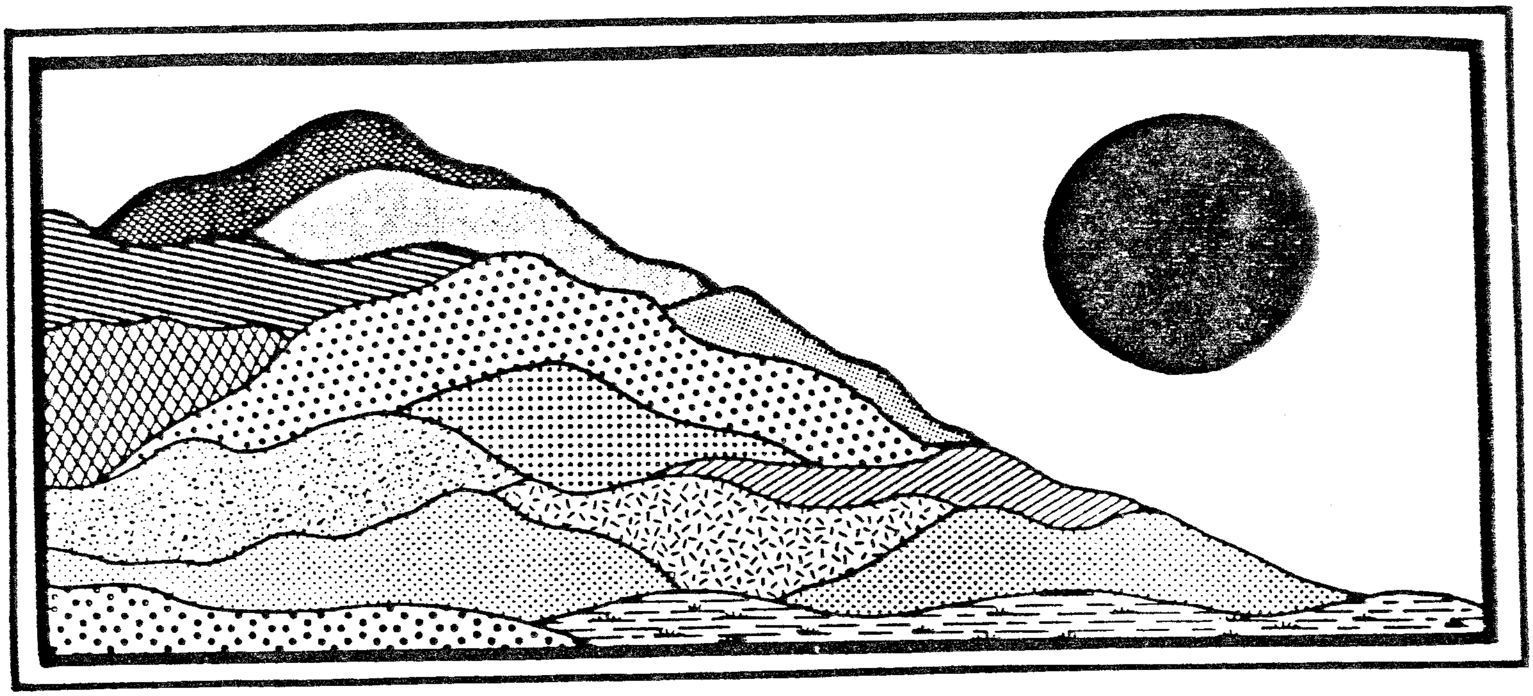
Rudko Pond Construction

Colchester, Connecticut

March 1986



ENVIRONMENTAL REVIEW TEAM REPORT

EASTERN CONNECTICUT RESOURCE CONSERVATION AND DEVELOPMENT AREA, INC.

Rudko
Pond Construction

Colchester, Connecticut

Review Date: FEBRUARY 6, 1986

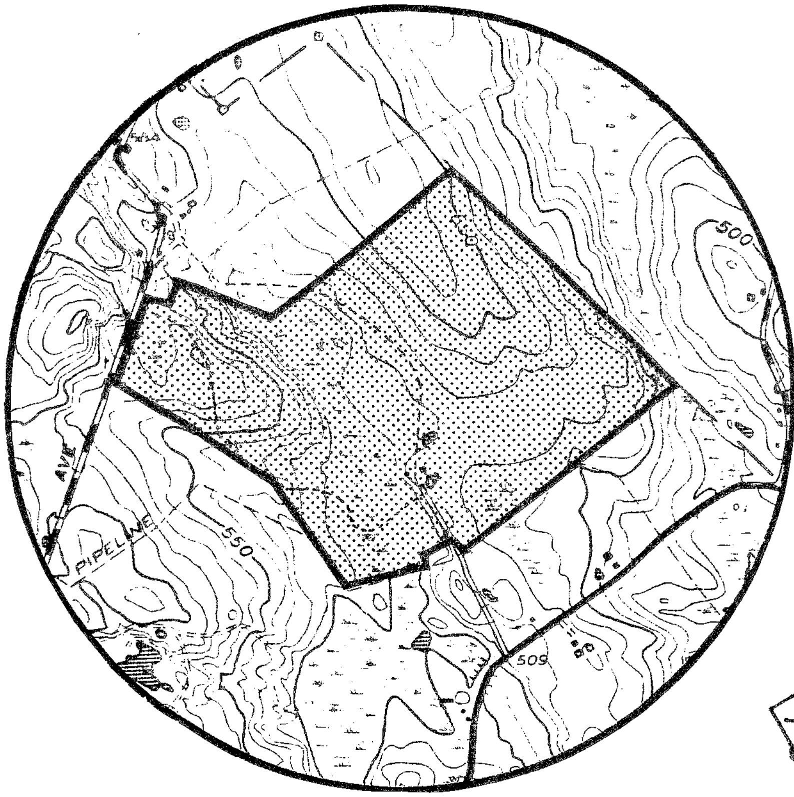
Report Date: MARCH 1986

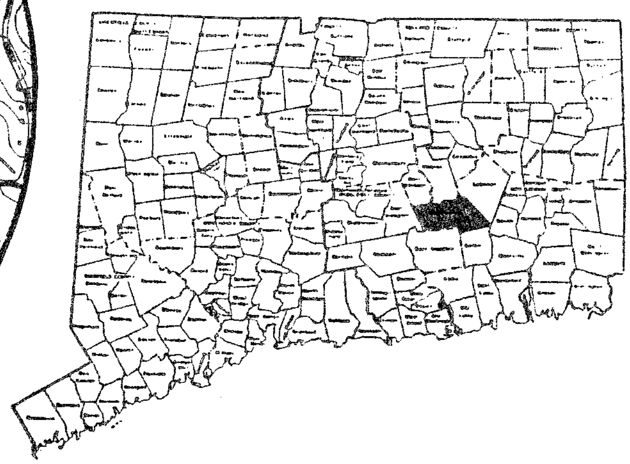
RC&D

ENVIRONMENTAL REVIEW TEAM
PO BOX 198
BROOKLYN, CONNECTICUT 06234

Site Location

RUDKO POND CONSTRUCTION
COLCHESTER, CONNECTICUT





EASTERN CONNECTICUT
RESOURCE CONSERVATION
& DEVELOPMENT AREA

ENVIRONMENTAL REVIEW TEAM REPORT
ON
THE RUDKO POND CONSTRUCTION
COLCHESTER, CONNECTICUT

This report is an outgrowth of a request from the Colchester Conservation Commission to the New London 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 reviewed by the Eastern Connecticut Environmental Review Team (ERT).

The ERT met and field checked the site on Thursday, February 6, 1986. Team members participating on this review included:

Robert Gilmore - Environmental Analyst-DEP, Water Resources Unit
Maria Martinez - Soil Conservationist-U.S.D.A., Soil Conservation Service
Pete Merrill - Forester-Department of Environmental Protection
Gary Nasiatka - Wildlife Assistant-Department of Environmental Protection
Eric Schluntz - Fisheries Biologist-Department of Environmental Protection
Elaine Sych - ERT Coordinator - Eastern CT RC&D Area
Bill Warzecha - Geologist-DEP, Natural Resources Center
Judy Wilson - Wildlife Biologist-Department of Environmental Protection

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 soils map, and a topographic map showing the boundaries of the study site. During the field review the team members were given site plans. The Team met with, and were accompanied by a member of the Conservation and Inland Wetlands Commission, a representative of AT&T, the landowner and his son, the applicant's engineer, and another geologist with the Department of Environmental Protection. Following the review, reports from each team member were submitted to the ERT Coordinator for compilation and editing into this final report.

The 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 and conclusions 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 result 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 Project Committee hopes you will find this report of value and assistance in making your decisions on this pond construction.

If you require any additional information, please contact:

Elaine A. Sych
ERT Coordinator
Eastern Connecticut RC&D Area
P.O. Box 198
Brooklyn, CT 06234
(203) 774-1253

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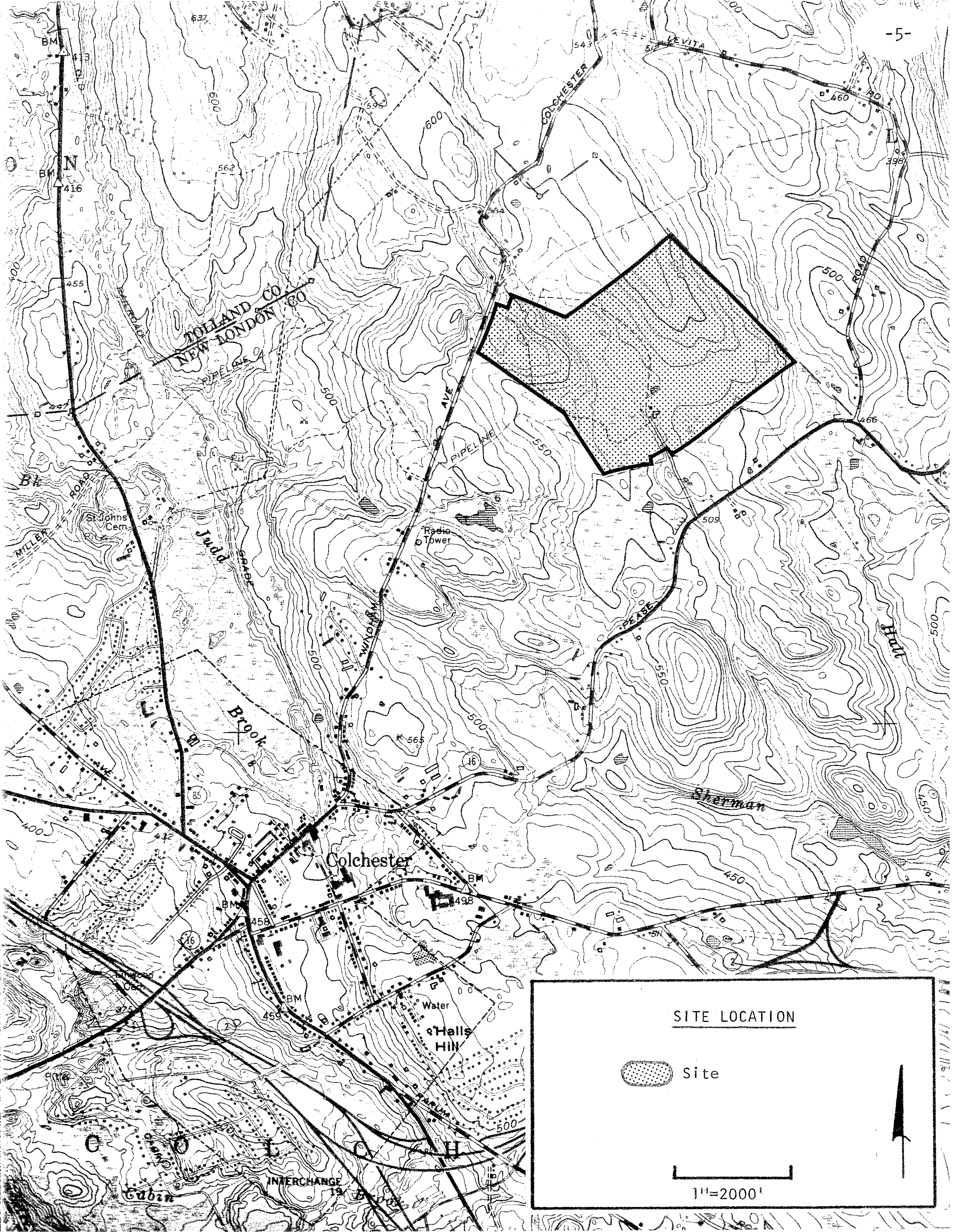
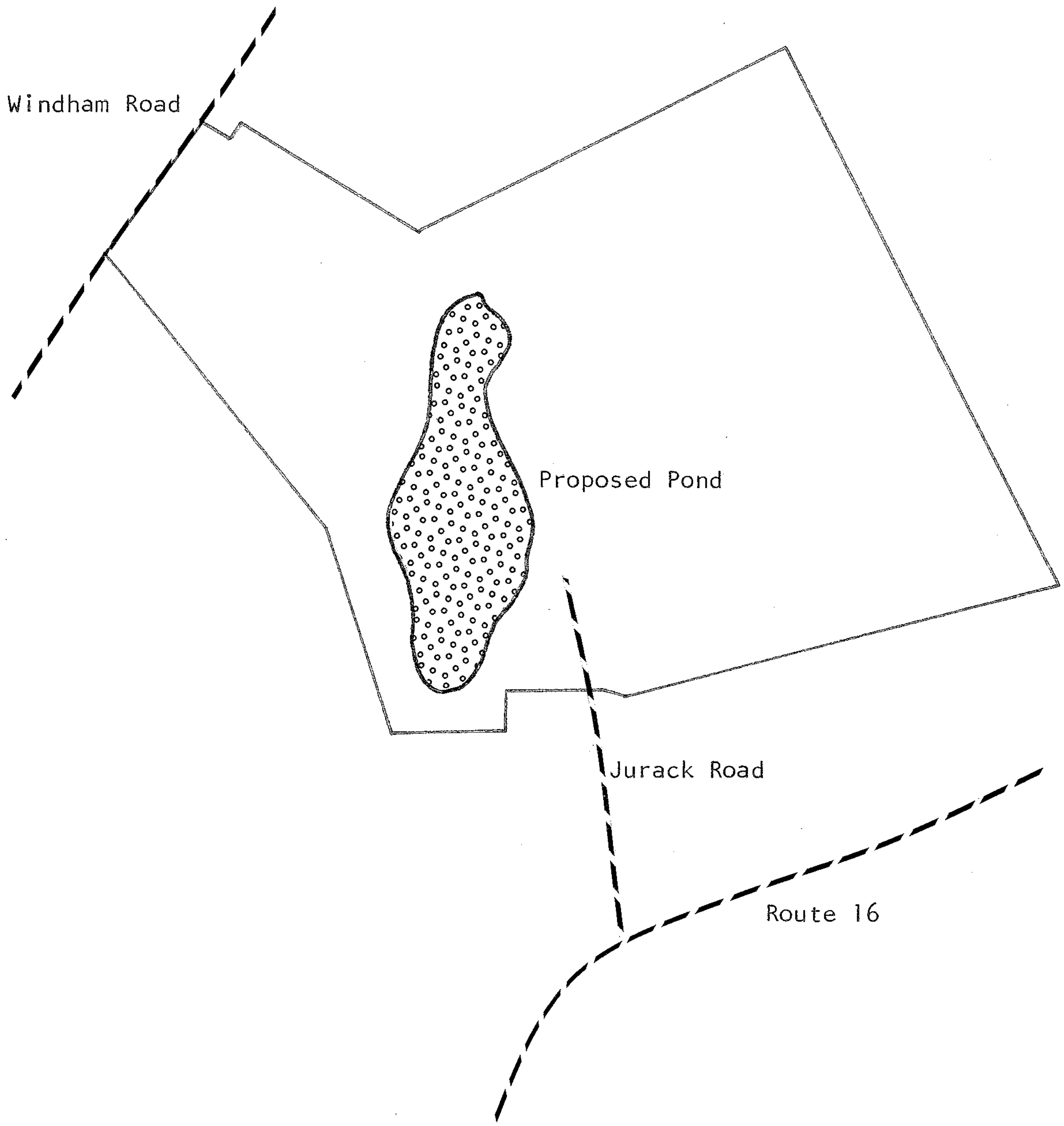

SITE LOCATION
Site
1"=2000'
Colchester
TOLLAND CO
NEW LONDON CO
PIPELINE
Judd
Brook
GRADE
WINDHAM
AVE
Radio Tower
PEASE
Sherman
Hall
ROAD
COLCHESTER
LEVITA
MILLER
St Johns Cem.
Water
Halls Hill
INTERCHANGE 19

PROPOSED POND SITE



SCALE 1" = 1000'

1. INTRODUCTION

The Colchester Conservation Commission acting as the Inland Wetlands Agency for the Town and borough of Colchester has asked for Environmental Review Team assistance in reviewing a proposed pond construction.

The ±265 acre parcel is located northeast of Colchester Center in the towns of Colchester and Lebanon. Approximately 17 acres of the parcel are located in Lebanon. The site may be accessed from Jurack Road to the south or Windham Avenue to the west.

The landowner is proposing to excavate a ±20 acre pond in an existing wetland area. The intended use of the proposed pond is to provide irrigation for blueberries which will be planted in the eastern parts of the property. According to the applicant, approximately 30 acres of the site would be used for the blueberry operation.

The Town has asked the ERT to evaluate and comment upon various aspects of this proposal. This report contains information and recommendations dealing with the geology, hydrology, soils, vegetation and natural habitats of the site, and the possible impacts on the environment from the creation of a pond. Comments are also made about site suitability and pond size as they relate to blueberry cultivation.

2. TOPOGRAPHY AND SETTING

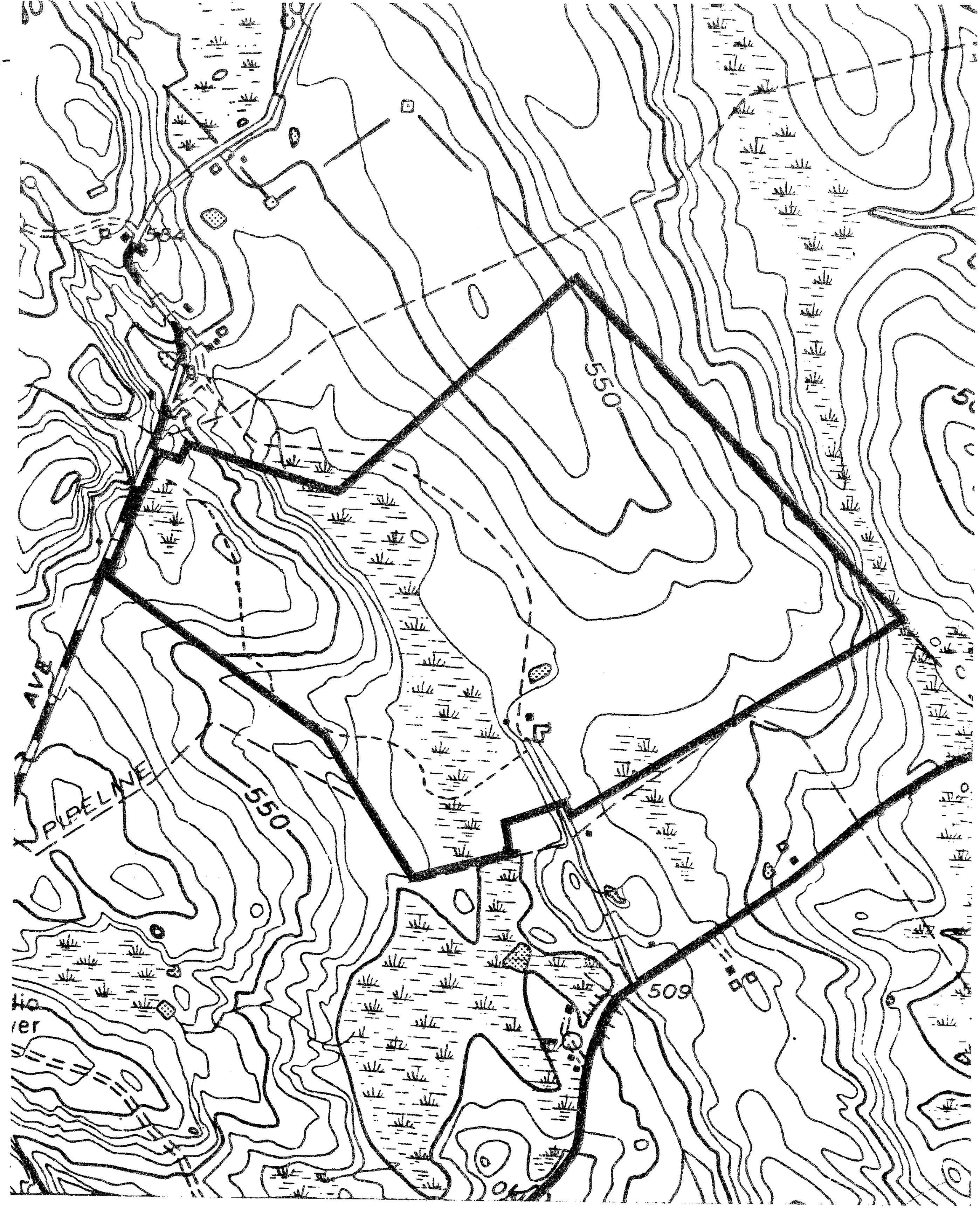
2.1 Size and Access

The ±265 acre parcel is mostly located in the northeast corner of Colchester, with 17 acres of the parcel located in Lebanon. There is access to the parcel from Jurack Road and from Windham Avenue. Most of the parcel is comprised of wooded land, but there are several active cornfields in the eastern portion.

2.2 Topographic Features

The major topographic feature is a wetland that bisects the parcel in a northwest-southwest direction. An unnamed streamcourse, which originates from a small pond about ±2,000 feet northwest of the parcel, meanders through the wetland enroute to Sherman Brook.

Except for the eastern limits of the parcel, land surface within the site slopes to the wetland. Slopes on the site range from gentle to moderate.



TOPOGRAPHY

Site Boundary

Scale 1''=1000'

The moderate slopes border the western side of the wetland in the north-central portion.

Maximum and minimum elevations on the site are about 580 feet and about 500 feet above mean sea level, respectively.

3. GEOLOGY

3.1 Introduction

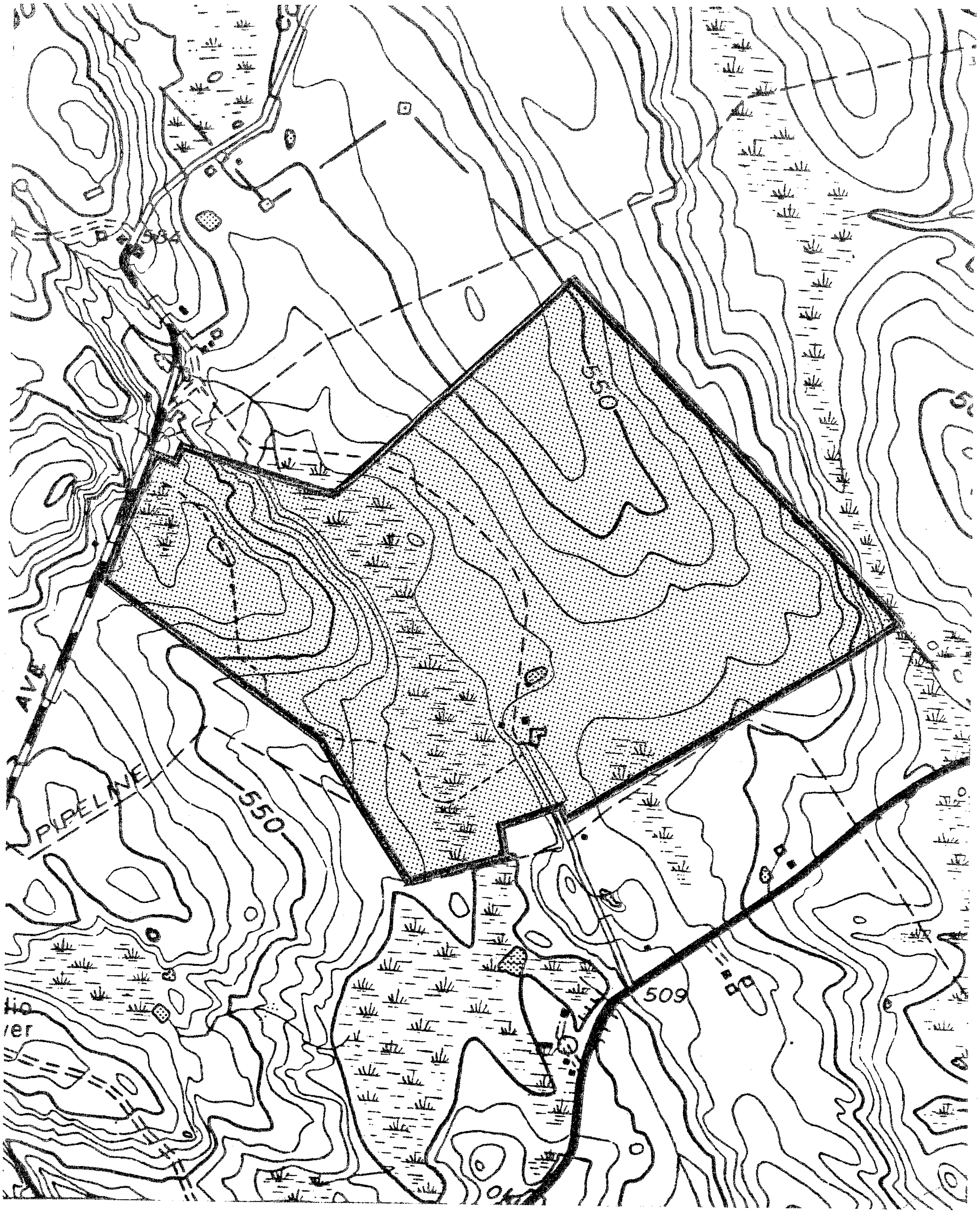
The study area is located in the Colchester topographic quadrangle. A bedrock geologic map (QR-27, by Lawrence W. Lundgren) has been published by the Connecticut Geological and Natural History Survey. This map is available at the DEP's Natural Resources Center in Hartford. No surficial geologic information for the quadrangle has been published to date. In regard to the surficial geologic materials on the site, the team's geologist referenced the Soil Survey for New London County and Water Resources Bulletin #16 (Hydrogeologic Data-Southeastern Coastal River Basins).

3.2 Bedrock Geology

The bedrock surface does not appear to break ground surface on the parcel. Lundgren identifies the bedrock underlying the parcel as Hebron Formation. These rocks are described as interlayered schists and gneisses. The schist layers are typically brownish-gray in color and are composed primarily of the minerals quartz, biotite, andesine and plagioclase. The "gneiss" layers are greenish gray in color, and are composed mainly of calc-silicate minerals such as labradorite, actinolite and diopside. Other minerals in the gneiss layers include quartz, biotite, and hornblende.

Gneisses and schists are crystalline metamorphic rocks that have been deformed by great heat and pressure in the earth's crust. These rocks are very old (ranging between 408 and 505 million years old) and have very complicated histories. The schist layers have a noticeably strong foliation (layering) caused by the alignment of flaky, platy or elongate mineral grains, and as a result tend to be slabby and break easily, especially where the rock is weathered. The gneiss layers are characterized by thin bands of elongated or flaky mineral grains that alternate with layers of more granular minerals. This mineral arrangement gives the gneisses a banded appearance.

There was no subsurface data, i.e., test holes, borings, well logs, etc. available to the Team's geologist which would demonstrate depth to bedrock in the study area. However, it is known that the upland section in the eastern half of the parcel is covered by relatively thick till deposits. As a result, the bedrock surface may range between 10 and 40 feet below ground surface in those parts. Depth to bedrock in the western parts is shallower, probably not much more than 10 feet.



BEDROCK GEOLOGY

Hebron Formation

SCALE 1"=1000'

3.3 Surficial Geology

Based on the Soils Survey of New London County, the study area is covered by unconsolidated materials comprised of ground-up rock fragments and particles, which were plastered by moving glacial ice onto the crystalline bedrock beneath the site. These nonsorted sediments, which range in size from clay to boulders, are referred to as glacial till. Two types of till exist on the site. The eastern parts of the study area are covered by till which is generally sandy, stony and relatively loose in the upper few feet, but it becomes siltier and very compact at deeper depths. Where the compact till is encountered, it is commonly called "hardpan," because of its great resistance to excavation with hand tools. The till-based soils in the western parts are comprised mainly of relatively loose, coarser-grained materials which lack the "hardpan" layer mentioned above. Both types of till are prevalent in the state. The presence of a compact zone associated with the "hardpan" soils throughout the central and eastern parts tends to impede the downward movement of water. As a result, a "perched" water table (18"-22" below ground surface) is commonly found in these soils during wet times of the year.

According to a publication entitled "Highbush Blueberry Culture,"[1] blueberries grow best in fertile, acid soils that are well-drained and have a plentiful water supply. However, the publication points out that water should not stand on the soil at any time. Based on this information, it appears that the upland, till-based soils, especially the WxA, WxB, CbB, SvA soils groups on the accompanying soils map would be very favorable for the cultivation of blueberries. Other soil types in the western parts may also have some potential, but they are droughtier than till-based soils in the eastern portions.

Overlying till and/or bedorck in the central parts of the study area are swamp sediments. They consist of poorly to very poorly drained mineral and muck soils which are nearly level to gently sloping. The soils delineated on the accompanying soils map as Rn and Rd mostly in eastern parts comprise the mineral variety and are typically seasonally wet and very stony.

The soils delineated as Aa and Ce on soils maps are typically mucky, where water is at or near ground surface most of the year.

The muck layers which are typically black, slimy and mushy and contain highly decayed plant remnants are found in the top 22 inches to 42 inches of the Aa soils. Beneath the mucky zone, the soil becomes a gravelly sand to a depth of 60 inches or more. The Ce soils have a deeper mushy, organic layer possibly to a depth of 60 inches or more.

Because subsurface data is lacking in the swamp area, it is difficult to explain its origin. Nevertheless, the swamp deposits, consisting of layers of organic material, sand and silt were probably deposited in a relatively

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[1] Highbush Blueberry Culture, 8th Edition, University of Rhode Island Cooperative Extension Service Bulletin 143, revised 1983, p. 8.

SURFICIAL GEOLOGY

Till (Thick)
Till (Less than 10' thick)
Regulated Inland Wetland Soils*

SCALE 1"=1000'

*See Soils Map for greater detail.

shallow basin of water over a very long period of time. The surrounding valley, which encompasses the wetland was gouged out by glacial ice advances. As sediment, eroded from upland sections of the drainage area continued to fill the basin, the water level rose somewhat, but the depth of the pond became shallower. Swamp vegetation was established and has existed to the present time. Constricting the outlet stream of the wetland at Pease Road, which is downstream from the property has probably prompted and accelerated the accumulation of organic material within the swamp.

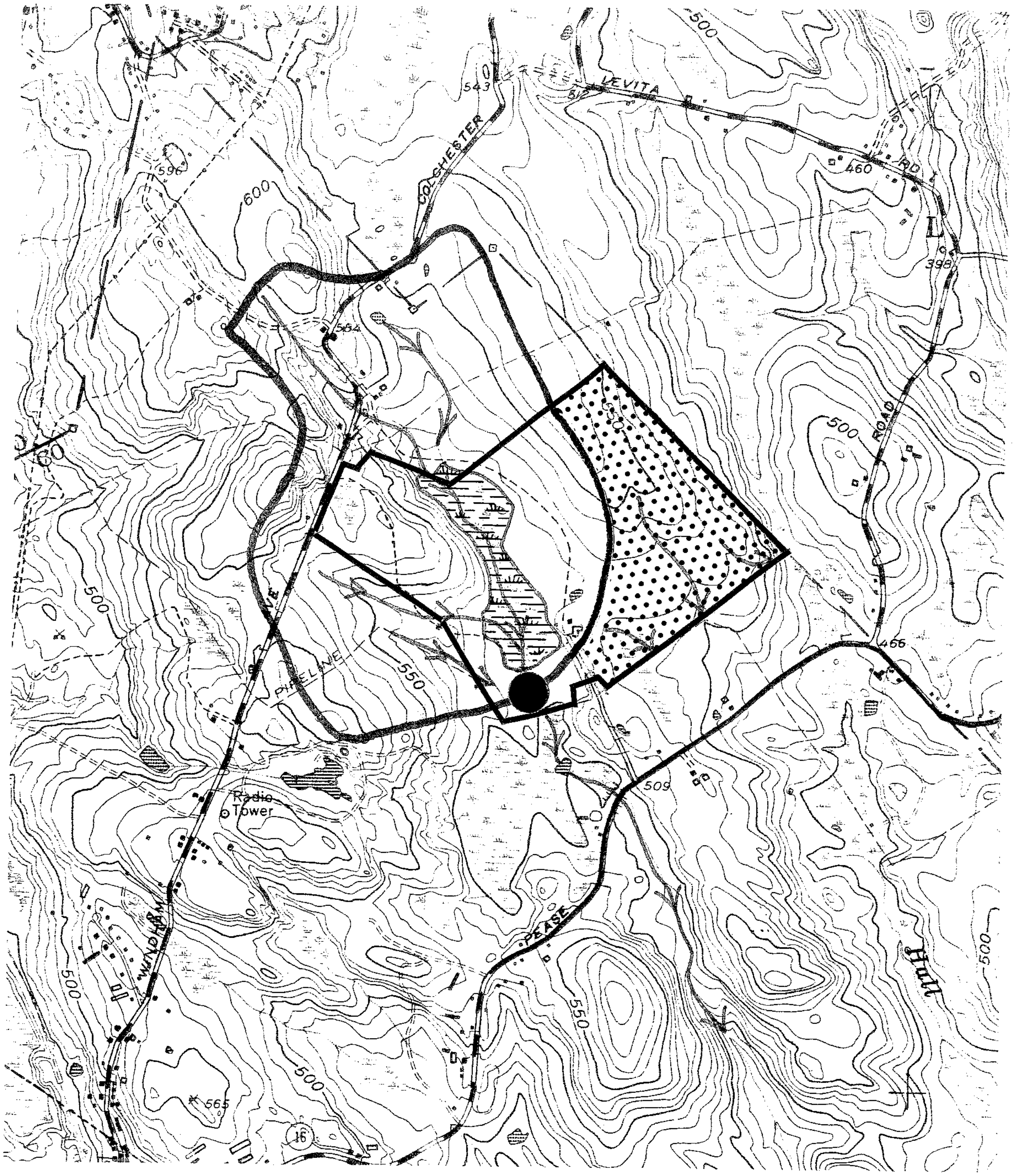
In order to determine the exact thickness and composition of the materials to be excavated, a series of soil borings would need to be placed in the areas proposed for excavation. Only then can an exact determination of the subsurface materials in the area of the proposed pond be made.

All of the soil types mentioned above Rn, Rd, Ce and Aa are classified as inland-wetland soils in the state. Because of their classification as inland-wetland soils, they are regulated under Public Act 155. Any activity which involves modification, dredging or removal of soil, will require a permit and ultimate approval by the Town's Inland-Wetland Commission. It should be noted that the soils group delineated as Sf (Scarboro) on the soils map are also classified as wetland soils, but it does not appear that they will be disturbed by the proposed pond construction.

The wetlands proposed for excavation plays an important role in reducing runoff, trapping sediment, controlling water quality and providing habitat for wildlife. In this regard, the applicant should determine the potential hydrologic and ecologic impacts, if any, of the proposed pond excavation with respect to the important wetland functions above before approval is granted (see Hydrology section for further discussion on this matter).

3.4 Material to be Excavated

The applicant mentioned on the review day that the material excavated from the proposed pond would be used for the blueberry operation. According to the applicant, the organic-rich muck would be mixed with the till-based soils in the eastern part. Since the most favorable soils for blueberries on the site are considered "prime farmland soils" by the Soil Conservation Service, there may not be a need for spreading the excavated organic soils over existing soils. There is a possibility that placing the excavated soils over existing soils may alter their physical and chemical composition to a point where they may not be considered "prime." If all of the materials excavated from the proposed 20 acre pond site were spread over the 30 acre blueberry field, it is estimated the material would cover 30 acres at a depth of 2.5 feet. However, there would probably be considerable shrinkage of the soil due to water loss. In addition, root matter from the top foot of material excavated plus wood, brush and branches would not be usable as a soil supplement and, therefore, will need to be disposed of properly (see Soil section). It is suggested that the applicant contact the New London County Soil Conservation District and UConn Extension Center in Norwich regarding these matters. Also, it should be pointed out that if any of the excavated material is sold commercially, this type of activity will probably require approval from the Town's Planning and Zoning Commission. It is recommended that the Town planner be consulted in this regard.



WATERSHED BOUNDARY MAP

Watershed boundary for stream meandering through the wetland in the central parts of the site.

Approximate point of outflow.

Watercourses showing direction of flow.

Approximate area to be excavated

Portion of property which drains to Hall Brook

Site Boundary

SCALE 1''=2000'

4. HYDROLOGY

4.1 Introduction

The Team's geologist was asked to analyze the potential hydrological effects of the proposed pond excavation on-site and off-site. More specifically, the Inland-Wetland's Commission asked the Team to address the affects of the proposed pond excavation on wetland roles such as reducing runoff, trapping sediment, and controlling water quality. However, it should be pointed out that analyzing the potential hydrological effects of the pond excavation is very difficult, particularly since no definite plans have been prepared to date. Nevertheless, the Team's geologist has attempted to discuss several potential environemntal concerns as they relate to local hydrology and the proposed pond excavation. Prior to approval, the applicant should be required to address all of the potential environmental concerns that may arise from the proposed pond excavation.

4.2 Water Inputs and Outputs

The hydrology of the swamp as it exists today may be examined in terms of inputs and outputs. Water inputs to the swamp consist of ground and surface water inflow from the upstream watershed areas and precipitation over the swamp itself. The total watershed for the stream, which flows through the swamp, to the point whereit intersects the southern property boundary, is approximately 448 acres. This does not account for possible dranage re-routing through piping and other man-made structures. The watershed as described above is shown in an accompanying illustration.

Water outputs from the swamp consist of surface and groundwater outflow and evapotranspiration from the swamp. It is the potential for change in total evapotranspiration that must be considered in predicting whether a change in long-term base flows will occur in the outflow stream. The reason is that total inputs to the site, whether it remains a swamp or is converted to a pond, will not be altered.

4.3 Flow Characteristics

Once the pond is excavated of material and refilled to its present water level, streamflow changes would depend entirely on whether the pond surface lost more or less water to evaporation, than the swamp did to both evaporation and transpiration. Although no data exists for this particular swamp as to the present rates of evapotranspiration, data recently obtained from other swamps suggest that evapotranspiration usually exceeds evaporation from a free-water surface (Source: "Water Resources and Wetlands," a report contained in an American Water Resources Association symposium publication). As a result, base streamflows during hot, dry periods may increase if the pond is created. During spring thaws, the wetlands might be expected to thaw less rapidly than a free ice-and-snow surface, so that the normally heavy spring streamflows may be reduced by the presence of the swamp. Conversely, creation of the pond could lead to higher spring flows.

It was assumed that the ±20 acre pond would fill to the level existing presently in the swamp. This assumption is based on a couple of factors. First, using a statistical average for flow rates of ungaged streams in Connecticut based on the size of the contributing watershed areas (about 448 acres), it may be estimated that the long-term average surface inflow to the swamp is about 1.3 cubic feet per second (cfs). At this rate, the entire planned excavation could fill in about 40 days. However, it should be pointed out that if the pond was constructed on phases, it might take less time for any particular section. The bulk of filling the excavated area would occur during the normally wet times of year (spring and late fall/early winter), when evaporation would also be minimal.

The following table gives estimated flow duration characteristics of the outlet point of the proposed excavated area and shows the time period (in days) to fill the proposed 20 acre pond.

TABLE 1

Percent of time flow equalled or exceeded	10	30	50	80	90
Flow equalled or exceeded in cubic feet per second (CFS)	2.5	1.32	.63	.1	.068
Time period (in days) to fill a 20 acre pond whose average depth is five feet	20	40	80	504	741

As shown in Table 1, the rate of which the pond will refill with water will depend upon the amount of rainfall received during a given period of time. For example, an inflow rate of .068 cubic feet per second, which will be equalled or exceeded at least 90 percent of the time, would fill the pond in 745 days. On the other hand, a flow rate of 2.5 cubic feet per second, which will be equalled or exceeded 10 percent of the time would fill the pond in 20 days. It should be noted that very low flows are exceeded most of the time, and very high flows are exceeded only a small percent of the time.

Secondly, once the pond is constructed, the bottom would consist of silt and sand underlain by till and/or bedrock. These materials (till and bedrock) would not allow for rapid groundwater outflow. If they were, one would not expect the swamp to exist as it is today. Finally, it is expected that the surface elevation of the proposed pond would probably be controlled by a man-made structure, which would be at about the same level as the existing swamp. It should be noted that the construction of a dam, dike, etc., may require a permit from DEP's Water Resources Unit, Dam Section, 566-7244. Once plans become more concrete, the Dam Section should be contacted by the applicant or applicant's engineer.

4.4 Flood Flows

The effectiveness of the proposed pond, as opposed to the present swamp, in reducing flood flows is very difficult to address. In most cases, watersheds are evaluated for flood storage capabilities by adding total swampy and ponding areas, these two different systems are not distinguished in a hydrologic evaluation. This suggests that the two are approximately equally effective for reducing flood flows. Nevertheless, to the extent that rainfall onto the wetland may percolate through the hummocks of "land" above the watertable, while rainfall onto the pond would reach the surface instantly, a certain additional retentive ability (a "sponge" effect) may exist in the swamp. This, of course, would be partly offset by the volume of potential storage space that the "land" itself occupies. Another factor to consider is the extent to which the swamp vegetation and microtopography itself slows surface flow rates. This factor would, in turn, depend upon the existing water or ice level at the time of the flood-causing storm event or snowmelt; the lower the water, the greater the slowing effect of the wetland on surface flows. In conclusion, knowledge in the area of this specific hydrologic function is too little to allow a definite answer, but it seems likely that the differences between the two would be relatively small.

4.5 Water Quality

Another potential hydrologic concern raised by Town officials on the review day was water quality. As mentioned earlier, a major hydrologic function of a wetland is trapping sediment and maintaining water quality. A pond may also serve the same functions, particularly trapping sediment. Moreover, the removal of swamp vegetation may cause, in the long run, a decrease in the acidity and iron-manganese content of the outflowing water, especially since the proposed projects calls for complete removal of wetland soils which tend to be highly acidic in this part of the state. However, it should be pointed out that during and immediately following the proposed pond excavation, the acidity and iron/manganese levels may increase dramatically because of the disruption of the organic material. Acidification of the outlet stream could conceivably kill fish in downstream areas and affect local vegetation (see Fish Resources section and Vegetation section). The applicant will need to address this potential concern. For example, there may be a need to buffer the outflowing water from the proposed pond site to an acceptable level.

Team members and the applicant discussed on the review day, the possibility of diverting the inflowing stream to the wetland around the area to be excavated. This would physically separate the stream from the proposed excavation project, thereby reducing the threat of possible water quality deterioration. However, because the stream would be relocated and because it drains an area greater than 100 acres, this type of activity would be subject to Connecticut Water Diversion Policy Act PA-402. Therefore, if the applicant considers stream relocation, DEP's Water Resources Unit, 566-7220, should be contacted first.

In order to reduce the potential for substantial short-term deterioration of water quality if the project is undertaken, it is strongly recommended that a detailed erosion and sediment control plan be formulated and carefully followed through all phases of the project. This would also apply to any areas where the stockpiling of excavated materials may occur or where excavated materials are spread over the existing upland soils.

4.6 Size of Pond

Team members were asked to comment on the size of the proposed irrigation pond as it relates to blueberry cultivation. According to the publication, "Highbush Blueberry Culture" (8th Edition),[2] blueberries require approximately 1-2" of water per week during the growing season through harvest. If one assumes that the proposed blueberry operation covers a 30 acre area and that it would be irrigated at a rate of 2"/week for a period of 8 weeks, it is estimated that a pond (average depth 5 feet) 40 acre feet (one acre-foot is equal to the amount of water to a depth of 1 foot over 1 acre, a total of 325,851 gallons) in size would probably be adequate. These calculations assumed no recharge or rainfall during an eight week irrigation period.

The applicant presently wishes to construct a pond that is 20 acres in size. If one assumes the average depth of the pond to be 5 feet, then the pond would cover an area of about 100 acre-feet. Based on the calculations in the last paragraph, the proposed pond is two and a half times larger.

4.7 A Possible Alternative

It seems likely that the proposed pond excavation would be very costly, in view of the applicant's intended use. A possible alternative, which might reduce costs would be to investigate the possibility of utilizing the existing farm pond on the east side of the swamp for irrigation purposes. If a larger volume of water is needed, perhaps one or two smaller ponds could be constructed on the wetland soils in the eastern, upland sections of the site. This would be closer to the proposed blueberry operation, thereby reducing the costs of pumping water from the proposed pond area.

Based on discussions during the field review, it appears that the applicant wishes to excavate most of the wetland soils in order to create the pond. From a wildlife/ecologic standpoint, consideration should be given to leaving a wetland fringe around the pond.

5. SOILS

5.1 Pond Information

"Proposed Pond Layout" does not provide enough information about the construction. A complete design should be prepared showing details like construction schedule and disposition sites for the excavated material. Also, an "Erosion and Sediment Control Plan " should be prepared showing measures for erosion control during construction and pond area stabilization after construction. A water diversion permit must be obtained before any construction.

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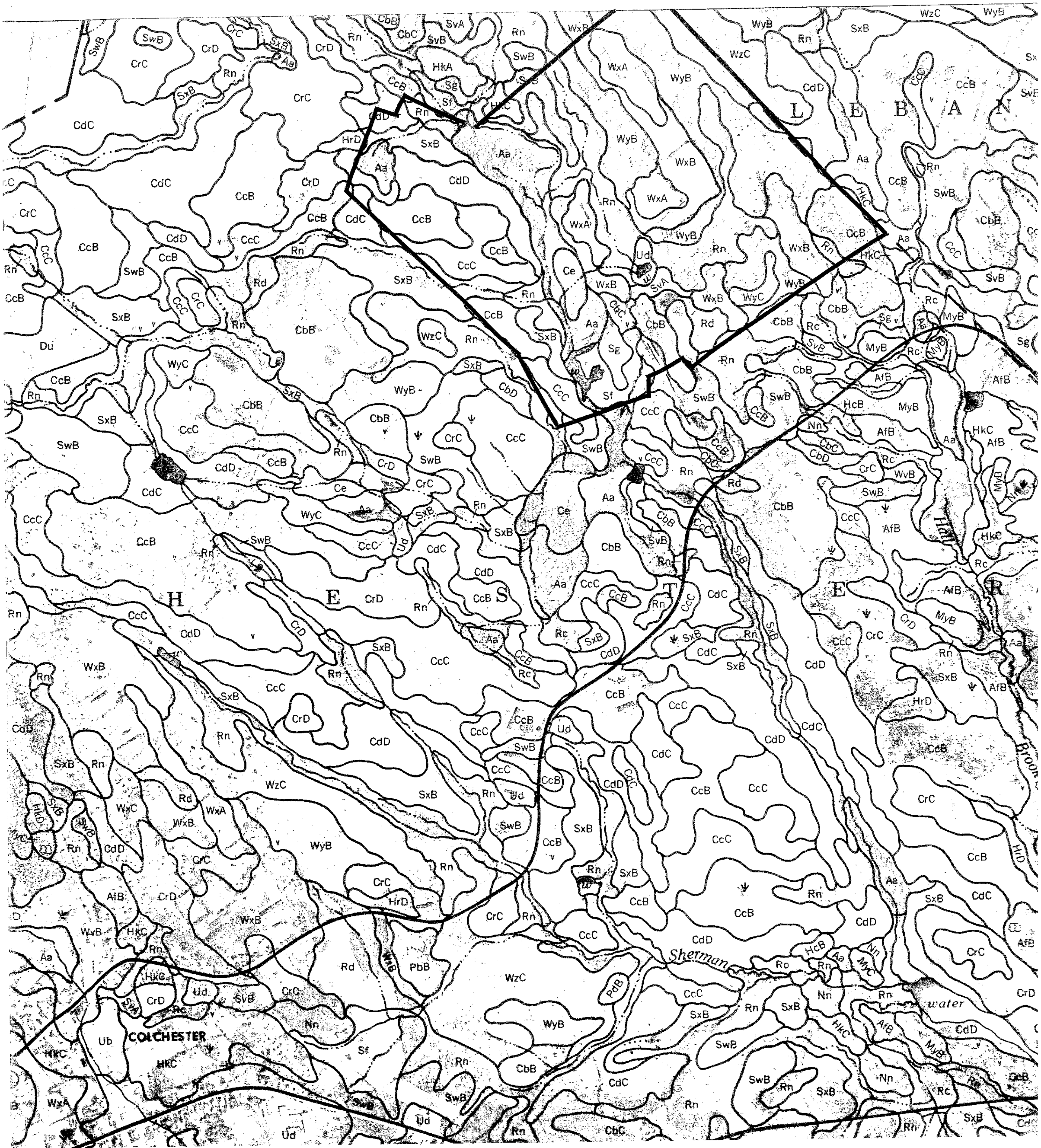
[2] Ibid., p. 22.

SOILS MAP

Approximate Site Boundary

Scale 1"=1320'



5.2 Pond Location

Proposed site looks adequate in relation to drainage and water availability. It is located about 1000 feet from the main piece of cropland. Soils of the site are the following:

Aa - Adrian and Palms muck
Ce - Carlisle muck

There are other wetland soils on the property that should be evaluated and considered for the construction, too. These soils are located closer to the croplands (about 650 feet) and are the following:

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

5.3 Pond Size and Capacity

Assuming the irrigation of 30 acres of blueberries, on a critical time of 8 weeks of no rain and no recharge on the pond. Applying 2 inches of water per week, there is a need of 40 ac. ft. of water per total crop per season.

The proposed pond total capacity (assuming an average of 5 feet deep) provides for about 100 ac. ft. of water. That means that the pond capacity is 2½ times bigger than the irrigation needs of the crops.

(See enclosed information about irrigation from the "Highbush Blueberry Culture, 8th Edition" brochure University of Rhode Island, Cooperative Extension Service, Bulletin 143, pages 22 and 23.)

5.4 Prime Farmland on the Property

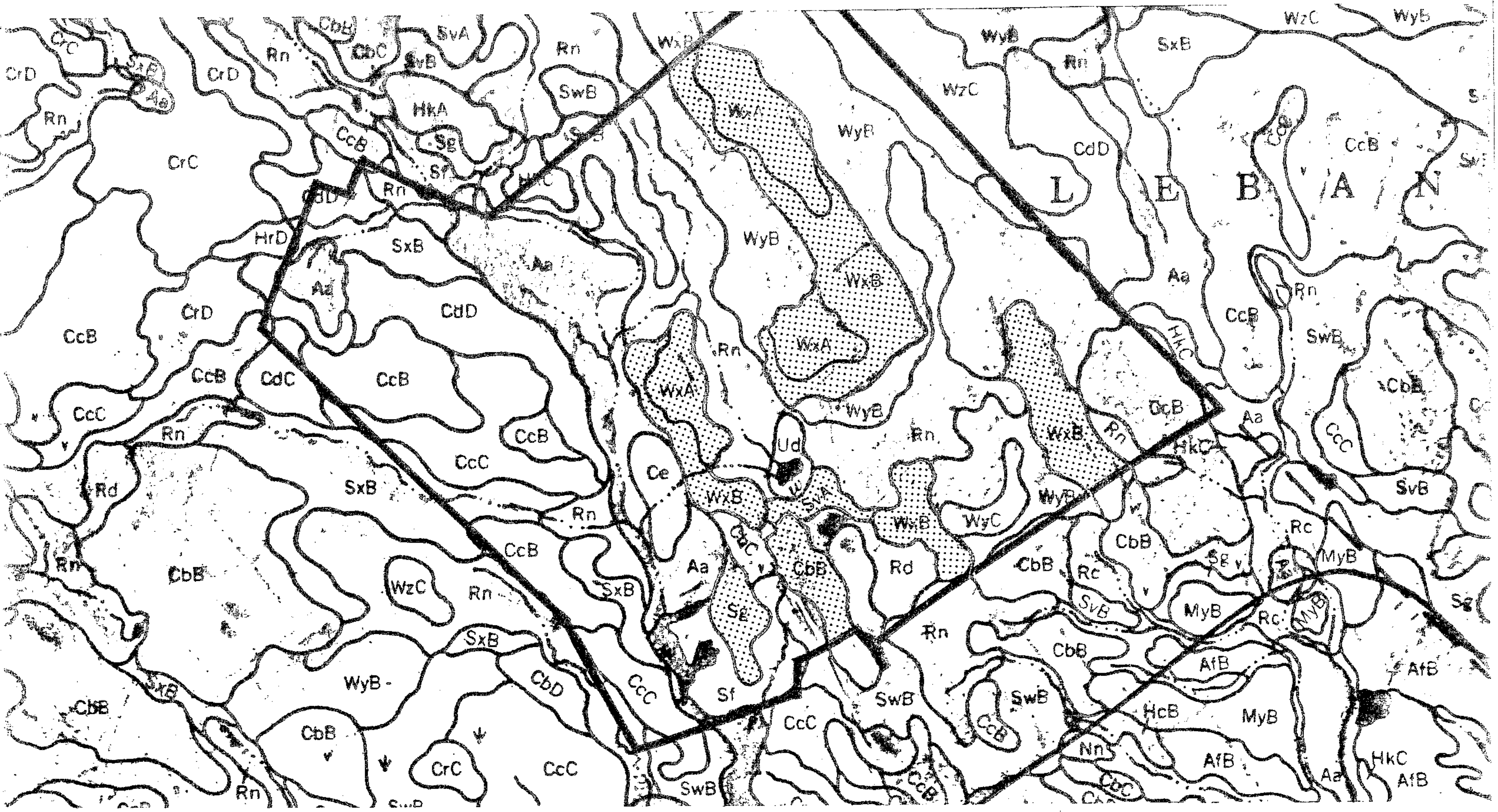
There are about 62 acres of Prime Farmland across the property. Prime Farmland is the land that is best suited to producing food, feed, forage, fiber and oilseed crops. It has adequate soil quality, growing season, and moisture supply to economically produce a sustained high yield of crops if acceptable farming methods are used. Usually has an adequate and dependable supply of moisture from precipitation. It has favorable temperature and growing season and acceptable soil reaction. It is not excessively erodible or saturated with water for long periods and is not flooded during growing season.

The following soils on the farm are classified as Prime Farmland:

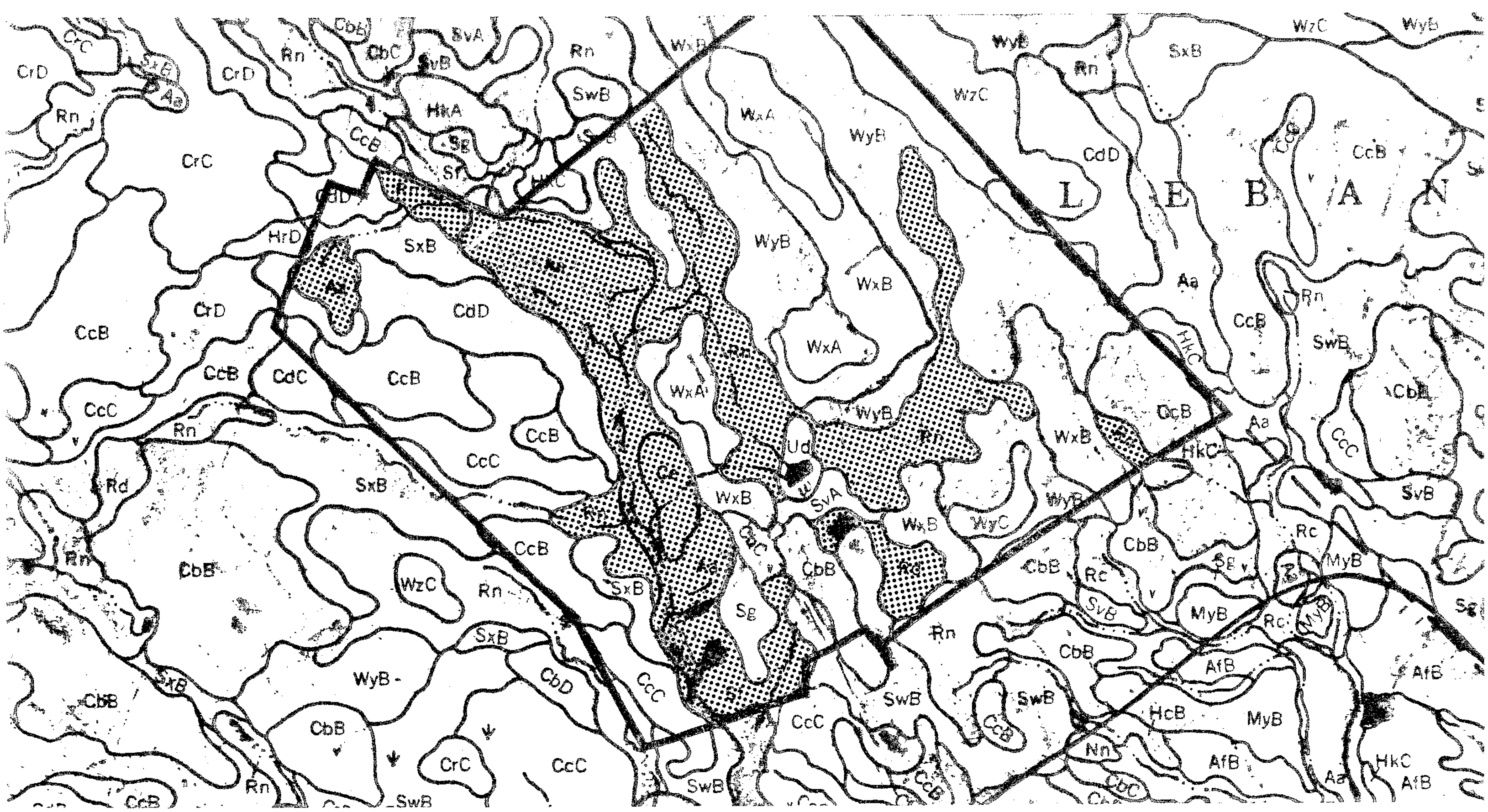
CbB - Canton and Charlton, fine sandy loam
Sg - Sudbury sandy loam
SvA - Sutton fine sandy loam
WxA & WxB - Woodbridge fine sandy loam

All these soils are adequate for planting blueberries, especially for the pH characteristics (medium acid soils) which is one of the basic requirements of this crop.

SOILS SUITABLE FOR BLUEBERRIES



REGULATED INLAND WETLAND SOILS



NOT TO SCALE

5.5 Deposition of Excavated Material

Landowner proposed to dispose the pond material over the farm croplands.

According to the proposed pond layout and assuming an average pond depth of 5 feet, there will be about 160,000 cubic yards of excavated material to be disposed.

Soils on the proposed site have mucky material on the first layers. One typical characteristic of this material is that it can be reduced in volume up to 50% when it dries out. Therefore, the total pond excavation material should be reduced in volume, depending on how deep the mucky layers go. Test pits across the site should be made to make a better estimate of the excavation.

There are 62 acres of prime farmland. These soils are ideally suited for farming on their natural conditions. No more than 3 inches of material should be applied to them in order to keep the natural characteristics. Three inches of material over 62 acres will make around 25,000 cubic yards. Landowner needs to have another disposal method for the excedent material. Also, an erosion and sediment control plan should be prepared for this operation.

Further assistance is available from the New London County USDA-SCS, 887-4163.

6. THE WETLAND

6.1 Description of the Area

The wetland associated with the site being considered for the proposed pond construction project is a large wooded complex that formed along a system of watercourses on an unnamed tributary to Sherman Brook. Based upon the U.S.D.A.-Soil Conservation Service Soil Survey, the wetland complex is approximately 160 acres in size. The wetland complex is irregularly shaped, thereby providing a large amount of habitat edge between the wetland and adjoining upland habitats. The habitat surrounding this wetland is approximately 85 percent forested and 15 percent agricultural in character. Stream flow through a large portion of this wetland is poorly defined.

6.2 Benefits to Society

The area being considered as the site of the proposed pond contains about 20 acres of wooded swamp dominated by red maple. The creation of a pond would result in the direct loss of ±20 acres of red maple swamp habitat. The ±20 acres of swamp as presently exists provides benefits to society by maintaining water quality (i.e., chemical, physical, biological condition of the water), by providing storage capacity for flood control, and by providing wildlife habitat. This wetland has aesthetic, scientific research and educational values associated with the natural development of a large wetland system that remains relatively unimpacted by man's activities.

6.3 Habitat Enhancement

The creation of a pond in this wetland system could enhance the habitat value of this wetland system and aid in increasing wildlife diversity. Creating a body of open water in this wetland could increase its attractiveness to waterfowl, wading birds, songbirds and aquatic mammals. The vegetative diversity and habitat edge within the wetland could be enhanced by providing shallow shoreline zone that would be suitable for the development of emergent vegetation zones.

6.4 Diversion Permit

As the drainage area above the proposed pond is greater than 100 acres, the creation of this pond and the subsequent withdrawal of water from the pond would be subject to the provisions of the Connecticut Water Diversion Policy Act, Connecticut General Statutes Sections 22a-365 through 22a-378. Accordingly, a permit application would have to be filed with the Commissioner of D.E.P. and a permit would have to be issued before pond construction could begin.

6.5 Recommendations

It is recommended that the plans for a pond be designed to incorporate the following:

1. The pond be no greater than 8 acres in size; this is based on the configuration of the wetland, and the recommendation that existing wetland remain to be beneficial for wildlife and vegetation.

2. The pond be irregularly shaped so as to maximize the amount of habitat edge between open water and vegetated habitats.

3. Removal of all organic soil material from the pond basin.

4. The pond be dug to an average depth of at least 10 feet if sufficient surficial deposits exist to accommodate this depth.

5. Provide a gradual slope to the pond basin in the shoreline area.

6. Provide a plan which details the logistics and methods to be used in the handling and deposition of the timber, stumps and organic deposits and dredge material.

7. VEGETATION

7.1 Disruption of Vegetation

The proposal centered around the construction of a 20 acre pond. The owner's proposal to excavate the present wetland should not substantially change the water level in the area. Creating a diversion around the border or edge of the swamp will definitely disrupt the present cover, but there should be no permanent change.

7.2 Deposition of Spoil and Replanting Spoil Banks

Because of the lack of a definitive engineering plan, disposition of and the amount of spoil was not completely addressed, but these are the biggest concerns for the remaining pond-side vegetation.

First, in the northern two-thirds of the pond site, there is considerable woody vegetation in the form of a red maple stand. What is to be done with not only the trunks and branches, but also the stump and root mass: This cannot be spread in the fields as was proposed for the rest of the spoil. The material from 12-14 acres will be no small pile to dispose of.

Comment #2 has to do with depositing any of the swamp soil along the edge. These soils might be very acid and cause problems in replanting these spoil banks.

Other than these two problems, and the potential for a change in ground water level, there should be no adverse effects on the remaining vegetation.

8. FISH RESOURCES

8.1 Fish Habitat

Currently, no fish or fish habitat exist on the site of the proposed pond construction.

8.2 Pond Water Evaporation

Pond water evaporation may be a problem with this site considering the small drainage area size. Summer evaporation (up to 1"/day) may exceed inflow thereby lowering the water level of the pond. Use of the pond for irrigation would increase the probability of habing a problem maintaining the water level in summer months. Therefore, construction of a small deep pond would be better than a large shallow pond on this site.

8.3 pH Level

The pH of effluent should be monitored daily during peat removal. If a change of greater than 0.5 occurs in the pH level, lime should be used to restore pH levels and, thereby, protect downstream areas from acidification and potential fish kills.

8.4 Fish Stocking

When pond construction is complete, fish stocking recommendations can be obtained from Connecticut D.E.P., Fisheries Staff (295-9523).

9. WILDLIFE RESOURCES

9.1 Description of Area

A wetland with a flow of roughly north to south divides an area of mixed hardwoods. Cornfields and other scattered open areas exist to the northeast and east of the wetland. The western edge exhibits stony slopes of approximately 5% to 15% with uneven aged stands of mixed hardwoods such as oaks, yellow birch, maples and scattered hemlocks. The 30-40 acre wetland includes small, scattered patches of open water interspersed with cattails, dogwood and red maple.

The present overall habitat for a variety of wildlife is good. Fields and brushy areas provide a degree of open and transition habitat. The mixed hardwood forest is somewhat lacking in diversity, but does provide an element of habitat. The existing wetland enhances the wildlife potential of the tract by providing nesting areas, cover, and feeding areas needed by many species including waterfowl, amphibians, aquatic reptiles, and furbearing mammals. Many cavity trees, important for nesting and brood rearing activities, also exist in the wetland.

9.2 Recommendations

Conversion of 15 to 20 acres of the wetland into pond may improve wildlife habitat because it will increase habitat diversity. Generally, greater habitat diversity or variety of cover types and habitat features can satisfy more species requirements, resulting in the area supporting a greater variety of species.

Due to the relative remoteness from existing and possible future development, and the abundance of observed wildlife activity evident, it is recommended that the northern portion and the western edge of the wetland be left as is. Special care should be taken to leave some of the 12" to 16" diameter maples with existing cavities, located in the western portion of the wetland.

9.3 Conclusion

Presently, the property offers good habitat for many species of wildlife. Converting existing wetlands into a pond for irrigating a proposed blueberry operation could enhance wildlife potential because of the increase in habitat diversity.

The western and northern portions of the wetland should be left undeveloped. During dredging and pond construction operations, care should be taken to preserve several snag and cavity trees.

10. SUMMARY

NOTE: This is a brief summary of the major concerns, comments and recommendations of the Team. You are strongly urged to read the entire report, and to refer back to specific sections of the report in order to obtain all the information concerning a specific topic. The numbers in parentheses refer to a section in the report.

-- It appears that the upland, till-based soils (especially WxA, WxB, CbB, SvA) would be very favorable for the cultivation of blueberries. Other soil types in the western parts may also have some potential. (3.3, 5.4)

-- A series of soil borings would need to be placed in the areas proposed for excavation to determine the exact thickness and composition of the materials to be excavated. When this is done, an exact determination of the subsurface materials in the area of the pond site can be made. (3.3, 5.5)

-- The Rn, Rd, Ce, Aa and Sf soil types are all classified as inland wetlands and are regulated under Public Act 155. Any activity which involves modification, dredging or removal of soil will require a permit and approval by the Town's Inland Wetland Agency. (3.3)

-- The applicant should determine the potential hydrologic and ecologic impacts (if any) of the proposed pond excavation on important wetland functions (reducing runoff, trapping sediment, controlling water quality, habitat for wildlife) before approval is granted. (3.3, 6.2)

-- Placing the excavated soils over the existing soil in the eastern parts may alter their physical and chemical composition to a point where the soils may not be considered "prime farmland." (3.4, 5.4)

-- All excavated material, wood, roots and brush will need to be disposed of properly. Any excavated material sold commercial will probably require approval from Planning and Zoning. (3.4)

-- Analyzing the potential hydrological effects of the pond excavation was difficult, particularly since there were no definite plans prepared for the Team's review. (4.1)

-- Data obtained from other swamps suggest that evapotranspiration usually exceeds evaporation from a free-water surface. As a result, base streamflows during hot, dry periods may increase if the pond is created. During spring thaws the normally heavy spring streamflows may be reduced by the presence of a swamp. Conversely, creation of a pond could lead to higher spring flows. (4.3)

-- The rate at which the pond will refill with water will depend upon the amount of rainfall received during a given period of time. (4.3)

-- It is expected that the surface elevation of the proposed pond would probably be controlled by a man-made structure. Construction of a dam, dike, etc. may require a permit from DEP's Water Resources Unit, Dam Section. (4.3)

-- The effectiveness of the proposed pond, as opposed to the present swamp, in reducing flood flows is difficult to address, but it seems likely that the differences between the two would be relatively small. (4.4)

-- A pond may also serve the same function as a wetland by trapping sediment and maintaining water quality. (4.5)

-- The removal of swamp vegetation may cause a decrease in the acidity and iron-manganese content of the outflowing water, but during and immediately following the pond excavation the acidity and iron-manganese levels may increase dramatically because of the disruption of organic material. (4.5)

-- Acidification of the outlet stream could cause fish kills in downstream areas and affect local vegetation. (4.5, 8.3)

-- There is the possibility of diverting the inflowing stream to the wetland around the area to be excavated. This may reduce the threat of possible water quality deterioration. Since the stream to be located drains an area greater than 100 acres, this activity would be subject to the CT Water Diversion Policy Act PA-402. The DEP's Water Resources will need to be contacted first. (4.5, 6.4)

-- It is strongly recommended that a detailed erosion and sediment control plan be formulated and followed through all phases of the project, this should also apply to areas of stockpiled excavated materials and where excavated materials are spread over existing upland soils. (4.5, 5.5, 6.5, 7.2)

-- Based on calculations made by the Team Geologist and Soil Conservationist, the proposed 20 acre pond is two and one half (2½) times larger than needed to irrigate 30 acres of blueberries. (4.6, 5.3)

-- An alternative to creating a new 20 acre pond for irrigation is the possibility of using the existing pond on the east side of the swamp or constructing one or two smaller ponds on the wetland soils in the eastern upland sections of the site closer to the proposed blueberry operation. (4.7, 5.2)

-- Consideration should be given to leaving a wetland fringe around the pond. This would benefit wildlife and vegetation. (4.7, 6.5, 9.2)

-- The Proposed Pond Layout does not provide enough information about the construction. A complete design should be prepared showing details such as a construction schedule, disposition sites for excavated material and an erosion and sediment control plan. (5.1)

-- The entire parcel contains about 62 acres of "prime farmland." Prime farmland is the land best suited to producing food, feed, forage, fiber and oilseed crops. No more than 3 inches of material should be applied to them in order to keep the natural characteristics. (5.4, 3.3)

-- The creation of a pond would result in the direct loss of ±20 acres of red maple swamp habitat. This swamp as it exists now provides benefits to society by maintaining water quality, providing storage capacity for flood control, and by providing wildlife habitat. (6.2)

-- This particular wetland has aesthetic, scientific and educational values associated with the natural development of a large wetland system that remains relatively unimpacted by man's activities. (6.2)

-- The creation of a pond in this wetland system could enhance the habitat value and aid in increasing wildlife diversity. (6.3, 9.2)

-- It is recommended that the plans for the pond construction incorporate the following: 1) the pond be no greater than 8 acres in size; 2) the pond be irregularly shaped to maximize the amount of habitat edge; 3) removal of all organic soil material from the pond basin; 4) the pond be dug to an average depth of at least 10 feet; 5) provide a gradual slope to the pond basin in the shoreline area, and 6) provide a plan which details the logistics and methods to be used in the handling and deposition of the timber, stumps and excavated material. (6.5)

-- By creating a diversion around the edge of the swamp the present vegetative cover will be disrupted, but there should be no permanent change. (7.1)

-- The depositing of the excavated swamp soils on the banks may cause problems in replanting the banks because of the acidic nature of the soils. (7.2)

-- There may be the potential for a change in ground water level which could have an effect on the remaining vegetation. (7.2)

-- No fish or fish habitat presently exist on the site proposed for pond construction. (8.1)

-- Because of potential evaporation problems, a small deep pond would be better than a large shallow pond for this site. (8.2)

-- The pH of the effluent should be monitored daily during removal of soils. If a change of greater than 0.5 occurs in the pH level, lime should be added to restore the pH level. This will protect downstream areas from acidification which could kill fish. (8.3, 4.5)

-- Fish stocking recommendations once the pond is constructed can be obtained from the DEP Fisheries Staff. (8.4)

-- The present overall habitat for a variety of wildlife is good. (9.1)

-- It is recommended that the northern and western edge of the wetland be left as is because of the observed wildlife activity. (9.2, 6.5)

-- Care should also be taken to leave some of the 12" to 16" diameter maples with existing cavities which are located in the western portion of the wetland, as well as snag trees. (9.2)

Appendix

Aa-Adrian and Palms mucks

These nearly level, very poorly drained soils are in pockets and depressions of stream terraces, outwash plains, and glacial till uplands. Slopes range from 0 to 2 percent. Mapped areas consist of either Adrian soils or Palms soils, or both. These soils were mapped together because there are no major differences in most uses and management. Adrian soils have a high water table which is at or near the surface for most of the year. Permeability is moderately rapid in the organic layers and rapid in the substratum. The available water capicity is high. Runoff is very slow or ponded. Adrian soils are stronly acid through slightly acid. Palms soils have a high water table which is at or near the surface for most of the year. Permeability is moderately rapid in the organic layers and moderately slow in the substatum. The available water capacity is high. Runoff is very slow or ponded. Palms soils are strongly acid through slightly acid.

CbB-Canton and Charlton fine sandy loams, 3 to 8 percent slopes

These gently sloping, well drained soils are on glacial till upland hills, plains, and ridges. Areas of this unit consist of either Canton soil or Charlton soil, or both. These soils were mapped together because there are no major differences in use and management. Permeability of the Canton soil is moderately rapid in the surface layer and subsoil and rapid in the substratum. The available water capacity is moderate. Runoff is medium. This soil warms up and dries out rapidly in the spring. Unless limed, the soil is strongly acid or medium acid.

Permeability of the Charlton soil is moderate or moderately rapid. The available water capacity is moderate. Runoff is medium. The soil warms up and dries out rapidly in the spring. Unless limed, the soil is strongly acid or medium acid.

These soils are well suited to cultivated crops. These soils are in capability subclass IIe.

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

These sloping, well drained soils are on glacial till upland hills, plains, and ridges. Mapped areas consist of either Canton soil or Charlton soil, or both. These soils were mapped together because there are no major differences in use and management. Permeability of the Canton soil is moderately rapid in the surface layer and subsoil and rapid in the substratum. The available water capacity is moderate. Runoff is rapid. This soil warms up and dries out rapidly in the spring. Unless limed, the soil is strongly acid or medium acid.

Permeability of the Charlton soil is moderate or moderately rapid. The available water capacity is moderate. Runoff is rapid. The soil warms up and dries out rapidly in the spring. Unless limed, the soil is strongly acid or medium acid.

These soils are suited to cultivated crops. However, the hazard of erosion is severe. These soils are in capability subclass IIIe.

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

These gently sloping, well drained soils are on glacial till upland hills, plains, and ridges. Stones and boulders cover 1 to 8 percent of the surface. These soils were mapped together because there are no major differences in use and management. Permeability of the Canton soil is moderately rapid in the surface layer and subsoil and rapid in the substratum. The available water capacity is moderate. Runoff is medium. This soil warms up and dries out rapidly in the spring. The soil is strongly acid or medium acid.

Permeability of the Charlton soil is moderate or moderately rapid. The available water capacity is moderate. Runoff is medium. This soil warms up and dries out rapidly in the spring. It is strongly acid or medium acid.

These soils are not suited to cultivated crops. Stones and boulders make the sue of farming equipment difficult. These soils are in capability subclass VIs.

CcC-Canton and Charlton very stony fine sandy loams, 8 to 15 percent slopes

These sloping, well drained soils are on glacial till upland hills, plains, and ridges. Stones and boulders cover 1 to 8 percent of the surface. These soils were mapped together because there are no major differences in use and management. Permeability of the Canton soil is moderately rapid in the surface layer and subsoil and rapid in the substratum. The available water capacity is moderate. Runoff is rapid. The soil warms up and dries out rapidly in the spring. It is strongly acid or medium acid.

CdD-Canton and Charlton extremely stony fine sandy loams, 15 to 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 to 25 percent of the surface. Permeability of the Canton soil is moderately rapid in the surface layer and subsoil and rapid in the substratum. The available water capacity is moderate. Runoff is very rapid. The Canton soil warms up and dries out rapidly in the spring. It is strongly acid or medium acid.

Permeability of the Charlton soil is moderate or moderately rapid. The available water capacity is moderate. Runoff is very rapid. The Charlton soil warms up and dries out rapidly in the spring. It is strongly acid or medium acid.

These soils are not suited tocultivated crops. Stones and boulders make the use of farm equipment impractical. The hazard of erosion is severe. 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 to 25 percent of the surface. These soils were mapped together because there are no major differences in use and management. The Ridgebury soil has a seasonal high water table at a depth of about 6 inches. Permeability is moderate or moderately rapid in the surface layer and subsoil and slow or very slow in the substratum. The available water capacity is moderate. Runoff is very slow or slow. Ridgebury soil warms up and dries out slowly in the spring. It is strongly acid through slightly acid.

The Leicester soil has a seasonal high water table at a depth of about 6 inches. Permeability is moderate or moderately rapid. The available water capacity is moderate. Runoff is very slow or slow. Leicester

soil warms up and dries out slowly in the spring. It is very strongly acid through medium acid.

The Whitman soil has a high water table at or near the surface for most of the year. Permeability is moderate or moderately rapid in the surfacelayer and subsoil and slow or very slow in the substratum. The available water capacity is moderate. Runoff is very slow, or the soil is ponded. Whitman soil warms up and dries out very slowly. It is very strongly acid through slightly acid.

These soils are not suited to cultivated crops. Stoniness makes the use of farming equipment impractical. These soils are in capability subclass VIIs.

Rd-Ridgebury fine sandy loam

This nearly level, poorly drained soil is on drumloidal, glacial till, upland landforms. The Ridgebury soil has a seasonal high water table at a depth of about 6 inches. Permeability is moderate or moderately rapid in the surface layer andf subsoil and slow or very slow in the substratum. The available water capacity is moderate. Runoff is very slow or slow. Ridgebury soil warms up and dries out slowly in the spring. Unless limed, it is strongly acid through slightly acid. This soil is suited to cultivated crops. This soil is in capability subclass IIIw.

Sg-Sudbury sandy loam

This nearly level to gently sloping, moderately well drained soil is on outwash plains and stream terraces. Slopes range from 0 to 5 percent. The Sudbury soil has a seasonal high water table at a depth of about 18 inches. Permeability is moderately rapid in the surface layer and subsoil and rapid in the substratum. The available water capacity is moderate. Runoff is slow or medium. Sudbury soil warms up and dries out slowly in the spring. Unless limed, it is strongly acid or medium acid. This soil is well suited to cultivated crops. This soil is in capability subclass IIw.

Ce-Carlisle muck

This nearly level, very poorly drained soil is in pockets and depressions of flood plains, stream terraces, outwash plains, and glacial till uplands. Slopes range from 0 to 2 percent. The Carlisle soil has a high water table near or above the surface for most of the year. Permeability is moderately rapid. The available water capacity is high. Runoff is very slow. The soil is strongly acid through slightly acid. This soil is not suited to cultivated crops because of wetness. This soil is in capability subclass VIw.

Sf-Scarboro mucky fine sandy loam

This nearly level, very poorly drained soil is on stream terraces and outwash plains. Slopes range from 0 to 3 percent. The Scarboro soil has a high water table at or near the surface for most of the year. Permeability is rapid in the organic layer and rapid or very rapid in the mineral surface layer and substratum. The availabe water capacity is low. Runoff is very slow, or the soil is ponded. Scarboro soil is very strongly acid through medium acid. This soil is not cultivated crops because of wetness. This soil is in capability subclass Vw.

SvA-Sutton fine sandy loam, 0 to 8 percent slopes

This nearly level, moderately well drained soil is on upland glacial till plains, hills, and ridges. The Sutton soil has a seasonal high water table at a depth of about 18 inches. Permeability is moderate or moderately rapid. The available water capacity is moderate. Runoff is slow. Sutton soil warms up and dries out slowly in the spring. Unless limed, it is strongly acid or medium acid in the surface layer and subsoil and strongly acid through slightly acid in the substratum. This soil is well suited to cultivated crops. This soil is in capability subclass IIw.

SxB-Sutton extremely stony fine sandy loam, 0 to 8 percent slopes

This nearly level to gently sloping, moderately well drained soil is on upland glacial till plains, hills, and ridges. Stones and boulders cover 8 to 25 percent of the surface. The Sutton soil has a seasonally high water table at a depth of about 18 inches. Permeability is moderate or moderately rapid. The available water capacity is moderate. Runoff is slow or medium. Sutton soil warms up and dries out slowly in the spring. It is strongly acid or medium acid in the surface layer and subsoil and strongly acid through slightly acid in the substratum. This soil is not suited to cultivated crops because stoniness makes the use of farming equipment impractical. This soil is capability subclass VIIs.

SwB-Sutton very stony fine sandy loam, 0 to 8 percent slopes

This nearly level to gently sloping, moderately well drained soil is on upland glacial till plains, hills, and ridges. Stones and boulders cover 1 to 8 percent of the surface. The Sutton soil has a seasonal high water table at a depth of about 18 inches. Permeability is moderate or moderately rapid. The available water capacity is moderate. Runoff is slow or medium. Sutton soil warms up and dries out slowly in the spring. It is strongly acid or medium acid in the surface layer and subsoil and strongly acid through slightly acid in the substratum. This soil is not suited to cultivated crops. Stones and boulders make the use of farming equipment difficult. This soil is in capability subclass VIs.

WxA-Woodbridge fine sandy loam, 0 to 3 percent slopes

This nearly level, moderately well drained soil is on drumloidal, glacial till, upland landforms. The Woodbridge soil has a seasonal high water table at a depth of about 18 inches. Permeability is moderate in the surface layer and subsoil and slow or very slow in the substratum. The available water capacity is moderate. Runoff is slow. This Woodbridge soil warms up and dries out slowly in the spring. Unless limed, it is strongly acid or medium acid in the surface layer and subsoil and strongly acid through slightly acid in the substratum. This soil is well suited to cultivated crops. This soil is in capability subclass IIw.

WxB-Woodbridge fine sandy loam, 3 to 8 percent slopes

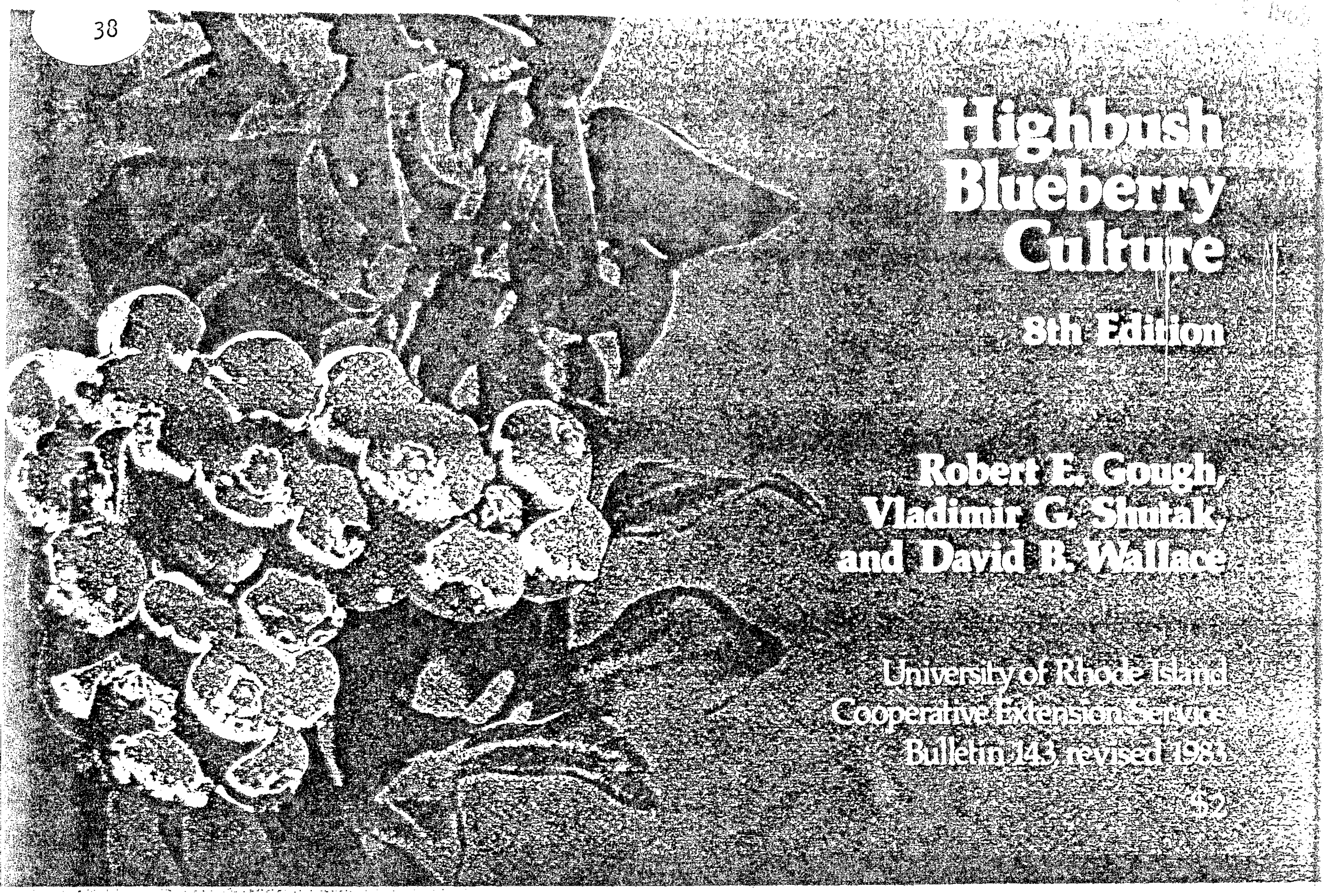
This gently sloping, moderately well drained soil is on drumloidal, galcial till, upland landforms. The Woodbridge soil has a seasonal high water table at a depth of about 18 inches. It has moderate permeability in the surface layer and subsoil and slow or very slow permeability in the substratum. The available water capacity is moderate. Runoff is medium. This soil warms up and dries out slowly in the spring. Unless limed, it is strongly acid or medium acid in the surface layer and subsoil and strongly acid thorough slightly acid in the substratum. This soil is well suited to cultivated crops. This soil is in capability subclass IIw.

WyB-Woodbridge very stony fine sandy loam,
0 to 8 percent slopes

This nearly level to gently sloping, moderately well drained soil is on drumloidal, glacial till, upland landforms. Stones and bounders cover 1 to 8 percent of the surface. The Woodbridge soil has a seasonal high water table at a depth of about 18 inches. Permeability is moderate in the surface layer and subsoil and slow or very slow in the substratum. The available water capacity is moderate. Runoff is medium. This Woodbridge soil warms up and dries out slowly in the spring. It is strongly acid or medium acid in the surface layer and subsoil and strongly acid through slightly acid in the substratum. This soil is not suited to cultivated crops because of stoniness. This soil is in capability subclass VIs.

WyC-Woodbridge very stony fine sandy loam,
8 to 15 percent slopes

This sloping, moderately well drained soil is on drumloidal, glacial, upland landforms. Stones and boulders cover 1 to 8 percent of the surface. The Woodbridge soil has a seasonal high water table at a depth of about 18 inches. Permeability is moderate in the surface layer and subsoil and slow or very slow in the substratum. The available water capacity is moderate. Runoff is medium. This Woodbridge soil warms up and dries out slowly in the spring. It is strongly acid or medium acid in the surface layer and subsoil and strongly acid through slightly acid in the substratum. This soil is not suited to cultivated crops because of stoniness. This soil is in cpability subclass VIs.



Irrigation

For best growth and production, blueberries require a constant moisture supply. A mature planting should receive about one to two inches of water per week during the growing season, at least through the harvest period. This rate would require about 600 or 1,200 gallons per 1,000 square feet. Growers often employ the "feel test" to determine the moisture needs of the soil. A sample of soil is squeezed in the palm of the hand. If soil moisture is adequate, the ball of soil thus formed is weak and easily broken. If the soil ball is not easily broken, the soil may be too wet; if the soil will not form a ball, it is too dry and irrigation may be necessary. Considerable experience and some knowledge of soil type is necessary to use this test properly.

Drought may sometimes become a problem to New England growers. Typical drought symptoms often include reddened foliage, weak thin shoots, early defoliation, and decreased fruit set. If rainfall is insufficient, irrigation is strongly recommended. Some research has shown that overhead sprinkler irrigation may be used but should be avoided during ripening because steady wetting may cause ripe fruit to split. Early morning overhead irrigation with good drying, however, can be used quite safely. This type of irrigation can also be used for frost protection during bloom. It should start when the temperature drops to just above freezing and should be continued, at the rate of one-tenth to five inches per hour, until the temperature rises or ice melts. This practice can protect the blossoms down to 25°F (see section on winter injury). It has also been reported that overhead irrigation may increase vegetative growth by maintaining cooler temperature in the leaf, providing higher humidity, and decreasing water loss from the plant.

Other types of irrigation, such as ditch and trickle irrigation, may be used. The advantages of these methods are a more constant and uniform water supply and water conservation.

Whatever system is used, water should not be applied at too rapid a rate. This may result in puddling and soil erosion especially if the field is not mulched.

Ditch irrigation has a number of disadvantages. It requires extensive ditch system with great attention paid to maintaining an even depth of "canals" to provide complete and even water distribution. This may be quite difficult in view of New England's uneven soil contours, and if mulch is used it will provide further difficulty. This method also uses a great amount of water and may disturb the blueberries' shallow roots.

Trickle irrigation may be achieved with a regular soaker hose or with a specially designed portable system of plastic pipes and tubings. This system, although more expensive than ditch or overhead in original investment, is the most efficient water conserving method providing constant and even moisture supply.

Fortunately, if the blueberry planting is well mulched with sawdust, the New England grower may not need to irrigate more then 2-3 times during the growing season. In most cases simple overhead irrigation may prove to be most practical.