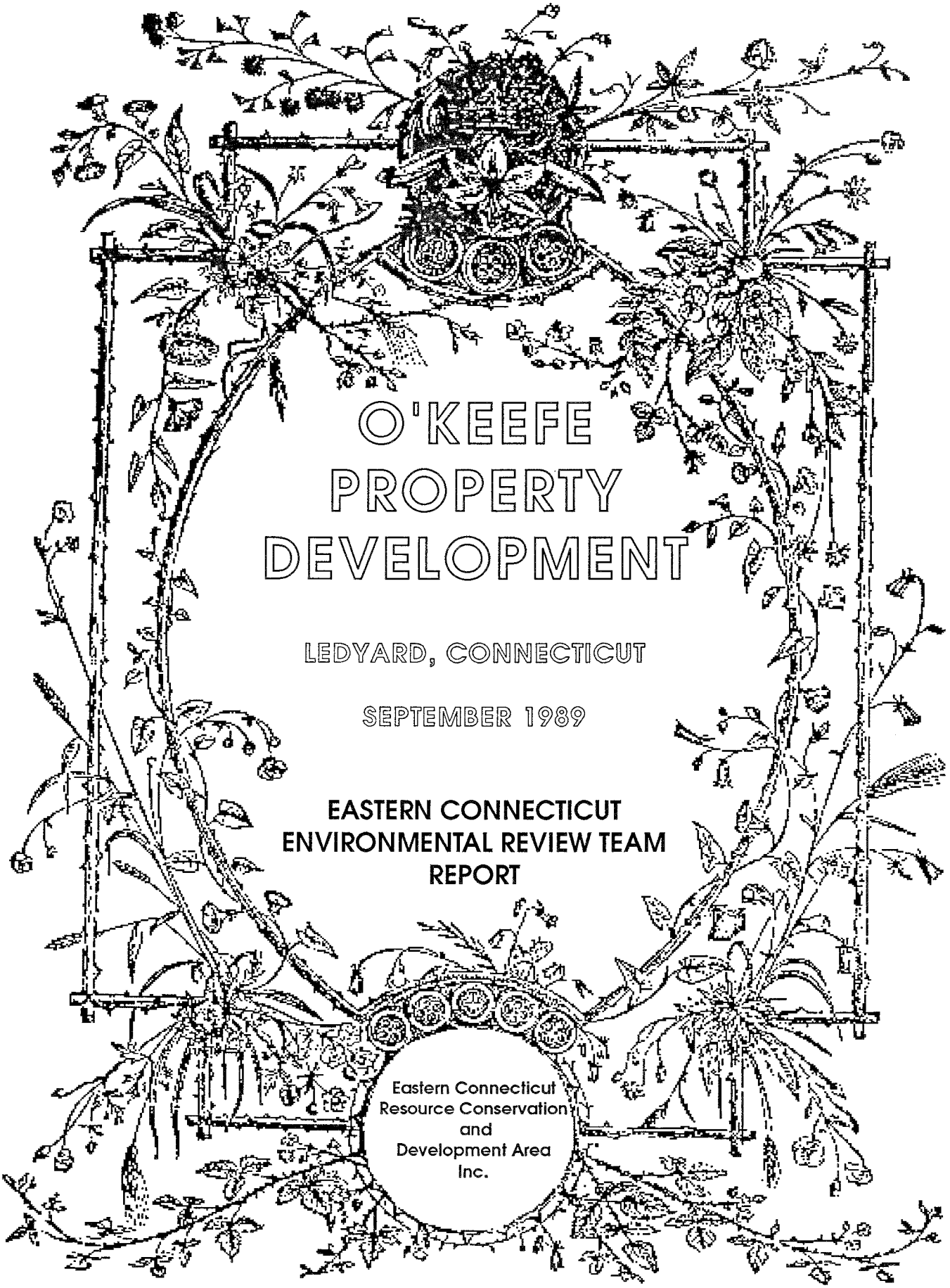


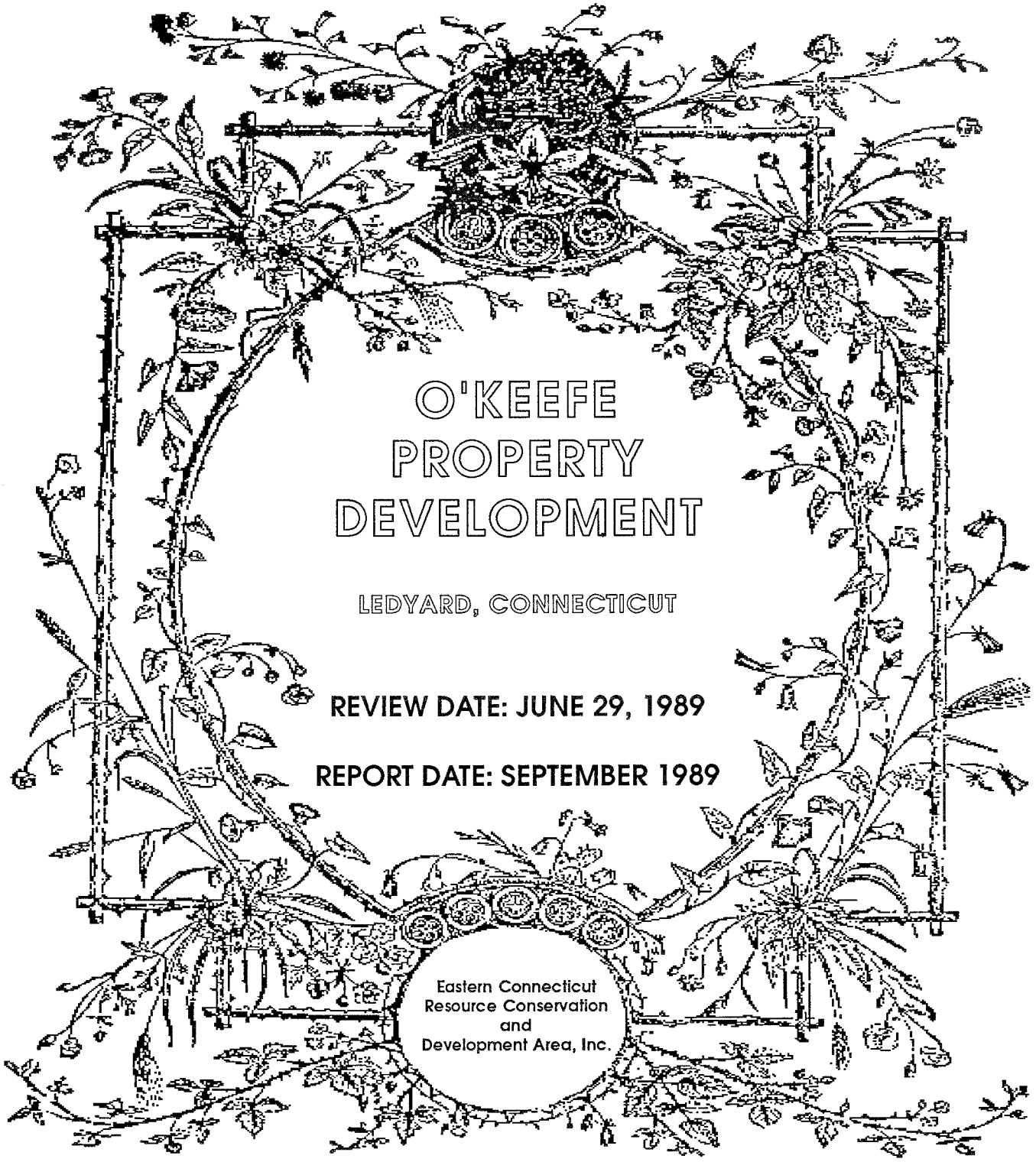
O'KEEFE PROPERTY DEVELOPMENT

LEDYARD, CONNECTICUT

SEPTEMBER 1989

EASTERN CONNECTICUT ENVIRONMENTAL REVIEW TEAM REPORT

Eastern Connecticut Resource Conservation and Development Area Inc.



O'KEEFE PROPERTY DEVELOPMENT

LEDYARD, CONNECTICUT

REVIEW DATE: JUNE 29, 1989

REPORT DATE: SEPTEMBER 1989

Eastern Connecticut
Resource Conservation
and
Development Area, Inc.

EASTERN CONNECTICUT ENVIRONMENTAL REVIEW TEAM
P.O. BOX 70, ROUTE 154
HADDAM, CONNECTICUT 06438
(203) 345-3977

ENVIRONMENTAL REVIEW TEAM REPORT
ON

THE O'KEEFE PROPERTY

LEDYARD, CONNECTICUT

This report is an outgrowth of a request from the Ledyard Planning Commission to the New London County Soil and Water Conservation District (SWCD). The S&WCD referred this request to the Eastern Connecticut Resource Conservation and Development (RC&D) Area Executive Council for their consideration and approval. The request was approved and the measure reviewed by the Eastern Connecticut Environmental Review Team (ERT).

The ERT met and field checked the site on Thursday, June 29, 1989. Team members participating on this review included:

Gerry Amt	**Regional Planner**	**SE CT Regional Planning Agency**
Patrice D'Ovidio	**Soil Conservationist**	**USDA-Soil Conservation Service**
Laura McNamera	**Environmental Analyst**	**DEP-Water Resources Unit**
Brian Murphy	**Fisheries Biologist**	**DEP-Eastern District Headquarters**
Elaine Sych	**ERT Coordinator**	**Eastern CT RC&D Area, Inc.**
Bill Warzecha	**Geologist/Sanitarian**	**DEP-Natural Resources Center**

Prior to the review day, each Team member received a summary of the proposed project, a list of the town's concerns, a location map, a topographic map, and a soils map. During the field review the Team members were given preliminary plans and information. The Team met with, and were accompanied by the Town Planner, the Wetlands Enforcement Officer and the Project Engineer. Following the review, reports from each Team member were submitted to the ERT Coordinator for compilation and editing into this final report.

This report represents the Team's findings. It is not meant to compete with private consultants by providing site designs or detailed solutions to development problems. The Team does not recommend what final action should be taken on a proposed project -- all final decisions rest with the Town and landowner. This report identifies the existing resource base and evaluates its significance to the proposed development, and also suggests considerations that should be of

concern to the developer and the Town. The results of this Team action are oriented toward the development of better environmental quality and the long-term economics of land use.

The Eastern Connecticut RC&D Executive Council hopes you will find this report of value and assistance in making your decisions on this proposed residential subdivision and commercial development.

If you require additional information, please contact:

Elaine A. Sych
ERT Coordinator
Eastern Connecticut RC&D Area
P.O. Box 70
Haddam, Connecticut 06438
(203)345-3977

Table of Contents

Table of Maps

1. Setting, Zoning and Land-Use

The proposed project consists of the subdivision of wooded land, ±120 acres in size, into a 22 lot subdivision. The site, located in the southeast corner of Ledyard, would comprise 21 residential building lots and one commercial building lot. Since municipal sewers and water mains are not available to this part of Ledyard, each lot would be served by an on-site sewage disposal system and an individual water supply well.

Pumpkin Hill Road abuts the site on the west, while Shrewville Road abuts it to the east. Red Brook, a Haley's Brook tributary, bisects the site.

Except for about 8 acres at the western limits which is zoned C-3 (General Commercial), the site is zoned R-60 or Low Density Residential. The R-60 zone allows single family residences on lots of at least 60,000 square feet. The general commercial zone would permit such uses as professional offices and a grocery store. Existing commercial buildings now vacant occur on the 8 acre parcel.

In comparing a 1934 air photo to a 1986 air photo of the area little change has taken place on the site. The presence of numerous stonewalls gives testimony to the site's agricultural past. Land-uses in the vicinity of the site include low to medium density residential use and agriculture.

LOCATION

Scale 1" = 2000

Project Site

Remainder of Property

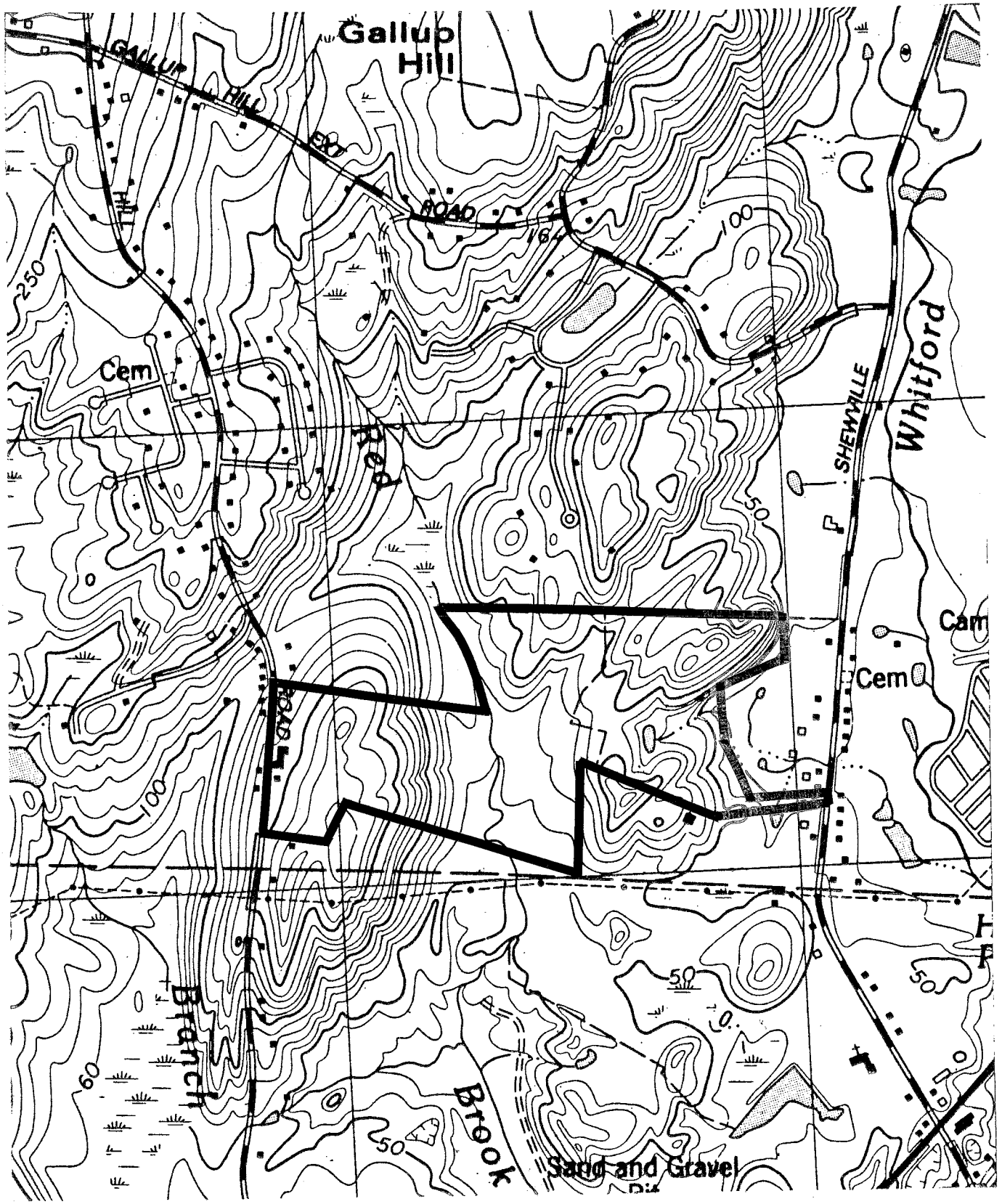
2. Topography

Red Brook Valley bisects the central parts of the site. To the west, land rises to the top of a rock cored drumlin (a stream-lined hill whose main axis runs north-south). The land lying east of the brook rises to a rocky knoll. Topography throughout the site is controlled to a large degree by the underlying bedrock. Steepest slopes occur in the west central parts which flank the east side of the drumlin. Slopes in this area are about 20%. Steep slopes also occur in the eastern parts. The remainder of the site is characterized by gentle to moderate slopes. Maximum and minimum elevations are 180 feet above mean sea level and 60 feet above mean sea level, respectively.

TOPOGRAPHY

Scale 1" = 1000'

Approximate Site Boundary



3. Geology

Bedrock was encountered in several deep test holes excavated for subsurface sewage exploration on the site. It was encountered at shallowest depths on Lots 3 and 4, where it ranged between 33" and 40". Also, bedrock is exposed at ground surface throughout the eastern parts, an area which has not been subdivided to date.

Published geologic maps for the area indicate that three main rock types underlie the site: 1) a gray, medium grained hornblende-biotite gneiss (Mamacoke Formation); 2) a gray to pinkish gray, medium to coarse grained porphyritic quartz monzonite; and 3) an orange-pink to light-gray, fine to medium grained granitic gneiss (Hope Valley Alaskite Gneiss). An accompanying bedrock map shows the approximate distribution of the rock units as they exist on the site. It should be pointed out that the porphyritic quartz monzonite revealed in the northern parts of the eastern section is a unique rock that has not been previously reported in the region. It is believed to be an intrusive, igneous (formed from molten magma) rock which has not been subjected to metamorphism (geologically altered by great heat and pressure within the earth's crust). The other rock units on the site have been metamorphosed and are older in age than porphyritic quartz monzonite. The term porphyritic refers to the textural aspect of igneous rocks. In general, these crystalline rocks are characterized by large crystals that are set in a finer groundmass.

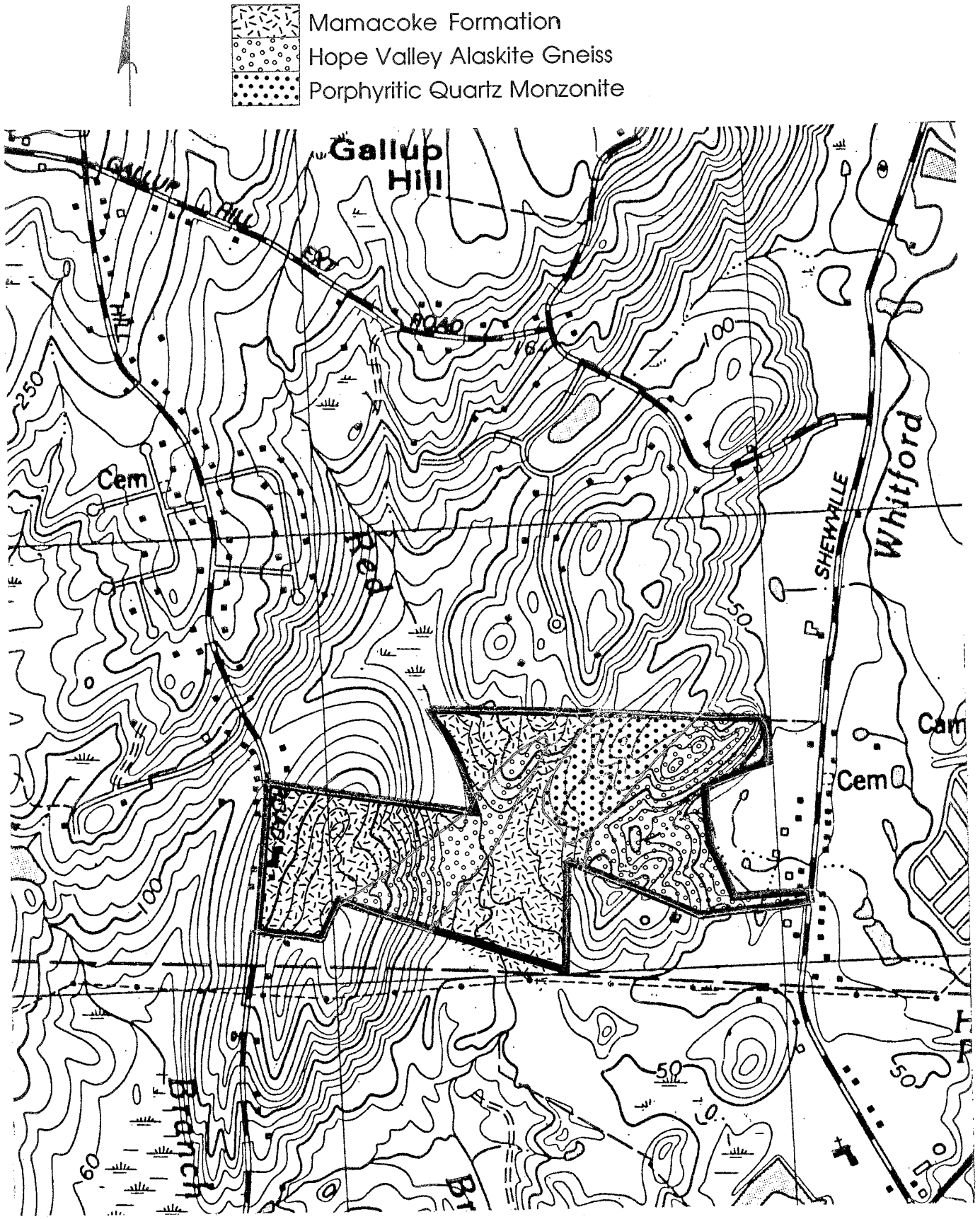
The site overlies the east side of the Mystic Basin, an area in which the layering (foliation) of the rocks beneath the site dip radially to a central point. Additionally, the site lies west of the Mystic River Valley, an area of numerous, generally north-south trending faults. Because of the sites proximity to the fault zone, one can expect that the upper few hundred feet of the bedrock surface have been fractured and may be capable of transmitting usable amounts of water to individual wells. The faults mentioned above occurred during the geologic past and are no longer experiencing active movement.

Most homes in the area rely on the underlying bedrock as a source of domestic water supply. Depth to bedrock is probably 10 feet or less throughout the site.

The unconsolidated or surficial geologic material underlying bedrock on the site is glacial till. It consists of an unstratified, unsorted mixture of sediments ranging from silt to boulders that were transported and deposited directly by glacial ice. Based on deep test hole information and consideration of soil mapping data for the site, the texture of the till is sandy and gravelly with varying quantities of cobbles and boulders. It is light gray to gray in color and was slightly compacted to compacted where encountered during exploration for subsurface sewage disposal. Shallow mottling (an indicator of high groundwater tables) was observed in a few deep test holes. In general, the soil mottling was coincident with the compact zone which gives an indication of its moderate to low permeability.

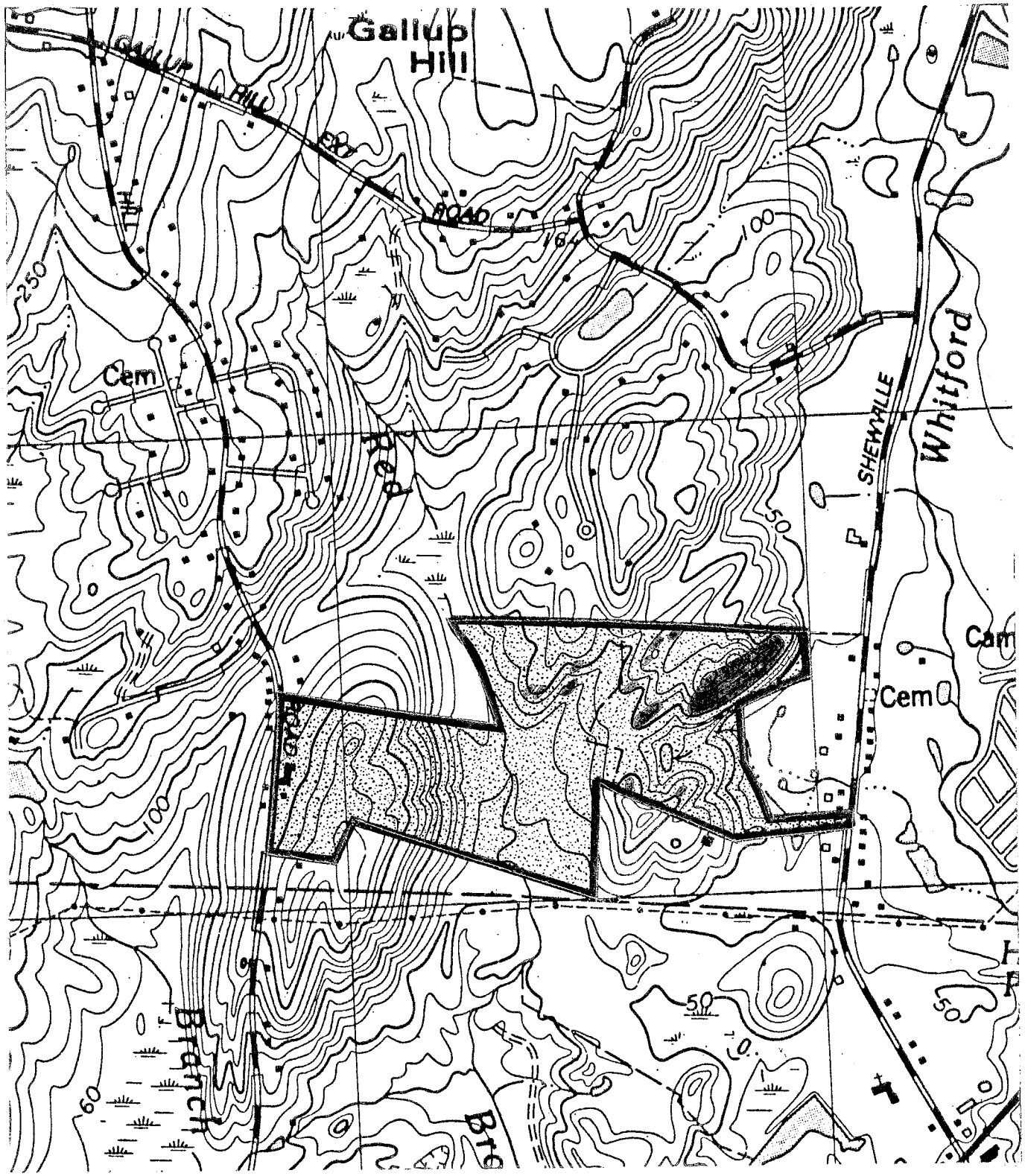
BEDROCK GEOLOGY

Scale 1" = 1000'



SURFICIAL GEOLOGY

Scale 1" = 1000'



4. Soil Resources

The dominant soil on this site is Charlton-Hollis fine sandy loams which are very rocky and shallow to bedrock in some places. Permeability is moderate and runoff is medium to rapid. These soils have a moderate to severe potential for erosion. Because of this, establishing a good vegetative cover and using erosion control devices during and after construction is essential. The steeper slopes in the middle of the site toward the brook would be especially susceptible. Due to the stoniness and shallowness to bedrock, extensive on-site investigation would be required to determine suitable sites for on-site septic systems. These septic systems may need engineered design and installation to function properly. Precautions should be taken to prevent effluent from seeping downslope and breaking out at the surface. Depth to bedrock and steepness of slope (>25%) are the two main obstacles to on-site septic systems.

A sediment and erosion control plan was not prepared for this site. Particular care must be taken to protect the wetlands area from upslope construction and land clearing. The road crossing of the stream and wetland area will also be a cause for environmental concern, and will require sediment control traps. Chapter 7 of the Connecticut Guidelines for Soil Erosion and Sediment Control gives recommendations on application and installation of control measures.

Enclosed is the Sediment and Erosion Control checklist and TR-55 stormwater control checklist to use as a guide in developing a sound plan.

The New London County USDA-SCS office will be available to review the plan at the town's request.

SOILS MAP

Scale 1" = 1320'

5. Soils Descriptions

PUMPKIN HILL ERT

CbC - Canton and Charlton fine sandy loams, 8 - 15 percent slopes

These sloping, well drained soils are on glacial till upland hills, plains, and ridges. Permeability of the Canton soil is moderately rapid in the surface layer and subsoil and rapid in the substratum. Permeability of the Charlton soil is moderate or moderately rapid. The available water capacity for these soils is moderate. Runoff is rapid. These soils warm up and dry out rapidly in the spring. Unless limed, the soil is strongly acid or medium acid. These soils are suited to cultivated crops. The hazard of erosion is severe. These soils are suited to trees. Major limiting factor for community development is steepness of slope.

These soils are in capability subclass IIIe.

CcB - Canton and Charlton very stony fine sandy loams, 3 - 8 percent slopes

These gently sloping, well drained soils are on glacial till upland hills, plains, and ridges. Stones and boulders cover 1 - 8 percent of the surface. Permeability of the Canton soil is moderately rapid in the surface layer and subsoil and rapid in the substratum. Permeability of the Charlton soil is moderate or moderately rapid. The available water capacity of these soils is moderate. Runoff is medium. These soils warm up and dry out rapidly in the spring. The soil is strongly acid or medium acid. These soils are not suited to cultivated crops. These soils are suited to trees.

These soils are in capability subclass VIs.

CdD - Canton and Charlton extremely stony fine sandy loams, 15 - 35 percent slopes

These moderately steep to steep, well drained soils are on glacial till upland hills, plains, and ridges. Stones and boulders cover 8 - 25 percent of the surface. Permeability of the Canton soil is moderately rapid in the surface layer and subsoil and rapid in the substratum. Permeability of the Charlton soil is moderate or moderately rapid. The available water capacity of these soils is moderate. These soils warm up and dry out rapidly in the spring. They are strongly acid or medium acid. These soils are not suited to cultivated crops. The hazard of erosion is severe. These soils are suited to trees. Steepness of slope is a major limitation for community development.

These soils are in capability subclass VIIs.

CrC - Charlton-Hollis fine sandy loams, very rocky, 3 - 15 percent slope

This gently sloping to sloping complex consists of somewhat excessively drained and well drained soils on glacial till uplands. Rock outcrops cover up to 10 percent of the surface. Stones and boulders cover 1 - 8 percent of the surface. Permeability of the Charlton soil is moderate or moderately rapid, the available water capacity is moderate. Permeability of the Hollis soil is moderate or moderately rapid above the bedrock, the available water capacity is low. The runoff of this complex is medium or rapid. It warms up and dries out rapidly in the spring. It is strongly acid or medium acid. These soils are not suited to cultivated crops. The hazard of erosion is moderate to severe. These soils are suited to trees. Windthrow is common on the Hollis soil because of the shallow rooting depth. The major limiting factor for community development is the shallow depth to bedrock.

These soils are in capability subclass VIs.

CrD - Charlton-Hollis fine sandy loams, very rocky, 15 - 45 percent slopes

This moderately steep to steep complex consists of somewhat excessively drained and well drained soils on glacial till uplands. Rock outcrops cover up to 10 percent of the surface. Stones and boulders cover 1 - 8 percent of the surface. Permeability of the Charlton soil is moderate or moderately rapid, the available water capacity is moderate. Permeability of the Hollis soil is moderate or moderately rapid above the bedrock, the available water capacity is low. Runoff of these soils is rapid or very rapid. These soils warm up and dry out rapidly in the spring. They are strongly acid or medium acid. These soils are not suited to cultivated crops. The Hollis soil has a shallow rooting depth and is droughty. These soils are suited to trees. Windthrow is common the Hollis soil because of the shallow rooting depth. The major limiting factors for community development are steepness of slope, shallow depth to bedrock, and rock outcrops.

These soils are in capability subclass VIIs.

HrC - Hollis-Charlton-Rock outcrop complex, 3 - 15 percent slopes

This gently sloping to sloping complex consists of somewhat excessively drained and well drained soils and rock outcrop on glacial till uplands. Stones and boulders cover 1 - 8 percent of the surface. Permeability of the Hollis soil is moderate or moderately rapid above the bedrock, the available water capacity is low. Permeability of the Charlton soil is moderate or moderately rapid, the available water capacity is moderate. Runoff of these soils is medium or rapid. These soils warm up and dry out rapidly in the spring. They are strongly acid or medium acid. These soils are not suited to cultivated crops. The hazard of erosion is moderate to severe. These soils is suited to trees. Windthrow is common on the Hollis soil because of the shallow rooting depth. The major limiting factors for community development are the shallow depth to bedrock in many places, and rock outcrop. The Hollis soil is droughty.

These soils are in capability subclass VIIs.

Rn - Ridgebury, Leicester, and Whitman extremely stony fine sandy loams

These nearly level, poorly drained and very poorly drained soils are in drainageways and depressions of glacial till upland hills, ridges, plains, and drumloidal landforms. Stones and boulders cover 8 - 25 percent of the surface. The Ridgebury and Leicester soils have a seasonal high water table at a depth of about 6 inches. The Whitman soil has a high water table at or near the surface for most of the year. Permeability of Ridgebury and Whitman soils is moderate or moderately rapid in the surface layer and subsoil and slow or very slow in the substratum. The Ridgebury and Whitman soils are strongly acid through slightly acid. Permeability of Leicester soil is moderate or moderately rapid, it is very strongly acid through medium acid. Runoff for the Ridgebury and Leicester soil is very slow or slow. Whitman soil runoff is very slow, or the soil is ponded. The available water capacity for these soils is moderate. These soils are not suited to cultivated crops. The erosion hazard is slight. These soils are suited to trees. Windthrow is common because of the shallow rooting depth above the high water table. The major limiting factors for community development are the high water table and the slow or very slow permeability in the substratum.

These soils are in capability subclass VIIs.

Wd - Walpole fine sandy loam

This nearly level, poorly drained soil is on stream terraces and outwash plains. The Walpole soil has a seasonal high water table at a depth of about 6 inches. Permeability is moderately rapid in the surface layer and subsoil and rapid or very rapid in the substratum. The available water capacity is moderate. Runoff is slow. Walpole soil warms up and dries out slowly in the spring. It is very strongly acid or medium acid. This soil is suited to cultivated crops. The hazard of erosion is slight. This soil is suited to trees. Windthrow is common because of the shallow rooting depth above the high water table. The major limiting factor for community development is the seasonal high water table.

This soil is in capability subclass IIIw.

6. TR-55 Review Checklist

SCS-CT-ENG-HYD1-Trial
April 1988

U.S. DEPT. OF AGRICULTURE
SOIL CONSERVATION SERVICE
STORRS, CONNECTICUT

This form should be used in conjunction with Chapter 9 of the Connecticut Guidelines for Sediment and Erosion Control to develop Hydrologic Reports.

This form should also be used with TR-55 (2nd edition) released in June 1986 which provides other hydrologic procedures not noted in Chapter 9.

CHECKLIST FOR REVIEWING REPORTS USING TR-55 ANALYSIS

PROJECT: Pumpkin Hill

LOCATION: Pumpkin Hill Road, Ledyard

BY: Azimuth Engineering

DATE: 6-29-89

1. ____ Watershed Map at a scale of 1" = 500' or larger. Show watershed boundary, subarea boundaries, and subarea names or numbers. (Optional - show Tc, CN, and Drainage Area for each subarea on the map) Contour maps must include some additional area outside the property line boundaries.

2. ____ Large scale map showing different soils within each subarea and subarea boundaries. May also be used to measure drainage areas. Could also show Tc calculation path used for each subarea.

3. ____ Tabulation sheet or computer printout showing Curve Number and Time of Concentration calculations for each subarea. Drainage areas, Hydrologic Soils Groups, and Land Use areas should be documented from soils maps or other references.

4. ____ Tabulation sheet showing calculations and equations used for any storage estimates to design a detention basin or other misc. calculations.

5. ____ TR-55 printout showing graphical or tabular peak discharge calculations. Include printouts for both pre-development and post development conditions. The printout showing the design of a detention basin should be included. These printouts should document the zero discharge increase for all required storms.

6. ____ The written report should state the initial conditions and storm frequencies to be analyzed. Include a summary table showing the pre-development, post development, and designed system peak discharges for all design frequencies. Show a sketch of the structure outlet system with elevations and dimensions.

7. Erosion and Sediment Control Plan Worksheet

EROSION AND SEDIMENT CONTROL PLAN WORKSHEET

This is a guide for the development and review of erosion and sediment control plans. Local commissions should be consulted for regulatory requirements concerning erosion and sediment planning.

Checked ( ) items are those that have been provided on the current erosion and sediment control plan. Items identified with a star (*) should be incorporated into final plans.

Name of development Pumpkin Hill

Materials received preliminary subdivision

Total Area 42 acres Location Pumpkin Hill Road, Ledyard

Engineer Azimuth Engineering

Date Received 6-29-89 Site Visit 6-29-89 Reviewed by SCS

Submitted by Ledyard Planning Dept.

NARRATIVE SECTION DESCRIBING:

_____ The development
_____ Major land uses of adjoining areas
_____ The number of total acres and acres to be disturbed in the project
_____ The schedule of grading and construction activities including start and completion dates.
_____ Application sequence of all E&S control measures
_____ The design criteria for all proposed E&S control measures
_____ Construction details and installation procedures for all proposed E&S control measures
_____ The operations and maintenance program for all proposed E&S control measures
_____ The name of the person or organization that will be responsible for the installation and maintenance of the E&S control measures
_____ Organization or person responsible for maintenance of permanent measures when project is completed. Measures include: _____

A SITE PLAN AT A SUFFICIENT SCALE SHOWING:

Natural Features

_____ Existing topography
_____ Existing vegetation
_____ Soils information, including test pit data if available
_____ Identification of wetlands, watercourses, major drainageways and water bodies on the site
_____ Name of soil scientist who performed wetlands delineations and flag numbers
_____ Rock outcrop areas
_____ Seeps, springs
_____ Major aquifers
_____ Floodplains (100 yr.) and floodways
_____ Channel encroachment line (DEP permit required)
_____ Coastal zone boundary
_____ Public water supply watershed boundaries
_____ Possible Army Corps Sec. 404 or Sec. 10 Permit Areas (Contact Corps @ 1-800-343-4789).

Project Features

_____ The location of the proposed development
_____ A plan legend
_____ Adjacent properties
_____ Property lines
_____ Lot lines and setback lines
_____ Lot and/or building numbers
_____ Planned and existing roads
_____ Proposed structures
_____ Location of existing and planned utilities
_____ Location of wells and septic systems
_____ Proposed Topography
_____ North arrow

Clearing, Grading, Vegetative Stabilization

_____ The sequence of grading, construction, and sediment and erosion control activities
_____ The location of and construction details for all proposed E&S control measures
_____ Recommended measures include _____
_____
_____ Limits of disturbed areas
_____ Extent of areas to be graded
_____ Disposal procedure for cleared material
_____ Location of stockpiled topsoil and subsoil

_____ Temporary erosion control in method for protection of disturbed areas when time of year or
_____ Weather prohibit establishment of permanent vegtative cover
_____ Seedbed preparation (including topsoiling specifications)
_____ Fertilizer and lime application rates
_____ Mulch application rate
_____ Mulch anchoring measures

Drainage System

_____ Existing and planned drainage pattern
_____ Drainage areas used in design of stormwater management system
_____ Size and location of culverts and storm sewers
_____ Drainage calculations for review by town engineer
_____ Stormwater management measures and construction details
_____ Groundwater control measures (footing drains, curtain drains)
_____ Planned water diversions and dams (DEP permit may be required)

House Site Developments

_____ Sediment and erosion control measures for individual lot development

Additional Comments

8. Hydrology

The eastern limits of the subdivision site lie within the Whitford Brook drainage area. The central and western parts drain to Red Brook, which bisects the property in a north-south direction. Red Brook is tributary to Haley's Brook. At its intersection with Route 184, Red Brook drains an area of about 2.40 square miles or 1536 acres. The O'Keefe property represents about 8 percent of this watershed area.

According to the Water Quality Classifications Map of Connecticut. Murphy, 1987, surface water quality of the streamcourses on the site is 'A'. Designated uses for this classification are: potential drinking water supply, fish and wildlife habitat, recreational use, agricultural and industrial supply, and other legitimate uses. In order to maintain the existing natural quality characteristics of the streamcourses on the site, incompatible discharges to the streamcourse would be prohibited. Every effort should be made to protect streamcourses on the site.

Development of the site for residential and commercial purposes would be expected to increase the amount of runoff during periods of rainfall. These increases would result from soil compaction, removal of vegetation, and placement of impervious surfaces (roofs, driveways, parking areas) over the soil.

A hydrologic review was not available on the review day. It is suggested that a hydrologic study that includes a summary report be prepared with the final proposal for the project. The report should demonstrate that no adverse impacts such as flooding or erosion (streambank) are anticipated from increased runoff conditions. Connecticut's Guidelines for Soil Erosion and Sediment Control (1988) should be followed closely. Close examination of culverts passing under Wells Road and Route 184 in Groton and Shrewville Road in Ledyard is warranted.

A detailed and site specific soil erosion and central plan should be developed and implemented for the site. Areas of concern include the proposed roadway crossing of Red Brook and its accompanying wetlands, the steep roadway section in the central parts, storm drain outlets into wetlands and stabilization of the cuts and fills that will be required to construct roads and driveways. A detailed plan should be developed using the criteria contained in the Connecticut Guidelines for Soil Erosion and Sediment Control (1988) and enforced by the Town. (See E&S

Control Plan Worksheet for further information)

Present plans call for two road crossings of Red Brook and its accompanying wetland, which totals about 250 feet. According to the Soil Survey of New London County, Rn soils (Ridgebury, Leicester, and Whitman extremely stony fine sandy loams) parallel Red Brook. The Rn group consists of poorly drained (Leicester and Ridgebury) and very poorly drained (Whitman) soils that occur in drainageways and depressions on glaciated uplands. As a result, these soils are regulated by law and any activity which involves modification, filling, removal of soils, etc. will require a permit and ultimate approval by the Town's Inland Wetland Commission. Topographic conditions in the area covered by Rn soils range from flat to gentle. The water table in the Whitman soil is at or near ground surface for most of the year, but is seasonally high at an average depth of approximately 6 inches below grade in the Ridgebury and Leicester.

Although undesirable, wetland crossings are feasible, provided they are properly engineered. The road should be constructed adequately above the surface elevation of the wetlands. This will allow for better drainage of the road and decrease the frost heaving potential. Road construction through wetlands should be done during the dry time of year and should include provisions for effective erosion and sediment control. Any unstable, organic or mucky material should be removed and replaced with a permeable road base material. Culverts should be properly sized and located so they do not alter the water levels in the wetland or cause flooding problems.

It is understood that there is an access point to the site via Shrewville Road at the eastern limits, but it does not meet the town's 50 foot right-of-way requirement. If the additional land could be acquired so that the 50 foot requirement is met, the need for crossing Red Brook could be eliminated. Based on visual observations made during the field walk, any expansion of the right-of-way would infringe on wetlands and/or watercourses but there is an area of an existing wetland disturbance (gravel road). It is suggested that the applicant be required to study the alternative from a geotechnical, hydrologic and ecologic standpoint. It is expected that the crossing of Red Brook would require more extensive earthwork (unless possibly if it is bridged) and erosion potential than if the right-of-way in the eastern parts is utilized.

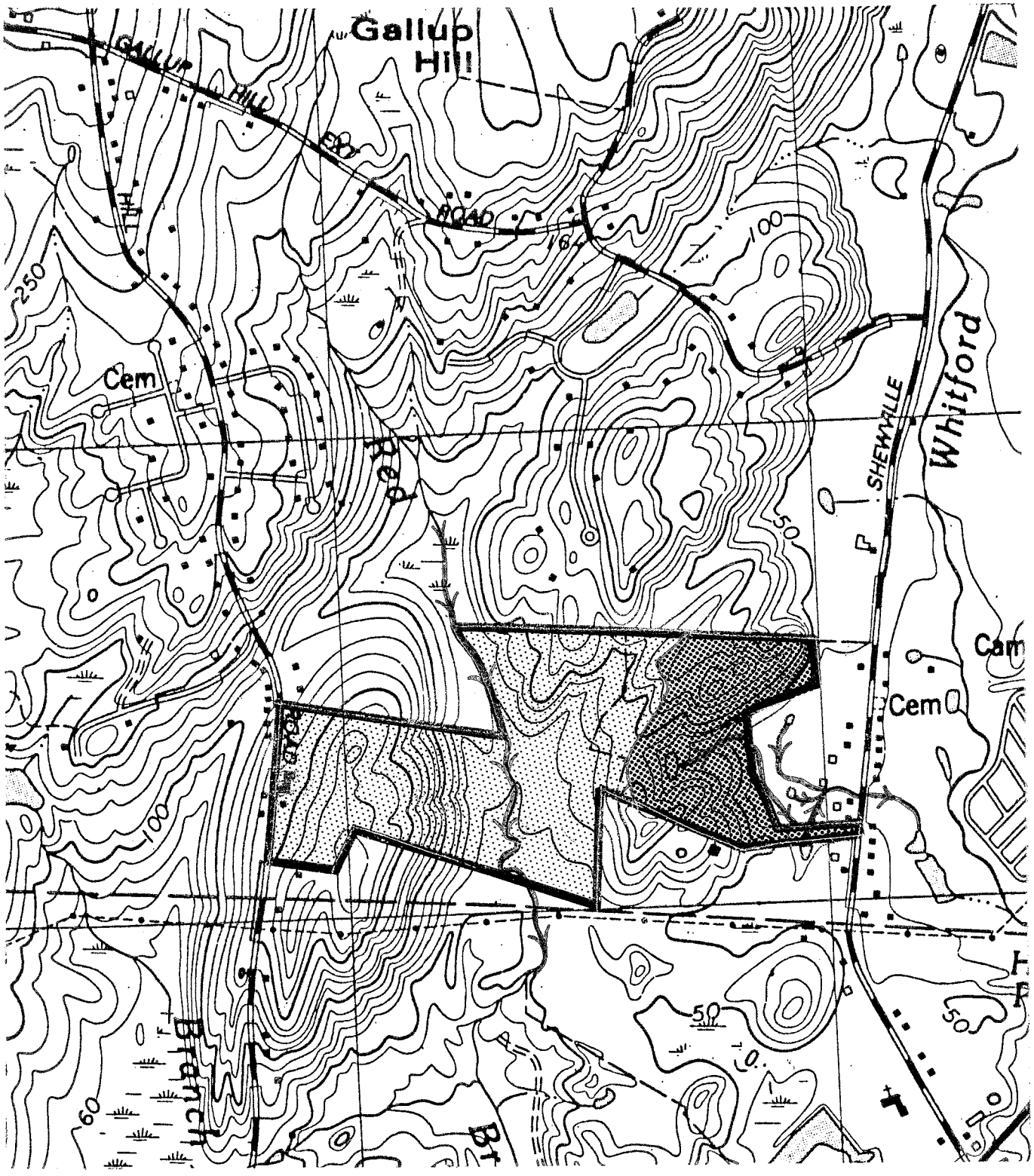
WATERSHED BOUNDARY

Scale 1" = 1000'

Portion of site that drains to Red Brook

Portion of site that drains to Haley's Brook

Watercourses showing direction of flow



9. Wetland Resources

The major wetland/watercourse resource on the property is Red Brook and the associated wetlands. The National Wetlands Inventory Map classifies the area as Palustrine Forested Broad Leaf Deciduous wetlands.

Although stormwater detention is not shown on the plan provided, it was discussed during the ERT meeting. Whenever possible, storm water detention and stormwater discharges should be constructed outside of wetlands, allowing some renovation of water quality, and reduction in water velocities prior to the water entering the wetland system.

The driveway for Lot 12 should be moved to the extreme east of the lot to minimize impacts on the wetlands.

The proposal includes a crossing of Red Brook to service 5 lots. During the ERT meeting, there was discussion of development of the rest of the property to the east of Red Brook, however, at present the developer does not have adequate frontage for access to Shewville Road, and is researching options. The crossing of Red Brook would impose a significant impact to this wetland system. If feasible and prudent alternatives are considered, it may be more prudent for the developer to wait to construct the crossing until the rest of the property can be developed since the cost of the crossing will be extensive, and the benefits of the crossing are private. If the crossing is not done until access has been gained onto Shewville Road, there will be a public benefit by the addition of a east/west road in the area.

Due to the span of wetlands to be crossed, if and when a crossing is made, an elevated crossing should be considered. The Bebo bridge proposed by the applicant would be a good type of crossing. The slopes for the fill approaching the bridge should be minimized to lessen their impacts on the wetlands.

10. Sewage Disposal

Residential Zoned Land

Preliminary subsurface exploration has been conducted for the proposed subdivision only in the western parts. No subsurface information was available for the land east of Red Brook on the review day. Fifteen (15) deep test holes were excavated on the site. Typically encountered in the test holes was topsoil, a weathered and rooted subsoil 2 to 2.5 feet thick, and then a bony till. Ledgerock was encountered at depths less than 60" in 5 of 15 holes. If ledge is encountered in deep test holes at depths less than 60" (5 feet), the area in question would be considered an area of special concern by the Public Health Code. Therefore, in those lots where ledgerock is less than 60", depths to ledge will be an important design constraint. Since the bedrock surface can undulate over a very short distance, it is important to establish a good profile of its surface. This can be accomplished by excavating several deep test holes in the proposed primary and reserve leaching areas. In general, the shallow to bedrock areas appear to be at the northern parts of the eastern section.

Groundwater was not encountered in any of the 15 deep test pits excavated on the site. Mottling, an indicator of high water table was encountered at depths ranging between 2.5' and 5.5' below ground level in several deep test holes. Based on texture and probable permeability of the glacial till on the site, it is considered likely that this mottling is an indicator of seasonally high water. It should be noted that deep test holes were excavated during summer months, when water levels are typically at their lowest.

Based on review of preliminary test pit data more testing needs to be conducted on the site to determine whether or not subsurface conditions are suitable for on-site sewage disposal. Preliminary deep test holes indicate that most lots will require engineered systems. Filled and raised systems will probably be required on most lots. Because of shallow bedrock conditions Lot 5 appears to be unsuitable for subsurface sewage disposal at the present time.

Before an accurate assessment of the site's ability to support on-site sewage disposal systems can be made, a sufficient number of deep test pits is necessary in

the proposed primary and reserve leaching field areas on each lot. Deep test holes either don't exist or are out of proposed leaching field area on most lots.

On-site sewage disposal for the subdivision east of Red Brook appears moderately favorable, but that ledgerock will probably be the major design constraint. Engineered septic systems will probably be required for most lots. The area in the eastern parts most favorable for on-site sewage disposal is in the area of the conifer stand. Soils mapping data indicates the presence of deep, well-drained soils.

Before subdivision approval, the applicant's engineering firm must demonstrate that each of the proposed lots in the subdivision meets the minimum soil standards set forth in Section 19-13e(a)(3) of the State's Public Health Code.

The process should be a coordinated effort between the design engineer and the town's certified sanitarian. Because most of the lots will be deemed of "special concern" by the State Public Health Code, plans for the design of the subsurface sewage disposal facilities (along with the placement of each on-site well water supply) must be prepared by a professional engineer and submitted to the Town Health Department for review and approval by their certified staff.

The final configuration of lots should not be approved until the town is assured of the feasibility of each lot meeting all of the State Health Code Requirements and above listed concerns.

Commercial Zoned Land

Soil testing on the commercially zoned land which comprises about 8 acres has not been conducted to date. Since there are existing buildings in this area, it is expected that they are served by an on-site sewage disposal system. The location and type of sewage disposal system was not available for Team members to review. Due to the size of the parcel (± 8 acres) and soil type (CrC), which is limited by slope and shallow to bedrock condition, the parcel has limited capacity to be developed for commercial purposes. There probably would be sufficient area for construction of a small leaching system (less than 5,000 gallons per day) but detailed site investigations will be required. Discharges to septic system(s) in the commercial

area should be limited to domestic type effluent. This will hopefully reduce the chances for groundwater contamination problems in the area, especially since individual, on-site wells service the area.

11. Water Supply

The water supply for each lot in the proposed subdivision would be derived from drilled (6 inch diameter) wells with steel pipe cased firmly into solid rock and completed as open boreholes in the underlying metamorphic bedrock. In general, the casing should extend at least 5 feet into the bedrock.

A typical well depth for a bedrock well ranges from 150 to 300 feet. Although bedrock is not known to be a prolific aquifer, Water Resources Bulletin No. 15 (Lower Thames and Southeastern Coastal River Basin) indicates that of 274 wells surveyed which tap metamorphic bedrock, 90% yielded 3 gallons per minute or more. Generally speaking, a yield of 2 - 3 gallons per minute is desirable for domestic purposes. A well yielding 3 gallons per minute would be equivalent to 4320 gallons of water for a 24 hour period.

The Team's geologist reviewed well completion reports for 25 bedrock wells that serve homes just north of the site on Huntingways, Avelring Berwick, Brentford Berwick and Chatham Berwick. Yields ranged between 1 and 30 gallons per minute. The medium yield for the wells surveyed is 5 gallons per minute. Depths of the wells varied between 100 feet and 560 feet below ground level.

Because lot sizes are moderate in size (will exceed 1.5 acres or more) and because a high portion (about 95%) of the renovated domestic wastewater will percolate downward to recharge the underlying bedrock via on-site sewage disposal systems, the annual groundwater usage for the site should not exceed annual groundwater recharge. As long as the underlying bedrock is fractured and capable of transmitting water to drilled wells, the bedrock aquifer can be expected to adequately meet the water demands of the proposed subdivision. Lots +1.5 acres in size should permit separating distances of 200 feet between neighboring wells. This appears to be attainable, based on the present layout, and if accomplished, each well would have about 1 acre of recharge per well or abut 595 gallons per day. The latter assumes the recharge rate of about 8 inches per year for an upland till covered site. It is estimated that a family of five would use about 375 gallons per day or 75 gallons per person per day.

In order to provide the adequate protection of the bedrock aquifer, all wells will need to be properly installed in accordance with applicable State Public Health Code and Connecticut Well Drilling Board regulations. Additionally, the Town sanitarian will need to inspect and approve all well locations. The well location for each lot should be shown on the subdivision plan. Note: A well location was not shown on Lot 1 or 11 of the plan.

The natural quality of groundwater should be satisfactory. According to the Water Quality Classification Map of Connecticut (Murphy, 1987) groundwater in the area of the site is classified as GA, which means that it is suitable for drinking water supplies without need for treatment.

12. Fish Resources

Site Description

The proposed residential housing development includes a total of 21 single family housing lots and 1 commercial lot fronting on Pumpkin Hill Road. All lots will be served by on-site wells and septic systems. It is proposed that Red Brook and its associated wetlands be crossed by use of an precast arch bridge to gain access to building lots Numbered 8 through 12. A possibility exists for a future road extension from the proposed cul-de-sac to Shewville Road. This report will address all major impacts to aquatic resources and delineate mitigation measures required to minimize impacts.

Red Brook

Red Brook, a tributary of Haleys Brook, meanders through the proposed development parcel. Instream habitat is comprised of shallow riffles and pools with streambed substrate being mostly gravel and cobble. Waters are relatively slow moving in this low gradient reach of the brook. Stone wall construction along and within the brook have resulted in the creation of numerous and small split channels resulting in the retention of very fine silts in the stream from past runoff events. The stream's riparian (streamside zone) is primarily comprised of wetland vegetation types. Adequate amounts of overhanging vegetation were observed providing beneficial shading and cooling of stream waters, albeit a previous logging operation east of Red Brook has somewhat reduced the effectiveness of the local tree canopy. Water clarity is excellent. The stream does contain various species of rooted aquatic vegetation which is not typical of Connecticut streams; hence, it is suspected that prior runoff events have added nutrients to Red Brook resulting in aquatic vegetation growth.

Surface waters of Red Brook are classified by the Department of Environmental Protection (DEP) as "Class A". Designated uses for this classification are: potential drinking water supply; fish and wildlife habitat, recreational use, agricultural and industrial supply, and other legitimate uses.

Fish Population

Viable fish habitat was observed in the brook. Fish species expected to inhabit this area of the stream and downstream sections are: native (wild) brook trout, longnose dace, blacknose dace, American eel, fallfish, and white sucker.

As previously mentioned, Red Brook empties into Haleys Brook. Haleys Brook contains a very important and diverse coldwater fisheries. In addition to being stocked by the DEP Bureau of Fisheries with yearling brook trout on an annual basis, native brook trout and "wild" (naturally reproduced) brown trout populations have been documented in this stream. Furthermore, since Haleys Brook empties into the Mystic River, "sea-run" brown trout have also been documented in the lower stretches of Haleys Brook.

Impacts

The following impacts of the proposed subdivision on the aquatic resources of Red Brook can be expected if proper mitigation measures are not implemented:

1. **Construction site soil erosion and sedimentation of Red Brook through increased runoff from unvegetated areas :** During construction topsoil within the proposed building lots will be exposed and susceptible to runoff events, especially along the steeply sloped land that lies west of Red Brook. Erosion and sedimentation due to construction has long been regarded as a major cause of stream degradation. Excessive sediment deposition could damage the Red Brook aquatic ecosystem in the following ways:

(1) Sediment reduces the survival of resident fish eggs and hinders the emergence of newly hatched fry. Adequate water flow, free of excess sediment particles is required for fish egg respiration and successful hatching.

(2) Sediment reduces the survival of aquatic insects. Since aquatic insects are important food items in fish diets, reduced insect populations levels in turn will adversely affect fish growth and survival. Fish require an excessive output of energy to locate preferred prey when aquatic insect levels decrease.

(3) Sediment reduces the amount of usable habitat required for spawning purposes. Excessive fines can clog and even cement gravels and other desirable substrate together. Resident fish may be forced to disperse to other areas of Red Brook not impacted by siltation.

(4) Sediment reduces stream pool depth. Pools are invaluable stream components since they provide necessary cover, shelter, and resting areas for resident fish. A reduction of usable fish habitat can effectively limit fish population levels.

(5) Turbid waters impair gill functions of fish and normal feeding activities of fish. High concentrations of sediment can cause mortality in adult fish by clogging the opercular cavity and gill filaments.

(6) Sediment encourages the growth of filamentous algae and nuisance proportions of aquatic macrophytes (CTDEP 1989). Eroded soils contain plant nutrients such as phosphates and nitrates. Once introduced into aquatic habitats, these nutrients function as fertilizers resulting in accelerated plant growth.

(7) Sediment contributes to the depletion of dissolved oxygen (CTDEP 1989). Organic matter associated with soil particles is readily decomposed by microorganisms thereby effectively reducing oxygen levels.

2. **Degradation of wetland habitat :** Proposed building lots include or are located adjacent to "vital riparian" wetland habitat of Red Brook. Wetlands will also be impacted by the proposed road network which will cross Red Brook and its wetlands. Moreover, stormwaters will be most likely discharged into various locations that outlet into wetlands.

Wetlands are beneficial in several ways. They serve to: **(1)** control flood waters by acting as a water storage basin, **(2)** trap sediment from natural and man-made sources of erosion, and **(3)** help filter-out pollutants from runoff before they enter watercourses. Development which brings about polluted stormwaters, excessive stream sedimentation, lawn fertilizers, and lawn herbicides can negatively impact these wetland complexes by hindering their ability to properly function.

3. **Loss of streamside (riparian) overhead vegetation at the proposed road crossing :** Vegetation loss will increase evaporation of exposed stream waters. Trees are very important in that they help cool stream water temperatures in the summer and

provide important cover for resident fishes. Resident fish may be forced to disperse and locate in more suitable sections in lower sections of these streams. The proposed crossing over Red Brook will be accomplished through the construction of an arch bridge. This proposal is environmentally preferable to the use of box culverts since it will not prevent fish passage or result in a substantial loss of instream fisheries habitat or the stream's natural substrate.

4. **Percolation of septic effluent into watercourses :** A failure of individual septic systems to operate properly (refer to Sewage Disposal section) would be potentially dangerous to Red Brook and its wetlands. Septic systems, especially for proposed housing lots adjacent to Red Brook, will be within close proximity (within 100 feet) to designated wetlands. Nutrients and assorted chemicals that may be placed in septic systems could possibly enter wetlands or stream waters in the event of a septic system failure or infiltrate the groundwater during the spring when water tables are close to the surface. Failure of septic systems could inflict long-term damage to local aquatic environments since the introduction of septic effluent could result in a major threat to fish habitat, public health, and overall water quality conditions.

5. **Aquatic habitat degradation in Red Brook due to the influx of stormwater drainage from nearby residential housing :** A detailed stormwater management plan was not available at the time of the review. Stormwaters along the proposed road system will likely be outletted from catch basins at various discharge locations and outletted into downslope areas. The construction of a stormwater detention basin is anticipated. Stormwaters can contain a variety of pollutants that are detrimental to aquatic organisms. Pollutants commonly found in stormwaters are: hydrocarbons (gasoline and oil), herbicides, heavy metals, road salt, fine silts, and coarse sediment. Once introduced into stream environments, stormwater runoff will fertilize stream waters causing water quality degradation. Additionally, fine silts in stormwaters that remain in suspension for prolonged periods of time often cannot be effectively removed from stormwater detention basins. More harmful still are spilled petroleum based chemicals or other toxicants that can precipitate partial or complete fishkills.

6. **Transport of lawn fertilizers and chemicals :** Runoff and leaching of nutrients from fertilizers on lawns will stimulate filamentous algae growth in streams and degrade water quality. Introduction of lawn herbicides can result in "fish kills" and overall water

quality degradation. Rooted or floating aquatic vegetation may proliferate in slower moving stream reaches.

7. **Impacts to downstream environments :** Any water quality problems and habitat degradation that occurs within Red Brook may eventually be observed downstream in Haleys Brook.

Recommendations

The following recommendations should be considered by the Town of Ledyard to mitigate impacts to Red Brook and its associated wetlands.

1. **It is strongly recommended that the subdivision road not cross wetlands and Red Brook:** there is a possibility that roadway access can be obtained from the east off of Shewville Road; this strategy would eliminate any need for a stream crossing. The disturbance of wetlands and Red Brook is unwarranted at this site, especially to access only 5 building lots.

2. **It is highly recommended that at the minimum a 100 foot open space buffer zone be maintained along the wetland boundary of Red Brook:** No construction nor alteration of existing habitat should be allowed in this zone. This buffer can be an effective mitigation measure at this development location. Research has shown that 100 foot buffer zones help prevent damage to wetlands and stream ecosystems that support diverse fish and aquatic insect life (USFWS 1984;USFWS 1986;0DFW 1985). Specifically in regards to streams, these buffers act to: **(1)** filter fine sediment, debris and man-induced pollutants from penetrating streams, **(2)** provide invaluable shading of stream waters which maintain water temperature regimes necessary for survival of cold water fishes such as trout, **(3)** stabilize and prevent excessive undermining of streamside banks by maintaining masses of living roots, **(4)** assist in the regulation of stream hydrology, **(5)** provide fallen trees, woody debris, and leaves necessary for the survival of trout and aquatic insects, **(6)** regulate the natural productivity of aquatic ecosystems by supplying organic detritus to streams.

3. **Install and maintain proper erosion and sedimentation controls during site construction activities :** Silt fences and haybales should be placed within excavated trenches to ensure that all runoff is properly contained. A town official should be responsible for inspecting this development on a daily basis to ensure that

contractors have complied with all stipulated mitigation devices. Past stream siltation disturbances in Connecticut associated with residential housing developments have occurred when individual contractors either improperly deployed mitigation devices or failed to maintain these devices on a regular basis. Proper installation and maintenance of these devices is critical to environmental well being.

4. **The developer should submit a detailed stormwater management plan for town review :** The effective management of stormwaters and roadway runoff can only be accomplished through proper design, location, and maintenance of catch basins and stormwater detention basins that may be constructed. Stormwaters from catch basins should be initially outletted into non-wetland habitat; thus avoiding direct contact with wetlands. Maintenance of catch basins is very critical. Roadway catch basins should be regularly maintained to minimize adverse impacts to riverine/wetland habitats. The use of road salt to deice roads should be prohibited. Catch basins and stormwater detention basins will only trap heavy, coarse sediments reducing the likelihood of excessive stream sedimentation; however, waters that contain pollutants such as hydrocarbons, salts and even small amounts of fine enriched sediments will eventually cause water quality and aquatic habitat degradation. This impact can not be prevented since catch/detention basins will not remove these materials.

5. **Properly design and locate individual septic systems (refer to <u>Sewage Disposal</u> section) :** Accordng to the Fisheries Biologist systems should not be placed adjacent (within 100 feet) to sensitive wetland and aquatic ecosystems. It is crucial that all septic systems be placed in areas that will effectively limit septic effluent. The addition of septic effluent to streams and wetlands can be one of the greatest threats to stream ecology. All septic systems should be maintained on a regular basis. It is also important to prevent the disposal of harmful chemicals into septic systems which may negatively effect operation and possibly result in system failure. Residents should be encouraged to utilize nonphosphate laundry detergents to reduce nutrient loading of the aquatic system.

6. **Limit liming, fertilization, and the introduction of chemicals to subdivision lawns :** This will help abate the amount of additional nutrients to aquatic resources. Non-phosphorus lawn fertilizers are currently available from various lawn care distribution centers.

Literature Cited

CTDEP (Connecticut Department of Environmental Protection) 1989. Non Point Source Pollution: An Assessment and Management Plan. CTDEP, Hartford.

ODFW (Oregon Department of Fish and Wildlife) 1985. The Effects of Stream Alterations on Salmon and Trout Habitat in Oregon. Oregon Department of Fish and Wildlife, Portland, Oregon. 70 pp.

USFWS (United States Fish and Wildlife Service) 1984. Habitat Suitability Information: Rainbow Trout. United States Fish and Wildlife Service, Biological Report FWS/OBS-82(10.124). 64pp.

USFWS (United States Fish and Wildlife Service) 1986. Habitat Suitability Index Models and Instream Flow Suitability Curves: Brown Trout. United States Fish and Wildlife Service, Biological Report FWS/OBS-82/(10.60). 65pp.

13. Planning Review

The proposal would involve about two-thirds of a mile of new streets, serving 21 residential lots and one commercial lot fronting on the east side of Pumpkin Hill Road. The property is bisected by Red Brook, resulting in five of the proposed lot being on the east side of the brook. The developer intends that the road system should eventually extend to, and intersect with, Shewville Road, the next north/south road to the east.

The physical characteristics of the property complicate development and must be carefully considered in the design of the subdivision. The commercially zoned lot and the ten lots immediately behind them (Lots 1 to 3 and 15 to 22) are on land that is comparatively flat or gently sloping, posing fewer development limitations. East of these are 7 lots that occupy an area having a fairly uniform 20/25 percent slope extending to the flood plain of Red Brook. The rather limited area between the toe of the slope and the wetlands associated with Red Brook appears to be the better building land in this part of the subdivision, but it barely accommodates the building locations for two lots.

Another physical feature which may complicate the developers future intention is the steep slope bordering the eastern edge of the subdivision. If the road were to be extended in the future, as suggested by the plan, a significant cut would have to be made through this hillside, which rises about 40 feet in a distance of about 130 feet.

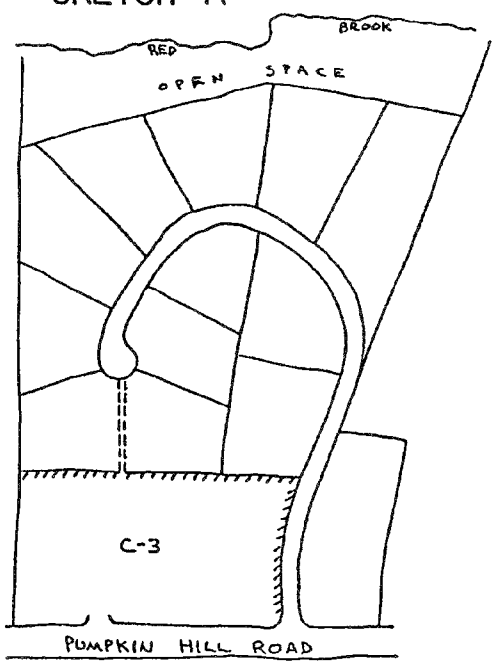
A road crossing of Red Brook will no doubt involve major environmental impacts. If there was some certainty that the road would be extended to Shewville Road within a reasonable period of time, thus providing improved east/west traffic circulation in that part of the town, the public benefits of such a crossing might justify certain adverse impacts. However, it would seem prudent to delay a decision concerning a brook crossing until there is a firm proposal for the development of the land between Red Brook and Shewville Road. This implies that the land lying east of the brook in this proposed subdivision should not be approved for building lots at this time.

Another planning concern involves the impact of the proposed subdivision on the traffic on Pumpkin Hill Road. The Average Daily Traffic (ADT) on this road is

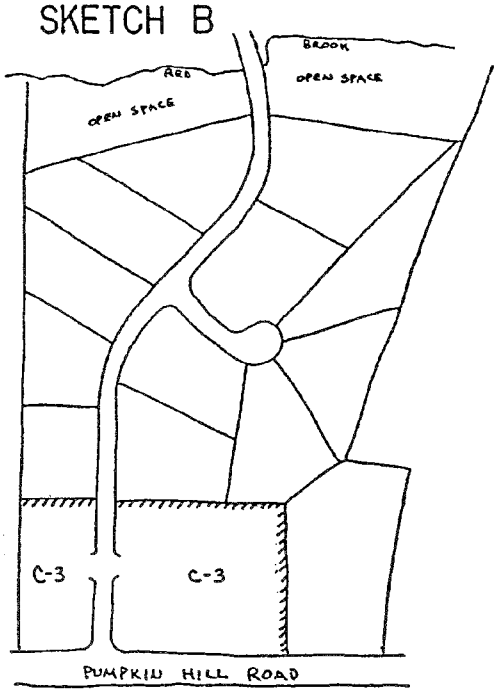
estimated to be 3500 vehicles per day.* This is a lot of traffic on a local road having sub-standard lane widths and virtually no shoulders. Therefore, the numbers of road and driveway intersections should be minimized wherever possible. Two alternatives to the proposed access arrangements are suggested for consideration in the interests of improving traffic safety. These are illustrated below.

ALTERNATE LOT ARRANGEMENTS

SKETCH A



SKETCH B



Sketch A is intended to totally separate the residential part of the subdivision (including its access) from the commercial lots. The new road system would involve a single intersection with Pumpkin Hill Road, serving only the residential lots. More flexibility is retained for the use of the commercial lots since they would not be split by a second road right-of-way. A pedestrian access could be reserved between the cul-de-sac and the commercial property, depending on the nature of the property use.

Sketch B is recommended if it appears likely that the proposed road will be extended to Shewville Road. As a connector road between Shewville Road and Pumpkin Hill Road, part of its traffic is likely to be generated by the commercial uses that occupy the subject property. In that event, driveways to such uses would connect with the proposed road, rather than directly to Pumpkin Hill Road. All traffic turning from or into Pumpkin Hill Road would do so at a single intersection, simplifying traffic control measures.

The developer should be required to estimate the traffic impacts that his development will have on Pumpkin Hill Road if he realizes his intentions of constructing the road through to Shewville Road. The amount of traffic generated by the development will depend on: the number of residential lots in the subdivision (each single family detached residence generates approximately 10 vehicle trips per day); the use of the commercial lot (a broad range of business and retail uses are permitted in the C-3 Zone); and the amount of through traffic the new connecting road attracts (with so few good east/west roads in this part of the town, through traffic may be significant). Traffic-control devices or improvements to Pumpkin Hill Road in this location may be essential to the safe and efficient movement of future traffic.

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* Based on an increase of 2% per year for an ADT of 3400 vehicles per day in 1987, as reported by the Connecticut Department of Transportation for a location on Pumpkin Hill Road north of the intersection with Route 184.

ABOUT THE TEAM

The Eastern Connecticut Environmental Review Team (ERT) is a group of professionals in environmental fields drawn together from a varety of federal, state and regional agencies. Specialists on the Team include geologists, biologists, foresters, soil specialists, engineers and planners. The ERT operates with state funding under the supervision of the Eastern Connecticut Resource Conservation and Development (RC&D) Area — an 86 town region.

The services of the Team are available as a public service at ***no cost*** to Connecticut towns.

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 reviewing a wide range of projects including subdivisions, landfills, commercial and industrial developments, sand and gravel excavations, elderly housing, recreation/ open space projects, watershed studies and resource inventories.

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 town commissions such as planning and zoning, conservation, inland wetlands, parks and recreation or economic development. Requests should be directed to the chairman of your local Soil and Water Conservation District and the ERT Coordinator. A request form should be completely filled out and should include the required materials. When this request is approved by the local Soil and Water Conservation District and the Eastern Connecticut RC&D Executive Council, the Team will undertake the review on a priority basis.

For additional information and request forms regarding the Environmental Review Team please contact the ERT Coordinator: **203-345-3977, Eastern Connecticut RC&D Area, P.O. Box 70, Haddam, Connecticut 06438.**