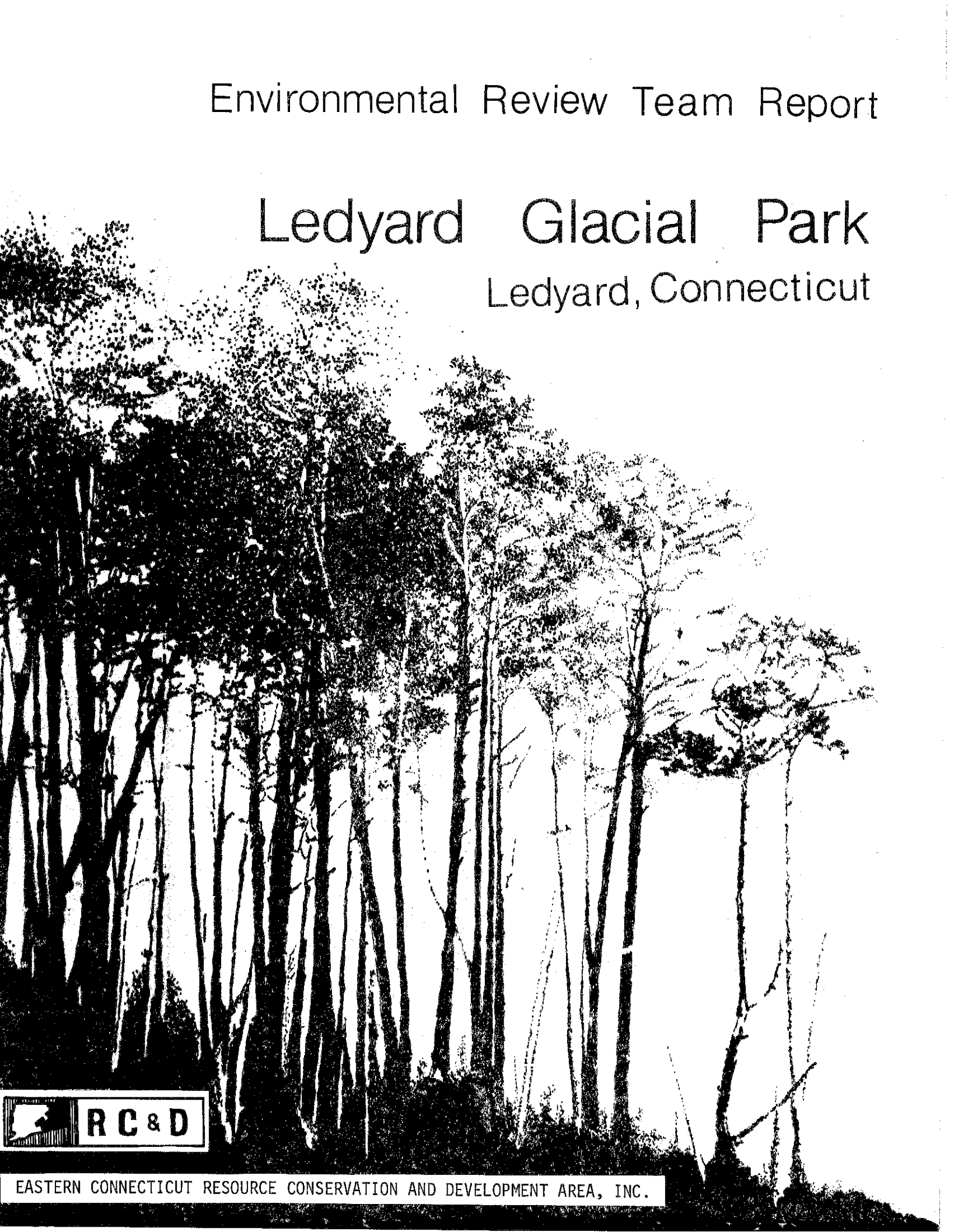
Environmental Review Team Report

Ledyard Glacial Park

Ledyard, Connecticut



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EASTERN CONNECTICUT RESOURCE CONSERVATION AND DEVELOPMENT AREA, INC.

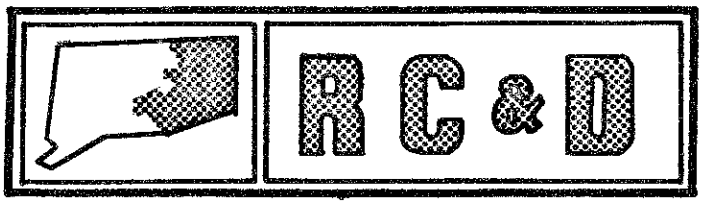
Environmental Review Team Report

on

Ledyard Glacial Park

Ledyard, Connecticut

June 1979

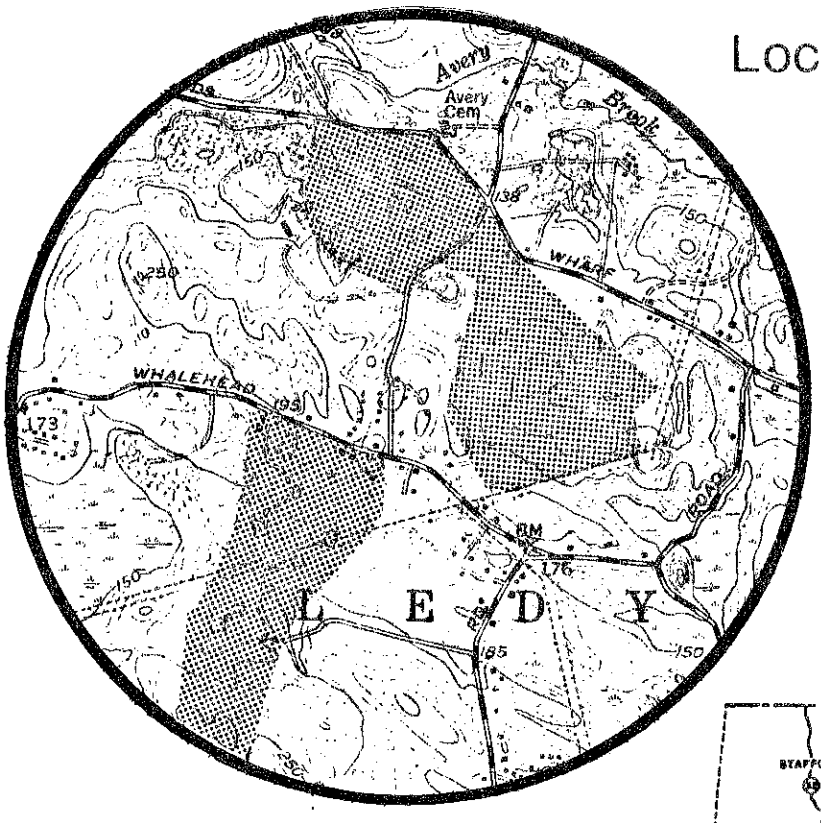


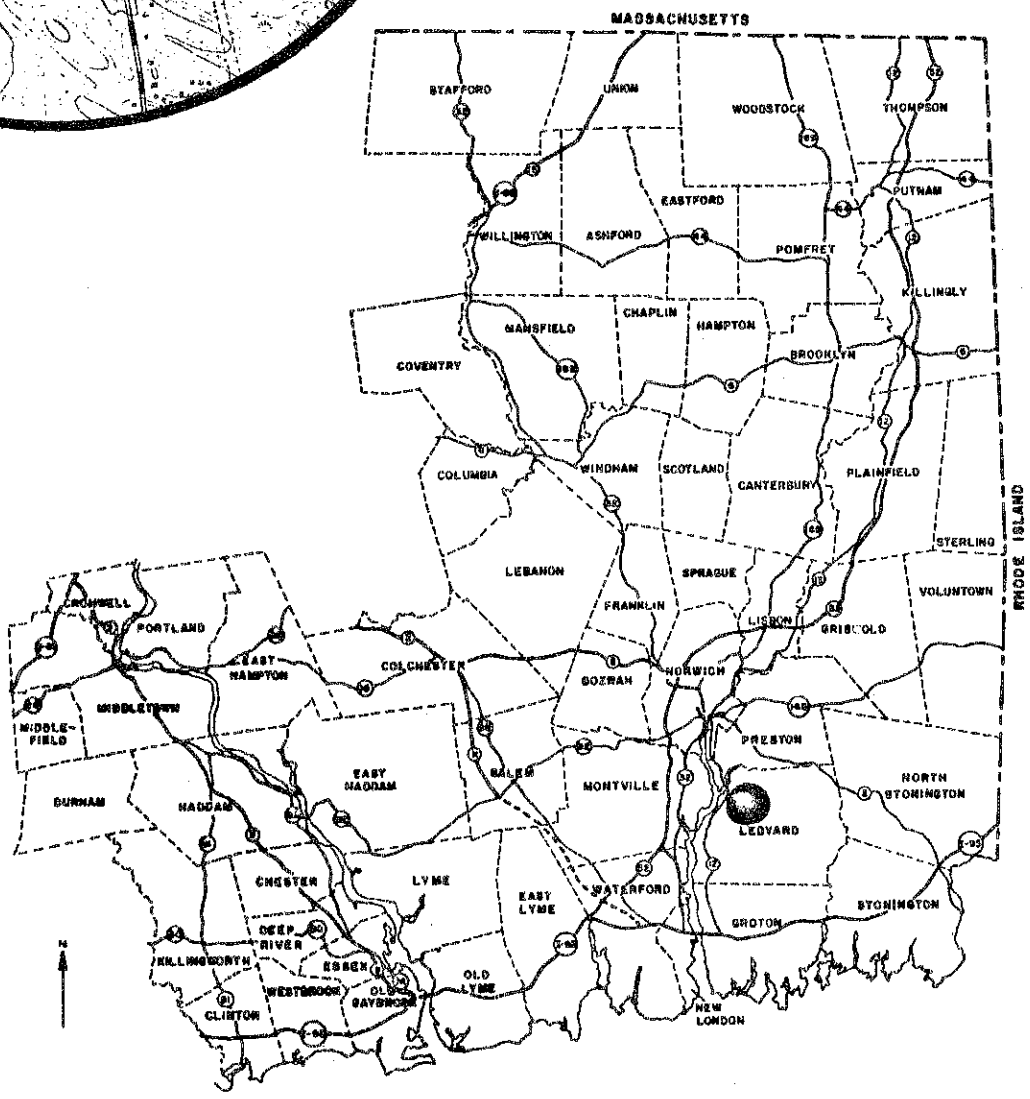
eastern connecticut resource conservation & development area

environmental review team
139 boswell avenue
norwich, connecticut 06360

Location of Study Site

LEDYARD GLACIAL PARK
LEDYARD, CONNECTICUT





EASTERN CONNECTICUT
RESOURCE CONSERVATION AND DEVELOPMENT PROJECT

ENVIRONMENTAL REVIEW TEAM REPORT
ON
LEDYARD GLACIAL PARK
LEDYARD, CONNECTICUT

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

The soils of the site were mapped by a soil scientist from the United States Department of Agriculture, Soil Conservation Service (SCS). Reproductions of the soil survey map, a table of soils limitations for certain land uses and a topographic map showing property boundaries were distributed to all Team members prior to their review of the site.

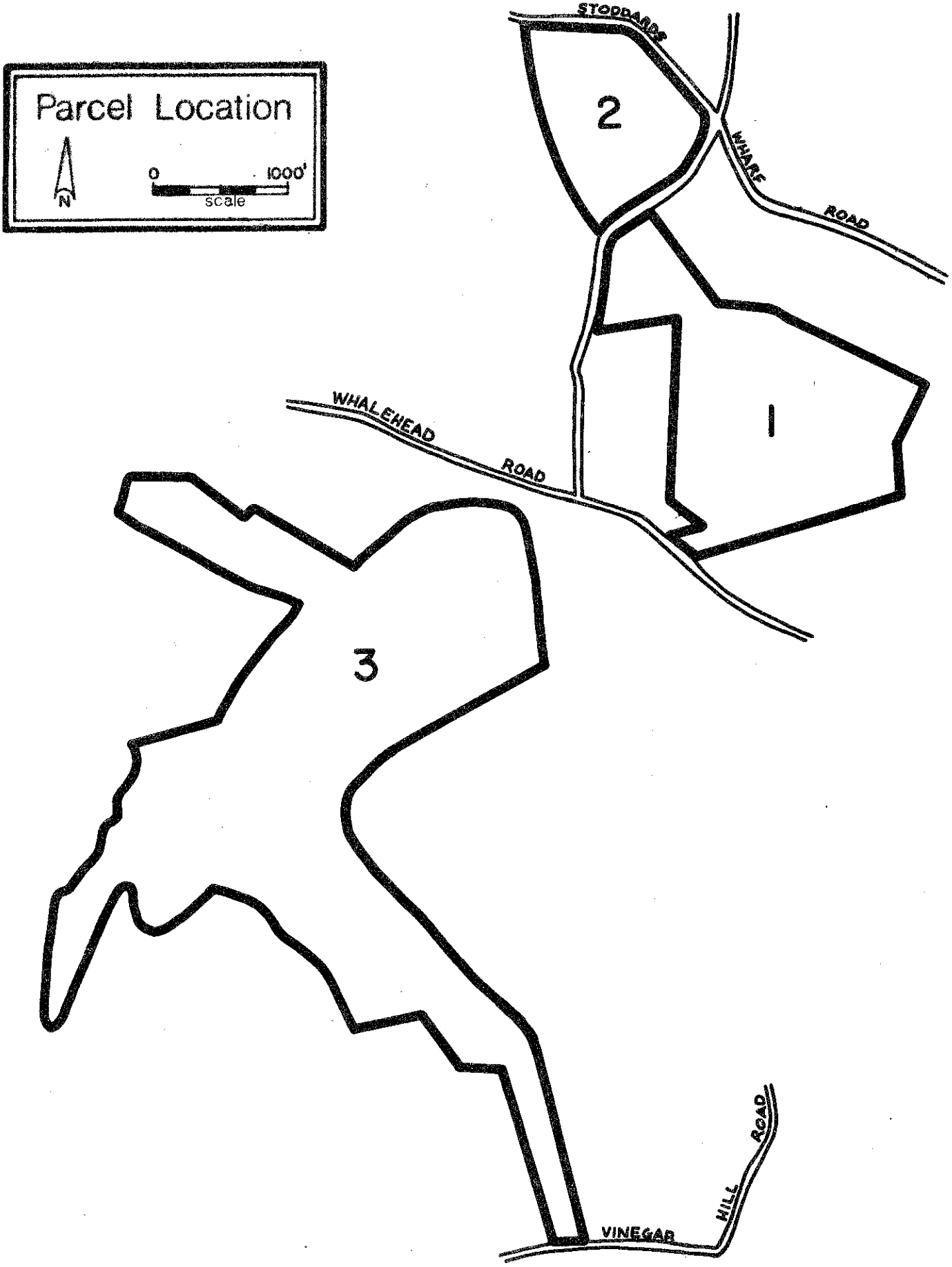
The ERT that field-checked the site consisted of the following personnel: Gary Parker, District Conservationist, SCS; Mark Traceski, Soil Conservationist, SCS; Rob Rocks, Forester, Connecticut Department of Environmental Protection (DEP); Michael Zizka, Geologist, DEP; Andy Petracco, Recreation Specialist, DEP; Richard Krueger, Geologist, DEP; William Wadleigh, Archeologist, PAST; Gerhard Amt, Regional Planner, Southeastern Connecticut Regional Planning Agency; and Jeanne Shelburn, ERT Coordinator, Eastern Connecticut RC&D Area.

The Team met and field checked the site on Thursday, April 12, 1979. Reports from each contributing Team member were sent to the ERT Coordinator for review and summarization for the final report.

This report is not meant to compete with private consultants. As requested by the Town, this report, which identifies the existing resource base of the Ledyard Glacial Park, shall constitute the environmental assessment portion of the Town's open space application for Federal Department of the Interior, Heritage Conservation and Recreation Service funds to assist in the acquisition of this property.

The Eastern Connecticut RC&D Area Committee hopes that this report will be of value and assistance in making any decisions regarding this particular site.

If you require any additional information, please contact: Ms. Jeanne Shelburn, Environmental Review Team Coordinator, Eastern Connecticut RC&D Area, 139 Boswell Avenue, Norwich, Connecticut 06360, 889-2324.


Parcel Location
N
0
1000'
scale
STODDARD
2
WHARF
ROAD
1
WHALEHEAD
ROAD
3
VINEGAR
HILL
ROAD

DESCRIPTION OF THE PROPOSAL

The Ledyard Conservation Commission proposes to acquire several tracts of land in Ledyard which contain well-preserved features of glacial activity that occurred in this area several thousands of years ago. The sites being considered for initial acquisiton contain several dry kettle holes and a large deposit of huge boulders. The features are unique in this area and represent an excellent source of information on glacial history.

The sites are located on either side of Avery Hill Road Extension, to the north of Whalehead Road. An objective of the Conservation Commission is to acquire land or easements to preserve all of the major glacial remnants in Ledyard, both north and south of Whalehead Road, and link them together by a system of trails. The purpose is to afford present and future generations the educational experience of viewing these features.

Parcels for acquisition have been divided into three separate areas as indicated in the accompanying illustration. Parcel 1 is being considered for immediate acquisition, Parcel 2 is ranked as next most important in the Park's development, and Parcel 3 is considered in the long-range planning for the Park.

The glacial features are located in an area of Ledyard containing other significant natural and historic objects and areas. Just north of the site is a 75-acre tract of woodland owned by the Mashantucket Land Trust. Southeast of the site is the Ledyard Oak Park, a publicly-owned historic district which contains the Ledyard Oak Tree and the Nathan Lester House. The latter is a restored 18th Century farm house and is open to the public. The Lester House and the Oak Tree are surrounded by 100 acres of publicly-owned woodland. Ideally, the Mashantucket Land Trust holdings on Avery Hill Road, the glacial features, and the Ledyard Oak Park would be interconnected with trails to make their varied features accessible to the public.

The glacial remains have long been identified as assets worthy of public attention. Ledyard's Plan of Development, adopted by the Ledyard Planning Commission in 1972, and the Town's Conservation Plan, adopted by the Ledyard Conservation Commission in 1974, recommend preservation of the areas containing these land forms. Some of the areas containing glacial features are identified in the Regional Development Plan for Southeastern Connecticut, adopted by SCRPA in 1976.

DESCRIPTION OF THE ENVIRONMENT

PRESENT/PAST LAND USES

The sites are presently unused and wooded. The zoning for the area proposed for acquisition east of Avery Hill Road Extension is R-60, a zone intended primarily for low-density, single-family residences on lots containing at least 60,000 square feet. The land westward of Avery Hill Road Extension is zoned industrial.

EXISTING SOCIO/ECONOMIC CONDITIONS

Ledyard's current population is 16,500 according to the 1978 estimate by the State Department of Health. East Lyme is the only town in the region that has exceeded Ledyard in growth during this decade.

Ledyard is a predominantly residential community, with its economy closely tied to the defense activities in neighboring Groton. The 1970 Census revealed that children represent a disproportionately high percentage of the population. This age group is 10% larger in Ledyard than the average for Southeastern Connecticut, reflecting the high number of large families in the Town. The Census also disclosed that 98.5% of the population is White, one percent Black and one-half of one percent Other (Indian, Japanese, Chinese or Filipino). Median family income for Ledyard topped all other towns in the region in 1969, at $12,237.

The proposed Glacial Park is located along the fringes of the most built up section of Ledyard. Several major subdivisions lie immediately to the south and west of the area.

EXISTING TRANSPORTATION ROUTES

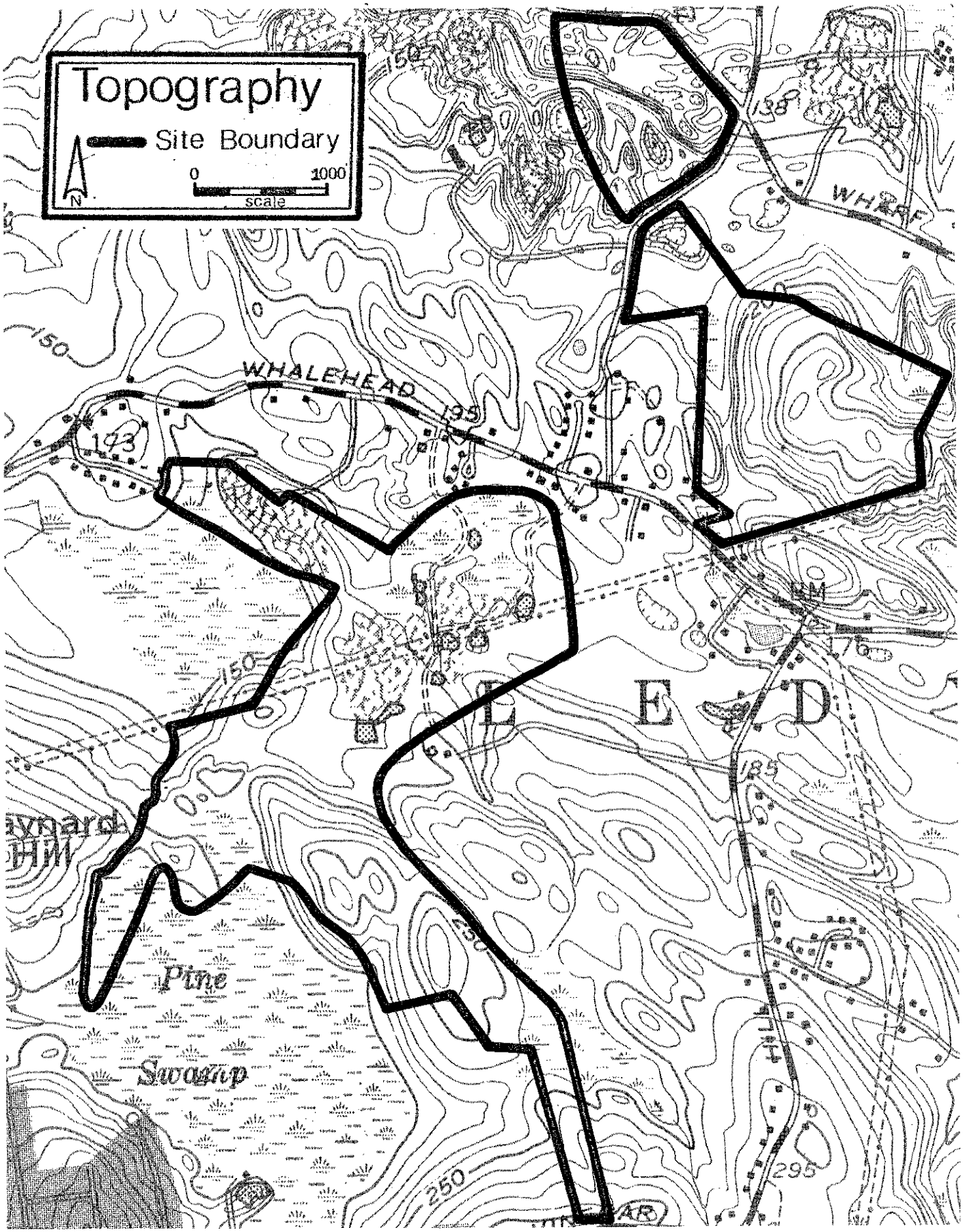
The proposed park area is served by State Route 214 and several narrow, winding Town roads: Whalehead Road, Avery Hill Road Extension and Vinegar Hill Road.

ARCHEOLOGICAL RESOURCES

The assessment of cultural resources usually involves several stages of investigation. These normally include an examination of written records and documents, informant contacts, surficial walkover, and a program of subsurface testing. The scope of 'feasibility studies' such as this, precludes such comprehensive investigation of the archaeological record. As a result, the study of cultural resources in the proposed Ledyard Glacial Park was restricted to a surficial walkover from which some preliminary inferences can be made.

Specific cultural resources are usually assessed in relation to the local environmental setting and its relevance to prehistoric subsistence and settlement patterns. The archaeological potential of an area can be determined on the basis of some broad topographic, physiographic and vegetational criteria such as soil type, slope, drainage, distance to water, and species composition. Preferences for site locations are generally associated with areas having good drainage and slope gradients of less than 10%. High site density zones are often located in areas of abundant floral and faunal resources such as rivers, streams, swamps and marshes. Within the project area, Pine Swamp may constitute one such important resource zone.

Research in other portions of Connecticut has demonstrated that wetlands such as marshes and coniferous swamps may have been particularly attractive as site locations for aboriginal inhabitants of Connecticut. Specific locations for sites associated with swamps and marshes tend to be on well-drained bluffs and knolls which border these wetlands. The presence of this type of feature in the vicinity of Pine Swamp makes it a likely place for the location of prehistoric archaeolgical sites.


Topography
Site Boundary
N
0
1000
scale
WHALEHEAD
WHARF
Pine
Swamp
E E D
150
195
143
185
295
250

Ethnohistorical sources attest to the intensity of aboriginal activities throughout southeastern Connecticut. The location of numerous late Mohegan and Pequot villages and forts along the Thames River is well known. In addition, the Town of Ledyard is the site of the first, and currently oldest, extant Indian Reservation in the State of Connecticut. This wealth of ethnohistorical information should prove useful in determining to what degree lands in the vicinity of the proposed Glacial Park, might have been aboriginally utilized.

The limited subsurface disturbances suggested for the initial phases of proposed park development would not seem to seriously threaten any extant archaeological sites. However, greater public accessibility, in and of itself, often increases the likelihood of site visibility and disturbance. Any park development which involves soil disturbance or which increases the chances of soil erosion (such as that resulting from foot traffic), should be more carefully examined.

With the exception of a stone tunnel (locally referred to as a cattle crossing), which passes beneath Avery Hill Road, no other historic structures were noted within the project area. However, the short amount of time, and cursory nature of these investigations, makes it impossible to present a definitive statement concerning the historical archaeological potential of the project area. In order to adequately assess the impact of development on the archaeological resources in the area, it is recommended that the following procedural steps be initiated:

1. A complete title search of the area from the founding of Ledyard to the present.

2. An archaeological survey of the proposed park area, particularly those areas bordering, and in the vicinity of Pine Swamp.

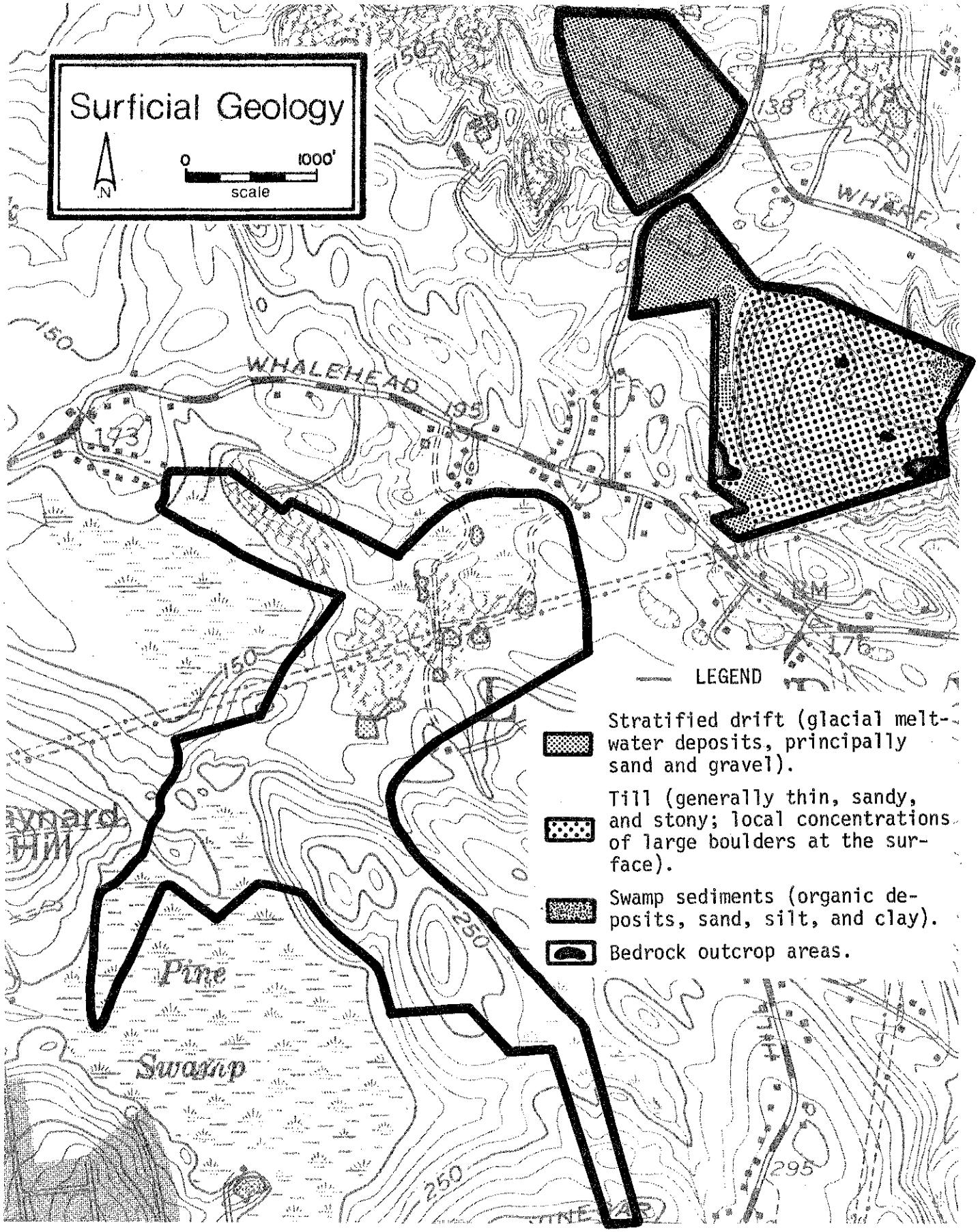
TOPOGRAPHIC FEATURES

Numerous dry basins are located in the stratified drift deposits of Section 2 and part of Section 1. The largest basin, located in Section 1, is about 600 feet wide and 40 feet deep; the deepest basin, on the western border of Section 2 is about 500 feet wide and 60 feet deep. The basins were formed during glacial retreat, when sand and gravel was deposited by meltwater around blocks of stagnant ice that had calved off the main body of the ice sheet. When the ice blocks melted, the sand and gravel collapsed, leaving enclosed depressions. Where two basins are very close together, the intermediate stratified drift forms a ridge, as along the west central area of Section 2.

SURFACE AND SUBSURFACE GEOLOGIC CHARACTERISTICS

The proposed park lies within the Uncasville topographic quadrangle. Surficial and bedrock geologic maps of the quadrangle have been published by the U.S. Geological Survey (Maps GQ-138 and GQ-576, respectively). Both maps are by Richard Goldsmith.

Map GQ-576 shows several bedrock units within the boundaries of the site, but only one type is exposed. That type is a gray, fine- to medium-grained, gneissic


Surficial Geology
N
0
1000'
scale
WHALEHEAD
WHARF
Pine
Swamp
LEGEND
Stratified drift (glacial melt-water deposits, principally sand and gravel).
Till (generally thin, sandy, and stony; local concentrations of large boulders at the surface).
Swamp sediments (organic deposits, sand, silt, and clay).
Bedrock outcrop areas.

granite. Non-exposed units consist largely of gneissic granites of slightly different mineralogy, but they also include other gneisses, schists, quartzites, and amphibolites.

The bedrock is covered in most places by unconsolidated deposits of glacial origin. The upland area of Section 1of the proposed park consists largely of till. Till is a nonsorted material composed of rock fragments of widely varying sizes and shapes. These fragments were plucked or abraded from preglacial bedrock outcrops, or scooped up from a former soil zone, by the action of moving glacier ice. The till was later redeposited directly from the ice without being substantially reworked by meltwater. The lower-lying area of Section 1 and all of Section 2 of the site are covered by stratified drift deposits. These sediments, which consist largely of sand and gravel, were washed from a wasting mass of glacier ice and deposited in meltwater streams or pools. The stratified drift ranges in thickness from approximately 30 feet to approximately 100 feet.

SOILS

The soils found on the Glacial Park site fall into the following categories:

The Adrian series (91) consists of nearly level, very poorly drained soils in depressional areas within outwash plains, lake plains, till plains, and moraines. They formed in mucky organic deposits, 16 to 51 inches thick, over sandy mineral deposits. Adrian soils have rapid permeability and a high water table at or near the surface 9 to 10 months of the year. Major limitations are related to wetness and low strength.

The Agawam series (96B) consists of nearly level and gently slopes, well-drained soils on outwash plains and stream terraces. The formed in water-sorted sands. Agawam soils have moderately rapid permeability in the surface layer and subsoil, and rapid permeability in the substratum. They have few limitations.

The Canton series (11MC, 11MD, 11XB) consists of gently sloping, sloping, moderately steep, and steep, well-drained soils on uplands. They formed in a fine sandy loam mantle underlain by friable gravelly sand glacial till. Canton soils have moderately rapid or rapid permeability. Major limitations are related to slope and stoniness.

The Carlisle series (92) consists of nearly level, very poorly drained soils in bogs and other depressional areas within lake plains, outwash plains, till plains, and moraines. They formed in muck deposits greater than 51 inches thick. Carlisle soils have slow to rapid permeability and a high water table at or near the surface 9 to 10 months of the year. Major limitations are related to wetness and low strength.

The Charlton series (11MC, 11MD, 11XB, 17LC, 17LD) consists of gently sloping, sloping, moderately steep, and steep, well-drained soils on uplands. The formed in friable glacial till. Charlton soils have moderate to moderately rapid permeability. Major limitations are related to slope and stoniness.

The Hinckley series (60C, 60D) consists of nearly level, gently sloping, sloping, moderately steep, and steep, excessively drained soils on stream terraces, outwash plains, kames, and eskers. They formed in water-sorted outwash. Hinckley

soils have rapid and very rapid permeability. Major limitations are related to slope and droughtiness.

The Hollis series (17LC, 17LD, 17MC, 17MD) consists of gently sloping, sloping, moderately steep, and steep, shallow, well-drained soils on uplands where relief is influenced by the underlying bedrock. They formed in glacial till less than 20 inches deep, over granite, gneiss, and schist bedrock. Hollis soils have moderate permeability. Major limitations are related to depth to bedrock, rockiness, and slope.

The Merrimac series (70B) consists of nearly level, gently sloping, and sloping, well-drained soils on stream terraces, outwash plains, kames, and eskers. They formed in water-sorted outwash. Merrimac soils have moderately rapid or rapid permeability in the surface layer and subsoil, and rapid permeability in the substratum. They have few limitations.

The Narragansett series (6MC, 6MD) consists of gently sloping, sloping, and moderately steep, well-drained soils on uplands. They formed in silt-mantled, friable glacial till. Narragansett soils have moderate permeability in the surface layer and subsoil, and moderately rapid or rapid permeability in the substratum. Major limitations are related to stoniness.

The Ninigret series (25A) consists of nearly level and gently sloping, moderately well-drained soils on stream terraces and outwash plains. They formed in water-sorted outwash. Ninigret soils have moderately rapid permeability and a seasonal high water table at 18 to 24 inches. Major limitations are related to wetness.

Rock outcrop (17MC, 17MD) consists of exposed, weathered, and unweathered granite, gneiss, and schist bedrock. There are also areas of reddish brown micaceous schist bedrock.

The Sutton series (41XB) consists of nearly level and gently sloping, moderately well-drained soils on uplands. They formed in friable glacial till. Sutton soils have moderate or moderately rapid permeability, and a seasonal high water table at 18 to 24 inches. Major limitations are related to stoniness and wetness.

The Tisbury series (45A) consists of nearly level and gently sloping, moderately well-drained soils on stream terraces and outwash plains. They formed in silt-mantled glacial outwash. Tisbury soils have moderate permeability in the surface layer and subsoil, rapid or very rapid permeability in the substratum, and a seasonal high water table at 18 to 24 inches. Major limitations are related to wetness.

No significant erosion or plant maintenance problems in Parcel 1 were existing at the time of the review. The proposed environmental education activity does not pose any threat to the soil or plants of the site. (soils charts and descriptions.) The Adrian (91) soils are subject to flooding.

The proposed use will not have a significant effect on other land uses, water resources, or vegetation if motor vehicles can be successfully excluded. If disturbed, 96B, 60C, and 60D soils will be difficult to revegetate.

All the soils in Parcel 2 are droughty and would be difficult to revegetate if disturbed. No problems are anticipated with the proposed use.

The northwest section of Parcel 3 is almost entirely an abandoned borrow pit without topsoil. The exposed soil is a sand so fine that it is being windblown. There is a large, but currently stabilized, gulley draining to the south halfway into this section. A massive area west of this section is under active sand and gravel removal to below the watertable.

This section of Parcel 3 is of little wildlife value and extremely sensitive to erosion forces. Restoration of this area will be expensive and difficult. The 91 and 92 soils are flood prone. The 96B, 70B, and 25A soils are classified as prime farmlands by the U.S. Department of Agriculture.

CLIMATE

The climate is typical of southern New England. Cool dry air from the sub-arctic regions of North America and moist warm air from the Gulf of Mexico have a major effect on day-to-day weather.

Average winter temperature is 29°F and average summer temperature is 69°F. The length of the growing season varies from 180 to 220 days, but averages about 200 days. Annual precipitation averages nearly 48". Seasonal snowfall averages 26". Winter storms moving northeastward along the coast frequently bring rain and thawing, and then more snow and cold weather.

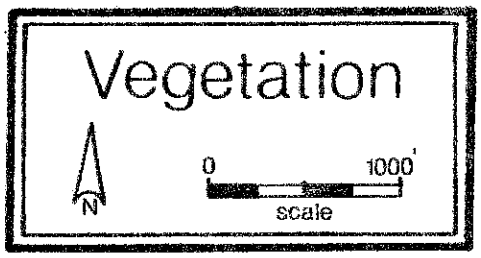
WATER RESOURCES

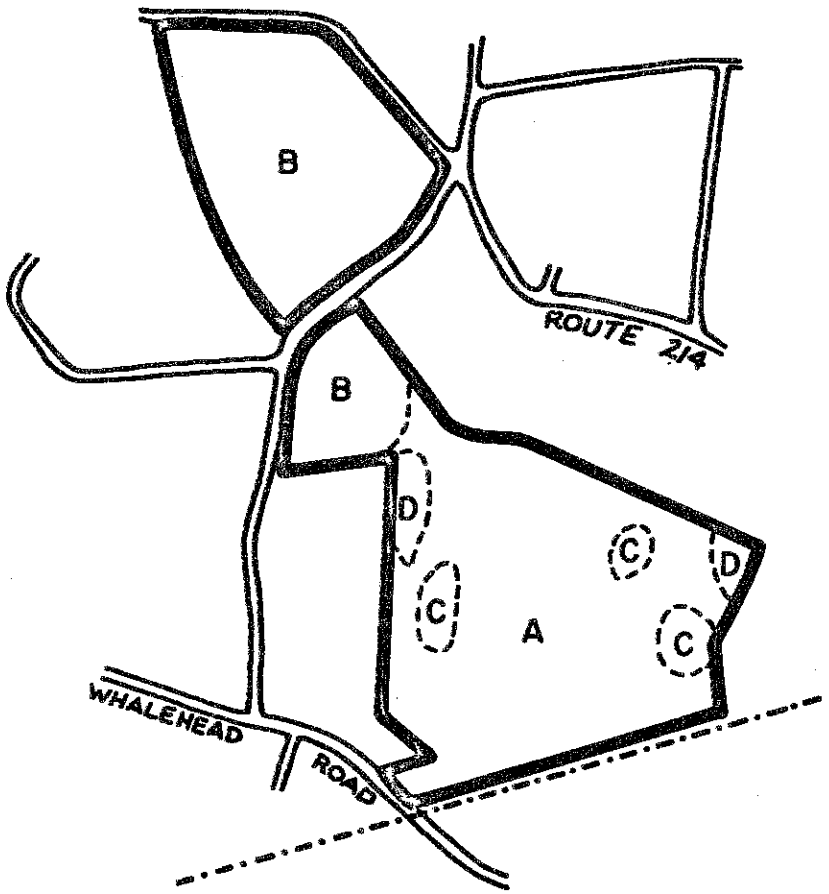
In most places within Section 2, the groundwater table appears to be at a depth of ten feet or more below the land surface. Near the bottoms of several of the larger basins, the water table may be closer to the surface. In the till-covered portion of Section 1, groundwater is probably within five feet of the surface of both the compact nature of the till, which restricts water movement through the overburden, and the proximity of bedrock to the surface.

Water derived from bedrock in Section 1 would probably be of good quality, although a very slight possibility of high iron or manganese concentrations exists. Although the natural quality of groundwater derived from the stratified drift deposits would also be expected to be good, it is likely that the industrial operations adjacent to the site have degraded the water qualtiy to some extent. The stratified drift in this area would not be recommended as a site for high-yielding water-supply wells.

VEGETATION

Rockiness, and in some places steep slopes, have limited land uses in this area. Those areas which are relatively flat (parts of Stand B) were cleared and possibly used for pasture during colonial times. Periodically, the vegetation growing in Stand B has been utilized for either sawlogs or fuelwood. In recent years cordwood has been removed from the most accessible sections of Stand B. The





LEGEND

- Road
- Property Boundary
- Vegetation Type Boundary
- Utility Lines

LEGEND*

STAND A Mixed hardwoods, under-stocked to fully stocked, pole size, 50-acres.

STAND B Mixed hardwoods, fully-stocked, pole size, 41-acres.

STAND C Mixed hardwoods. Same as Stand A but with dense mountain laurel, 5-acres.

STAND D Hardwood swamp, under-stocked to fully-stocked, pole size, 3-acres.

* Seedling size = less than 1 inch in diameter at breast height (DBH).
Sapling size = 1 to 5 inches in DBH.
Pole size = 5 to 11 inches in DBH.
Sawlog size = 11 inches and greater in DBH.

residual trees in this area have taken advantage of the reduced competition and are now growing more vigorously than the trees in the parts of Stand B that have not received a thinning.

Vegetation Type Description:

Stand A. Mixed Hardwoods. Poor quality, pole-size black oak, scarlet oak, white oak, black birch, and shagbark hickory are present in this 50-acre stand which is fully stocked on the hillsides and understocked on the droughty hill tops. Management of the vegetation in this area is severely limited by steep slopes and numerous boulders. Hardwood tree seedlings dominate this site's understory. Occasional sassafras, mapleleaf viburnum, mountain laurel, rhododendron and white pine are also present. Ground cover vegetation consists of lowbush blueberry, huckleberry, club mosses, and several species of ferns including rock polypody, hayscented fern, and Christmas fern.

Stand B. Mixed Hardwoods. Pole size black oak, scarlet oak, white oak, shagbark hickory, and black birch are present with scattered American beech and red maple in this 41-acre fully stocked stand. The total volume on this medium-quality site ranges between 10 and 13 cords per acre. The tree mortality in this stand is noteworthy, and may become a hazard as trails are developed. Dead trees could be removed and utilized as fuelwood. Revenue from such sales could be used for trail development. The understory is dominated by hardwood tree seedlings, including red maple, American beech, oak, and hickory with highbush blueberry, speckled alder, viburnum, and scattered mountain laurel. Ferns, clubmosses, rattlesnake plantains, partridgeberry, wild strawberry, dewberry, cinquefoil, and pipsissewa make up the herbaceous ground cover. The topography in this area is variable, with numerous kettleholes predominating. The vegetation in these kettleholes is similar to that of the surrounding area; however, the density of understory shrub vegetation is greater.

Stand C. Mixed Hardwoods. This 5-acre stand is identical to Stand A; however, mountain laurel and rhododendron, rather than being scattered, form a dense thicket in the understory.

Stand D. Hardwood Swamp. Pole-size red maple with occasional black birch, yellow birch, and blackgum occupy this 3-acre site. Stocking density is variable, ranging from understocked to fully-stocked. Highbush blueberry, sweet pepperbush, greenbrier, and scattered white pine form a dense understory throughout much of this wetland. Poison ivy, skunk cabbage, cinnamon fern, hayscented fern, sedges, and sphagnum moss are also present.

WILDLIFE

Wildlife usage of the site is light except for those favoring dead trees. The area also seems good for chipmunks and squirrels but little evidence of them was seen. The most woodpecker activity was in trees on the 11MD soil. Generally, the site was notable for an absence of visible wildlife. Wildlife disturbance will not be an important factor in use of this site. The powerlines and old logged areas have the most wildlife value.

PROBABLE FUTURE ENVIRONMENT

If the project is not initiated, it is probable that portions of the site will come under development pressure. Subdivision development as well as land uses other than open space (i.e. solid waste disposal site) would destroy many of the glacial features which the Town hopes to preserve.

ENVIRONMENTAL IMPACT

QUANTIFIABLE LAND USE CHANGES

Acquisition of the land east of Avery Hill Road Extension is not likely to affect land uses significantly. The physical characteristics of the land make it difficult to develop, with the exception of land fronting on the road. Steady residential growth of the areas surrounding the site will probably continue and not be affected by the acquisition. Since the site is far removed from commercial areas, it is not expected to influence commercial activity in any way.

SOCIO/ECONOMIC CHANGES

The area of the site west of Avery Hill Road Extension is more susceptible to development because of its zoning, soils, and ownership. (It is owned by Charles Pfizer, Incorporated.)

EFFECT ON TRANSPORTATION ROUTES

Roads in the area of the proposed Glacial Park are winding and narrow, and any significant increase in traffic would increase road hazards. If more than occasional use of the proposed Park occurs, adequate off-street parking must be provided.

GENERATION OF SOLID WASTES

Acquisition of this parcel will not cause any direct generation of solid waste. Development of the parcel, however, may cause undesirable litter problems without proper planning.

EFFECT ON WATER RESOURCES

Acquisition of the parcel will have no effect on water resources.

EFFECT ON VEGETATION

The proposed development of a trail network in parcels one and two to improve the recreational and educational opportunities offered in the Town of Ledyard will have limited impact on the vegetation.

Soil compaction, mechanical root injury, direct trampling, and vandalism, all brought about by increased use of this area, may reduce or eliminate ground cover vegetation and accelerate mortality of low-vigor, unhealthy trees along the trail.

Loss of ground cover vegetation along the trail may reduce aesthetics and increase runoff, potentially causing accelerated erosion. Dead trees along the trail may become hazardous to trail users.

EFFECT ON WILDLIFE

As wildlife use of Parcels 1 and 2 has been noted to be relatively light, acquisition of the parcel for park use will have no effect on habitat quality.

MITIGATING MEASURES INCLUDED IN THE PROPOSED ACTION

The establishment of well-defined, clearly marked trails should limit extensive soil compaction, root injury, and trampling of herbaceous vegetation outside the trails system.

Education of the users of this area through handouts, signs, or guided tours should help to reduce loss of vegetation through vandalism.

Soil compaction may be reduced by spreading woodchips several inches deep along the trail. As woodchips rot they lose their effectiveness and should be replaced. Crushed stone or cinders also reduce soil compaction and are more permanent than woodchips; however, they are usually more expensive.

Loss of some trees caused by soil compaction, even with the addition of woodchips, crushed stone, or cinders, is unavoidable. As these trees die they should be removed to prevent possible hazard.

Potentially hazardous dead trees (specifically the mortality in Stand B) should be removed prior to, or at the time of, trail development.

Provisions for trail maintenance, trail use (hiking, horseback riding, motorcycling, etc.) and enforcement of trail use should be established before the trails are developed.

ALTERNATIVES TO THE PROPOSED ACTION

Since this proposed acquisition involves a unique geologic feature, no alternative site is available. Lack of public acquisition of the land east of Avery Hill Road Extension would not necessarily threaten the continued existence of the features because of the poor condition of the land for building purposes. On the contrary, the present lack of public access to the glacial features probably accounts for their unspoiled preservation.

The threat of inappropriate use and possible spoilage of the kettle area west of Avery Hill Road Extension is real. Zoning permits a variety of uses for this section and it is impossible to predict what the owners may want to use it for in the future. If preservation of this area is to occur, public acquisition appears to be the only guarantee.

RECREATION POTENTIAL

The Ledyard Glacial Park concept is unique in the State. Availability of such a facility which preserves evidence of past glacial events would be very desirable to Connecticut schools and colleges. The only other sizable park in the State which is based on a significant geological event or series of geological events is Dinosaur State Park in Rocky Hill.

Interpretive signs could be employed to give insight into the sequence of events which caused the natural formations seen. It may be possible to post a bibliography or list of films related to the geological history, in a central location, such as at a Rules and Regulation board. This would aid school groups in their further investigation of the subject. Such a list might be included on the backside of a handout map of the park.

Acquisition of land and securing of permanent easements or R.O.W.s should be of high priority to ensure preservation of the geological features and the recreation and wildlife potential it presents.

Glacial History.

The composition and morphology of the unconsolidated materials (overburden) in the proposed park are peculiar to deposits of glacial origin. Evidence from the local area, in conjunction with data obtained elsewhere, indicates that Connecticut was glaciated several times within the past 70,000 years. The last major glacial advance culminated around 18,000 years ago.[1] Disappearance of ice from the area occurred over the next 4,000-5,000 years and was accomplished by a process of gradual thinning. During this stage, the ice margin moved slowly back and forth in response to differences in flow rates and melting. At those periods when the flow rate was just enough to offset ice losses due to melting, the margin in the glacier remained relatively stationary, and sediments were able to accumulate in narrow bands. Such accumulations are called end moraines.

The boulder belt that crosses Section 1 of the property is part of a discontinuous, relatively linear boulder concentration that passes through the towns of Ledyard, Montville, Waterford, and East Lyme.[2][3] In some areas, the boulder belt grades into hummocky, bouldery till deposits. This series of glacial sediments has been called the Ledyard Moraine. The boulder concentrations appear to represent ice-edge deposits from which all the fine materials were removed by meltwater; the bouldery till areas probably are similar deposits which retained their finer components.

Meltwater that issued from the wasting glacier carried large amounts of rock debris. These materials were deposited in or near temporary streams or pools, both adjacent to and away from the ice sheet. As the glacier receded, blocks of

ice calved off near the margins and became surrounded and buried by the meltwater-derived sediments. As these ice blocks melted, the sediments surrounding them collapsed to form enclosed depressions known as kettles. The proposed park contains numerous kettles: their greatly varied sizes indicate the substantial differences in the sizes of the ice blocks that were formerly present. The meltwater deposits, which are known as stratified drift because of their layered structure, are thick enough that the kettles do not intersect the groundwater table; hence, the kettles have remained dry.

1/ Flint, R.F. 1975, The Surficial Geology of the Essex and Old Lyme Quadrangles, Connecticut Geological and Natural History Survey Quadrangle Report No. 31.
2/ Goldsmith, Richard, 1960, Surficial Geology of the Uncasville Quadrangle, U.S. Geological Survey Map GQ-138.
3/ Goldsmith, Richard, 1962, Surficial Geology of the Montville Quadrangle, U.S. Geological Survey Map GQ-148.

Interpretive Potential.

Many geological processes can be explained to non-geologists by comparing them to similar processes in the local area. Glacial processes in Connecticut do not present many opportunities for such comparisons. In addition, it is often difficult for people to visualize in three dimensions from verbal or written descriptions. Hence, a great deal of emphasis should be placed on carefully prepared graphics in the interpretive material.

The boulder belt and the kettles are depositional features that convey a sense of the magnitude and tremendous force of the ice sheet. However, since they are only medium-scale glacial features (as compared with large end moraines, outwash plains, drumlin fields, etc.), their relation to the vast activity of the ice sheet is not readily apparent. There are no elevations with sweeping views of glacial landscapes to arouse one's interest. A great deal of skill will be demanded of the interpreter who attempts to use these limited features as a springboard to the whole subject of glacial geology. The kettles, being less dramatic features than the boulder belt (they convey a sense of size but not of power), will require more interpretive effort. The smaller kettles, those which can be seen in their entirety from one place, will be more useful for interpretation than the larger basins.

A brief description of the soils and hydrology should be included in the geologic interpretive materials. These in turn should be related to the types of vegetation found within the site. The vegetation in the vicinity of the kettles is sparse and may not contain a great deal of interpretive value, with the possible exception of its relation to such physical parameters as slope orientation, water table, and microclimates within the kettles. The plants growing on the tops of some of the boulders suggest some interesting possibilities. A detailed study of this specialized habitat might yield something of interpretive value. Certainly the lichens should be identified.

The human historical aspects should also be included in developing an interpretive educational program on the history of this site. The Ledyard Glacial Park report by Barbara Lahr Maire mentions the Indian and colonist use of the pine swamp in Parcel 3. A sign or signs could be erected to briefly outline historical

use. The botanical and wildlife aspects of the site could also be incorporated. The present habitat, as determined by past geological events, and how this helped determine the sites' flora and fauna would readily work into a program of this type. The interplay of the many factors which went into making up the environment found here, could be made more understandable by a well-designed and concise interpretive program. From this standpoint the site is an excellent resource even if considered only as an educational tool.

Interpretive trails and multi-purpose trails should be kept separate in the park. A detailed survey of the park site should be completed before interpretive trails are planned. In this wooded area, panoramic views may be difficult to achieve, but they would make an important contribution to the interpretive program. A few of the kettles can be easily traversed but those that can't should be skirted. Grades should be gentle. Trails to features of minimal interest should be avoided to preserve the naturalness of the site. Loop trails are ideal.

The construction of trails through the boulder belt will be very difficult and costly. Sections will have to be elevated--some boulders could be traversed with stair-type stiles. A good plan might be to cross the boulder belt along the small ravine, keeping the main leg of the trail near and parallel to the ravine and extending a side trail to the west. The side trail could have a cul-de-sac terminus. Trees which obscure the best views should be cut. The stumps should be cut low and treated, and the slash removed entirely. The interpretive trail should include a split boulder, boulders with vegetation, and a boulder cut and polished to show the rock type.

Public Safety.

Road crossings present a real hazard. In addition, many children and some adults will be strongly tempted to leave the trails and climb into the deep kettles or to cross the boulder belt. When the rocks are wet or covered with leaves, the footing becomes treacherous. Visitors should be forewarned.

Amphitheater.

The amphitheater should be placed between the main parking area and the beginning of the main interpretive trail. It should be carefully sited so that visitors have the sun at their backs and are not distracted by extraneous sights or sounds. It would be unwise to use one of the kettles for an amphitheater if it does not meet the criteria previously mentioned.

Development Considerations

Parking Areas:

1. Minimize impact on neighborhood traffic flow.
2. Afford ready access to high use (e.g. picnic) areas.
3. Minimize site work necessary to install and close to paved road.
4. Reduce conflict with adjacent landowners. Location close to homes or property bounds may bring with it evening activity which is disruptive to residents if lots are not gated. Locating parking lots away from private property would help reduce the possibility of this problem eventuating as the pressure for house lots increases.

Foot Trails:

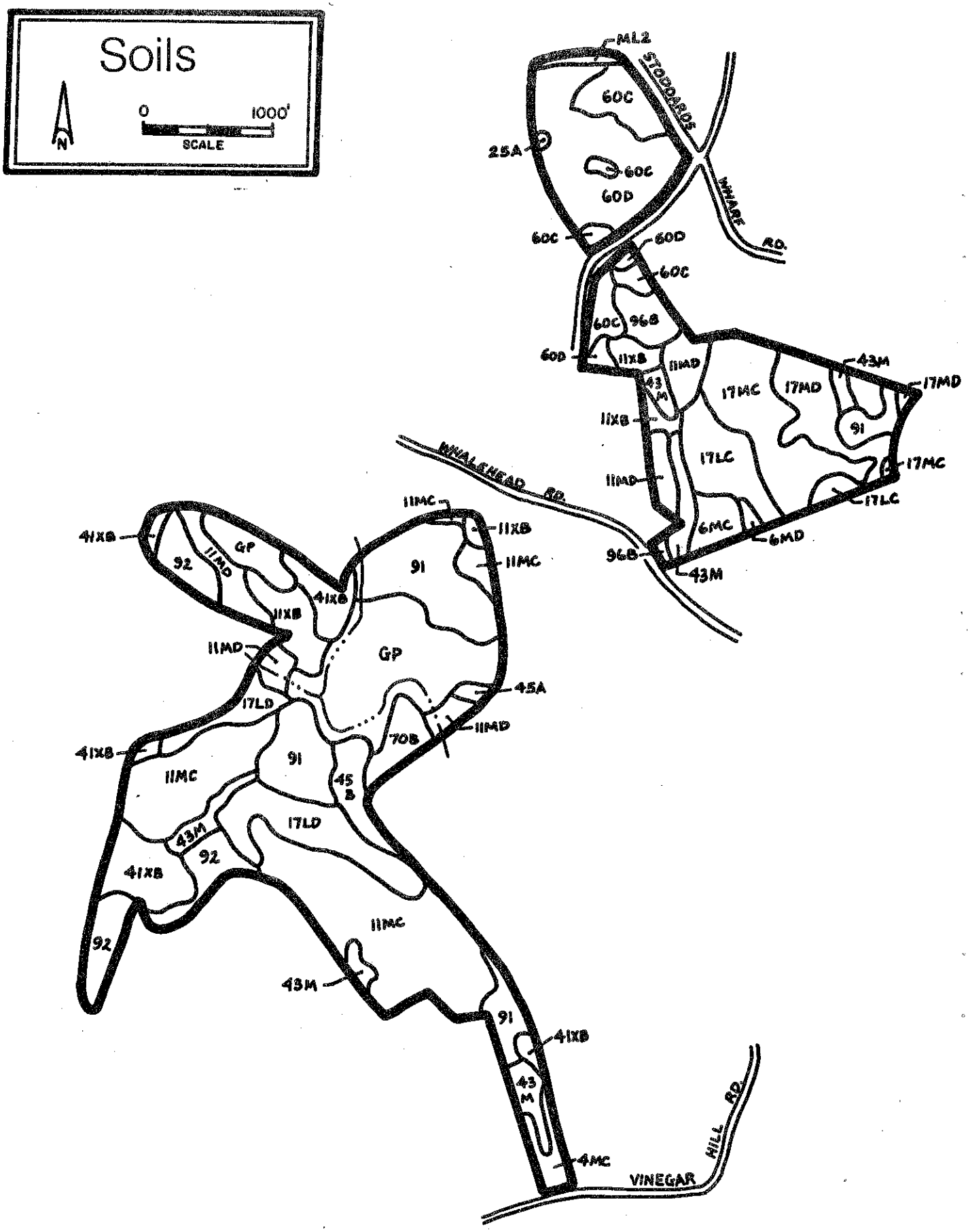
1. Trail bed quality - provision should be made for diverting water from the trail so that erosion does not become a problem on steeper slopes.
2. Routing the path to and over boulders of the terminal moraine and pine/rhododendron swamp would probably necessitate building a boardwalk over these areas. Traversing the boulders would otherwise increase the probability of people breaking legs. etc.
3. Type of site markers (for interpretive programs). A bevel-cut, treated post with a routed key number or legend works well. A handout sheet or map cross-keyed to numbered site markers may be best.
4. Locations of Rules and Regulations, interpretive signs, or handout sheets for a self-guiding tour. Parking lot and trail heads would be a logical location. These self-help maps usually dwindle rapidly and it may become necessary to have people get them at manned locations (e.g. Ledyard Oak Park, Town Hall).
5. Trail sections or spurs for the more hearty should be so noted as should distances on either a handout map or trail head.
6. If decision is to make the trail purely for pedestrian use, then motorcycle discouragement barriers should be incorporated (especially important for boardwalk blockage). Walk-around barriers on boardwalks are feasible because the access is limited to the boardwalk ends. Use of stairs instead of ramps would help discourage motorcycle use also.

Picnic Areas:

1. Located near parking areas for ease of servicing. If rest stops are provided along the trail with no provision for garbage pickup, a positive signing program appealing to people not to litter and to pack out their refuse may be necessary.
2. Toilet facilities will be necessary. They need not be flush toilet units.
3. Anchoring of tables may be necessary to prevent theft.
4. Fireplaces could be simply stone bases for hibachi use--as long as picnickers are forewarned they must bring their own cooking gear. Ash disposal areas would have to be provided with this setup.
5. A relatively flat area would be preferable. Horseshoe toss areas should be away from tables and paths (areas of heavy use).
6. Closed top garbage barrels with a swinging disposal gate will minimize ground litter, animal foraging, and spillage.

Establishment of an extensive trail network brings increased possibilities for trailside litter, forest fires, and unwanted activity such as motorcycle use. Motorcycles may be discouraged from using trails by proper design but are hard to lock out because of their extreme mobility. Physical barriers, signs, and law enforcement action must all combine to keep this activity in check.

Appendix


Soils
N
0
1000'
SCALE
ML2
STODDARDS
WHARE RD.
60C
25A
60C
60D
60C
60D
60C
60C
96B
60D
11XB
11MD
43M
43M
17MC
17MD
17MD
91
11XB
17LC
17MC
11MD
17LC
WHALESHEAD RD.
6MC
6MD
96B
43M
11MC
11XB
41XB
GP
92
11MD
91
11MC
41XB
11XB
11MD
GP
45A
17LD
70B
11MD
41XB
91
11MC
45B
17LD
43M
92
41XB
11MC
92
43M
91
41XB
43M
4MC
VINEGAR
HILL RD.

Soils

Soil Symbol	Soil Name	Slope Range
6 MC	Narragansett ext. Stony Silt Loam	3-15 %
6 MD	" " " " "	15-25%
11MC	Canton and Charlton extremely stony fine sandy loam	3-15%
11MD	" " " " "	15-35%
11 X B	Canton and Charlton very stony fine sandy loam	3-8%
17 LC	Charlton - Hollis fine sandy loam	3-15%
17 LD	" " " " "	15-35%
17 MC	Hollis - Rock out crop complex	3-15%
17 MD	" " " " "	15-35%
25 A	Ninigret fine sandy loam	0-5%
41 X B	Sutton very stony fine sandy loam	0-8%
45 A	Tisbury silt loam	0-5%
45 B	" " "	"
60 C	Hinckley gravelly sandy loam	3-15%
60 D	" " " "	3-8%
70 B	Merrimac sandy loam	3-8%
91	Adrian and palms mucks	—
92	Carlisle muck	—
96 B	Agawam fine sandy loam	3-8%

Soils Interpretation Chart
Limitation Classes*

Picnic Areas		Paths and Trails		Septic Fields		Local Roads	
Slight	Moderate	Slight	Moderate	Slight	Moderate	Slight	Moderate
11 XB	6 MC	25A	11 X B	70 B**	11 X B	70 B	6 MC
25 A	11 MC	45A	17LC	96 B**	Charlton Part of 17LC	96 B	11 X B
41 X B	17 LC 17MC	45B	17LD		60C**		Charlton part of 17LC
45 A ~~45 B~~	60 C	70B 96B	17MC 17MD				25A
70 B			41 X B				41 X B
96 B			60C				60C
			60D				

* All soils not listed have severe limitations for the use

** Excessive permeability may cause ground water pollution
Refer to attached soil legend, soil series descriptions, and definitions for explanations

SOIL INTERPRETATIONS FOR URBAN USES

The ratings of the soils for elements of community and recreational development uses consist of three degrees of "limitations:" slight or no limitations; moderate limitations; and severe limitations. In the interpretive scheme various physical properties are weighed before judging their relative severity of limitations.

The user is cautioned that the suitability ratings, degree of limitations and other interpretations are based on the typical soil in each mapping unit. At any given point the actual conditions may differ from the information presented here because of the inclusion of other soils which were impractical to map separately at the scale of mapping used. On-site investigations are suggested where the proposed soil use involves heavy loads, deep excavations, or high cost. Limitations, even though severe, do not always preclude the use of land for development. If economics permit greater expenditures for land development and the intended land use is consistent with the objectives of local or regional development, many soils and sites with difficult problems can be used.

Slight Limitations

Areas rated as slight have relatively few limitations in terms of soil suitability for a particular use. The degree of suitability is such that a minimum of time or cost would be needed to overcome relatively minor soil limitations.

Moderate Limitations

In areas rated moderate, it is relatively more difficult and more costly to correct the natural limitations of the soil for certain uses than for soils rated as having slight limitations.

Severe Limitations

Areas designated as having severe limitations would require more extensive and more costly measures than soils rated with moderate limitations in order to overcome natural soil limitations. The soil may have more than one limiting characteristic causing it to be rated severe.

About the Team

The Eastern Connecticut Environmental Review Team (ERT) is a group of professionals in environmental fields drawn together from a variety of federal, state, and regional agencies. Specialists on the Team include geologists, biologists, foresters, climatologists, soil scientists, landscape architects, archeologists, recreation specialists, engineers and planners. The ERT operates with state funding under the supervision of the Eastern Connecticut Resource Conservation and Development (RC&D) Area.

The Team is 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, sanitary landfills, commercial and industrial developments, sand and gravel operations, 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 officials 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. This request letter should include a summary of the proposed project, a location map of the project site, written permission from the landowner 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 Eastern Connecticut RC&D Executive Council, the Team will undertake the review on a priority basis.

For additional information regarding the Environmental Review Team, please contact Jeanne Shelburn (889-2324), Environmental Review Team Coordinator, Eastern Connecticut RC&D Area, 139 Boswell Avenue, Norwich, Connecticut 06360.