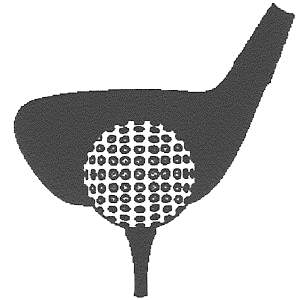


The Middletown Golf Club

Middletown, Connecticut

EASTERN CONNECTICUT ENVIRONMENTAL REVIEW TEAM REPORT

**The Middletown Golf Club
Middletown, Connecticut**



Environmental Review Team Report

**Prepared by the Eastern Connecticut Environmental Review Team
of the Eastern Connecticut Resource Conservation & Development Area, Inc.
Haddam, Connecticut**

for the

Middletown Inland Wetlands and Watercourses Agency

December 1995

**CT Environmental Review Teams
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Acknowledgements

This report is an outgrowth of a request from the Middletown Inland Wetlands and Watercourses Agency to the Middlesex County Soil and Water Conservation District (SWCD). The SWCD 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 Tuesday, October 31, 1995. Team members participating on this review included:

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Prior to the review day, each Team member received a summary of the proposed project, and location and soils maps. During the field review the Team members were given plans and a copy of the inland wetland application and environmental assessment. The Team met with, and were accompanied by the Middletown environmental planner and the director of public works, the applicant, landowners and their engineering and environmental consultants. 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 decision on this proposed golf course.

If you require additional information, please contact:

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Introduction

An environmental review was requested by the Middletown Inland Wetlands and Watercourses Agency for the proposed Middletown Golf Club.

An 18 hole championship golf course is proposed for 215.9 acres located on Mile Lane which is off of Newfield Street (Route 3). The City of Middletown owns 187.2 acres and Tuttle Road Associates owns 28.7 acres. The City land was originally purchased in 1968 for the purposes of constructing a municipal golf course. The land will be leased to a development team who will construct and manage the golf course. A club house and parking facilities are also planned. The project is proposed for an environmentally sensitive area with 54% percent of the land classified as wetland. The site contains West Swamp Brook which drains to the Mattabesset River.

The ERT was asked to review the golf course plans to aid the decision-making and advisory town commissions with independently collected and analysis on the project's impacts to the environment.

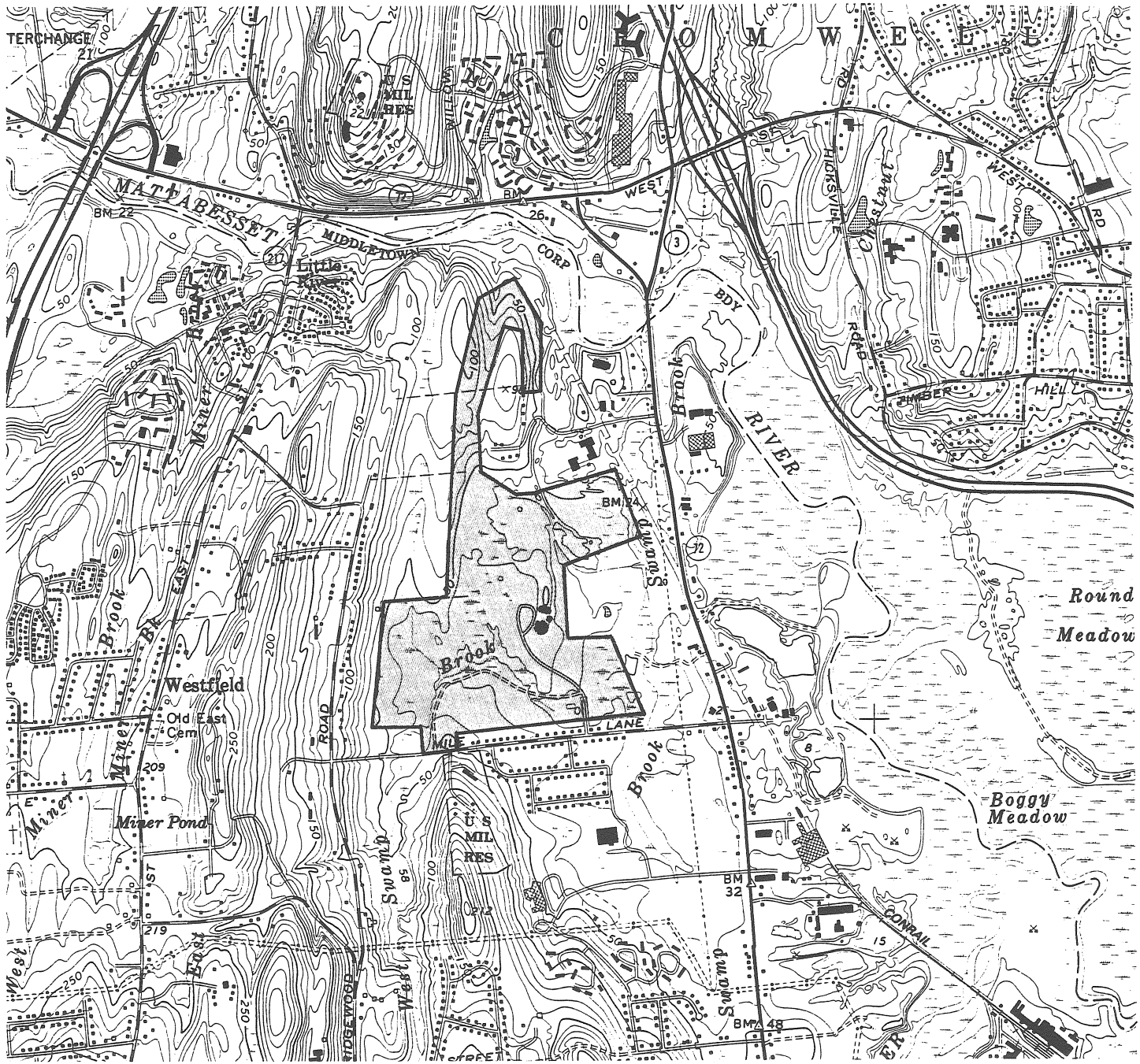
This report primarily provides a description of on-site natural resources and presents planning, management and land use guidelines.

Location Map

Scale 1" = 2000'



Approximate Location



Geology and Hydrology

Bedrock Geology

Since no bedrock material was observed during the site visit, all the information presented here is drawn from the Connecticut Geological and Natural History Survey Quadrangle Report Number 8 (Lehmann, 1959). The rock material underlying the study area is Portland Arkose, a gray-red to red-brown and pale brown coarse to fine-grained arkose sandstone with interbedded arkose conglomerate. Some shale layers are also interbedded. Arkose is a sandstone that has a high concentration of grains composed of feldspar, rather than quartz. Portland Arkose is Jurassic in age, about 170 million years old, dating from about the time that the North American continent broke apart from North Africa. This material is not present at the surface in the study area, but is the same as the material exposed in the brownstone quarries in the town of Portland.

The ridge to the west of the study area followed by Ridgewood Road is Hampden Basalt, or traprock. This unit is slightly older than the Portland Arkose, and was produced by volcanic activity as result of crustal extension at the time North America and North Africa were splitting apart. There is an inferred fault line at the bottom of the ridge. The fault shows no signs of recent activity.

Surficial Geology

Much of the study area is underlain by very fine-grained sediments from Glacial Lake Middletown, about ten to twenty thousand years old. The abandoned clay pits in the east-central portion of the study area were excavated into these sediments. Fine-grained sediments such as these are not easily picked up by running water, but, once picked up, tend to stay in suspension for a long period of time. In areas higher than about 50 above sea level, the surficial material is till, deposited directly from the ice sheet.

Hydrology

The study area is in the Mattabesset River Basin. The northern portion of the area drains directly into the Mattabesset River. Rainwater in the southern portion drains into West Swamp Brook, and finally the Mattabesset River. Drainage is poor in this area because of the fine grain size of the glacial lake sediments and the low elevations

relative to the river basin. Groundwater can also be expected to flow into the Mattabesset River, but will not necessarily follow the same flow paths as surface water.

References

- Lehmann, Elroy P., 1959. Bedrock Geology of the Middletown Quadrangle, Connecticut, State of Connecticut Geological and Natural History Survey, Department of Environmental Protection, Quadrangle Report #8.
- Rogers, John, 1985. Bedrock Geological Map of Connecticut, Connecticut Natural Resources Atlas Series, Connecticut Geological and Natural History Survey.

Soil Resources

The soils within the Middletown Golf Course ERT area include: Berlin (BcA), Cheshire and Holyoke (CyC), Ludlow (LpA and LpB), Raypol (Rb), Bash (Rv), Urban land (Ud), and Wethersfield (WkD). The primary limitations for these soils (Table 1), associated with developing a golf course include, but are not limited to: **wetness, slope, and erosion**. Recommendations to address these limitations are listed below. Additional soils information associated with the golf course are provided in Tables 2 and 3. Urban land (Ud) also has the same above limitations. However, due to the typical alteration of this soil type by excavating or filling activities, these areas require on-site investigation and evaluation to determine the suitability for most uses. Therefore, Urban Land will not be further addressed in this section.

Golf Course Development Recommendations

The limitations which may be associated with golf course development do not necessarily preclude development. The following recommendations will address the limitations associated with, but not limited to golf paths, fairways, and golf courses in general, in order to provide guidance to minimize disturbance to the soil resources during the planning and implementation process. The suitability of the soils for golf tees or greens is not considered in rating the soils.

Wetness: This limitation for BcA, LpA, and LpB is rated **moderate** and for Rb and Rv is rated **severe**. Rb and RV are wetland soils.

Approximately 54 percent of the study area is wetlands. The best soils are not wet, are firm after rains, not dusty when dry, and are not subject to flooding more than once a year during the period of use. Limit development to during the summer. This represents a time of year when water tables are traditionally at their lowest and will help to minimize disturbance to the soil resources. Avoid areas which may pond water, areas which traditionally pond water, or both. Where feasible for paths, place materials, such as geotextile material and stone, to minimize soil disturbance and erosion. The wetlands (Rb) within the area of golf hole numbers 8 and 9 have been identified as "pingo" wetlands. Pingos are geologically important and sensitive areas created by water freezing beneath fine grained soil left behind by glaciers in the Connecticut River Valley. Biologists also consider pingos as vernal pools in which

wildlife seasonally depend on for survival. Therefore, it is recommended that experts in geology and biology be further consulted in regards of evaluating these pingos. (Please also refer to Wetland Resources and Wildlife sections of this report.)

Slope: This limitation for CyC is rated **moderate** and for WkD is rated **severe**. In areas where slope exceeds 25 percent, these soils are not suited for development. They erode easily during construction and landscaping. It is recommended that if development is accomplished within these soils, development be planned and implemented in phases to minimize disturbance to and maximize stabilization of the soil resources.

Erosion: This limitation for BcA, LpA, LpB, Rb, and WkD is not rated, but it is identified that these soils erode easily during construction and landscaping. Therefore, accomplishing development in phases, and ensuring that soil erosion and sediment controls are properly installed and maintained throughout the entire development period will minimize the disturbance to the soil resources.

Summary

Limitations for golf course development within this area include, but are not limited to: wetness, slope, and erosion. These limitations do not preclude development, but require careful consideration during the planning and implementation processes to minimize the disturbance to the soil resources in particular and the total natural resources in general. Due to the extensive area of wetlands on the site, and in particular the areas of "pingo" wetlands, it is recommended that development within wetlands be accomplished in phases, and each preceding phase be evaluated and used as a reference for each subsequent wetland development phase.

Soils Map



Scale 1" = 1320



RECREATIONAL DEVELOPMENT
MT GOLF COURSE

(The information in this report indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
BCA: Berlin-----	Severe: wetness, percs slowly	Severe: percs slowly	Severe: wetness, percs slowly	Moderate: wetness	Moderate: wetness
CyC: Cheshire-----	Moderate: slope, large stones	Moderate: slope, large stones	Severe: large stones, slope	Slight	Moderate: large stones, slope
Holyoke-----	Severe: depth to rock	Severe: depth to rock	Severe: large stones, slope, depth to rock	Slight	Severe: depth to rock
LpA: Ludlow-----	Moderate: wetness	Moderate: wetness	Moderate: small stones	Moderate: wetness	Moderate: wetness
LpB: Ludlow-----	Moderate: wetness	Moderate: wetness	Moderate: slope, small stones	Moderate: wetness	Moderate: wetness
Rb: Raypol-----	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness
RV: Bash-----	Severe: flooding, wetness	Severe: wetness	Severe: wetness, flooding	Severe: wetness	Severe: wetness, flooding
WkD: Wethersfield----	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope

TABLE 2

NONTECHNICAL SOILS DESCRIPTION REPORT
MT GOLF COURSE

Map Symbol	Soil name and description
BcA	<p>Berlin silt loam, 0 to 5 percent slopes</p> <p>These soils have slight limitations for cultivated crops. They are moderately well drained soils with a moderate to high water holding capacity for plant growth. The seasonal high water table may be a limitation for some crops, and prohibit early spring planting and late fall harvests.</p> <p>CT0042 THE BERLIN SERIES CONSISTS OF DEEP, MODERATELY WELL-DRAINED SOILS ON TERRACES. THEY FORMED IN LACUSTRINE SEDIMENTS. TYPICALLY, THESE SOILS HAVE A DARK REDDISH-BROWN SILT LOAM SURFACE LAYER, 6 INCHES THICK. THE SUBSOIL, FROM 6 TO 12 INCHES, IS REDDISH-BROWN SILT LOAM, FROM 12 TO 20 INCHES, IS REDDISH-BROWN SILTY CLAY LOAM, AND FROM 20 TO 34 INCHES, IS MOTTLED, DARK REDDISH-BROWN SILTY CLAY LOAM. THE SUBSTRATUM, FROM 34 TO 60 INCHES, IS DARK REDDISH-BROWN VARVED, SILTY CLAY. SLOPES RANGE FROM 0 TO 25 PERCENT.</p> <p>This nearly level, moderately well drained soil formed in silty and clayey glaciolacustrine deposits. It is on lacustrine terraces. Depth to bedrock is commonly more than 60 inches below the surface. The soil has a seasonal high water table at a depth of about 20 inches from fall to spring. Permeability is moderate to slow in the surface layer and subsoil, and very slow in the substratum. Surface runoff is medium to rapid and the available water capacity is moderate.</p> <p>These soils are fairly suited to community development. The primary limitation is the seasonal high water table. These soils erode easily during construction and landscaping.</p>
Cyc	<p>Cheshire-Holyoke very stony silt loams, 3 to 15 percent slopes</p> <p>These soils have major limitations for cultivated crops. They are generally considered unsuitable for agriculture without major alterations or expensive management practices. These soils contain one or more of the following limitations: steepness, stoniness/rockiness, depth to bedrock, or wetness.</p>

TABLE 2

NONTECHNICAL SOILS DESCRIPTION REPORT
MT GOLF COURSE

Map Symbol	Soil name and description
	<p>This soil complex consists of gently sloping and sloping, well drained soils formed in firm or friable loamy glacial till and somewhat excessively drained soils formed in a thin layer of glacial till. It is on uplands. In the Cheshire part, depth to bedrock is commonly more than 60 inches below the surface, and in the Holyoke part, depth to bedrock is commonly between 10 and 20 inches below the surface. The water table is commonly more than 6 feet below the surface in both parts. The Cheshire part has moderate permeability and the Holyoke part has moderate permeability above the bedrock. Both parts have medium to rapid runoff. The Cheshire part has high available water capacity and the Holyoke part has low available water capacity.</p> <p>These soils are well suited to community development in areas of the deeper soil. They are not suited where there are shallow depths to bedrock and rock outcrops.</p>
LpA	<p>Ludlow silt loam, 0 to 3 percent slopes</p> <p>These soils have slight limitations for cultivated crops. They are moderately well drained soils with a moderate to high water holding capacity for plant growth. The seasonal high water table may be a limitation for some crops, and prohibit early spring planting and late fall harvests.</p> <p>CT0025 THE LUDLOW SERIES CONSISTS OF VERY DEEP, MODERATELY WELL DRAINED SOILS ON UPLANDS. THEY FORMED IN GLACIAL TILL DERIVED MAINLY FROM RED SANDSTONE, SHALE AND CONGLOMERATE. IN TILLED AREAS, THESE SOILS TYPICALLY HAVE A DARK BROWN SILT LOAM SURFACE LAYER 8 INCHES THICK. THE SUBSOIL FROM 8 TO 26 INCHES IS REDDISH BROWN AND DARK REDDISH BROWN SILT LOAM THAT IS MOTTLED IN THE LOWER PART. THE MOTTLED SUBSTRATUM FROM 26 TO 60 INCHES IS DARK REDDISH BROWN VERY FIRM AND BRITTLE GRAVELLY LOAM. SLOPES RANGE FROM 0 TO 15 PERCENT.</p>

TABLE 2

NONTECHNICAL SOILS DESCRIPTION REPORT
MT GOLF COURSE

Map Symbol	Soil name and description
Lp8	<p>This nearly level, moderately well drained soil formed in compact glacial till. It is on the top of broad drumlins, in slight depressions, and near the base of drumlins and ridges of glacial till uplands. Depth to bedrock is commonly more than 60 inches below the surface. The soil has a seasonal high water table at a depth of about 20 inches from late fall to mid spring. Permeability is moderate in the surface layer and subsoil and slow or very slow in the substratum. Surface runoff is slow and the available water capacity is moderate.</p> <p>These soils are fairly suited to community development. The primary limitation is the seasonal high water table. These soils erode easily during construction and landscaping.</p> <p>Ludlow silt loam, 3 to 8 percent slopes</p> <p>These soils have slight limitations for cultivated crops. They are well drained soils with a moderate to high water holding capacity for plant growth. They are subject to erosion if left unprotected.</p> <p>CT0025 THE LUDLOW SERIES CONSISTS OF VERY DEEP, MODERATELY WELL DRAINED SOILS ON UPLANDS. THEY FORMED IN GLACIAL TILL DERIVED MAINLY FROM RED SANDSTONE, SHALE AND CONGLOMERATE. IN TILLED AREAS, THESE SOILS TYPICALLY HAVE A DARK BROWN SILT LOAM SURFACE LAYER 8 INCHES THICK. THE SUBSOIL FROM 8 TO 26 INCHES IS REDDISH BROWN AND DARK REDDISH BROWN SILT LOAM THAT IS MOTTLED IN THE LOWER PART. THE MOTTLED SUBSTRATUM FROM 26 TO 60 INCHES IS DARK REDDISH BROWN VERY FIRM AND BRITTLE GRAVELLY LOAM. SLOPES RANGE FROM 0 TO 15 PERCENT.</p>

TABLE 2

NONTECHNICAL SOILS DESCRIPTION REPORT
MT GOLF COURSE

Map Symbol	Soil name and description
	<p>This gently sloping, moderately well drained soil formed in compact glacial till. It is on the top of broad drumlins, in slight depressions, and near the base of drumlins and ridges of glacial till uplands. Depth to bedrock is commonly more than 60 inches below the surface. The soil has a seasonal high water table at a depth of about 20 inches from late fall to mid spring. Permeability is moderate in the surface layer and subsoil and slow or very slow in the substratum. Surface runoff is medium and the available water capacity is moderate.</p> <p>These soils are fairly suited to community development. The primary limitation is the seasonal high water table. These soils erode easily during construction and landscaping.</p>
Rb	<p>Raypol silt loam</p> <p>These soils have moderate limitations for cultivated crops. They are poorly drained soils with a moderate to high water holding capacity for plant growth. The seasonal high water table causes the soil to warm up and dry out slowly in the spring. Wetness limits the use of farming equipment in the spring and fall. The seasonal high water table is a limitation for crop production in most years.</p> <p>CT0055 THE RAYPOL SERIES CONSISTS OF VERY DEEP, POORLY DRAINED SOILS ON TERRACES AND PLAINS. THEY FORMED IN LOAMY OVER SANDY AND GRAVELLY GLACIAL OUTWASH DERIVED MAINLY FROM ACID CRYSTALLINE AND SEDIMENTARY ROCKS. TYPICALLY, THESE SOILS HAVE A VERY DARK BROWN SILT LOAM SURFACE LAYER 8 INCHES THICK. THE MOTTLED SUBSOIL FROM 8 TO 29 INCHES IS GRAYISH BROWN, DARK YELLOWISH BROWN AND OLIVE BROWN SILT LOAM AND VERY FINE SANDY LOAM. THE SUBSTRATUM FROM 29 TO 65 INCHES IS MOTTLED LIGHT OLIVE BROWN AND DARK GRAYISH BROWN, LOOSE, STRATIFIED GRAVELLY AND VERY GRAVELLY SAND. SLOPES RANGE FROM 0 TO 5 PERCENT.</p>

TABLE 2

NONTECHNICAL SOILS DESCRIPTION REPORT
MT GOLF COURSE

Map Symbol	Soil name and description
	<p>This nearly level, poorly drained soil formed in loamy over sandy and gravelly glacial outwash. It is in shallow drainage ways and low-lying positions on terraces and outwash plains. Depth to bedrock is commonly more than 60 inches below the surface. The soil has a seasonal high water table at or near the surface much of the year. Permeability is moderate in the surface layer and subsoil and rapid or very rapid in the substratum. Surface run off is slow and the available water capacity is high.</p> <p>These soils are poorly suited to community development. The primary limitations are the high water table and poor filtering capacity. The rapid permeability of the subsoil may cause groundwater pollution in areas used for onsite septic systems. Steep slopes of excavations are unstable and these soils erode easily during construction and landscaping.</p>
Rv	<p>rumney variant silt loam</p> <p>These soils have moderate limitations for cultivated crops. They are poorly drained soils with a moderate to high water holding capacity for plant growth. The seasonal high water table causes the soil to warm up and dry out slowly in the spring. Wetness limits the use of farming equipment in the spring and fall. The seasonal high water table is a limitation for crop production in most years.</p> <p>CT0058 THE RUMNEY VARIANT CONSISTS OF VERY DEEP POORLY DRAINED SOILS ON FLOOD PLAINS. THEY FORMED IN ALLUVIUM. TYPICALLY, THESE SOILS HAVE A DARK BROWN SILT LOAM SURFACE LAYER, 11 INCHES THICK. THE SUBSOIL, FROM 11 TO 28 INCHES, IS REDDISH BROWN MOTTLED SILT LOAM. THE SUBSTRATUM FROM 28 TO 60 INCHES IS REDDISH BROWN MOTTLED SILT LOAM. SLOPES RANGE FROM 0 TO 3 PERCENT.</p>

TABLE 2

MONTECHNICAL SOILS DESCRIPTION REPORT
MT GOLF COURSE

Map Symbol	Soil name and description
	<p>This nearly level, somewhat poorly to poorly drained soil formed in recent silty alluvial deposits, derived from acid, reddish, sandstone, siltstone, and shale. It is on floodplains. Depth to bedrock is commonly greater than 60 inches below the surface. The soil has a seasonal high water table at a depth of 6 to 18 inches from winter to spring. Permeability is moderate in the surface layer and subsoil, and moderate or moderately slow in the substratum. Surface runoff is slow and the available water capacity is moderate.</p> <p>These soils are not suited to community development because they are subject to periodic flooding.</p>
Ud	<p>Udorthents-Urban Land complex</p> <p>These soils have major limitations for cultivated crops. They are generally considered unsuitable for agriculture without major alterations or expensive management practices. These soils contain one or more of the following limitations: steepness, stoniness/rockiness, depth to bedrock, or wetness.</p> <p>These areas consists of nearly level to sloping, excessively drained to moderately well drained soils. The Urban Land areas are used for buildings, paved roads and parking lots. The Udorthents are mostly on outwash plains and terraces of stream valleys and have been altered by excavating or filling. They are mostly irregular in shape but may be rectangular or long and narrow. Most areas of Urban Land are in the more intensely built-up areas of towns. Depth to bedrock is commonly more than 60 inches below the surface. The water table is commonly below a depth of 6 feet. Permeability is rapid or very rapid, surface runoff is slow and the available water capacity is low in the Udorthent part. Urban land is not rated for permeability, surface runoff and available water capacity. These areas require on-site investigation and evaluation to determine the suitability for most uses.</p> <p>This unit requires onsite investigation and evaluation for community development uses.</p>
W	Water

TABLE 2

MONTECHNICAL SOILS DESCRIPTION REPORT
MT GOLF COURSE

Map Symbol	Soil name and description
WKD	<p data-bbox="245 359 727 390">Wethersfield loam, 15 to 35 percent slopes</p> <p data-bbox="245 415 850 562">These soils have major limitations for cultivated crops. They are well drained to somewhat excessively drained soils with a moderate to high water holding capacity for plant growth. Steep slopes are a significant erosion hazard for cultivated crops.</p> <p data-bbox="245 590 862 877">CT0009 THE WETHERSFIELD SERIES CONSISTS OF VERY DEEP, WELL DRAINED SOILS ON UPLANDS. THEY FORMED IN GLACIAL TILL DERIVED MAINLY FROM RED SANDSTONE SHALE AND CONGLOMERATE. IN TILLED AREAS, THESE SOILS TYPICALLY HAVE A DARK BROWN LOAM SURFACE LAYER 8 INCHES THICK. THE SUBSOIL FROM 8 TO 26 INCHES IS REDDISH BROWN LOAM AND DARK REDDISH BROWN GRAVELLY LOAM. THE SUBSTRATUM FROM 26 TO 65 INCHES IS DARK REDDISH BROWN, VERY FIRM AND BRITTLE GRAVELLY LOAM. SLOPES RANGE FROM 0 TO 35 PERCENT.</p> <p data-bbox="245 905 889 1192">CT0062 THE WOODBRIDGE SERIES CONSISTS OF VERY DEEP, MODERATELY WELL DRAINED SOILS ON UPLANDS. THEY FORMED IN GLACIAL TILL. IN TILLED AREAS, THESE SOILS TYPICALLY HAVE A VERY DARK GRAYISH BROWN FINE SANDY LOAM SURFACE LAYER 7 INCHES THICK. THE SUBSOIL FROM 7 TO 30 INCHES IS DARK YELLOWISH BROWN AND LIGHT OLIVE BROWN FINE SANDY LOAM, MOTTLED BELOW 18 INCHES. THE SUBSTRATUM FROM 30 TO 60 INCHES IS LIGHT OLIVE BROWN, VERY FIRM AND BRITTLE GRAVELLY FINE SANDY LOAM. SLOPES RANGE FROM 0 TO 25 PERCENT.</p> <p data-bbox="245 1220 894 1514">This moderately steep, well drained loamy soil formed in compact glacial till on uplands. It is on till plains, low ridges, and drumlins. Depth to bedrock is commonly greater than 60 inches below the surface. This soil has a seasonal high water table that is perched at a depth of about 2 feet for a short period in early spring. Permeability is moderate in the surface layer and subsoil, and slow or very slow in the dense substratum. Surface runoff is medium to rapid and the available water capacity is moderate.</p> <p data-bbox="245 1541 899 1661">These soils are well suited to community development. However, in areas where slope exceeds 25 percent, these soils are not suited to community development. They erode easily during construction and landscaping.</p>

WATER FEATURES
MT GOLF COURSE

Map symbol and soil name	Hydro- logic group	Flooding			High water table and ponding				
		Frequency	Duration	Months	Water table depth	Kind of water table	Months	Ponding duration	Maximum ponding depth
					Ft				Ft
BcA: Berlin-----	C	None	---	---	1.0-2.5	Apparent	Oct-Apr	---	---
CyC: Cheshire-----	B	None	---	---	>6.0	---	---	---	---
Holyoke-----	C/D	None	---	---	>6.0	---	---	---	---
LpA: Ludlow-----	C	None	---	---	1.5-2.5	Perched	Nov-Apr	---	---
LpB: Ludlow-----	C	None	---	---	1.5-2.5	Perched	Nov-Apr	---	---
Rb: Raypol-----	C	None	---	---	0.0-1.0	Apparent	Nov-May	---	---
Rv: Bash-----	C	Frequent	Brief	DEC-APR	0.5-1.5	Apparent	Dec-May	---	---
Ud: Udorthents-----		None	---	---	---	---	---	---	---
Urban Land-----		None	---	---	>2.0	---	---	---	---
WkD: Wethersfield----	C	None	---	---	1.5-2.5	Perched	Feb-Apr	---	---

WATER FEATURES

Endnote -- WATER FEATURES

This report gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms. The four hydrologic soil groups are:

Group "A". Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group "B". Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group "C". Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group "D". Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in this report, the first letter is for drained areas and the second is for undrained areas. Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes. This report gives the frequency and duration of flooding and the time of year when flooding is most likely. Frequency, duration, and probable dates of occurrence are estimated.

Frequency is expressed as "None", "Rare", "Occasional", and "Frequent". "None" means that flooding is not probable; "Rare" that it is unlikely but possible under unusual weather conditions; "Occasional" that it occurs, on the average, once or less in 2 years; and "Frequent" that it occurs, on the average, more than once in 2 years.

Duration is expressed as "Very brief" if less than 2 days, "Brief" if 2 to 7 days, "Long" if 7 to 30 days, and "Very long" if more than 30 days. The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding. Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods.

WATER FEATURES

Endnote -- WATER FEATURES--Continued

Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in this report are the depth to the seasonal high water table; the kind of water table, that is, "Apparent", "Artesian", or "Perched"; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in this report.

An "Apparent" water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

An "Artesian" water table exists under a hydrostatic beneath an impermeable layer. When the impermeable layer has been penetrated by a cased borehole, the water rises. The final level of the water in the cased borehole is characterized as an artesian water table.

A "Perched" water table is water standing above an unsaturated zone. In places an upper, or "Perched", water table is separated from a lower one by a dry zone. Only saturated zones within a depth of about 6 feet are indicated.

Ponding is standing water in a closed depression. The water is removed only by deep percolation, transpiration, evaporation, or a combination of these processes.

This report gives the depth and duration of ponding and the time of year when ponding is most likely. Depth, duration, and probable dates of occurrence are estimated.

Depth is expressed as the depth of ponded water in feet above the soil surface. Duration is expressed as "Very brief" if less than 2 days, "Brief" if 2 to 7 days, "Long" if 7 to 30 days, and "Very long" if more than 30 days. The information is based on the relation of each soil on the landscape to historic ponding and on local information about the extent and levels of ponding.

The Natural Diversity Data Base

The Natural Diversity Data Base maps and files regarding the golf course area have been reviewed. According to our information, there are no known extant populations of Federal or State Endangered, Threatened or Special Concern Species that occur at the site in question.

We do have records for *Oxalis violacea*, Violet wood-sorrel north of the site in question. This population of *Oxalis violacea* is associated with the Mattabeset River floodplain. It is unlikely the population will be affected by proposed activity. However, if water diversions or other activities that would affect floodplain areas of the river are considered please contact Nancy Murray of the DEP-NDDB at (860) 424-3589.

Natural Diversity Data Base information includes all information regarding critical biologic resources available to us at the time of the request. This information is a compilation of data collected over the years by the Natural Resources Center's Geological and Natural History Survey and cooperating units of DEP, private conservation groups and the scientific community. This information is not necessarily the result of comprehensive or site-specific field investigations. Consultations with the Data Base should not be substituted for on-site surveys required for environmental assessments. Current research projects and new contributors continue to identify additional populations of species and locations of habitats of concern, as well as, enhance existing data. Such new information is incorporated into the Data Base as it becomes available.

Also be advised that this is a preliminary review and not final determination. A more detailed review may be conducted as part of any subsequent environmental permit applications submitted to DEP for the proposed site.

Wetland Resources

Included in this section are observations of the wetland resources, the impacts that the proposed activities will have on those resources and recommendations for future development of this parcel.

The applicant has assembled a detailed environmental assessment (EA) to satisfy the local wetland application requirements. This assessment is well organized and thorough in that it includes much of the process that a wetlands agency should follow in making a decision on an application: an assessment of the functional value of the wetland resources in and around the subject parcel, how these resources would likely be affected by the proposed activities, a discussion of the various design alternatives considered, and a statement as to how wetland impacts have been avoided, minimized and compensated for. It is not the intention here to restate information contained in the EA, however the following are observations, comments and recommendations concerning this assessment.

Existing Conditions

Based on the limited field inspection and aerial photo interpretation, the wetlands boundaries as represented on the site plan entitled "Middletown Golf Course / Mile Lane / Connecticut" and dated 9/18/95, appear to be accurate. However, a portion of that boundary was not marked correctly on sheet 2 to the west of the Divito property, as well as an upland portion where an existing path is located between the old railroad and proposed hole six.

It is encouraging to see mention of the proper role that DEP Bulletin No.9 serves, to be used on a watershed basis and not for site specific purposes. Their use of the ranking modifiers "low", "moderate" and "high" rather than relative numerical values is more appropriate. Conversely, this ranking procedure is more subjective and open to interpretation.

Reference to the Purcell study stated that the subject wetland rated #16 of the top 25 wetlands of Middletown. The full relative value of this wetland to all wetland units of Middletown was not listed. This would be helpful to determine its overall rated value. It would also be helpful to include a more expanded discussion of how the wetlands of

this parcel were described and rated within the Purcell study, if further information is available.

Concerning the fourteen functional categories reviewed, while each was summarily discussed, many of the categories received no rating at all including finfish habitat, flood control, nutrient retention/sediment trapping, noteworthiness and educational.

The wildlife habitat and noteworthiness categories would have benefited with a more revealing discussion of the vernal pools located in the wooded swamp west of the school and playing fields. While the Environmental Planning Services' (EPS) Botanical Inventory uses the terms "miniature kettle hole-like ponds" and "mini-ponds" the EA did refer to them as vernal pools and, after field inspection, the Team Wetland Specialist would concur. Aerial photos reveal at least 15 of these features in a contiguous 15-acre area of red-maple swamp.

Vernal pools are small, shallow, circular depressions in the landscape which fill with water during periods of high Spring meltwater and storm-water runoff, becoming drier during the warm summer months. True vernal pools support abundant and diverse wildlife populations. Much of this wildlife is dependent on these areas for one or more periods of their life cycle. Because of the absence of permanent water, fish do not live in these ephemeral pools, making these areas very attractive to invertebrate and amphibian populations. The possibility that rare and endangered wildlife can be found in these pools is significant. Additionally, being an area of such high biological productivity, vernal pools provide an abundant source of food for upland wildlife species.

Not only do these vernal pools have an exceptional level of biological noteworthiness, but geological significance as well. Refer to the soil resources section of this report for more discussion of "pingo scars."

The wildlife lists adapted from the Purcell report indicated the confirmed presence of a sharp-shinned hawk. This species is listed as "threatened" under Connecticut's Endangered and Threatened Species Act, yet was not included in the DEP Natural Diversity Database as reported in Appendix F. Additionally, the Purcell report indicated some level of likelihood of finding other species listed within the Endangered and Threatened Species Act such as the American bittern, red-headed woodpecker, long-

eared owl, yellowbreasted chat (all categorized as endangered), short-eared owl, Cooper's hawk, northern spring salamander (categorized as "threatened"), black-crowned night-heron, yellow-crowned nightheron, red-shouldered hawk, whip-poor-will, golden-winged warbler and the Jefferson salamander (listed as "species of special concern"). EPS's "Plant Species List" was not reviewed for the presence of any species on Connecticut's list of endangered, threatened, or species of special concern.

The applicant may wish to amend the "Noteworthiness" section found on page 11 due to the observed presence of the sharp-shinned hawk, a threatened species, and the presence of several vernal pool / pingo-scars, a unique biological and geological feature.

A more detailed discussion of flood control function of wetlands could have been made. Admittedly, DEP Bulletin No. 9 does focus primarily on overall storage depths and area, however the wetland vegetation itself creates a force of resistance or "roughness" as the flood flows through and around wetland vegetation, effectively decreasing the velocity or "travel time" of the flood flow. Interception and transpiration of rainfall by wetland vegetation are also known to reduce stormwater runoff and thus flood flows themselves.

Impact of Proposed Activities on Watercourses and Wetlands

Given the figures listed on page 3 (215.9 acres total land area, 116.9 acres of wetland or 54% of the total land area) and the figures in the first table on page 12 (37.35 acres of wetland impact as per Middletown wetland regulations) the total percentage of wetland impact should be 32% not the 20% listed in the second table on page 12. If this figure was intended to be a percentage of "wetland area commitment" as listed on the first table, it appears that the proportion should be 18%, not the 20% total listed on the second table. It is understood that the "wetland area commitment" figure removes those areas of fairway and rough where the trees are to be "clear-cut" and the low vegetation and wetland soils are to remain intact.

Under "Ecological Integrity" on page 12, it is stated that the proposed activity "...will not interfere with the movement of wildlife along the wetland corridor." While this is not the "wildlife" section of this report, it is conceivable that altering roughly one third of the wetlands on this parcel and conducting daily, continuous, organized recreation on most of this altered area would have some effect, if not a significant effect on the

wildlife corridors of this parcel.

Page 13, paragraph one correctly states that most impact will occur in the wooded swamp west of the school. Specific impacts to songbirds requiring a deep-woods habitat are mentioned, however a description of the unique wildlife communities associated with vernal pools could have been included here, as well as their sensitivities to human intrusion.

It is likely that several of the species listed above which are included on Connecticut's Endangered and Threatened Species list could be found in this type of natural community (wooded swamp) including the "threatened" sharp-shinned hawk which was actually observed on this parcel. Other species which could conceivably be found in this type of community include the threatened Cooper's hawk and northern spring salamander; as well as the Jefferson's salamander, a species of special concern.

According to DEP's *Guide to Protected Reptiles and Amphibians* the Jefferson's salamander is a very "...secretive species seldom seen outside the breeding season...Adults migrate to ponds during heavy rain." This quotation brings out two points essential to the protection of vernal pools. First, the unique species that characterize a true vernal pool are not present year round and that, not only should vernal pools be protected when possible but also a forested "buffer area" surrounding the pools itself. The USDA Forest Service recommended in their booklet *Forested Wetlands - Functions, Benefits and the Use of Best Management Practices* a buffer area extending approximately 130 feet from the edge of the pond to help ensure successful amphibian migrations. Apparently, clearing of the forest canopy in these buffer areas effects the soil's temperature and moisture content, two variables which can influence the migration of salamanders.

The impact on the flood control function of these wetlands should not be determined until the actual floodplain boundary is located. It is recommended that the applicant approximate the location of the Federal Emergency Management Agency's (FEMA) "100-year" Flood Hazard Area and "Floodway Areas" on the site plan to determine what development activities are taking place there (refer to a copy of the appropriate FEMA map). It is difficult to judge, however, it appears that hole 4, tee 5, fairways 6 and 7, and ponds 8 and 9 may be taking place within this flood area. It appears that no activity is proposed in the FEMA Floodway Area.

Mitigation Measures

It is evident that much effort has been made to address mitigation of proposed wetland impacts. The diligent search for the least environmentally damaging alternative, innovative stormwater management, the proposed use of Integrated Pest Management guidelines, and proposed Best Management Practices for erosion & sedimentation control and fertilizer usage, as well as the proposed stream monitoring program all speak to this effort.

Compensation for the 37 acres of impact is currently in the form of four created ponds totaling approximately 6 acres. These ponds are designed to diversify the existing wetland habitat through the inclusion of an emergent marsh perimeter, however, actual creation of additional wetland area will be negligible.

Ideally, wetlands compensation projects should strive to replace not only the area of unavoidable wetland impact but also the functional values of the impacted wetlands on at least a 1:1 ratio, if not more. Unfortunately, most of the wetland impact will occur in the wooded swamp / vernal pond/ pingo scar area. This type of wetland habitat would be very difficult to duplicate and no attempt is made to do so.

Additional Recommendations

It is suggested that the applicant confirm or deny the presence of true vernal ponds and any of the rare, sensitive wildlife which is expected to be present in them. Delaying any possible development in these areas until Spring so that a more intensive biological survey may be conducted may be prudent. At any rate, all of these pools should be located on the site plan.

Investigate the possibility of incorporating a groundwater monitoring program, in addition to the surface water monitoring program proposed. This would serve to alert golf course management of any contamination from pesticides or nutrients prior to its entry into the brook.

The use of gravel on the proposed parking lot may lead to a compacted surface which may become relatively impervious. The use of "pervious pavement" which is

specifically designed for this purpose may prevent this from occurring.

Determine the basis for requiring a 180-vehicle capacity in the parking lot.

It is recommended that clearing limits be added to the site plan.

Re-flagging the wetland boundary and marking the clearing limits in the field prior to construction may help to avoid any unpermitted wetland activity. Recording the flag numbers on the site plan would help regulators and contractors find their way in the field.

Additional details should be added to the site plan, including cart path bridges and pond spillways and pond inlet splash pads (engineered for expected water velocities).

A hydrologic study could be useful to determine how proposed irrigation may affect existing ground and surface waters. This study will be valuable to address the concern of de-watering wetlands as a result of irrigation needs.

Be advised that this proposed golf course would most likely require a permit from the DEP Inland Water Resource Division as called for in the Connecticut Water Diversion Policy Act (sections 22a-365 through 22a-378 of the Connecticut General Statutes) if there are to be any groundwater withdrawals exceeding 50,000 gallons an any given day. It is recommended that the applicant call Bob Gilmore of this division at 424-3019 to determine the need for such a permit.

If this project is not phased, and construction activities covering five acres or more are approved, the applicant is required to apply to the CT-DEP for a general permit for the discharge of stormwater under the National Pollutant Discharge Elimination System (NPDES) program. For further information on this permit program contact Christopher Stone of the DEP Permitting Enforcement and Remediation Division at 424-3850.

Pesticide applicators and their supervisors are required to obtain certification from the CT-DEP Pesticides Section. Contact Judy Singer of this section at 424-3369 for further information.

In closing, the Middletown Inland Wetlands and Watercourses should carefully apply "all relevant facts and circumstances..." as listed in section 8.1(D) of your inland wetland and watercourses regulations prior to rendering a decision on this application, especially item 6 which deals with the "suitability of the activity to the area for which it is proposed." Part of this process would be to establish the need for such a facility in Middletown, in as much as it balances the need for economic growth with the need for environmental protection.

Erosion and Sediment Control and Stormwater Management Plans

The following comments and recommendations refer to the Erosion and Sediment Control (E&S) plan and the stormwater management plan for the golf course development plans:

1. A uniform key of symbols should be used on the plans. The current plans show two different symbols for the wetland boundary, and only one should be used. Clarification of the symbols and the key should help facilitate installation of controls in the field.

2. In the details for the monitoring program, TSS (total suspended solids) should be added to those parameters being monitored for this project. This project is located in the Mattabesset River Watershed, and all stormwater from the site drains to the river. The underlying geology of this area is a combination of glacial till and fine grained glacial lake clays (former Glacial Lake Middletown). When this fine grained material is disturbed and transported by stormwater, it takes a long time for the fine materials to settle out of suspension. For these reasons, it is extremely important that this project is conducted in phases and that minimum areas are disturbed and exposed for any length of time. Monitoring for TSS will serve as a tool for management of stormwater carrying sediment and associated pollutants which can impact tributary streams and the mainstem of the Mattabesset River.

3. Drainage discharge calculations for the site, including pre and post construction calculations, should be included with the plans. Also, a drainage overlay showing the locations of where stormwater will be exiting the site should be included. Information concerning the affect of stormwater discharges on any adjacent properties should be indicated.

4. Given the size of the project, the developers will be required to register for a stormwater general permit for construction activities from the Connecticut DEP. Some of the information which should be considered at this time, as it will be required as part of the permit's stormwater pollution control plan, include the following:

- time tables for work, including information about completing the work in phases;
- detailed information about the installation and maintenance of all E&S controls on a map scale which is easy to interpret in the field;
- the number and location of stormwater outfalls or channelized flows of stormwater;
- the total number of acres of disturbed soil on the site;
- the name of the individual responsible for the installation and maintenance of all E&S and stormwater management controls;
- design calculations which show that sedimentation basins and other management controls are sized properly;
- the location of major soil stockpile areas with proper E&S controls;
- plans for managing the site should construction fall outside of the recommended seeding dates, including provisions for mulching and the use of geotextiles in appropriate areas;
- a permanent vegetation and seeding plan;
- a plan for the maintenance of BMP's during and after construction.

5. Construction details for items such as the spillways and risers for the ponds and sedimentation basins should be included on the plans. It is unclear what is meant on page 19 in the item stating "spillways are designed with Soil Conservation Service methods for erosion control".

6. More information should be provided concerning the interconnected pond system, including how the ponds relate to the site's subdrainage system. If the higher elevation ponds drain more rapidly to the lower ponds, they will have a different stormwater storage capacity than the lower elevation ponds.

Vegetation

Approximately 215 acres of open space which includes 116 acres of wetlands is being considered for development into an 18 hole golf course. The vegetation which is present on this tract was inventoried, mapped and described for the applicant by Environmental Planning Services. This information has been incorporated into the document *Inland Wetland Application and Environmental Assessment for the Middletown Golf Club, Mile Lane, Middletown, CT* (September 1995).

Forest Vegetation

Tree and vegetation clearing and removal will take place on a significant portion of this tract should development of the golf course occur. The sawtimber size trees (11.1" in diameter at breast height (d.b.h.) and larger) and pole size (6.1" to 11" in d.b.h.) that are going to be removed should be tallied and sold as sawlogs and fuelwood rather than chipped and removed at a cost to the developer. The mixed hardwood forest to the west of the athletic field is dominated by sawtimber and pole size pin oak, white oak, swamp white oak, red oak, black oak, hickory, white ash, red maple, sugar maple, and American beech. If and when development occurs the wood products in this area should be utilized.

Ideally trees that are going to be retained for buffers between holes or as aesthetic standards should be healthy, free of decay and long lived species such as oaks, hickories and sugar maple. These trees may be left in groups or "islands" to reduce the impact of soil disturbance and mechanical injury during construction. Construction activities that occur close to trees that are to be retained will adversely effect their health, vigor and longevity and potentially create future hazard trees. Trees are very sensitive to the condition of the soil within the entire area of their root systems. Excavation, filling and the general use of heavy machinery will lead to some degree of soil compaction that will adversely affect the soil moisture and aeration balance. This imbalance could lead to a decline in tree health and vigor and may even lead to tree mortality within three to five years. Physical damage to the root system (by excavation) or bark damage may allow the introduction of decay organisms which may result in the decline of a tree's health over time. Both individual trees and "islands" of trees can be designated for retention with vinyl flagging or fencing prior to construction so that tree injury may be avoided. No excavation, filling or driving of heavy equipment should be permitted

within 25-50 feet (depending on tree diameter - the larger the tree to be retained the greater the no disturbance area should be) of single trees or groups of trees. A general rule to follow is no excavation, filling or heavy equipment should be permitted within two times the radial spread distance of the tree's crown. When making grade cuts, trees should be removed back from the cut for at least a distance of two feet for each one foot of depth of cut, e.g. 20 feet back for a 10 foot cut. Where feasible undisturbed buffer zones of at least 75-100 feet deep of natural vegetation should be left between the golf course and pre-existing homes to provide a visual and sound barrier. Reinforcement plantings of native conifer trees, hardwood trees and shrubs should be made after final grading has been completed.

Trees and forests have value in reducing climatic extremes, controlling runoff, filtering out pollutants from the air and water, reducing noise, providing aesthetic enjoyment, creating wildlife habitat, recharging aquifers, supplying wood fiber and functioning as a carbon sink. Healthy forests provide these long term amenities. Therefore a good relationship between development and the retention of forested open space is essential if generations to come are to enjoy a high quality of life.

Fish Resources

This report will address impacts to fisheries resources due to the proposed creation of a 18 hole golf course and delineate appropriate measures to mitigate impacts.

Fish Population

The golf course borders West Swamp Brook and East Swamp Brook. Both of these watercourses confluence and enter the Mattabesset River. Contrary to information provided in the inland wetland application materials, these resources are expected to support dense and diverse warmwater fish populations. No recent fisheries survey information is available within these watercourses; however, based on a field review of physical instream and riparian resources on the site and from known fisheries data in adjacent watersheds and the Mattabesset River, the following freshwater finfish should be found: blacknose dace, fallfish, white sucker, tessellated darter, redbfin pickerel and golden shiner. Chain pickerel would be the dominant gamefish and panfish such as bluegill, pumpkinseed, and redbreast sunfish should be present. American eel, a species which exhibits catadromous migratory behavior should also be very common.

Surface waters of these watercourse are classified as "Class A". Designated uses for this classification are: potential drinking water supply, fish and wildlife habitat, recreational use, agricultural and industrial supply, and other legitimate uses.

Impacts

The following impacts can be expected if proper mitigation measures are not implemented:

- 1. Reduced streamflow in west Swamp Brook and East Swamp Brook.** The loss and alteration of over 37 acres of wetlands that supply ground and surface waters to these watercourses may effectively reduce stream flows. This situation would be most critical during normal summer low flow periods since Connecticut streams are dependent upon groundwater inputs to maintain base flows. The functional value of wetlands to supply waters to stream resources may be impacted with the loss/alteration of wetlands. This alteration coupled with the actual withdrawal of groundwaters from man-made ponds used for irrigation purposes may further compromise stream flows. Man-made

ponds can interrupt groundwaters that function to augment stream flows. Evaporative losses from ponds and from turf maintenance can also be expected. The decrease of low flows may inflict myriad impacts to local fisheries. The main concern is that reduced stream flow could translate into a loss of instream habitat for fish. Other impacts from reduced stream flows are water quality related. Reduced flows can significantly elevate stream water temperatures and decrease dissolved oxygen levels. Low gradient watercourses that contain pool habitat are particularly susceptible to dissolved oxygen deficiencies. These habitats are prevalent in this area where long stretches of pools were observed partitioned by very short riffle habitat. Riffle areas contain turbulent fast flowing waters where dissolved oxygen levels can be inherently higher than in pools.

2. Site soil erosion and sedimentation of watercourses due to extensive vegetation clearing and cut/fill activities. Without proper safeguards, the placement of fill in concert with land disturbances associated with golf course construction may introduce suspended sediments to watercourses. If not properly controlled, suspended sediments will cause stream degradation in downstream areas. Sedimentation is of special concern in a meandering, low gradient system such as East and West Swamp Brooks where deposited sediments take much longer to be washed and transported downstream by spring freshets. In addition, local soils contain clays which can cause excessive turbidity once introduced into aquatic environments. Excessive sediment deposition could damage the 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 macroinvertebrates. 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 the

opercular cavity and gill filaments.

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

(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.

Recommendations

The following recommendations are provided to assure protection of aquatic resources.

1. Hydrologic analyses should investigate anticipated impacts to streamflow regimes.

No information was provided to evaluate and assess the extent to which existing stream flows will be diminished due to the alteration of 37 acres of wetlands. The period of concern is during the base flow period, typically June through September. Diminished flows could translate into instream habitat losses. A detailed groundwater and water budget analysis should be conducted to investigate anticipated impacts to stream flows by estimating groundwater losses and evaporative losses from ponds and turf maintenance. Further information may also be required if water losses are expected to be significant. This could include stream habitat based studies which predict instream habitat losses in different microhabitat types and water quality models to project increases in stream water temperatures and subsequent decreases in dissolved oxygen levels.

2. The excavation of wetlands to create ponds for irrigation and subsequent withdrawal of waters is considered a water diversion, and as such, may require a State of Connecticut Water Diversion Permit. The applicant should contact the DEP Water Diversion Program Coordinator, Bob Gilmore, at 424-3019 for further details.

3. Develop an aggressive and effective erosion and sediment control plan. Proper installation and maintenance of erosion/sediment controls is critical to environmental well being. This includes such mitigative measures as filter fabric barrier fences, staked hay bales, and sediment basins. Land disturbance and clearing should be kept to a minimum and all disturbed areas should be restabilized as soon as possible. Exposed,

unvegetated areas should be protected from storm events.

4. Instream Habitat Improvements. Applicants are interested in potential wetland mitigation sites. Opportunities to conduct instream habitat improvements may exist in West Swamp Brook and East Swamp Brook which could possibly be utilized as mitigation for wetland impacts if so approved by regulatory agencies. As an example, instream habitats could be improved by installing wooden structures to provide cover for fish or to enhance riffle habitat by flushing out sediments and increasing dissolved oxygen levels. If the applicant is interested in exploring instream habitat improvements as mitigation, the Team's fisheries biologist is willing to further evaluate such opportunities in the West Swamp and East Swamp Watersheds.

Wildlife

General Background

The 187.2 acre parcel of land owned by the City of Middletown being considered for development as a golf course provides diverse wildlife habitat in an urbanizing area. The diversity in wildlife habitat is directly linked to the diversity of the eight plant communities located on the property. The wildlife currently utilizing the property are a reflection of the diversity of the plant communities and their proximity to each other.

Conversion of Predominantly Woody Plant Communities to Open Mowed Habitat

In general, the conversion of predominantly wooded plant communities to open and mowed habitat will be detrimental to most forest-dwelling and shrub-swamp-dwelling wildlife currently occupying the site. A predictable shift in the type of wildlife communities occupying the property will occur. Species such as the Canada goose, Red fox, Woodchuck, Cottontail rabbit, European starling, House sparrow, Cowbird, and other generalists will benefit from the habitat changes. Wildlife that are considered specialists (i.e. neotropical migrants) are more sensitive to the effects of development and will be the most adversely affected by the proposed development. Other wildlife that may be negatively affected from the proposed habitat changes will be the amphibians which thrive best in areas with abundant woody plant debris on the ground and clean unaltered water sources.

Discussion of Wildlife Species Changes

The wildlife species that are likely to benefit from the open and mowed habitats of this proposed development are, today, considered nuisances in many parts of the state. In particular, the Canada goose has been associated with causing nuisance situations of golf courses. They congregate in large numbers, feed on turf grass, nest on open water ponds, get in the way of golfers, and leave large volumes of feces in and around the greens and waterbodies. Other detrimental wildlife species that benefit from open and mowed areas are Cowbirds which parasitize the nests of other birds which leads to lower recruitment of young especially for many area sensitive songbirds that are already declining due to forest fragmentation.

On page 13 of the *Middletown Golf Club Wetland Application and Environmental Assessment* (September 1995) it is stated that "there will be no loss of habitat type due to the construction of the golf course". This statement is true, except somewhat misleading. Although the habitat types are not entirely lost, most of them are significantly altered or reduced in size.

Although the Middletown Golf report (September 1995, page 13) states that the proposed golf course "will not impede the movement of wildlife ...", it is difficult to be sure without further wildlife surveys of the site especially from a seasonal perspective. A thorough study of the reptiles and amphibians is also warranted on a site like this one which has such extensive wetlands and unsurveyed vernal pools. Reptiles and amphibians are slower at moving between habitat types and are less tolerant of habitat alterations. Although paved areas are avoided in the golf course plan, there is still proposed extensive removal and alteration of existing habitat types. Also, more information is needed about the wildlife that are nesting on the property by species and abundance in order to better understand the effects of habitat removal or alteration and the possible migration of losses.

There are many scientific studies in wildlife ecology that indicate a strong relationship between small forests and high human use leads to declining function as meaningful reserves for area-sensitive wildlife (those that require larger unbroken parcels) (Bond 1957, Levensen 1981, Hoehne 1981, O'Meara 1984, Askins et. al. 1987). As forests and habitat sizes shrink in size, they are less viable as breeding places for interior forest birds and an increase in predation and parasitism of nests occurs (Blake and Karr 1984).

Open Space, Wildlife Habitat and the Future

Connecticut is the fifth most densely populated state in the United States. As urban areas become developed, habitats are divided into smaller and more isolated pieces. Land that is in public ownership can be maintained and managed for the long term. In contrast, private land, which makes up 88% of the land in Connecticut, usually changes ownership and is not managed for wildlife for the long term.

The current proposed golf course will significantly alter or reduce the size of the habitats on this city-owned property. As forest fragmentation continues, city-owned natural areas will gain in importance as wildlife habitat and refugia. Retaining natural

areas in close proximity to urban centers should be carefully planned and considered.

Wildlife areas that are close to urban centers serve as refugia for wildlife and are also gaining in popularity. Public opinion surveys of urban residents of five metropolitan centers in New York State indicated that 96% of the respondents felt that it was important for their children to learn about nature and 73% were interested in wildlife in their backyard or neighborhood area (Brown et al 1989).

Management Recommendations

In reviewing the tree planting list, the Team Wildlife Biologist recommends that the native type of Red Maple (*Acer rubra*) is planted rather than a hybrid or other variety. Also, an effort to salvage existing vegetation should also be made. The Team Wildlife Biologist can provide further technical assistance concerning this upon request.

Summary

Building a golf course requires major alteration of existing natural vegetation, soils, and topography. Inherent with these changes are the expected changes to wildlife and habitat currently found on the property (discussed earlier). It is difficult to recommend minimizing the impacts from habitat alteration without requesting significant reductions in numbers of golf holes or green sizes.

A more detailed field survey of the wildlife occupying the diverse habitats is warranted for this property especially for those species that are listed as threatened, endangered or species of special concern. More information should also be gathered on the seasonal use of the habitats by birds, reptiles and amphibians; especially during the breeding season.

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Planning Review

On November 9, 1995 the Team Planning Specialist met with the staff of Close, Jensen and Miller. They provided him with the background of the proposal and explained some of the details of construction. They had no traffic information available. Evidently, there is no traffic information available anywhere, probably because this application is before the Inland Wetlands Commission and traffic information will be made available when it goes to the Planning and Zoning Commission.

On November 15, 1995 the Team Planning Specialist visited the site. The plan shows a two hundred car parking lot for the club house and first tee. This would not appear to increase the numbers of vehicles using Mile Lane to an extent that the road would be dangerous or near capacity. It appears to be a feeder/connector road with mixed uses long the frontage. Immediately, across the street from the site is a U.S. Army installation that was actively being used on the day of the visit. Also in this vicinity is the best access to the site via a dirt road.

The entire site is relatively flat and very wet with some increase in elevation at the northern locations. Years of misuse and abuse are evident due in large part to location and ownership. Trash and dump conditions appear to have occurred prior to the efforts of the city to prohibit access to the inner portions of the property. Middletown intended, many years previous, to use this property for the purpose of a golf course. It is the Team Planning Specialist's understanding that was why it was purchased. The conditions on the site have not improved over the years, for the purpose of a golf course or any other use. The best property in the vicinity was utilized for school construction. If the school were to be expanded into the subject property a great deal of site preparation would be necessary. If the City were to use or propose to use this site for any other municipal use (public works garage, active ball fields, library, city offices), site preparation would be extensive.

The sale of this property to a private party would only lead to speculation into development for an intensive land use.

The City now has a plan for conservation which includes this property with the intention of keeping it in as natural a state as possible, because of the presence of

unique flora and fauna. This information was offered in two telephone conversations with Linda Bowers of the Middletown Planning Department. If the proper authorities could obtain or purchase this tract for that purpose it could be considered as the only viable alternative to the golf course. Without this happy circumstance the Team Planning Specialist believes the golf course to be the best possible use of this property. It is a beneficial urban use. It maintains well over 95% of the property open to the sky, which is an objective of all conservation. With a golf course actively functioning on this property it will benefit from stewardship. That is to say, persons will be present daily to avoid the most detrimental effect on-site, at present. That is the existence of a junk yard and trash collecting appearance. Different parts of automobiles and appliances are scattered all about this property. Stewardship would help to clean up the existing trash and help ensure that the problem does not continue or get worse.

Construction of a golf course will have immediate and detrimental effects on the ecosystems operating on the property. That is not to say that they cannot be restored to near original with necessary effort and expense when the construction is near completion. Disturbing the flow and direction of streams is fraught with difficulties. New ponds or water retention systems, so necessary on this site to prepare fairways and greens, will give the appearance of a great deal of destruction. If the City is confident in the contractor, certainly many of these problems can be overcome.

Although there are existing residences along Mile Lane (R-1 zone) and Tuttle Road (Industrial zone) the development of a golf course in their vicinity could prove to have a beneficial effect on the values for two reasons: one, many potential homebuyers would appreciate the convenience of the close by golf course and two, having a functioning land use removes any possible speculation of other and more detrimental uses threatening the residential uses.

Archaeological Review

A review of the State of Connecticut Archaeological Site Files and Maps shows one known archaeological site in the project area. This prehistoric Native American encampment is located in the southern portion of the project area along West Swamp Brook. The site has yielded stone tool artifacts of quartz and flint representing four thousand years of seasonal occupation by Indian groups migrating through the Mattabesset and Connecticut River drainages. While listed as a campsite, this occupation is of importance due to the presence of Late Woodland projectile points and a sandstone digging hoe which may indicate a combined subsistence base including hunting and horticulture. This site and others in the area may yield important information on the shift from hunting and gathering to horticultural societies around 1,000 years ago.

Archaeological sites are primarily located on well-drained soils adjacent to wetland systems. The most archaeologically sensitive areas for the proposed golf course property are those within 200 yards of the wetland and brook systems draining into the Mattabesset River.

The Office of State Archaeology recommends an archaeological reconnaissance survey for all areas within 200 yards of any wetland system. This survey would locate and identify all archaeological resources which might exist in the proposed project area. The Office of State Archaeology is prepared to provide any technical assistance to the property owner and the City of Middletown in accomplishing this archaeological fieldwork. All archaeological testing should be conducted in accordance with the Connecticut Historical Commission's *Environmental Review Primer for Connecticut's Archaeological Resources*. The Office of State Archaeology looks forward to working with all concerned parties to protect and preserve any archaeological sites which may be affected by the proposed golf course development.

ABOUT THE TEAM

The Eastern Connecticut Environmental Review Team (ERT) is a group of professionals in environmental fields drawn together from a variety of federal, state and regional agencies. Specialists on the Team include geologists, biologists, foresters, 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: 860-345-3977, Eastern Connecticut RC&D Area, P.O. Box 70, Haddam, Connecticut 06438.