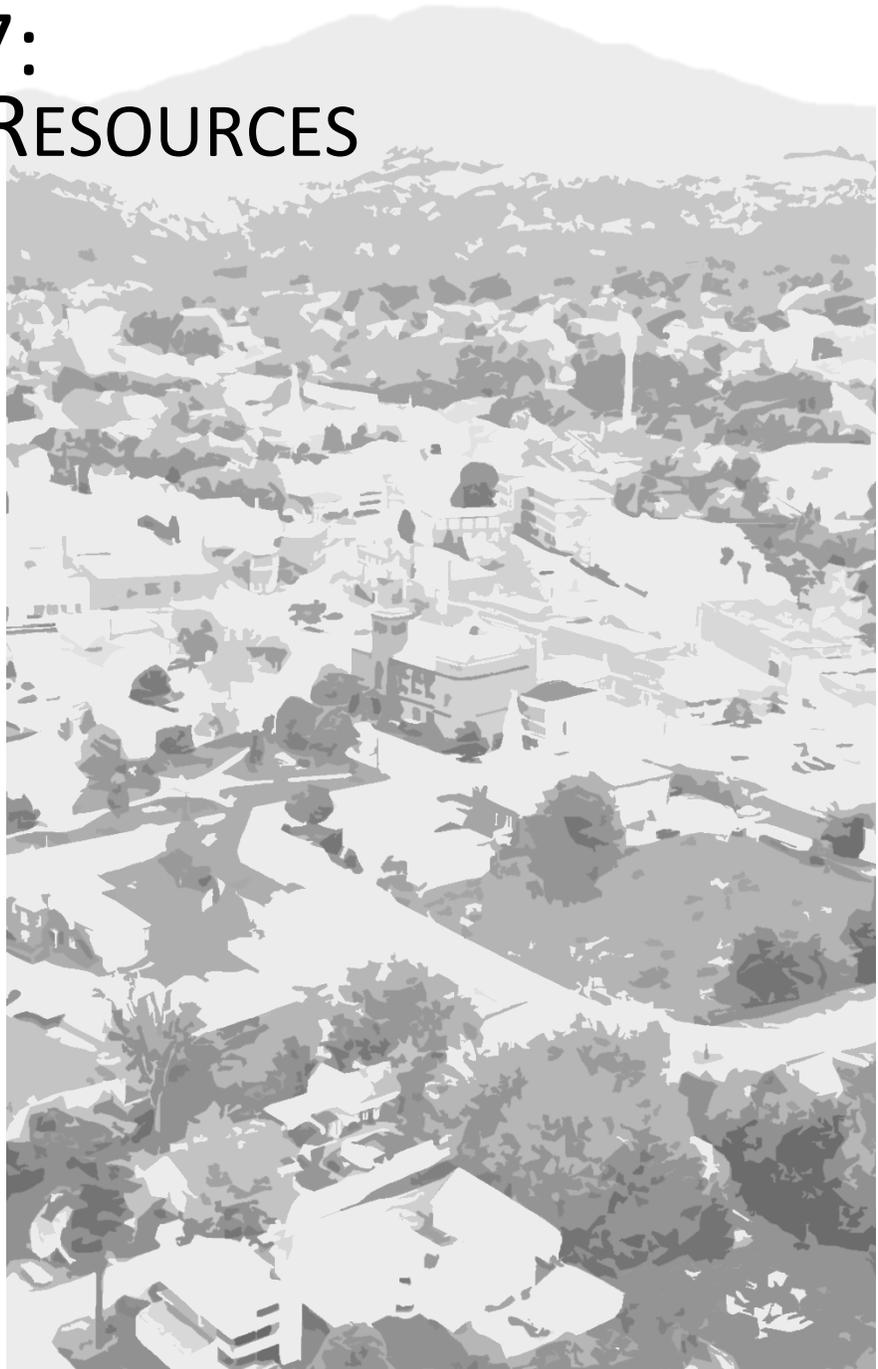


CITY OF CLAREMONT MASTER PLAN 2017

CHAPTER 7: NATURAL RESOURCES



Prepared by the
Claremont Planning Board
and the
Claremont Planning and
Development Department

Chapter 7: Natural Resources

Vision

Claremont residents:

- understand the importance of natural resources that are properly and sustainably managed;
- take pride in their publicly owned natural resources and forestlands;
- have access to local outdoor recreational opportunities;
- support the preservation of key areas in Claremont with significant natural resources values.

Recent survey results showed that 74% of respondents support conservation efforts, such as volunteering to remove invasive species or beautification of city open spaces.

Implementation of the goals and objectives of this chapter will at times require collaboration with regional organizations, because ecosystems, wildlife and water resources are not confined within the City limits. Fortunately, there are a number of such agencies available to assist including, but not limited to:

- Connecticut River Watershed Council (<http://www.ctriver.org/>)
- Sullivan County Conservation District (http://www.sullivancountynh.gov/index.php?n=conservation_district)
- NH Association of Conservation Commissions (<http://www.nhacc.org/>)
- USDA Natural Resources Conservation Service (<https://www.nrcs.usda.gov/wps/portal/nrcs/site/nh/home/>)

Introduction

This chapter describes the key components of Claremont's natural resources and sets forth a philosophy and vision for their use, management, and conservation. The history and current condition of these resources were considered in developing this plan and its stated goals.

Also addressed in this chapter are the ecologically significant areas in the community as identified in the 2013 Natural Resources Inventory ¹.



Resources covered in this chapter include:

- Water Resources
- Landscape and Geography
- Forest Resources and
- Wildlife Resources
- Invasive Species
- Ecologically Significant Areas.

The economic, cultural, public safety and health benefits of environmental protection are increasingly being quantified in economic and social measures that show them to bring significant values to human society.

Glossary

A glossary is provided here to define terms used in this chapter that may be unfamiliar to the reader.

- **Aquifer:** An aquifer is an underground layer of water-bearing permeable rock, rock fractures or unconsolidated materials (gravel, sand, or silt) from which groundwater can be extracted using a water well.
- **Biomass:** Biomass is organic material that comes from plants and animals, and it is a renewable source of energy
- **Carbon Sequestration:** a natural or artificial process by which carbon dioxide is removed from the atmosphere and held in solid or liquid form.
- **Fen:** One of the main types of wetland, the others being grassy marshes, forested swamps, and peaty bogs. Along with bogs, fens are a kind of mire
- **Forest:** A large area of land covered with trees or other woody vegetation.
- **Flood Plain:** An area of land adjacent to a stream or river that stretches from the banks of its channel to the base of the enclosing valley walls and experiences flooding during periods of high discharge.
- **Groundwater:** Water below the land surface
- **Hydric:** Soil which is permanently or seasonally saturated by water, resulting in anaerobic conditions, as found in wetlands.
- **Hydrophytes:** Aquatic plants are plants that have adapted to living in aquatic environments (saltwater or freshwater). They are also referred to as hydrophytes or macrophytes.
- **Invasive Species:** An invasive species can be any kind of living organism - plant, insect, fish, fungus, bacteria, or even an organism's seeds or eggs - that is not native to an ecosystem and which causes harm.
- **Riparian Zone:** The interface between land and a river or stream. Plant habitats and communities along the river margins and banks are called riparian vegetation. Riparian zones are important for their role in soil conservation, their habitat biodiversity, and the influence they have on fauna and aquatic ecosystems, including grasslands, woodlands, wetlands, or even non-vegetative areas.

- **Shorelands Protection Act:** The Shoreland Water Quality Protection Act was originally named the Comprehensive Shoreland Protection Act (CSPA) and was enacted into law in the 1991 session of the New Hampshire Legislature. The act establishes minimum standards for the subdivision, use and development of shorelands adjacent to the state's public water bodies.
- **Substrate** (stratum): In geology and related fields, a stratum (plural: strata) is a layer of sedimentary rock or soil with internally consistent characteristics that distinguish it from other layers. The "stratum" is the fundamental unit in a stratigraphic column and forms the basis of the study of stratigraphy.
- **Turbidity:** Turbidity is the cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eye, similar to smoke in air. The measurement of turbidity is a key test of water quality.
- **Urban Forest:** The term urban forest refers to all publicly and privately-owned trees within an urban area— including individual trees along streets and in backyards, as well as stands of remnant forest.²
- **Watershed:** An area of land where all surface water from rain, melting snow, or ice converges to a single point at a lower elevation, usually the exit of the basin, where the waters join another body of water, such as a river, lake, wetland, sea, or ocean. Thus, if a tributary stream joins a brook that in turn joins a small river which is a tributary of a larger river, there is a series of successively larger (and lower elevation) drainage basins. Also known as drainage basin or catchment basin.

¹ *City of Claremont Natural Resources Inventory*, Jeffrey N. Littleton, Moosewood Ecological LLC, Chesterfield NH, January 2013

² *Sustaining America's urban trees and forests: Forests on the Edge report. Gen. Tech. Rep. NRS-62*, Nowak, David J.; Stein, Susan M.; Randler, Paula B.; Greenfield, Eric J.; Comas, Sara J.; Carr, Mary A.; Alig, Ralph J., Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station.

Water Resources

Water is essential to the survival of most living things. Water resources are also one of our most fragile ecosystems. Therefore, it is important to protect our water resources to ensure viable water supplies for present and future generations. Protection means preventing water pollution, improving the quality of water resources that may already be compromised, and minimizing waste.

[Note: For security purposes, the locations of Claremont's municipal water resources are not shown or directly discussed in this chapter.]

Water is present both on the earth's surface and beneath it. Surface water includes streams, brooks, rivers, ponds, lakes and wetlands. Subsurface water or groundwater exists primarily in aquifers.

Surface waters

Surface waters in all of their forms are critically important to a wide variety of wildlife and plants for part or all of their life cycle needs. Surface waters also provide a multitude of human benefits including drinking water and recreational activities.

Surface water is very vulnerable to a wide array of pollutants. Its quality can be degraded by too much sediment, chemical pollution, or even by temperature fluctuations. Pollution is often the result of human activity, either accidental or deliberate. Once water quality is degraded, it can be very expensive to restore it.

Claremont is relatively rich in water resources—making up approximately 3,300 acres of land area (*Upper Valley Lake Sunapee RPC, 2007*). Two of the region’s major rivers flow through the community as well a number of smaller brooks. There are no major lakes, although there are several small ponds and manmade reservoirs such as the Rice and Dole Reservoirs north of the Sugar River.

Wetlands

Wetlands are areas where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands include such areas as swamps, bogs, fens, floodplains and shorelands. They are delicate ecosystems that are susceptible to disruption by change.

Wetlands are valued for their ability to:

- recharge groundwater and streams,
- provide flood attenuation,
- abate pollution, and
- provide wildlife habitat.

Wetlands function as natural water treatment and storage areas and provide an important part of the overall habitat for wildlife.

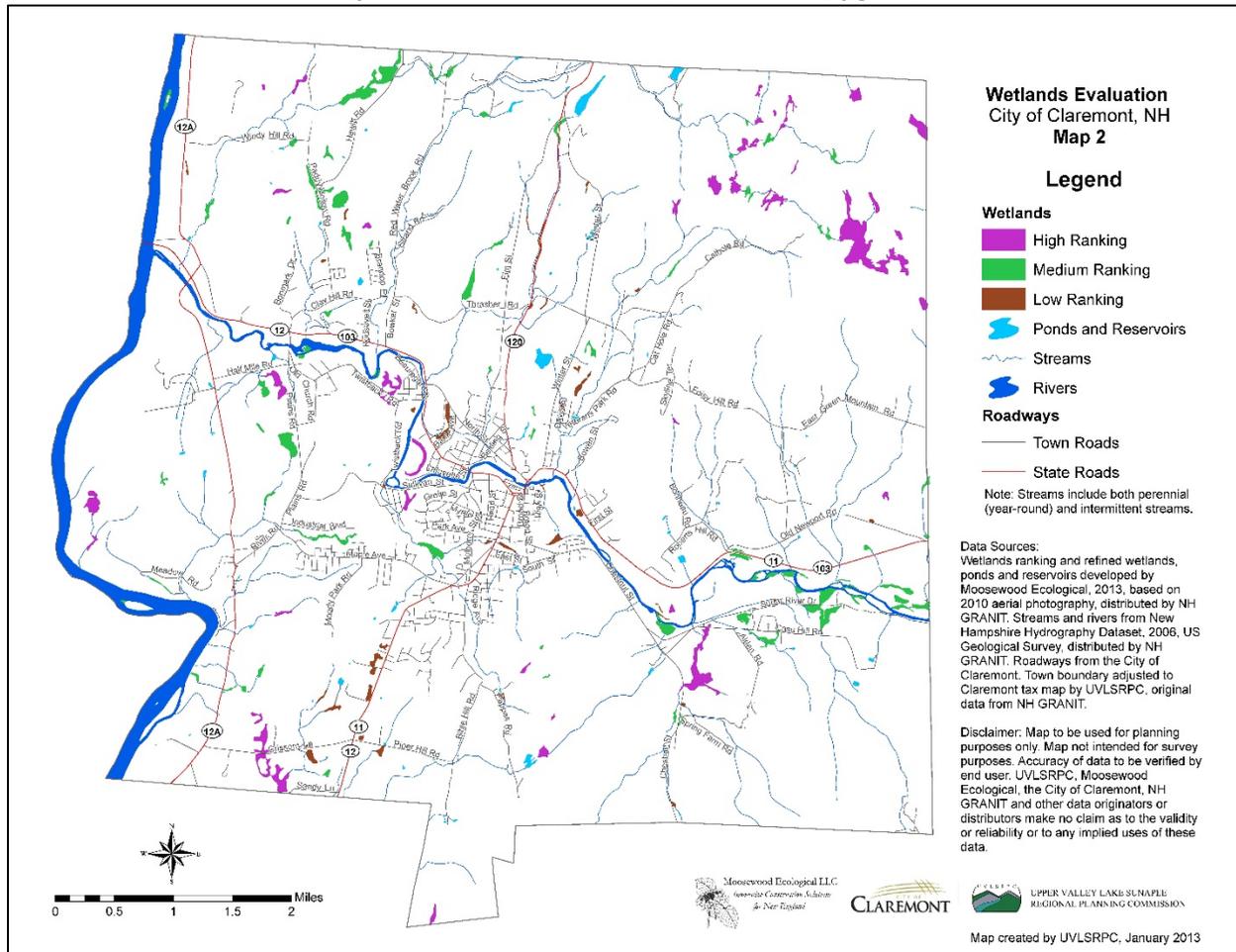
Wetland areas in Claremont are generally well-distributed with concentrations along river ways and in small catchment areas. The 2013 Natural Resources Inventory mapped 358 wetlands in the City, of which 146 (totaling 510 acres) were identified for comparative evaluation. Each wetland was ranked as having high, moderate, or low functional value. The results are shown in Table 1 below.

Table 1. Summary of the wetlands comparative evaluation.

Functional	Count	Size(acres)	Average(acres)	Maximum(acres)	Minimum(acres)
High Value	37	238.4	5.8	63.8	0.5
Moderate Value	73	215.3	2.6	29.1	0.5
Low Value	36	54.1	1.4	7.4	0.5

Source: Moosewood Ecological LLC (2013).

Map 1: Wetlands Evaluation [from the NRI, pg. 17]



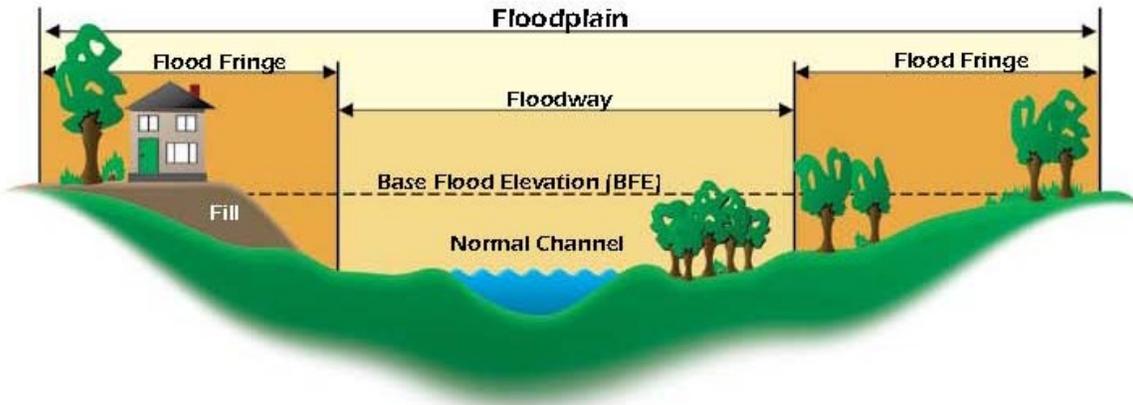
The wetlands functional ranking can be used in a variety of land use efforts. One of the main uses can be to prioritize wetlands for conservation. Wetlands with an overall high value can be evaluated by the City when working with willing landowners for natural resources protection (e.g. conservation easements). Other protection efforts may include land use regulations and the identification of wetland mitigation efforts in the City. Likewise, low value wetlands may offer opportunities for wetlands restoration projects. (NRI, pg. 12)

Floodplains

Floodplains are the periodically inundated flat lands adjacent to rivers and streams. Floodplains serve as storage areas for water during times of flooding and provide travel corridors for wildlife. Due to their important ecological characteristics, development in floodplains presents some special problems, including:

- A high probability of property damage during flooding;
- The restriction of periodic water storage resulting in potentially greater flooding; and
- The increased likelihood of erosion and sedimentation. The latter factor can, in turn, cause increased turbidity of water in rivers and streams.

Characteristics of a Floodplain



Source: <http://www.co.umatilla.or.us/planning/floodhazard.htm>

The City participates in the National Flood Insurance Program which allows residents access to affordable flood insurance. Participation requires strict adherence to floodplain regulations that provide guidance for development within mapped flood plain areas. Failure to comply with this regulation can result in the City being removed from the Program.

Groundwater Resources

Groundwater is water below the land surface. Groundwater is found in gravel pockets or in fissures in bedrock. The term “aquifer” describes water-saturated earth materials from which a water supply can be obtained.

Groundwater is a vitally important resource for drinking water for those properties in Claremont that are currently outside of the City’s water distribution system. Groundwater also serves to support sensitive ecosystems, such as wetlands and wildlife habitats.

Claremont contains approximately 6,352 acres of stratified drift aquifers (Table 2 and Map 2). The largest contiguous aquifer is located along the Sugar River and Connecticut River, as well as their associated wetlands, totaling 6,198 acres. The other location is found along Redwater Brook.

Aquifers are divided into categories based on transmissivity, or the rate at which water moves through an aquifer, measured in square feet per day (ft^2/day). Higher rates of transmissivity correspond to a potentially higher yield of groundwater. Most of the aquifers in Claremont have a transmissivity rate of $1,000 \text{ ft}^2/\text{day}$ or less, which corresponds to a potential yield of less than 75 gallons per minute. However, a few smaller areas are predicted to have a much higher yield. These aquifers are suitable sources of drinking water for the City. They should be protected from contamination.

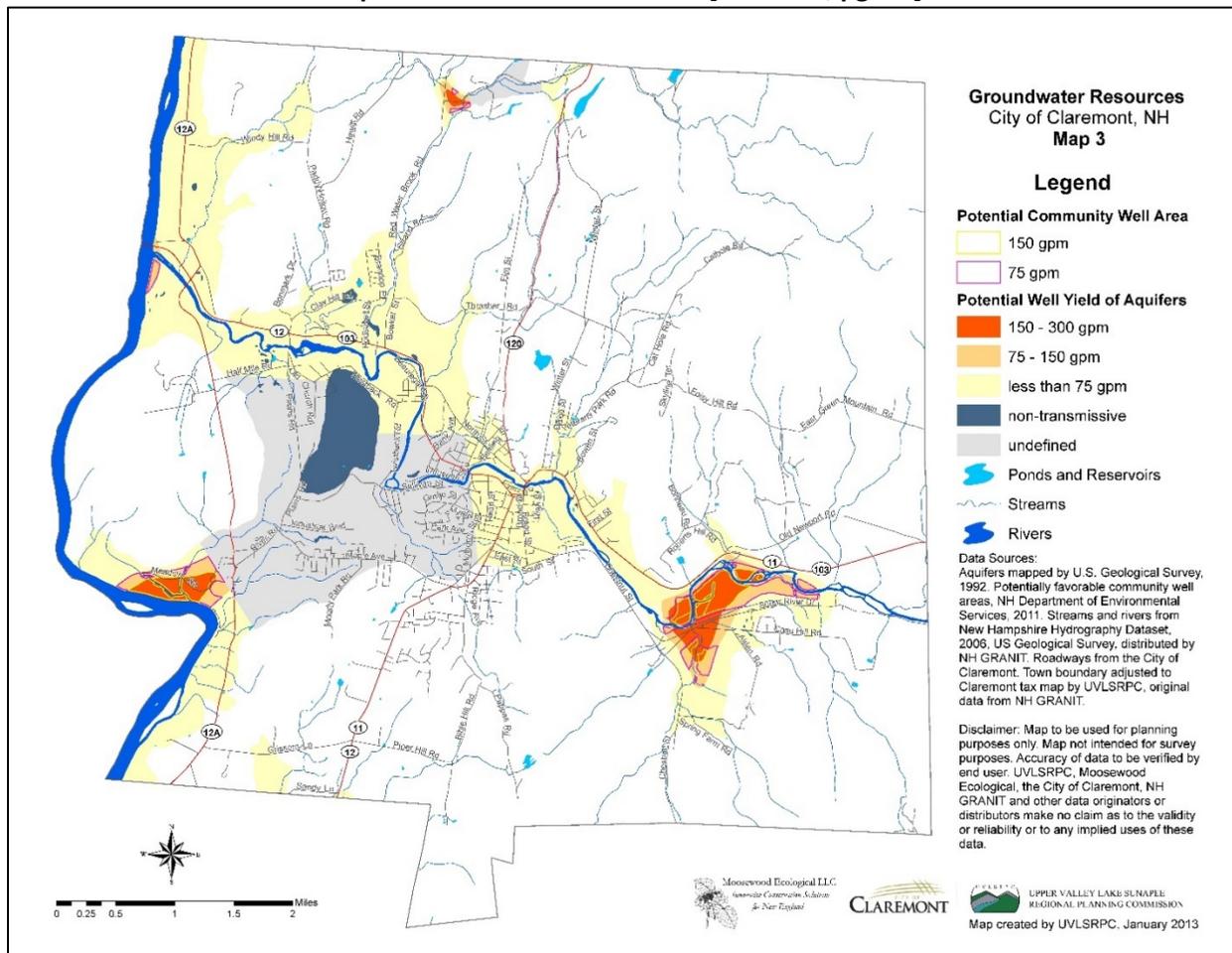
Table 2. Summary of aquifers and favorable gravel well analysis.

Groundwater Attribute	Size(acres)	% of Town
Stratified Drift Aquifers	6351.7	22.5
Favorable Gravel Well Analysis		
75Gallons/Minute	139.5	0.5
150Gallons/Minute	162.2	0.60

Source: USGS stratified drift aquifers (GRANIT 2000) and NH DES favorable gravel well analysis (2011). (NRI, pg. 19)

Map 2 shows the locations of areas suitable for future community water supplies. Particular attention should be paid to land development in these locations.

Map 2: Groundwater Resources [from NRI, pg. 20]



Groundwater is easily contaminated by surface spills of toxic substances, leaking underground storage tanks, poorly functioning septic systems, and the deliberate injection of wastes into disposal wells. Once groundwater is contaminated it is extremely difficult and costly to restore. Hence proactive prevention measures are critically important.



Fishing on the Sugar River (Credit City of Claremont)

Surface Waters as a Recreational Resource

Surface waters provide multiple recreational opportunities such as boating, swimming and fishing. However, it is critical to the long-term health of this resource that such activities cause no harm to the quality of the water or the integrity of the streambanks and shorelines used for such access.

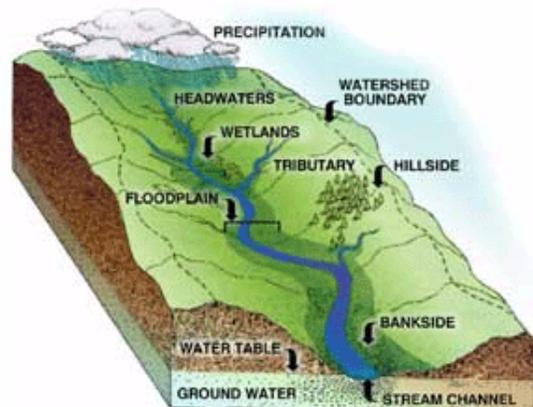
Protection Strategies

Regulation of activities on or near surface waters is one way to protect surface water quality. Such regulations may be local ordinances or state statutes. One example is the Shoreland Water Quality Protection Act (RSA 483-B, The Act) - a state statute that protects water quality of designated public waters. The Act protects six water bodies in Claremont including the Connecticut River, the Sugar River, Chapin Pond, Coy Paper Dam, Rice Reservoir, and Whitewater Brook. NOTE: The Sugar River is exempt from the Act between the Sarah B. H. Smith Riverside Park at 43 Washington Street and the KZM Properties parcel at 247 Sullivan Street.

The City has adopted variance ordinances to protect streambanks and surface water quality as well. These include (in part) the Floodplain and Streambank Districts in the City's Zoning Ordinance.

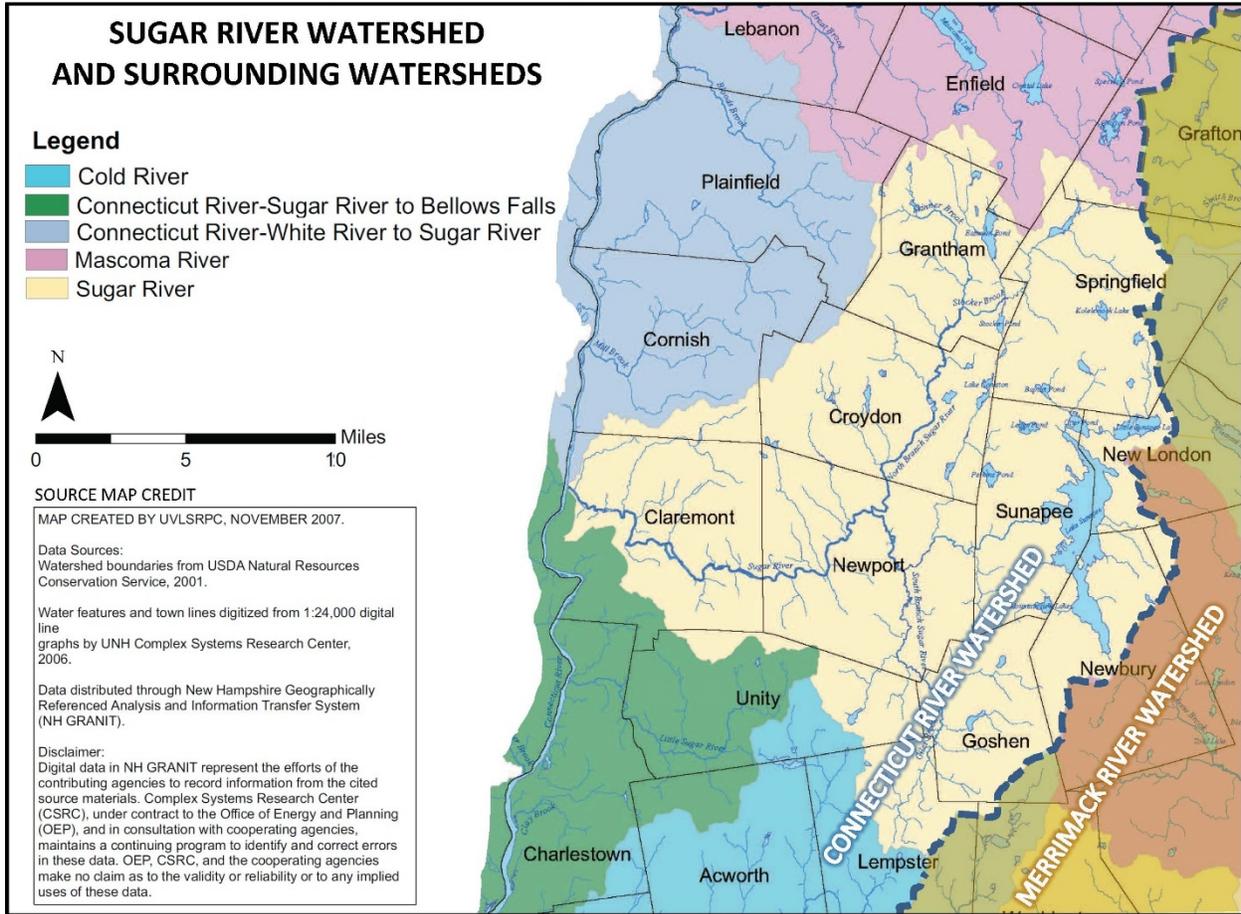
Watershed Protection

Watershed protection is a means of protecting surface waters by managing the entire watershed that drains into it. As rain and snowmelt travel within this "catch basin" and flow by gravity into the water bodies and ground, they carry various amounts of nutrients and pollutants with them. A watershed approach to water resources planning is critically important, as watersheds are the main units of surface water and groundwater recharge. In addition, the land uses located within a watershed directly impact the water quality. All of Claremont is within the Connecticut River watershed and most of it is within the Sugar River watershed.



**Conceptual Watershed
Cross Section**

Map 3: CT River and Sugar River Watershed Boundaries



Future Challenges and Opportunities

Preservation of both our water quality and water quantity is paramount to a healthy future for our City. Quality can be guarded by regulating our activities on and near our water bodies, and while we can't do much to influence how much rain falls in any given year, we can do much to minimize water waste.

Preservation of Water Resources

Much can be done at the local level to prevent degradation of water resources. As stated previously, management of watersheds in their entirety is the preferred method.

Tools for Watershed Protection/Management

1. Land Use Planning: The basic goal of the watershed plan is to apply land use planning techniques to redirect development, preserve sensitive areas, and maintain or reduce the impervious cover within a given watershed. Land Use Planning techniques can include watershed-based zoning, overlay zoning, large lot zoning and transfer of development rights.

2. **Land Conservation:** Land acquisition, from willing owners, is an important non-regulatory measure to protect water quality. The Conservation Commission is authorized by RSA 36-A: 4 to acquire the fee simple (full title) or a lesser interest in land for conservation purposes. Other water resource protection options to pursue are (A) conservation easements, which place permanent restrictions on certain uses of the land, or (B) landowner donations.
3. **Aquatic Buffers:** Stormwater runoff from roads and other impermeable surfaces often enters surface waters directly or via drainage structures, and carries with it salt, sediment and other pollutants. Aquatic buffers can prevent these contaminants from entering the surface waters.
4. **Better Site Design:** Site plan regulations can be developed to foster better site design during the development review process.
5. **Erosion and Sediment Control:** Erosion and sedimentation control and stormwater management are other tools that can be used to decrease surface water quality degradation associated with development and other activities. Stormwater Best Management Practices (BMPs) is a term used to describe optimum methods of controlling stormwater runoff and discharge. BMPs reduce water pollution and flooding.
6. **Watershed Stewardship Programs:** Programs that can be developed locally or regionally to care for the health of a watershed.

The Claremont Conservation Commission oversees the Stevens Brook Conservation Easement, a site that is managed primarily for wildlife and water quality protection with low impact recreation as a secondary function. The plan is to preserve the wetlands and to maintain the existing and restored upland buffers along Stevens Brook and the Sugar River to maximize the conservation area's functions and values particularly for wildlife and water quality. At present, the boundaries of the easement area are not completely delineated on the ground and the signage that would identify it has not been posted. Both tasks should be completed to ensure protection of the resource.

The City should consider employing all of the above tools to improve and protect its valuable water resources to ensure that clean, healthy water is available for humans and wildlife well into the future.

Water Resources Goals

Goal 1. Protect and improve the quality of the City's surface and groundwater resources.

- Objective No. 1.1: Integrate water resource protection best practices into City land use planning priorities and regulatory updates.

Action Items:

1. Create and adopt a watershed management plan to regulate land use activities that affect the quality and quantity of the City's surface and groundwater resources. The plan should incorporate the tools discussed in this chapter.

2. Update the 1991 Source Water Protection Plan. Assess the current level of resource protection in zoning, subdivision and site plan regulations.
 3. Integrate wetland and aquifer protection into water resource protection strategies.
 4. Work with Parks & Recreation Department to ensure that recreation does not compromise the water resources in or near which they may be located.
- Objective No. 1.2: Manage City-owned properties to protect water resources.

Action Items:

1. Finish marking the boundaries of the Stevens Brook Easement area and post the necessary signage.
2. Ensure compliance with the terms of the Stevens Brook Conservation Easement.
3. Enhance undeveloped buffer zones around City public water supply reservoirs.
4. Develop a land management plan for all City properties with emphasis on water quality improvement and protection.

Goal 2. Floodplains: Maintain regulatory floodplains in the City to serve as flood storage and attenuation areas while minimizing risk to property damage, injury, or loss of life during a flood event.

- Objective No. 2.1: Make Claremont a community resilient to flooding.

Action Items:

1. Conduct periodic reviews of City land use regulations to assure compliance with the minimum regulatory requirements of the National Flood Insurance Program. Amend as needed to remain compliant.
2. Utilize grants, technical assistance, and other opportunities to evaluate and improve City infrastructure, development policies, and land use regulations to increase flood resilience.
3. Incorporate, as appropriate, findings and recommendations of the current Hazard Mitigation Plan into municipal land use planning practices.
4. Map dam failure inundation areas in the City and identify appropriate actions to manage development within those areas.

Landscape and Geography

The physical characteristics of a community – its topography, its open and forested spaces, and its man-made features - together create the visual landscape of a community. The ‘patchwork’ of these components defines its character and establishes its identity. A visually pleasing landscape makes a significant contribution to a community’s



The ‘Patchwork’ of Downtown Claremont and Surroundings (Credit WMUR)

overall quality of life. The degradation of any one or more of these components – whether suddenly or gradually - can completely change that character. The erosion of the visual character of a community can have not only psychological impacts, but also very real economic impacts through the loss of tourism, depreciated real estate, and an inability to market the community to prospective businesses and residents. It is therefore critically important in the review of development or forestry projects to evaluate them in the context of community character.

Topography

Steep Slopes

Areas of slopes over 15% are areas in which special precautions need to be taken to be developed. Development should be avoided in these areas because of the extra costs and inconveniences involved with controlling erosion and installing a properly functioning septic system.



Development of a Steep Slope, Main Street, Claremont (Credit d. Bearse)

There are abundant steeply sloping areas in Claremont. They are scattered throughout the northern and southeast sections of the city and are also found to the west of the downtown on Twistback Hill and on Barber Mountain along the Connecticut River. For the most part, these areas are zoned for low density development with one house per five acres and should remain that way.

Hilltops and Ridge Lines

The very top of a ridge is called the ridge line. It is here that development can become controversial. The best views, and abundant wind and solar exposure are often found at the ridge line. However, development of hill tops and ridge lines can be detrimental to a community's visual landscape because of the loss of trees and the presence of structures set against a bare sky backdrop. Development of ridge lines can also be environmentally detrimental to both wildlife and water quality. The City should inventory its hilltops and ridge lines and decide how it wants to protect or develop them individually. In a recent survey, 41% of respondents said development should not be allowed along the City's ridgelines. (41% said "maybe"; 17% said "yes")

Scenic Areas

The scenic areas of a community are often its most cherished visual component. These areas add a great deal to the community's unique character. Scenic areas can include:

- Hilltops and ridgelines
- Meadows and agricultural lands
- Water bodies
- Cultural and historic features (think battlegrounds or training fields)

- “Working landscape” (farms, animals, crops)
- Natural features and open space
- Community gateways

In a 2016 survey, 41% of respondents rated scenic views as being the most important component of rural character for them when ranked against ten other components.

The City’s scenic areas should be defined and inventoried by the City and protection, preservation, and development strategies should be developed for them.

Soils and Geology

Soils

The USDA Natural Resources Conservation Service (NRCS) defines soil as:

“a natural body comprised of solids (minerals and organic matter), liquid, and gases that occurs on the land surface, occupies space, and is characterized by one or both of the following: horizons, or layers, that are distinguishable from the initial material as a result of additions, losses, transfers, and transformations of energy and matter or the ability to support rooted plants in a natural environment.



Ridgeline Development (Credit d. Bearse)

The upper limit of soil is the boundary between soil and air, shallow water, live plants, or plant materials that have not begun to decompose. Areas are not considered to have soil if the surface is permanently covered by water too deep (typically more than 2.5 meters) for the growth of rooted plants.”

Soils are classified by their chemical and physical characteristics. The NRCS has classified Claremont's soils into the following five groups:

Windsor-Unadilla Variant-Agawam: This group is found in the level areas along the Connecticut River and in the Downtown. The soils in this group were formed by glacial outwash deposits and tend to be deep, excessively drained and well drained sandy and loamy soils.

Bernardston-Cardigan-Kearsarge-Dutchess: Most of Claremont's soils are in this group. These are mainly loamy soils formed in glacial till and can be well drained or excessively drained.

Colton-Adams-Rumney: These soils are located along the Sugar River west of the Downtown. They are deep, loamy and sandy soils formed in glacial outwash deposits and alluvium.

Monadnock-Marlow-Lyman: This soil group is only found in the far southeast corner of Claremont. It consists of well drained and excessively drained loamy soils formed in glacial till.

Monadnock-Marlow-Herman: This soil group is found only in the far northeast corner of Claremont. It consists of well drained and excessively drained loamy soils formed in glacial till.

With the exception of a few small isolated patches, all of Claremont's soils are classified by the NRCS as having severe limitations for on-site septic disposal. This means that properties of the soil or site are so unfavorable that the need for special design results in significantly increased construction costs. In some areas, the limitation is caused by poor drainage, shallow depth to bedrock, or a high water table. In others, the problem is caused by layers of silt or clay. During the glacial period, the lower river valleys in Claremont were the bed of glacial Lake Hitchcock. Soils in these areas contain layers of clay and silt that were deposited by this glacial lake. These deposits cause problems for on-site septic disposal because the effluent drains across these impermeable layers instead of down into the ground.

Most of the areas in Claremont with frequent reports of septic system problems are in the areas of glacial lake bed. These include the following:

- Chestnut Street Extension
- Lower portions of Green Mt. Road and Winter Street
- Hanover Street (ledge)
- Paddy Hollow
- Plains Road
- Beaugard Village
- Sullivan Flat
- Airport Hill
- Claremont Junction
- River Road-Grissom Lane area

Agricultural Soils

The best soils for growing crops are called "Prime Agricultural Soils". Soils along the Connecticut River are prized as some of the finest agricultural soils in the world. Claremont is rich with important soils for both forest management and agriculture. These areas represent some of the best soils for the production of forest products and food, feed, and fiber from farming. These natural resources can help provide us with insight into the potential production within the working landscape.

In response to the Farmland Protection Policy Act of 1981, agricultural soils were mapped by the US Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Based on a variety of physical and chemical properties (i.e., drainage, texture, hydric regime, pH, erodibility factor), these soils have been identified as being among the most productive

lands for many types of farming practices. These include prime farmland soils, farmland soils of statewide significance, and farmland soils of local significance. (NRI, pg. 31)

Important agricultural soils cover approximately 10,096 acres, or roughly 36% of Claremont. These soils are widely distributed throughout the town. Prime farmland soils make up about 15% of the total acreage of agricultural soils while farmlands of local and statewide significance total approximately 21% of these soils.

Unfortunately, prime agricultural soils usually impose the least constraints to development for residential, commercial, or industrial uses. This partly explains why the amount of farmland has decreased, and is a reason why the community should act if it wishes to conserve agricultural lands.

Community Use of Natural Resources

Open Space

The term “Open Space” is generally understood to mean any land area that lacks human structures. Agricultural fields, open pastures, and meadows are considered “open space”. It can relate to rural areas where development is spread wide apart with areas of undeveloped land in between. It can also relate to urban open space in the form of public parks and recreation areas – anywhere in the urban area that is mainly grass, trees, shrubs, and flowers – areas designed to provide respite from pavement, buildings, and vehicles.

Open space helps:

- Enhance the small-town character;
- Provide scenic views that contribute to the quality of life and to a visitor’s aesthetic experience;
- Support tourism;
- Promote self-sufficiency and small-scale economy when continued for agricultural purposes;
- Enhance and protect wildlife habitat; and
- Ensure a positive fiscal impact on the city by enhancing property values and keeping property taxes down.

Much of the northern New England character is built upon the framework of the agricultural economy. The very pattern of development in New England is based upon a densely developed center that is surrounded by open agricultural lands. Towns are visibly separated from one another by open, undeveloped lands, which allows each town to maintain its own unique identity. Picture the difference between traveling the Route 12 corridor between Claremont and Keene and traveling the route between Boston and Framingham in Massachusetts. The Massachusetts driver will find it difficult to know when they have left one community and entered another because there is no clear separation between them. However, the traveler on the Route 12 corridor in New Hampshire will have little difficulty knowing that they have passed from one town to another because of the undeveloped spaces in between.

Rural open space lands provide habitat and travel corridors for wildlife, educational opportunities and “breathing space” for residents and visitors, as well as a disappearing link with history. Local farms provide fresh, high-quality food directly to the community and the region, eliminating the need for energy- and cost-intensive shipment and travel. They contribute directly and also indirectly to the economy by providing the quality of life that attracts companies and their workforce as well as tourists.

The City is well endowed with urban open space with its well-maintained parks and recreation areas. These areas are overseen by the Parks and Recreation Department. (Refer to that chapter for more details.) The City also owns a former railroad right-of-way that has been converted to a walking/biking trail. The trail extends from Pleasant Street in the downtown to the Newport-Claremont town line and provides a popular resource for residents and visitors. The Conservation Commission is responsible for developing the long-range plan for the trail and for overseeing activities along it.

Land Development and Current Use

The current use program in New Hampshire provides property owners the benefit of reduced property taxes on open space lands, but does not ensure long-term protection. The purchases of conservation easements, development rights or fee simple acquisition of significant open space or agricultural lands do provide long-term protection.

Table 3. Summary of properties enrolled in current use as farmland and forest land.

Working Landscape Type	# of Parcels	Size (acres)	% of Town
Farmlands	65	3,298.34	12
Forest Lands -Managed	21	3,331.63	13
Forest Lands -Unmanaged	166	11,110.40	42

Source: City of Claremont tax assessor’s database (2016).

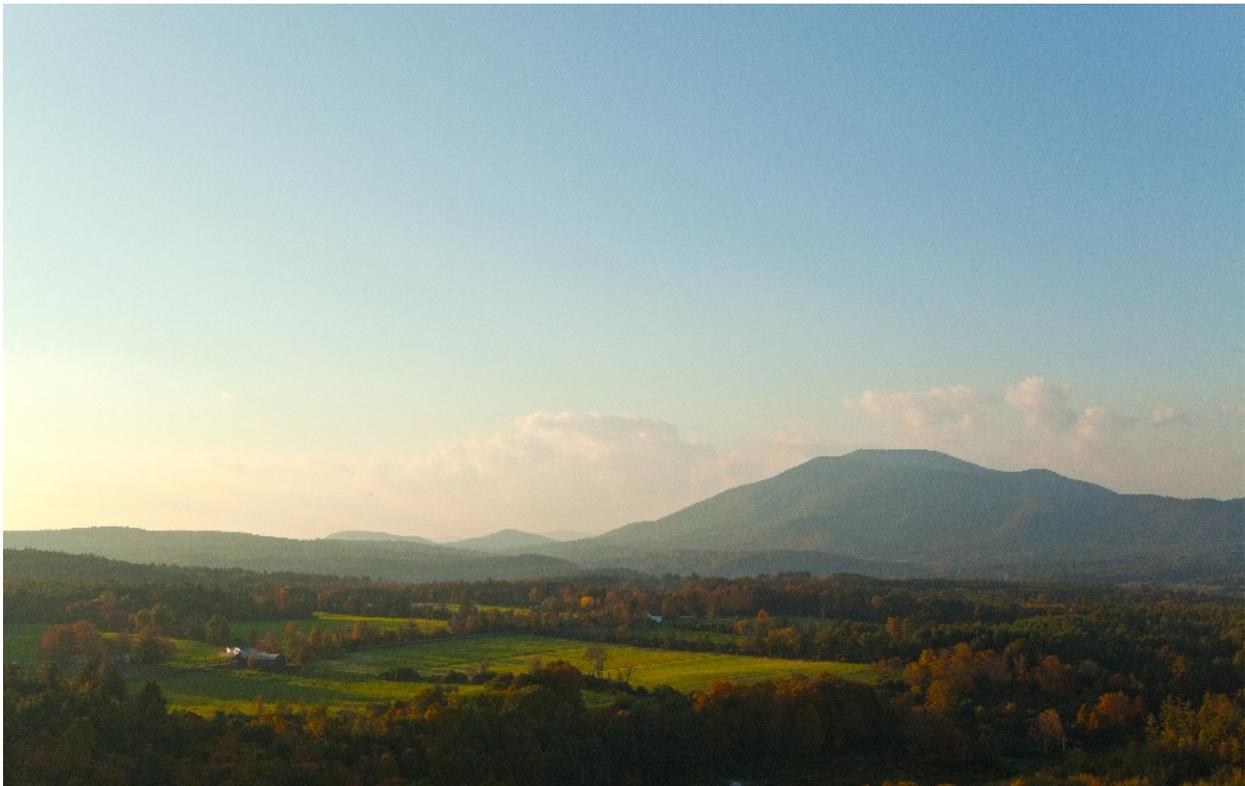
Landowners in the program are encouraged to keep their land open to the public all year for hunting, fishing, skiing, hiking, and nature observation. Willing landowners that do not post their property against trespassing receive additional tax savings. Although few properties in the program are posted against trespassing it is not a requirement to keep lands open.

Approximately 70% of Claremont’s total land area is enrolled in the Current Use program. Most of these are enrolled as forest land. This includes more than 14,000 acres of managed and unmanaged forests distributed throughout Claremont. Of the total 187 parcels listed as forest lands only 21 currently have management plans. These properties may be eligible for reduced tax assessments if they meet the criteria set forth by the program for good land stewardship.

Agriculture was thriving in Claremont in the early to mid-1800s. However, with the expansion of industries in the city, development pressure increased dramatically, whereby changing land use from farming to residents and businesses. Today, roughly 7% of Claremont is enrolled as active

farmlands. These include a variety of land use practices, such as corn fields and other row crops for vegetables, hayfields, dairy, and other livestock production. As one drives along Routes 12A and 12/11 one can see many open fields that are used for farming.

Claremont's working landscape and the Current Use program help to maintain open space throughout the city. Many studies have been conducted in NH that compare the cost of services of residential, commercial/industrial, and open space land. These studies have shown that residential development often results in higher community costs (schools, roads, fire and police protection) than revenues generated. (NRI, pg. 38-39)



View from near Cat Hole Road (Credit WMUR)

Recreation and Natural Resources

Trails, river access, parks and open space are integral parts of the community. It is often through recreation that the human environment and natural environment amalgamates to create a whole community. The recreational use of natural resources, however, should never result in the degradation of them.

More detail on the recreational opportunities in the City of Claremont's urban and rural areas can be found in the Recreation Chapter of this Master Plan.

Landscape and Geography Goals

Goal 1. Sense of Place: The City should recognize characteristics in its natural landscape that define its character, as experienced by its citizens, and strive to preserve and protect them.

- Objective 1.1: Identify and protect important topographic and scenic features in the City landscape.

Action Items:

1. Minimize development on areas with slopes greater than 15%.
2. Identify hilltops and ridgelines that warrant protection from development and develop appropriate protection strategies.
3. Identify important scenic vistas and develop protection strategies.

- Objective 1.2: Conserve important agricultural soils.

Action Items:

1. Minimize development/impermeable surfaces on mapped Prime Agricultural Soils.
2. Promote agricultural development and agricultural tourism.

- Objective 1.3: Enhance community use of natural resources

Action Items:

1. Maintain the traditional New England development pattern with a densely developed center surrounded by gradually less dense development and increasing open space toward the City's boundaries.
2. Foster good land and natural resource stewardship (e.g. agriculture and forestry best management practices) of private and City-owned open space through education and outreach efforts. Encourage individual landowners to be good stewards of their own properties.
3. Identify open space parcels that have significant natural resource value and/or serve as wildlife corridors for the City or a third party to purchase or obtain easements for natural resource conservation.
4. Assess current level of resource protection in City Land Use Regulations. Develop regulatory amendments to increase protections, where necessary.
5. Continue to provide for both motorized and non-motorized sustainable recreation opportunities such as ATV and snowmobile trails, foot paths, and cross-country skiing and snowshoe trails where it is appropriate and compatible with the ecology of the parcel.
6. Manage City recreation areas for ecologically and socially sustainable recreation opportunities including maintaining a recreational infrastructure (e.g. picnic areas, shelters, trails, etc.), hunting (where appropriate), and creating vistas along recreational trails for scenic areas and wildlife viewing.
7. Complete the long-range plan for the rail-trail and implement its findings.
8. Work with the Parks and Recreation Department to ensure that recreational activities on City-owned open space lands are not incompatible with the ecosystems of those lands.

Forest Resources

Forest resources within New Hampshire are significant for many reasons. They provide:

- diverse ecological functions, such as:
 - nutrient cycling,
 - carbon sequestration,
 - water quality maintenance through sediment trapping;
- substantial habitats for wildlife and plants;
- clean air;
- a multitude of forest products; and
- sources of employment.



New England Forest (Credit: Justin Reznick/iStockphoto.com)

Healthy forests also help promote local economies, recreation and tourism and provide the appealing backdrop for New England villages. Benefits of forests include reduced energy use, improved water quality, diverse wildlife habitat, as well as improved human health and well-being. Urban forests are an essential component of a ‘green infrastructure’ and their benefits extend well beyond the cities and towns where they are located.

For these reasons, it is important to maintain large tracts of forest lands and to better understand where important forest soils exist in Claremont. (NRI, pg. 35)

Overview of City of Claremont Forest Management Plan

In 2008 forestry consultants, Ecosystem Management Co., Meadowsend Timberlands, LTD was hired by the City of Claremont and prepared a Forest Management Plan for the City of Claremont Forestlands. It included the following parcels:

- Arrowhead Forest ^{1,2},
- Cat Hole Road ¹,
- Industrial Road Lots,
- Moody Park,
- Rice Reservoir,
- Veteran’s Park,
- White Water Reservoir, and the
- Winter Street Lot.

These lots contain approximately 1535 acres.

The plan identified trends and common features of all the above parcels, and the management goals, objectives, and practices that will be generally applied. The forest conditions, specific management goals and objectives, timber volumes, soil types, access considerations, special wildlife habitat considerations, historical information and other specific details are addressed parcel by parcel. The Natural Resource Chapter of the Master Plan adopts the Forest Management Plan in its entirety.

In 2009, New England Forestry Consultants Inc. (NEFCO) was hired to implement the Forest Management Plan. Although the management plans for each individual parcel are written for a ten-year period, they are meant to be flexible. As the science and knowledge base grows, as market conditions change, and as technology changes, so must the management techniques. While the overall goals of management plan will remain consistent, the objectives and practices used to reach desired goals must be flexible.

As of August 2016, NEFCO had completed about 40% of the plan, with 641 acres being treated to various timber harvesting and thinning operations. In addition, twenty-two miles of City-owned forestlands' property boundary lines were surveyed, marked and painted.

We are approaching the end of the initial ten-year lifespan of Claremont's Forest Management Plan and updating it will be a priority. This will require a review of progress to date and obtaining public input on future management.

Forest Management and Natural Resources

Management of the City of Claremont forestlands will be geared to meet multiple, often interrelated goals and objectives. Even though economically and sustainably growing and harvesting trees is notably a major focus of ownership, timber is only part of the resource evaluated in the planning process. Water resource protection, open land, wetland and riparian conditions, wildlife habitat, recreational opportunities, scenic value, as well as renewable natural resource products such as biomass and fuel wood are evaluated and included in management recommendations. In the future, the City may choose to consider the potential for carbon storage in its forests as well. Forest management on these lands will occur under the umbrella of land stewardship for the good of the forest and the people it serves.

Mission Statement

"The City of Claremont will actively manage Claremont's natural areas with a strong land ethic in order to achieve responsible land stewardship. These stewardship activities will help to promote Claremont as a healthy community with a quality of life that values the environmental quality of forest ecosystems and the benefits of commercial and recreational land uses." (Taken from the Forest Management Plan, 2008)

Principles for Management

- Adopt a holistic view of natural systems which places human activity within rather than apart from the natural environment.
- Implement forest management that is ecologically, economically, and socially responsible.
- Resource extraction should not exceed the regenerative capacity of the ecosystem or reduce natural productivity or diversity.
- Whenever possible management shall incorporate the results of previous actions into future decision-making efforts.
- Management practices shall support indigenous habitats and prevent fragmentation so that wildlife can migrate for seasonal food and reproductive needs.

- Manage for ecologically and socially sustainable recreational opportunities

It is critical that the Forest Management Plan be adhered to in order to create positive outcomes: develop and implement educational and communication programs regarding forestry for public and private lands, incorporate the 2013 Natural Resources Inventory into the Forest Management Plan.

Important Forest Soils

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

The USDA Natural Resources Conservation Service has mapped the distribution of important forest soils and has classified them according to their capacity to grow trees. These soils signify areas as providing the most productive lands for timber production. The NRCS has identified three soils groups within this category and have described each as follows:

Forest Soil Class IA

This group consists of the deeper, loamy textured, moderately well, and well drained soils. Generally, these soils are more fertile and have the most favorable soil moisture relationships. The successional trends on these soils are toward stands of shade tolerant hardwoods, i.e., beech and sugar maple. Successional stands frequently contain a variety of hardwoods such as red oak, beech, sugar maple, red maple, white birch, yellow birch, aspen, and white ash in varying combinations with red spruce, hemlock, and white pine. Hardwood competition is severe on these soils. Softwood regeneration is usually dependent upon persistent hardwood control efforts.

Forest Soil Class IB

The soils in this group are generally sandy or loamy over sandy textures and slightly less fertile than those in group IA. These soils are moderately well and well drained. Soil moisture is adequate for good tree growth, but may not be quite as abundant as in group IA soils. Soils in this group have successional trends toward a climax of tolerant hardwoods, predominantly beech. Successional stands, especially those which are heavily cutover, are commonly composed of a variety of hardwood species such as red oak, red maple, aspen, paper birch, yellow birch, sugar maple, and beech, in combinations with white pine, red spruce, balsam fir, and hemlock. Hardwood competition is moderate to severe on these soils. Successful softwood regeneration is dependent upon hardwood control.

Forest Soil Class IC

The soils in this group are outwash sands and gravels. Soil drainage is somewhat excessively to excessively drained and moderately well drained. Soil moisture is adequate for good softwood growth, but is limited for hardwoods. White pine, red maple, aspen, and paper birch are common in early and mid-successional stands. Successional trends on these coarse textured, somewhat draughty and less fertile soils are toward stands of shade tolerant softwoods, i.e., hemlock and red spruce. Hardwood competition is moderate to slight on these soils. Due to less hardwood competition, these soils are ideally suited for softwood production. With modest levels of management, white pine can be maintained and reproduced on these soils. Because these soils are highly responsive to softwood production, especially white pine, they are ideally suited for forest management.

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

Table 4. Summary of important forest soils for timber production in Claremont.

Important Soil Type	Size (acres)	% of Town
Hardwood Production (IA and IB)	13602.1	48.2
Softwood Production (IC)	2371.0	8.4

Source: GIS Analysis (Moosewood Ecological 2012) of USDA Natural Resources Conservation Service soils. (NRI, pg. 36)

Urban Trees

The trees that line the City’s streets and grace the City’s cemeteries and parks are also valuable resources. Urban street trees provide multiple benefits including (but not limited to):³

- Traffic calming
- Safer walking environment
- Aesthetics
- Reduces Storm water runoff
- Rain, sun, heat protection
- Pollution absorption
- Lower ambient air temperature in summer
- Public health
- Added value to adjacent businesses and homes
- Longer pavement life
- Screening

At present, there is no plan, no guideline, and no budget for the management of the City’s urban trees. (There is a small budget for the removal of dead trees in the City’s rights-of-way.) The Parks and Recreation Department oversees trees in the City’s parks, while the Public Works Department responds to calls regarding hazard trees and dead trees in the City’s rights-of-way and cemeteries. However, there is no policy for determining ownership of trees in the right-of-way and no guidelines for determining whether a tree should be removed or not.

Future Challenges and Opportunities

Claremont’s forest resources are critically important to the City’s character and natural resource inventory. They warrant continual careful stewardship to improve and maintain their health, beauty and ecological functions and to prevent a future of “benign neglect”. Therefore, the 2008 Forest Management Plan should be updated right away, beginning with those parcels that have been logged since 2008. Such updates should be sure to include plans to monitor invasive species in newly opened areas.

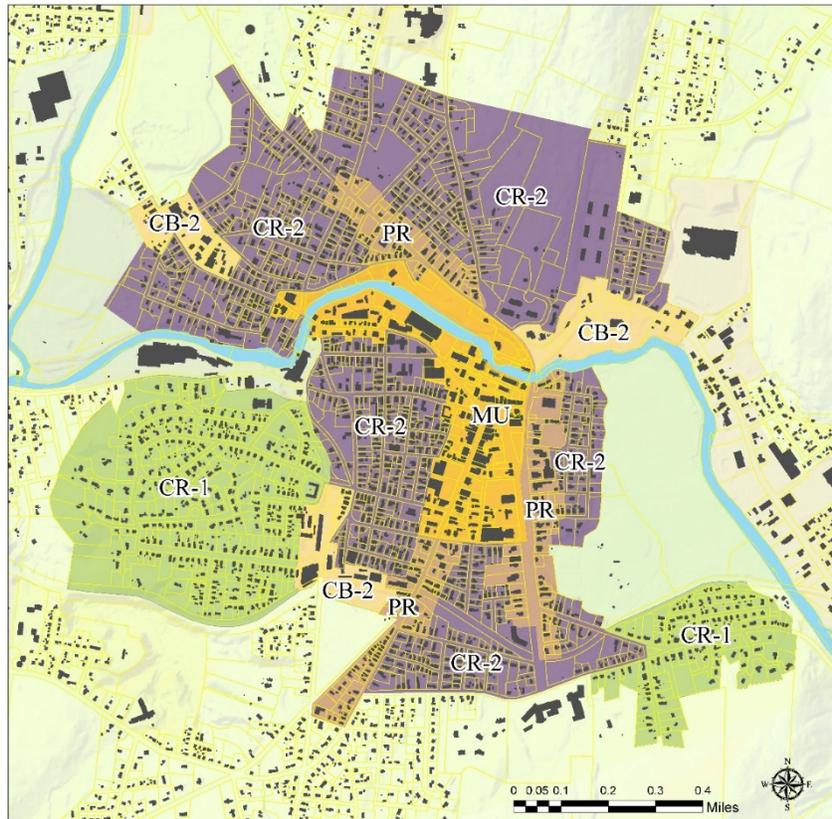
Careful oversight of upcoming “cuts” on the remaining parcels must be provided to ensure adherence to the existing plan. Public outreach and education is also very important and the Conservation Commission should make every effort to inform the public about present and future plans and activities.

The City’s urban trees also warrant careful stewardship. The City should create a management plan for the trees in the right-of-way and in the parks and public spaces within the City Center. A policy and guidelines for managing trees in the rights-of-way outside the City Center and in the City’s cemeteries should also be developed.

City Center

The City Center would correspond roughly to the extent of the City Center Zoning Districts, which include the CR-1, CR-2, PR, CB-2 and MU zones.

Map 4: City Center Zoning Districts



Tree City USA

The City should consider acquiring “Tree City USA” status once again as a means of creating a sustainable urban forestry program. Additional benefits of the program include public education about the value of trees in the urban environment and the importance of sustainable tree management.



Street Trees, Broad Street, Claremont (Credit d. Bearse)

Forest Resources Goals

Goal 1. Recognize the value of the City’s urban and rural forests in the character and quality of life in the City.

- Objective 1.1 Improve management of the City’s urban trees
Action Items:
 1. Pursue membership in the Tree City USA program.
 2. Create a policy and guidelines for management of trees in the public cemeteries and in the public rights-of-way outside of the City Center.
 3. Create a Management Plan for trees in the public spaces of the City Center.
- Objective 1.2 Improve where necessary and maintain healthy, biodiverse, productive and aesthetically pleasing forests.

Action Items:

1. Incorporate the 2013 Natural Resources Inventory into the 2008 Forest Management Plan.
2. Implement and regularly update the Forest Management Plan.
3. Assess current level of resource protection in zoning, subdivision and site plan regulations

¹ Identified as “ecologically significant” in 2013 Natural Resources Inventory.

² Identified as most important to survey respondents, March 2016

³ *Urban Street Trees, 22 Benefits, Specific Applications*, Dan Burden, 2006, https://www.michigan.gov/documents/dnr/22_benefits_208084_7.pdf

Wildlife Resources

The following information is taken directly from the 2013 Natural Resources Inventory.

Wildlife Habitats

The NH Fish and Game Department, in cooperation with other agencies, organizations, and individuals, produced the NH Wildlife Action Plan (WAP) in 2005 (habitats revised 2010). The

WAP was designed as a planning and educational tool for federal, state, and municipal governing bodies, conservation commissions, land trusts and other conservation organizations, and private landowners, as well as the general public, to promote the conservation and management of NH's biological diversity. The WAP provides a resource for developing informed land use decisions and land management planning. The intent was to ensure that an adequate representation of various wildlife habitats is maintained across our landscape, keeping common species common in NH and working to prevent the loss of our rare and endangered species.

The WAP identified approximately 11 different types of large and medium-scale wildlife habitats for Claremont in their revised habitat mapping in 2010. However, since these habitats were based on models, they only predict where these habitat types may be present and ground-truthing is essential to better understand the extent of habitats. As such, the WAP habitats were refined based on 2010 aerial photography interpretation in combination with roadside surveys and site assessments on City-owned lands. This resulted in the elimination of certain habitat types and the addition of others. It also represents a more representative effort at understanding the true extent of wildlife habitats located within Claremont.

A total of eight wildlife habitats as recognized by the WAP were mapped for Claremont (Table 5 and Map 5). Habitats that were eliminated included pine barrens, cliffs, and Appalachian oak-pine forests since evidence of these habitat types were not observed. The pine barrens and cliffs were mapped in very discrete areas. As such, there is high confidence that these habitats do not exist in the locations as predicted by the WAP. However, the WAP predicted that Appalachian oak-pine forests were more widespread in the western part of the City. Evidence of this forest type was not present from roadside observations. However, it is possible that it may be present in small patches in the unfragmented block west of Route 12A and south of the confluence of the Sugar River and Connecticut River. Site investigations within this area would need to be performed to confirm its presence or absence.

Additional habitats recognized but not mapped in the WAP included potential vernal pools and shrub lands. These habitats are predicted to be more widespread throughout Claremont and are best mapped during ground-truthing exercises. Mapping of these important wildlife habitats was beyond the scope of the WAP. However, they do recognize their importance for wildlife diversity.

Vernal pools supply critical habitat for a variety of species. Amphibians such as spotted salamanders and wood frogs need these pools to complete their life cycles. In early spring they emerge from their winter habitats and migrate to vernal pools for breeding. During April and May one can easily view their egg masses, which are usually attached to live plants or twigs just beneath the water surface. After breeding, the adults leave the pools, retreating back to their upland habitats. These egg masses can serve as a critical food supply for wildlife, including the rare Blanding's turtle. Aquatic macroinvertebrates also need vernal pools for survival, such as fairy shrimp and fingernail clams.

Map 5: Highest Ranked Wildlife Habitat (from 2015 NH Wildlife Action Plan)

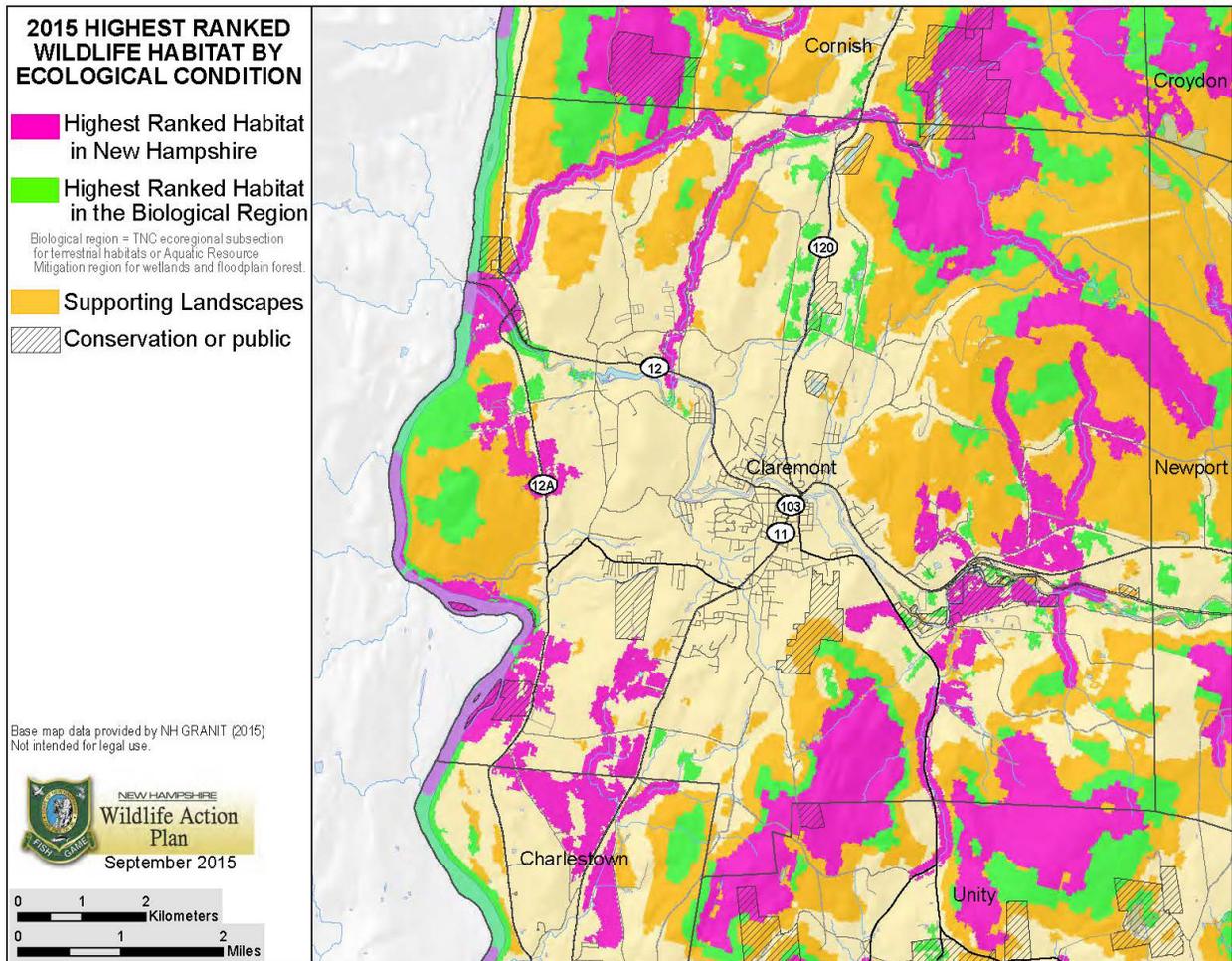
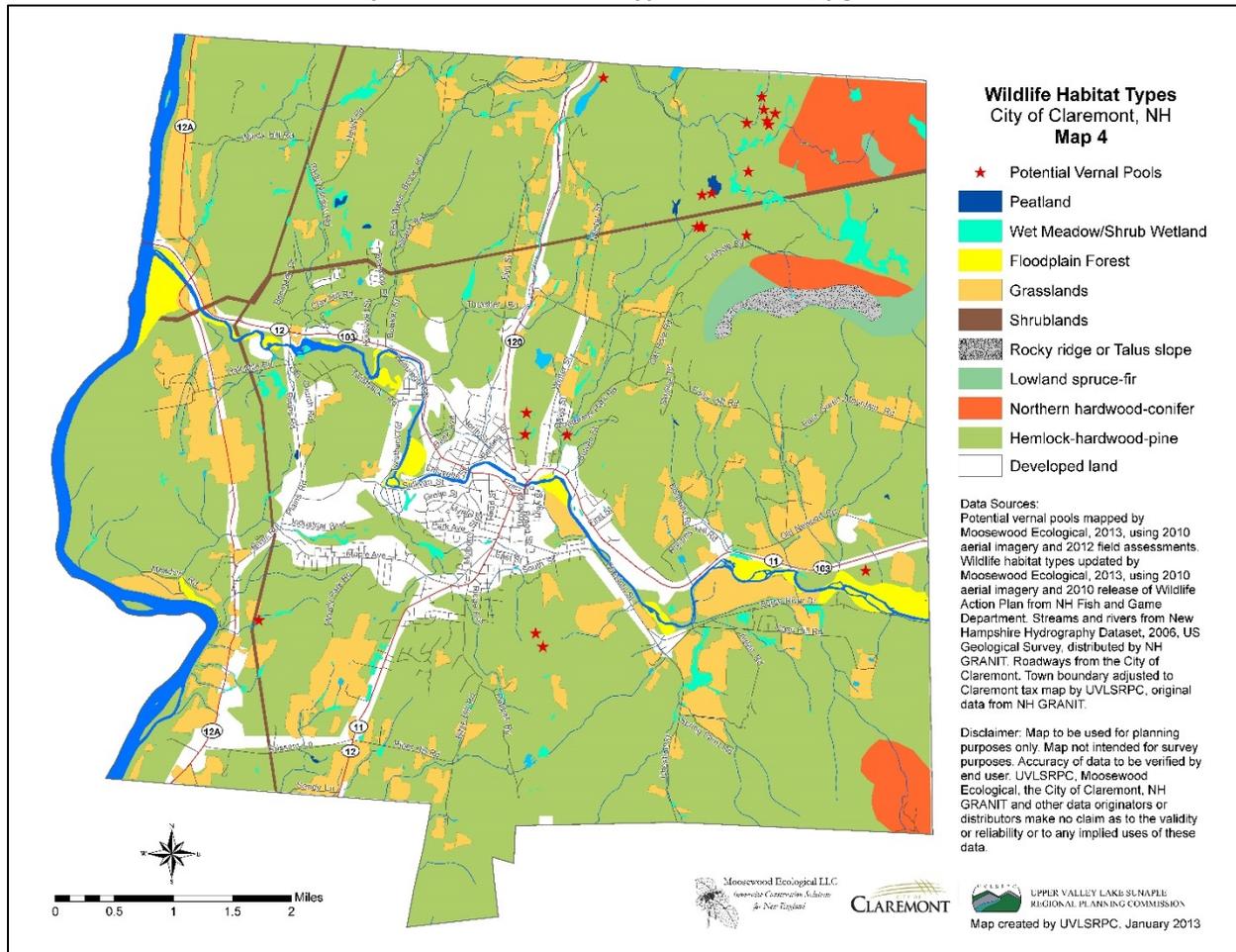


Table 5. Summary of wildlife habitats in Claremont.

Wildlife Habitat Type	Size/Count	% of Town
Marsh and Shrub Wetlands	391 acres	1.4
Peatlands	19.4 acres	0.1
Vernal Pools	30 pools	n/a
Floodplain Forests	403.8 acres	1.40
Ponds and Reservoirs	104.2 acres	0.4
Rivers and Streams	164 miles	n/a
Lowland Spruce-Fir Forests	397.6 acres	1.4
Northern Hardwood-Conifer Forests	980.4 acres	3.5
Hemlock-Hardwood-Pine Forests	19254.7 acres	68.2
Ridge or Talus Slopes	155 acres	0.60
Shrub lands	226.4 acres	0.80
Grasslands	3146.2 acres	11.2

Source: Refined wildlife habitats (Moosewood Ecological 2013) and NH hydrography (GRANIT 2006).

Map 5: Wildlife Habitat Types [from NRI, pg. 23]

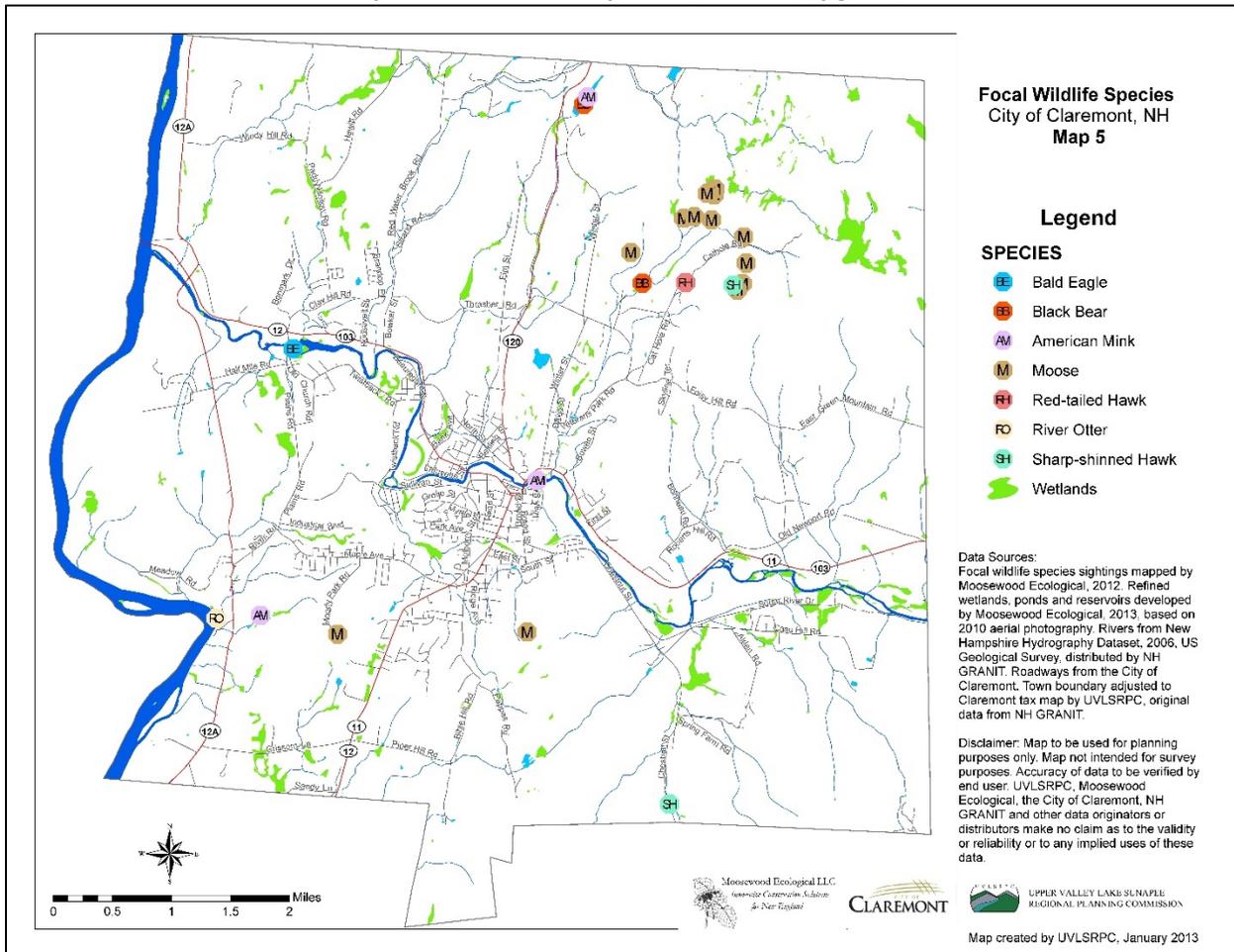


Focal Wildlife Assessment

Focal species included bear, bobcat, moose, river otter, mink, beaver, birds of prey, leopard frog, and wood turtle. These species were identified to act as surrogates to better understand connectivity, habitat quality, and long-term viability of wildlife habitats in light of the effects of fragmentation and land use patterns. In essence, it helps to get a sense of the relative ecological integrity, or health, within Claremont.

A total of seven focal species were observed throughout Claremont (Map 6). These included bear, moose, river otter, mink, bald eagle, red-tailed hawk, and sharp-shinned hawk. An additional focal species, beaver, was observed in Cornish on the city-owned Whitewater Reservoir property. Of these, sign of moose was the most frequently documented. Six out of the seven focal species observed were located in the Cat Hole area located in the northeast part of Claremont. The presence of greater species diversity in the area was expected based on the variety of wildlife habitats available within the largest unfragmented block in Claremont.

Map 7: Wildlife Focal Species [from NRI, pg. 26]



Sign of moose was observed on four city-owned properties, including Arrowhead Forest, Industrial Area Forest, Cat Hole Road Forest, and Whitewater Reservoir. Sign was most abundant on the latter two properties. They are located within the largest unfragmented block in Claremont, and associated with a much larger forested block (48,723 acres) that extends north and east. Moose require large, remote forests with embedded wetlands and can travel long distances in search of food. The Cat Hole area provides the best, high quality habitat and connectivity for moose with its intact forest communities and diverse concentration of numerous wetlands. The other two areas provide limited habitat for moose but do afford decent connectivity possibilities with areas to the south.

Like moose, bear require large areas of intact forests with diverse wetland complexes. They can serve as an umbrella species, whereas protecting prime bear habitat will also protect habitat for a wide variety of species. Bear sign was observed in the Cat Hole area, which provides excellent habitat and a multitude of food sources. Bear sign was also observed next to Fitch Reservoir.



Urban Wildlife- Hawk atop "Ourhandsthenandnow" Sculpture, Visitor Center Park (Credit d. Bearse)

River otter was observed in only one locale in Claremont, primarily along the Connecticut River. However, it is suspected that this species is more widespread in Claremont, including such areas as the wetlands and tributaries in the Cat Hole area and relatively undisturbed parts of Sugar River and other streams. Unlike mink, river otters prefer habitats with little to no human presence, preferring intact riparian buffers. They are strongly associated with beaver, which was only observed on the city-owned Whitewater Reservoir property in Cornish.

American mink are more tolerant of humans than river otter. Mink tracks were observed at Rice Reservoir, Sugar River at Riverside Park, and along a stream associated with the Industrial Area Forest. If an adequate supply of aquatic wildlife is present mink is expected to be found in most parts of Claremont, especially along well-shaded streams with intact riparian areas.

Three birds of prey were observed throughout the City, including red-tailed hawk, bald eagle, and sharp-shinned hawk. The presence of these species can indicate productive habitat for prey. While red-tailed hawks are more commonly found in more open areas sharp-shinned hawks (known as a woodland hawk) generally reside in larger forested areas. This species was located in the southeast and in the Cat Hole area. The bald eagle was observed scanning the dammed area of Sugar River at the City-owned Twistback property. This area provides good habitat for waterfowl, a favored prey of bald eagles.



Photo by Bruce Denis- taken at the confluence of the Sugar and Connecticut Rivers

Unfragmented Lands and Habitat Connectivity

Unfragmented lands are defined by the surrounding human infrastructure (roads and developed areas). Fragmentation of these blocks can negatively affect species survival rates by increasing outright mortality, lowering rates of breeding success, and ultimately leading to

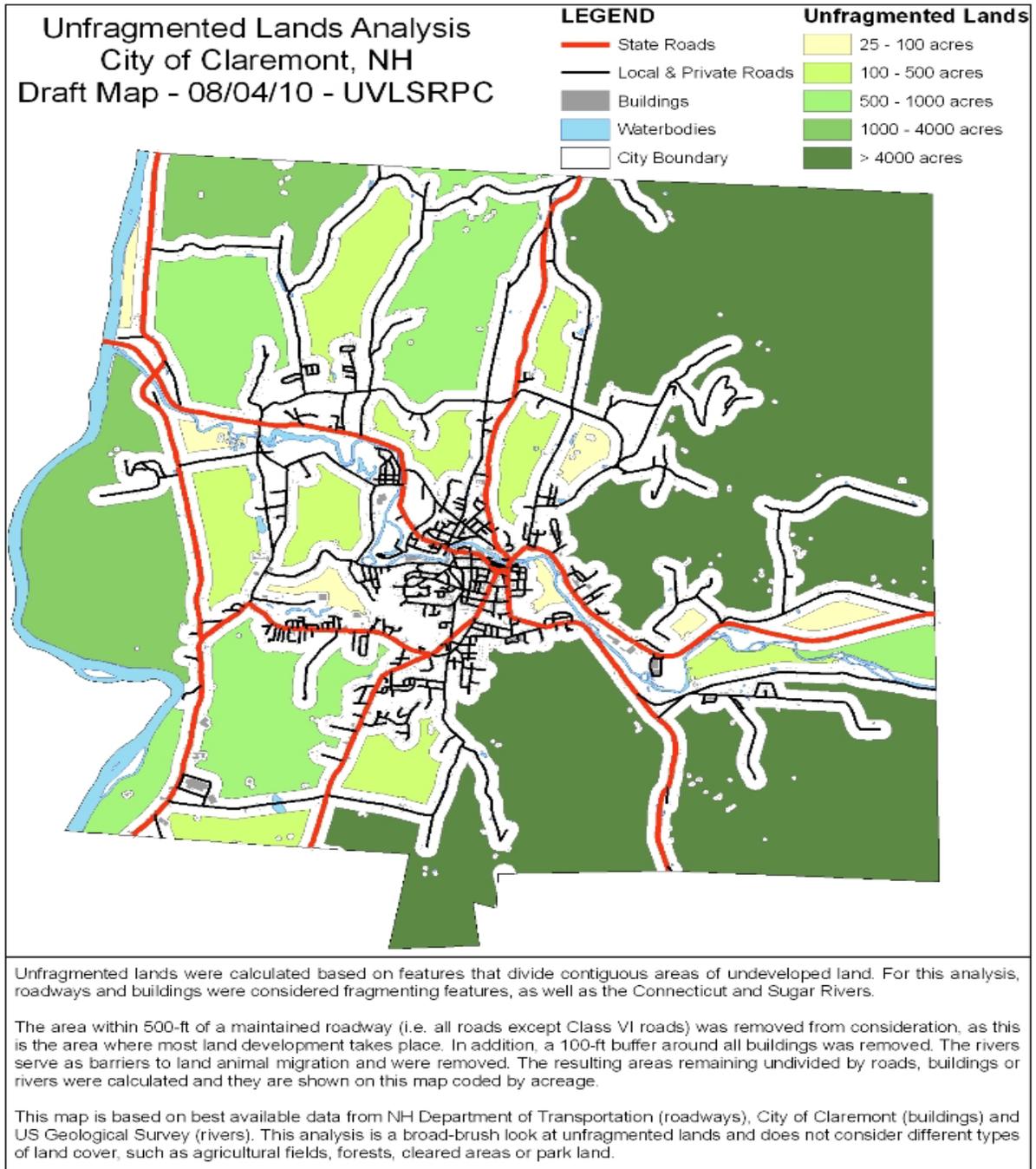
species loss altogether. The degree of severity of fragmentation depends upon many aspects, such as the size and shape of the unfragmented block, the species or community in question, the extent of loss of natural habitats, intensity of human use, and colonization of invasive species.

The NH Wildlife Action Plan (WAP) developed an unfragmented lands analysis. However, this data layer has inherent errors. Therefore, the unfragmented lands were revised for the NRI to more accurately reflect Claremont's landscape (Map 7). For the purposes of the Natural Resources Inventory, fragmenting features were defined as 500 feet on either side of existing roadways, including all state and town roads but excluding Class VI roads and trails, as well as private driveways. It is within this 500-ft wide area that most development occurs.

Unfragmented blocks of land include a variety of natural habitats such as forests, wetlands, streams, and ponds but also can include human-modified areas such as agricultural lands and shrub lands.

Large blocks of unfragmented areas are widely known to support greater biodiversity than smaller blocks. As forest blocks become smaller due to the construction of roadways and developments their biodiversity will generally be reduced. This fragmentation affect has less immediate impact on generalist species or those with small home ranges (such as gray squirrels, raccoon, many amphibians, and small rodents) while affecting and potentially eliminating area-sensitive specialists that need large forested blocks in order to maintain their home ranges and for long-term survival (such as bear, bobcat, moose, some reptiles, wood thrush, and goshawk). Table 6 provides a general list for habitat block size requirements for wildlife to help illustrate this point.

Map 8: Unfragmented Land



Another function of large landscapes considers wildlife movement and habitat connectivity. By maintaining connectivity between critical habitats, it may be possible to provide permanent wildlife corridors within the built environment. Wildlife travel corridors function as areas that one or many species may use to move from one habitat to another. This movement can be based on traveling to various areas for feeding, breeding, nesting, or shelter.

Wildlife must be able to travel safely throughout the landscape in order to meet their biological needs. Many depend upon a variety of habitats for their survival and may utilize many natural features for travel. These may include features such as riparian zones of wetlands, ponds, and streams, ridgelines, utility rights-of-way, and forest patches acting as a safe route between two or more habitats. A variety of wildlife can be associated with these corridors, including otter, muskrat, fox, coyote, bobcat, deer, moose, fisher, mink, and bear.

Wildlife corridors are not only significant for mammals but are equally as important for amphibians, reptiles and migratory birds. Both amphibians and reptiles begin to move from their wintering habitats to their respective breeding and nesting grounds in the spring. This is the time of year that most mortality can be noticed as these species travel across roadways in search of suitable habitats. This affect can often be exacerbated as the same individuals must return back to their wintering habitats. Thus, there is a great significance in maintaining habitat connectivity, as well as understanding where these patterns of movement are taking place.

This latter point can be a very important educational tool for community education and awareness about corridors across road ways. It can provide a means to adjust transportation patterns to help eliminate potential road mortality.

Based on the assessment of focal species and unfragmented lands in Claremont the Cat Hole area provides the most impressive, high quality habitats to support a wide diversity of wildlife. The presence of bear and moose points to this fact. It is suspected that many other focal species are likely present in this area, including beaver, otter, mink, and wood turtle. Winter mammal tracking can also be used to develop an even better understanding of habitat connectivity and quality, especially when assessing roadway crossings.

Land uses that continue to fragment Claremont's landscape, especially those on the outskirts of the city decreases quality, connectivity and long-term viability of wildlife habitats and natural communities. Concentrating developments within the built environment and maintaining large unfragmented blocks can help to maintain connectivity, allowing species to continue to travel from habitat to habitat to meet their life cycle needs. Likewise, the use of appropriate culverts at steam crossings can help to maintain connectivity for aquatic-related species such as otter, mink, turtles, and fish.

The urban area of Claremont and various developments along NH Route 103 act as a major barrier for wildlife movement, inhibiting connectivity for many species. Routes 120, 11/12, and 12A also act as fragmenting features that can disrupt wildlife movement. However, the more rural areas of these roads most likely allow for habitat connectivity although they also contribute to road mortality. Moose and bear associated with the Cat Hole area are most likely moving north and east through the landscape, avoiding the more disturbed parts of Claremont to the south and west. Similarly, wildlife movement in the southeast quadrant of Claremont most likely flows south and east, whereas wide-ranging wildlife most likely will avoid the disturbed areas to the west and north. This does not suggest that you will not see these wide-

ranging mammals near more disturbed sites but these areas do not provide for their long-term viability.

In general, the western part of Claremont, particularly between Route 12A and Routes 120 and 11/12 are prohibitive for wildlife movement due to the sheer number of roadways and smaller unfragmented blocks. Thus, habitat connectivity in this area has been negatively impacted. As noted above, this does not suggest that wildlife can't travel through parts of this portion of the City but the long-term viability and quality of habitats have been degraded. Clearly, moose and mink are moving through the Industrial Area Forest but it does not provide habitat to sustain productive populations.

The Connecticut River and Sugar River most likely function as corridors for various species, including mink and river otter. However, sign of river otter is likely much less frequently observed along the more heavily disturbed riparian areas of the Sugar River. The eastern and western sections of the river provide good habitat for aquatic-related wildlife.

The presence and rampant spread of invasive plants also has a major negative effect on habitats and communities. Invasive plants displace native species and decrease the ecological integrity of the landscape. Invasive plants are widespread in Claremont and were observed on all properties visited (during development of the NRI), as well as many locations along roads. Disturbance associated with developments, previous agricultural lands that have since become reforested, and forestry activities can exacerbate the spread of invasive plants unless managed properly.

Long-term Protection of Wildlife Habitat

Important benefits of protecting wildlife habitat and maintaining biological diversity are:

- Wildlife and its habitat enhance our quality of life and enrich our community.
- Wildlife related activities, such as fishing, hunting and wildlife watching, generate significant economic activity.
- Wildlife and its habitats cannot be supported solely through public acquisition of lands for protection, so local communities and private landowners are critical partners in wildlife conservation.

Future Challenges and Opportunities

The Conservation Commission's 2016 Conservation Plan commits to long-term stewardship of the City's wildlife resources in a variety of ways. The City should lend whatever support will be required to assist in the achievement of the Plan's goals. There is ample opportunity to preserve and/or improve wildlife habitat and populations in the City through both regulation and education. In a 2016 survey, 64% of respondents felt that creation and/or protection of wildlife corridors is important for the Conservation Commission to pursue.

Table 6 Habitat Block Size Requirements for Wildlife

1-19 Acres	20-99 Acres	100-499 Acres	500-2,500 Acres	>2,500 Acres
raccoon	raccoon hare	raccoon hare	raccoon hare	raccoon hare coyote
small rodent	small rodent porcupine	small rodent porcupine	small rodent porcupine	small rodent porcupine bobcat
cottontail	cottontail beaver	cottontail beaver	cottontail beaver	cottontail beaver black bear
squirrel	squirrel weasel	squirrel weasel mink	squirrel weasel mink	squirrel weasel mink fisher
muskrat	woodchuck muskrat	woodchuck deer muskrat	woodchuck deer muskrat moose	woodchuck deer muskrat moose
red fox songbirds	red fox songbirds	red fox songbirds sharp-shinned hawk	red fox songbirds sharp-shinned hawk bald eagle	red fox songbirds sharp-shinned hawk bald eagle
skunk	skunk	skunk Cooper's hawk harrier broad-winged hawk kestrel great-horned owl barred owl osprey turkey vulture turkey	skunk Cooper's hawk harrier broad winged hawk goshawk kestrel red-tailed hawk great-horned owl raven barred owl osprey turkey vulture turkey	skunk Cooper's hawk harrier broad-winged hawk goshawk kestrel red-tailed hawk great-horned owl raven barred owl osprey turkey vulture turkey
most reptiles	most reptiles garter snake ring-necked snake	reptiles garter snake ring-necked snake	reptiles garter snake ring-necked snake	reptiles garter snake ring-necked snake
most amphibians wood frog	most amphibians wood frog	most amphibians wood frog	most amphibians wood frog	most amphibians wood frog



Photo by Gary Dickerman

Wildlife Resources Goals

Goal 1. Recognize the value of wildlife resources in the character and quality of life in the City.

- Objective 1.1: Adopt a holistic view of natural systems which places human activity within rather than apart from the natural environment.

Action Items:

1. Wildlife Habitats
 - a. Map vernal Pools and shrub lands
 - b. Work to reduce

riparian buffer disturbance to enhance river otter habitat.

1. Long-Term Protection of Wildlife Habitat
 - a. Enhance the natural biological diversity of wildlife habitat in forest, wetland, and open land settings
 - b. Manage with respect to Natural Community type
 - c. Maintain the stability and integrity of the ecosystems within our control
 - d. Develop conservation plan unique to the Cat Hole property
 - e. Assess current level of wildlife resource protection in zoning, subdivision and site plan regulations and recommend updates as needed.
- Objective 1.2: Adopt management practices that support indigenous habitats and prevent fragmentation so that wildlife can migrate for seasonal food and reproductive needs.

Action Items:

1. Unfragmented Lands and Habitat Connectivity
 - a. Include protection and/or creation of wildlife corridors in development regulations and in City highway policy
 - b. Consider wildlife travel patterns when creating wildlife corridors; adjust transportation patterns to reduce road mortality
 - c. Protect against fragmentation of existing large blocks of undeveloped lands.
 - d. Work with DPW to ensure appropriate culverts are installed where aquatic travel patterns are known.



Norway Maple

Invasive Species

An invasive species can be any kind of living organism—an amphibian, plant, insect, fish, fungus, bacteria, or even an organism's seeds or eggs—that is not native to an ecosystem and which causes harm. They can harm the environment, the economy or even, human health. (National Wildlife Federation)

A species is invasive when it is both nonnative to the ecosystem in which it is found and capable of causing environmental, economic, or human harm. Invasive species often compete so successfully in new ecosystems that they displace native species and disrupt important ecosystem processes. Plants, fish, insects, mammals, birds, and diseases all can be invasive.

How Species Become Invasive

Often, invasive species owe their success in colonizing new ecosystems to one or more of the following characteristics:

- They tolerate a variety of habitat conditions;
- They grow and reproduce rapidly;
- They compete aggressively for resources (like food, water, and nesting sites)
- They lack natural enemies or pests in the new ecosystem.

Like invasive species in general, invasive plants possess characteristics that make them especially suited for colonizing new ecosystems. Plant-specific characteristics can include invasive plants' ability to:

- Produce abundant, easily dispersed seeds that can withstand adverse conditions
- Reproduce via multiple pathways: roots, stems, and seeds
- Release chemicals that inhibit the growth of or kill surrounding native plants. (US Forest Service)



Japanese Knotweed

Ecological Harm

Invasive plants can reduce biodiversity, imperil rare species, reduce wildlife habitat by eliminating native foods or changing cover or nest sites, degrade water quality, reduce forest and farm crop production, and cause human health problems. They can:

- Displace native species;
- Reduce native wildlife habitat;
- Reduce forest health and productivity;
- Alter ecosystem processes;
- Degrade recreation areas.

Invasives in New Hampshire

(From "New Hampshire Guide to Upland Invasive Species"; New Hampshire Department of Agriculture, Markets and Food, Plant Industry Division, 3rd Edition, 2011, Douglas Cygan)



Damage caused by Emerald Ash Borer

Invasive Insect Species

Common Name

- Hemlock Woolly Adelgid
- Emerald Ash Borer
- Asian Longhorned Beetle

Scientific Name

Adelges tsugae
Agrilus planipennis
Anoplothora glabripennis

Invasive Aquatic Plant Species

Common Name

- Variable Milfoil
- Purple Loosestrife
- Common Reed

Scientific Name

Myriophyllum heterophyllum
Lythrum salicaria
Phragmites australis

Invasive Upland Plant Species

Common Name

- Norway Maple
- Tree of Heaven
- Garlic Mustard
- Japanese Barberry
- European Barberry
- Oriental Bittersweet
- Spotted Knapweed
- Black Swallow-Wort
- Pale Swallow-Wort
- Autumn Olive
- Burning Bush
- Giant Hogweed
- Dame's Rocket
- Perennial Pepperweed
- Blunt-Leaved Privet
- Showy Bush Honeysuckle
- Japanese Honeysuckle
- Morrow's Honeysuckle
- Tatarian Honeysuckle
- Japanese Stilt-grass
- Japanese Knotweed
- Mile-a-Minute Vine
- Bohemian Knotweed
- Common Buckthorn
- Glossy Buckthorn
- Multiflora Rose

Scientific Name

Acer platanoides
Ailanthus altissima
Alliaria petiolata
Berberis thunbergii
Berberis vulgaris
Celastrus orbiculatus
Centaurea biebersteinii
Cynanchum nigrum
Cynanchum roscicum
Elaeagnus umbellata
Euonymus alatus
Heracleum mantegazzianum
Hesperis matronalis
Lepidium latifolium
Ligustrum obtusifolium
Lonicera x bella
Lonicera japonica
Lonicera morrowii
Lonicera tatarica
Microstegium vimineum
Polygonum cuspidatum
Polygonum perfoliatum
Reynoutria japonica
Rhamnus cathartica
Rhamnus frangula
Rosa multiflora

The State of New Hampshire has 27 plant species on a prohibited list. Some of these are already widespread in our environment, such as burning bush, buckthorns, multiflora rose, bittersweet, and Japanese barberry. For all the plants on this list the rule states: No person shall collect, transport, import, export, move, buy, sell, distribute, propagate or transplant any living and viable portion of any plant species, which includes all of their cultivars and varieties. New Hampshire lists another 24-plant species as restricted. These plants are not yet prohibited, but are exhibiting many of the invasive plant characteristics. Some of these are also familiar in our landscape including black locust and reed canary grass. The [NH Department of Agriculture, Markets & Food](#) regulates the plant industry including invasive species. (Photographs of the invasive species can be found at this site.)



Purple Loosestrife

Invasives in Claremont

Invasive plants are widespread in Claremont and were observed on all properties visited in the making of the NRI, as well as many locations along roads. Disturbance associated with developments, previous agricultural lands that have since become reforested, and forestry activities can exacerbate the spread of invasive plants unless managed properly.

What Can Be Done

74% of survey respondents think that the City should take a more aggressive role in controlling invasive species on publicly owned lands and roadsides. There are many things that can be done – individually and by the City - to help control the spread of invasive species and preserve native flora and fauna:

- Minimize impacts to natural vegetation, soils, and drainage.
- Learn how to identify invasive plants and know how to tell them apart from native species.
- Control invasives by following recommended practices in all development activities.
- Consult with the County Extension Service about alternative plantings for landscaping projects.
- Become active in local or regional initiatives to control invasives.
- After working in an area with invasive species remove any soil, or propagules that may have adhered to clothing, shoes, vehicle tires, etc.
- Do not collect invasive plants, their seeds, or reproductive bodies

- Control invasive plants in the City
- Manage the growth of ornamental plants on City property
- Avoid driving or recreating in areas where invasive plants grow
- Report invasive plant infestations to your local land management agency (US Forest Service)
- Prevent spread of road-side invasives during routine road maintenance activities.



Glossy Buckthorn

Invasive Species Goals

Goal 1. Recognize the harm that invasive species have to indigenous habitats and species in the City.

- Objective 1.1: Work to reduce the spread of invasive species throughout the City.

Action Items:

1. Educate the public about invasive species and the damage they cause.
2. Work with DPW to reduce the spread of invasives along roads during routine road maintenance work.
3. Control invasive species on City-owned lands.

Ecologically Significant Areas

The final outcome of the NRI was the identification of ecologically significant areas (ESAs) within the community. ESAs are those areas in the City that exhibit unique ecological characteristics that deserve special attention in terms of land use. This further provides a basis for informed land use planning, recognizing that some areas have high ecological value based on the various attributes present.

ESAs were identified using a multitude of factors, including landscape-level and site-specific attributes. These included a combination of unfragmented lands, wildlife movement and habitat connectivity, clustering effect of significant habitats that occur in close proximity to one another, presence and distribution of focal species, wetlands of high value, presence and distribution of rare elemental occurrences and priorities for conservation developed by the Wildlife Action Plan (WAP). These landscape-level considerations aid in a more comprehensive approach that recognizes large-scale habitats and ecological processes within the built and natural environments.

As a result of the NRI, 11 ESAs have been identified (Map 10). The map shows the general location of each. These ESAs can serve as a starting point for identifying conservation priorities within Claremont. Below is a brief explanation of the special ecological attributes.

ESA 1 - Cat Hole area

(ranked 2nd most important area in City in recent survey¹)

- Largest intact forest associated with a large unfragmented block (48,723 acres) extending beyond Claremont boundary
- Most diverse wildlife habitat aggregation providing excellent habitat connectivity
- Largest high ranked wetland complex (high functionality for ecological integrity and wildlife habitat, maintaining water quality, high flood storage value)
- Largest aggregation of high ranked wetlands
- High quality headwater streams to Redwater Brook
- Numerous sign of multiple focal species (moose, bear, mink, red-tailed hawk, sharp-shinned hawk, grouse)
- Largest intact hardwood forest
- Identified in WAP as containing highest ranked habitat

ESA 2 - Grissom Lane wetland complex

(ranked third most important area in the City in a recent survey¹)

- 2nd largest high ranked wetland complex (high functionality for sediment and nutrient trapping)
- Exemplary natural community: red maple-black ash swamp
- Wetland complex provides habitat connectivity to lands to the north where focal species (moose and mink) were observed

ESA 3 - Unity Road wetland complex

- 3rd largest high ranked wetland complex (high value for maintaining water quality and flood storage)
- Large aggregation of grasslands
- Identified in WAP as containing highest ranked habitat
- Located in association with highest yield aquifer for potential water supply

ESA 4 - Sugar River east

- Largest intact wetland complex
- Large aggregation of grasslands adjacent to floodplains
- Identified in WAP as containing highest ranked habitat
- Located in association with highest yield aquifer for potential water supply

ESA 5 - Southeast comer

- Large intact forest associated with a large unfragmented block (13,471 acres) extending beyond Claremont boundary
- Diverse forested habitats providing habitat connectivity to the south and east
- High quality headwater streams
- Focal species present (sharp-shinned hawk)

ESA 6 - Arrowhead Forest area

(ranked the most important area in the City in a recent survey¹)

- Large intact forest associated with a large unfragmented block (5,490 acres) extending beyond Claremont boundary
- Presence of focal species
- Diverse habitats providing habitat connectivity to the south
- Presence of 3 high ranked wetlands

ESA 7 - Connecticut River north

- Large aggregation of grasslands adjacent to Connecticut River
- Identified in WAP as containing highest ranked habitat
- Prime agricultural soils currently being farmed

ESA 8 -Twistback area

- Presence of focal species (bald eagle)
- Waterfowl migratory stopover area
- Intact forest buffer along Sugar River
- Diverse wildlife habitats providing habitat connectivity along Sugar River
- High ranked wetland with high value for maintaining water quality and flood storage
- Identified in WAP as containing highest ranked habitat

ESA 9 - Sugar River west

- Intact forest buffer along Sugar River
- Diverse wildlife habitats providing habitat connectivity along Sugar River
- Identified in WAP as containing highest ranked habitat
- Exemplary natural community - sycamore floodplain forest

ESA 10 - Connecticut River south

- Largest intact forest buffer along Connecticut River
- Large unfragmented block
- Diverse wildlife habitats providing habitat connectivity along Connecticut River
- Large aggregations of grasslands
- Identified in WAP as containing highest ranked habitat
- Presence of 40 known rare species and exemplary natural communities
- Presence of 2 high ranked wetlands (both exhibiting excellent ecological integrity and wildlife habitat; one with high flood storage function)

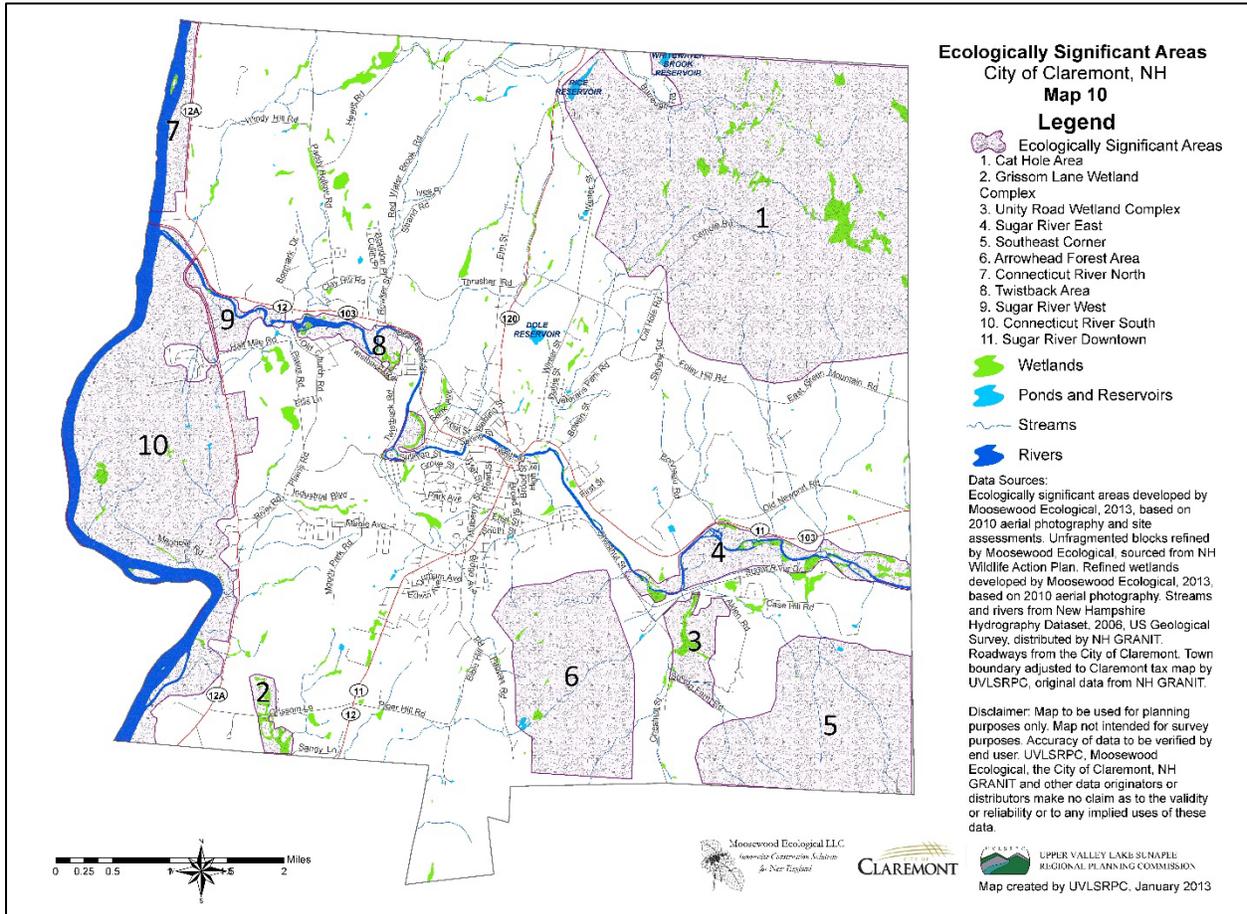
ESA 11 - Sugar River downtown

- Floodplains present providing habitat connectivity along Sugar River
- High quality ranked wetland with moderate flood storage value

¹ Survey conducted at Master Plan Public Forum on March 4, 2016

68% of survey respondents said that these ecologically significant areas should be protected with a combination of outright purchase by the City, landowner education, conservation easements, and zoning/subdivision regulations. The City should consider developing individual management plans for each of the significant areas to ensure their long-term health and preservation.

Map 8: Ecologically Significant Areas [from NRI, pg. 45]



Ecologically Significant Areas Goals

Goal 1. Recognize the ecological and community significance of each of the ecologically significant areas in the City.

- Objective 1.1: Protect the ecological integrity of the ecologically significant areas in the City.

Action Items:

1. Develop management plans for the long-term health and preservation of each of the ecologically significant areas and implement them.
2. Assess current level of protection of these areas in the current zoning, subdivision and site plan regulations.