Environment

Protecting the region's natural resources is a common theme that runs through all of the chapters of the Nashua Regional Plan. The natural character evident in the region's farms and forests, river valleys and hills contribute to the high quality of life that residents value most about living in the Nashua Region. The Environment Chapter sets forth the vision, goals and strategies for preserving and protecting the region's natural resources. The Chapter is divided into four sections: Natural Resources, Water Resources and Infrastructure, Climate Change, and Energy Efficiency. Each section examines the existing and future conditions of the region's environment, reviews current issues and identifies opportunities. In addition, each section identifies specific regional goals and strategies as well as tools for municipalities to use in their own planning.

Adopted December 17, 2014

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Executive Summary

The Environment Chapter begins with a vision statement and a list of goals and strategies for both the region and municipalities. The Chapter is then divided into four sections: Natural Resources, Water Resources and Infrastructure, Climate Change, and Energy Efficiency. Each section examines the existing and future conditions of the region's environment, reviews current issues and identifies opportunities. In addition, each section identifies specific regional goals and strategies as well as tools for municipalities to use in their own planning.

Natural Resources

Time and time again, residents expressed their love for the beauty and rural character of the region. This strong sentiment is reflected in the high priority common to all of the chapters in the Regional Plan: protecting the region's natural resources.

Agriculture remains one of the most prized features of the landscape. The region boasts 36% of conserved land that has productive agriculture soils and over twenty farms including vegetables, fruit, Christmas trees, meat and dairy. Some farms have endured since the late 1700's.

In addition to numerous agricultural uses, a large portion of the region (66%) is forested. More than two thirds of all forest lands in the region are privately held. There are many different forest and land cover types that offer a variety of recreation opportunities such as walking, hiking, biking, kayaking and fishing.

Through extensive outreach we found that municipal officials are largely interested in implementing protection strategies that maintain the quality of the region's resources. Goals that NRPC can assist with include: developing technical feasibility studies, conducting an inventory of what resources are available, creating educational materials to decrease the degradation of resources such as water quality, and providing regional coordination.

Communities throughout the region recognize the value in working together and want more opportunities to collaborate on protecting natural resources which cross municipal boundaries.

Goals of the Environment Chapter

The overarching goals of the environment chapter are:

- Preservation of existing natural resources
- Public education and outreach
- Technical studies and resources
- Regional coordination

Water Resources and Infrastructure

The maintenance of good water quality is one of the most important issues for residents and communities throughout the region. Some of the issues that communities face in this area include stormwater contamination and the lack of good data.

The effects of contaminated stormwater are a priority for communities. Over the next ten years, the estimated the stormwater needs in the region will be over $19,000,000. Aging water infrastructure maintenance and repair will be one of the largest costs for communities in the coming years. Additionally, new MS4 permit regulations will require more testing and mitigation efforts to reduce the effects of stormwater on regional water bodies.

The lack of accurate and consistent data to accurately assess regional water quality is a major issue for communities. Water quality testing is expensive and time consuming. The updated MS4 permits will require communities to complete additional testing for water quality. Residents expressed a love for the water resources in the region from drinking water to recreational opportunities but also noted a concern about declining water quality in water bodies throughout the region.

Climate Change and Natural Hazards

The Nashua region is not immune to the effects of climate change. Climate changes on a regional scale over a long period of time. Over the past four decades, the number of snow covered days has decreased across most of the region. Most of the reduction is driven by decreases in December snowfall. While this may be beneficial for some residents and wildlife, negative effects include increase in pests, decrease in seasonal jobs such as snow plowing and decreased recreational opportunities such as snowmobiling and pond hockey. Other potential effects of climate change and warming could result in increased seasonal temperatures and extreme heat.

Energy Efficiency and Green Building

Energy efficiency programs were named as the most effective method of reducing energy consumption in the region. For example, the Hollis Energy Committee has completed a municipal energy audit and installed retrofits which resulted in reduced energy consumption over the past three years and additional energy savings. Additionally, the Better Buildings Program provided retrofits for a number of commercial and residential buildings in the region saving thousands of dollars per year.

One of the most successful programs is the Energy Aggregation from NRPC. The Energy Aggregation consists of communities and school districts which jointly procure electricity from a competitive supplier. In 2012, the first year of the aggregation, participants saw an estimated annual savings of $299, 578 on their electric bills. Year to date, the 2014 aggregation savings have been $165,781.

One of the largest issues with energy efficiency is the lack of awareness of programs. Most state programs are offered to business and residents without extensive marketing in the region. For example, there was only one applicant from the region for the 2013 season of the commercial and industrial wood pellet program. Municipal officials, residents and business owners would like to see more education and guidance about the resources available. Some communities in the region have local energy committees which can help identify appropriate programs and help with project implementation.

Vision Statement

Natural resources in the Nashua region provide access to recreation opportunities, good water quality and abundant open space for residents and wildlife.

The Region's natural resources enhance and protect the rural, small community character while ensuring a positive quality of life.

Goal 1: Preserve Existing Natural Resources

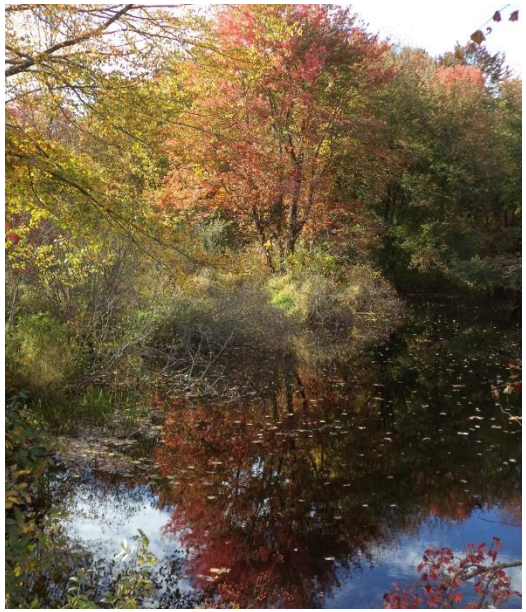
Preserve the quintessential small community feel of the region through the protection of natural resources such as water, open space and agriculture for generations to come.

What can municipalities do?

- Compare open space plans with neighboring communities to maintain large forest blocks for wildlife habitat and recreation connectivity.
- Protect natural resources in high and low income areas.
- Evaluate economic and environmental needs simultaneously.
- Consider the needs of local agriculture producers through zoning regulations and programs to enhance access to locally produced foods.
- Mitigate climate change through the protection of natural resources.
- Participate in the Bicycle and Pedestrian Committee in planning for alternative modes of transportation. Other programs exist statewide such as Commute Green NH and NH Park and Ride System.
- Increase the recreational use of the Merrimack River corridor by at least 20 percent as measured in numbers and types of recreational users over the next ten years by increasing the quality and quantity of the recreational resource.
- Conserve prime and active farmland within the Lower Merrimack River corridor through purchase of easements and/or development rights and adoption of local regulations which protect farmlands.
- Retain the existing character of the Lower Merrimack River shoreline by planning a "greenbelt" system along the Lower Merrimack River shoreline.
- Implement regulations to address setback, buffer, and shoreland protection issues within the Lower Merrimack River Corridor.

Goal 1 Continued:
Preserve Existing Natural Resources

Preserve the quintessential small community feel of the region through the protection of natural resources such as water, open space and agriculture for generations to come.

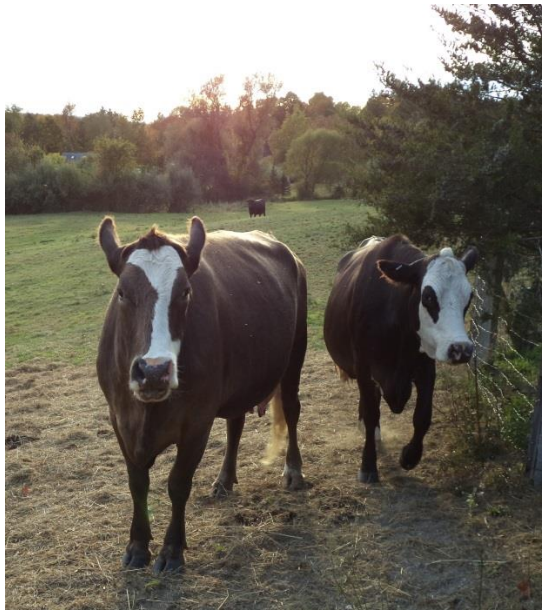


What can NRPC do?

- Assist communities with planning to preserve the rural character of the region.
- Support communities with identification of natural resource areas through mapping.
- Encourage municipalities to consider potential threats, such as extreme weather events, to resources while planning for future projects.
- Assist communities with the creation of local committees such as energy committees.
- Help communities identify Best Management Practice's (BMP's) and Low Impact Development (LID) methods for new developments and redevelopment projects.
- Conduct policy audits to regulatory barriers which inhibit the protection of natural resources.
- Work with municipalities to create or update an open space plan to preserve undeveloped lands and plan for future land use.
- Increase the knowledge of local citizenry of the river corridor resources by conducting at least year information disseminations efforts.
- Assist with implementation of River Corridor Management Plans such as the Lower Merrimack River Management Plan.
- Encourage connectivity in the management of the river corridor resources.

Goal 2: Education and Outreach

Effectively communicate the importance of protecting natural resources to municipal boards and residents.



What can municipalities do?

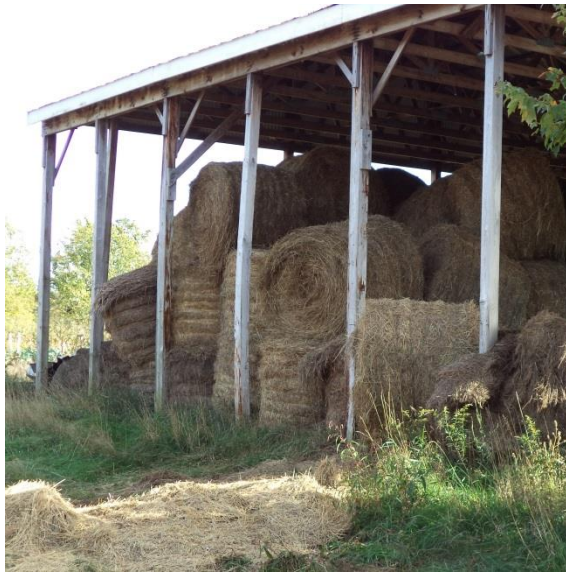
- Synchronize education outreach efforts with existing outreach materials produced by other communities to ensure consistent messaging and reduce staff time.
- Consider revising regulations which support innovative and new building technologies including barriers to alternative financing, education to communities about power lease agreements and their legality.
- Consider rebates and other incentive programs to retrofit existing energy options into green technologies.

What can NRPC do?

- Provide examples and case studies of education and outreach campaigns for natural resources for communities.
- Assist communities in the creation of emergency management manuals outlining proper responses to specific hazards/emergency preparedness for distribution at community events.
- Investigate and develop necessary education materials for reduced or no-salt programs in sensitive areas.
- Research and develop education and outreach programs about the benefits of using non-motorized and alternative forms of transportation.
- Develop public education on sustainable development and energy conservation.
- Publicize programs that offer incentives for installing and retrofitting energy efficient materials and systems.
- Assist communities in the education of citizens about point-source and non-point source pollution within watersheds.
- Encourage and support the creation of volunteer water quality monitoring programs.
- Develop materials to establish an anti-idling policy to encourage municipal fleet users and the general public to turn off their vehicles when not in use.

Goal 3: Conduct Technical Studies

Work with communities to identify infrastructure needs, explore funding for technical studies and identify the means for implementation.



What can municipalities do?

- Consider policies encouraging private well testing every five years for water quality monitoring efforts.
- Conduct baseline health inventories for local public health issues.
- Cooperate regionally in the development of data and other resources that can be shared such as for MS4 permits, brownfield assessments and river continuity studies.
- Revise regulations which support innovative and new building technologies including barriers to alternative financing, and education to communities about power lease agreements.
- Utilize rebates and other incentive programs to retrofit existing energy options into green technologies.

What can NRPC do?

- Provide technical expertise on emergency planning software such as HAZUS.
- Assist communities with asset management inventories and creating cost benefit analyses for funding opportunities.
- Assist communities with conducting vulnerability assessments on community resources. Conduct regional vulnerability assessments.
- Act as a regional database for technical information and funding from private, state and federal sources.
- Research and develop a review checklist for subdivisions and site plans that incorporates water recharge protection and water demand management protections.
- Create GIS mapping, parcel data that locates point and nonpoint source pollution locations, land use in watersheds, wetlands, and other information related to water resource management.
- Assist communities with using EPA Portfolio Manager to benchmark progress of energy consumption.
- Provide partnership opportunities with public health officials for private well testing requirements.

Goal 4: Regional Coordination

Assist communities with the opportunity to work collaboratively through sharing existing resources and plan for future resource protection.

What can municipalities do?

- Look for opportunities for regional interconnection of water infrastructure.
- Coordinate policies that ensure access to clean water in the event of an emergency.
- Collaborate with other community efforts to purchase testing kits and necessary training for radon, uranium and arsenic.
- Consider locally available decentralized renewable energy sources.
- Participate in regional assessments to save resources on MS4 permits, brownfield assessments and river continuity studies.

What can NRPC do?

- Host workshops on environmental topics for municipal boards and state representatives.
- Help communities identify a point of contact to act as a communication coordinator about local mitigation and adaptation projects.
- Develop and encourage communities to use consistent messaging for stormwater education.
- Encourage communities to plan based on a watershed scale.
- Assist communities in sharing of resources to meet requirements of MS4 permits.
- Share case studies and examples of implemented projects in other communities.
- Continue to bring municipalities and other stakeholders to the table.

Natural Resources

The natural resources in the Nashua region provide access to recreational opportunities, good water quality and abundant open space for residents and wildlife. The Region's natural resources enhance and protect the rural, small community character while ensuring a positive quality of life. Natural resource components include: floodplains, forests, steep slopes, and wildlife and water resources.

It is evident that natural resources are highly valued in the region and the area retains much of its rural landscape through forests and conservation lands. Every community in the Region has identified priority protection areas in their community master plans.

This section examines the existing and future conditions of natural resources in the region, discusses issues and opportunities, and sets forth strategies for their protection.

Natural Features

The Nashua Region benefits from a wide range of natural resources. From the hills of Mont Vernon, Lyndeborough and Mason to the river valleys that run through Milford, Merrimack, Litchfield and Nashua, and the farms of Hollis residents have easy access to nature and open spaces.

Protecting natural resources is one of the top priorities identified across all chapters in this plan. Table 1 provides an overview of some of the natural features commonly addressed in local planning: wetlands, unproductive land, forest land and farm land. Unproductive land includes wetlands, and other lands which are incapable of producing agricultural or forest products due to poor soil or site characteristics, or the location of which renders it inaccessible or impractical to harvest agricultural or forest products.

There are over 50,000 acres of forest lands in the region. Lyndeborough contains 21% of all the forest lands in the region while Nashua has the least with .7%. The City of Nashua has zero acres of unproductive land while the most are in Wilton at 702 acres.

Pelham and Amherst contain the most wetlands in the region at 12 and 13% each. Wilton has the least number of wetlands at just 3%.

Farmland is very important to residents in the region and every community still retains some of that acreage. Amherst has the most acres in the region (2,307 acres or 20 %), followed by Hollis at 16% and Hudson at 14%. The least amount in the region is Brookline with 19 acres, or .1%.

This section of the plan provides an overview of the region's agricultural soils, floodplains, forest lands, steep slopes, wildlife habitat, wildlife, and vernal pools

Table 1: Natural Resource Lands by Acres

COMMUNITY NAME	Wetland	Unproductive Land	Forest Lands	Farm Land
Amherst	2,413	49	2,970	2,307
Brookline	1,090	81	4,412	19
Hollis	1,936	426	3,911	1,866
Hudson	1,634	387	1,101	1,588
Litchfield	1,374	111	970	732
Lyndeborough	958	653	10,642	796
Mason	647	18	6,543	260
Merrimack	2,118	105	2,120	282
Milford	839	355	3,937	727
Mont Vernon	701	123	4,632	458
Nashua	1,898	0	347	127
Pelham	2,289	278	2,168	652
Wilton	586	702	6,308	1,543

* Wetland acres are calculated based on 2014 National Wetlands Inventory data

Source ***(United States Department of the Interior & United States Geological Survey, 2014)***

Agricultural Soils

The Natural Resource Conservation Service (NRCS) defines prime farmland as "land containing the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses," and unique farmland as "land other than prime farmland that is used for the production of specific high-value food and fiber crop."

In Figure 1, prime farmland is designated where 50% or more of the land composition is prime soil. Farmland of statewide importance consists of a combination of prime or lands of statewide importance and with at least 50% of statewide importance. Farmland of local importance is designated where less than 50% of land is considered of prime or statewide importance but the total of land of prime, statewide, and/or local importance is 50% or more of the area.

Hollis comprises the largest contiguous blocks of prime farmland and farmland of statewide importance in the region. Brookline is the only community in the region lacking prime farmland soils. Farmland of local importance is the most abundant agricultural soil type across the region. The location of farmland soils varies based on local geomorphology and drainage systems.

The soils of the Merrimack River valley are unique from other regions in New Hampshire. Floodplains and riverine areas contain nutrient rich soils with minimal rocks and stones. It is the flat land and well drained soils which make the region vulnerable to development.

Table 2: Conserved Land with Productive Soils

COMMUNITY	Total Community Acres	Productive Soil Acres Conserved	Percent Land Area with Productive Soil and Conserved
Amherst	22025	696	3.16%
Brookline	12924	131	1.02%
Hollis	20668	700	3.39%
Hudson	18779	220	1.17%
Litchfield	9784	493	5.04%
Lyndeborough	19370	948	4.89%
Mason	15353	139	0.91%
Merrimack	21412	446	2.08%
Milford	16299	531	3.26%
Mont Vernon	10820	374	3.46%
Nashua	20305	276	1.36%
Pelham	17151	346	2.02%
Wilton	16447	645	3.92%
Region Total	**221339**	**5945.577**	**35.67%**

Source (GRANIT)

Map 1: Productive Farm Soils NRPC Region

Source: (GRANIT, 2012)

Jackson Falls Crest Gate Project

When the City of Nashua was faced with the decision to mitigate flood risk as a component of the revitalization of the downtown Millyard area, there was an option to flood proof existing buildings, make structures "flow thru", or remove/enlarge river restrictions.

As part of a private/public partnership with the Stabile Companies, the best alternative to move potential redevelopment properties out of the 1% flood plain was to install a hydraulic crest gate at the top of the Jackson Mill Hydroelectric Dam.

This project helped to mitigate the flood risk to structures for 70 properties upstream of the dam. Shaving off the top of the dam and adding adjustable crest gates allows more water to pass through the dam when needed in a flood. The crest gates involve steel plates which can be raised and lowered through the use of compressed air pillows, called bladders. The system is controlled by a small computer.

Floodplains

Flooding is a routine natural process that occurs when water flows exceed the capacity of stream channels to carry them. The adjacent lands, called floodplains, serve an important function. As the water spreads out over the floodplain it slows down, and as a result, both downward erosion in the riverbed and lateral erosion of the riverbanks are reduced. Vegetation on the banks and in the floodplain slows the floodwaters further **(New Hampshire Department of Environmental Services, 2008b)**.

The Federal Emergency Management Agency (FEMA) has defined floodplains as "any land area susceptible to being inundated by flood waters from any source." Lakes, rivers and streams absorb larger quantities of rain and snow melt throughout the course of the year and over the lifetime of the body of water. National Flood Insurance Rate maps delineate 1% (100-year) and .2% (500-year) storm events for all communities in the region **(Federal Emergency Management Agency, 2014)**.

National Flood Insurance Program

The Government Accounting Office estimates that the standards for new construction required by participating communities in the National Flood Insurance Program (NFIP) save about $1 billion annually in flood damage nationwide (United States General Accounting Office, National Flood Insurance Program – 2004). All of the communities in the Nashua region participate in the NFIP. Litchfield is the only community in the region where the floodplain regulations exceed the minimum requirements of the NFIP in Section 1100 according to NH OEP.

Conserved Flood Storage Lands

The Nashua region has 2,658 flood storage land acres conserved. Currently, Hollis has the most flood storage land conserved at 516 acres, 3% of the total community land area that is conserved, followed by Amherst at 435 acres (2%). Mont Vernon and Mason have the least due to their terrain and fewer water features.

Forest Lands

Forested landscapes are quintessential to maintaining the rural character of the region. Multiple threats exist to wildlife and forests such as invasive species, development and climate change. Forested landscapes perform many ecosystem services for local residents such as carbon reduction through storage and purification, soil stabilization and aquifer recharge areas. Additionally, forests deliver a vital economic role in production of paper products, renewable fuel sources and food such as fruit and maple syrup.

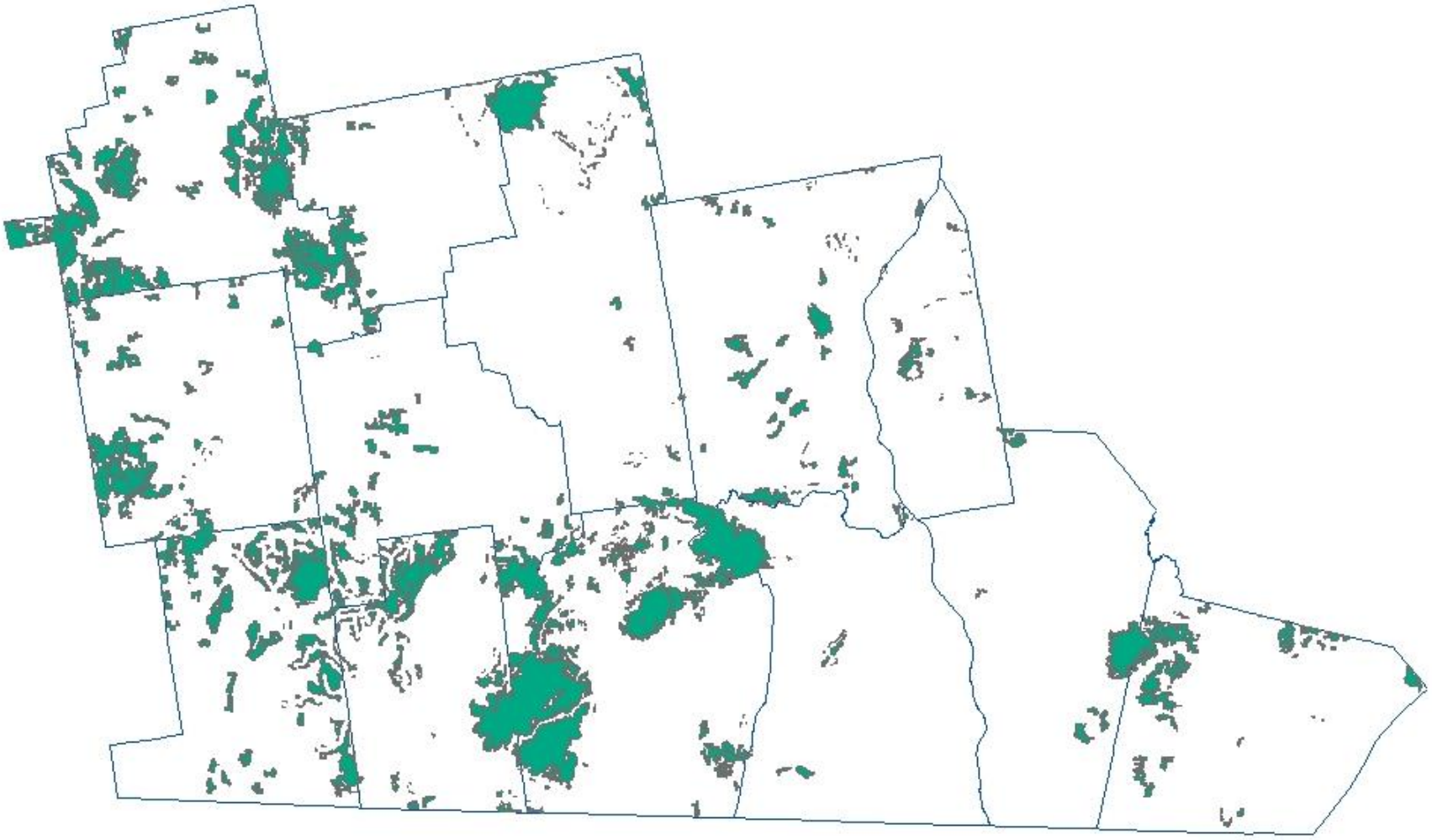
According to The Society for Protection of New Hampshire Forests (SPNHF), "New Hampshire remains the second-most forested state in the nation following Maine, but forest cover has been steadily diminishing since the early 1980s. This loss, which totals about 17,500 acres per year, is largely driven by land development" **(SPNHF, 2010)**.

Land development creates forest fragments, isolating species into small patches and reducing ecosystem services. Patch to patch migration is feasible for mobile species such as birds or larger mammals however patch migration significantly reduces mobility for smaller species such a small mammals and reptiles.

Figure 2 demonstrates significant forest habitat in the Nashua Region. Private owners hold 70 percent of forest lands in the state **(Division of Forests and Lands, 1997)** SPNHF found that a 500 acre forest block can support significant wildlife habitat, forest management and protect water quality when compared to a 5,000 acre forest plot which can sustain long term ecological function. Presently, the Nashua region lacks 5,000 acre forest blocks but there are 68,500 forested acres in the region..

The 2006 Land Cover map demonstrates that the deciduous and evergreen forest types in the region include Northern-Hardwood-Conifer, Appalachian Oak-Pine and Hemlock-Hardwood-Pine forest covers. Floodplain forests exist in spots along the Souhegan, Nashua and Merrimack Rivers and other water bodies throughout the region. Other land cover types that occur in every community in the region include grasslands and peatlands **(NHF&G, 2005)**.

Map 2: Forest Lands



Steep Slopes

Steep slopes are measured at 15 percent grade or greater and are associated with unique wildlife habitats, scenic vistas and watershed protection. They also provide excellent recreational opportunities for hiking, mountain biking, climbing and wildlife observation (NHDES, 2008).

Steep slopes are vulnerable to erosion and sedimentation resulting in soil loss and degradation potentially impacting water quality. Commercial operations for steep slopes generally are limited but can include recreation and bottled water facilities depending on local aquifers.

Development on steep slopes can adversely impact water quality through altered drainage patterns, infrastructure failures and to maintain rural character. In New Hampshire, no septic system may be built on a slope 33 percent or greater (NHDES, 2008). Additionally, NHDOT limits commercial drives to an 8 percent grade and residential driveways to 15 percent grade to limit erosion and maintain access of emergency vehicles to the development.

The Nashua region lacks a significant amount of steep slopes except in western section with the largest, contiguous blocks occurring in Lyndeborough. Two examples of steep slopes preservation occur in the Hollis Rural Character Preservation Ordinance and the Lyndeborough Rural Lands Three District. Both ordinances seek to protect the most sensitive and remote land from development and maintain scenic vistas and open spaces.

Map 3: Steep Slopes in the NRPC Region

Source (GRANIT)

Habitat and Wildlife

The Nashua region contains significant habitat for terrestrial and aquatic wildlife. The diverse topography of the region ranges from low-level river lands and floodplains to rolling hills and rocky outcrops creating a wide array of habitats. The region is home to three major rivers and fifty four bodies of water which provide unique aquatic habitats and support recreational opportunities such as fishing and bird watching. The Merrimack River corridor is second area in the state for winter American Bald Eagle activity.

While the region enjoys many types of biodiversity, development continues to be the largest threat. Urban and suburban development threatens wildlife and natural landscapes which support ecosystems services. The majority of the region enjoys good drinking water which requires natural landscapes to serve as aquifer recharge areas

Wildlife in the region is similar to that of other regions in southern New Hampshire and northern Massachusetts. The watersheds of the Souhegan, Nashua and Merrimack Rivers are home to a variety of mammals, insects and fish habitat. These river ways serve as wildlife corridors between larger forest patches and connect isolated populations.

The Merrimack River provides essential habitat for freshwater mussels, alewives, American shad, blueback herring and Atlantic salmon **(Nashua Regional Planning Commission, 2006, 2008; New Hampshire Fish and Game, 2005)**. The Nashua region is home to many threatened and endangered species, terrestrial and aquatic. Habitat protection of these fragile species will ensure future survival rates.

The New Hampshire Wildlife Action Plan offers a comprehensive analysis of wildlife throughout the state. The Regional Wildlife Habitats map demonstrates the three tiers of wildlife habitat. The hot pink tier represents the, "Highest Ranked Habitat in NH by Ecological Condition." These landscapes are of utmost ecological importance for being in the best condition in the state.

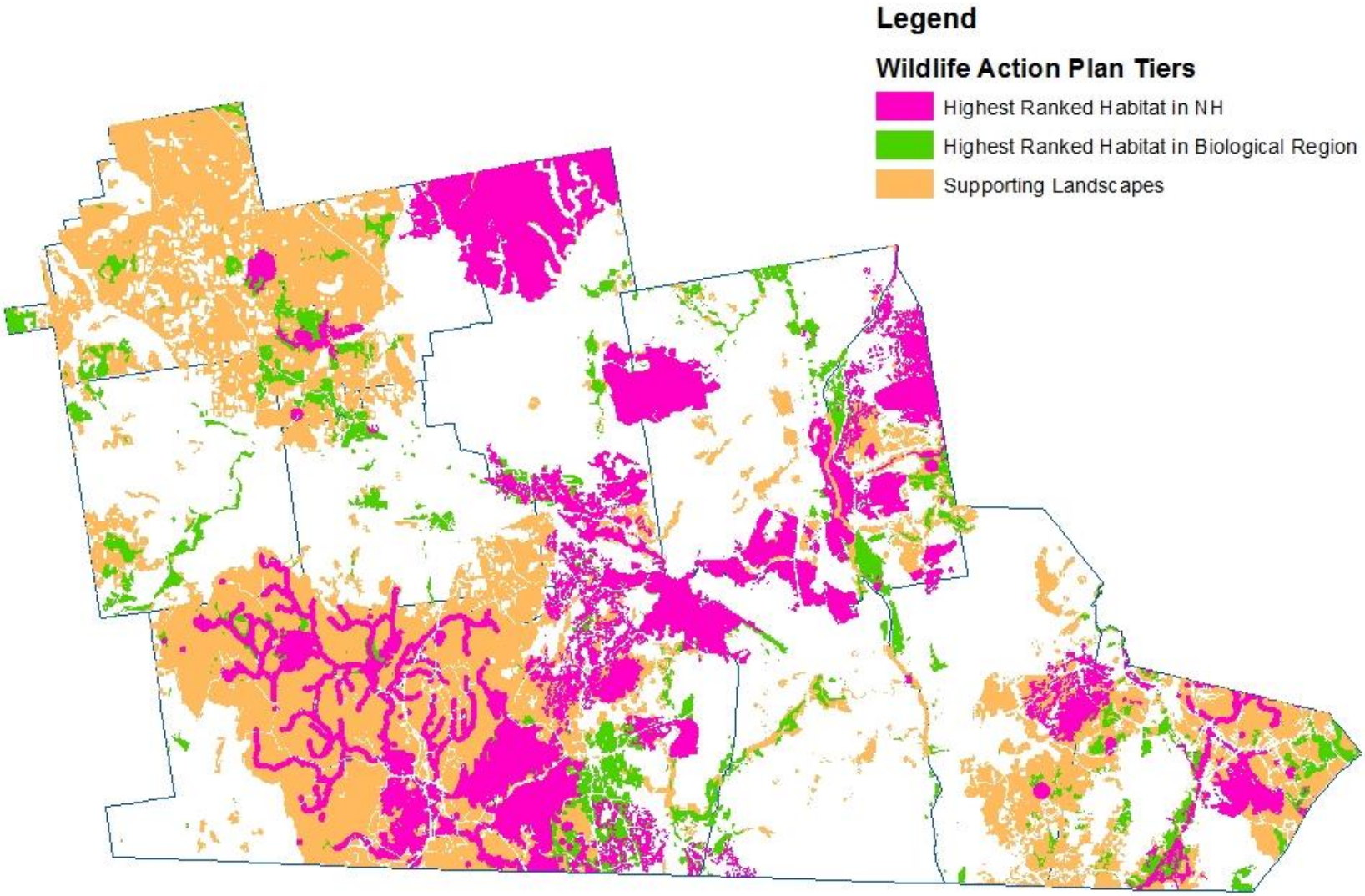
In the Nashua region, highly ranked habitats occur along waterways, highly transmissive areas and productive soil areas with the largest area of all habitat tiers occurring in the communities of Mason, Brookline, Hollis and Litchfield. Lyndeborough and Mont Vernon provide a large scale supporting habitats. The net acres of agriculture and natural resource land lost annually to development and residence is .5 acres lost per person gained region.

Vernal Pools

According to the New Hampshire Wildlife Action Plan**(2005)**, vernal pools are, " … depressional wetlands characterized by generally small size, physical isolation and alternative periods of flooding and drying." Despite the lack of vegetation in the pool, vegetation around the pool consists of mosses, sedges, rushes, ferns, shrubs and trees.

Vernal pools in the Nashua region are relatively undocumented which is consistent with state findings. There is no statewide vernal pool inventory. Vernal pools lack protection due to the often isolated locations. Despite the lack of protection and nonexistent mapping, vernal pools remain a critical habitat for a number unique or endangered species: Jefferson's and blue spotted salamander, Blanding's turtle, marbled salamander, fairy shrimp and the wood frog **(Clyde, M., 2013).**

Map 4: Regional Wildlife Habitat



Land Use Trends

The Nashua region is rich in natural resources; however, in order to maintain their abundance, we must understand how they are impacted by development and other environmental factors such as climate change and contamination. Development causes changes in land cover and can impair water resources through impervious surfaces. In addition, invasive species and other human-made contaminants are having impact on the region's environment.

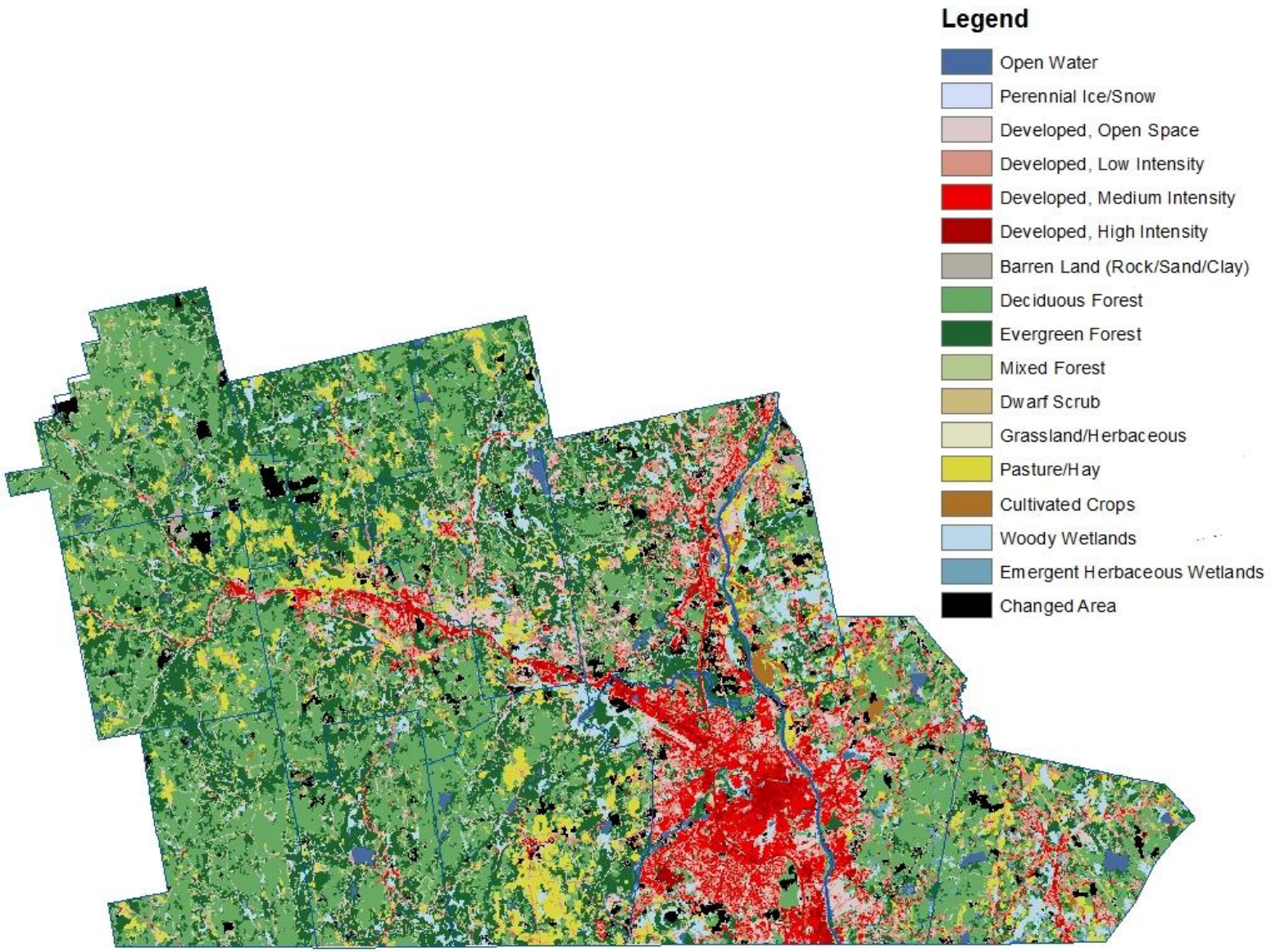
Figure 5: 2001-2006 Land Cover Map shows the development patterns along the region's transportation corridors. Development is displayed in four tiers: heavy, medium, low and open space. Open space can include recreational opportunities such as golf courses or manicured parks.

Communities in the region have been working to address development impacts through programs such as promoting open space through current use, supporting local farms and agritourism, redeveloping brownfields, managing solid waste through recycling and household hazardous waste programs.

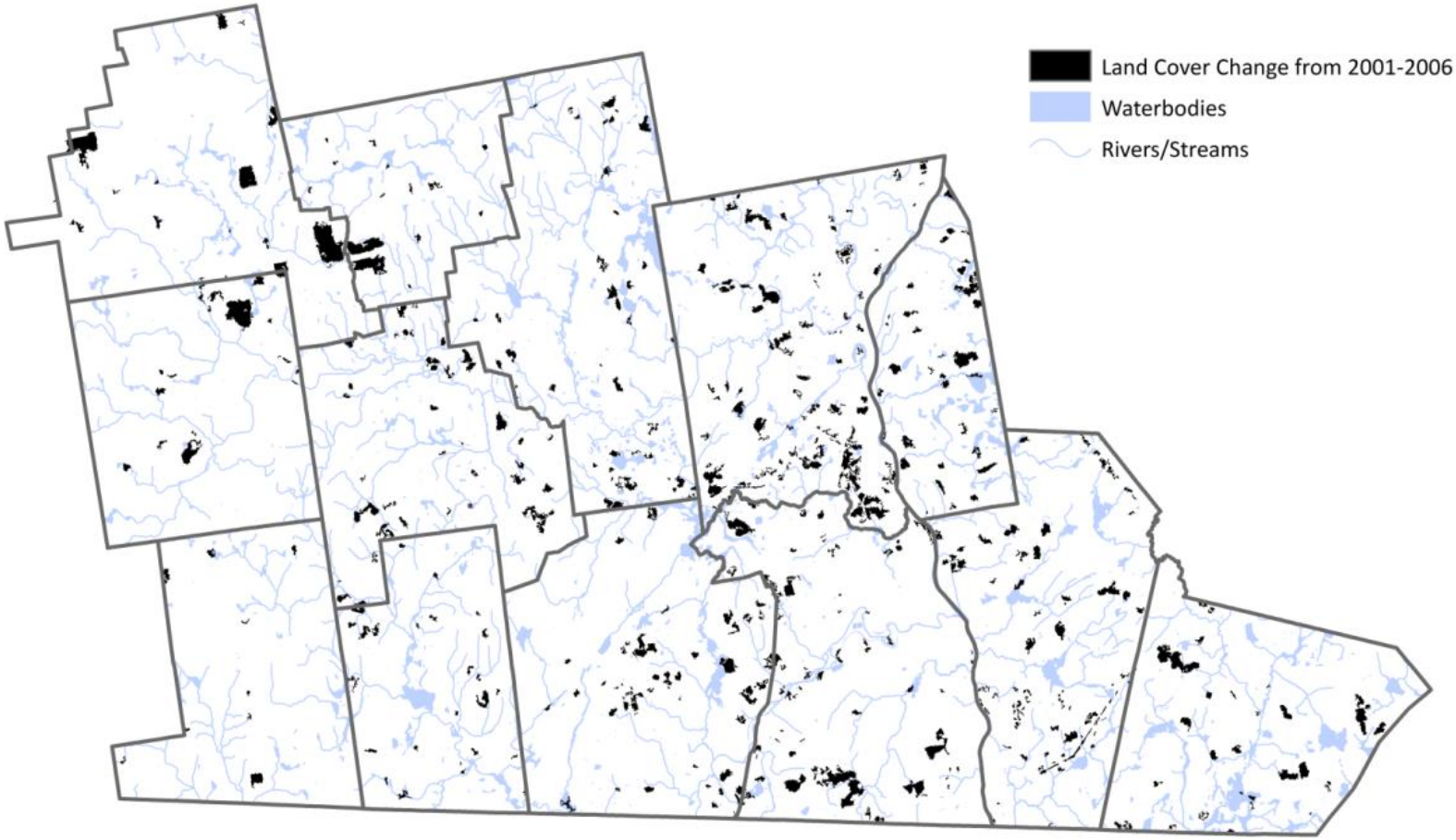
Tracking development using land use cover can help to understand where development is occurring or anticipated through increased activity. Figure 6 shows just the changes in land between 2001 – 2006. In the past, the most significant development changes have occurred around the City of Nashua and surrounding communities through the creation of subdivisions and single family housing.

Most recently, however, the largest change in land cover in the region was due to large logging operations from 2001-2006 in Lyndeborough and Mont Vernon. The 2010 New Hampshire Wildlife Action Plan map of Lyndeborough reveals the area is currently grassland and Appalachian oak-pine forest.

Map 5: 2001-2006 Land Cover Map



Map 6 Land Cover Change 2001-2006



Source (United States Department of the Interior & United States Geological Survey, 2014)

Impervious Surfaces

Land is considered impervious when it is covered by material that impedes the infiltration of water into soil. Common examples of impervious surfaces are buildings, pavement, concrete and severely compacted soils.

As our region continues to develop, the resulting increase of impervious surfaces within our urbanizing watersheds poses significant threat to stream quality and the natural environment. Communities and local governments concerned with water resource protection will need to address the adverse impacts of increased stormwater runoff, reduced water quality, degraded aquatic habitats, and the weakened visual appeal of our lakes, streams and natural landscapes **(New Hampshire Estuaries Project, 2007)**.

Table 3 demonstrates that the City of Nashua, the region's most developed community, has the most impervious surface area (65%). Litchfield, a community with a number of intact historical farms, is 20% impervious surface area. Litchfield has experienced an increase in single family home development within the last 30 years.

Hudson has the third highest amount of farm land in the region yet is 31% impervious surface area, the second highest after the City of Nashua. Merrimack is the third most developed community with 28% impervious surface. Lyndeborough and Mason have 2% impervious surface area followed by Mont Vernon at 3% and Wilton at 4%. The region as a whole is over 18% impervious surface areas.

Table 3: 2006 Impervious Surface Areas by Community

Community	Total Community Acres	Impervious Acres	Impervious %
Amherst	22,025	2,612	12%
Brookline	12,924	645	5%
Hollis	20,668	1,516	7%
Hudson	18,783	5,771	31%
Litchfield	9,783	1,966	20%
Lyndeborough	19,371	405	2%
Mason	15,353	249	2%
Merrimack	21,415	5,977	28%
Milford	16,298	2,738	17%
Mont Vernon	10,820	309	3%
Nashua	20,303	13,186	65%
Pelham	17,152	3,190	19%
Wilton	16,447	735	4%

Table 4: Acres of Changed Lands from Pervious/Agricultural to Impervious 2001-2006

Community	Pervious to Impervious (acres)	Agricultural to Impervious (acres)
Amherst	141.31	31.38
Brookline	0.11	0
Hollis	249.6	74.7
Hudson	221.88	58.39
Litchfield	247.05	82.13
Lyndeborough	1.94	0
Mason	0.06	0
Merrimack	644.63	115.2
Milford	154.78	41.79
Mont Vernon	0.01	0.009
Nashua	511.18	65.2
Pelham	290.31	83.01
Wilton	0.07	0.008
Region	**24,62.93**	**551.817**

Source (United States Department of the Interior & United States Geological Survey, 2014)

Invasive Species

The Nashua region is not immune to the threat of invasive species which effect terrestrial and aquatic habitats. The increased warming of the region due to climate change is one reason invasives have infected the region. As the climate warms, the threat and destruction caused by invasive species can have irrevocable effects on the region's wildlife and agricultural practices.

> "Invasive species" means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health."
> (Executive Order 13112)

Invasive species have a specific advantage over native species reducing native species habitat and changing the local ecosystems. Invasives out-compete native species in speed of reproduction, rapid development, and adaptation to varying environmental condition. Long term effects of invasive species include: reducing wildlife habitat, eradication of threatened and endangered species, personal property damage, and compromised water quality and health issues **(Cygan, 2011)**. Agencies focused on invasive control include NH National Plant Board State Regulated Noxious Weeds (USDA), the New Hampshire Invasive Species Committee and the New Hampshire Division of Forests and Lands **(UNH Cooperative Extension, 2013a)**.

As of 2011, exotic aquatic weeds have been identified in the Nashua and Merrimack Rivers, Horseshoe Pond (Merrimack), Flints Pond (Hollis), Robinson Pond (Hudson), and Ottamic Pond (Hudson); additional contamination have occurred since 2011. Cross contamination is the most frequent cause of infected waters. New Hampshire RSA 487:15 defines 'exotic aquatic weeds' as, "…only those species of vascular aquatic plants which were not part of New Hampshire's native aquatic flora before 1950." Additionally, the statute establishes a grant program administered through New Hampshire Department Of Environmental Services to begin management plans, research and remediation efforts to prevent further distribution of exotic aquatic weeds.

Table 5: Effects of Invasive Species on Native Wildlife

Invasive Plant	Wildlife Species	Effect on Wildlife
Common buckthorn	American Robin	Increased nest predation compared to native species
	Migrant Birds	Low quality fruits (Low fat content)
Honeysuckle species	Migrant Birds	Low quality fruits (Low fat content)
Japanese barberry	New England Cottontail	Increased escape cover
	Wild turkey	Increased fruits for winter foraging
	Migrant Birds	Low quality fruits (Low fat content)
Multiflora rose	New England Cottontail	Increased escape cover
	Northern mockingbird	Fruit provides enough nutrients for birds to overwinter further north
	Eastern towhee and other migrants	Fruits offer lower nutritional value than native dogwood species
Oriental bittersweet	Migrant Birds	Low quality fruits (Low fat content)

Source: (Clyde, 2002)

Asbestos

Asbestos is a grouping of silica crystals that combine to form mineral fibers used for the tensile strength and thermal insulating properties (New Hampshire Department of Environmental Services, 2014d). Historically, asbestos has been used in heating system insulation, vinyl flooring, shingles, and cement siding shingles and as a fire retardant (United States Environmental Protection Agency, 2013a). Asbestos insulation was installed in homes, schools and work places nationwide and was banned for use as insulation due to health concerns.

Asbestos is only harmful if disturbed. Small particles of microscopic fibers are released most notably through demolition and construction projects. Microscopic fibers become trapped in the lungs causing asbestosis, mesothelioma and other lung diseases. Asbestosis is scarring of the lungs and lung tissue which leads to respiratory distress and decreased lung capacity.

Naturally occurring asbestos can infiltrate water systems as rock erodes over time. In addition, deteriorating cement water mains can also contaminate water supplies for humans and wildlife. Residents who ingest asbestos-contaminated water over time can develop benign intestinal polyps (United States Environmental Protection Agency, 2013a).

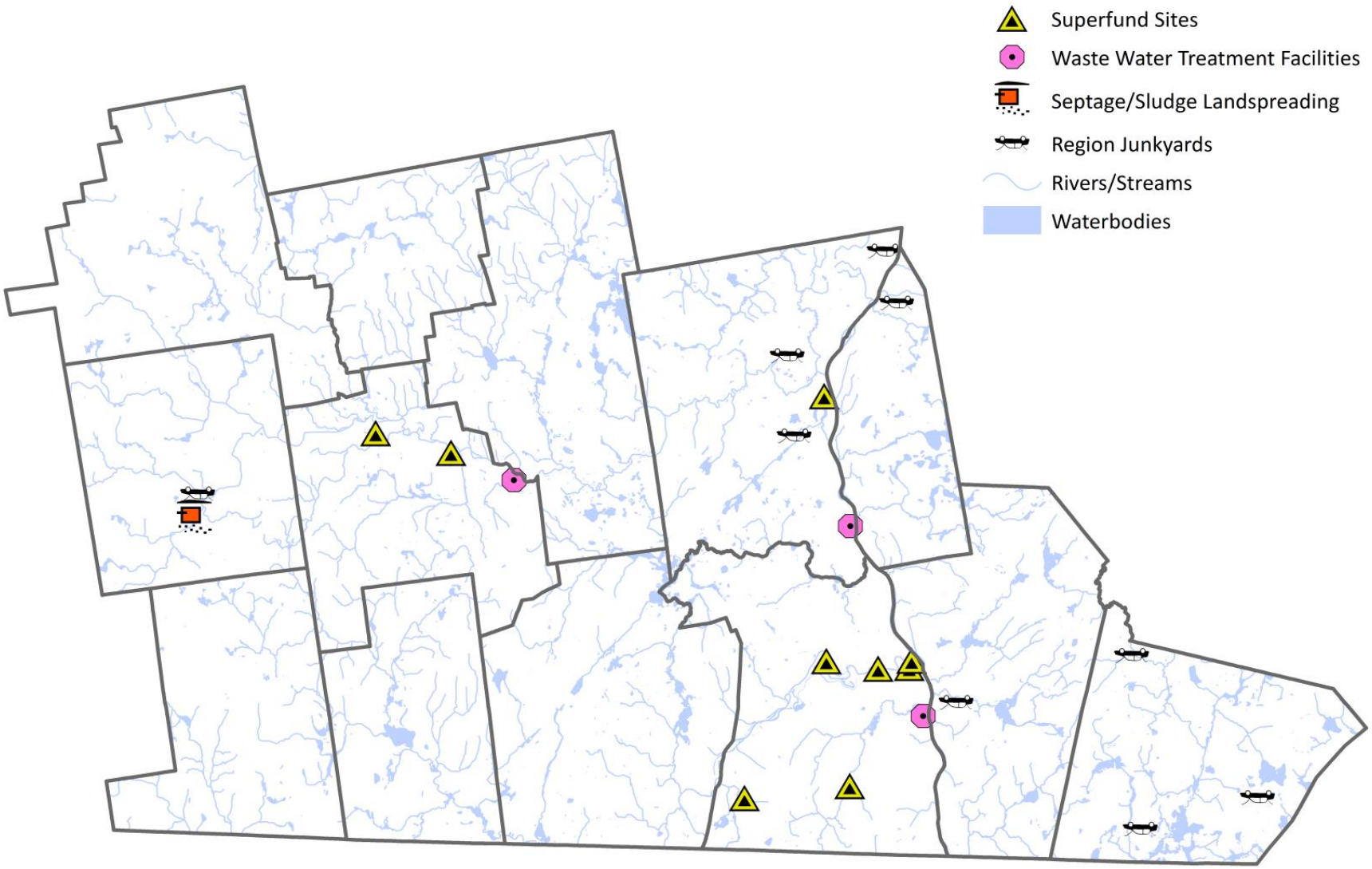
In 1992, the United States Environmental Protection Agency (US EPA) set the maximum contaminant level (MCL) for asbestos in drinking water as seven million fibers per liter. The US EPA recommends regular well testing and corrosion control to reduce asbestos in water supplies.

Asbestos and the Nashua Region

The Nashua region has a long manufacturing heritage which included the disposal of asbestos in the City of Nashua and surrounding communities. Local manufacturers gave away asbestos as free fill to local property owners. Additionally, asbestos was used in existing transportation structures, canals and railroad beds. These hazardous sites can potentially contaminate water ways with microscopic fibers, however buried asbestos in lawn and yards poses little risk until disturbed. The City of Nashua and New Hampshire Department Of Environmental Services have household asbestos removal programs to safely collect and dispose of historical asbestos in homes.

Upon analysis of asbestos point data in the region, asbestos sites generally occur within one mile of the Nashua or Merrimack Rivers. Points also occur in clusters or straight lines which is consistent with neighborhoods or a row of houses. If houses were constructed before asbestos was known to be a hazard, it is possible that they contain asbestos.

Map 7: Waste Threats to Water Resources



Source: (New Hampshire Department of Environmental Services, 2014c)

Addressing Impacts of Change

There are a number of ways that communities have addressed impacts of development and land use change over the years. A combination of formal and informal programs has helped communities to retain the current landscape. Formal programs include Current Use, Brownfields, municipal solid waste and disposal policies, recycling and household hazardous waste collections. Informal programs include supporting local agriculture through purchasing local goods through farms or CSAs and agritoursim.

Current Use

A majority of the land in the region is designated residential (44%). Despite being one of the most urban regions in the state, 43% of the region's area is undeveloped, recreational, open space or agricultural. Residents in the Nashua region truly value its open spaces and natural resources; nearly 44% of those surveyed said it was a top priority **(Keirns, 2013)**.

One way to track the amount of open space in the region is to examine land enrolled in Current Use (see RSA 79-A), a taxation program enacted in 1973 to encourage the preservation of open space in New Hampshire. Under current use land is assessed in its present use rather than its highest real estate market value. In the past decade, the overall loss of land in current use in the region is consistent with increased development. Only 4 out of 13 communities increased the percent land in current use in a ten year time frame: Lyndeborough (3%), Mont Vernon (18%), Pelham (10%) and Wilton (4%). All other communities saw a decrease in the percent of land in current use

Table 6: Land in Current Use

Community Name	Acres in Current Use 2000	Percent of Total Land Use	Acres in Current Use 2010	Percent of Total Land Use
Amherst	7,572	35	6,567	30
Brookline	7,075	56	4,967	39
Hollis	8,362	41	7,014	35
Hudson	4,091	22	3,446	19
Litchfield	2,755	29	2,335	24
Lyndeborough	14,527	75	14,968	78
Mason	8,919	58	8,561	56
Merrimack	4,512	22	3,145	15
Milford	7,198	44	5,950	37
Mont Vernon	3,857	36	5,850	54
Nashua	1,581	8	647	3
Pelham	2,392	14	3,996	24
Wilton	9,677	59	10,250	63

Mohawk Tannery

The Mohawk Tannery Site in Nashua, NH site consists of two contiguous parcels that are each approximately 15 acres which was historically used for tannery manufacturing and waste disposal operations.

The former tannery facility produced tanned hides for leather from 1924 until it closed in 1984. During its operation, the tannery produced a number of waste streams, which initially were discharged into the adjacent Nashua River and later were disposed of onsite in unlined lagoons. Several of the onsite waste lagoons are located within the 100-year flood plain of the Nashua River.

The site has been re-zoned for residential use by the City of Nashua and there is significant interest to see the site put back into productive use. There are approximately 5,000 residents located within four-square-miles of the site.

Brownfields

According to the US EPA, brownfields are "the expansion, redevelopment, or reuse of (real property) which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant". Source? Examples of brownfields include: former manufacturing facilities, gas stations, dumps, dry cleaners or printers.

When a brownfield is revitalized with new development, surrounding residential property values can increase between 5.1-12.8% **(United States Environmental Protection Agency, 2013f)**. In addition, brownfield infill development can mitigate the potential for greenfield development, increases access to amenities, and creates opportunities for using alternative modes of transportation.

The connection between toxic materials and health is well documented. Brownfield sites can harbor toxic materials and other dangers which can be detrimental to the neighboring population. Redevelopment of brownfield sites can decrease public health concerns and enhance a community's quality of life. The removal of neglected structures decreases the opportunity for crime and other nefarious activities.

Environmental justice issues are often associated with Brownfield or Superfund sites. Research conducted in the past decade demonstrates the imbalanced exposure of lower income and poverty stricken populations to environmental hazards.

Revitalization of brownfield sites is currently under way for twenty sites in the Nashua region (New Hampshire Department of Environmental Services, 2014a) with the majority occurring in the City of Nashua. There are also eleven completed brownfield sites (New Hampshire Department of Environmental Services, 2014b). Two larger projects in the City of Nashua are the revitalization of the Mohawk Tannery and Whitney Screw.

Overall, the biggest threats to water resources in the region are asbestos and brownfields. Junk yards and waste water treatment are also sources of potential contaminants. Land spreading of waste materials occurs only in Wilton while junk yards are most prevalent in the eastern half of the region and along the Merrimack River Corridor. Nashua contains the most amounts of Superfund sites in the region which is consistent with the large industrial history of the City.

Solid Waste Management

The Nashua region contains a variety of solid waste facility types. Nashua has a number of municipal solid waste (MSW) facilities and a robust recycling program compared to less populated communities. This is an effort where communities in the region have coordinated resources.

Historically, solid waste facilities were unplanned dumps or junk yards relating back to the agricultural and heavy industrial time periods. New Hampshire Department of Environmental Services Waste Division maintains some historical landfill data but no good records exist prior to 1981. Currently, there are 38 total Solid waste facilities in the region with 16 operating and 22 not operating **(New Hampshire Department of Environmental Services, 2014c)**.

The most commonly used landfill in the region is the unlined landfill (44%) followed by Collection, Storage, and Transfer (CST) facilities (41%). Unlined landfills are hazardous to human health and are no long built. Landfills operate by compacting solid waste and covering with soil.

Research within the last 40 years has shown the connection between solid waste areas and groundwater contamination. The breakdown of solid waste produces toxic substances such as benzene and methane **(United States Environmental Protection Agency, 2003)**.

Plumes of toxic substances can be detected using groundwater monitoring wells. Plumes required remediation of the materials causing the plume as well as aeration of gases created during decomposition **(United States Environmental Protection Agency, 2003)**. The New Hampshire Department of Environmental Services works with solid waste facility owners to prevent and remediate waste facility leakages and runs the unlined landfill closure program to stop further use of unlined landfills and protect public health.

Figure 1: Region Solid Waste Facilities Types

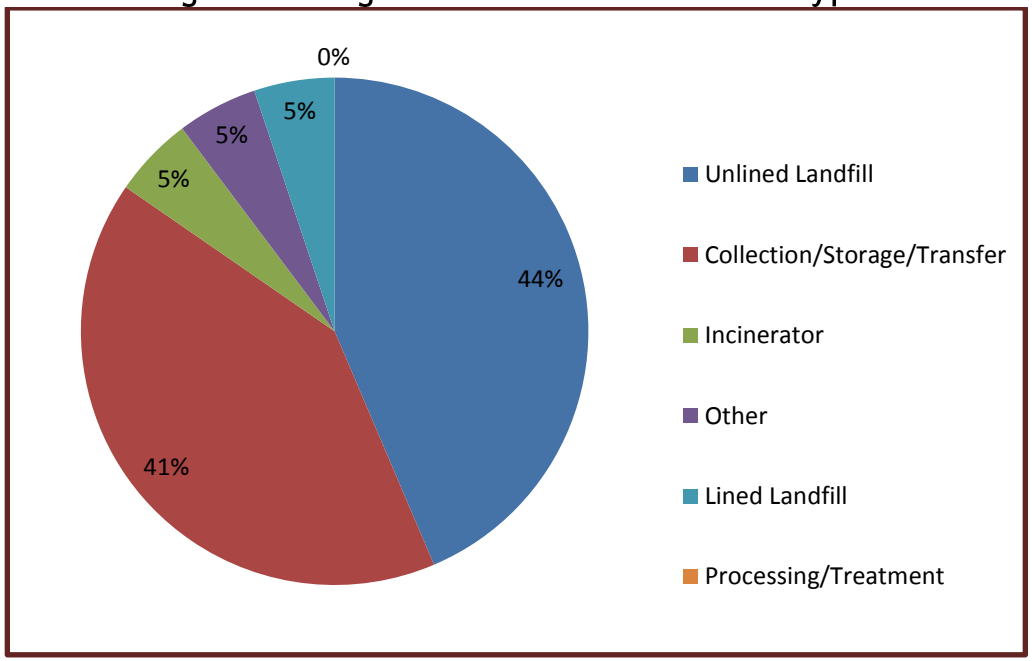
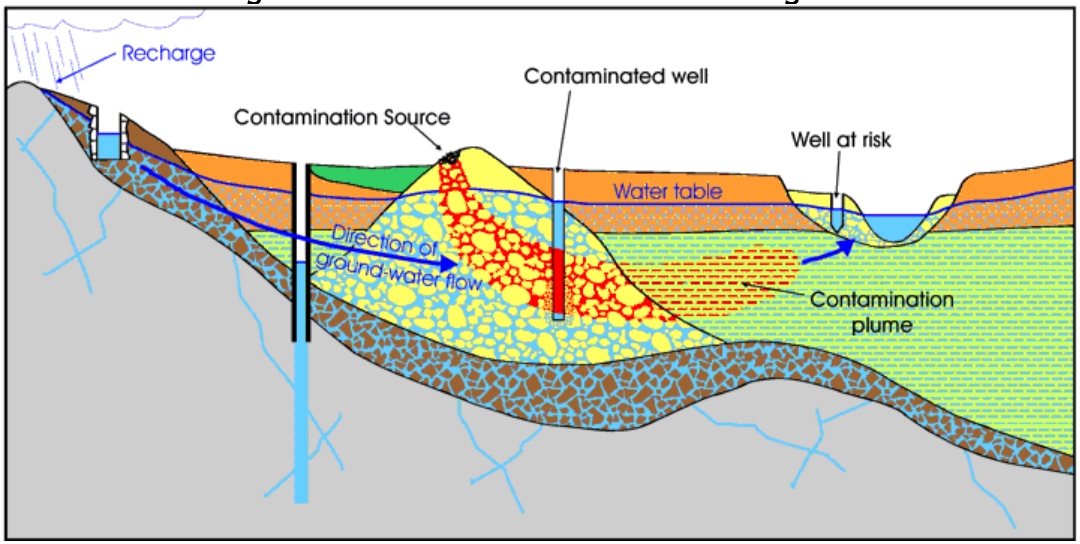


Figure 2: Plume Contamination Diagram



Source Maine Department of Agriculture, Conservation and Forestry

Table 8 lists the unlined landfills in the region. Most landfills are capped with High Density Polyethylene (HDPE) a substance with very small pores spaces to prevent leakages of contaminants. As landfills reach capacity and close, new facilities will need to be sited. However, recent facilities previously accepting construction and demolition waste have closed potentially resulting in trucking and disposing of materials outside of the region. Trucking materials to outside of the region will result in an increase of carbon emissions and cost for developers.

Table 7: Unlined Landfill Closure Program Municipal and Non-municipal Facilities					
Facility	Active Gas w/Flare or Turbine	Passive Gas	Year Closure Construction Complete	Size (Acre)	Cap Type
Amherst Souhegan Regional Landfill (Phase 1)		x	1986	5.5	HDPE
Hudson		x	1991	11	HDPE
Nashua-Shady Lane		x	1998	10	GS/Clay
Nashua-Four Hills (Construction and Demolition)		X	1997	11	HDPE
Merrimack Municipal/Winter Dump		x	2000	27	HDPE
Nashua Four Hills (Municipal Solid Waste-Unlined)	x		2003	60	HDPE
Nashua (Roussell-Gardner Park)		x	2003	10	Soil w/fabric
Nashua Lincoln Park		x	2003	15	Soil/Geonet
Nashua Atherton	NA	NA	2003	4+/-	Soil
Milford			Pre-81	10.5	none
Pelham			exempt		none
Hollis			Pre-81		none
Old Hudson Landfill			Pre-81		none
Litchfield					none
Mont Vernon			Pre-81		none
Nashua Old Landfill/ Stellos Stadium Lot		x	2001	8	Asphalt pavement
Wilton			Inactive		none
Nashua Subaru-Nashua			1992	2	Till
Rogers Mobile Homes-Hollis			1994	<2	Till
Pelham (Roketenetz)			1998	28	HDPE
Morgan Ryan Realty Trust Landfill-Hollis			2001	1+/-	Removal (approval still needed)
Milford Elm Street Trust	no information				
Gilbane/ Bishop Guertin High School-Nashua	no information				
Source: New Hampshire Department Of Environmental Services One Stop					

Recycling

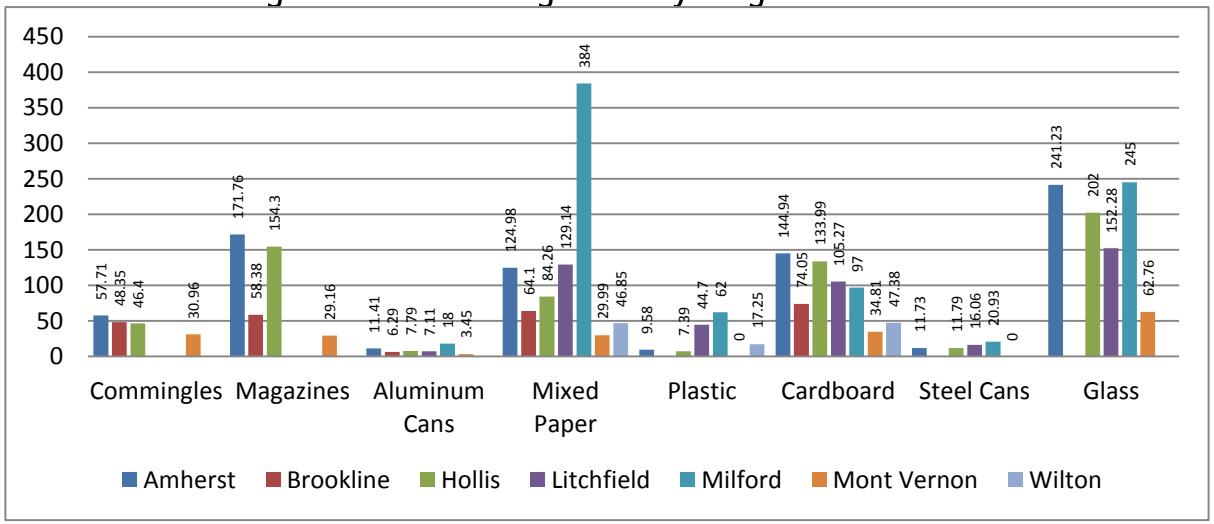
Recycling collection in the Nashua region varies based on the community. It is important to note the Towns of Lyndeborough and Mason partner with Wilton for recycling services. Regionally, communities report recycled materials based on type and the reporting varies based on the capacity of the facility to track materials.

Seven communities use multi-stream facilities and four use single stream facilities. Single stream facilities prevent specific materials data as all materials are grouped together which prevented comparison between all communities in the region.

Milford recycled the most amount of mixed paper at 384 tons followed by Amherst at 125 tons. Milford also recycled the most amount of glass (245 tons) and Amherst at 241 tons. Aluminum can recycling produced the least amount of tonnage of all comingles followed by steel can and third is plastics. Amherst recycled the most magazines at 171 tons followed by Hollis at 154 tons. Single stream recycling facilities occur in four communities in the region. Nashua collected the most recycled materials at 4,600 tons. This is consistent with the large population of Nashua and the staff capacity to track materials. Hudson collected the next highest amount of recycled material, 2,428 tons in 2013.

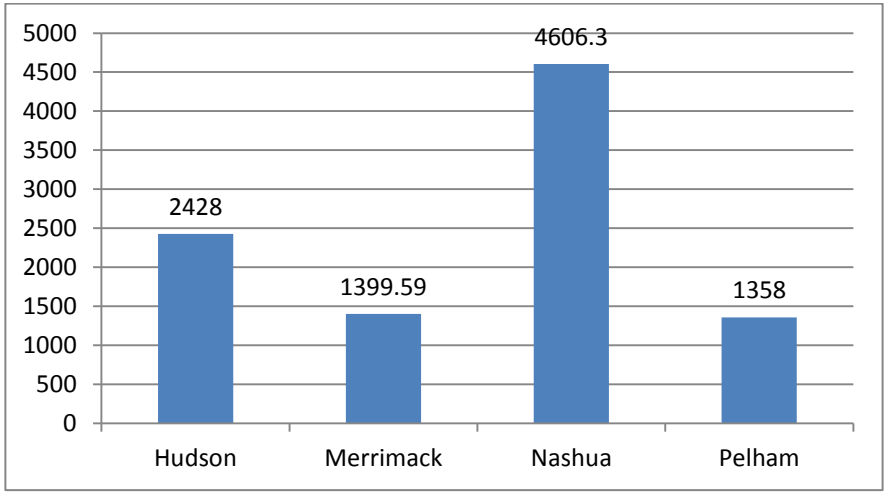
Recycling materials have saved communities in the region thousands of dollars per year. Merrimack saved $148,000; these saving can lead to millions of dollars in savings over time. Litchfield had the next highest savings of $81,000 followed by Hollis with $78,000 in savings.

Figure 3: 2013 Region Recycling Data in Tons



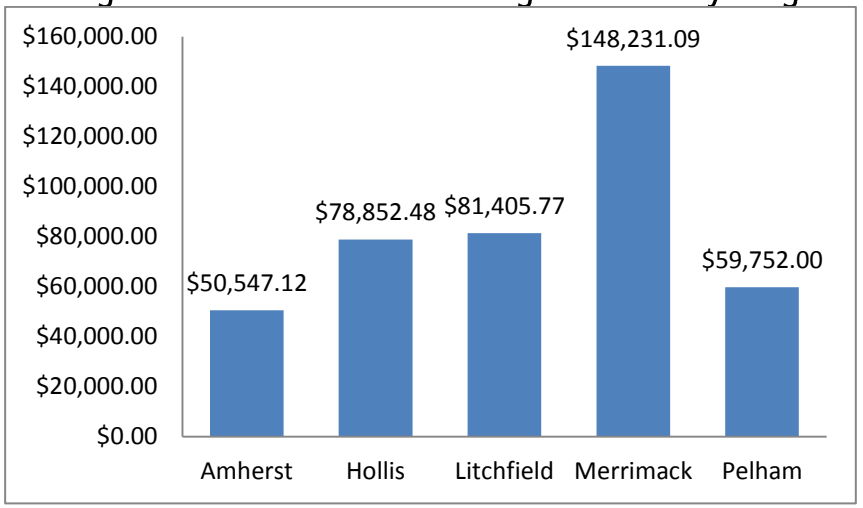
Source: Community Reports, Community Administrators/Public Works Departments/Transfer Stations

Figure 4: 2013 Single Stream Recycling in Tons



Source: Community Reports, Community Administrators/Public Works Departments/Transfer Stations

Figure 5: 2013 Town Savings from Recycling



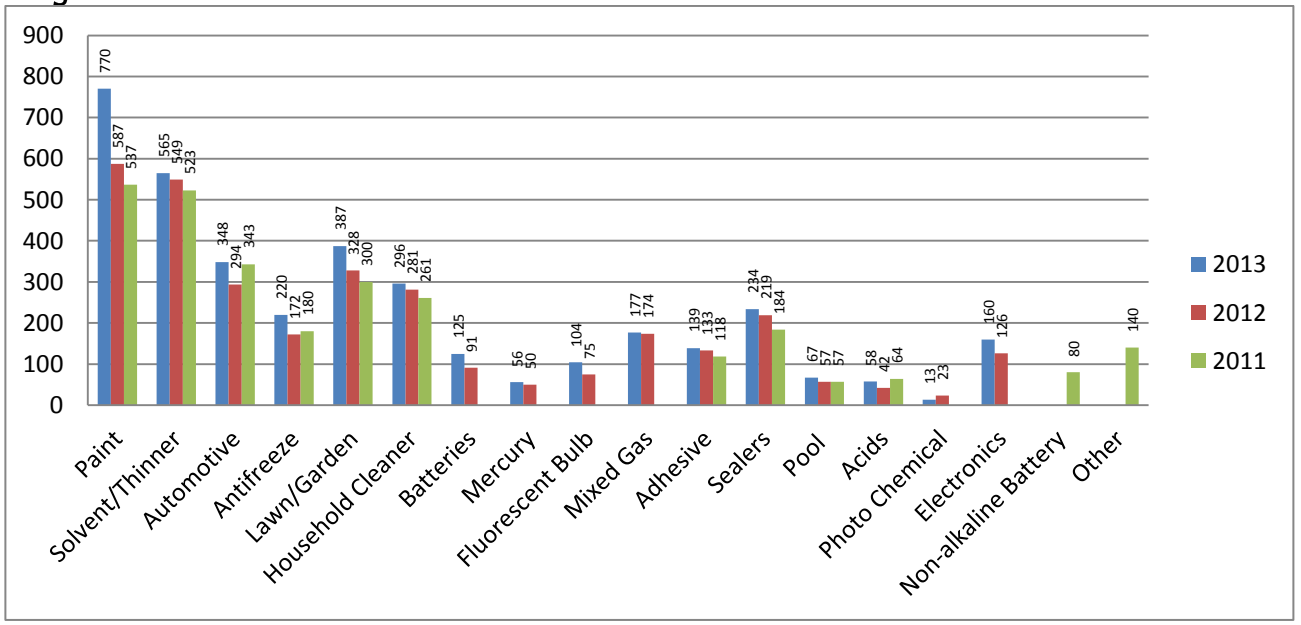
Source: Community Reports, Community Administrators/Public Works/ Transfer Stations

Household Hazardous Waste

The Nashua Regional Planning Commission coordinates Household Hazardous Waste collection days throughout the region. Household Hazardous Wastes (HHW) come from everyday products used in the home, yard, or garden. By definition, they are corrosive, flammable, toxic, or reactive. Oil-based paints, solvents, auto products, antifreeze, pesticides, mixed gas, and household cleaners are just a few examples. When hazardous waste is improperly disposed of — in the trash, on the ground, down the sink, or into a storm drain — it poses a threat to water quality, human health, and wildlife. Household toxins may also injure humans and animals if they are exposed to these chemicals due to careless storage and handling. Improperly handled electronic waste can pose human and environmental risk of exposure to lead and mercury. Furthermore, electronics can be recycled for valuable metal, plastic, and glass. For these reasons, New Hampshire is taking steps to keep certain electronics out of the solid waste stream. The disposal of video display devices in solid waste landfills or incinerators is prohibited under RSA 149-M: 4.

Residents voiced more Ideas were needed for recycling incentives for people to participate in recycling efforts which could in turn create collaboration in the community between residents, resulting in a positive outcome. Paint and solvents or paint thinners are the most commonly collected hazardous waste items with 770 units and 569 units. Participation increased in 2013 since each material category showed an increase in collection quantity. Photo chemicals are the least collected items followed by mercury and acids

Figure 6: NRPC Household Hazardous Waste Quantities Collected 2011-2013



Source Nashua Regional Planning Commission

Fast Farm Facts

- #1 Agriculture product sold in NH : Cow Milk
- $43,477 Average per farm of market value of ag products sold in NH
- $5,509 Average per farm of net cash farm income of operation
- Hillsborough County ranked 27th in the nation with over $5 million in direct market sales
- NH ranked second in the nation for the percentage of farms reporting direct market sales, at 30.7% nearly one out of three
- NH ranks third in the 2014 Locavore Index which calculates numbers of farmers markets, CSAs and farm to school programs per capita for each state
- Consistent with a thirty-year trend, farmers' average age continued to increase
- New England has one of the country's highest concentrations of women farmers.
- States in New England have higher proportions of farms with sales under $50,000

Source (United States Department of Agriculture, 2014a)

Agriculture

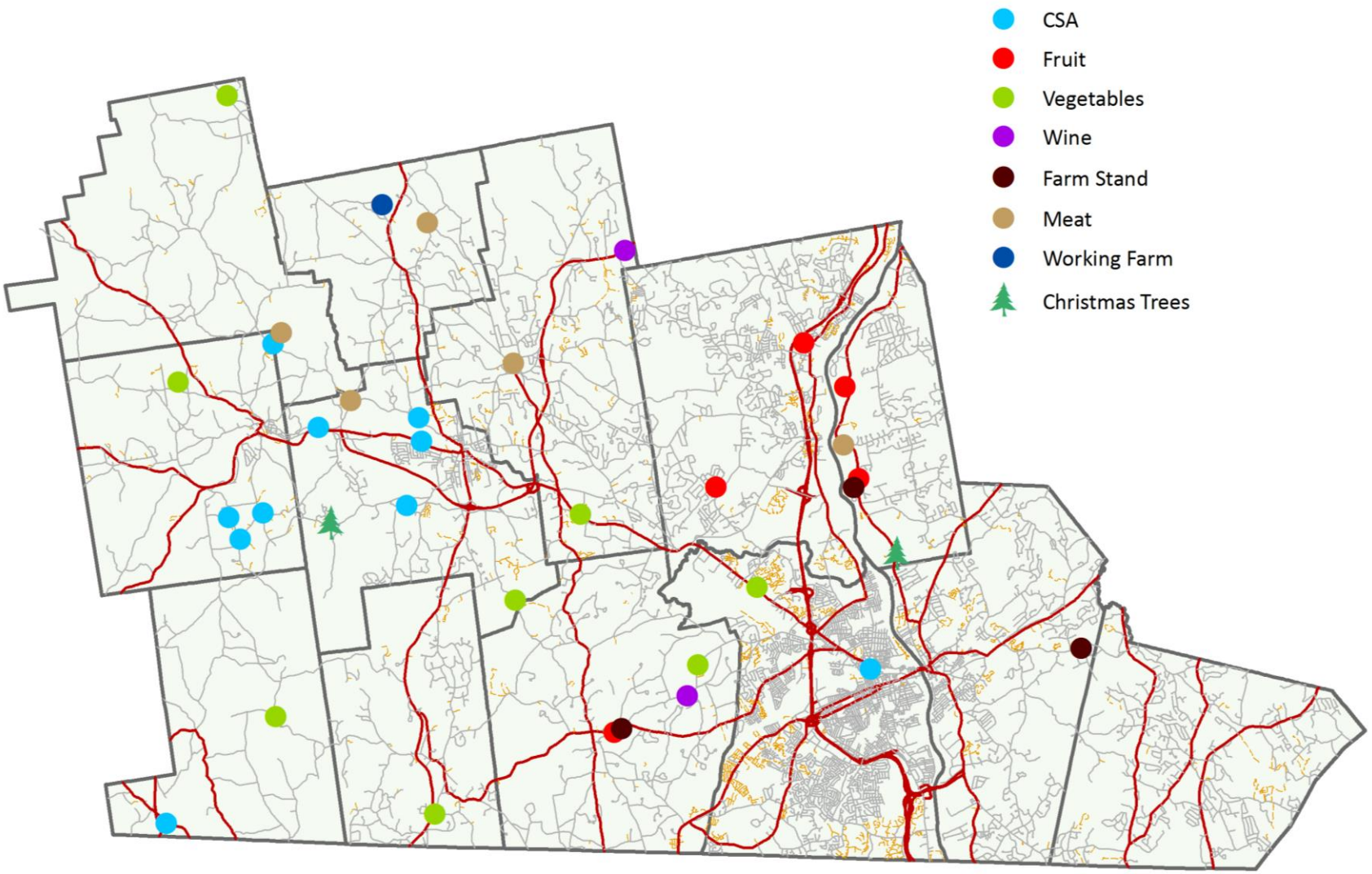
Agriculture is a strong tradition in the Nashua region. Historically, the economy in the region was based on farming, logging and small manufacturing. Outreach conducted by NRPC indicated that residents felt there was ample access to locally produced foods. The Nashua region has approximately 35 small family farms which harvest fruits, vegetables, meat, dairy and timber including Christmas tree farms.

Agriculture is subject to a myriad of threats including residential and commercial development, unsupportive tax structure, invasive pests and disease and variable weather patterns. The 2012 US Ag Census Preliminary Report shows New Hampshire contains 4,391 farms with an average size of 108 acres compared to Hillsborough County which has 688 farms with an average size of 69 acres **(United States Department of Agriculture, 2014a)**.

The New Hampshire Department of Agriculture, Markets and Food (NHDAMF) maintains a list of all the farms in New Hampshire and categorizes them according to commodity. The NHDAMF produces location maps of the farms by tourist region and the Nashua region farms are classified under the Merrimack Valley tourist area. The map below shows the location of the farms based on the maps produced by NHDAMF in the region according to commodity. There are over 36 farms in the region. The largest commodity type is vegetables and fruit. The classification of types in the map below is based on self-reported commodity production by the farms and lacks a specific definition.

In 2002, NRPC conducted a comparison of aerial imagery to determine the change in agricultural land use from 1974-1998. The initiative sought to create more comprehensive analysis lacking in the Census of Agriculture report for actual acreage of land and current use on properties below ten acres. During analysis years, Mason was a part of the Southwest Regional Planning Commission and did not join NRPC until July 2008. The analysis revealed a 34 percent loss in agriculture land over the 24 year period. The largest percentage loss occurred in Brookline (-82.3%) while the greatest acres lost occurred in Hudson (-912 acres), Hollis (-601.7 acres) and Litchfield (-522.7 acres) **(Nashua Regional Planning Commission, 2002)**. An updated comparison has not been completed.

Map 8: Farms in the Nashua Region



Source: (New Hampshire Department of Agriculture, 2013)

Agritourism

NH RSA 21:34-A defines agritourism as "Engagement by a farm in agritourism, meaning attracting members of the general public to a working farm for recreational, entertainment, or educational purposes, and to view or enjoy activities and attractions in the farm's rural environment. An activity is an agritourism activity whether or not the participant paid to participate in the activity."

In essence, agritourism is providing educational and authentic agricultural experiences that enhance direct marketing of farm products and improve public support for agriculture. Agritourism also helps educate the public about the importance of agriculture to a community's economic base, quality of life, history, and culture (Chase, 2011).

Agritourism is the Nashua region is focuses on wine and wine tasting, pick your own farms, farm education and tours, CSA's, farm stores, agricultural festivals and events. There are a number of farms in the region that gain valuable income through direct market shares. As stated above, Hillsborough County ranks 27th in the country for direct market sales at $5million (United States Department of Agriculture, 2014a). There is an opportunity for farms to capitalize on agritourism in the region and continue to increase the amount of direct market sales.

Community Supported Agriculture (CSA)

CSA's are a national movement to secure capital and support for small local farms. CSA's sell various forms of agriculture products but all follow a similar business structure. A farm sells "shares" of the local produce or food product in exchange for a set price to be paid to the farmer. The farms can engage in other forms of revenues such as farmers markets, retail farm stores and wholesale to local restaurants. The CSA structure allows for partnering with other local producers to increase the variety of products to shareholders **(DeMuth, 1993)**. CSA's offer an alternative to traditional farming structures in support of local grown products and securing a local agriculture economy **(United States Department of Agriculture, 2014b)**.

Table 8: CSA's in the Nashua Region

Name	Address	Community	Products
Barrett Hill Farm	149 Barrett Road	Mason	HYO strawberries & blueberries, vegetables & meats, CSA
Bee Fields Farm	555 Abbot Hill Road	Wilton	Vegetable, medicinal herbs, chickens, bees and goats, CSA
Holland Farms	269 Osgood Road	Milford	Eggs, roaster chicken, raw goat milk, goat cheese, Earthlings Granola, goat milk soap, CSA
Ledge Top Farm and Frog Hollow Farm	487 Lyndeborough Road	Wilton	Retail small fruits and vegetables, CSA
McLeod Bros. Orchards	749 North River Road	Milford	HYO apples, pumpkins, harvest subscriptions, CSA
Nomadic Farms	108 Gage Road	Wilton	Growing herbs, vegetables and flowers, CSA
Temple-Wilton Community Farm	195 Isaac Frye Hwy	Wilton	Vegetables, herbs, CSA
Trombly Farms	150 North River Road	Milford	PYO strawberries, vegetables, sweet corn, pork & beef, eggs, CSA

Source: (New Hampshire Department of Agriculture, 2013)

Future conditions

Scenario Planning

The land use modelling exercises demonstrated in the Scenario Planning Chapter provide an overview of potential future conditions and results of particular interest to natural resources. The scenarios tested are based on business-as-usual under current local regulations and an enhanced environmental protection scenario.

The Business-as-Usual scenario predicts growth at year 2040 based on current zoning district regulations that are assumed constant over time. It takes into account a limited number of common land-use constraint conditions such as steep slopes, permanent conservation lands, and wetlands or other water bodies that would prevent future development. The model takes into account the presence of existing building structures in order to identify parcels that are undeveloped or underdeveloped.

In contrast, the *Increased Local Environmental Protection* scenario is an alternative growth scenario marked by the conservation of additional environmentally important lands such as additional conservation lands, floodplain, protective buffer zones around select wetlands and water bodies, and important habitat. This scenario removes approximately 40,000 additional acres from development, resulting in approximately 51% of the total land being unbuildable. The other model inputs, including data and assumptions, are identical to Business-As-Usual in order to facilitate comparison between the scenarios.

The visual results of complete build-out are somewhat fantastical, but are presented to emphasize the impact of the increase local environmental protection. Over this theoretical extreme, the overall pattern of new development is much more clustered within a smaller amount of developable land, and the overall intensity of development is decreased by approximately 22%.

The model results pose a challenge to popular assumptions about the effects of increased land conservation. In this aggressive and idealized scenario, where a significant portion of land is earmarked because of environmental merit, there virtually no significant constraint on overall growth in the short term. Because much of our environmentally-sensitive lands are also in built-up areas of our region, new housing development shifts somewhat unexpectely towards less-dense residential areas and slightly further away from downtown community centers and existing parks.

Non-commercial growth is slightly more likey to be sited in industrial zones associated with higher allowed floor area that is associated with additional energy use but also potentially more commercial jobs. Over longer timelines, the effects of additional land conservation curtail the quanity and placement of new development more profoundly and serve to amplify existing differences in land use patterns across our region.

These findings should be considered in light of the model limitations discussed above and are meant to stimulate additional community conversations about appropriate land-use strategies on the local level.

The next two sections identify some of the key issues that we heard from residents and some potential strategies that local communities can undertake to help maintain the region's rural characteristics.

Regional Natural Resource Issues

Through the extensive outreach process, residents identified key issues that they felt their communities will be facing in the future. These issues include:

- Land Use
- Flooding
- Green Space
- Boating
- Fishing
- Parks
- Swimming/Water Quality
- Recreation, open space, health

Land Use

The way we use land directly impacts the natural resources in the region. Increased development has led to traffic congestion, air quality and a host of other impacts on the environment.

A better understanding of the regional land use picture can be obtained by examining individual communities' land use profiles. NRPC maintains maps of existing land use based on windshield surveys and updated by local communities. The region's more rural communities can benefit from examining land use patterns and changes in the more developed neighboring communities. An understanding of these patterns can help municipalities anticipate and plan for their own future.

Flooding

Flooding is an issue of increasing concern for residents during rainstorms and spring thaws. Just a few inches of swiftly moving water can knock people off their feet, and it only takes a couple feet of water to carry an automobile away. Often the greatest damage from flooding is caused by the debris carried by the floodwaters, or by debris obstructing stormwater flow. Damage to or obstruction of flows through bridges, dams and culverts can have devastating effects **(NH DES, 2008b)**.

Flooding is costly both to the victims and the public. In the short term, there is the cost of the emergency response, temporary housing, conducting damage assessments, and the administrative cost of organizing assistance. The long term costs associated with property damage, such as loss of business and personal income, reduction in property values, loss of tax revenues, and infrastructure repair, can be devastating to residents, businesses and the local government.

Green Space

The discussion of green space was common throughout the outreach process. Residents mentioned green space in regards to the availability, access, and use of parks and trails. Some residents felt there were an abundance of green space and parks and suggested more advertisement to increase the number of users. Residents suggested expanding the rail trail to Mine Falls Park, and other parks. This would allow more community members to be active or gather. The lack of trail connectivity within the region, including the Nashua rail trail, was cited as problem.

Other green space concerns included the lack of community gardens. Greely Park, in Nashua, has plots that are passed down through generations to grow fruits or vegetables. Some respondents were concerned about the lack of management to ensure the land is being used properly and cited the need to create a maintenance schedule so the growing potential is not wasted.

Boating

The Merrimack River provides excellent opportunities for smaller watercraft. The Merrimack River is the largest water body in the region yet lacks significant access. Currently, only two access points exist in Greely Park in Nashua and Moore's Falls Recreation Area in Litchfield, of which many residents are unaware (Nashua Regional Planning Commission, 2008).

The Souhegan River originates in Massachusetts and flows north east through the NRPC region terminating at the Merrimack River in Merrimack, New Hampshire. Boating activities are limited to kayaking and canoeing. The shallow sandy bottom is prohibitive to large water craft. Sections of the river are suitable for intermediate level whitewater kayaking and canoeing during spring floods. There are multiple access points in all communities along the river.

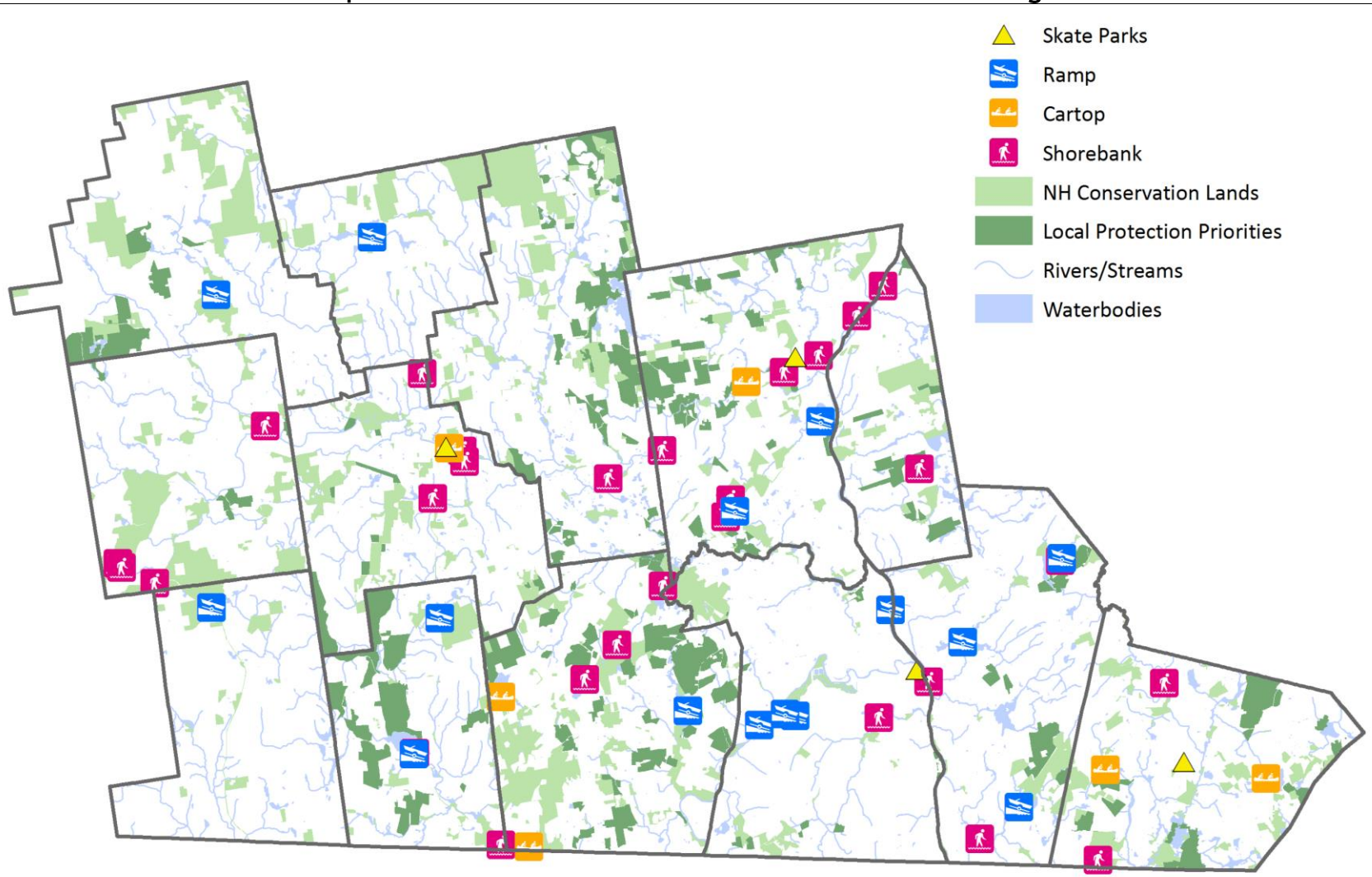
The third major river in the region, the Nashua River, does provide some recreational boating, however, the Jackson Falls Dam in the heart of Nashua alters in stream flow levels above and below the dam impoundment. Access to the Nashua River is limited to one hard top ramp in Nashua (New Hampshire Fish and Game, 2014). Additionally, economic development along the river has created large impervious areas especially through downtown Nashua. Impervious areas couple with industrial waste water releases (NPDES) decrease water quality before the confluence with the Merrimack, rendering areas unsuitable for swimming.

Fishing

Development threatens fish species through stormwater runoff. Runoff created on impervious surfaces stores more heat and increases water temperatures once it enters the water body (New Hampshire Department of Environmental Services, 2008c). The temperature difference decreases cold water habitat typically found in southern New Hampshire for warmer waters dominated by invasive species. Increased water temperatures effect spawning time for native fish species including the newly restored Atlantic Salmon (Nugent, 2014).

The amount of fishing in the region is determined by access points. Residential lakes and ponds are accessed more easily by residents through ramps, docks and trail systems. River access points vary depending on the community. There are a number of access points on the Souhegan River compared to the Merrimack River and Nashua River. Lake and river advisory groups could consider inventorying access points and increasing access to river to educate new fisherman species conservation efforts and diligent fisherman practices (Nashua Regional Planning Commission, 2006, 2008).

Map 9: Conserved Land and Water Access in Region



Source (GRANIT)

Parks

Parks provide a variety of recreational opportunities and additionally act as sound buffers for traffic, locations for arts and culture festivals which increase opportunities for social cohesion. Park types in the Nashua region include forested areas, riparian buffers, skate parks, athletic fields and open space areas.

The population within .5 miles in an urban area and one mile in a rural area map reveals that 65% of the Nashua region is within a park or open space. The proximity of a half mile to one mile of a park indicates the relative distance a person will use alternative transportation to an amenity. In addition to the emission reduction, using alternative modes of transportation increases physical activity reducing risk of obesity and associated diseases **(Bedimo-Rung, Mowen, & Cohen, 2005)**.

Swimming and Water Quality

The Conservation Lands map demonstrates access points for swimming locations around the region; however, there are many swimming locations located on private properties and indoor areas which are not listed. The largest threat to swimming activities is a decline in water quality. A decline in water quality would decrease tourism, effecting thousands of jobs and lost revenue. Development and lack of data and monitoring are threats to water quality in our region. Past sampling efforts of impaired water bodies revealed reduced swimming opportunities due to contamination. The top three impairments to swimming in the region are Chlorophyll-a, cyanobacteria and E.coli.

Beach closures appear to be on the rise in the Nashua region based the Annual Beach Fecal Advisories graph (See Existing Conditions). Beach closures not only effect humans but contaminated water ways reduce dissolved oxygen necessary for aquatic life and wildlife who rely on local waterways for water to drink and cooling during excessive summer heat.

This issue is going to increase and cause more water issues with rising summer temperatures and an increase in excessive flooding events in the next 100 years. The Annual Beach Fecal Advisories per 100 samples demonstrates the amount of beach closures in the Nashua Region in a given year. Beach closures are determined by high chlorophyll a from cyanobacteria blooms and E. coli contamination. Bacterial growth is limited by nutrient availability. The presence of excess nutrient causes a large growth in cyanobacteria leading to blooms in the presence of sunlight. Excessive fertilizing and nutrient loading from pet waste, turf management products, and naturally occurring nutrient levels are all causes of nutrient pollution.

Recreation, Open Space and Public Health

Regionally, open space provides a number of services to protect public health and environment. Residents enjoy the natural resources of the area and feel communities should actively pursue environmental protection which includes the acquisition of open space areas. Additionally, open space can promote tourism and economic development and improve the health of a local population. Other services include:

Growth Management: Conservation lands can guide communities into areas more suitable for development and are a cost relief on community services.

Historic Resources: Archeological and historic sites can be maintained through legal protections and transformed into other pursuits.

Agriculture Preservation: Local farms are increasingly important in the preservation of local food systems and enhance the community character and sustain the local economy and local employment.

Scenic Vistas: Particular hills or other parcels of land can be protected for residents and tourists to enjoy. Intact views can enhance or maintain property values.

Water Quality: Open space provides a multitude of water quality maintenance services such as flood control, aquifer recharge, aquatic buffers, greenway maintenance through the filtering of pollutants and mitigating stormwater runoff.

Air Quality: Forested areas absorb noxious gases, ozone, and particulate matter reducing the risk of respiratory issues such as asthma on vulnerable populations. Approximately eight percent of children in Hillsborough County have asthma.

Habitat Protection: Open spaces provide a variety of unique habitats essential for wildlife preservation. Wildlife is a draw for residents and tourists for hunting, fishing, bird watching and hiking. State parks and recreation contribute $545 million through spending and tax revenues.

Public Health: Approximately 38 percent of adults in NH are classified as overweight and 25 percent are classified as obese. Recreation and access to outdoor space provide much needed exercise opportunities for New Hampshire's growing obese population. Diseases associated with obesity such as diabetes and stroke are reduced with daily physical activity. Nationally, New Hampshire has one of the highest rates of asthma when compared to other states.

Social Cohesion: Social cohesion can be described as social support or social networks. Social cohesion can also be recognized as, "the degree to which an individual is interconnected and embedded with in a community-is vital to an individual's health and well-being…" Open spaces serve as meeting places for all populations which promotes positive social networks and an enhanced sense of wellbeing. Furthermore, increased social networks can provide child services such as increased physical activity opportunities and resources to help relieve poverty and parental stress. Additionally, social networks are improved for seniors residing near paths and open space.

Sources: (Anderson, Ludmila, 2010; Berke, et al., 2007; Conley, A. & Daniels, D., 2011; McNeill, et al., 2006; NH Division of Parks and Recreation & NH OEP, 2013)

Natural Resource Opportunities

To ensure that the region maintains the quality of its natural resources and the character of the region remains intact, there are a number of strategies that communities can employ from encouraging voluntary efforts to changing regulations.

Farms

Integrated pest management (IMP) efforts curb the effects of crop destruction from invasive pests. IMP incorporates many pest management techniques at one time to reduce pest damage below threshold levels (UNH Cooperative Extension, 2000). Historical pest management relied heavily on the use of pesticides, however new techniques include the use of pesticides along with ecologically minded methods. Other methods include:

- Soil testing and amendment
- Good sanitation: removing crop refuse, sterilizing tools and destroying plants which may harbor pests
- Plant resistant varieties
- Use barriers and traps: polyester row cover, cutworm collars and fences
- Proper timing: delay or plant early to avoid pests
- Biological controls: conserve natural enemies such as predators, parasites and diseases

Source: (UNH Cooperative Extension, 2013a)

An additional opportunity to support local farms includes agritourism. Communities who value agriculture lands can provide necessary regulations to enable agritourism activities. Typical residential or commercial zoning may be too restrictive for expanded agriculture activities. Flexible or agriculture zoning provides necessary relief for farms to be able to conduct additional activities to maximize profits and create an economy that supports farming into the future.

Protection Strategies: Voluntary

There are a multitude of voluntary methods for private land owners to conserve or protect agriculture or open space areas. Voluntary measures provide an alternative to land owners to conserve land and retain some property rights. Options for land acquisition may exist to the land owner and a consultation with the land owner's financial counselor and attorney is advised. Voluntary measures include:

- Donation of Land
- Conservation Easements
- Fee Simple Purchase
- Current Use Assessment
- Bargain Sale
- Options to Purchase and First Right of Refusal

(SPNHF, 2007; Tripp Taylor, 2000)

Protection Strategies: Regulatory

NH RSA 674:21, Innovative Land Use Controls, provides communities with options for open space and natural resource protection. Municipalities can use zoning methods to reduce sprawl and protect open space according to local master plan goals and areas of importance indicated by the community.

- Environmental Characteristics Zoning
- Agriculture Friendly Zoning
- Open Space Development and Conservation Subdivision Ordinances
- Transfer of Development Rights

Costs of Land Protection

In New Hampshire, local governments are reliant on property taxes to fund public operations. The 2005 Managing Growth study from the Trust for Public Land reviewed the theory of conservation land

leading to higher property taxes. The conclusions revealed there are short term increases in property taxes after the acquisition of permanent open space or conservation land. However, land acquisition reduces property taxes over time (Brighton, 2005).

Impervious Surface Impact Reduction Strategies

Residents and municipalities can use a number of strategies to identify natural resource areas and manage impervious surfaces. Impervious surface strategies help protect stream water quality and buffer areas.

- **Conducting a Natural Resource Inventory (NRI):** A NRI in your watershed will help communities identify protection priorities and the best areas for development.
- **Targeting Conservation Efforts:** A recent study by the NH Coastal Program and the US Geological Survey found that impervious surfaces near water bodies have a greater impact on water resources than impervious surfaces that are farther away.
- **Considering Conservation Design Alternatives:** Conservation designs for development minimize the amount of land disturbed, maintain significant ecological areas in a natural state, and reduce the amount of impervious surface created.
- **Managing Existing Impervious Surfaces and Stormwater Drainage Systems:** From planting vegetative buffers, to keeping parking areas clean of debris, to capturing stormwater for treatment or groundwater recharge, there are many approaches communities can pursue to reduce the impacts of impervious surfaces.
- **Providing Community Outreach:** Educating your community about the impacts of impervious surfaces and what they can do will not only get residents on board for new local regulations, but will also reduce impacts from existing developed areas. Municipalities in the New Hampshire coastal watershed that are under the federal Phase II Stormwater Management Program can use this information to assist them with meeting the federal requirements.

  Source (New Hampshire Estuaries Project, 2007)

Managing Invasive Species

New Hampshire Department Of Environmental Services offers a number of tips to avoid cross contamination which is the number one region invasive species spread into new areas. Residents should discard all plant fragments from the boat, trailer and hitch after every launch or equipment removal. Avoid boating/fishing in areas of dense plant growth. Avoid areas marked, "Restricted Use Area" which have been established to contain exotic aquatic plants. Be aware of signs at boat ramps indicating if the water body has been affected by an exotic aquatic plant (New Hampshire Department of Environmental Services, 2011a).

Previous Open Space Priorities

In 2005, NRPC conducted a regional open space plan. Projects and associated implementation strategies were identified as long term protection efforts for conservation commissions. The 2005 potential projects and studies/plans include:

- Route 3A Agricultural Preservation Project
- Pennichuck Brook Watershed Buildout Analysis
- Protection for Locally Significant Parcels in Brookline, Hudson, Merrimack, Milford and Wilton
- The Souhegan River Corridor

- The Merrimack River Corridor
- Musquash Area-Hudson
- Frog Pond-Wilton

In the past, open space and recreation planning efforts have been led by conservation commissions, recreation committees and local planning boards. The 2005 report highlighted open space and implementation strategies identified by local conservation commissions for improving relations with adjoining communities for more public participation.

Regional Open Space Strategies

1. Continue Encouragement of Concentrated Public Infrastructure Investment in Developed Areas
2. Use Local Open Space and Recreation Plans for Implementation
3. Encourage Private Sector Open Space Donations and Planning Assistance
4. Create a Regional Open Space District
5. Encourage Inter-Municipal Cooperation in Land Protection
6. Promote Public Awareness of Land Protection

Source: (Nashua Regional Planning Commission, 2005)

These strategies are specific efforts for conservation in the Nashua region.

Other planning efforts were conducted through the Regional Environmental Planning Program (REPP) in January 2000. REPP was funded by the New Hampshire Department of Environmental Services, and was focused on identifying local and regional conservation priorities.

Inventories were completed to identify significant unprotected waters, land, forest, historic, cultural, ecological, geological and public resources.

The priority areas identified in 2000 remain priorities in the 2005 Open Space Strategy. No regional update has been completed. since. More recently in August 2009, NRPC collaborated with Litchfield, Pelham and Hudson through the I-93 Community Technical Assistance Program (CTAP) to create open space plans that identify priority areas such as agriculture, riparian buffers, water quality and air quality.

Local open space plans conducted by NRPC focus on environmental co-occurrences, high priority parcel areas for the community and protection strategies. Voluntary and regulatory protection strategies are equal to those listed in the Agriculture section

Table 9: Regional Priorities in 2000

Priority	Communities	Largest Threat
Merrimack River Corridor	Merrimack, Nashua, Litchfield, Hudson	Industrial and Suburban Development
Nashua River Corridor	Hollis, Nashua	Suburban Development
Pennichuck Brook Watershed	Hollis, Nashua, Amherst, Merrimack	Industrial and Shoreland Development
Purgatory Brook and Falls	Mont Vernon, Lyndeborough	None
Souhegan River Watershed	Wilton, Milford, Amherst, Merrimack	Golf Course Development

Source: (Nashua Regional Planning Commission, 2000)

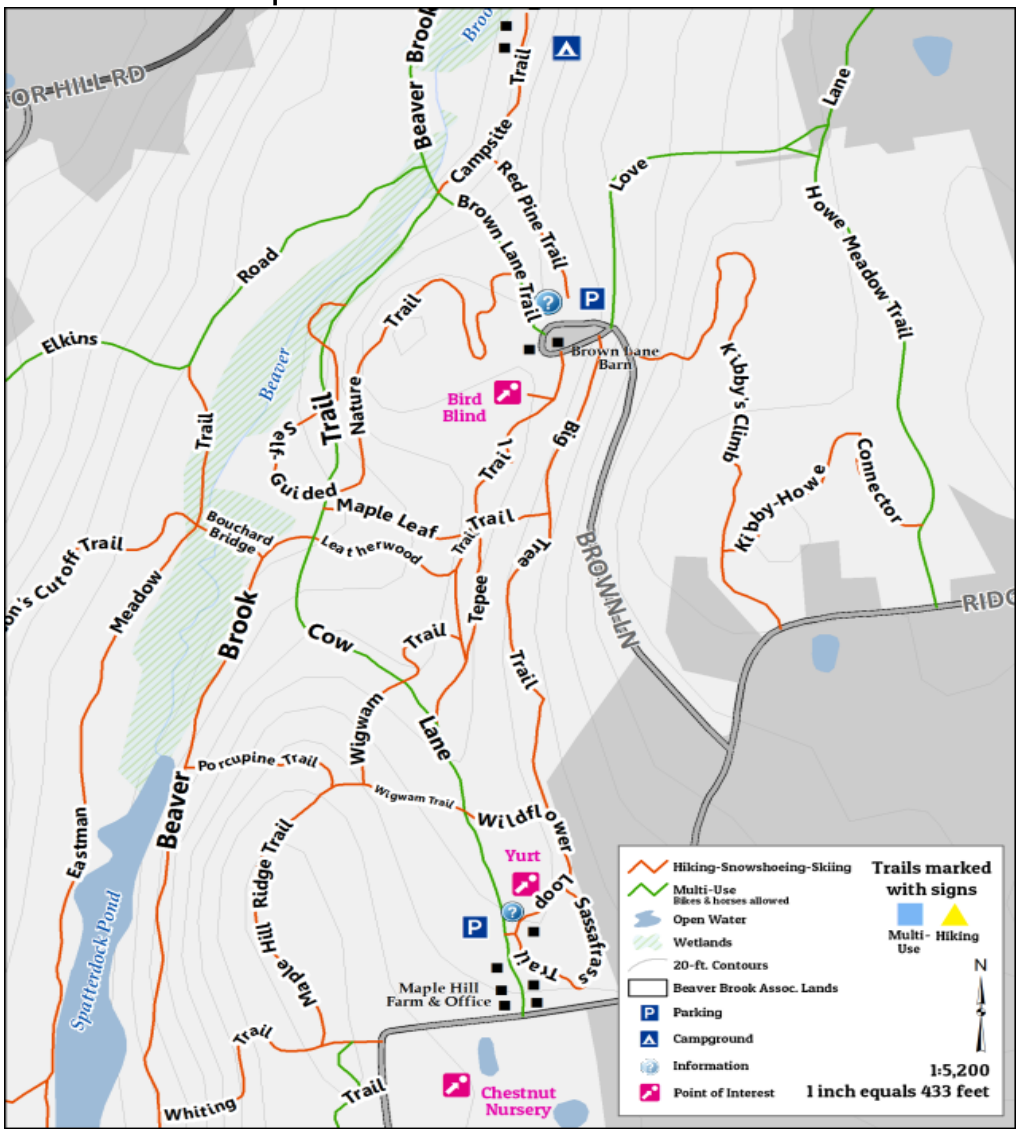
Recreation Opportunities

The Nashua region contains a variety of recreational opportunities, both terrestrial and marine. The Nashua region has an abundance of hiking, biking and walking opportunities in addition to swimming and boating. Recreation and open space was one of the most important topics vocalized by residents in the region.

Hiking, Biking and Walking

Hiking/walking and biking are an excellent form of passive recreation(Wen, Kandula, & Lauderdale, 2007). Minimal equipment is required and the low impact increases accessibility for all income levels and age groups. In 2010, approximately 349,570 New Hampshire residents participated in some form of hiking including trail running, climbing and day hiking. Additionally, 241,100 residents participated in paved or off road biking (New Hampshire Division of Parks and Recreation & New Hampshire Office of Energy and Planning, 2013). The NH Heritage Bureau and The New Hampshire Bureau of Trails maintain and upgrade trails and data including conditions and locations for NH State Parks.

Map 10: Beaver Brook Trails-Hollis



Source Beaver Brook Association, NRPC

Former rail trails, such as the Nashua Rail Trail and greenways are examples of the many hiking, biking and walking areas in the region. In addition to state agencies, local conservation commissions and land trusts maintain hundreds of miles of trails throughout the region.

The Merrimack River corridor and Souhegan River Corridors offer segmented hiking opportunities through conservation easements and right away along the river depending on bank slope and stabilization. The NH Heritage Trail should be considered as a regional asset that should continue to be a priority for development by municipalities. Currently, no regional trail maps exist; however, NRPC currently in the process of working with local groups to develop a region-wide trail dataset for a future trails map.

Conclusion

The purpose of this chapter has been to identify and describe the protected lands, agriculture and recreational facilities that exist within the region, as well as to emphasize the importance of land conservation and community open space planning in order to protect the natural resources that have been prioritized for protection in the future.

Some of the major open space and recreation objectives for the region should be to continue to identify and protect the most important natural resource and large undeveloped tracts of land remaining; to foster linkages between existing protected areas and state parks and forests; and to guide communities to consider the regional importance of open space and recreation in their community planning efforts.

Natural Resource Tools for Municipalities

- New Hampshire's Innovative Land Use Planning Guide published by the NH Department of Environmental Services includes provide a suite of flexible regulations to support natural resources such as: habitat management, energy efficient development, wetlands, and agriculture incentive zoning and groundwater protection ordinances.

- NPRC constructs a Master Transportation Plan for the Nashua which includes plans for alternative modes of transportation. Additionally, the Bicycle and Pedestrian Committee and local municipalities participate in planning for alternative modes of transportation. Other programs exist statewide such as Commute Green NH and NH Park and Ride System.

- The UNH Cooperative Extension assists communities and residents on how to set up a community garden. The website details soils types, choosing a garden site and appropriate fruits and vegetables. There are currently six community gardens in the Nashua region.

- The USDA maintains a list of statewide partners collaborating on invasive species infestations. Communities can use these statewide resources to integrate invasive species control in all sectors of local government.

    a. New Hampshire: *Aquatic Nuisance Species Task Force. Stop Aquatic Hitchhikers.*
    b. Industry: New *Hampshire Department of Agriculture, Markets & Food.*
    c. Exotic Species Program: *New Hampshire Department of Environmental Services. Watershed Management Bureau.*
    d. Forest Health: *New Hampshire Division of Forests and Lands*.
    e. Aquatic Nuisance Species in New Hampshire: *New Hampshire Fish and Game Department.*
    f. Landowners: New *Hampshire Fish and Game Department*.
    g. Invasive Species: *New Hampshire Department of Transportation*.
    h. Invasive Plants and Insects: *UNH Cooperative Extension*

- Zoning and Land Use: Zoning tools used to manage growth include growth management ordinances, impact fees, and phased development. These can be used to protect natural resources
    a. A growth management ordinance limits the number of building permits in any given year to a predetermined number and must be based on statistical data that demonstrates the municipality is growing faster than it can provide municipal services to serve its population.

    b. The village plan alternative promotes more efficient and economical development, which minimizes overdevelopment, preserves open space and retains village character.

c. Performance zoning reviews the performance of the parcel and how it impacts nearby community services and other parcels, rather than the specific land use.

d. Open Space or conservation subdivisions are a return to the neighborhood concept, with all types of residential uses in close proximity to one another and to community services such as schools, hospitals, businesses and shopping facilities.

- Preserving Rural Character through Agriculture Toolkit, from UNH Cooperative Extension is a resource guide for municipalities to identify areas of opportunity and strategies for balancing the goals of the master plan with existing agriculture practices.
-

Water Infrastructure and Resources

Introduction

"Water resource protection is the ultimate example of a regional issue. Amherst's zoning ordinance has been protecting Nashua's water supply for years, with the costs borne by Amherst and the benefits shared by all Pennichuck users. Shared infrastructure that benefits all the stakeholders is completely appropriate." – Comment from resident in Nashua region

Water is a shared resource by all residents in the Nashua region. The Nashua region contains 413.6 miles of rivers and streams and 3,296 acres of open water. The Merrimack, Souhegan and Nashua rivers are the main waterways of the region. The region's many lakes support recreation opportunities such as swimming, fishing and boating and a variety of wildlife habitats. Historically, waters of the region, especially rivers, were used as dumping areas for industrial manufacturing wastes, transportation corridors and drinking water resources. Today, residents enjoy positive water quality, restored wildlife habitat, recreation opportunities and vibrant local economy that celebrate the preservation of natural resources. There is an opportunity for communities to collaboratively address their water infrastructure vulnerabilities and incorporate local protection measures in their master plans and municipal codes.

Existing Conditions

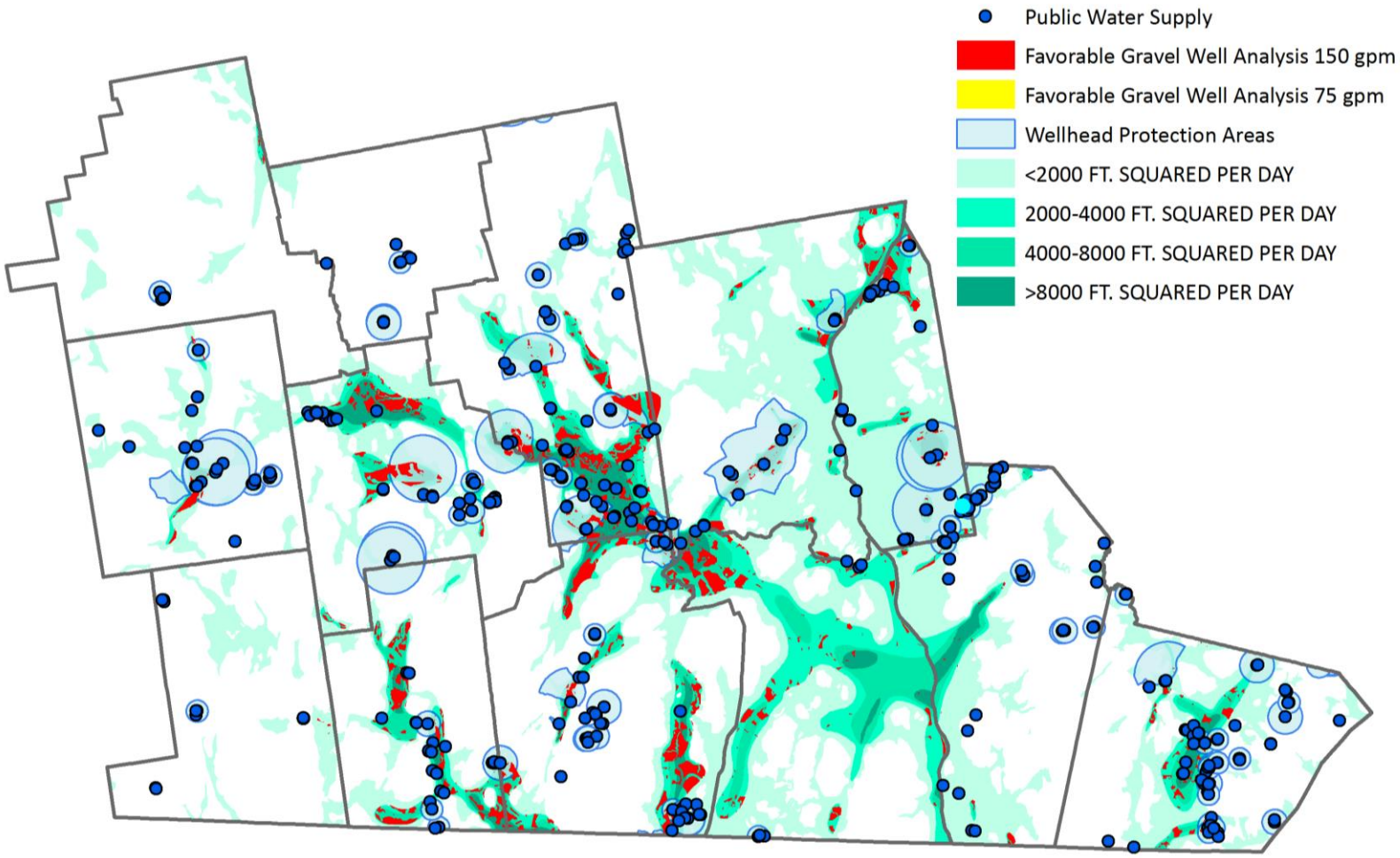
The plentiful water resources are one of the region's best assets. The communities in the region have made the protection of water resources a priority through the multiple groundwater and aquifer protection ordinances. Additionally, the Nashua Stormwater Coalition has worked to provide regional stormwater coordination for municipalities to cope with the requirements of the MS4 permits.

The forested character of the region continues to be the best resource for maintaining groundwater quality. Residents were committed to additional protections for water resources to maintain the water quality in the region.

The residents and municipalities are vital to the protection of existing water quality resources and protecting future supplies. One example of this is Ponemah Bog Wildlife Sanctuary. One resident commented that, "Ponemah Bog Wildlife Sanctuary is a fascinating, easy walk and a hidden gem."

The map below demonstrates the region's groundwater supplies. Stratified drift aquifers provide the majority of the water supplies. Additionally, dug wells, bed rock wells and surface waters support residential and commercial operations. The largest confluence of resources exists at the intersection of Amherst, Hollis and Nashua along the Souhegan River corridor where the stratified drift aquifer exceeds 8,000 feet squared per day and gravel well analysis of 150 gallons per minute. A gravel well analysis is the minimum well yield required by the community water system. The Merrimack and Nashua River corridors provide lower level of gravel well analysis but significant water resources reside under the City of Nashua.

Map 11: Nashua Region Drinking Water Resources



Source (GRANIT)

Shoreland Protection and Riparian Buffers

Riparian buffers refer to the naturally vegetated shoreline, floodplain or upland forest adjacent to a surface water body. Buffer areas serve as filter areas for sediment and other debris in runoff waters, trapping it and preventing it from entering the main water body. The wider a buffer area is, the better the chance that any foreign substances will be caught and filtered (United States Army Corps of Engineers, 2006).

Trail systems are an appropriate use of riparian buffer areas and double as wildlife corridors for migrating species on the east and west sides of the Merrimack River (Nashua Regional Planning Commission, 2008). There are two kinds of riparian buffers – shoreline and woodland. Shoreline buffers are areas of small grassy vegetation appearing along the water banks. Shoreline buffers are much smaller than woodland buffers and are generally less effective than their woodland counterparts at effectively removing sediment from runoff before it reaches the main water body (New Hampshire Department of Environmental Services, 2008d). Wider buffer areas accommodate larger mammal movement than smaller buffer areas.

Water quality protection is a priority for all of the communities as evidenced by the results from the UNH Survey. Nearly all residents (95%) of the survey participants view protecting water quality for drinking as a high priority for their community. Shoreland protection is a regulatory mechanism to protect water quality and reduce sedimentation, erosion and other pollution such as fertilizer. By protecting riparian buffers throughout the region, impervious surfaces are reduced thus protecting the public from further water quality degradation.

All forth order and greater streams and rivers are also subject to the State Shoreland Water Quality Protection Act (RSA 483-B). The protected shoreland are those lands that are located within 250 feet (measured using a horizontal surveyors line) from the reference line of protected water bodies. Many low impact activities that propose no greater than 1,500 square feet of total impact area, of which no more than 900 square feet is new impervious area, may qualify for a shoreland permit by notification

Communities in the Nashua region that have adopted some form of Shoreland Protection in their plans:

- Amherst- Section 4:11 Wetland and Watershed Conservation District
- Brookline-Section 4: Brookline Master Plan
- Hudson-Hudson Master Plan
- Merrimack-Section 2.02.12 Shoreland Protection District
- Milford-Shoreland Protection Application

Source (New Hampshire Office of Energy and Planning, 2013)

Wetlands

"Wetlands are sometimes described as 'the kidneys of the landscape' because they function as the downstream receivers of water and waste from both natural and human sources. They stabilize water supplies, thus ameliorating both floods and drought. They have been found to clean polluted waters, protect shorelines and recharge groundwater aquifers." - ***(Mitsch & Gosselink, 2007)***

Wetlands are defined as, "an area that is inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal conditions does support, a prevalence of vegetation typically adapted for life in saturated soil conditions," (RSA 482-A:2, X). The inundated soils of the wetlands acts as a carbon sink removing excessive carbon in the air, an important consideration for mitigating against climate change. Wetlands provide many other functions plus flood control, water filtration, water storage and recharge to surface water and ground water, wildlife habitat and aquatic nurseries and economic value **(New Hampshire Department of Environmental Services, 2008d)**. A study conducted in 2006 estimated the economic benefits generated by a single acre of wetland were $150,000-$200,000. Additionally, the same study found wetlands surrounding real estate increased the value by 28 percent and enhancing the quality of life of those residents **(New Hampshire Department of Environmental Services, 2008d)**.

Table 10: Wetland Acres

Community Name	Wetland Acres
Amherst	2,413
Brookline	1,090
Hollis	1,936
Hudson	1,634
Litchfield	1,374
Lyndeborough	958
Mason	647
Merrimack	2,118
Milford	839
Mont Vernon	701
Nashua	1,898
Pelham	2,289
Wilton	586
Total	18,483

There are many different types of wetlands found in the region forested and shrub swamps, marshes, peatlands, wet meadows, and bordering vegetated shallows of streams, rivers, lakes and ponds **(UNH Cooperative Extension, 2013b)**.There are several classifications of wetlands, including but not limited to emergent wetlands, vernal pools, floodplain wetlands and upland wetlands. Amherst has the most amount of wetland at 2,413 acres. Pelham and Merrimack have the second and third highest acres of wetlands at 2,289 and 2,118. Mason has the second lowest amount of wetlands in the region at 647 acres and Wilton has the lowest at 586 acres.

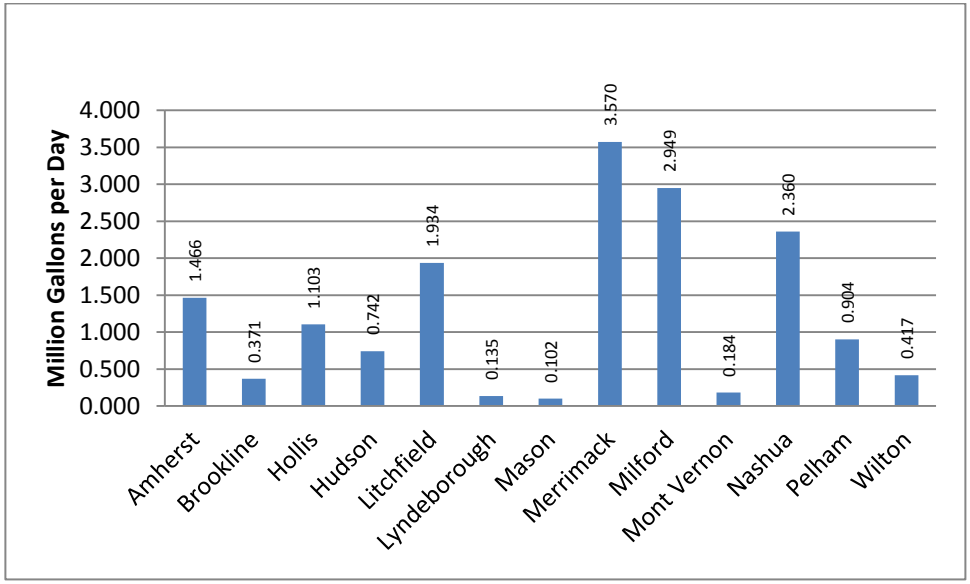
Local Aquifer or Well-Head Protection Ordinances

Groundwater is the most common withdrawal source in the region, and accordingly water quality is important to the residents of the region, according to the 2012-2014 outreach conducted by NRPC. Every community in the region uses groundwater for a water source. Merrimack had the highest groundwater withdrawal at 3, 570,000 gallons per day. The next highest is Milford with 2,949,000 gallons per day and Nashua at 2,360,000 gallons per day. Mason had the least with 102,000 gallons per day. Merrimack has the highest groundwater withdrawal from the Anheuser Busch plant.

In order to protect water resources, communities have implemented water protection ordinances for well-head areas, aquifer areas and wetlands. Each community has a different ordinance but many used the "Model Groundwater Template Ordinance" from New Hampshire Department of Environmental Services which uses USGS Stratified Drift Transmissivity Maps for boundaries of water resource areas. Other communities define the boundaries differently according to where the resources are located with the municipality. Typically, the ordinance or overlay district defines land uses and performance standard required to mitigate adverse impacts of development

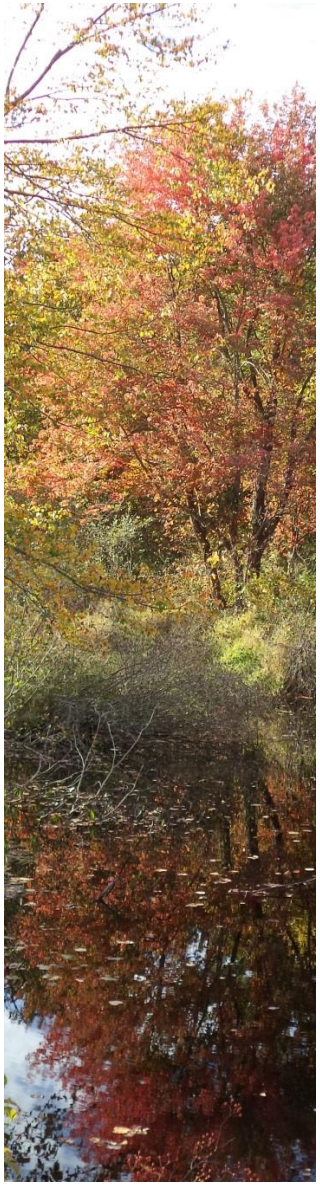
The New Hampshire Department of Drinking Water and Groundwater Bureau maintain information on groundwater throughout the state. In addition to groundwater, NHDES recommends ordinances for wetlands, private wells and surface waters for enhanced protection. Currently, no municipality in the region has a private well ordinance.

Figure 7: 2005 Groundwater Withdrawals



Source: United States Geological Survey, 2005

Table 10: Groundwater Regulations in the NRPC Region	
Community	Regulation Title
Amherst	Aquifer Conservation District Zoning Ordinance
Brookline	Aquifer Protection Ordinance, Wetlands Conservation Ordinance
Hollis	Water Supply Conservation Zone, Aquifer Protection Overlay
Litchfield	Aquifer Protection District
Merrimack	Aquifer Conservation District
Milford	Groundwater Protection District
Pelham	Aquifer Conservation District
Wilton	Aquifer Protection District



Public Drinking Water

Water quality standards emerged from public health issues dating back to the Industrial Revolution; most notably the Cuyahoga River Fire in 1969. Since that time, the interrelationship between public health and water quality has grown exponentially. State and federal standards regulate water quality to protect the public and reduce exposure to harmful contaminants: bacteria, metals, sewage and water borne diseases (New Hampshire Department of Environmental Services, 2008a).

Water quality and drinking water is the most important topic for residents in the state and in the Nashua region. The New Hampshire Department of Environmental Services states that 60% of N.H. relies predominantly on groundwater for their drinking water needs. The New Hampshire Department of Environmental Services Water Primer estimated that 36% of residents in the state use private wells as their drinking water source and much of the drinking water infrastructure in N.H. is 50 to 100 years old and is costly to maintain or replace.

Table 11 demonstrates the population in the Nashua region served by public water (community water systems), public sewer, household wells and private septic. The population served by these amenities is consistent with the rest of the State. Private septic remains the most common form of waste disposal with nine of the thirteen communities completely reliant on septic. Public sewer is confined to those communities with wastewater treatment facilities and community septic systems see Wastewater Section for the definition of a collection system. Eight of the thirteen communities have 50 percent or more of the population served by house hold wells. Naturally, the populations with a wastewater treatment facility also have a higher population served by public water. Nashua and Merrimack the communities most served by public water.

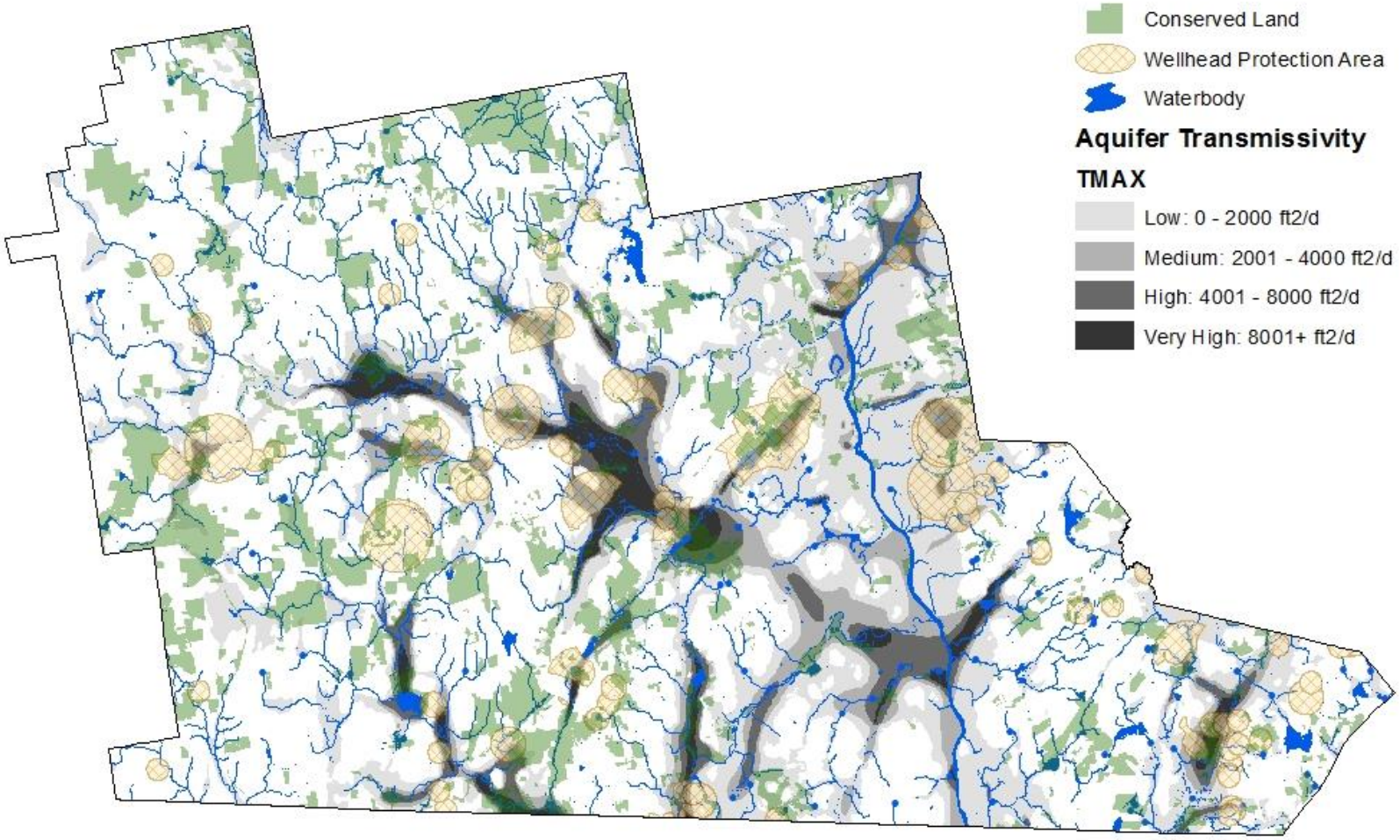
The Source Water Protection Map includes lands currently in conservation, however, as stated in the Forest Lands section, the majority of forests in the region are privately owned. The effort of maintaining private forest lands is not reflected in the current Conserved Lands layer. Regional conservation efforts to protect stratified drift aquifers from contamination require community collaboration to preserve water resources for future generations and mitigate the effects of climate change.

Table 11: Percent of Population Served by Public Water, Public Sewer, Household Well and Private Septic

	% Population Served by			
Communities	Public Water	Public Sewer	Household Well	Private Septic
Amherst	19.7	0.2	80.3	99.8
Brookline	0.0	0.0	100.0	100.0
Hollis	5.8	0.0	94.2	100.0
Hudson	61.8	0.0	38.3	100.0
Litchfield	65.1	0.0	34.9	100.0
Lyndeborough	0.0	0.0	100.0	100.0
Mason	0.0	0.0	100.0	100.0
Merrimack	80.9	38.3	19.2	61.7
Milford	60.0	49.9	40.0	50.1
Mont Vernon	3.1	0.0	96.9	100.0
Nashua	85.2	79.2	14.9	20.8
Pelham	9.0	0.0	91.0	100.0
Wilton	41.3	36.4	59.0	63.6

Source New Hampshire Department of Environmental Services

Map 12: Source Water Protection Map



Designated Rivers

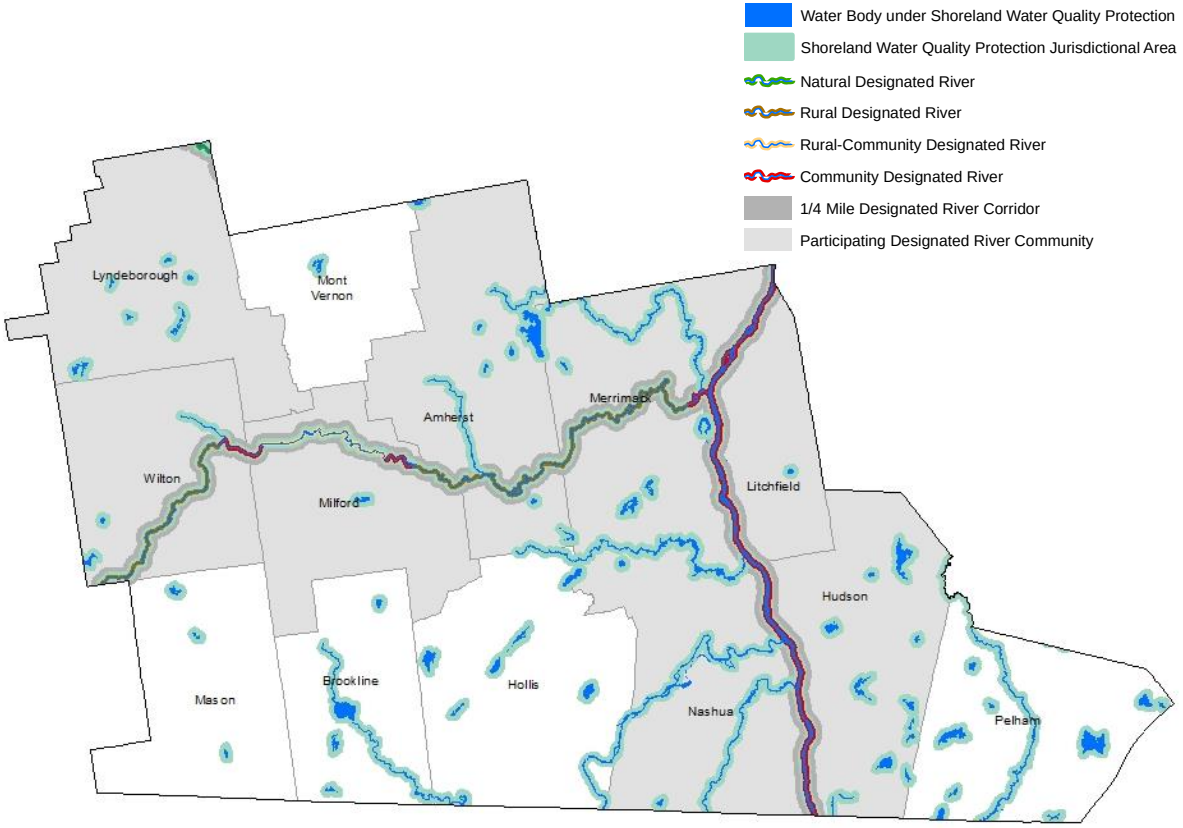
The New Hampshire Rivers Management and Protection Program (RMPP) was established in 1988 with the passage of RSA 483 to protect certain rivers, called Designated Rivers, for their outstanding natural and cultural resources.

For a river to be designated for protection, an interested individual or organization must first develop a River Nomination outlining the river's values and characteristics. Support by local municipal officials and residents of the riverfront communities for the designation must also be sought and reported. Once completed, the nomination is submitted to the DES Commissioner (New Hampshire Department of Environmental Services, 2014d).

The Merrimack and Souhegan Rivers are the only designated rivers in the region. The Merrimack is a designated river for 15 miles south of Bedford, New Hampshire. The Souhegan is protected for all 34 miles that flow through New Hampshire.

However, the Nashua River and a number of smaller rivers and water bodies throughout the region have added protections through the Shoreland Water Quality Protection Act. River designation is an excellent coordination exercise for communities to collaborate on river health and protection.

Map 13: Rural-Natural-Community Designated River



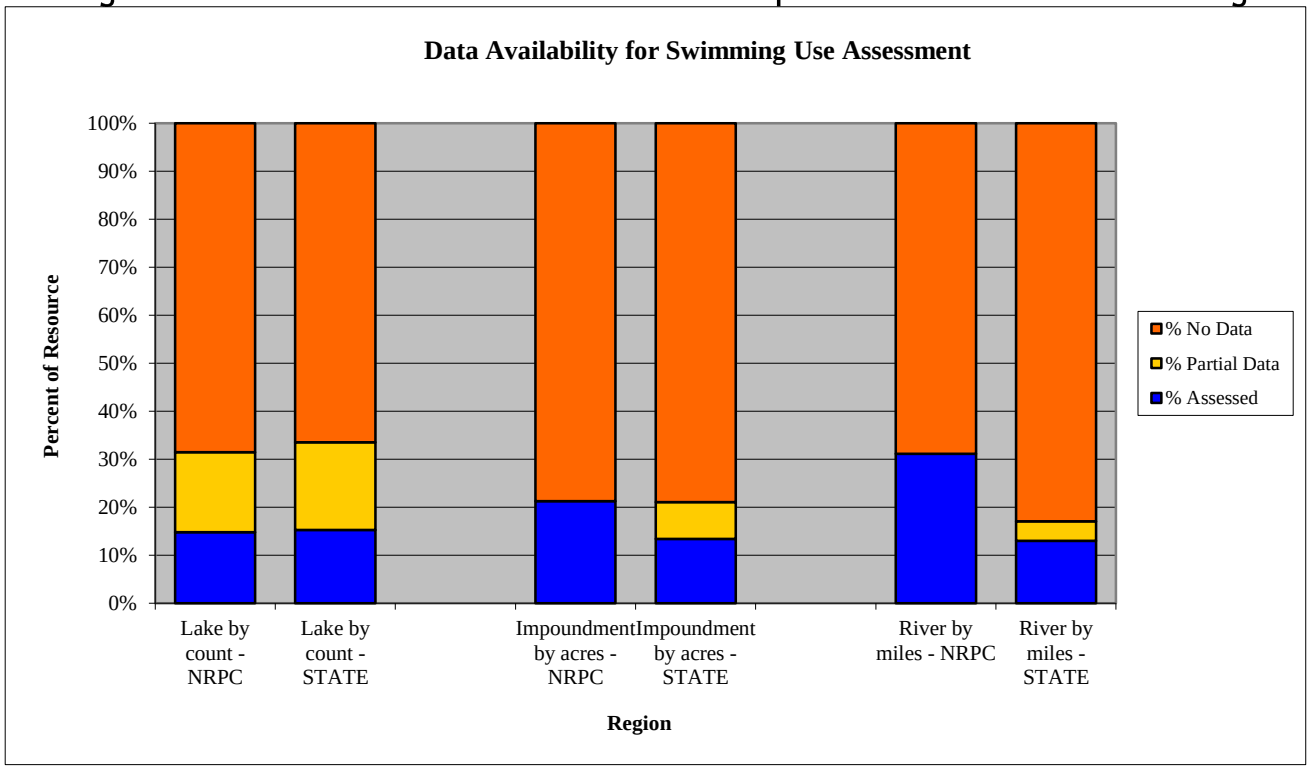
Water Quality

Residents in the region thought that the confluence of two major rivers was a significant asset. Outreach conducted revealed residents wished the canal was swimmable, due to the poor water quality. Residents also wished the waterways had more boat launches since they are perfect for recreation such as kayaking, canoeing, and river tours. Additionally, the depth of private wells and declining water tables levels were a concern especially during the summer months.

The resident concerns about water quality are not unfounded. Currently, the Nashua region lacks significant water quality data. Previous sampling efforts have been completed but updated information would provide trends analysis of water quality in the region. New Hampshire Department of Environmental Services in conjunction with the Volunteer Lakes Assessment Program and the UNH Lakes Lay Monitoring Program conducts surface water quality assessments throughout the summer in New Hampshire.

Figure 8 demonstrates the lack of water quality data available in the region. The Nashua region contains more than 54 bodies of water and less than half have been assessed for water quality standards and some only partial data exists.

Figure 8: Percent of Water Assessed for Aquatic Life Use and Swimming



Source NH DES

Sources of the impairments result from heavy nutrient pollution such as fertilizers, nutrient sedimentation in stormwater runoff and existing soil composition. Additionally, E.coli bacteria contamination results from fecal matter. Leaky septic systems, pet waste, wildlife waste and Combined Sewer Overflows (CSO) contribute to bacteria contamination through direct sourcing at the CSO outflow and indirect sourcing (leaky septic systems) **(United States Army Corps of Engineers, 2006)**. Combined Sewer Overflows deposit overflows stormwater and sewage directly into water bodies which contaminate water systems resulting in beach closures and infected areas. The Merrimack River receives raw sewage periodically from the City of Manchester and City of Nashua CSO's resulting in heavy contamination and infected waters. Additionally, the Merrimack and Nashua Rivers receive a number of industrial discharges from local manufacturing operations, as detailed in the Non-point Source Discharge Elimination Systems (NPDES) section **(United States Army Corps of Engineers, 2006)**.

Table 12: Top Five Impairments of Water Quality

Waterbody Type	Area	#1	#2	#3	#4	#5
Lake by Count	NRPC	pH	Dissolved oxygen saturation	Non-Native Aquatic Plants	Chlorophyll-a	Phosphorus (Total)
	State	pH	Dissolved oxygen saturation	Chlorophyll-a	Phosphorus (Total)	Non-Native Aquatic Plants
Impoundment by acres	NRPC	Non-native Aquatic Plants	pH	Dissolved oxygen saturation	Chloride	Oxygen, Dissolved
	State	pH	Non-Native Aquatic Plants	Dissolved oxygen saturation	Phosphorus (Total)	Chlorophyll-a
River by miles	NRPC	pH	Oxygen, Dissolved	Aluminum	Bethic-Macroinvertebrate Bioassessments (Streams)	Dissolved oxygen saturation
	State	pH	Oxygen, Dissolved	Aluminum	Dissolved oxygen saturation	Bethic-Macroinvertebrate Bioassessments (Streams)

Source (New Hampshire Department of Environmental Services, 2012c)

A decline in water quality is detrimental to humans and wildlife. Polluted waters are harmful to wildlife through alteration of turbidity, pH, sedimentation and temperature. The priority water quality impairment is pH for the state and Nashua region. The acidification of New Hampshire waters is an ongoing issue due to the burning of fossil fuels in neighboring states. The change in pH alters native species habitat favoring nonnative invasive species and shifting sedimentation rates causing accumulations in heavy metals such as mercury (United States Army Corps of Engineers, 2006). Another ongoing barrier is dissolved oxygen levels. Dissolved oxygen refers to the amount of oxygen molecules integrated with water molecules at any one time. Oxygen levels naturally vary throughout the year based on flooding, groundwater inundation and plant growth. Fast moving cold waters contain more dissolved oxygen then slower moving warmer waters. Slower, warmer waters with higher bacteria levels can lead to eutrophic conditions leading to beach closures and fish kills (United States Geological Survey, 2014b).

Table 13: Wastewater Infrastructure in the Nashua Region

Regional WWTFs	Built Year	Population Served by WWTF	Communities Served by WWTF or Collection System?	Average Daily Design Flow, MGD	Receiving Water (for surface water discharges)	Does the WWTF have a flood preparedness plan?	What is the projected risk to the WW collection system infrastructure for flooding?
AMHERST (Baboosic Lake System)	2005	Approx. 500	Amherst	Unknown	No surface water discharge	Unknown	Unknown
HUDSON COLLECTION SYSTEM	Unknown	Approx. 14,000	Hudson	Unknown	Hudson sewers discharge to the Nashua WWTF	Unknown	Unknown
MERRIMACK WW	1969	50,000 (Includes pop. Eqv of Anh-B flow	Merrimack, Bedford	5.000	Merrimack River	Included in SOPs for WWTF	High
MILFORD WW	1981	15,200	Milford, Wilton	2.150	Souhegan River	Included in SOPs for WWTF	Medium
NASHUA WW	1959	100,000	Hudson, Nashua; Tyngsboro. Merrimack	16.000	Merrimack River	Included in WWTF Emergency Response Plan	Low
WILTON COLLECTION SYSTEM	Unknown	Approx. 1600	Wilton	Unknown	Wilton sewers discharge to Milford WWTF	Unknown	Unknown

Wastewater Infrastructure

Wastewater infrastructure refers to the collection system and treatment facilities designed to transport and treat sewage wastes. The Nashua region has three wastewater treatment facilities (WWTF) in Nashua, Merrimack and Milford. Additional smaller treatment systems include the Baboosic Lake Community Septic System (no discharge) and the Hudson and Wilton Collection Systems which discharge into a neighboring WWTF.

Nashua WWTF

The Nashua WWTF is the largest in the region with a capacity of 16.0 MGD and a current use of 11.0 MGD. The Nashua WWTF serves four communities including Tyngsborough, Massachusetts and the most developed communities in the region. The Nashua WWTF capacity is available for communities in the region and across state lines. Typically, wastewater treatment is one of the largest expenditures for a municipality due to the energy required to power the facility. The Nashua WWTF uses anaerobic digestion to treat municipal waste. Anaerobic digestion produces methane gas as the end product, also known as 'biogas.' Recently, the Nashua WWTF installed a methane collection system and reuses the biogas to heat the digester or generate electricity to reduce the energy costs **(United States Department of Energy, 2005)**.

Merrimack WWTF

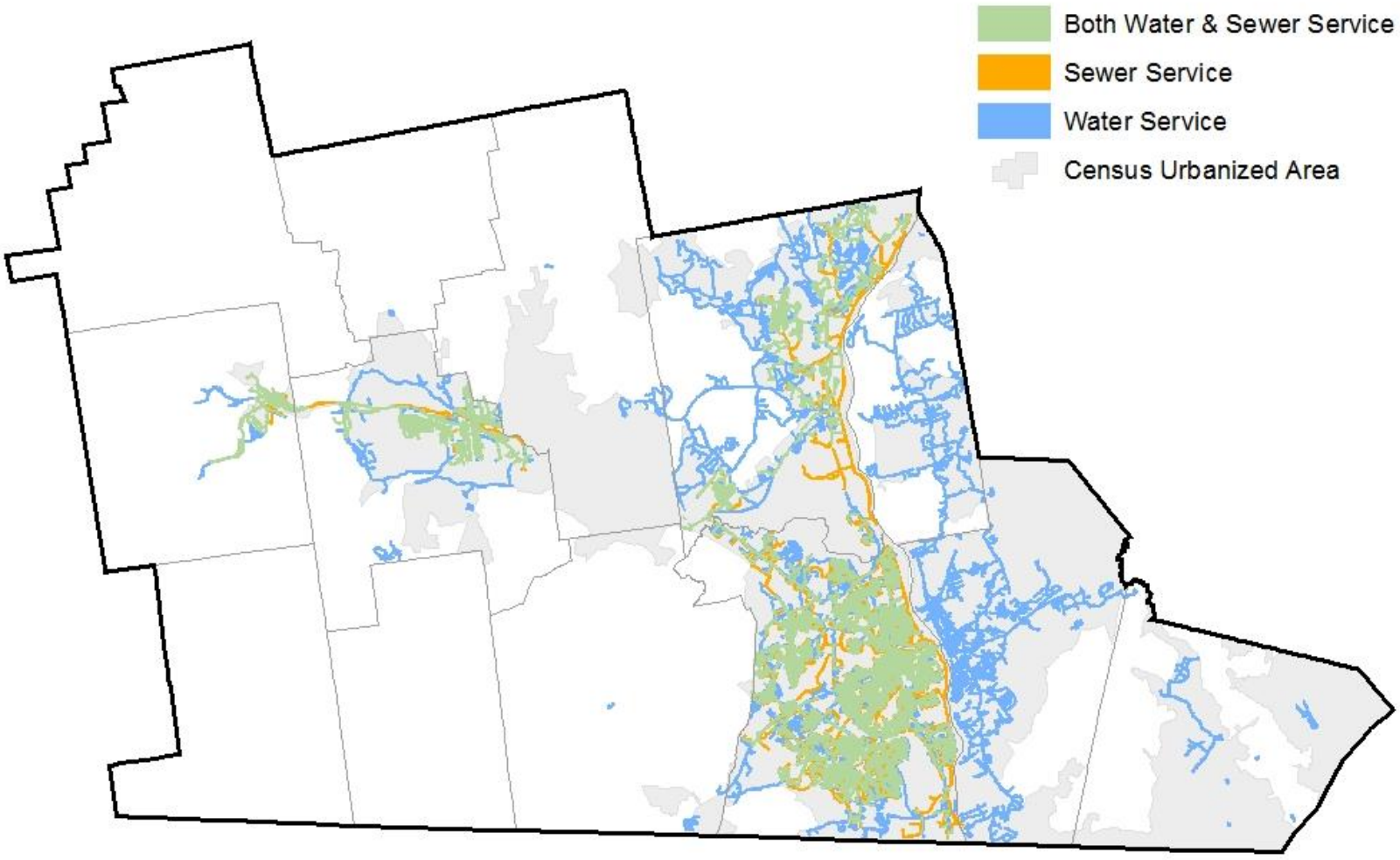
The Merrimack WWTF has a unique customer base. The facility serves 50,000 residents but 36,000 are resident equivalents used by Anheuser Busch for product development. Merrimack WWTF has a 5.0 MGD capacity with a 1.8 MGD current use. The WWTF turns waste produces into a resource by creating compost from the residuals from the wastewater treatment process. This nutritious compost is distributed to local residents for use as a soil amendment and fertilizer. Merrimack WWTF serves other communities outside the region, such as Bedford, and has the capacity to serve additional communities within the region as the region grows.

Milford WWTF

According to Dave Boucher, Director, Milford Water Utilities department, the current capacity of the Milford WWTF is 2.15 MGD (million gallons per day). However, the current use is only 1.2 MGD. Wilton purchased 14.89 percent capacity of the 2.15 MGD plant when constructed in 1981.Additional opportunities exist with the Community of Amherst as the Route 101 corridor begins to continue to be developed.

The map below demonstrates the public water service areas and the sewer areas of the region. Outreach efforts revealed residents expressed the need for more sewer areas to maintain water quality and increase the opportunity for commercial development. The City of Nashua has the most sewer of the region, followed by Merrimack and then Milford. Water services are extended to those communities east of the Merrimack River, Litchfield and Hudson.

Map 14: Map of Public Water Service Infrastructure



Source: New Hampshire Department Of Environmental Services

Sources of Impairment

Point Sources

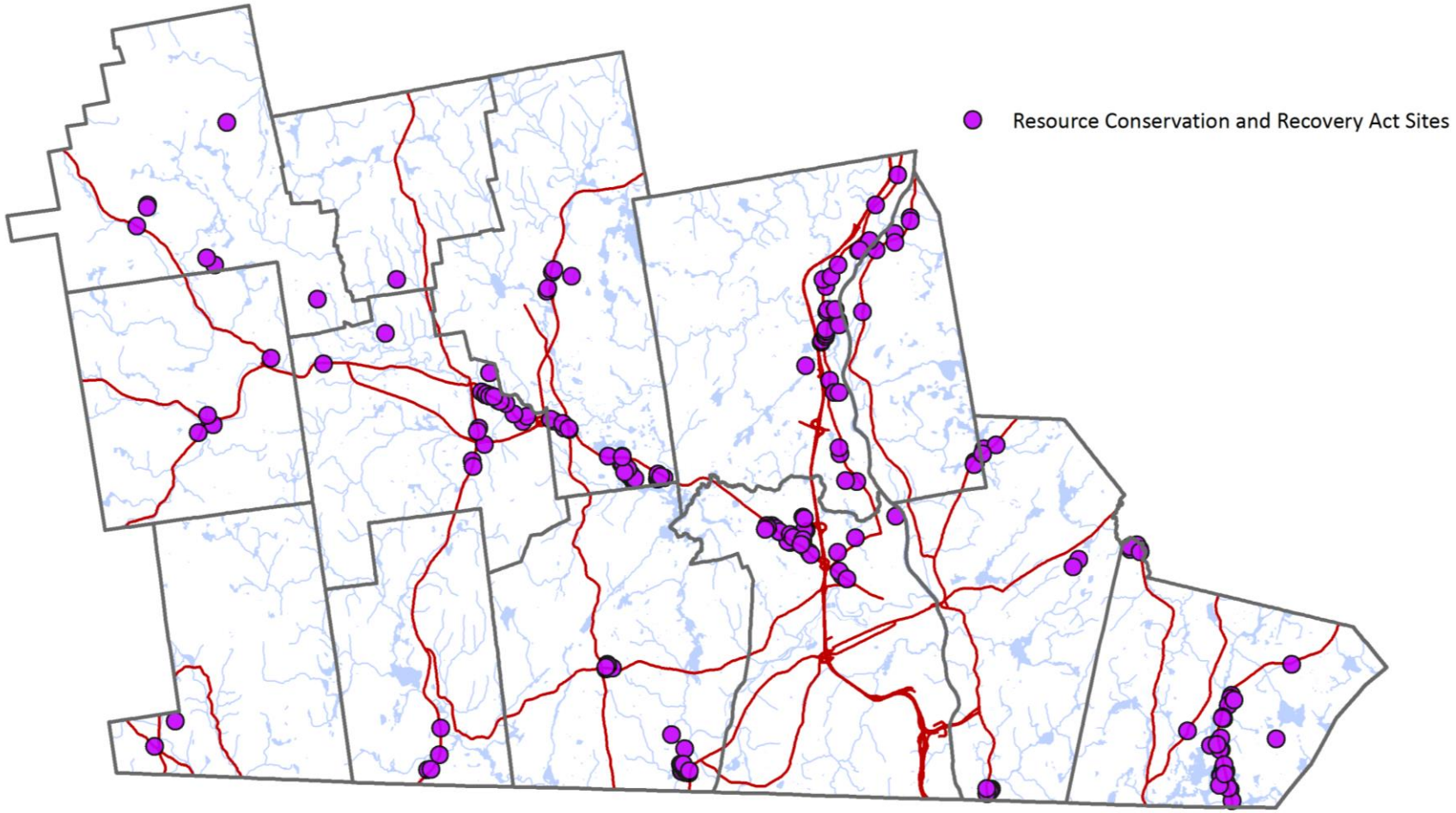
Point source pollution is when contaminants are distributed into a water body through a direct source. Point source pollution there refers to an identifiable place where contaminants enter the water body. Typical point source discharges include discharges from publicly owned treatment works (POTWs), discharges from industrial facilities, and stormwater discharges associated with industrial activity, construction and urban runoff. Under the National Pollutant Discharge Elimination Program (NPDES), all facilities that discharge pollutants from any point source into waters of the United States must obtain a NPDES permit (United States Environmental Protection Agency, 2009). Sources of Pollution in the Nashua region include Hazardous waste generators, storage tanks, combined sewer overflows and wastewater facilities.

Hazardous Waste Generators

The federal Resource Conservation Recovery Act (RCRA) tracks hazardous waste from the cradle-to- point it is generated through its ultimate point of disposal. This law and its implementing regulations define hazardous waste, and specify labeling, storage, treatment, disposal and reporting requirements for these wastes. RCRA regulations generally require that printers document the amount and type of wastes they ship and where it is treated or disposed (United States Environmental Protection Agency, 2013e).

The majority of RCRA or "Hazardous Waste Generators" occur along roadways and water ways in the Nashua region. The Route 3, Daniel Webster Highway and Route 101 corridors are the areas with the most commercial and industrial development in the region. Every community in the Nashua region contains at least one RCRA and sites will increase as the region develops. It is important for municipalities to be aware of hazardous waste protocol in case of an incident and the potential impacts on resources and surrounding populations.

Map 15: Regional Resource Conservation and Recovery Act Sites



Source (New Hampshire Department of Environmental Services, 2014c)

Table 14: Regional Underground Storage Tanks

Municipality	Facility Type (s)	Total Number of Tanks	Total Number of Active Tanks
Amherst	Local Government, Gas Station, Commercial, Contractor, Industrial, Other	78	11
Brookline	Gas Station, Contractor, Local Government	30	12
Hollis	Commercial, Local Government, Contractor, Gas Station, Industrial, State Government, Petroleum Distributor, Residential or Farm	61	17
Hudson	Gas Station, Petroleum Distributor, Local Government, Contractor, Commercial, Industrial, Trucking/Transport, School, Other	212	37
Litchfield	Commercial, Gas Station, Contractor, Local Government	33	6
Lyndeborough	Local Government, Gas Station	10	0
Mason	Commercial, Local Government	24	2
Merrimack	Industrial, Petroleum Distributor, Gas Station, Commercial, Federal-Non-Military, Local Government, Contractor, Industrial, Trucking/Transport, State Government, Church	246	77
Milford	Commercial, State Government, Trucking/Transport, Industrial, Gas Station, Auto Dealership, Industrial, Contractor, Local Government, Other, Utilities, Residential or Farm	260	53
Mont Vernon	Gas Station, Local Government	10	1
Nashua	Contractor, Commercial, Gas Station, Utilities, Industrial, Local Government, Trucking/Transport, Other, Auto Dealership, School, College/University, State Government, Church, Federal-Non-Military, Hospital, Petroleum Distributor, Aviation, Residential or Farm	1097	174
Pelham	Utilities, Commercial, Local Government, Gas Station, School, Local Government	75	17
Wilton	Commercial, Residential or Farm, Local Government, Industrial, Gas Station, School	70	14
	Total	**2206**	**421**

Source (New Hampshire Department of Environmental Services, 2014c)

Underground Storage Tanks

Underground Storage Tanks (USTs), according to RSA 146-D: Oil Discharge and Disposal Cleanup Fund, are defined as: "a location consisting of a system of underground storage tanks, pipes, pumps, vaults, fixed containers and appurtenant structures, singly or in any combination, which are used or designated to be used for the storage, transmission, or dispensing of oil or petroleum liquids, and which are within the size, capacity and other specifications prescribed by rules adopted by the commissioner pursuant to Chapter 146-A: Oil Discharge or Spillage in Surface Water or Groundwater".

USTs are regulated by the Department of Environmental Services (DES). The Underground Storage Tank Program, which is a division within DES, has the purpose to prevent and minimize contamination of the land and waters of the state due to the storage and handling: heating oils, hazardous substances, lubricating oils, motor fuels, other petroleum and petroleum contaminated liquids. **(New Hampshire Department of Environmental Services, 2014e)**

There are 2,206 tanks in total in the region, but only 421 are currently active. Table 14 demonstrates underground petroleum storage tanks in each municipality within the Nashua region. These underground tanks are located primarily at gas stations along with commercial, local government, and other facilities. The decrease in the use of underground storage tanks in the region a result of the implementation of higher standards, required thank upgrades and transition to alternative fuel sources. Naturally, Nashua has the highest number of underground storage tanks at 1,097 but only174 in current use. Nashua is the most developed community in the region with the most commercial and industrial operations in the region. Lyndeborough contains ten underground tanks but none in current use.

Above Ground Storage Tanks

Aboveground storages tanks (ASTs) are defined as containers that hold petroleum products. Petroleum ASTs are regulated by both the Department of Environmental Services (DES) and the New Hampshire Fire Marshal's Office. The Aboveground Storage Tank Program, which is a division within DES, is designed to prevent releases of oil from these tanks throughout New Hampshire.

Table 15 demonstrates that aboveground petroleum storage tanks are located in 11 communities in the Nashua region. Mason and Mont Vernon lack any tanks which are generally associated with commercial or industrial development. Petroleum and local government facilities are two of the most common facilities in the region. Altogether there are 487 aboveground storage tanks in the Nashua region, 350 of which are currently in use. Nashua contains the most number of active and non-active given that Nashua is the most heavily developed community in the region with the most commercial and industrial development. Many of the older tanks associated with closed businesses have been removed. These tank removals represent a significant reduction in the threat of contamination from petroleum products since many of these former tanks were 30 to 40 years old, which is well beyond the typical design life of steel tanks

Table 15: Regional Aboveground Storage Tanks

Municipality	Facility Type (s)	Total Number of Tanks	Total Number of Active Tanks
Amherst	Petroleum Distributor, Utilities, Industrial, Trucking/Transport, Recreation	21	17
Brookline	Local Government	1	1
Hollis	State Government, Petroleum Distributor, Utilities, Commercial, Local Government	31	20
Hudson	Petroleum Distributor, Local Government, Commercial, Asphalt Batching, Trucking/Transport, Recycling Center, Utilities	62	44
Litchfield	Commercial, Industrial	8	8
Lyndeborough	Local Government	2	2
Mason	None	0	0
Merrimack	Industrial, Utilities, Commercial, Local Government, Trucking/Transport, Federal-Non-Military, Other	85	64
Milford	Petroleum Distributor, Gas Station, Utilities, Asphalt Batching, Recycling Center, Trucking/Transport	71	42
Mont Vernon	None	0	0
Nashua	Trucking/Transport, Industrial, Petroleum Distributor, Local Government, Auto Dealership, Utilities, Aviation, Oil Change Facility, Commercial, School, Federal-Non-Military, Other	181	133
Pelham	Utilities, Petroleum Distributor, Industrial, Recycling Center, Auto Salvage	14	12
Wilton	Commercial, Industrial	11	7
	Total	487	350

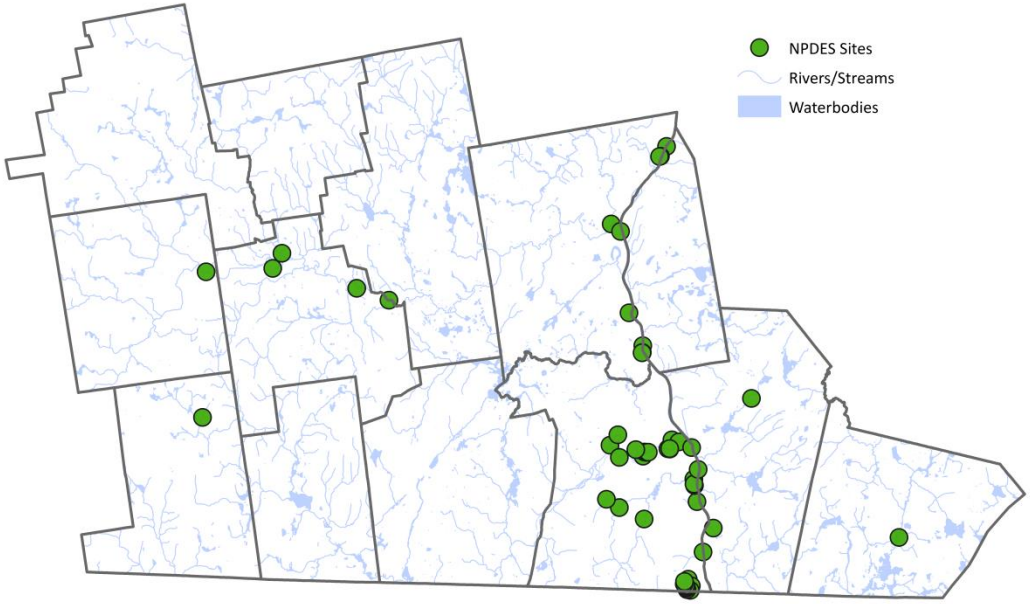
Source (New Hampshire Department of Environmental Services, 2014c)

National Pollutant Discharge Elimination System Requirements (NPDES-Phase 1)

In response to the Clean Water Act (CWA) amended in 1987, the Environmental Protection Agency (EPA) developed the National Pollution Discharge Elimination System (NPDES) Stormwater Program in 1990. Phase I of the program addressed the most threatening sources of stormwater: large municipal separate storm sewer systems (MS4s) and industrial activities. Phase II, implemented in 1999 required permit coverage for stormwater discharge from small MS4s and construction activities of smaller scales than those covered by Phase I (United States Congress, 1972; United States Environmental Protection Agency, 2009).

The Merrimack River receives the most number of NPDES permits (23). The Nashua Wastewater Treatment Facility receives ten permits, the most in the region, seven discharges into the Merrimack River and three into the Nashua River. Sanders, Lockheed Martin receives seven permits all discharging into the Merrimack River (New Hampshire Department of Environmental Services, 2014c).

Map 16: National Pollution Discharge Elimination Sites



Source (New Hampshire Department of Environmental Services, 2014c)

Combined Sewer Overflows

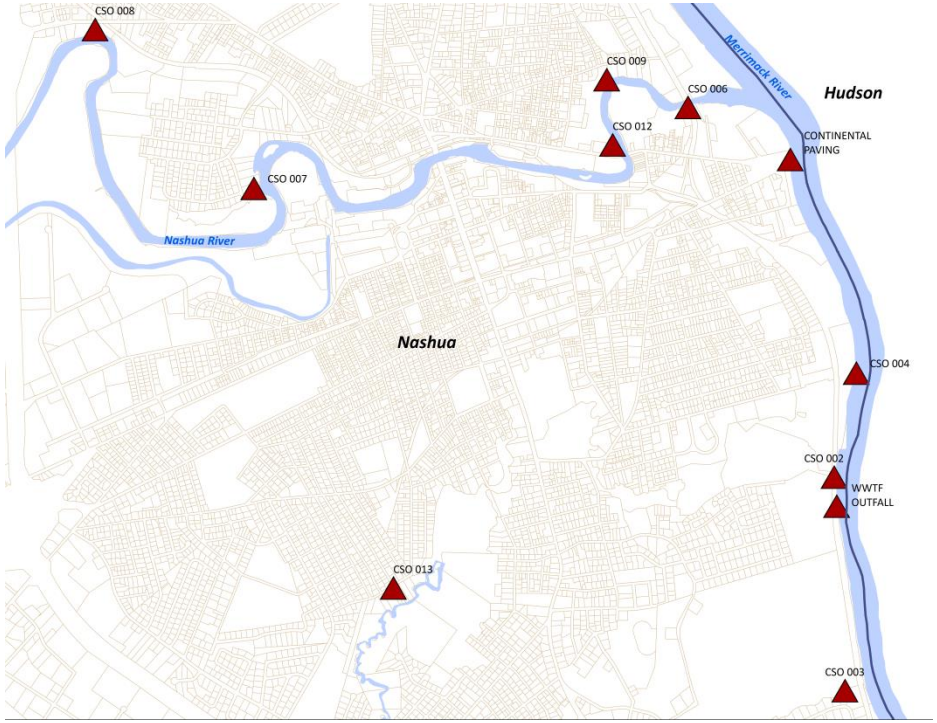
Combined sewer overflows are designed to collect stormwater, industrial wastewater, and municipal wastewater or sewage. During storms, water enters storm drains (catch basins) installed in streets to minimize flooding and combines with sewage already flowing in the pipes **(New Hampshire Department of Environmental Services, 2008d)**. Heavy rains flows can exceed the capacity of the pipes leading to overflow into surface waters. Public health issues associated with CSO's can result in stress to the aquatic environment and associated species from depleted oxygen in the water column, exposure to animal and human fecal matter, suspended solids may increase turbidity or damage benthic communities, excessive algae and aquatic plant growth from nutrient loading and floatable litter that may either harm aquatic wildlife or become a health and aesthetic nuisance to swimmers and boaters **(New Hampshire Department of Environmental Services, 2008d)**.

The Nashua CSO system consists of eight active and one inactive outfall in the City of Nashua. Four discharge into the Merrimack River and four into the Nashua River. The ninth CSO is bolted shut and inoperable.

The Nashua collection discharges approximately 26 million gallons of untreated overflow into the Merrimack and Nashua Rivers annually with a maximum of 25 discharge events per year. In general, the Hollis Street and Nashua River CSOs contribute the largest discharge volumes accounting for 70 percent of the total average discharge.

The Burke Street, Broad Street and Locke Street outfalls discharge most often, averaging once every two weeks **(United States Army Corps of Engineers, 2006)**

Map 17: Combined Sewer Overflows-City of Nashua



Source: City of Nashua

Non-Point Source Pollution

Nonpoint source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. The term "nonpoint source" is defined to mean any source of water pollution that does not meet the legal definition of "point source" in section 502(14) of the Clean Water Act (United States Environmental Protection Agency, 2012a). Stormwater is the primary source of non-point pollution and is generated by precipitation, surface runoff, and snow melt from land, pavement, building rooftops and other impervious surfaces

Stormwater Infrastructure

As the rain moves across the landscape it picks up and carries contaminates, which are finally deposited into lakes, rivers, wetlands, coastal waters, and underground sources of drinking water. When polluted stormwater is left untreated, it enters our systems and can cause water quality impairments. Built environments store heat in addition to contaminants, therefore, stormwater moves over an impervious area storing heat and warming bodies of water when dispersed causing significant effects on wildlife and polluting drinking water sources.

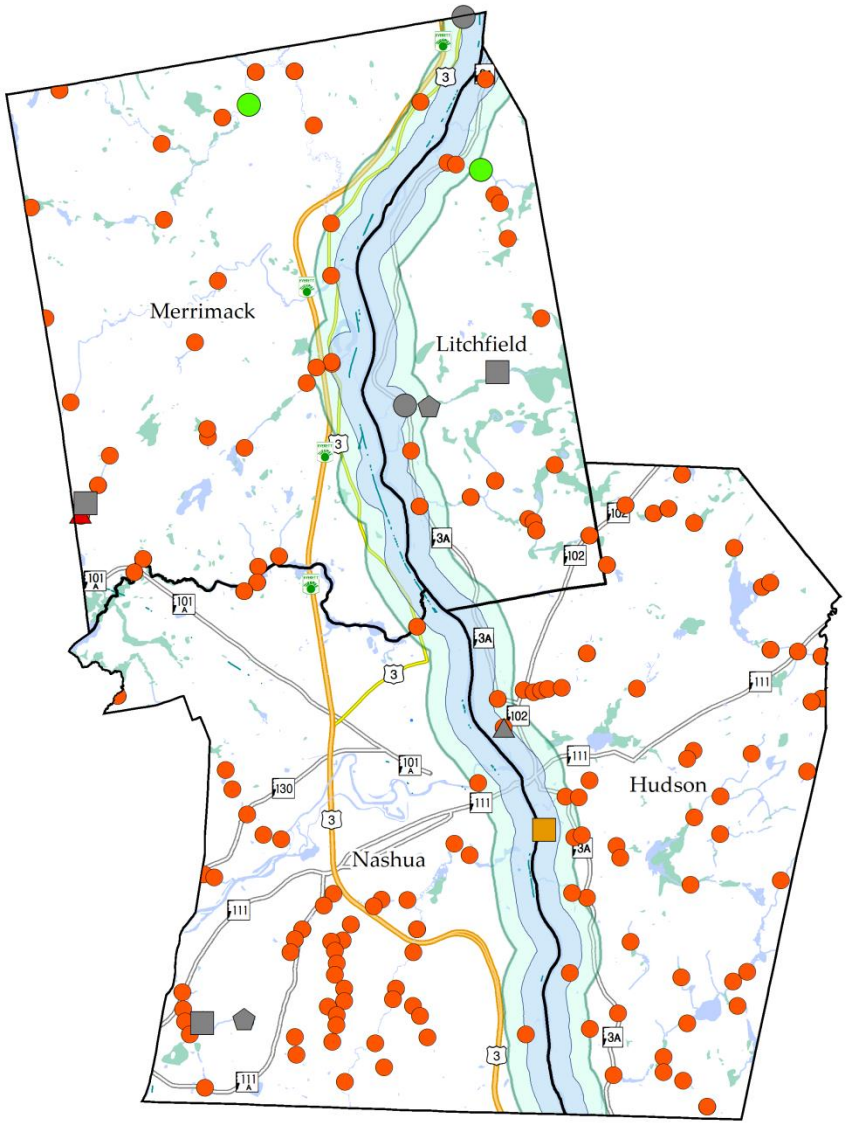
In the Nashua Region, some 74 percent of the water bodies with documented water quality problems are related to the pollutants commonly found in stormwater. An additional 23 percent of water bodies have problems related to an intermingling of stormwater and other types of pollutants sources (From the 2012 305(b)/303(d)).

Lower Merrimack River Continuity Assessment

The Lower Merrimack River Continuity Assessment was a one-year project conducted by the Nashua Regional Planning Commission in 2012. The project took place in the Lower Merrimack River Corridor, a 15-mile segment of the Merrimack River beginning at the northern borders of Merrimack and Litchfield, New Hampshire, flowing south through Hudson and Nashua to the Massachusetts border.

The Nashua region has started climate change adaptation planning through inventories of water infrastructure and culvert assessments. Last year, NRPC began by determining culvert locations within the municipalities of Hudson, Litchfield, Merrimack, and Nashua. Next, NRPC prioritized culverts to receive field assessments based on criteria including proximity to high quality habitat, proximity to the Merrimack River, and accessibility. Staff conducted field assessments of the prioritized culvert locations using the NH Stream Crossing Protocol. The data was then analyzed by staff at NH Geological Survey and each culvert was assigned a score ranking it from “fully compatible” to “fully incompatible.” These rankings provide guidance on the long-term ability of culverts to handle flow and sediment transport processes and their risk of failure. This study is one of many which can determine future hazards and empower communities to begin climate change planning

Map 18: Fluvial Erosion and Culvert Compatibility Map



Case Study: Nashua Levee System

The Nashua Local Protection Project, referred to as the Nashua Levee, is located at the confluence of the Nashua and Merrimack Rivers. The Nashua Levee is part of the comprehensive flood protection plan for the Merrimack River Basin, authorized by the 1936 Flood Control Act and modified by the 1938 Flood Control Act. The construction of the Nashua Levee System was completed in 1949 by the U.S. Army Corps of Engineers (USACE).

Since the construction of the Nashua Levee, a wastewater treatment system has been built in Nashua. All flows from the combined sewer at the levee, sanitary sewer, and drainage systems are intercepted, conveyed to the treatment plant, where the treated effluent discharges into the Merrimack River. During times of intense runoff, the detention time that the combined sewer and drainage flow goes through the treatment plant is reduced. Interception of storm and sanitary sewer by the treatment system has reduced the loading to this pump station by removing interior drainage from the protected area.

Dams

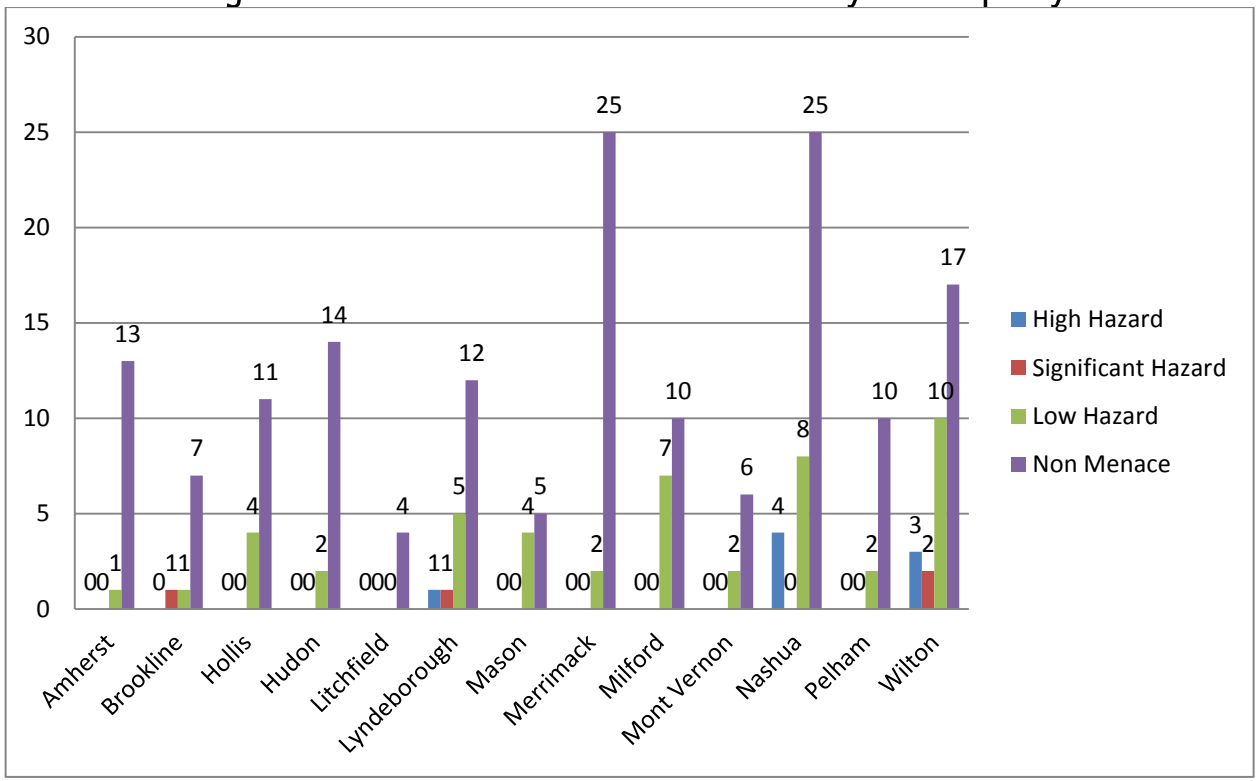
Dams have been a fixture on New Hampshire's landscape for centuries, having first been constructed by the early settlers to power grist mills and lumber mills in the eighteenth century, then by large manufacturers to fuel the industrial revolution. Some of these dams, dating back to this period, are among the oldest and most massive engineering projects still in service in New Hampshire.

In New Hampshire, the risks associated with many dams are increasing rapidly due to the encroachment of businesses and homes downstream from dams in areas that would be flooded if the dams were to fail. Adding to the risks are increasingly frequent extreme rainfall events due to climate change and a lack of important maintenance on many privately owned and some publicly owned dams.

In 2009, the New Hampshire Legislature changed the statutory definition (RSA 482:2, II) of a dam by increasing the minimum height criteria from four feet to six feet. In making this change, the Legislature determined that dams less than six feet in height are not likely to pose a threat to human life or downstream property if they were to fail. This change was also enacted to make New Hampshire's definition of a dam more consistent with the national standard. As a result of this change, over 700 structures were removed from New Hampshire's inventory of dams **(New Hampshire Department of Environmental Services, 2008d)**.

There are 3,070 active dams in New Hampshire, 214 are in the Nashua region. Currently, there are 90 dams in New Hampshire classified as High Hazard. Regionally, there are eight high hazard dams and four significant hazard dams. High hazard dams failures would inundate homes or other occupied structures downstream and likely cause loss of life. **(New Hampshire Department of Environmental Services, 2008d)**

Figure 9: Classification of Active Dams by Municipality



Source NH Dam Bureau

Dam Status

There are six breached dams which no longer have the ability to impound water in the occurrence of a storm. Forty nine exempt dams exist in the region, which once met the criteria of existing dams but no longer meet the DES standards of the definition of a dam. A status of not built describes a dam which has been permitted but was never constructed. There are 16 dams with this status. There are four pending dams which have been permitted but have not yet been confirmed as constructed. The three removed dams have been intentionally extracted due to various reasons. Those in ruins, the second largest category in the region with 74 dams, describe the remains of a dam which is no longer functional and is deteriorated to the point where the original configuration of the dam can no longer be determined.

Table 18: Dam Status by Community

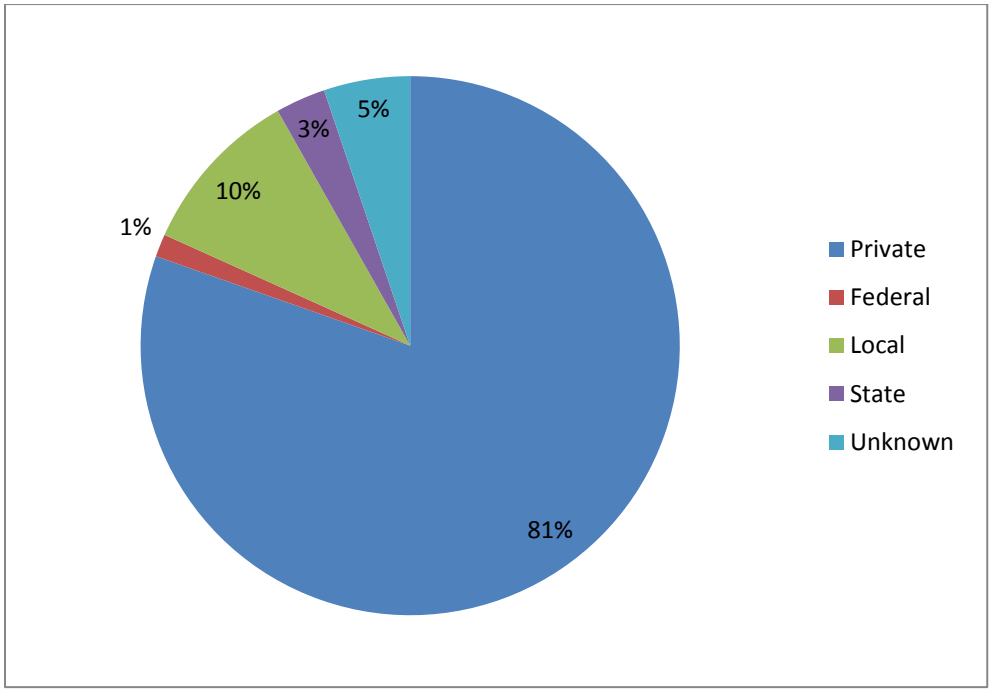
Community	Total Dams, Dikes, Ponds	Active Dams	Ruins	Exempt	Not Built	Removed	Breached	Pending
Amherst	24	14	4	5	1	0	0	0
Brookline	20	9	6	5	0	0	0	0
Hollis	28	15	4	3	4	1	1	0
Hudson	39	16	9	11	3	0	0	0
Litchfield	6	4	0	2	0	0	0	0
Lyndeborough	39	18	17	0	2	0	1	1
Mason	10	9	1	0	0	0	0	0
Merrimack	46	25	7	9	2	1	0	1
Milford	29	16	6	2	2	0	2	1
Mont Vernon	12	8	4	0	0	0	0	0
Nashua	48	36	2	7	1	1	0	1
Pelham	23	12	6	3	1	0	1	0
Wilton	42	32	8	2	0	0	1	0
Regional Total	366	214	74	49	16	3	6	4

Source (New Hampshire Department of Environmental Services, 2014c)

Dam Ownership

The chart below displays the classification of ownership of all active dams throughout the region. When comparing regional to statewide dam ownership, the trend is fairly similar. Statewide, seventy seven percent of dams are privately held **(New Hampshire Department of Environmental Services, 2008d)**. The majority of all dams in the Nashua region are privately owned. Larger dams impound high amounts of water resulting in hazardous situations. This can be contributed to these dams being used by the state for purposes such as water supply and recreation, which may retain higher amounts of water than private uses. The region does not host any of the 40 active federally owned dams in the state and only one of the 12 owned by a public utility. Overall, regional dam ownership stays true to the trends of dam ownership throughout the state.

Figure 10: Regional Classification of Dam Ownership



Source NH Dam Bureau

Aging Dams

According to the New Hampshire Department of Environmental Services Water Resource Primer, dams must be maintained to keep them safe. Occasional upgrade or rehabilitation is necessary due to deterioration, changing technical standards, improved construction techniques, better understanding of the area's precipitation conditions, increases in downstream populations, and changing land use.

When a dam's hazard classification is changed to reflect an increased hazard potential, the dam may need to be upgraded to meet an increased need for safety **(New Hampshire Department of Environmental Services, 2008d)**.

Dams fail for one of five reasons:

1. Overtopping (water spilling over the top of a dam)
2. Structural failure of materials used in dam construction
3. Cracking caused by movements such as the natural settling of a dam
4. Inadequate maintenance and upkeep
5. Piping: when seepage through a dam is not properly filtered and soil particles continue to progress and form sink holes in the dam

Source (New Hampshire Department of Environmental Services, 2008d)

New Hampshire ranks third in the country in number of know dam deficiencies. Below is the schedule of dam inspections based on hazard class. The amount of high hazard dams is increasing across the state due to encroachment of inundation areas downstream if a dam were to fail **(New Hampshire Department of Environmental Services, 2008d)**.

A lack of funding for dam upgrades is a concern, especially since the majority of dams in New Hampshire are privately held. Unfortunately, operation, maintenance and rehabilitation of dams can range in cost from the low thousands to millions of dollars, and owners are responsible for these expenses. In 2012, thirteen letters of deficiency were sent to dam owners around the region. All of the dams are low hazard and pose no threat to life or would cause property damage if failure occurred.

Table 16: Dam Hazard Classification

Hazard Classification	Inspection Interval in Years
High	2
Significant	4
Low	6
Non Menace – if certain criteria are met	6

Table 17: Letters of Deficiency

DAM #	HAZCL	COMMUNITY	NAME	DAM OWNER	SENCOMMUNITYER
33.13	L	BROOKLINE	TAYLOR POND DAM	BROOKLINE CONSERVATION COMMISSION	1/19/2012
122.07	L	HUDSON	AYERS POND DAM	JOHN MURPHY	4/17/2012
147.38	L	LYNDEBOROUGH	CURTIS BROOK DAM	MS IRENE & HAROLD KREIDER	10/9/2012
154.04	L	MASON	MCCAFFREY DAM	MS EILEEN MCCAFFREY	6/26/2012
159.01	L	MILFORD	RAILROAD POND DAM	COMMUNITY OF MILFORD	4/17/2012
159.04	L	MILFORD	OSGOOD POND DAM	COMMUNITY OF MILFORD	4/23/2012
159.05	L	MILFORD	HARTSHORN POND DAM	COMMUNITY OF MILFORD	6/4/2012
159.16	L	MILFORD	COMPRESSOR POND DAM	COMMUNITY OF MILFORD	12/28/2012
159.25	L	MILFORD	MILFORD ELM ST TRUST FIRE PD	COMMUNITY OF MILFORD	5/24/2012
163.07	L	MONT VERNON	HARTSHORN BROOK II DAM	MR DAVID CRUDEN	6/28/2012
189.02	L	PELHAM	GUMPAS POND DAM	GUMPAS POND ASSOC LTD	10/25/2012
254.2	L	WILTON	BATCHELDER POND DAM	DR CHARLES CRAWFORD	5/15/2012

Source NH Dam Bureau

Dam Use

Historically, dams were built to provide electricity, control floods and provide water sources for recreation and irrigation of crops. Dams still offer significant power generation opportunities. Green energy sources are increasing in popularity and usage by competing with unsustainable fossil fuel sources. Hydroelectric dams are used throughout the world to power cities, homes, schools and workplaces.

Hydroelectric power production is advantageous for communities in a variety of ways. It uses the energy of running water to produce electricity without reducing water quantity.

The use of water as an energy supply provides stability of resources while emitting very small amounts of greenhouse gasses. Compared to fuel burning power plants, hydroelectric power produces minimal pollution and has low maintenance costs **(United States Geological Survey, 2014a)**

Dams can be created for a variety of different purposes. Recreation is the most common use with 121 dams in the region. There are 42 dams built for conservation and farming purposes and are used to collect water for farmland irrigation, to create small pools for wildlife, and other assorted purposes. These dams are beneficial to local regional farming as well as providing environment for animal species in the region.

Local farming is constructive in supporting the economy in the region. Further damming purposes in the region are: water detention (88), fire protection (19), hydropower (3), six dams are used for water supply, only seven are used for flood control and four are mill related.

Table 18: Active Dam Uses by Community

Community	Recreation	Hydro	Flood Control	Sewage Lagoon	Water Supply	Detention	Mill	Conservation/ Agriculture	Fire Protection
Amherst	10	0	0	0	0	3	0	4	3
Brookline	8	0	0	0	0	6	0	0	0
Hollis	9	0	0	0	0	8	0	3	3
Hudson	12	0	0	0	0	16	0	1	1
Litchfield	2	0	0	0	0	1	0	3	0
Lyndeborough	8	0	4	0	0	0	2	5	3
Mason	8	0	0	0	0	0	0	0	1
Merrimack	11	0	0	0	0	24	0	2	1
Milford	11	0	0	0	0	7	1	1	3
Mont Vernon	6	0	0	0	0	0	0	2	0
Nashua	11	2	0	0	5	13	0	13	1
Pelham	6	0	0	0	0	8	0	2	1
Wilton	19	1	3	0	1	2	1	6	2
Regional Total	121	3	7	0	6	88	4	42	19

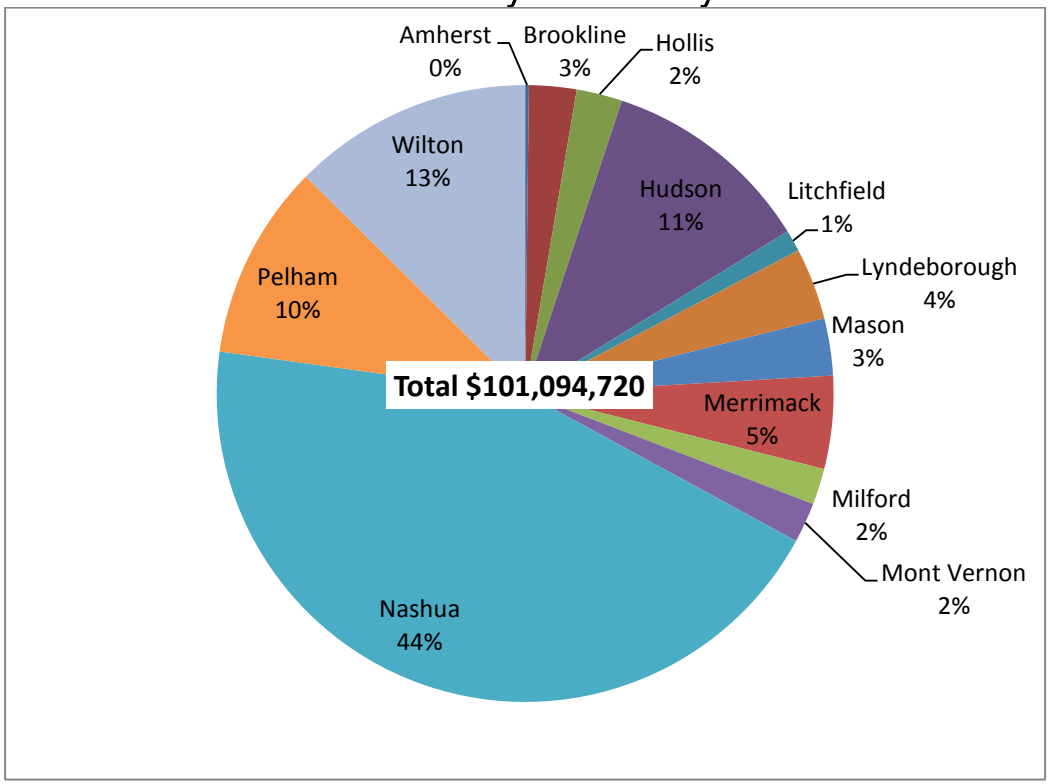
Source NH Dam Bureau

Future conditions

Water infrastructure in the region has historically relied on private well and septic systems. Aging water infrastructure will be the number one priority for communities in the region as the existing infrastructure nears its end of life use. The Clean Watershed Needs Survey (CWNS) is conducted every four years by New Hampshire Department of Environmental Services and fulfills Sections 205(a) and 516 of the Clean Water Act.

The CWNS is a comprehensive assessment of the capital needs to meet the water quality goals set in the Clean Water Act. The CWNS review of the costs of wastewater treatment, sewer rehabilitation and treatment, new sewers, combined sewer overflow abatement and stormwater costs for each municipality throughout the country. The CWNS estimates the needs to address water quality or water quality related public health problems, collects location and contact information for facilities and projects, collects facility populations served, flow, effluent, and unit process information and identify Non-Point Source Best Management Practices.

Figure 11: Waste Water Treatment Infrastructure Needs by Community



Source (New Hampshire Department of Environmental Services, 2012a)

The estimated total costs for the Nashua region are $100 million with 44% of the needs attributable to the City of Nashua. The total needs will grow over time as the regional population increases. Climate change will affect water quality and water flow patterns throughout the region due to increased storm events, and maintenance and replacement costs will increase. **(Brown, 2013; Wake, C. et al., 2014)**. Combined sewer overflows are prohibitive to maintaining water quality throughout the region. The closure of CSO's could protect and enhance water quality for humans and wildlife near the Merrimack River and Nashua River **(New Hampshire Department of Environmental Services, 2012b)**.

The 2012 Clean Watersheds Needs Survey breaks down existing stormwater infrastructure techniques and the capital required to achieve unmet needs. Conveyances need to be replaced or repaired as most are undersized and unequipped to fulfill the needs of larger storms occurring more frequently. Nashua requires the most capital investment ($7,596,455) as the city has a large sewer system, contains CSO's and the most developed community in the region. Wilton has the second highest need for conveyances at $1,476,190 but minimal needs for LID and green infrastructure. The total for the Nashua region is $19,600,718.

Table 19: 2012 Stormwater Needs for the Nashua Region

Community	Innovative Method Category	Community Category	Clean Watersheds Needs Survey				
			Capital				
			Conveyance	Traditional Treatment	Green Infrastructure/ LID	Stormwater Management	CWNS Totals
Amherst	Contribute	Large MS4	-	$26,091	$13,045	-	$39,136
Brookline	Extrapolate	Rural	$187,652	$89,174	$166,205	$59,310	$502,341
Hollis	Extrapolate	Small MS4	-	$11,098	$155,942	$317,737	$484,777
Hudson	Extrapolate	Large MS4	$838,050	$368,393	$221,449	$817,718	$2,245,610
Litchfield	Extrapolate	Small MS4	-	$5,212	$73,243	$149,234	$227,689
Lyndeborough	Extrapolate	Rural	$284,109	$135,011	$251,638	$89,796	$760,554
Merrimack	Contribute	Large MS4	$593,626	$208,019	$31,560	$150,476	$983,681
Milford	Contribute	Large MS4	$75,238	-	-	$307,221	$382,459
Mont Vernon	Extrapolate	Rural	$158,568	$75,353	$140,445	$50,117	$424,483
Nashua	Contribute	Large MS4	$7,596,455	$833,662	$186,926	$320,539	$8,937,582
Pelham	Extrapolate	Large MS4	$771,930	$339,328	$203,978	$753,202	$2,068,438
Wilton	Contribute	Rural	$1,476,190	$393,651	-	$674,127	$2,543,968
Percent of Total Stormwater Needs			40%	8%	5%	12%	66%
Total Stormwater Needs			$11,981,818	$2,484,992	$1,444,431	$3,689,477	$19,600,718

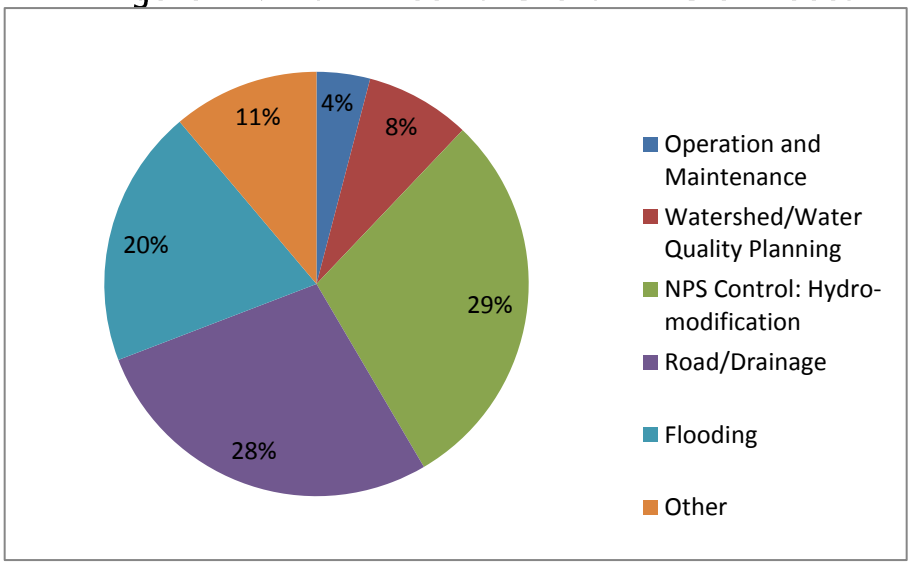
Source: 2012 Clean Watershed Survey

Notes:

- Contributing Community: Dollar values for contributing communities were taken from actual, documented stormwater projects and their associated costs. Contributing communities were used to set a per acre rate for extrapolated communities.
- Extrapolated Community: Dollar values for extrapolated communities are representative and do not reflect actual, documented data. See NH Innovative Method of Overview for more information.
- Data is unpublished and preliminary and not approved by Congress.
- Community Categories were determined by MS4 status, population size and density.

The Clean Watershed Needs Survey also identifies additional stormwater needs for the communities in the Nashua region. The graph below demonstrates the costs for specific strategies to address stormwater needs for the Nashua region. Communities are experiencing larger storms and more frequent flooding events which require adaption strategies such as modifying road and drainage issues (28 %), non-point source pollution control (29 %) and flooding mitigation (20 %). Capital Improvement plans are a resource for communities to acquire funding and conduct additional watershed planning to better prepare for the effects of storms.

Figure 12: 2012 Additional Stormwater Needs



Source: 2012 Clean Watershed Survey

Regional Water Infrastructure Issues

Water resource protection was mentioned by residents as the "ultimate example" of a regional issue. The UNH Survey found that older people are more likely to want to protect our natural water resources compared to younger people. Other outreach revealed residents were ambivalent about the quality of tap water in their community. Some residents indicated it was undrinkable and filled with chlorine; while other residents were pleased with the drinking water flavor.

Water Quality Data

Existing water quality data can be found through New Hampshire Department Of Environmental Services for almost all of the major water bodies in the region. However, there is minimal aggregated data for water quality in the region. Previous efforts to maintain water quality include the Regional Environmental Protection Program, the Volunteer Lakes Assessment Program and the UNH NH Lakes Lay Monitoring Program. None of these programs have been able to provide long term quality data. It is important for communities in the region to have historical and up to date information on water quality to coordinate water resources efforts with adjoining municipalities. The New Hampshire Department Of Environmental Services Watershed Report cards do provide minimal testing but fail to produce data reports with specific water quality impairments. The region currently lacks a region water quality baseline which could be detrimental to residents and wildlife if water quality deteriorates.

Access Issues

There are only three access points to the 15 miles of Merrimack River that flow through the region. This is a missed opportunity for recreation on the river. The Merrimack is ideal for boating and some fishing but lacks hard top boat ramps and parking for residents and tourists. The Nashua River also experiences a lack of access points. The Jackson Falls Dam is a significant impediment to boating through the City of Nashua and into the confluence of the Nashua and Merrimack. Increase access to the rivers can provide additional recreation opportunities for city residents and bolster a sense of community for the water body which entices residents to protect and conserve the water body.

Municipal Separate Storm Sewer System

Municipal Separate Storm Sewer System (MS4) - A Small MS4, located outside of urbanized areas, is defined as "a publicly owned conveyance or system of conveyances from ditches, curbs or underground pipes that divert stormwater into the surface waters of the state." A small MS4 operator is required to obtain a permit if the potential for significant water impairment exists. A small MS4 permit differs from a MS4 general permit which is required within urban areas. General MS4s call for the Notice-of-intent (NOI) which require general information about the MS4, such as location, owner and operator, and the surface water into which the MS4 discharges (United States Environmental Protection Agency, 2013b).

According to the 1999 Phase II Stormwater Rule, the universe of the regulated small MS4 program expands every ten years based on the decennial Census definition of urbanized area. The U.S. Census Bureau recently completed the maps of 2010 urbanized areas. These maps can be used

to assist authorized states (and EPA Regional Offices for unauthorized states) as they determine which new MS4s are located in the 2010 urbanized area and would require coverage by an MS4s permit. Municipalities can also use these maps to determine which parts of their jurisdiction are located in the 2010 urbanized area where the MS4 program would apply (United States Environmental Protection Agency, 2013b).

Region MS4 Communities

- Large MS4's- Amherst, Merrimack, Milford, Nashua, Hudson, Pelham
- Small MS4'S-Litchfield, Hollis
- Rural- Wilton, Brookline, Mason
- Waivers-Mont Vernon, Lyndeborough

Waivers: If fewer than 1,000 people reside in the entire census blocks classified as urbanized in a municipality, that community may apply for a waiver from the permit requirements. If they were granted a waiver under the 2003 permit, they still must reapply for a waiver under the upcoming permit. In the Nashua region, only Lyndeborough and Mont Vernon meet this standard and have subsequently been granted waivers by EPA. No other communities in the region meet the waiver requirements (Nashua Regional Planning Commission, 2012).

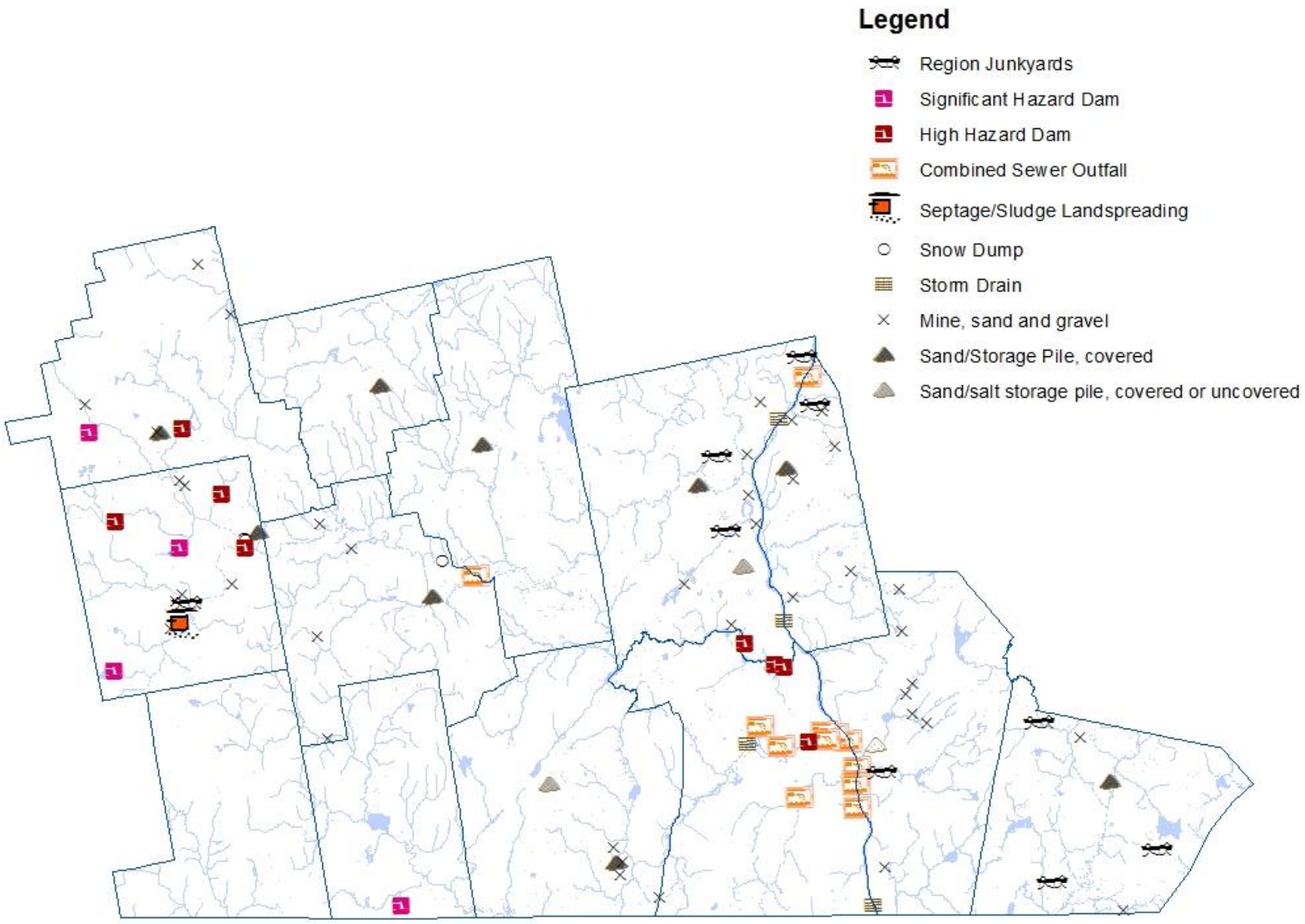
The continued population growth in the region may eventually require Nashua and other communities to fulfill requirements of a general MS4 permit rather than a small operator permit. This will require additional community resources and planning for new developments community coordination since the financial burden of meeting permit requirement may strain communities.

Road Salt

New Hampshire winters demand an effective and affordable means of de-icing roadways by using chemicals to lower the freezing point of water. The primary agent used for this purpose is sodium chloride (road salt). Chloride in the form of salt is imported to local watersheds from several major sources: roadway deicing, snow removal, food waste, water softeners, atmospheric deposition, and roadway salt pile runoff. Chloride is most commonly transported within a watershed through stormwater runoff and groundwater flow to surface waters. Year to year variations in chloride contribution is primarily due to differences in the severity of winter in a given year (NH DES,a).

At this time, the only way to prevent chloride from reaching surface and ground water is to reduce the amount applied to our roadways and parking lots without compromising safety. When road salt dissolves in water, the chloride molecule is not retained by the soil and easily moves with water flow. Chloride is not significantly removed by chemical reactions or evaporation. Therefore, nearly all of the chloride applied to the land surface as road salt will eventually end up in the nearby surface waters or groundwater (NH DES,a).

Map 19: Threats to Water Resources



Source: New Hampshire Department Of Environmental Services

It is difficult to measure how much chloride is being transported from our transportation systems to the region's watersheds because municipalities in New Hampshire are not required to report their salt usage to DES. Mason is the only community in the region that lacks a chloride, sand or dam threat in the region. Rural communities require fewer community services that are necessary for higher trafficked and more populated areas. The largest contributor of chloride is roadways and parking lots. The second common man made water quality threat in the region is sand. Storage of sand and salt, covered and uncovered occurs in 11 of the 13 communities in the region. Mining for sand and gravel is also a concern in the region. Local mining industries harvest sand and gravel from local aquifer areas for construction materials. Wilton and Hudson have seven mines each.

Threats of Sand

Any activity that adds material to a lake, in addition to the natural supply, will increase the rate of lake filling. The regular addition of sand to a lake or shoreline where it can erode into the lake accelerates the process. Street sweeping is one method to collect accumulated sand deposits that occur over the winter. Another method includes blowing sand together into piles for collection or disposal. These methods are used in spring time after snow melt before the majority of spring rains occurs to minimize runoff. The mineral composition of sand is not consistent. Although clean, washed sand is primarily quartz, which is relatively inert, sand can contain other materials. In New Hampshire, iron is a common component of sand and gravel. Iron rich sand can encourage the growth of iron bacteria that create rust colored slime deposits and oil like films on the sand as they oxidize the iron. Iron bacteria are not a health hazard, but the resulting deposits are aesthetically displeasing.

Sand may also contain contaminants other than iron, all of which have the potential to wash out of the sand and into the water. Clay is a material that, if present in the deposited sand, can cause reduced water clarity, or turbidity, problems in the pond. If phosphorus is contained in the dumped sand, it will contribute to increased plant growth in the pond, similar to lawn fertilizer. Dumping sand can smother bottom dwelling algae and invertebrates in nearby roadways, causing a disruption in the food chain of higher organisms including fish. Deposited sand may also destroy spawning or nesting sites for fish. Turbidity from the deposited sand may clog gills and interfere with normal fish behavior. **(New Hampshire Department of Environmental Services, 2010)**

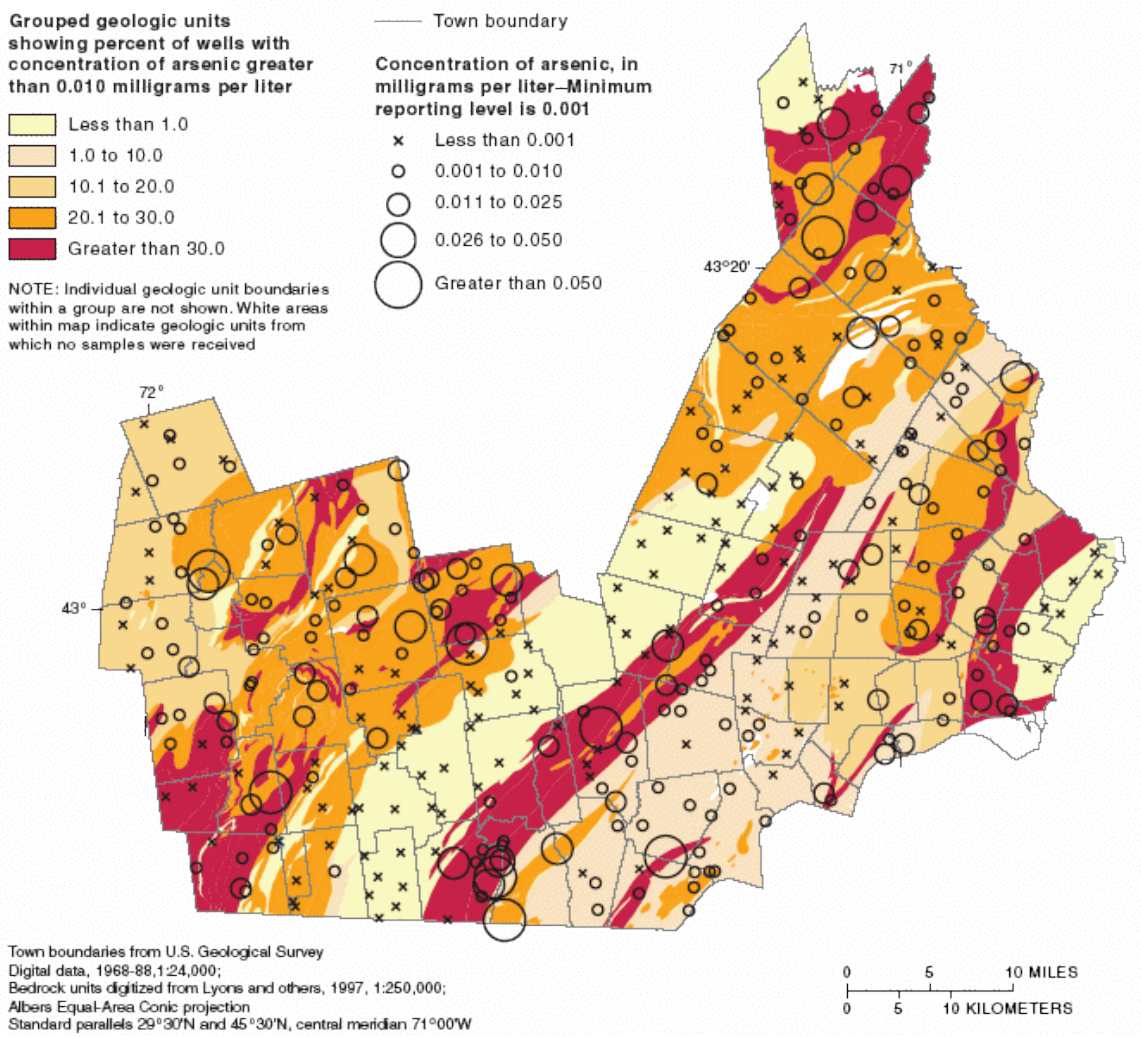
Erosion and Sediment

The development process typically involves the removal of vegetation, the alteration of topography, and the covering of previously vegetated surfaces with impervious cover such as roads, driveways, and buildings. These changes to the landscape may result in the erosion of soil and the sedimentation of water bodies as soil travels to streams, rivers, and lakes in water runoff during storms at an increased velocity due to the lack of vegetative cover. The removal of vegetative cover and its roots system compromise the ability of vegetation to stabilize soil, reduce the velocity of runoff, shield the soil surface from rain, and maintain the soil's ability to absorb water **(New Hampshire Department of Environmental Services, 2008b)**.

Arsenic

New Hampshire is a water abundant state; however, the bedrock geomorphology harbors a plethora of metals and toxins including arsenic. The USGS map demonstrates an arsenic belt extending through southern NH into Maine. Historical well testing across the region reveals elevated arsenic levels, potentially harming residents who are served by private wells **(Ayotte, Montgomery, Flanagan, & Robinson, 2003; Conley, A. & Daniels, D., 2011)**. In addition to arsenic in bedrock geomorphology, historical spraying of pesticides and herbicides contained toxic levels of arsenic accumulating in soils. Arsenic is stored in soils and released through land disturbance activities. Once unrestricted, it accumulates in stormwater runoff polluting water ways, harming wildlife and communities downstream.

Map 20: Arsenic Striations in Southern New Hampshire



Source (United States Geological Survey, 2003)

Private Well Testing

The New Hampshire Department of Environmental Services (NH DES) has collected private well locations since 1984. The status of any wells drilled before 1984 is unknown including dug (shallow) and abandoned wells. New Hampshire does not require well testing for private systems but New Hampshire Department Of Environmental Services strongly encourages well water testing schedules for private homeowners (New Hampshire Department of Environmental Services, 2011b). For this reason, private wells are usually only tested when a lender requires the test at the time of the sale or when problems with the quality of the water become an issue. There are however a few communities in the state which actually do require well water testing in order to obtain a certificate of occupancy or for property transfer, none of which are in the Nashua region.

Regional Water Infrastructure Opportunities

Asset Management

In water and wastewater systems, an "asset" is a component of a facility with an independent physical and functional identity and age (e.g., pump, motor, sedimentation tank, main). Asset Management is the practice of managing infrastructure capital assets to minimize the total cost of owning and operating them while delivering the desired service levels **(United States Environmental Protection Agency, 2012b)**. Asset Management can be used for all drinking water, stormwater and wastewater infrastructure systems. Asset management programs include elements such as: mapping, equipment inventory, condition assessment, preventive maintenance plans, critical infrastructure identification, desired level of service, capital budget based on replacement costs and life expectancy schedule, and rate design that covers life-cycle costs **(New Hampshire Department of Environmental Services, 2013)**.

There are many barriers to beginning an Asset Management program such as: the state does not require Asset Management implementation, competing priorities for resources, utilities can be slow to change practices, benefits are not always clearly defined, lack of support from customers or management and lack of education on the program by management and staff **(New Hampshire Department of Environmental Services, 2013)**. Despite barriers, Asset Management programs reduce infrastructure costs over time and create a baseline of inventories for communities to use when planning future capital improvement projects and identify infrastructure replacement costs before an event occurs. The New Hampshire Department Of Environmental Services Wastewater Engineering Bureau assists communities and facilities with Asset Management by identifying appropriate tracking programs and funding sources **(New Hampshire Department of Environmental Services, 2013)**.

Marketing Compost

The Merrimack Waste Water Treatment Facilities utilizes the product of waste water and turns it into a valuable commodity. The compost from the facility has been used by other residents and municipalities throughout New England. Other municipalities in the region can use the example of Merrimack to create additional revenue for the community.

Merrimack markets to Agrisource markets for 80% of the compost to New Hampshire, Massachusetts, Connecticut, Vermont and New York. The WWTF also markets to local residents and landscapers about 1-2,000 cubic yard and larger customer for between 10,000 and 12,000 cubic yards. Benefits of the compost include: composting outside wastewater treatment plant sludge from the communities of Jaffrey, Hooksett, and Amesbury, Massachusetts. Bristol and Henniker and generate gross revenues of approximately $140,000 per year, compost sales for Fiscal Year 12-13 was $120,000 and revenue generating composting is the least expensive method of treating wastewater sludge.

Gas to Energy

The Nashua WWTF used a gas-to-energy projects that brought immediate and long-term benefits to the municipality through: energy cost savings, energy security, utility cost stabilization, environmental benefits—significant reductions in greenhouse gas emissions (the methane from is 25 times more harmful to the atmosphere than carbon dioxide). Other waste water treatment facilities can install biogas generators to save thousands of dollars on heating, cooling and fuel costs. (United States Department of Energy, 2005)

Stormwater Management Resources

New Hampshire Stormwater Manual: The New Hampshire Stormwater Manual is intended as a planning tool for the communities, developers, designers, and members of regulatory boards, commissions, and agencies involved in stormwater programs in New Hampshire. The Manual addresses measures to manage stormwater runoff through site design, pollutant source controls, structural Best Management Practices (including associated operation and maintenance measures), and construction-phase practices.

Volume 1: Stormwater and Antidegradation presents an overview of New Hampshire's stormwater program together with related federal program requirements, describes New Hampshire's "Antidegradation Provisions" with respect to controlling water quality impacts due to stormwater discharges, and provides an introduction to the non-structural and structural measures for managing stormwater.

Volume 2: Post-Construction Best Management Practices Selection and Design presents a detailed description of the structural Best Management Practices (BMPs) applicable for use in New Hampshire for the prevention, control, and treatment of stormwater. Volume 2 describes information applicable to the screening, selection, design, and application of particular post-construction BMPs.

Volume 3: Erosion and Sediment Controls during Construction provides a selection of practices applicable during the construction of projects, to prevent adverse impacts to water resources as a result of the land-disturbance activities typically associated with development and redevelopment projects.

State Revolving Fund Loans: The New Hampshire Department of Environmental Services under the Clean Water State Revolving Fund recently started accepting applications for stormwater and nonpoint source projects. Historically, this program funds landfill closures and wastewater treatment but starting in 2010 it has been available for nonpoint and stormwater projects. These are low interest loans, although principal forgiveness for a portion of the loan may be available to the applicant.

Innovative Land Use Guide for Local Stormwater Model Ordinance - Communities are encouraged to adopt a local stormwater management ordinance instituting stormwater controls for projects of all sizes and during all phases of development. The model ordinance should satisfy EPA's requirements under Phase II of the National Pollutant Discharge and Elimination System (NPDES) for small municipal separate storm and sewer systems (MS4) to regulate land disturbances greater than one acre.

Guidelines and Standard Operating Procedures: Illicit Discharge Detection and Elimination and Pollution Prevention/Good Housekeeping for Stormwater Phase II Communities in New Hampshire - This Manual not only assists the municipalities in meeting the Stormwater Phase II regulations, but encourages them to use targeted best management practices (BMPs) within the watershed with the long-term goal of consistent application by all regulated entities within the watershed. The manual of Guidelines and Standard Operating Procedures will help promote behavior that will improve the water quality of New Hampshire's lakes, ponds, streams, rivers, and estuaries.

Stormwater Management for Homeowners - Education of homeowners is important in reducing the effects of stormwater erosion and pollution. To lower a household's effect on the environment, homeowners can utilize these do-it-yourself home management practices.

Pet Waste Outreach Campaigns - Just like human sewage, untreated pet fecal matter is harmful to waterways. Rain washes dog waste and the associated disease-causing organisms, such as giardia and salmonella, into rivers, beaches and bays via storm drains. Enough bacteria make water unsafe for drinking and swimming and also contribute to shellfish bed closures. These campaigns promote owner responsibility to prevent dog waste from washing into waterways. Dog waste can carry disease causing organisms, and via storm drains wash into water bodies contributing to pollution.

Wetland Protection Methods

Federal and state protections exists for wetlands, however, communities play an active role in restoring wetland areas.

- Zoning and Subdivision Regulations – Wetlands can be protected through zoning ordinances by implementing a Wetlands Conservation Overlay District. A model ordinance for this is provided in the 2008 New Hampshire Department Of Environmental Services publication Innovative Land Use Planning Techniques. Setback requirements can be incorporated into subdivision regulations.

- Prime Wetland Designation – Under the New Hampshire statute (RSA 482 - A) for protecting wetlands from "despoliation and unregulated alteration", municipalities are able to designate some of their high value wetlands as "Prime Wetlands" (RSA 482-A: 15). Prime Wetlands are given special consideration by the Wetlands Bureau in permit application reviews.

  Nashua, Brookline and Pelham have completed Prime Wetlands designation for the wetlands contained in that area. Typically, a wetland receives this designation because of its large size, unspoiled character and ability to sustain populations of rare or threatened plant and animal species. Field and "desk top" data are used for the evaluation process (NH DES, 2014g).

- Acquisition of wetlands – Wetlands and their buffers can be acquired either through the purchase of development rights, gifts, or by securing conservation easements on lands encompassing wetlands.

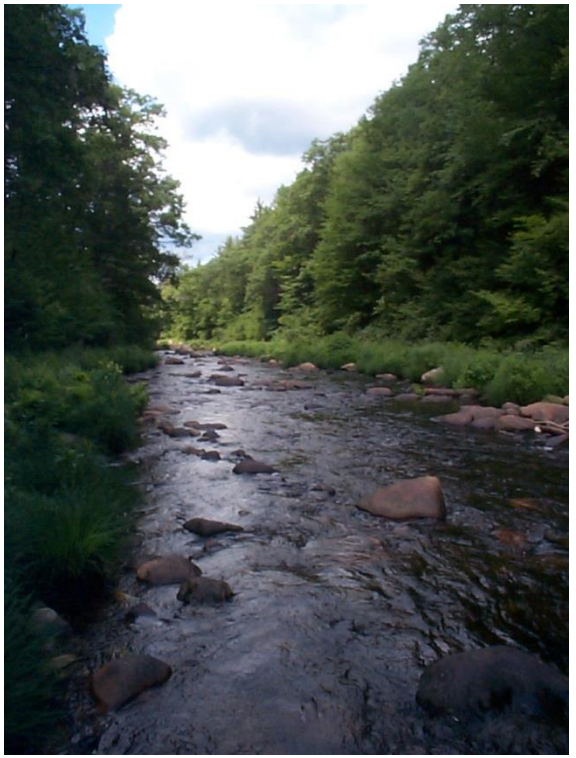
- Comments to the New Hampshire Wetlands Bureau – Although wetland permits are issued at the state level, there is opportunity for local input into land use decisions affecting wetlands. Municipal conservation commissions

have the legal authority to comment on permit applications on behalf of the community. Individuals may also comment on these applications.

- Aquatic Resource Mitigation Fund (ARM Fund) - The ARM Fund Program provides wetlands permit applicants with the option to contribute payments to this fund in lieu of implementation of several other possible and more traditional compensatory mitigation alternatives. These other wetlands mitigation options might include restoration of existing impaired wetlands, land acquisition and preservation, or construction of new wetlands. DES accounts for ARM Fund payments on a major watershed basis" (NH DES, 2012c). In 2014, $990,000 is available for projects in the Merrimack River Watershed. No projects were awarded in the Nashua region during 2013.

Conclusion

With the continuing growth and development of the region, there will be greater demands placed on local resources stretching local services and the use of local facilities to the maximum extent and capacity. Ultimately, this could have negative consequences on public health, welfare and safety. Identifying capital facility needs early on and beginning to plan for and address those needs is an important planning function and responsibility.



Water Infrastructure Resources and Tools for Municipalities

- New Hampshire Department Of Environmental Services supports the efforts of local volunteer lake monitoring programs through training and technical assistance. Volunteers can contribute in direct data sampling efforts and monitoring programs which aid DES in making educated decisions on water quality trends.
- new Hampshire Department Of Environmental Services Stormwater Manual, Pennichuck Stormwater Manual, NRPC Stormwater Manual provide examples of BMP's for stormwater management and LID techniques to reduce stormwater runoff.
- The Green SnoPro program offered through the UNH T^2 Center, offers workshops and training certification on brine making, effective plowing techniques, salt accounting and a suite of additional services to reduce salt use thus decreasing contamination to local water resources.
- new Hampshire Department Of Environmental Services, UNH Stormwater Center, NRPC and the EPA all have stormwater education materials for various audiences. Stormwater education is helpful at a regional or watershed scale as watersheds are rarely community specific.
- new Hampshire Department Of Environmental Services Private Well Testing Program provides private well owners with recommendations for testing schedules, fact sheets and a list of certified testing laboratories.
- new Hampshire Department Of Environmental Services Watershed Management Bureau works to reduce non-point source pollution in all watersheds throughout NH and can assist municipalities with watershed planning in their community.
- Nashua Region Stormwater Coalition provides an opportunity for communities to collaborate on regional water needs, solutions for technical issues and water quality issues at a regional level.

Climate Change/Natural Hazards

Existing and Future Conditions

There is a growing body of evidence to support the effects of climate change on a regional and global scale. The Southern New Hampshire Climate Assessment (SNHCA) is an in-depth analysis of the current climate situation and future projections to the next century. The long term trends for New England demonstrate a cooler period in the earlier part of the 20th century and a significant warming trend in the second half of the century **(Wake, C. et al., 2014)**. The US EPA defines climate change as, "any significant change in the measures of climate lasting for an extended period of time. In other words, climate change includes major changes in temperature, precipitation, or wind patterns, among others, that occur over several decades or longer." Climate change occurs over a long period of time from decades to millennia.

The New Hampshire Climate Assessment Reports observed the following climate change parameters for the State:

Temperature

- Average maximum temperatures have warmed by 2.0°F (annual) and 2.9°F (winter) since 1970
- Winters will be warmer: 20-45 fewer days below 32°F
- Summers will be hotter: 16-47 days above 90°F for southern NH (compared to 7 currently)

Rainfall

- Annual precipitation has increased by 8-22% since 1970
- Both the frequency and magnitude of extreme precipitation events has increased
- Annual precipitation averages will increase by 15-20%

Snow and Ice

- Fewer days with snow cover since 1970
- Lake ice out dates are occurring earlier
- Significant decrease in number of snow occurred days: 20-50% decrease in southern NH

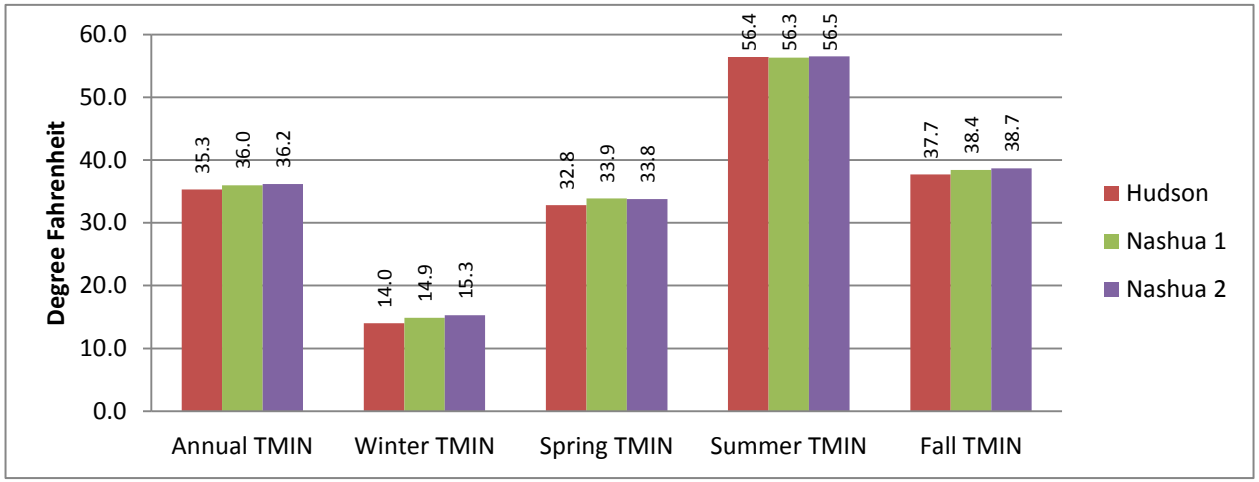
The SNHCA does provide existing and model data indicators for the Nashua area for temperature, extreme temperature, precipitation, extreme precipitation, snow cover and snow fall. The model data is representative of the future conditions in the region. Future conditions data is only available for Nashua and Hudson but can be extrapolated to the rest of the region. Indicator changes are based on a higher emissions scenario or a lower emissions scenario. The scenarios are based on Global Climate Models (GCM) for global carbon emissions.

Temperature

Historical temperature trends have been increasing across Southern New Hampshire for the past one hundred years with the largest increases occurring in the last four decades in the winter.

Regionally, residents will experience an increase in daytime temperatures with a larger increase in nighttime temperatures. Overall temperature increases will be compounded by urban island heat effects as climate change continues to occur in the region. One impact of these changes is the increase in the number of growing days per year. The Nashua region supports a robust agriculture economy which has seen an increase in ten growing days per year since 1960. A significant expansion of growing days has positive consequences such as an increased diversity of crops. A longer growing season has potentially more negative consequences including: increased pests, heat stress, inadequate chill period and decreased soil moisture **(Wake, C. et al., 2014)**.

Figure 13: Minimum Historical Temperature 1980 - 2009



Urban Island Heat Effect is the elevated temperature from urban heat islands, particularly during the summer, which can affect a community's environment and quality of life. While some heat island impacts seem positive, such as lengthening the plant-growing season, most impacts are negative and include:

Increased energy consumption: Higher temperatures in summer increase energy demand for cooling and add pressure to the electricity grid during peak periods of demand. The heat island effect is responsible for an estimated 5–10% of peak electricity demand for cooling buildings in cities.

Elevated emissions of air pollutants and greenhouse gases: Increasing energy demand generally results in greater emissions of air pollutants and greenhouse gas emissions from power plants. Higher air temperatures also promote the formation of ground-level ozone.

Compromised human health and comfort: Warmer days and nights, along with higher

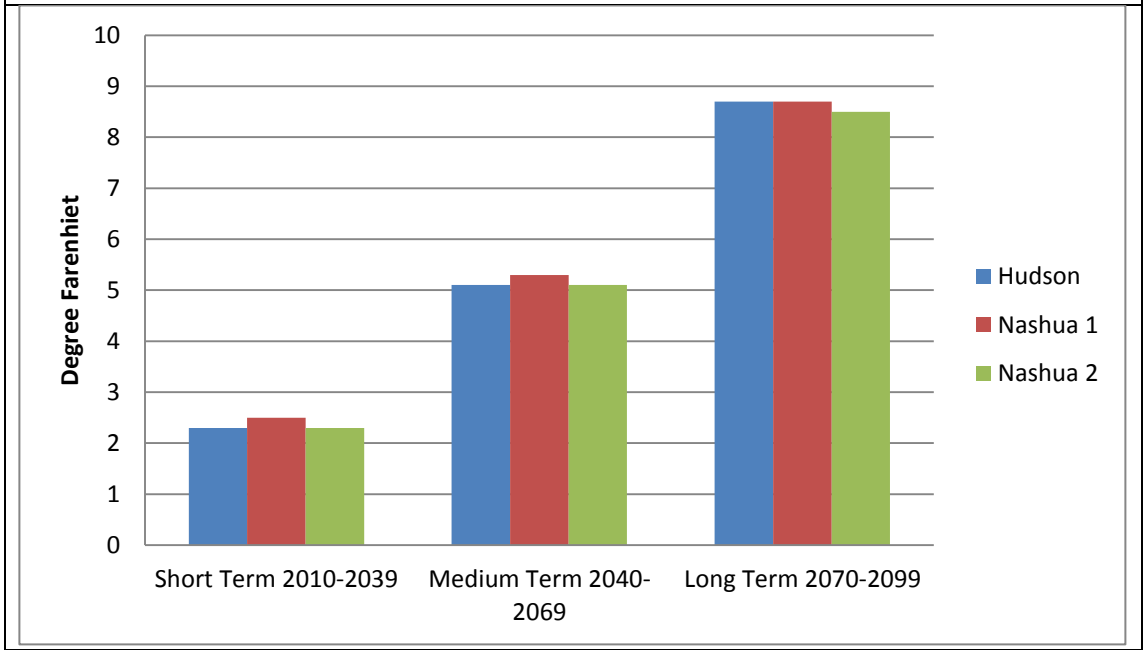
air pollution levels, can contribute to general discomfort, respiratory difficulties, heat cramps and exhaustion, non-fatal heat stroke, and heat-related mortality.

Impaired water quality: Hot pavement and rooftop surfaces transfer their excess heat to stormwater, which then drains into storm sewers and raises water temperatures as it is released into streams, rivers, ponds, and lakes. Rapid temperature changes can be stressful to aquatic ecosystems.

Source (United States Environmental Protection Agency, 2013c)

Projected Temperature Trends: During the first part of the century, southern New Hampshire annual minimum and maximum temperatures will increase. The minimum winter temperatures could increase by eight and a half degrees under a high emissions scenario to 23 degrees Fahrenheit. Temperature increases under the higher emissions scenario are nearly twice that expected under the low emission scenario by the end of the century for southern New Hampshire.

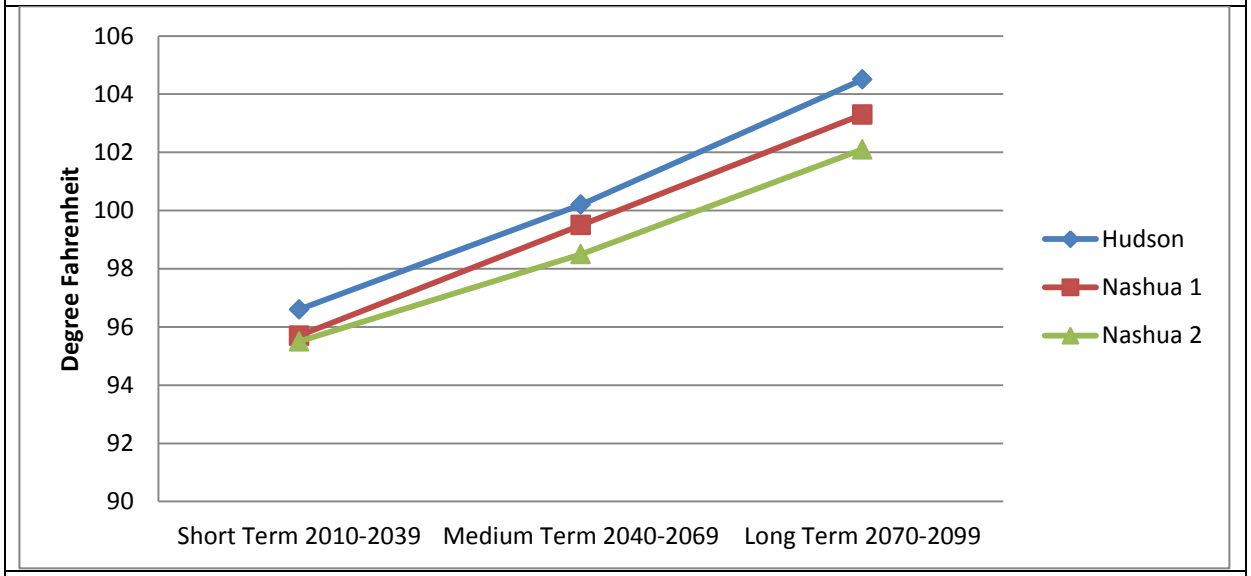
Figure 14: Minimum Winter Temperature Increase for High Emissions Scenario



Extreme Temperature

The Nashua region has witnessed a marginal increase in hot days but a greater decrease in coldest days of the year. The 1960-2012 average for days less than 32 degrees Fahrenheit is 154 and has been declining by five days per decade. Moreover, the historical average minimum temperature for coldest day of the year is -12.1 degree Fahrenheit and has been increasing in temperature by three degrees every decade. Cold days are difficult on people and wildlife; however the lack of cold days contribute too many significant consequences which are discussed further in the chapter.

Figure 15: Temperature Maximum on the Hottest Day of the Year, High Emissions Scenario



Projected Extreme Temperature Trends:
As temperatures increase in southern New Hampshire, the number of very hot days is expected to become more frequent and the hottest days hotter, while extreme cold is expected to become less frequents and the coldest days less severe. Hudson could experience temperature maximum of 104 degrees Fahrenheit on the hottest day of the year under a high emissions scenario. Additionally, Nashua could experience up to 103 degree Fahrenheit days which is less than Hudson. However, the City of Nashua contains more impervious surface area which contributes to urban island heat effects. The 100 degree days may be bearable for a short time; the urban island heat effects could alter some areas to even higher localized temperatures.

Precipitation

Southern New Hampshire has seen an increase in average precipitation with a threefold increase over the past four decades. Precipitation trends are not statistically significant in the Nashua region. There has been a slight increase in seasonal precipitation and a decrease in winter precipitation due to a decrease in snowfall. The past twelve years of FEMA data for Hillsborough County demonstrates a significant increase in FEMA spending on major disasters and emergency declared events. The first part of the decade remains steady with the largest spending occurring in 2006 (Mother's Day Flood) and 2007 (Patriots Day Storm). The Hillsborough County trends are synchronous with the rest of the state.

Projected Precipitation Trends: Annual precipitation across southern New Hampshire is projected to increase 17 to 20% under both emissions scenarios. Precipitation increases are largest during the winter and spring. Hudson could experience an 8" increase in precipitation under a high emissions scenario while Nashua could see a 7" increase in the latter half of the century.

Figure 16: 2001-2013 Total FEMA Relief Funds, Hillsborough County

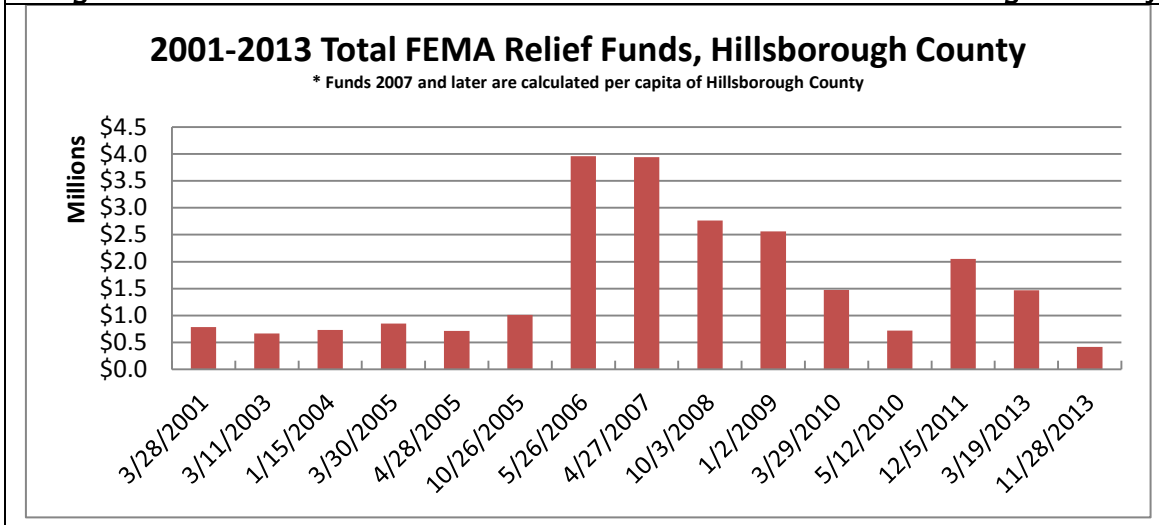
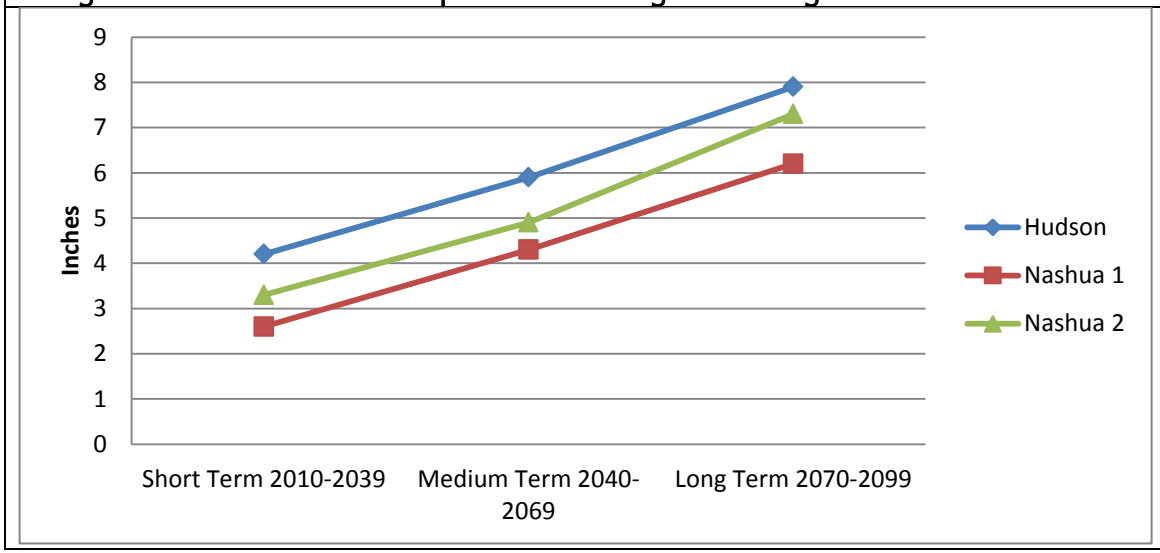


Figure 17: Annual Precipitation Changes for High Emissions Scenario

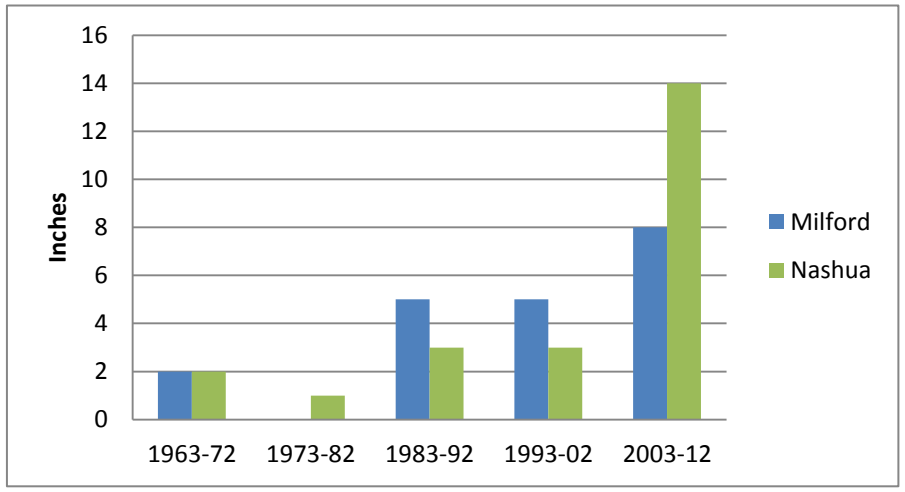


Extreme Precipitation

Trends in extreme precipitation events per decade are defined as greater than 4 inches in 48 hours. The Nashua region has experienced a four- to ten-fold increase in the number of events per decade since the 1960s. Nashua alone experienced 14 events during 2003-2012, a 50 percent increase since 1993-2002. Milford experienced eight events during 2003-2012, a 33 percent increase since 1993-2012. The amount of precipitation falling on the wettest day of the year has increased in Nashua; an overall increase of 0.13 inches per decade, equal to a half inch more rain on the wettest day of the year over the past five decades.

Projected Extreme Precipitation Trends: Southern New Hampshire can expect to see more extreme precipitation events in the future and more extreme precipitation events under the higher emissions scenario relative to the lower emission scenario. Historically, southern New Hampshire experienced 10.4 events per year with greater than one inch of precipitation in 24 hours. By the latter half of the century, that will increase to 13.3 events under the lower emissions scenario and 14.7 events under the high emissions scenario. The communities in the Nashua region currently experience 11 extreme precipitation events per year which could increase to 13 events under a low emissions scenario and 14 under a high emissions scenario for one inch in 24 hour events. This is consistent with the rest of southern New Hampshire trends.

Figure 18: Historical Trends in Extreme Precipitation Events per Decade



Source (Wake, C. et al., 2014)

Snow Cover and Snowfall

The number of snow covered days has decreased across most of the region over the past four decades. Most of the reduction in snowfall is driven by decreases in December snowfall. Nashua has not experienced a decreased trend for annual snow fall. Conversely, Milford is showing a significant decreasing trend of -6.1 days per decade of annual mean snow covered days. Overall, the mean number of snow-covered days in southern New Hampshire has been decreasing by two days per decade.

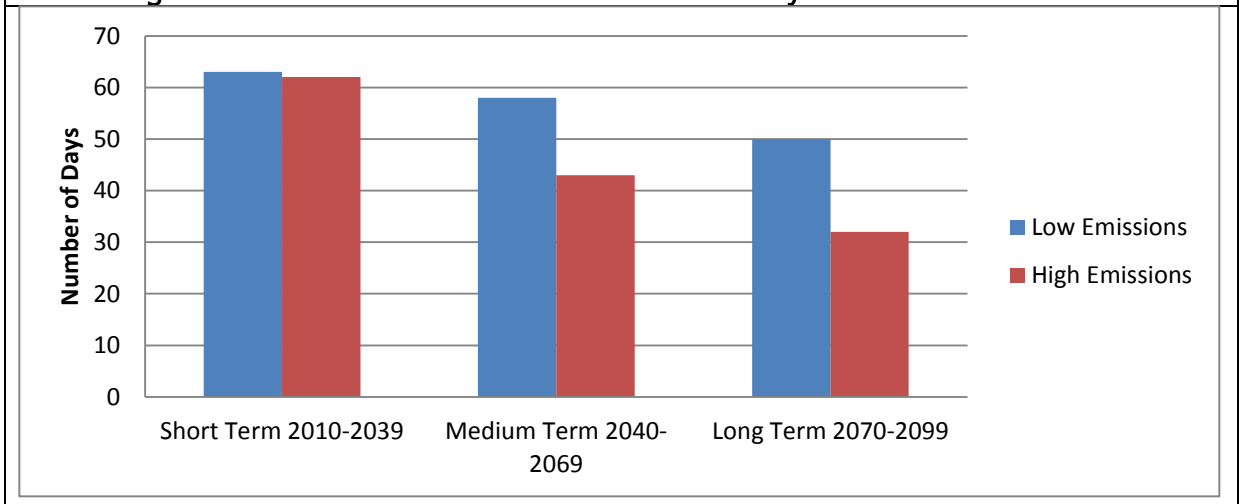
Projected Snow cover Trends: Changes in snow cover will depend on both temperature and precipitation. By the end of the century, snow-covered days are projected to decrease by 20 percent under the low emissions scenario or 50 percent under the higher emissions scenario. Over the long-term, the influence of warming winter and spring temperatures will dominate over expected increases in winter precipitation. The decrease in snow covered days is the same for all three stations. All locations could experience only 50 days of snow covered days under a low emissions scenario and only 32 days under a high emissions scenario.

Lake Ice Out

There is no ice out data for lakes in the Nashua region. Currently, data exists for two lakes in New Hampshire, Lake Winnipesaukee and Lake Sunapee. Spring ice-out dates have been getting earlier over the past 115 years; approximately one week earlier. It can be inferred there is a similar trend for the lakes in the Nashua region.

Projected Lake Ice out Trends: There is currently no future lake ice out data for the Nashua region. However is can be assumed the water bodies in the region will experience earlier ice out dates as seasonal temperatures increase which would be consistent with the rest of southern New Hampshire.

Figure 19: Decrease in Snow Covered Days for Both Scenarios



Regional Climate Change Issues

Our region is confronted by a challenging set of land use and hazard management concerns that include extreme weather events, flooding, and erosion. These issues are exacerbated by changes in climate that result in an increase in the frequency and intensity of extreme weather events, changes in yearly precipitation patterns, and rising temperatures. These effects are compounded by land conversion and development which result in increased stormwater runoff, non-point source pollution and flooding impacts. Advanced planning and preparedness will allow communities to adapt and thrive into the future (Arndt, et al., 2010; Wake, C. et al., 2014). The Confronting Climate Change in the US Northeast provides more in depth descriptions of climate change impacts which Nashua area residents could potentially experience.

Land Use

Land development and impervious surfaces aggravate stormwater runoff and flooding through the conversation of pervious areas such as fields and forests to impervious area. The loss of forest and open spaces reduce carbon sequestration for the region and limit pollutant removal and decrease biomass storage. Additionally, the previous design of infrastructure and buildings are not built to accommodate heat stressed area, fluctuations in water levels and/or are not equipped for heating and cooling necessary for vulnerable populations. Just like most New England communities, the Nashua region was settled along its waterways. Frequent flooding and storm events will exacerbate flood insurance rates and increased damaged costs to communities.

Transportation

Extreme precipitation and flooding can temporarily block roadways with standing water. Water can tear through roads and destroy bridges, leaving areas impassable and facing millions of dollars in repairs. Homes and businesses in flood zones are susceptible to expensive damage as well. Severe storms can impact the larger economy when extensive damage to key infrastructure occurs. Outreach efforts reveal that low income households are more likely to be very concerned about snow or ice storms due to a lack of snow removal.

Built Environment

Frequent extreme precipitation events and higher temperatures in particular can damage built infrastructure such as water systems, power grids and housing. For this reason, climate change adaptation efforts are essential to protecting infrastructure and saving money in infrastructure repair and maintenance costs. Extreme precipitation events result in adverse effects, such as:

- Excessive stormwater runoff
- Increased seasonal cooling costs
- Reduction in tax revenue for damaged or vulnerable property
- Increased costs for property such as flood insurance
- Disruption to economy and businesses
- Flooding
- Increased erosion
- Degradation of water quality
- Damage to critical infrastructure (e.g. buildings, roads, dams, bridges, culverts, water supply)

The UNH Survey revealed a large majority of residents in the region (78%) are concerned (39% “very concerned” and 39% “somewhat concerned”) with power outages in their community followed by

snow or ice storms (78%), wind damage (56%), flooding (38%), drought (38%) and wildfires (31%). Additionally, older populations were generally more concerned about snow, ice storms and damaging winds than younger people. Other outreach revealed a common concern in Nashua was to clear sidewalks more quickly after storms since children were endangered from being forced to walk to school in the street. Seniors were also concerned about sidewalk clearing since inadequate clearing can result in a decreased access to necessary amenities. Comparatively, other residents in the region were pleased with how quickly the snow was removed.

Natural Environment

More precipitation through stronger summer storms will alter stream flooding and wetland discharge in inland areas and fresh water habitat throughout the Nashua region. Increasing temperatures will also affect the habitat ranges and reproductive cycles aquatic species, while in terrestrial species will relocate to new locations that accommodate their preferred temperature and moisture ranges. Species composition will shift and will potentially result in altered food webs and other natural process.

Forests are expected to change in a similar manner to freshwater species through the shifting of habitats and species present. Climate change further enables the northward expansion of invasive insects like the woolly adelgid (Adelges tsugae), an aphid-like insect that has decimated stands of eastern hemlock. According to the US Forest Service, the woolly adelgid has already infected all communities in the region. Floodplain habitats in the region may experience more flooding, possibly altered timing and duration and will also be affected by summer droughts. An increase in flooding events reduces ground water inundation which can deplete ground water stores over time. Less ground water stores can lead to increases in summer droughts. The end result may be altered species composition, including more invasive and gradual colonization by southern species. Human responses to flooding may change flow patterns if flood control dams or other structures alter where and how storm water is stored. However, if one response is to abandon flood prone areas, those floodplains will be ideal for habitat restoration. Other shoreline habitats, such as along the Merrimack River, may experience increased erosion due to floods and provide more habitat for invasive plants **(New Hampshire Fish and Game, 2013)**.

Water Resources

The Nashua region has a plethora of water resources potentially affected by climate change. Flooding and erosion of river systems by increasing stream flow and runoff in spring could lead to decreased stream flow and water supplies in the summer and fall. A decrease in water supply storage will ultimately decrease water quality and exacerbate drought conditions. The region depends on local aquifer storage to support the residents in the region on private and public well systems. Intense rainstorms could result in less soil saturation which would lead to more runoff and diminish potential to replenish groundwater. Changes in sedimentation rates and more intense storms increase the potential for dam failure. Other risks include impacts to Combined Sewer Overflow's (CSO) in the region. Shifts in the magnitude and timing of storms could overburden CSO's with increased stormwater flows. The increased flow could worsen existing sewage

contamination problems such as *Escherichia coli (*E.coli) and excessive nutrients in the Nashua and Merrimack River's already struggling with decreased water quality and exposes residents to higher levels of water borne diseases.

Human Health

The frequency of extremely hot days per year will greatly increase over the coming century, especially under a higher-emissions scenario leading to adverse health impacts. These heat waves will increase the risk of heat-related illness (heat stroke or heat exhaustion) and death among vulnerable populations such as youth, seniors and low income populations who cannot afford air conditioning. The situation is especially true in urban areas which may experience urban heat island effects due to increase impervious surface areas.

Due to higher temperatures, global warming could increase air pollution in the state, creating more days when national air-quality standards cannot be met. Poor air quality will exacerbate the risk of respiratory, cardiovascular, and other ailments, if local vehicle and industrial emissions of ozone-forming pollutants are not reduced. Allergy sufferers can expect rising temperatures, carbon dioxide levels and pollen levels across New Hampshire **(Conley, A. & Daniels, D., 2011)**.

Food Security

Residents in the region value the rural character and farms in the region. Access to local foods and the beauty of farm are among one of the top ten things residents love about the region. Farmers in the region will experience a longer growing season, which may provide opportunities for farmers to grow new crops. However, many existing crops will likely experience yield losses associated with increased frequency of high temperature stress, inadequate winter chill period for optimum fruiting, and increased pressure from invasive weeds, insects, or disease. Portions of the region may become unsuitable for growing some traditional New England fruit varieties of apples and blueberries and similar varieties. Rising minimum temperatures in winter will also likely open the door to invasion of cold-intolerant species that prey on the region's forests and crops.

Regional Barriers to Climate Change Planning

There are many barriers to climate change adaptation and mitigation planning and a few are relevant to the region. The number one barrier is funding. Currently, there is no central funding source for municipalities and businesses in the State. Previous funding sources occurred through emergency management, water infrastructure planning or transportation planning resources.

Resources and Funding

Climate change adaptation and mitigation planning has gained momentum in municipalities throughout New Hampshire. However, project implementation is stagnant due to lack of funding and information resources. Currently, Hazard Mitigation Funding is one of the only grants available for municipalities to complete climate change adaptation projects such as updating outdated culverts. Communities in the region routinely expressed the need for more funding and encourage NRPC to act as a liaison for statewide or federal resources since there is an expectation that communities are supposed to be self-reliant.

Quality Data

Data collection for climate change is difficult to identify and can lack quality standards. There is no set of guidelines for climate change data collection in the State. Many communities lack baseline inventories of water infrastructure, transportation infrastructure and other municipal assets. Asset management is one method for collecting this information to determine what the community has and what is needed in the future. Merrimack is in the process of completing an asset inventory for drinking water and waste water infrastructure.

Competing Demands

As stated in the beginning of the chapter, changes in the climate occur on a long time scale and require long range planning. Typically, longer term climate projects may not be able to compete with day to day projects which take precedent. Outreach conducted revealed municipalities are heavily burdened with existing priorities and are routinely understaffed and underfunded which decreases the likelihood of implementing climate adaptation projects. Municipalities were willing to complete projects if NRPC was able to provide technical assistance, staff capacity and trainings and public education tools.

Miscommunication

There has been much debate about the legitimacy of climate change. Municipal boards in the region have experienced confusion and apathy from residents regarding adaptation planning. There is a wide range of understanding regarding climate change and potential impacts. It is up to each community to determine how to best cope with the impacts of climate change and communicate the message to residents.

Generally, residents and municipalities respond to the economic impacts of climate change and the potential future costs associated. The Southern New Hampshire Climate Assessment is one information source that communities in the region can utilize to accurately assess historical data and potential future trends. Other communities, such as Nashua, use emergency management and hazard mitigation to plan for potential climate impacts on residents.

The Nashua Regional Planning Commission can provide support to communities through educational materials and coordination to help educated municipal boards and residents on the importance of planning for climate change impacts.

Conclusion

Climate adaptation strategies must be tailored to address exposure and sensitivity to climate change impacts at the local level. In addition to minimizing or preventing vulnerability and preserving quality of life, adaptation planning can result in significant cost savings for individuals and municipalities. This is particularly true because the cost of inaction or delaying adaptation is potentially very high but also because failure to address how climate change will exacerbate many existing challenges in the region such as the challenge of managing stormwater to protecting property and the ecological integrity of water bodies in an increasingly impervious landscape, will likely result in the need to modify policies, regulations and infrastructure in the future.

Climate Change and Natural Hazard Opportunities and Tools for Municipalities

Current and future challenges presented by climate change include reducing carbon pollution and adapting to and preparing for climate change impacts discussed above. Communities included climate change mitigation and adaptation efforts in municipal Master Plans as a starting point. Outreach through the UNH Survey revealed only 14% of residents are very concerned about their community's level of preparedness in weather-related situations, while 36% are somewhat concerned, 31% are not very concerned, 18% are not at all concerned and 1% do not know.

- Hazard Mitigation Plans: Hazard mitigation activities may be implemented prior to, during, or after an event. However, it has been demonstrated that hazard mitigation is most effective when based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs. It includes both structural interventions, such as culvert replacements, and nonstructural measures, such as avoiding construction in the most flood-prone areas or property buyouts. All of the communities in the region have completed Hazard Mitigation Plans and participate in the National Flood Insurance Program.

- Global Warming Video: The video created by Michael Ranney at the Graduate School of Education at UC Berkeley explains the mechanics of global warming in one minute or less.

- The Southern NH Climate Assessment from Carbon Solution New England demonstrates the current state of weather patterns in our region including temperature variations, precipitation changes and future effects of carbon emissions. Additionally, the NH Climate Action Plan addresses climate change issues including energy efficiency and recommendations for adaption and mitigation strategies.

- The City of Nashua provides residents with ideas on how to prepare for a natural with through the emergency management website displaying kit building, emergency contact information and further links to Ready.gov.

- new Hampshire Department Of Environmental Services Climate Adaptation Toolkit provides a suite of choices for communities to begin climate adaptation and mitigation planning.

- The GIS Department at NRPC is trained in working with HAZUS software and can assist communities in using hazard planning software for future hazard planning. The Northeast States Emergency Consortium is a nonprofit dedicated to coordinated emergency management through technical services, planning and assistance with software such as HAZUS.

- New Hampshire Handbook on Energy Efficiency & Climate Change Volume 1&2: The New Hampshire Handbook on Climate Change & Energy Efficiency was produced as a tool in support of the mission of the NH Local Energy Committee Working Group. Handbook volume II follows the

volume I, which was written to answer the immediate needs of emerging local energy committees. Volume II is provided to help local governments and LECs measure and manage their energy consumption.

- Southern NH Climate Assessment: Carbon Solutions New England (CSNE), an initiative of the UNH Sustainability Institute, was tasked by the Granite State Future project to assess past and potential future climate change across New Hampshire. The resulting reports, "Climate Change in New Hampshire: Past, Present, and Future," detail how the state has been getting warmer and wetter over the last century, how the rate of change has increased over the last four decades, and how those trends will likely continue over the 21st century. They are intended to provide decision-relevant information as municipalities and regions face challenging choices regarding future investments.

- NH Homeland Security and Emergency Management: The 2009 update of the NH's Hazard Mitigation Plan included new (first ever) goals about addressing climate change hazards, planning, assessment and adaptation statewide. The Plan is available on the Department of Safety – Homeland Security and Emergency Management website.

- NH Wildlife Action Plan- 2013 Amendment: Ecosystems and Wildlife: Climate Change Adaptation Plan released in October 2013 is an amendment to the NH Wildlife Action plan which includes assessments of habitats for coastal species, freshwater species, terrestrial and a list of strategies for management of habitats.

- Department of Health and Human Services: The NH Department of Health and Human Services received a four-year grant from the Centers for Disease Control in Atlanta to assess vulnerability to climate changes in three regions including the southeast/coast, central-western, and the North Country. The results will be used to assess the changing disease patterns for weather-dependent impacts like heat injury, trauma from storms, asthma, allergies, infections such as Lyme disease and other relevant health effects.

- Department of Transportation: The New Hampshire Department of Transportation (NHDOT) is in the process of developing a Resilience and Preparedness Action Plan. This study will identify NHDOT programs, policies, and activities that impact or are impacted by changing weather trends, and identify opportunities to increase the resilience of existing infrastructure and future investments. The plan will include short-, mid-, and long-term goals for the Department to respond to climate change impacts.

Energy Efficiency and Green Building

Introduction

The Nashua region needs reliable and affordable energy in order to sustain the region's high quality of life. Nearly every activity of our day-to-day lives requires energy. Energy efficiency measures and consumption in the Nashua region is similar to other regions throughout the state. According to almost half of all residents in the region expressed that local governments should be very involved in creating guidelines for renewable energy policies in the region. This is slightly higher than the state average.

The Nashua Regional Planning Commission and other organizations have completed energy efficiency work for municipalities, residents and commercial operations. A number of residents in the region have taken advantage of the Residential, Commercial and Industrial Energy Efficiency Programs (CORE) energy programs offered by the utilities and have enjoyed the savings associated with the programs as highlighted in the renewable energy and energy efficiency sections.

Although sustainable funding is an issue, the current grants available to commercial operations and residents, such as the renewable energy grant through the Public Utilities Commission (PUC), are helpful to overcome some financial burdens associated with energy efficient projects.

Since the creation of Local Energy Committee's, municipalities have been able to achieve greater saving and reduced energy costs, such as the Hollis Energy Committee. The committees are of great value to the communities to conduct local energy action plans, research and secure funding and implementing projects. The Nashua Regional Planning Commission has been a facilitator in two local energy roundtables, conducted trainings on small wind ordinances and on the EPA Portfolio Manager. Residents expressed the need for continued work by NRPC to train local municipal boards on energy issues, provide LEC's with additional staff capacity and data collection to accurately gauge current energy use and potential future conditions.

: Energy in NH Quick Facts

- New Hampshire was the eighth lowest per capita consumer of energy among the States in 2010.
- The transportation sector accounted for 36 percent of the State's energy consumption in 2010.
- The Seabrook nuclear power reactor, the largest in New England, provided 42 percent of New Hampshire's 2011 net electricity generation.
- Natural gas accounted for 33 percent of New Hampshire's net electricity generation in 2011, up from 24 percent in 2010.
- New Hampshire's Renewable Portfolio Standard requires 23.8 percent of electricity sold to come from renewable energy resources by 2025; 14 percent of New Hampshire's 2011 net electricity generation came from renewable energy.

Source (United States Energy Information Administration, 2014)

Existing Conditions

There are a number of energy efficiency efforts in the region some of which are initiated by NRPC. The region is different than the rest of the state since it lacks any large scale energy production. Overall, residents were very concerned about energy efficiency opportunities with the volatile costs of home heating and cooling according to community outreach conducted.

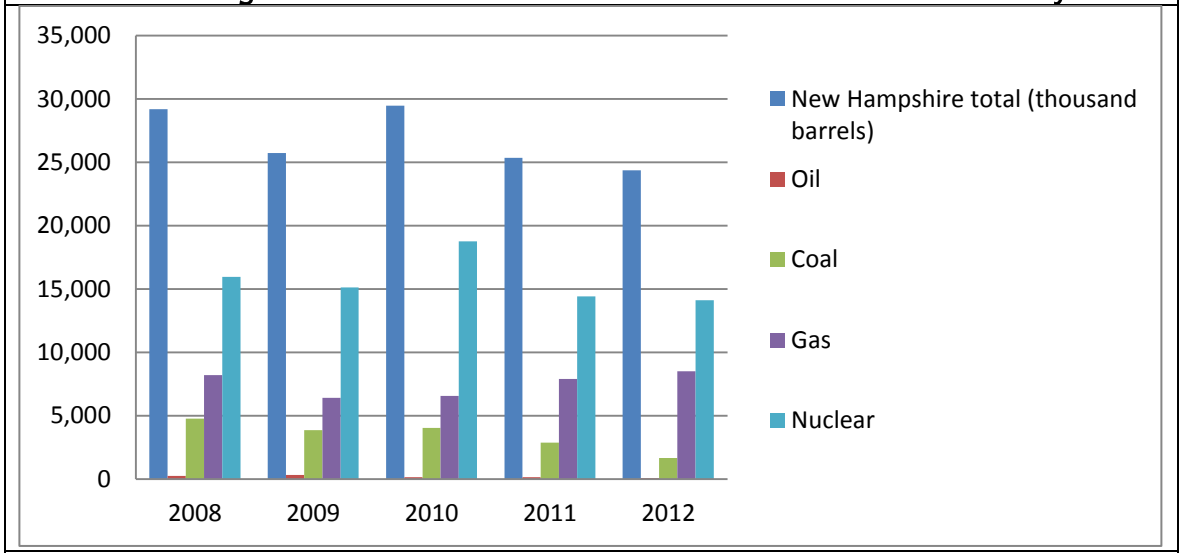
Energy Consumption

Regional fuel consumption data is lacking for the region and county but the Nashua region is similar to the State which is a net importer of energy.

There were approximately 90.5 trillion BTU's imported to New Hampshire in 2011.

According to the Figure 20, the consumption of nuclear energy was steady since 2010. Coal consumption continued to decline over time from 2008-2012 while natural gas rates have increased with the opening of natural gas plants around the state.

- Figure 20: NH Fuel Consumed to Generate Electricity



Source (United States Energy Information Administration, 2014)

Production

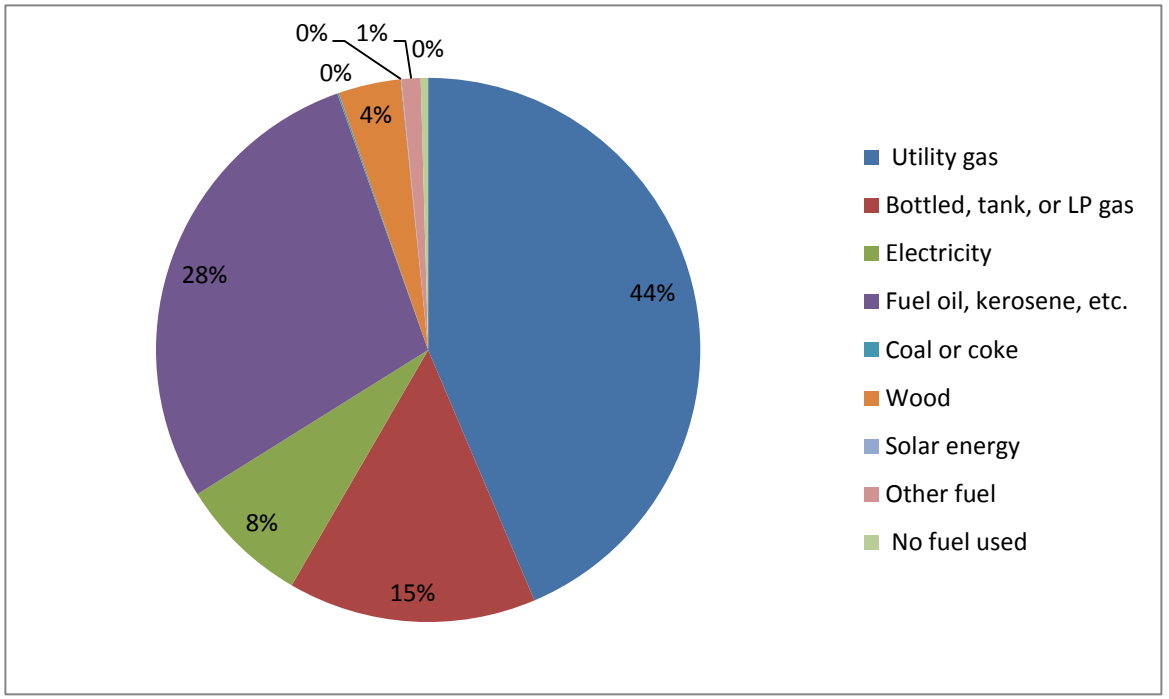
There are a number of large energy producers in the state but none in the Nashua region. The Nashua region does produce a small amount of hydro energy.

Hillsborough County has the potential to produce more biomass but lacks a plant at this time. Hydro power is the largest renewable energy source in the state, 1,580,928 Megawatt hours (MWh) and biomass at 1,089,623 MWh.

Regional Home Heating Costs

Proper insulation and weatherization techniques reduce heat/cooling requirements by decreasing air flow into and out of the structure. Annual household energy expenditure for the region is not available; however the average annual household energy expenditures in 2010 for New Hampshire residents were $2,816.09. In the Nashua region, utility gas and fuel oil account for 73 percent of fuel heating types. Bottled, tank or LP gas ranks third with electricity in fourth and renewables last. The Nashua region is consistent with other areas of the state which rely on 70 percent of heating occurring through fuel oil and utility gas with a larger percent (50) on fuel oil.

Figure 21: 2008-2012 Nashua Region Home Heating Fuel Source



Source: (U.S. Census, 2008-2012 American Community Survey)

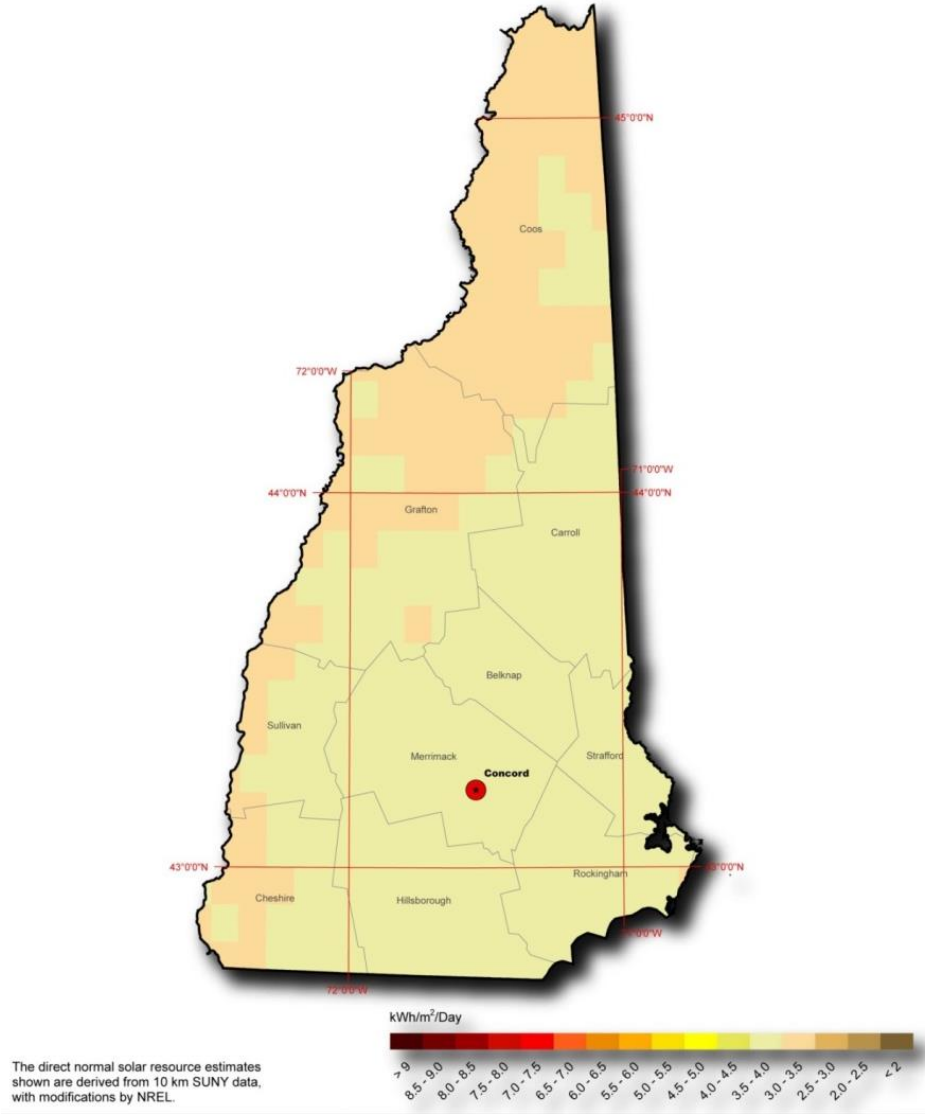
Renewable Energy

The Nashua region renewable energy options include hydropower, solar, biomass and small wind systems. While energy demand cannot be eliminated completely, renewable energy can be a valuable complement to energy efficiency efforts. Residents and businesses have already started installing renewable energy systems on a small scale for local use only.

Solar

The NH Solar Map shows the potential to average a daily total radiation of3-5 KWH per sq. meter per day. This means the average households will most likely need to supplement any type of solar installation with other forms of energy. Large-scale solar installations could prove to be an effective means of energy production for large businesses or communities as an alternative energy source. Despite the lack of large scale solar projects in the region, three solar technology companies provide the region with "green" jobs. Commercial and industrial solar rebates are available for businesses in the region from the PUC. During the 2013-2014 year, there were only two applicants in Amherst and one in Nashua.

Map 21: New Hampshire Solar Map



Source (National Renewable Energy Laboratory, 2014)

Solar hot water systems are currently limited to residential USERS and do not exist on a large scale in the region. There are three regional installer options for solar hot water systems. However, rebate options and other incentive programs are incentivizing solar hot water programs in the region. According to the PUC, Statewide 459 rebates have been issued with 21 rebates originated from the Nashua region, just four percent of the total issued in the state. Six of the 21 households that participated were from Hollis; while Merrimack is the only community in the region where residents have not participated.

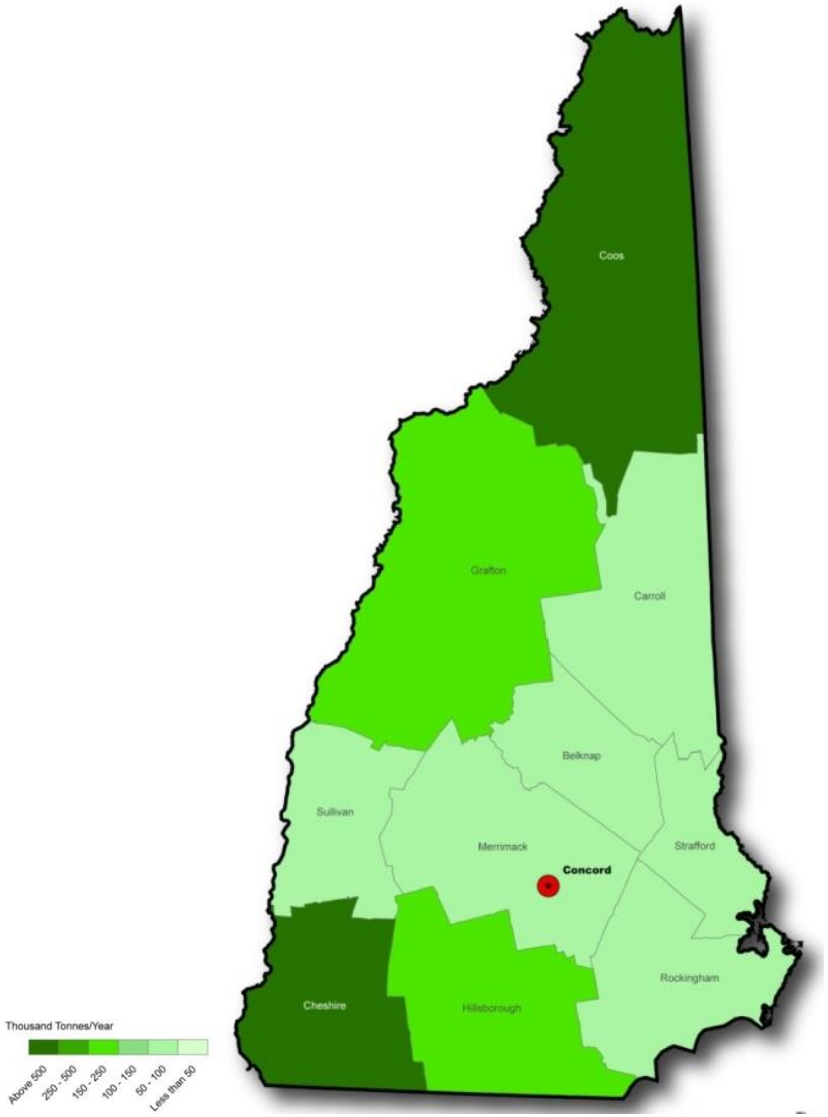
Biomass

Biomass generally refers to low value wood from logging. The biomass industry supports forest product industries while sustainably managing the natural forested landscape and preserving the quality of life for Nashua area residents. Today, 150 megawatts of power are produced in seven facilities across the state none of which are in the region. These plants currently use approximately 1.9 million green tons of wood fuel.

The map below accounts for agricultural residues, wood residues, municipal discards and dedicated energy crops. Hillsborough County has the potential of 150 – 250 thousand Tons per year despite being one of the most populated areas in the state. There are a handful of companies in the region which sell biomass products for home heating including pellets, bricks and fire starters. In 2013-2014, the Wood Pellet Rebate programs, from the NH PUC, issued five rebates to applicants in Amherst residents, one from Hollis, one from Merrimack and one in Wilton. The average rebate issued was $6,000. There was only one applicant for the Commercial and Industrial Wood Pellet rebate program from the region in Mason.

In 2013, the High Mowing School, located in Wilton, was awarded at $200,000 grant from the PUC Renewable Energy Fund to install a biomass heating plant. Xylogen, LLC is working with the school to install and a central biomass heating plant to provide for the heat and hot water needs of seven buildings. Thirteen boilers will be replaced. Xylogen will finance the project and share cost savings with the school. The new heating system will displace 21,000 gallons of heating oil and 9,800 gallons of propane per year, reduce carbon emissions by 259 tons per year, and generate 1021 Class I thermal RECs annually. Total project cost is $525,000.

Map 22: Biomass Resources in New Hampshire



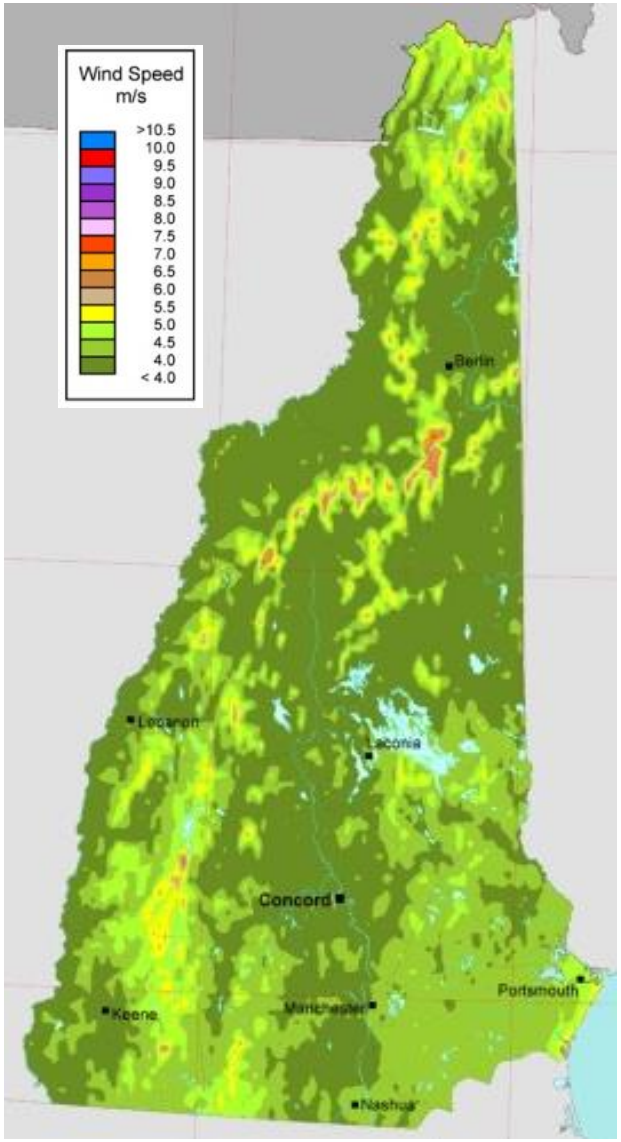
Source (National Renewable Energy Laboratory, 2014)

Wind

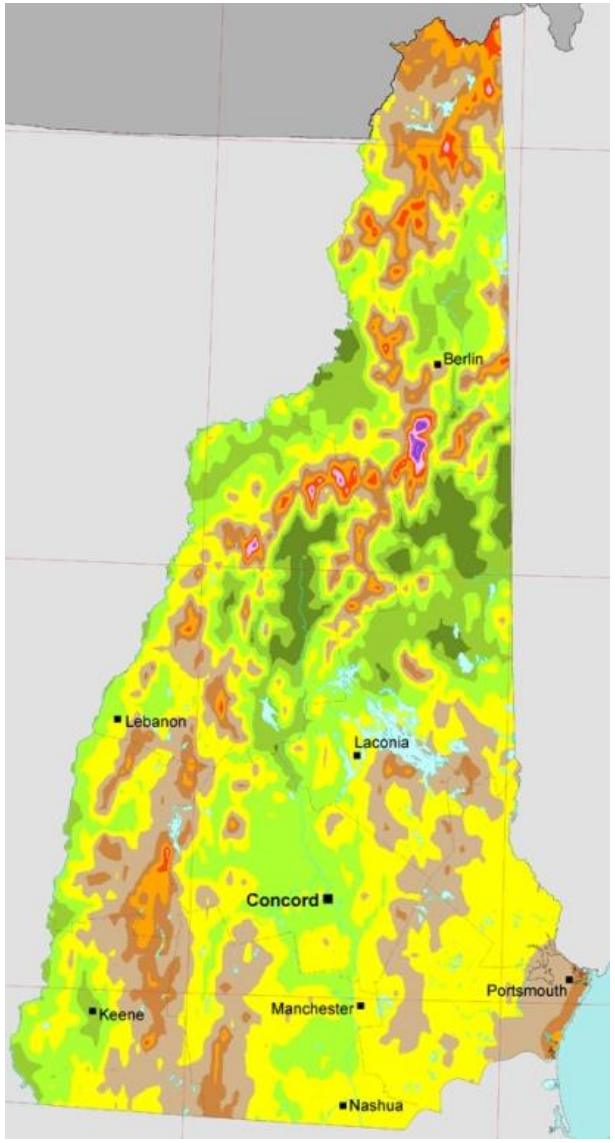
As a renewable resource, wind is classified according to wind power classes which are based on wind speed frequency distributions and air density (United States Energy Information Administration, 2014). The Nashua region lacks major ridge lines suitable for wind at 30 meters or 80 meters. Regionally, at 30 meters, wind speeds are approximately 4.0 meters per second and 4.5-5.0 meters per second for speeds at 80 meters. Currently, no small scale operations exist in the region. Amherst, Hudson, Merrimack, Milford, Pelham and Wilton have small scale wind operations ordinances for future projects. The wind operation ordinances seek to protect the public's health, safety and welfare and promote the safe, effective and efficient use of small wind energy systems to reduce the on-site consumption of utility supplied electricity.

Map 23: New Hampshire Average Annual Wind Speeds

NH Average Annual Wind Speed at 30 M



NH Average Annual Wind Speed at 80 M



Source (National Renewable Energy Laboratory, 2014)

Energy Efficiency

According to the UNH Survey, residents in the Nashua region believe that energy efficiency and energy choices should be the top priority for investing public dollars. Residents are largely in favor of all the proposed energy efficiency and renewable energy projects, except for the idea of having public charging stations made for electric vehicles. Municipal energy committees such as Hollis and Hudson can assist residents and municipal officials with energy efficiency project ideas for investing public dollars and renewable energy projects.

Energy Technical Assistance Program

The Energy Technical Assistance Program (ETAP) was an ARRA funded program offered through the NH Office of Energy and Planning. The goal of ETAP was to offer technical assistance to all New Hampshire communities and counties to improve the energy efficiency of its municipal and county buildings. The program was designed to assist communities in identifying potential energy efficiency projects through energy inventories and building assessments. The Nashua Regional Planning Commission utilized ETAP funds to write energy action plans in six municipalities and complete the energy chapter for the Community of Brookline. Additionally, ETAP funding was used to begin the NRPC Regional Energy Aggregation which continues to be supported by NRPC; see Energy Aggregation section below. Through the ETAP program, 19 buildings across five communities were assessed. Recommendations were made to Hollis and Pelham on techniques to increase energy efficiency in the specific building. The status of those recommendations is unknown at this time.

Energy Action Plans

Energy inventories help communities to assess their current energy use and track their energy reduction progress. A thorough inventory is the base of the Energy Action Plan (EAP). Previous funding through ETAP provided NRPC the opportunity to collaborate with the communities of Hollis, Lyndeborough, Mason, Milford and the Hollis & Brookline SAU 41 to complete Energy Action Plans. For example, Hollis conducted an energy inventory of the community's municipal buildings, vehicles, and streetlights using the Small Community Carbon Calculator (STOCC) and the EPA's Portfolio Manager. In particular, STOCC allows communities to track their overall energy usage, costs, and greenhouse gas emissions resulting from buildings, vehicles, and street lights. Through the EAP, the Hollis Energy Committee was able to identify the buildings in community that require more energy efficiency planning to reduce municipal costs.

Local Energy Committee

The purposes of Local Energy Committees are to promote energy conservation, energy efficiency, and explore other ways to reduce carbon emissions among the community's residents, businesses, and in municipal affairs. The committees can accomplish conservation and efficiency through educational activities and programs designed to encourage people to pay attention to their energy needs, consumption habits, and short-and long-term interests. The most active committee's in the region are Hollis, Hudson and Wilton which continue to promote energy efficiency practices.

Case Study: Hollis Montessori School

The Hollis Montessori School is the first Certified Passive House Elementary School in the US and the first example of a passive building in the region. The project team is Windy Hill Associates, architects, and ZeroEnergy Design, passive house consultant and mechanical engineers who shared the project description below. The project successfully balances multiple goals, including education, Montessori principles (such as independence, freedom, and respect), and the institutional goals of healthy indoor air, durability/longevity, cost effectiveness, and exceptional energy performance. The solution for the school was a high performance building enclosure, very high efficiency systems, design to maximize daylighting, orientation for passive solar gain, and adherence to the Passive House Standard.

The super-insulated air tight building enclosure includes a double stud wall system that provides R-41 dense pack cellulose continuous insulation, an R-111 roof assembly that combines dense-packed cellulose in the roof trusses and continuous rigid insulation outbound of the roof sheathing, R-54 under the concrete floor slab, and building details to mitigate all thermal bridging. High performance U-0.15 triple pane windows/doors offer a SHGC-glass of 0.50 to capture the sun's energy. The exterior sheathing was taped and sealed to serve as the primary air barrier, yielding a final infiltration rate of only 0.25ACH50. In addition to capturing passive solar gain, the south facing windows readily offer natural daylighting throughout the classrooms. Vacancy sensors and daylight sensors help to further reduce lighting use and minimize electrical loads.

There is an air source heat pump system with one head per classroom that provides space conditioning, offering heating, cooling, and dehumidification. Zehnder Comfoair 550 HRVs complete the package with highly efficient ventilation and heat recovery. The building's very limited need for hot water comes in demand spikes, justifying the electric tank less water heaters at each point of use. A future roof mounted photovoltaic system is planned, with all wiring and conduits in place and plenty of south facing roof space. One classroom includes a ventilation supply fabric duct that inflates when active, offering a teaching opportunity about indoor fresh air. Conduit and the heating and cooling systems are selectively exposed to openly display the building's functionality. Energy monitoring systems are kid accessible to provide insight regarding operational energy usage.

Table 20: Performance Data

Performance Data	
Heat Demand	2.93 kBTU/(ft2yr)
Air Tightness	.25 ACH50
Primary Energy	20.2 kBTU/(ft2yr)
Cooling Demand	.10 kBTU/(ft2yr)
Heat Load	3.32 kBTU/(ft2yr)
Cooling Load	1.25 kBTU/(ft2yr)

Source (ZeroEnergy Design, 2014)

Preliminary monitoring results, even in the high heating environment of southern New Hampshire, project annual consumption of approximately 28,000kWh for all the building's energy requirements. With plenty of room for solar on the roof, an estimated 30 kW photovoltaic system would offset all consumption, yielding net zero energy.

Regional Energy Aggregation

The goal of the Nashua Region Electricity Supply Aggregation is to purchase energy as a group from a competitive supplier at a lower rate than each member could receive on its own. By purchasing as an aggregation, municipalities and school districts can offer energy suppliers a larger demand than if they each tried to purchase energy individually. The larger demand, in turn, allows suppliers to offer a better rate to the aggregation than it could to individual members.

The Nashua Regional Planning Commission serves as an aggregator to facilitate a bid process among competitive electricity suppliers licensed with the NH Public Utilities Commission. Each aggregation member signs its own contract with the supplier for a fixed electricity supply rate. Rates and contracts are identical for each member within a given electric distribution territory.

In 2012, NRPC utilized funding from the ETAP program to work with nine communities and six school districts to form an aggregation to procure electricity from a competitive supplier. As a result of a successful bidding process, the aggregation saw an estimated combined annual savings of $299,578 on their electricity bills. Although the ETAP program ended in April 2012, NRPC was able to continue working with the aggregation to help members renew their electricity supply contracts for 2013. The aggregation's total cost savings in 2013 were $274,200. The Nashua Regional Planning Commission reconvened the aggregation in the fall of 2013 to conduct a third competitive electricity supply bid process. Aggregation members signed nine-month contracts beginning in February 2014. The aggregation as a whole will save $165,781 or 19.4% during the nine-month contract period.

Table 21: 2014 Total Aggregation Savings

2014 Total Aggregation Savings	**$165,781**
Amherst	$5,728
Brookline	$2,146
Hollis	$4,027
Hudson	$28,207
Litchfield	$3,655
Lyneborough	$863
Milford	$35,201
Mont Vernon	$1,014
Pelham	$10,707
Mason School District	$1,522
Milford School District	$32,866
Windham School District	$34,054
Wilton-Lyndeborough School District	$5,790

Savings among aggregation members vary based on usage. Individual nine-month savings resulting from the 2014 bid process range from $863 to $35,201. The total nine-month savings for the Nashua Region Aggregation in 2014 is $165,781 or 19.4% vs the electric utility.

Green Building Programs

The process of green building incorporates environmental considerations into every phase of the building process. The impact to the environment is accounted for during the design, construction, and operation of a building. Other considerations include energy and water efficiency, lot development, resource efficient building design and materials, indoor environmental quality, homeowner maintenance and the building's overall impact on the environment. The region has a few examples of green buildings and green building programs.

LEED

Leadership in Energy and Environmental Design (LEED) is a set of rating systems for the design, construction, operation, and maintenance of green buildings, homes and neighborhoods. LEED was developed by the U.S. Green Building Council (USGBC), and is intended to help building owners and operators be environmentally responsible as well as use resources efficiently. Proposals to modify the LEED standards are offered and publicly reviewed by USGBC's member organizations, which number almost 20,000.

LEED Certified Buildings in the Nashua Region

- Stop and Shop #202: Hudson, NH
- CEI NH LEED: Merrimack, NH
- Nike Store, Merrimack Premium Outlets: Merrimack, NH
- Starbucks: Merrimack, NH
- Stop and Shop #205: Milford, NH
- Kohl's Nashua: Nashua, NH
- NH State Liquor Store #69: Nashua, NH
- Greater Nashua YMCA: Nashua, NH
- Second Nature Academy: Nashua, NH
- The Courtyard at Twin Ponds: Nashua

Better Buildings Program

NH Better Buildings program was established in 2012 as an initiative, from the Community Development Finance Authority, to achieve transformative energy savings and reductions in fossil fuel use and greenhouse gases through deep energy retrofits and complementary sustainable energy solutions. Throughout the grant period, which was 2011-2013, the NH Better Buildings Program was focused on overcoming key market barriers including demand for energy efficiency services, bank participation and understanding of the energy efficiency marketplace, availability of funding for energy efficiency, and the public's understanding of audit and upgrade processes. The City of Nashua was selected as a participant, along with Berlin and Plymouth for the program.

Nashua's goals were to upgrade many old commercial buildings and multifamily housing structures and bring them into compliance with current energy codes. During the original grant award process NH Better Buildings created estimates for the number of residential and commercial buildings that could be retrofit. While not all of the initial goals were met, more than 50 percent of the proposed residential buildings assessments were completed and 28 percent of commercial buildings with retrofits.

The Better Buildings Program highlighted three commercial case studies which had noticeable energy savings results: Alphagraphics, Coliseum Senior Residence and the Nashua Farmers' Exchange. The chart below indicates the general costs of each project as well as the projected energy, gas and electricity savings. The average electricity savings is 55,873 kWh and 1,233 therm savings on gas.

The retrofits were specific to each building but there were common elements to each project such as weatherization, lighting and duct changes. Initial savings from the retrofits were 28 percent on electricity at Alphagraphics, $18,000 per year energy savings at Colesium Senior Residence and a savings of 84 percent on heating costs at the Nashua Farmer Exchange. The Nashua Farmer Exchange project also included asbestos abatement which provides safer air quality for employees and customers.

Table 22: Residential vs. Commercial Retrofits in Nashua

Nashua	Residential	Commercial
Original Goals	310	70 (350,000 sq ft)
Actual Retrofits	216	20 (625,321 sq ft)

Table 23: Better Buildings Program Savings by Project

Indicator	Alphagraphics	Colesium Senior Residence	Nashua Farmers Exchange
Project cost (pre-rebate)	$30,385	$293,165	$110,863
Better Buildings rebate	$4,673	$73,291	$27,249
Better Buildings 1% loan	$16,712	n/a	$62,796
Better Buildings partner rebates	$10,519	$24,224	$23,639
Projected energy savings	15.60%	9%	47%
Estimated annual gas savings	1,183 therms	1,690 therms	826 therms
Estimated annual electricity savings	29,913 kWh	134,363 kWh	3,342 kWh

Nashua Green Team

The Nashua Green Team was created to help the City of Nashua identify areas to reduce greenhouse gas emissions, increase energy efficiency, decrease air pollution and reduce energy expenditures. The Team took an inventory of previous actions and goals already completed, researched funding opportunities, established a working relationship with local businesses and implemented energy and cost cutting measures. Since the group was a municipal organization, the focus of the energy efficiency efforts was on municipal buildings: the public library, the street department, fire and rescue and City Hall. The most common retrofit for all the projects was the installation of motion sensing lighting system. Additional retrofits included: altering heating systems, establishing recycling programs and resealing window to prevent heat and cool loss. The Street Department retrofits yielded the most annual savings of $42,000.

Building Health Concerns

Building design and materials deteriorate over time releasing harmful toxins hence creating poor environmental areas subjecting vulnerable populations to molds, fungi and vermin. “Indoor air pollution” can include the following: ozone, allergens, paints and other volatile organic compounds, cleaning products, tobacco smoke, soil gas intrusion (e.g. Radon) and bioeffluents (Jacobs, Kelly, & Sobolewski, 2007).

Probable indoor air quality contaminants are linked to adverse health impacts: asthma, radon poisoning, lead poisoning, systemic inflammation and oxidative stress. Indoor air quality matters greatly since on average, United States citizens spend 90 percent of their time indoors where indoor pollutant levels can be worse than those outside. Extended amounts of indoor periods expose a resident to potentially harmful substances over time. Building health concerns are directly related to the age of housing stock and building materials. See Housing Section for more information (Giles et al., 2011; Jacobs et al., 2007).

Ozone

Ozone at the ground level is formed from pollution emitted by cars, power plants, refineries and chemical plants react and change chemically in the presence of sunlight **(United States Environmental Protection Agency, 2013d)**. Ozone gas includes sulfur dioxide and smog in levels of parts per billion (ppb). Smog consists of ground levels of nitrogen oxides (NOx) and volatile organic compounds (VOC) reacting in the presence of sunlight. Quantities of smog occur due to the amount of released emissions from motor vehicles, electric utilities, gasoline and chemical solvents **(United States Environmental Protection Agency, 2013d)**. The reduction of ground level ozone and increased energy efficiency can decrease potential health effects on humans.

Short-Term Effects	Long-Term Effects
Coughing	Lung Inflammation
Painful Breathing	Impairment of Lung
Temporary Loss of Lung	Changes in Lung
Aggravate Asthma, Emphysema and	Premature Aging of Lungs

Source: City of Nashua

The decline in coal use state wide combined with the increase in natural gas plants directly contributes to the decrease in ozone and particulate matter in the region. Nashua area residents expressed concern for the flora at one spot in Nashua which has stunted tree growth and killed the downtown Christmas tree due to increased vehicle emissions. The tables below compare Hillsborough County ozone and particulate matter to the rest of the state from 2000-2013. Hillsborough County is consistent with the number of state wide exceedance days. There were 16 exceedance days in 2002, the highest of the 13 year data period. The statewide average and Hillsborough County was the highest from 2001-2007 and has declined since. Particulate matter (PM), particulates, or particle pollution are general terms for solid or liquid particles found in the atmosphere. Some particles enter the air as solids while others form secondarily from condensing gases or as the result of a chemical reaction of gases, typically sulfur dioxide, nitrogen oxides, and volatile organic compounds **(NH DES, b)**.

Table 24: Ozone and Particulate Matter in Hillsborough County

Year	Number of 8-Hour Ozone Exceedance Days in Hillsborough County	Number of 24-Hour PM2.5 Exceedance Days in Hillsborough County
2000	2	
2001	13	
2002	16	2
2003	8	2
2004	5	1
2005	10	1
2006	5	1
2007	14	1
2008	5	
2009		
2010	4	
2011	1	
2012	3	
2013		

Note: Blank cells may indicate either zero exceedances or lack of monitoring data from that county.

Source New Hampshire Department Of Environmental Services

Attainment and Non-Attainment

In New Hampshire, Hillsboro, Merrimack, Rockingham and Strafford counties are currently classified as nonattainment for ozone. The four most western communities in the region, Mason, Wilton, Lyndeborough and Mont Vernon are all within attainment standards and the four least populated communities in the region. Ozone is not emitted directly from stationary sources and is instead formed by the precursor pollutants nitrogen oxides (NOx) and volatile organic compounds (VOC). Eight of the 13 communities in the region are in the Current 8 Hour Ozone Nonattainment Area which are not meeting the National Ambient Air Quality Standards (NAAQS) for one or more criteria pollutants under the Clean Air Act (United States Environmental Protection Agency, 2013d).

Regional Energy Efficiency and Green Building Issues

There are many issues and barriers to energy efficiency and green building in the state. Energy efficiency programs are generally statewide programs which affect the Nashua region. Although there is much work to done at the state level to clearly define efficiency goals, there are a number of issues and barriers that apply to the region. There are two studies which identify the issues for residents and LEC's throughout the state and the region. Outreach confirmed the issues identified by the residents and municipal officials listed below.

The **New Hampshire Draft State Energy Strategy** was commissioned by the Office of Energy and Planning and written by Navigant Consulting. The strategy is to provide forward looking guidance on electric, gas and thermal energy strategies in order to optimize the use of readily available energy resources while minimizing negative impacts on the economy, the environment, and the natural beauty of the state.

The **Increasing Energy Efficiency in New Hampshire: Realizing Our Potential** was commissioned by the Office of Energy and Planning and written by the Vermont Energy Investment Corporation. This study addresses the potential for increasing energy efficiency in buildings, which accounts for about 52%, or $3.1 Billion, of total energy costs in the state.

Program Longevity

One of the challenges currently facing energy efficiency loan programs is the lack of sustainable, consistent funding sources.

Since most of the existing funds are completely loaned out and loan repayments revolve slowly, it is difficult to maintain programs at a continuous level of service.

There may be an apprehension to advertise a program to customers that may not always be available which prevents programs from being well promoted and decreases efforts to educate customers and increase program support.

Municipal officials and LEC members expressed a discontentment with the lack of sustainable funding sources. There seemed to only be public funding sources and no private sources available.

There are many projects that could be done but communities are not able to complete them due to a lack of funding and continuity of data.

Potential future conditions involve the recommendation that policy and regulatory items should remain stable and unchanged for a period of time.

Competing Energy Programs

There are multiple programs with varying eligibility requirements and lack of program coordination adds to resident confusion and frustration.

Multiple programs could result in combined benefits while other times consumers must determine which single program provides them the best value. This leads to lower participation rates because the effort to proceed may be high.

New Hampshire lacks a clear over-arching policy direction for energy efficiency.

Outreach results indicated residents and municipalities were overwhelmed by the number of choices available. Other residents had never heard of some programs and were surprised to learn about the rebates.

Building Codes

The NH State Building Code for residential and commercial buildings is now the 2009 International Energy Conservation Code (IECC). A subset of the overall building code, energy codes and standards set minimum requirements for energy efficient design and construction for new and renovated buildings. By establishing the very minimum requirements, the codes set the baseline for energy efficiency in new construction and renovations to which further design upgrades and strategies may be compared.

A structure built to the 2009 energy code requirements will be 14% more energy efficient than one built to the 2006 code. Likewise, the 2012 code represents a 30% improvement in energy performance over the 2006 code. These represent incremental steps toward the goal of net zero buildings by 2030.

Municipalities in the region voiced the challenges in adopting up to date codes and gaining support of local business.

Communities expressed the concerns from residents that anything seen as a hindrance to economic development is not desirable.

Enforcement of energy efficiency varies widely across municipalities, a result discovered through outreach efforts.

Additionally, municipalities need to be aware of the 2015 buildings codes which are expected to be released in mid-2014.

Lack of Understanding

Lack of quality information is a long-standing barrier in building energy efficiency investments.

The multiple programs and lack of data collection statewide is similar to the Nashua region.

Residents and municipal officials were unclear about programs offered in the state and how energy efficiency effects can make a difference. Progress has been made by local LEC's and NRPC, there continues to be lack of funding for sustained education efforts on energy efficiency programs for all residents and businesses in the region.

Development Patterns

A historical development pattern has positive and negative energy efficiency impacts throughout the region.

The Nashua region has many small community centers which are good for energy efficiency. However, rural development frequently requires larger lot sizes, outside of public transit opportunities increasing the need to drive even short distances.

Driving increases fossil fuel consumption and reduces energy efficiency.

Residents expressed the need for communities to encourage infill development and energy efficient buildings.

Demand for electric power in New Hampshire is forecast to rise in all sectors. Electric demand in the residential and commercial sectors is forecast to grow more slowly than in the industrial sector with increases in population (0.4% annual growth through 2025), housing stock and commercial building space is offset by modest gains in the efficiency of appliances and building systems (recent savings of 0.64% annually).

Natural Gas – Kinder Morgan Pipeline

In NH, there are only four natural gas pipelines. The current line servicing NH residents is the Tennessee Gas Pipeline (TGP) which is owned by Kinder Morgan

and brings gas from Texas, Louisiana, and the Gulf of Mexico into New England. This pipeline crosses New York and Massachusetts and distributes gas across a large section of MA. There are several tributaries off of the main line, one of which branches off near Lowell and heads north through the communities along the Merrimack River and into the Lakes region. Kinder Morgan is proposing an additional pipeline to service the Nashua area. The Nashua region does not have many natural gas opportunities. Residents commented on the need for more natural gas to reduce the regional consumption of fossil fuels.

Single Source of Information

One of the barriers is a lack of a single, trusted source of accurate information to program offerings for energy efficiency, even if programs are implemented by multiple organizations. There are a multitude of energy efficiency and sustainable energy programs and initiatives:

There is no single and trusted source of information that is the "one stop shopping" destination for those interested in exploring their options.

NHSaves is partial progress towards this, but it is not used consistently for all program offerings, even within just the regulated energy efficiency programs.

Municipal officials regularly express the need for NRPC to act as a data collector and manager of information from State agencies.

Access to Financing for Efficiency

One barrier preventing consumers from investing in cost effective efficiency measures is the up-front cost. Some residents are apprehensive to conduct money-saving projects due to a lack of immediate funds on hand. As a result, there needs to be a focus on helping consumers access reasonably priced private capital to finance efficiency improvements and equipment.

The Hollis Energy Committee was able to secure funding and implement multiple energy saving projects for a number of municipal buildings. Inventories and bench marking were completed use the EPA Portfolio Manager to provide a baseline of current energy use. Additionally, the Hollis-Brookline Coop School District was able to evaluate the energy efficiency in the elementary schools. The recommendations were implemented using multiple funding sources.

State Energy Programs for Residents and Businesses

Substantial opportunities exist to maintain and improve energy productivity while reducing consumption through investments in energy efficiency in the region. The State offers energy efficiency programs for municipalities, business and residents. The four utilities in the state also offer fuel assistance programs for individuals in need.

CORE / NH Saves

Administered by electric and natural gas utilities to make energy efficiency improvements, residential programs include home weatherization, with an additional program focused on low income residents, energy star lighting, hot water, appliance and HVAC rebates. Other programs such as the Large Business Energy Solutions (200 kWh or more), $40,000 therms or more) and Small Business Energy Solutions, for rebates on lighting, thermostats, coolers, hot water measures, refrigeration, etc., target businesses performing retrofits or new construction.

Greenhouse Gas Emissions Reductions Fund

The Greenhouse Gas Emissions Reductions Fund (GHGERF) provided financial support for energy efficiency, conservation, and demand response programs that reduce greenhouse gas emissions through proceeds from the Regional Greenhouse Gas Initiative (RGGI). In 2013, legislation replaced the GHGERF with an Energy Efficiency Fund that is used solely to provide support for the CORE energy efficiency programs. Currently one dollar of auction proceeds for each allowance sold is allocated to the Energy Efficiency Fund, and the remaining proceeds are provided as rebates to ratepayers.

PACE Financing

In 2010, House Bill 1554 was signed into law and allowed municipalities to establish energy efficiency and clean energy districts. Once a district is adopted by a municipality, an innovative financing tool called Property Assessed Clean Energy (PACE) is required. PACE enables municipalities to set up programs to fund energy improvements in buildings and allows repayment of the investments through property “tax” assessments. It is important to note that the financing is tied to the property, not the building owner.

Business Energy Conservation Revolving Loan Fund

Administered by the NH Business Finance Authority, loans are available for commercial, industrial, nonprofits and agricultural businesses to improve energy efficiency in New Hampshire work places. Some of the requirements for the program are a minimum loan amount of $100,000 with a term not to exceed five years.

Enterprise Energy Fund

The Enterprise Energy Fund is another program managed by Community Development Finance Authority and is a low-interest, revolving loan fund available to businesses and nonprofit organizations to help finance energy improvements and renewable energy projects in their buildings.

Giving Power Back

The New Hampshire Retail Association has collaborated with Resident Power and Freedom Energy Logistics to offer businesses energy savings on the electric portion of their bill. Through the NH Retail Association Energy Purchasing Program, a business can purchase discounted

electricity and natural gas for business and employees. At least one business in the Nashua region is participating in this program.

Low Income Weatherization Program

The overall goal of the NH OEP Weatherization Program is to serve those low-income households that are most vulnerable to high-energy costs and who do not have the means of making cost-effective energy conservation improvements to their homes. The goal is to increase your home's energy efficiency, safety, and comfort by eliminating drafts by weather-stripping or repairing broken exterior doors, patching small holes in walls and roofs (and repairing damaged windows), and performing minor furnace maintenance and repair, insulation in attic, walls, floor and perimeter, and insulating water heater pipes or furnace ducts.

Net Metering

NH Public Utilities Commission, Code of Administrative Rules, Chapter PUC 900, provides for net metering, which permits homeowners to receive credit for on-site electricity generation such as from a solar photovoltaic (PV) or wind turbine installation when the generation exceeds household consumption. This is accomplished by use of an electric meter that can run both forward and backward so that the homeowner is billed only for the net reading on the meter.

Municipal Energy Reduction Fund (MERF)

This Program is managed by the Community Development Finance Authority (CDFA) and is available to help municipalities improve the energy efficiency of their municipal buildings and operating systems. Eligible activities are improvements to HVAC equipment, air sealing and insulation in walls attics and foundations and installation of alternative energy sources.

Pay for Performance

The Pay for Performance Program, administered by TRC Energy, comprehensively addresses the energy efficiency needs of the commercial, industrial, and municipal government sectors by working with participants, such as developers, building owners and their representatives, to improve energy efficiency of commercial and industrial buildings. Currently, four projects have been completed in the Nashua region. Each saw an energy savings of more than 12 percent based on the retrofits which included lighting, low flow water installations and air system modifications. Each project had a different program partner to do assessment and installations.

- Pine Valley Apartments, Milford
- Airmar Technology Corporation , Milford
- Colesium Senior Residence, Nashua
- Pheasant Run Apartments, Nashua

Fuel Assistance

As funds become available, the Fuel Assistance Program provides benefits to qualified New Hampshire households to assist with heating costs. The Fuel Assistance Program can also help households during a heating emergency by securing an emergency delivery of fuel, delaying a shut-off notice, or referring clients to another source of assistance. Fuel Assistance benefits range from $120 to $975, depending on household income and energy costs.

The Low-Income Home Energy Assistance Program (LIHEAP) provides elderly, handicapped and low-income residents with the financial assistance necessary to meet vital heating and utility expenses. This important program is funded by the U.S. Department of Health and Human

Services and administered through NH OEP.

Energy Conservation

One of the best ways to lower energy costs is to simply use less energy by employing conservation and efficiency measures. The Energy Conservation Tips available from NH OEP which support the Energy Savers Booklet issued by US Department of Energy.

Private and Federally Funded Energy Programs

High Performance School Exchange

The Northeast Collaborative for High Performance Schools (Northeast CHPS) is a set of building and design standards for all schools from pre-K through community colleges. It is based on California's pioneering CHPS guide for the building of energy efficient, environmentally friendly, healthy school facilities. The Mason Elementary School is the only school in the region to take part in the program. No energy savings data is available.

Zero Net Energy

The Hollis Montessori School is the only example of a zero net energy facility in the region. A Zero Net Energy facility combines state-of-the-art, energy-efficient construction techniques and equipment with renewable energy systems to return as much energy as it takes on an annual basis. Specifically, when renewable resources cannot provide the entire homes power, e.g., at night or on a cloudy day, the homeowner purchases energy from the utility.

High Performance Design Guide

The High Performance Design Guide is a tool to help architects, designers and building owners create better performing, more energy-efficient commercial buildings in Vermont and the Northeast region. Organized by design phases rather than by system, the guide makes it easy to integrate performance goals into the design process.

NAHB Model Green Home Building Guidelines

The guidelines were created by the National Association of Home Builders for developers who are interested in green building products and practices for residential design, development and construction. The guidelines use a point system to incentive using the most appropriate method for the building process.

National Grid Natural Gas

Southern New Hampshire Services (SNHS) and National Grid implemented a program designed to secure maximum energy conservation and effective customer relations through education and the installation of energy-saving measures in houses of qualified customers. Customers receiving LIHEAP benefits who are natural gas space heating and natural gas water heating customers are eligible for the installation of gas efficiency measures.

Electric Energy Assistance

The Electric Assistance Program (EAP) provides qualifying utility customers with a discount on their monthly electric bill depending on their household income. Renters, subsidized renters and homeowners who receive an electric bill may apply for EAP.

USDA Rural Energy for America Program

The USDA created this program to aid agricultural producers and small businesses in rural areas to reduce their energy use

and expand opportunities for renewable energy. The program issues grants, guaranteed loans, or a combination of the two to a variety of projects. Eligible Areas are communities of less than 50,000 population and those not contiguous to a community of 50,000 or more. In New Hampshire, all communities would be eligible except Manchester, Nashua and any abutting communities.

2009 IECC Energy Efficiency Certificate

The *International Energy Conservation Code* (IECC) is a model code that regulates minimum energy conservation requirements for new buildings. The IECC addresses energy conservation requirements for all aspects of energy uses in both commercial and residential construction, including heating and ventilating, lighting, water heating, and power usage for appliances and building systems.

Conclusion

Region-wide energy efficiency can best be implemented when other public policies are taken into consideration. Implementation of energy measures can only work when integrated with programs dealing with other region-wide issues such as land-use, air quality, transportation, housing and economic development and other issues that are at the forefront of NRPC's efforts to make our region a healthier and more functional place to live. The Nashua Regional Planning Commission recognizes that a region-wide energy plan needs to be created to ensure that municipalities have access to accurate energy information. The education and dissemination of energy efficient programs and alternatives are key pieces to region-wide energy efficiency.

Additional Energy and Green Building Programs and Tools for Municipalities

- Communities can organize Local Energy Committees to review community wide energy expenditures and reduce energy consumption. The Local Energy Solutions website hosts resources for local energy committees including funding options, tools for measurement and trainings.
- Energy efficiency programs for homeowners and businesses exist most notably through PSNH and NH OEP. PSNH highlights rebate programs and energy efficient systems for building installations. NH OEP Better Building program supports building retrofits and sustainable energy solutions.
- EPA Portfolio Manager created by the US EPA tracks and creates benchmarks for energy consumption, water usage and greenhouse gas emissions.
- Vulnerability assessment and asset management inventories are important tools for identifying what communities have for infrastructure assets and threats to those assets in the future. The Nashua Regional Planning Commission can assist communities with vulnerability assessment through hazard mitigation plans. Additional resources can be located through the NH Office of Emergency Management.
- Zoning tools: Planning and zoning concepts and tools such as mixed use development, compact village centers, preservation of open spaces, lot size averaging help to reduce energy by reducing the number of vehicle trips between shopping areas and the distance between these shopping areas and where residents live. Alternative transportation reduces vehicular traffic and subsequently carbon dioxide emissions.
- Community Improvement Plan and Master Plan: To plan for the community facilities that are most needed in the future, an assessment and needs evaluation of existing facilities must be accomplished and included in Community Master Plans. It is critical that this information be evaluated, prioritized and included in a municipality's CIP.
- Renewable Energy Property Tax Exemption: RSA 72:61-72 permits cities and communities to offer exemptions from local property taxes for certain renewable energy installations. These include solar systems (thermal and photovoltaic), wind turbines, and central wood-fired heating systems. Woodstoves and fireplaces are not included. The goal of the exemption is to create a tax neutral policy within a municipality that neither increases an individual's property tax, nor decreases the municipality's property tax revenues.

  Renewable energy exemptions are not popular in the Nashua region. Currently, Milford, Mont Vernon and Nashua have exemptions for solar. Mont Vernon is the only community in the region with solar and wind exemptions. No communities have exemptions for wood fired heating systems. The Nashua region relies on outside sources of renewable energy offered through major energy suppliers such as Public Service of New Hampshire (PSNH) to meet any renewable energy demand.

- Energy Efficient Development Ordinance: Currently, there are not any communities in the region with an Energy Efficient Development ordinance. Energy efficient development ordinances are permitted in New Hampshire as a means of carrying forth the purposes of zoning ordinances established in RSA 674:17. Section I (j) of that statute encourages the uses of solar, wind, or other renewable energy systems. The law also gives zoning ordinances the power to establish buffer zones or other zoning districts that overlap any existing districts. When these zoning provisions, promoting renewable energy and efficiency, are combined with enabling legislation for performance standards under RSA 674:21 I (h), communities can develop a comprehensive zoning article that provides incentives to developers in exchange for meeting a number of energy efficiency performance standards.
- New Hampshire Sustainable Energy Association: The mission of NHSEA's is to educate NH citizens, businesses, and organizations about sustainable energy and to advocate in NH for favorable sustainable energy policies. One helpful tool is the My Energy Plan: Energy Connector tool which can help you locate contractors, installers, and vendors who provide energy efficiency and renewable energy products and services in and around New Hampshire.
- Nashua Regional Planning Commission Factsheets: Through iTRAC Transportation Program, NRPC created fact sheets for energy efficiency and green building. The Energy Efficiency fact sheet discusses the importance of energy efficiency design in the planning process, supporting statutes and resources for developers and municipalities. The Green Building fact sheets compliments the Energy Efficiency fact sheet by discussing the importance of green building techniques and the two certification programs: ENERGYSTAR and LEED.
- Small Wind Systems Technical Bulletin: This technical bulletin was created pursuant to Chapter 357:4 of the laws of 2008 (HB310). Small Wind Systems are a new technology for smaller communities. The bulletin reviews existing statewide statutes and considerations for municipalities for future projects.
- Energy Auditing: A good starting point for municipalities is the Field Guide to New Hampshire's Municipal Buildings & Energy Audit Guidelines. The Field Guide reviews what to expect from an audit, statutes for auditing guidelines and energy efficiency in building systems. Consumers can seek out auditors or contractors who have a certification such as those from the Residential Energy Performance Association of New Hampshire, the Buildings Performance Institute, or the Association of Energy Engineers.

Environment Chapter Conclusion

Natural resources are the heart of the region. The protection of the natural resources in the region is evident in all four chapters. The forest lands in the region provide areas for groundwater infiltration to protection and maintain the water quality for the residents in the region. Four of the thirteens communities rely entirely on private wells and septic. Climate change will affect all areas of the built environment and natural resources. Energy efficiency and green building provide the opportunity to use less energy thereby protecting natural resources through less consumption. Regional collaboration to protect existing natural resources reduces the burden on individual municipalities and recognizes the important fact that natural resources are a common good void of community boundaries.

Potential Regional Projects

The potential projects are local or regional projects or studies that meet one or more of the four Regional Goals denoted in this chapter. The project ideas originated from outreach conducted to local municipalities and residents on what is needed in the region. Projects center on the preservation of natural resources and address information gaps.

The Nashua Region Environment goals are:

Goal 1: Preservation of Existing Natural Resources
Goal 2: Public Education and Outreach
Goal 3: Technical Studies and Resource Database
Goal 4: Regional Coordination

Potential Projects include:

Collaborate with the Nashua River Watershed Association to update watershed plan and file appropriate documentation to classify the Nashua River as a NH Designated River.

Description: The Nashua River flows through the heart of the City of Nashua. Currently, the River lacks a designated river designation which is managed and protected for its outstanding natural and cultural resources in accordance with RSA 483, The Rivers Management & Protection Act. The River lacks a formal watershed plan on the NH side and has an old vision plan from 1995 on the Massachusetts side. Sedimentation and waste releases are affecting the water quality which reduces recreation opportunities and impacts wildlife. Classification of the river to designated status

would allow for the identification of outstanding natural resources and establish the cultural heritage of the River.
Goals Met: Preservation of Existing Natural Resources (1), Technical Studies and Resource Database (3), Regional Coordination (4)

Coordinate with NHF&G to conduct a baseline inventory of vernal pools in the region.

Description: There is no statewide inventory of vernal pools and few community wide studies are available. Communities can begin to maps vernal pools on community owned property to establish a baseline and make educated decisions on development with baseline information.
Goals Met: Preservation of Existing Natural Resources (1), Technical Studies and Resource Database (3)

Coordinate with NHF&G to establish a plant to provide at least one modern, safe public launch on the lower Merrimack River.

Description: Look for sites that are undergoing redevelopment, such as the Nashua Renaissance Project, or other suitable areas, such as near the Veterans Memorial Bridge, where it is feasible to attract visitors that could arrive by boat. Encourage construction of amenities such as walkways and riverside docks configured to accommodate several motor boats of the type in use on the River. A ramp for kayaks and canoes should also be provided both for visitor arriving by water and for the use of the public as a launch location. Suitable reserved parking near the walkway would also need to be provided.

Facilitate baseline recycling data retrieval with New Hampshire Department Of Environmental Services and all communities in the Nashua region.

Description: Recycling data has never been aggregated on a region wide scale. Each community reports recycling data different since some communities have single stream facilities and others have multi-stream facilities. The Nashua Regional Planning Commission can begin collecting recycling data to establish baseline savings and tonnage data on a region wide scale such as with the HHW project.
Goals Met: Technical Studies and Resource Database (3), Regional Coordination (4)

Conduct regional vulnerability assessments on transportation and water infrastructure and other critical facilities.

Description: Climate change adaptation and mitigation projects have occurred on a small scale throughout the region. Climate change happens on a region wide basis. Transportation and water infrastructure are vulnerable to the impacts of climate change through increased flooding and more severe storms. A region wide vulnerability assessment of the transportation and water infrastructure can add to the climate change adaptation work that has occurred at the state level through NH DOT and New Hampshire Department Of Environmental Services.
Goals Met: Technical Studies and Resource Database (3), Regional Coordination (4)

Collaborate with communities to conduct baseline asset management inventories.

Description: Technology has greatly increased the capacity for community to track municipal assets. However, much of the water infrastructure and waste water infrastructure was installed more than 50 years ago in some parts of the region. Asset management is a vital tool to tracking operation and maintenance cost on infrastructure as well as identifying infrastructure locations. The Community of Merrimack has already started asset management and is a good case study for other communities to draw from in the region.
Goals Met: Technical Studies and Resource Database (3)

Recreation studies especially in association with diabetes and obesity prevention.

Description: There is a lack of regional recreation studies identifying recreation sites and opportunities. This is especially important as more children and adults are diagnosed with Type 2 Diabetes, obesity and asthma. The Existing Conditions section of this plan indicates that 65 percent of people are a half a mile to a mile of a park or open space. Regional coordination of recreation can help identify connecting trails, stakeholders; recreation used most often, funding for conversion of brownfield to open space and mapping greenways.
Goals Met: Preservation of Existing Natural Resources (1), Public Education and Outreach (2), Technical Studies and Resource Database (3), Regional Coordination (4)

Adopt a Trout school program with Trout Unlimited

Description: The three major rivers in the region support cold water fish habitats but require restocking every spring from NH Fish and Game. Previous efforts for restocking salmon occurred at the Florence Rideout Elementary School in Wilton. The salmon program has ended but Trout Unlimited has opportunities for restocking an education program for cold water Trout species with local schools. The process of growing and restocking fish is an excellent outreach and education campaign for protecting wildlife.
Goals Met: Preservation of Existing Natural Resources (1), Public Education and Outreach (2)

Coordinate with community Conservation Commissions to obtain and map trails and trail conditions and provide towns with community public open space maps

Description: There are hundreds of miles of unmapped trails and logging roads in the region. Conservation Commissions can play a vital role in identifying private trails, open trails and working with land owners to create a region wide trail map for residents and tourists. Many residents may not be aware of trail recreation opportunities close to home.
Goals Met: Preservation of Existing Natural Resources (1), Public Education and Outreach (2)

Create a regional wildlife advisory committee to oversee regional wildlife habitats

Description: New Hampshire Fish and Game is responsible for all wildlife in the state but planning for wildlife corridors occurs on a local level. Some wildlife in the region require large forest block for adequate population survival while others require a small but continuous habitat such as river corridors. There is a lack of wildlife habitat planning among all communities in the region which can be a detriment to wildlife moving on the landscape. Communities can coordinate efforts to plan for wildlife habitats which intersect municipal boarders to maintain the rural character necessary for some wildlife species.
Goals Met: Preservation of Existing Natural Resources (1), Public Education and Outreach (2), Regional Coordination (4)

Reinstitute Lower Merrimack River Continuity Assessment

Description: The Lower Merrimack River Continuity Assessment was a one-year project conducted by the Nashua Regional Planning Commission in 2012. The project took place in the Lower Merrimack River Corridor, a 15-mile segment of the Merrimack River beginning at the northern borders of Merrimack and Litchfield, New Hampshire, flowing south through Hudson and Nashua to the Massachusetts border.

The Nashua Regional Planning Commission began by determining culvert locations within the municipalities of Hudson, Litchfield, Merrimack, and Nashua. Next, NRPC prioritized culverts to receive field assessments based on criteria including proximity to high quality habitat, proximity to the Merrimack River, and accessibility. The Nashua Regional Planning Commission staff conducted field assessments of the prioritized culvert locations using the NH Stream Crossing Protocol. The data was then analyzed by staff at NH Geological Survey and each culvert was assigned a score ranking it from “fully compatible” to “fully incompatible.” These rankings provide guidance on the long-term ability of culverts to handle flow and sediment transport processes and their risk of failure.
Goals Met: Technical Studies and Resource Database (3), Regional Coordination (4)

Coordinate with river and lake advisory groups for nutrient loading studies

Description: During the writing of this plan, it became evident there is a significant lack of water quality and nutrient loading studies for the water bodies in the region. Nutrient loading and fertilizers use is a major source of impairments for water quality in the region. Since there are no studies, it is difficult to establish a baseline of external loading compared to internal loading on water bodies throughout the region. Education and public outreach campaigns can be targeted to various audiences such as homeowners to reduce fertilizer use and to dispose of pet waste properly.

Goals Met: Preservation of Existing Natural Resources (1), Public Education and Outreach (2), Technical Studies and Resource Database (3)

Agriculture programs with NH Farm Bureau

Description: The NH Farm to School (NHFTS) Program was established in 2003 as a pilot program to introduce local apples and cider into NH K-12 schools. Within three years, over half the K-12 schools in the state were purchasing them for their cafeterias. In addition to continuing with this successful program integrating apples and cider, the NHFTS is working to expand local food procurement. Opportunities exist throughout the region to expand the Farm to School Programs.

Another project funding opportunity is the United States Department of Agriculture (USDA), Agricultural Marketing Service (AMS) under the annual Specialty Crop Block Grant Program (SCBGP). The NHDAMF offers eligible New Hampshire organizations the opportunity to apply for a portion of these funds under the New Hampshire Specialty Crops Grant Program to conduct projects that benefit New Hampshire Specialty Crops. Specialty Crops are defined as: fruit, vegetable, nursery, floriculture, herb, maple, Christmas tree and honey crops.
Goals Met: Preservation of Existing Natural Resources (1), Public Education and Outreach (2)

Additional Potential Projects:

- Assist municipalities in establishing climate change and adaptation committees as part of their hazard mitigation teams.
- Assist NH DES in promoting the Volunteer Lakes Assessment Program in the region.
- Assist municipalities in establishing local energy committees.
- Assist municipalities with facilitation and grant writing in conjunction with the Lower Merrimack River Local Advisory Committee to build the NH Heritage Trail.
- Compile a database of technical assistance documents and funding sources for environmental projects.
- Conduct a study on recycling rates in each municipality and the associated cost savings.

- Conduct a workshop for municipal officials, building managers, and local energy committees on energy audits, including what types of audits are available and how to select an auditor.
- Conduct a workshop for planners, chambers of commerce, and local farmers on establishing farmers markets
- Conduct a workshop for planners, Local River Advisory Committees, and conservation commissions on how to take a watershed approach to planning.
- Conduct municipal policy audits to ensure regulations protect natural resources and promote best management practices
- Continue to support the Nashua Region Stormwater Coalition by hosting meetings and serving as a clearinghouse for MS4 permit resources.
- Develop a model subdivision and site plan review checklist that incorporates water recharge protection and water demand management protections.
- Develop and distribute educational materials for reduced and no-salt programs in sensitive areas.
- Develop and distribute educational materials on point and non-point sources of pollution within watersheds.
- Develop model stormwater education materials and distribute to municipalities to promote consistent messaging.
- Develop open space plans for municipalities in the region.
- Distribute education materials on sustainable development and energy conservation.
- Draft model language for incorporating agricultural considerations into site plan and subdivision regulations.
- Host workshops on environmental topics for municipal boards and state representatives.
- Identify vacant lots that could support small farming and community garden projects.
- Provide GIS support to municipalities for mapping and identification of their natural resources.

- Provide training to municipalities and school districts on how to use EPA Portfolio Manager.
- Use HAZUS (FEMA Emergency Management Tool) as a tool for developing vulnerability assessments in hazard mitigation plans.
- Utilize Nashua Regional Solid Waste Management District as an information source for recycling, composting, and other solid waste reduction programs such as pay-as-you-throw.

Performance Measures

Over time it is important to evaluate the maintenance of regional natural resources, benchmark energy consumption and efficiency, maintain or improve water quality throughout the region and conduct adaptation projects to protect against climate change. There are a number of core performance measures the region can track after implementation of this plan. Additionally, NRPC will use the metrics to ensure that progress is made in advancing the four goals outlined in the Potential Projects section.
The metrics may be applicable to multiple sections.

a. Increased total miles of distribution of water infrastructure per population served by decade
b. Number of community centers or other compact development areas served by public water systems
c. Acres of open space available and number of acres per capita
d. Acres of public recreation and park land per capita
e. Changes in In-fill development
f. Brownfield sites identified for redevelopment
g. Number of brownfields in the region per capita, with their current status
h. Impaired waters in the region
i. Reduced threats to the environment, human health, or property associated with expected climate changes
j. Baseline data on municipal energy use and building assessments
k. Increase in miles and/or percentage of streets served by bike and pedestrian infrastructure
l. Improved status of ozone and or particulate matter
m. Forest Lands
n. Population served by public water and sewer
o. Average annual house hold energy expenditures

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Table of Regional Land Use per Acre 2006

	AMHERST	BROOKLINE	HOLLIS	HUDSON	LITCHFIELD	LYNDE-BOROUGH	MASON	MERRIMACK	MILFORD	MONT VERNON	NASHUA	PELHAM	WILTON	GRAND TOTAL BY USE
Residential	10,927.9	5,568.0	8,827.8	8,667.1	4,049.0	7,567.3	5,611.2	9,518.8	6,340.1	4,995.0	8,333.6	8,590.1	6,860.1	95,855.5
Vacant	5,307.8	3,534.6	3,796.3	3,293.8	1,816.8	7,701.0	6,346.9	3,787.9	3,781.9	3,247.5	1,807.2	3,902.5	4,295.1	52,619.2
Permanent Open Space	2,939.8	2,371.1	4,587.6	1,576.3	1,177.6	2,534.1	2,395.2	2,489.0	2,335.9	2,190.2	468.8	1,757.2	2,379.7	29,202.6
Road	901.5	344.9	512.6	928.2	503.1	314.0	279.1	1,629.9	739.9	265.2	2,560.5	681.5	394.7	10,055.2
Agricultural	97.6		1,696.3	186.5	1,028.0	862.3	177.8		779.2	66.5	97.3	317.2	1,476.0	6,784.8
Industrial	89.2		135.5	1,336.5	419.3	241.4	219.1	1,524.7	482.9		1,052.0	241.4	442.3	6,184.3
Commercial	457.2	293.9	145.0	545.0	69.0	12.1	56.6	761.1	930.1	37.9	1,347.4	280.5	167.2	5,103.1
Recreation	517.3	243.2	157.5	521.9	151.1			161.9	132.5		891.8	283.9	21.8	3,082.8
Municipal Facility	173.3	65.5	55.6	247.0	82.8	29.7	177.9	250.3	175.6	65.0	885.5	67.0	75.5	2,350.7
Water	285.6	158.5	310.8	165.3	253.4	54.4		289.6	110.2	25.5	220.1	383.4	19.5	2,276.2
School	93.0	116.9	139.2	209.4	93.9	8.5	7.1	194.8	94.1	13.1	368.2	140.9	227.2	1,706.2
Institutional	68.0	0.9	10.3	240.5	39.9	1.1	1.0	213.2	31.9		409.1	377.3	19.5	1,412.7
Utility	49.1	53.8	14.1	160.8	68.9			119.9	77.6		489.7	77.1	6.7	1,117.6
Mixed Use	32.0	178.1	262.6	147.0	23.6		57.0	29.0	14.7	4.7	198.9	85.1	13.0	1,045.6
ROW	39.6	0.4	3.5	323.1	7.4	43.4	23.1	1.9	62.7	0.2	188.2	2.7	54.8	750.8
Other Government	0.9	1.1	9.3	4.8		4.4		90.7	198.0		156.2			465.4
Airport											369.2			369.2
Group Quarters	10.3			6.3				2.5	8.7	4.8	97.6		17.7	147.8
Grand Total by Community	21,989.9	12,930.7	20,663.9	18,559.4	9,783.8	19,373.9	15,351.9	21,065.0	16,296.2	10,915.4	19,941.3	17,187.9	16,470.8	220,530.2

Source(United States Department of the Interior & United States Geological Survey, 2014)

Percent Land Use by Type 2001

	AMHERST	BROOKLINE	HOLLIS	HUDSON	LITCHFIELD	LYNDE-BOROUGH	MASON	MERRIMACK	MILFORD	MONT VERNON	NASHUA	PELHAM	WILTON
Residential	49.7%	43.1%	42.7%	46.7%	41.4%	39.1%	36.6%	45.2%	38.9%	45.8%	41.8%	50.0%	41.7%
Vacant	24.1%	27.3%	18.4%	17.7%	18.6%	39.7%	41.3%	18.0%	23.2%	29.8%	9.1%	22.7%	26.1%
Permanent Open Space	13.4%	18.3%	22.2%	8.5%	12.0%	13.1%	15.6%	11.8%	14.3%	20.1%	2.4%	10.2%	14.4%
Road	4.1%	2.7%	2.5%	5.0%	5.1%	1.6%	1.8%	7.7%	4.5%	2.4%	12.8%	4.0%	2.4%
Agricultural	0.4%	0.0%	8.2%	1.0%	10.5%	4.5%	1.2%	0.0%	4.8%	0.6%	0.5%	1.8%	9.0%
Industrial	0.4%	0.0%	0.7%	7.2%	4.3%	1.2%	1.4%	7.2%	3.0%	0.0%	5.3%	1.4%	2.7%
Commercial	2.1%	2.3%	0.7%	2.9%	0.7%	0.1%	0.4%	3.6%	5.7%	0.3%	6.8%	1.6%	1.0%
Recreation	2.4%	1.9%	0.8%	2.8%	1.5%	0.0%	0.0%	0.8%	0.8%	0.0%	4.5%	1.7%	0.1%
Municipal Facility	0.8%	0.5%	0.3%	1.3%	0.8%	0.2%	1.2%	1.2%	1.1%	0.6%	4.4%	0.4%	0.5%
Water	1.3%	1.2%	1.5%	0.9%	2.6%	0.3%	0.0%	1.4%	0.7%	0.2%	1.1%	2.2%	0.1%
School	0.4%	0.9%	0.7%	1.1%	1.0%	0.0%	0.0%	0.9%	0.6%	0.1%	1.8%	0.8%	1.4%
Institutional	0.3%	0.0%	0.0%	1.3%	0.4%	0.0%	0.0%	1.0%	0.2%	0.0%	2.1%	2.2%	0.1%
Utility	0.2%	0.4%	0.1%	0.9%	0.7%	0.0%	0.0%	0.6%	0.5%	0.0%	2.5%	0.4%	0.0%
Mixed Use	0.1%	1.4%	1.3%	0.8%	0.2%	0.0%	0.4%	0.1%	0.1%	0.0%	1.0%	0.5%	0.1%
ROW	0.2%	0.0%	0.0%	1.7%	0.1%	0.2%	0.2%	0.0%	0.4%	0.0%	0.9%	0.0%	0.3%
Other Government	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	1.2%	0.0%	0.8%	0.0%	0.0%
Airport	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	0.0%	0.0%
Group Quarters	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.5%	0.0%	0.1%

Source (United States Department of the Interior & United States Geological Survey, 2014)

Closed Brownfields in the Nashua Region as of April 2014

Site Number	Site Name	Site Address	Site City
198903054	JASPER FARM	124 ROUTE 101-A	AMHERST
198611001	MERRIMACK WELL #6 & #7 VILLAGE H2O DIST	OFF MILFORD RD	MERRIMACK
199409066	POST ROAD PLAZA SITE	ROUTE 101A	MERRIMACK
199205036	FMR MILFORD POLICE DEPT	589 ELM ST	MILFORD
198404002	GRANITE STATE LEATHER (MOHAWK TANNERY)	FAIRMOUNT ST	NASHUA
199402011	TRIANGLE PACIFIC CORPORATION	25 CROWN ST	NASHUA
199503054	37 BRIDGE STREET SITE	37 BRIDGE STREET	NASHUA
199708043	FMR INTERNATIONAL PAPER BOX MACHINE CO.	315 MAIN ST	NASHUA
199902001	FORMER JOHNS MANVILLE SITE	BRIDGE STREET	NASHUA
200109030	WHITNEY SCREW	14B BROAD STREET	NASHUA
201011000	3-5 CURTIS DRIVE	3-5 CURTIS DRIVE	NASHUA

Source: (New Hampshire Department of Environmental Services, 2014c)

Active Brownfields in the Nashua Region as of April 2014

Site Number	Site Name	Site Address	Site City
198403082	MERRIMACK METALS	RT 101A	MERRIMACK
198901022	HARCROS CHEMICAL GROUP	441 DANIEL WEBSTER HWY	MERRIMACK
198403086	GRUGNALE SITE	5,7,11 JENNISON RD	MILFORD
199809050	KAMINSKI PROPERTY	BEECH HILL ROAD	MONT VERNON
198404000	FIMBEL DOOR (GRANITE ST LEATHER)	FAIRMOUNT STREET	NASHUA
198704027	HAMPSHIRE CHEMICAL CORP	2 E SPIT BROOK RD	NASHUA
198708017	BEAZER EAST (FORMER KOPPERS SITE)	HILLS FERRY ROAD, PO BOX 3485	NASHUA
198806019	FORMER LEVESQUE SECURITY OIL	22 BENNETT ST	NASHUA
198906013	HENRY HANGERS COMPANY	110 EAST HOLLIS ST	NASHUA
199007010	BROAD STREET PARKWAY	PINE ST-FAIRMONT ST-BROAD ST	NASHUA
199105038	BEEBE RUBBER CO	20 MARSHALL ST	NASHUA
199505020	FORMER NASHUA CORPORATION	21,25,30,31,33 & 36 FRONT ST	NASHUA
199507003	WHITNEY SCREW	14A BROAD ST	NASHUA
199810022	ENERGY NORTH NATURAL GAS	38 BRIDGE ST	NASHUA
200410117	88 TEMPLE STREET (FORMER ADS 231)	88 TEMPLE ST	NASHUA
201106038	17 JACKSON STREET PROPERTY	17 JACKSON STREET	NASHUA
201208113	73-75 BROAD STREET PROPERTY	73-75 BROAD STREET	NASHUA
198406042	GARABEDIAN	10 LORI LANE	PELHAM
199701019	GENDRON JUNKYARD	13 HOBBS ROAD	PELHAM
198406003	EJ ABBOTT MEMORIAL TRUST	MAIN ST.	WILTON

Source: (New Hampshire Department of Environmental Services, 2014c)

Example List of Regional Terrestrial Invasive Species

Common Name	Scientific Name	Invasive List
Amur Honeysuckle	Lonicera maackii	NH Watch List
Autumn Olive	Elaeagnus umbellate	NH Prohibited Invasive Species List
Black Locust	Robinia pseudoacacia L.	NH Watch List
Black Swallow-wort	Cynanchum nigrum	NH Prohibited Invasive Species List
Blunt-leaved privet	Ligustrum obtusifolium	NH Prohibited Invasive Species List
Blunt-leaved Privet	Ligustrum obtusifolium	NH Prohibited Invasive Species List
Burning bush	Euonymus alatus	NH Prohibited Invasive Species List
Common buckthorn	Rhamnus cathartica	NH Prohibited Invasive Species List
Common Privet	Ligustrum vulgare	NH Watch List
Dame's Rocket	Hesperis matronalis	NH Prohibited Invasive Species List
European barberry	Berberis vulgaris	NH Prohibited Invasive Species List
Garlic Mustard	Alliaria petiolata	NH Prohibited Invasive Species List
Giant Hogweed	Heracleum mantegazzianum	NH Prohibited Invasive Species List
Glossy buckthorn	Rhamnus frangula	NH Prohibited Invasive Species List
Japanese barberry	Berberis thunbergii	NH Prohibited Invasive Species List
Japanese honeysuckle	Lonicera japonica	NH Prohibited Invasive Species List
Japanese knotweed	Polygonum cuspidatum	NH Prohibited Invasive Species List
Japanese stilt grass	Microstegium vimineum	NH Watch List
Kudzu	Pueraria lobata	NH Watch List
Mile-a-Minute Vine	Polygonum perfoliatum	NH Watch List
Morrow's honeysuckle	Lonicera morrowii	NH Prohibited Invasive Species List
Multiflora rose	Rosa multiflora	NH Prohibited Invasive Species List
Norway maple	Acer platanoides	NH Prohibited Invasive Species List
Oriental Bittersweet	Celastrus orbiculatus	NH Prohibited Invasive Species List
Pale Swallow-wort	Cynanchum rossicum	NH Prohibited Invasive Species List
Perennial Pepperweed	Lepidium latifolium	NH Prohibited Invasive Species List
Russian Olive	Elaeagnus angustifolia	NH Watch List
Showy bush honeysuckle	Lonicera bella(pretty)	NH Prohibited Invasive Species List
Showy Bush Honeysuckle	Lonicera x bella	NH Prohibited Invasive Species List
Spotted Knapweed	Centaurea maculosa	NH Watch List
Tartarian honeysuckle	Lonicera tatarica	NH Prohibited Invasive Species List
Tree of Heaven	Ailanthus altissima	NH Prohibited Invasive Species List
Wand loosestrife	Lythrum virgatum	Federal Noxious Weed List
White Poplar	Populus alba	NH Watch List
Wintercreeper	Euonymus fortune	NH Watch List

Source: (Cygan, 2011; Nashua Conservation Commission, 2004)

List of Exotic Aquatic Weeds in the Nashua Region

Common Name	Scientific Name	Invasive List
Brazilian elodea	Egeria densa	Federal Noxious Weed List
Common Reed	Phragmites australis	Federal Noxious Weed List
Curly-leaf pondweed	Potamogeton crispus	Federal Noxious Weed List
European frogbit	Hydrocharis morsus-ranae	Federal Noxious Weed List
European naiad	Najas minor	Federal Noxious Weed List
European water-milfoil	Myriophyllum spicatum	Federal Noxious Weed List
Fanwort	Cabomba caroliniana	Federal Noxious Weed List
Flowering Rush	Butomous umbellate	Federal Noxious Weed List
Hydrilla	Hydrilla verticillata	Federal Noxious Weed List
Parrot's feather	Myriophyllum aquaticum	Federal Noxious Weed List
Purple loosestrife	Lythrum salicaria	Federal Noxious Weed List
Reed canary grass	Phalaris arundinacea	NH Watch List
Sweet reedgrass	Glyceria maxima	NH Watch List
Variable milfoil	Myriophyllum heterophyllum	Federal Noxious Weed List
Water chestnut	Trapa natans	Federal Noxious Weed List
Water Flag	Iris pseudacorus	NH Prohibited Invasive Species List
Winged loosestrife	Lythrum alatum Lythraceae	Federal Noxious Weed List
Yellow floating heart	Nymphoides peltata	Federal Noxious Weed List

Source: (Cygan, 2011; Nashua Conservation Commission, 2004)

Example List of Statewide Invasive Pests

Common Name	Scientific Name	Invasive List
Asian Longhorned Beetle	Anoplophora glabripennis	NH Pest Alert
Brown Marmorated Stinkbug	Halyomorpha halys	NH Pest Alert
Elongate Hemlock Scale	Fiornia externa	NH Pest Alert
Emerald Ash Borer	Agrilus planipennis	NH Pest Alert
Hemlock Wolly Adelgid	Adelges tsugae	NH Pest Alert
Red Pine Scale	Pinus resinosa	NH Pest Alert
Spotted Wing Drosophila	*Drosophila suzukii*	NH Pest Alert
White Pine Blister Rust	Cronartium ribicola	NH Pest Alert
Winter Moth	*Operophtera brumata*	NH Watch List

Source: (Cygan, 2011; New Hampshire Bugs, n.d.)

Farms in the Nashua Region

Farm/ Farmers Markets	Address	Community	Products
Amherst Farmers Market	The Village Common, Church Street	Amherst	Vegetables, fruit, cut flowers, herbs, artisan breads and baked goods, salad dressings, olive oil, coffee, raw goat milk, antibiotic/hormone free meats, organic & free range eggs, preserves, prepared meals, maple syrup, honey, plants, soaps, Heritage breed sheep/alpaca wool, agricultural crafts
Barrett Hill Farm	149 Barrett Road	Mason	HYO strawberries & blueberries, vegetables & meats, CSA
Bee Fields Farm	555 Abbot Hill Road	Wilton	Vegetable, medicinal herbs, chickens, bees and goats, CSA
Brookdale Fruit Farm	41 Broad St.	Hollis	Wholesale, retail, produce, seasonal PYO apples and berries
Butternut Farms	483 Federal Hill Road	Milford	Market farm producing vegetables, flowers, raspberries
Country Dreams Farm	855 Brookline Road	Mason	Asian greens, beans, broccoli, corn, cucumbers, eggplant, garlic, kale, peppers, onions, tomatoes
Currier Orchard	9 Pearlee Road	Merrimack	U-pick apples, peaches, vegetables, apple cider, jelly, pickles, pies
Durocher Farm	157 Charles Bancroft Highway	Litchfield	HYO blueberries and raspberries
Farmers' Market Association of Nashua	Main Street Bridge	Nashua	Vegetables, fruits, flowers, plants, baked goods
Fitch's Corner Farm	499 North River Road	Milford	Pasture-raised meat and dairy from their farm, cage-free eggs, and a wide range of produce
Fox Den Farm	1857 2nd NH Turnpike	Lyndeborough	Vegetables, cut flowers
Fulchino Vineyard and Nursery	187 Pine Hill Road	Hollis	Signature blended wines, plant, garden, tree & shrub materials
Hillside Apiaries	31 Hillside Terrace	Merrimack	PYO Raspberries & blueberries; honey and hive products
Holland Farms	269 Osgood Road	Milford	Eggs, roaster chicken, raw goat milk, goat cheese, Earthlings Granola, goat milk soap, CSA
Hungry Bear Farm	27 Fairfield Ln.,	Wilton	Vegetables, herbs and berries
Jennings Family Farm	58 Weston Hill Road	Mont Vernon	Duck eggs, chicken eggs, fresh pork and pork share
Kessler Farms	4 Sunapee Street	Nashua	Native vegetables, assorted fruits & vegetables
Kimball Fruit Farm	184 Hollis St	Hollis	Fruits, vegetables, herbs
LaBelle Winery	345 New Hampshire 101	Amherst	Award-winning winery featuring wines that reflect New England
Lamson Farm	25 Lamson Road	Mont Vernon	Working farm, house, and museum
Lavoie Farm	172 Nartoff Road	Hollis	Apples, sugar pumpkins, winter squash, potatoes and onions only
Ledge Top Farm and Frog Hollow Farm	487 Lyndeborough Road	Wilton	Retail small fruits and vegetables, CSA

Farm/ Farmers Markets	Address	Community	Products
Lilac Valley Farm	47 South Main Street	Brookline	Vegetables, eggs
Lull Farm	65 Broad Street	Hollis	Farm stand - retail
McLeod Bros. Orchards	749 North River Road	Milford	HYO apples, pumpkins, harvest subscriptions, CSA
McQuesten Farm	330 Charles Bancroft Hwy.	Litchfield	Fruits, vegetables, eggs, herbs, Christmas trees
Milford Farmers Market	Elm St. at the Granite Community Plaza/Tractor Supply parking lot	Milford	Local produce, fruit, flowers, wine, meat, eggs, baked goods
Miracle Acres Farm	523 Mason Road	Milford	Christmas tree, maple syrup and honey
Noel's Tree Farm	21 Charles Bancroft Hwy	Litchfield	Christmas trees
Nomadic Farms	108 Gage Road	Wilton	Growing herbs, vegetables and flowers, CSA
Paradise Farm	468 Center Road	Lyndeborough	Grass fed beef, eggs, raw honey, PYO apples, cider, views
Ponemah Farms	42 New Hampshire 101A	Amherst	Local produce in-season, fruits, berries, corn
Smith Farm	3 Gibson Rd.	Hudson	Farm stand & greenhouses, bedding & vegetable plants
Steve Normanton Grass Fed Beef	226 Charles Bancroft Hwy	Litchfield	Pastured chickens, eggs, pastured pork, 100% grass-fed beef, and certified organic vegetables
Temple-Wilton Community Farm	195 Isaac Frye Hwy	Wilton	Vegetables, herbs, CSA
Trombly Farms	150 North River Road	Milford	PYO strawberries, vegetables, sweet corn, pork & beef, eggs, CSA
Wilson Farm	144 Charles Bancroft Hwy.	Litchfield	Agriculture - farm stand

HYO: Harvest Your Own

PYO: Pick Your Own

CSA: Community Supported Agriculture

Source (New Hampshire Department of Agriculture, 2013)

Operating Solid Waste Facilities in Nashua Region

FACILITY_TYPE	NAME	FACILITY_ADDRESS_1	FACILITY_CITY	OWNER_TYPE	STORAGE_CAPACITY	THROUGHPUT_CAPACITY
C/S/T	AMHERST TRANSFER STATION	260 RTE 101	AMHERST	PUBLIC	100 TONS	25 TONS PER DAY
C/S/T	BROOKLINE TRANSFER STATION	38 NORTH MASON RD	BROOKLINE	PUBLIC	20 TONS	<10 TONS/DAY
C/S/T	HOLLIS TRANSFER STATION	10 ROCKY POND RD	HOLLIS	PUBLIC	45 TONS	28 TONS
C/S/T	HOLLIS STUMP DUMP	275 DEPOT RD	HOLLIS	PUBLIC	420 TONS	30 TONS PER DAY
C/S/T	LITCHFIELD RECYCLING CENTER	ONE INCINERATOR AVE	LITCHFIELD	PUBLIC	84 TONS	10TPD
C/S/T	MERRIMACK TRANSFER STATION & RECYCLING FACILITY	1 FEARON RD	MERRIMACK	PUBLIC	600 TONS	
C/S/T	MAJESTIC MOTORS, INC	734R DANIEL WEBSTER HIGHWAY	MERRIMACK			
C/S/T	MILFORD TRANSFER STATION & RECYCLING FACILITY	76 NORTH RIVER RD	MILFORD	PUBLIC		
C/S/T	H2O WASTE DISPOSAL SERVICES LLC	5 JENNISON RD	MILFORD	PRIVATE	30 CYDS/ 40 TONS RECYCLEABLES	30 TONS PER DAY
C/S/T	MONT VERNON TRANSFER STATION	WESTON HILL RD	MONT VERNON	PUBLIC	35 TONS	15 TONS PER DAY
LINED LANDFILL	NASHUA FOUR HILLS LANDFILL EXPANSION	840 WEST HOLLIS ST	NASHUA	PUBLIC		
C/S/T	NASHUA TRANSFER STATION	840 W HOLLIS ST	NASHUA			
C/S/T	SCRAP METALS INC	128 EAST GLENWOOD AVE	NASHUA	PRIVATE	600 TONS	30 TONS /DAY
C/S/T	NASHUA HHW/SMALL QUANTITY GENERATOR WASTE COLLECTION FACILITY	6 RIVERSIDE ST	NASHUA			
C/S/T	PELHAM TRANSFER STATION & RECYCLING CENTER	74 NEWCOMB FIELD PARKWAY	PELHAM	PUBLIC	260 TONS	28 TONS
C/S/T	WILTON RECYCLING CENTER	291 GIBBONS HWY	WILTON	PUBLIC	200 TONS	17.5 TONS/DAY

Source (New Hampshire Department of Environmental Services, 2014c)

Ozone

Site ID	City	County	Date	Max 8-Hr Ozone (PPB)
33-011-1010	Nashua	Hillsborough	6/10/2000	90
33-011-1010	Nashua	Hillsborough	6/16/2000	78
33-011-1010	Nashua	Hillsborough	5/2/2001	80
33-011-1010	Nashua	Hillsborough	5/3/2001	76
33-011-1010	Nashua	Hillsborough	5/4/2001	76
33-011-1010	Nashua	Hillsborough	6/13/2001	90
33-011-1010	Nashua	Hillsborough	6/14/2001	88
33-011-1010	Nashua	Hillsborough	6/19/2001	110
33-011-1010	Nashua	Hillsborough	6/20/2001	92
33-011-1010	Nashua	Hillsborough	7/22/2001	80
33-011-1010	Nashua	Hillsborough	7/23/2001	91
33-011-1010	Nashua	Hillsborough	7/24/2001	91
33-011-1010	Nashua	Hillsborough	8/9/2001	83
33-011-1010	Nashua	Hillsborough	8/16/2001	78
33-011-1010	Nashua	Hillsborough	9/8/2001	85
33-011-1010	Nashua	Hillsborough	6/21/2002	84
33-011-1010	Nashua	Hillsborough	6/26/2002	94
33-011-1010	Nashua	Hillsborough	7/13/2002	76
33-011-1010	Nashua	Hillsborough	7/14/2002	76
33-011-1010	Nashua	Hillsborough	7/22/2002	88
33-011-1010	Nashua	Hillsborough	8/11/2002	81
33-011-1010	Nashua	Hillsborough	8/12/2002	109
33-011-1010	Nashua	Hillsborough	8/13/2002	110
33-011-1010	Nashua	Hillsborough	8/14/2002	98
33-011-1010	Nashua	Hillsborough	8/15/2002	78
33-011-1010	Nashua	Hillsborough	8/18/2002	82
33-011-1010	Nashua	Hillsborough	8/22/2002	77

Site ID	City	County	Date	Max 8-Hr Ozone (PPB)
33-011-1010	Nashua	Hillsborough	9/9/2002	76
33-011-1010	Nashua	Hillsborough	9/10/2002	77
33-011-1010	Nashua	Hillsborough	9/14/2002	84
33-011-1010	Nashua	Hillsborough	6/26/2003	82
33-011-1010	Nashua	Hillsborough	6/27/2003	79
33-011-1010	Nashua	Hillsborough	6/29/2003	85
33-011-1010	Nashua	Hillsborough	7/3/2003	76
33-011-1010	Nashua	Hillsborough	7/30/2003	78
33-011-1011	Nashua	Hillsborough	7/18/2004	76
33-011-1011	Nashua	Hillsborough	4/20/2005	81
33-011-1011	Nashua	Hillsborough	6/24/2005	76
33-011-1011	Nashua	Hillsborough	6/25/2005	83
33-011-1011	Nashua	Hillsborough	6/27/2005	96
33-011-1011	Nashua	Hillsborough	7/26/2005	82
33-011-1011	Nashua	Hillsborough	7/27/2005	81
33-011-1011	Nashua	Hillsborough	8/4/2005	77
33-011-1011	Nashua	Hillsborough	9/14/2005	84
33-011-1011	Nashua	Hillsborough	6/19/2006	84
33-011-1011	Nashua	Hillsborough	4/23/2007	84
33-011-1011	Nashua	Hillsborough	5/25/2007	90
33-011-1011	Nashua	Hillsborough	6/8/2007	81
33-011-1011	Nashua	Hillsborough	6/19/2007	78
33-011-1011	Nashua	Hillsborough	6/25/2007	78
33-011-1011	Nashua	Hillsborough	8/3/2007	80
33-011-1011	Nashua	Hillsborough	8/30/2007	76
33-011-1011	Nashua	Hillsborough	9/7/2007	81
33-011-1011	Nashua	Hillsborough	7/28/2010	81
33-011-1011	Nashua	Hillsborough	9/2/2010	78
33-011-1011	Nashua	Hillsborough	7/21/2011	90

Site ID	City	County	Date	Max 8-Hr Ozone (PPB)
33-011-1011	Nashua	Hillsborough	7/17/2012	85
33-011-1011	Nashua	Hillsborough	7/23/2012	78

Source (New Hampshire Department of Environmental Services, 2014c)

Particulate Matter

Site ID	City	County	Date	24-Hr PM2.5 (ug/m3)	Data Collection Method
33-011-1010	Nashua	Hillsborough	7/7/2002	69	Periodic 24-Hour Sampler
33-011-1010	Nashua	Hillsborough	6/26/2003	37	Periodic 24-Hour Sampler
33-011-1010	Nashua	Hillsborough	8/22/2003	37	Periodic 24-Hour Sampler
33-011-1010	Nashua	Hillsborough	7/23/2004	44	Periodic 24-Hour Sampler
33-011-1015	Nashua	Hillsborough	6/19/2006	40	Periodic 24-Hour Sampler
33-011-1015	Nashua	Hillsborough	12/23/2007	36	Periodic 24-Hour Sampler

Source (New Hampshire Department of Environmental Services, 2014c)

Inventory of Point Sources

ID	FACILITY	ADDRESS	COMMUNITY	STREAM
0022365-SD	CHOMERICS, INC. (W.R. GRACE COMPANY)		Hudson	Merrimack River
NH0023469	Brox Industries - Hudson		Hudson	
0001163	CHEMFAB CORPORATION		Litchfield	
0020524	Fletcher Granite Company, Inc.	Starch Mill Road	Mason	Spaulding Brook via trib.
0000817	New England Chemical	n/a	Merrimack	Souhegan River
0020486-SD	Jones Chemical, Inc.	40 Railroad Ave.	Merrimack	Merrimack River
0000027-SD	Anheuser-Busch, Inc.	n/a	Merrimack	Merrimack River
0100161	Merrimack Wastewater Treatment Facility	36 Mast Road	Merrimack	Merrimack River
G250023-SD	NASHUA CORPORATION		Merrimack	Merrimack River
NHG250392	Chemfab/Saint Gobain Performance Plastics	Daniel Webster highway	Merrimack	Merrimack River
NHG250376	Nashua Corporation, SCP Division	59 Daniel Webster Highway	Merrimack	Merrimack River
NHG250465	Jones Chemical, Inc.		Merrimack	Merrimack River
0100471	Milford Wastewater Treatment Facility	Nashua Street	Milford	Souhegan River
0001376	Hitchiner Manufacturing Co., Inc.		Milford	Souhegan River via trib.
0022900-SD	Gulf Station	n/a	Milford	n/a
0110001-001	Fish Hatchery - Milford	408 North River Road	Milford	Purgatory Brook
0022390-SD	Astron, Inc.	85 Northeastern Boulevard	Nashua	Harris Brook via S.D.
0021873	Turnpike Shell Service Station		Nashua	Salmon Brook via trib.
G250198	INGERSOLL-RAND (IMPCO DIV.)		Nashua	Salmon Brook
0000639-001	Fish Hatchery - Nashua National		Nashua	Nashua River
G250040	Norcross Footwear, Inc.		Nashua	Nashua Canal
G250253-005	Sanders Associates, Inc.	95 Canal Street	Nashua	Nashua River
G250253-003	Sanders Associates, Inc.	95 Canal Street	Nashua	Nashua River
G250253-001	Sanders Associates, Inc.	95 Canal Street	Nashua	Nashua River
0100170-CSO3	Nashua WWTP	Sawmill Rd.	Nashua	Merrimack River
0100170-001	Nashua WWTP	Sawmill Rd.	Nashua	Merrimack River
0100170-CSO2	Nashua WWTP	Sawmill Rd.	Nashua	Merrimack River
0021920-SD	Sanmina Corporation		Nashua	Nashua Canal

ID	FACILITY	ADDRESS	COMMUNITY	STREAM
0021393-002	NASHUA CORPORATION		Nashua	Nashua River
0021393-004	NASHUA CORPORATION		Nashua	Nashua River
0021393-001	NASHUA CORPORATION		Nashua	Nashua River
0021393-003	NASHUA CORPORATION		Nashua	Nashua River
0000591	Hampshire Chemical Corporation	Spit Brook Road	Nashua	Merrimack River/Spit Bk.
0022551-007	Sanders, A Lockheed Martin Co.		Nashua	Merrimack River
0022551-001	Sanders, A Lockheed Martin Co.		Nashua	Merrimack River
0022551-005	Sanders, A Lockheed Martin Co.		Nashua	Merrimack River
0022551-006	Sanders, A Lockheed Martin Co.		Nashua	Merrimack River
0022551-003	Sanders, A Lockheed Martin Co.		Nashua	Merrimack River
0022551-002	Sanders, A Lockheed Martin Co.		Nashua	Merrimack River
0022551-008	Sanders, A Lockheed Martin Co.		Nashua	Merrimack River
0022551-009	Sanders, A Lockheed Martin Co.		Nashua	Merrimack River
0022551-004	Sanders, A Lockheed Martin Co.		Nashua	Merrimack River
0022829-SD	Southland 7-11 Store #19555	266 Main Dunstable Road	Nashua	Hale Brook via S.D.
0100170-CSO8	Nashua WWTP	Sawmill Rd.	Nashua	Merrimack River
0100170-CSO7	Nashua WWTP	Sawmill Rd.	Nashua	Merrimack River
0100170-CSO12	Nashua WWTP	Sawmill Rd.	Nashua	Merrimack River
0100170-CSO9	Nashua WWTP	Sawmill Rd.	Nashua	Merrimack River
0100170-CSO6	Nashua WWTP	Sawmill Rd.	Nashua	Merrimack River
0100170-CSO5	Nashua WWTP	Sawmill Rd.	Nashua	Merrimack River
0100170-CSO4	Nashua WWTP	Sawmill Rd.	Nashua	Merrimack River
NHG250490	BAE Systems Information and Electronic Systems	95 Canal Street	Nashua	Nashua River
NHG250490	BAE Systems Information and Electronic Systems	95 Canal Street	Nashua	Nashua River
0022403	Getty Service Station-Pelham	Bridge Street, Route 38	Pelham	Beaver Brook
0000451	Souhegan Wood Products, Inc.		Wilton	Souhegan River

Source ***(New Hampshire Department of Environmental Services, 2014c)***