ENVIRONMENTAL REVIEW TEAM REPORT

SHARON WATER SUPPLY WATERSHEDS
SHARON, CONNECTICUT

KING'S MARK
RESOURCE CONSERVATION AND DEVELOPMENT AREA

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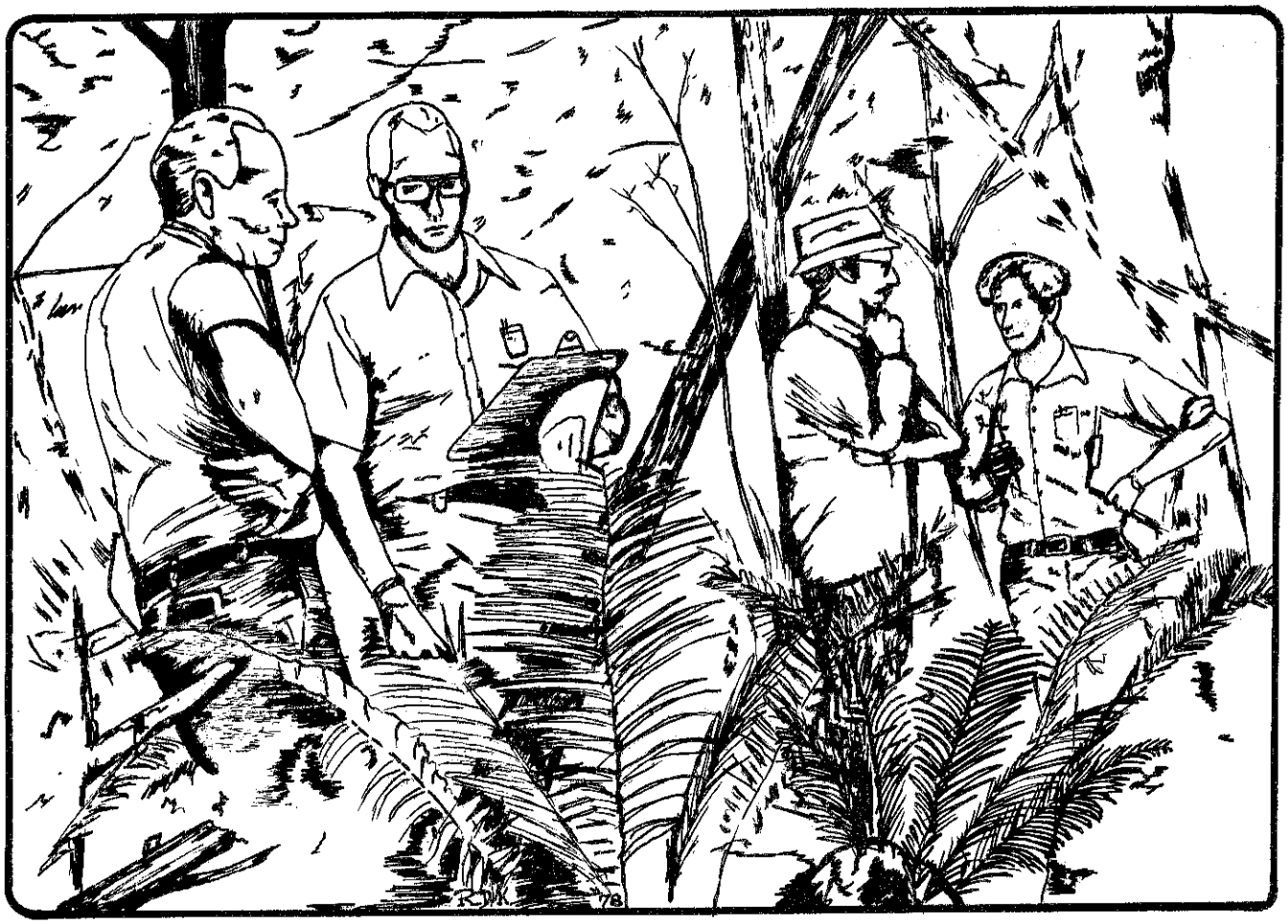
ENVIRONMENTAL REVIEW TEAM REPORT

On

SHARON WATER SUPPLY WATERSHEDS

SHARON, CONNECTICUT

JULY, 1978



King's Mark Resource Conservation & Development Area

Environmental Review Team

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The King's Mark Environmental Review Team operates through the cooperative effort of a number of agencies and organizations including:

Federal Agencies

U.S.D.A. SOIL CONSERVATION SERVICE

State Agencies

DEPARTMENT OF ENVIRONMENTAL PROTECTION
DEPARTMENT OF HEALTH
DEPARTMENT OF TRANSPORTATION
UNIVERSITY OF CONNECTICUT COOPERATIVE EXTENSION SERVICE

Local Groups and Agencies

LITCHFIELD COUNTY SOIL AND WATER CONSERVATION DISTRICT
NEW HAVEN COUNTY SOIL AND WATER CONSERVATION DISTRICT
HARTFORD COUNTY SOIL AND WATER CONSERVATION DISTRICT
FAIRFIELD COUNTY SOIL AND WATER CONSERVATION DISTRICT
NORTHWESTERN CONNECTICUT REGIONAL PLANNING AGENCY
VALLEY REGIONAL PLANNING AGENCY
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CENTRAL NAUGATUCK VALLEY REGIONAL PLANNING AGENCY
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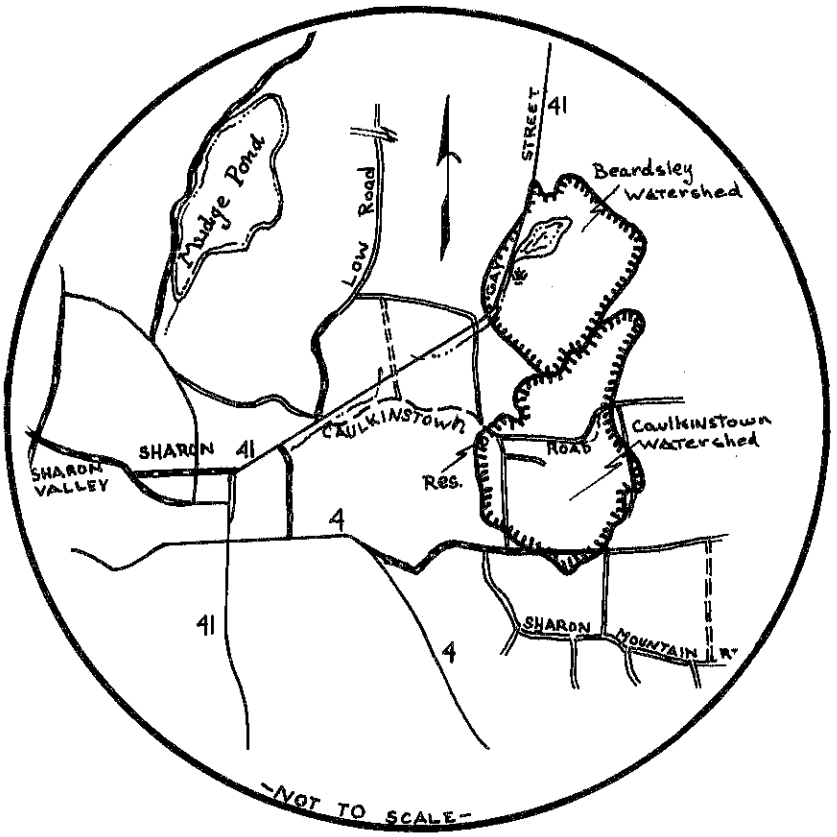
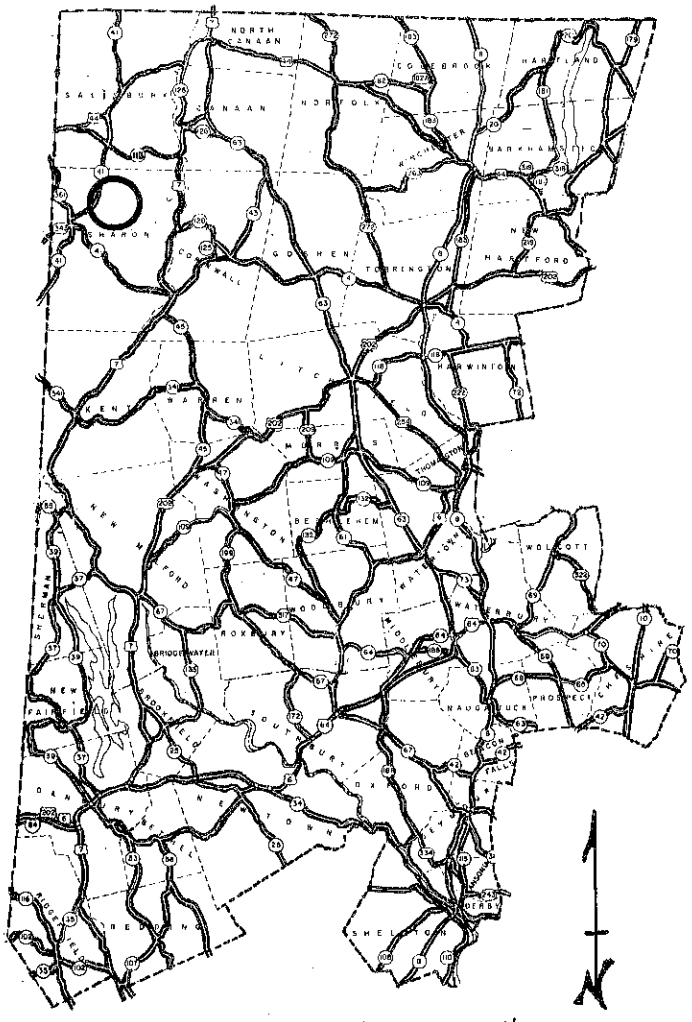




ENVIRONMENTAL REVIEW TEAM REPORT
ON
SHARON WATER SUPPLY WATERSHEDS
SHARON, CONNECTICUT

I. INTRODUCTION

The Town of Sharon is interested in protecting the water quality of the Town's two public water supply watersheds. These two watersheds include the Beardsley Pond watershed (± 306 acres) and the Caulkinstown Reservoir watershed (± 547 acres). Beardsley Pond is the major public drinking water supply source for the Town with Caulkinstown Reservoir presently serving as a supplementary source. Water withdrawn from both Beardsley Pond and Caulkinstown reservoir is treated in a central facility and subsequently delivered to 315 buildings in the center of town including the Sharon Hospital.

The Town's major concern is meeting the water quality requirements mandated in the federal Safe Drinking Water Act. In recent years the Town has had problems in meeting established standards for turbidity and odor. Coupled with this is the threat of additional development within the watersheds which might further degrade water quality. Most of the land in both watersheds is privately owned and hence developable.

The Town asked the King's Mark Environmental Review Team (ERT) to study and analyze the Beardsley Pond and Caulkinstown Reservoir watersheds and to recommend techniques for protection and enhancement of water quality. The thesis is that the most effective means of ensuring high quality drinking water is through sound watershed management rather than expensive water purification processes.

The ERT's work program for this study consisted of the following:

1. Identification of the Natural Resource Base of the Project Site (soils, topography, geology, vegetation, hydrology, land use).

2. Discussion of the effects of alternative land uses on water quality within the watersheds and the need for land use control.

3. Development of implementable land use controls to protect and enhance water quality within the watersheds.

4. Discussion of the feasibility of augmenting the existing water supply system with groundwater.

The ERT met and field reviewed the site on Wednesday, April 12, 1978. Team members for this review consisted of the following:

Art Cross	District Conservationist. . .	U.S.D.A. Soil Conservation Service
Mike Zizka . . .	Geohydrologist	Connecticut Department of Environmental Protection
Don Smith	Forester	Connecticut Department of Environmental Protection
Carol Youell. . .	Environmental Planner. . . .	Northwestern Connecticut Regional Planning Agency
Jay Zaragoza. . .	Regional Planner	Northwestern Connecticut Regional Planning Agency
Cliff McClellan .	Water Quality Specialist . .	Connecticut Dept. of Health

Prior to the review day, each team member was provided with a summary of the water quality/watershed problem, a suggested ERT work program, a soil survey map, a soils limitation chart, a topographic map of the area, and a copy of the current state health code regulations on watersheds. Following the field review, individual reports were prepared by each team member and forwarded to the ERT Coordinator for compilation and editing into this final report.

This report presents the Team's findings and recommendations. It is hoped this information will assist the Town of Sharon in effectively planning the management of their watershed lands for protection and enhancement of water quality.

If any additional information is required, please contact Richard Lynn, (868-7342), Environmental Review Team Coordinator, King's Mark RC&D Area, P. O. Box 30, Warren, Connecticut.

* * * * *

II. EXISTING WATER SUPPLY SYSTEM

The Town of Sharon draws its public water supply from two sources: 1) Beardsley Pond and 2) the Caulkinstown Reservoir. Figure 1 illustrates the water transmission system.

Beardsley Pond is the major water supply source for the Town. The Pond is shallow, eutrophic (nutrient rich) and about 25 acres in size. Water is drawn from the central portion of the Pond via a 12" clay pipe and gravity fed through 6" and 8" pipe to a treatment plant located on Caulkinstown Road. Maximum yield from Beardsley Pond is approximately 268 gallons per minute according to the Town Superintendent of Water Supply.

Caulkinstown Reservoir serves as a supplementary water supply source to Beardsley Pond. The Reservoir is shallow, appears to be much less eutrophic than Beardsley Pond and is about one acre in size. Water from the Reservoir is drawn down via an 8" transfer main to the treatment plant on Caulkinstown Road. Storage capacity of the Reservoir is estimated to be about 500,000 gallons. Maximum yield is estimated at 700 gallons per minute.

Despite the storage and yield of Caulkinstown Reservoir, it cannot meet the entire water demands of the community on a continuing basis. The amount of water entering the Reservoir is dependent on the drainage area (watershed) serving the Reservoir. Statistically, based on watershed size and surficial geology, 10% of the time inflow to the Reservoir will be less than 10,000 gallons per day. According to the Town Superintendent of Water Supply, Town water use during peak periods is approximately 200,000 gallons per day.

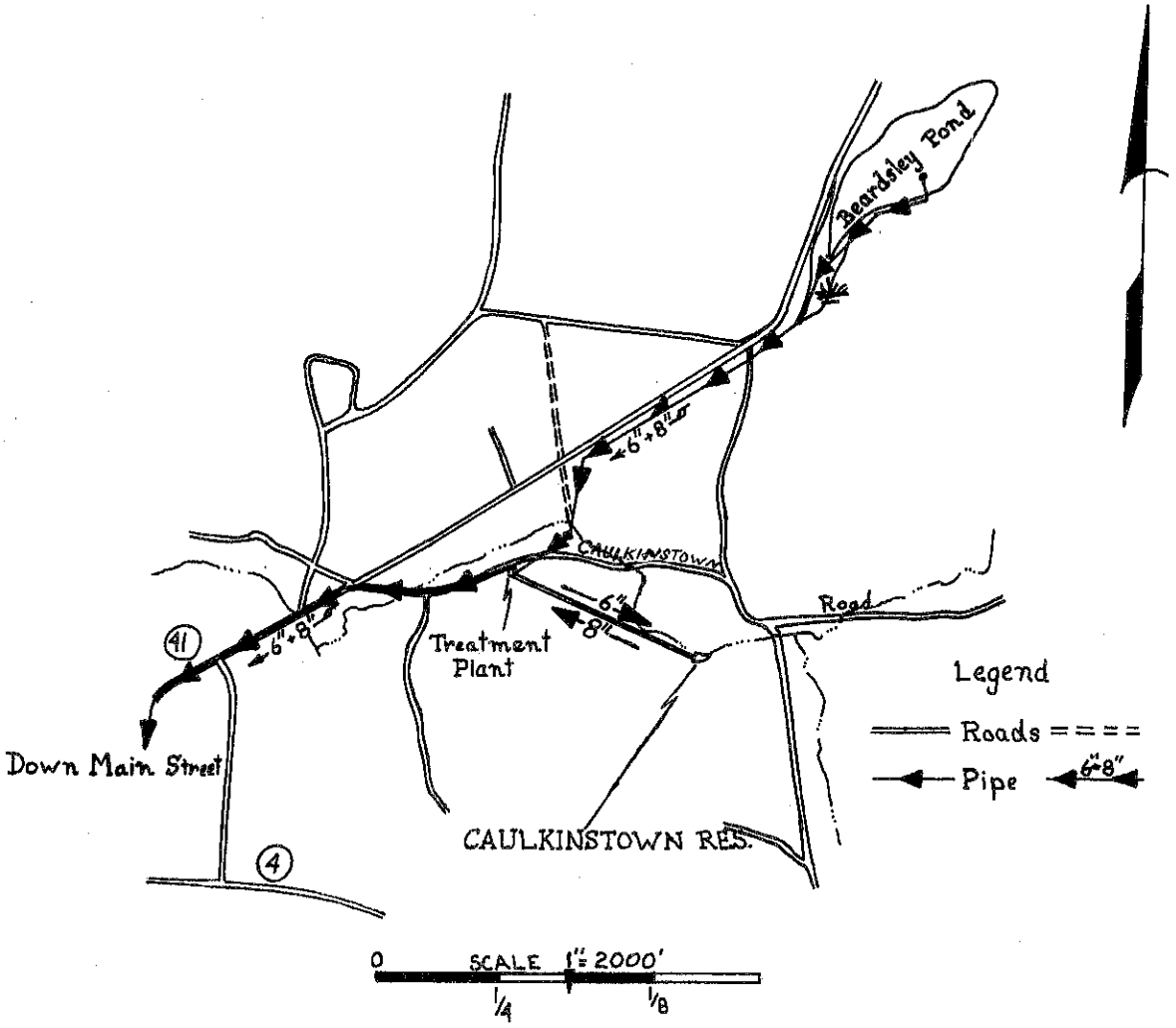
The Caulkinstown Reservoir nonetheless provides a vital function in providing satisfactory water pressure in the transmission lines serving the Town. The transmission line from Beardsley Pond alone lacks the hydraulic gradient or pitch to provide adequate water pressure. When this flow is supplemented by the flow from Caulinstown Reservoir, satisfactory water pressure is achieved.

The Town has the capability of pumping water from Beardsley Pond to the Caulkinstown Reservoir. A 6" pump transfer line runs from the treatment plant to the Reservoir (see Figure 1). This transfer line is utilized when water from Beardsley Pond is particularly turbid. By pumping to the Caulkinstown Reservoir, additional settling time is created and better (less turbid) water quality is achieved.

Water from both Beardsley Pond and Caulkinstown Reservoir is treated at the chlorine plant on Caulkinstown Road and distributed to 315 service connections in the center of Town. Portions of Town not served by the Town's public water supply system rely upon individual wells for potable water.

FIGURE I

WATER TRANSMISSION SYSTEM



III. WATERSHED CHARACTERISTICS

A. SETTING, TOPOGRAPHY, LAND USE

As mentioned previously, the public water supply of Sharon is derived from two watersheds. These include the Beardsley Pond watershed and the Caulkinstown Reservoir watershed.

A watershed may be defined as the entire area that contributes surface-water run-off to a stream from the headwater region of the stream to a designated cross-section. For the Beardsley Pond and Caulkinstown reservoirs, the designated stream "cross-sections" would be the points of outflow from the reservoirs into the piping system; hence, the watershed consists of all areas from which runoff may be carried into the reservoirs either directly or by streamflow. The watershed areas, then, "terminate" at the impoundments of their respective reservoirs.

The two watershed areas, as determined by analysis of topographic maps and aerial photos and by field inspection, are shown in Figure 2. Although the boundaries could not be located with precision in some areas, particularly along the crest of Red Mountain, the accuracy of Figure 2 should be sufficient to maintain a very high degree of watershed control.

Beardsley Pond watershed consists of a steeply sloping southeastern slope (Red Mountain) and a gently sloping northwestern slope. Elevations of the watershed range from a low of 849 feet at Beardsley Pond to a high of 1,220 feet at the crest of Red Mountain.

The Caulkinstown Reservoir watershed is an area of diverse relief sloping to the north and west. Minimum - maximum elevations are approximately 900 and 1,216 feet.

Land use of the two watersheds consists of agricultural and open areas, residential, forested, and water surface areas (see Figure 3). The table on the following page presents the acreage and percentages of each land use within the watersheds. Note that forested areas occupy 55% of the watersheds with agricultural and open lands comprising the second largest land use at 30%. Together, these two categories represent 85% of the watershed areas of the Town.

The Beardsley Pond Watershed lies within the Town's rural residential zoning district, minimum lot size is two acres. The steep agricultural land just to the south of the Pond has been subdivided for future residential use. The majority of the watershed land is privately owned; however, the state owns a right of way along Route 41, and the Town owns the Pond, a 50 foot strip of land around the Pond, and a small parcel on the northwestern shore.

The Caulkinstown Reservoir Watershed also lies within the Rural Residential zoning district, and is primarily privately owned. The Reservoir is owned by the Town with access via a right-of-way through private property.

WATERSHED LAND USE*

BEARDSLEY POND WATERSHED	ACRES	% OF TOTAL
Agricultural and Open Areas	98	32
Residential	13	4
Mixed Hardwood - Softwood	70	23
Mixed Hardwood	94	31
Water Surface Area	31	10
TOTAL	306	100

CAULKINSTOWN RESERVOIR WATERSHED		
Agricultural and Open Areas	156	28
Residential	78	14
Mixed Hardwood - Softwood	6	1
Mixed Hardwood	303	56
Water Surface Area	4	1
TOTAL	547	100

COMBINED WATERSHED TOTALS		
Agricultural and Open Areas	254	30
Residential	91	9
Mixed Hardwood - Softwood	76	12
Mixed Hardwood	397	43
Water Surface Area	35	6
TOTAL	853	100

*Based on analysis of 1976 aerial photographs.

FIGURE 2 SHARON WATERSHED MAP

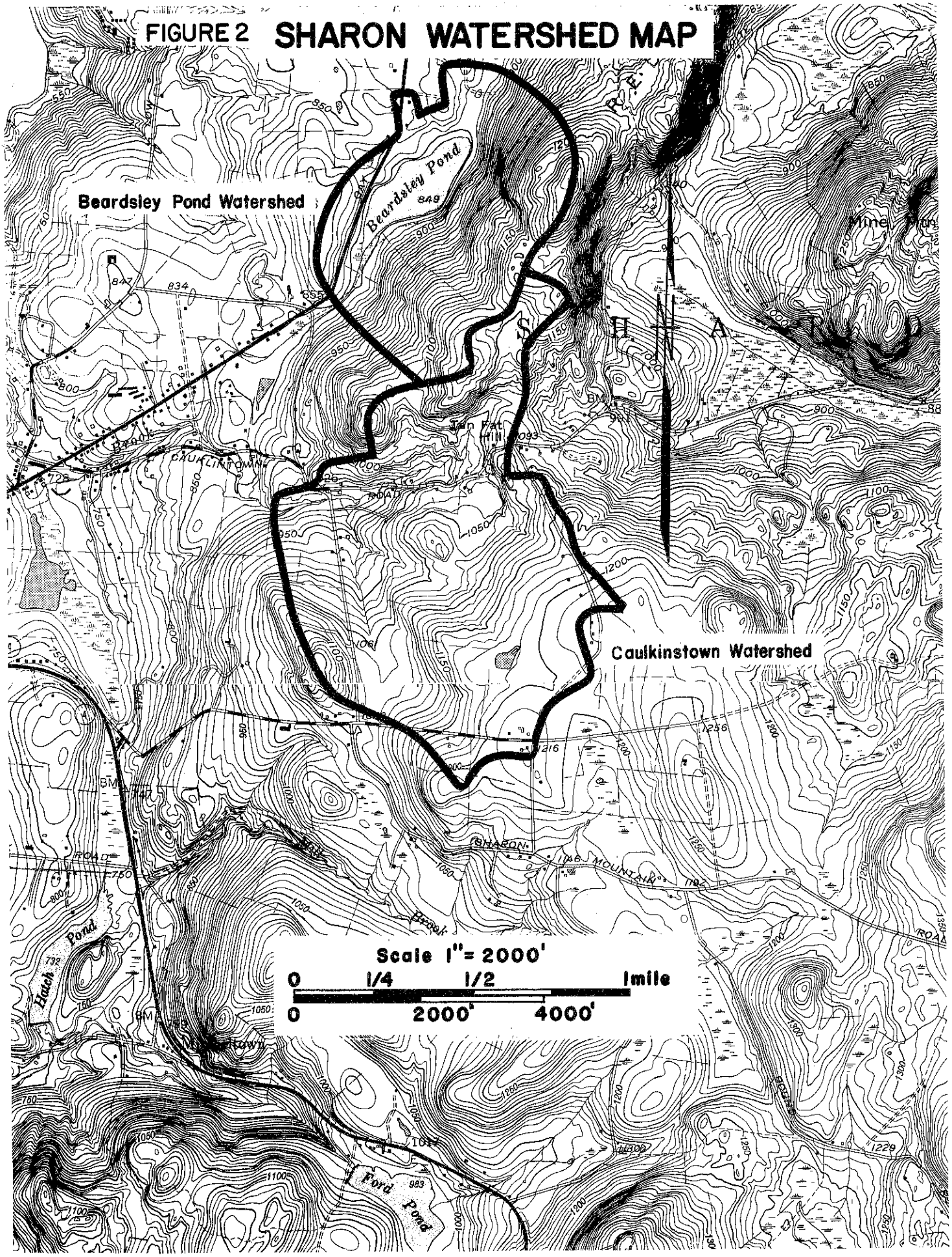
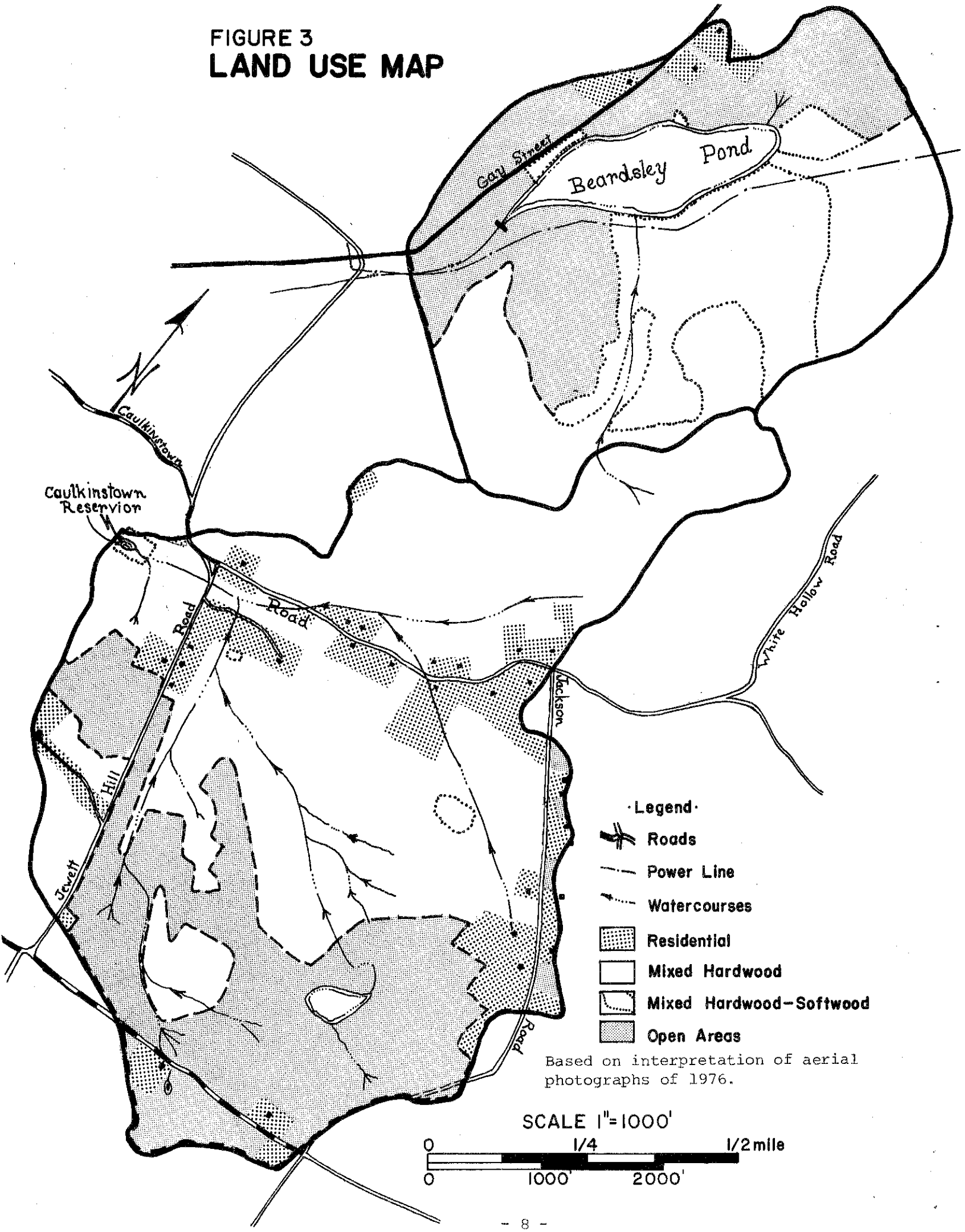


FIGURE 3

LAND USE MAP



B. SOILS

A detailed soils map together with a list of limitations for each soil type identified on the watershed land is presented in the Appendix of this report.

Basically there are 37 soil types on the land which fall into five natural soil groups. These five natural soil groups include:

A. Terrace Soils - Over Sands and Gravels (Map Symbols CwB, CwC)
The terrace soils occur above flood plains in river and stream valleys. They are underlain by water-deposited beds of sand or sand and gravel. In most places a few inches to 3 feet of loamy or fine sandy material cover the older, coarser water deposits. Nearly all sources of sand and gravel, and many of the important sources of water supply, are in areas associated with the terrace soils.

B. Upland Soils - Friable to Firm Glacial Till (Map Symbols CrC, CrD, CaB, CrC, DoB, Le, Lg)
The soils in this group are formed in the thicker, unconsolidated deposits of till usually occurring on hillsides. The capacity of these soils to hold water for plant growth is good where the till is loamy, but is fair to poor on the sandy till. Stones and large boulders are common in these glacial deposits and add difficulty when excavating or earth moving operations are needed.

C. Upland Soils - Over Compact Glacial Till (hardpan) (Map Symbols AnB, AaB, Ka, Ke, Ly, PbA, PbB, PdB, PdC, PeC, Rg, SrC, Wp, WxB, WyB, WzC)
These soils occur mostly on the tops and slopes of drumlins-hills that were smoothed and elongated north to south by the movement of glaciers. The soils are underlain by compact glacial till and have a hardpan 16 to 36 inches below the soil surface. Permeability above the hardpan is moderate but the pan drastically reduces percolation. During wet seasons, excess water in the soil moves downslope above the hardpan. The till commonly contains stones and boulders which add difficulty when excavating or earth moving operations are needed. These soils have good moisture-holding capacity for plant growth. Exceptional panoramic views are afforded from the higher areas.

D. Upland Soils - Rocky and Shallow to Bedrock (Map Symbols FaC, HxC, HxE, HrC, Rh)
The soils of this group occur mostly in the rougher areas of the uplands. They may occupy narrow ridge tops but most often are on steep side slopes. The soils are underlain by hard bedrock and the areas contain barren rock outcrops. In most places, hard rock is less than 20 inches below the soil surface. These areas provide contrast in the landscape and scenic overlooks.

F. Marsh and Swampy Soils (Map Symbol Pk)

C. GEOLOGY

Bedrock Geology

The bedrock geology of the property, shown in Figure 4, is adapted from an unpublished preliminary bedrock geologic map of the Sharon quadrangle by Robert M. Gates; that map is on file with the Natural Resources Center of the Connecticut Department of Environmental Protection. Description of the rocks are based on information contained in Quadrangle Report No. 32 of the Connecticut Geological and Natural History Survey; the report is entitled Bedrock Geology of the South Canaan Quadrangle, by R. M. Gates (1975).

Four bedrock types are shown within the boundaries of the watershed; three form part of the Housatonic Highlands massif, which is composed of metamorphosed volcanic rocks, while the fourth, a member of the Stockbridge Formation, is predominantly composed of marble. The contact of the Housatonic Highlands rocks with those of the Stockbridge Formation lies approximately along the western foot of Red Mountain in the vicinity of Beardsley Pond. This contact is interpreted as a thrust fault: a fracture in the earth's crust along which Housatonic Highlands rocks were thrust over the rocks of the Stockbridge Formation. The marked change in slope at this contact probably derives from both the metamorphic structure of the rocks and the differences of the major units in their resistance to weathering (rocks rich in the mineral calcite are usually quickly worn down by natural physical and chemical processes in regions that have a temperate, humid climate).

The Housatonic Highlands massif in the watershed areas is separated into three units: unit (1) is composed of dark gray to black, fine to medium-grained, biotite-hornblende rich gneisses and amphibolites; unit (2) is composed of biotite-granite and biotite-quartz-plagioclase gneisses; unit (3) is undifferentiated. The Stockbridge Formation in the watershed areas is a massive to sheared, almost fissile (breaking into sheets or plates), iron-gray to white, fine-grained dolomite marble with minor calcite cement (dolomite is a calcium-magnesium carbonate).

Surficial Geology

The surficial geology (those materials above solid bedrock but below the soil zone) of the Sharon quadrangle has not been mapped to date, but information provided by the Soil Conservation Service, as well as a brief on-site field review, suggests that the watershed areas are composed principally of till. Till is a complex mixture of rock particles that range in size from clay to boulders and in shape from flat to angular to round. The till was produced as glacier ice flowed over and abraded a previous geologic landscape, and incorporated the solid debris throughout its mass. The till was then deposited on the ground directly by the ice. In places, pockets of sand and gravel may be found within the till, indicating that meltwater flowed through the wasting glacier ice. The texture of till generally varies from sandy and loose to clayey, hard, and compact.

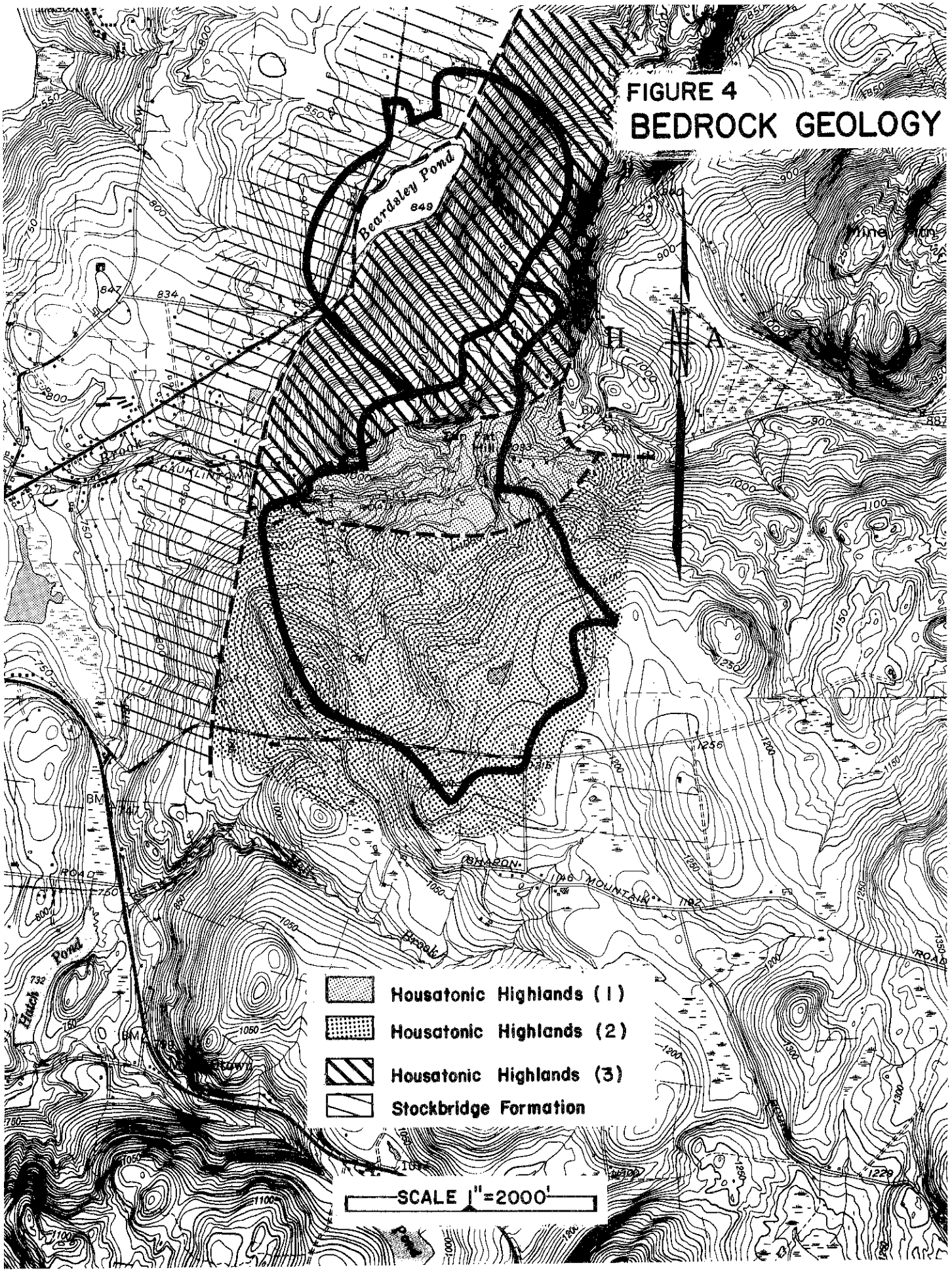


FIGURE 4
BEDROCK GEOLOGY
Beardsley Pond
Housatonic Highlands (1)
Housatonic Highlands (2)
Housatonic Highlands (3)
Stockbridge Formation
SCALE 1"=2000'

Figure 5 shows the approximate thickness of till in the watershed and the location of bedrock outcrops. Thicknesses were mapped only on the basis of topography, outcrop distribution, and soils information; they are not expected to be completely accurate.

A well on a farm just west of Route 41 near Beardsley Pond is reported to have penetrated about 75 feet of gravelly material and to yield 50 gallons per minute of groundwater. A deeper well at a neighboring house reportedly has a poor groundwater yield. It is therefore likely that the gravel is of limited extent; it may represent a particularly coarse-grained textural variation of the till, a small knoll of sand and gravel deposited in a pool on or within wasting glacier ice, or an area of greatly weathered bedrock. In any case, the well cannot at this time be considered evidence of a high-potential aquifer near Beardsley Pond.

Further discussion of potential aquifers within or near the watersheds is presented in a later section of this report.

IV. MANAGING FOR OPTIMUM WATER QUALITY

A. THE NEED FOR WATERSHED MANAGEMENT

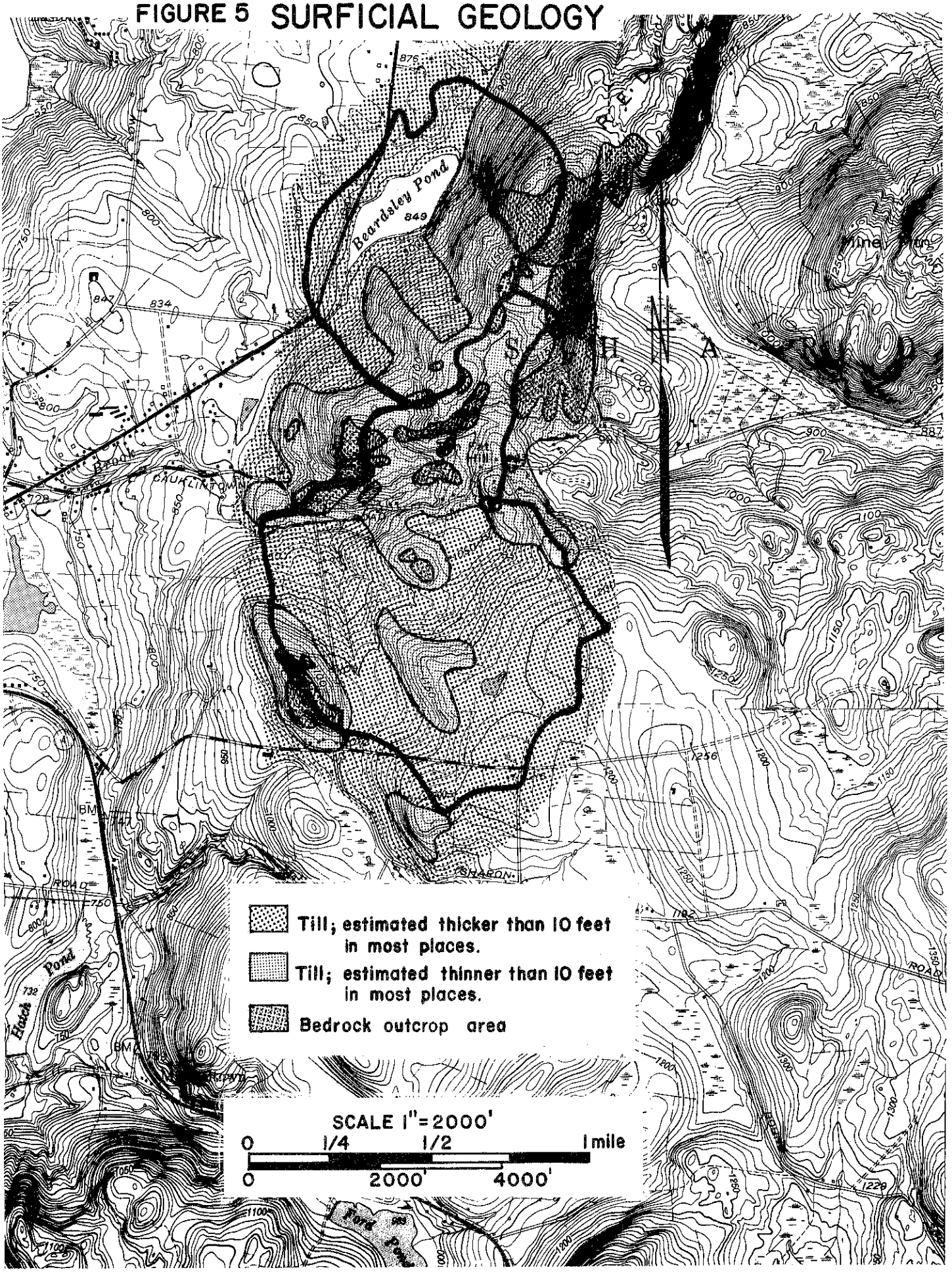
As mentioned above, the Town has had problems in recent years meeting the strict water quality standards established by the Safe Drinking Water Act relative to turbidity and odor. The Town is justifiably concerned about the water quality problem and is seeking measures to effectively enhance and protect the Town's public water supply to ensure meeting public drinking water standards in the future.

Water quality management is essentially a problem of managing shorelands and watershed land use rather than management of surface waters per se. Human activities such as land development strongly effect the quality of water resources. Generally speaking, human activities tend to degrade the natural purity of water, which in turn limits the utility of water resources for future use. One may attempt to reclaim the water by treatment processes such as water purification, but is is less expensive , and hence more desirable, to control water quality on the land.

Many land use activities in a watershed, especially those activities occurring near streams, can impact water quality. It is from the entire watershed that a water body gets its nutrients, sediment, and other pollutants; therefore, the way in which a watershed is used and managed now and in the future will be directly related to the future water quality condition of the water body and its utility as a source of drinking water supply.

Present trends in both watersheds could adversely impact water quality. Beardsley Pond watershed, being privately owned, is threatened by increased subdivision activity. As mentioned previously, the steep agricultural land

FIGURE 5 SURFICIAL GEOLOGY



just to the south of the reservoir has recently been subdivided for future residential use. Such development could have an adverse impact on the Pond's water quality if provisions for proper development are not made.

Two very important land use trends now occurring in the Caulkinstown watershed are an increase in subdivision activity and the re-emergence of agriculture. There are a number of newly built homes in the eastern section of the watershed, along Jackson Road. In addition, agricultural land in the western section of the watershed along Jewett Hill Road is scheduled to be subdivided into house lots. Land clearing activities for agricultural use (cornland) have occurred in the western section of the watershed, and it was learned by the Team that additional land clearing is scheduled north and east of the reservoir for livestock grazing.

Present trends in land use could adversely effect water quality if controls are not implemented prior to, during and following land disturbance activities. The State Public Health Code provides some regulations for the sanitation of watersheds (Public Health Code Regulation 19-13-B32, see Appendix), but additional land use controls are necessary at the local level to effectively protect and enhance water quality.

Recommended land use controls discussed in the following section of this report focus upon controlling rate and amount of run-off, chemical and biological pollution, and erosion and sedimentation. Through such controls, the turbidity and odor problems of the reservoirs should be effectively mitigated.

B. WATERSHED MANAGEMENT RECOMMENDATIONS

The ERT maintains that the most effective means to control land use and hence water quality in both watersheds is to establish a special Watershed District. A "Watershed Resource Protection District" (Watershed District) could be created encompassing the entire area of both watersheds. The function of the Watershed District would be to regulate land use for optimum water quality. The essence of the Watershed District would be the formulation of a number of stringent land use controls under the following categories: 1) control of urban development, 2) erosion and sedimentation and run-off control measures, 3) streambank/shoreline controls, and 4) woodland controls. Following a discussion of these land use controls, a number of additional watershed management recommendations are offered to protect the watershed and enhance water quality.

1. Control of Urban Development

Under the Watershed District concept, uses should be permitted within the watershed area which will not deteriorate streams, ground water, and wetlands as well as the reservoirs' water quality. Uses that are likely to have an adverse effect on wetlands and water courses should not be permitted, such as locating a building, parking lot, street, sewage disposal system, or land fill close to a water course or wetland. Special regulations can be developed and applied for the Watershed District toward the objective of eliminating the inflow of nutrients, sediment and other pollutants to the streams, groundwater, wetlands and the reservoirs themselves.

Within the Watershed District, it is suggested that present zoning regulations be revised to more accurately correspond with the capability of the land to support various land uses. It is suggested that the topography and soil types within the watersheds should serve as the basis for such zoning. Depending upon soil type and slope, various parcels of land have slight to severe limitations for on-site sewage disposal, foundation development, road construction, and other urban uses.

Existing zoning throughout both watersheds is two acres under the "Rural Residence District" with special exceptions for cluster and one acre development.

The great majority of soils/slopes within the watersheds have severe limitations for urban development including hazards of pollution from septic systems due to hardpan, seasonal high water tables and shallow to bedrock conditions on slopes 8% or greater (see Soils Limitation Chart in Appendix). Areas of shallow to bedrock on slopes of 15-35% and wetlands should be excluded from development unless it can be proven that adequate conditions exist for septic systems, foundations, drives, etc. Other soil areas should be correspondingly zoned according to soils/slopes with lot sizes 2 - 3 acres or larger.

It should also be noted that the map of the Town's Comprehensive Plan of 1970, shows almost the entire Beardsley Pond Watershed as "Preserved open space". The current zoning regulations do not reflect the intent of the Comprehensive Plan in this case.

Other towns in Connecticut (Washington, Woodbury) have successfully developed a system of zoning by soils and slopes using the Soil Survey of the U.S.D.A., Soil Conservation Service. Zoning by soils can eliminate any future need for sewers if lots are sized and septic systems properly designed and installed according to soil limitations. For more information and assistance in developing a zoning by soils system, contact the Northwestern Connecticut Regional Planning Agency, Warren and the Litchfield County Conservation District, Litchfield.

2. Erosion and Sedimentation and Run-off Control Measures

Since turbidity is already a major problem with the existing water supply reservoirs, erosion and sedimentation and run-off control measures are essential for protection and enhancement of future water quality. The Town's current zoning regulations are weak with regard to erosion and sediment control (pertaining mainly to removal of fill or excavations) and there are no provisions for storm water management. In addition, the subdivision regulations have no provisions for erosion and sediment control or storm water management. In light of this, it is recommended that strigent erosion and sediment controls and run-off controls be formulated and enforced for the Watershed District under the Town's zoning and subdivision contol powers.

The purpose of such regulations would be to insure that land disturbance activities and construction do not cause erosion, sedimentation or flooding on the property being developed or on surrounding properties, wetlands or water courses. The key feature of the regulations should be the requirement of an erosion and sediment and run-off control plan for all proposed development and approval of that plan by an appropriate agency prior to land disturbance activities. Measures for erosion, sediment and run-off control should be in accordance with U.S.D.A. Soil Conservation Service standards. The local county Soil and Water Conservation District can enter into an agreement with a local jurisdiction (i.e. zoning commission) for the purpose of reviewing and approving the erosion, sediment and run-off control plan to insure the proposed controls are sufficient. For more information concerning erosion, sediment and run-off controls contact the Litchfield County Conservation District Office. Assistance in developing and incorporating erosion, sediment and run-off controls in the town's zoning and subdivision regulations can be obtained by contacting the Northwestern Connecticut Regional Planning Agency, Warren, Connecticut.

As with newly developed land, agricultural land may contribute large amounts of sediment and other pollutants to nearby streams if proper land use controls are not implemented. It is recommended that all farmers within the Watershed District prepare a farm management plan with the assistance of the Litchfield County Conservation District.

3. Streambank/Shoreline Controls

The streams feeding Caulkinstown Reservoir are sensitive areas. Development activities within and adjacent to the streams can have drastic effects on stream hydrology and water quality. To protect the streams from adjacent development, it is recommended that a streambelt ordinance be developed for the Watershed District whereby no buildings, septic systems, and other uses likely to have an adverse impact on water quality would be permitted within a minimum distance of 150 feet from any perennial stream. Distances greater than 150 feet should be determined using U.S.D.A. Soil Conservation Service streambelt criteria.

Not all land uses need be prohibited under such a streambelt ordinance. Uses which would not disturb soil, vegetation, or streambanks nor pose the threat of pollution should be permitted. Such uses would include conservation, recreation and perhaps agriculture.

Although Beardsley Pond has no feeder stream (according to the U.S.G.S. topographic map), it is recommended that a minimum buffer zone distance of 150 feet be established along all shorelines of Beardsley Pond.

The development of streambank/shoreline controls could also serve positive functions. If vegetation (particularly conifers) is preserved adjacent to streams and shorelines, the forces of run-off would be reduced and consequently potential sediment loads would decrease. In addition the shade from vegetation would lessen thermal pollution, and leaves and litter would serve to trap harmful biological pollutants.

4. Woodland Controls

Woodlands serve important functions in the protection and conservation of watersheds. Forest vegetation stabilizes the soils, reduces the impact of precipitation and run-off, and moderates the effects of winds and storms. In so doing, the forest functions to reduce erosion, siltation and flooding. Without some form of land use regulations in woodland areas the above benefits of woodlands could be lost.

Erosion of forested lands stems principally from harvesting operations, primarily the phase involving transportation of the felled tree (skidding). By regulating rather than prohibiting harvesting, the productivity of the watershed and forest resources can be maintained. The most feasible and productive means to accomplish this is through mandating better harvesting practices through the establishment of an effective timber harvesting zoning ordinance. Through such an ordinance, which could be included with the foregoing land use controls under the Watershed District concept, the watershed's wooded land can be maintained and enhanced for a variety of purposes including watershed values, recreation, improved wildlife habitat, aesthetics, and forest products.

The Town of Lyme, Connecticut has a zoning ordinance for commercial cutting of timber which may serve as a model. Under this ordinance, no commercial cutting of timber is permitted within a special "Conservation Zone" without a permit issued by the Lyme Zoning Enforcement Officer. After submission of a commercial cutting plan to the Zoning Enforcement Officer, a permit is granted if the proposed cutting plan is found to be consistent with established minimum standards. An application for a permit must include a plot plan showing the applicant's property and the abutting property owners, a cutting plan indicating the nature of the operation, and a certification of the cutting plan by a public or consulting forester indicating the plan's conformance with the minimum standards established by the ordinance. Standards under the ordinance consist of performance controls for stream protection, logging roads and trails, aesthetic considerations, harvest methods, wildlife considerations, regeneration and fire control considerations.

Further guidance for the achievement of a reasonable ordinance may be obtained from reviewing the "Harvesting Guidelines of the Wood Producers Association of Connecticut". Examples of recommended harvesting controls under these guidelines include:

a. Crossing streams at right angles at minimum places. This should prevent changes in channel and minimize bank disturbance. Crossing where bottom is hard will also prevent pools slowing water flow.

b. Keep slash out of streams. Prevention of acid build-up from vegetative decay and maintenance of fast flow of streams.

c. Leave over half of original shade over water bodies after logging. Maintenance of cool, high oxygen content water and cool fishing places are desired.

d. Locate skid trails on less than 15% grade or water bar while in use. On all grades not outsloped, install water bars and run-offs immediately after use. This is done to minimize rainfall flow and velocity and resulting silt loss. We wish to keep soil to grow other trees and to allow the generations following us to benefit from our access systems.

e. Get permit from town or DEP on all road construction on wetland soils. This is the law.

5. Additional Management Recommendations

In addition to implementation of the foregoing watershed controls, the following specific land treatment measures are recommended to insure optimum water quality:

Beardsley Pond Watershed

a. The Town should seek to obtain a 150 foot buffer strip on the east shoreline of the Pond. If the open fields on the east side of the Pond are to be developed or used for agriculture, a diversion ditch should be installed on the open land east of the Pond to divert surface water southerly, beyond the Pond.

b. Abandoned agricultural fields are recommended to be planted to conifers.

c. Woodlands, predominantly of hardwoods, should be inter-planted to conifers.

d. The dam and pond outlet should be improved according to U.S.D.A. Soil Conservation Service standards and specifications. Presently the freeboard is too low, spillway inadequate, and there is no emergency spillway. It should be noted here that it is not considered feasible to raise the water level of Beardsley Pond unless Route 41 and road culverts are also raised.

e. Shallow areas of the Pond should be deepened, particularly along the northwestern shore. Deepening of shallow areas through dredging will decrease thermal pollution, retard algal proliferation, and enhance water retention time and settlement of suspended matter.

f. Hardwoods and brush should be removed a distance of 50 feet back from the water edge. Removal of excessive organic debris (e.g. leaves, pine needles) is also suggested to reduce organic and nutrient inflow into the Pond and hence lessen the probability and extent of algal blooms. Conifer growth adjacent to the Pond should be encouraged.

g. Deltas at outlet of road culverts should be removed.

Caulkinstown Reservoir Watershed

a. The eroding banks of inlet streams should be stabilized, particularly east of Jewett Hill Road. Stabilizing techniques include sloping, rip-rapping, removal of log jams, and revegetating.

b. A "dry" sediment basin should be installed and maintained southeast of the junction of Caulkinstown Road and Jewett Hill Road. This basin would function as a sediment trap during periods of rapid storm water run-off.

c. More "leak-offs" should be installed along Jewett Hill Road so that sand entering the stream is kept to a minimum.

d. Agricultural land owners within the watershed should be encouraged to work with the Litchfield County Conservation District and Soil Conservation Service to put conservation practices on their cropland. Such practices include, but are not limited to, rotations, cover crops, contouring, and animal waste management.

e. The inlet/outlet of the small silt trap above the reservoir should be improved. Barrels, filled with varied sized stones, sunk into the stream and silt trap bottoms can filter out more effectively than the existing inlet/outlet pipes.

f. Abandoned agricultural fields are recommended to be planted to conifers.

g. Woodlands, predominantly of grey birch and other poor quality hardwoods are recommended to be interplanted to conifers.

h. A regular septic system maintenance and inspection program should be developed and undertaken periodically in the watershed. This program should be enforced through local regulations.

i. A regular maintenance program for culverts and storm drains should be developed and undertaken periodically in the watershed. The town and/or state road crews could assume the responsibility.

General Statement

Serious consideration should be given to performing an economic evaluation of some of the preceding recommendations that involve engineering and construction. It may be more feasible/economical to go to high yielding wells for public water supply (see discussion below). The only way to treat the surface water supply so that water standards would always be met is the coagulation, flocculation, sedimentation and filtration process--an expensive proposition.

C. THE GROUNDWATER ALTERNATIVE

Groundwater is contained in underground geologic formations called aquifers. Groundwater under natural conditions is relatively pure, especially in comparison to surface water, as many impurities are filtered out as water percolates through the soil and aquifer. In many areas, groundwater can be utilized untreated for human consumption.

The feasibility of augmenting the existing water supply system with groundwater was explored by the Team. Augmentation of the type desired would require an aquifer capable of providing a sustained yield of at least 50 gallons per minute (gpm). (Currently, the town withdraws from its reservoirs approximately 170,000 - 200,000 gallons per day, or about 118 - 139 gpm.) Although aquifers in Connecticut may be composed of consolidated rock (bedrock), till, or stratified drift (layered sand and gravel deposits), only stratified drift aquifers are thought capable of yielding large groundwater supplies.

Figure 6 shows the location of several areas near the village of Sharon and Sharon Valley that are presumed to contain stratified drift. Three of these areas are taken (with very slight modifications) from Plate B, Part 3, of the Connecticut Water Resources Bulletin No. 21 (Water Resources Inventory of Connecticut, Part 6, Upper Housatonic River Basin, U.S.G.S., 1972). The other area shown is adapted from information contained in Soil Survey of Litchfield County, Connecticut, a U. S. Department of Agriculture, Soil Conservation Service publication. It is thought that gravel deposits may exist within these areas that could provide substantial quantities of water.

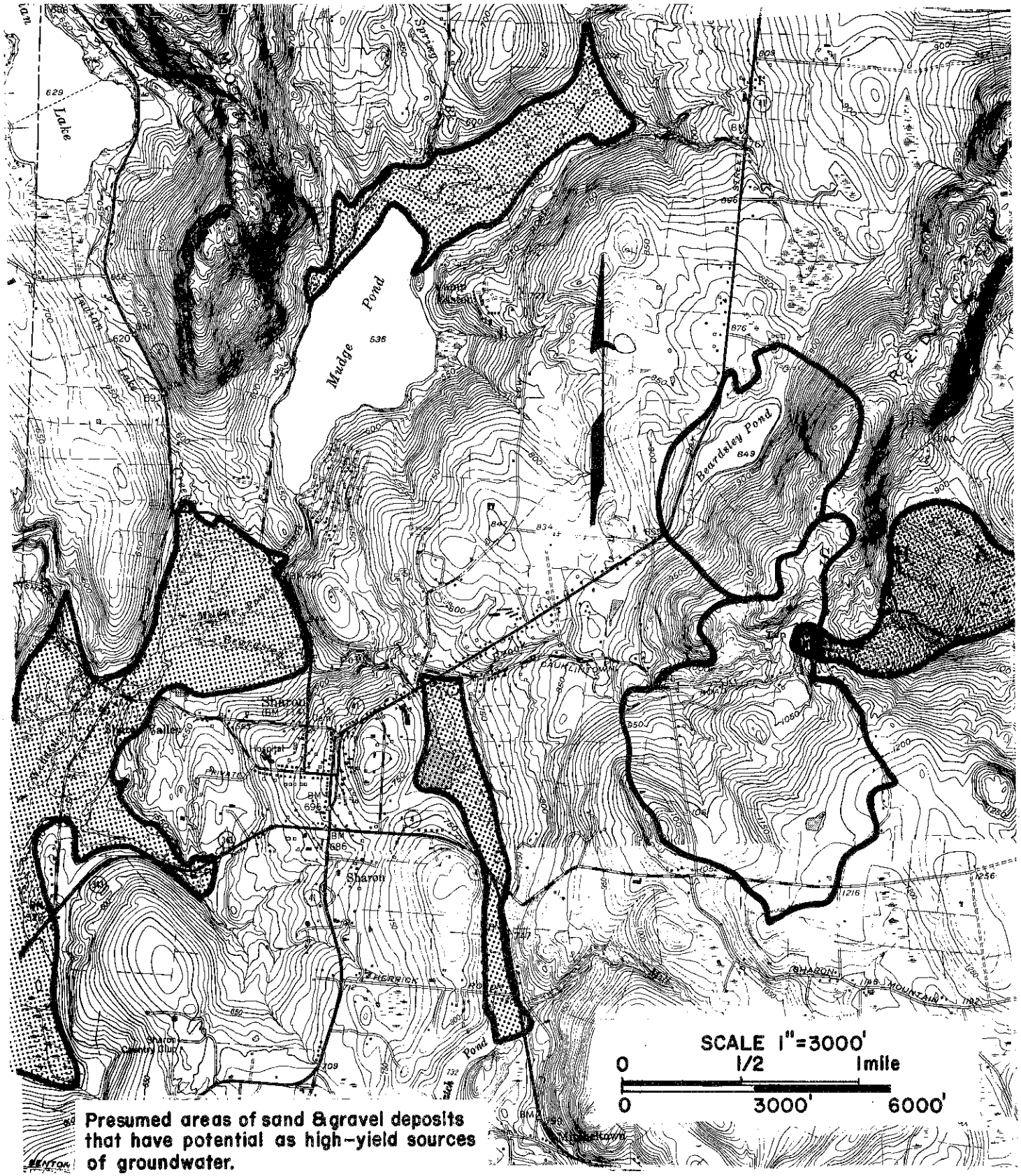
The amount of water that an aquifer can actually provide can be determined only by pumping tests. It should also be pointed out that a certain amount of risk is involved in locating and developing any new water sources. Even in a proven high-yield aquifer, local differences in grain size or distribution may prevent groundwater from being rapidly replenished to a specific well. Choosing an appropriate site for a well may require a lengthy and expensive trial and error process, the services of a water resources consultant, or both.

If this alternative water source is to be seriously explored, records of wells at homes in these areas should be checked to ascertain the specific nature of the surficial geology at different sites and the amount of water provided in each case. Such data may not pinpoint a location for a new town well, but it may at least indicate the amount of risk that the town would face in the endeaver.

It may also be possible to use bedrock-floored wells to augment water supply, but again the yields cannot be predicted comfortably. Groundwater is supplied to such wells almost entirely by fractures within the rock. The amount, size, and depth of fractures vary from point to point, and the yields vary with them. Carbonate bedrock, such as that found west of Beardsley Pond and along the majority of the water supply transmission system, is softer than most other local rock types; it therefore crumbles and fractures more easily and tends to produce higher yields. Still,

FIGURE 6

POTENTIAL HIGH YIELD SOURCES OF GROUNDWATER



Presumed areas of sand & gravel deposits that have potential as high-yield sources of groundwater.

Adapted from Soil Survey of Litchfield County

Information taken from Conn. Water Resources Bull No. 21

Connecticut Water Resources Bulletin No. 21 (hereinafter called Bull. 21) states that only 10% of the wells which were surveyed for that report and which were based in carbonate bedrock yielded 50 gpm or more. Moreover, water obtained from these wells was almost always hard or very hard. However, Bull. 21 also notes that weathered bedrock (which may be the actual water source for the high-yield well near Beardsley Pond, see page 12) tends to produce significantly more water than fresh, or unweathered, rock. Furthermore, 50% of the wells surveyed in Bull. 21 that drew from carbonate rock supplied 20 gpm or more, and 80% produced 4.5 gpm or more; it may therefore be possible to augment water supply by the desired amount merely by drilling more than one well.

Wells could also be drilled in the areas underlain by the Housatonic Highland massif (see Figure 5). However, according to Bulletin 21, only 3-4% of the wells which were surveyed in this type bedrock supplied 50 gpm or more; 50% gave 7 gpm or more and 80% gave 3 gpm or more. Although these yields are less than those found in carbonate bedrock, water quality is likely to be better (free from hardness and iron and manganese problems).

Once again, the quality and quantity from such wells can only be determined by pumping tests. If development in the town is expected to be slow, wells could be added over a period of many years to lessen the immediate financial impact. It will, of course, be essential for the Town to obtain appropriate easements for any wells drilled on private property.

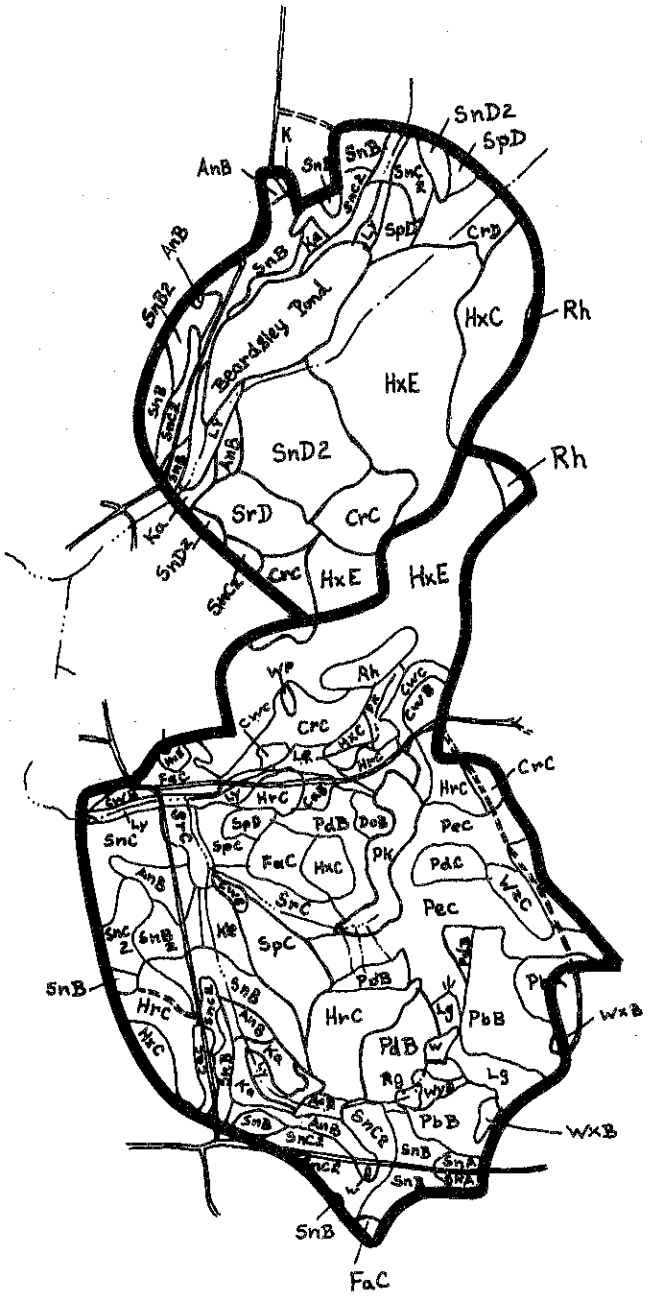
D. CONCLUDING REMARKS

The foregoing report identifies two options the Town may pursue in developing, protecting, and enhancing their public water supply system. The first option is to retain the existing water supply system and strive to implement land use controls to protect and enhance water quality in the watersheds. The other option is to explore the possibility of tapping groundwater wells to supplement or supplant existing water supply sources.

In the event high yielding wells are found and tapped by the Town for public water supply, it would still be advisable to maintain the reservoirs as a back-up system. However, some of the more costly watershed management recommendations identified in this report could justifiably be withheld.

V. APPENDIX

SOILS MAP



Prepared by:
USDA SCS 1978
Advance copy subject to change.

1" = 2000'

SOILS LIMITATION CHART

BEARDSLEY POND WATERSHED

MAP SYMBOL	SOIL NAME	SEPTIC ABSORBTION FIELDS		BUILDINGS WITH BASEMENTS		ROADS OR DRIVEWAYS	
		RATING	REASON	RATING	REASON	RATING	REASON
AnB	Amenia silt loam, 3-8% slopes	Severe	Wet, Percs Slowly	Severe	Wetness	Severe	Frost Action
CrC	Charlton very stony fine sandy loan, 3-15% slopes	Moderate	Large Stones	Moderate	Large Stones	Slight-Moderate	Slope
CrD	Charlton very stony fine sandy loan, 15-35% slopes	Severe	Slope	Severe	Slope	Severe	Slope
HxC	Hollis extremely rocky fine sandy loan, 3-15% slopes	Severe	Depth to Bedrock	Severe	Depth to Bedrock	Severe	Depth to Bedrock
HxE	Hollis extremely rocky fine sandy loam, 15-35% slopes	Severe	Slope,Depth to Rock	Severe	Slope,Depth to Rock	Severe	Slope,Depth to Rock
Ka	Kendaia silt loam	Severe	Percs Slowly	Severe	Wetness	Severe	Wet, Frost Action
Ly	Lyons silt loam	Severe	Wet, Percs Slowly	Severe	Wetness	Severe	Wet, Frost Action
SnB	Stockbridge loam, 3-8% slopes	Severe	Percs Slowly	Moderate	Wetness	Slight	--
SnB2	Stockbridge loam, 3-8% slopes, eroded	Severe	Percs Slowly	Moderate	Wetness	Slight	--
SnC2	Stockbridge loam, 8-15% slopes, eroded	Severe	Percs Slowly	Moderate	Slope, Wetness	Moderate	Slope
SnD2	Stockbridge loam, 15-25% slopes, eroded	Severe	Slope,Percs Slowly	Severe	Slope	Severe	Slope
SpD	Stockbridge stony loam, 15-25% slopes	Severe	Large Stones Percs Slowly	Severe	Slope	Severe	Slope

EXPLANATION OF RATING SYSTEM

1. SLIGHT LIMITATION: indicates that any property of the soil affecting use of the soil is relatively unimportant and can be overcome at little expense.
2. MODERATE LIMITATION: indicates that any property of the soil affecting use can be overcome at a somewhat higher expense.
3. SEVERE LIMITATION: indicates that the use of the soil is seriously limited by hazards or restrictions that require extensive and costly measures to overcome.

SOILS LIMITATION CHART

CAULKINSTOWN WATERSHED

MAP SYMBOL	SOIL NAME	SEPTIC ABSORBTION FIELD		BUILDINGS WITH BASEMENTS		ROADS OR DRIVEWAYS	
		RATING	REASON	RATING	REASON	RATING	REASON
AnB	Amenia silt loam, 3-8% slopes	Severe	Wet, Percs Slowly	Severe	Wetness	Severe	Frost Action
AoB	Amenia stony silt loam, 3-8% slopes	Severe	Wet, Percs Slowly	Severe	Wetness	Severe	Frost Action
CaB	Charlton fine sandy loam, 3-8% slopes	Slight	---	Slight	---	Slight	---
CrC	Charlton very stony fine sandy loam, 3-15% slopes	Moderate	Large Stones	Moderate	Large Stones	Slight-Moderate	Slope
CwB	Copake loam, 3-8% slopes	Slight	---	Slight	---	Moderate	Frost Action
CwC	Copake loam, 8-15% slopes	Moderate	Slope	Moderate	Slope	Moderate	Slope,Frost Action
DoB	Dover fine sandy loam, 3-8% slopes	Slight	---	Slight	---	Slight	---
FaC	Farmington very rocky silt loam, 3-15% slopes	Severe	Depth to Rock	Severe	Depth to Rock	Severe	Depth to Rock
HxC	Hollis extremely rocky fine sandy loam, 3-15% slopes	Severe	Depth to Rock	Severe	Depth to Rock	Severe	Depth to Rock
HxE	Hollis extremely rocky fine sandy loam, 15-35% slopes	Severe	Slope,Depth to Rock	Severe	Slope,Depth to Rock	Severe	Slope,Depth to Rock
Ka	Kendaia silt loam	Severe	Percs Slowly	Severe	Wetness	Severe	Wet,Frost Action
Ke	Kendaia - Lyons very stony silt loams	Severe	Wet,Percs Slowly	Severe	Wetness	Severe	Wet,Frost Action

EXPLANATION OF RATING SYSTEM

1. SLIGHT LIMITATIONS: indicates that any property of the soil affecting use of the soil is relatively unimportant and can be overcome at little expense.
2. MODERATE LIMITATION: indicates that any property of the soil affecting use can be overcome at a somewhat higher expense.
3. SEVERE LIMITATION: indicates that the use of the soil is seriously limited by hazards or restrictions that require extensive and costly measures to overcome.

SOILS LIMITATION CHART

CAULKINSTOWN WATERSHED

MAP SYMBOL	SOIL NAME	SEPTIC ABSORBTION FIELD		BUILDINGS WITH BASEMENTS		ROADS OR DRIVEWAYS	
		RATING	REASON	RATING	REASON	RATING	REASON
Le	Leicester stony fine sandy loam	Severe	Wetness	Severe	Wetness	Severe	Wet,Frost Action
Lg	Leicester, Ridgebury & Whitman very stony fine sandy loams	Severe	Wetness	Severe	Wetness	Severe	Wet, Frost Action
Ly	Lyons silt loam	Severe	Wet, Percs Slowly	Severe	Wetness	Severe	Wet, Frost Action
PbA	Paxton fine sandy loam, 0-3% slopes	Severe	Percs Slowly	Moderate	Wetness	Moderate	Frost Action
PbB	Paxton stony fine sandy loam, 3-8% slopes	Severe	Percs Slowly	Moderate	Wetness	Moderate	Frost Action
PdB	Paxton stony fine sandy loam, 3-8% slopes	Severe	Percs Slowly	Moderate	Wet,Large Stones	Moderate	Frost Action
PdC	Paxton stony fine sandy loam, 8-15% slopes	Severe	Percs Slowly	Moderate	Wet,Large Stones	Moderate	Frost Action
PeC	Paxton very stony fine sandy loam, 8-15% slopes	Severe	Percs Slowly	Moderate	Wet,Large Stones	Moderate	Frost Action
Pk	Peat and Muck	Severe	Wetness	Severe	Wetness	Severe	Wetness
Rg	Ridgebury stony fine sandy loam	Severe	Percs Slowly	Severe	Wetness	Severe	Wet,Frost Action
Rh	Rock land	Severe	Depth to Rock	Severe	Depth to Rock	Severe	Depth to Rock
SnB	Stockbridge loam, 3-8% slopes	Severe	Percs Slowly	Moderate	Wetness	Slight	---

EXPLANATION OF RATING SYSTEM

1. SLIGHT LIMITATIONS: indicates that any property of the soil affecting use of the soil is relatively unimportant and can be overcome at little expense.
2. MODERATE LIMITATION: indicates that any property of the soil affecting use can be overcome at a somewhat higher expense.
3. SEVERE LIMITATION: indicates that the use of the soil is seriously limited by hazards or restrictions that require extensive and costly measures to overcome.

SOILS LIMITATION CHART

CAULKINSTOWN WATERSHED

MAP SYMBOL	SOIL NAME	SEPTIC ABSORBTION FIELD		BUILDINGS WITH BASEMENTS		ROADS OR DRIVEWAYS	
		RATING	REASON	RATING	REASON	RATING	REASON
SnB2	Stockbridge loam, 3-8% slopes, eroded	Severe	Percs Slowly	Moderate	Wetness	Slight	---
SnC	Stockbridge loam, 8-15% slopes	Severe	Percs Slowly	Moderate	Slope, Wetness	Moderate	Slope
SnC2	Stockbridge loam, 8-15% slopes, eroded	Severe	Percs Slowly	Moderate	Slope, Wetness	Moderate	Slope
SpC	Stockbridge stony loam, 8-15% slopes	Severe	Percs Slowly	Moderate	Slope,Wetness Large Stones	Moderate	Slope
SpD	Stockbridge stony loam, 15-25% slopes	Severe	Large Stones Percs Slowly	Severe	Slope	Severe	Slope
SrC	Stockbridge very stony loam 3-15% slopes	Severe	Large Stones Percs Slowly	Severe	Slope, Large Stones	Severe	Slope
Wp	Whitman stony fine sandy loam	Severe	Wetness, Percs Slowly	Severe	Wetness	Severe	Wet,Frost Action
WxB	Woodbridge fine sandy loam, 3-8% slopes	Severe	Percs Slowly	Severe	Wetness	Severe	Frost Action
WyB	Woodbridge stony fine sandy loam, 3-8% slopes	Severe	Percs Slowly	Severe	Wetness	Severe	Frost Action
WzC	Woodbridge very stony fine sandy loam, 3-15% slopes	Severe	Percs Slowly	Severe	Wetness Large Stones	Severe	Frost Action
HrC	Hollis very rocky fine sandy loam, 3-15% slopes	Severe	Depth to Rock	Severe	Depth to Rock	Severe	Depth to Rock

EXPLANATION OF RATING SYSTEM

1. SLIGHT LIMITATION: indicates that any property of the soil affecting use of the soil is relatively unimportant and can be overcome at little expense.
2. MODERATE LIMITATION: indicates that any property of the soil affecting use can be overcome at a somewhat higher expense.
3. SEVERE LIMITATION: indicates that the use of the soil is seriously limited by hazards or restrictions that require extensive and costly measures to overcome.

CONNECTICUT STATE DEPARTMENT OF HEALTH

PUBLIC HEALTH CODE REGULATION 19-13-B32

SANITATION OF WATERSHEDS

Section 19-13-B32 of the regulations of Connecticut state agencies is repealed and the following is substituted in lieu thereof:

Unless specifically limited, the following regulations apply to land and watercourses tributary to a public water supply including both surface and ground water sources.

(a) As used in this section, "sewage" shall have the meaning found in Section 19-13-B20 (a) of the Public Health Code: "toxic metals" shall be arsenic, barium, cadmium, chromium, lead, mercury and silver and the salts thereof: "high water mark" shall be the upper limit of any land area which water may cover, either standing or flowing, at any time during the year and "watershed" shall mean land which drains by natural or man-made causes to a public drinking water supply intake.

(b) No sewage disposal system, cesspool, privy or other place for the deposit or storage of sewage shall be located within one hundred feet of the high water mark of any reservoir or within fifty feet of the high water mark of any stream, brook or watercourse, flowing into any reservoir used for drinking purposes.

(c) No sewage disposal system, cesspool, privy or other place for the deposit or storage of sewage shall be located on any watershed, unless such facility is so constructed that no portion of the contents can escape or be washed into the stream or reservoir.

(d) No sewage shall be discharged on the surface of the ground on any watershed.

(e) No stable, pigpen, chicken house or other structure where the excrement of animals or fowls is allowed to accumulate shall be located within one hundred feet of the high water mark of a reservoir or within fifty feet of the high water mark of any watercourse as above mentioned, and no such structure shall be located on any watershed unless provision is made in a manner acceptable to the commissioner of health for preventing manure or other polluting materials from flowing or being washed into such waters.

(f) No toxic metals, gasoline, oil or any pesticide shall be disposed of as a waste into any watercourse tributary to a public drinking water supply or to and ground water identified as supplying a public water supply well.

(g) Where fertilizer is identified as a significant contributing factor to nitrate nitrogen occurring in excess of 8 mg/l in a public water supply, fertilizer application shall be made only under current guidelines established by the commissioner of health in cooperation with the state commissioner of agriculture, the College of Agriculture of the University of Connecticut and the Connecticut Agricultural Experiment Station in order to prevent exceeding the maximum allowable limit in public drinking water of 10.0 mg/l for nitrite plus nitrate nitrogen.

(h) Where sodium occurs in excess of 15 mg/l in a public drinking water supply, no sodium chloride shall be used for maintenance of roads, driveways, or parking areas draining to that water supply except under application rates approved by the commissioner of health, designed to prevent the sodium content of the public drinking water from exceeding 20 mg/l.

(i) The design of storm water drainage facilities shall be such as to minimize soil erosion and maximize absorption of pollutants by the soil. Storm water drain pipes, except for crossing culverts, shall terminate at least one hundred feet from the edge of an established watercourse unless such termination is impractical, the discharge arrangement is so constructed as to dissipate the flow energy in a way that will minimize the possibility of soil erosion, and the commissioner of health finds that a discharge at a lesser distance is advantageous to stream quality. Special provisons shall be taken to protect stream quality during construction.

Effective date August 2, 1977.

ABOUT THE TEAM

The King's Mark Environmental Review Team (ERT) is a group of environmental professionals drawn together from a variety of federal, state, and regional agencies. Specialists on the team include geologists, biologists, foresters, climatologists, soil scientists, landscape architects, recreation specialists, engineers, and planners. The ERT operates with state funding under the aegis of the King's Mark Resource Conservation and Development (RC&D) Area - a 47 town area in western Connecticut.

As a public service activity, the team is available to serve towns and developers within the King's Mark Area --- free of charge.

PURPOSE OF THE TEAM

The Environmental Review Team is available to help towns and developers in the review of sites proposed for major land use activities. To date, the ERT has been involved in the review of a wide range of significant activities including subdivisions, sanitary landfills, commercial and industrical developments, and recreation/open space projects.

Reviews are conducted in the interest of providing information and analysis that will assist towns and developers in environmentally sound decision-making. This is done through identifying the natural resource base of the project site and highlighting opportunities and limitations for the proposed land use.

REQUESTING A REVIEW

Environmental Reviews may be requested by the chief elected official of a municipality or the chairman of an administration agency such as planning and zoning, conservation, or inland wetlands. Requests for reviews should be directed to the Chairman of your local Soil and Water Conservation District. This request letter must include a summary of the proposed project, a location map of the project site, written permission from the landowner/developer allowing the team to enter the property for purposes of review, and a statement identifying the specific areas of concern the team should address. When this request is approved by the local Soil and Water Conservation District and the King's Mark RC&D Executive Committee, the team will undertake the review. At present, the ERT can undertake two reviews per month.

For additional information regarding the Environmental Review Team, please contact your local Soil Conservation District Office or Richard Lynn (868-7342), Environmental Review Team Coordinator, King's Mark RC&D Area, P.O. Box 30, Warren, Connecticut 06754.