SOURCE WATER PROTECTION PLAN

for the

TOWN OF AUSTERLITZ
COLUMBIA COUNTY, NEW YORK

2011

Prepared by:

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New York Rural Water Association

In cooperation with:

Town of Austerlitz Comprehensive Plan Oversight Committee

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(24x36-inch maps located in back)

1.0 INTRODUCTION

1.1 Goals and Objectives

The term source water refers to all sources of drinking water. In Austerlitz, virtually all residents and businesses rely upon groundwater for drinking water. Some of this groundwater is supplied to the public by businesses regulated by the Columbia County Health Department and the New York State Department of Health (see Section 3.0). However, most of the groundwater used for drinking water in the Town of Austerlitz is not regulated and serves individual homes and smaller businesses.

Unfortunately, groundwater contamination can and does occur as a consequence of a variety of land use activities. In addition, groundwater resources are not uniformly distributed, and some areas suffer from poorer well yields. In order to better develop and at the same time preserve the drinking water resources of Austerlitz for today and the future, the following Source Water Protection Plan has been prepared by the New York Rural Water Association (NYRWA). This plan inventories and maps the drinking water resources of Austerlitz, discusses sources of drinking water, evaluates the susceptibility of drinking water resources to growth and development, and outlines potential protection planning strategies.

1.2 Scope and Methods

NYRWA Source Water Protection Specialist, Steven Winkley, consulted with members of the Town of Austerlitz Comprehensive Plan Oversight Committee and the Town Supervisor to develop this Source Water Protection Plan. New York Rural Water Association utilized a variety of published and unpublished data sources for this plan. All data were inputted into a Geographical Information System (GIS). This is a computer system that allows one to visualize, manipulate, analyze, and display geographic (spatial) data.

Subsurface data was collected from a variety sources, including the United States Geological Survey's Water Data Site Inventory System, the New York State Department of Environmental Conservation's Water Well Program, the New York State Department of Health's Source Water Assessment Program (SWAP), and the New York State Department of Transportation's geotechnical borings. Subsurface data compiled as part of this plan is summarized on Plate 1.

NYRWA analyzed responses to an online survey that was made available to Austerlitz residents on the Town's website. Questions from this survey are contained in Appendix A. Results are discussed in Section 3.

A digital version of the Columbia County Soil Survey and the New York State Geologic Map were utilized for analyses and mapping. In addition, elevation data for Austerlitz were taken from digital elevation models (DEMs). This information was then used to derive slope data and hillshading images. A parcel boundary dataset was utilized by NYRWA. Real property from the New York State Office of Real Property Services was linked to this parcel dataset as well. Other digital data on wetlands, floodplains, surface waters, roads, regulated facilities, aerial photography, etc. were downloaded from the New York State GIS Clearinghouse and the Cornell University Geospatial Information Repository.

Finally, New York Rural Water Association conducted on-site activities in Austerlitz to map surficial geology and unconsolidated aquifers, and to also document the location of public water supply wells, land uses, etc. A global positioning system (GPS) device was used to capture the geospatial coordinates of such features.

2.0 SETTING

2.1 Physiography and Topography

As illustrated on Figure 1, Austerlitz lies primarily within the Taconic physiographic region, with the westernmost part of Town situated within the Hudson Valley region. A *physiographic region* is a large area with distinctive topographic relief, landforms, and geology. In Austerlitz elevations vary from around 500 feet above sea-level along the northwestern portion of Town in the Hudson Valley region to as high as 2,050 feet along the Massachusetts border in the Taconic region (see Figure 1). Slopes in Austerlitz average 8.7 percent. Approximately 11 percent of the Town of Austerlitz has slopes in excess of 15 percent (see Figure 2).

Local topography is largely a function of bedrock lithology and structure as well as the differing surficial geologic materials across Town. Surficial geologic materials are the unconsolidated (loose) sediments that overlie solid rock (bedrock). These materials, discussed further in Section 2.3, were largely formed by glacial and deglacial processes during the last stage of continental glaciation (some 15,000 to 12,000 years ago).

2.2 Bedrock Lithology and Structure

Austerlitz's bedrock geology is the result of ancient geologic history that occurred hundreds of millions of years ago. Initially, the area was covered by marine waters where a deep ocean trench analogous to those found in today's Pacific Ocean developed. Here, a thick layer of silty mud was deposited in this deep trench. These sediments eventually consolidated to form shale rock and were later metamorphosed into slate and a higher grade rock known as phyllite. Collectively, the slate and phyllite are referred to as the Walloomsac Formation (see Figure 3). It is dark gray to black, with numerous thin layers. Underlying the Walloomsac Formation are carbonate rocks of the Stissing Formation, Stockbridge Group, and the Balmville Limestone (Figure 3). These rocks are whitish to gray limestone and dolostone, often weathering to an orange-gray color. The Stockbridge Group carbonates were metamorphosed in places to marble.

The cause of the heat and pressure that caused metamorphism of the Walloomsac Formation and Stockbridge Group was related to a mountain building event that began to occur some 458 million years ago. At this time, the area that is today Austerlitz was at the intersection of two crustal plates. As these two plates collided, the Taconic Mountains were thrust upwards and older rocks were pushed large distances westward over the younger Walloomsac Formation and Stockbridge Group. The rocks that were thrusted make up slices of rock known as *allochton* material. The underlying rocks that were originated in place are part of *autochton* material. In

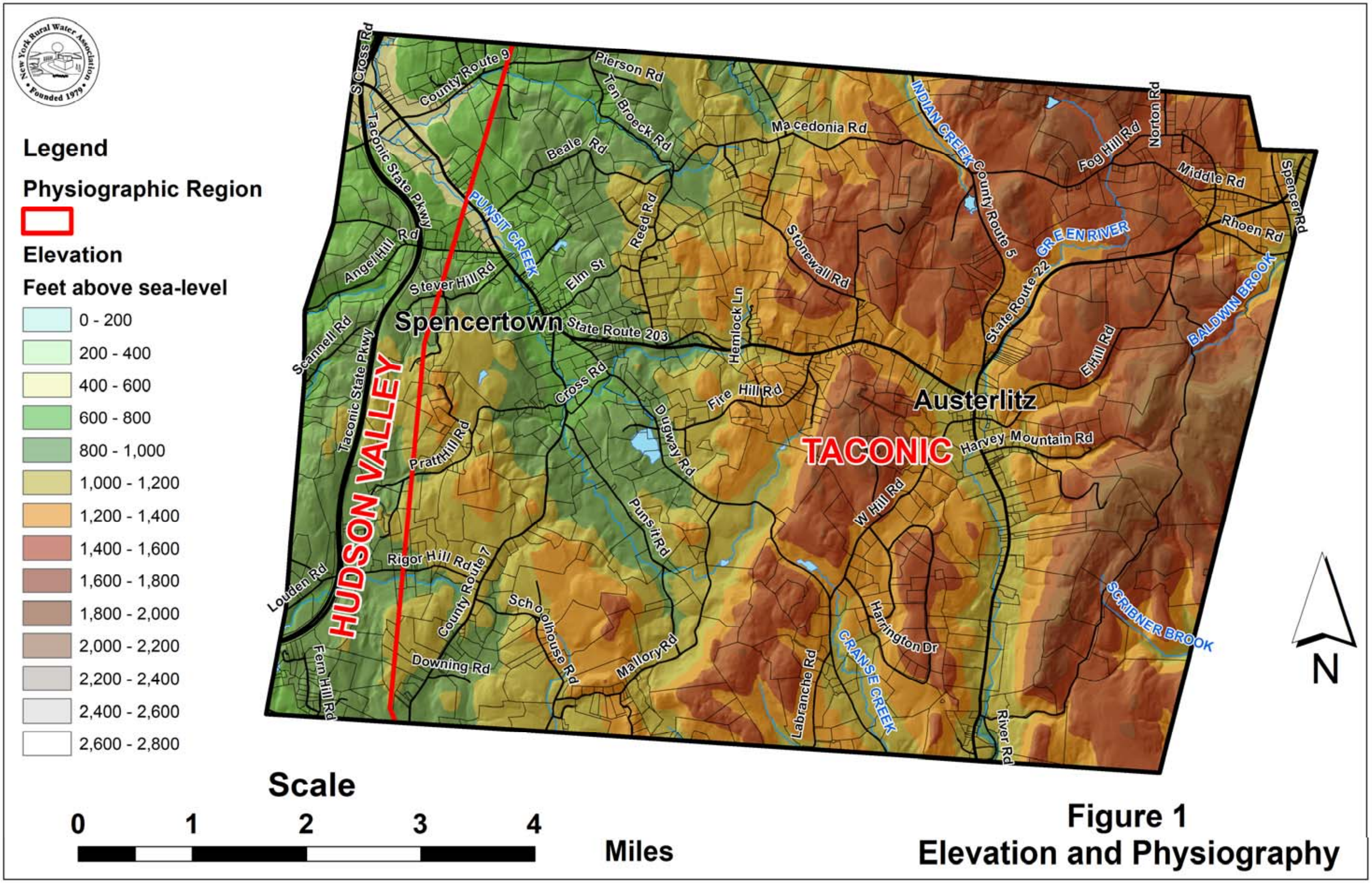
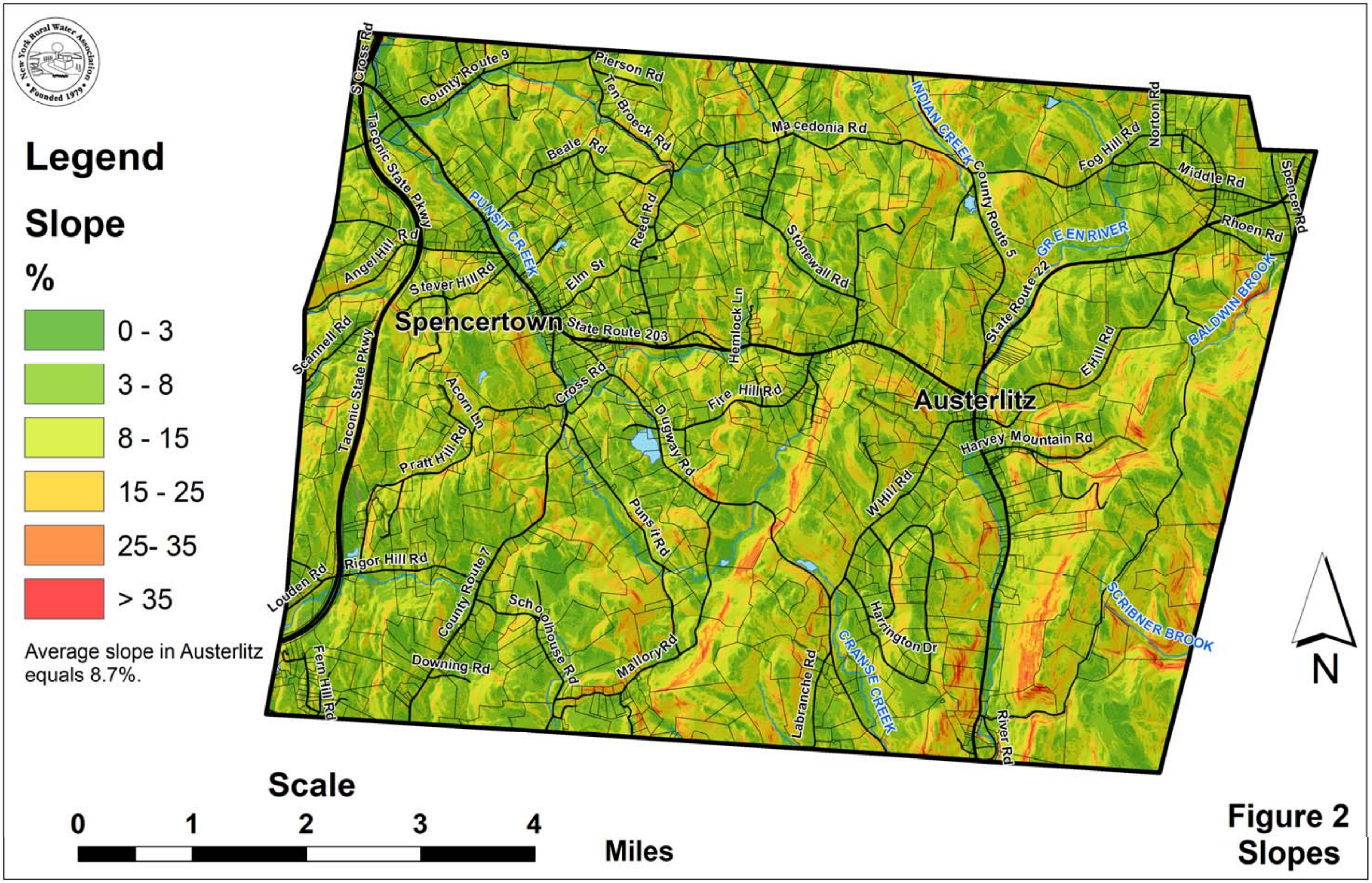
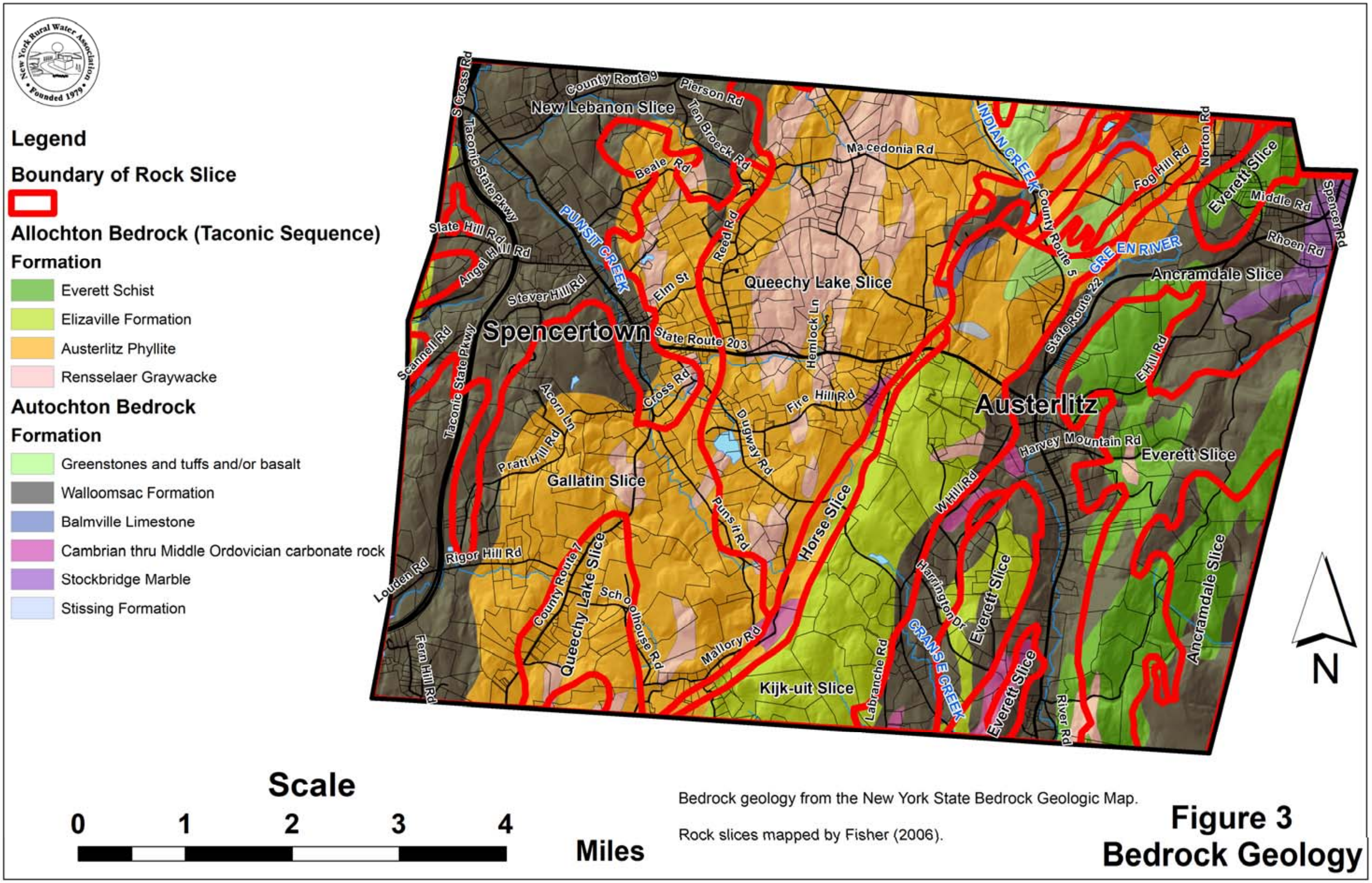


Figure 1
Elevation and Physiography


Legend
Slope
%
0 - 3
3 - 8
8 - 15
15 - 25
25- 35
> 35
Average slope in Austerlitz equals 8.7%.
Spencertown
Austerlitz
State Route 203
County Route 9
County Route 5
County Route 7
State Route 22
Taconic State Pkwy
Pierson Rd
Ten Broeck Rd
Macedonia Rd
Beale Rd
Reed Rd
Elm St
Stever Hill Rd
Angel Hill Rd
Scannell Rd
Stonewall Rd
Hemlock Ln
Fire Hill Rd
Cross Rd
S Cross Rd
Dugway Rd
Acorn Ln
Pratt Hill Rd
Punsit Rd
Rigor Hill Rd
Louden Rd
Fern Hill Rd
Downing Rd
Schoolhouse Rd
Mallory Rd
Labranche Rd
Harrington Dr
W Hill Rd
E Hill Rd
Harvey Mountain Rd
River Rd
Fog Hill Rd
Norton Rd
Middle Rd
Rhoen Rd
Spencer Rd
PUNSIT CREEK
INDIAN CREEK
GREEN RIVER
BALDWIN BROOK
SCRIBNER BROOK
CRANSE CREEK
N
Scale
0
1
2
3
4
Miles
Figure 2
Slopes



Bedrock geology from the New York State Bedrock Geologic Map.

Rock slices mapped by Fisher (2006).

Figure 3
Bedrock Geology

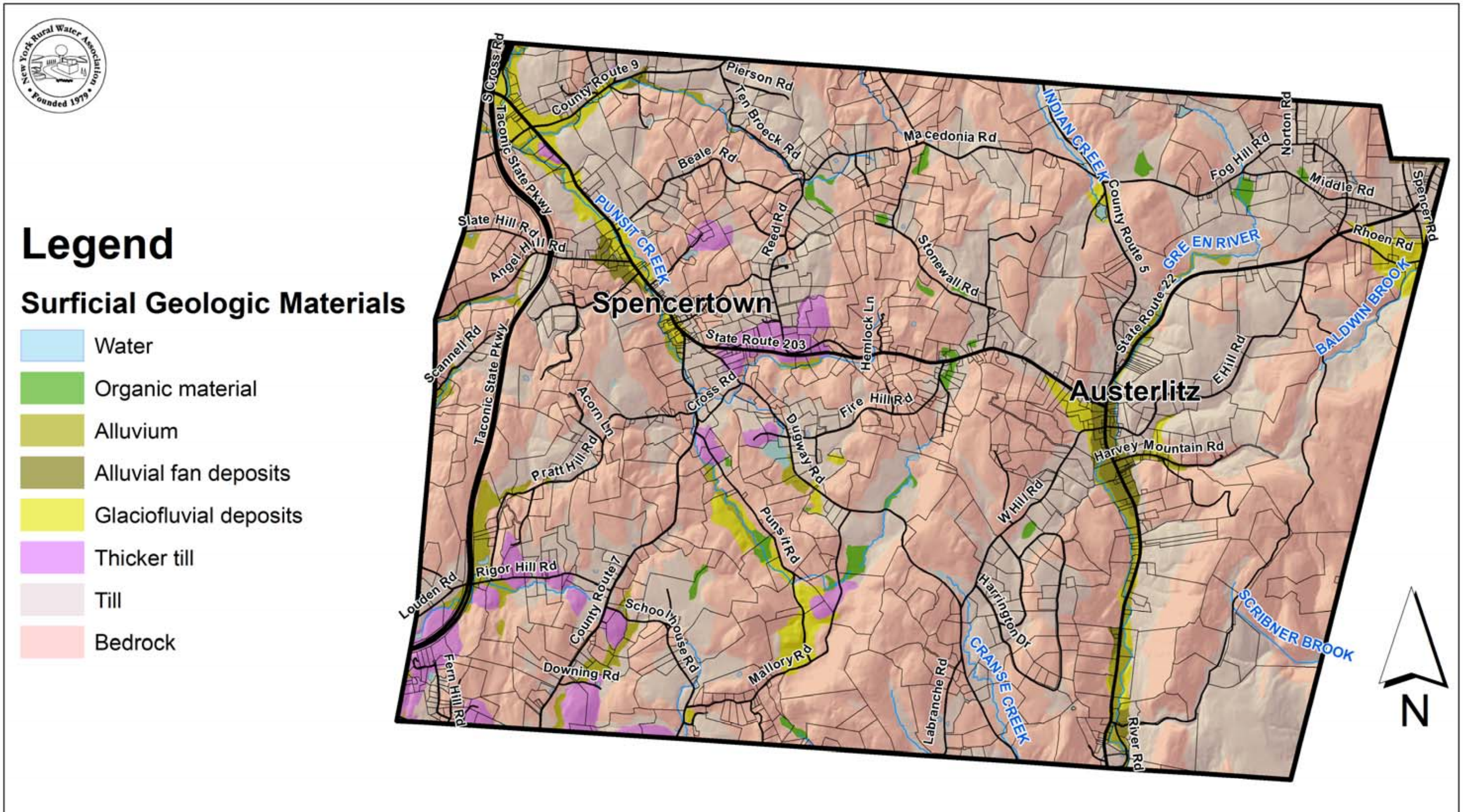
Austerlitz, the allochton material is composed of the Rensselaer Graywacke, the Austerlitz Phyllite, the Elizaville Formation, and the Everett Schist (Figure 3). The Rensselaer Graywacke is an impure sandstone. The Austerlitz Phyllite, well-exposed along Rt. 203 between the hamlets of Spencertown and Austerlitz, is a purple and green to greenish-gray phyllite. The Elizaville Formation consists of greenish-gray shale or slate. The Everett Schist, exposed in many of the highest elevations of the Taconic region, consists of a greenish colored schist.

The rock bodies that were moved and thrusted westward are separated by ancient faults. The boundaries between these allochton and autochton rock slices are marked by low angled thrust faults. Most of the mapped faults are thrust faults. Rocks of the allochton and the underlying autochton were severely deformed along these fault zones. In other places, the rocks were also folded as a result of the tremendous pressures that were exerted. Each body of rock separated by major faults is a so-called rock slice. In Austerlitz, Fisher (2006) has mapped several different rock slices (see Figure 3). The presence of these various different rock slices and fault zones is a major control on the topography and physiography of Austerlitz.

2.3 Surficial Geologic Materials

Surficial geologic deposits are geologic materials that are found at or near the land surface. The unconsolidated deposits above the bedrock originated within the past 15,000 years and actually continue to be formed today. A detailed map of surficial deposits has been completed by NYRWA (see Figure 4 and Plate 2). These maps were derived from examination of digital soils mapping, topographic expression of the various deposits, water well data, and site reconnaissance. Surficial geologic maps have many different potential uses for planning purposes. One of the most frequent uses is to help identify sand and gravel aquifer boundaries. Surficial geologic maps are also important for identifying economically important deposits such as sand and gravel for aggregate. Surficial geologic maps are also important to study environmental issues such as the potential for migration of groundwater contaminants. Finally, surficial geology maps are useful for planning site development activities such as designing and locating septic systems, building new roads, excavating foundations, etc

The principal material left by the advancing glacial ice sheet was glacial till, a relatively dense poorly-sorted mixture of boulders, gravel, sand, silt and clay. Till is commonly found in areas of bedrock highs and underlies other deposits in valleys. Relatively thin accumulations of till are commonly found in some of the higher areas of Austerlitz (see Figure 4 and Plate 2). Here there is generally less than ten feet of till present, and bedrock outcrops are common. In some places, streamlined hills known as drumlins exist. Here, thicker till thicknesses occur (Figure 4 and Plate 2). Glacial till has relatively low permeability and does not typically produce significant water well yields. Nevertheless, some large-diameter dug wells are sometimes constructed in thicker till deposits. However, these wells can fail during dry periods and are sometimes prone to contamination from surface water runoff.



The surficial geologic materials of the Town of Austerlitz were digitally mapped by Steven Winkley of the New York Rural Water Association using the interpretation of digital elevation models and topographic maps, field observations, soils mapping, and subsurface data from water wells.

Figure 4
Surficial Geology

Once the glacial ice in the region began to melt, very large volumes of meltwater carried large amounts of coarse-grained sand and gravel. These so-called glaciofluvial deposits were laid down by meltwater that flowed adjacent to and in front of the decaying glacial ice. Glaciofluvial deposits are largely concentrated in the Punsit Creek, Indian Creek, and Green River valleys.

After deglaciation, modern-day drainage patterns developed. Alluvium and alluvial fans formed along these rivers and streams. Alluvial deposits consist of sand, gravel, and silt deposited on flood plains and stream beds. Although alluvium is capable of producing usable water well yields, its use as a water supply source should be approached with caution due to concerns over its close hydraulic connection with surface water. Disease-causing pathogens are associated with surface water. The final surficial geologic materials formed are organic materials in wetlands, depressions, and other poorly drained areas across Town.

2.4 Drainage and Watersheds

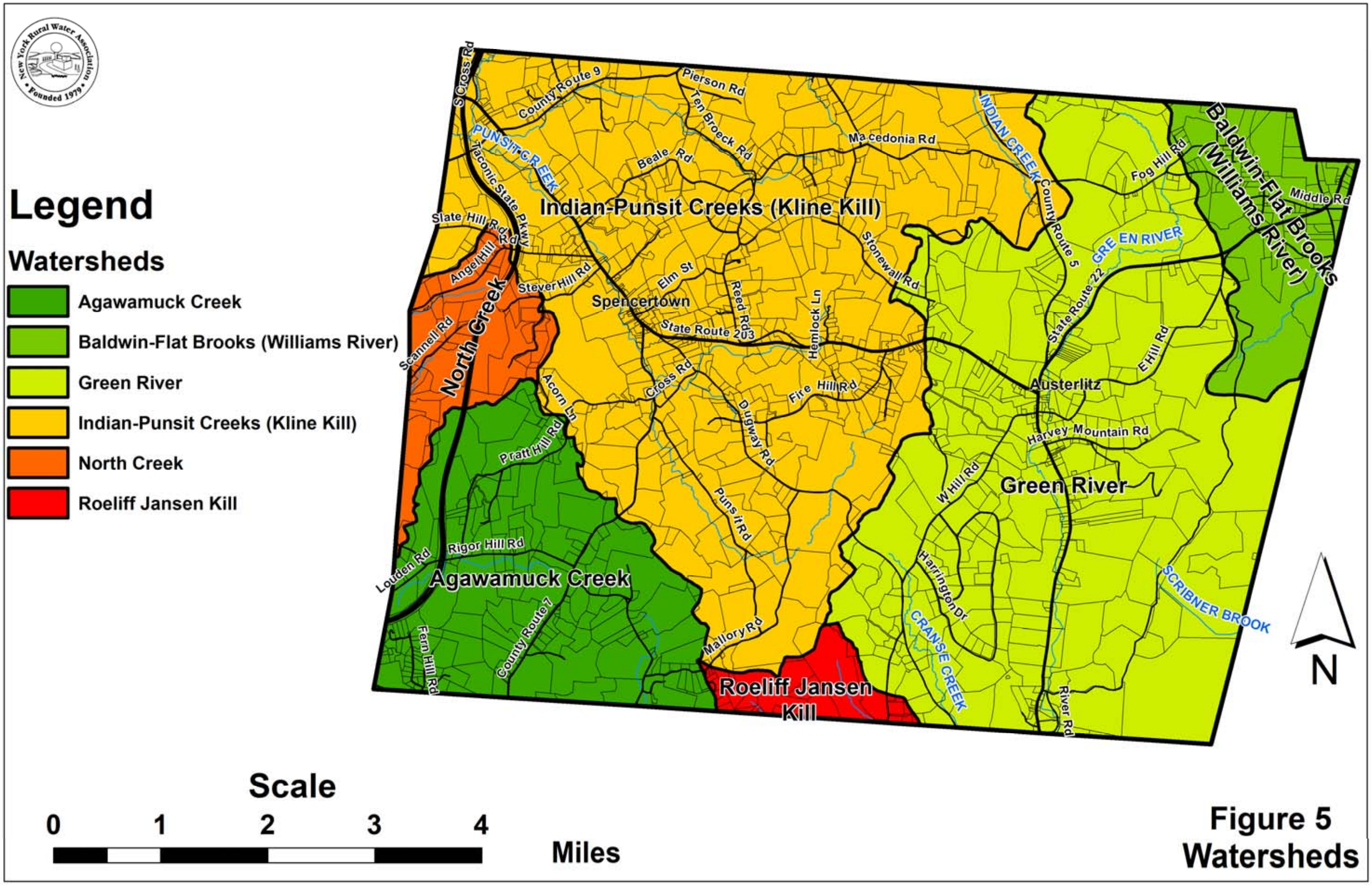
Austerlitz is located in two different regional drainage basins: the Hudson River Basin and the Housatonic River Basin. These drainage basins can be divided into various watersheds and sub-watersheds as depicted on Figure 5. Two different watersheds comprise the Housatonic River Basin in eastern Austerlitz: the Baldwin Brook & Flat Brook Watershed in the northeastern corner of Austerlitz and the Green River Watershed across most of eastern Austerlitz (see Figure 5). Four different watersheds comprise the portion of the Hudson River Basin in Austerlitz. The largest of these watersheds is drained by Punsit Creek and tributaries of Indian Creek. This watershed represents forty percent of the land area of the Town of Austerlitz. Punsit Creek and Indian Creek merge to form the Kline Kill, just within Austerlitz. The Kline Kill is a tributary of Kinderhook Creek. Other portions of eastern Austerlitz are tributary to Agawamuck Creek, North Creek, and the Roeliff Jansen Kill. The former two streams are in turn tributaries of Claverack Creek.

3.0 WATER SUPPLY SOURCES

3.1 Public Water Supply Wells

Although there are no municipal water supply systems in Austerlitz, there nevertheless are several public water systems. All rely upon groundwater wells for their source of supply and all are classified as transient, non-community public water supply systems. A public water system is an entity that provides water to the public for human consumption through pipes or other constructed conveyances. Any system having at least 5 service connections or that regularly serves an average of at least 25 people daily for at least 60 days out of the year is considered a public water system. A transient, non-community water system water system does not serve year-round residents, and does not regularly serve at least 25 of the <u>same</u> people more than six months per year. This type of system has the least number of regulatory requirements.

Table 1 below lists the transient, non-community public water supply systems in Austerlitz. Each of these systems relies upon groundwater. Wells for the active public water systems in Austerlitz are plotted on Figure 6. A 1,500-foot protective radius has been mapped on Figure 6 around each of these sources.


Legend
Watersheds
Agawamuck Creek
Baldwin-Flat Brooks (Williams River)
Green River
Indian-Punsit Creeks (Kline Kill)
North Creek
Roeliff Jansen Kill
Indian-Punsit Creeks (Kline Kill)
Green River
Agawamuck Creek
North Creek
Roeliff Jansen Kill
Baldwin-Flat Brooks (Williams River)
Spencertown
Austerlitz
PUNSIT CREEK
INDIAN CREEK
GREEN RIVER
CRANSE CREEK
SCRIBNER BROOK
S Cross Rd
County Route 9
Pierson Rd
Ten Broeck Rd
Macedonia Rd
Beale Rd
Taconic State Pkwy
Slate Hill Rd
Angel Hill Rd
Stever Hill Rd
Elm St
Reed Rd
Hemlock Ln
State Route 203
Stonewall Rd
County Route 5
State Route 22
Fog Hill Rd
Middle Rd
E Hill Rd
Scannell Rd
Acorn Ln
Cross Rd
Fire Hill Rd
Dugway Rd
Harvey Mountain Rd
Pratt Hill Rd
W Hill Rd
Punsit Rd
Harrington Dr
Rigor Hill Rd
Louden Rd
County Route 7
Fern Hill Rd
Mallory Rd
River Rd
N
Scale
0 1 2 3 4
Miles
Figure 5
Watersheds

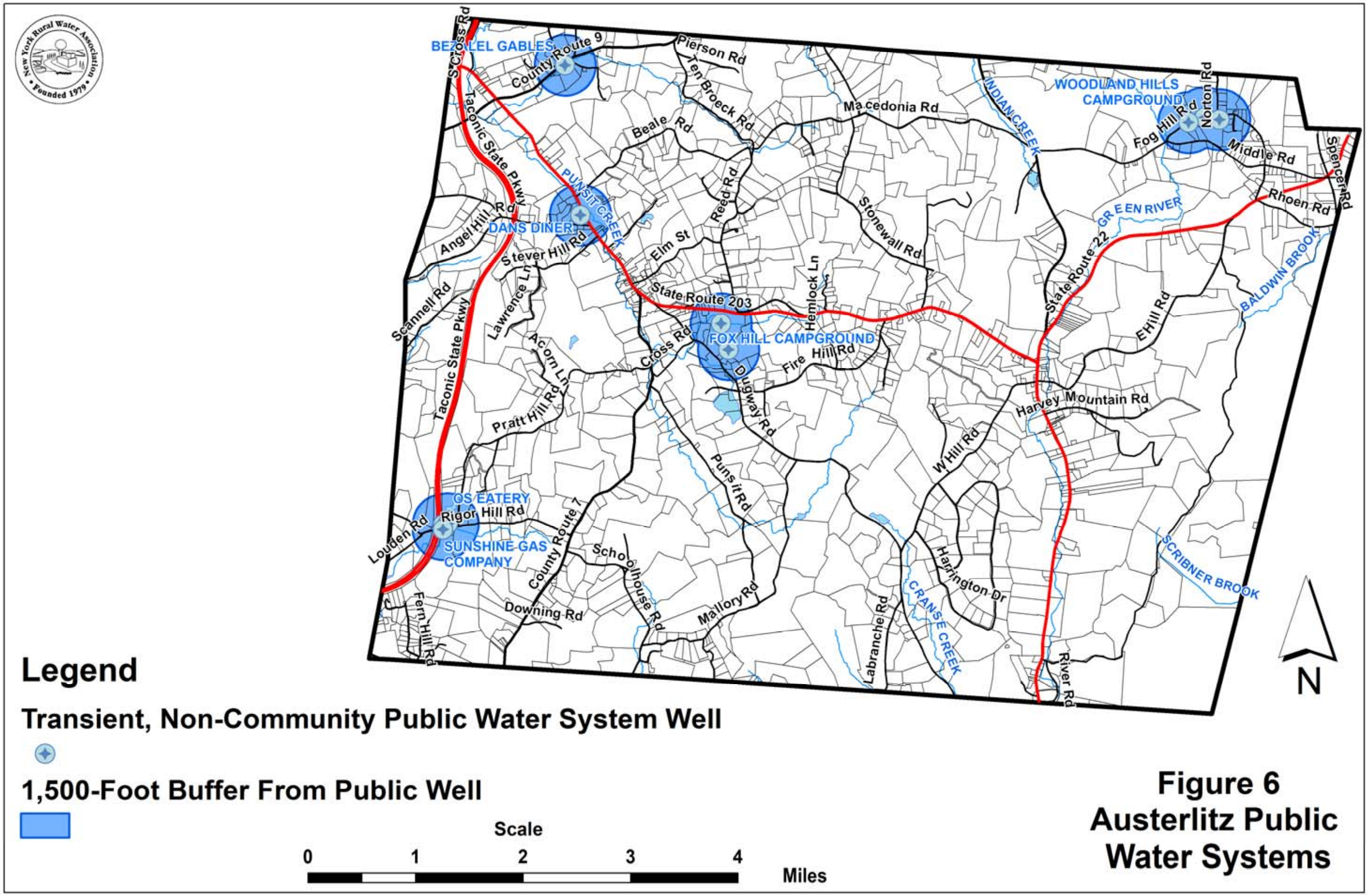


Figure 6
Austerlitz Public Water Systems

PWS ID #	Name	# of Wells	Population Served	Status
NY1012325	Fox Hill Campground	2	110	Active
NY1012326	Woodland Hills Campground	3	448	Active
NY1015314	The Austerlitz Inn			Closed
NY1015357	Os Eatery	2	150	Active
NY1030058	Spencertown Country House B&B			Closed
NY1030121	Spencertown Country Store			Closed
NY1030138	Sunshine Gas Company	1	30	Active
NY1030221	Bezalel Gables	1	25	Active
NY1030233	St Peter's Presbyterian Church Office for the Aging			Closed
NY1030244	Dans Diner	1	?	?

Table 1. Public Water Systems.

3.2 Household Wells

Residents in Austerlitz receive their drinking water from individual domestic wells (household wells). Since 2000, a Well Completion Report must be completed by the well contractor and filed with NYSDEC and the well owner for each water well drilled. Figure 7 is a map of where water wells have been drilled in Austerlitz from 2000 through January 2010 when NYRWA requested the well data from NYSDEC. Drilling activity peaked in 2005, when 16 wells were drilled. In contrast, 2 wells were drilled in 2009.

4.0 WATER-BEARING FORMATIONS

4.1 Bedrock

Bedrock in the Town of Austerlitz is the source of groundwater for nearly all residents and businesses with the exception of a few wells in some valley settings. Although the median depth of bedrock wells in Austerlitz is 405 feet, well depths range from 100 to 1000 feet. Figure 8 is a statistical distribution of bedrock water well depths. Figure 9 is a contour map of bedrock water well depths across Austerlitz.

In bedrock, steel casing is set through the overburden (unconsolidated deposits) and into the first few feet of sound rock. The median depth to bedrock based upon drilled wells is 14 feet across Austerlitz. Bedrock depths range from zero to 158 feet below the land surface. Water well drilling regulations promulgated by the NYSDOH specify a minimum of 19 feet of casing below grade. Larger casing depths will be necessary in areas of thicker till (see Figure 4 and Plate 2).

The statistical distribution of bedrock well yields in Austerlitz is displayed in Figure 10. The median yield of bedrock wells in Austerlitz is fair at 4 gallons per minute (gpm). However, 19 percent of wells yield 1 gpm or less. NYSDOH does not recommend the use of wells with yields of 1 gallon per minute or less for any homes with four or more bedrooms. As indicated on Figure 10, 62 percent of wells yield less the 5 gpm required by FHA for new home loans. The incidence of poor well yields is also reflected in the online well survey. Three of seven respondents (43 percent) indicated having experienced not having enough water.

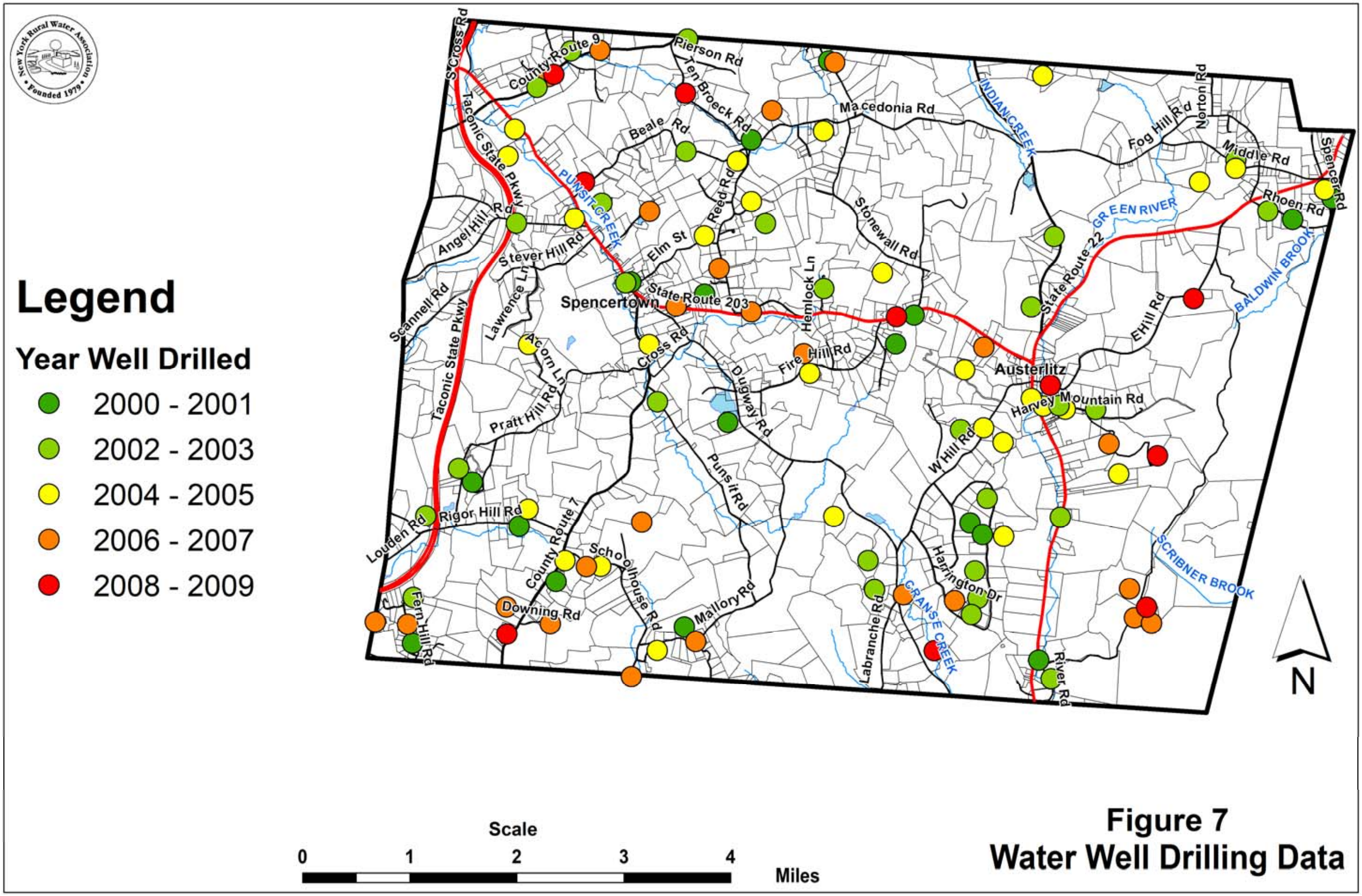


Figure 7
Water Well Drilling Data

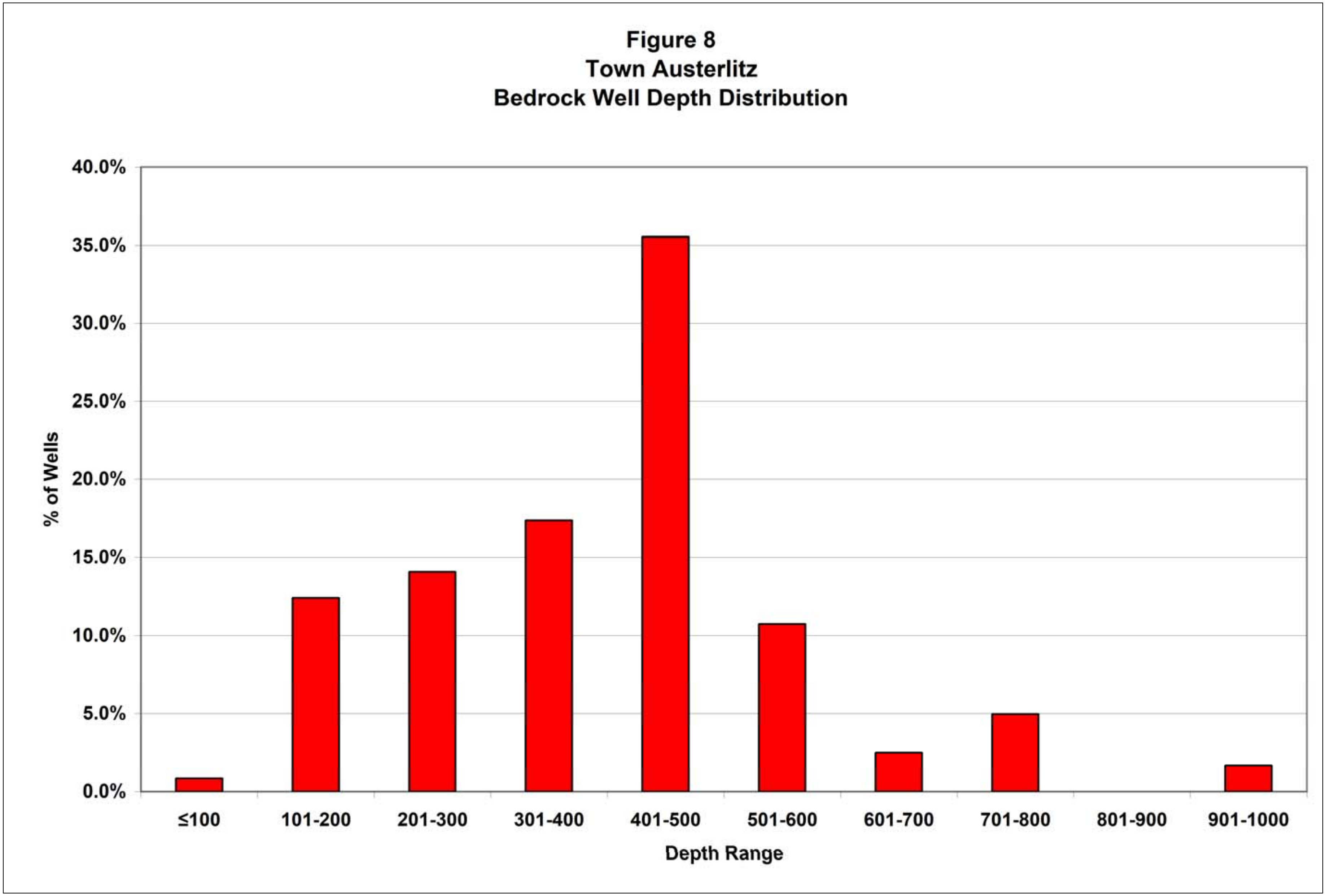


Figure 8
Town Austerlitz
Bedrock Well Depth Distribution
40.0%
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
% of Wells
≤100
101-200
201-300
301-400
401-500
501-600
601-700
701-800
801-900
901-1000
Depth Range

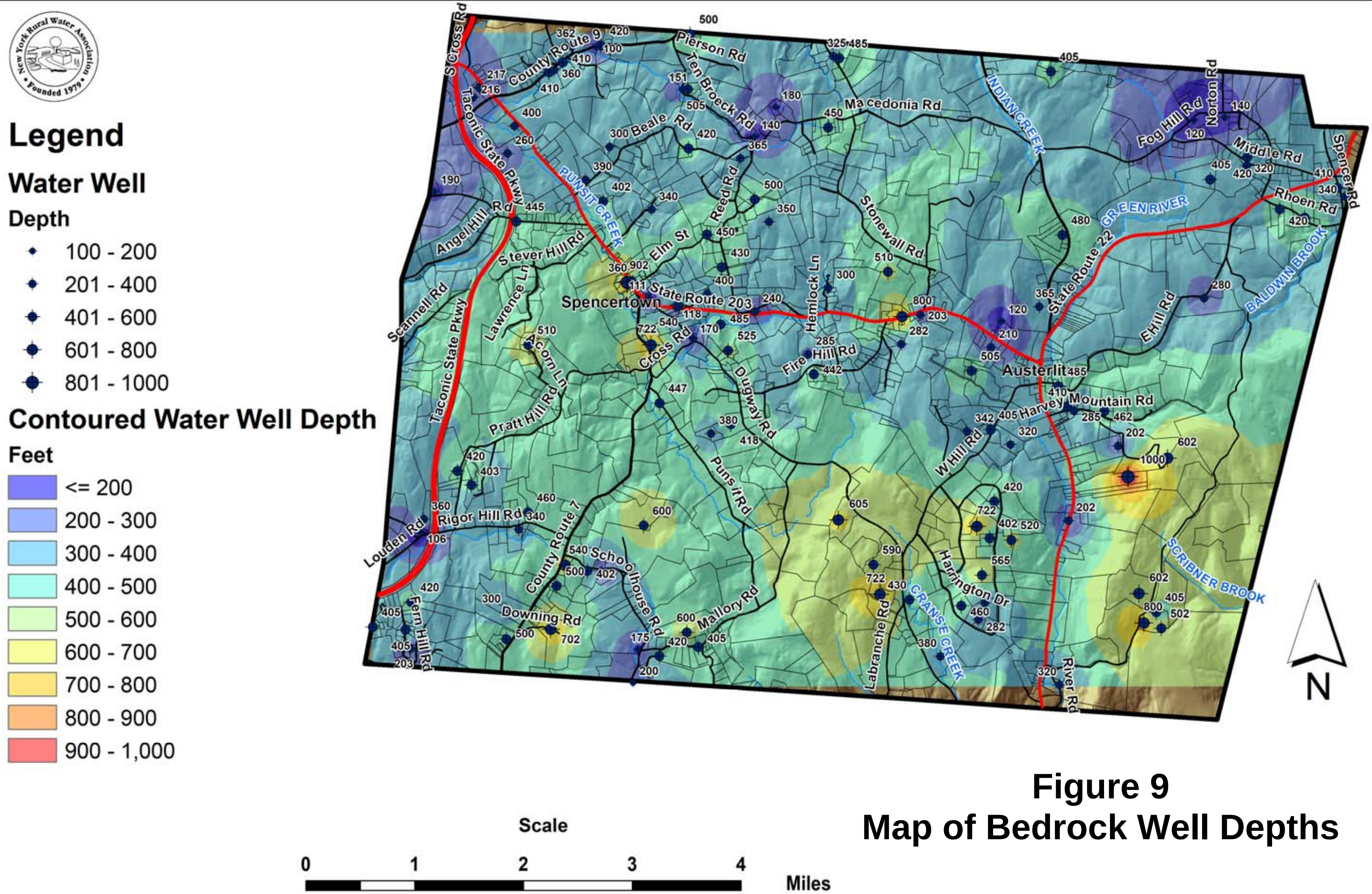


Figure 9
Map of Bedrock Well Depths

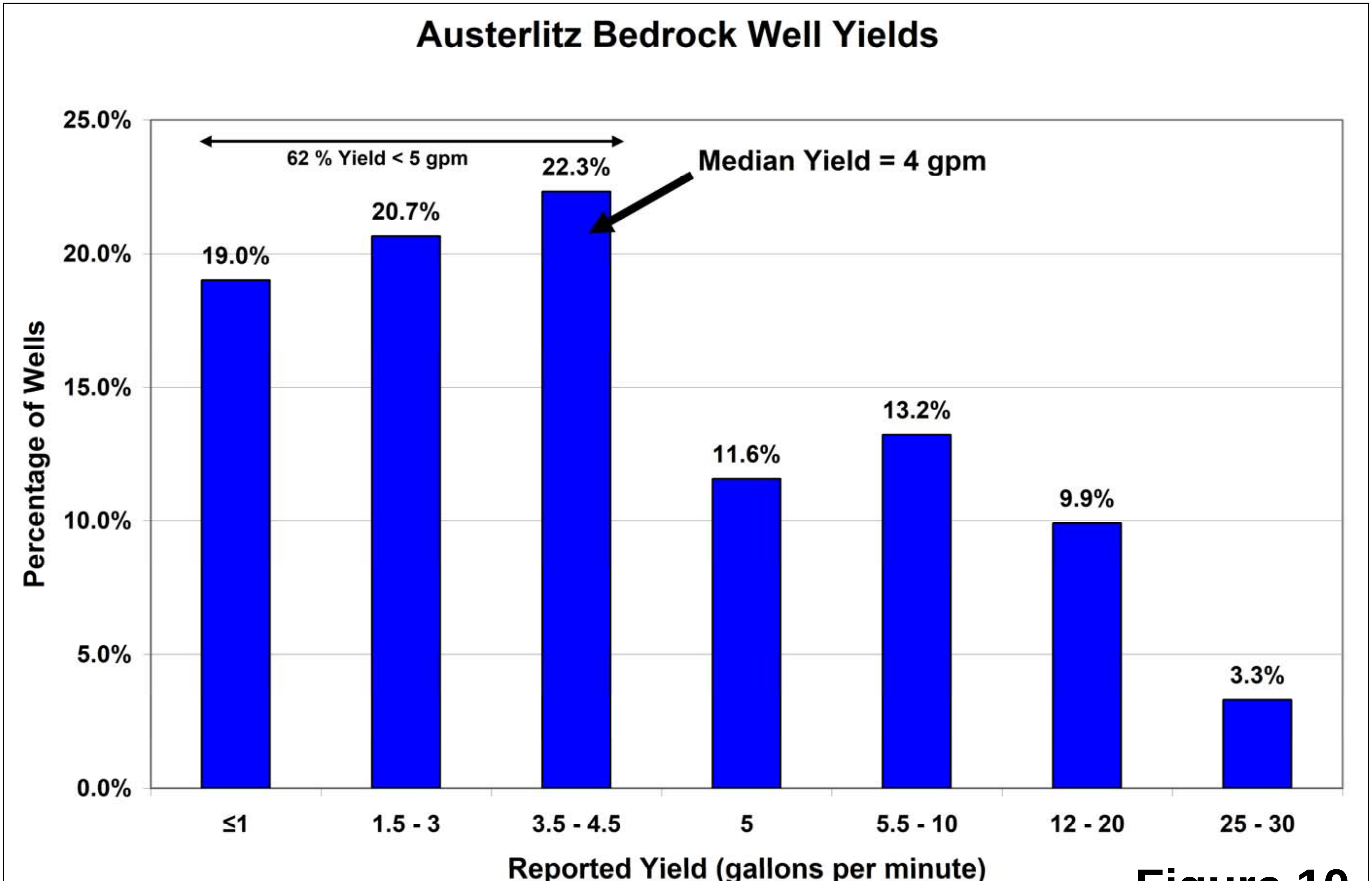

Austerlitz Bedrock Well Yields
Percentage of Wells
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
62 % Yield < 5 gpm
Median Yield = 4 gpm
19.0%
20.7%
22.3%
11.6%
13.2%
9.9%
3.3%
≤1
1.5 - 3
3.5 - 4.5
5
5.5 - 10
12 - 20
25 - 30
Reported Yield (gallons per minute)

Figure 10

Plate 3 is a contour map of bedrock well yields across Austerlitz. As indicated on this map, there are some variations in bedrock well yields across Austerlitz. The chief factor likely to explain well yield variation is the localized degree of fracturing of the bedrock. Wells intersecting numerous fractures can produce significantly more water. Currently there is insufficient well or geologic data to map specific subsurface bedrock fracture zones across Austerlitz. On Plate 3, NYRWA did map linear features that may be reflective of underlying bedrock fracture zones. These were identified from topographic evidence as well as orthoimagery.

Another factor to explain the distribution of bedrock water well yields may be the bedrock formation. Table 2 displays the water well yields statistics by bedrock formation. The relationship between bedrock formation and well yield is not as clear in Austerlitz as in other towns that NYRWA has locally worked. This may be due to the complex nature of the overlapping rock slices in Austerlitz. Typically well yields are much higher in marble bedrock. However, NYRWA only compiled data from two wells that intersect this type of bedrock. This is largely due to the fact that the marble is found only in the extreme northeast corner of Austerlitz.

Formation	No. of Wells	Median Yield	Range of Yields
Austerlitz Phyllite	42	4	0.25 to 30
Elizaville Formation	9	2.5	0.25 to 15
Everett Schist	7	4	1 to 25
Rensselaer Graywacke	9	4	1 to 20
Stockbridge Marble	2	6	6
Walloomsac Formation	50	4	0.25 to 27

Table 2. Well Yield Data by Bedrock Formation.

Unfortunately, water quality data is not reported to NYSDEC or other agencies for residential wells in Columbia County. NYRWA did compile available water quality data from public water supply wells. As transient, non-community water systems most of these wells were sampled for bacteria and nitrate. No nitrate contamination was evident from these analyses and only an occasional sample tested positive for total coliform (not E coli or fecal coliform).

Elevated nitrate was reported in one of the wells in the survey. This was a relatively shallow well completed in unconsolidated deposits. Most water quality issues reported by homeowners appear to be largely aesthetic in nature and not health-based. For example in the well survey, 57 percent of the residents reported hard water and 43 percent indicated a rotten-egg or sulfurous odor.

4.2 Unconsolidated Aquifers

Unconsolidated (sand and gravel) aquifers supply only a few wells in Austerlitz. Plate 4 shows the distribution of these sand and gravel wells and unconsolidated (sand and gravel) aquifers. The median yield of wells completed in sand and gravel in Austerlitz is 8.5 gpm.

Local wells that are completed in the unconsolidated deposits for private, residential use are typically left as open ended casing. However, unconsolidated deposits are capable of producing very high yields if wells are finished with a properly sized and developed screen. A well screen is a filtering device that permits water to enter the well but prevents the unconsolidated material (sand, etc.) from entering the well. Screening is placed in the well and the casing is generally pulled back to expose the screen to the unconsolidated material. Screens are typically made of stainless steel and have openings referred to as slots. Public water supply wells in sand and gravel are typically fitted with screens. The casing is terminated in the water-bearing material.

NYRWA mapped the unconsolidated aquifers on Plate 4 using a combination of surficial geology and subsurface data. The unconsolidated aquifers mapped on Plate 4 include the Green River Aquifer, the Lower Punsit/Indian Creek Aquifer, the Agawamuck Creek Aquifer, and the Upper Punsit Creek Aquifer. The former two aquifers are known to be relatively productive, with thicknesses in excess of 50 feet in some locales. In contrast, the latter two aquifers should be considered as potential aquifers in that little to no subsurface data exists.

In terms of quality, water from unconsolidated aquifers is typically hard. Water from unconsolidated aquifers usually has less reported problems with odor, but can have staining and sediment difficulties. Shallow sand and gravel wells (less than 25 feet) are prone to contamination from activities at the land surface and are more susceptible to surface water contamination.

5.0 INVENTORY OF POTENTIAL SOURCES OF CONTAMINATION

Groundwater resources are susceptible to contamination from a variety of manmade sources. These include various industrial, commercial, residential, and agricultural uses and activities. Practices involving the handling, use, storage, and/or disposal of petroleum and other hazardous substances have the highest potential to contaminate groundwater. Once contaminated, groundwater is very difficult and costly to cleanup. It is best to reduce the likelihood of contamination through the use of environmentally-sound best management practices and/or structural methods.

Several potential sources of groundwater contamination are regulated by government agencies. NYRWA has conducted an inventory of facilities regulated by state and federal agencies. Results are presented on Figure 11. As part of the inventory NYRWA used databases available from the NYSDEC and USEPA on regulated activities such as: wastewater dischargers (SPDES facilities); waste generators, transporters, and storers (RCRA); hazardous waste sites (Superfund); petroleum bulk storage facilities; active spills; and mines/quarries.

Also shown on Figure 11 are higher risk land uses that historically have a higher risk of contaminating groundwater. These land uses were identified using property tax assessment data. Note that inclusion on this map does not mean that a particular property or use has resulted in groundwater contamination.

6.0 HYDROGEOLOGIC ANALYSES

In addition to inventorying drinking water resources, it is also very important to conduct analyses to determine the potential impacts of future development upon such resources. With the aid of GIS, NYRWA utilized detailed groundwater resource mapping and digital elevation data to

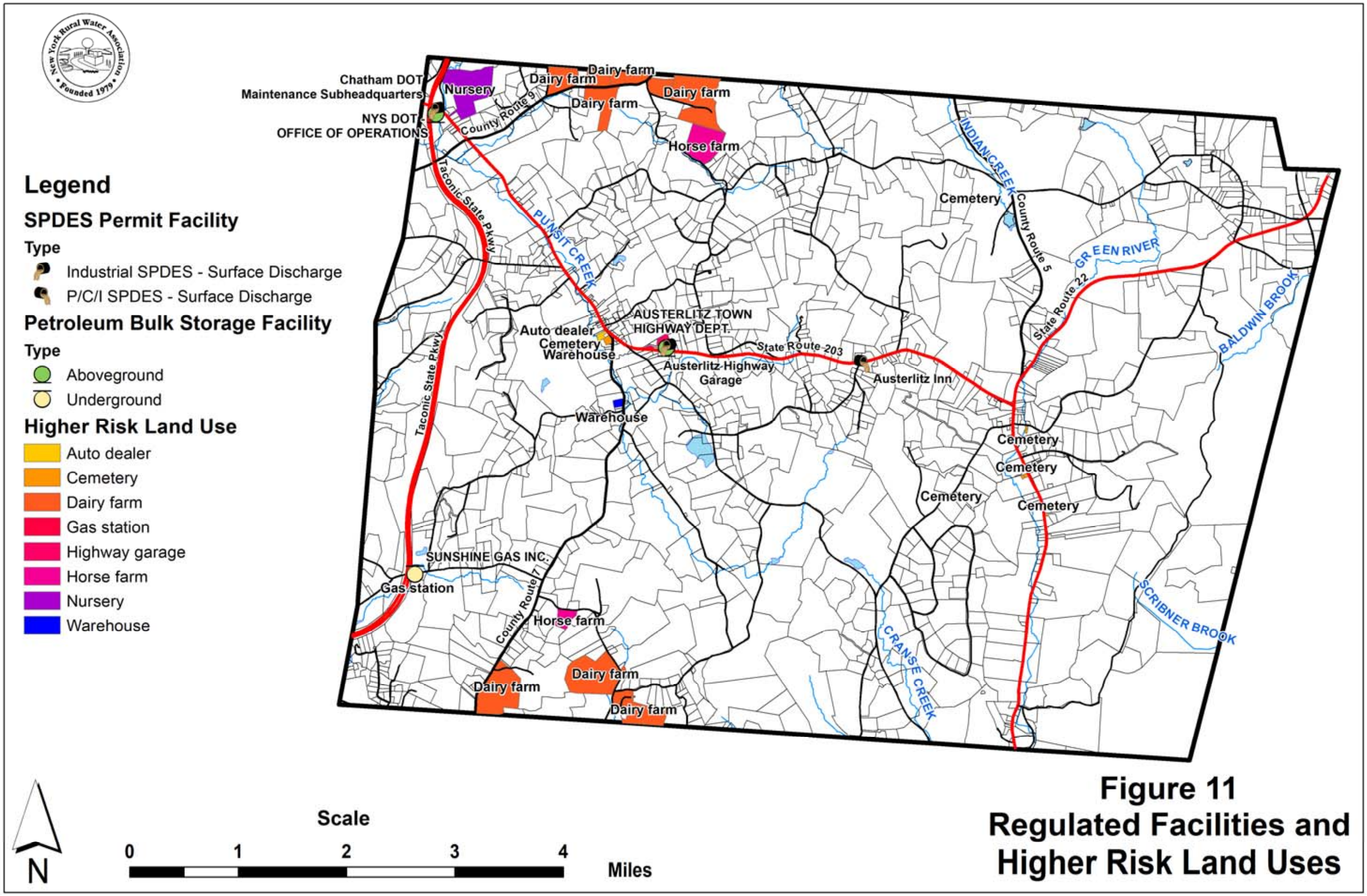


Figure 11
Regulated Facilities and Higher Risk Land Uses

determine: (1) what areas of Austerlitz have hydrogeologic settings that are sensitive to future development; and (2) if the density of allowable development is consistent with drinking water quality protection.

6.1 Hydrogeologic Sensitivity

The *hydrogeologic sensitivity* of a location is a relative measure of the ease and speed with which a contaminant could migrate into and within the upper-most water-bearing unit. High to very high hydrogeologic sensitivity ratings indicate that, in general, groundwater could be readily impacted by surface activities. Development activities that could contaminant groundwater include nitrates and bacteria from septic systems, nutrients from fertilization and irrigation of lawns, salts from deicing, and volatile organics and other contaminants from leaks and improper disposal of petroleum and other fluids. If possible, higher-risk land uses should be steered away from areas of high to very high hydrogeologic sensitivity.

The hydrogeologic sensitivity is a function of the naturally occurring hydrogeologic characteristics of an area. The two factors controlling the hydrogeologic sensitivity are the site's geologic materials (uppermost water-bearing unit and the overlying soils) and the site's topographic position (the topographic factors influencing the vertical migration of groundwater). Areas of high to very high sensitivity are mapped on Figure 12. Due to their characteristics, sensitive hydrogeologic settings also have enhanced groundwater recharge capability.

In Austerlitz, areas with very high hydrogeologic sensitivity are those areas of coarse-grained soils overlying unconfined aquifers that are situated in topographic highs with relatively gentle slopes (< 3 percent) (see Figure 12). High sensitivity is found in areas of shallow bedrock (less than ten feet) or coarser-grained soils, that are situated in topographic highs with relatively gentle slopes (< 3 percent) (Figure 12).

6.2 Safe Development Densities

With no municipal water or sewer systems, residential development in Austerlitz is chiefly in the form of individual septic systems and household water wells. Excessive nitrate loading of groundwater can conceivably occur if there is too high a density of septic systems in a given area. Also, depletion of groundwater resources is possible if well withdrawal rates exceed the rate of groundwater recharge from infiltration of precipitation and snowmelt. To avoid excessive nitrate loading and groundwater depletion, lots must be large enough for groundwater recharge to: 1) adequately dilute the effluent from septic systems; and 2) balance the withdrawal and use of water by landowners.

Some concerns were raised about the ability of local groundwater resources in the Town's hamlets (Austerlitz and Spencertown) to sustain future development. The area of Moorhouse Corner (near the intersection of NYS Route 203 and County Route 9) was also identified as a population center that may experience future growth. In order to determine if groundwater resources in these three hamlet areas are adequate to sustain potential development, NYRWA conducted a groundwater build-out analysis. This technique looks at a possible future when all land is developed to the maximum extent allowed under the zoning law. It essentially allows Austerlitz to test the minimum lot sizes in its recently enacted regulations.

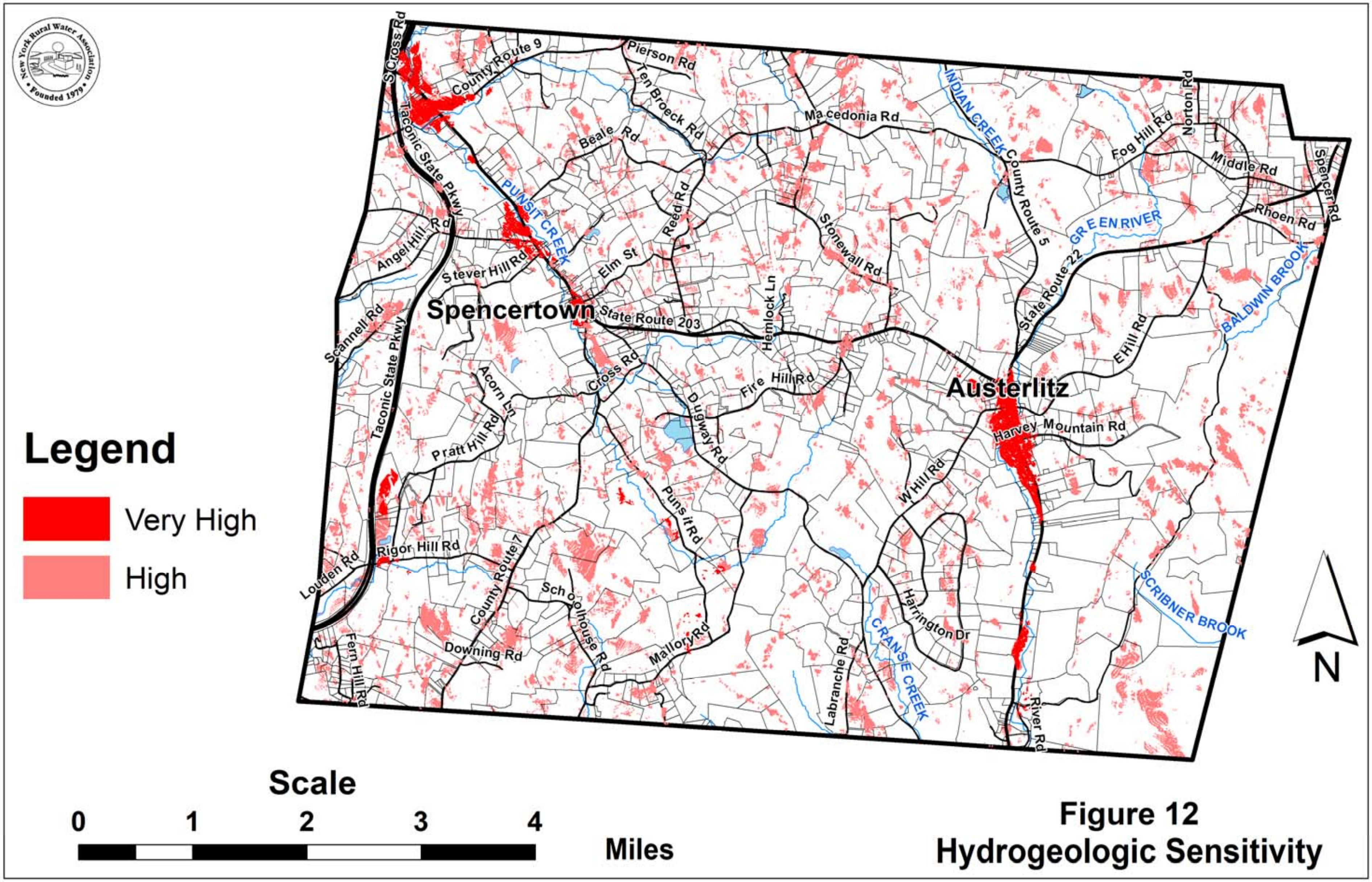


Figure 12
Hydrogeologic Sensitivity

In general, the minimum lot size(s) specified in the current zoning satisfactorily protects groundwater resources in these hamlet areas from excess nitrate loading or depletion. However, the calculated build-out level of nitrate of 5.5 mg/l in Spencertown is above the action level of 5 mg/l that would trigger monitoring by NYSDOH if public water systems experienced this level. Under the maximum build-out scenario, an average calculated level of 5.5 mg/l nitrate in the hamlet of Spencertown likely means that some parcels would experience nitrate levels closer to the maximum concentration level (MCL) of 10 mg/l at some times of the year.

7.0 PROPOSED PROTECTION STRATEGIES

Although there are several state and federal programs that directly or indirectly protect groundwater, local land use controls have often proven to be most effective. Land use controls can include zoning ordinances, site plan review regulations, and subdivision regulations. Public education is another protection strategy that can be locally implemented. Regulations cannot address every use, and are heavily dependent upon enforcement. To improve outreach and understanding, activities can target the general public or specific groups such as business owners, or residents of a particular area for example.

7.1 Land Use Regulations

7.1.1 Subdivision Regulations

Subdivision regulations relate to how land is to be divided into lots and what improvements such as streets, lighting, fire protection, utilities, drainage, etc. are made to service the lots. Subdivision regulations were adopted by the Town in 2005. Although recently enacted, there are some steps that leaders may wish to take to amend Austerlitz's subdivision to optimize the protection of drinking water and groundwater. These are discussed below.

<u>Documents to be Submitted</u>

Additional documentation could be submitted for preliminary plat approval of a major or minor subdivision. The preliminary plat submitted for approval could include the location of any existing wells and proposed water supply wells. The location of these wells would be shown with respect to local topography, lot lines, roads, on-site sewage system components (septic tank, absorption field, distribution box, effluent line, etc.), sewer lines, petroleum storage tanks, surface water and other drainage features, and stormwater conveyance systems.

Documents to be submitted for approval could also include a statement of compliance with the below list of required minimum separation distances to water wells (from NYSDOH regulations).

Contaminant Source	Separation Distance to Water Well (Feet)
Chemical storage sites not protected from the elements (e.g., salt and sand/salt storage)[2]	300
Landfill waste disposal area, or hazardous or radiological waste disposal area[2]	300
Land surface application or subsurface injection of effluent or digested sludge from a Municipal or public wastewater treatment facility	200
Land surface application or subsurface injection of septage waste	200
Land surface spreading or subsurface injection of liquid or solid manure [3]	200
Storage Areas for Manure piles [4]	200
Barnyard, silo, barn gutters and animal pens [5, 6]	100
Cesspools (i.e. pits with no septic tank pretreatment)	200
Wastewater treatment absorption systems located in coarse gravel or in the Direct path of drainage to a well	200
Fertilizer and/or pesticide mixing and/or clean up areas	150
Seepage pit (following septic tank) [5]	150
Underground single walled chemical or petroleum storage vessels	150
Absorption field or bed [5]	100
Contained chemical storage sites protected from the elements (e.g. salt and sand/salt storage within covered structures) [7]	100
Septic system components (non-watertight) [5]	100
Intermittent sand filter without a watertight liner [5]	100
Sanitary Privy pit [5]	100
Surface wastewater recharge absorption system constructed to discharge storm water from parking lots, roadways or driveways [5]	100
Cemeteries	100
Sanitary privy with a watertight vault	50
Septic tank, aerobic unit, watertight effluent line to distribution box	50
Sanitary sewer or combined sewer	50
Surface water recharge absorption system with no automotive-related Wastes (e.g., clear-water basin, clear-water dry well)	50
Stream, lake, watercourse, drainage ditch, or wetland	25
All known sources of contamination otherwise not shown above	100

Table 3. Required Separation Distances for New Wells.

Other items that could be required for approval are:

- Copies of New York State Department of Environmental Conservation Well Completion Reports for completed well(s) (including the well log and pump test data).
- Any and all water quality testing results.
- Proposed individual water supply system details such as pumps, storage, treatment, controls, etc.
- A completed hydrogeological study, if required.

A hydrogeological study could be required for any new major subdivision that relies upon on-site groundwater withdrawals and/or on-site sewage disposal. Proposed requirements for this study are found in Appendix B.

Requirements and Standards

Standards could be added to subdivision regulations that specifically cover wells. These standards can specify the following:

A. Well locations. Existing and proposed wells are located at minimum separation distances from on-site and off-site potential sources of contamination as specified in Appendix 5-B of 10 NYCRR Part 5 (same as table above).

B. Supply suitability. A representative number of well(s) indicate that the available quantity and quality of on-site groundwater resources are suitable for household purposes. Unless otherwise stated, test wells shall be installed and tested on at least twenty percent (20%) of the proposed lots in representative locations.

C. Adverse impacts. For proposed subdivisions requiring a hydrogeological study, a determination has been made that the subdivision avoids adverse impacts to existing or future groundwater users and/or surface waters within 1,500 feet of the subdivision. If adverse impacts cannot be avoided, the applicant must provide adequate mitigation of such impacts. An adverse impact to groundwater can be defined as any reductions in groundwater levels or changes in groundwater quality that limit the ability of a groundwater user to withdraw groundwater. An adverse impact to surface water would be any reductions in the level of flow or water quality needed for beneficial uses such as protection of fish and wildlife habitat, maintenance of waste assimilation, recreation, navigation, cultural and aesthetic values, drinking water supply, agriculture, electric power generation, commercial, and industrial uses.

7.1.2 Site Plan Review

Site plan review is a local regulatory process that involves municipal review and approval of how development is to occur on a *single* parcel of land. In this way, site plan review differs substantially from subdivision regulations. Site plan review does not prohibit certain land uses. However, it does regulate how development will take place by specifying the arrangement, layout and design of the proposed use.

Several proposed uses require site plan approval based upon the Town of Austerlitz's Zoning Law. All uses that require a special use permit require site plan review and approval. In addition, all business uses, community uses, and all land clearing, grading, and/or excavation in excess of 1 acre on a vacant property without a primary residential or business use requires site plan review and approval.

§ 195-30 D (5) and § 195-30 D (7) of the zoning law stipulate studies and plans to minimize impacts on groundwater. These requirements could be specified by requiring the following elements as part of site plan submission:

- Copies of New York State Department of Environmental Conservation Well Completion Reports for completed well(s) (including the well log and pump test data).
- Any and all water quality testing results.
- The location(s) of all public water systems and other groundwater users within 1,500 feet of the proposed development boundaries;
- The proposed means of storage, distribution, use, treatment, and/or disposal of wastewater, other wastes, chemicals, etc.
- The proposed means of water supply, including if applicable an estimate of the total daily groundwater withdrawal rate;
- A list of all petroleum, chemicals, pesticides, fuels and other hazardous substances/wastes to be used, generated, stored, or disposed of on the premises;
- A description of the pollution control measures proposed to prevent groundwater or surface water contamination; and
- A statement as to the degree of threat to water quality and quantity that could result if the control measures failed.

Submittal of a site plan *and* a hydrogeological study could be required for any proposed project in Austerlitz that has projected on-site groundwater withdrawals and/or on-site sewage disposal flows equal to or exceeding a certain amount (1,000 gallons per day (gpd) perhaps). Proposed requirements for a hydrogeological study are indicated in Appendix B.

§ 195-29, standards for approval of a site plan, could be amended to include the following requirement:

> (8) Reductions in water levels or changes in water quality do not limit the ability of an adjacent user to withdraw or utilize water resources.

7.1.3 Zoning

Zoning regulates land uses, the density of land uses, and the siting of development. There are several zoning points that the Town of Austerlitz should consider with respect to drinking water resources.

First, based upon the results discussed in Section 6.2, the Town may wish to consider increasing the minimum lot size in the S-HM Spencertown-Hamlet Zoning District. For example, a minimum lot size of 1.5 acres would reduce the calculated build-out level of nitrate to 4.3 mg/l in Spencertown.

Second, uses of land with a higher-risk of groundwater contamination could be “steered-away” from areas of very high hydrogeologic sensitivity in Austerlitz (Figure 12). Examples of uses typically found on lists of higher risk uses that would be allowed by current zoning in Austerlitz include automotive repair stations, cemeteries, heavy equipment yards, light industry, mining, nurseries/greenhouses, and warehouses.

In addition, various different retail businesses that could potentially store liquid petroleum products, or generate, treat, store, or dispose of hazardous waste/substances would be permissible in areas of very high sensitivity. In order to direct high-risk land uses away from very sensitive areas, an aquifer protection overlay district could be enacted. Overlay zoning creates a set of regulations for a given area that are in addition to the regulations in the standard "underlying" zoning districts.

7.2 Building Permits and Certificates of Occupancy

In order to help ensure the proper location of a new water well supply, the Town of Austerlitz should consider amending § 90-4 D 5 (e) (regarding building permits)to read as follows (new text is underlined):

> Where applicable, include a site plan that shows any existing and proposed buildings and structures on the site, the location of any existing ~~or proposed~~ well, existing or proposed septic system, the location of the intended work, and the distances between the buildings and structures and the lot lines. For any proposed work that will eventually include the drilling of a new water well, the site plan should include the location of the new well and the location of any potential contaminant sources listed in Table 1 of 10 NYCRR Part 5, Appendix 5B (Standards for Water Wells).

In order to help ensure the adequacy of a new water well supply, the Town of Austerlitz may also wish to amend § 90-7 (regarding certificates of occupancy) to require the following before a certificate of occupancy is issued:

1. Proof that any new well was drilled and constructed by a contractor registered with the NYSDEC.
2. A well completion report has been submitted to the Code Enforcement Officer and the information on it has been verified as recommended on NYSDOH Fact Sheet #6: "Guidance for Code Enforcement Officials" (available online at http://www.health.state.ny.us/environmental/water/drinking/part5/append5b/docs/fs6_guidance_for_code_enforement_officials.pdf).

If the Town of Austerlitz amends its laws similar to that indicated above, it should inform local water well contractors. Based upon water well completion reports that have been filed with NYSDEC, registered water well contractors that have worked in Austerlitz are indicated below. These contractors may also be interested in a copy of this report and plan.

Registration No.	Contractor Name.	Address
NYRD10001	Smith Well Drilling, Inc.	PO Box 585 Niverville, NY 2130-0585
NYRD10005	Hanson Well Drilling & Pump Co., Inc	PO Box 463 Nassau, NY 12123-0463
NYRD10010	Keyser Drilling Co. LLC.	PO Box 834 Claverack, NY 12513-0834
NYRD10055	W Gordon Goold Inc.	17 Goold Rd. Valatie, NY 12184-4000

Table 4. Registered Water Well Contractors with Completed Wells in Austerlitz.

7.3 Education

Public education can be an excellent non-regulatory tool to promote drinking water protection. There are several instances where education may be effective. These include:

- Informing residents about the results of this study;
- Educating homeowners on proper operation and maintenance of onsite wastewater treatment systems and wells;
- Encouraging the use of water saving devices within homes;
- Promoting natural landscaping and other lower demand vegetation;
- Educating homeowners on proper fertilizer/pesticide application rates and practices; and
- Supporting proper waste disposal (i.e. recycling).

8.0 FUTURE PLANNING

8.1 Emergencies

Unfortunately, emergency situations affecting groundwater do sometimes occur. One conceivable scenario involves petroleum/hazardous material spills and/or the discovery of contamination. With the NYS Route 203, NYS Route 22, and the Taconic State Parkway corridors in the Town, the potential exists for accidents to occur.

Under state law, all petroleum and most hazardous material spills must be reported to the DEC Hotline (1-800-457-7362). NYSDEC then informs other response agencies such as the local fire department if the spill poses a potential explosion and/or fire hazard and the health department if a drinking water supply is threatened as result of a spill. However, in most instances, the local municipality is not required to be notified. Nevertheless, it is important that the Town be notified if a spill is discovered.

Another emergency situation involving ground water is drought. Here in New York State we on average have ample precipitation. However, there are variations in weather patterns that result in periods of drier weather. Based upon data from the National Climatic Data Center, New York State regularly experiences moderate drought conditions every 2 to 5 years. These moderate droughts typically last for a few months. Of much more concern is the fact that we also experience severe to extreme droughts every 10 to 20 years. These can last nearly a year to over two years.

During these periods of severe to extreme drought, many wells with marginal yields may fail. The Town of Austerlitz may wish to work with local water suppliers to have a plan in place in order to assist households or water systems in such difficulty.

8.2 Data Collection

As new wells are drilled in Austerlitz over the years, the Town should seek to obtain and plot Well Completion Forms for these wells. In this way, the subsurface data compiled for this plan can be continually updated. New data may shed more light on the hydrogeologic conditions across Town where data was not available at the time of preparation of this plan. Requiring well completion forms in order to acquire a certificate of compliance (see Section 7.2 above) would be a mechanism to do this.

8.3 Plan Review

This plan should be periodically reviewed by the Town of Austerlitz. Proposed protection strategies and measures should be evaluated for their effectiveness. If necessary, the plan should be updated with new data (see Section 8.2 above).

9.0 BIBLIOGRAPHY

Fisher,D.W., Isachsen, Y.W., and L.V. Rickard, 1970, Geologic Map of New York. New York State Museum Map Chart Series 15.

Fisher, Donald W., 2006. The rise and fall of the Taconic Mountains: a geological history of eastern New York. Black Dome Press Corp.

USDA Natural Resources Conservation Service, 2006, Soil Survey Geographic (SSURGO) database for Columbia County, New York.

APPENDIX A

ONLINE WATER WELL SURVEY FORM

Austerlitz Residential Water Well Survey

Exit this survey >>

1. Please enter your street address (e.g. 100 Somewhere Road). This information is necessary and information on your well's water quality and quantity will be kept strictly confidential.

2. What type of well do you have?

Drilled (6 to 8 inch diameter casing with sanitary well cover)

Driven (1 to 3 inch diameter pipe with attached point)

Dug (2 to 8 foot diameter constructed of concrete or stones)

Not Sure

3. When was your well drilled?

Since 2000

1990-1999

Before 1990

Not Sure

4. Which drilling contractor installed your well (you can check the well cap if you are not sure).

Hanson Well Drilling & Pump Co.

Keyser Drilling Co.

Smith Well Drilling

W Gordon Goold Inc.

Other

Not sure

Other (please specify)

5. If you have a copy of your well completion report (well log), please enter the information below:

Well Depth

Casing Depth

Depth to Bedrock

Well Yield

6. Have you ever had any of the following problems with your well?

- Not enough water
- Hardness (scale, soap scum, poor lathering, white/tan particles)
- Reddish, yellowish, or blackish water or staining
- Bluish-green water or staining
- Rotten-egg odor
- Methane gas odor
- Salty taste
- Metallic taste
- Sediment
- Coliform bacteria
- Elevated nitrate
- Other
- No problems

Other (please specify)

7. If you have any comments or questions, please state them below.

Done >>

APPENDIX B.

PROPOSED REQUIREMENTS FOR A HYDROGEOLOGICAL STUDY

TOWN OF AUSTERLITZ
HYDROGEOLOGICAL STUDY REQUIREMENTS

SECTION 1.0 INTRODUCTION

Hydrogeological studies are required for certain development activities as specified below. The purposes of such hydrogeological studies are to: (1) assess the adequacy of the available groundwater supply to support the proposed development; and (2) evaluate the potential impacts for adverse impacts upon any nearby groundwater users and surface waters. Hydrogeological studies as set forth in this document are based on both on-site testing, and existing and readily available information.

Hydrogeological testing and evaluation shall be performed by a qualified consultant approved by the Town of Austerlitz Planning Board. Work shall be performed or directly supervised by a professional geologist who has related project experience in Columbia County. Alternatively, work may be performed or directly supervised by a licensed professional engineer who is experienced in performing groundwater studies and has related project experience in Columbia County. Where not specifically defined in this document, the methodology used for testing and evaluation shall follow generally accepted professional hydrologic and hydrogeologic practices and standards.

SECTION 2.0 APPLICABILITY

Hydrogeological studies are required for two general types of land development projects: (1) certain residential subdivisions utilizing on-site groundwater and/or on-site sewage disposal; and (2) other types of development that utilize relatively large amounts of on-site groundwater and/or dispose of a high volume of sewage on-site (see specific thresholds below).

A hydrogeological study must be performed for any new subdivision involving five or more lots that relies upon either on-site groundwater withdrawals and/or on-site sewage disposal. Eight (8) copies of a hydrogeological study for such a subdivision must be submitted to the Town of Austerlitz Planning Board in conjunction with submission of the preliminary plat. The hydrogeologic study must be formally approved prior to approval of the preliminary plat.

A hydrogeological study is also required for any type of proposed development project with on-site groundwater withdrawals and/or on-site sewage disposal flows potentially equal to or exceeding an average of 1,000 gallons per day (gpd) during any single thirty (30)-day period. These types of projects could include, but are not limited to, recreational developments (golf courses, water theme parks, etc.), multi-family housing (apartments, condominiums, townhouses, etc.), industrial, or commercial developments. Ten (10) copies of a hydrogeological study for such a development project is required to be submitted to the Town of Austerlitz Planning Board as part of the site plan review process indicated in the Town’s zoning regulations.

SECTION 3.0 BACKGROUND EVALUATION

A background evaluation and analysis of the regional and site specific hydrogeologic conditions should be conducted using readily available existing resources such as publications and/or data from the New York Rural Water Association, U.S. Geological Survey, U.S. Environmental Protection Agency, U.S. Department of Agriculture's Natural Resources Conservation Service (formerly the Soil Conservation Service), New York State Geological Survey, New York State Department of Environmental Conservation, New York State Department of Transportation, New York State Department of Health, Columbia County Health Department, etc. At a minimum, the evaluation shall include the area within approximately one (1) mile beyond the project boundary.

The evaluation and analysis shall include the following:

- Topographic information from USGS mapping and other sources.
- Property maps, aerial photographs, and land use data (for example from real property classifications).
- Geologic maps and data reports (well logs, water quality analyses, geologic information, soils data, etc).
- Existing well data and descriptive statistical summary of the same (e.g. minimum, maximum and mean of well data, etc.)
- Existing research reports, hydrogeologic reports, etc.
- Locations and identifications of all wells within a minimum of 1,500 feet of the proposed development boundaries, including public water supplies.
- Existing and potential contaminant sources of record or those observed on site and within a minimum of 1,500 feet of the project site boundary. An attempt shall be made to verify sources of record by field reconnaissance.
- Preliminary field verification of existing geologic information including rock outcrops, bedrock fractures, karst features, linear features, photo linears, etc.
- At sites with bedrock outcrops, fracture orientations (strike and dip measurements) shall be measured and documented in the report. The number and orientations of linear features or photo lineaments shall be analyzed and correlated with documented bedrock fractures.
- Evaluation of the site hydrogeology and the occurrence, quality, and quantity of groundwater.

SECTION 4.0 TESTING REQUIREMENTS

Section 4.1 Water Supply Testing for Applicable Subdivisions

A. Wells

1. The applicant must submit a plan to the Town of Austerlitz Planning Board showing the locations and construction details of proposed test wells. The Town of Austerlitz may approve, approve with conditions, reject, or request more information within 45 days of receipt of such a well plan.

2. Well construction and testing shall be performed by a certified water well contractor (NYS Environmental Conservation Law 15-1525) in accordance with Appendix 5-B of 10 NYCRR Part 5 (Standards for Water Wells).

3. Pumping tests should be conducted during a period of time of average or below average seasonal stream flow conditions (typically not during the months of March, April, and May).

4. Where individual wells are proposed for each lot, test wells shall be installed and tested on at least twenty percent (20%) of the proposed lots. The purpose of these wells is to provide evidence that the hydrogeologic system is capable of furnishing and sustaining the potable water needs of the proposed development.

5. Test wells may be used as designated lot wells if they meet all requirements of Appendix 5-B of 10 NYCRR Part 5 (Standards for Water Wells).

6. For wells that will be used for public water systems, all test wells shall also be located, constructed, and protected in accordance with Appendix 5-D of 10 NYCRR Part 5 (Special Requirements for Wells Serving Public Water Systems) as well as other applicable portions of Subpart 5-1 of 10 NYCRR.

7. Where individual wells are proposed for each lot, test well locations should provide a representative geographic distribution across the proposed subdivision.

8. Where individual wells are proposed for each lot, test well sites shall include wells in each bedrock and/or unconsolidated geologic unit in which wells are proposed.

9. Where individual wells are proposed for each lot, test wells shall be situated in each topographic setting that wells are proposed on the subdivision (i.e. high areas, low areas, sloping areas, etc.).

10. Where individual wells are proposed for each lot, an adequate number of test wells should be installed on adjacent lots in the proposed subdivision in order to evaluate potential adverse impacts to adjacent wells.

11. If there are existing, off-site wells within 1,500 feet of the subdivision, test well(s) should be located in order to evaluate the potential for adverse impacts to these existing wells.

12. If any portion of the subdivision is located within 100 feet of a surface water body or wetland, and individual wells are proposed for each lot, at least one well should be located between 25 and 100 feet of such surface waters in order to determine potential adverse impacts and groundwater quality issues.

13. A well log must be submitted to the Town for each well drilled, along with a copy of the New York State Department of Environmental Conservation Well Completion Report.

14. Where individual wells are proposed for each lot, physical or chemical alteration of geologic materials or structures (e.g., hydraulic fracturing, use of explosives, or addition of chemicals) to increase yield of test wells will not be permitted prior to the pumping test.

B. Formation Sampling

1. During all drilling, representative samples shall be collected for each unconsolidated and consolidated geologic formation encountered. The applicant shall retain these samples and provide them to the Town if requested.

2. A well driller certified in accordance with NYS Environmental Conservation Law (ECL) 15-1525 or a professional geologist shall complete and submit to the Town a well log for each test well constructed for the investigation. The log shall describe materials encountered during drilling (unconsolidated and consolidated materials), and indicate the depth below ground surface of each material change. The log should be indicated on the New York State Department of Environmental Conservation Well Completion Report.

C. Pumping Tests

1. The applicant must submit a plan to the Town of Austerlitz Planning Board showing the wells that are to be pump tested, along with water level monitoring locations, surface water bodies and wetlands, possible pumping rates, discharge locations, schedules, and laboratory water quality testing details. The Town of Austerlitz may approve, approve with conditions, reject, or request more information within 45 days of receipt of such a testing plan.

2. No pumping should be conducted at or near the test well site for at least 24 hours

prior to the test.

3. A pumping rate shall be used that reasonably stresses the aquifer but does not result in excessive drawdown in the well. The minimum acceptable pumping rate for the test shall be two (2) gallons per minute. However, a water well that yields a pumping rate of at least 5 gallons per minute is usually necessary to safely meet peak and daily needs of most residences.

4. A test pump capable of providing a minimum of 2 to 5 gallons per minute at the required head must be used to perform the test. Any pump failure must have no significant effect on the data or a similar termination and restart is necessary.

5. The pumping rate shall be measured using a flow meter installed in the discharge line along with a control valve. The flow meter shall be calibrated at the beginning of the pumping period (all calibration measurements shall be recorded). The discharge flow rate shall be monitored and recorded at least once every 15 minutes during the first hour of the test and every 60 minutes thereafter.

   For relatively low flow rates, (< 5 gallons per minute), the flow rate may be obtained by determining the time required to fill a container of known volume (e.g., a 5-gallon bucket). The number of seconds/minutes to fill the container and the exact time of day shall be recorded.

6. The pumping test should include a minimum four-hour period of stabilized drawdown while pumping occurs at a constant flow rate. During the period of stabilized drawdown the stabilized water level shall not fluctuate more than plus or minus 0.5 foot (i.e., within a vertical tolerance of one foot) for each 100 feet of water in the well (i.e., initial water level to bottom of well) over the duration of constant flow rate of pumping. During the duration of constant flow rate pumping, the pumping rate shall not vary by more than 10 percent.

7. Water level measurements must be made to the nearest 0.01 foot. Preferred measurement methods include electronic sensors and pressure transducers.

8. Water level measurements in the pumping well and in at least two (2) of the closest available test wells are required immediately before the start of the test and during the pumping test at the following intervals:

Time After Pumping Started	**Time Intervals**
0 to 15 minutes	5 minutes
15 to 120 minutes	15 minutes
120 to 360 minutes	30 minutes

Note that <u>all</u> wells within a minimum distance of 500 feet of the pumping well shall be monitored, including any off-site wells (if practicable).

9. The water height of any bodies of water within 500 feet of the pumping well shall be monitored prior to the test, hourly during the pumping test, and at the end of the recovery period (see item 11).

10. Water discharged from the pumping well must be discharged a sufficient distance from the pumping well and other measured wells to avoid possible impacts from re-circulating the water. The water should be discharged to a drainage ditch or swale that will direct the water away from the well(s) if possible. If necessary, a temporary water storage tank can be used.

11. Upon completion of the pumping portion of the test, water level measurements should be recorded at the pumped well until the water level recovers back to at least 90 percent of the initial water level or for a period of 24 hours, whichever occurs first. If the water level does not recover to 90 percent of the initial water level after 24 hours, the tested flow rate may not be sustainable for an extended period of time.

12. A check valve must be installed at the base of the pump column pipe in the pumping well to eliminate backflow of water into the well during the recovery period.

13. For public water systems, all test wells shall be tested in accordance with Appendix 5-D of 10 NYCRR Part 5 (Special Requirements for Wells Serving Public Water Systems) as well other applicable portions of Subpart 5-1 of 10 NYCRR. In addition for community water systems, pump tests will follow NYSDEC Appendix 10, TOGS 3.2.1 (Recommended Pump Test Procedures for Water Supply Applications).

D. Laboratory Testing for Water Quality.

1. Water quality samples should be collected at the conclusion of the pumping test.

2. Water quality samples should be analyzed for the following: coliform bacteria, lead, nitrate, nitrite, iron, manganese, sodium, chloride, pH, hardness, sulfate, alkalinity and turbidity.

3. Additional tests for petroleum products or solvents may be necessary if the pumping well is located in the vicinity of a spill, petroleum storage facility, or other similar land use.

4. Tests for hazardous substance list metals, PCBs, and pesticides may be necessary if the pumping well is located adjacent to a landfill, junkyard, etc.

5. Analyses for specific chemicals may be necessary if the pumping well is located near an industry that stores and/or uses particular chemicals.

6. For public water systems, all test wells shall be tested for water quality in accordance with Subpart 5-1 of 10 NYCRR including Appendix 5-D of 10 NYCRR Part 5.

Section 4.2 Water Supply Testing For Other Developments with Groundwater Withdrawals and/or On-Site Sewage Disposal Flows ≥ 1,000 GPD

A. Geology

1. During all drilling, representative samples shall be collected for each unconsolidated and consolidated geologic formation encountered. The applicant shall retain these samples and provide them to the Town if requested.

2. A well driller certified in accordance with NYS Environmental Conservation Law (ECL) 15-1525 or a certified/professional geologist shall complete a well log for each test well constructed for the investigation. The log shall describe materials encountered during drilling (including unconsolidated materials), and indicate the depth below ground surface of each material change. The log should be indicated on the New York State Department of Environmental Conservation Well Completion Report.

B. Wells

1. The applicant must submit a plan to the Town of Austerlitz Planning Board showing the locations and construction details of proposed test wells. The Town of Austerlitz may approve, approve with conditions, reject, or request more information within 45 days of receipt of such a well plan.

2. Well construction and testing shall be performed by a certified water well contractor (NYS Environmental Conservation Law 15-1525) in accordance with Appendix 5-B of 10 NYCRR Part 5 (Standards for Water Wells).

3. For water wells that will serve a public water system, the location, protection, construction, yield, etc. of such wells shall be in accordance with Appendices 5-D and other applicable portions of Subpart 5-1 of NYCRR Title 10.

4. A well log must be submitted to the Town for each well drilled, along with a copy of the New York State Department of Environmental Conservation Well Completion Report.

C. Pumping Tests

1. The applicant must submit a plan to the Town of Austerlitz Planning Board showing the wells that are to be pump tested, along with water level monitoring locations, surface water bodies and wetlands, possible pumping rates, discharge locations, schedules, and laboratory water quality testing details. The Town of

Austerlitz may approve, approve with conditions, reject, or request more information within 45 days of receipt of such a testing plan.

2. A pumping test shall be performed on each well that is to be utilized by the proposed development in order to determine that the water supply adequately meet the needs of the applicant without adversely affecting others who may rely on the same aquifer.

3. For public water systems, all pumping tests shall be conducted in accordance with Appendix 5-D of 10 NYCRR Part 5 (Special Requirements for Wells Serving Public Water Systems) as well other applicable portions of Subpart 5-1 of 10 NYCRR. In addition for community water systems, pump tests will follow NYSDEC Appendix 10, TOGS 3.2.1 (Recommended Pump Test Procedures for Water Supply Applications).

3. Pumping tests should be conducted during a period of time of average or below average seasonal stream flow conditions (typically not during the months of March, April, and May).

4. No pumping should be conducted at or near the test well site for at least 24 hours prior to the test.

5. Pumping tests should be done when nearby wells normally in operation are running. Pumping of such other wells in the test area should be monitored.

6. A test pump capable of providing the design flow rate at the required head must be used to perform the test. Any pump failure must have no significant effect on the data or a similar termination and restart is necessary.

7. The pumping rate shall be measured using a flow meter or circular orifice weir installed in the discharge line along with a control valve. The flow meter or weir shall be calibrated at the beginning of the pumping period (all calibration measurements shall be recorded). The discharge flow rate shall be monitored and recorded manually at least once ever 15 minutes during the first hour of the test and every 1 to 4 hours thereafter.

   For relatively low flow rates, (< 5 gallons per minute), the flow rate may be obtained by determining the time required to fill a container of known volume (e.g., a 5-gallon bucket). The number of seconds/minutes to fill the container and the exact time of day shall be recorded.

8. The pumping test(s) shall be conducted at a pumping rate at least equal to the design pumping rate. If multiple wells are to be pumped simultaneously to achieve the necessary yield, the test should incorporate such a pumping plan.

9. Water discharged from the pumping well must be discharged a sufficient distance from the pumping well and other measured wells (minimum 200 feet) to avoid

possible impacts from re-circulating the water. The water should be discharged to a drainage ditch or swale that will direct the water away from the well(s) if possible.

10. Water from the pumping well cannot be discharged into any water body or wetland if such discharge results in turbidity or erosion leading to turbidity or down stream flooding. If it is anticipated that discharged water will create flooding, erosion and/or turbidity, water must be directed to a holding area and released in a controlled manner to prevent such problems.

11. The selected pumping rate shall not vary by more than ten (10) percent during the test. Pumping rates should be frequently measured and recorded, following the schedule of the water level measurements (see below).

12. Pumping tests shall be conducted for a minimum of 72 hours at a constant pumping rate. A minimum of six hours of stabilized drawdown must be displayed at the end of the test. Stabilized drawdown is defined as a water level that has not fluctuated by more than plus or minus 0.5 foot for each 100 feet of water in the well. If stabilized drawdown is not achievable, the test period may be extended or semi-log extrapolation of drawdown versus time (or other similar methods) may be employed to demonstrate the ability of the aquifer to supply a pumping rate equal to the desired yield.

13. Water level measurements must be made to the nearest 0.01 foot. Preferred measurement methods include electronic sensors and pressure transducers.

14. Periodic water level measurements in the pumping well and in the observation wells are required immediately before the start of the test and during the pumping test at the following intervals:

Time After Pumping Started	**Time Intervals**
0 to 15 minutes	1 minute
15 to 50 minutes	5 minutes
50 to 100 minutes	10 minutes
100 to 500 minutes	30 minutes
500 to 1000 minutes	1 hour
1000 to 5000 minutes	4 hours

15. At least three (3) observation wells should be monitored on-site during the pumping test. Note that all site wells shall be monitored, as well as any off-site wells within 1,500 feet (if practicable). Observation wells should be located at varying distances from the pumping well in order to characterize the well’s zone of pumping influence. Observation wells should be large enough to allow

accurate and rapid measurement of the water levels. Observation wells should be screened in, or open to, the same formation as the pumping well.

16. The water height of any bodies of water within 1,500 feet of the pumping well shall be monitored before the pumping test, every four hours during the test, and at the end of the recovery period (see item 17).

17. Water level measurements should be collected during the recovery period for all wells using the same procedure and time pattern followed at the beginning of the pump test (see item 14). Measurements at the pumping well should continue for at least 24 hours or until the well recovers to 90 percent of the original water level.

18. A check valve must be installed at the base of the pump column pipe in the pumping well to eliminate backflow of water into the well during the recovery period.

19. Rainfall should be measured to the nearest 0.01 inch and recorded for one day preceding the pump test, during the test, and during the recovery period.

D. Laboratory Testing for Water Quality.

1. Water quality samples should be collected at the conclusion of the pumping test.

2. Water quality samples should be analyzed for the following: coliform bacteria, lead, nitrate, nitrite, iron, manganese, sodium, chloride, pH, hardness, sulfate, alkalinity and turbidity.

3. Additional tests for petroleum products or solvents may be necessary if the pumping well is located in the vicinity of a spill, petroleum storage facility, or other similar land use.

4. Tests for hazardous substance list metals, PCBs, and pesticides may be necessary if the pumping well is located adjacent to a landfill, junkyard, etc.

5. Analyses for specific chemicals may be necessary if the pumping well is located near an industry that stores and/or uses particular chemicals.

6. For public water systems, all test wells shall be tested for water quality in accordance with Subpart 5-1 of 10 NYCRR including Appendix 5-D of 10 NYCRR Part 5.

SECTION 5.0 REPORTING REQUIREMENTS

The detailed hydrogeologic report shall include, at a minimum, the items described below. Note that the all data shall be organized by either "type" (well completion reports, pumping test data and analyses, water quality reports, etc.) or by well, in tabbed appendices clearly marked showing the content of the tabbed section.

A. Description of the Proposed Development

The proposed development project must be summarized including information on property acreage; projected water demand; means of wastewater disposal; stormwater runoff control; parking areas and other impervious surfaces; fuel storage; and the number, size and distribution of proposed residential lots (if applicable).

B. Discussion of Site and Regional Hydrogeology

A written discussion of the site and regional hydrogeology shall be included. Items to be included in this discussion include:

1. Geologic setting;
2. Local drainage and watershed(s);
3. Lateral and vertical distribution of local unconsolidated and consolidated hydrogeologic units as well as their hydraulic properties;
4. Land surface elevation and relief;
5. Occurrence and flow characteristics of surface water and groundwater;
6. The relationship between local groundwater and surface water;
7. Well yield and depth data;
8. Local groundwater use and quality; and
9. Known or potential contamination sources.

Appropriately-scaled maps and cross-sections should be used to depict the hydrogeologic setting (see below).

C. Maps

A set of maps at appropriate scales covering the proposed development should be enclosed. The maps shall contain all existing planimetric features, topography, all proposed roads, proposed lot lines, proposed lot sites, proposed house sites, proposed septic systems, surface water features, proposed and existing wells, bedrock outcrops, karst features, linear features, springs, hydrogeologic units, etc. In addition, map(s) of static groundwater elevations shall be illustrated, along with maps showing drawdown contours and pumping groundwater elevations.

D. Cross-Sections

The report shall contain one or more cross-sections, at true horizontal scale and vertical scale (exaggerated as appropriate). The location of each cross-section shall be shown on the plan view map(s) and the cross-section shall contain the following information:

1. Geologic data including bedrock contacts and structural features if present.
2. Well site locations showing well casings, total depths, and specific capacities.
3. Elevations of ground surface, bedrock depths, and static water surfaces.
4. Final water level in each pumped well and observation well(s) at the end of the pumping tests with the corresponding pumping rate of the well.

E. Well Completion Reports

For each well drilled for the investigation, a New York State Department of Environmental Conservation Well Completion Report will be completed and enclosed. This will include a log of materials encountered that is completed by a certified well driller or a licensed/certified professional geologist. Well construction details will also be noted on each Well Completion Report, including the well number, date of construction, well location coordinates (lat/long, UTM, or State Plane), land surface elevation, total depth, well casing depth, grout depth, bentonite seal thickness, top and bottom of well screen, height of casing above land surface, static water level and date, etc.

F. Well Construction Summary

For all wells constructed for the investigation, a summary table will be provided that includes, at a minimum, the well number, completion date, land surface elevation, well diameter, total well depth, well casing depth, screened interval (if applicable), depth to bedrock, static water level (all on the same date), well yield, and aquifer.

G. Well Testing Summary

In a separate table(s), well testing results shall be summarized, including at a minimum: the well number (and pumping well number if different); date tested; duration of pumping; pumping rate; pre-pumping (static) water level; maximum observed water level drawdown; distance to pumped well; percent of available drawdown used (assume maximum available drawdown is 40 feet above well bottom or use more stringent criteria if appropriate); specific capacity; transmissivity; storativity (if available); and time to achieve 90 percent recovery (or the percent recovery after 24 hours) in the pumped well. Note that the analytical method used to calculate the aquifer transmissivity and storativity should be noted. All pumping test data will be included in the appendices.

H. Groundwater Quality

For all wells tested for the investigation, provide a table summarizing the groundwater quality and include the maximum contaminant levels (MCLs) for each tested parameter. Copies of the laboratory reports shall be included in the appendices.

I. Water Balance

The report shall contain groundwater mass balance and recharge estimates for the area. Applicable calculations and references shall be included as well as assumptions and limitations of the methods used. The report shall include a discussion of the following information, including appropriate supporting calculations and diagrams, which shall include, at a minimum:

1. Identification of the source or sources of recharge, using recharge from rainfall for normal conditions and for drought conditions (assume 60% of average annual precipitation), and the average outflow from the development area.

2. Comparison of calculated recharge to projected withdrawals associated with the development.

J. Potential Impacts to Water Quality

The report shall contain an analysis of potential impacts to groundwater and/or surface water quality that may result from the development. For example, this could include a discussion of impacts from fuel storage, stormwater runoff, nitrate loading associated with septic system effluent, etc.

Calculations should be developed and discussed in the report to estimate the overall loading of inorganic nitrogen to groundwater from the development's subsurface wastewater disposal systems (if applicable). In general, the nitrate entering the groundwater can be computed for a given area by dividing the annual nitrate load from the area by the annual amount of groundwater recharge (see above). Both normal and drought conditions should be assumed. In order to prevent cumulative degradation of groundwater quality in the region, the resultant projected nitrate level in groundwater at the project boundary should not exceed ½ of the MCL (5 mg/L).

K. Potential Impacts of Pumping

The report will present an analysis of the magnitude and extent of water level drawdown that will result from groundwater withdrawals at the project as well as an evaluation of potential impacts of drawdown on groundwater and surface waters within a minimum of 1,500 feet from the development boundary. This analysis will be developed using standard methods and will include an analysis of potential conditions during normal and drought periods. The possibility of other adverse affects of pumping such as altering the flow direction of groundwater from potential pollution sources, introducing zones of poor water quality, etc. must be discussed as well. For community water system wells, the zone contributing groundwater (zone of contribution) for such wells must be delineated.

L. Suitability of Groundwater Resources

The consultant must prepare a preliminary written conclusion regarding the suitability of groundwater resources to support the proposed development. A comparison of projected water demands to available source capacity should be included. If applicable, mean and median yields of lot wells must be presented and compared to the 5 gallons per minute usually necessary to safely meet peak and daily needs of a typical residence. In addition, the possibility of wells on the remaining (non-tested) individual lots having inadequate yield must be discussed. Plans on how to overcome potential inadequacies must be addressed.

The adequacy of the development's drinking water quality should be evaluated. The possibility of contamination from on-site and off-site sources must be assessed. Any necessary treatment options should be identified.

M. Investigation and Mitigation Plan

The report must include a plan for investigating and mitigating existing water supply wells or surface waters in the event that either experience reductions in water level or water quality during and/or after construction of the development.