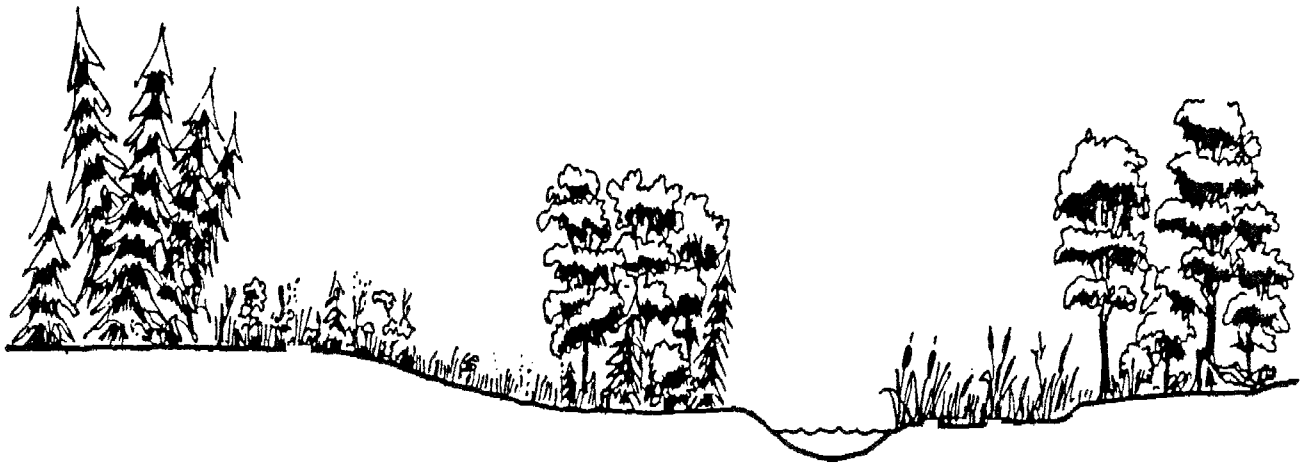
Greenscape Development Corporation Subdivision

Salem, Connecticut

May 1989

EASTERN CONNECTICUT ENVIRONMENTAL REVIEW TEAM REPORT



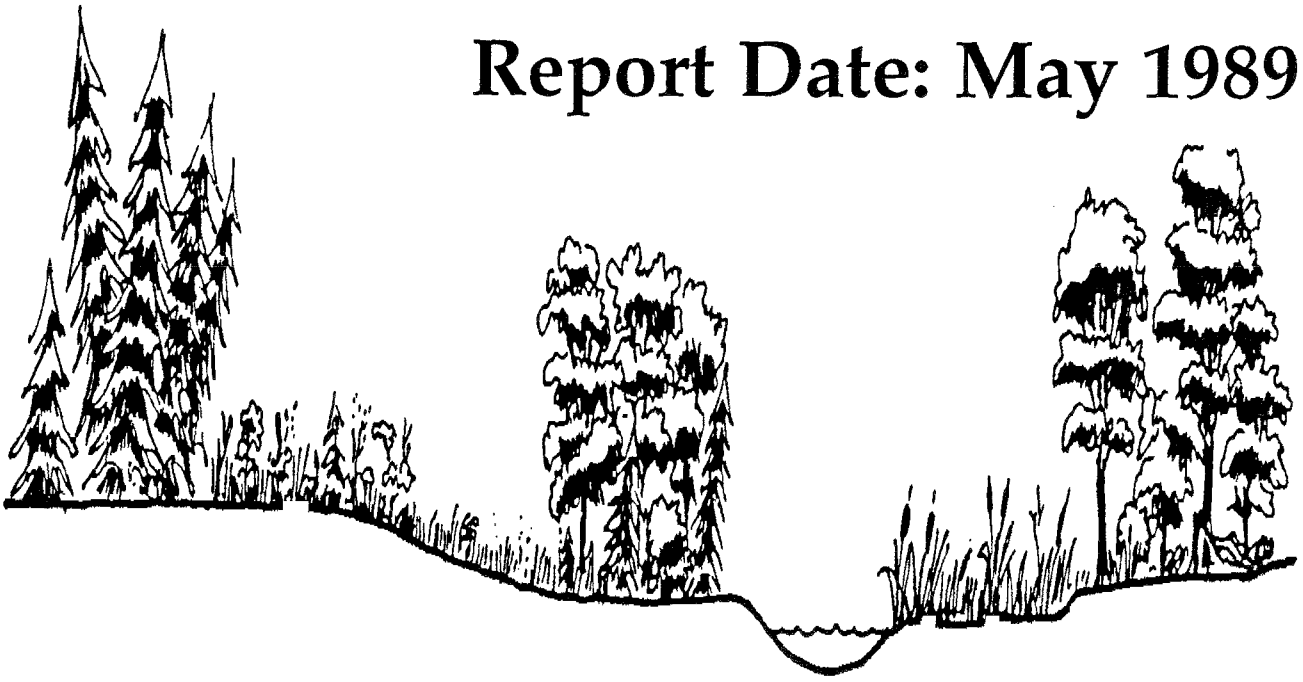
Eastern Connecticut Resource Conservation and Development Area, Inc.

Greenscape Development Corporation Subdivision

Salem, Connecticut

Review Date: February 23, 1989

Report Date: May 1989



Eastern Connecticut Environmental Review Team
P.O. Box 70, Route 154
Haddam, Connecticut 06438
(203) 345-3977

ENVIRONMENTAL REVIEW TEAM REPORT
ON
GREENSCAPE DEVELOPMENT CORPORATION SUBDIVISION
SALEM, CONNECTICUT

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

The ERT met and field checked the site on Thursday, February 23, 1989. Team members participating on this review included:

Kevin DesRoberts	**Wildlife Assistant**	**DEP-Eastern District**
Steve Hill	**Wildlife Biologist**	**DEP-Eastern District**
Laura McNamera	**Environmental Analyst**	**DEP-Water Resources**
Pete Merrill	**Forester**	**DEP-Patchaug State Forest**
Brian Murphy	**Fisheries Biologist**	**DEP-Eastern District**
Liz Rogers	**District Conservationist**	**USDA-Soil Conservation Service**
Tom Seidel	**Regional Planner**	**Southeastern CT Regional Planning Agency**
Elaine Sych	**ERT Coordinator**	**Eastern CT RC&D Area**
Bill Warzecha	**Geologist/Sanitarian**	**DEP-Natural Resources Center**

Prior to the review day, each Team member received a summary of the proposed project, a list of the town's concerns, a location map, a topographic map, and a soils map. During the field review the Team members were given full sets of plans and the consultant studies that were available. The Team met with, and were accompanied by the Wetlands Enforcement Officer, the Town Planner, the chairman of the Conservation Commission, the applicants and their engineer and environmental consultant. Following the review, reports from each Team member were submitted to the ERT Coordinator for compilation and editing into this final report.

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

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

If you require additional information, please contact:

Elaine A. Sych
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(203)345-3977

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1. LOCATION, ZONING AND LAND USE

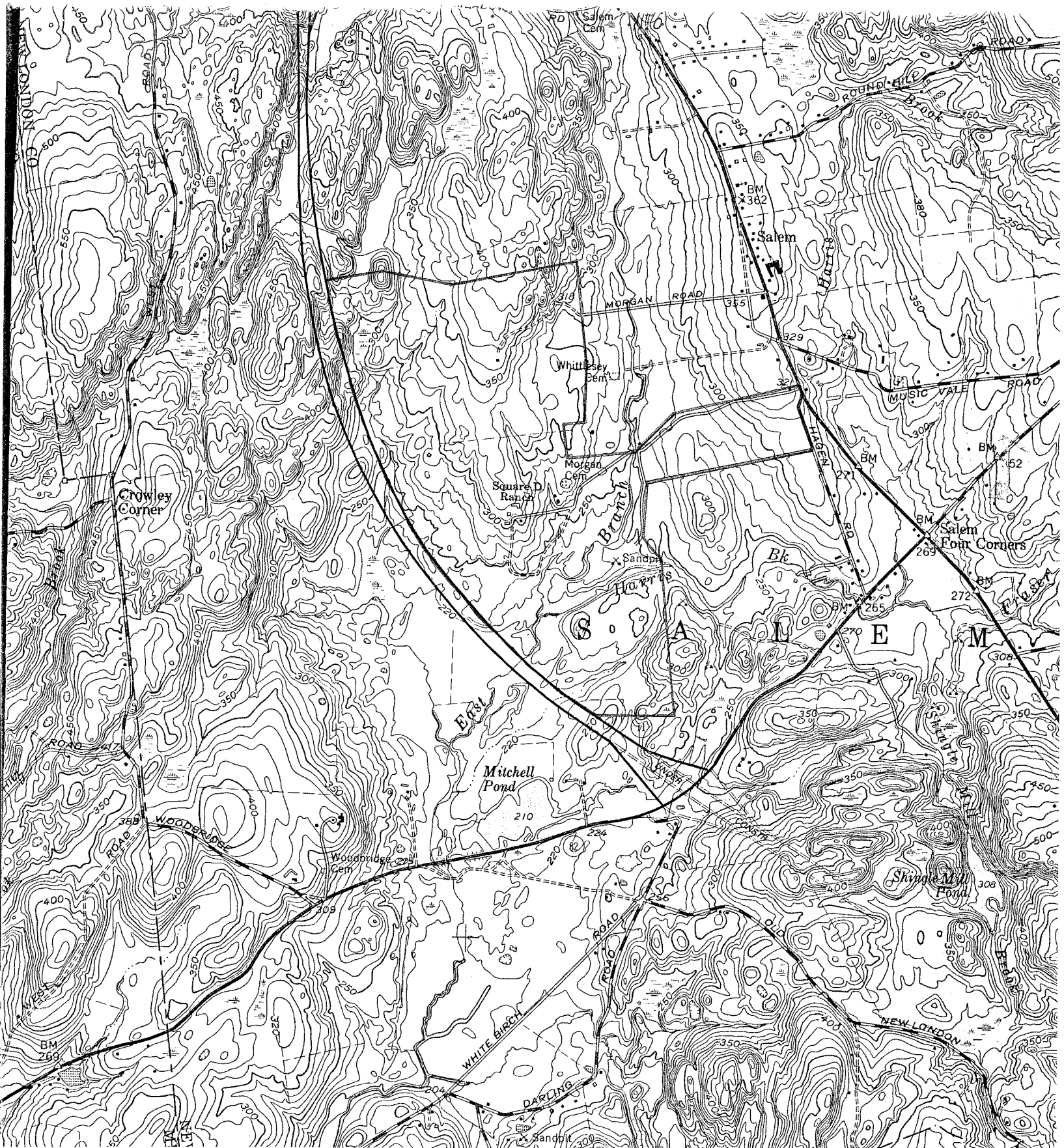
The ± 650 acre site is located in the southeast corner of Salem. It is bounded on the south and west by Route 11, on the east by Hagen Road and Route 85 (Hartford Road) and private, undeveloped land on the north. Morgan Road terminates at the northeast corner. An existing gravel road system (unnamed) and Walden Road, which provides access to a horse farm and former gravel pit, respectively, occurs in the southern parts. Present plans indicate that the proposed subdivision roads would closely follow the roads mentioned in the preceding sentence.

The site is currently zoned RU-A which allows single family residences on lots of at least 80,000 square feet or about 2 acres. Any other uses which do not meet the requirements would require a formal zone change. It is understood that the applicants wish to construct 152 single-family homes which would be served by individual on-site wells and septic systems and 125 condominium units. The latter would be served by a community septic system and water supply.

Low to moderate density residential and agricultural land uses characterize the area. Several farm fields, which are contiguous, bisect the central parts of the site. A sand and gravel mine was operated about 15 years ago in the southern part of the site. The sand and gravel was used primarily for the construction of Route 11. The land was extensively disturbed in this area and retains features resulting from the mining operation. These include berms surrounding mined areas, ponds, poorly-drained depressions, all of which disrupt the natural drainage of the southern parts. Building relics of the sand and gravel processing facility are also visible on the site.

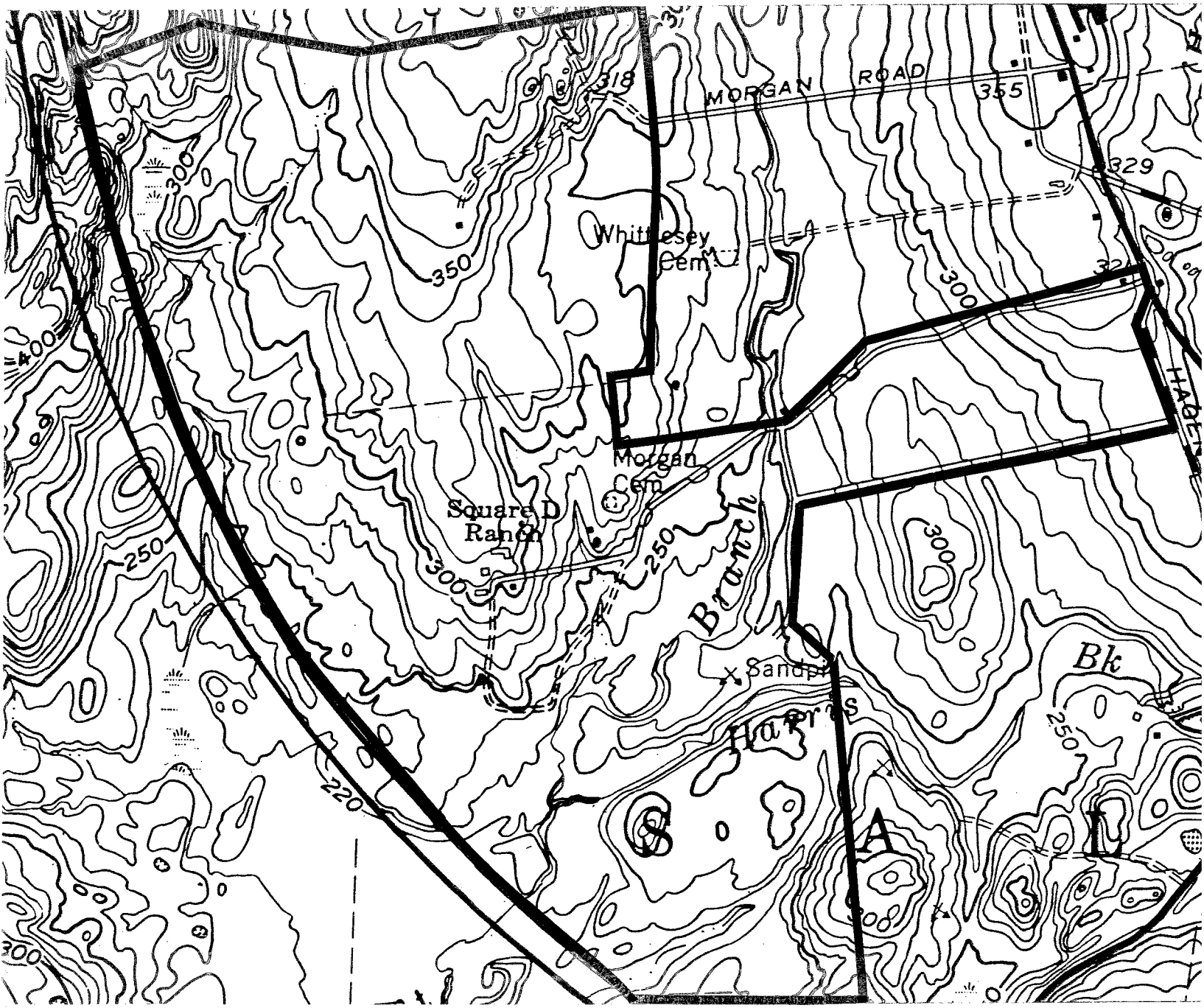
LOCATION MAP

Scale 1" = 2000' —— Approximate Site Boundary



TOPOGRAPHY

Scale 1" = 1000' Approximate Site Boundary



2. TOPOGRAPHY

The site is located west of Salem center. Grades on the site range from about 400 feet above mean sea level to 220 feet above mean sea level, north to south. Slopes generally range from gentle to moderate with small areas of steep slopes which occur at the southern and northern limits. The East Branch Eight Mile River and Harris Brook flow in a southwesterly direction through the south central parts of the site.

3. GEOLOGY

The site lies entirely within the Hamburg topographic quadrangle. A bedrock geologic map (QR-19, L.L. Lundgren) for the quadrangle has been published by the Connecticut Geologic and Natural History Survey. No surficial geologic map has been published to date for the quadrangle.

A. Bedrock Geology

Bedrock outcrops are scattered throughout the site but are not concentrated in any particular area. It should be pointed out that the Honey Hill Fault, a major low-angle thrust fault in eastern Connecticut bisects the central parts of the site. The fault is a structural feature that occurred during the geologic past and is no longer experiencing active movement.

According to map QR-19, bedrock underlying the site consists of northeast-southwest trending belts of metamorphic rocks. "Metamorphic" rocks are rocks that have been subjected to great heat and pressure within the earth's crust. They consist of very complex rock units of variable composition and texture.

Six rock types have been identified on the site and their boundaries delineated on the accompanying bedrock geologic map. The rock types underlying the site include: 1) Monson Gniess; 2) a subunit of Monson

Gneiss; 3) Tatnic Hill Formation; 4) a subunit of Tatnic Hill Formation; 5) Canterbury Gneiss; and 6) Hebron Formation.

The major rock types found on the site south of the Honey Hill Fault are Monson Gneiss and a subunit of Monson Gneiss. North of the Honey Hill Fault, the major rock types found are Canterbury Gneiss, Hebron Formation, Tatnic Hill Formation and a subunit of Tatnic Hill Formation. A detailed description of each rock unit accompanies the bedrock geologic map, which was adopted from Map QR-19 and the Bedrock Geological Map of Connecticut. J. Kolger, 1985. They consist of schists, gneisses and amphibolites.

The single-family homes are likely to tap the underlying bedrock as a source of domestic water (see Water Supply Section).

In consideration of soil mapping data and geologic maps, shallow to bedrock soils are not prevalent on the site. This suggests that extensive blasting will not likely be required. Based on the proposed development and size of the site, there may be some isolated areas where blasting will be necessary, but it should not be excessive.

B. Surficial Geology

Based on surficial geologic and soil mapping data, the unconsolidated materials overlying bedrock on the site consist of glacial till and stratified drift. The till was plastered onto the metamorphic bedrock underlying the site by moving glacial ice. It consists of groundup rock material which may range in size from clay to boulders or any combination of these intermediate sizes. Because the ice moved the particles without regard to their sizes or shapes, till textures may be locally quite variable. Two types of till have been identified in Connecticut. One is fairly loose and sandy, while the other is typically silty, crudely layered and compact. Based on deep test hole information for Phase I and soil mapping data, the site contains both types of till. The compact or "hardpan" variety is found primarily in the eastern and central parts (open farm fields). The compact till or hardpan is characterized by a firm or dense soil zone that has developed about 2.5 to 3.5 feet below

ground surface. The presence of this firm layer generally impedes the downward movement of water. This condition results in a seasonally high water table condition. This would occur mainly during the wet months of the year when the upper, more permeable soil zones become saturated. Percolation rates which are generally moderately slow to slow characterize the compact till.

The remainder of the parcel in the southern limits is covered by stratified gravelly sands, which were deposited by streams of glacial meltwater in East Branch Eight Mile River and Harris Brook Valleys. Several tens of feet of sand and gravel may cover this area. The log of a bore hole along Route 11 at the southern parts of the site located 41 feet of sand and gravel. As mentioned earlier in this report, the sands and gravel in the southern parts were mined in the past, probably for road base material.

It is understood that the applicant has hired a consulting firm to investigate the water supply potential of the stratified drift deposits in the southern parts. This water supply would serve the proposed condominium units but not the single-family homes.

Another post glacial sediment, occurring mainly along the East Branch Eight Mile River is alluvium. It consists of silt, sand and gravel that have been recently deposited over the sand and gravel on the East Branch Eight Mile River and Harris Brook floodplain.

Final surficial geologic materials found on the parcel are swamp deposits. These post-glacially deposited sediments consist of decayed vegetative matter, intermixed with differing amounts of silt, sand and a little clay, which filled depressional features on the site. Seasonally wet areas which contain mostly mineral matter parallel many drainageways on the site. A certified soil scientist had mapped regulated inland-wetland soils only on a portion of the site at the time of this field review.

Any proposed activity such as grading, filling or modifications that impact regulated areas are subject to approval by the Salem Inland-Wetland Commission. In reviewing a proposal, the Commission needs to determine

the impact that the proposed activity will have on the wetland. If the Commission feels that the regulated areas are serving an important hydrologic or ecologic function and that the impact of the proposed activity will be severe, they may deny the activity altogether, or at least require measures that would minimize the impact. (See Wetland Review Section)

BEDROCK GEOLOGY

Scale 1" = 1000'

Hebron Formation - interlayered dark gray schist and greenish-gray, fine to medium grained calc-silicate gneiss.

Canterbury Gneiss - light gray, medium grained, locally strongly lineated gneiss.

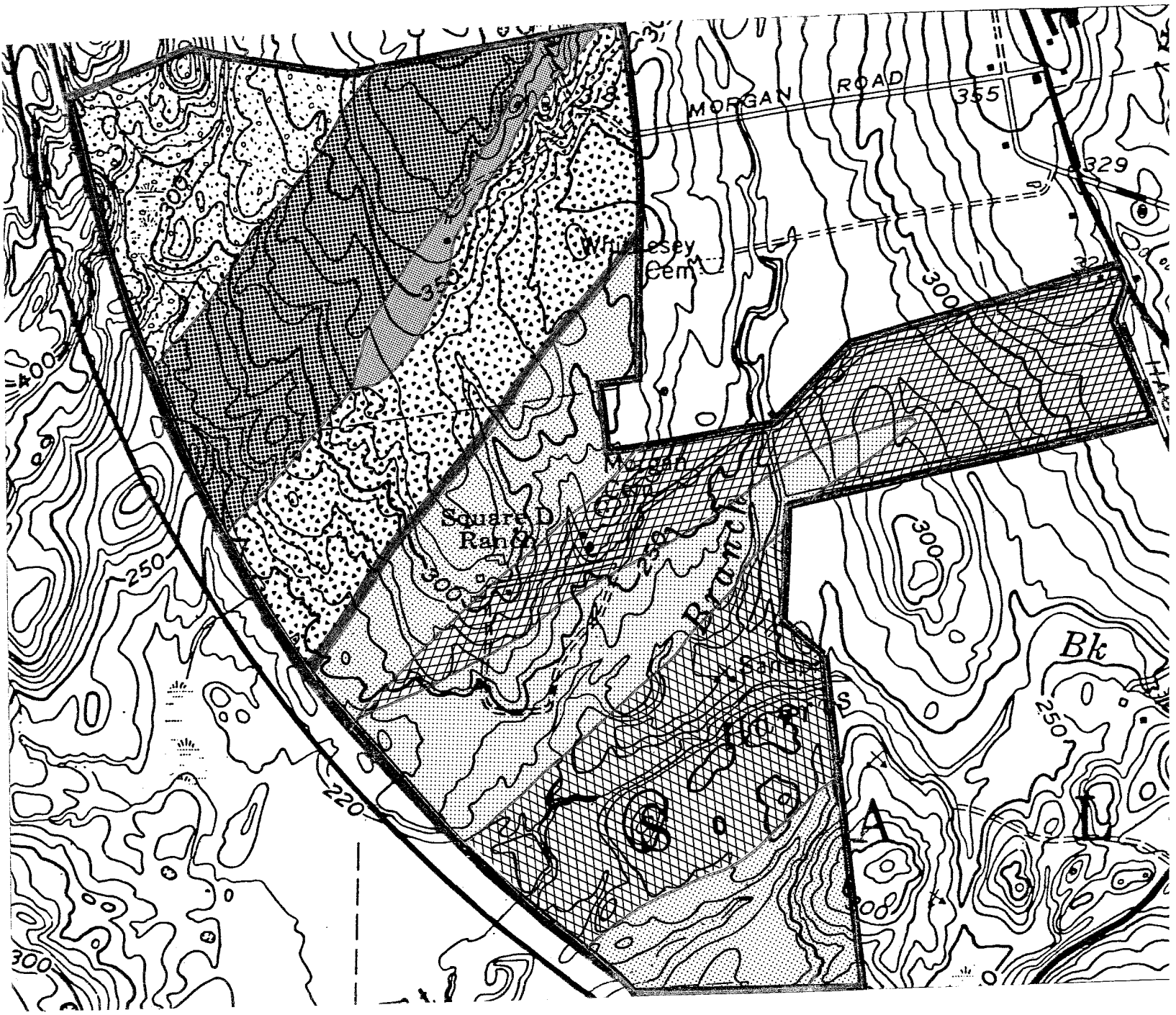
Tatnic Hill Formation subunit - greenish gray clac-silicate gneiss, interlayered with Canterbury Gneiss and biotite-muscovite schist.

Tatnic Hill Formation - gray to dark gray, medium grained gneiss and schist.

Honey Hill Fault

Monson Gneiss - light to dark gray, medium grained plagioclase-quartz-biotite-horneblende gneiss and dark gray to greenish black amphibolite.

Monson Gneiss subunit - pink alaskite gneiss.



SURFICIAL GEOLOGY

Scale 1" = 1000'

Till
Alluvium
Stratified Drift
Thick Till

4. HYDROLOGY

A. The Watershed

The ±650 acre site lies entirely within the East Branch Eight Mile River watershed. The river, which has a drainage area of about 22.4 square miles or 14,336 acres bisects the south central parts of the site enroute to the Eight Mile River. The site therefore represents about 4.5 percent of the total drainage area. Another major streamcourse found on the site and tributary to the East Branch Eight Mile River is Harris Brook. It flows through the area formerly mined for sand and gravel in the southern parts. A smaller, unnamed streamcourse which flows generally in a south-southeasterly direction occurs in the northwest corner of the site.

Based on review of recent air photos and topographic maps of the watershed area, land-use is characterized mostly by low to moderate density residential with scattered agricultural fields. Most of the land cover is wooded. Mean annual precipitation in the Salem area is about 47 inches per year. ("Precipitation in Connecticut 1951 - 1980", Hunter and Meade, DEP Bulletin No. 6, 1987) The portion of annual precipitation that infiltrates into the underlying bedrock on most of the site is estimated to be about 8 to 9 inches. The remainder of the precipitation runs off into surface streams or is lost to evapo-transpiration. As mentioned earlier, the East Branch Eight Mile River is classified as B/A. The remaining surface waters within the site are classified as A by the DEP. A class A surface waterbody means that the surface waters may be suitable for drinking water supply and that compatible discharges to the waters include treated backwash/drinking water treatment facilities and minor cooling or clean water.

Converting the site to a residential subdivision at proposed densities would be expected to increase the amount of runoff shed from the site. Increased runoff would result from soil compaction, removal of vegetation and placement of impervious surfaces (roof tops, roads, driveways, etc.) over otherwise pervious soils.

Because plans are preliminary, it is not known how storm drainage will be handled from individual lots or what the hydrologic impacts will be once they are developed. The latter will depend upon the ultimate density of the subdivision and the amount of impervious surfaces created. It is expected that stormwater arising from roads and driveways would be artificially collected in catch basins and routed at various points to the streamcourses on the site or to detention basins. The design engineer should reference Connecticut's Guidelines for Soil Erosion and Sediment Control for the design of the stormwater management plan and detention basin(s) if needed. Close examination of all downstream culverts is warranted. Once, the stormwater drainage plans and computations have been finalized, the Town's engineer should carefully review the plan and calculations.

B. Flood Hazard Areas

According to the Flood Insurance Rate Map for Salem, the 100-year flood boundary parallels the East Branch of the Eight Mile River and Harris Brook in the southern half of the property and throughout the land west of Route 11. The flood boundary zone widens considerably to the east and west side of Route 11.

A 100-year flood is a flood with a 1 chance in 100 or 1% chance that it will happen in any year. This does not mean that a flood of this size will occur only once in 100 years. The probability of occurrence remains the same each year regardless of what happened the year before. The 500-year flood boundary fringes the 100-year flood boundary in the broad floodplain area east of Route 11. A 500-year flood is a flood with a 1 chance in 500 or .2% chance of occurring during a given year. Because of the potential for major flooding events in these areas, they hold low potential for development purposes. If wells or septic systems are located in these zones, they would need to be protected from flood waters.

C. Seasonally High Water Table

As mentioned earlier, "hardpan" soils, which are characterized by seasonally high water tables occur throughout the site. The presence of these soils suggests that building footing drains should be installed around houses and condominium units with basements to protect them from groundwater infiltration. This will hopefully keep basements dry. The discharge points for drains should be properly outletted so that they do not cause water problems to adjoining properties.

WATERSHED BOUNDARY

Scale 1" = 1000'

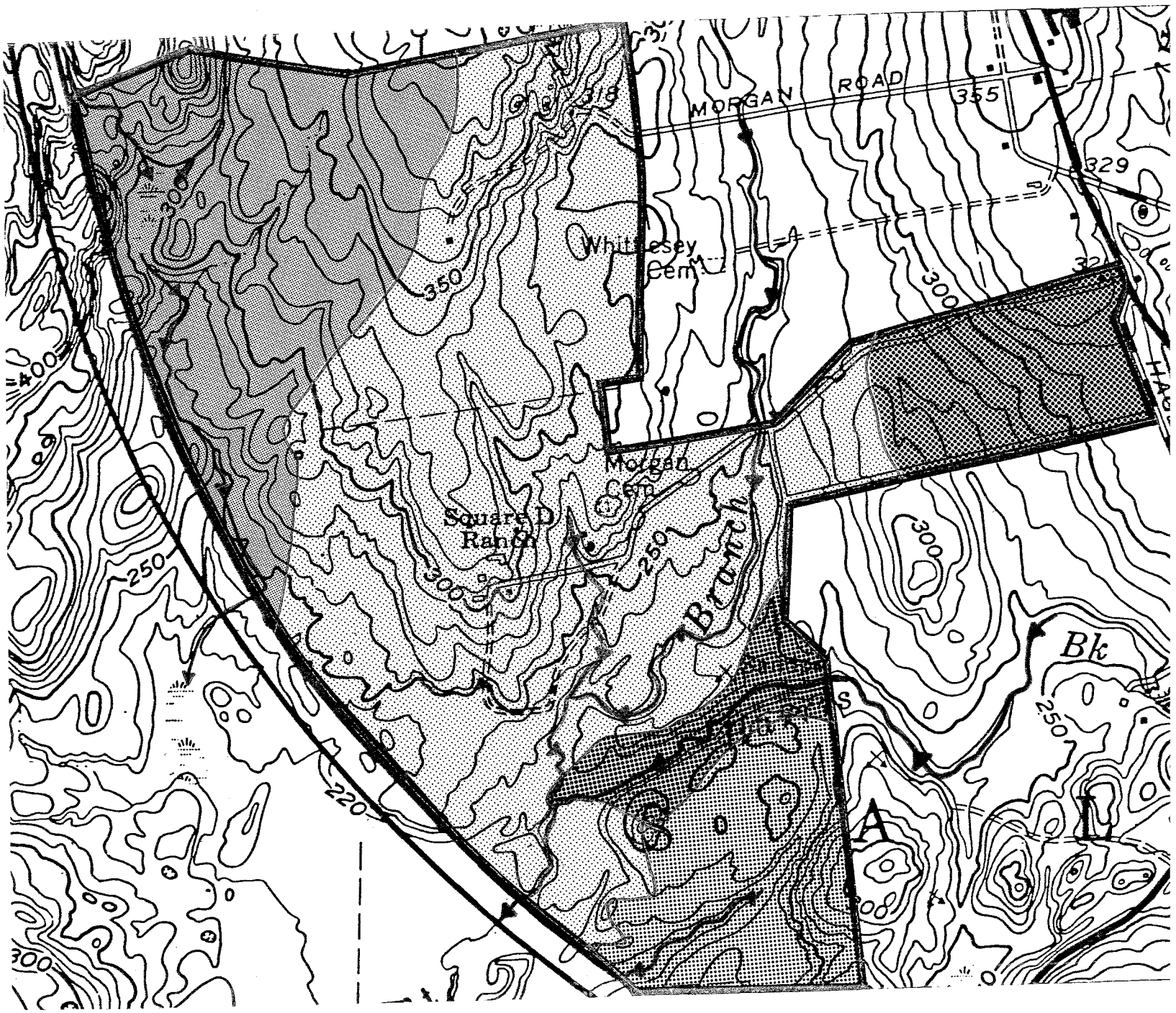
Portion of site that drains to unnamed tributaries to the East Branch Eight Mile River.

Portion of site that drains directly to the East Branch Eight Mile River.

Portion of site that drains to Harris Brook.

Portion of site that drains to unnamed East Branch Eight Mile Tiver tributary.

Watercourses showing direction of flow.



5. SOILS REVIEW

B. Erosion and Sediment Control

Because of the magnitude of this proposal it is suggested that development and construction be performed in phases. A seperate detailed Erosion and Sediment Control plan for each phase of the development should be outlined on the site plan.

In the "general notes", references made to the CT Guidelines for Sediment and Erosion Control for design criteria, construction or methods and details is inadequate. The developer should use the guidelines as a reference and follow its procedures, however, all design criteria and construction details should be outlined on the site plan. (see checklist for items which should be incorporated into the final plan.)

It is extremely important that a stormwater management system be designed in accordance to the standards outlined in chapter 9 of the CT Guidelines for Soil Erosion & Sediment Control. The size of the watershed would necessitate using TR-20 as opposed to TR-55 as the design standard for the system. (see checklist for items which should be included in the plan.)

When the plan is submitted, the Soil Conservation Service, working through the New London County Soil and Water Conservation District will be available to review it at the town's request.

C. Checklist for Reviewing Reports Using TR-20 Analysis

1. __ TR-20 Watershed Map at a scale of 1" = 500' or larger. Show subarea boundaries, cross section locations and numbers, structure locations and numbers, and subarea names or numbers. (Optional - show Tc, CN, and Drainage Area for each subarea on the map) Contour maps must include some additional area outside the property line boundaries.

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

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

4. __ Tabulation sheet showing calculations and equations used for structure stage-discharge-storage volumes and cross section elevation-discharge-area calculations.

5. __ TR-20 printout showing input listing and a minimum output of the summary tables. The minimum required output is listings and summary tables for the pre-development, post develpment, and post development with control for all required storms. These runs must document the zero discharge increase for all required storms.

6. __ The written report should state the initial conditions and storm frequencies to be analyzed. Include a summary table showing the pre-development, post development, and designed system peak discharges for all design frequencies. A "fullprint" printout of the TR-20 run is not needed in the report, only the input and summary tables. The fullprint output can be attached as extra material.

A. Soils Descriptions

CbC - Canton and Charlton, 8 to 15 percent slopes.

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

Ce - Carlisle Muck.

CdC - Canton and Charlton extremely stony fine sandy loams, 3 to 8 percent slopes.

CrC - Charlton-Hollis fine sandy loams, very rocky, 3 to 15 percent slopes.

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

HkA - Hinkley gravelly sandy loams, 0 to 3 percent slopes.

HkC - Hinkley gravelly sandy loams, 3 to 15 percent slopes.

Ln - Limerick Variant Silt loam.

MyB - Merrimac sandy loam, 3 to 8 percent slopes.

Nn - Ninigret Fine sandy loams.

PbB - Paxton and Montauk fine sandy loams, 3 to 8 percent slopes.

Ro - Rippowam fine sandy loam.

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

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

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

Ub - Udorthants, pits complex, gravelly.

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

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

Ps - Pootatuck Variant fine sandy loam.

SOILS

New London County USDA-SCS
562 New London Turnpike
Norwich, CT 06360
887-4163

Scale 1" = 1320'

6. WETLAND REVIEW

This section of the report will evaluate the potential effects to the wetlands located on and adjacent to the property. After the site inspection and a subsequent review of the proposed development plans the following report has been prepared describing wetland resources, and outlining wetland impacts and proposals to lessen the impacts.

A. Wetlands Descriptions

As defined by the U.S. Fish and Wildlife Service the wetlands on the site are classified as follows:

PFOIE Palustrine, forested, broad leaved deciduous, seasonally saturated
POWH Palustrine Open Water
PSSIB Palustrine Scrub/Shrub, broad leaved deciduous, saturated

The wetlands soils on the property are:

Rn Ridgebury, Leicester and Whitman extremely stony fine sandy loams
Ln Limerick Variant silt loam
Ro Rippowam fine sandy loam
Ps Pootatuck Variant sandy loam

There are approximately 90 acres of wetland soils on the property as interpreted from the New London County Soil Survey and shown on the location map provided with the Subdivision Plans for Greenscape Development Corp. dated 12/8/88.

In addition there are several watercourses on the property, most notably Harris Brook and the East Branch of the Eight Mile River. Associated with these two watercourses are floodways, and 100 and 500 flood hazard

areas. (see Floodway Map)

The watercourses, floodway boundaries and at least the 100 year flood hazard area should be shown on the plans in order to properly evaluate the impact of the proposed construction activities on these sensitive areas.

Since it appears that some of the watercourses on the property may not be associated with wetland soils, a biologist should be hired by the applicant to locate any additional watercourses, ponded areas, swamps, marshes or bogs that do not have soil types that meet the qualifications for wetlands soils.

Since the floodway and/or 100 year flood hazard area may not include wetland soils, Planning and Zoning should give careful consideration to activities which might impact these areas. For any construction activities within the floodway, the applicant must provide engineering data demonstrating that the proposed activities will not increase the flood elevations. For construction within the 100 year flood hazard area the lowest floor of any residence must be above the 100 year flood elevation.

Realignment of the East Branch of the Eight Mile River was discussed during the site inspection. Any proposal of this type would in addition to local approvals requires State and Federal permits. It is strongly recommended that a proposal be developed that does **not** require such a major impact to the River.

B. Wetland Impacts (for the areas that have been mapped)

During the site inspection, it was mentioned that the applicant was interested in altering the path of the proposed road between lots 12 and 24 to run along the elevated areas left by the mining operation within the central section of the wetlands. This proposal would essentially cut this tract of wetlands in half, with significant long term implications for wildlife use of this area. It appears that if the road were realigned the short term and long term impacts to the wetlands would be greater.

Lot 16. The house proposed for this lot would be mostly surrounded by wetlands, additionally, the house and septic could not be constructed outside of the setback/buffer zone. Due to the proximity of the house and septic area and the long expanse of the driveway to the wetlands there could be significant impacts to the wetlands during the construction activities, eg. clearing, and grading. Additionally, secondary impacts by the homeowner would compound these impacts, eg. a desire for a larger lawn or a garden could lead to the inadvertent clearing of wetland vegetation and possibly fringe wetland filling. This lot should be eliminated and combined with the wetland area to the west and subsequently deeded as open space.

Lot 17. Impacts could be reduced for this lot by modifying the lot lines for lots 18 and 19 to move the proposed house out of the buffer area and away from the wetlands.

Lots 39 and 41. As currently proposed, there is insufficient buildable land on either lot to provide adequate area for the construction of a house and septic area. If the two lots were combined into one lot, there should be sufficient area for one house and septic system.

Lots 30, 31 & 32. As shown on the plans the driveways would not impact the wetlands. A different alignment of the driveways (ie. to cross the wetlands from the road that the lots will front on) would result in significant impacts to the wetlands.

Lots 24, 25 & 26. House, septic and well locations are not shown, nor does it appear that test pits have been dug for these lots. In order for impacts to be properly evaluated for these three lots, these are preliminary steps which must be taken by the applicant.

As plans are developed for the remainder of the property the concerns outlined for the areas already laid out should be taken into consideration, and incorporated into the design. Wherever possible impacts to the wetlands should be avoided, and alternatives carefully considered.

FLOOD BOUNDARY AND FLOODWAY MAP

KEY TO MAP

500-Year Flood Boundary

100-Year Flood Boundary

FLOODWAY FRINGE — FLOODWAY

100-Year Flood Boundary

500-Year Flood Boundary

Approximate 100-Year Flood Boundary

Cross Section Line (A — A)

Elevation Reference Mark RM7

River Mile M1.5

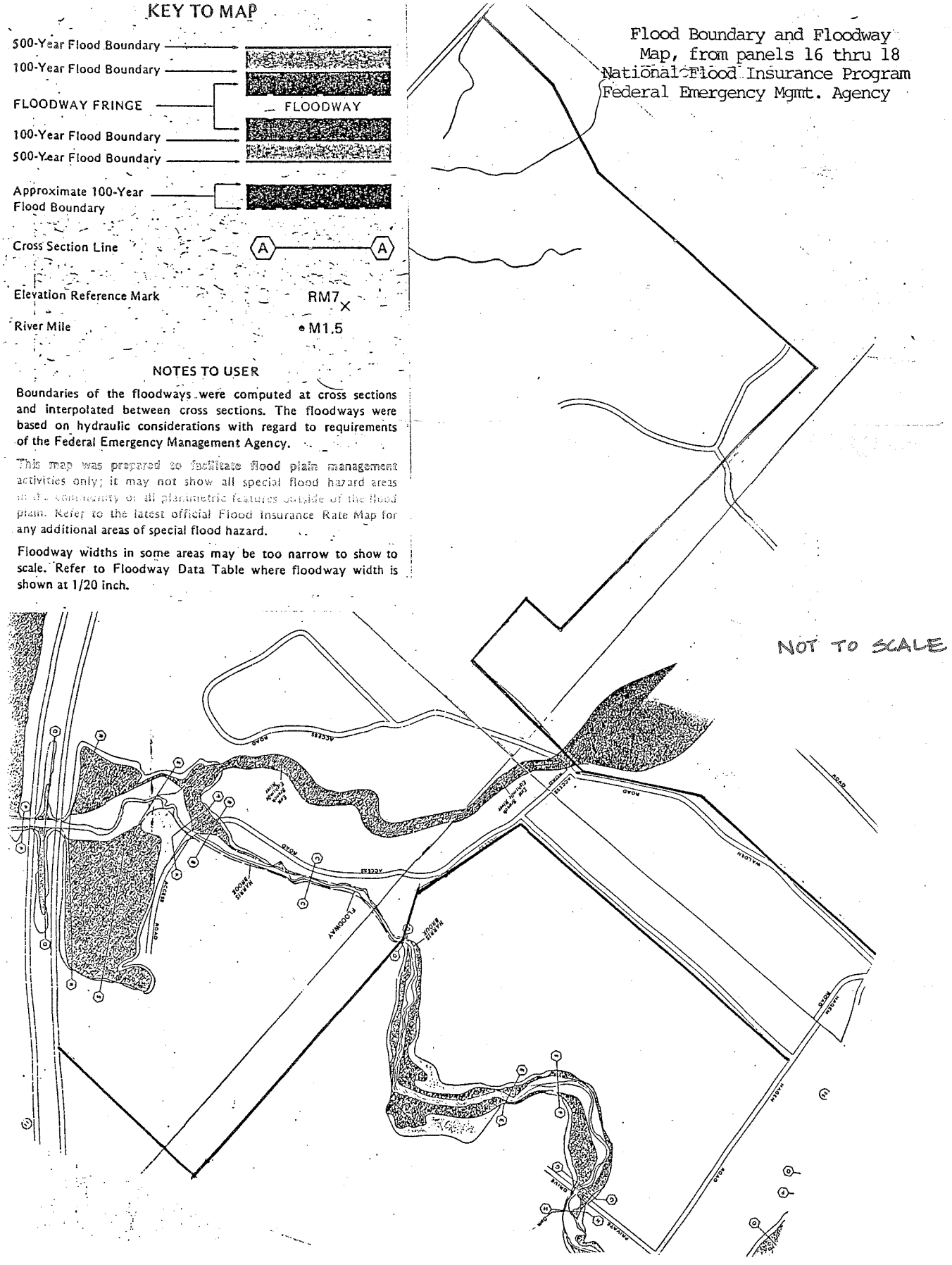
NOTES TO USER

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

This map was prepared to facilitate flood plain management activities only; it may not show all special flood hazard areas in the community or all planimetric features outside of the flood plain. Refer to the latest official Flood Insurance Rate Map for any additional areas of special flood hazard.

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 1/20 inch.

Flood Boundary and Floodway Map, from panels 16 thru 18 National Flood Insurance Program Federal Emergency Mgmt. Agency



7. SEWAGE DISPOSAL

As mentioned earlier, single-family homes in the residential subdivision would be served by individual wells and septic systems. The condominium units would be served by a community water supply and septic system.

A cursory review of a feasibility study prepared by the applicant's technical consultant indicates that the sandy/gravelly soils in the southern part may be favorable for construction of a community septic system. However, it must be kept in mind that these sandy/gravelly soils are known for having rapid seepage which in turn may not have the ability to provide good filtration and renovation of septic effluent or other types of pollutants. Natural dilution by infiltrating precipitation will be increased on the other hand. It seems likely that further testing of the soils in this area will be necessary in order to determine the area's ability to handle the projected sewage flows, particularly since this area appears to be the most favorable for development of a community water supply system (see Water Supply Section).

Present plans indicate that 37,500 gallons of wastewater per day would need to be discharged to the community septic system. Since the projected flows exceed 5,000 gallons per day, the Department of Environmental Protection's Water Compliance Unit must issue a permit.

Before the DEP could act on a permit application, the applicant's technical consultant would have to provide detailed technical information on the hydrogeologic conditions in the disposal area, the design of each sewage disposal system; a thorough hydraulic analysis of the disposal areas, and analysis of the probable impact on any nearby water resources and the underlying aquifer from a drinking water quality standpoint. This last requirement should include an analysis of bacterial travel, virus removal and nitrate and phosphate transport. The "burden of proof" is clearly upon the developer to show that the proposed sewage disposal system(s) will function properly and not pose a threat to the environment or public health. Prior to

acting on a permit application, the applicant should be required to make arrangements for ownership, operation and maintenance of the sewage disposal system. The Salem Health Department will also play an important role in the permit application, review of the plans and inspection of the sewage disposal system(s) during installation.

Development of the condominiums should proceed only within the limits of acceptable density as to the capacity of the soil and particularly not to overload the East Branch Eight Mile River aquifer with too great a volume of sewage waste water discharge. Groundwater in the area is classified by the DEP as GA, which means that it is suitable for private drinking water supplies without treatment. This area currently under investigation for the community septic system lies within the 100-year flood boundary.

The remaining sections of the parcel, which includes Phase I (56 single-family lots) of the proposed subdivision would be served by individual on-site septic systems. A review of deep test hole information for the 56 lots and soil mapping data indicates that the compact till ("hardpan") which is characterized by slow percolation rates and seasonally high water table will be the major geologic limitation for development of the site. Nevertheless, lot-by-lot investigation will be required for future sections of the subdivision. Sufficient depths to bedrock were obtained in most test holes excavated in Phase I.

These limitations (high water tables, slow percolation rates) will weigh most heavily on the ability to provide adequate subsurface disposal. The compact till layer ("hardpan") at a shallow depth may limit the feasibility of "standard" septic systems, but this limitation may be overcome by properly engineered system. Sewage disposal systems typically constructed in compact soils require installation of groundwater control drains and/or placement of sandy fill material to elevate leaching systems above seasonally high groundwater tables.

Prior to subdivision approval, the applicant's engineering firm must demonstrate that each of the proposed lots in the subdivision meets the

minimum soil standards set forth in Section 19-13-B103e(a)(3) of the State's Public Health Code.

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

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

8. WATER SUPPLY

A. Sand and Gravel Aquifer

Through their consultant (Geotoxi Associates, Inc.), the applicants are investigating the sand and gravel deposits in the south central parts to determine their potential to supply water to the proposed condominium units. The potential for extracting large volumes of groundwater yields from sand and gravel deposits to a well or wells will depend upon many hydrogeologic characteristics such as thickness and texture of deposits, the saturated thickness of the deposits, proximity to and size of watercourses, etc.

According to a map entitled Groundwater Availability in Connecticut by Daniel B. Meade (1978), the sand and gravel deposits covering the southern parts are thought to be coarse-grained stratified drift deposits that may be capable of yielding moderate to very large amounts of water (50-2,000 gallons per minute). Hydrogeologic data are incomplete for the area and verification requires further investigation. It is understood that Geotoxi Associates, Inc. is

studying in detail the potential of the sand and gravel, in the southern parts, to transmit water.

Based on visual observation made during the field review and cursory review of the water supply report (Geotoxi Associates, Inc.), the area presently being investigated for a community water supply is on the south side of East Branch Eight Mile River in the southern parts (open field area). Because of their proximity to the river, the gravel packed well or wells would be hydrologically connected to the river. During pumping periods, the well may lower the water table below the level of the river, drawing water from the river into the well. This phenomenon is known as induced filtration. This could have an adverse impact on aquatic habitats in the river, particularly during low flow periods. Therefore, it is strongly recommended that the developer be required to conduct a detailed hydrogeologic study in the area of the proposed well or wells, which would discuss all potential concerns regarding the water supply well and its effect on the river, proposed community septic system, etc.

It should be pointed out that according to DEP - Water Compliance, the surface water quality of the section of the river which traverses the site is classified as B/A. This means that surface water quality is impaired by wastewater discharge. DEP's ultimate goal is to upgrade the river to an A classification. Designated uses for a Class A surface water body includes potential drinking water supply; fish and wildlife habitat; recreational use; agricultural/industrial supply and other legitimate uses, including navigation. Class B waters would have the same designated uses as Class A waters, except as a potential drinking water supply source.

If the proposed well or wells pump in excess of 50,000 gallons per day or more, a diversion permit from DEP's Water Resources Unit will be required. Robert Gilmore of DEP's Water Resources Unit should be contacted regarding this matter (566 - 7160).

Finally, because the proposed well site is located within the 100 year flood boundary of the river, it will be subjected to flooding and possible contamination during certain storm events (Flood Insurance Rate Map -

Town of Salem, CT, February 3, 1982). As a result, the well will need to be properly protected from flood waters or relocated to an area which would not be subject to flooding.

The proposed well or wells will first require approval by the State Department of Health Services (Public Water Supply Section) and the Department of Public Utilities Control.

Information on projected needs of the development in terms of water quantity, water quality testing and plans for pumpage, storage, treatment, if necessary, and the distribution system would also be necessary for a community water supply. Consideration should be given in advance to providing for proper operation and maintenance of the community water supply system (i.e., establishment of a homeowner's association or takeover by a private or municipal water supply company).

It is understood that additional land of the Greenscape Development Corporation exists on the westerly side of Route 11, which includes the East Branch Eight Mile River floodplain. Based on the Groundwater Availability in Connecticut (Meade, 1978) map, this land is underlain by coarse grained stratified drift deposits known or inferred to be capable of yielding moderate to very large amounts of water (50-2,000 gallons per minute) to individual wells. As a result, the applicant's consultant may want to investigate the potential of this area for groundwater development. Most of the area appears to be located in the 100-year flood zone. Additionally, access to this area may be problematic.

B. Bedrock Aquifers

Although not a prolific aquifer, the underlying metamorphic bedrock would be the likely source of water to serve the single-family homes proposed for the subdivision.

Obtaining water from any given bedrock well is dependent upon the number and size of water bearing fractures that are encountered by the well. Since fractures in bedrock are irregular there is no practical way of predicting

the yield of a bedrock well drilled in a specific location. Even with geophysical exploration, it is extremely difficult to predict such yields. As such, the yield of a well tapping crystalline rock cannot be estimated with any certainty before drilling.

The metamorphic rocks underlying the site respond to geologic forces by fracturing and forming distinct open joints. If the underlying rock contains continuous and interconnected fractures and joints, then the availability of groundwater for domestic uses should be good provided the well intersects these zones. In the lower Connecticut River basin (the site is encompassed by this area) numerous wells were surveyed for Connecticut Resources Bulletin No. 21. Of all the wells (314) surveyed that tapped a type of bedrock similar to that underlying the subdivision site, 80 percent yielded 3 gallons per minute or more and 90 percent yielded about two (2) gallons per minute. In general, a yield of 5 gallons per minute is desirable for domestic purposes.

Drilled wells should be located toward the high side of lots in a direction away from the normal expected flow of groundwater from any source of subsurface pollution. They must be properly separated from on-site sewage disposal systems and other potential sources of pollution which could affect the safety and quality of the water. In housing developments, in addition to sewage, particular concern must be given to any buried fuel storage tanks, on-site disposal for any waste water associated with water softening equipment utilizing salt, and road/driveway drainage. Consideration should be given to prohibiting buried fuel storage tanks in the subdivision.

Proper well construction and separating distances in accordance with State Public Health Code, Connecticut Well Drilling Board and Town regulations will allow for adequate protection of the quality of the bedrock aquifer.

Properly constructed drilled wells generally afford the greatest degree of protection against possible sources of pollution. They will also usually allow for more flexibility in actual site placement. All types of wells are to be

constructed by persons who are state licensed for this profession. Proposed well sites should be inspected by the Town sanitarian or appropriate sanitation official before the issuance of a permit of approval to actually construct such wells. The sanitation or health official must generally insure that provisions of the State Public Health Code, State Well Drilling Board and local ordinances have been followed.

According to local regulation, single-family homes in the subdivision will require a minimum land area of 80,000 square feet or about 2 acres. Separating distances of 200 feet or more between on-site well and septic system should be easily achieved on lot sizes of 2 acres and more. Maintaining this separating distance will allow for approximately 1 acre of recharge to the well. If one assumes a natural recharge rate of 8 inches per year to the bedrock aquifer, than a one acre area would provide about 595 gallons of water per day. This of course assumes the underlying bedrock is fractured and capable of transmitting water to a well. It is estimated that a family of four would probably use about 300 gallons per day. Since lots are 2 acres in size, which should allow for minimum separating distances of 100 feet between well and septic systems and since properly renovated effluent will be reintroduced to the bedrock aquifer that is roughly equivalent to the groundwater withdrawals, groundwater recharge should exceed groundwater demands of each lot. This assumes that usable amounts of water are available in the bedrock aquifer.

The natural quality of groundwater should be satisfactory. However, the bedrock, beneath the site, especially north of the Honey Hill Fault may have elevated amounts of iron and/or manganese minerals. If elevated, these constituents may lower the overall aesthetic quality of the water. There are suitable treatment filters available to ameliorate the potential water quality concerns.

9. VEGETATION REVIEW

A. Section A

Area #1: Field land, mostly grasses with some red cedar invading. Field edges are being invaded by gray dogwood, blue beech and red maple.

Area #2: This is basically a pole size (6 -10 inches) red maple stand with a few black oak, shag bark hickory and American Elm trees scattered here and there. The understory is fairly light, but does include Highbush blueberry, pepperbush and spicebush.

The #2a area of the patch of woods has a Ridgebury group soils which is a wetland soil and apparently is included as the "open space" portion of the plan but the adjacent area has seasonally high water so any impediment of the drainage can be expected to cause ponding and tree mortality. Also with this type of soils the trees are quite shallow rooted so creating openings for driveways and house lots can be expected to cause considerable windthrow. Tree loss due to heating the soil around these shallow roots is also a possibility.

Area #3: This is a reverted old field with red cedar and red maple predominating. There is also some hickory and black cherry. The understory is mostly blueberry, azalea and pepperbush.

Area #4: This is dominated by black-scarlet oaks with some black birch and hickory. There is not much understory except along the edges were there is some tartarian honeysuckle, azalea, viburnum and blueberries.

Area #5: Old gravel bank area - very broken ground with boulders, holes and water. The area supports a growth of small trees and brush. Species include red maple, speckled alder, willows, sumacs, gray and black birch, Highbush blueberry and Mt. Laurel.

B. Section B

Area #1: Open hay fields: various planted and wild grasses.

Area #2: Leveled gravel bank area.

Trees and shrubs mostly confined to speckled Alder and red maple with some gray birch and black oaks on the upper slopes. Ground cover includes rushes, wild grasses, running blackberry, spirea and golden rod.

Area #3: Maple Swamp

Tree species are mostly red maple with a few American Elm and blue beech. There is even some poison sumac. The understory includes grasses and sedges, Highbush blueberry, pepperbush and azalea.

Area #4: Mixed hardwood sapling - Pole sized:

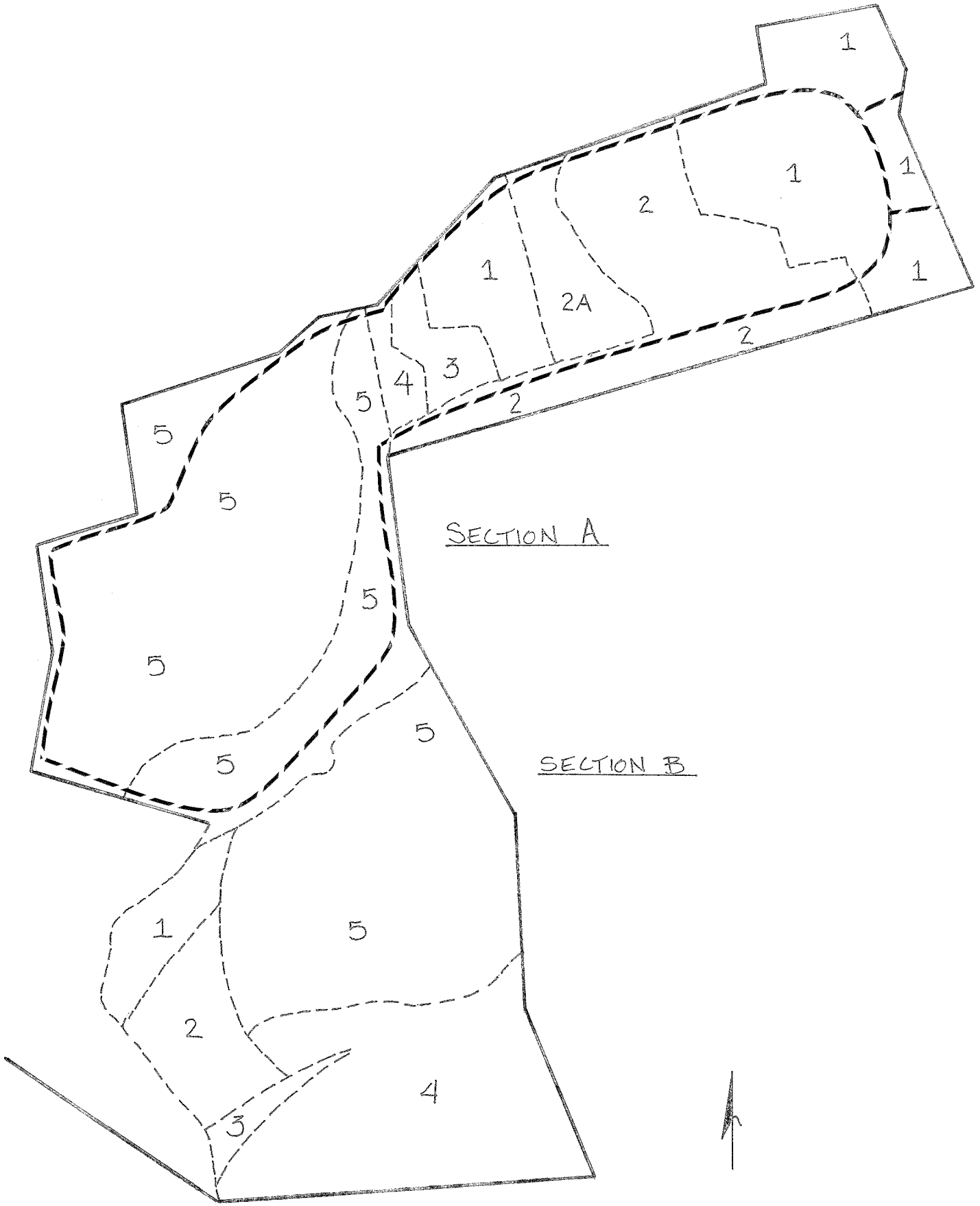
This area was cut very heavily in the late 1970's but is now well wooded with saplings and large stump sprouts. Species include black-red oak, white oaks, red and sugar maple, American beech, black and yellow birch. In some areas the understory is quite sparse and in other areas there are greenbriar, azalea, witch-hazel and blue beech. Mt. Laurel is scattered throughout the area and forms quite dense stands in some places.

Area #5: Not too different from Area #4 except oaks (White, black and scarlet) are much more prevalent. Sugar maple is scarce and white pine is present both as saplings and dominant large poles. There are two critical areas on this section. The first is the southwestern section of Area #2. This area appears to have a very high seasonal water table as noted by the growth of Alders and rushes. Drainage impediment in this area will alter plant species drastically. The second problem area is in Area #4, along the banks that slope into

area #3 (Maple Swamp). These banks are quite steep. Tree removal or dumping storm water down these banks will cause erosion of soil into the wetland area. It will also expose the wetland to more wind which can then be expected to cause extensive windthrow in this bottom land.

VEGETATION MAP

Section A and B



C. Section C

This is the rest of the parcel that was not in the first phase of development.

Area #1: These are all open lots. Some are pastures with grass cover, some are hay fields and still others have corn cover, and still others have corn fields with corn stubble and the usual assortment of annual weeds.

Area #2: An old field site reverting to oaks, red maple and black birch. Grasses and sedges still evident as a light ground cover.

Area #3: Conifer Plantations:

White pine, Norway spruce and some red pine were planted in these dense plantations. These stands are quite dense so there is little or no ground cover however, cutting small openings such as for a house lot or roadways in these will open up the stand for wind damage. Some trees may tip over but more likely the trees will break off at mid point. House sites should be planned outside these areas.

Area #4: This is a bog-like area and the associated stream bed. Red maple and speckled Alder are the major tree/shrub species. But there is also much open water, grasses, rushes, cattails and associated bog plants. Caution must be used not to allow sedimentation of this area as any changes in water level will quickly change the plant life in an area like this.

Area #4A: Mined out gravel bank:

This old gravel bank area has some standing water, many stones and brush which includes willows, speckled Alder, red maple, black birch and gray birch. There is sweet fern and brambles on the sand banks and bog species along the water.

Area #5: Red maple swamps. These are areas of poorly drained soils where the main species are red maple with some associated American Elm, yellow birch and oaks (scarlet and swamp white).

The understory is mainly spice bush and pepperbush with blue beech, yellow birch, witch hazel, azalea and various Viburnum.

The trees are two problems with building houses or roads in this area.

First because of the seasonal high water table the trees are shallow rooted and tend to blow over if holes are created in the canopy and second because of the poor drainage seasonal flooding is a problem and if the development dikes or restricts the water movement the impounded water will cause tree mortality.

Area #6, a,b,c:

All these areas are mixed hardwood and contain about the same mixture of species in the overstory. (see #6a) Overstory is mainly red and white oak with a good mixture of sugar maple in some places. Red maple, white ash, shag bark or Mockernut Hickory are present, but not in large numbers. There are a few scattered white pine which provides some white pine in the understory along with Mt. Laurel, Highbush blueberry, azalea and many viburnums.

Blue beech and witch Hazel are found mainly along the intermittent streams.

These trees are quite wind firm with a minimum amount of standing dead trees so there should be minimal problems in development. There are sawlogs that could be harvested but the dollars gained from sawlog sale would probably be offset by loss in the value of the house lot.

Area #6b is similar in species, but the area has been woodland pasture so most of the undergrowth is barberry, multiflora rose or grasses. Development considerations are the same. Area #6c is different in that the average tree size is much smaller and there is more undergrowth but the wind firmness of the trees is about the same.

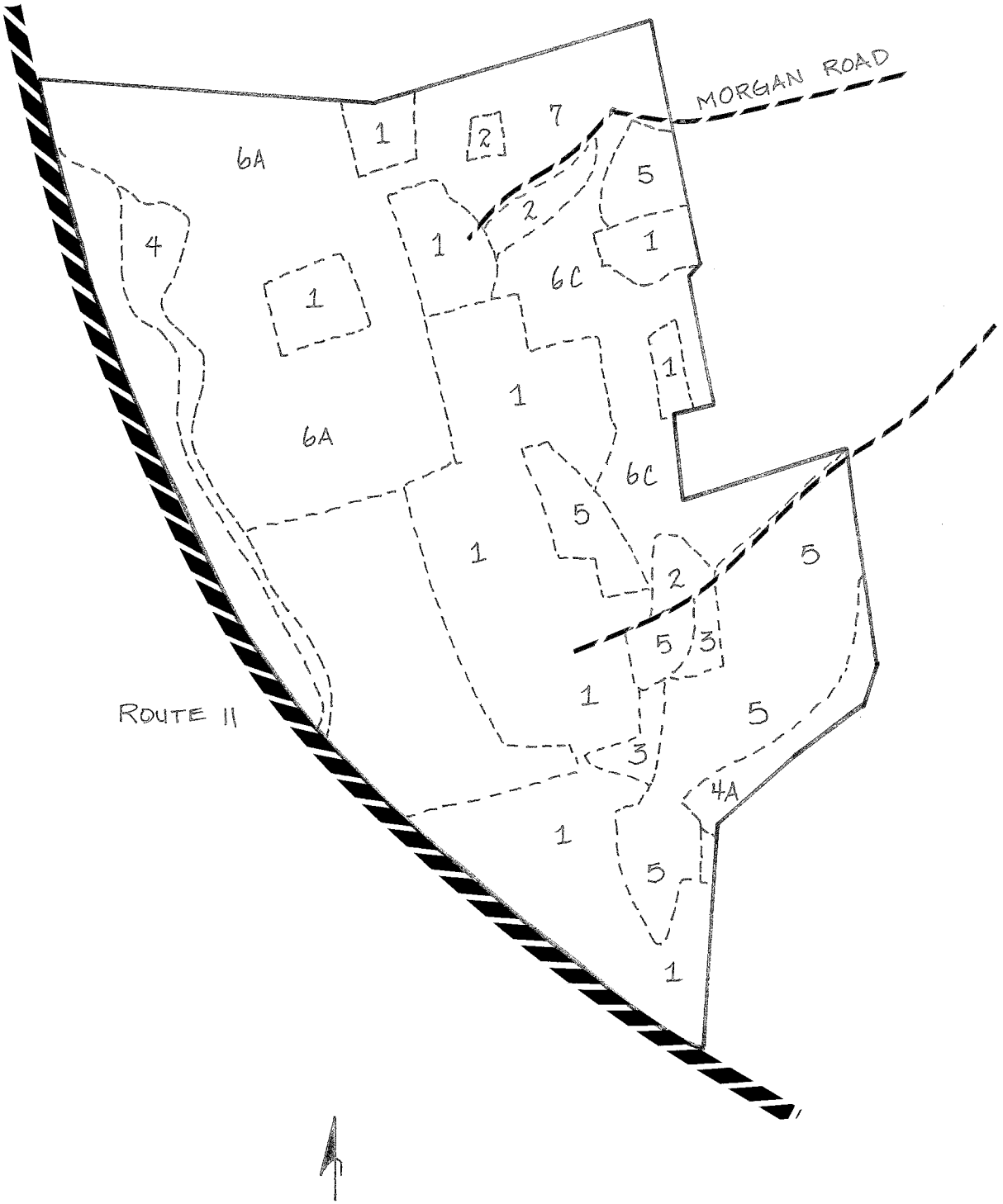
Area #7: Upland hardwoods:

This site is dominated by white oaks and Hickory (Shagbark and Mockernut) with some black oak, black birch and red maple. The undergrowth is mostly white oak, black birch and hornbeam.

This area has a unique feature in that the hillside has a grove of large white oaks. These trees vary in size from three to five feet in diameter and if thinned around and treated carefully they will be a considerable asset to this development. It is suggested that the developer avoid putting roads or houses directly into the grove, but rather using them as a buffer between houses.

VEGETATION MAP

Section C



10. WILDLIFE RESOURCES

A. Wildlife Habitat

The area of the proposed Greenscape Development Corporation subdivision is composed of four major habitat types; mixed hardwoods, wetland/riparian areas, reverting areas, and agricultural fields. With the abundance of wetland/riparian habitat this area provides a diversity of cover types that support a number of wildlife species.

Mixed hardwoods occupy the majority of upland areas. Overstory vegetation consists of shagbark hickory, red maple, and white oak. The understory is open in many areas and is dominated by maple seedlings, viburnum, highbush blueberry, and witch hazel.

Centrally located on the property are planted groves of white pine, red pine, hemlock, spruce, and white cedar.

The first phase of the development contains a large amount of wetlands. Wetland/riparian habitat consists of the Eight Mile River, Harris Brook, two small ponds, and associated wetlands. A deadwood swamp exists in the northwestern portion of the property.

Shoreline and floodplain vegetation along the Eight Mile River consists of silver maple, sycamore, and beech in the overstory. Understory vegetation is dense in many areas and is dominated by sweet pepperbush, silky dogwood, witch hazel, ironwood, spicebush, winterberry, greenbriar, mountain laurel, and grape. A number of snags which are important for cavity nesting birds and waterfowl occur in this area. The braided network of water flows through the floodplain providing important spring breeding pools for amphibians.

Overstory vegetation along Harris Brook is dominated by beech, silver maple, and white oak. Understory vegetation consists of mountain laurel, sweet pepperbush, spicebush, and witch hazel.

Two small ponds exist on the property east of the Eight Mile River. These ponds were created as a result of a gravel excavation that occurred about twenty years ago. The lapse of time has allowed vegetation to be re-established in these areas.

One pond is located in the eastern portion of the property between the Eight Mile River and a hay field. Bank vegetation is dominated by speckled alder, white birch, and multiflora rose. Some aquatic vegetation occurs in the shallows including phragmites, and a variety of wetland grasses. Several small islands also exist in the pond.

The second pond is located in the southeastern portion of the property between the Eight Mile River and Harris Brook. Shore vegetation is dominated by speckled alder. This pond is shallow and probably reverts to a wet meadow during summer months. The gravel bottom has allowed some aquatic vegetation growth including a variety of grasses, sedges, and rushes. A pair of black ducks were observed utilizing this pond.

A small brook connects the two ponds. Vegetation along the brook consists of red maple, speckled alder, phragmites, and a variety of grasses.

The vegetation associated with the ponds and brook is dense in many areas, providing seclusion for wildlife species utilizing these areas. These wetlands also provide important habitat for a number of amphibian and reptilian species.

The deadwood swamp in the northwestern corner of the property contains a diversity of aquatic vegetation and provides important waterfowl habitat. There also has been previous beaver activity in this area.

Reverting areas are dominated by red cedar, bayberry, speckled alder, laurel, juniper, and a variety of grasses.

A number of agricultural fields are located throughout the property. These areas are presently being used for hay crop production and pasturing

horses. Hay fields provide habitat for field dwelling mammals and provide an abundance of insects for foraging songbirds during spring, summer, and fall. With the adjacent mixed hardwood habitat, open fields also provide forage areas for raptors preying on small mammals.

B. Wildlife Species

Mammalian species inhabiting the area include white-tailed deer, raccoons, eastern cottontails, grey squirrels, red fox, red squirrels, and a variety of other small mammals.

Bird species observed inhabiting the area include redtailed hawk, chickadees, hairy woodpeckers, and a variety of other song birds.

With the abundance of wetland/riparian habitat this area supports a number of amphibian and reptilian species.

C. Effects of Development

As the preliminary plans indicate, development will occur in all of the four habitat types mentioned. This will result in fragmentation and elimination of habitat types which will in turn reduce species diversity and richness. Species that are intolerant of human disturbance will be forced to emigrate into adjacent habitat. Species dispersion into adjacent habitats may result in competition with species already occupying the area. Many species will also be forced to inhabit less desirable habitat; decreasing survivability. Species more tolerant to man such as starlings, robins, house sparrows, and raccoons may increase in number and become a nuisance.

The abundance of wetland/riparian habitat warrants special concern. Wetlands support a high diversity of wildlife due to the complexity of the vegetative structure, high productivity and abundant food supply, and a high carrying capacity (Brown et al. 1978). There are many small species that are endemic to wetland/riparian habitat and many larger animals require access to streams or waterbody margins for survival even though they may spend much of their time in other habitats (Milligan and Raedeke 1986). Part of the

food supply for many vertebrates is the high abundance and diversity of insect populations that are typical of wetland ecosystems (Brown et al. 1978). The planned discharge of stormwater into wetlands may have negative impacts on invertebrates, amphibians, and reptiles due to increased pollution, sedimentation, and water levels (Campbell 1973). The use of riprap plunge pools and staked hay bales will help reduce water flow and filter out heavy sediments, but will allow fine silt and pollutants to enter wetlands.

Since thirty-two of the proposed building lots (Phase 1) contain wetlands there will be a negative impact on these areas if there is any clearing or removal of vegetation within wetlands. Vegetation removal in wetlands would have severe impacts on wildlife, especially reptiles and amphibians. Soil and water types, cover, food, breeding grounds, and hibernation areas may be altered so that species dependent on specialized habitats are eliminated and more adaptable species reduced (Campbell 1973). Barriers to seasonal movement and population dispersal, such as roads, are also serious threats (Campbell 1973). The proposed road network crosses wetlands in ten locations and there are two driveway crossings.

The proposed creation of a small pond to compensate for wetland disturbances due to road construction will offer limited wildlife use. It would be beneficial to wildlife if the road was constructed on the gravel road that is now present. Relocation would require filling of wetlands and removal of vegetation. The creation of the pond would be more aesthetically pleasing, but would lack the natural vegetation that has regenerated in wetlands since the gravel excavation.

D. Mitigation of Impacts

Several measures can be taken to minimize impacts of development on wildlife. There should be at least a 100 foot buffer surrounding all wetland areas in which no vegetation removal should take place. Owners of lots with conservation easements to wetlands should be discouraged from any removal of vegetation within this buffer. These buffer strips will help limit disturbance to wetlands and provide important corridors for a number of wildlife species.

Since many of the proposed building lots in forested areas are 2 acres in size, as much of each lot as possible should be left wooded. This would reduce vegetation removal, habitat destruction, and be more aesthetically pleasing for the residents of the development. Owners of lots with conservation easements to forested areas should be discouraged from removal of understory vegetation and dead wood. The existence of many wildlife species depends on the presence of dead trees. Removal of snags will reduce potential nest sites for both primary (cavity excavating) and secondary cavity nesting birds (i.e. black-capped chickadees, downy woodpeckers, white-breasted nuthatches) (Best et al. 1978). Fallen trees are also a necessity for many species (i.e. salamanders, snakes, mice, shrews, insects) (Hassinger 1986) and should not be removed.

Owners of lots in open field areas should be encouraged to plant tree and shrub species that are utilized by wildlife. To attract birds, a variety of plants are needed that are fairly small, bear fruit and have thorns (Geis 1986).

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11. FISHERIES RESOURCES

This report will address all major impacts to aquatic resources and delineate mitigation measures required to minimize impacts.

A. Eight Mile River

Approximately 1.1 miles of a very unique section of the Eight Mile River (east branch) flows through the proposed development location. This low gradient stretch of the river is very dynamic (in a constant state of change) and prone to flooding. Throughout a portion of the river, the main stream channel breaks up into numerous small channels that meander in a "braid-like" fashion through extensive wetland habitat. Inland wetland boundaries in this floodplain section extend far from the stream edge. The river contains superb instream and streamside (riparian) habitat for trout and other cold water resident fishes. Average stream width was estimated to be 30 feet. Dominant streambed substrate is "cobble" (2-12" diameter) type rocks interspersed on sands and gravels. Undercut streambanks and fallen trees are common. These structures provide beneficial cover "hiding and resting areas" for stream fishes. Extensive pool and riffle habitats were observed.

Upper reaches of riffles are commonly used as feeding areas by fish since aquatic insects, their primary food source, reside in these areas, conversely, pools are used by fish for hiding and resting areas. Sufficient overhead shading is provided by streamside trees. Shading benefits aquatic resources by cooling stream waters. The lack of filamentous algae and rooted or floating aquatic vegetation is evidence of healthy, clean waters.

B. Harris Brook

Approximately 0.4 miles of Harris Brook, a tributary of the Eight Mile River, flows through the proposed development parcel. Harris Brook is somewhat similar in nature to the Eight Mile River except that it does not contain a large floodplain. This stream contains a greater percentage of riffle habitat than the Eight Mile River and a more well developed overhead tree canopy. Average width was estimated to be 20 feet.

C. Fish Population

The Eight Mile River and Harris Brook both support a valuable recreational trout fishery. The Eight Mile River is annually stocked by the DEP Bureau of Fisheries with more than 4,300 adult (9-12") brook, brown, and rainbow trout. Harris Brook is stocked with over 300 yearling (6-8") brook trout in the town of Salem. Other fish species expected to inhabit these streams are: tessellated darter, native (wild) brook trout, longnose dace, blacknose dace, American eel, fallfish, and white sucker.

Surface waters of the Eight Mile River are classified by the Department of Environmental Protection (DEP) as "Class B/A". Designated uses for this classification are: fish and wildlife habitat, recreational use, agricultural and industrial supply, and other legitimate uses. Long term DEP goals are to improve this classification to "Class A" where water quality would meet drinking water standards. Harris Brook is classified as a "Class A" stream.

D. Impacts

The following impacts of the proposed subdivision on the Eight Mile River and Harris Brook can be expected if proper mitigation measures are not implemented:

1. **Construction site soil erosion and sedimentation of watercourses through increased runoff from unvegetated areas:** During construction topsoil within the proposed building lots will be exposed and susceptible to runoff events, especially if suitable erosion and sediment controls are not properly installed and maintained. Areas of particular concern are building lots adjacent to Harris Brook where construction activities will occur within 100 feet from the edge of wetlands associated with the brook. Lots of special concern are: 3/24, 3/25 and 3/46 through 3/50. Erosion and sedimentation due to construction has long been regarded as a major cause of stream degradation. Nationally, silt is considered a major stream pollutant. Excessive sediment deposition could damage aquatic ecosystem in the following ways:

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

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

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

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

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

(6) Sediment encourages the growth of filamentous algae and nuisance proportions of aquatic weeds. Eroded soils contain plant nutrients such as phosphates and nitrates. Once introduced into aquatic habitats, these nutrients function as fertilizers resulting in accelerated plant growth. Presently, both streams support very sparse aquatic weed communities.

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

2. **Road construction over the Eight Mile River:** Development plans call for crossing the Eight Mile river with double box culverts at two separate locations. Preliminary plans call for channelizing a section of the Eight Mile River at the southerly road crossing. Placement of box culverts in the Eight Mile River may prevent resident fish passage due to: (1) increased water velocities within the culvert during periods of high river flows, and/or (2) insufficient water depth with in the culvert during summer low flow conditions. Moreover, culvert placement results in the direct loss of instream fisheries habitat since the local stream bottom will be replaced with concrete. The negative impacts of stream channelization have been well documented. Essentially, stream channelization will also result in a direct loss of fisheries habitat and cause possible streambank erosion problems in downstream areas. Instream culvert placement in concert with placement of fill alongside the river will inevitably result in stream sedimentation problems if proper precautions are not followed. Impacts due to stream sedimentation were previously discussed. The proposed crossing over Harris Brook will be accomplished through the construction of an arch bridge. This proposal will not prevent fish passage or result in a loss of instream fisheries habitat.

3. **Loss of streamside (riparian) overhead vegetation along all three proposed road crossings:** This will result in a net loss of this important stream parameter. Vegetation loss will increase evaporation of exposed stream waters. Trees are very important in that they help cool stream water temperatures in the summer and provide important cover for resident fishes. Resident fish may be forced to disperse and locate in more suitable sections in lower sections of these streams.

4. **Percolation of septic effluent into watercourses:** A failure of individual septic systems to operate properly (refer to Sewage Disposal Section) would be potentially dangerous to stream environments. Numerous septic systems, especially for proposed housing lots adjacent to Harris Brook, will be located within 100' from the edge of designated wetlands. Nutrients and assorted chemicals that may be placed in septic systems could possible enter stream waters in the event of a septic system failure or infiltrate the groundwater during the spring when water tables are close to the surface. Failure of a community type septic system proposed for the condominium complex could inflict long term damage to local aquatic environments since the introduction of septic effluents could result in a major threat to fish habitat, public health, and overall water quality conditions. Effluent will also stimulate the growth of nuisance aquatic vegetation and algae. Local watercourses do not currently support nuisance types of aquatic vegetation.

5. **Reduced streamflow in watercourses may occur due to the diversion of water for individual wells and a community well system:** proposed wells for Phase I construction lots would be close to Harris Brook. Future construction, especially of a community well system complex may also impact Harris Brook and the Eight Mile River. If a direct hydrological connection exists between wells and these streams, well operation would negatively impact stream flows and river ecology. (See Water Supply Section) This situation would be most critical during normal summer low flow periods. Expected impacts would be increased water temperatures, decreased dissolved oxygen levels and reduction of overall usable habitat for fishes and aquatic insects. These impacts would ultimately result in reduced aquatic resource populations.

6. **Aquatic habitat degradation in streams due to the influx of stormwater drainage from nearby residential housing:** Stormwaters along the proposed road system will be outletted from catch basins to plunge pools at various discharge locations. Stormwaters can contain a variety of pollutants that are detrimental to aquatic organisms. Pollutants commonly found in stormwaters are: hydrocarbons (gasoline and oil), herbicides, heavy metals, road salt, fine silts, and coarse sediment. Once introduced into stream environments, stormwater runoff will fertilize stream waters causing water quality degradation. Additionally, fine silts in stormwaters that remain in

suspension for prolonged periods of time often cannot be effectively removed from stormwater detention basins. More harmful still are spilled petroleum-based chemicals or other toxicants that can precipitate partial or complete fishkills. Stormwater drainage from this property may result in increased stream flows. Increased volumes of water in both streams can negatively impact stream channel hydraulics, e.g. natural stream scouring processes are disrupted.

7. **Transport of lawn fertilizers and chemicals to watercourses:** Runoff and leaching of nutrients from fertilizers on lawns will stimulate filamentous algae growth in these streams and degrade water quality. Introduction of lawn herbicides can result in "fish kills" and overall water quality degradation. Rooted or floating aquatic vegetation may proliferate in slower moving stream reaches.

8. **Degradation of wetland habitat:** The proposed development site contains a tremendous amount of wetland habitat; total acreage of wetlands was not available at the time of the review. Proposed building lots will be constructed adjacent to vital wetland habitat. Wetlands will also be impacted by the proposed road network. Moreover, stormwaters will be discharged into various locations within wetlands. These wetlands serve to protect the water quality of Harris Brook and the Eight Mile River. Wetlands are beneficial in many ways. They serve to: (1) control flood waters by acting as a water storage basin, (2) trap sediment from natural and man-made sources of erosion, and (3) help filter-out pollutants from runoff before they enter watercourses. Development which brings about polluted stormwaters, excessive stream sedimentation, lawn fertilizers, and lawn herbicides can negatively impact these wetland complexes by hindering their ability to function properly.

9. **Impacts to downstream environments:** Any water quality problems and habitat degradation that occurs within the East branch of the Eight Mile River and Harris Brook will eventually be observed in the lower stretch of the Eight Mile River which drains into the Connecticut River. In addition to resident trout populations, the lower section of the Eight Mile River is utilized by

"sea-run" brown trout and anadromous fish species (alewives and blueback herring).

E. Recommendations

The following recommendations should be considered by the Town of Salem to mitigate impacts to the Eight Mile River and Harris Brook.

1) **Discourage residential development on lots that abut Harris Brook:** Due to their close proximity, development on lots 3/24, 3/25 and 3/46 through 3/50 pose the greatest threat to the aquatic resources of Harris Brook. These areas should be converted to "open space". Impacts such as soil erosion, septic effluent, stormwater runoff, and wetland degradation can be more effectively minimized if these areas are left in their natural condition.

2) **It is highly recommended that at the minimum, a 100 foot open space buffer zone be maintained along wetland boundaries, in particular those that border the Eight Mile River and Harris Brook:** This buffer can be an effective mitigation measure at this development location No construction and alteration of existing habitat should be allowed in this zone. Research has shown that 100 foot buffer zones help prevent damage to wetlands and stream ecosystems that support diverse fish and aquatic insect life (USFWS 1984; USFWS 1986; ODFW 1985). These buffers will absorb surface runoff and other pollutants before they can enter wetlands, ponds, and stream ecosystems. Additionally, buffer zones can improve the quantity of instream habitat for fishes. For example, research has shown that brook trout habitat units can increase 2,400% when well-vegetated buffer zones are used for stream corridor protection (HEP Notes, 1988).

3) **The Eight Mile River should be crossed with span bridges rather than with double box culverts:** Span bridges will allow trout and other resident fish species to move freely and unimpeded within the river and also preserve natural instream substrate. Any stream channelization work involved with the southern road crossing will require a water diversion permit from the Water Resources Unit of the DEP. Please contact Bob Gilmore at 566-7160 for more information.

4) **All instream work and land grading/filling near the Eight Mile River and Harris Brook should take place during low flow periods:** This will help minimize the impact to the aquatic resources. Reduced stream flows and rainfall during the summer and early fall provide the least hazardous conditions in which to work near sensitive aquatic environments.

5) **Riparian (streamside) vegetation should be restored and replanted at the proposed stream crossings of the Eight Mile River and Harris Brook:** Fast growing trees that provide good overhead canopy such as red maple, white pine, American larch, and black willow should be planted. In addition, these plantings will greatly improve the visual aesthetics of the altered streambelt.

6) **Install and maintain proper erosion and sedimentation controls during site construction activities:** Silt fences and haybales should be placed within excavated trenches to ensure that all runoff is properly contained. A town official should be responsible for inspecting this development on a **daily** basis to ensure that contractors have complied with all stipulated mitigation devices. Past stream siltation disturbances in Connecticut associated with residential housing developments have occurred when individual contractors either improperly deployed mitigation devices or failed to maintain these devices on a regular basis. Proper installation and maintenance of these devices is critical to environmental well being.

7) **Properly design and locate individual septic systems** (refer to Sewage Disposal Section): It is critical that all septic systems be placed in areas that will effectively renovate septic effluent. It is the Team Fisheries Biologist's opinion that septic systems should not be placed adjacent (within 100 feet) to sensitive wetland and aquatic ecosystems. The addition of septic effluent to these streams can be one of the greatest threats to stream ecology. The negative impacts associated with a septic failure, especially of any proposed community septic system, would be a great concern on this parcel. Any community septic system that will be constructed in association with the condominium complex will require a permit from the Water Compliance Unit of the DEP. All septic systems should be maintained on a regular basis. Prevent the disposal of harmful chemicals into septic systems which may

negatively effect operation and possibly result in system failure. Residents should be encouraged to utilize non-phosphate laundry detergents.

8) **A detailed hydrologic analysis should be completed for the development parcel to investigate hydrologic connections, if any, between proposed community well fields/individual housing lot wells and local streams:** If a direct hydrological connection exists between wells and these streams, well operation would negatively impact stream flows and river ecology; hence, wells should relocated to areas that will not severely reduce streamflows.

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

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

F. Literature Cited

Habitat Evaluation Notes. 1988. Nonpoint Source Pollution: Linking Land Use and Fisheries Potential in the Upper Milwaukee River. Vol. 1 No 4.

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

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

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

12. PLANNING REVIEW

A. Land Use

The proposed development is located in central Salem on the westerly side of Route 85. Immediately surrounding land uses are undeveloped land, low density residential and agriculture. Low density residential uses are located along Route 85 to the east, and governmental and institutional uses are located on the east side of Route 85 north of the proposed development. With the exception of the agricultural fields to the southeast, most of the surrounding undeveloped land is forested. Commercial land uses are found southeast of the proposed site at the intersection of Routes 82 and 85.

This area is depicted as low density uses on the adopted Regional Development Plan, with residential densities of more than 1.5 acres per dwelling unit. The Salem Plan of Development recommends residential development for this area of the Town with lot sizes of 80,000 square feet. The Eight-Mile river valley is depicted as an aquifer area on the Salem Plan of Development with recommended residential discharges of no more than 350 gallons of waste water per day per acre. The Town Plan notes that this is the approximate equivalent of one unit per acre. The area of proposed single

family homes should meet this standard, but it should be reviewed in terms of any proposed community sewage disposal system to be located over the aquifer. The area is zoned Rural Zone A with required lot sizes of 80,000 square feet for a single family homes, while multi-family dwellings are allowed as a special exception at densities of 25,000 square feet of lot area per bedroom. Thus, two bedroom units will require 50,000 square feet of lot area or 143.5 acres for 125 units. Overall the development meets this requirement with 151.6 acres allotted to the multifamily portion of the development. It appears that there will be conflicts between the proposal and some of the details of Salem's multi-family requirements found in Section 15 of the Zoning Regulations which most likely will require zoning text changes to resolve. For instance, Section 15.2.5 requires that if a subsurface sewage disposal system is utilized, no more than four units can be located on any four acres of land. Section 15.3 a. requires that unless a project is served by a public sewage system, a private sewage system shall be provided for each multi-family dwelling. Section 15.2.6 states that no multi-family dwelling project shall contain more than 80 units.

B. Transportation

Initial access to the proposed development for the single family homes will be from Route 85 and Hagen Road. Later phases of the development will provide another access to Route 85 about 2,000 feet to the north via Morgan Road. It might be desirable to provide another access to the development such as from Route 82 to the south, although it is recognized that this would be difficult because of terrain. The traffic study conducted for Greenscape projects that 82 percent of the traffic approaches and departures will be from the south along Hagen Road and Route 85. If other properties to the north of this proposed development are developed, then it would be desirable to provide a connection to Witch Meadow Road which would provide another access to Route 11. Without adjacent development this would be an expensive connection because of nearly a mile of road length and rugged topography.

Data from the Institute of Transportation Engineers indicate a single-family development can be expected to generate 10 daily trips per home and a

condominium 5.2 trips per unit. 152 single family units and 125 condominiums would mean 2,170 daily new trips using Route 85 when the project is completed. In 1987 Route 85 had an average daily traffic(ADT) count of 3,300 in the area of the proposed development. No major highway improvements are indicated in the Regional Transportation Plan for Route 85 in Salem. However, it would be desirable to review the design plans for the intersection of Hagen Road , the new subdivision roads and Route 85 with appropriate DOT officials to determine if any improvements such as sight lines, turning lanes, or traffic control devices will be required.

ABOUT THE TEAM

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

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

PURPOSE OF THE TEAM

The Environmental Review Team is available to help towns and developers in the review of sites proposed for major land use activities. To date, the ERT has been involved in reviewing a wide range of projects including subdivisions, landfills, commercial and industrial developments, sand and gravel excavations, elderly housing, recreation/open space projects, watershed studies and resource inventories.

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

REQUESTING A REVIEW

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

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