Section 4

Environmental Inventory and Analysis

4A. Geology, soils, and topography

The topography in Stow varies from the low elevations along the Assabet River (180 feet above Mean Sea Level) to the high elevation of 457 feet on Marble Hill. The Assabet River is the main drainage area for most of Stow. The areas of highest elevations in Stow are the bedrock and glacial till areas in the northwest quarter of the Town. Other major topographic highs include drumlins such as Spindle Hill, Birch Hill, Pilot Grove Hill, Spring Hill and Orchard Hill.

Stow's geology was studied extensively in 1977 by IEP, an environmental consulting firm. Relevant highlights from this report are contained in the sidebar, and the report and accompanying maps are available in the office of the Stow Conservation Commission.

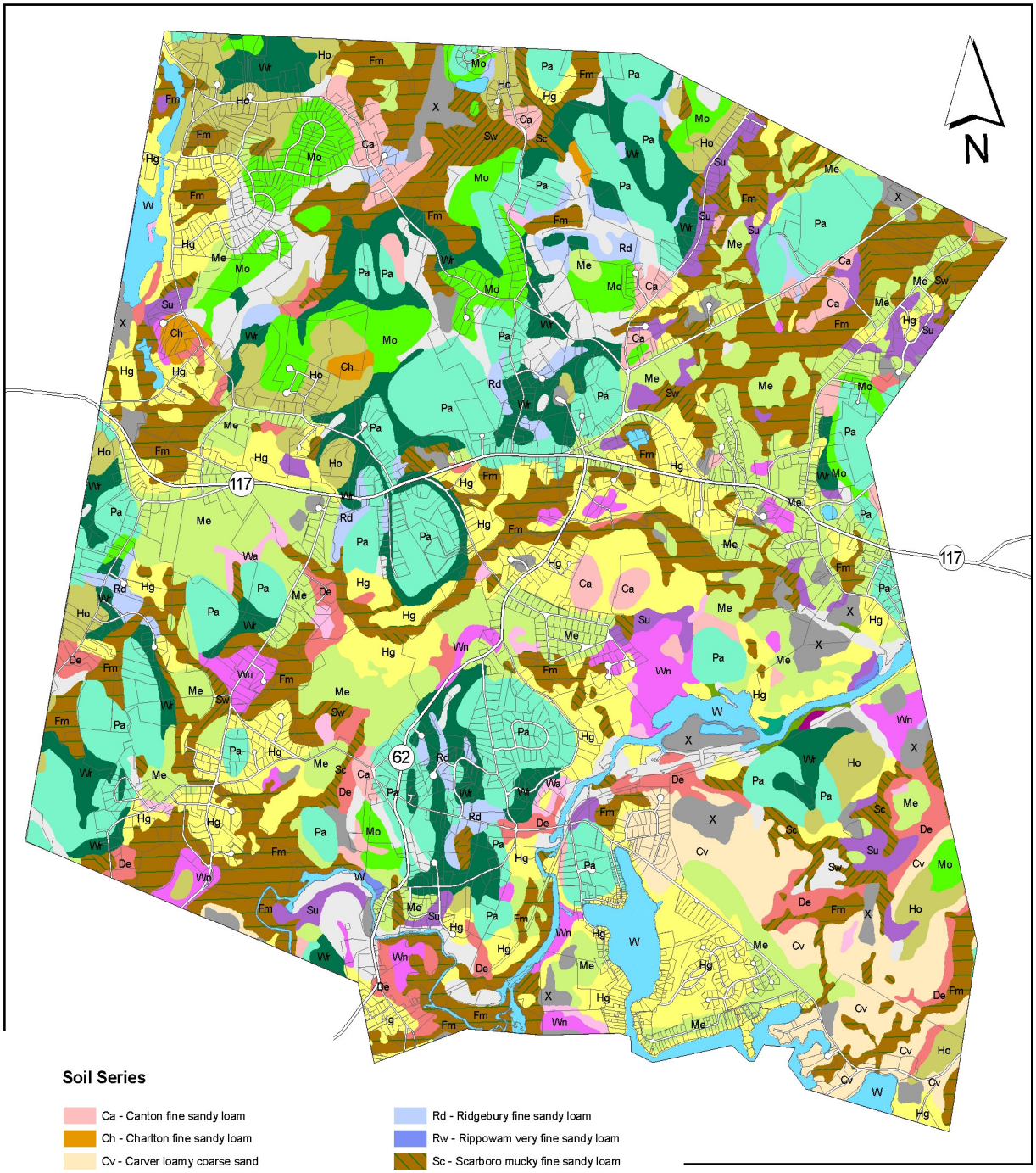
Soils and topography place constraints on development in Stow and affect land use patterns. In steep areas, access often requires significant cuts or fills, creating drainage problems, and erosion and sedimentation. An example of this can be seen in the lots that have been developed along the southwest side of Wheeler Road on the side of Spindle Hill or the access road to Pilot Grove Apartments on Pilot Grove Hill. The Town has not adopted a steep slopes bylaw to address these issues but has recently adopted a common driveway bylaw which may serve to reduce the problem of multiple driveways serving individual single family houses. Similar changes could be made in the subdivision rules and regulations to require that additional scrutiny be given to lots with severe topographic constraints. For example, some towns limit the amount of cut and fill or clearing that is permissible in these situations.

Stow's Geology

The present topography in Stow is a product of previous glacial activity. During the past glaciations, bedrock areas in Stow were cleared of loose rock and smoothed over. In some cases small bedrock knobs were plastered with unconsolidated material thereby increasing the height of these features (drumlins). Channels which existed in the bedrock were widened and deepened through glacial scouring action. And finally, as the glaciers were retreating, meltwater streams flowing out from under the glaciers dropped sands, gravels and silts either in large glacial lakes or along those drainage areas that existed in Stow. These meltwater deposits created the flat plains and irregularly shaped hills and ridges found throughout the Town.

*The bedrock units in Stow include a wide variety of rock types that are classified as **igneous** and **metamorphic**. These types of rocks were altered from their original form through tremendous heat and pressure that was generated during the process of Appalachian mountain building. Igneous rocks are rocks that have been completely re-melted and have lost all original appearances. These rocks are composed of minerals (such as quartz, feldspar, mica, and amphibole) that are usually large enough to be seen by the naked eye. Metamorphic rocks are rocks that have been modified in composition or appearance by mountain building forces. They contain the same types of minerals common in igneous rocks and which are usually visible to the naked eye. The common igneous rock type in the Stow area is **granite** (a coarse grained rock dominated by light-colored minerals). The common metamorphic rock types are **gneiss** (a coarse grained rock with alternating bands of dark and light colored minerals), **schist** (a rock with fine grained, flat minerals arranged in sheets or laminae), and **amphibolite** (a schist which is dominated by the minerals amphibole and plagioclase). Also found are **marble** (a light colored, crystalline rock, the metamorphic equivalent of limestone) and **quartzite** (a fine to medium grained rock, the metamorphic equivalent of sandstone.)*

Stow - Soils



Soil Series

- Ca - Canton fine sandy loam
- Ch - Charlton fine sandy loam
- Cv - Carver loamy coarse sand
- De - Deerfield loamy sand
- Fm - Freetown muck
- Hg - Hinkley loamy sand
- Ho - Hollis-Charlton or Charlton-Hollis Rock Outcrop
- Lm - Limerick silt loam
- Me - Merrimac fine sandy loam
- Mo - Montauk fine sandy loam
- Pa - Paxton fine sandy loam
- Po - Pootatuck fine sandy loam
- Rd - Ridgebury fine sandy loam
- Rw - Rippowam very fine sandy loam
- Sc - Scarboro mucky fine sandy loam
- Su - Sudbury fine sandy loam
- Sw - Swansea muck
- Wa - Wareham loamy sand
- Wn - Windsor loamy fine sand
- Wo - Winooski very fine sandy loam
- Wr - Woodbridge fine sandy loam
- X - gravel pits, urban, disturbed (Udorthents)
- Not classified
- Water bodies

0 1 Mile

Soils data from NRCS 2006.
Provided by MassGIS.

Map produced June 2006.

The rock types described above can be divided into four units. This division is based upon similarities in mineralogy and age of the bedrock. The units are (from youngest to oldest): the Andover Granite, Nashoba Formation, Shawsheen Gneiss, and Marlboro Formation. Each of these units consists primarily of gneiss, schist, and granite. These units are quite similar in composition and physical properties. The subdivision of the Nashoba Formation into "member" units is largely based upon the differences in the location, distribution, and quantity of magnetic minerals found in the various units. Faults and contacts between major units have also been inferred largely based upon differences in magnetic properties. This type of division is the result of recent advances by the U. S. Geological Survey which permitted bedrock geologic interpretations to be made in areas where the bedrock was hidden under thick surficial deposits.

From a land use perspective, the bedrock in Stow has not been a major impediment to human uses of land. In most of Stow, bedrock is found only at considerable depths. Where bedrock occurs at the surface, the exposures are small and rather scattered. Most of the exposures are limited to either the northwest quarter of Stow or the southeast corner within the Assabet Refuge. In most places where bedrock is exposed, there are other constraints on land use such as high slope and/or perched water tables.

The bedrock elevations determine the subsurface drainage pattern for groundwater flow. Although subsequent erosion and deposition has significantly reduced the relief and filled in the valleys, subsurface water in Stow is directed essentially toward two southward flowing aquifers which connect with a larger aquifer which flows east-southeastward along the Hudson-Stow town boundary.

Glacial processes occurring in Stow have had two major effects: (1) pre-existing bedrock topography was scoured and eroded and (2) most areas of Stow were covered with a veneer of unconsolidated deposits of varying thickness. The material eroded from the land surface by glacial erosion became incorporated into the ice and was transported southward. Although recent glacial erosion slightly modified the bedrock topography, it does not appear to have had any major effect on the overall pre-glacial bedrock topography. Deposition of material from the ice did create many new land forms which have caused major modifications of the pre-glacial drainage patterns. Glacial deposition consists of two types: deposition of material directly by the ice, and deposition of material melted from the ice and then transported and deposited by melt-water streams.

Stow has many low-lying wet areas that place constraints on the development on septic systems. A good example is the 124- acre Kane property on Rt. 117, which was examined by the School Building Committee in 2005 as a potential site for a new school. Despite its large size and access to Rt. 117, large areas of wetlands and streams, combined with steep slopes on a portion of the property, will make any development on this parcel challenging.

As the town approaches buildout the remaining parcels will be more and more constrained by wetlands and steep slopes. This will necessitate increased scrutiny of proposed projects, including professional review of applications, particularly roadway designs and stormwater management plans.

4B. Landscape Character

Stow is frequently considered a rural community by its residents. This impression is reinforced by the areas of open space and scenic vistas visible along the Town's roadways. In particular, the many active orchards and farms lend a distinctively rural element to the Town of Stow that is not found in many nearby communities. In addition to the agricultural and conservation aspect of the community, Stow has five active golf courses – Stow Acres North and South, Butternut, Wedgewood, and Stowaway. These open spaces contribute to the rural visual impression and sense of "elbow room" in Stow.

In addition, to the visible farms and golf courses, there is a large amount of undeveloped land that is "hidden" behind the many lots which front along public ways. One has only to look at the assessors' maps to discern the large parcels behind these lots; areas left in their natural state because of difficult access, wetlands, rocky soils, or poor drainage.

Where the forested hills rise behind these homes, or one is able to see between the buildings, then one is able to sense the extensive undeveloped landscape of Stow.

Also contributing to the town's open character are "odd" lots, which occur at forks in the road, or on the outside of curves, or at wetland crossings, and bring a welcome relief to the developed roadside landscape, contributing a positive landscape attribution far beyond their size. Some of these lots have been identified in this plan, however, there has been no comprehensive inventory of Stow's scenic assets. The "Scenic Resources" map accompanying this Plan identifies important unprotected scenic parcels in Stow.

One of Stow's more noticeable landscape aspects is the health of the roadside trees. These trees are endangered by road salt, by extensive cut-backs for telephone, TV cable and electric wires, and by disease - Dutch Elm has killed most of the majestic Elm trees, and Ash Decline is quickly eliminating the White Ash, which is currently the predominant roadside tree. About 10 years ago, Stow purchased 100 of the newly developed Elms which are resistant to the Dutch Elm disease. These trees are being grown on Town conservation land and when they reach a reasonable size they will be placed throughout the Town to enhance the scenic roadways. A similar effort is underway using the newly developed resistant variety of the American Chestnut.

In an attempt to preserve the existing character of Stow, the Town has adopted a zoning bylaw that provides for "planned cluster development" of larger parcels. This bylaw encourages a developer to build houses on reduced size lots, leaving large areas open for recreation and conservation purposes instead of using the traditional "cookie cutter" approach to subdivision. The landowner can realize the value of the property and the Town gains by retaining some of the open space. Several developments are now underway or planned that make use of this bylaw.

In addition, the town has a Lower Village Committee that is working to improve the visual character of the streetscape in Stow's commercial center by promoting design standards that will achieve a consistent "look and feel" to this area.

A final element of landscape character is the town's "dark skies." Stow has an active Lighting Subcommittee that is working with local businesses and others to reduce light pollution in the night sky.

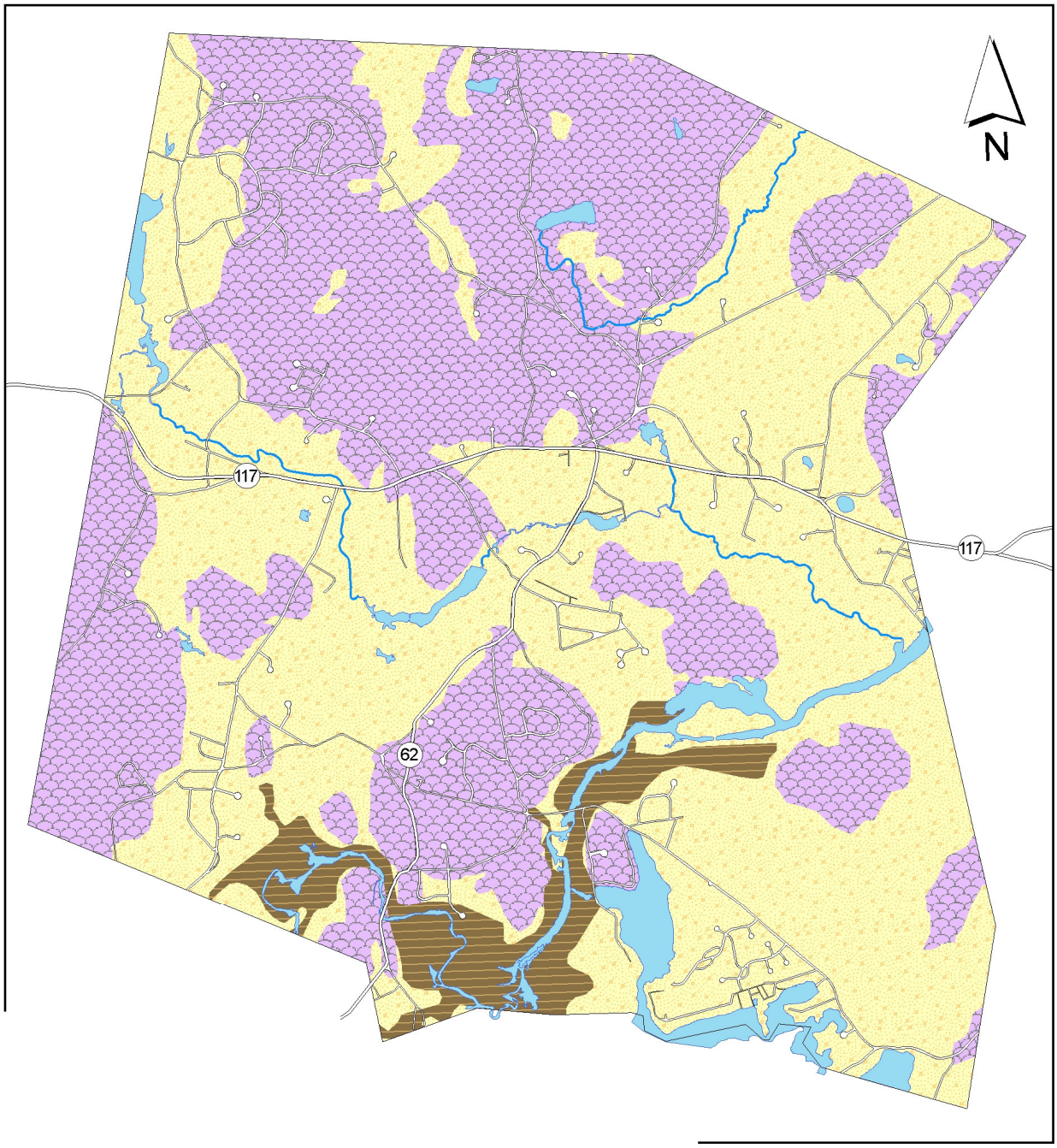
4C. Water Resources

Watersheds and Surface Waters

Stow is located within the Concord River basin and the Assabet River sub-basin of the SuAsCo river basin (Sudbury, Assabet, Concord rivers). Nearly all the surface runoff in Stow enters one of three drainage areas: Heath Hen Meadow Brook which flows northward into Acton and joins Fort Pond Brook; Elizabeth Brook which drains the middle of Stow and empties into the Assabet River near the Maynard town line; and Assabet River, which with its smaller tributaries directly drains the lower third of Stow as it continues eastward to meet the Sudbury River and form the Concord River. The Elizabeth Brook is the largest tributary of the Assabet River.

The Delaney Flood Control Project in the northwest corner of Stow also uses land in Bolton and Harvard; it is essentially the headwaters of Elizabeth Brook. Although the Delaney Control Project was constructed for flood control, upland development in Stow, Harvard and Bolton has increased the peak and volume of flow entering this flood storage area, decreasing its effectiveness.

Stow - Surficial Geology



Surficial Geology

- Sand and Gravel
- Till or Bedrock
- Floodplain Alluvium
- Water Bodies

0 1 Mile

Surficial Geology data provided by MassGIS.
Based on 1:125,000 scale USGS dataset.

Map produced June 2006.

Lake Boon is another major surface water body in Stow (and Hudson); the pond itself is made up of three major basins, which were formed by the construction of a dam in order to provide water storage to drive the Assabet Mills in Maynard. The Town of Stow purchased the water rights and subsurface land area of Boon pond (in Stow) from the heirs of Assabet Mills.

As Stow has grown and developed, the summer cottages which ring the basins of Lake Boon have been converted to year-round homes; many of the sewage disposal systems for these residences do not meet the Board of Health's Regulations, and failures have to be treated as emergencies, resulting in limited upgrading to the extent practical, given the small lots, short distance to the water body, and proximity of adjacent lots' wells and sewage disposal systems. The recent changes to Title 5 are resulting in improvement to many of these systems, which is likely to improve water quality.

A recognized problem associated with Lake Boon is the eutrophication that is occurring due to increased growth of aquatic weeds (notably Milfoil and Fanwort) caused by runoff from lawn fertilizers and septic leachates from the densely developed shores. Despite regular pump outs and improvements to septic systems, installation of 25 leaching catch basins within the watershed, and broad community education on practices to minimal runoff,excessive growth of several species of invasive aquatic weeds are still adversely affecting recreational use of Lake Boon. The Lake was treated for weeds in the summer of 2007 as part of three-year Community Preservation project to restore the lake for swimming and boating. The Town of Hudson also contributed funds to this effort.

The Assabet River is a major regional surface water feature that flows from the southwestern part of Stow to the east-central part of Stow. Nearly all surface drainage in Stow flows either directly to the Assabet or to tributaries of the Assabet - Heath Hen Meadow Brook in northern Stow and Elizabeth Brook in central Stow. A small area in the southeastern corner of Stow drains into the Sudbury River.

Assabet River from Boon Road

Stream discharge normally varies in an annual cycle, declining from peak flows in the early spring, reaching minimums in the later summer and early fall, and then rising and remaining at moderate heights during the winter. The US Geological Survey has maintained measuring stations on the Assabet River (150 feet upstream from the bridge on Route 27 in Maynard) and on Heath Hen Meadow Brook.

The Assabet River has serious water quality problems that are related to both water quality (excessive nutrients) and water quantity. A local nonprofit watershed association, Organization for the Assabet River, is regularly monitoring both issues at various monitoring stations and is working with EPA and DEP to address discharges from sewage treatments plants upstream of Stow in Hudson, Marlborough, Northboro and Westboro that are affecting the river. While these are significant sources of nutrient flow, “background” impacts from septic systems, surface runoff, and water supply wells from development within the watershed are also contributing to the river’s poor water quality.

Aquifer Recharge Areas

Abundant and clean ground water supply is one of Stow's most valuable resources. The subsurface hydrology of Stow is directly related to its subsurface geology, the ability of the rainfall to infiltrate into the ground, thereby becoming groundwater. Once there, it is constantly moving from areas of higher

elevation to areas of lower elevation. Therefore, it has to be constantly replenished; removal occurs as withdrawal for use, or through seasonal discharge into streams, ponds, and wetlands.

There are four general hydrogeologic requirements that must be met for an area to be a high yield aquifer:

1) surficial geologic deposits of proper size and sorting to produce high rates of water movement

2) sufficient saturated thickness of surficial deposits

3) sufficient area-wide recharge, and

4) acceptable water quality.

The 1977 IEP study mapped aquifer areas in the town of Stow that are likely to meet these requirements. Prudent protection of these aquifers and their recharge areas is vital to not only Stow but to other communities as well.

The quality of groundwater in the aquifers will depend to a large extent on the quality of water which recharges the aquifer – which is affected by the land uses at the surface. Land uses which discharge polluted or toxic wastes, or result in pollutants leaching into the ground water, must be carefully regulated if Stow is to preserve and protect its groundwater supply. In general, the quality of water from the surficial aquifer is naturally of high quality. However, high concentrations of iron and manganese have been widely reported in Stow, especially where wells have been located near wetlands. The high iron and manganese levels are highly variable in terms of site locality. Thus, in the event that testing of a well is occurring it is necessary to analyze well samples at different depths and within short distances in order to determine where groundwater quality is best. Alternatively, filtration methods or other technological means can be used to treat the water.

Water Resources Protection District

The surface hydrology or flow of surface waters is directly related to the groundwater systems in Stow and must be thought of as one complex hydrologic system. The streams, ponds and wetlands of Stow reflect the location of the water table that continues below the ground surface. Fluctuations in the surface water levels coincide directly with fluctuations in the water table and vice versa. During most of the year surface waters are fed and maintained predominantly by groundwater flow.

To aid in the protection of its water resources, Stow has established a zoning overlay district, the Water Resource Protection District, and the town has adopted protections within the Stow Zoning Bylaw that regulate the types and intensity of land uses within the overlay district. The Map on the next page shows the location of the Water Resource Protection District.

Flood hazard areas

Flooding may be defined as the occurrence of flow in a stream or river that exceeds the capacity of the banks formed by normal flows. All waterways have floodplains, those areas that flood during significant storms. An increasingly important factor related to flooding in Stow is the creation of impervious surfaces that limit infiltration and increase surface flow. Flood hazard areas in Stow are shown on the "Floodway - Flood Boundary and Floodway Map", done for the Town of Stow by the Federal Emergency Management Agency, Community-Panel Number 250216-0005 B, Effective Date: August 1, 1979, as modified November 1989. Stow has, through its Zoning Bylaw