and Conservation Commission have done a tremendous job with land conservation and open space easements. Much of this is done through strong partnerships with regional and statewide land conservation trusts and state sources of conservation funding. Most of these conserved lands are open to the public and provide excellent opportunities for non-motorized recreation and outdoor education. This NRI recommends that these partnerships and land conservation efforts be strengthened. Specific areas warrant concern for water quality and wildlife travel. These are:
    a. Areas along the Contoocook River
    b. Land south of the Mast Yard State Forest and Ware easements
    c. Class VI New Road

d. Unfragmented areas in the northwest corner of Hopkinton north of Clement Pond and Grassy Pond.

7. **Hillside and Viewshed Protection** - Hopkinton's hilly topography is directly related to the town's tourism industry, scenic beauty, and diversity of natural resources - from the tops of hills to the beaver ponds, streams, and floodplain river habitat at the bottom of the slopes. This NRI recommends research and consideration towards evaluating and updating the Zoning Ordinance in Hopkinton to conserve viewsheds that are basic to the rural character of the town.
8. **Cooperation** - Ecosystems, watersheds and wildlife habitats often transcend municipal boundaries. The health of our natural resources is often dependent on actions taken by neighboring towns. An important example of this is the need to protect Bear Pond in Warner, a source of the Contoocook Village Precinct water system. A watershed approach to conserving these shared resources is recommended. Many surrounding towns have completed Natural Resources Inventories, and the data from Hopkinton and other towns is compatible in GIS formats. Hopkinton should continue working with government agencies, regional planning commissions, neighboring municipalities, and natural resource organizations to enhance the protection of our shared natural resources.

HISTORY OF NATURAL RESOURCE USE IN HOPKINTON

Human relationship with natural resources in Hopkinton stretches back through more than 13,000 years of habitation by Indigenous Peoples, who called their homeland N'dakinna. The Contoocook River was the foundational resource. Collaborative research between the Abenaki Trails Project and Hopkinton Historical Society, as well as the most current Abenaki Dictionary used to teach the language at the Middlebury College Language School, confirm that the name "Contoocook" is an adaptation of the Abenaki word "Pagontegok," meaning "nut river." Indeed, there are many stands of butternut and other nut-bearing trees along the Pagontegok.

In the words of Sherry Gould, member of the Nulhegan Abenaki, "The waterways were not only our highways, but the basis of all life - and they still are." The Abenaki relied on the fertile soils and forests along the Contoocook River for farming, fishing, hunting, making tools, creating art and building homes. Although intrinsic to their existence and spiritual beliefs, the Abenaki did not perceive themselves to be the owners of the land or its resources.

The arrival of European settlers in the 17th century caused a dramatic shift in land use, ending an era of human relationship with natural resources as the basis of community sustenance, culture and religion, and ushering in the English system of individual rights, with all the legal protections landowners rely on today.

Although the original Abenaki settlements disappeared into the landscape long ago, their cultural traditions were woven into the fabric of the region and are kept alive by today's members of the Coosuk Band of the Nulhegan Abenaki Nation. We have much to learn from the original stewards of Hopkinton's natural resources, who existed sustainably for millennia on the landscape of N'dakinna, which we now call Hopkinton.

Today, the Town of Hopkinton, New Hampshire is rural and mostly forested containing 45 square miles or 28,851.7 acres of land including over 1,492 acres of lakes and ponds. There were 1,715 residents in Hopkinton when the first census was taken in 1790. The population was 3,861 in 1980 and rose to 6,036 in 2021. The Town's geography is quite diverse, ranging from flat floodplain areas along the Contoocook River to rugged hilly areas including steep slopes to the top of Gould Hill and Beech Hill. Shaker Hill (920 feet) is the highest point in Hopkinton. It is in the southwestern part of town on the town line with Henniker. Gould Hill is the second highest hill in the central part of town - 872 feet. It lies between Gould Hill Road and Route 103. Putney Hill tops out at 789 feet, Beech Hill at 783 feet, Irish Hill at 771 feet, Clement Hill at 733 feet, Rattlesnake Hill at 653 feet, and Dimond Hill at 623 feet. Out of 28,851.7 acres of land, 5,075 acres are conserved or under special easements – 17.5%, (with an additional 3,150 acres restricted by the US Army Corps of Engineers - 11%). Nearly 70% of Hopkinton is forested.

Incorporated in 1765, the state legislature met in Hopkinton occasionally between 1798 and 1807. In 1808, the town competed for the coveted position of state capital but was

defeated by neighboring Concord. It was a popular stop on the passenger rail line between Boston and Montreal. The town was made up of three distinct entities: Hopkinton, mainly as a residential area; West Hopkinton, primarily the location for the town's agricultural center; and Contoocook Village, the town's business hub. Many still refer to the three separately, but they comprise one town with three sections that share the same zip code and school system (Town of Hopkinton Website, 2023).

The land within Hopkinton has a long and rich history based on natural resources, dating back to use by Abenaki communities living in the region described above. With the immigration of European settlers, the presence of fertile land for farming and the proximity to waterpower for mills led to the establishment of three distinct areas within the Town of Hopkinton: Hopkinton Village, Contoocook Village, and West Hopkinton. Within two generations, Hopkinton became an influential town as farms prospered, mills were built, with churches, roads and schools following (Hopkinton Master Plan, 2012). Since the 1940s, Hopkinton's rural character, tourism, small businesses, and proximity to Concord have been among its defining characteristics.

Hopkinton contains a wide range of ecological habitats including the Contoocook River, several lakes and ponds, as well as headwater streams. The latest Master Plan in Hopkinton was initiated in 2022. One of its main visions is to "encourage preservation and protection of natural resources, scenic views, and open spaces while encouraging recreational opportunities."

- Respect and protect valuable natural resources while encouraging recreational activities in suitable areas.
- Actively expand and strengthen the greenway system while stewarding the existing trails in town and attaining regional connections where appropriate.
- Encourage the protection of open space through land acquisition and conservation easements to protect critical habitats (Town of Hopkinton, 2022).

GOALS OF THE NATURAL RESOURCES INVENTORY

This project provides a Natural Resources Inventory (NRI) that, with the addition of data to the existing Hopkinton GIS database, can be integrated with past and future studies. One of the goals of this project is to provide an inventory and management recommendations, as well as educational and planning tools, for the Town of Hopkinton. It consists of a written report with maps, as well as an extensive GIS database that can be added as an overlay to existing maps in the town's database. It promotes conservation of water, forested land, riparian habitat, wetlands, and unique co-existing natural resource features throughout the town.

METHODOLOGY

Bonnie Christie, member of the Hopkinton Conservation Commission, was the main contact for consultant Elise Lawson of Watershed to Wildlife. Elise has worked as a natural resource consultant for over 20 years. This town-wide Natural Resources Inventory uses a combination of existing mapping data, previous work, and current field work to produce an overall base NRI for Hopkinton, NH.

Field Work

Elise completed three days of field work for this study (September 23 and 24 and October 20, 2022). The Hopkinton Conservation Commission reached out to landowners for permission to walk on their properties for this NRI. We respect the rights of landowners, and we did not trespass on private property; we ensured that we were granted permission. Field work was conducted to get an overall view of Hopkinton with a focus on previously identified targeted areas. This work included inventories and assessments on several wetland complexes, riparian habitats, and upland habitats including higher elevation uplands. In most cases, Class VI roads and established trails were followed, while in other cases, compass-based orienteering and handheld GPS units were used. At points of interest, GPS locational data was taken, along with photographs and field notes. During field work sessions, any rare or endangered species found were noted and located on a map. Observed invasive plant species were also documented. Bonnie Christie joined for the first field day.

Several Hopkinton residents contributed local knowledge for this NRI as well. They recorded and reported on plant species, wildlife sightings, as well as invasive species found throughout town. A list of species recorded is shown in Appendix A. We thank everyone who helped collect and report data for this Natural Resources Inventory.

Compiling Existing Data and Integrating into ArcGIS

Elise Lawson conducted GIS analyses. She gathered digital data from the Town of Hopkinton, GRANIT, Natural Resource Conservation Service (NRCS), and the US Fish and Wildlife Service. These data include the following:

1. Aerial photography
2. Topographic maps
3. Hydrology (rivers, streams, lakes and ponds)
4. Roads and trails
5. Power lines and rail corridors
6. Conservation lands
7. National Wetlands Inventory
8. Soil information (NRCS – Natural Resources Conservation Service)
9. Aquifers and subwatersheds
10. Bedrock geology

11. Maps created during the Wildlife Action Plans completed by the NH Fish and Game Department

Existing available maps were then integrated using ArcMAP software. Using the USDA 2009 and 2015 aerial photography, topographic maps, and soils maps, Elise digitized features and overlaid them onto a base map. These include wetlands, farmland soils, forestry soil groups, steep slopes, permanent wildlife openings, and dense softwood stands. Potentially significant wildlife habitat areas were noted.

Wetlands were reviewed and analyzed using the 2009 and 2015 aerial photos, National Wetland Inventory (NWI), Natural Resource Conservation Service (NRCS) soils maps (displaying hydric soil map units), and field work to confirm wetland locations where visited. 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 hydrophytic[1] vegetation. When soil maps alone are used, they could potentially overestimate the number of wetlands throughout the town. 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 under-represents 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 Hopkinton were determined using the NRCS soils map data. Data were displayed in ArcMap and queried so only those soils classified as important farmland were displayed in the Town.

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

[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.

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 to produce 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, soil 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 to produce food, fiber, forage and oilseed crops. The criteria used to define this farmland were determined by local agencies in Merrimack County.

Permanent openings (fields - areas dominated by grasses, forbs, brambles) were digitized from 2015 aerial photographs. The regions digitized include only those openings managed as permanent opening habitat. They do not include clear-cuts where the intent is for timber harvesting and regeneration for future logging. **Dense softwood** (or conifer excluding white and red pine) cover areas were also digitized from the aerial photographs. These areas are considered significant wildlife habitat and could be used by deer and moose for wintering areas.

Steep slopes were determined using the NRCS soils maps. Data was displayed in Arc Map and queried so only those soils map units with 20% slope and greater were displayed.

Maps are found at the end of this report with the features described above. All information gathered, compiled, and mapped for this report was delivered to the Hopkinton Conservation Commission in digital format. It is the property of the Town of Hopkinton

Public Presentation and Discussion

At the completion of this NRI, a public information meeting will be held to explain the results from this study. The goal of this meeting is to increase public awareness of the importance of the natural resource inventory including scenic and recreation areas, water resources, riparian habitat, forested land, and associated wildlife habitat. In addition, we will display work from this project for public access on Hopkinton's town website.

RESULTS

Forested Lands (Maps #1 and #2 at the end of report)

Hopkinton is 70% forested. There are several different forest types, typical for this part of southern New Hampshire including:

- Appalachian Oak-Pine – 12,740ac = 44.16%
- Hemlock-Hardwood-Pine – 6,877 ac = 23.83%
- Dense softwood – 948 ac = 3.3%
- Floodplain Forest – 165 ac = .57%
- Rocky Ridge – 52 ac = .18%

The list of forest types, acreages and percentages above are taken directly from the NH Fish and Game's Wildlife Action Plan mapping of habitat types. Dense softwood stands were digitized from the most recent aerial photographs. The age of forests throughout Hopkinton is diverse, ranging from newly regenerating forest to mature hardwood and softwood forests.

Carbon sequestration – Forests have always provided tremendous personal and public benefits, including clean water, wildlife habitat, recreational opportunities, and forest products. Moreover, forests are an essential natural solution for climate change. Carbon sequestration is the process where atmospheric carbon dioxide is taken up by trees, saplings, and other plants through photosynthesis and stored as carbon in biomass (trunks, branches, foliage, and roots) and soils. The sink of carbon sequestration in forests and wood products helps to offset sources of carbon dioxide put into the atmosphere through deforestation, forest fires, and fossil fuel emissions. Sustainable forestry practices can increase the ability of forests to sequester atmospheric carbon while maintaining or enhancing soil stabilization and water quality.

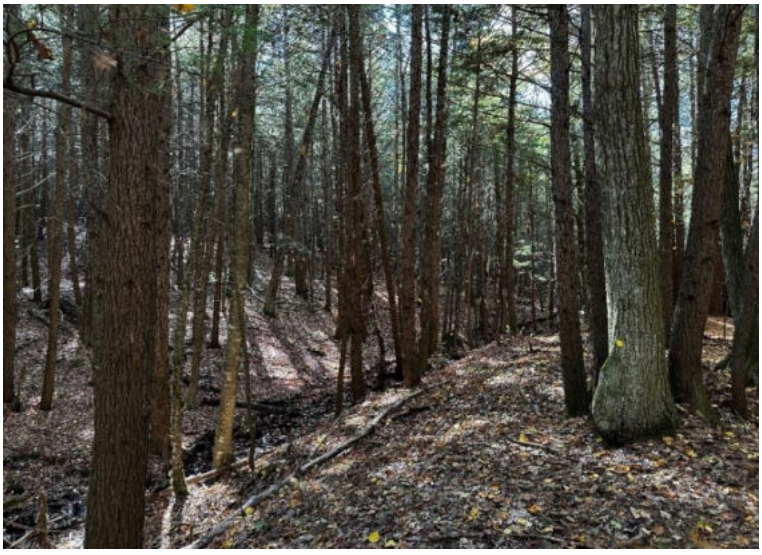
Looking across a beaver pond wetland towards an upland hardwood stand (9-23-2022).
Forests are an essential natural solution for climate change.

Dense Softwood – 948 acres (3.3%) of Hopkinton's forested land contains dense softwood stands, primarily eastern hemlock, balsam fir, and/or spruce. They do not include stands of white or red pine. These softwood stands range in size from less than 1 acre to over 55 acres. Some of the larger softwood stands are found adjacent to ponds including along the east side of Clement Pond and throughout the Hopkinton-Everett Flood Control Reservoir area. In Hopkinton, softwood stands are found in a variety of soil types ranging from the flat, moderately well drained soils such as Croghan loamy fine sand, to excessively well-drained soils including Champlain loamy fine sand. Many of these dense softwood stands are found along rivers, streams, ponds, and wetland complexes offering proximity to good cover for wildlife and a diversity of habitat types. The softwood stands in Hopkinton are isolated, but a few are close enough to allow for excellent winter cover and travel corridors for wildlife.

Dense Softwood

Dense softwood stands cover only about 3% of the land base in New Hampshire, so their identification and management are an important part of conserving the entire State's natural resources.

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, snowshoe hare, ruffed grouse, white-tailed deer, and moose 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 require dense softwood stands to survive New Hampshire's harsher winters. When they congregate in these stands, they are referred to as deer yards or deer wintering areas. 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.



This dense softwood stand is in the Hawthorne Town Forest in Hopkinton. There is often very little undergrowth, as not much sunlight makes it to the forest floor. Photo taken on 10-20-22.

Looking out of a dense softwood stand towards a beaver pond. There is a large network of wildlife trails within this hemlock stand all around the wetland. Photo taken on 9-24-22.

Mast Trees - 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, chickadees, squirrels, and eastern chipmunks to white-tailed deer, black bears, turkeys, and wood ducks rely heavily on mast as a source of feed. Hopkinton has several species of trees that are considered important because of their mast production. These include red oak, beech, maple, hophornbeam, hemlock, black cherry, white ash, apple, pine, and even some chestnut. Hard mast produced by red oak, beech, and some shrubs such as beaked hazelnut, is considered extremely important because it can persist for longer than soft mast and therefore is accessible to wildlife during times of the year when other food sources are limited.

Both the mature and younger red oak trees along Broad Cove Road are producing acorns. That combined with low bush blueberries in the foreground, offer both hard and soft mast for wildlife. (9-23-22)

Bear claw marks on this American beech indicate that it is a good mast tree. Both beech nuts and acorns are important fall food supply for many wildlife species.

Early Successional Habitat – Early successional habitat includes an area with grasses, forbs, shrubs, and young trees (aspen, white birch, and white pine are common in New Hampshire). It provides excellent food and cover for wildlife but needs some sort of disturbance to be maintained. Early successional habitats have been declining throughout the Northeast for decades, as have the wildlife species associated with them. For example, American woodcock have declined by 40% over the past 30 years, and New England cottontails occur in only 20% of their historic range. In Hopkinton, two examples of areas with early successional habitat are along the transmission lines and inactive gravel pits. In gravel pits especially, the topsoil has been removed so there is little organic matter. In these early successional habitats, the soil is sandy with very little topsoil. As a result, there were areas where birds had dusted themselves with the sand. Dust baths are part of a bird's preening and plumage maintenance. The dust is worked into the bird's feathers and absorbs excess oil to help keep the feathers from becoming greasy or matted. It also helps smother or minimize lice, feather mites and other parasites.

This type of habitat is also important for turtles. The proximity of a sandy area to open water gives turtle hatchlings a better chance of making it to water. Examples of early successional habitats in Hopkinton include abandoned/reclaimed gravel pits, timber harvesting areas, transmission lines, and, in rare cases, in areas that experienced wildfires or prescribed burns.

One of the biggest problems with early successional habitat is invasive species. Invasives can grow quickly and prevent native species from establishing and thriving. An example of this is at a town-owned gravel pit where several colonies of Japanese knotweed are thriving at the expense of native pioneer species.

Early successional habitat under this transmission line is maintained by the utility company. Although transmission lines are not visually aesthetic, the early successional habitat maintained along with forested edge habitat is excellent for wildlife. Pioneer species shown here include reindeer lichen, grasses, wildflowers, ferns, white pine, and low bush blueberry. This photo taken on 9-23-22 is entering Mast Yard State Forest in Hopkinton.

Permanent Wildlife Openings[2] (Map #1 at the end of report)

Permanent wildlife openings are dominated by grasses, forbs, wildflowers, 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. White-tailed deer, black bear, rodents, such as deer mice, meadow voles, shrews, and woodchucks, commonly feed on the vegetation present in these habitats, and carnivores from weasels and hawks 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, Bobolink, and northern harrier, which are species of concern in New Hampshire. They also create important edge habitats. 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 that specialize in transition zone areas and will frequent these edge habitats. For example,

[2] 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.

many bird species that feed in openings are known to nest within the edge habitat because there is typically more structural diversity and cover.

Currently, Hopkinton has 2,006.71 acres maintained as permanent wildlife openings which make up 7.0% of the town's area. The New Hampshire state average is 10% permanent wildlife openings. Elise digitized a total of 252 different openings from aerial photos during this project ranging in size from 0.3 acres to approximately over 142 acres. These openings are scattered throughout town and generally found along roads and often associated with a private residence or working farm. Varying sizes of permanent openings are preferred by different species. For example, northern harriers – a predatory bird or raptor - prefer larger openings while feeding, yet snowshoe hare are more likely to feed in smaller openings where cover is more readily available. There are other permanent wildlife openings throughout Hopkinton that are too small to be mapped into the Town's overall acreage of permanent wildlife openings. These include lawns near homes and seeded woods roads. These openings, especially those in more isolated parts of the town, are still important habitat and help maintain Hopkinton's plant and wildlife diversity.

As the percentage of permanent openings in New Hampshire has decreased significantly over the past 50+ years, the state is encouraging landowners to create or maintain permanent openings as important wildlife habitat.

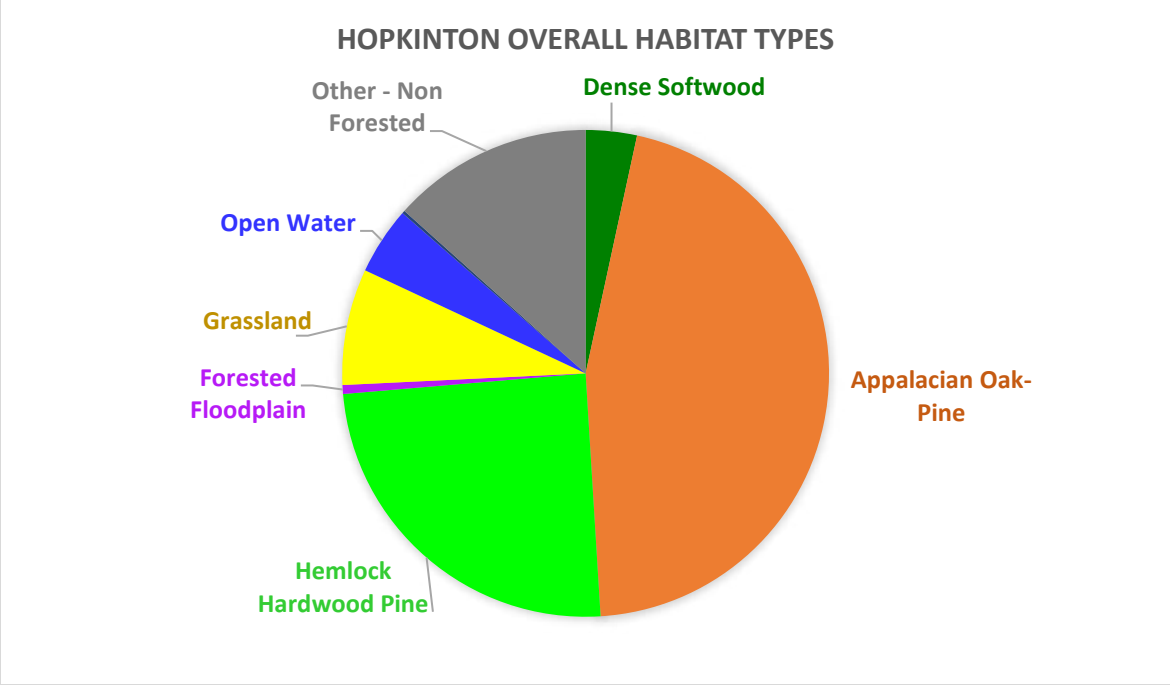
Open field adjacent to the Contoocook River at Tyler Landing Town Forest. The combination of fields, forested areas and proximity to the river, makes this area excellent wildlife habitat. Photo taken on 9-24-22.

Permanent Wildlife Openings

Retain, and possibly increase, permanent wildlife openings to increase the diversity of wildlife and plant community types throughout Hopkinton.

When possible, it is a good practice to remove non-functioning fencing, such as barbed wire and woven sheep fence.

Permanent openings are excellent not only for wildlife, but also for scenic and expansive views. This photo was taken from Briar Hill Road on 9-23-22.



Conservation Land (Maps #3 and #10 at the end of report)

Nearly 5,075 acres equaling 17.5% of Hopkinton is land conserved by conservation easements and special open space easements or restricted by governmental ownership. Land conservation has thus far been a successful goal for Hopkinton, with the town proactively conserving special areas that contribute to the protection of wildlife and natural resources while also providing recreational opportunities. Some of the larger conserved or otherwise undeveloped areas are listed below. A full list of conserved and restricted land is in Appendix B.

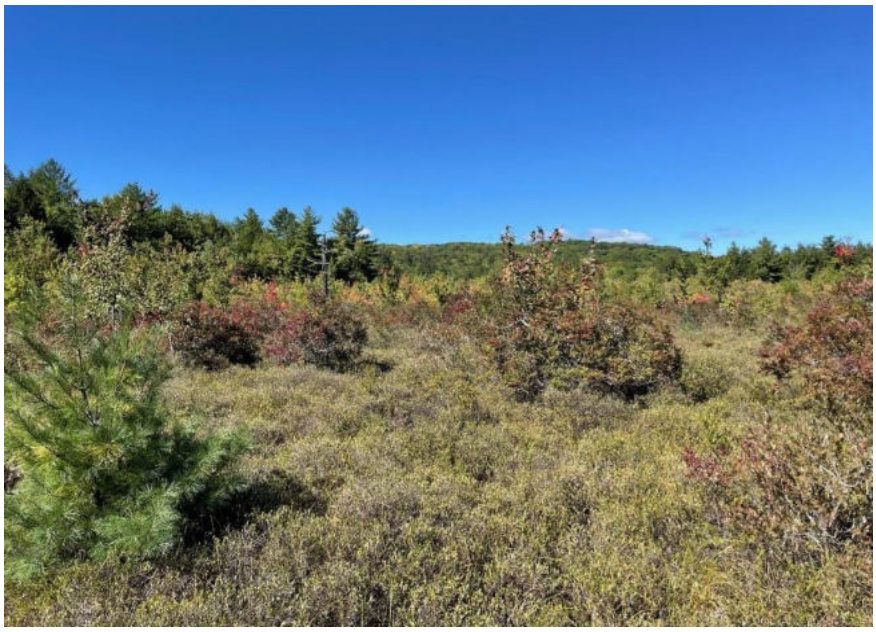
1. 3,182.15 acres of land under conservation easements including:
    a) 1,263.95 acres owned by Meadowsend Timberlands
    b) 252.65 acres that are part of the Ware Easements
    c) 413 acres that are part of the Bohanan Farm
2. 706.10 acres owned by the Town of Hopkinton with parcels located throughout town
3. 493 acres that are part of the Mast Yard State Forest
4. 463 acres that are part of the Samuel Myron Chase Wildlife Sanctuary

An additional 3,149.5 acres comprise the Hopkinton-Everett Flood Control Reservoir which is maintained as undeveloped land for flood control by the US Army Corp of Engineers.

View across Smith Pond Bog Wildlife Sanctuary which is owned by New Hampshire Audubon 60.36 acres is protected including a diversity of wetland types. Photo taken on 10-20-22.

The Hawthorne Town Forest in Hopkinton offers hiking and outdoor classroom opportunities. A forest management plan was completed for this property along with the Contoocook River, Brockway, Townes, Chase, Gould Forest, French, Foote, Aqueduct, Lewis, and Stevens Trail properties (Forest Resource Consultants, 1999). The timber cruise and management plan can be found at the link above and is on Hopkinton's Municipal website.

This expansive scrub shrub wetland is part of the 463.23-acre Samuel Myron Chase Wildlife Sanctuary off a Class VI New Road in Hopkinton. The diversity of habitat types – both wetland and upland – as well as the remote location make it excellent wildlife habitat. Two vernal pools as well as moose, deer, bear, coyote, fox, and several bird species were noted during the walk to and from the site.



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

Land Conservation

Consider updating the management plans for town owned properties. Additional things to consider in these management plans include:

- Inclusion of additional non-motorized recreation opportunities
- Protection of wildlife corridors
- Protection of sensitive areas including wetlands, streams, steep slopes and vernal pools
- Cooperation with agencies to determine eligibility for carbon offset programs, which can provide additional revenue for Hopkinton

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 for 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.

Four additional areas were highlighted for priority conservation efforts in the future. They are described in the Discussion – Future Actions and Opportunities section, and also shown on Map #10 at the end of this report. The Conservation Commission has a Conservation Fund with monies coming from land use change tax. This fund can facilitate land conservation projects.

Rivers, Streams, Lakes, and Ponds (Maps #3 and #4 at end of report)

There are 82.6 miles of perennial streams and rivers that flow through Hopkinton. The Contoocook River is the largest and flows for 11.79 miles through Contoocook Village. This river begins at the outlet of Poole Pond on the Jaffrey/Rindge border. It travels for 71 miles to Penacook, NH, where it enters the Merrimack River. Encompassing a drainage basin of 766 square miles, the Contoocook has a total drop of 700 feet. This river provides an excellent habitat for wildlife and fish species as well as serving recreational purposes. It is a Designated River in New Hampshire and part of the NH Rivers Management and Protection Program (NH DES, 2019). The NH Rivers Management and Protection Program is the partnership created between state government and local citizens through the formation of a Local River Management Advisory Committee (LAC) for each Designated River. The LAC for the Contoocook River is The Contoocook and North Branch Rivers (CNBRLAC) and can be found at www.cnbrlac.org. The Contoocook flows in a predominantly north, flowing NE through

Hopkinton. There are two covered bridges over the Contoocook in town: one in West Hopkinton Village, and the other in Contoocook Village.

One of two covered bridges over the Contoocook River in Hopkinton facing northeast / downstream. This bridge is the oldest extant covered railroad bridge in the country. Photo taken 10-20-22.

Contoocook River flows through Contoocook Village. Photo taken 10-20-2022.

Several rivers and stream tributaries enter the Contoocook River as it flows through Hopkinton including Hardy Spring Brook, Warner River, Blackwater River, Deer Meadow Brook, as well as several unnamed streams.

Dolf Brook flows through Hopkinton in a northeast direction. It begins in a wetland just north of Smith Pond Bog. Like the Contoocook River, it flows northeast through town for 4.65 miles before entering Concord. It enters the Contoocook River in Concord just upstream from Broad Cove Road.

Hardy Spring Brook flows for 4.68 miles in a southeast direction. Its headwaters are just north of Hopkinton, and it enters town flowing through the Bermuda / Harris Property which is under a conservation easement. It enters the Contoocook River just east of Route 89 near the Contoocook Village Center.

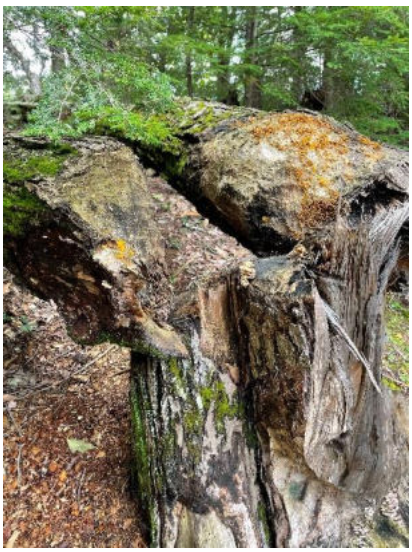
Hardy Spring Brook crossing Bound Tree Road. This photo shows an associated red maple floodplain area adjacent to the river. The other side of the road is predominantly eastern hemlock. Photo taken 10-20-22.

All perennial streams in Hopkinton not only have a variety of upland forest types, but they also have several wetland types associated with them. Beaver activities along streams are dynamic and ongoing. Beavers enhance the diversity of wildlife habitat and make these rivers and streams some of the most diverse river/wetland complex systems throughout town. There are many unnamed streams located throughout Hopkinton with high value habitat and excellent vegetative buffers. These areas provide high value plant and wildlife habitat and connectivity to forests, wetlands, and other habitat types.

Contoocook River

The Contoocook River is the largest river in Hopkinton and the most vulnerable to runoff, erosion, and pollution because it flows right through downtown. Wherever possible:

- Minimize impervious surfaces adjacent to the river
- Maintain and enhance native vegetative buffers
- Continue to test the water quality throughout the year



This beaver pond is part of Dolf Brook adjacent to the town's gravel pit. Although there was no fresh evidence of beaver, they have been here in the past, and this ponded area has been considerably larger. The felled logs (right photo) were taken down by beavers several years ago. Photos taken on 9-23-22.

Table1: List of Named Rivers and Streams in Hopkinton

River/Stream	Length in Hopkinton (miles)	Direction of flow	Watershed Area in Hopkinton (HUC 12)	River Confluences
Contoocook River	11.79	Northeast	Contoocook River Mouth Hopkinton Dam to Blackwater River Hopkinton Lake	Merrimack River in Boscawen
Blackwater River	1.6	Southeast	Lower Blackwater River	Contoocook River in NE Hopkinton
Warner River	1.5	South	Lower Warner River	Contoocook River in north-central Hopkinton
Hardy Spring Brook	4.68	Southeast	Hopkinton Dam to Blackwater River	Contoocook River in NW Hopkinton
Dolf Brook	4.65	Northeast	Contoocook River Mouth	Contoocook River in Concord
Boutwell Mill Brook	3.72	South to southeast	Turkey River	Beta Brook in Bow and then Turkey Pond in Concord

River/Stream	Length in Hopkinton (miles)	Direction of flow	Watershed Area in Hopkinton (HUC 12)	River Confluences
One Stack Brook	2.34	Southeast	Turkey River	Beta Brook in Bow (just upstream from Boutwell Mill Brook) and then Turkey Pond in Concord
Browns Brook	1.88	East	Lower Warner River	Warner River and then Contoocook River
Deer Meadow Brook	1.22	South	Black Water River	Contoocook River in the northeast part of Hopkinton

Lakes/Ponds – Hopkinton contains 1,492.61 acres of lakes, ponds and open water making up 5.2% of the town's area. The Hopkinton Everett Reservoir is the largest area of open water at 458.27 acres. It is owned by the United States Army Corp of Engineers and part of a flood control program. Construction of the Hopkinton Dam started in November 1959 and was completed in January 1963. "In addition to the protection of the Merrimack River Basin, Hopkinton Lake provides protection to downstream communities along the Contoocook River. The dam is an earth dam consisting of rolled earth fill with rock slope protection. It is approximately 79 feet long and 76 feet high" (USACOE, May 2021). Along with the dam there are a series of conduits and spillways, with the farthest spillway being located 1.8 miles east of the dam near Cressy Brook.

Clement Pond is the next largest pond at 111.73 acres. It contains a series of wetlands and beaver ponds to the north and south making it diverse with excellent wildlife habitat types. Hardy Spring Brook forms at the outlet of Clement Pond, flowing north and then southeast into the Contoocook River.

Drew Lake is 48.3 acres. It is part of the Hopkinton Everett Reservoir area, with the north side undeveloped and the south side with some development. It is a popular recreation area and fishing site.

Clement Pond is not heavily populated. There are diverse wetland types to the north and south of this pond. Photo taken 10-20-22 from Camp Merrimac Road facing north.

The habitat on the south side of Camp Merrimac Road contains excellent wildlife habitat including a forested, scrub-shrub, emergent and open water wetlands with a mature red oak and white pine upland island. The oaks are mature enough to produce a good acorn crop for wildlife. Photo taken on 10-20-22.

Drew Lake is at the southern end of the Hopkinton Everett Reservoir area, is relatively undeveloped and contains a diversity of habitat types around the lake. The inset photo shows button bush which was located near where this photo was taken on 9-24-22.

Grassy, Rolf and Kimball Ponds are all similar in size at 31.84, 28.85, and 27.32 acres respectively. Both Rolf and Kimball Ponds have some development around them, whereas Grassy Pond is relatively remote.

Kimball Pond (also known as Kimball Lake) looking across a shallow cove. Photo taken on 9-24-22.

Smith Pond Bog is a diverse hotspot for wildlife with several wetland and upland community types. The open water itself is a kettle hole formed by a retreating glacier. At the time of this NRI, the old trail heading west along the northern shore, had been flooded by beaver. There is a trail along the east side, which is overgrown, but leads to the scenic lookout shown above. Photo taken on 10-20-22.

Appendix C at the end of this report contains the most recent lake report for Clement Pond in Hopkinton, NH. From 2019-2021, volunteers collected water samples along the shore and in deep water areas through the Volunteer Lake Assessment Program. The New Hampshire Department of Environmental Services created the report.

Table 2: Description of Named Ponds in Hopkinton, New Hampshire

Lake/Pond Name	Acres	Location
Hopkinton Everett Reservoir	458.27	Western part of Hopkinton upstream from the Hopkinton Dam
Clement Pond	111.73	Northwestern Hopkinton
Grassy Pond	31.84	West of Clement Pond on town line with Henniker
Rolf Pond	28.85	Western Hopkinton, just south of Pine Street
Kimball Lake/Pond	27.32	Central Hopkinton between Main Street and Interstate 89
Whittier Pond	18.62	Eastern Hopkinton, just north of Route 202

Lake/Pond Name	Acres	Location
Smith Pond	7.87	Central Hopkinton between Smith Road and Old Henniker Road
Carr Pond	7.2	West central Hopkinton on the town line with Henniker and north of Kast Hill Road

There are several smaller unnamed ponds found in Hopkinton, most of which are dependent on beaver activities. These ponds can be any size from no open water to a ponded area of several acres. The size can vary year to year.

All rivers and water bodies offer wildlife and recreational value for Hopkinton and the entire region. Swimming, kayaking, canoeing, birdwatching, hiking, skiing, fishing and hunting are all common activities in Hopkinton. Tourism accounts for a large portion of income for New Hampshire and these water bodies are significant contributors.

Maintaining good water quality in Hopkinton's rivers, streams, lakes and ponds is important for ecological protection and recreational opportunities for residents and visitors.

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 town. Sub-watersheds do not stop at municipal boundaries. All things downstream are affected by land management upstream, particularly in the headwaters. The State of NH breaks down the watershed to the HUC 12 level, and most towns and cities contain more than one subwatershed determined by topography and ridgelines.

Hopkinton contains portions of 10 sub-watersheds when broken down to the level 12 hydrologic unit code (HUC) listings. The largest subwatershed in Hopkinton is Hopkinton Dam to Blackwater River Subwatershed which covers north central portions of town at 8,623.61 acres. It includes most of the Contoocook River in town along with Clement Pond, the west side of Gould Hill and the Hopkinton Dam. The Hopkinton-Everett Reservoir subwatershed is the next largest in Hopkinton covering 6,776.67 acres and flows across the southern and western part of town. This subwatershed includes all the Hopkinton-Everett Reservoir and surrounding areas and flows into the Contoocook River. The Contoocook River Mouth is the third largest at 5,606.39 acres and is in the northern and central parts of Hopkinton. It includes Kimball Pond to

the south, and Mast State Yard and the Contoocook River in the northeastern corner of Hopkinton.

All 10 of the subwatersheds in Hopkinton are part of a larger watershed area called the Merrimack River Watershed. A list of the subwatersheds in Hopkinton are shown and described in the following chart and table.

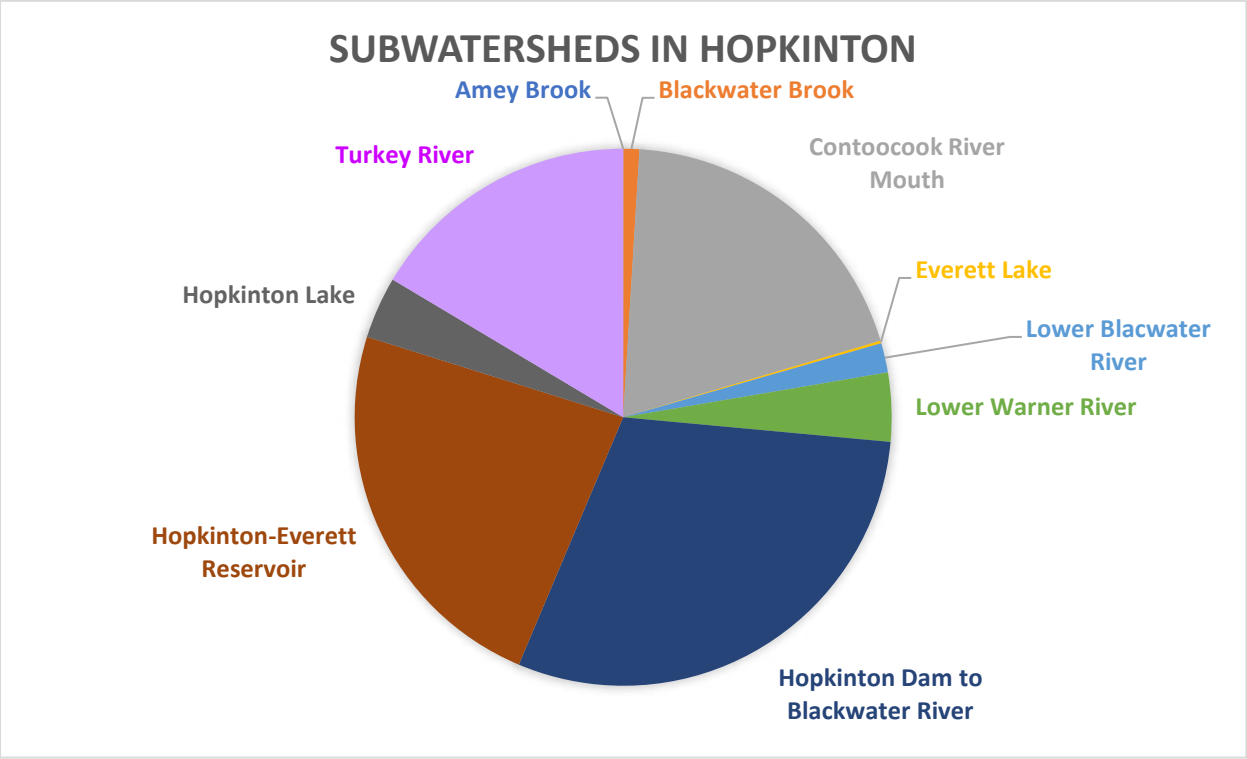


Table 3: List of Sub-watersheds in Hopkinton, NH

HUC 12 Name - Subwatershed	Acres in Hopkinton	General Location Description	HUC 6 Name – Larger Watershed Area	Acres in Hopkinton
Hopkinton Dam to the Blackwater River	8,623.61	Most of the northern half of town	Merrimack River	28,851.7
Hopkinton-Everett Reservoir	6,776.67	South and western		
Contoocook River Mouth	5,606.39	Northeast to central		
Turkey River	4,741.30	Southeastern portion and corner of town		
Lower Warner River	1,194.59	North central and along the town line		
Hopkinton Lake	1,741.30	West central		
Lower Blackwater River	510.29	Northeast part of town just east of Lower Warner River watershed		
Blackwater River	276.46	Northeast corner of town just east of Lower Blackwater River watershed		
Everett Lake	45.30	Small area on the south-central town line		
Amey Brook	2.70	Less than 3 acres in the northwest corner of town		

Riparian Zones and Floodplains

A riparian zone or riparian area is the interface between land and a stream or river. Riparian zones are important habitats 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.

They are important travel corridors for many wildlife species as well as valuable habitat for frogs, turtles, snakes, minks, otters, and birds. Riparian habitats moderate stream flow, stabilize riverbanks, and provide shade to stabilize soil and water temperatures. 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 often support rich, diverse ecosystems. Hopkinton contains a diverse amount of riparian and floodplain areas.

Floodplains are very fertile agricultural areas, especially along larger rivers. The floodplains along the Contoocook River contain fertile areas and have a long history of farming. Many of these farms continue today. There are smaller although equally fertile floodplain areas along some of the smaller rivers and streams including Warner River, Blackwater River, Dolf Brook, Boutwell Mill Brook, and Browns Brook. Floods carry nutrient-rich sediment and distribute it across a wide area. Although some portions of Hopkinton's riparian areas and floodplains have been impacted by development, most areas have not, and there are a few opportunities for maintenance of adjacent riparian habitat and creation of additional buffers.

Small floodplain, riparian area and red maple swamp along Dolf Brook. Riparian areas like this one moderate stream flow, stabilize riverbanks, and provide shade to stabilize soil and water temperatures. Riparian areas are especially valuable habitat for many wildlife species including frogs, turtles, snakes, minks, otters, and birds. Riparian areas also function as travel corridors for animals moving from one habitat to another. Photo taken on 9-23-22.

Mature Silver Maple floodplain habitat along the Contoocook River in Hopkinton. The fine soils are replenished during floods and are well drained with lots of nutrients. Other species common in this type of floodplain include sensitive fern, ostrich fern, joe pye weed, wood nettle, and devil's beggarticks. Photo taken on 9-24-22.

Floodplains and riparian areas are home to a diversity of wildlife. The rich soils create excellent insect and amphibian breeding habitats, and these species in turn become prey for birds such as woodcock and barred owl, for mammals such as mink and raccoon, and for reptiles such as smooth green snake and wood turtle. These corridors allow wildlife to move from one habitat to another. 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. 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 and subsequent sediment accumulation that the constant moving water and flooding situations can cause. Riparian habitats also slow and hold floodwaters reducing shoreline damage and can work as a filtration system removing nutrients and toxins from the water and assisting in maintenance of water quality. Riparian vegetation can also provide habitat structure to aquatic systems through dead or broken limbs and whole trees that fall into the water.

Timber Harvest in Riparian Habitat

Logging forested riparian areas is generally not recommended due to proximity to the rivers and wetlands. If timber is harvested in these areas, it should occur during the winter months when the ground is completely frozen.

Riparian Habitat Conservation

Conserving or expanding riparian areas and shoreland buffers is a vital part of conserving Hopkinton's natural resources. Adherence to New Hampshire's Shoreland Protection Program will help maintain existing riparian habitat, provide wildlife travel corridors and maintain good water quality.

Click here for more information on the NH Shoreland Protection Program including several fact sheets.

This well buffered riparian habitat along Deer Meadow Brook contains a combination of eastern hemlock, red maple, white pine, and speckled alder. It not only provides excellent habitat, but also is close to a dense softwood stand just north of Hopkinton, which is important winter habitat. Photo taken on 9-23-22.

Despite flowing right through Contoocook Village in Hopkinton, the Contoocook River still contains adequate vegetative buffers in most locations.

Wetlands and Hydric Soils (Maps #4 at end of report)

Wetlands are an essential habitat type for most plant and animal species in New Hampshire. 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 Palustrine[3] wetlands: forested, scrub shrub, emergent (wet meadow), and open water, with additional subtypes within each of these categories. This diversity extends into each individual wetland where a variety of plant/wildlife species and water regimes co-exist. In addition, the edge habitats within and around wetlands are frequently used by many 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 50% of local species.*** For these reasons wetlands provide plentiful wildlife habitat, viewing and hunting opportunities.

This kettle hole is a quaking bog filled with cotton grass and sphagnum moss, and it is surrounded by high bush blueberry and eastern hemlock. Quaking bogs contain peat and sphagnum moss mats which tremble underfoot as they are essentially floating. Photo taken 9-23-22.

[3] 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.

A diverse wetland located between Hopkinton Road and Maple Street. The open area is mostly an emergent wetland with open water. Scrub shrub and forested wetlands are around the edges, followed by upland habitats. There is an unnamed perennial stream flowing through this wetland as well as fresh beaver activity. Photo taken 9-24-22.

Overview of Smith Bog Pond showing a diversity of wetlands as well as an excellent viewpoint just east of the wetland area. Photo taken on 10-20-22.

Beaver have impacted this former boardwalk along the northern part of Smith Bog Pond. This portion of the trail system should be removed and the trail system along the eastern boundary of the wetland, which contains upland areas and scenic overlooks, should be enhanced. Photo taken 9-23-22.

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 store significant amounts of flood and/or run-off water, minimizing serious damage in times of high water. Wetlands are important contributors to groundwater recharge. This ability to retain water allows wetlands to act as filters. As moving water is slowed and stored in wetlands, suspended sediments and particles settle to the mucky substrate, giving plant roots a chance to absorb excess nutrients, toxins, 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 over time, submerged plants appear. Floating-leafed plants, such as water lilies, eventually follow. Then emergent plants such as reeds, sedges, and wetland grasses begin to flourish. Shrubs such as high bush cranberry (*Viburnum trilobum*), sweet gale (*Myrica gale*), mountain holly (*Ilex mucronate*), 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 including red maple (*Acer rubrum*),

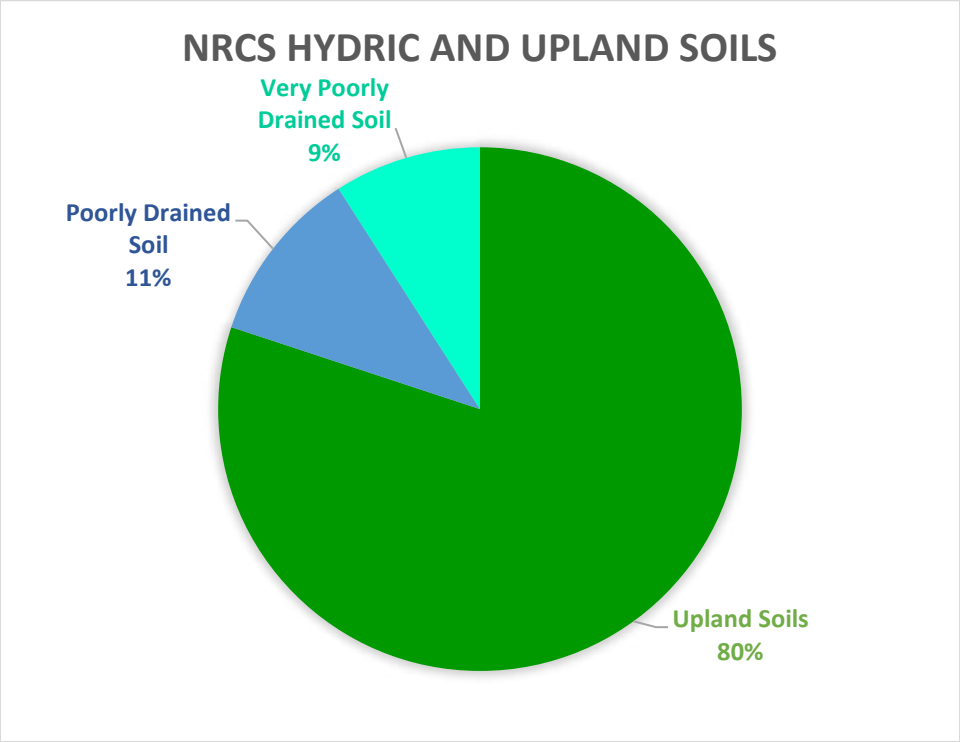
gray birch (*Betula populifolia*), and larch (*Larix laricina*) subsequently emerge. This natural successional process is often referred to as lakefill.

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

- 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 beavers as hardwood saplings regenerate in early succession. In Hopkinton there is fresh sign of beaver activities in most of the wetland complexes throughout the town.
- Human activities such as logging and landscape alteration can dredge out wetland areas or increase the amount of runoff into wetlands.

Left Photo: 2003 aerial photo of a wetland in Hopkinton. At the time of this photo, there were no open water areas indicating the beaver were not living there and maintaining the dams. The area is predominantly emergent wetland.
Right Photo: Recent aerial photo (7-8-2019) taken from Google Earth of the same wetland. The presence or absence of beaver living in this area will dictate the amount of open water. This wetland is not conserved but is an excellent wildlife habitat and considered a hotspot. Beaver activities can dramatically change the look and hydrology of wetlands and are impressive engineers.

Hopkinton contains over 2,883.95 acres of wetlands (10% of town). They range in size from less than an acre to several hundred acres and contain a variety of wetland habitats including forested, scrub shrub, emergent, riverine, and open water wetlands. Most wetlands mapped in Hopkinton have been obtained from the U.S. Fish and Wildlife Service's National Wetland Inventory. By examining the 2015 aerial photographs, Elise digitized 61 additional wetland areas for this study.



Wetland Protection

Recommendations:

- Continue to prioritize good water quality, working to conserve and maintain all types of wetlands throughout the town. Emphasis should be placed on wetlands outside of conserved lands that are important linkages for wildlife.
- Continue to work towards the revision of the Conservation District Overlay to add protective buffers to wetlands in town.

Of the hydric soils mapped throughout Hopkinton, 3,130.25 acres are classified as poorly drained and 2,620.49 acres are very poorly drained – for a total of 5,750.74 (20%) hydric soils throughout Hopkinton. Poorly drained soils are defined as soils where water is 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 Town with some of the larger areas listed below. There are generally fewer wetlands in the hilly or mountainous parts of town (near Gould, Rattlesnake, and Putney Hills). On the other hand, in flatter sections near ponds, reservoirs, and drainages, there are larger areas of very poorly drained soil. The largest wetland areas are found along the Hopkinton-Everett Reservoir and associated drainages, containing a combination of forested, scrub shrub, and emergent wetlands. Other large wetland areas

are found in wide valleys associated with One Stack Brook and Boutwell Mill Brook in the southeastern part of Hopkinton.

This flat wetland area is associated with Dolf Brook. It contains very poorly drained soil called Chocorua Mucky Peat as well as poorly drained soil called Moosilauke Fine Sandy Loam, both common hydric soils in New Hampshire. Photo taken 9-23-22.

This scrub shrub wetland is in the southern part of town off of New Road (a class VI road). The predominant vegetation here includes leather leaf, wild raisin, red maple, sphagnum moss, willow, and twinberry honeysuckle. Soil here is classified as very poorly drained Chocorua Mucky Peat. Photo taken on 9-24-22.

Vernal Pools – Despite field work not occurring during ideal vernal pool inventory season (April-June), five (5) vernal pools were documented in Hopkinton for this NRI. Undoubtedly there are many more throughout town. ***We recommend continuing to build upon this database as new vernal pools are discovered in town***. Vernal pools are unique, often isolated and important wetland types. Vernal pools provide essential breeding habitat for certain amphibians and invertebrates such as wood frogs (*Rana sylvatica*), spring peepers (*Pseudacris crucifer*), yellow spotted salamanders (*Ambystoma maculatum*), 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 painted turtles (*Chrysemys picta*) also rely on vernal pools as important feeding areas in early spring. Vernal pools fill annually from precipitation, runoff, and rising groundwater in the fall and spring. By mid-summer, however, these wetlands are typically dry, making them a dynamic system inhabitable to many species except for 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 gives them special attention. Refer to Map #4 – *Wetlands and Water Resources* - at the end of the report for locations of known vernal pools throughout Hopkinton. A description of vernal pools documented during this study is shown in the table below.

Vernal Pool Number	Location/Description	Probable or Confirmed	Date
VP01	North shore of Smith Bog Pond. Created or enhanced by beaver activities. Within the wetland area. Forested wetland	Probable	9-23-22
VP02	Mast Yard State Forest. 100’ x 100’. Dry, but evidence that it holds enough water to support VP species. Red maple and red oak	Confirmed by fingernail clams and hydrology	9-23-22
VP03	West of town-owned transfer station. Adjacent to Deer Meadow Brook in a hemlock forest	Probable	9-23-22
VP04	Off Class VI Irish Hill Road. 50’ x 100’ sinuous and well buffered in a mixedwood forest.	Confirmed by hydrology and presence of adult wood frog	9-24-22
VP05	Off Class VI Irish Hill Road. 50’ diameter. In a natural bowl in hemlock forest adjacent to large scrub shrub wetland.	Probable due to hydrology and topography.	9-24-22

A vernal pool in Hopkinton in Mast Yard State Forest. When this photo was taken (9-23-22), the vernal pool was dry, but soil saturated to the surface. The color of the leaves, soil and natural depression indicate that it fills with water annually. The presence of fingernail clams under the leaves indicate that it holds enough water from April to June to support obligate vernal pool species. This vernal pool is circular in shape and approximately 100 feet in diameter. It is well-buffered with red maple and red oak.

The above vernal pool was confirmed with the observation of an adult wood frog. It is located along Class VI New Road and is approximately 50 feet by 100 feet, although quite sinuous with little hummock islands. It is well buffered in a mixedwood forest with yellow birch, white pine, red maple, balsam fir, beech high bush blueberries, royal fern, sensitive fern, beech fern, sedges and many fallen logs. Photo taken 9-24-22.

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

Geologic events that occurred thousands and millions of years ago still influence the management of forests today. Parent bedrock material provides the nutrients for vegetation today and, to some extent, determine which species will grow where in the forest. The last glacier broke apart, transported, and deposited the material in a way that has an even stronger influence on what species will grow where in the forest. The glacier also had an influence on the soil and forest types that are seen today.

Most of the geologic types in Hopkinton are plutonic and associated volcanic rocks. When magma never reaches the Earth's surface and cools to form intrusions, the resulting rocks are called plutonic. These include granite, granodiorite, and diorite rocks which are found throughout NH. When the magma does reach the surface during a volcanic eruption, the rocks that form there are called volcanic rocks (examples in NH are rhyolite rocks). There are large areas of plutonic rocks throughout town including Spaulding Tonalite, Kinsman Granodiorite, and Concord Granite. The Spaulding Tonalite is the largest plutonic feature. It runs north/south through the middle of Hopkinton at 11,351.5 acres. The next largest is Kinsman Granodiorite (5,011.1 acres), also Plutonic and found east of Spaulding Tonalite and running in a similar direction. Granite and Quartz Diorite are the two most common igneous rocks. Granite is a coarse-grained, light-colored igneous rock composed mainly of feldspars and quartz; it also contains minor amounts of mica and amphibole minerals. Coarse-grained Quartz Diorite is slightly different with a composition between granite and basalt.

There are some large areas, particularly in southern Hopkinton, that contain a metamorphic rock. These are the Smith Falls Formation, the upper and lower parts of the Rangeley Formation and the Perry Mountain Formations. Smith Falls Formation is the largest of the metamorphic rock features at 4,103.1 acres. It is found in the southern and eastern half of Hopkinton. Metamorphic rock includes Schist and Quartzite. Schist is a metamorphic rock that can be formed from basalt (igneous rock), shale (sedimentary rock) or slate (metamorphic rock). This type of rock is formed through tremendous heat and pressure. Schist has wavy layers of minerals and breaks easily. Schist is used as a building stone in construction. Quartzite is a metamorphic rock composed almost entirely of quartz. It forms when a quartz-rich sandstone is altered by the heat, pressure, and chemical activity of metamorphism.

The bedrock and resultant soil formed during past geologic periods together with the transport and deposition of this material by the glacier is a strong influence on the trees, shrubs and herbaceous vegetation that grows on the forest. The bedrock geology map attached at the end of this report, was done at a coarse scale without field verification. Future detailed studies can be completed to refine and give a more detailed view of geology throughout Hopkinton.

Soils

Similar to bedrock geology, 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, 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 types of vegetation that the area will support. Because soils affect the vegetation that will grow in an area, they also influence the habitat types and therefore the wildlife species dwelling there. Understanding soil conditions and characteristics can help in identifying 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, sand and gravel production, 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.

Farmland Soils (Map #7 at the end of report)

As is true with many New England towns and cities, Hopkinton had family farms in the 1800's and early 1900s. Many of the farms in the past and today are found near the Contoocook River where the soils are fertile and less stony.

Overall, New Hampshire has experienced a loss of working farms. Many of the former, larger-scale farms have been replaced with smaller farms offering a wide range of products throughout Town, including dairy, vegetable, berry, equestrian, and tree farms. Fortunately, Hopkinton contains a variety of working farms including:

- Beech Hill Farm
- Breakwind Farm on Maple Street
- Gould Hill Farm on Gould Hill Road
- Stonynook Farm on Emerson Hill Road
- Dawn-Mar Ranch – Merrimack Valley Equestrian Special Olympics, Easy Riders 4-H, and Changing Lives Equine Center
- Houston's Pine Lane Farm – dairy farm on Main Street
- Crow Valley Farm – maple syrup and Christmas tree farm on Hopkinton Road
- Work Song Farm – certified organic CSA farm on Beech Hill Road
- Contoocook Alpaca Farm on Gould Hill Road
- Contoocook Creamery at Bohanan Farm on Penacook Road – a five generation dairy farm
- Terra Organics on Blackwater River offering vegetable CSA

- Owen Farm – a family and educational learning farm on Brockway Road
- Dearborn Tree Farm on Hopkinton Rd. between Contoocook and Hopkinton Villages
- Harvest Moon Farm – MRF Dressage; a horse boarding, lesson and training facility on Hatfield Road
- Grounding Stone Farm – organic blueberry farm on Maple Street

In the survey for the latest Master Plan for Hopkinton, residents were asked what businesses or services they would like to see more of in Hopkinton, results showed that 83% of people who completed the survey believe that farms and agricultural businesses are considered one of the most desirable businesses (Hopkinton Master Plan, 2022).

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 28,851.7 acres of land within Hopkinton, the NRCS has classified 19,152.84 acres (66.4%) as farmland with 1,810.62 acres (6.3%) of land classified as USDA prime farmland soils, 2,717.5 acres (9.4%) classified as farmland soils of statewide importance, and 14,624.7 acres (50.7%) classified as farmland soils of local importance. Although farmland soils are found throughout town, the majority of prime farmland is scattered through the middle of Hopkinton and associated with the Contoocook River area. Generally, where there are steeper slopes (hills and mountains in town), there is less agricultural soil.

Wildlife Fields

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.

Former and active landings such as this one in Mast Yard State Forest, are easily maintained and are an excellent permanent opening for wildlife habitat. Photo taken 9-23-22.

This field on Penacook Road and adjacent to the Contoocook River is classified as Prime Farmland. Photo taken on 9-24-22.

The many stone walls in Hopkinton indicate farming occurred here. The upland sections of this parcel are classified as locally important farmland. Although this area has not been a field for many years, the mature, healthy mixedwood forest indicates good soil quality for vegetation growth. Several mature, mast-producing red oaks were observed. Photo taken 9-24-22.

Forestry Soil Groups (Map #8 at the end of report)

New Hampshire soils are complex and highly variable primarily due to their glacial origins. The Natural Resources Conservation Service (NRCS) has organized the soils into Important Forest Soil Groups like the work they have done with farmland soils described in the previous section. The objective is to offer a simplified tool to aid natural resource professionals and landowners. These groupings allow managers to evaluate the relative productivity of soils and to better understand patterns of plant succession and how soil and site interactions influence management decisions. All soils have been grouped into one of six categories, as described below (UNH Extension, 2023). Map #8 at the end of the report displays the forest soil classifications.

Group IA consists of the deeper, loamy, moderately well-drained and well-drained soils. Generally, these soils are more fertile and have the most favorable soil-moisture conditions. Successional trends are toward climax stands of shade-tolerant hardwoods such as sugar maple and beech. Early successional stands frequently contain a variety of hardwoods such as sugar maple, beech, red maple, birch (yellow, gray, and white), aspen, white ash and northern red oak in varying combinations with red and white spruce, balsam fir, hemlock, and white pine. The soils in this group are well-suited for growing high-quality hardwood veneer and sawtimber, especially sugar maple, white ash, yellow birch, and northern red oak. Softwoods are usually less abundant and are best managed as a minor component of predominantly

hardwood stands. Hardwood competition is severe on these soils. Successful natural regeneration of softwoods and the establishment of softwood plantations requires intensive management.

Group IB generally consists of soils that are moderately well-drained and well-drained, sandy or loamy-over-sandy, and slightly less fertile than those in group 1A. Soil moisture is adequate for good tree growth but may not be quite as abundant as in group 1A. Successional trends and the trees common in early successional stands are similar to those in group IA; however, beech is usually more abundant in group IB and is the dominant species in climax stands. Group IB soils are well-suited for growing less-nutrient-and-moisture-demanding hardwoods such as white birch and northern red oak. Softwoods generally are scarce to moderately abundant and managed in groups or as part of a mixed stand. Hardwood competition is moderate to severe on these soils. Successful regeneration of softwoods and the establishment of softwood plantations are dependent upon intensive management. The deeper, coarser-textured and better-drained soils in this group are generally suitable for conversion to intensive softwood production.

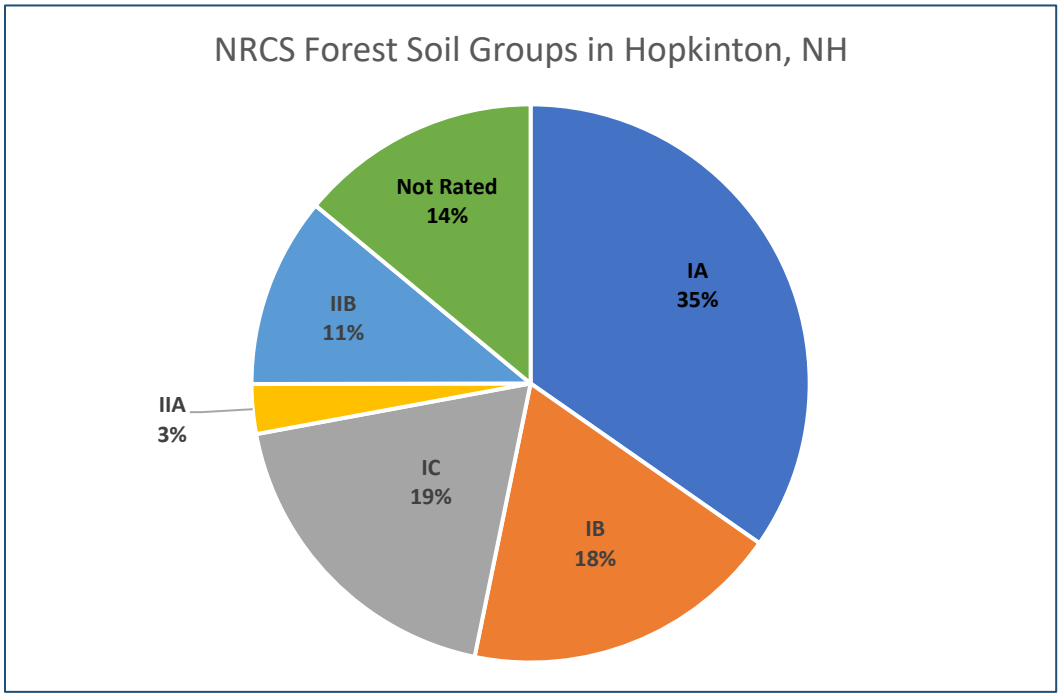
Group IC soils are derived from glacial outwash sand and gravel. The soils are coarse-textured. Soil moisture and fertility are adequate for good softwood growth but are limiting for hardwoods. Successional trends on these soils are toward stands of shade-tolerant softwoods, such as hemlock. White pine, northern red oak, red maple, aspen, gray birch, and paper birch are common in early successional stands. These soils are well-suited for high quality softwood sawtimber, especially white pine, in nearly pure stands. Less site-demanding hardwoods such as northern red oak and white birch have fair to good growth on sites where soil moisture is more abundant. Hardwood competition is moderate to slight. With modest levels of management, white pine can be maintained and reproduced. Although chemical control of woody and herbaceous vegetation may be desirable in some situations, softwood production is possible without it.

Group IIA consists of diverse soils and includes many of the soils that are in groups IA and IB. The soils in IIA, however, have limitations such as steep slopes, bedrock outcrops, erodibility, surface boulders, and extreme stoniness. Productivity of these soils isn't greatly affected by those limitations, but management activities such as tree planting, thinning, and harvesting are more difficult and more costly.

Group IIB soils are poorly drained. The seasonal high-water table is generally at a depth of 12 inches or less. Productivity is lower than in IA, IB, or IC. Fertility is adequate for softwoods but is limited for hardwoods. Successional trends are toward climax stands of shade-tolerant softwoods, such as hemlock. Early successional stands frequently contain a variety of hardwoods such as red maple, birch (yellow, gray, and paper), aspen, and white and black ash in varying mixtures with red spruce, hemlock, balsam fir, and white pine. Advanced regeneration is usually adequate to fully stock a stand. Hardwood competition isn't usually a

major limitation, but intensive management by chemical control of competing woody and herbaceous vegetation may be desirable.

Not Rated Several mapping units in New Hampshire are either so variable or have such a limited potential for commercial production of forest products that they haven't been placed in a group. Examples are very poorly drained soils and soils at high elevations.



Stratified-Drift Aquifers (Maps #4 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. 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. Areas of more porous sand and gravel will allow infiltration, and are known as "recharge zones," signifying their importance in replenishing groundwater reservoirs.

Stratified-drift aquifers are an important source of groundwater for commercial, industrial, domestic, and public-water supplies in the state. They typically are the most productive sources of groundwater; therefore, the highest 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 Hopkinton 7,272.87acres (25.2%) of the land area contains an aquifer. The largest contiguous aquifer is in the northern half of Hopkinton. It is associated with the Contoocook River, its tributaries, including Dolf Brook and Kimball Pond. Most areas of the aquifer have a transmissivity of less than 2,000 square feet per day with some areas close to the Contoocook River, Blackwater River, and Dolf Brook having transmissivity rates between 2,000 and 4,000 and even over 4,000 square feet per day. These smaller areas within the larger aquifer areas are excellent water sources.

Aquifers

The largest contiguous aquifer is in the northern half of Hopkinton. It is associated with the Contoocook River and its tributaries including Dolf Brook and Kimball Pond.

Aquifers provide many residents with drinking water and are important water sources for use in the future. It is recommended that these aquifers be protected from contamination from impervious surfaces, point and non-point source pollution sources, and development to ensure their future water quality and availability for the town.

The aquifer under and around Kimball Pond has some of the highest water transmissivity in the town. Photo taken 9-24-22.

Stratified drift aquifers consisting of sand materials, such as those in Hopkinton, tend to be more porous and have a higher potential for quicker transmissivity and recharge. This also raises the risk of contamination and requires a region-wide approach that entails working with neighboring towns.

Slope (Map #7 at the end of this report)

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 amount of

surface water runoff is higher, and the erosion potential is greater compared to 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.

Steep slopes provide opportunities for panoramic views and, for this reason, tend to be sought for residential development. However, there are significant problems associated with development on steep slopes. 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 capability of the land, and in severe cases, visual scars that can be seen from far away. 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.

NRCS soil data was used to determine areas in Hopkinton with slopes equal to and greater than 20%. Using NRCS data, 4,219.32 acres or 14.6% of the land in Hopkinton contains slopes that are 20% and over. Of that nearly 840 acres or about 2.9% of Hopkinton's land mass contains slopes over 30%. Although steep slopes are scattered throughout town, some of the steepest include Rattlesnake Hill, Gould Hill, Clement Hill, and several hills in the southwest corner of Hopkinton.

View towards Gould Hill in Hopkinton. It has a very steep slope ranging from 30 to 48%. Photo taken on 9-24-22. Views from the top of hillsides such as this offer panoramic views.

Rare Species and Exemplary Natural Communities

The Town of Hopkinton has documented occurrences of rare species and communities. They are listed by the NH Natural Heritage Bureau (NHB), the state agency that houses reported occurrences.

New Hampshire is home to more than 500 species of vertebrate animals. Many of these animals live in Hopkinton 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. Thirty species are endangered and 21 are threatened in the state. The New Hampshire Fish and Game Department maintains lists of Endangered or Threatened animal species in New Hampshire (https://www.wildlife.state.nh.us/nongame/endangered-list.html). Minimal information is available relative to their occurrence in Hopkinton, but their habitats, when identified, should be protected.

Hopkinton has large tracts of land that are unfragmented, with many areas being conserved. These contain a diversity of habitat types and, thus, Hopkinton has the potential for containing many rare and endangered plant and wildlife species, beyond those currently recorded in the town.

Left Photo: Bald Eagle nesting in Hopkinton according to the NH Audubon Society. Photo taken by Donna Ellis.

Right Photo: There have been 4 documented reports of Blanding's Turtles in Hopkinton. It is classified as endangered in NH, but Hopkinton offers excellent habitat for this species. Blanding's turtles require large intact landscapes consisting of a diversity of wetland types and sizes, sandy open areas for nesting, and limited human disturbance. Marshes and scrub/shrub wetlands, vernal pools, floodplains, peatlands and temperate swamps are their preferred aquatic habitats. Photo credit: UNH Cooperative Extension.

Chestnut Trees were once massive and common from Maine to Georgia. A chestnut blight fungus called *Cryphonectria parasitica*, killed mature trees, and they no longer dominate our forests. This American Chestnut photo was taken by Cooper Kimball-Rines. This tree is located near the corner of Beech Hill and Currier Roads. It is producing chestnuts.

Photo taken by Bonnie Christie 10-16-22 showing a chestnut still on the tree. She noted several chestnuts on the ground. The American Chestnut Foundation is creating and planting several of these trees that are genetically resistant to the blight.

NH Natural Heritage Bureau Listing for Hopkinton

NH Natural Heritage Bureau

Town Flag	Species or Community Name	Listed? US	Listed? NH	~ reports last 20 yrs Town	~ reports last 20 yrs State
Hopkinton					
	Natural Communities - Terrestrial				
*	- *Chestnut oak forest/woodland*	--	--	1	5
~	- *Hemlock - beech - oak - pine forest*	--	--	Historical	11
~	- *Hemlock forest*	--	--	Historical	4
	Natural Communities - Palustrine				
**	- *Medium level fen system*	--	--	1	51
~	- *Temperate minor river floodplain system*	--	--	Historical	7
	Plants				
~	giant rhododendron - *Rhododendron maximum*	--	T	Historical	13
~	wild lupine - *Lupinus perennis* ssp. *perennis*	--	T	Historical	30
	Vertebrates - Birds				
**	Bald Eagle - *Haliaeetus leucocephalus*	T	SC	1	140
**	Common Loon - *Gavia immer*	--	T	1	339
**	Eastern Meadowlark - *Sturnella magna*	--	T	1	28
~	Marsh Wren - *Cistothorus palustris*	--	--	Historical	37
~	Purple Martin - *Progne subis*	--	T	Historical	22
	Vertebrates - Reptiles				
***	Blanding's Turtle - *Emydoidea blandingii*	--	E	4	1098
**	Northern Black Racer - *Coluber constrictor constrictor*	--	T	5	70
**	Smooth Green Snake - *Opheodrys vernalis*	--	SC	1	85
**	Spotted Turtle - *Clemmys guttata*	--	T	2	165
***	Wood Turtle - *Glyptemys insculpta*	--	SC	9	281
	Vertebrates - Fish				
**	American Eel - *Anguilla rostrata*	--	SC	1	177
	Invertebrates - Dragonflies & Damselflies				
***	Pygmy Snaketail - *Ophiogomphus howei*	--	--	1	8
***	Skillet Clubtail - *Gomphus ventricosus*	--	SC	1	7
	Invertebrates - Mollusks				
~	Brook Floater - *Alasmidonta varicosa*	--	E	Historical	33

Listed? E = Endangered T = Threatened SC = Special concern

Flags
**** = Highest importance
*** = Extremely high importance
** = Very high importance
* = High importance
~ = Historical Record

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 town. Please contact the Natural Heritage Bureau at (603) 271-2215 to learn more about approaches to setting priorities.

May 2022

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 at 603-271-2214. Website: https://www.nh.gov/nhdfl/about-us/natural-heritage-bureau.htm.

Wildlife Action Plan (Maps #2 and #9)

The New Hampshire Fish and Game Department worked together with many partners in the conservation community to create New Hampshire's 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 states that the Wildlife Action Plan is 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. It was then revised in 2015.

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.

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: https://wildlife.state.nh.us/wildlife/wap.html. The plan and associated maps can be downloaded and viewed. Fish and Game keeps record of updates and ways the WAP is being used and updated. There is also an opportunity to sign up for regular WAP e-mails.

NH WAP High Priority Areas

Hopkinton contains several areas classified as "Highest Ranked Habitat in NH" as well as "Highest Ranked Habitat in the Biological Region". Areas with both classifications include the following:

- Along most of the Contoocook River as it flows through Hopkinton. Some of these areas are conserved by or are under the control of the Town of Hopkinton, private conservation easements, and the USACE Hopkinton-Everett Flood Control Reservoir.
- A large section in northeastern Hopkinton including Mast Yard State Forest and a large area south of the state forest between Broad Cove, Briar Hill and Patch Roads.
- Two large areas south of Route 89 between Jewett and Drew Roads. Much of these areas are under private conservation easements.
- Sections in the southwest corner of town. Many of these areas are also conserved privately or owned by the Town of Hopkinton.
- An area in the northwest corner of Hopkinton NW of Clement Pond and north of Grassy Pond.

Scenic Resources

With a hilly topography, ponds, rivers, and wetlands, Hopkinton has many scenic views and viewsheds throughout the entire town. Most areas offer scenic views overlooking rivers, streams, lakes, ponds, and hillsides across valleys. Almost every road in Hopkinton is scenic. A list of designated scenic roads includes:

- Clement Hill Rd.
- Hatfield Rd.
- Pet Dow Rd.
- Morgan Rd.
- College Hill Rd.
- Thain Rd.
- Patch Rd.
- Beech Rd. (the northern section)
- Barton Corner Rd.
- Brockway Rd.
- Hooksett Tpke.
- Old Putney Hill Rd.

Scenic View across the northern part of Drew Lake towards Irish Hill. Views like this one are found throughout town across fields, rivers, lakes and ponds. Photo taken 9-24-22.

In addition to views across ponds, lakes and rivers, excellent views can be found across fields and permanent wildlife openings. People experience scenic views in all directions while driving, biking or walking along the roads in the town, particularly where fields and permanent wildlife openings are maintained. ***Continuing to maintain permanent wildlife openings will retain these outstanding views throughout Hopkinton.***

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 tops

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.

The Contoocook River is a Designated Protected River. View from the bridge in Hopkinton's village of Contoocook. Photo taken 10-20-22.

Maintaining fields such as this one along Briar Hill Road, offers views of the beaver pond and wetland in the valley and Gould Hill across the valley. Photo taken on 9-23-22.

Cultural Resources

The Town of Hopkinton has an exceptionally rich history of land use changes and cultural features from when Indigenous people first lived with the land, to the first settlements, to current times. Many of these historic and cultural features can be seen at:

1. The three villages – Hopkinton, Contoocook, and West Hopkinton
2. Two covered bridges – Rowell Bridge and Hopkinton Railroad Covered Bridge
3. Several town-owned and private cemeteries throughout town
4. Along trails on town-owned property
5. Snowmachine trails
6. Old railroad trails through town
7. Many rural, Class VI roads

In Hopkinton, the Abenaki called their ancestral homeland N'dakinna. Land and resources were not owned, but intrinsic to the Abenaki's existence and spiritual beliefs. They relied on the fertile soils and forests along the Contoocook River for farming, fishing, hunting, making tools, creating art, and building homes. Abenaki settlements dotted the landscape, and their cultural traditions were woven into the fabric of the region. Although the original villages of the Abenaki disappeared into the landscape long ago, their culture is kept alive by today's members of the Coosuk Band of Nulhegan Abenaki Nation.

European settlers and later entrepreneurs were drawn to Hopkinton in the 17th century due to its forested landscape topography, the Contoocook River, and farming and timber opportunities. Construction of the railroad made Hopkinton a hub for new residents and visitors to the area. Hopkinton was, and still is, a land of abundant opportunity thanks to its natural resources.

Along the main streets in the three villages of Hopkinton there are several historical buildings and homes. They offer a window into Hopkinton's history and are very attractive along the main streets. The 2012 Master Plan has a comprehensive list of historical and cultural resources in town as well as recommendations to maintain them (Town of Hopkinton, 2002 with 2012 revision).

Mural called "*A Celebration of the Matriarchs of Dawnland*" created by Artist Charlie Adams.
Photo taken by Sherry Gould, Nulhegan Band of the Coosuk Abenaki Nation.

There are many stone walls in the Hawthorne Town Forest in Hopkinton. They are evidence of land clearing for farming and often along property boundaries. Photo taken 10-20-22.

The Rowell Covered Bridge in Hopkinton. Photo by Sillman Rogers.

This covered bridge in Hopkinton's Contoocook Village is the oldest surviving covered railroad bridge in the country. Photo taken 10-20-22.

Invasive Plant Species

There continues to be an increase in public awareness and concern about the rapid spread 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 and old gravel pits. They can also be found at old farm sites where people have planted various fruit and ornamental plants for agricultural purposes.

Invasive species were documented during field work for this NRI as well as reports sent in from several residents of Hopkinton. Those documented and links to eradication methods are shown in the table below.

Species	Eradication Methods (sources: USDA Forest Service, 2007, UNH Cooperative Extension, 2018, NH Division of Forests and Lands, 2012, and NH Department Environmental Services, 2019)
Japanese Knotweed (*Polygonum cuspidatum*) Located throughout town	• Repeated cutting several times (4-6) during growing season leaving cut plants onsite • Or cover with durable material for 3-5 years, checking regularly • Knotweed plants may be controlled by application of a systemic herbicide containing glyphosate or triclopyr to the actively growing plants. The injection method is recommended to reduce injury to desirable vegetation. • Click here for more information
Japanese barberry (*Berberis thunbergii*) Observed in mixed forested areas throughout town (mostly isolated plants)	• Hand removal is the best option for eliminating small, isolated plants. Larger plants can be removed with a garden spade, hoe, or weed wrench. • Try to remove as much of the root system as possible because Japanese barberry can easily re-sprout from the remaining roots. • Large populations can be effectively controlled using recommended herbicides. • Click here for more information
Autumn Olive (*Elaeagnus umbrellate*) Found along roads and edges of fields	• Young plants may be hand-pulled, especially when the soil is moist • Herbicide treatment is probably the best method for eradicating larger, well-established plants, and is best applied in early summer through the fall • Click here for detailed information from UNH Cooperative Extension
Multiflora Rose (*Rosa multiflora*) In many locations in town	• Individual plants can be dug up or hand pulled. Remove all roots if possible • Large populations can be treated with chemical controls adding herbicides to cut stems and foliage • Click here for detailed information
Purple Loosestrife (*Lythrum salicaria*) Documented throughout town	• Best time to manage is when it is flowering (late summer) • Small new infestations can be hand-pulled or removed with a shovel • Before digging remove flower heads to prevent seed spreading • Plants can also be cut to the ground. This treatment only slows their spread • Dispose of all plant parts – do not put them on a compost pile • Can be controlled with an herbicide if in an upland area • Purple loosestrife is also being biologically controlled by two species of introduced leaf-eating beetles • Click here for more information
Oriental Bittersweet (*Celastrus orbiculatus*) Documented throughout town	• Hand-pulling vines is effective if infestation is light. Place vines in plastic trash bags and dispose of them • Heavier infestations may be controlled by cutting stems and painting them with an herbicide in early summer through winter • Click here for more information

Hemlock Wooly Adelgid Documented throughout town and particularly around Kimball Pond	• Treatment depends on severity of infestation and health and vigor of infested trees • Can be any combination of no action, removal of infected trees, and use of insecticides • Click here for more information
Red Pine Scale Has killed many red pine trees in town	• Several species of native predators attack red pine scale, but not abundant enough for effective control • There are no effective chemical controls or introduced predators to date • Maintaining tree vigor may aid in bark beetles but avoid fertilizing as this favors scale. • Click here for more information
Milfoil (*Myriophyllum heterophyllum*) Found in Kimball Pond, Kimball Lake and Hopkinton-Everett Lake	• NH Department of Environmental Services assesses each infestation and develops a long-term management plan • Hand pulling, diver-assisted suction harvesting, herbicide treatment are some of the strategies used - depending on the site and amount of infestation • Click here for more information

Japanese knotweed was found in several locations in Hopkinton, but particularly prevalent in the town-owned gravel pit off Patch Road (Photo taken 9-23-22).

Left Photo: Japanese barberry in a mixedwood forest in Hopkinton. This isolated shrub does not appear to be taking over currently. There were several of these isolated shrubs noted throughout town. (Photo taken 9-23-22)

Right Photo: Hemlock Wooly Adelgid on an Eastern hemlock. Photo by Michael O'Connor.

This NRI is not an all-inclusive search and documentation of invasive species in Hopkinton. Undoubtedly, other species and locations where invasive species occur in Hopkinton have been or will be documented. The Town of Hopkinton should continue its 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 Wildflower Society, UNH Cooperative Extension, 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 https://www.eddmaps.org/ipane/. The Invasive Plant Atlas of New England's (IPANE) mission is to create a comprehensive web-accessible database of invasive and potentially invasive plants in New England that will be continually updated by a network of professionals and trained volunteers.

Habitat Area Summary Table

The table below is a summary of different habitat areas in acres, square miles, and percentage of town land area.

Habitat Type	Acres	Square Miles	Percentage of Town Land Area
Town of Hopkinton	28,851.7	45.08	100%
Conservation Land	5,074.5	7.93	17.6%
Flood Control Area	3,150	4.92	10.9%
Ponds and Open Water	1,492.61	2.33	5.2%
Wetland Complexes (from National Wetland Inventory data & field work)	2,883.95	4.51	10%
Hydric Soils – poorly and very poorly drained	5,750.74	8.99	20.9%
Floodplain Forest	164.48	0.26	0.57%
Aquifers	7,272.87	11.36	25.2%
Appalachian Oak-Pine Forest	12,739.35	19.9	44.2%
Hemlock-Hardwood Pine Forest	6,876.06	10.74	23.8%
Dense Softwood Cover	948.00	1.48	3.3%
Permanent Wildlife Openings	2,006.71	3.14	7.0%
Farmland Soils – prime, statewide and local importance	19,152.84	29.93	66.4%
Steep slopes – 20% and greater	3,379.94	5.28	11.7%
Steep slopes – 30% and greater	839.38	1.31	2.9%

DISCUSSION – RECOMMENDATIONS FOR FUTURE ACTIONS AND OPPORTUNITIES

This project is an inventory of natural resources, including a written report, maps, and a digital database in GIS format. It is the property of the Town of Hopkinton and was funded by the Hopkinton Conservation Commission. The data from this project is compatible for integration with the existing Town GIS. Efforts from this project will aid in future work and inventories, as well as provide tools to guide future development and conservation decisions in Hopkinton.

We anticipate that the results from this study will help the Town of Hopkinton in various ways. Town-wide zones based on habitat and vegetation can be assessed and modified. Data gathered from this work will also assist the Conservation Commission, along with the Planning and Zoning Boards, 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, Elise Lawson and the Hopkinton Conservation Commission offer the following additional recommendations:

1. **Climate Change** - The most significant threat to the existing natural resources in Hopkinton is climate change. The predictions of impacts as described in the 2021 NH Climate Assessment Report should be considered by town departments and committees in planning for Hopkinton's future.
    a. Incorporate actions to minimize, mitigate and adapt to climate change impacts when making land use planning decisions.
    b. Develop a town energy use plan to reduce municipal and residential activities that create greenhouse gases.
2. **Surface Water Protection** - Hopkinton's residents obtain drinking water from town-treated water as well as from personal drilled or dug wells. Maintaining good water quality is one of the highest priorities for the Hopkinton Conservation Commission.

    Currently, water quality in Hopkinton's streams and rivers is in very good to excellent condition. Water quality should continue to be addressed not only in large rivers like the Contoocook River, but also in the headwater streams and brooks that feed into the Contoocook River and other rivers outside of Hopkinton boundaries (Merrimack River for example).

    a. Where possible, work to maintain or enhance riparian habitat adjacent to headwater streams and brooks. Any wetland setback should also apply to all riparian habitat along perennial streams.

   b. Continue monitoring water quality in the Contoocook River as well as some of the smaller feeder streams and ponds in town. Areas where there are little buffers and/or downstream from the Wastewater Treatment Facility should be priorities.

   c. The town should update any potential contamination source location inventory at least on an annual basis and ensure that compliance measures (secondary containment structures, and spill kits) are in place.

3. **Aquifer Protection** - Based on the locations of the underlying aquifers in Hopkinton, it is important to protect the quality of groundwater, brooks, streams, and aquifers in town. Future water supplies are an invaluable natural resource for Hopkinton and the abutting municipalities. Those areas with the highest water quality and quantity, whether zoned residential or industrial, should have the least impactful development. Correspondingly, where the least potential for aquifer recharge exists, the more desirable and suitable the area is for development, barring other development concerns.

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

   b. Monitor septic system plumes with a focus on parcels adjacent to rivers, wetlands, and aquifers.

   c. Monitor the placement of future septic systems keeping in mind the typically high permeability of many of Hopkinton's soils.

   d. Develop town-wide ordinances to help protect aquifers, including restrictions on impervious surface development and dumping of waste on top of aquifers, particularly areas with high productivity and flow.

4. **Dense Softwood Stand Protection** – Based on results from this project, there are a few areas that contain adequate acreage of dense softwood stands (excluding white pine stands) scattered throughout the town. These areas are beneficial to many wildlife species for cover as well as important wintering areas.

   a. Maintaining existing stands for the benefit of the deer, moose and other wildlife populations is very important.

   b. Where possible, investigate extending some existing softwood areas and/or connecting patches of softwood stands to increase overall size. Willing landowners can be encouraged to do so, particularly those whose property abuts wetlands and riparian habitat.

5. **Continued Wetland Conservation**– The Hopkinton Conservation Commission recognizes the importance of wetland protection as an important means to maintaining good water quality. It is hoped that the town will continue to pursue ways to further conserve the functionality and diversity of these wetlands. An overall wetland study could help

Hopkinton work with willing landowners to conserve some of these valuable wetland resources. This NRI recommends the following:

a. Conduct an overall wetland study throughout Hopkinton to identify, assess and functionally rank wetlands in town.

b. Revise the Wetlands Conservation District Overlay to incorporate a protective buffer around wetlands in town to protect them from development pressures.

c. Continue to inventory vernal pools throughout Hopkinton to enable the Conservation Commission, Planning Board, and Select Board to critique and adjust future subdivision proposals if vernal pools are likely to be impacted.

d. Continue to monitor stormwater runoff and associated drainage immediately after storm events whenever possible. Treatment devices for stormwater structures should be installed and maintained, particularly within 150 feet of rivers and wetlands.

6. **Land Conservation** – Hopkinton has done notable work conserving land in town. Over 17.5% of the land is conserved, including 10 town-owned properties. There are a few significant areas which could be conserved to create linkages for wildlife travel and to maintain excellent water quality. These areas in Hopkinton have been identified as higher priority areas for conservation based on this NRI and previous studies. They are described below and shown on Map #10 at the end of this report.

   a. **Contoocook River and Floodplain Habitat** – Several areas along the Contoocook River have been conserved, but any opportunity to conserve forested floodplain habitat along this river would increase water quality, aquifer protection, and unique habitat in Hopkinton. Within these areas, maintaining and increasing vegetative buffers is highly recommended.

   b. **South of Mast Yard State Forest and around the Ware Easements –** The protection of Mast Yard State Forest and the Ware Easements along and south of Dolf Brook are admirable as they are classified as high priority for conservation. There is a large, unfragmented block south of Mast Yard State Forest particularly along Dolf Brook and associated wetlands which contains diverse wildlife habitat and a travel corridor. It is a priority area for future conservation efforts.

   c. **Class VI New Road** –The south-central part of Hopkinton contains a large, unfragmented area between South and Jewett Roads. New Road is a class VI road which runs down the middle of the area. It is used for recreation and hunting and contains diverse wildlife habitats including uplands, series of wetlands, and vernal pools. Over half of this area is under conservation

easements owned by Samuel Myron Chase Wildlife Sanctuary and Meadowsend Timberlands. Conservation of any connecting parcels would continue to enhance this area.

d. **Clement and Grassy Pond Areas -** The northwest corner of Hopkinton has a large area of unfragmented land around and north of Clement and Grassy Ponds. The area also contains Hardy Spring Brook and associated wetlands, a series of isolated wetlands, and is relatively unpopulated. It offers diverse wildlife habitat and is ranked high priority for future efforts.

7. **Hillside and Viewshed Protection** - Hopkinton's hilly topography, lakes, ponds and rivers are directly related to the town's tourism industry, scenic beauty, and diversity of natural resources (wetlands, streams and rivers, wildlife, plants, soils, etc.). We recommend evaluating and updating the Zoning Ordinance in Hopkinton to conserve viewsheds as an important feature and tourist attraction to the area, while continuing to consider landowner rights.

    a. **Scenic View Conservation** - The potential for continued population increase throughout the town makes it wise to take a proactive approach in dealing with future development pressures and preserving the scenic vistas and beauty. Scenic easements are types of conservation easements that make protection of scenic resources possible.

    b. **Ridgeline Development Criteria** - Several municipalities throughout the state have developed ridgeline ordinances to protect ridgeline views. Hopkinton may want to review some of these and explore the possibility of implementation.

    c. **Steep Slope Development Criteria** – Develop town-wide ordinances to restrict future development and road construction at sites with over 25% slopes and limit development on slopes between 20% and 25%.

8. **Cooperation** – Natural resources do not end at the town boundary. Hopkinton should continue to work with neighboring towns, schools, organizations, and state and federal agencies throughout the region to share future data as it becomes available. This will avoid the common problem of separate entities replicating work. A watershed approach to conserving natural resources including water quality is prudent. Most of the surrounding municipalities have completed or are in the process of completing Natural Resources Inventories, and all the data among the towns should be compatible in GIS software programs.

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

b. Continue to support and coordinate with the Contoocook and North Branch Rivers Local Advisory Committee (https://cnbrlac.org/) and the Warner River Local Advisory Committee (http://www.wrlac.com)

c. Partner with local high schools and colleges to encourage young people to be involved.

9. **Carbon Sequestration** – Explore the possibility of securing funds for Hopkinton from carbon offset programs. A great resource is The Northeast Forest Carbon Program (website: https://www.northeastforestcarbon.org/). Funds from participating organizations can be used to incentivize landowners to protect their land from development for a period of time. Sustainable forestry is an important part of this process.

Furthermore, Hopkinton officials should consider requesting that all future development plans be delivered in digital format, which would build upon the existing database (including assisting in updating tax maps for assessment) at little cost to the town.

Friday morning visitor in Contoocook Village. Photo by Jack Ruderman September 24, 2022.

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Appendix A: Natural Resource Reports by Hopkinton Residents

Name	Siting	Location	Reporting Date
Cooper Kimball-Rines	American Chestnut (Producing nuts)	Corner of Beech Hill and Currier Road	October 2022
Hunter whom Elise met while doing field work (did not get his name)	Moose, Deer, Bear, Bobcat, Coyote, Fox	Captured by hunter's game camera off of New Road	September 24, 2022
Mike O'Connor	Bittersweet – Invasive	Briar Hill Road	September 20, 2022
Mike O'Connor	Hemlock Woolly Adelgid	Briar Hill Road	September 20, 2022
Jeff Demers	Bobcat	In Hopkinton – seen while bow hunting	September 26, 2022
Jack Ruderman	Mature Bull Moose	Contoocook Village	September 23, 2022
Elizabeth Hall	Hemlock Woolly Adelgid (affected trees being treated)	Crowell Rd.	September 21, 2011
Elizabeth Hall	Emerald Ash Borer	Crowell Rd	September 21, 2022
Allison Cummings	Hemlock Wooly Adelgid	Kimball Lake	September 20, 2022
Allison Cummings	Native plant species including: Joe Pye Weed, Elderberry, Hazelnut, Alder, Red Maple, native viburnums and dogwoods, milkweed, goldenrod, ferns, etc.	Wetland between Stickney Hill and Clinton Street	September 20, 2022
Allison Cummings	Invasive species: Japanese Knotweed, Bittersweet, and Multiflora Rose	Wetland between Stickney Hill and Clinton Street	September 20, 2022
Allison Cummings	Native species – Joe Pye Weed, Turtlehead, Colt's foot, ferns, dogwoods, winterberry, etc	Stickney Hill Road – dirt section	September 20, 2022
Allison Cummings	Invasive species – Bittersweet and multiflora rose	Stickney Hill Road – paved section	September 20, 2022

Name	Siting	Location	Reporting Date
Linden Rayton	Invasive species observed – Bittersweet, Japanese Knotweed, Barberry, Burning Bush, Asian Jumping Worms	In various places throughout Hopkinton	September 20, 2022
Linden Rayton	2 very, very large oak (?) trees – magnificent	Private section of trail that continues off Sweatt Preserve	September 20, 2022
Bill Dunlap	Adult Black Bear	Watchtower Road – walking down road and visiting a birdfeeder	September 8, 2022
Bill Dunlap	Bats seen at dusk – first time in years	Watchtower Road	September 8, 2022
Bill Dunlap	Whippoorwill - heard since June for the first time in years	Near Watchtower Road	September 8, 2022
Kim Minich	Turtles laying eggs – some eggs taken by predators, but observed a hatchling leaving the nest	Tucker Dr.	September 8, 2022
Vicky Bram	Pink Lady Slipper (*cypripedium acaule aiton*)	Hopkinton Road near police station	September 8, 2022
Vicky Bram	Heirloom Lily-of-the-valley (*Convallaris majalis rosea*)	Hopkinton Road near police station	September 8, 2022

Appendix B – List of Conserved Land, Restricted Land and Scenic Easements in Hopkinton, NH as of February 2023

Tax ID	NAME	TYPE	ACRES
148-053 -001	Albin-Hart	CE	31.55
148-030 -001	Bermuda/Harris	FO	69.76
149-061 -003	Bohanan East	CE	138.38
149-061 -001	Bohanan West	CE	278
150-001 -001	Brockway	FO	104.35
149-030 -001	Brown / Robinson	DR	15.8
149-058 -001	Butterworth-Zanes	CE	24.07
149-042 -001	Carriage Lane Parcel	FO	1.48
149-059 -001	Carson	FO	35.68
148-006 -001	Contoocook State Forest	FO	29.88
149-066 -001	Dustin	CE	36.02
149-064 -001	Eastman Conservation Area	CE	0.11
149-050 -001	Evermore Timberlands Corporation	CE	221.43
149-049 -005	Flowage Area	CE	26.07
149-043 -001	French Lot	FO	10.18
149-033 -001	Galloping Hills Open Space	SA	22.8
149-003 -001	Goodwin Chandler State Forest	FO	24.53
149-001 -001	Hawthorne	FO	95.95
149-023 -001	Hopkins Green Open Space	SA	15.4
149-006 -001	Hopkinton-Everett Flood Control Reservoir	FO	3149.49
149-069 -001	Houston	CE	55.32
149-011 -001	Janeway #1	CE	5.67
149-025 -001	Kimball Lake	FO	27.98
149-008 -002	Kimball, F. & D.	CE	158.37
149-007 -001	Kimball, R.	CE	59.47
149-002 -001	Mast Yard State Forest	FO	492.97
149-046 -001	Meadowsend Timberlands Ltd #2	CE	7.17
149-049 -013	Meadowsend Timberlands Ltd #3	CE	837.5
149-012 -001	Murphy	CE	12.2
150-014 -001	Pages Corner State Forest	FO	1.6
149-057 -001	Ransmeier Woods	CE	63.98
149-063 -001	Rice	FO	194.33
149-062 -001	Rollins	FO	45.47
149-028 -001	Samuel Myron Chase Wildlife Sanctuary	FO	463.23
149-024 -001	Smith Pond Bog Wildlife Sanctuary	FO	60.36
148-034 -001	Stone Easement	CE	0.04
149-052 -001	Sweatt Tract	FO	69.72
149-045 -001	T.C. Houston Farm	FO	71.74
149-047 -001	The Marshall Fund	CE	103.77
149-020 -001	Town of Hopkinton Land	FO	384.98
149-060 -001	Ware Easement	CE	45.43
149-056 -001	Ware, D	CE	207.22
149-010 -001	Wells, R. + B.	CE	108.86

CE = Conservation Easement FO = Fee Ownership

DR = Deed Restriction SA = Set Aside – open space areas in developments

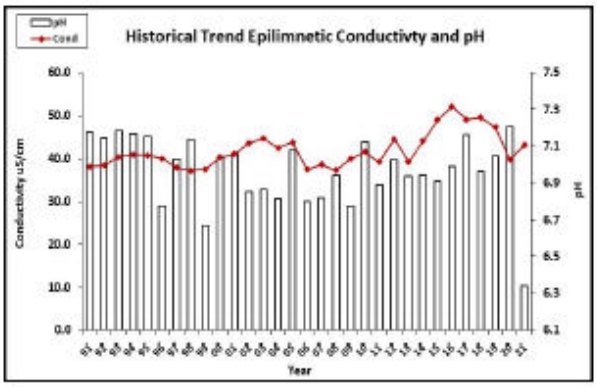
Appendix C: Volunteer Lake Assessment Program – Clement Pond

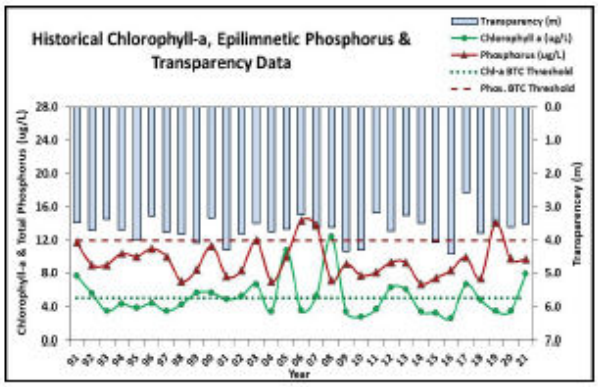
VOLUNTEER LAKE ASSESSMENT PROGRAM INDIVIDUAL LAKE REPORTS
CLEMENT POND, HOPKINTON
2021 DATA SUMMARY

RECOMMENDED ACTIONS: Great job sampling in 2021! Pond quality is representative of mesotrophic, or average, conditions and the improving Hypolimnetic phosphorus levels are encouraging. However, Metalimnetic and Hypolimnetic phosphorus levels were elevated in 2021 which likely fueled the elevated algal growth (chlorophyll). Elevated phosphorus levels may have been a result of record summer rainfall amounts, flushing of wetland systems into the pond, and lack of nutrients flushing out of the pond. This highlights the delicate balance of the pond system and potential vulnerability to increased climate variability with drought conditions experienced in 2020 and record rainfall in 2021. This also highlights the importance of maintaining flow at the Outlet to help flush nutrients out of the system during wet years and following high intensity storm events. Evaluate shoreline areas, dirt/gravel roads, and watershed properties to identify areas prone to stormwater runoff and erosion. Prioritize high impact sites and implement best practices to mitigate loading to the pond. Encourage shoreline property owners to be certified LakeSmart through NH LAKES lake-friendly living program. Consider development of a Watershed Management Plan to help identify and quantify pollutant loads to the pond and make recommendations on ways to reduce nutrient loading. Keep up the great work!

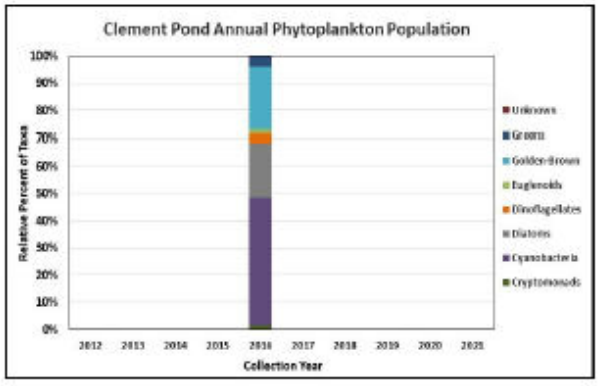
HISTORICAL WATER QUALITY TREND ANALYSIS

Parameter	Trend	Parameter	Trend
Conductivity	Worsening	Chlorophyll-a	Stable
pH (epilimnion)	Stable	Transparency	Stable
		Phosphorus (epilimnion)	Stable





DISSOLVED OXYGEN AND PHYTOPLANKTON
(Note: Information may not be collected annually)



NHDES Volunteer Lake Assessment Program (VLAP) | sara.e.steiner@des.nh.gov

LM-022

VOLUNTEER LAKE ASSESSMENT PROGRAM INDIVIDUAL LAKE REPORTS
CLEMENT POND, HOPKINTON
2021 DATA SUMMARY

OBSERVATIONS (*Refer to Table 1 and Historical Deep Spot Data Graphics*)

- **CHLOROPHYLL-A:** Chlorophyll level was slightly elevated in June, increased in July, remained stable in August, and then decreased to a low level September. Average chlorophyll level increased from 2020 and was greater than the state median and the threshold for mesotrophic lakes. Historical trend analysis indicates relatively stable chlorophyll levels since monitoring began.
- **CONDUCTIVITY/CHLORIDE:** Epilimnetic (upper water layer), Metalimnetic (middle water layer), Hypolimnetic (lower water layer), Inlet, and Outlet conductivity and chloride levels were low and approximately equal to the state median. However, historical trend analysis indicates significantly increasing (worsening) epilimnetic conductivity levels since monitoring began.
- **COLOR:** Epilimnetic color data indicates the water was lightly tea colored, or light brown, in June, and then darkened to moderately tea colored conditions from July through September.
- **TOTAL PHOSPHORUS:** Epilimnetic phosphorus level was low in June, increased slightly in July but remained within a low range, and remained stable through September. Average epilimnetic phosphorus level remained stable with 2021 and was less than the state median and the threshold for mesotrophic lakes. Historical trend analysis indicates stable epilimnetic phosphorus levels since monitoring began. Metalimnetic and Hypolimnetic phosphorus levels were slightly elevated in June, August and September and average phosphorus levels increased from 2020. Historical trend analysis indicates significantly decreasing (improving) hypolimnetic phosphorus levels since monitoring began. Inlet phosphorus level was slightly elevated in August following significant storm event and flushing of wetland systems. Outlet phosphorus level was elevated in June when the water level was low, and in August following significant storm event.
- **TRANSPARENCY:** Transparency measured without the viewscope (NVS) was within an average range for the pond in June, decreased (worsened) in July and August following significant rainfall, and then increased (improved) in September. Average NVS transparency remained stable with 2020 and was slightly higher (better) than the state median. Historical trend analysis indicates stable NVS transparency since monitoring began. Viewscope (VS) transparency was generally higher than NVS transparency and a better measure of actual conditions.
- **TURBIDITY:** Epilimnetic turbidity level was slightly elevated from June through August when algal growth was elevated. Metalimnetic turbidity level was slightly elevated in June, July and September. Hypolimnetic turbidity level was slightly elevated in July and increased gradually through September indicating potential formation and accumulation of organic compounds under anoxic (no dissolved oxygen) conditions. Lab data noted all deep spot samples contain low levels of organic matter in July either from algal growth or particulate fallout from record July rainfall amounts. Inlet and Outlet turbidity levels fluctuated within a low range for those stations.
- **PH:** Epilimnetic and Metalimnetic pH levels were within the desirable range 6.5-8.0 units in June and became increasingly acidic following record summer rainfall amounts. Historical trend analysis indicates stable epilimnetic pH levels since monitoring began. Hypolimnetic and Inlet pH levels were slightly acidic and less than desirable. Outlet pH levels fluctuated around the low end of the desirable range.

Station Name	Table 1. 2021 Average Water Quality Data for CLEMENT POND - HOPKINTON									
	Alk. (mg/L)	Chlor-a (ug/L)	Chloride (mg/L)	Color (pcu)	Cond. (us/cm)	Total P (ug/L)	Trans. (m)		Turb. (ntu)	pH
							NVS	VS		
Epilimnion	10.7	7.88	5	52	43.2	10	3.51	3.71	0.80	6.34
Metalimnion					47.8	14			1.02	6.30
Hypolimnion					48.2	17			2.16	5.94
Hardy Brook Outlet			5		43.2	13			0.64	6.56
Hopkinton Inlet			4		41.4	17			0.71	5.80

NH Median Values

Median values generated from historic lake monitoring data.

Alkalinity: 4.5 mg/L **Chlorophyll-a:** 4.39 ug/L
Conductivity: 42.3 uS/cm **Chloride:** 5 mg/L
Total Phosphorus: 11 ug/L **Transparency:** 3.3 m
pH: 6.6

NH Water Quality Standards

Numeric criteria for specific parameters. Water quality violation if thresholds exceeded.

Chloride: > 230 mg/L (chronic) **Turbidity:** > 10 NTU above natural
E. coli: > 88 cts/100 mL (beach)
E. coli: > 406 cts/100 mL (surface waters)
pH: between 6.5-8.0 (unless naturally occurring)

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MAPS

Map #1: Dense Softwoods and Permanent wildlife openings

Map Data Sources:

- Town Boundary, Roads, Open Water, and Streams obtained from GRANIT
- Dense Softwood Stands and Permanent wildlife openings digitized by Elise Lawson 2020 using the 2015 aerial photographs

Map #2: Wildlife Action Plan – Habitat Map

Map Data Source:

- New Hampshire Fish and Game Department – downloaded from GRANIT and queried so habitat types displayed

Map #3: Conservation Lands

Map Data Sources:

- Town Boundary, Roads, Open Water, Streams obtained from GRANIT
- National Wetlands Inventory wetlands obtained from U.S. Fish and Wildlife Service and GRANIT
- Additional Wetlands were field verified by Elise Lawson and or digitized using 2015 aerial photographs (obtained from GRANIT)
- Conservation Lands obtained from GRANIT and the Town of Hopkinton

Map #4: Wetlands and Water Resources

Map Data Sources:

- Town Boundary, Roads, Aquifers, Open Water, Streams, obtained from GRANIT
- Vernal Pool locations taken using a handheld GPS unit (Garmin GPSmap 76CSx) during field work by Elise Lawson over three days of field work
- National Wetlands Inventory wetlands obtained from U.S. Fish and Wildlife Service and GRANIT
- Additional Wetlands were field verified by Elise Lawson and/or digitized using 2015 aerial photographs (obtained from GRANIT)
- Poorly and Very Poorly Drained Soils obtained from the Natural Resource Conservation Service

Map #5: Subwatersheds

Map Data Sources:

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

Map #6: Bedrock Geology

Map Data Source:

- Town Boundary, Roads, Bedrock Geology downloaded from GRANIT

Map #7: Steep Slopes and Farmland Soil

Map Data Sources:

- Town Boundary, Roads, 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 #8: New Hampshire Forest Soil Groups

Map Data Sources:

- Town Boundary, Roads, Open Water, Streams obtained from GRANIT

- Soil data obtained from Natural Resource Conservation Service and queried to display NH Forest Soil Groups

Map #9: Wildlife Action Plan – Tiers Map

Map Data Source:

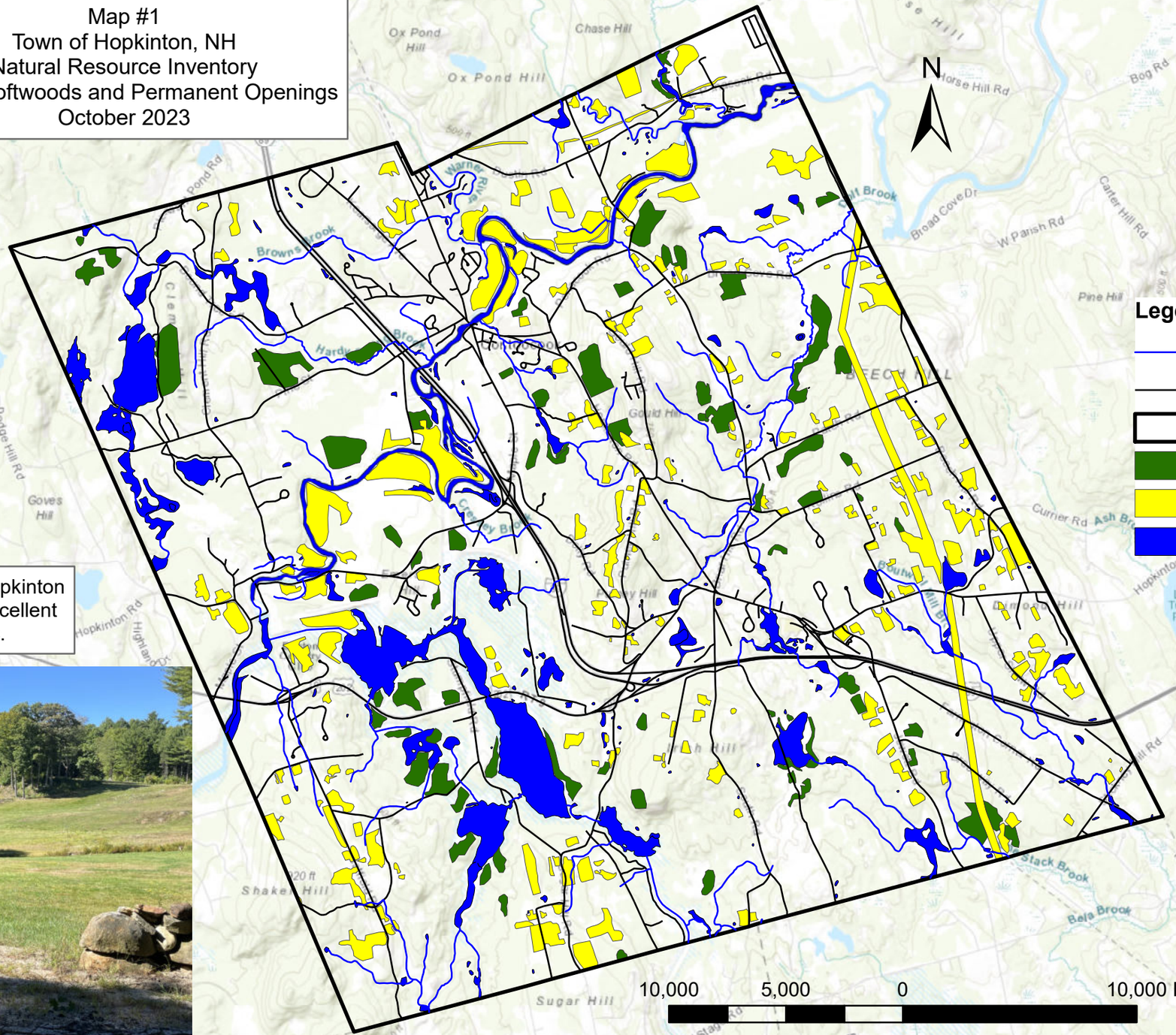
- New Hampshire Fish and Game Department – downloaded from GRANIT and queried so the highest rank and supporting areas displayed.

Map #10: Conserved Lands with Priorities for Future Conservation

Map Data Source:

- Town Boundary, Roads, Open Water, Streams obtained from GRANIT
- National Wetlands Inventory wetlands obtained from U.S. Fish and Wildlife Service and GRANIT
- Additional Wetlands were field verified by Elise Lawson and/or digitized using 2015 aerial photographs (obtained from GRANIT)
- Conservation Lands obtained from GRANIT and the Town of Hopkinton
- Priorities Areas for Conservation obtained from New Hampshire Fish and Game Department – downloaded from GRANIT and queried so the highest rank and supporting areas displayed

Map #1
Town of Hopkinton, NH
Natural Resource Inventory
Dense Softwoods and Permanent Openings
October 2023



Permanent opening in Hopkinton with forested edges is excellent wildlife habitat and scenic.

Map Produced by:
Watershed to Wildlife / Elise Lawson
507 West Darling Hill Rd
West Burke, VT 05871
watershedtowildlife.net

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, Geo
Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Map #2
Town of Hopkinton
Natural Resource Inventory
NH Wildlife Action Plan Habitat Types
October 2023

Floodplain forest along the Contoocook River.
This area contains silver maple, wood nettle, sensitive fern, joe pye weed and devli's beggarticks.
Photo taken 10-24-22

Legend

- Roads
- Rivers and Streams
- Town Boundary

NH WAP Habitat

- Appalachian oak-pine
- Developed Impervious
- Developed or Barren land
- Floodplain forest
- Grassland
- Hemlock-hardwood-pine
- Open water
- Peatland
- Rocky ridge
- Sand/Gravel
- Temperate swamp
- Wet meadow/shrub wetland

N

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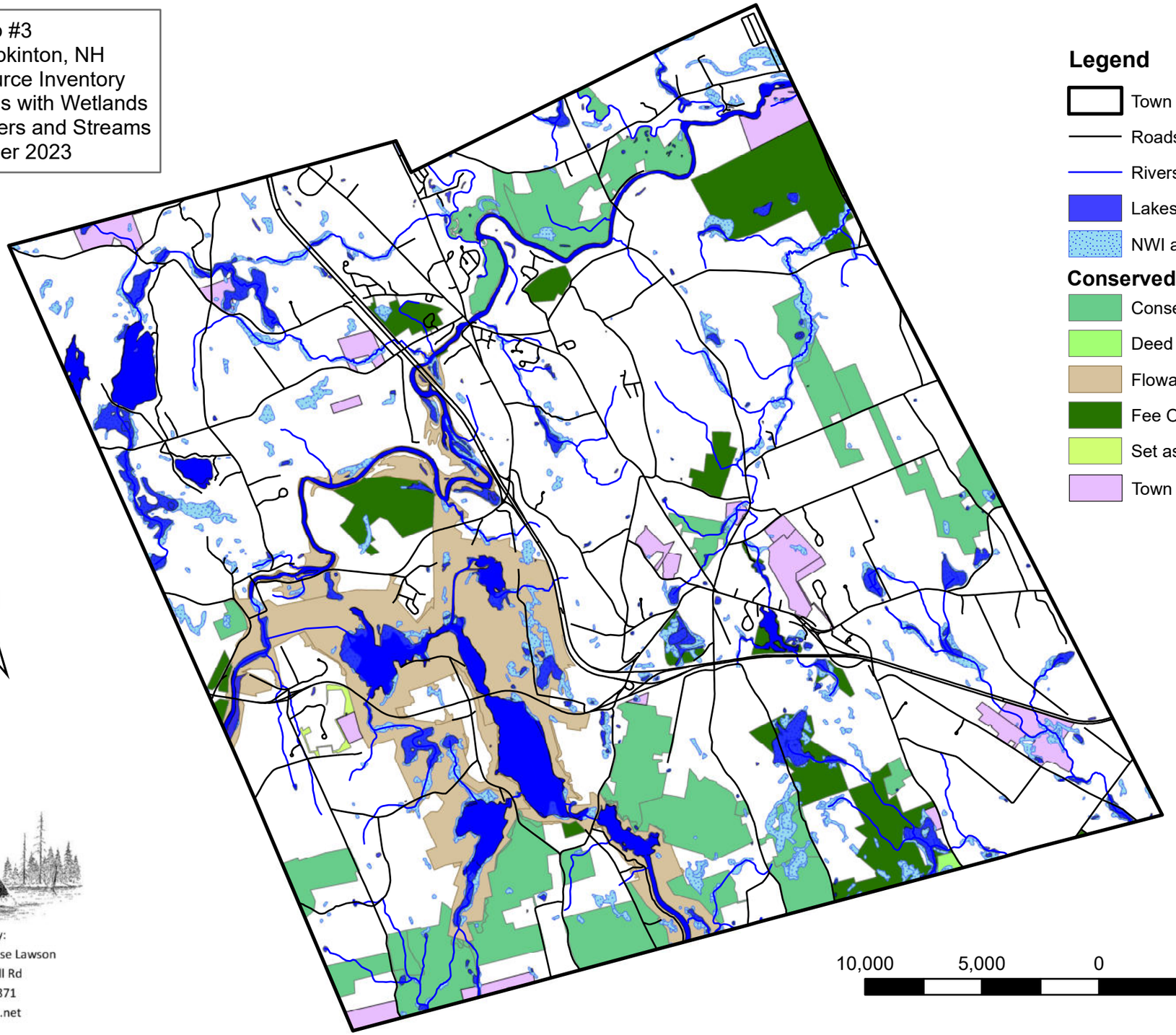
Map #3
Town of Hopkinton, NH
Natural Resource Inventory
Conserved Lands with Wetlands
Open Water, Rivers and Streams
November 2023



Legend

- Town Boundary
- Roads
- Rivers and Streams
- Lakes and Ponds
- NWI and Digitized Wetlands

Conserved Land Types

- Conservation Easement
- Deed Restriction
- Flowage Rights or Easement
- Fee Ownership
- Set aside - open space areas of developments
- Town of Hopkinton Land

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Map #4
Town of Hopkinton, NH
Natural Resource Inventory
Wetlands and Water Resources
October 2023

Contoocook River

Clement Pond

Grassy Pond

Rolf Pond

Whittier Pond

Kimball Lake

Smith Pond

N

Legend

- Vernal Pools
- Town Boundary
- Roads
- Rivers and Streams
- Lakes and Ponds
- NWI and Digitized Wetlands
- Poorly drained soils
- Very poorly drained soils
- Aquifers

Smith Pond and associated wetlands.

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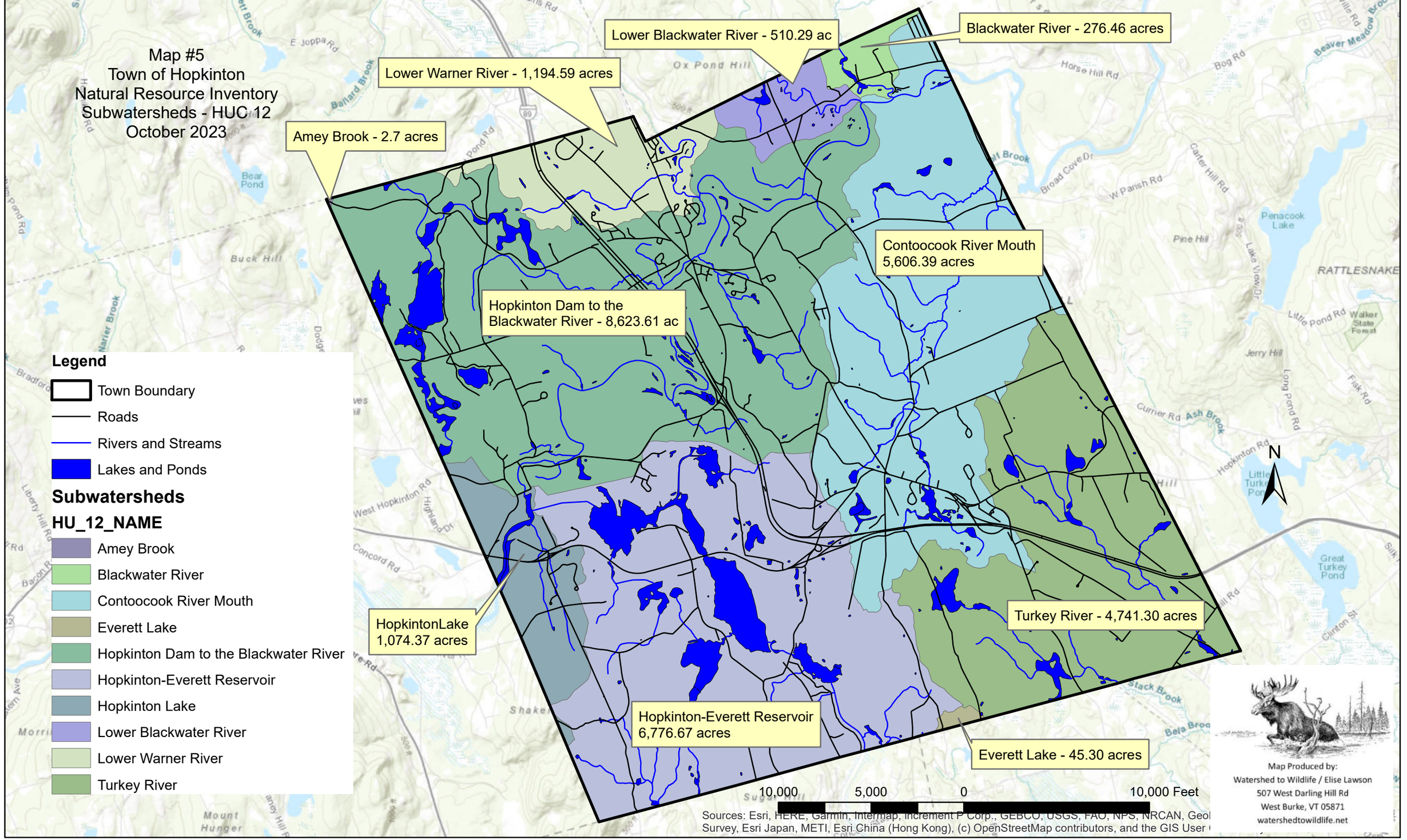
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community


Map #5
Town of Hopkinton
Natural Resource Inventory
Subwatersheds - HUC 12
October 2023
Lower Blackwater River - 510.29 ac
Blackwater River - 276.46 acres
Lower Warner River - 1,194.59 acres
Amey Brook - 2.7 acres
Contoocook River Mouth
5,606.39 acres
Hopkinton Dam to the
Blackwater River - 8,623.61 ac
HopkintonLake
1,074.37 acres
Turkey River - 4,741.30 acres
Hopkinton-Everett Reservoir
6,776.67 acres
Everett Lake - 45.30 acres
Legend
Town Boundary
Roads
Rivers and Streams
Lakes and Ponds
Subwatersheds
HU_12_NAME
Amey Brook
Blackwater River
Contoocook River Mouth
Everett Lake
Hopkinton Dam to the Blackwater River
Hopkinton-Everett Reservoir
Hopkinton Lake
Lower Blackwater River
Lower Warner River
Turkey River
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Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, Geol
Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User
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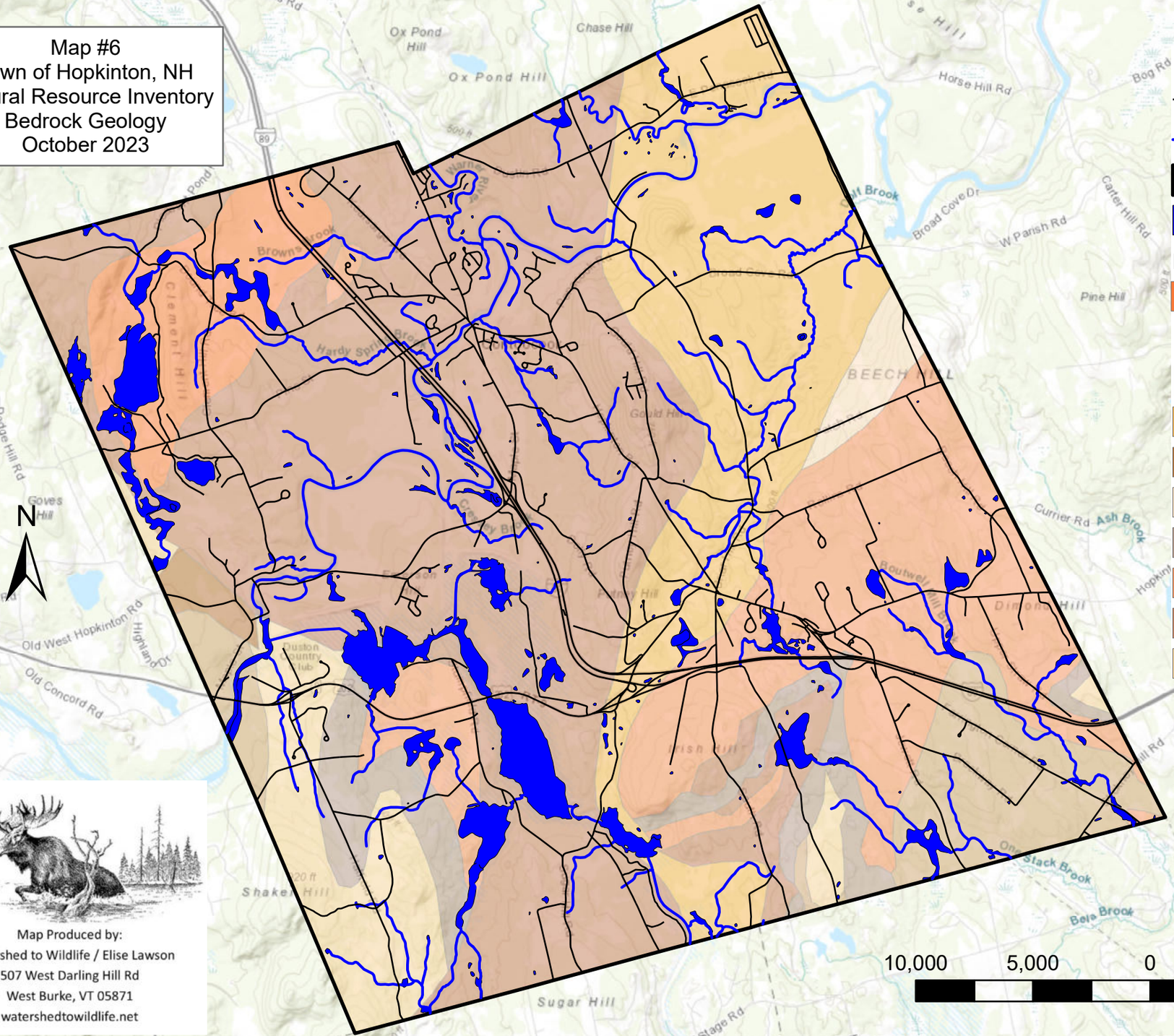
Map #6
Town of Hopkinton, NH
Natural Resource Inventory
Bedrock Geology
October 2023



Legend

- Roads
- Rivers and streams
- Town Boundary
- Lakes and Ponds

Bedrock Geology

- Hypersthene-biotite quartz diorite and hornblende or actinolite diorite or gabbro
- Concord Granite
- Kinsman Granodiorite
- Lower part of Rangeley Formation
- Madrid Formation
- Perry Mountain Formation, undivided
- Smalls Falls Formation, undivided
- Spaulding Tonalite
- Upper part of Rangeley Formation

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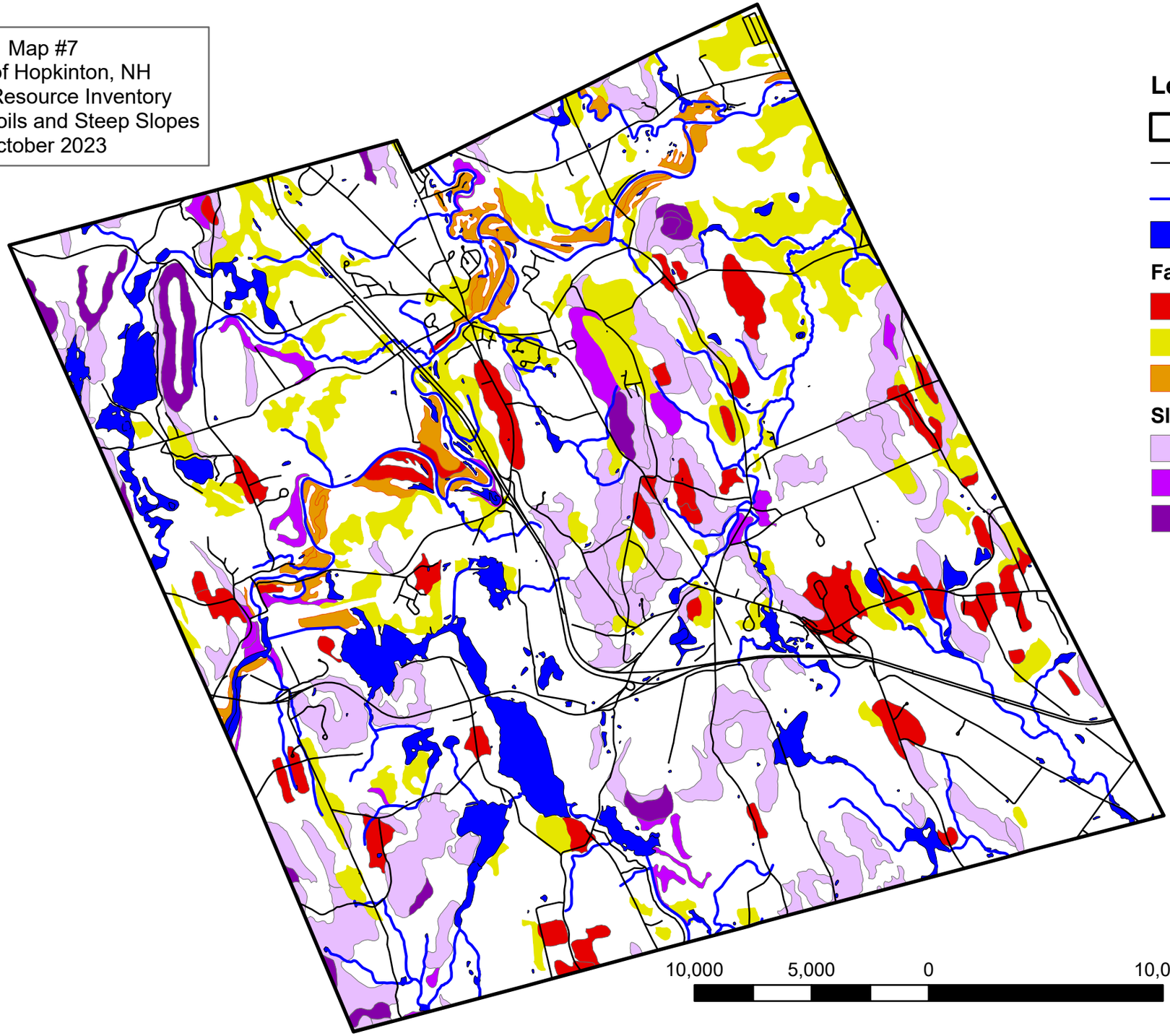
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Map #7
Town of Hopkinton, NH
Natural Resource Inventory
Farmland Soils and Steep Slopes
October 2023



Legend

- Town Boundary
- Roads
- Rivers and Streams
- Lakes and Ponds

Farmland Soils

- Prime Farmland
- Farmland of Statewide Importance
- Prime Farmland in a Flood Zone

Slope

- 20% - 25%
- 30% - 38%
- 42% - 48%

N

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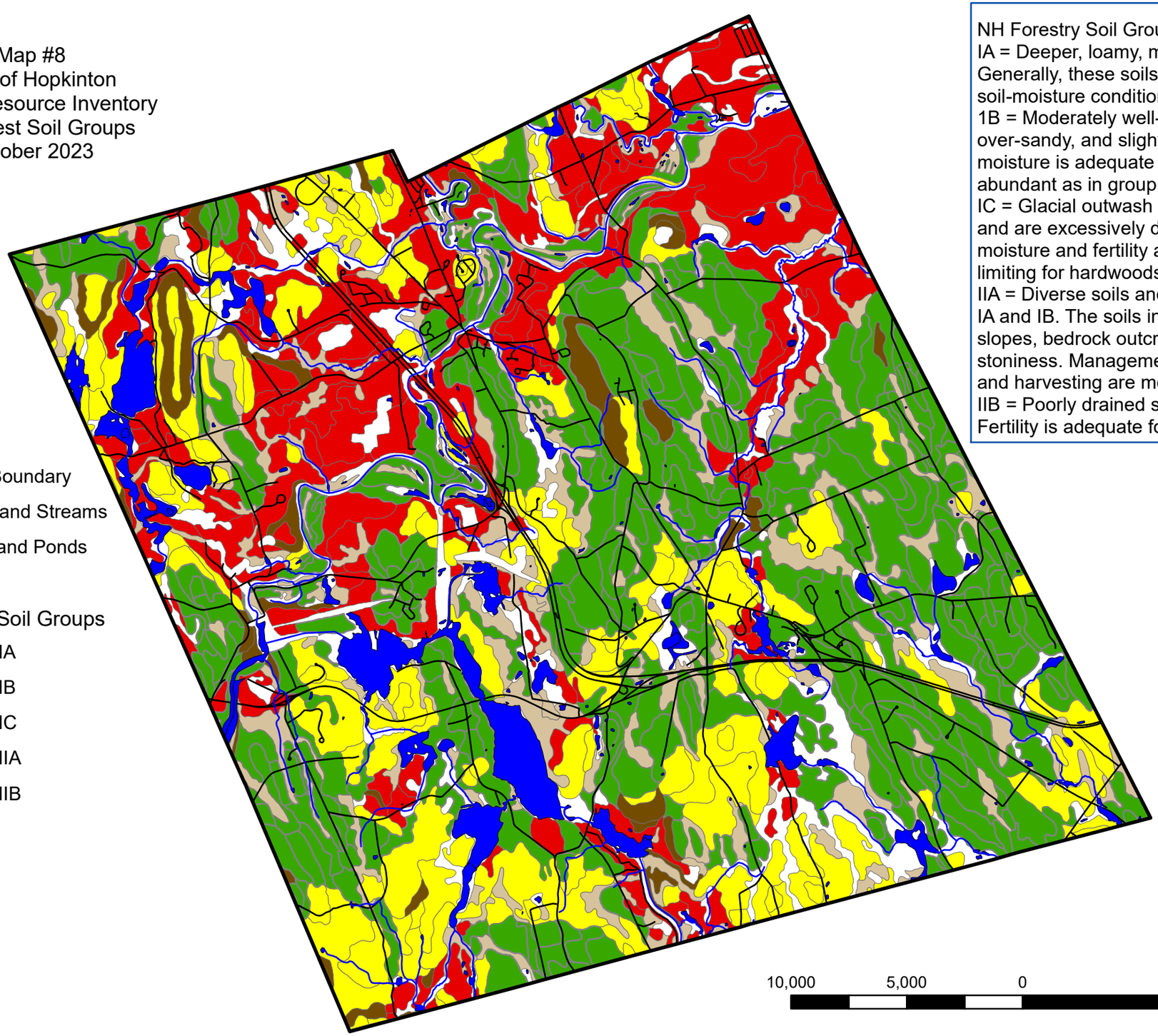
Map #8
Town of Hopkinton
Natural Resource Inventory
NH Forest Soil Groups
October 2023



Legend

- Town Boundary
- Rivers and Streams
- Lakes and Ponds
- Roads

NH Forestry Soil Groups

- Group IA
- Group IB
- Group IC
- Group IIA
- Group IIB

NH Forestry Soil Groups
IA = Deeper, loamy, moderately well-drained and well-drained soils. Generally, these soils are more fertile and have the most favorable soil-moisture conditions.
1B = Moderately well-drained and well-drained, sandy or loamy-over-sandy, and slightly less fertile than those in group 1A. Soil moisture is adequate for good tree growth but may not be quite as abundant as in group 1A.
IC = Glacial outwash sand and gravel. The soils are coarse textured and are excessively drained and moderately well-drained. Soil moisture and fertility are adequate for good softwood growth but are limiting for hardwoods.
IIA = Diverse soils and includes many of the soils that are in groups IA and IB. The soils in IIA, however, have limitations such as steep slopes, bedrock outcrops, erodibility, surface boulders, and extreme stoniness. Management activities such as tree planting, thinning, and harvesting are more difficult and more costly.
IIB = Poorly drained soils. Productivity is lower than in IA, IB, or IC. Fertility is adequate for softwoods but is a limitation for hardwoods.

N

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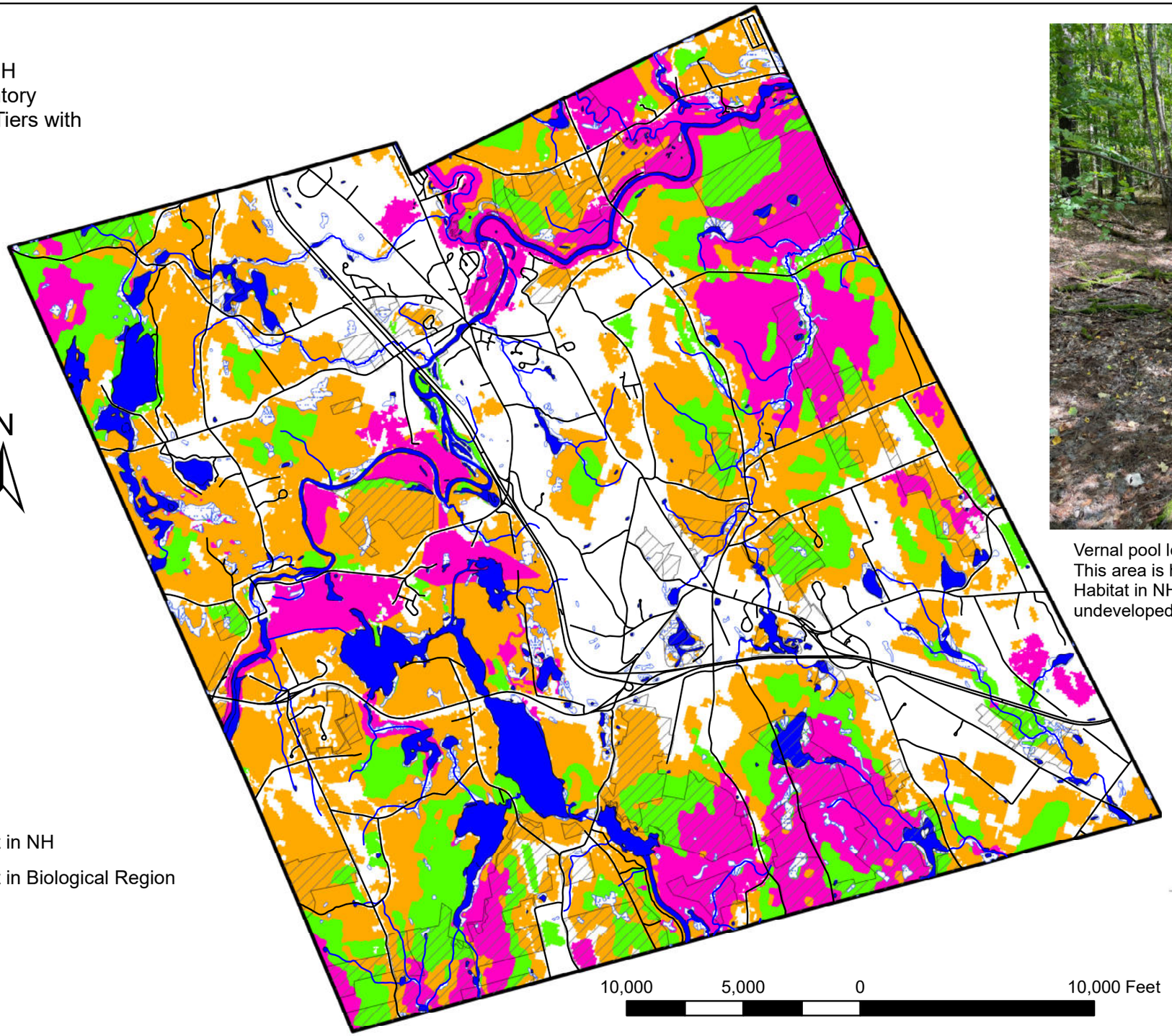
Map #9
Town of Hopkinton, NH
Natural Resource Inventory
Wildlife Action Plan RankedTiers with
Conservation Land
October 2023



Vernal pool located in Mast Yard State Forest. This area is highligted as Highest Ranked Habitat in NH due to diversity and large undeveloped blocks of habitat.

Legend

- Roads
- Rivers and Streams
- Lakes and Ponds
- Wetlands
- Town Boundary
- Highest Ranked Habitat in NH
- Highest Ranked Habitat in Biological Region
- Supporting Landscape
- Conservation Land

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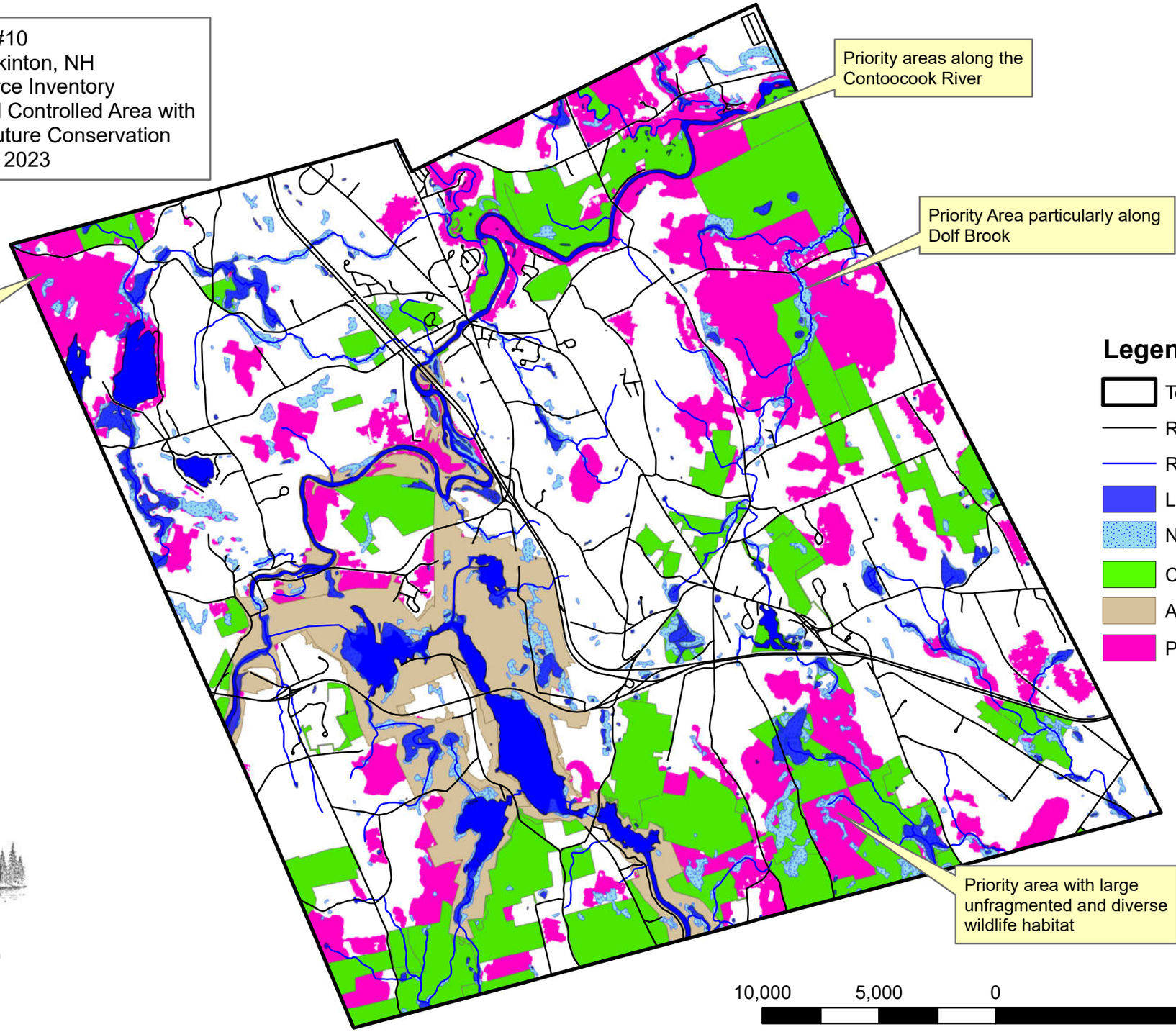
Map #10
Town of Hopkinton, NH
Natural Resource Inventory
Conserved Lands, Flood Controlled Area with
Priorities Areas for Future Conservation
October 2023



Legend

- Town Boundary
- Roads
- Rivers and Streams
- Lakes and Ponds
- NWI and Digitized Wetlands
- Conserved Lands
- ACOE Flood Control
- Priority Areas for Conservation

N

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