Natural Resources

Enduring Features

The term "**enduring features**" refers to features such as bedrock, hills, ravines, and valleys that are substantially unaffected by human land uses and ordinary natural events such as floods, wildfires, hurricanes, and even climate change. These are the foundations upon which our streams, ponds, forests, and other habitats have developed. For conservation planning, and in the absence of more detailed information, we can use enduring features as "surrogates" for the species, communities, and processes that sustain our ecosystems (Austin et al. 2013).

Protecting representative intact areas of these features connected across the landscape will help preserve a host of natural communities, interactions, and ecological services. This *Plan* considers three kinds of enduring features to be especially significant for conservation:

- bedrock—the variety of bedrock types throughout New Lebanon
- surficial materials—the gravel, sand, silt, clay, and peat that sits on top of the bedrock
- landforms—mountaintops, hillsides, and valleys.

Certain ecological communities or rare species occur only in certain landscape and geological settings—such as a north-facing slope, or a ravine, or a marble valley. We may not know all the places where that rare species occurs in the town, but protecting representative intact areas with suitable slopes, topography, or bedrock will help to ensure that those species can continue to persist.

There are seven major bedrock formations in the town (Figure 5) represented by the following rock types and combinations:

- phyllite (southeastern hills)
- marble (southeastern valleys)
- shale, argillite, quartzite (northwest)
- slate, graywacke (very small areas in northwest)
- phyllite, schist, limestone (most of the rest of town)

This *Plan* calls for protecting significant areas of the landscape encompassing each of these bedrock types, preferably connected by substantially undeveloped corridors. Bedrock types can be combined with other resources of concern—such as intact mountaintops, glacial outwash deposits, large forests, good farmland soils, aquifer areas, and wetland complexes—to help identify the areas of highest conservation priority throughout the town.

Mineral Resources

Sand and gravel materials were deposited here during the melting of glaciers in the Wisconsin ice sheet 11,000 – 17,000 year ago, and large deposits occur in only limited areas in the region. Sand and gravel are widely used in construction industries but, because of their great weight, are expensive to transport long distances. Maintaining local sources of sand and gravel can be important to local construction interests, but mining sometimes competes with other land development and land conservation interests for areas with outwash deposits. These areas typically have well-drained soils on flat or gently-sloped terrain, and thus may be attractive areas for residential or commercial development. They also may support uncommon or rare species of plants and animals.

Once an area of sand and gravel has been developed for residential, commercial, or industrial uses it is generally no longer available for mining or for habitat conservation. Some municipalities that wish to promote local economic self-sufficiency have designated certain sand and gravel deposits as reserves for local mining uses (Kelly 2011). New Lebanon may want to consider this kind of proactive designation to preserve the capability for future mining of sand and gravel. Figure 6 shows the areas of major glacial outwash and kames—the main areas of sand and gravel deposits. Three commercial gravel mines were active along the mainstem Wyomanock Creek in 2017. In addition, some farms excavate sand and gravel from their own **borrow pits** for onsite uses.

Protecting sand and gravel areas from pavement or structures will preserve the potential for future mining.

Gray fox, a common but secretive mammal, is an important predator on small mammals. Moy Wong © 2017

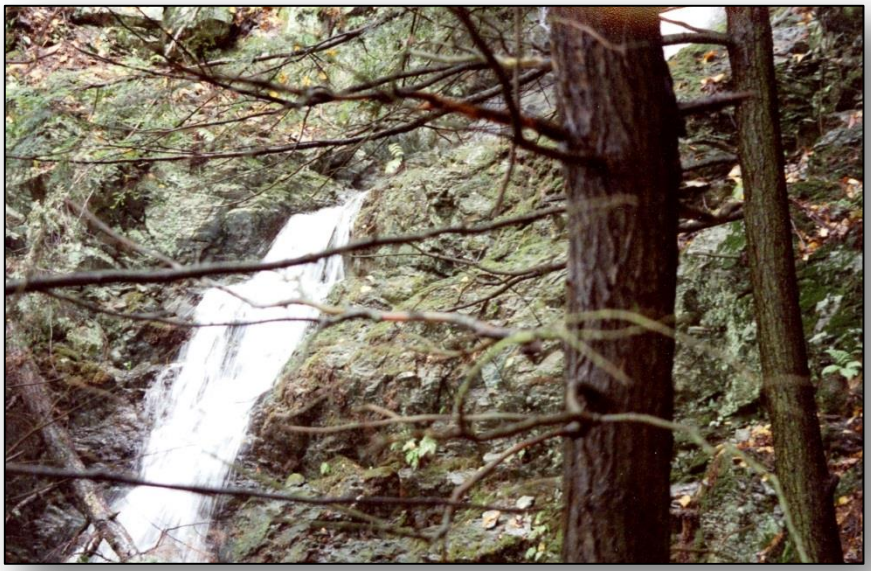
While actively mined areas of sand and gravel mines tend to have low habitat value for native plants and animals, inactive areas and abandoned mines are used by many kinds of wildlife, and support communities of **pioneering plant species** that sometimes include rarities. The habitat values of gravel mines are discussed in the Biological Resources section below. We have little information on past uses of other mineral resources in the town. The Shakers used limestone in construction of building foundations, but we do not know if it was mined locally.

Conservation of Mineral Resources

New Lebanon has long benefited from local sand and gravel deposits, and those materials remain a valuable resource for domestic use and commercial sale. Sand and gravel are limited resources, however, and have become scarce or inaccessible in other parts of Columbia County (Mark Barbato, pers. comm.), so may deserve some conservation attention from the town. Once land is developed with pavement, structures, and other more-or-less irreversible land uses, the underlying mineral deposits become unavailable for future mining. The town may wish to adopt measures that will help reserve local sources of sand and gravel to ensure their continuing availability.

When available sand and gravel became scarce in parts of California, the state established "natural resource districts" that serve as reserves for mining. Once the resource is played out and the land reclaimed, the land then becomes available for other kinds of land uses including residential or commercial development (Kelly 2011). For similar reasons, when reviewing new land uses the Province of Ontario (Canada) considers impacts on mining potential along with other matters before final regulatory decisions are made (Ontario Province 2005).

In reviews of development proposals for lands in the vicinity of glacial outwash (Figure 6), New Lebanon may want to consider mineral resource availability, and determine whether some projects can be located and designed in ways that will preserve the possibilities for mining. Should uses and markets for other kinds of mineral resources develop in the future, similar considerations could be incorporated into project reviews, to help ensure that opportunities for future mining are not eliminated by land uses that would render them unavailable.



Waterfall on the Dymond property, Gale Hill. Dale Dymond © 2017

Water Resources

The term "water resources" refers both to surface water— i.e., streams, **springs**, lakes, ponds, and **wetlands—**and to **groundwater,** the water that resides beneath the soil surface in spaces between sediment particles and in rock fissures and seams.

Stream water quality and habitat quality depend on the condition of the land in the entire watershed.

The quantity and quality of water available to natural habitats and humans depends on much more than the footprints of the streams, ponds, and **aquifers**. The water quality, flow volumes, and flow patterns of a stream, for example, as well as the types and quality of instream habitats, depend to a large extent on characteristics of the stream's watershed—the entire land area that drains to the stream. The depths and textures of the soils in the watershed, the depth and quality of **organic duff** at the soil surface, the kinds of vegetation, the extent of **impervious surfaces** (e.g., roads, parking lots, roofs), and the configuration of surface water channelization throughout the watershed all influence the volumes and patterns of surface runoff during precipitation and snowmelt events, the degree of water infiltration to the soils, and the amount and quality of water reaching streams, wetlands, ponds, and groundwater reserves throughout the year.

Because clean and abundant water is critical both to ecosystems and to the New Lebanon human community, a major goal of this *Plan* is the conservation of the volumes, accessibility, and quality of surface water and groundwater resources.

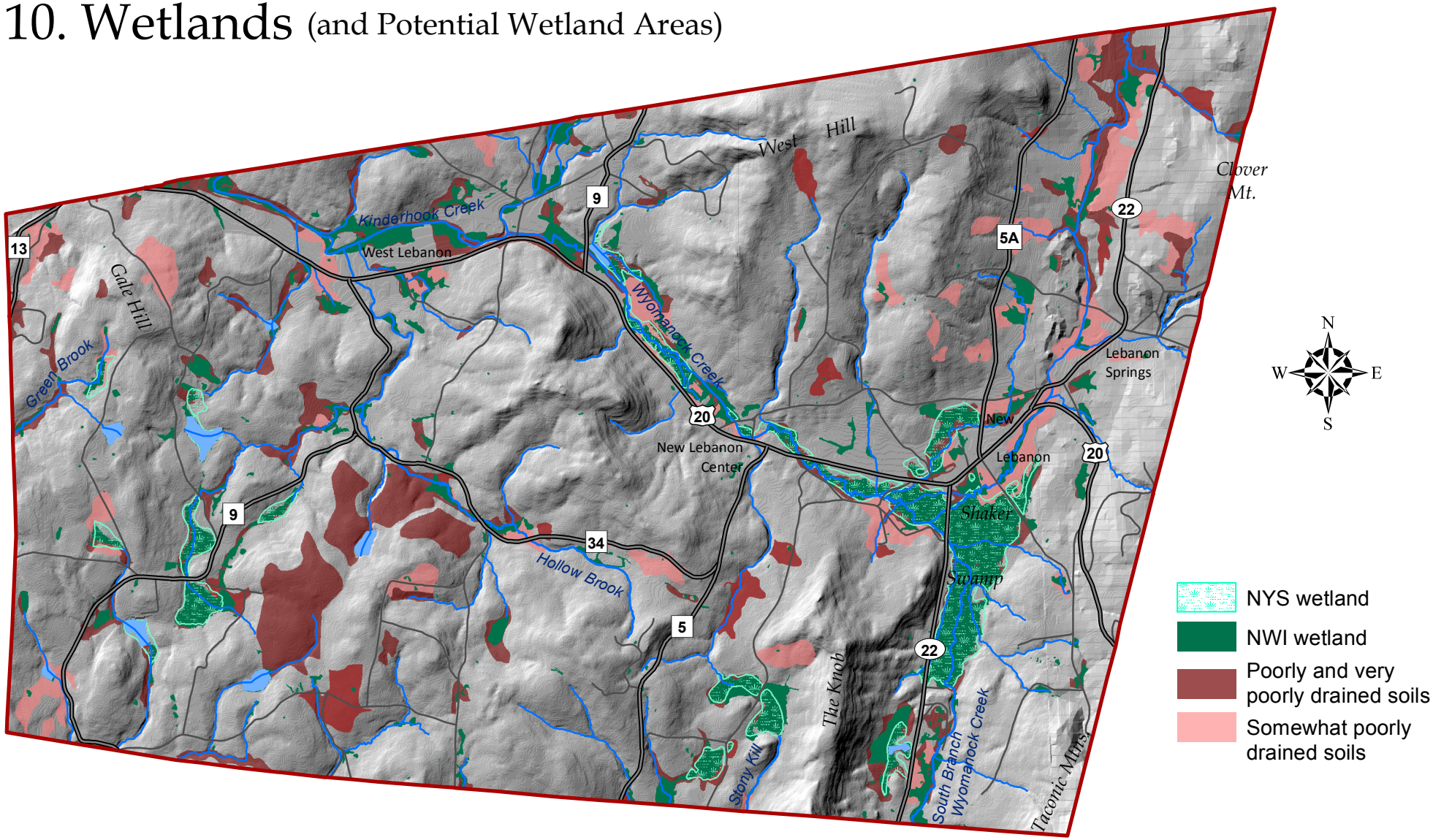
Figure 10 shows many of New Lebanon's streams, ponds, and wetlands, but does not show most of the intermittent streams and small wetlands in the town. (See Figure 10a for a sample of additional streams identified by the New Lebanon CAC.) Small streams and wetlands have great ecological value (see discussion below) and should not be overlooked in conservation planning, but most do not appear on publicly available maps.

Groundwater

Groundwater supplies nearly all the drinking water for New Lebanon's residents and businesses, and also feeds our upland habitats, springs, ponds, and wetlands, and is the source of **base flow** for most of our perennial streams. Those surface water resources in turn support farms, fish and wildlife, and recreation, and are important components of some of the town's scenic landscapes.

Drinking water wells in New Lebanon tap into groundwater from a variety of shallow and deep sources. Most of the shallow wells—tens of feet deep— are in the coarse glacial outwash deposits (sand and gravel), and the deep wells—tens to hundreds of feet deep—are in the finer glacial till material or in bedrock fractures, seams, and solution cavities.

10. Wetlands (and Potential Wetland Areas)



Environmental Research and Education
Science for Conservation
Hudsonia Ltd.

Figure 10. Wetlands on the New York State (NYS) and federal (NWI) wetland maps and other potential wetland areas, based on soil drainage, in the Town of New Lebanon, Columbia County, New York. Potential wetland soils are shown only where they occur outside the mapped NYS and NWI wetlands. Many other wetlands are omitted on the state and federal wetland maps. All wetland jurisdictional determinations should be made on the basis of field observations. New Lebanon Natural Resource Conservation Plan, 2017.

DATA SOURCES

State-regulated wetlands from NYS Department of Environmental Conservation. National Wetland Inventory (NWI) Wetlands from US Fish and Wildlife Service. Soils data from USDA Natural Resources Conservation Service. See Figure 2 for relief-shading, roads, streams, and waterbodies. Map created by Hudsonia Ltd., Annandale, NY.

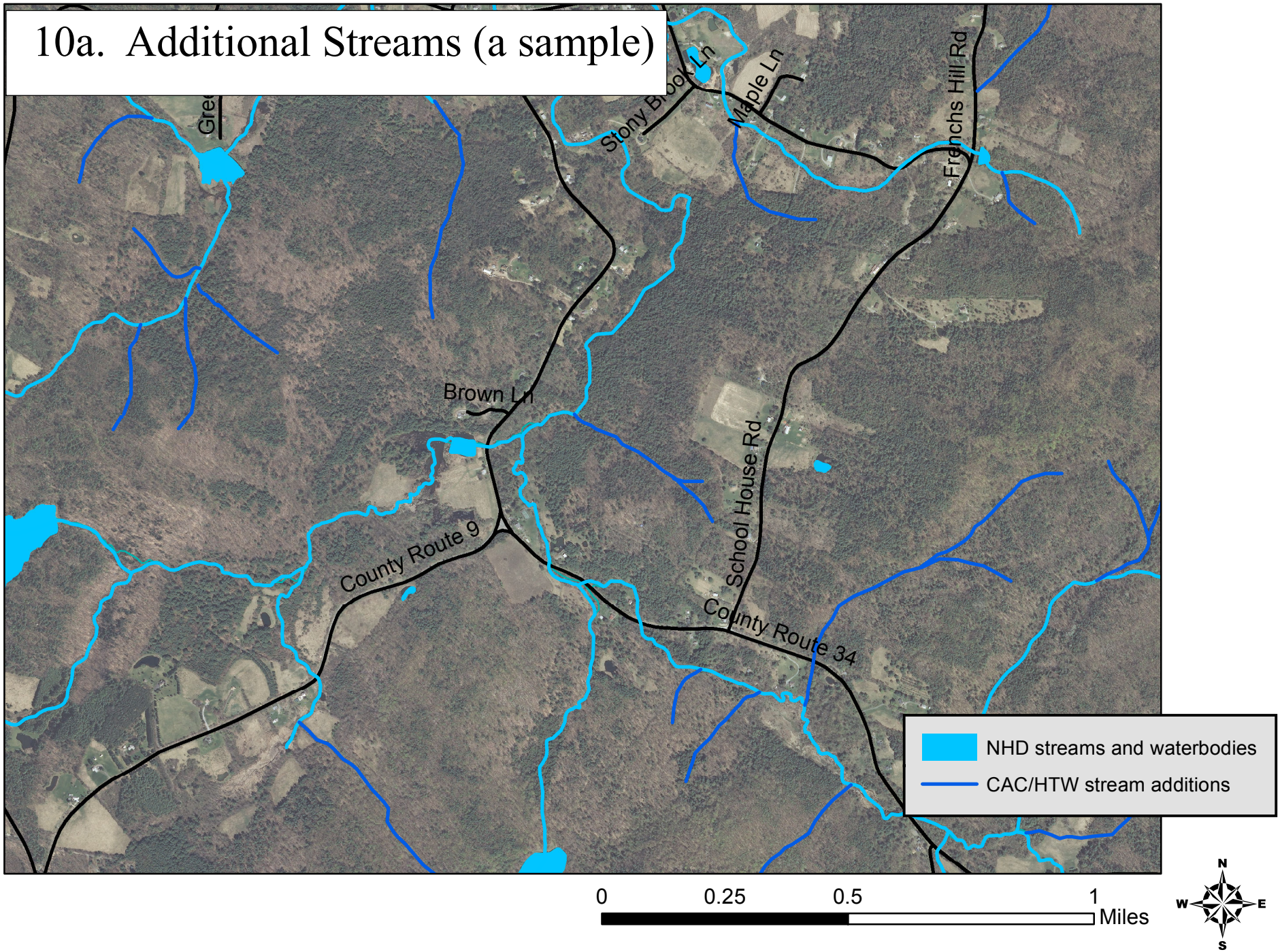


Figure 10a. A sample of streams in the National Hydrography Dataset (NHD, light blue), and additional streams (dark blue) identified by remote sensing by the New Lebanon Conservation Advisory Council and Darrow School students. New Lebanon Natural Resource Conservation Plan, 2017.

A preliminary groundwater study for New Lebanon was undertaken in 1990-91 to determine the presence, extent, and yields of the groundwater in bedrock and **surficial deposits** in the town (LaFleur and DeSimone 1991). The study examined publicly available information on bedrock and surficial geology, along with data from 177 well sites.

Figure 9 shows an approximation of the **unconsolidated aquifers** in the town, based on data from that study. An unconsolidated aquifer is a place where groundwater is stored in saturated sand and gravel deposits. These areas represent the largest and most accessible potential water sources for shallow wells, but are also the most vulnerable to contamination due to the permeability of the overlying material (sands and gravels) that can be efficient conduits for contaminants introduced by above-ground human activities. Groundwater contamination can occur from, for example, nitrates and bacteria from septic systems, fertilizers and pesticides from lawns and farm fields, de-icing salts from roads and driveways, and volatile organic compounds from leaks and improper disposal of petroleum and other fluids (Winkley 2009). Wherever possible, higher-risk land uses should be steered away from unconsolidated aquifer areas. Avoiding contamination of the aquifer is of particular importance for protecting well water sources in the New Lebanon valleys.

Water in an unconsolidated aquifer is typically abundant and accessible, but also vulnerable to contamination.

Quantity and quality of groundwater will best be protected by maintaining forested landscapes wherever possible, using agricultural fertilizers judiciously, avoiding or minimizing use of pesticides and other toxins as much as possible, and carefully designing stormwater management systems to reduce surface runoff and ensure that ample volumes of precipitation and snowmelt infiltrate the soils.

Springs and Seeps

Springs and seeps are places where groundwater discharges to the ground surface, either at a single point (a spring) or diffusely (a seep). They are often conspicuous where they discharge into **upland** habitats, but they also may discharge unseen into streams, ponds, and wetlands, and are sometimes critical water sources for those habitats. Springs and seeps are common throughout New Lebanon, occurring here and there at all elevations. The habitat values of spring and seeps are discussed in

Many of our streams originate at forested seep like this one. Claudia Knab-Vispo © 2017

the Biological Resources section below. In addition to their ecological importance, springs are important drinking water sources for humans and livestock, and have often been modified with constructed or excavated basins and, sometimes, spring houses.

Springs have particular significance for the Town of New Lebanon. The western slopes of the Taconic Hills on the east edge of town are riddled with the springs and seeps that gave the name to the Lebanon Springs hamlet. Reportedly the springs were long used by the Mahicans for bathing and medicinal purposes, and are the feature that attracted some of the earliest European settlers to this area in the mid-to-late 1700s. The reputed curative powers of the warm spring at the upper end of Spring Hill Road were the centerpiece of a summer hotel and resort that was active ca. 1794– 1925 (Stott 2007).

> "The buildings erected comprise a large bath-house, summer cottages, and spacious hotels. In the court-yard of one of these—the Columbia Hall—is the spring. It is on the south slope of the hill, three hundred feet above the valley and twelve hundred feet above tidewater. The water bubbles up from the bottom of a basin twelve feet in diameter and four deep, and has an unvarying temperature of 73° Fahrenheit the year around" (Ellis 1878).

While many springs in the region emerge from the ground at temperatures of 45-55^{0}F—much warmer than surface water streams and ponds in winter—this is the only true "warm spring" in New York State (Bakewell and Silliman 1829, Peale 1886, Waring 1983), with measured temperatures in the range of 65.7 – 79.9 ^{0}F (Hobba et al. 1979) year-round. The flow from this spring is copious, emerging at the rate of 500 gallons per minute (not recently verified [Dunn 1981]), and has long furnished many nearby dwellings with their household water supply. Today, the spring water is still piped to 40 households in Lebanon Springs, and is also available to the public at a piped outlet below the spring on Pool Hill Rd. Since 1940 it was also piped to the Indian's Blessing Fountain on NYS Route 22 in Lebanon Springs, but has since been shut off due to accumulation of bacteria in the conduit.

Water issues from the warm spring at 65.7 – 79.9 °F year-round.

The water at the warm spring issues from **dolomite** bedrock. "The most usual interpretation of such thermal springs in non-volcanic areas is that they are caused by normal groundwater circulating deeply enough into the Earth's crust to be warmed by normal geothermal heat and then rising to the surface under artesian pressure. This would be the situation at Lebanon Springs" (Dunn 1981).

A study was undertaken for the NYS Energy Research and Development Authority (NYSERDA) to determine the feasibility of using thermal groundwater in New York's Capitol Region as an energy source (Dunn 1981). The investigators studied New Lebanon's warm spring and data from other active and abandoned wells along the Taconic thrust fault between Lebanon Springs and Williamstown, Massachusetts. They found no other warm springs in New York, but two on the west

side of the Hoosic River valley northwest of Williamstown, with water issuing at 67° and 68° F. They determined that a system combining groundwater heat pumps and a microhydroelectric plant could be used to heat the New Lebanon Town Hall, town garage, and high school, and would achieve significant savings on energy costs for the town. We do not know if this idea has been explored further since 1991.

Streams

Figure 9 shows most of the perennial streams in New Lebanon but few of the smaller streams that flow only intermittently. (See Figure 10a for an example of additional streams.) **Perennial streams** flow continuously throughout years with normal precipitation, although some may dry up during severe droughts. They provide essential water sources for wildlife throughout the year, and are critical habitat for many plant, vertebrate, and invertebrate species. **Intermittent streams** may flow for a few days or weeks or for many months during the year, but ordinarily dry up at some time during years of normal precipitation.

Intermittent streams are significant water sources for larger streams and for lakes, ponds and wetlands. This stream in the Darrow forest feeds Shaker Swamp. Claudia Knab-Vispo © 2017

Although often ignored in conservation planning and environmental reviews, intermittent streams possess ecological importance disproportionate to their size. They constitute the headwaters of most perennial streams, and are also significant water sources for lakes, ponds, and wetlands of all kinds. They provide important habitat in their own right, and strongly influence the water quantity and quality of the larger water bodies and wetlands that they feed. The habitat values of perennial and intermittent streams are discussed in the Biological Resources section below.

All the streams that the DEC has classified in New Lebanon are Class C, except for a small Class B segment on a **tributary** to the Wyomanock along Chair Factory Road (Figure 16). Class B waters are suitable for swimming and other contact recreation, but not for drinking. Class C waters support fisheries and are suitable for non-contact activities. The Wyomanock (mainstem and South Branch) and Kinderhook creeks, Black River, Tackawasick Creek, and several tributaries are classified as **trout streams**, and most of those **reaches** are also classified as **trout spawning streams** (Figure

16). Many other streams, however, have the cool water and high oxygen environments that are likely to support trout. Figure 16 shows other stream segments where wild native trout have been found in DEC fish surveys.

A DEC waterbody inventory program was conducted through 2007 to monitor water quality and trends, and identify impaired streams, lakes, and ponds most in need of improvement. The inventory found that the New Lebanon reaches of Wyomanock Creek and Kinderhook Creek, Green Brook, Black River, and their tributaries have "no known impact"—that is, "monitoring data and information indicate that there are no use restrictions or other water quality impacts, threats or issues" (NYSDEC 2008). (The Stony Kill and its tributaries were not sampled, nor were any of New Lebanon's lakes or ponds.) A study in 2000 found minor nutrient enrichment at a Kinderhook Creek sampling station in West Lebanon, but that impairment was not reflected in the stream macroinvertebrate community (Bode 2001), and was not expected to interfere with the fishery or recreational uses.

The Nature Conservancy developed the concept of the "Active River Areas" to describe those areas within stream corridors that contribute most directly to the physical and ecological processes that drive and sustain a stream. The Active River Areas in New Lebanon are shown in Figure 14 and described below in the Biological Resources section.

Water is directly withdrawn from some streams for irrigating commercial crops, watering livestock, and watering domestic gardens, and streams are also an essential source for recharging groundwater and for feeding lakes and ponds. During the wetter times of year, streams receive surface runoff from their watersheds, and a portion of the water infiltrates the streambank and substrate and reaches the groundwater. During the drier times of year, the process is reversed and the groundwater provides the base flow of many streams. Many of our lakes and ponds also rely on intermittent and/or perennial streams for a significant part of their water supply.

There may be opportunities for microhydropower development on some of New Lebanon's other streams, and this could contribute measurably to local energy production and a reduced carbon footprint. Such projects should be undertaken only after thorough studies of the stream ecology and hydrodynamic capacity to ensure that the stream, the site, and the technology are suitable.

The scenic and recreational values of New Lebanon streams are described in sections below.

Ponds and Lakes

Ponds in New Lebanon include small ornamental ponds on residential lots, and larger ponds and lakes up to ca. 21 acres. In addition there are woodland pools, open water areas within larger wetlands, and at least one waterbody that falls under the circumneutral bog lake classification. That habitat is described below (Biological Resources section), but here we describe some of the more ordinary natural and artificial waterbodies that are largely unvegetated.

These include ponds constructed by excavation in upland or wetland areas, and/or by damming of streams. Many of these ponds are created for fishing, watering livestock, irrigation, swimming, or boating, or for their visual appeal. Some are constructed near houses or other structures to serve as a source of water in the event of a fire, and some were excavated during mining. If constructed ponds are not intensively managed by humans, they can become important habitats for many of the common and rare species that are associated with naturally formed open water habitats (see below), but more typically the management (e.g., weed control, introduced fish) reduces the habitat values for native communities of plants and animals. All of the large ponds and lakes in New Lebanon were created in part by installing dams in small streams.

Although the DEC Waterbody Inventory surveys some lakes and ponds in addition to streams, none of the New Lebanon lakes and ponds have been included in that program to date. Biological resource values of ponds and lakes are discussed below

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Constructed ponds with emergent vegetation (such as the cattails, above) and unmanicured edges are likely to have greater habitat value for wildlife than those without emergents and with closely-mowed edges. David Farren © 2017

Conservation of Water Resources

Clean and ample surface water and groundwater are essential to New Lebanon's residents, farms, and businesses, as well as the natural habitats and communities of the undeveloped landscape. The town is fortunate to have abundant and high-quality streams, lakes, ponds, and groundwater, and recognizes the importance of protecting them long into the future.

The general measures for water conservation (next page) are based on some basic principles for water conservation:

- The water quality, flow volumes, and flow patterns of a stream, as well as the types and quality of in-stream habitats depend on characteristics of the stream's watershed.
- Forests with intact canopies, understories, ground vegetation, and forest floors are extremely effective at promoting infiltration of precipitation to the soils.
- Maintaining intact forests throughout a stream's watershed may be the best insurance for maintaining ample groundwater volumes, as well as flow volumes, cool temperatures, water quality, bank stability, and habitat quality in streams and ponds.
- Undisturbed vegetation and soils, minimum impervious surfaces, and careful management of stormwater runoff along roadways and on developed lots can help to protect the water quality and habitat quality of groundwater, streams, and ponds.
- Well-vegetated floodplains without structures help to stabilize streambanks, absorb floodwater, slow water velocities during flood events, attenuate downstream flooding, and maintain high-quality instream and stream corridor habitats.
- Springs and seeps in the headwaters and along stream corridors are important for maintaining the cool stream temperature that are critical to sensitive stream and pond invertebrates, fishes, and amphibians.
- Unconsolidated aquifers—generally the most accessible and high-yielding water sources for well withdrawals—are also the most vulnerable to contamination from above-ground human activities.
- Free-flowing streams unobstructed by dams or inadequate culverts are more likely to support the full complement of invertebrates, fishes, and other organisms of an intact stream ecosystem.

Intermittent stream bed on DeLano property.
Peg Munves © 2017

GENERAL MEASURES FOR WATER RESOURCE CONSERVATION

FOR LANDOWNERS

- M**aintain forests** with intact vegetation and undisturbed forest floors wherever possible to promote infiltration of rainwater and snowmelt to the soils.
- **Minimize applications of polluting substance**s, such as de-icing salts to driveways, and pesticides and fertilizers to lawns, gardens, and agricultural fields. Any of those substances might end up in streams, ponds, or groundwater.
- On land development sites, **minimize impervious surfaces and manage stormwater** in ways that maintain pre-development patterns and volumes of surface runoff and infiltration to the soils.
- **Direct runoff from agricultural fields into basins and well-vegetated swales**, instead of directly into streams or wetlands, to maximize infiltration to the soils, and prevent the introduction of excess nutrients and toxins to streams and wetlands.
- **Consider the 100-year floodplain** when considering land management and land uses along streams. (Consider the 500-year floodplain once the data become available from FEMA.)
- **Keep floodplain meadows well-vegetated**. Minimize tillage in floodplains; seed immediately after tilling; leave abundant thatch to cover exposed soils; use cover crops in winter.
- **Remove structures, pavement, and hazardous materials** from floodplains wherever possible.
- In floodplains, **shift to resilient land use**s that can withstand moderate to severe flooding; for example, pastures, hayfields, or forests.

FOR MUNICIPAL AGENCIES

- Adopt local legislation to **protect small and isolated wetlands** that are unprotected by state and federal wetland regulatory programs.
- Adopt local legislation to **protect streams (including intermittent streams)** from direct disturbance, and establish **broad buffer zones** of undisturbed vegetation and soils along streams.
- Adopt local legislation to **protect unconsolidated aquifers**.
- **Redesign and retrofit roadside ditches** and other stormwater systems to maximize water infiltration to the soils, and minimize rapid and direct runoff into streams, ponds, and wetlands.

(continued)

Measures for Water Resource Conservation (cont.)

For Municipal Agencies (cont.)

- Design any new culverts and bridges and retrofit existing ones to **accommodate storms of 100-year intensity** or greater, in anticipation of more frequent and severe storms in coming decades.
- **Design, install, and retrofit culverts** to maintain the **continuity of stream gradients and substrates**.
- In floodplains, **shift to resilient land uses**; i.e., uses that can withstand moderate to severe flooding, such as parks, ballfields, hiking trails, picnic areas, fishing access sites, pastures, hayfields, or undisturbed buffer zones.
- **Prohibit the building of new structures in 100-year floodplains**. (Upgrade this to 500-year floodplains when the FEMA data becomes available.)
- On land development sites, **minimize impervious surfaces and manage stormwater** in ways that maintain pre-development patterns and volumes of surface runoff and infiltration to the soils.
- **Minimize applications of polluting substance**s, such as de-icing salts to roads and parking lots and pesticides and fertilizers to lawns. Any of those substances might end up in streams, ponds, or groundwater.
- In areas of coarse glacial deposits (sand and gravel) or carbonate bedrock (marble or limestone), **avoid siting land uses with potential for contaminating soils and water.** Educate landowners in those areas about the vulnerability of groundwater resources.
- **Regulate and monitor extractive commercial uses of water** to ensure that water withdrawals from groundwater or surface water sources do not exceed sustainable levels.