

**Mountain Lakes District  
Haverhill, NH**

**Wetland Inventory and Documentation**



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Report Prepared for:  
Mountain Lakes District

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## Introduction

The Mountain Lakes District is found within the northern part of the town of Haverhill, New Hampshire. It contains 1,546 acres, revolving around two man-made lakes, which were constructed in the 1960's by Town and Country Realtors. The entire area was purchased with a vision of creating a four-season private community. It was subdivided into 1,260 building lots, with 1,235 in Haverhill and 25 in Bath, NH. In 1975 the developers became bankrupt and the Mountain Lakes organized as a District with its own elected officials. To date there are 310 homes, and new houses will likely be constructed in the future. Approximately 39% of the homes contain full time residents, while 61% are second homes.

In 1988 the first Mountain Lakes Five Year Plan was developed and accepted by district voters. In 1996 a Master Plan was adopted. It was later updated including tightening of zoning ordinances in 2001, and further changed in 2004. Currently, another revision of the District's Master Plan is underway, illustrating the dynamic nature of these working documents as well as the diligence and hard work of Mountain Lakes District residents.

In 2007, a *Management Plan for the Mountain Lakes Watershed* was completed by Jennifer Palmiotto of Granite State Rural Water Association. This plan addresses the prevalent concerns of the Mountain Lakes Watershed as identified by the Mountain Lakes Watershed Advisory Committee as well as 30+ people who attended a two day workshop entitled "Protecting Water Quality in the Mountain Lakes Watershed." In 2008, Watershed to Wildlife, Inc., partnering with North Country Council, Inc. completed a town-wide assessment of wetlands in Haverhill, some of the wetlands being in the Mountain Lakes District. These two documents, along with the District's Master Plan will compliment work done for this project.



Lower Mountain Lake (northern lake) facing south towards the public beach and offices.

The goal of this project is to inventory wetlands throughout the Mountain Lakes District with an overall goal of protecting water quality throughout the District. Measurable objectives of this project include the following:

1. Document culverts with associated wetlands along all roads within the District
2. Improve upon existing wetlands and hydric soil data with field work and verification
3. Enable the District to determine lots with potential wetland sensitivity

## **Methodology**

Mountain Lakes commissioner, Karl Schmid and Planning Board chair, Sandy Schmid were project contacts. The District hired Watershed to Wildlife, Inc., (WTW) to conduct an assessment of wetlands and associated culverts and to integrate the data to create a geographical information system (GIS) data base as well as a plot of data collected. Throughout the project WTW communicated with Sandy and/or Karl Schmid to give updates of the work as it progressed.

### ***Field Work***

Three days of field work were conducted to inventory culverts and wetlands along the 17 miles of roads found within the District. All roads were driven and when a wetland or culvert with a wetland was found, a GPS point was taken to record its location. Digital photographs and field notes were also taken to describe the type of wetland and its relative size where possible. In some cases undeveloped roads were followed, particularly if there appeared to be wetlands in the area. During field work sessions, any areas of interest, such as vernal pools or erosion concerns were noted and located on a map. The northern lots and roads in the town of Bath were not included in this study.

### ***Gather Existing Digital Data***

Existing maps and data for the Mountain Lakes District were collected. The following table shows which maps were obtained, their scale, and the national mapping standard accuracy measure. Since many decisions are based on parcels as they relate to lakes, rivers, wetlands, roads, and other features, it is important to point out the working accuracies of these data sources. Combining these sources in various overlays provides an excellent overview and planning tool, but does not replace the need to perform site-specific investigations for many development requests. Please refer to the table below to better understand some of these accuracy issues.

**Accuracies of Existing Maps**

<b>Data</b>	<b>Source</b>	<b>Ratio</b>	<b>Scale</b>	<b>National Mapping Standard Accuracy</b>
1998 and 2003 Digital Orthophoto Quadrangle (DOQ)	GRANIT - .sid version	1:5,000	1" = 416.7'	Acceptable accuracy within 12.48 feet

<b>Data</b>	<b>Source</b>	<b>Ratio</b>	<b>Scale</b>	<b>National Mapping Standard Accuracy</b>
Topographic Maps (DRGs)	GRANIT .tif version	1:24,000	1" = 2,000'	Acceptable accuracy within 60 feet
Roads and Trails, Power Lines, Watershed Boundaries, Hydrology	GRANIT	1:24,000	1" = 2,000'	Acceptable accuracy within 60 feet
Soils – Poorly and Very Poorly Drained	Natural Resource Conservation Service (NRCS)	1:20,000	1" = 1,667'	Acceptable accuracy within 50 feet
Aquifers	USGS & NH –Dept. of Environ. Services	1:24,000	1" = 2,000'	Acceptable accuracy within 60 feet
National Wetland Inventory	U.S. Fish and Wildlife Service	1:24,000	1" = 2,000'	Acceptable accuracy within 60 feet
GPS Points	Garmin GPSMAP 76CSx	N/A	N/A	10-16 feet 95% of the time – WAAS accuracy in North America

**Compile Existing Data into Arcview and ArcGIS**

GIS analyses were conducted by WTW. Digital data were gathered from GRANIT, Natural Resource Conservation Service (NRCS), and the US Fish and Wildlife Service.

These data include the following:

1. DOQs – Aerial photography
2. Topographic maps
3. Hydrology (rivers, streams, lakes and ponds)
4. Roads and trails
5. National Wetlands Inventory
6. Soil Information, particularly hydric soils
7. Aquifers and Subwatersheds

Existing available maps were then integrated using ArcView and ArcGIS software. Using the USDA 2003 aerial photography, topographic maps, and soils maps, features were overlaid onto a base map.

Wetlands were reviewed and analyzed using the Digital Orthophoto Quadrangles (DOQs), National Wetland Inventory (NWI), Natural Resource Conservation Service (NRCS) soils maps (displaying hydric soil map units), and fieldwork. New Hampshire state laws require that three parameters be met for classification as a jurisdictional wetland: the presence of hydric soil (very poorly and poorly drained soils); sufficient hydrology; and hydrophytic<sup>1</sup> vegetation. When soils maps alone are used, they could potentially over-

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<sup>1</sup> Hydrophytic vegetation are plants that grow in water or on a substrate that is at least partially deficient in oxygen as a result of excess water; plants typically found in and adapted to wet habitats.

estimate the number of wetlands throughout the District. This is particularly true given that up to 35% of a soil classification can be inclusions (for example, upland areas within NRCS hydric soil units or wetland areas within NRCS upland units). On the other hand, examining the NWI data alone would under-represent the number of wetlands, due to the U.S. Fish and Wildlife Service's method of using aerial photography to identify wetlands. Open water, emergent, and scrub-shrub wetlands can readily be identified using aerial photography alone, but forested wetlands are often missed. Some types of wetland delineations require extensive fieldwork beyond the scope of this project. Despite differences and potential errors, data provided from these sources are important tools, and can be built-upon in future studies.

Wetland areas documented during field work were located using the handheld GPS unit. They were downloaded into ArcMap-ArcView. Streams, wetlands and other areas of interest were then digitized into the mapping program using the GPS points, with associated digital photographs and field notes. All new and relevant existing data were displayed on plots provided to the District.

### ***Public Information Presentation***

At the completion of the fieldwork, and GIS analyses for the wetlands throughout the District's road system, a public information meeting will be held on February 12, 2009 to explain results from the wetland study. The goal of this meeting is to increase public awareness of the importance of sensitive areas, including wetlands, steep slopes and vernal pools. The meeting will also illustrate the amount of digital data available to the District. In addition, work done for this project will be displayed for public viewing at the meeting. All digital information belongs to Mountain Lakes District and was delivered on CD-ROM(s) and in hardcopy format.

## Results

### **Wetlands**

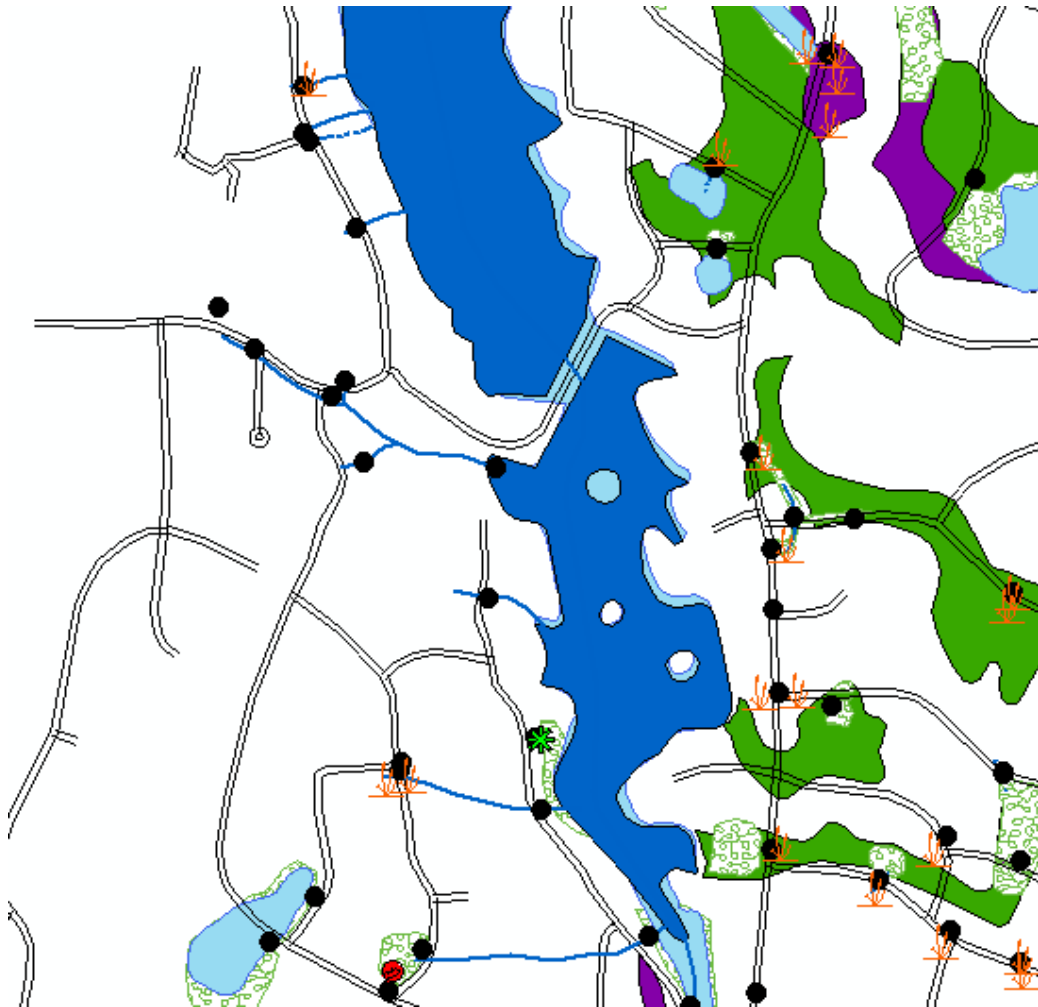
Wetlands are the core of life for the majority of plant and animal species and contain diverse habitats with edge habitat needed by many species. It is estimated that riparian areas and wetlands are utilized by over 90% of the region's wildlife species and provide the preferred habitat for over 40% of local species. Future trails and observation points overlooking these wetlands provide excellent opportunity for wildlife viewing.

Based on National Wetland Inventory (NWI) alone, there are just over 105 acres of wetlands or 6.8% of the District's area. Although an excellent tool, NWI data generally under-represents and size and number of wetlands. On the other hand, based on the NRCS soils data, there are 248.7 acres of poorly drained soils, very poorly drained soils and open water areas, which represents over 16% of the District's area. Because New Hampshire requires three parameters in defining wetlands (hydrophytic vegetation, hydric soils, and hydrology) using soil data alone can over-represent the amount of wetlands in an area.

Because of these discrepancies, data from three days of field work was incorporated into ArcMap. Several different types of wetlands were located onto the GIS database. These include; wetland points, wetland polygons, intermittent streams, and perennial streams. Details on what each of the new data layers mean is described below.

- **Wetland points** – Any wetland which was either too small to draw a polygon or size of wetland could not be determined, was given a single point (or series of points) to indicate the presence of a wetland. There is no area associated with this point, but it indicates the presence of a documented wetland and indicates the need for wetland delineation on the lot to determine wetland boundaries if any construction is proposed.
- **Wetland polygons** – Any wetland area where a polygon could be drawn for one or all of the following reasons
  - distances were listed in the field book during field inventory
  - the ends of the wetland area were located using the handheld GPS unit
  - the boundaries of the wetland could be seen on aerial photography
  - the aerial photography matched either existing NWI wetlands or hydric soil units (particularly very poorly drained soils) to confirm the presence of a wetland
- **Perennial Streams** – Perennial streams are channelized streams or rivers that have continuous flow in parts of its bed throughout the year during years of normal rainfall. Even a stream considered to be a trickle at the dry time of the year, still qualifies as a perennial stream. Perennial streams were noted with the GPS unit where they flowed under the road via a culvert or parallel to the road with ditches.
- **Intermittent Streams** – Intermittent streams are channelized streams that do not have continuous flow throughout the year during years of normal rainfall. Intermittent streams contain a channel like perennial streams, but the channel dries up for weeks to months during the year. Intermittent streams were collected with the GPS unit where there existed a channel under the road via a culvert or parallel to the road with ditches.

Although most of the wetlands and streams are displayed for the entire District, many were not mapped if they were too far from the District Roads. For example, along Kearsarge and Lakeside Drives, several perennial and one intermittent stream were documented. Although it was clear how they entered the Lakes, it was unclear how far from the lake they originated.



Additional Perennial and Intermittent Streams were added to existing data as shown to the West (left) of the Mountain Lakes. To keep costs reasonable, streams were not followed from the roads. However there were instances where the streams could be connected between roads based on the location of culverts, digital photographs, field notes and use of aerial photography.

Wetland Inventory and Documentation



This small perennial stream flows down the side of Vernon Road, under Hanover Drive and eventually into the north end of the southern Mountain Lake. Although just a trickle during low flow periods, it is still considered a Perennial Stream.



In contrast to the above photo, Waterman Brook is also a perennial stream and the main tributary to the upper (southern) Mountain Lake.

In 2008, a Wetland Study was completed for the Town of Haverhill. The study was done to equip the Town to designate prime wetlands if residents choose to do so. Two of the wetland areas assessed and ranked were partially located in Mountain lakes. These are:

1. The Mountain Lakes-French Pond Wetland Complex
2. The Waterman Brook Wetland Complex

The Mountain Lakes-French Pond Wetland Complex received the highest ranking of all wetland complexes inventoried and assessed throughout Haverhill, due to both its size as well as diversity of wetland and habitat types. The wetland is over 465 acres, nearly 164 acres being within the Mountain Lakes District. It runs from Benton Road in Central Haverhill at the southern portion of the wetland, and runs north along French Pond Road, through French Pond and into the Mountain Lakes. This wetland complex also contains a diverse wetland south of Mountain Lakes and part of Waterman Brook, which ranks very high for diversity and wildlife habitat alone.



Large, diverse wetland complex south of the Southern Mountain Lake was part of the Mountain Lakes-French Pond Wetland Complex.

The Waterman Brook Wetland Complex is a 56 acre wetland in Haverhill with nearly 3 acres being in the Mountain Lakes District. It is mostly forested with very little impact from development at this point. This wetland received high scores for functions such as floodwater control, nutrient export, groundwater recharge/discharge, and production export based the undeveloped nature of the area. The fact that it is well vegetated with adequate buffers contributed to higher scores for these functions. It also scored high for wildlife potential, and offers excellent cover and thus is a potential wildlife travel corridor. In

addition, because of the nature of the topography in the area, there is a high likelihood of finding vernal pools throughout the area.



This wetland complex is located behind the Skiway. Nearly 3 of the 56 acres are found within the Mountain Lakes District boundary. The stream in this photo is a tributary to Waterman Brook and is part of the wetland complex within the Mountain Lakes District.

The *Functional Assessment of Wetlands throughout Haverhill, NH* report has additional details and mapping of these and all wetlands inventoried and assessed throughout Haverhill.

***It is anticipated that additional data generated will help improve existing data. On a lot by lot basis, field delineations are necessary to accurately map all wetlands in the District. These can be incorporated over time with additional field verification. In addition, the District could work with the Town of Haverhill to pursue Prime Wetland Designations.***

## ***Hydric Soils***

Hydric soils are those that are formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop conditions where the upper part of the soil lacks oxygen. As a result of soil saturation and reducing conditions, hydric soils undergo chemical reactions and physical processes which differ from those found in upland soils which are more aerated. The Natural Resource Conservation Service classifies two types of hydric soils; very poorly drained and poorly drained.

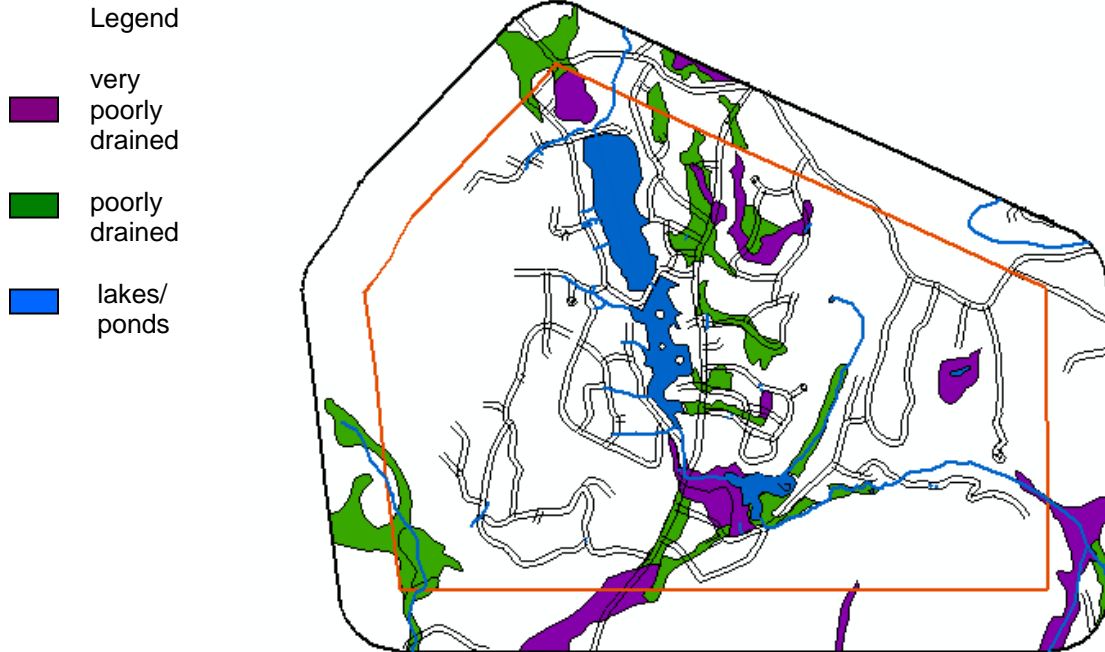
Very poorly drained soils are typically very soft, mucky, organic soils, with a depth of greater than 60" to bedrock, high water potential, and a water table ranging a maximum of

12” below the surface to 12” above the surface. These characteristics make these soils unsuitable sites for agriculture and development, but there can be limited potential for timber harvesting. Due to the deep, soft, wet soil conditions heavy equipment can only successfully access these sites during winter months when the ground is frozen. These soil conditions also create high potential for wind throw and seedling damage. Very careful planning and proper permitting must take place in order for timber harvesting to be successful on these sites.



The soils in this diverse wetland off Waterman Brook are classified as very poorly drained: Chocoura Mucky Peat and Peacham + Ossipee soils.

Poorly drained soils are firmer soils, but generally still have moderate to high water potential, and have seasonal high water table levels that range from 0 to 18 inches below the surface. Some of these soils have periods throughout the year when they are drier giving them potential for pasture land and developable sites. If development is to occur on these soils, careful, detailed planning must go into details such as drainage and septic systems. These soils typically have the same limitations for forestry practices as very poorly drained soils, so access during the winter months or dry periods are recommended. Again careful planning and proper permitting must take place for intense activity to be productive on these soil types.



Hydric soils in and around the Mountain Lakes District.

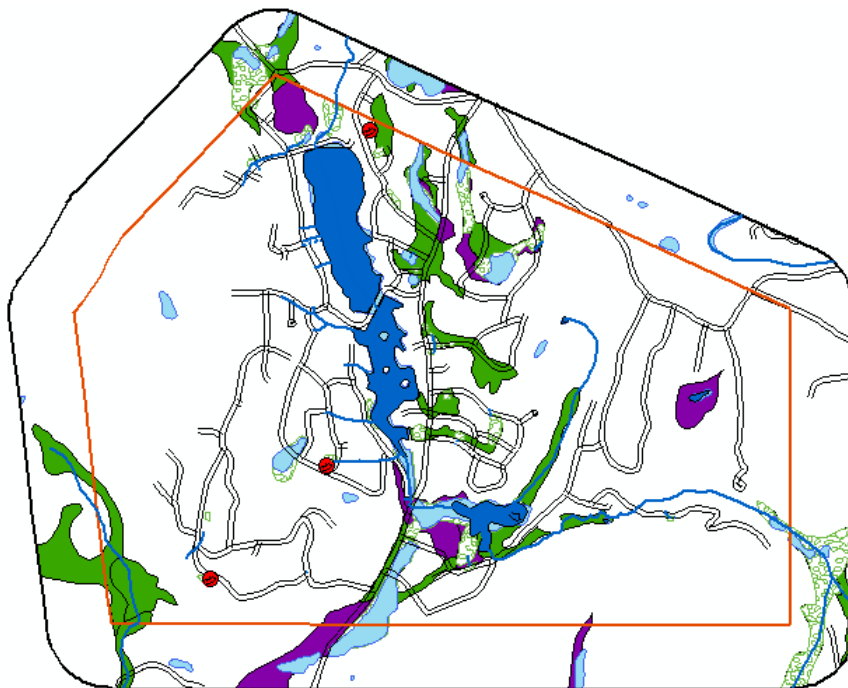
It should be noted that when soil maps alone are used to identify wetlands, they could potentially over-estimate the number of wetlands throughout an area. This is particularly true given that up to 35% of a soil classification can be inclusions (for example, upland areas within NRCS hydric soil units or wetland areas within NRCS upland units). ***Despite mapping errors, data provided from hydric soil information are important tools, and provide a warning flag indicating that onsite evaluation is necessary to determine wetland and upland boundaries.***

### ***Vernal Pools***

Vernal pools are unique and sometimes isolated wetlands. A vernal pool is a temporary body of water which provides essential breeding habitat for certain reptiles, amphibians, and crustaceans – such as woods turtles, wood frogs, spotted salamanders, and fairy shrimp. They fill annually from precipitation, runoff, and rising groundwater. Vernal pools are usually dry by the middle of the summer, making them uninhabitable for fish, and therefore a safer environment for amphibians. Vernal pools vary in size, shape, and location. With the abundance of hydric soils and wetlands, Mountain Lakes potentially contains many vernal pools. Three were found during field work in September, and future studies will likely document additional ones throughout the District. Three probable vernal pools were found during field work at Mountain Lakes.



A probable vernal pool found off of Mountain Road.



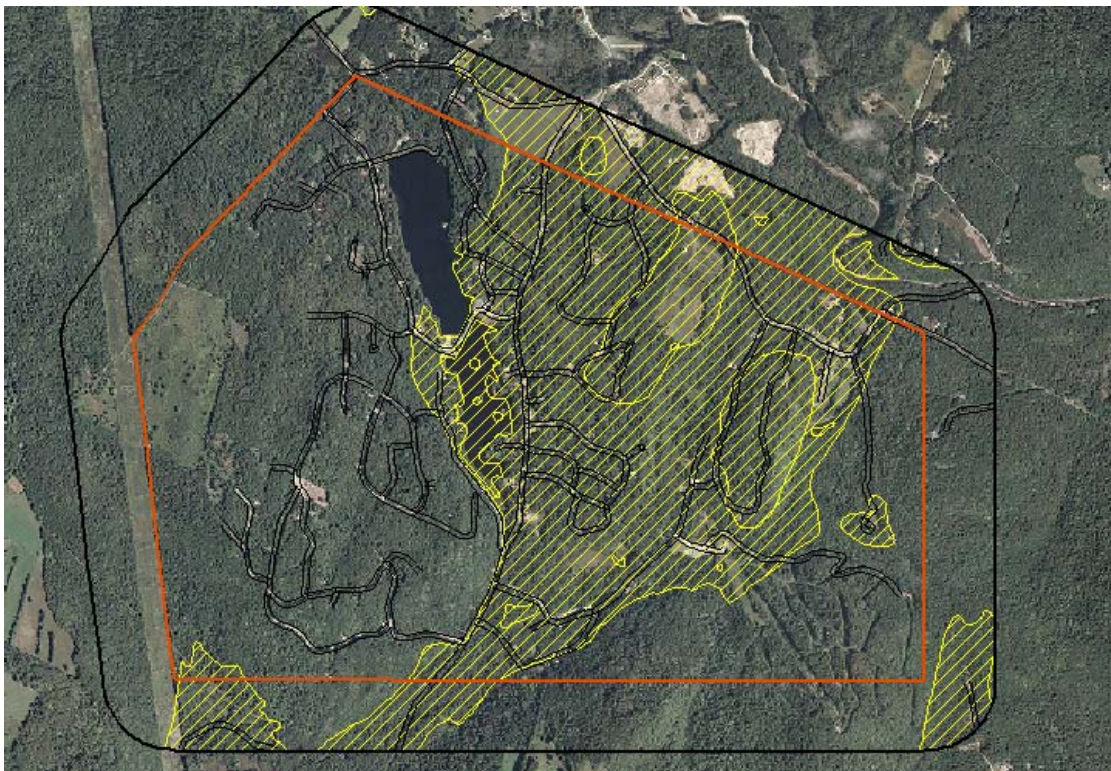
Locations of three probable vernal pools in Mountain Lakes District are shown with the red circles.

***It is recommended that these vernal pools be verified during amphibian breeding season, which runs from the end of April through May. Some of the species to look for include wood frog (*Rana sylvatica*), yellow spotted salamander (*Ambystoma maculatum*), jefferson/blue-spotted salamanders (*Ambystoma spp.*), and fairy shrimp (*Branchiopoda anostraca*). In many cases, documentation of egg masses will suffice.***

## **Aquifers**

An aquifer is an underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt, or clay) from which groundwater can be usefully extracted using a water well. There are three different types of groundwater aquifers; stratified-drift, till, and bedrock. The basic difference is that stratified drift and till aquifers are composed of unconsolidated glacial deposits (loose earth materials), while bedrock aquifers are solid rock. In stratified drift aquifers, the materials are sorted sand and gravel. In till aquifers, the material is a gravel, sand, silt and clay mixture. In bedrock aquifers, the rock is fractured.

Stratified-drift aquifers are an important source of ground water for commercial, industrial, domestic, and public-water supplies in the State of New Hampshire. Approximately 14% of the land surface in the State is underlain with stratified-drift aquifers. In and around Mountain Lakes District there are nearly 702 acres of aquifers, with 550 acres containing sandy material and the remaining containing mostly till materials. These are located along the southern Mountain Lake and well east of the lakes to the Skiway area. On a larger scale the aquifer connects the Wild Ammonoosuc to the north of Mountain Lakes in Bath with the Connecticut River along the western portion of Haverhill.



Aquifers in Mountain Lakes District are shown with the yellow hatched areas.

Wells used by communities and private landowners draw groundwater from aquifers. The stratified-drift aquifers represent the greatest potential groundwater source for the Mountain Lakes District. These aquifers represent potential usable water resources and should be protected to ensure their future quality and availability.

***It is recommended to maintain minimal development of impervious surfaces over areas containing aquifers.***

## Conclusion

This study was done to equip the Mountain Lakes District of Haverhill, NH with additional field verified mapping to strengthen an inventory and assessment of wetlands and water resources throughout the area as development pressures continue to increase. The Town of Haverhill is one of the few towns in the North Country to have a wetland and aquifer ordinance. However, the District and Town may wish to establish additional wetland and aquifer ordinances to further strengthen existing ones.

This study focused on wetlands along and adjacent to the existing road network within the District. A more comprehensive natural resource inventory with a focus on wetlands, water quality and water resources would help continue to improve data for the Mountain Lakes. Because there are areas within the district which have been studied, and which are protected, any additional work should focus on those areas vulnerable to future development and not currently protected.

The Mountain Lakes District has recognized some wetland areas and drinking water resources and has protected them from future development by setting aside portions of the District's land. Because many of the small lots throughout the Mountain Lakes District have not been developed, the District has an opportunity to go even further and do something very few communities can: proactively protect unique, valuable, and diverse natural resources before fragmentation occurs.

## References

Granit State Rural Water Association. 2007. *Management Plan for the Mountain Lakes Watershed*. Mountain Lakes District, Haverhill, NH. Retrieved from the world wide web in December 2008 [http://www.mtlakesnh.com/Mtlakesnh%20Planning%20Board\\_files/Mountain\\_Lakes\\_Watershed\\_Plan\\_FINAL.pdf](http://www.mtlakesnh.com/Mtlakesnh%20Planning%20Board_files/Mountain_Lakes_Watershed_Plan_FINAL.pdf)

Mountain Lakes District. 2004. *Mountain Lakes District Master Plan*. Written by the Mountain Lakes District Planning Board and approved by District residents.

Watershed to Wildlife, Inc. 2008. *Functional Assessment of Wetlands throughout Haverhill, NH*. Town of Haverhill, NH.

## Maps

**Excel File of all GPS Points and Associated Data from Field  
work in September 2008**

(All data is available digitally in MS Office Excel format)