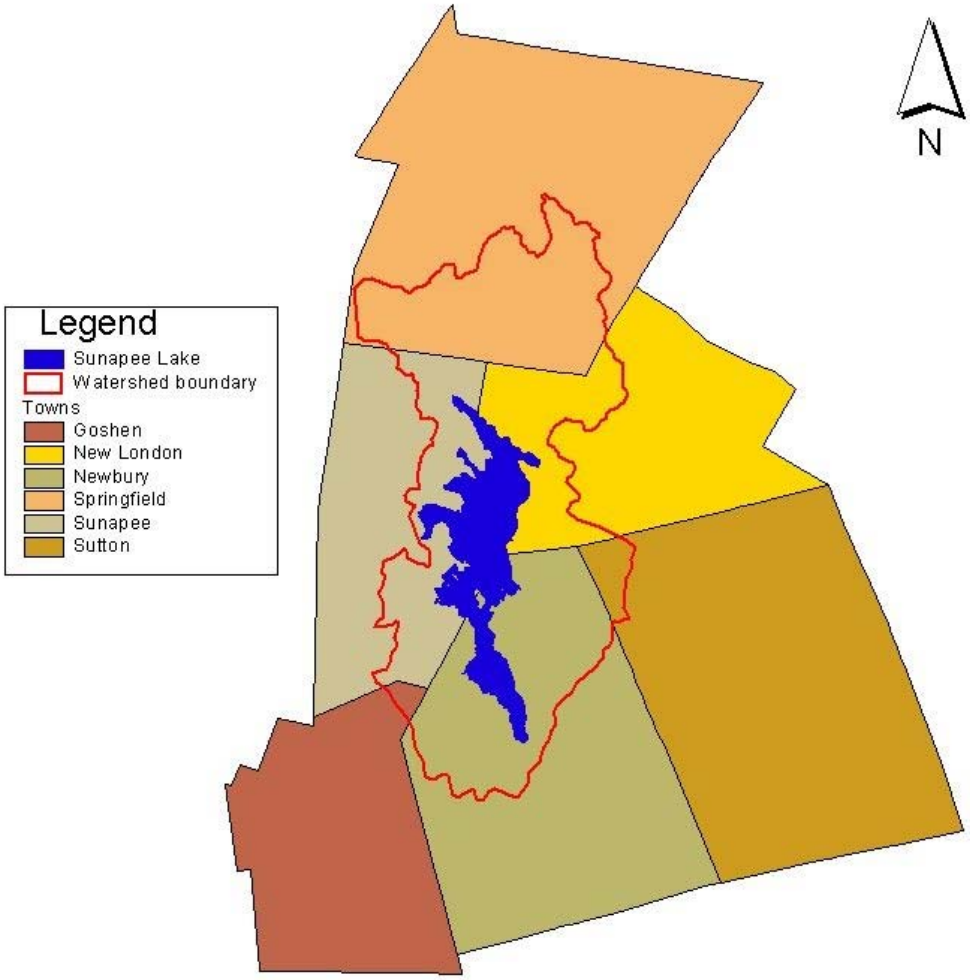
WATERSHED INVESTIGATION

To gain a more complete and advanced understanding of the Lake Sunapee Watershed, our class conducted a watershed investigation. To cover the six towns of the watershed, our class broke into small groups ranging from 3-4 students. Each group focused on one of the six towns of the watershed which allowed students to gain a much richer and more in-depth knowledge of a specific area. The towns studied include:

The investigation focused on the following aspects of the towns of the watershed:

- How many acres of the town are located within the watershed?
- What is the population of the town, both inside the watershed and the entire town?
- How developed is the land? What had been the rate of development? What is the potential for further development?
- What are the zoning regulations in the town?
- Are there conserved lands within the watershed in your town? Provide details of size, location, and any other interesting facts about the land.
- Are there wetlands within the town? Where? Evaluate these like we did in class.
- What are the plant communities are present in the watershed in your town? Are there special habitats? Invasive species? Rare or threatened species?
- Based on the plant communities/habitats found in area, what animal or bird species do you predict inhabit the land? Any evidence to verify this?
- Rank the tributary streams in watershed and describe land use around these significant tributaries.
- Are there potential or actual surface or groundwater contamination sites?
- What are the recreational uses of land within the watershed? Are these helpful or harmful to the watershed and waterbody?
- Are there scenic viewing opportunities of Lake Sunapee? Where are these and what is the noise level in these places?

Lake Sunapee Watershed Towns



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Lake Sunapee Watershed Investigation

Goshen, New Hampshire

Prepared by:
Paul Barrile, Tamsen Bolte and Matthew Cummings

Community and Environmental Studies
Colby-Sawyer College
Fall 2003

Town History

Goshen was first settled in 1768 as part of Saville, now Sunapee. The town was incorporated in 1791, with portions of territory from Newbury, Lempster, Unity, Newport, and Sunapee. It was named Goshen because many residents had relatives in Goshen, Connecticut, and had served in a Revolutionary regiment with soldiers from that same town.

Acreage

Total Area: 14,420 acres
Watershed Area: 266 acres
Percentage in Watershed: 1.8%

Population

Total Population: 741
Watershed Population: 3
Percentage in Watershed: 0.4%

Town Development

Population Growth
- 1990-2000: remained virtually unchanged

Population Density
- 2002: 33.5 persons/mi^2

Housing Development
- 2001: 400 housing units
  - Single-Family Units: 351 w/ 6 building permits issued
  - Multi-Family Units: 14 w/ 0 building permits issued
  - Manufactured Housing Units: 35

The 2000 US Census for Goshen is one less than the 1990 US Census count, making a decrease of 0.1% in population change. This steady population has enabled the town to remain rural. Recently, however, the town has been concerned with a potential influx of growth as a result of proposals to develop condominiums in conjunction with the expansion of Mount Sunapee. Adding such housing complexes will provoke challenges and changes, such as water and energy supply, municipal capacities, and economic stability. As historically a small community, the slightest increase in growth will be felt throughout the community. The potential for growth within the town is high as a result of the large parcels of undeveloped land, which could be potentially subdivided into smaller lots. However the reality of such divisions is minimal due to the nature of the land and the uses that exist. An additional factor that will assist in preserving the rural setting of Goshen, is the value of the land and the economic status of the town. Resident of Goshen have, for the most part, deep roots into the community.

Their families have been established in the area for a long time, and not too many outsiders are seeing this town as a high demand area to permanently to live.

In reference to the state of the land within the watershed, the land remains largely undeveloped. The potential for growth in this small area is very low. Only hosting 1.8% of the town's land, about half of that has been dedicated to Mount Sunapee State Park, which is under a conservation easement.

Zoning and Planning Regulations

Refer to the 'Goshen Zoning' document for specific Ordinances that have been excerpted from the original Zoning Ordinance for this investigation. These ordinances have been excerpted as a result of their relevance to the health of the environment within the watershed, and to the health of the lake itself.

The Town of Goshen has established land use regulations that coincide with the values and interest of the community members. This town is unique in that they are a part of a major watershed, yet do not have any lakefront property, and only a small percentage of the town is actually in the watershed. As a result of the town's geographical situation there are no specific ordinances that apply directly to the presence of Lake Sunapee. A major impact that could be a concern in relation to the lake system could be erosion from development. However this could be minimized as a result of the prohibited developing on steep slopes, which are present in the watershed. The other advantageous situation is that a large portion of this land has been placed under a conservation easement, only allotted to the recreational activity of skiing. Goshen's regulations are in compliance with state regulations and have been adequate in keeping the rural atmosphere of the town. Future concerns about the town's regulations might come into play when developing proposals and plans for new condominium complexes, although they will not necessarily exist in the watershed.

Conserved Lands

Conserved lands are an important aspect of a town's character. Land with restricted development can assist in preserving the quality of life for the town's residents and wildlife. Not only is the amount of conserved lands within a town important, but also the size of these parcels. In relation to the town's rate of development, conserved lands will reduce the amount of land that could potentially become developed. Within the watershed, the presence of conserved lands plays an important role in reducing the lake's vulnerability to impairment.

Within the small part of Goshen that is in the watershed, there is a large section of land that falls under the boundary of Mount Sunapee State Park. This area, 143.159 acres, makes up about 54% of Goshen's watershed district. A map of Goshen's conserved lands can be viewed in Appendix B. What this means is that the majority of Goshen will be remain undeveloped for a while, allowing wildlife

to continue to utilize the area and keeping most of the land that has an affect on the lake stable. Even if all of the potential developable land is developed, most of Goshen will remain conserved helping to maintain that status of the lake as it is now. To extend the area of land that is conserved, individual property owners should be encouraged to place their property under conservation easements. Keeping this land undeveloped with assist in preserving the scenic character of the entire watershed.

Area in Watershed	Conserved Land
265.542 acres	143.159 acres

Wetlands

Wetlands are defined as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" by the New Hampshire Wetlands Bureau and the Army Corps of Engineers (Stone 29). Wetlands are an ecological asset to the environment and provide a variety of functions important to both people and wildlife. The function of a wetland extends beyond the physical quality into the chemical and biological functions of the environment. Some of these functions include: flood control, wildlife and fish habitat, pollutant removal, aesthetic and recreational, wood products, groundwater, and erosion control. The value of these attributes cannot be compromised with development and degradation of the surrounding environment. In acknowledgement of the importance of wetlands, national, state and local regulations protecting these ecosystems have been institutionalized.

There are no existing wetlands in Goshen that are in the boundaries of the Lake Sunapee Watershed.

Unfragmented Lands

The presence, abundance, and size of unfragmented lands within an area is an important foundation for understanding the value of the land in relation to wildlife habitat. Unfragmented lands are "undeveloped sections of the landscape with few or no roads" (Stone 28). To illustrate where these tracts of unfragmented lands exist within a town, roads along with a 500 foot buffer are set as the limiting factor in defining the boundary of these lands. Roads present wildlife as a source of mortality and a human defined boundary for territory. The size of the unfragmented land will predict what kind and how diverse the wildlife will be in the area. In order to properly present the parcels of unfragmented land within the watershed, the graphics were extended beyond the boundaries of both the town and the watershed. This was done to display how unfragmented lands do not conform to human-made political boundaries, as opposed to man-made physical boundaries, such as roads. Another reason for portraying the extended boundary

is to display how towns need to look beyond their own boundary. What they do inside their boundaries may influence what happens outside in other towns.

The presence and size of unfragmented land within the Goshen watershed reflects the limited development in this area. Goshen's involvement with the watershed is small, yet as a result of these parcels extremely important. Being a host to these large unfragmented tracts of land allows Goshen to be vital hosting habitat for wildlife.

Wildlife

The presence of wildlife is an indicator used to help define the condition of an area. Species diversity is usually a signal of the health of the habitat; high diversity implying a good healthy, stable ecosystem and a low diversity implying a degrading habitat. Ecologists have studied the roles of species within a habitat and have developed patterns of relationships between the quality of the habitat and the abundance and diversity of species. Through these relations, indicator species have been marked as species that have populations that fluctuate based on the health of the inhabited system. One of the greatest factors in decreasing wildlife diversity is human development and sprawl. Development has caused for fragmentation to occur in critical habitats that host species with specific needs. Just like people, each species has its own individual needs for survival and reproduction. These demands are in the form of suitable habitat, adequate food supplies, sufficient home ranges, and access to a diversified genetic pool. If a habitat cannot meet these needs, populations will inevitably suffer as a consequence. The smaller the parcel of unfragmented land is, the less diversified the local wildlife population becomes. The opposite effect is true as the lot size increase, the species diversity intensifies. In order to ensure future and more detrimental challenges are not brought on against wildlife it is necessary to understand what critical habitat is left and how to protect these habitats. Unfragmented lands symbolize areas where wildlife can exist under reasonable conditions, as they once did before human development. These environments will always have the presence of human disturbance, however limiting future disturbance is necessary to keep intact the value that these habitats bring to life. "Protection of wildlife habitat is one of a variety of values that depend on larger areas of open space and undeveloped land" (Patterns of Development Task Force).

Although Goshen has a small area in the watershed, this area provides an excellent source of habitat for many wildlife species. This is a result of the highly undeveloped land here. The following page has a preliminary list of the wildlife species that could exist within the unfragmented parcels.

Raccoon	Woodchuck	Turkey
Small rodents	Garter Snake	Wood Frog
Cottontail	Weasel	Osprey
Squirrel	Mink	Coyote
Muskrat	Deer	Bobcat
Red Fox	Sharp-shined Hawk	Black Bear
Songbirds	Cooper's Hawk	Fisher
Skunk	Harrier	Moose
Reptiles	Broad-winged hawl	Bald eagle
Amphibians	Kestrel	Goshawk
Hare	Horned Owl	Raven
Porcupine	Barred Owl	
beaver	Turkey Vulture	

Tributary Streams

Tributary streams are the small drainage ditches and small streams that are the origin of larger streams and rivers. They are very important to the water quality of Lake Sunapee because they all eventually wind up directing water into the lake. Consequently these tributary streams play a vital role in the health of the lake. By understanding how these streams are connected to the entire system, it can be easier to understand the importance of being aware of potential contamination. By degrading the land adjacent and/or uphill from these streams, the water can become contaminated with chemicals and sediment.

Goshen is on the outskirts of the watershed and the stream that is present within the watershed boundary is a first order tributary stream. The land use around this stream consists of rural residential development and agricultural uses. This stream is probably not at a high risk for contamination as a result of the large amount of undeveloped land that surrounds it.

Surface and Ground Water Contamination Sites

Potential surface and ground water contamination sites are important to locate within a watershed. Knowing where these places are located and what types of risks they pose to the environment will enable for precautionary measures to be taken to avoid any accidents.

There were no surface or groundwater contamination sites found in Goshen's part of the Lake Sunapee Watershed according to the 'potential contamination site data' produced by NH DES.

Recreational Use

The recreational uses of the land in the watershed are pretty uniform throughout. Activities such as hunting, fishing, camping, hiking, and canoeing do not really have negative impacts on the land or water bodies. However other activities such as snowmobiling, four-wheeling, and power boating can add contaminants to the land, air, and water. Since Goshen is not on the water, water activities do not apply to this town, yet residents may participate in these activities on Lake Sunapee. Goshen is probably more vulnerable to recreational uses such as snowmobiling, four-wheeling, hiking, and hunting. Snowmobiles and four-wheelers release exhaust into the air and/or onto the snow. This can then seep into the ground into the groundwater, or be carried with the snow melt into the tributary streams and into the lake. The noise from these machines can disturb wildlife native to the area causing them to flee from the area. Although recreational machines are fun, they pose some problems that need to be watched so that they do not destroy in the name of enjoyment. Lower impact uses, such as hiking and hunting can be beneficial in preserving the land. As people enjoy the area as a result of the naturalness, they will discourage the development of the area.

Scenic Viewing Opportunities

Lake Sunapee cannot be seen from any point in Goshen. This may cause residents to feel “out of sight out of mind”. This is because they cannot see the lake, which could possibly make the residents to feel detached from the lake and feel their actions do not affect the lake. When in actuality the town of Goshen plays an important part in the make up of the quality of the lake. Since part of Goshen and a tributary stream is in the watershed, the need to understand what they do has an affect that can place a sense of being in touch with the watershed, more then being able to see it.

Sources

"Granit". Complex Systems Research Center. University of New Hampshire. 3 Dec. 2003 <http://granit.sr.unh.edu/>.

"New Hampshire Demographics". Economic and Labor Market Information Bureau, New Hampshire Employment Security. 6 June 2003. 3 Dec. 2003. <http://www.nhes.state.nh.us/elmi/htmlprofiles/pdfs/goshen.pdf>.

Stone, Amanda J. Lindley. Natural Resources Inventories: A Guide for New Hampshire Communities and Conservation Groups. UNH Cooperative Extension. 2001.

Wetland Field Study Worksheets for Wetland Functions Evaluation. NH DES. "A Response to Sprawl: Designing Communities to Protect Wildlife Habitat and Accommodate Development". Patterns of Development Task Force Maine Environmental Priorities Project. July 1997.

Zoning and Planning Regulations

District: Residential and/or Agricultural

Business is prohibited in this district. This district will include all areas of the town not otherwise defined as another district. (Section III.A.1)

District: Tourist Related District

All activities allowed in a Residential-Agricultural District shall be allowed in a this district. All entrances and exits for tourist related activities shall be to Brook Road. (Section III.A.2)

District: Light Commercial District

All activities allowed in Tourist Related and Residential-Agricultural districts shall be allowed to be in this district. (Section III.A.3)

There shall only be one building allowed for residential purposes on a lot except when a special exception has been granted. In addition to the other standards, the lot involved must be of sufficient size that has the overall density of one building per three acres. (Section III.B.3)

Three apartments or units for permanent or temporary residents shall be the maximum allowed for any one building except when a special exception has been granted. The lot must not exceed three residential units per three acres. (Section III.B.4)

No building permits will be granted to build residential buildings on land designated on official town soils and elevation maps as having a slope of 15%-25%, or greater (Section III.B.5 and 6)

Town of Goshen
Zoning and Planning Regulations
(in respect to the area within the Lake Sunapee Watershed)

Section I. Adoption
1.01 Preamble: In pursuance of authority conferred by Chapter 31:60-89 and amendments, and for the purpose of promoting the health, safety, morals, prosperity, convenience or general welfare, as well as efficiency and economy in the process of development, of the inhabitants of the incorporated Town of Goshen by securing safety from fire, panic, and other dangers, providing adequate areas between buildings and various rights-of-way, by preserving the rural charm now attached to our town, the promotion of good civic design and arrangement, wise and efficient expenditure of public funds, and the adequate provision of public utilities and other public requirements and by other means in accordance with a comprehensive plan.

Section III. Districting
A.1 There shall be a district of Residential or Agricultural use only. Business is prohibited in this district except as hereinafter provided. This will include all areas of the town not otherwise defined as another district.

B.1 No building shall be erected in Goshen without a valid building permit issued by the town official or employee designated by the Board of Selectmen.

B.3 There shall only be one building allowed for residential purposes on a lot except when a special exception has been granted by the Zoning Board of Adjustment; provided, however, that in order to grant such a special exception, the board must find, in addition to the other standards in this ordinance, that the lot involved is of sufficient size that the overall density on the lot does not exceed one residential building per three acres.

B.5 No building permits will be granted to build residential buildings on land designated on official town soils and elevation maps as having a slope of 25%, or greater.

B.6 No building permits will be granted to build residential buildings on land designated on official town soils and elevation maps as having a slope of 15%-25% except by special exception granted by the Zoning Board of Adjustment following presentation of satisfactory evidence that septic, erosion, and access factors will be adequately addressed.

C. Lots shall be at least three acres in size, providing however, that in proposals to subdivide land, one lot of less than two acres may be created.

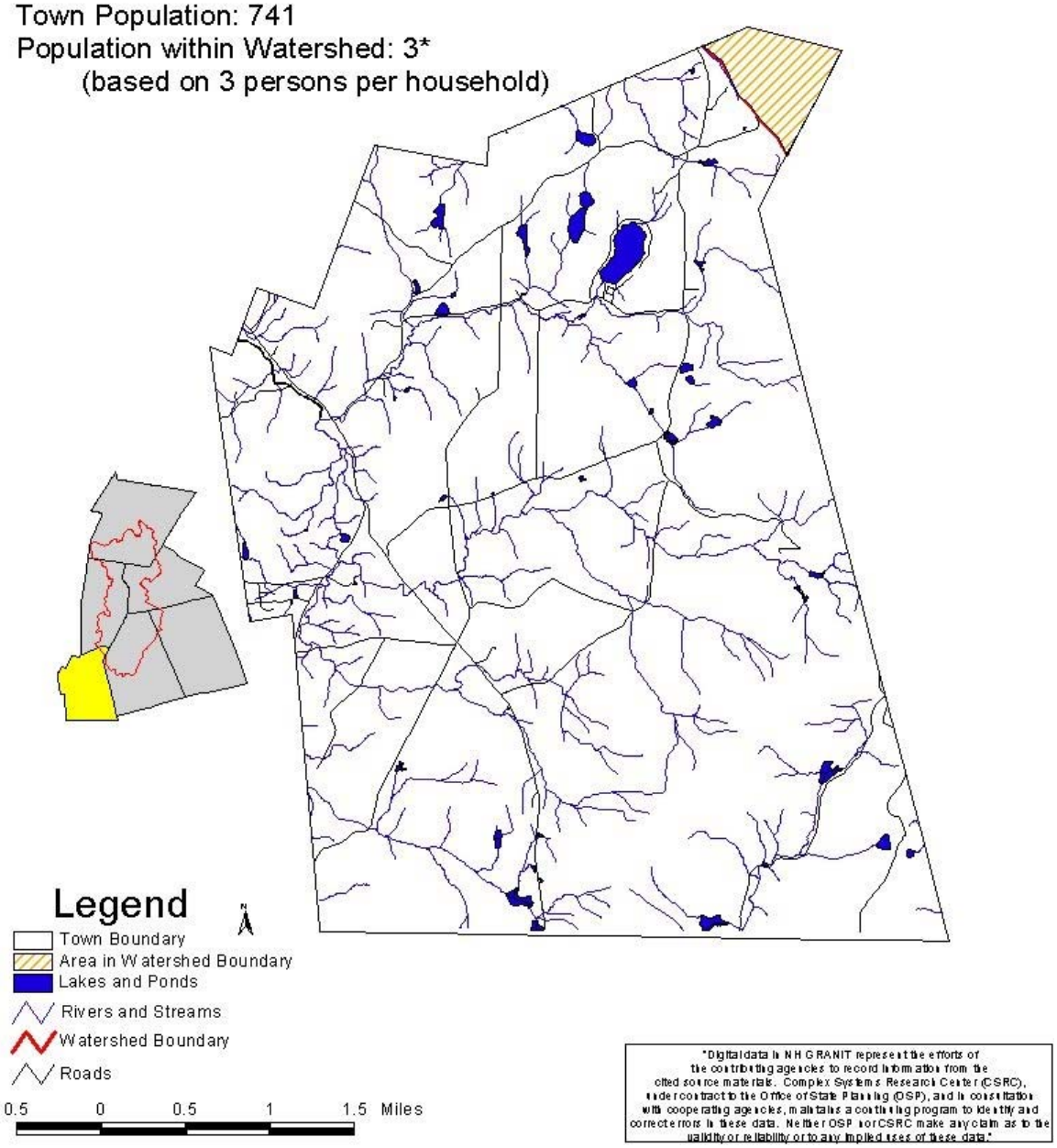
Ordinances Voted at Town Meeting
A. No tar-mix, asphalt or gravel crushing plant shall be set up within the borders of the Town of Goshen, nor shall any hazardous wastes be deposited within the borders of the Town of Goshen. (March 12, 1968)

Source: Town of Goshen Zoning Ordinance: Adopted in 1970 and Building Ordinance: Adopted in 1968

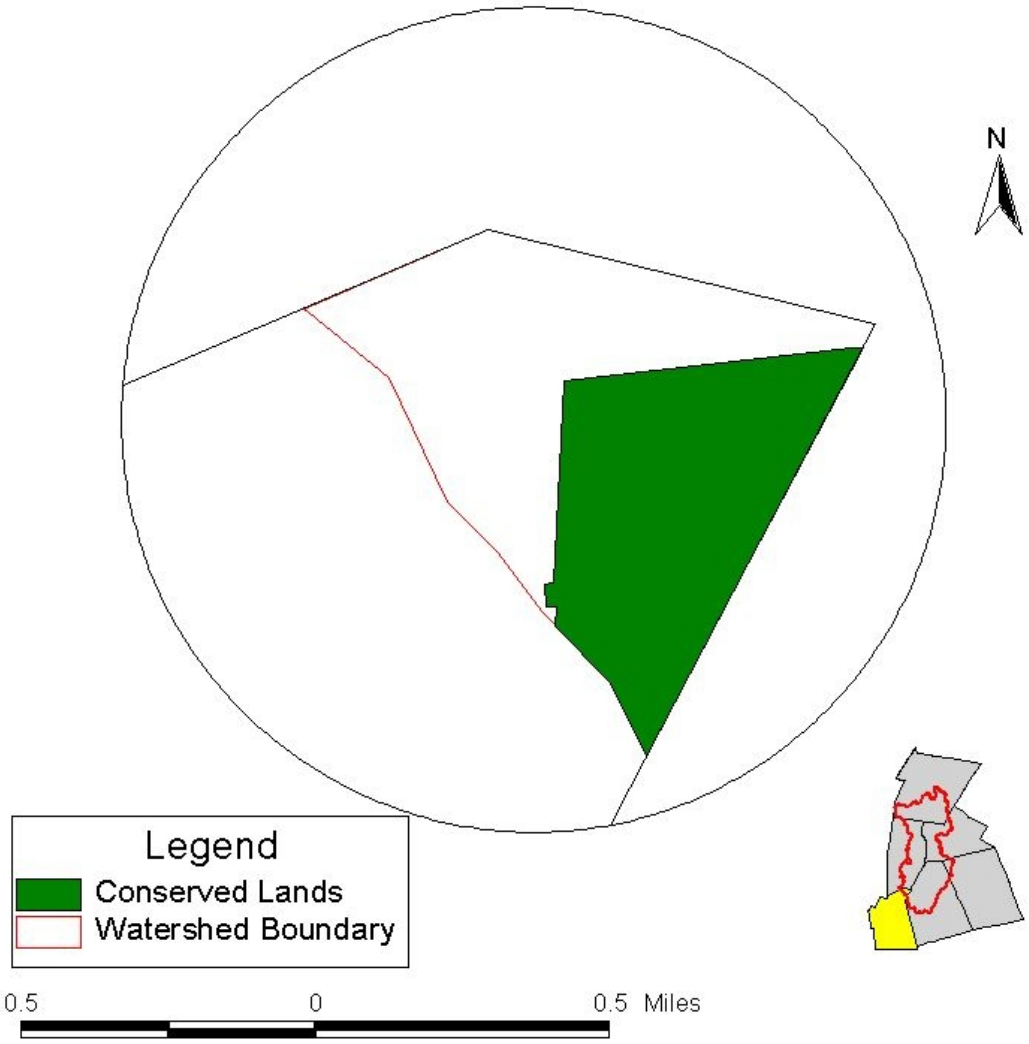
Town of Goshen

Area: 14,420 acres
Area within Watershed: 266 acres

Town Population: 741
Population within Watershed: 3*
(based on 3 persons per household)



Goshen Conserved lands



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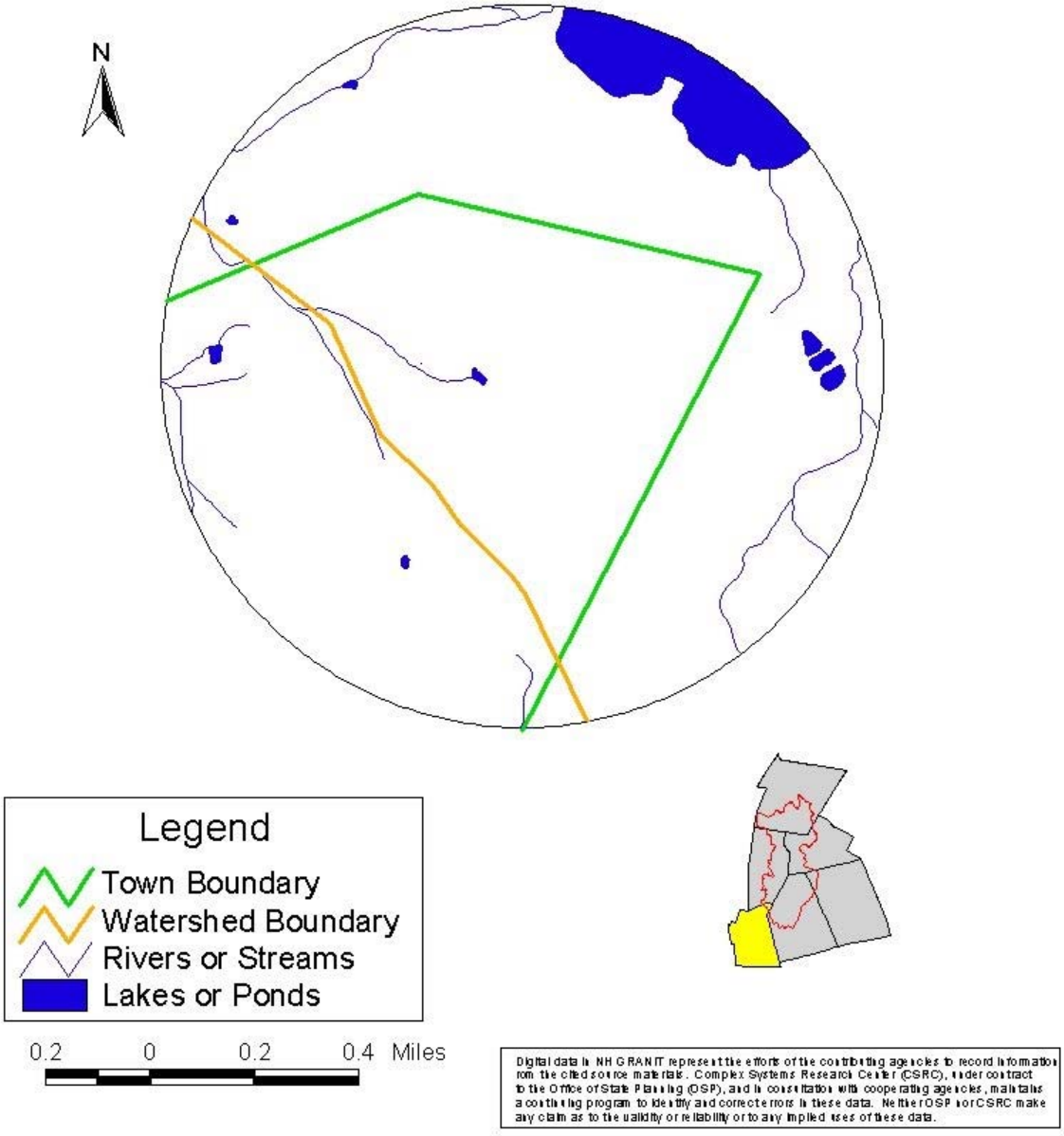
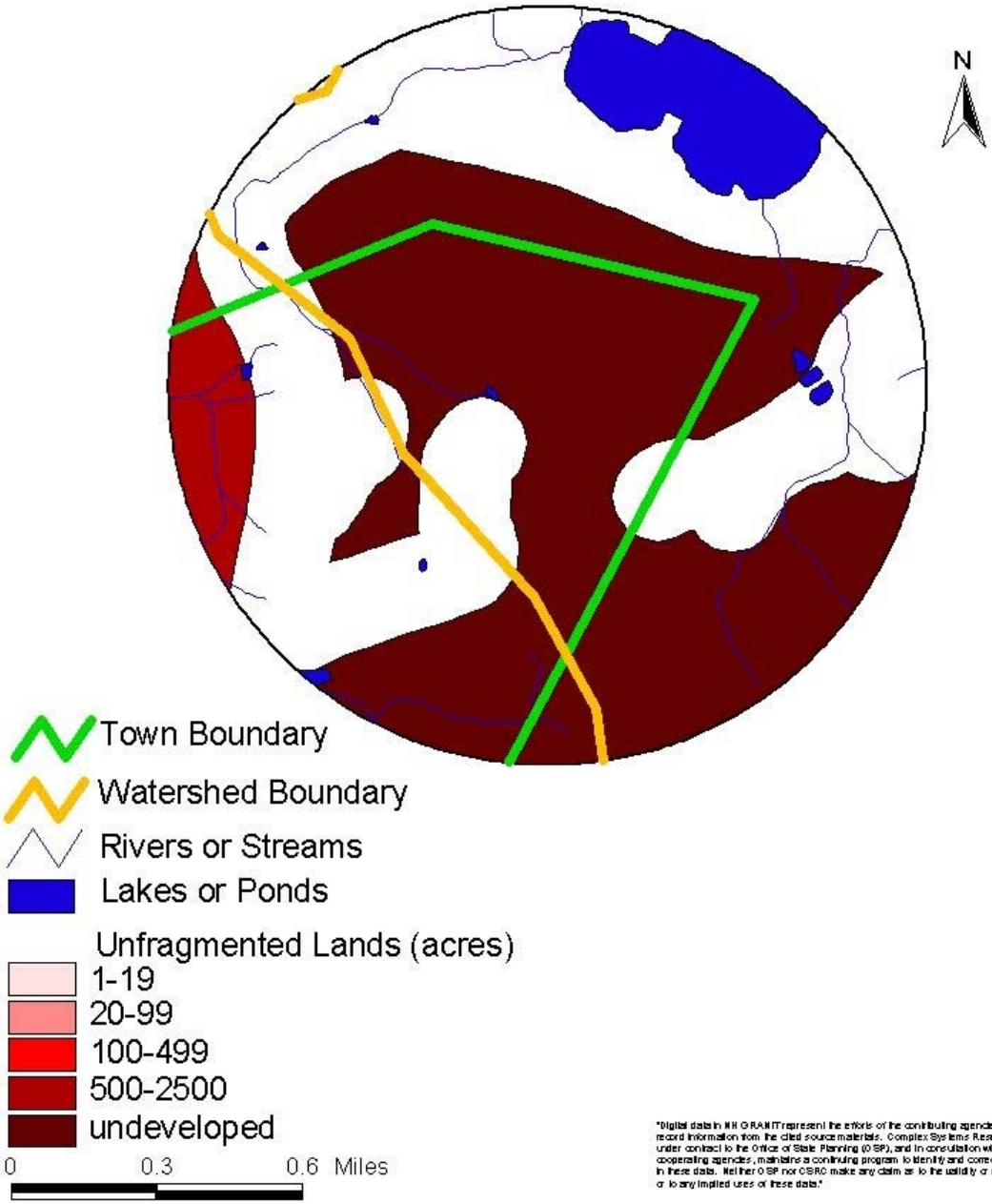
Town of Goshen Tributary Streams



Town of Goshen Unfragmented Lands



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Lake Sunapee Watershed Investigation

Newbury, New Hampshire

Jenni Beaulieu, Beau Etter-Garrette and Sarah Young

Community and Environmental Studies
Colby-Sawyer College
Fall 2003

1. **How many acres does your town represent in the watershed?**

The town of Newbury, New Hampshire represents approximately 9,433 acres in the Lake Sunapee watershed. This is the largest watershed compared to the other five towns within the Lake Sunapee watershed. This means that the activities that occur in Newbury can have a great cumulative effect on the lake and its watershed. With so much land in the watershed, Newbury must take on more responsibilities than a town that may not be within a watershed. Certain ordinances and regulations must be made to protect the area from destruction and development that could pollute the water, which is a major drinking water resource.

GRANIT. (2002). The New Hampshire Geographically Referenced Analysis and Information Transfer System. *Metadata Database*. http://www.granit.sr.unh.edu (5 Nov. 2003).

2. **What is the population in your town and in the watershed?**

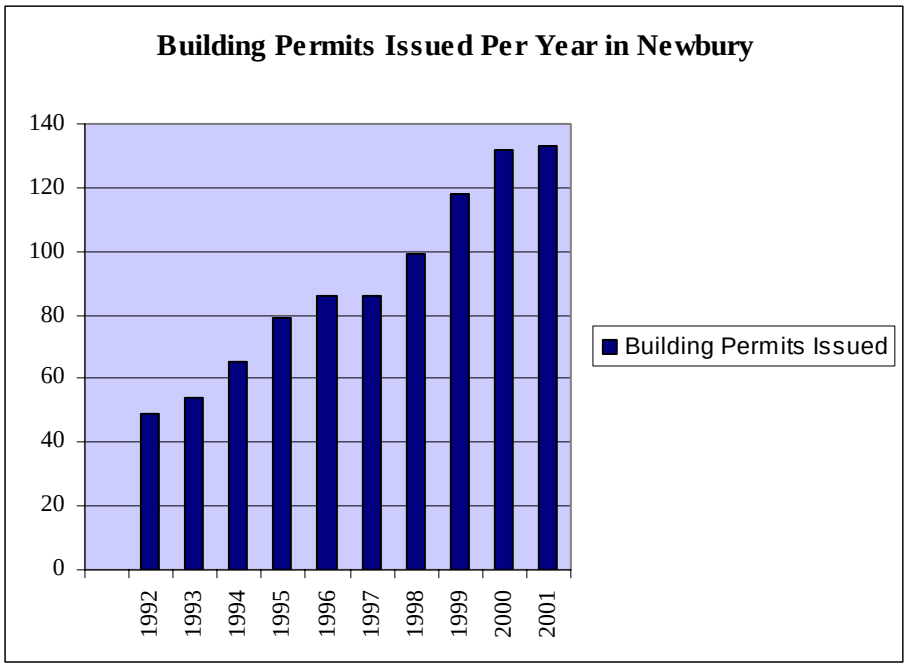
Looking at the topographical map of Newbury we counted the number of homes (little black dots) both inside and outside the watershed. We found 69 homes outside the watershed and 680 inside the boundary of the watershed. According to the Economic and Labor Market Information Bureau, the average amount of residents per household is 2.5. Using this information we calculated the population outside the watershed and our results found 173 people. This we know is fairly accurate because the housed are clearly marked and distinguishable between one another; whereas those within the watershed are clustered and difficult to count. We found the population to be 1,743 by referred to the 2001 population estimates also from the Economic and Labor Market Information Bureau. We subtracted 173 people who live outside the watershed from the total population and found that approximately 1,670 people live within the watershed. This can be attributed to the attraction of lakeside housing. Since there is a concentration near the lake, perhaps some action could be taken to keep the rest of Newbury undeveloped.

"Newbury, NH." NH Employment Security Economic and Labor Market Information Bureau. 04 Dec. 2003 http://www.nhes.state.nh.us/elmi/htmlprofiles/pdfs/newbury.pdf

3. **How developed is the land? What has been the rate of development? What is the potential for development?**

To gather an educated estimate of the rate of development within Newbury's watershed we collected building permit data and analyzed the possible developable land via steep slopes, conserved lands, and zoning regulations. Taking into consideration the zoning and developable land in the watershed helps to accurately assume the amount of building permits actually issued within the watershed; rather than the entire town.

The following chart shows the building permits issued in the town of Newbury from 1992 through 2001.



Total	901
Percent Increase	63%

By reviewing the building permits over a ten-year period, it is obvious that the issuance of building permits each year has increased. These permits are a good way to estimate the rate of development in the entire town of Newbury. In order to delineate how much of this development might have occurred within the watershed we must there are roughly 3,500 acres of potentially developable land in Newbury.

Newbury, New Hampshire. Town Selectmen. The Town of Newbury, New Hampshire 2002 Annual Report. Newbury: Newbury Town Offices, 2002.

New Hampshire. UPPER Valley Lake Sunapee Regional Planning Commission. Lake Sunapee Watershed Study. Lebanon: U.V.L.S.R.P.C., 1995.

4. **What are the zoning and planning regulations in your town?**

"The purpose of the Zoning Ordinance is to promote the health, safety, and general welfare of the inhabitants of the Town of Newbury, New Hampshire; to enhance and preserve the value and natural beauty of our lakes, ponds, and natural environment; to conserve the value of buildings and encourage the most appropriate use of land; and to carry out the purposes defined in the Overall Vision of the Newbury Master Plan. It is the intent of the ordinance to allow individual landowners as great a degree of freedom in the use and enjoyment of their land as is consistent with the accomplishment of these purposes." (Town of

Newbury Zoning Ordnance Purpose, see Appendix II for complete zoning ordinance)

5. **Are there conserved lands within the watershed in your town?**

There is substantial amount of conserved land within Newbury's watershed. These are directly linked to the large parcels of un-fragmented land that provides excellent habitat for a wide range of animal and plant species. The conserved lands in the watershed provide wonderful learning experiences for young people as well as adults.

- Mount Sunapee State Park (6,675 acres) is used for a ski resort and also hosts the largest tract of old growth forest south of the White Mountains in New Hampshire. Included in the state park is Sunapee State Beach, mainly utilized by swimmers, picnickers and boaters. This is managed by the Division of Parks and Recreation and owned by the state of New Hampshire.
- The Fells/John Hay National Wildlife Refuge (165 acres) is a non-profit organization that offers educational programs in history, horticulture and the environment. Over 600 members of The Fells, including 150 active volunteers, support the on-going restoration of the historic gardens and buildings large undeveloped tract of land across the street from the estate. The Fells is managed by the Friends of the Fells and owned by the U.S. Fish and Wildlife Service.
- Society for the Protection of New Hampshire Forests (SPNHF) owns the large parcel (729 acres) of land across the street from the Fells. There is interpretive trail through out this land that allows the public to access the unique opportunities available.
- Stoneybrook Wildlife Sanctuary (212 acres) became conserved land when the private landowners decided they wanted to protect the land and wildlife in the area. They offered a large donation to the Audubon Society to help purchase the land from a logging company. The land includes a large marsh/shrub swamp and woodland area. It is now managed and owned by the Audubon Society.

Trail Guide: Stoney Brook Wildlife Sanctuary Newbury, New Hampshire. Concord: The Audubon Society of New Hampshire, date unknown.

6. **Are there wetlands in your town within the watershed? Evaluate them.**
   Using the Wetland Field Study Worksheets for Wetland Functions Evaluation, we visited the two major wetlands in Newbury within the watershed and evaluated them, are results are as follows:
   Bay Point Road Wetland
   - **How natural is the wetland?**
     i. Bay Point wetland is rated high for how natural it is because there is no evidence that people have interfered with it. Rather than being inundated by urban and industrial development, this wetland consists mostly of forest and shrub habitats. There is a possibility of sediment washing into the wetland from a cleared parcel of land near by that is going to be used for a residential development; however, the proximity of this development to the wetland does not take away from its natural qualities.
   - **How vulnerable is the wetland?**
     i. This wetland is highly forested, which means it is able to hold soil in place and reduces erosion, and it does not depend on a dam that fails over time. It received a medium rating for vulnerability because it has strong qualities such as its independence and forestry; however, it is not protected by town ordinances or regulations, which makes it an attractive place for development.

     ii. Bay Point receives a medium rating for wildlife habitat because it is not large enough to sustain a variety of species and there are no natural travel corridors to other wetlands. On the other hand, it is ranked highly natural and the surrounding uplands over another natural wildlife habitat.
   - **Educational Value**
     i. There is virtually no educational value offered by this wetland because it is difficult and unsafe to travel to and throughout, it offers no parking, and the area is on private land.
   - **Appearance and Scenery**
     i. The appearance of this wetland would be high if it were not located in such a remote area. There is no litter or unpleasant visual scenes and there are no buildings within sight of the wetland, but the thick forest, the lack of open water and the Route 103 traffic noise makes the rating of the appearance and scenery fairly low.
   - **Recreational Value**
     i. There is no recreational value to this wetland because it is too difficult to get to and there is no open water or safe trails to utilize.
   - **Stormwater Storage**
     i. Wetland size = 11.8 acres
     Watershed size = 113.2 acres
     Width of wetland outlet = 1.5 feet

The stormwater storage for the Bay Point wetland is rather high because the size of the watershed is fairly large in relation to the size of the wetland. This means there is a greater storage potential than a smaller watershed could offer. The size of the outlet also affects the stormwater storage capacity. The size of this outlet is small, only 1.5 feet, which means it will release water slower; therefore, this generally means greater stormwater storage potential.

- **Groundwater Relations**
  i. This wetland received a high rating for groundwater relations because it is upstream from Lake Sunapee, a major drinking water resource, which means it acts as a water filter for that resource.
- **Pollution Control**
  i. This wetland has moderate pollution control. There is a degree of pollution in the watershed from Route 103B runoff, and the stormwater storage is high, which means that the wetland is able to filter large amounts of polluted water from reaching Lake Sunapee.
- **Uniqueness**
  i. There is no uniqueness to this wetland because it is not exceptionally large, it is not unusual for the region, and it does not provide any habitat for rare plants or animals.

Stoneybrook Wetland

- **How natural is the wetland?**
  i. Stoneybrook wetland is rated high for how natural it is because there are no signs of current pollution or water quality problems and it is a healthy forest and shrub habitat. There are signs of select trees that have been cut in the past to make an old road, but there are no current indications of deforestation or human interference.
- **How vulnerable is the wetland?**
  i. This wetland is highly forested, which means it is able to hold soil in place and reduces erosion, and it does not depend on a dam that fails over time. It received a medium rating for vulnerability because it has strong qualities such as its independence and forestry; however, it is not protected by town ordinances or regulations, which makes it an attractive place for development.
- **Wildlife Habitat**
  i. Stoneybrook wetland is received a high rating for wildlife habitat because it is very large and is able to sustain a variety of species. There are no natural corridors to other wetlands but it is located within a large parcel of un-fragmented land. This wetlands habitat consists mostly of shrubs and emergent plants, but it also offers

open water. These characteristics will support a variety of species such as bear, moose, deer, woodpeckers, and chickadees.

- **Educational Value**
  i. This has plenty educational value because it is a sanctuary managed by the Audubon Society who welcomes visitors to the area. It is close to schools that may visit regularly, there is parking available and the area is safe due to the trails that lead around it.
- **Appearance and Scenery**
  i. Stoneybrook wetland receives a medium rating for appearance and scenery because it is quiet and there is no litter, but there are no viewing opportunities of the area; therefore, the pleasant appearance and scenery offered cannot be fully enjoyed to its greatest potential.
- **Recreational Value**
  i. This wetland is ranked low for recreational value because it only offers the option to hike half way around the wetland. Since there is not a large enough area of open water to use a canoe on and it is too difficult to get to the location of open water to utilize.
- **Stormwater Storage**
  i. Wetland size = 97
     Watershed size = 690 acres
     Width of wetland outlet = 18 feet
     The stormwater storage for the Stoneybrook wetland is rather high because the size of the watershed is fairly large in relation to the size of the wetland. This means there is a greater storage potential than a smaller watershed could offer. The size of the outlet also affects the stormwater storage capacity. The size of this is small, 18 feet, in relation to the size of the watershed, which means water flows out slowly; therefore, this generally means higher stormwater storage potential.
- **Groundwater Relations**
  ii. This wetland received a high rating for groundwater relations because it is upstream from Lake Sunapee, a major drinking water resource, which means it acts as a water filter for that resource.
- **Pollution Control**
  i. This wetland has high pollution control. Due to the large size of this wetland, it is able to hold and filter more water that may potentially contain pollutants. This wetland is able to filter large amounts of polluted water from reaching Lake Sunapee, which is important because this is a major drinking water resource.
- **Uniqueness**
  i. The size of this wetland is a very unique feature; however it is the only unique characteristic of the wetland. It does not provide

any habitat for rare plants or animals and it is not unusual for the local region.

New Hampshire Department of Environmental Services. "Wetland Field Study Worksheets for Wetland Functions Evaluation." Handout, 2003.

Trail Guide: Stoney Brook Wildlife Sanctuary Newbury, New Hampshire. Concord: The Audubon Society of New Hampshire, date unknown.

7. Are there any special habitats? Invasive species? (see attached map)

A special habitat within Newbury's watershed is an old growth forest located on the eastern side of Mount Sunapee State Park. The old growth forest is very important because it is so rare; it is the only known old growth forest known in New Hampshire, south of the White Mountains. Old growth forests are important because they consist of unique plant species that are otherwise not found in any other types of forests. Most old growth forests have been deforested because people were unaware of their importance and rarity and the wood provided by these old trees has great monetary value.

By driving around and getting to know the watershed of Newbury, we looked for two major invasive species, Japanese Knotweed *(Polygionum cuspidatum)* and Burning Bush *(Euonymus alatus)*. We observed only six locations with Japanese Knotweed *(Polygionum cuspidatum)*, and zero locations with Burning Bush *(Euonymus alatus)*. It is important to note the location of these species because they out compete the native species. These locations should be identified so that they are kept under control and monitored to prevent further invasion.

The fact that no Burning Bush *(Euonymus alatus)* was found within Newbury's watershed indicates that this invasive species is being controlled. For such a commonly used landscaping plant it is quite impressive that, there are no noticeable species in any of the yards within the watershed. Since there are six locations found with Japanese Knotweed *(Polygionum cuspidatum)*, this shows that there is a potential problem for future spread in the Newbury watershed. Currently four out of the six locations are within Blodgett's Landing. This can be interpreted positively because this illustrates that it has not spread far, but the invasion is actually centrally located around that residential development. The cluster of invasion makes for easier removal and control of the species within the watershed. There are simple ways to prevent the spread, such as the common herbicide "Round Up," but there is no town wide elimination program. Future studies will find more efficient ways to control the spread of invasive species such as these, but as of now we must use what we have and educate others to prevent future infestations.

8. What animal and bird species do you predict inhabit or utilize the un-fragmented land? Did you find any evidence that verifies the presence of any of these species? (see attached map)

The town of Newbury within the watershed has a substantial amount of un-fragmented land parcels. The Mount Sunapee State Park and surrounding conserved lands make up an area of 5,659 acres. Other large areas include the John Hay National Wildlife Refuge and the land to the east of it. Just to the northeast across Chalk Pond lies the Stoneybrook Wildlife sanctuary, which also lies inside a huge area of undeveloped land. These areas are protected and this will ensure that these parcels of un-fragmented lands remain large and undeveloped for a long period of time. Also within the un-fragmented land that the Stoneybrook Wildlife Sanctuary is in, lie two other adjacent parcels of protected land.

The largest parcel of un-fragmented land provides excellent habitat for a diverse amount of species. Some large animals that require this amount of undeveloped land include: coyote, bobcat, black bear, and fisher cats. It is important that this area remain protected to provide a habitat for these species because there are no other areas this large within the watershed of Newbury. The other slightly smaller, but equally important, areas of un-fragmented land represent a majority of the land within the watershed. Land areas of this size also consist of a diversity of animal's species, but these animals are smaller than those found in the larger tract of land. Such animals include: moose, bald eagles, goshawks and red-tailed hawks.

Evidence of animal species found in Newbury's watershed includes:

Scat/tracks of white-tailed deer

Tracks of a wild turkey

Tracks of a snowshoe hare

Tracks of a cottontail

Bear scratches on a Beech *(Fagus grandifolia)* tree

A  goshawk sighting

Myers, Philip. "Kingdom Animalia." The Animal Diversity Web University of Michigan Museum of Zoology. 03 Dec. 2003 <http://animaldiversity.ummz.umich.edu/>

9. Rank the tributary streams in your watershed and describe the land use around significant tributaries.

Using the Strahler Method of stream ranking we counted how many first, second, and third, order streams are within the watershed. There are 80 first order streams, 17 second order streams, and 3 third order streams. A third order stream is important because it made up of multiple lower order streams, hence the pollution concentrations of these third order brooks needs to be noted. Johnson Brook, a second order stream, flows from Mt. Sunapee State Park and meets up with Chandler Brook just outside of the state beach. This brook crosses Route 103, which is a heavily traveled highway, and there could be runoff from road maintenance. So anything that might be in the runoff would be concentrated near the beach and swimmers. Blodgett Brook is also a third order brook and it is located near Blodgett's Landing. Baker Hill Golf Course is located within the Blodgett Brook watershed and was a point of concern when runoff from the construction made its way down to the brook arousing alarm within the Blodgett Landing community. These brooks are significant to the ecology in the watershed because of their third order ranking and it is important to note that there is major residential development located by all the third order brooks. The significance of this is that the traffic and development can contribute pollutants to these third order streams which make there way into the lake that is used as a drinking water source for many communities.

10. Are there potential or actual surface or groundwater contamination sites in your watershed area?

Identifying potential or actual surface or groundwater contamination sites within a watershed is important because once we identify these sources we can work towards prevention and control. All of the areas in our watershed are potential groundwater contamination sites. It is important to note that there are no actual surface or groundwater contamination sites. Using the GIS data layer for contamination sites, which was compiled by the Department of Environmental Services (DES), we identified the following types that are found in the Newbury watershed;

- Underground Storage Tanks/ Aboveground Storage Tanks:

Both buried and aboveground storage tanks raise increasing environmental, safety, legal and economic concerns. Underground storage tanks still have the potential of leaking and may be difficult to fix because they are underground. Also a tank that is buried could go on leaking for a long period of time before a problem is noticed. Some underground tanks that can be found around the watershed in Newbury include Jake's Market in Newbury harbor, two at Trans Medic Transmission located just south of the harbor, two at Mount Sunapee Resort, and one at the Citgo gas station that is just west of the mountain.

There is one above ground tank at Jake's Market which might be prone to external damage such as a car crash or some other event that might cause the tank to leak. The market is located relatively close to the lake be in the event of a spill from this aboveground tank I feel that there would be a quick response and no pollutants would reach the lake.

- Hazardous Wastes:

According to Genencor International, Inc. hazardous waste is "a subset of solid wastes that pose potential threats to public health or the environment and meet any of the following criteria: - is specifically listed as a hazardous waste by EPA; exhibits one or more of the characteristics of hazardous wastes (ignitability, corrosiveness, reactivity, and/or toxicity); is generated by the treatment of hazardous waste; or is contained in a hazardous waste." There are four places in our watershed that are listed on GIS as hazardous waste sites; Bobs Beacon Marina, Mount Sunapee Resort, Rainbow Garage, and Trans Medic Transmission.

- Groundwater Hazards:

There are several different types of groundwater hazards located in the watershed in Newbury. These include leaking underground storage tanks, leaking residential of commercial heating oil tanks, and spray irrigation. The leaking tank sites are not actually leaking pollutants into the ground now, they are sites that have had problems in the past and have been corrected. DES keeps records of these sites for any future development that might go on at

these sites so that testing can be done to ensure that the ground water is safe. This is done in most cases for the construction of private wells.

The spray irrigation hazard is at the Mount Sunapee Resort water treatment facility. This could involve the process that they use to treat water for snowmaking or possibly for the water that runs off the mountain before it goes back to Lake Sunapee.

- Vehicle Service Repair Shops:

The vehicle service and repair shops include Trans Medic Transmission and Newbury Safety Services. Shops like these process all the types of fluids that go into your vehicle from motor oil to transmission fluid. When an oil change is done on a car there is the old motor oil that needs to be processed and this is where there could be a potential contamination problem. If garage is irresponsible with their disposal techniques these pollutants could potentially get into the groundwater and eventually make its way to the lake.

- Non-point/Point Potential Pollution:

There are four locations under this title in our watershed. All are either mines, or sand and gravel storage sites. Runoff from these sites may have the possibility of contain heavy metals that would be toxic to species living in the lake.

"Genencor Glossary." Genencor International, Inc. 05 Dec. 2003
http://www.genencor.com/wt/gcor/glossary

Institute of Physics and IOP Publishing Limited 2003.
<http://www.iop.org/EJ/abstract/0031-9120/36/4/302>

11. What are the recreational uses of the land in your watershed? Are they helpful or harmful to Lake Sunapee? How?

- skiing
- swimming
- kayaking
- canoeing
- fishing
- hiking
- mountain biking
- picnicking
- summer chairlift rides
- camping
- sea plane landing
- snowmobiling
- boat tours
- waterskiing
- cross-country skiing
- ice fishing
- snowshoeing
- hunting

Water Sports – two-stroke vs. four stroke engines
Hiking – John Hay Forest Ecology Trail (pamphlet), SPNHF trails (across from the Fells)
Mount Sunapee State Park – skiing and camping
State Beach – swimming
Monadnock Sunapee Greenway Trail

"Wildernet, Your Guide to Outdoor Recreation." Interactive Outdoor. 04 Nov. 2003. <http://areas.wildernet.com/pages/statepark.cfm?areaID=NHSPMS>

12. Where are there scenic viewing opportunities of Lake Sunapee? What is the noise level in those places?

1. High Meadows Road: this is located on the eastern boundaries of the watershed on a mountain summit, this is also known as "the 360°." The noise level at this scenic viewing opportunity is very little because it is a steep, dead end, dirt, road with minimal residential development.
2. Mountain Sunapee State Park: This is located on the southwestern boundaries of the watershed; it is also the ski area. The noise level of this viewing opportunity depends on the season. During the winter season the noise level is increased because of the amount of people using the slopes and the chairlifts. During the summer season the noise level is lower because there are less people attracted to the slopes, but there are summer chairlift rides and the occasional hiker. Overall, the noise level is comfortable because automobiles are rarely heard from this location.
3. Scenic Driving: Route 103 A and B provides excellent viewing opportunities of the lake. The noise level is hard to measure because it depends on where people stop to look out at the lake, but overall the noise level is disturbing because it *is* a road with other vehicles driving past and it is not a secluded road by any means.
4. Eagles Nest: This is a small hiking trail, roughly a half mile walk from the Newbury Harbor, off Route 103. It is a popular trail because it offers a clear

view of Lake Sunapee. The noise level of this area is fairly high because the trail does not lead deep into the forest; therefore, Route 103 traffic can be heard at the furthest point of the trail.

5. Sunapee State Beach: This is located off Route 103; it offers an excellent view of Lake Sunapee since the beach is on the lake. The noise level is rather high here because it is a popular location for hosting recreational activities such as swimming, picnicking, and boating. The road also adds to the noise level because of the traffic on the major road, which is regularly used throughout the year.

Lake Sunapee Watershed Investigation:

New London, New Hampshire

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Community and Environmental Studies
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Fall 2003

Town History

The Town of New London, NH was first named in 1753, as Heidelberg, in honor of George II's visit to his German possessions at the time. The town was then named again in 1777 as Alexandria Addition, but that name didn't last long. Two years later, New Londonderry was incorporated, which was eventually shortened to New London that same year. The first town meeting was held on August 3, 1779.

Acreage

Total Area: 16,268 acres
Watershed Area: 5,310 acres
Percentage in Watershed: 32.6 %

Population

Total Population: 4,116
Watershed Population: 2,035
Percentage in Watershed: 49.4%

New London's population is based on the 2000 United States Census. A population trend line for the entire town from 1920 to 2000 can be viewed in Appendix A, which displays historical growth of New London. The population within the Lake Sunapee Watershed Boundary cannot be received as a definite number, as the entire population can be. This number is an estimate based on several factors. Estimation of the population within the watershed within the Town of New London involves a combination of conditions and variables. With the use of a pre-existing GIS map, produced by the Town of New London, that defines the zoning districts, individual property boundaries, and placement of structures, predictions of the number of housing units within the watershed could be made. Then by incorporating this number, which totaled to be 783 parcels, each assumed to host one housing unit, with the average family size of New London, which is 2.6 persons combined to make the watershed population. Multiplying these factors produced the rough estimate of 2,035. There is one main variable which can influence this estimate greatly; the presence of seasonal residents. According to the New London Zoning Administrator, Peter Stanley, about one out every three homes that lies immediately along the lake can be classified as a seasonal home. With this variable added into the equation, the estimated population within the watershed is actually lower than estimated.

Town Development

Population Growth
1990-2000: increased 29.4% (about 93 people/year over 10 years)
Population Density
2002: 189.3 persons/mi^2
Housing Development
2001: 2,124 housing units
Single-Family Units: 1,854 w/ 15 new permits issued
Multi-Family Units: 270 w/ 0 new permits issued

Build-Out Analysis

The purpose of a Build-Out is to predict the future development rates under current land use regulations. The outcomes of such a study are important for towns to understand. Build-Outs provide towns with evidence to either to allow for the predicted expansion, or declination, or to make changes to accommodate the town's needs, what ever they may be. Population and land development increases are the main focal points. The goal is to determine the priorities of the community. Through analyzing the predicted information, reforms concerning development regulations and limitations can be established based on how community members want to see the town grow. A full Build-Out involves calculating a potential maximum population for the town. This includes proportioning the land that is already developed, land that is undevelopable (due to being surface waters, wetlands, steep slopes, or rights-of-way), and land that has the potential to be developed. The area that has the potential to be developed is at the greatest risk and is the number one factor for increasing population. The land that has the potential to be developed on has to be subdivided into the smallest lot parcels possible, in accordance with the minimum lot size in the defined districts, along with the average household size will predict the potential development of a town.

The conclusions for the 1990 Build-Out Plan for the Town of New London include the following three main points:

1. 46% or 7,500 acres in New London is considered developable.
2. Within this area, an additional 2,568 dwelling units could be developed. This represents an increase in dwelling units of 142% over the 1,806 dwelling units existing in 1990. The total number of dwelling units at build-out is projected to be 4,374.
3. These additional 2,568 dwelling units could support an increase of 6,496 in the year-round and seasonal population. This represents an increase in the year-round and seasonal population of 132% over the 4,909 year-round and seasonal populations in 1990. The build-out population could reach 11,405 which is 2.3 times the total 1990 Town population.

Between 1970 and 1990, New London's population rate was 1.8%. At this rate the full Build-Out of the town would be reached by the year 2050, a sixty year period. Reaching full Build-Out potential would also entail the population density to increase three-fold within this time frame. A twenty-year population increase estimate can be viewed in Appendix B. From the presentation of the Build-Out Analysis, community members of New London developed a growth policy concerning land use:

1. To reduce the overall development potential of the community by reexamining and reducing permitted densities with particular emphasis on the rural areas.
2. To promote the traditional New England development patterns of compact villages surrounded by natural, rural and undeveloped outlying areas.

An important factor to incorporate into the future development of the Town of New London is the amount of public involvement. Reactions to the results of the Build-Out were received through feedback surveys and proposals to amend current and potential future regulations. The community survey revealed positive attitudes concerning the present and future state of the town. The percentage increase for both population and development appalled many community members, calling for a change in how the town views their growth policy. For instance, 68% of the community felt the Build-Out plan presented the town with too much growth and would like to see further limits on potential growth. The number one attribute that contributes to making New London a desirable place to live are the scenic vistas of the lakes, mountains and open spaces. These values allow for New London to keep their visions of preserving the historical and natural characteristics that it has been known for.

As of 1994, under the town's existing zoning and regulations, almost half of the total area was considered developable.

Developed or Protected Land:	5,745.6 acres (35.3%)
Undevelopable Land:	3,019.1 acres (18.6%)
Developable Land:	7,499.9 acres (46.1%)

Although New London's Build-Out Plan applies to the entire town, the potential development for the area within the watershed can be scaled according to the entire town's Build-Out. The area within the watershed hosts roughly half of the town's entire population. Without definite percentages and numbers affixed to the area within the watershed, certain assumptions must be made in categorizing the potential for development. In analyzing the present land use within the watershed, the potential growth can be assumed to be lower than the entire town's predicated rate of increasing three-fold in sixty-years. The reason for such an assumption comes from the historical use of the land and how parcels have been established and build upon. Subdivisions of present privately owned parcels with homes are less likely, since the value of homes in New London is associated with

the land it sits upon. Although recent tax increases due to this unique feature may lead to just the opposite effect. The minimal lot size required for the districts within the watershed will help to preserve the rural character that the area provides. With these factors and assumptions, along with existing development and building regulations, this area can be characterized as having a moderate potential for development.

A new Build-Out Plan for New London will be published in the summer of 2004.

Zoning and Planning Regulations

Refer to the 'NL Zoning' document for specific Ordinances that have been excerpted from the original Zoning Ordinance for this investigation. These ordinances have been excerpted as a result of their relevance to the health of the environment within the watershed, and to the health of the lake itself. After the full description of each ordinance, there is a quick reference chart. Refer to Appendix C for a map of the Zoning Districts.

The thoroughness of the New London Ordinances represents the town's commitment in keeping the attributes of both the community and environment as envisioned when the town was first convened. By instituting standards for residents, and business owners, through structure and land use regulations, the town has been successful in maintaining the "Town's rural charm". While there has been a concentration of development along the Lake Sunapee shoreline, the building regulations have assisted in limiting disturbance. When it comes to regulations of buildings and property boundaries within the watershed, New London's ordinances exceeds other lakefront towns and state regulations.. Amendments to pre-existing regulations have also been made. Noticeable changes were made after the 1990 Build-Out study was analyzed and presented to the community. Such concerns lead to rezoning districts and increasing minimum lot sizes. Not only has the town provided adequate regulations, they have also instituted an adequate method of enforcing these regulations through mandatory permits by presenting appropriate site plans and fees for violations.

Conserved Lands

Conserved Lands are an important aspect of a town's character. Land with restricted development can assist in preserving the quality of life for the town's residents and wildlife. Not only is the amount of conserved lands within a towns important, but also the size of these parcels. In relation to the town's rate of development, conserved lands will reduce the amount of land that could potentially become developed. Within the watershed, the presence of conserved lands plays an important role in reducing the lake's vulnerability to impairment.

New London hosts many conserved parcels of land. A map of these lands can viewed in the 'NL Conserved" document. Below is also a list of these parcels by

name with acreage, owners, and type of easement. The 789.4 acres that are conserved in the 5,309.6 acres of New London within the watershed are broken up into many parcels. Most of these parcels, however, are nearby each other or within very close proximity of one another. This is a positive aspect for the habitat and wildlife in the area.

Name	Year Conserved	Acreage	Agency Title	Primary Protection Type
Sunapee State Park	N/A	143.159		
Little Sunapee Associates Memorial Forest	1991	63.370	New England Forestry Foundation	Fee Ownership
Parkhurst and Sjostrom	1990	42.000	Ausbon Sargent Land Preservation Trust	Conservation Easement
Spaulding Parcel	N/A	4.708	Town of New London	Fee Ownership
Reed Parcel	1989	4.592	Town of New London	Fee Ownership
Phillips Memorial Preserve	1980	71.444	Town of New London	Fee Ownership
Cudney Easement	1998	2.654	Ausbon Sargent Land Preservation Trust	Conservation Easement
Little Sunapee Associates Memorial Forest	1991	49.975	New England Forestry Foundation	Fee Ownership
MacMillin Easement	2002	2.023	Ausbon Sargent Land Preservation Trust	Conservation Easement
Badmington	2000	12.417	Ausbon Sargent Land Preservation Trust	Conservation Easement
Little Sunapee Associates Memorial Forest	1991	2.417	New England Forestry Foundation	Fee Ownership
Parkhurst Easement	2002	3.545	Ausbon Sargent Land Preservation Trust	Conservation Easement
Stanely Point Trust	2002	11.181	Ausbon Sargent Land Preservation Trust	Conservation Easement
Lincoln Gordon	1995	38.417	Ausbon Sargent Land Preservation Trust	Conservation Easement
Frank and Dot Gordon	1996	47.543	Ausbon Sargent Land Preservation Trust	Conservation Easement
Phillips	1991	2.282	Ausbon Sargent Land Preservation Trust	Conservation Easement
Denny Beach Realty Trust	1991	5.269	Ausbon Sargent Land Preservation Trust	Conservation Easement

Stanely Farm Association	1989	14.659	Ausbon Sargent Land Preservation Trust	Conservation Easement
Kentlands Boathouse	1991	2.080	Ausbon Sargent Land Preservation Trust	Conservation Easement
Phillips	1991	1.611	Ausbon Sargent Land Preservation Trust	Conservation Easement
Philbrick-Crincenti Bog	1989	35.930	Town of New London	Fee Ownership
Phillips	1991	43.455	Ausbon Sargent Land Preservation Trust	Conservation Easement
Phillips	1991	59.532	Ausbon Sargent Land Preservation Trust	Conservation Easement
Bohanon	1988	8.926	Ausbon Sargent Land Preservation Trust	Conservation Easement
Bessie N Phillips	1994	9.564	Ausbon Sargent Land Preservation Trust	Conservation Easement
Tatum	1993	23.220	Ausbon Sargent Land Preservation Trust	Conservation Easement
Carroll	1993	34.637	Ausbon Sargent Land Preservation Trust	Conservation Easement
Estate of Marguerite D. Carroll	N/A	22.460	Ausbon Sargent Land Preservation Trust	Conservation Easement
Town of New London	1997	7.564	Ausbon Sargent Land Preservation Trust	Conservation Easement
Davis Easement	1998	18.857	Ausbon Sargent Land Preservation Trust	Conservation Easement
Total Conserved Lands		**789.400**		

Wetlands

Wetlands are defined as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" by the New Hampshire Wetlands Bureau and the Army Corps of Engineers (Stone 29). Wetlands are an ecological asset to the environment and provide a variety of functions important to both people and wildlife. The function of a wetland extends beyond the physical quality into the chemical and biological functions of the environment. Some of these functions include: flood control, wildlife and fish habitat, pollutant removal, aesthetic and recreational, wood products,

groundwater, and erosion control. The value of these attributes cannot be compromised with development and degradation of the surrounding environment. In acknowledgement of the importance of wetlands, national, state and local regulations protecting these ecosystems have been institutionalized.

Within the watershed boundary of New London, there are approximately twelve significant wetland areas. Some of these designated areas are larger than others, yet they all play an important ecological role. The Philbrick-Cricenti's Bog, Columbus Avenue wetlands, and the dissected Otter Pond wetlands were evaluated by using the Wetland Field Study Worksheet for Wetland Functions Evaluation, produced by the New Hampshire Department of Environmental Services. These three wetlands were targeted for such an evaluation as a result of their location in relation to major roads and Lake Sunapee. Below is a table of how each wetlands area was scored according to the evaluation criteria:

Wetland Function	**Cricenti's Bog**	**Columbus Ave Wetlands**	**Otter Pond Wetlands**
How natural is it?	High	Medium	Low
How vulnerable is it?	Medium	High	Medium
Wildlife habitat	High	Medium	Medium
Educational value	High	Medium	Medium
Appearance and scenery	High	Medium	Medium
Recreational value	Medium	Low	Low
Stormwater storage	----	----	----
Groundwater relations	----	----	----
Pollution Control	Medium	High	Medium
Uniqueness	High	Low	Low

While all of these categories are important in understanding the role a wetland area plays in conjunction with the rest of the environment, the function related to pollution control is probably one of the most important. An ecological role that wetlands contribute to the environment, is the ability to remove and/or trap certain pollutants. Non-point pollution is a major concern for waterbodies, such as Lake Sunapee. Essentially nature has its own filtering system when water must flow through wetland areas via rivers or streams into a large body of water. Wetlands serve as a buffer for the lake system. Without wetlands, pollutants would drain directly into the lake system causing even more drastic negative effects. The methodology used behind categorizing the Columbus Avenue wetland as 'high' is mainly derived from its location. Interstate 89 is a major component in assessing the vulnerability of polluting Lake Sunapee. This wetland receives run-off from the highway. Without this wetland, concentrated pollutants would feed directly into the lake system. The importance of this wetland was demonstrated when a group of Colby-Sawyer students conducted an evaluation of the area and

suggested recommendations for making this wetland even more efficient at buffering the lake against non-point pollution.

Unfragmented Lands

The presence, abundance, and size of unfragmented lands within an area is an important foundation for understanding the value of the land in relation to wildlife habitat. Unfragmented lands are "undeveloped sections of the landscape with few or no roads" (Stone 28). To illustrate where these tracts of unfragmented lands exist within a town, roads along with a 500 foot buffer are set as the limiting factor in defining the boundary of these lands. Roads present wildlife as a source of mortality and a human defined boundary for territory. The size of the unfragmented land will predict what kind and how diverse the wildlife will be in the area. In order to properly present the parcels of unfragmented land within the watershed, the graphics were extended beyond the boundaries of both the town and the watershed. This was done to display how unfragmented lands do not conform to human-made political boundaries, as opposed to man-made physical boundaries, such as roads. Another reason for portraying the extended boundary is to display how towns need to look beyond their own boundary. What they do inside their boundaries may influence what happens outside in other towns.

Within the watershed boundary of the Town of New London, there are a scattered unfragmented lands ranging in size. Immediately looking at the map on the following page, the amount of unfragmented lands seems to be abundant. However closer analysis of the size of these parcels, indicate that that these tracts of land are relatively small in size. About half of these parcels represent areas between 20 and 99 acres and the other half between 100 and 499 acres. These are medium sized tracts of land and can host sufficient habitat for a variety of species.

Wildlife

The presence of wildlife is an indicator used to help define the condition of an area. Species diversity is usually a signal of the health of the habitat; high diversity implying a good healthy, stable ecosystem and a low diversity implying a degrading habitat. Ecologists have studied the roles of species within a habitat and have developed patterns of relationships between the quality of the habitat and the abundance and diversity of species. Through these relations, indicator species have been marked as species that have populations that fluctuate based on the health of the inhabited system. One of the greatest factors in decreasing wildlife diversity is human development and sprawl. Development has caused for fragmentation to occur in critical habitats that host species with specific needs. Just like people, each species has its own individual needs for survival and reproduction. These demands are in the form of suitable habitat, adequate food supplies, sufficient home ranges, and access to a diversified genetic pool. If a habitat cannot meet these needs, populations will inevitably suffer as a

consequence. The smaller the parcel of unfragmented land is, the less diversified the local wildlife population becomes. The opposite effect is true as the lot size increase, the species diversity intensifies. In order to ensure future and more detrimental challenges are not brought on against wildlife it is necessary to understand what critical habitat is left and how to protect these habitats. Unfragmented lands symbolize areas where wildlife can exist under reasonable conditions, as they once did before human development. These environments will always have the presence of human disturbance, however limiting future disturbance is necessary to keep intact the value that these habitats bring to life. "Protection of wildlife habitat is one of a variety of values that depend on larger areas of open space and undeveloped land" (Patterns of Development Task Force).

The unfragmented lands located within the Lake Sunapee Watershed in New London provide the opportunity to host a variety of wildlife. The species that will inhibit these areas in good health, are those that can accommodate to the size and what the area has to offer in relation to shelter and food. The trend of having larger parcels of unfragmented land hosting more species can be viewed in comparing the number of species present in each of the four segments of land size. The following is a preliminary list of wildlife species that could exist within the unfragmented parcels:

1-19 acres	**20-99 acres**	**100-499 acres**	**Undeveloped**
racoon	racoon	racoon	racoon
small rodents	small rodents	small rodents	small rodents
cottontail	cottontail	cottontail	cottontail
squirrel	squirrel	squirrel	squirrel
muskrat	muskrat	muskrat	muskrat
red fox	red fox	red fox	red fox
songbirds	songbirds	songbirds	songbirds
skunk	skunk	skunk	skunk
reptiles	reptiles	reptiles	reptiles
amphibians	amphibians	amphibians	amphibians
	hare	hare	hare
	porcupine	porcupine	porcupine
	beaver	beaver	beaver
	woodchuck	woodchuck	woodchuck
	garter snake	garter snake	garter snake
	weasel	weasel	weasel
		mink	mink
		deer	deer
		sharp-shined hawk	sharp-shined hawk
		cooper's hawk	cooper's hawk
		harrier	harrier
		broad-winged hawk	broad-winged hawk
		kestrel	kestrel

horned owl	horned owl
barred owl	barred owl
turkey vulture	turkey vulture
turkey	turkey
wood frog	wood frog
osprey	osprey
	coyote
	bobcat
	black bear
	fisher
	moose
	bald eagle
	goshawk
	raven

Tributary Streams

Tributary streams are the small drainage ditches and small streams that are the origin of larger streams and rivers. They are very important to the water quality of Lake Sunapee because they all eventually wind up directing water into the lake. Consequently these tributary streams play a vital role in the health of the lake. By understanding how these streams are connected to the entire system, it can be easier to understand the importance of being aware of potential contamination. By degrading the land adjacent and/or uphill from these streams, the water can become contaminated with chemicals and sediment.

New London has an abundance of first order tributary streams that feed both directly and indirectly into Lake Sunapee. With the amount of development that is present within the town's watershed, the streams are at a high risk for contamination by runoff from yards and roads. Many of these streams also run into wetland areas, which is very beneficial to the quality of the lake. The wetlands act as a filter as the water runs through them into the big lake.

Surface and Ground Water Contamination Sites

Potential surface and ground water contamination sites are important to locate within a watershed. Knowing where these places are located and what types of risks they pose to the environment will enable for precautionary measures to be taken to avoid any accidents.

There are several sites that have been designated as potential surface and groundwater contamination sites within the New London watershed by the NH DES. There are both point and non-point sources in which the town should be aware of. Precautionary measures to avoid potential contaminations should be enforced fully as a result of their locale to the lake system.

Recreational Use

The recreational uses of the land in the watershed are pretty uniform throughout. Activities such as hunting, fishing, camping, hiking, and canoeing do not really have negative impacts on the land or water bodies. However other activities such as snowmobiling, four-wheeling, and power boating can add contaminants to the land, the air, and the water. Boating is one of the most popular summer activities on any lake. But power boats release unburned gas and oil back into the water in their exhaust. Snowmobiles and four-wheelers release it into the air or onto the snow on the ground. This can then seep into the ground into the groundwater or be carried with the snow melt into the tributaries and into the lake. Plus the noise from these machines can disturb and spook wildlife native to the area causing them to feel uneasy about being in that area. Although recreational machines are fun, they pose some problems that need to be watched so that they do not destroy in the name of enjoyment.

Scenic Viewing Opportunities

The Routes of 11 and 103A in New London, that run along the edge of lake Sunapee, hold scenic viewing opportunities, though there are no designated scenic viewing areas. Also the noise level at the sites could be due to high traffic.

Burpee Hill in New London is another scenic viewing opportunity that can be accessed from a Burpee Hill road, but limited because it too, is not a designated scenic viewing opportunity and has some traffic noise.

Davis Hill is also a prime viewing location of the lake. It is privately owned, yet the owners allow for some permission to use this area. It can only be accessed by foot or bike.

Most hill tops are privately owned, so viewing opportunities of Lake Sunapee are limited in the Town of New London.

Sources

"Granit". Complex Systems Research Center. University of New Hampshire. 3 Dec. 2003 <http://granit.sr.unh.edu/>.

"New Hampshire Demographics". Economic and Labor Market Information Bureau, New Hampshire Employment Security. 6 June 2003. 3 Dec. 2003. <http://www.nhes.state.nh.us/elmi/htmlprofiles/pdfs/newlondon.pdf>.

Stanley, Peter. New London Zoning Administrator. 14 November 2003.

New London Build-Out Analysis. Upper Valley Lake Sunapee Regional Planning Commission. 7 June 1994.

McWilliams, Ken. "Revised Build-Out Figures". 4 June 1996.

"Footpaths in New London and Vicinity". The Conservation Commission of the Town of New London, NH. The Country Press. October 1994.

Lake Sunapee Watershed Study. Upper Valley Lake Sunapee Regional Planning Commission. 3 January 1995.

New London Zoning Ordinance. As adopted March 11, 1958. <http://www.nl-nh.com/03zoningord.pdf>.

Stone, Amanda J. Lindley. Natural Resources Inventories: A Guide for New Hampshire Communities and Conservation Groups. UNH Cooperative Extension. 2001.

Wetland Field Study Worksheets for Wetland Functions Evaluation. NH DES.

"A Response to Sprawl: Designing Communities to Protect Wildlife Habitat and Accommodate Development". Patterns of Development Task Force Maine Environmental Priorities Project. July 1997.

Appendix A. New London Zoning Ordinances

Article I. Preamble

In pursuance of the Laws of the State of New Hampshire, (Title LXIV N.H. Statutes Annotated), in accordance with the intent of the New London Master Plan - 1987 as amended and to protect and promote the general welfare of the Town's inhabitants by preserving the Town's rural charm, the following Ordinance is enacted by the voters of the incorporated Town of New London, New Hampshire in official Town Meeting convened (March 7, 1989). (Corrected Date: March 14, 1989)

Article II. General Provisions

8. Sanitary Protection

a. No cesspool, septic tank or sewage disposal area shall be constructed or maintained less than 75 feet from the edge of a public water body; from a well; or from a dwelling other than that to which it is appurtenant.
As per Article XIII F.(1), no septic tank or leach field may be constructed or enlarged closer than 100 feet to any wetland whenever excessively well-drained soils with rapid permeability are encountered, otherwise 75 feet shall govern.

b. No waste waters or sewage shall be permitted to run free into a public water body or be discharged in any way that may be offensive or detrimental to the health of others. All such waste shall be conveyed away underground through use of an accepted sanitary system or in such a way that it will not be offensive or detrimental to health.

c. All dwellings and sanitary systems shall be constructed and maintained in accordance with standards set and enforced by the N.H. State Department of Health and the N.H. Water Pollution Commission.

Article V. Residential District

B. Lot area requirements

1. For lots within the Residential District R-1 not using public sewer and water services, the minimum lot area shall be not less than two acres and the road frontage not less than 150 feet of continuous frontage with population density of 1 family per acre except as specifically provided in sub-section 5.
2. For lots within the Residential District R-2, the minimum lot area shall be not less than 2 acres and the road frontage not less than 150 feet of continuous frontage with a population density of 1 family per 2 acres except as specifically provided in sub-section 5.
5. Not withstanding the above provisions, a lot having lake shore frontage on a public body of water shall be not less than 2 acres with frontage on the lake of not less than 200 feet. The population density shall be 1 family per 2 acres.

Article VI. Agricultural and Rural Residential District

B. Lot area requirements

1. No lot shall be less than 4 acres, and every building lot shall have a minimum lot frontage of 200 continuous feet provided that where lots are located on the

exterior of a curving street, a shorter front dimension shall be permitted provided the average width of the lot measured across its center shall be 200 feet.

2. The population density shall be 1 family per 4 acres.

Article VIII. Conservation District

C. Land Requirements

1. Within the Conservation District, the minimum lot size shall be 10 acres.
2. Any building lot within the Conservation District shall have a minimum of 200 feet of continuous road frontage.
3. A lot having lake shore frontage on a public body of water shall have frontage on the lake of not less than 300 feet.
4. The maximum population density shall be 1 family per 10 acres.

Article XIII. Wetlands Overlay District

F. Special Provisions

1. No septic tank or leach field may be constructed or enlarged closer than 100 feet to any wetland whenever excessively well-drained soils with rapid 50 permeability are encountered, otherwise 75 feet shall govern.

G. Wetland Buffers

The minimum width of the wetland buffers are as follows:

a) 200 feet, horizontal distance, from the boundary of all wetlands designated as prime wetlands by RSA 482-A:15 and as referenced in Section B. (2);
b) 150 feet, horizontal distance, from the boundary of all wetlands which adjoin or are connected to a prime wetland; and
c) 100 feet horizontal distance from the boundary of all other significant wetlands identified for protection on the New London Streams and Wetlands Protection Map dated March 13, 2001.

Article XIV. Steep Slope Overlay District

A. Purpose

The purpose of the Steep Slope Overlay District is to prevent development on slopes in excess of 25 percent. Development on such slopes causes soil erosion and stream sedimentation; unnecessary loss of vegetative ground cover and destruction of trees; on-site waste disposal problems; difficult street construction; and expensive street maintenance.

Article XVI. Shore Land Overlay District

A. Authority and Purpose

All lakes are essentially fragile. In order to protect the lakes, actual use of lake side lots is being limited through the establishment of a Shore Land Overlay District. Most of the land immediately adjacent to New Hampshire's lakes, ponds and rivers is overlaid by soil types characterized by above average erosion and drainage hazards. These lands require conservation and land management practices which minimize environmental and aesthetic degradation.

The Town of New London hereby adopts this Shore Land Overlay District and accompanying regulations in order to:

1. Protect, maintain and enhance the water quality of the lakes;
2. Conserve and protect aquatic and terrestrial habitat associated with lake areas;
3. Preserve and enhance those recreational and aesthetic values associated with the natural shore land and lake environment;
4. Encourage those uses that can be appropriately located adjacent to shorelines; and
5. Protect and promote public health, resource conservation, and the general welfare.

B. Shore Land Overlay District Boundaries

The Shore Land Overlay District extends to a line 300 feet inland from normal high water on all of the following lakes and ponds: Clark Pond, Goose Hole Pond, Little Lake Sunapee, Lake Sunapee, Messer Pond, Murray Pond, Otter Pond and Pleasant Lake.

E. Specific Provisions for Residential Development with Waterfront Access

All residential development with shore frontage or rights of access to shore frontage shall meet the following minimum requirements:

1. Each dwelling unit with direct water access and whose shore frontage is part of the lot dimension shall have a minimum shore frontage of 200 feet.
2. Lots within the Shore Land Overlay District used as common waterfront areas or for the purpose of waterfront access shall meet the following minimum criteria:
   a. The shore front common area shall contain a minimum of 2 acres.
   d. No more than 25 percent of the total shore frontage may be dedicated to docks or other structures designed to accommodate boating. All docks require a permit from the New Hampshire Wetlands Board. Applications for dock permits shall be reviewed by the Conservation Commission. In making its recommendations to the Wetlands Board and the Planning Board, the Conservation Commission shall consider the size and depth of the water area, the total shore frontage proposed for the common area, boat traffic already existing in the area, impact on neighboring property owners, protection of water quality, wildlife habitat, and public safety.

F. Erosion Control

1. Construction:
   a. Erosion and sedimentation control plans shall be required for all construction, filling, grading, dredging, and other activities requiring land disturbance within the first 50 feet of the normal high water level within the Shore Land Overlay District.
   b. Erosion and sedimentation control plans shall be required for construction, filling, grading, dredging, and other activities disturbing an area of more than 2,500 square feet which is located beyond the first 50 feet from normal high water within the Shore Land Overlay District.
2. Cutting and Removal of Natural Vegetation: The preservation of natural vegetation on the shore land is important for the protection of the water quality of

the lakes and ponds, the preservation of the aesthetic quality of the shore land and the control of erosion.

a. A cutting or clearing plan shall be approved by the Planning Board for any cutting of trees or removal of natural vegetation within 50 feet of normal high water except as provided in Section F. 2. b. below. The Planning Board shall request the Conservation Commission to review the plan and make recommendations.

b. No construction or land disturbance whatsoever will be permitted within the vegetative buffer 50 feet from normal high water, except as provided in Sections C.4. and D.2. above and F.2. e. below. Unless special construction practices ensure that no land disturbance will occur in the 50 foot vegetative buffer as a result construction activities, all structures must be set back a minimum of 10 feet from the 50 foot vegetative buffer to accommodate land disturbance resulting from such activities. Any existing vegetative buffer 50 feet in depth from normal high water shall be maintained except that:

Article XXV. Enforcement

3. Permits

a. After passage of this ordinance, it shall be unlawful to erect, relocate any building, sign or structure, or alter any building without first obtaining a building permit from the Board of Selectmen or their designee. The application for a permit for any new structure or addition other than a sign must include a plan designating size of lot, location of structure on lot and disposal of sewage and other waste waters.

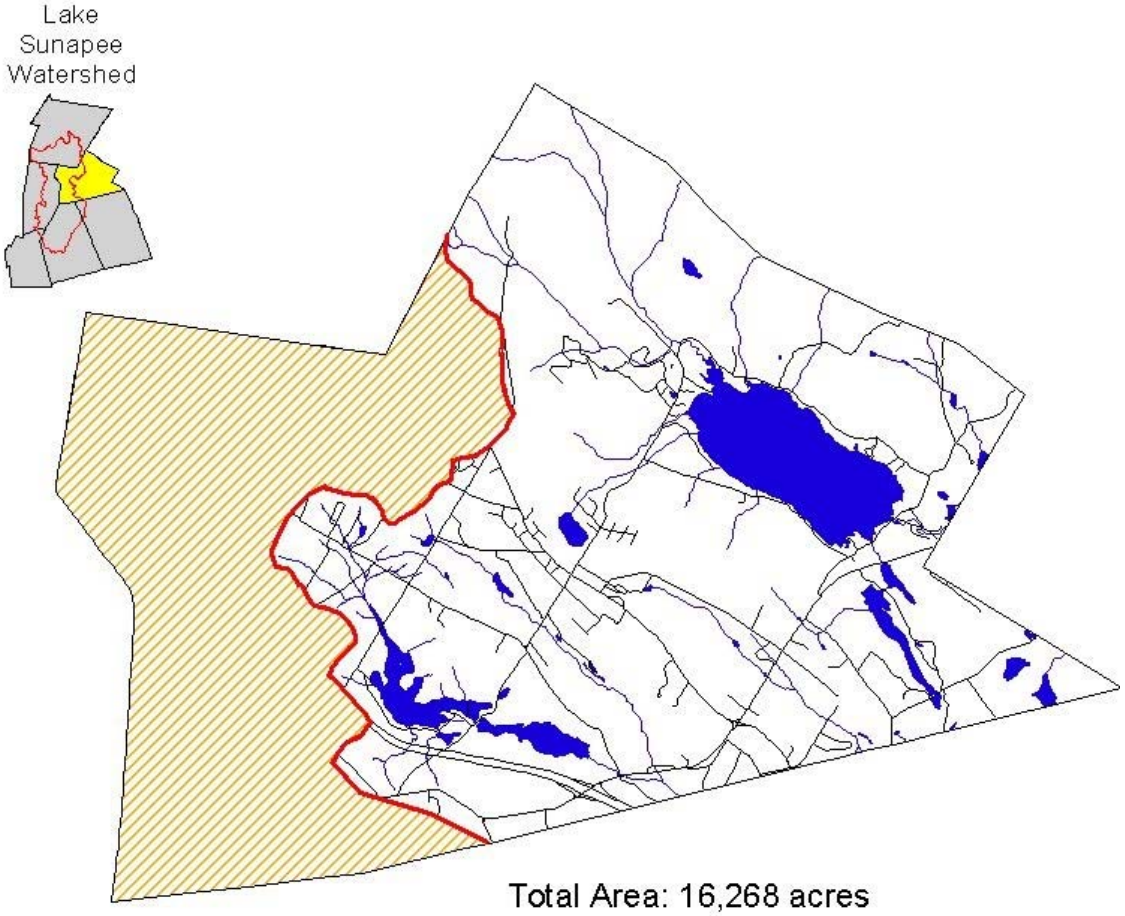
5. Upon any well-founded information that this ordinance is being violated, the Board of Selectmen shall take immediate steps to enforce the provisions of this ordinance by seeking Injunctive Relief as provided in RSA 676:15, Fines and Penalties as provided in RSA 676:17, Cease and Desist Orders as provided in RSA 676:17-a, and Local Land Use Citations as provided by RSA 676:17-b including any amended statutory provisions.

6. Upon conviction thereof, every person, firm or corporation violating any of the provisions of this ordinance shall be fined not more than $275 for each day such violation existed after official notification by the Selectman or their agent, or as specified in RSA 676:17, as amended.

1-19 acres	20-99 acres	100-499 acres
racoon	racoon	racoon
small rodents	small rodents	small rodents
cottontail	cottontail	cottontail
squirrel	squirrel	squirrel
muskrat	muskrat	muskrat
red fox	red fox	red fox
songbirds	songbirds	songbirds
skunk	skunk	skunk
reptiles	reptiles	reptiles
amphibians	amphibians	amphibians
	hare	hare
	porcupine	porcupine
	beaver	beaver
	woodchuck	woodchuck
	garter snake	garter snake
	weasel	weasel
		mink
		deer
		sharp-shined hawk
		cooper's hawk
		harrier
		broad-winged hawk
		kestrel
		horned owl
		barred owl
		turkey vulture
		turkey
		wood frog
		osprey

0-19	20-99	100-499	Undeveloped
10	16	29	38

New London



Total Area: 16,268 acres
Area in Watershed: 5,310 acres

Population: 4,116
Population in Watershed: 2,035*
(based on 2.6 persons per household)
(Seasonal residents will vary results)

Legend

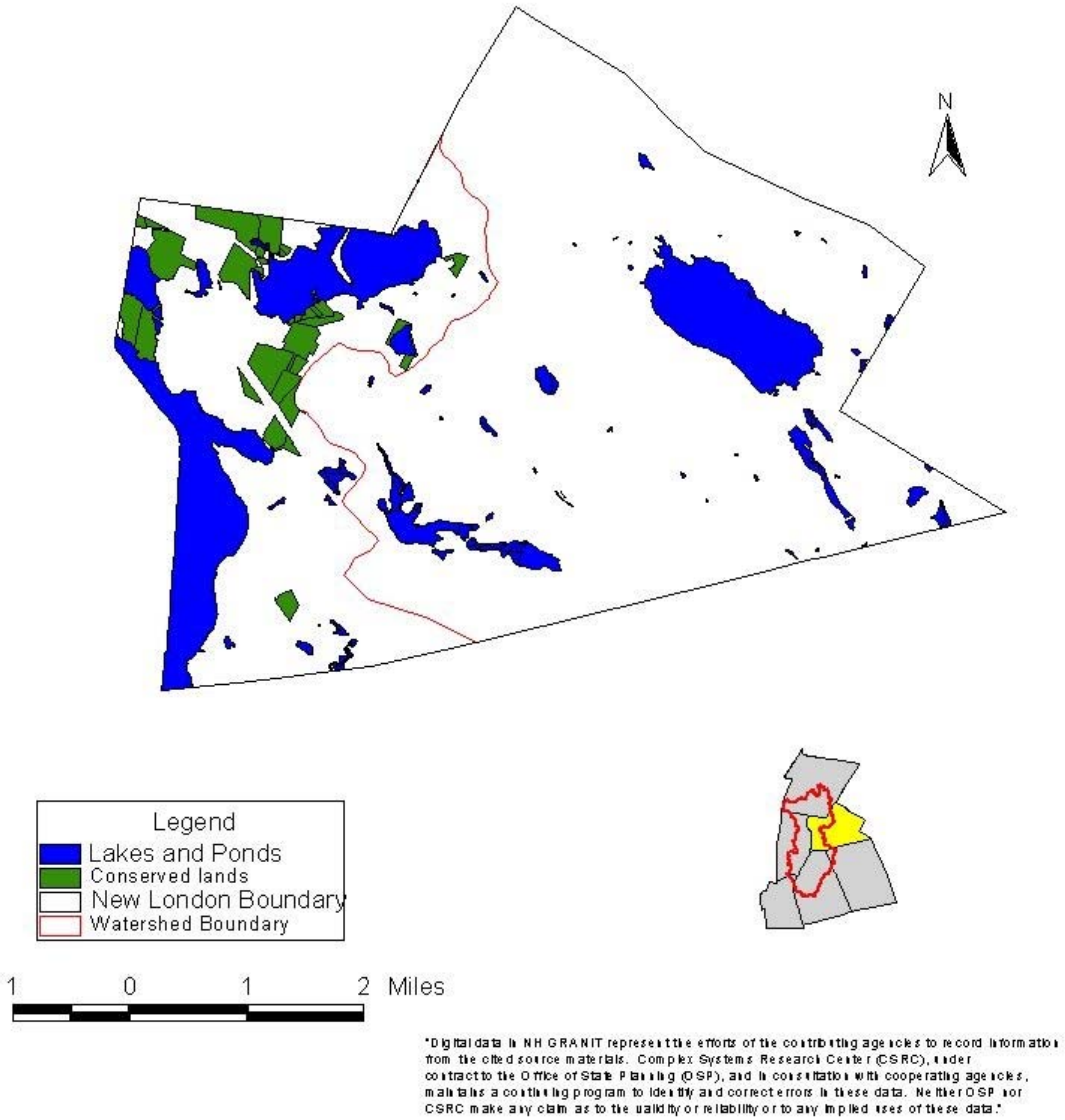
N

- Town Boundary
- Area in Watershed
- Roads
- Rivers and Streams
- Lakes and Ponds

1 0 1 Miles

Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center (CSRC), under contract to the Office of State Planning (OSP), and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. Neither OSP nor CSRC make any claim as to the validity or reliability or to any implied uses of these data.

New London Conserved lands



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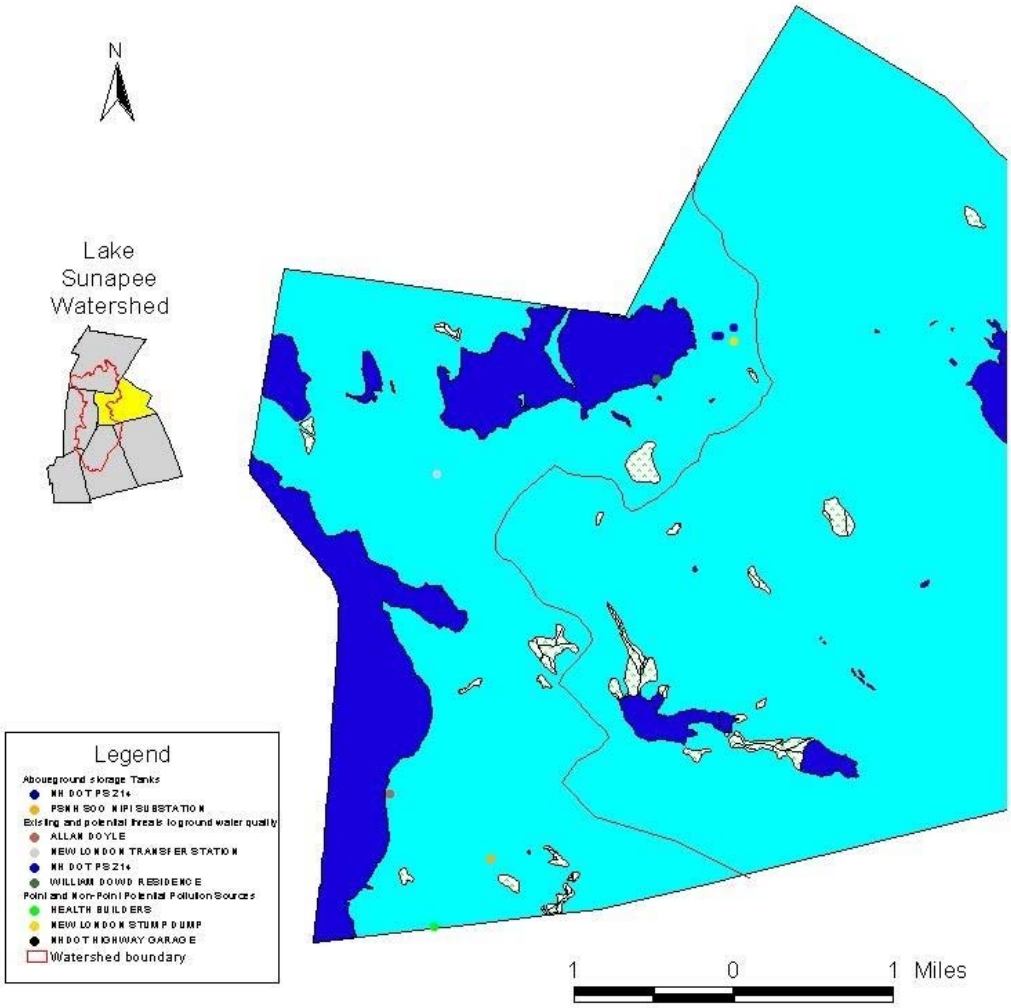
Potential Contamination Sources Map of New London



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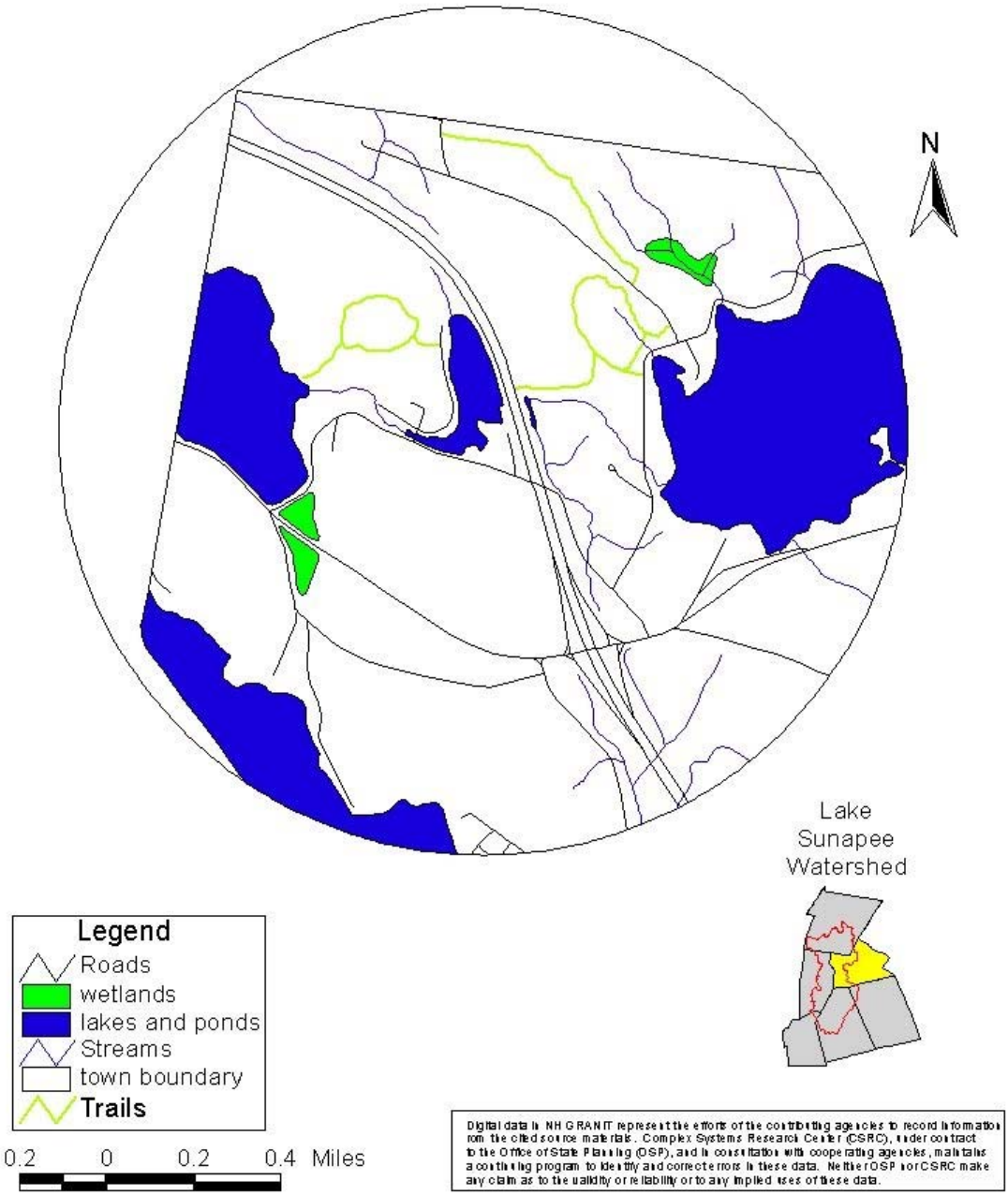
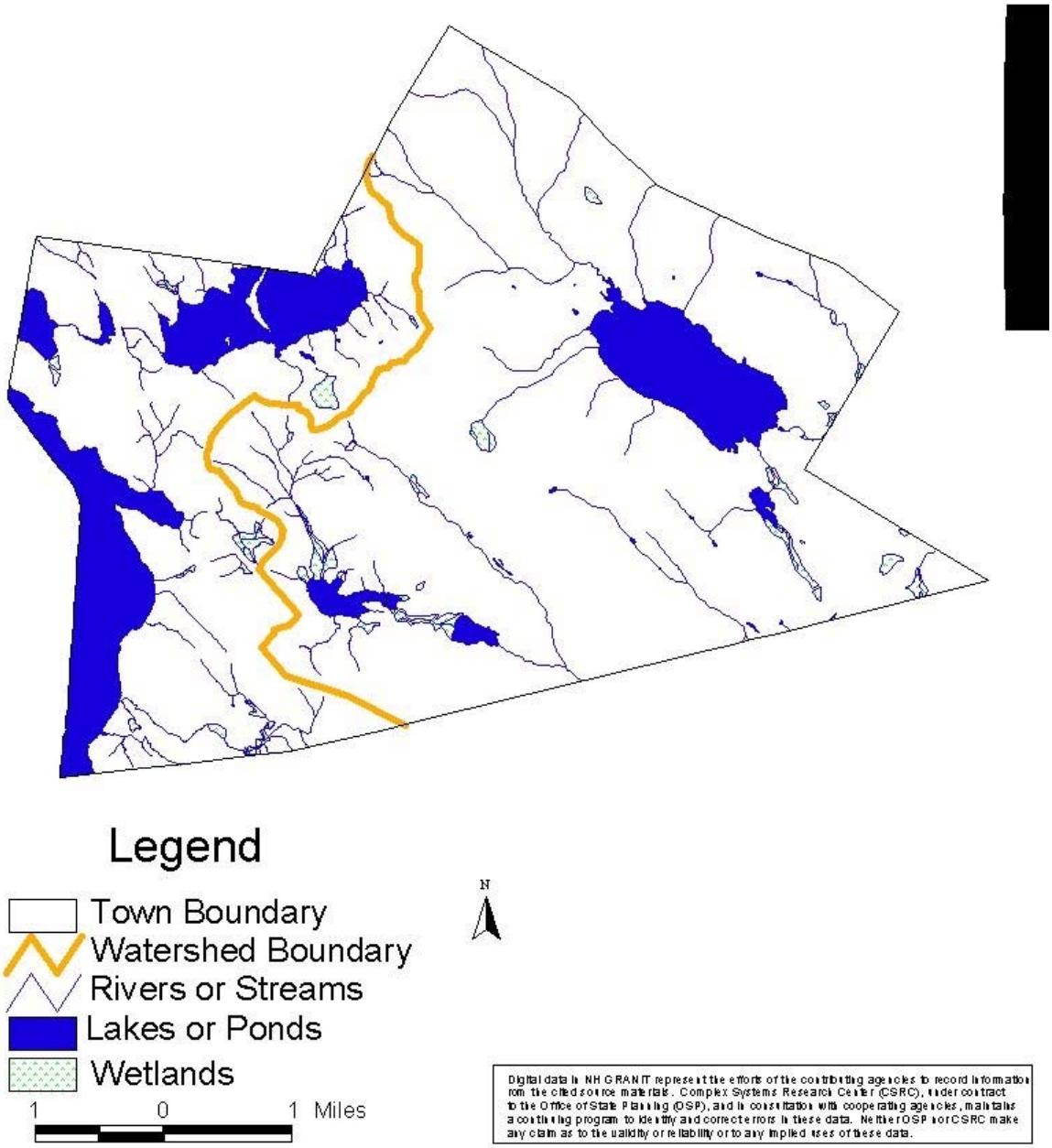
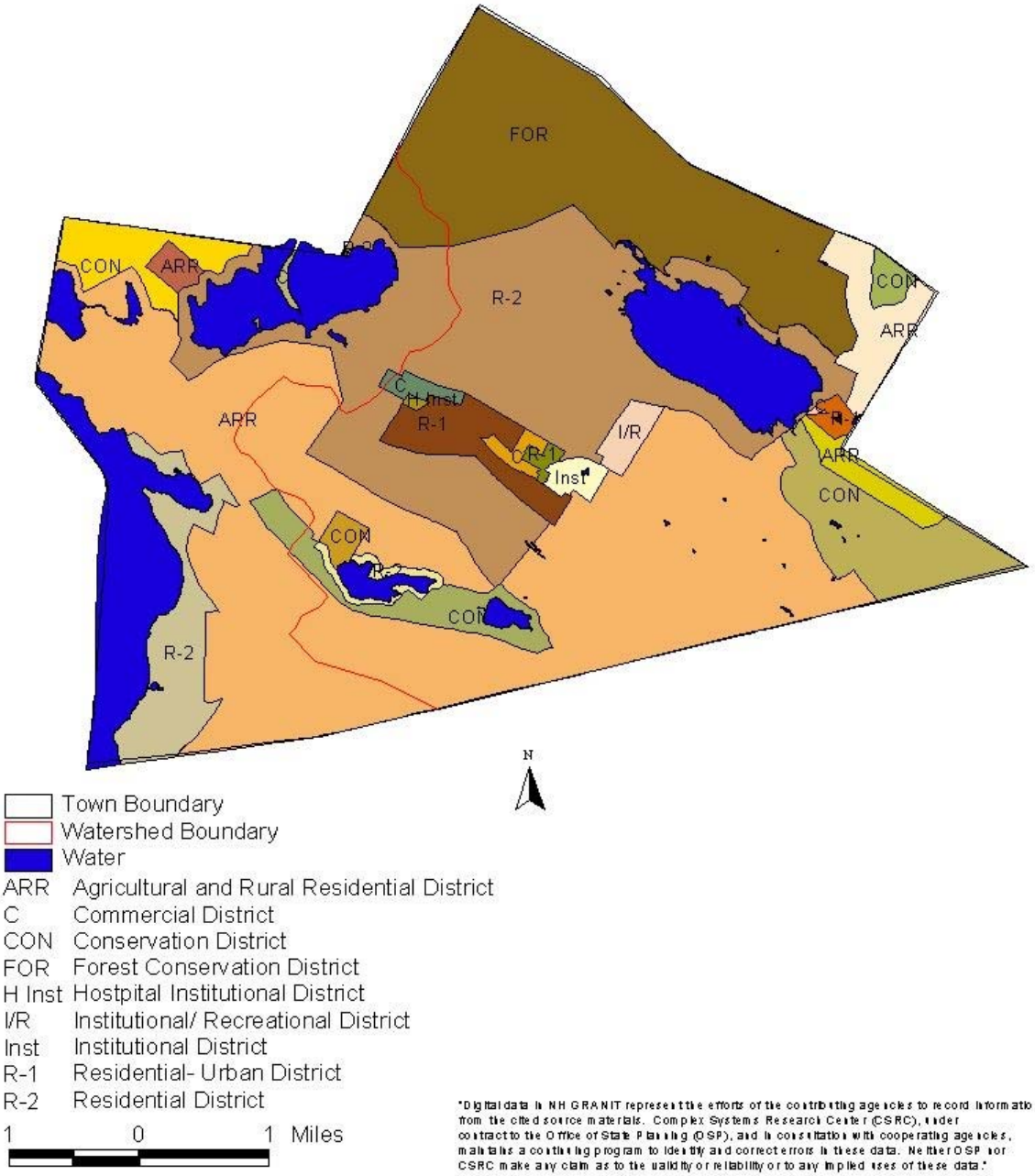
New London Hiking Trails



New London
Tributary Streams



New London
Zoning Districts



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Springfield Watershed Investigation

December 8, 2003

Joe Jennings
Stacey Philbrook
Gordon Krantz

Institute for Community and Environment
Colby-Sawyer College

1. How many acres does your town represent in the watershed?

See attachment

Using GIS maps from the Granit website, and ArcView for calculations, we found that Springfield's watershed occupies approximately 7,698 acres. This is 24.5 percent of the total acres in the Lake Sunapee Watershed.

Using the Upper Valley Lake Sunapee Regional Planning Commission's 1995 Watershed Study, we found the watershed acreage of Springfield to be approximately 7,360 acres.

2. What is the population in your town and in the watershed?

See attachment

The Economic & Labor Market Information Bureau released a document containing demographic material on the town of Springfield, which listed its population at 971 inhabitants for the year 2001. According to a study done in 1995 by the Upper Valley Lake Sunapee Regional Planning Commission approximately 406 people lived inside the watershed boundary when Springfield's population was still under 900. Unfortunately, no recent studies have been done to recalculate the population in the watershed since that time. The record of building permits, released by the Office of State Planning, showed that from 1995 to 2001 a total of 90 permits were issued. When consulting with the town clerk, Robert Morris, I was told that much of Springfield's population was concentrated in the southern part of the town, which the Lake Sunapee Watershed occupies.

Considering this information, it is reasonable to assume that at least half, if not more, of the population resides inside the watershed's boundary. This information is very important to take into consideration when designing a watershed management plan, the fact that a majority of the residents are in the watershed increases the potential effects that the town could have on Lake Sunapee.

3. How Developed is the land? What has been the rate of development? What is the potential for the development?

See attachments

Both within the watershed and town wide the percent of developed land was low, calculated to be 9% within the watershed and unknown throughout the remainder of the town. Of the approximate 7,360 acres of watershed land within Springfield, around 4,400 acres are currently undeveloped. The potential for large scale build-out is a constant threat to both the residents of Springfield's watershed and the entire town. Note that these numbers were calculated in 1995 by the Upper Valley Lake Sunapee Regional Planning Commission in their watershed report for Lake Sunapee.

The population of Springfield has more than tripled since 1970. Growth has been steady, with no serious increases or decreases. In 1970, approximately 300 people called Springfield home. By 1990, close to 800 people resided in Springfield. Recent estimates calculated the population to be just under 1,000 people.

The number of building permits issued by the town from 1990-2002 is a series of ups and downs, but overall the number of permits issued over the years are increasing as

population rises. Please note these numbers are town wide, not the watershed only. This number can be expected to continue rising slowly depending on population. Though there was a large jump from 15 permits in 2001 to 22 in 2002, this has happened before and should not cause alarm unless the next few following years experience the same type of jump.

4. What are the zoning regulations in your town?

See attached tables

Springfield has a single zone district town-wide, which is the Rural Residential District. All of the restrictions set forth in the Zoning Ordinance therefore pertain to the entire town. It is stated in the Town of Springfield Subdivision Regulations that the purpose of putting in place such rules is, "As a means of retaining the scenic beauty of our Town, and for the purpose of protecting the health, safety, convenience, prosperity and welfare of our inhabitants."

Springfield has developed some very important restrictions especially pertaining to setbacks from streams, lakes, ponds, and minimum lot sizes. All of these help to protect waterbodies from becoming contaminated by concerns such as runoff and septic system leakage. The way that the lot size requirements work is that as a soil type becomes less and less absorbent and more hydric or contains more bedrock, the required acreage rises. This way, not as many houses can be built on bedrock/hydric soils where runoff is more likely to be an issue for concern. This is the same for the case of slope classifications, as slopes become steeper more acreage is required. When trying to determine the lot size needed, first the slope is found then multiplied by the corresponding soil type. For instance, if a piece of property has a slope ranging between 0-8% and a soil type that is moderately well drained, 1.5 acres multiplied by 1.6 would require a minimum of 2.4 acres. These regulations will help Springfield protect its town from overcrowding and protect its natural habitats. By expanding the zoning regulations to be more specific as to where commercial development is allowed could be beneficial to Springfield's future and should be something that is looked into by town officials.

5. Are there conserved lands within the watershed in your town? Please provide details (How big, what agency holds the property or easement, brief description, etc.).

See attached map

Name	Acreage	Agency
Gile State Forest	1756.8	D.R.E.D.
Morgan Pond	236.9	New London-Springfield Water System Precinct
Springfield Town Forest-Royal Arc Lot	47.7	Town of Springfield, NH
Springfield Town Forest-Dutchman Pond	52.7	Town of Springfield, NH
Water Precinct Reservoirs	20.9	New London-Springfield Water System Precinct

Baptist Pond Island	.473	D.R.E.D.
The Donovan Family Trust	90.6	Ausbon Sargent Land Preservation Trust

- Gile State Forest- This is the largest section of un-fragmented conservation land in Springfield and is therefore home to several different species of the town's wildlife. The land provides hiking, biking, and trails that are groomed by the local snowmobile club and can also be used for cross-country skiing.
- Morgan Pond, Springfield Town Forest-Royal Arc Lot, Dutchman Pond, and the Water Precinct Reservoirs are either enclosed or adjacent to the Gile State Forest.
- Baptist Pond Island is almost a half-acre of land and is located in the center of Baptist Pond. Though its size may not allow it to support many animals the easement restricts the development of the island and helps protect the health of the pond.
- Donovan Family Trust- "The land includes 430 feet of undeveloped road frontage and helps preserve natural forestland, which is also an important part of the Little Lake Sunapee watershed. A trail has been constructed for public access. This easement prohibits subdivision. No structures are allowed with the exception of those related to forestry and agricultural activities. The land provides public access for hiking, while protecting the wildlife habitat, watershed and rural character of the area."

The entire northeast section of the watershed boundary is a combination of many conserved lands but most significantly the Gile State Forest. It is a great asset to the Lake Sunapee Watershed to have such a significant section of Springfield protected by conservation easements. Comparing the parcels of unfragmented land to the conserved lands map, we can see that there are two parcels of significant size that remain undeveloped and are not conserved. Baptist Pond and Star Lake both lie inside or adjacent to these properties, which create great habitats and allow for species to access the waterbodies without encountering human obstacles. By placing lands, such as these parcels, under conservation easements we effectively and efficiently help save land from being developed which is important to plant, animal, and watershed health.

6. Are there wetlands in your town within the watershed? Evaluate them (like the class exercise).

See attachments and map

Springfield has numerous wetlands throughout the town. However, only a few fall within the watershed of Lake Sunapee. The two evaluated, the Baptist Pond Wetland and the Hemphill Power and Light Company Wetland, were both within the watershed, and both large in size. The Baptist Pond Wetland evaluated was off of Stoney Brook Road, in between I89 and Baptist Pond Road. The large wetland d appeared to be in

good condition, but the evaluation was done with a ground covering of snow. The only major threat seemed to be I89 running parallel to the wetland for over 500 yards along the eastern border of the wetland.

The Hemphill Power and Light Company wetland was also large in size, and also appeared to be in good condition. Evaluation was difficult due to the lack of parking, and the traffic speeding by. The evaluation was completed from Georges Mills Road, looking towards the power plant. A large amount of litter was covering the ground along side the road, with a few pieces of asphalt and concrete lying around.

Each wetland serves as a filter to larger waterbodies. The Baptist Pond acts as one for Baptist Pond, and the Hemphill Power and Light Wetland serving as a filter to both Otter Pond and Lake Sunapee, respectively.

7. What plant communities are present in the watershed in your town? Are there any special habitats? Invasive species? Rare or threatened species.
*See attachment

The amount of unfragmented land is the watershed of Springfield, is astonishingly high, with the majority of the land undeveloped or non-developed in large parcels of land. Such numerous and large scaled parcels of land are hard to find in such a developed and developing area. It is rare to find so many acres of unfragmented land within such a small parcel of land. Such large parcels of undeveloped land enable more land to be available for conservation easements and other forms of protection.

Uncommon to the other watershed towns, Japanese Knotweed (*Polugonum cuspidatum*) was not found anywhere within the watershed nor the town, although it can be seen in every other town. Burning Bush (*Euonymus alatus*) was found sporadically, normally on house properties as a shrub. Common reed (*Phragmites australis*) was found near exit 12A off of I89, mostly in the wetlands and remnants of vernal pools.

8. Based on the plant communities and habitats you found in your area, what animal and bird species do you predict inhabit or utilize the land? Did you find any evidence that verifies the presence of any of these species? Please describe.
*See attachments

The majority of the unfragmented land within the watershed is in parcels of large size, with little to no development. Each tier (size) of land parcel is represented in the watershed, with the majority of these being at least 500-2,500 acres of completely undeveloped. For the most part, the larger the tier of land, the larger the animals that inhabit are, and the more different types of species are present.

Most commonly found throughout the various tiers were sign of squirrel, chipmunks, white-tailed deer, red and gray foxes, songbirds, owls, and other small species. The larger parcels of unfragmented land normally led to the occasional sign of larger species, such as moose, bear, and white-tailed deer. Scat was visible in numerous locations, as were a couple of Beech trees with claw marks down the side, most likely those of a black bear.

The types of forests found varied from the ever present Northern Hardwood Forests, to the Eastern Hemlock Forests, to White Pine Forests. Other types are present, but the above occupy the majority of the unfragmented land.

9. Rank the tributary streams in your watershed and describe the land use around significant tributaries. *See attachment

There were six third order tributaries in Springfield's section of the Lake Sunapee Watershed. One was located on the northeast side of Baptist Pond. This is one of the smaller third order tributaries but flows into one of the largest lakes in Springfield's watershed; the land around this river is forested. Morgan Pond's third order tributary is located on the southwest side of the pond and also surrounded by forests. Southeast of Morgan Pond was an additional tributary which was enclosed by forests. In the very southeast corner of Springfield there is another tributary that runs through Twin Lakes golf course and also flows beside route 114. The longest third order tributary runs into a wetland and flows along Georges Mills Road. Around this tributary the land consisted of mostly forests and some cleared land, permanent pastures, and scattered development. The most significant areas that may have potential impact are the golf course and roadways. Salts from the winter months will easily find their way into the stream next to Georges Mills Road. This could potentially be harmful to the pH balance of a lake or pond but luckily the wetland that this tributary empties into can act as a buffer for Otter Pond, which lies just past the southern border of Springfield. Fertilizers and other products used on the Twin Lakes golf course have the ability to increase the amount of phosphorus found in Little Lake Sunapee, and encourage algae growth. Awareness by the golf course and management of fertilizer use will help decrease the potential effects that could occur in this situation.

Overall, several of the tributaries are surrounded by forests, which are the least threatening habitat a stream could flow through. This is one of the best circumstances that could occur. The reason behind this is that much of what can affect the health and quality of a lake is what is carried down towards the water body by tributary streams. Tributaries in Springfield flow into and out of wetlands, ponds, and lakes which all help filter the water as it travels towards Lake Sunapee.

10. Are there potential or actual surface or groundwater contamination sites in your watershed area?

The town of Springfield has two sources of potential and actual contamination sites. These sites were identified with GIS information obtained through GIS coordinator George Hastings at the Department of Environmental Services. These sites are the Hemphill Power and Light Company and the Durgin and Crowell Company Incorporated. These two sites are located within close proximity to one another and to a wetland near Hemphill, which drains into Otter Pond. According to Laura Alexander a former employee, Durgin and Cromwell specialize in "white pine lumber, manufacturing

sawmill, planning, and dry kilns. They also sell by products such as: sawdust, shavings, bark mulch, and cut-up stock," says Alexander. Some of the potential contaminants that may be expelled during production are from the chemical dip tanks which are used to treat wood so they do not stain or warp. Other possible sources include fuel tanks on site. Another source of potential contamination is the Hemphill power plant. Hemphill is located next to Durgin and Cromwell. DES has classified Hemphill is a potential contamination source although most of its potential contamination sources may be expelled through its smokestack from wood burning; It is unclear if whether or not the plant produces any real ground water pollutants that directly affect the lake Sunapee watershed.

11. What are the recreational uses of the land in your watershed? Are they helpful or harmful to Lake Sunapee? How? *See attachments

Three of the most popular recreational uses of the land of Springfield are, snowmobiling, hunting, and hiking/snow shoeing trails. As expected, each offers both beneficial and negative threats towards the lake. Positive outcomes include the financial benefits of tourism, membership fees, licenses, and people discovering and caring about the land. Threats include the disturbance/deforestation of land, pollutants caused by snowmobiles, and the effects of disturbing the animal populations.

Snowmobiling is probably the most popular in the town, along with the majority of the watershed. Snowmobilers are required to be a member of a snowmobile club, and Springfield riders are commonly members of the Lake Sunapee Snowmobile Club, based in Newbury; the Mascoma Valley Club, based in Wilmot; or the Blue Mountain Snowdusters, based in Grantham. No official map of trails in Springfield is available; with local riders know of them. From any trail in Springfield, "one can get anywhere in the United States or Canada along the snowbelt," according to Tom Duling, who acts as the town official for snowmobiling and trail maintenance. Also interesting, Duling notes, "New Hampshire has around 6,000 miles of paved road, versus around 6,900 miles of marked trails". Thus, illustrating the importance of snowmobiling to Springfield and the entire state of New Hampshire as well.

Hunting is also a very popular recreational activity. With large parcels of undisturbed/undeveloped land throughout the entire town and watershed, conditions are ideal for hunting. Various types of forests and land coverage allow many different habitats to be present. Species either actually seen or signs of them seen of these species include: raccoon, rabbits, white-tailed deer, moose, turkey, songbirds, owls, skunks, etc. Even though no exact number of killed animals can be found for the watershed only, the New Hampshire Harvest Report indicates the following numbers for the 2002 hunting season for deer, bear, and turkey for the entire town:

Species	**Male**	**Female**	**Total**	**Kill/square mile**
Deer	35	10	45	1.04
Bear	3	1	4	N/A

Turkey	0	17	17	.39

Hiking trails are scattered throughout the watershed and the town. Most are not well known to hikers unfamiliar with the area. The more known of these trails include parts of trails 4 and 5 of the SRK Greenway Coalition Trails, which loop around the lake and its watershed. Two of the lesser known trails are Protectworth Trail and the Morgan Pond Trail. The Protectworth Trail begins on Route 114, with ample parking and depending on the season. The trail bears the name of the town when it was originally settled in 1769. The trail offers some historical sites, and numerous pleasant views of the area. The trail ends near the Baptist Pond Wetland. The Morgan Pond Trail leads to Morgan Pond, located in the northeastern section of the watershed. The trail entrance is located off of Route 114, near the entrance to the Protectworth Trail.

12. Where are the scenic viewing opportunities of Lake Sunapee? What is the noise level in those places?

The only scenic viewing opportunities of Lake Sunapee are located on private lands. Fox Run, located off route 114, is a private function center, normally used for conferences and private parties and gatherings. The view is exquisite, looking over the majority of the watershed, with Mount and Lake Sunapee visible in the far distance. New development appears to be taking place throughout the property, with no visible clues what is going in.

The other scenic viewing opportunities are from Oak Hill Road off of route 114. Currently, there are around ten houses completed on the road, with a tower located on the crest of the hill. Numerous lots of land are still available for development, each with a view or potential view of the lake. Lot sizes vary from one-two acre lots to seven acre lots.

Sources

Question 1. Data layers retrieved from Granit database: www.granit.sr.unh.edu
Lake Sunapee Watershed Study, Upper Valley Lake Sunapee Planning Commission, January 3, 1995. page 39

Question 2: www.nhes.state.nh.us/elmi/htmlprofiles/pdfs.springfield.pdf
Lake Sunapee Watershed Study, January 3, 1995. page 45
Robert Morris, Town of Springfield Town Clerk
Denyce Gagne, Upper Valley Lake Sunapee Planning Commission GIS land used data layer

Question 3. Lake Sunapee Watershed Study, Upper Valley Lake Sunapee Planning Commission, January 3, 1995. pages 25, 39, 42
http://www.nhes.state.nh.us/elmi/htmlprofiles/pdfs/springfield.pdf
Office of State Planning Building Permits (1990-2002)
Robert Morris, Town of Springfield Town Clerk

Question 4. Lake Sunapee Watershed Study, Upper Valley Lake Sunapee Planning Commission, January 3, 1995. page 20
Town of Springfield building permit application

Springfield Zoning Ordinance
Town of Springfield Subdivision Regulations

Question 5. Data layers retrieved from Granit database: www.granit.sr.unh.edu
http://www.ausbnsargent.org/lands/donor.asp?linkShade2=009999
http://www.nhparks.state.nh.us/Trails/Trails/Trailspages/xcPages/xctrails.html

Question 6. Completed Watershed Evaluation Form (2) (HANDOUTS)

Question 7. Data layers retrieved from Granit database: www.granit.sr.unh.edu

Question 8. Robert Morris, Town of Springfield Town Clerk
Unfragmented Lands Handout.

Question 9. Data layers retrieved from Granit database: www.granit.sr.unh.edu
http://www.shorelandmanagement.org/depth/rivers/02.html

Question 10. Robert Morris, Town of Springfield Town Clerk
George Hastings GIS coordinator for the NH Dept. of environmental Services.
Alexander, Gordon Krantz. Personal interview. 12/8/03.

Question 11. Tom Duling, Head of Snowmobile Activity in Springfield
www.wildlife.state.nh.us/Hunting/Hunting_PDFs/Wildlife_Harvest_2002_pdf
http://www.nhes.state.nh.us/elmi/htmlprofiles/pdfs/springfield.pdf
Robert Morris, Town of Springfield Town Clerk

Question 12. Robert Morris, Town of Springfield Town Clerk

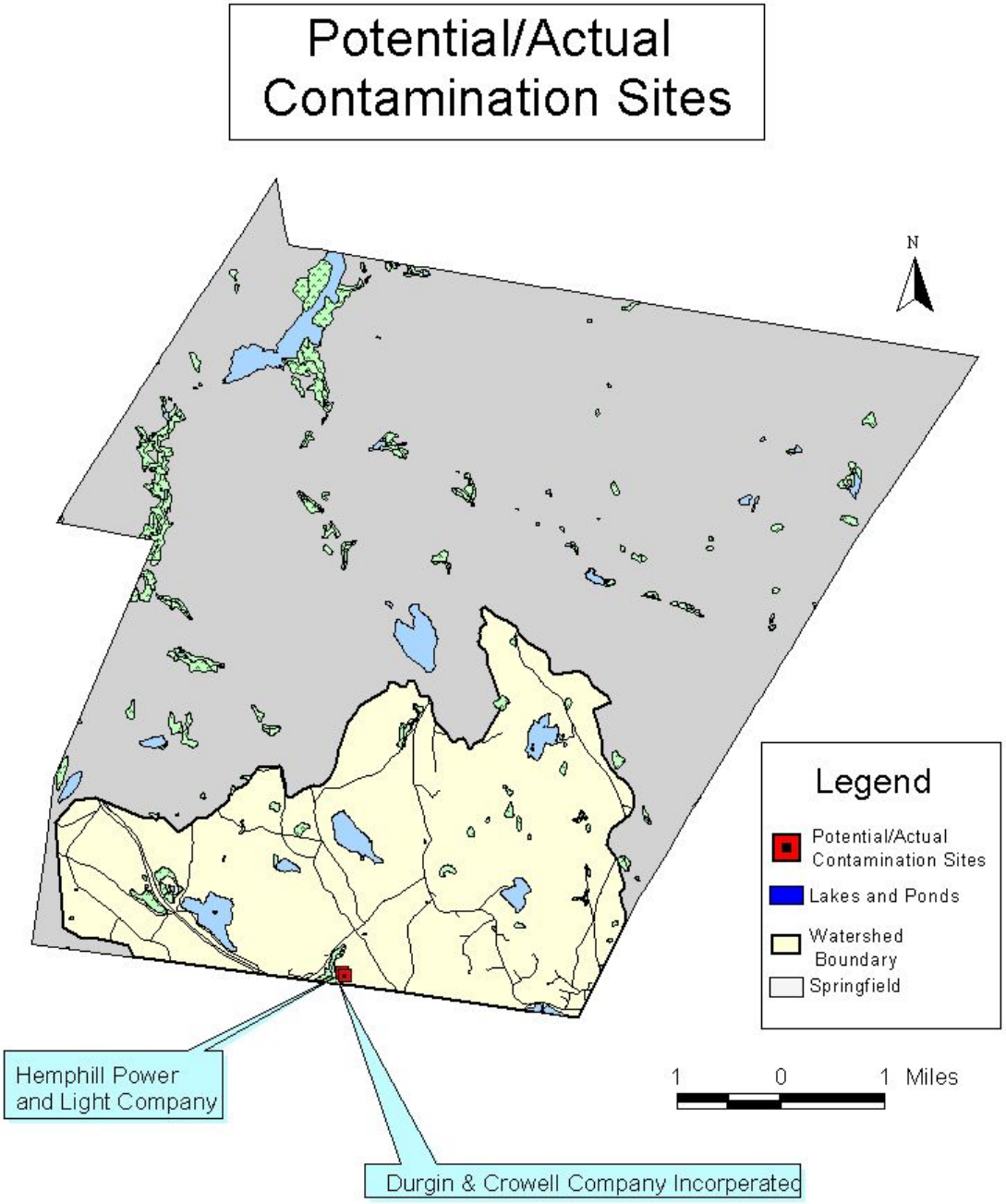
Zoning and Planning Regulations

Lot Size Requirements

Slope Classification	Minimum Lot Size
Zoning District	Rural Residential
Minimum Lot Size	1.5 acres dependant on soil and slope (see multiplier table)
Road Setbacks	35 feet from any public highway, street or roadway right-of-way 50 feet state road
Pond/Lake Setbacks	50 feet from normal high water mark for houses 150 feet from high water mark for Commercial/Multi-unit buildings
Septic System Setbacks	150 feet from any lake, pond, marsh 100 feet from any stream or other non-temporary body of water 40 feet inside all boundaries of the property
Minimum Frontage	200 feet Exceptions-curves, cul-de-sacs, private right-of-way access road 50 foot minimum
Maximum Height	35 feet Exceptions-television/radio antennae, lightning rods, cupolas, steeples, chimneys, utility poles, or silos.
0-8%	1.5 acres
8-15%	1.6 acres
15-25%	1.8 acres
25-35%	2.0 acres

Multiplier Table

	Soil Types				
Slope Classification	Well drained, rapid permeability	Well-drained, moderate permeability	Moderately well-drained	Bedrock close to surface	Poorly drained
0-8%	1.0 acres	1.3 acres	1.6 acres	2.0 acres	3.0 acres
8-15%	1.1 acres	1.43 acres	1.76 acres	2.2 acres	NS
15-25%	1.2 acres	1.56 acres	2.08 acres	2.4 acres	NS
25-35%	1.3 acres	1.69 acres	2.4 acres	2.6 acres	NS



"Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center (CSRC), under contract to the Office of State Planning (OSP), and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. Neither OSP nor CSRC make any claim as to the validity or reliability or to any implied uses of these data."

Map Created By:
Institute for Community and Environment
12/3/03

Watershed Investigation

Sunapee, NH

Micah Mitchell

Greg Van Steinburgh

Emily Goodrich

Institute for Community and Environment
Colby-Sawyer College

1. How many acres does your town represent in the watershed?

The town of Sunapee consists of 16,099 acres. 7,446 acres are found within the Lake Sunapee watershed. We calculated this by using the X Tools program on GIS.

Source:

"Granit." Complex Systems Research Center University of New Hampshire. 03 Dec. 2003 <http://www.granit.sr.unh.edu/>

2. What is the population in your town and in the watershed?

There are 3,120 people that reside year round in the town of Sunapee. As of 1994 the population in Sunapee was 2,597 people. The population within the watershed that year was 2,159. We found the percentage of residents within the watershed for 1994 by dividing the number of people in the watershed by the number of people in the town. We then multiplied the current population by the percentage of residents within the watershed and came up with approximately 2,589 people.

Source:

"New Hampshire Population." Office of State Planning. 07 Dec. 2003 www.state.nh.us/osp/sdc/90web.pdf

"Sunapee, NH." Economic and Labor Market Information Bureau. 07 Dec 2003 http://www.nhes.state.nh.us/elmi/htmlprofiles/pdfs/sunapee.pdf

3. How developed is the land? What has been the rate of development? What is the potential for development?

Due to time constraints and conflicting schedules we were unable to meet with the Zoning and Planning Commissioner at this time. Through research for the rate of development for the entire watershed we have calculated about a 15% increase for Sunapee alone over the last 17 years. We did this by dividing the total building permits issued since 1987 by the total amount of building permits for the entire watershed.

Source:

Sunapee Town Office, Building Permit Records

Bolte, Tamsen. "NH Comprehensive Lake Inventory." Question 9J.

4. What are the zoning and planning regulations in your town?

Due to time constraints and conflicting schedules we were unable to meet with the Zoning and Planning Commissioner at this time.

5. Are there conserved lands within the watershed in your town? Please provide details (how big, what agency holds the property or easement, brief description, etc.)

By using GIS we joined tables to find out what agencies hold the property and easements of each of the conserved lands in the watershed of Lake Sunapee, as well as the acreage of each. See the table tiled Conserved Lands or Lands Not Available for Development- Town of Sunapee. Also see the map labeled Wetlands and Conserved Lands. We found that there are more conserved lands outside the watershed than inside for the town. This is because there is a lot of development, especially on the shoreline, in the Sunapee watershed, therefore causing less potential for conserved lands.

Source:

"Granit." Complex Systems Research Center. University of New Hampshire. 03 Dec. 2003 http://www.granit.sr.unh.edu

6. Are there wetlands in your town within the watershed? Evaluate them.

Yes, there are wetlands within the town's watershed. The total acreage of them comes to 433.5 acres. We found this information by using GIS. The wetlands that we visited are shown in attached document labeled Sunapee Wetlands Evaluation. Wetland #1 was right off of 103B. The area was surrounded by forest and shrubbery. Since it was right off of a major road, there is more runoff and potential for pollution. The area of this wetland seemed to be "sitting;" it was more like a marsh. Wetland #2 was found off of New Province Rd toward the southern end of Sunapee. The area was very wet and had a consistent flow of water running through it. Please refer to the map labeled Wetlands and Conserved Lands.

Source:

"Granit." Complex Systems Research Center. University of New Hampshire. 03 Dec. 2003 http://www.granit.sr.unh.edu

7. What plant communities are present in the watershed in your town? Are there any special habitats? Invasive species? Rare or threatened species?

We were unable to locate any specific special habitats that are unique to this area, except for Webb Woods, a conserved tree farm, though this area is mostly outside the watershed. There are certain natural features that may attract animal species; however none of them stand out more so than other town's features. Some invasive species that we have found while driving through the watershed were: Japanese Knotweed, Barberry, and Burning Bush. These species are found sporadically alongside roadways, for example around Rt 103. Burning Bush is known to be an attractive species for landscaped yards of homes. We found a few houses along Rt 103 and other small roads that had this species in their yard.

8. Based on the plant communities and habitats you found in your area, what animal and bird species do you predict inhabit or utilize the land? Did you find any evidence that verifies the presence if any of these species? Please describe.

Based on the parcels of unfragmented lands found in the town, we were able to distinguish what wildlife lives in the watershed of Sunapee. These parcels of unfragmented lands are broken into different sizes according to acreage; please consult the map labeled Unfragmented Lands to see how the parcels are distinguished.

These large parcels of land are important for the town because they provide habitats for many different species. Larger species such as Moose and Black Bear require these larger parcels of land for their habitats. Within Sunapee we recognized on large piece of undeveloped land and numerous parcels larger than 500 acres. Some species that are found in the larger areas include: Moose, Black Bear, Deer, Coyote, Fisher, and Red-Tailed Hawks. Many of the common smaller species are morel likely to be found in the smaller parcels of land rather than the bigger ones. These species include many of the smaller rodents, most amphibians and reptile, song birds, and raccoons. The one characteristic that these animals have in common is that they need these parcels of land and undeveloped wildlife corridors to survive.

Source:

"Designing Communities to Protect Wildlife Habitat and Accommodate Development." A Response to Sprawl July: 1997: pg.9.

9. Rank the tributary streams in your watershed and describe the land use around significant tributaries.

By using GIS we were able to order the streams in the watershed of Lake Sunapee for the town of Sunapee. We found about 72 first order streams, 10 second order streams, and one third order streams. Consult our map labeled Tributary Streams.

Source:

"Granit." Complex Systems Research Center. University of New Hampshire. 03 Dec. 2003 http://www.granit.sr.unh.edu

10. Are there potential or actual surface or groundwater contamination sites in your watershed area?

Yes, there are potential surface or groundwater contaminants within the watershed of Sunapee. There are two gas stations that could potentially contaminate the lake. On our map we named Sunapee Harbor contamination site #1 and George's Mills contamination site #2. Consult our map labeled Potential Contamination Sites.

Source:

11. What are the recreation uses of the land in your watershed? Are they helpful or harmful to Lake Sunapee? How?

The watershed of Lake Sunapee allows plenty of recreational uses for tourists and residents. Obviously the lake provides swimming, boating and fishing during the summer. There are some hiking and biking trails are located in Webb Woods, which is a property under easement. During the winter, Sunapee provides ice-boating on the lake and snowmobile trails that are located in the northern and southern ends of the lake. One of the major trials comes from the iced over lake and travels through the woods to Ledge Pond. Another comes from the State Park Beach, past Mountain View Lake and comes out on Rt 103. Generally all of these recreational opportunities are helpful to the area, because they bring in more publicity and money from tourists. Environmental problems that occur from exhaust from the boats and snowmobiles could potentially be harmful by adding pollution the pristine environment. Some areas of the lake do not allow swimming because of intake pipes that provide drinking water to the towns surrounding the lake.

Source:

"Lake Sunapee Snowmobile Club." 07 Dec. 2003 http://www.lake-sunapee-snowmobile-club.org//issc_web_site 011002.gif

12. Where are there scenic viewing opportunities of Lake Sunapee? What is the noise level in those places?

Driving through the town of Sunapee we were able to find several scenic viewing opportunities of the lake. Sunapee Harbor has a great viewing area that allows you to see the other side of the lake where Dewey Beach is located. Dewey Beach, which is a public beach to Sunapee residents, allows scenic viewing towards Sunapee Harbor and

the New London and Newbury shore. Georges Mills Harbor, which is located at the northern end of the lake, allows people to see down the "channel" to Herrick Cove and the New London shore. The noise levels of these areas depend on the season mainly. During the summer, these areas would have a high level of noise due to tourists and summer residents. We found that Sunapee Harbor was generally noisy due to the small congested business and residential area. Other viewing opportunities are along Route 103, these are views that you can see when you drive along the road. There are no designated turn-out areas, but as you peer through the trees, you can catch a glimpse of the lake and the scenery around it.

Lake Sunapee Watershed Investigation

Sutton, New Hampshire

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Community and Environmental Studies
Colby-Sawyer College
Fall 2003

Town History

Sutton was first settle in 1748. The land had been granted to Obadiah Perry, and others, from Haverhill, Massachusetts and named Perrytown. Since it was located in the Indian country near Mount Kearsarge, many settlers forfeited their claims. Then in 1784 the land was regranted to settlers from Sutton, Massachusetts. Sutton was once inhibited by a religious sect known as the Osgoodites.

Acreage

Total Area: 27,735 acres
Watershed Area: 828 acres
Percentage in Watershed: 2.9 %

Population

Total Population: 1,544
Watershed Population: 73
Percentage in Watershed: 4.2%

Town Development

Population Growth
- 1990-2000: increased 6.0% (about 9 people/year over 10 years)

Population Density
- 2002: 37.6 persons/mi^2

Housing Development
- 2001: 868 housing units
  - Single-Family Units: 823 w/ 17 building permits issued
  - Multi-Family Units: 32 w/ 0 building permits issued
  - Manufactured Housing Units: 13

Through examining town tax maps, there are approximately thirty developed lots within the watershed. Seven to twelve of these plots are at least eighty-five acres, with the remaining plots being at least two acres. The entire area with the watershed is classified as a Rural-Agricultural District, having a two acre plot minimum. The potential for this area to be developed is great, especially considering the history and recent controversy over the town's growth. "Concerns about the nearly 240 percent average annual increase in residential construction that has occurred over the past four years in the area" is bound to have repercussions within the watershed boundary (LeRoy 1). As a result of such an increase, residents have worked with the Town Planning Board to put temporary controls on building and construction within the entire town. While Sutton residents are concerned with how this growth affects the school systems, road maintenance, and municipalities, there should also be the concern for loss of habitat and the effects of erosion and pollution. Placing controls on the number

and types of building permits issued will assist in preventing further unnecessary damage to the land and watershed

Zoning and Planning

Refer to the 'Sutton Zoning' document for specific ordinances that have been excerpted from the original Zoning Ordinance for this investigation. These ordinances have been excerpted as a result of their relevance to the health of the environment within the watershed, and to the health of the lake itself.

As a result of Sutton's locale in comparison to Lake Sunapee, there are no specific zoning regulations that explicitly refer to the lake. However with the new temporary controls on building permits, there will be more restrictions placed on how land can be developed in order to limit the town's population growth.

Conserved Lands

Conserved Lands are an important aspect of a town's character. Land with restricted development can assist in preserving the quality of life for the town's residents and wildlife. Not only is the amount of conserved lands within a towns important, but also the size of these parcels. In relation to the town's rate of development, conserved lands will reduce the amount of land that could potentially become developed. Within the watershed, the presence of conserved lands plays an important role in reducing the lake's vulnerability to impairment.

Although Sutton has the King Hill Reservation, a 431.9 acre piece of conserved land, only a small part of that is in the watershed. This small piece of the King Hill Reservation is the only conserved land in the watershed section of Sutton. Sutton has 827.9 acres in the watershed and with only a small section conserved; it leaves the area in the watershed vulnerable to extensive development. Even though right now there are large tracts of unfragmented land, those tracts are not conserved and therefore subject to future development. These lands need to be looked at for potential easements especially if the tract contains a wetland because those areas are crucial for the lake to continue to remain as clean as it is. Sutton should also look at the large farms that are located in the watershed because by putting them I easements, it could prevent the farmlands from being subdivided in the future. Sutton needs to conserve more land in the watershed to help both prevent overdevelopment and habitat loss, as well as maintain the wetlands and tributaries hat are so important to the health of the lake.

Wetlands

Wetlands are defined as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" by the New Hampshire Wetlands Bureau and the Army Corps of Engineers (Stone 29). Wetlands are an ecological asset to the environment and provide a variety of functions important to both people and wildlife. The function of a wetland extends beyond the physical quality into the chemical and biological functions of the environment. Some of these functions include: flood control, wildlife and fish habitat, pollutant removal, aesthetic and recreational, wood products, groundwater, and erosion control. The value of these attributes cannot be compromised with development and degradation of the surrounding environment. In acknowledgement of the importance of wetlands, national, state and local regulations protecting these ecosystems have been institutionalized.

There are no existing wetlands in Sutton that are in the boundaries of the Lake Sunapee Watershed.

Unfragmented Lands

The presence, abundance, and size of unfragmented lands within an area is an important foundation for understanding the value of the land in relation to wildlife habitat. Unfragmented lands are "undeveloped sections of the landscape with few or no roads" (Stone 28). To illustrate where these tracts of unfragmented lands exist within a town, roads along with a 500 foot buffer are set as the limiting factor in defining the boundary of these lands. Roads present wildlife as a source of mortality and a human defined boundary for territory. The size of the unfragmented land will predict what kind and how diverse the wildlife will be in the area. In order to properly present the parcels of unfragmented land within the watershed, the graphics were extended beyond the boundaries of both the town and the watershed. This was done to display how unfragmented lands do not conform to human-made political boundaries, as opposed to man-made physical boundaries, such as roads. Another reason for portraying the extended boundary is to display how towns need to look beyond their own boundary. What they do inside their boundaries may influence what happens outside in other towns.

As a result of the few roads that are present and the type of land use in Sutton within the watershed, the area has a few large parcels of unfragmented land. This area is probably at a high risk of loosing these categories of unfragmented lands as a result of the increase in development that is taking place within the town. The rural character of Sutton is attractive for people to build in, since their homes can be secluded. As more people move into the area, the more degradation the land and habitat will experience. More development will inevitably lead to more roads which will dissect important wildlife habitat.

Wildlife

The presence of wildlife is an indicator used to help define the condition of an area. Species diversity is usually a signal of the health of the habitat; high diversity implying a good healthy, stable ecosystem and a low density implying a degrading habitat. Ecologists have studied the roles of species within a habitat and have developed patterns of relationships between the quality of the habitat and the abundance and diversity of species. Through these relations, indicator species have been marked as species that have populations that fluctuate based on the health of the inhabited system. One of the greatest factors in decreasing wildlife diversity is human development and sprawl. Development has caused for fragmentation to occur in critical habitats that host species with specific needs. Just like people, each species has its own individual needs for survival and reproduction. These demands are in the form of suitable habitat, adequate food supplies, sufficient home ranges, and access to a diversified genetic pool. If a habitat cannot meet these needs, populations will inevitably suffer as a consequence. The smaller the parcel of unfragmented land is, the less diversified the local wildlife population becomes. The opposite effect is true as the lot size increases, the species diversity intensifies. In order to ensure future and more detrimental challenges are not brought on against wildlife, it is necessary to understand what critical habitat is left and how to protect these habitats. Unfragmented lands symbolize areas where wildlife can exist under reasonable conditions, as they once did before human development. These environments will always have the presence of human disturbance, however limiting future disturbance is necessary to keep intact the value that these habitats bring to life. "Protection of wildlife habitat is one of the variety of values that depend on larger areas of open space and undeveloped land" (Patterns of Development Task Force).

The wildlife in Sutton has the benefit of having a decent amount of unfragmented tracks of land. From the size of the tracks of land it can be expected that one would be able to find such animals as listed in table below. These animals can be found provided that enough food and the necessary recourses can found in the track of land. A major inhibitor to wild is human development. As more people develop the land the more the fragmented it will become causing the wildlife to live in tighter spaces. Also with the increase of development roads are built leading to more fragmentation and animals must cross the roads in order to get to other parts of their territories. The more animals have to cross the roads the more likely road kill will occur. The following page has a preliminary list of wildlife species that could exist within the unfragmented parcels.

100-499 acres	500- 2500 acres
raccoon	raccoon
small rodents	small rodents
cottontail	cottontail
squirrel	squirrel
muskrat	muskrat
red fox	red fox
songbirds	songbirds
skunk	skunk
reptiles	reptiles
amphibians	amphibians
hare	hare
porcupine	porcupine
beaver	beaver
woodchuck	woodchuck
garter snake	garter snake
weasel	weasel
mink	mink
deer	deer
sharp-shined hawk	sharp-shined hawk
cooper's hawk	cooper's hawk
harrier	harrier
broad-winged hawk	broad-winged hawk
kestrel	kestrel
horned owl	horned owl
barred owl	barred owl
turkey vulture	turkey vulture
turkey	turkey
wood frog	wood frog
osprey	osprey
	coyote
	bobcat
	black bear
	fisher
	moose
	bald eagle
	goshawk
	raven

Tributary Streams

Tributary streams are the small drainage ditches and small streams that are the origin of larger streams and rivers. They are very important to the water quality of Lake Sunapee because they all eventually wind up directing water into the lake. Consequently these tributary streams play a vital role in the health of the lake. By understanding how these streams are connected to the entire system, it can be easier to understand the importance of being aware of potential contamination. By degrading the land adjacent and/or uphill from these streams, the water can become contaminated with chemicals and sediment.

With Sutton being on the outskirts of the watershed, most of the streams present in the watershed boundary are order 1 tributary streams. The land use around these streams consists of rural residential development and agriculture. These waters could be at risk for contamination by fertilizers and run-off from household uses and construction. Erosion during the stages of development would create a situation of excess sediment being carried downstream by the waters, unless building permits require erosion control measures.

Surface and Ground Water Contamination Sites

Potential surface and ground water contamination sites are important to locate within a watershed. Knowing where these places are located and what types of risks they pose to the environment will enable for precautionary measures to be taken to avoid any accidents.

There were no surface or groundwater contamination sites found in Sutton's part of the Lake Sunapee Watershed according to the 'potential contamination site data' produced by NH DES.

Recreational Use

The recreational uses of the land in the watershed are pretty uniform throughout. Activities such as hunting, fishing, camping, hiking, and canoeing do not really have negative impacts on the land or water bodies. However other activities such as snowmobiling, four-wheeling, and power boating can add contaminants to the land, the air, and the water. Since Sutton is not on the water, water activities do not apply to this town, yet residents may participate in these activities on Lake Sunapee. Sutton is probably more vulnerable to recreational uses such as snowmobiling, four-wheeling, hiking, and hunting. Snowmobiles and four-wheelers release it into the air or onto the snow on the ground. This can then seep into the ground into the groundwater or be carried with the snow melt into the tributaries and into the lake. The noise from these machines can disturb and spook wildlife native to the area causing them to feel uneasy about being in that area. Although recreational machines are fun, they pose some problems that need to be

watched so that they do not destroy in the name of enjoyment. Lower impact uses, such as hiking and hunting can be beneficial in preserving land. As people enjoy the area as a result of the naturalness, they will discourage the development of the area.

Scenic Viewing Opportunities

Lake Sunapee can not be seen from any point in Sutton. This may cause residents to feel "out of sight out of mind". This is because they can not see the lake, which could possibly make the residents to feel detached from the lake and feel their actions do not affect the lake. When in actuality the town of Sutton plays an important part in the make up of the quality of the lake. Since part of Sutton and its tributary streams are in the watershed, the need for its residents and visitors to understand that what they do has an affect that can place a sense of being in touch with the watershed, more then being able to see it can.

Sources

"Granit". Complex Systems Research Center. University of New Hampshire. 3 Dec. 2003 <http://granit.sr.unh.edu/>.

LeRoy, Bridget. "Sutton's Rapid Growth Stirs Citizen Concerns." InterTown Record 18 November 2003: 1 and 3.

"New Hampshire Demographics". Economic and Labor Market Information Bureau, New Hampshire Employment Security. 6 June 2003. 3 Dec. 2003. <http://www.nhes.state.nh.us/elmi/htmlprofiles/pdfs/sutton.pdf>.

Stone, Amanda J. Lindley. Natural Resources Inventories: A Guide for New Hampshire Communities and Conservation Groups. UNH Cooperative Extension. 2001.

Wetland Field Study Worksheets for Wetland Functions Evaluation. NH DES. "A Response to Sprawl: Designing Communities to Protect Wildlife Habitat and Accommodate Development". Patterns of Development Task Force Maine Environmental Priorities Project. July 1997.

Zoning Ordinance, Building Ordinance, Flood Plain Ordinance. Town of Sutton, Office of Selectmen. May 2002.

Appendix A: Zoning and Planning Regulations

Article I. Preamble: Pursuant to the Authority conferred by Chapter 31, Sections 60-89, now codified as RSA 672-677, New Hampshire Revised Statues Annotated, and for the purposes of promoting the health, safety and welfare of the inhabitants, and preserving the values and charm, now attached to the town, the following ordinance is hereby adopted by the Town of Sutton, NH, in Town Meeting convened, as amended, in conformity with a comprehensive plan.

Article III. General Provisions

F. No land in any district shall be used for storage or disposal of junk as described in the State laws; nor old bottles, other solid textile waste, unfinished cloth or other textile mill yarns, old paper products, old rubber products, old plastic products, and other second-hand or waste articles, the accumulation of which is detrimental or injurious to the neighborhood.

K. No more than one principal building shall be allowed on a single lot.

L. Uses specifically prohibited in all Districts.

i. Facilities for the burial, disposal, storage, transfer or reprocessing of all types of waste material.

Article V. Rural-Agricultural District

A.2 It shall be a district of farms and residences.

C.1 Minimum lot area not less than two acres and conforming to the frontage and yard requirements.

D.1 All permanent, temporary, or portable buildings and structures shall be set back a minimum of seventy-five feet from normal high water of any wetland, as defined by the National Cooperative Soil Survey as poorly drained and very poorly drained soils, or surface water including lakes, ponds, rivers and streams.

D.2 Septic systems are prohibited within seventy-five feet of any wetland, as defined by NCSS poorly drained and very poorly drained soils or rivers, streams and ponds.

<u>Setbacks, Lot Size, Frontage, etc</u>. (March 14, 1990)

Frontage:

Residential: 250’ (temporary trailers for construction must be set back at least 75’)

Rural/Agricultural: 250’

Setback:

Residential: Buildings shall be set back 75’ from normal high water mark

Abutters: 15’

Right of Way: 30’

Rural/Agricultural: Buildings shall be set back 75’ from normal high water mark

Abutters: 25’

Right of Way: 50’

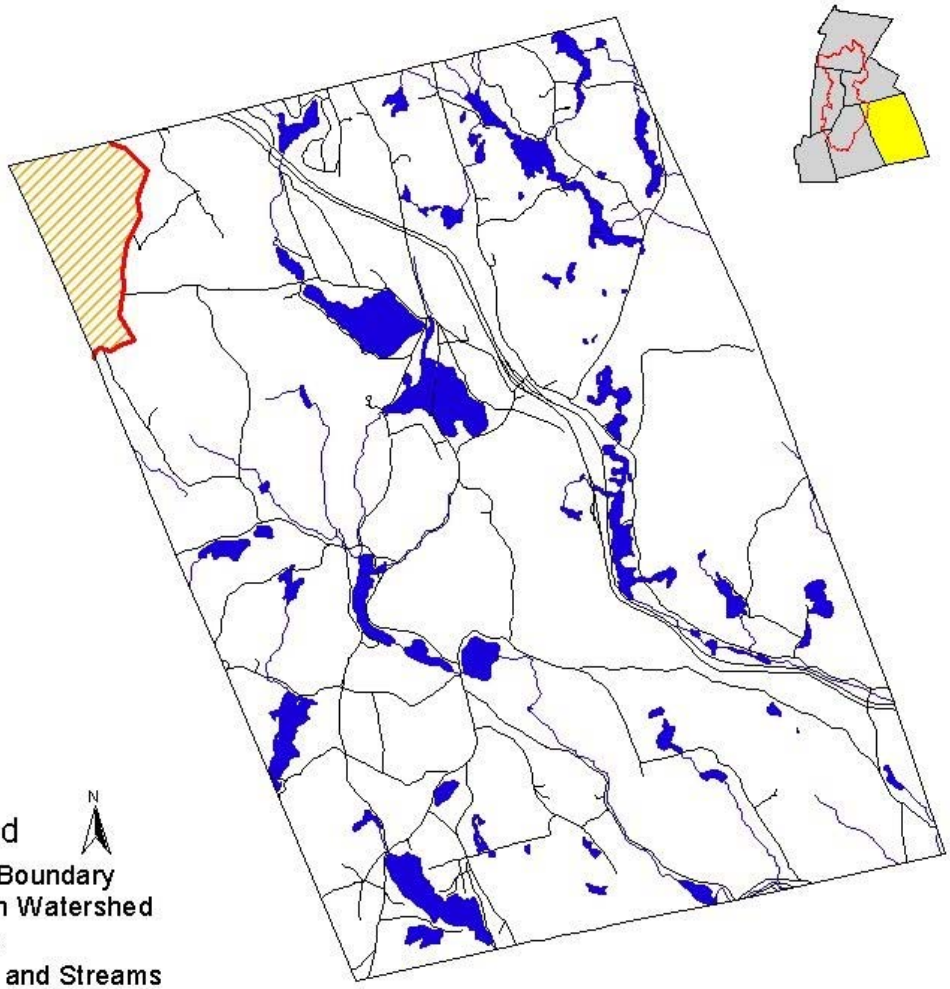
Lot Size:

Residential: 2 acres

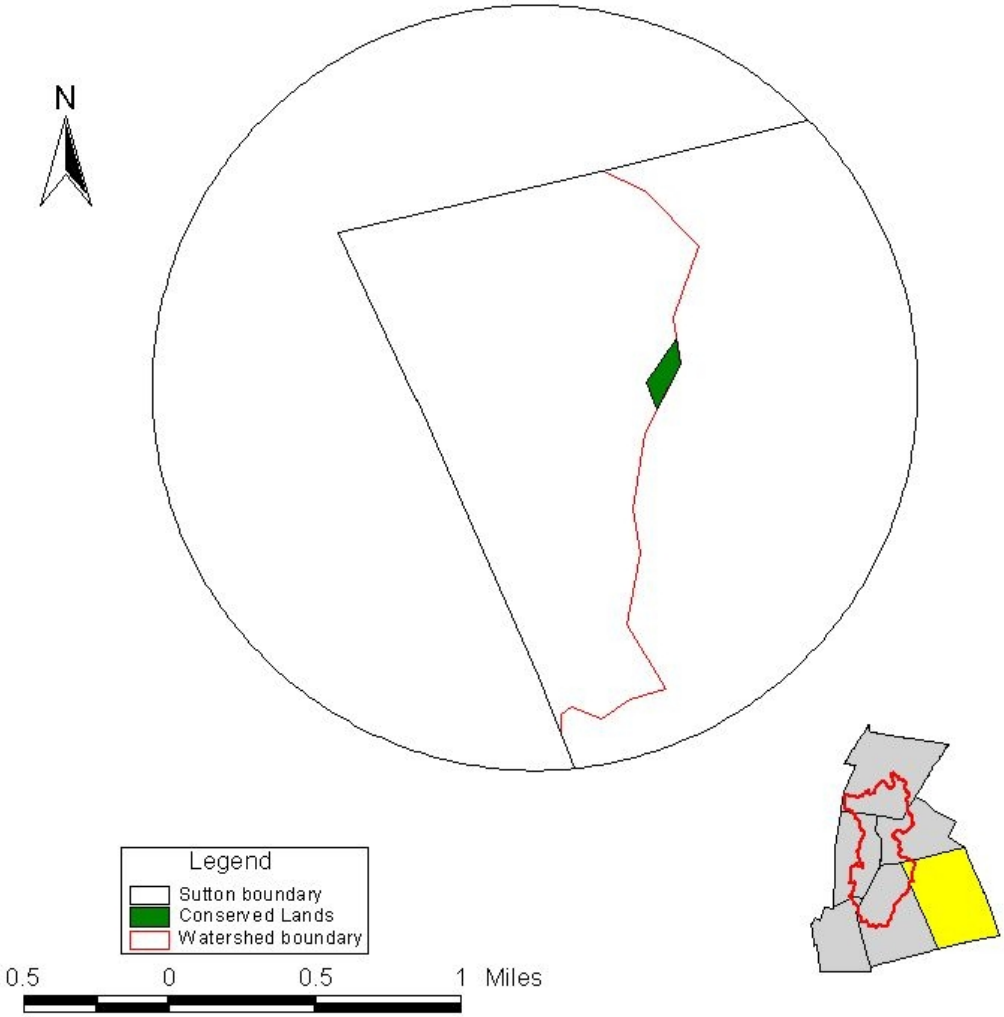
Rural/Agricultural: 2 acres

Town of Sutton

Total Area: 27,735 acres
Area in Watershed: 828 acres
Population: 1,544
Population in Watershed: 73*
(based on 2.5 persons per household)



Sutton Conserved Lands



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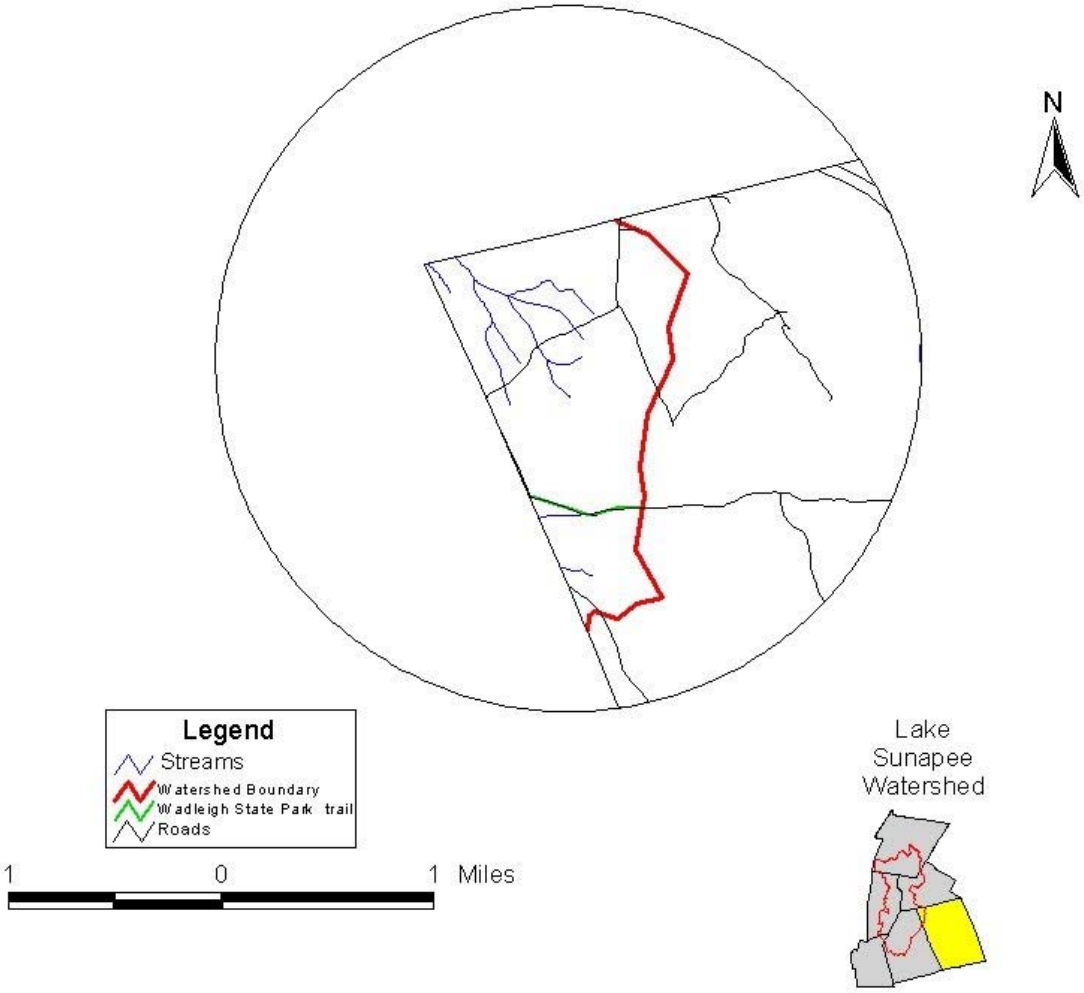
Sutton Hiking trails



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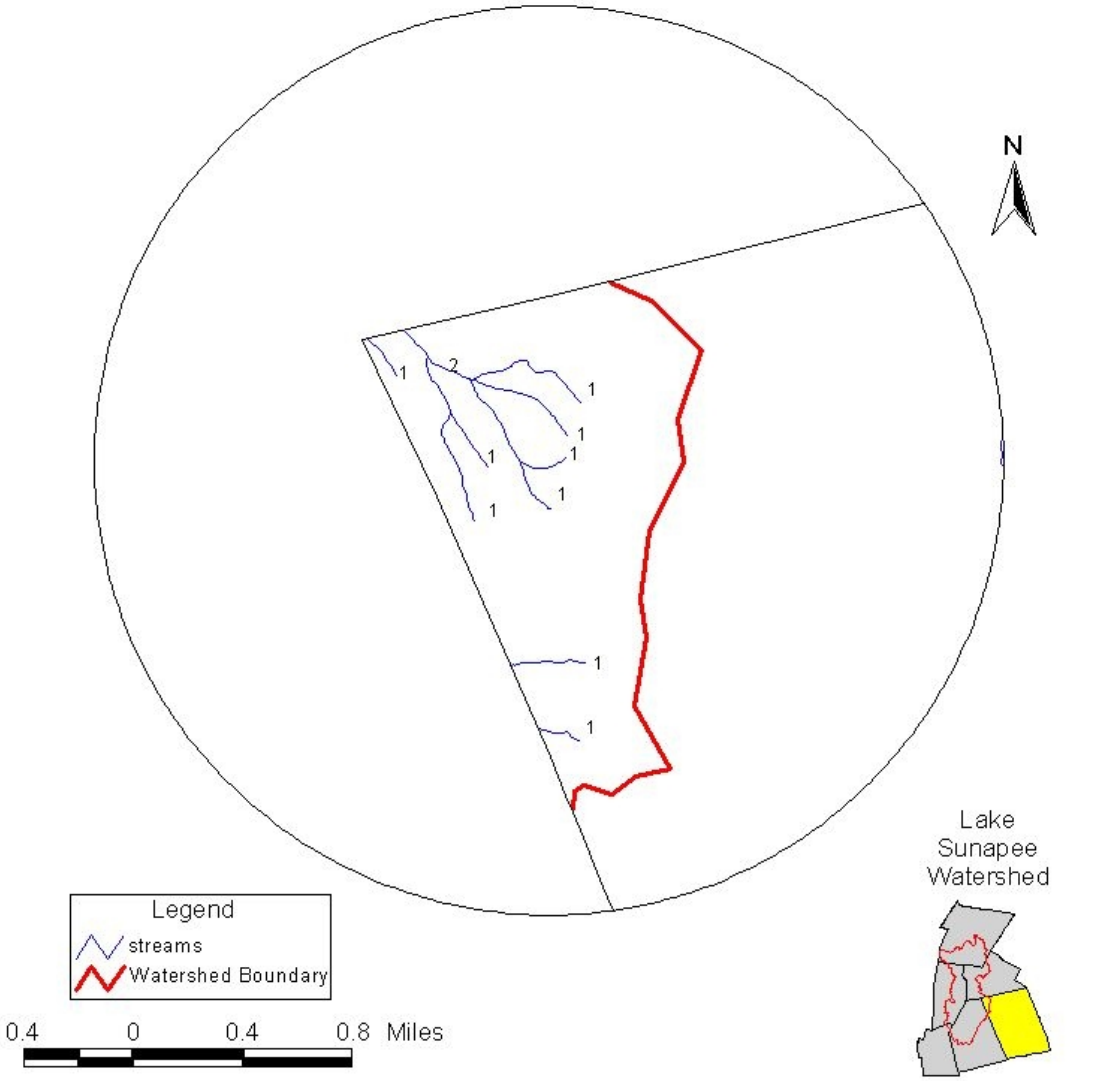
Sutton Tributary



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Town of Sutton Unfragmented Lands