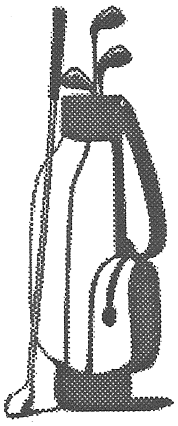
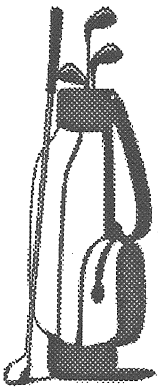


River Oaks of Sherman

Sherman, Connecticut

King's Mark Environmental Review Team Report

King's Mark Resource Conservation & Development Area, Inc.



River Oaks of Sherman

Sherman, Connecticut

Environmental Review Team Report

Prepared by the
King's Mark Environmental Review Team
of the
King's Mark
Resource Conservation and Development Area, Inc.

for the

Inland Wetlands Commission
Sherman, Connecticut

November 2000

CT Environmental Review Teams
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Acknowlegments

This report is an outgrowth of a request from the Sherman Inland Wetlands Commission to the Fairfield County Soil and Water Conservation District (SWCD). The SWCD referred this request to the King's Mark Resource Conservation and Development Area (RC&D) Executive Council for their consideration and approval. The request was approved and the measure reviewed by the King's Mark Environmental Review Team (ERT).

The King's Mark Environmental Review Team Coordinator, Elaine Sych, would like to thank and gratefully acknowledge the following Team members whose professionalism and expertise were invaluable to the completion of this report.

The field review took place on Wednesday, August 30, 2000.

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I would also like to thank John Bethel, chairman Sherman IWC, Malcolm McCluskey, applicant, Dudley Ashwood, project engineer, Robert Sonnichsen, environmental consultant, Robert McNeill, The Northeast Golf Company and other attendees, for their cooperation and assistance during this environmental review.

Prior to the review day, each Team member received a summary of the proposed project with location and soils maps. During the field review Team members were given additional plans and information. Some Team members unable to attend the field review made visits on their own and others made additional field visits to the site. 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 plans 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 use, and also suggests considerations that should be of concern to 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 King's Mark RC&D Executive Council hopes you will find this report of value and assistance in the review of this proposed golf course and residential development.

If you require additional information please contact:

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Introduction

I. Introduction

The Sherman Inland Wetlands Commission has requested assistance from the King's Mark Environmental Review Team in reviewing a golf course and residential development proposed for property located along the Housatonic River.

The ±343 acre site is located at the northern tip of the town of Sherman bounded on the north and east by the Houstonic River, on the south by Evans Hill Road, and on the west by forested private property (see Figure 1). This area was the subject of a 1977 ERT report -*Carlson Farm Property Acquisition* (see Appendix A). The town at that time was considering purchase of the Carlson Farm for recreation and open space use.

The property was used for agricultural purposes for many generations, but by the 1940's - 1950's this land use had declined. During the 1940's - 1950's sand and gravel mining had taken place on certain portions of the site. This use had ceased by the time of the 1977 ERT report. The town declined the purchase of the property and it was approved to be developed as an 85 lot residential subdivision sometime in the mid 1980's. A road network with storm drainage was constructed but no homes were ever built. The federal government gained ownership of the parcel and the present owner purchased the property at auction.

The River Oaks proposal includes the construction of an 18 hole golf course with a clubhouse and maintenance facilities and the construction of 65 two acre house lots (See Figure 2). The homes would be served by individual on-site wells and sewage disposal systems. At the review meeting it was said that approximately 170 acres will used for the golf course, 130 acres for the residential lots, and approximately 17 acres would be public open space.

II. Objectives of the ERT Study

The commission has asked for assistance with the review of this project because of its size and the complexity. The commission is requesting assistance in identifying site resources and factors that should be included in the evaluation of the proposed development. The ERT is asked to suggest measures that could be included to minimize adverse impacts on site resources and the surrounding area. Early concerns have focused on water quality issues, wetland and river impacts, site design, riparian buffers, wildlife and endangered species impacts, and management practices for golf courses.

III. The ERT Process

Through the efforts of the Sherman Inland Wetlands Commission, this environmental review and report was prepared for the town of Sherman.

This report provides an information base and a series of recommendations and guidelines which cover the topics requested by the town. Team members were able to review maps, plans and supporting documentation provided by the applicant.

The review process consisted of four phases:

1. Inventory of the site's natural resources;
2. Assessment of these resources;
3. Identification of resource areas and review of plans; and
4. Presentation of education, management and land use guidelines.

The data collection phase involved both literature and field research. The field review was conducted on Wednesday, August 30, 2000. The emphasis of the field

review was on the exchange of ideas, concerns and recommendations. Being on site allowed Team members to verify information and to identify other resources.

Once Team members had assimilated an adequate data base, they were able to analyze and interpret their findings. Individual Team members then prepared and submitted their reports to the ERT coordinator for compilation into this final ERT report.

Figure 1

⇑

Approximate Location Map

Scale 1″ = 2000

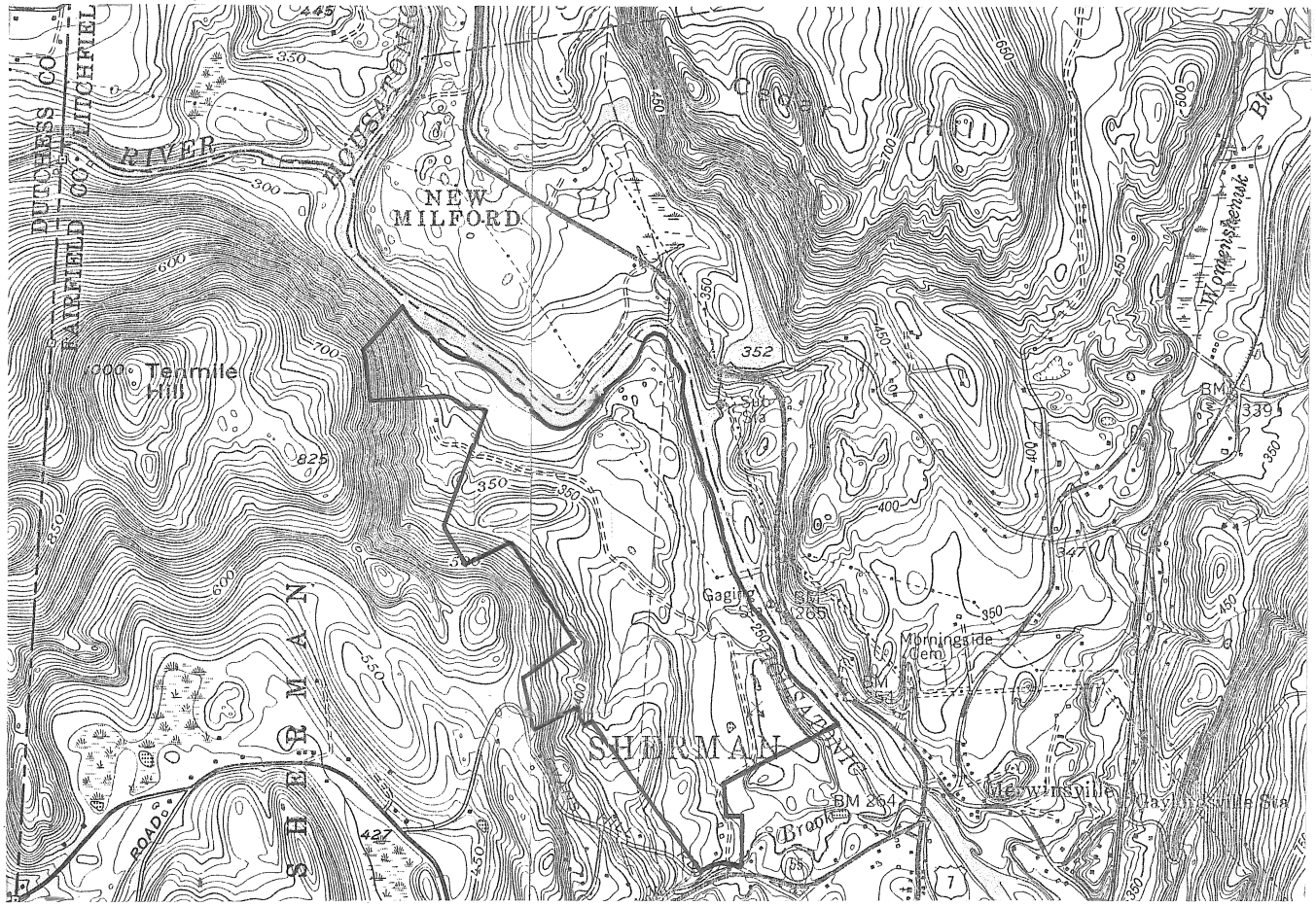
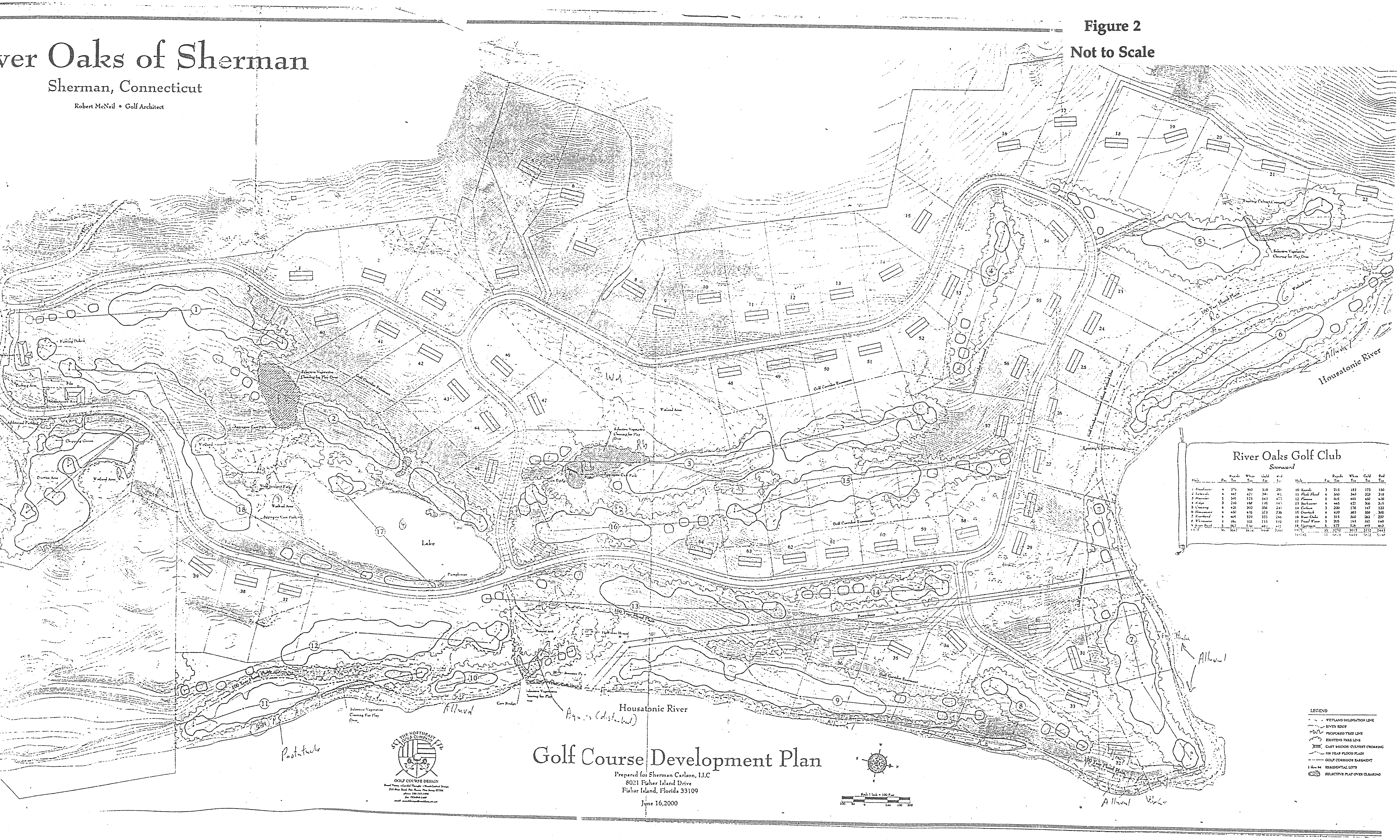


Figure 2

Not to Scale



A Watershed Perspective

These recommendations to the Sherman Inland Wetlands and Watercourse Commission (Commission) are given from the perspective of improving and maintaining water quality and supporting designated uses of the State's waters per the State of Connecticut Water Quality Standards[1]. These recommendations also reflect the CT DEP's growing commitment to address water quality concerns from a watershed perspective, taking into account the cumulative impact of numerous activities within a given watershed which may affect water quality. The watershed of concern in this instance is the Housatonic Main Stem Regional Basin, southward from the northern tip of Sherman. The surface water quality goal in this section of the Housatonic River is Class B with the following designated uses: recreational use; fish and wildlife habitat; agricultural and industrial supply and other legitimate uses including navigation. The groundwater quality goal in this vicinity is Class GA with the following designated uses: existing private and potential or private supplies of water suitable for drinking without treatment; baseflow for hydraulically-connected surface water bodies.

Some of these recommendations may overlap with those of other ERT members who are dealing with more specialized aspects of the review (i.e. - stormwater, fisheries, pesticides, etc.). In such cases, these recommendations are meant to support or supplement these specialized reviews, not to supplant them.

After participating in the field review and examining documents associated with the project, the following recommendations are offered to the Commission:

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[1] State of Connecticut, Department of Environmental Protection. Effective 1996 & 1997. Water Quality Standards. Bureau of Water Management - Planning and Standards Division. Hartford, CT.

- **The Commission may wish to compare the Applicant's "Golf Course Environmental Management Plan" with other best management practice guidelines for golf courses that have been researched and compiled by reliable institutions to see if there are additional measures the Applicant should take to protect water quality.**

One such document, entitled Professional Guide for IPM and Turf, has been published by the University of Massachusetts and is available, for a fee, by contacting: UMass Extension Bookstore, Draper Hall, Amherst, MA 01003-2010; Phone: (413)545-2717. This document is currently being revised. In addition, UMASS will be releasing a new publication by the end of October entitled Protocols for an IPM System on Golf Courses which is geared toward an audience which includes community decision-makers. Contact the UMASS Extension Turf Team Specialist at (508) 892-0382 for further information.

If the application for "River Oaks of Sherman" is approved, it is critical that the agreed upon best management practices be followed with regard to fertilizer and pesticide application. Toward this end, the Commission should consider requiring the Applicant to keep records and report to the Commission regularly as a condition of approval.

Nutrient and pollutant loading to wetlands and watercourses which drain to the State's major rivers and Long Island Sound (LIS) is an issue of great concern. The CT DEP and the New York State Department of Environmental Conservation are currently working with the U.S. EPA on an analysis regarding nitrogen loading to LIS in an effort to improve dissolved oxygen levels in the western end of the Sound. The goal is to achieve a substantial reduction in human generated nitrogen from point and non-point sources by the year 2014. In Connecticut,

much of this will be accomplished through a statewide program focusing on nitrogen removal at sewage treatment plants. However, Connecticut is also looking to significantly reduce nitrogen loading from non-point sources.

Non-point source pollution, in the form of nitrogen and phosphorus, is also of particular concern in the Housatonic River due to eutrophication problems in Lake Lillinonah and Lake Zoar which are impoundments of the river. Since "River Oaks of Sherman" would be located right on the banks of the Housatonic and a relatively short distance above the upper reaches of Lake Lillinonah, it is of particular importance that great efforts be made to eliminate the potential for nitrogen, phosphorus and other pollutants to enter the watercourse from this proposed development.

- **The Commission should consider comparing the Applicant's "Sedimentation and Erosion Control and Stormwater Management Plan" with the Connecticut Guidelines for Soil Erosion and Sediment Control[2] to see if there are additional measures that the Applicant should take to prevent erosion and sediment loss.**

Since the proposed project is so large, the Commission should consider requiring that the development be done in phases, such that work on one portion of the property be finished and soils completely stabilized before the next phase of work can begin. This will minimize the area of soil exposed to erosion at any one time. Without such precautions, a large storm event could cause major sediment washing from this site and into the Housatonic River. Throughout construction, the Commission should have an agent of the Town inspect the site regularly for compliance. Given the Town's limited personnel resources, the Commission

[2] The Connecticut Council on Soil and Water Conservation. January 1985 (Revised January 1988). Connecticut Guidelines for Soil Erosion and Sediment Control.

may wish to place a condition on the application which will require the Applicant to pay for inspection of the facility by a contractor of the Town's choosing.

As with the potential application of pesticides and fertilizers, erosion and sediment control on this project site should be regarded from a watershed perspective. The collective impact of improperly conducted soil disturbance activities throughout the watershed could significantly affect water quality in the Housatonic River during and after storm events.

- **The Commission should consider examining the concentration and location of proposed residential units on the property with an eye to the long-term effects that such intensive development could have on associated wetlands and watercourses, and the watershed.**

Of particular concern are: housing lots proposed to be located on fairly steep sections of the property; and housing lots on the north and northeastern boundaries of the property which include the steep river bank and/or floodplain and wetland areas along the Housatonic River. Although the plan may seem plausible on paper, the on-site realities may be very different. The Commission should consider the potential for problems which could occur and impact wetlands and watercourses. Potential problems might result from development in these areas which alters drainage patterns; or homeowner activities on steep slopes or within wetland and floodplain areas. The Commission could request the Applicant to present alternative development plans which might include: reducing the number of residential units; clustering residential units in more suitable areas; placing conservation easements on the steeper portions of the property currently proposed for development; and eliminating wetlands,

floodplains, and river shore frontage from all proposed residential lots and placing these areas under conservation easement.

- **The Commission may wish to examine the Applicant's stormwater management plan for the completed golf course and subdivision with regard to its potential effect on wetlands and watercourses.**

Traditionally, developments have been built in a manner which directs storm flow off-site and into storm drains and then surface receiving waters in the quickest and most efficient way. However, studies have revealed that the "first flush" of stormwater surface flow from our developed landscapes (roads, parking areas, lawns, farms, etc.) is the leading contributor to non-point source pollution. With "end-of-pipe" sources of pollution largely under control through stringent regulation, stormwater runoff now represents the greatest threat to our State's water quality. Surface water runoff carries with it pollutants such as fertilizers, pesticides, oils, salts, and other materials. In addition, during major storms, the collection and immediate discharge of large amounts of surface runoff into rivers can cause downstream flooding problems.

Currently, the Applicant is planning to direct much of the surface runoff that is collected into storm drains which will discharge into an on-site pond. The remaining runoff that is collected will be directed to storm drains that empty into the Housatonic River. These two scenarios present several concerns which the Commission may wish to consider.

First, the Applicant should demonstrate that the quantity and quality of the stormwater directed into the pond and associated wetlands will not adversely impact the natural system. Every watercourse and wetland is unique and some are more sensitive than others in terms of how they react to pulses of

stormwater and pollutants. Although the Applicant has proposed a catch basin to help capture suspended solids before the stormwater is discharged to the pond, the potential for other pollutants (such as fertilizers and pesticides from the golf course, oil and grease from the roadways, etc.) to enter the pond should also be assessed. For example, during the August site visit, it was noted that sizable mats of aquatic vegetation had formed along the edge of the pond. The addition of more nutrients into the system from contaminated stormwater may aggravate the current situation, causing excessive growth of aquatic plants and algae and ultimately eutrophication. This condition may be unacceptable to future residents and golfers, and require costly solutions to address the problem. Measures to prevent such situations from occurring, whether through project design or best management practices, should be included in the Applicant's plans.

Furthermore, the quality and quantity of water that discharges to the Housatonic River via the stream that drains the pond and its associated wetlands should be considered. If the pond and wetlands are overwhelmed by the quality and quantity of stormwater that passes through them, this effect will be passed on to the Housatonic River. Likewise, the runoff that drains directly into the Housatonic River by the stormwater drainage system should be assessed. On-site detention and pretreatment may be needed prior to discharge. By itself, the effect of stormwater runoff from this proposed development into the Housatonic River may seem insignificant. However, the contribution from this site should be viewed with regard to the collective impact of all other land use activities within the watershed. From this perspective, treating and reducing runoff from all developed sites throughout the region will help to minimize surface water pollution and flooding problems caused by storm events.

With regard to stormwater drainage, there are two other points the Commission may wish to consider. First, it is important that all catch basins and other stormwater treatment systems are cleaned and maintained on a regular basis. The Commission may wish to make this a condition of application approval. In addition, where the existing stormwater drainage culverts empty into the Housatonic River, there seems to be the potential for gullying and erosion of the river bank and shoreland to occur if large volumes of stormwater are collected and discharged through these pipes. The Commission may wish to evaluate this situation further and, if necessary, require the Applicant to upgrade the splash aprons under these culverts in an environmentally sensitive manner.

- **The Commission should consider requiring the Applicant to explore alternatives to minimize impervious surfaces and allow for greater on-site recharge of clean stormwater.**

In addition to recharging groundwater supplies, on-site recharge can help filter out minor pollutants and reduce the volume of instantaneous discharge to surface receiving waters. Although the proposed project site already has a certain amount of infrastructure in place (i.e. - roads and storm drains) due to prior development activities, there are still many opportunities where impervious surfaces might be reduced and on-site recharge utilized. For example, roof and driveway runoff might be handled in a manner other than the traditional approach of directing all runoff into a storm drain.

NEMO (Nonpoint Education for Municipal Officials), a program of the University of Connecticut's Cooperative Extension System, teaches local officials about: nonpoint source pollution, how different land uses affect water quality, and what towns can do to protect water quality. Particular emphasis is placed on topics regarding impervious surfaces and on-site recharge. While NEMO's focus

is education and proactive municipal planning, they may serve as a source of information for the Commission in this present instance. NEMO can be contacted at: NEMO, UCONN Cooperative Extension System, 1066 Saybrook Road, Box 70, Haddam, CT 06438-0070; Phone: (860)345-4511; Website: http://www.canr.uconn.edu/ces/nemo/.

- **The Commission should consider requiring the Applicant to perform remedial work in the regulated areas associated with wetlands and watercourses which appear to have been disturbed without the Commission's approval or supervision.**

During the field review, it was noted that the Applicant had already proceeded to clear vegetation, disturb soil and deposit materials in or adjacent to wetlands and watercourses associated with the proposed development. According to its regulations, the Commission has the right to regulate "activities within 100 feet measured horizontally from the boundary of any wetland or watercourse".[3] Although golf courses are considered a "non-regulated" use, such uses are permitted only if they "do not disturb the natural and indigenous character of the wetland or watercourse by removal or deposition of material, alteration or obstruction of water flow or pollution of the wetland or watercourse".[4]

The Applicant has cleared significant amounts of vegetation and disturbed soil in several locations adjacent to wetlands and watercourses within the 100 foot regulated review area, including: the northeastern tip of the property where the Housatonic River makes a sharp bend and the land slopes down to the river; along the upland edge of the northern-eastern portion of the property (west of

[3] Town of Sherman, CT. January 1975 (Last amended April 1999). Inland Wetlands and Watercourses Regulations of the Town of Sherman, Connecticut. p. 4.
[4] Town of Sherman, CT. January 1975 (Last amended April 1999). Inland Wetlands and Watercourses Regulations of the Town of Sherman, Connecticut. p. 8.

the river bend) which then drops steeply to the river; and along certain sections of stream channel in the interior of the property. In all these locations, the slope of the land adjacent to the wetland or watercourse is great enough that erosion, sedimentation and gullying could be significant if measures are not taken to correct the problem. Although the Applicant had installed silt fencing at the down-slope edge of these cleared sections, it did not appear that the Applicant had taken measures to stabilize the cleared slopes above the fencing. Measures should be taken to stabilize the faces of these slopes as soon as possible.

In addition, it appeared as though the Applicant had left piles of chipped wood from its vegetation clearing operations in some wetland areas of the property. This material is considered "fill" under the Commission's regulations and should be carefully removed from these areas.

- **The Commission should consider requiring the Applicant to reestablish and maintain vegetated buffers along the perennial and intermittent streams on the property as well as along the Housatonic River.**

The Applicant has cleared the natural vegetation along sections of interior streams and portions of the Housatonic River which may negatively impact water quality.

The importance of forested streamside buffers has been well documented in the scientific literature. Riparian forests play a major role in helping to maintain the overall health and integrity of a watershed. For a description of the functions that vegetated corridors provide, refer to the "Inland Wetlands and Watercourse Inventory and Surface Water Systems" by ESM Associates, Inc. contained in the Applicant's "Environmental Impact Assessment" (See page 4 under subsection: "Housatonic River & Adjacent Riparian Corridor".) Determining the appropriate

width of a buffer is site-specific and is dependent upon the geography of the land and the intended function of the buffer. The CT DEP Fisheries Division recommends a 100 foot buffer zone along perennial streams, and a 50 foot buffer zone along intermittent streams.[5] DEP Fisheries further recommends that this buffer zone remain in a naturally vegetated and undisturbed condition. In addition, the U.S.D.A. Natural Resources Conservation Service is in the process of developing guideline manual for planning and installing riparian buffers. For more information, contact the Torrington office at: 1185 New Litchfield St., Torrington, CT 06790; Phone: (860)626-8258.

- **In the spirit of the State's greenway initiative, the Sherman Inland Wetlands and Watercourses Commission, working in cooperation with the Zoning Commission, may wish to designate a riparian buffer greenway along the mile-and-a-half section of the Housatonic River which borders this property.**

In 1995, State legislation was adopted which allows municipalities to adopt plans for greenways protection and development into their "plans of conservation and development" (CGS Sec. 8-23). As defined by State statute, "greenway" means:

> a corridor of open space that (1) may protect natural resources, preserve scenic landscapes and historical resources or offer opportunities for recreation or nonmotorized transportation, (2) may connect existing protected areas and provide access to the outdoors, (3) may be located along a defining natural feature, such as a waterway, along a man-made corridor, including an unused right-of-way, traditional trail routes or historic barge canals or (4) may be a greenspace along a highway or around a village (CGS Sec. 23-100).

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[5] CT DEP Fisheries Division. 1991. Policy Statement - Riparian Corridor Protection; Position Statement - Utilization of 100 Foot Buffer Zones to Protect Riparian Areas in Connecticut.

This same legislation also established the Connecticut Greenways Council, which among other things, is "to advise and assist in the coordination of state agencies, municipalities, regional planning organizations and private citizens in voluntarily planning and implementing a system of greenways" (CGS Sec. 23 102).

The interests of towns within the Housatonic watershed are represented, in part, by the Housatonic Valley Association (HVA), a private, non-profit watershed organization, which also serves on the Connecticut Greenways Council. HVA has been actively working with communities along the Housatonic River and with the Connecticut DEP Greenways Assistance Center to help plan and establish a greenway along the entire length of the river in Connecticut. Although the Town of Sherman may not yet have adopted a greenways policy into a local "plan of conservation and development", it is noted that the "Zoning Regulations of the Town of Sherman, Connecticut"[6] require "golf course residential communities" to devote a portion of the development parcel to "public open space". As stated in the Town Zoning Regulations:

> A minimum of five (5) percent of the gross area of the development parcel shall be dedicated public open space where and as designated by the commission and shall be left in a wild state, but may include recreational uses, limited to biking and walking trails, fishing and water uses, boat access to rivers and water bodies. The owner must dedicate or transfer these uses or areas of public open space to land conservation or preservation entities, to the town, or the general public (Sec. 359A.5 emphasis added).

[6] Town of Sherman. Last amended October 1999. Zoning Regulations of the Town of Sherman, Connecticut.

This designated public open space is in addition to the "minimum of thirty-five (35) percent of the gross area of the development parcel that shall be considered open space" (Sherman Zoning Regs., Sec. 359A.4 - emphasis added).

If the Inland Wetlands and Watercourses Commission and Zoning Commission chose to pursue the option of creating a public open space and designating it as a greenway, the Commissions will need to carefully consider the types of uses that would be allowed in this area. CT DEP would suggest that opportunities to protect and conserve natural resources values such as water quality, fisheries, wildlife habitat and unique plant communities be considered first. A greenway may also offer opportunities to provide more public access to the Housatonic River for recreational activities such as fishing and canoeing, providing these uses are limited to appropriate areas such that impact on natural resources will be minimized.

- **The Commission should take advantage of its membership in the Connecticut Association of Conservation and Inland Wetlands Commissions (CACIWC), and consider contacting its Regional Representative to seek further guidance in reviewing this application.**

Hydrogeologic Setting and Potential Impact by Pesticides to the Water Resources Environment

I. Introduction

The "River Oaks of Sherman" project proposal seeks to establish an 18 hole golf course and housing complex of 64 homes on 343 acres in Sherman, Connecticut. The homes will require on-site water wells and septic systems. This portion of the ERT report focusses on the hydrogeologic conditions at the site. In particular, how the hydrogeology may be impacted by pesticides often associated with the use and maintenance of a golf course.

II. Background

Addressing the issue of pesticide usage at a new or existing golf course is critical for a number of reasons. Although registered pesticides are legal to use for labelled pest control reasons, their routine usage has resulted in the unintended consequence of impairment to water quality. These water quality impacts can affect two broad categories of receptors: 1) the public health when water is used for consumption, irrigation or other domestic uses and, 2) the ambient water resources environment, and the biological life that depends on it. Growing interest in groundwater quality together with increasingly refined laboratory analytical techniques have resulted in more studies and detections of pesticides residues in waters across the country. As a consequence, golf courses, lawn care practices, agriculture and many other instances of pesticide usage have come under increasing scrutiny.

Not surprisingly, pesticide occurrence in soil and water correlates with the frequency and variety of land pesticide applications. (1) Many pesticide occurrences in groundwater occur in the low part per billion (ppb) range and are thought to be the result of routine pesticide applications as a non-point source rather than spills occurring as a point source or the misuse of pesticides. Numerous studies document pesticide occurrence in groundwater. Specifically, 2,4-D, dicamba and DCPA, all products known to be used at golf courses, have been detected in groundwater in some areas of Connecticut. (2)

Historically, the three major categories of pesticides - herbicides, insecticides and fungicides have been routinely and abundantly used on golf courses. Today's trend in golf course design and maintenance is, however, toward more natural, less manicured conditions and less pesticide usage. The "greening of golf courses" is the term used to describe the approach toward more natural, environmentally sensitive golf courses. Water quality concerns and wildlife habitat issues have shifted the focus away from heavy pesticide usage toward keeping and maintaining this naturally-occurring vegetation and, therefore, diminished uses of pesticides. According to 1995 Golf Digest survey, 87% of readers favor golf course measures to prevent golf course pollution or to conserve water. Limiting pesticide usage is a cost-saving measure as well. One typical Connecticut nine-hole golf course applied about 7000 lbs of pesticide products for the 1994 season. Using the Integrated Pest Management (IPM) measure of eliminating the golf course rough from pesticide treatment would have cut pesticide usage and costs by about half.

Even when pesticides are used according to label directions, certain factors, such as site conditions, a pesticide's particular properties and applicator practices may increase the risk of groundwater contamination. Improper seals around well casings and pumps are thought to provide a conduit for pesticides infiltrating through the ground with rainwater. (3) An applicator or user of a pesticide

product is ultimately responsible for the effects caused by the pesticide use at the site of application and for any downstream and downgradient impacts.

III. Approach

A standard model to consider when evaluating pollutant effects on water resources employs the concept of ***source, pathways*** **and** ***receptors***. This is a useful model since it considers the transport method of how a pollutant moves to and occurs in water. In this case, the ***source*** (pollutant) is the pesticide usage, the ***pathways*** (transport of contaminants) are described by the hydrogeology and the ***receptors*** (impacts) are the downgradient and downstream water resources. Here, the water resource receptors include surface water in the form of streams, ponds, and wetlands and the Housatonic River; and, groundwater occurring naturally and that which is extracted from wells for consumption or irrigation. The groundwater in the Sherman area moves through a highly transmissable unconsolidated unconfined aquifer as well as the bedrock aquifer.

IV. Hydrogeologic Setting

Fundamentally, the hydrogeology at River Oaks consists of the earth materials at and below the ground surface. It also consists of the many forms of water at, in and below the site. This may include precipitation; surface water, groundwater; wetlands and all other manifestations of the water resources. The surficial earth materials are predominantly of glacial and fluvial origin. That is, the alluvium sediments are derived from the overbank flows of the Housatonic River and are the more recent Holocene deposits. The glacially derived sediments consist of gravel and a mixture of sand and gravel and are the older Pleistocene deposits. These are among the most permeable and the most hydraulically conductive unconsolidated materials. As such, they function as the most vulnerable types of sediments subject to the impact of water runoff and water infiltration together

with any constituents contained in the water. In this case, the constituents under consideration are the pesticides potentially used on a golf course. The site is one of only two stratified drift aquifers mapped for the town of Sherman. (4 & 5)

Gravel porosity is ranked as 20% meaning gravel can have that much void space. This is the space that can be occupied by groundwater. Gravel's hydraulic conductivity refers to its particular water transmitting characteristic expressed in quantitative terms. For gravel, the hydraulic conductivity can range from 1000 to 100,000 feet per day. (6)

One important condition prevalent in Connecticut is the shallow depth to groundwater which makes many areas especially susceptible to the migration of pesticides to groundwater. Depth to groundwater at the water table is almost everywhere less than 35 feet and frequently less than 15 feet from the land surface. (7) Depth to groundwater in the unconfined unconsolidated aquifer at the Sherman site is likely to be shallow.

V. Alternatives

Because, the River Oaks project proposal is new, there are invaluable opportunities to protect the water resource from any impact by pesticides.

The project proposal documents do not discuss the use of organic methods for the proposed golf course as an alternative to the conventional use of pesticides. With increasing frequency, more attention is devoted to the use of an organic approach for golf course maintenance. This shift is occurring, in part, because the risk of dealing with the unintended consequences of pesticide usage in the form of a contaminated water supply, public or private, is very high. Two major problems that can arise from such an unintended outcome are: #1, There is no assurance of effective remediation measures for low levels of pesticides in

groundwater and, #2, The ultimate responsibility for pesticide contamination of water is born by the pesticide applicator for on-site or downgradient effects from pesticide usage.

Once pesticide residues occur in water, their clean-up measures can be difficult, costly, ineffective and often incomplete. Literature reviews of a common herbicide, glyphosate, trade name "Round-up" document the inability of conventional water treatment methods to eliminate low levels of glyphosate in a water supply. Treatments such as activated carbon, ultrafiltration membranes, coagulation, sedimentation and sand filtration did not remove glyphosate appreciably. (8)

Another major difficulty when dealing with pesticide residues is the inability to practically test for the occurrence of a pesticide in environmental media such as surface water, groundwater or soils. While an analytical method should be required before a pesticide product can be registered with EPA, often, the method, equipment or analytical know-how is just not readily or practically available.

The acronym IPM is often referred to when considering the use of pesticides for any situation. IPM stands for Integrated Pest Management. Essentially, IPM means to consider the whole picture when contemplating a pest control situation. The underlying assumption that accompanies an IPM approach is to reduce or eliminate the use of pesticides. Among alternatives, the use of chemicals (pesticides) is the last choice to consider. Some useful cultural practices that reflect a strong Integrated Pest Management (IPM) approach for a golf course include planting drought resistant grasses, such as, perennial ryegrasses, and fine leaf fescues; using a compost substrate, watering deeply and infrequently, and mowing frequently, cutting no more than 1/3 of the grass blade.

VI. Issues

With regard to pesticide use on a golf course, there is no way to guarantee that the parent pesticide products or their metabolites will not migrate to the surface and groundwater resources other than not using them at all.

The following topics review additional concerns associated with the use of pesticides:

- ***Inerts***

One important issue in addition to the pesticide's "active ingredient" is the other component of pesticides called the "inert". This term "inert", however, is quite misleading since often the inert ingredient is not truly inert and actually can be quite toxic. The New York State Office of the Attorney General found that more than 200 chemicals used as inert ingredients in pesticides are actually hazardous pollutants according to federal environmental statutes. They also determined that fewer than 10 percent of pesticide products list any inert ingredients on their labels. (9) Industry resists disclosure of inert identification claiming that the information is confidential or proprietary. Ironically, there is a move to eliminate the use of the word "inert" by EPA and substitute the word "other" in the manner of the FDCA for example, in the labelling of cosmetics. The use of the word "inert" or "other" is intended to protect proprietary information but also imparts a misleading innocuous connotation. EPA has only addressed the issue of inerts since 1989 and has categorized common inerts into the four categories: List #1 consists of "Inerts of Toxicological Concern". As an example, trichlorethylene is on List #1. List #2 contains "Potentially Toxic Inerts with a high priority for testing". An example of a compound on List #2 is toluene. EPA strongly encourages pesticide product registrants to substitute or remove from their products List #1 or List #2 ingredients. Despite this, EPA has recently

registered some products that still contain "inerts" from List #2 chemicals that are supposed to be phased out of usage. Nonetheless, it is very important to ascertain what the inert is in a pesticide product since it can be a hazardous material and just as toxic or acutely toxic as the "active ingredient" in a pesticide. As an example, one popular golf course fungicide contains 85% solvents as the inerts. The percentage amount of active ingredient and inerts of the product will appear on the label but the actual identification of what the inerts are may not. A good way to find out what the inerts are is to have and refer to the Material Safety Data Sheets (MSDS) for the product.

- ***Metabolites***

Metabolites are another issue of great importance when considering the use of pesticides. A metabolite refers to the breakdown product of the original pesticide product's "active ingredient". The half-life property of a pesticide is related to the conversion of some of the pesticide's active ingredient into its respective metabolite. Full information on metabolites of all pesticides particularly their human and environmental toxicity is incomplete but it is known that some metabolites can be more toxic than the original parent compound. Analytical identification capability of the metabolite may be absent or incomplete. It is also critical to identify metabolites since monitoring for pesticides in soil or water would be occurring after the fact. Because the half-life conversion is underway, analyzing for the metabolite as well as the parent compound is necessary.

- ***New Data***

New data from current research reveals that pesticide products once thought to be non-leachers are being discovered in groundwater. (2 & 10) Previously, there were screening tools to evaluate the physical and chemical characteristics of pesticides, such as the solubility, half-lives and the KOC or soil/water

partitioning coefficient. Heretofore, the screening tool would categorize the pesticide as a leacher or an adsorber meaning the pesticide would display a tendency to leach into surface and groundwater or to adsorb onto soil or sediment particles. Of course, as an adsorber, the residual pesticide would then function as a source (pollutant) for periods of time and be available for migration into the groundwater resource for longer residence times. Now, however, the data is revealing that those products thought to be categorized as non-leachers are migrating to the groundwater. An important concept to keep in mind is that the knowledge of pesticide occurrence in surface and groundwater has been developing since about 1979 when discoveries were made on Long Island of the pesticide aldicarb. Refinements in analytical tools together with an emphasis on discovery is resulting in more and more information about how sensitive the water resource environment really is to pesticides applied according to label directions.

- ***Endangered Species***

The Connecticut DEP Natural Diversity Database (NDDB) report (September 5, 2000) for the area at and adjacent to the River Oaks site reveals the documentation of seven endangered, threatened and special concern plant species all of which could be sensitive to the use and migration of golf course pesticides. The state endangered and threatened species are protected by the Connecticut Endangered Species Act (Connecticut General Statutes Section 26-303 to Section 26-315). The purpose of the Act is to conserve, protect, restore and enhance any endangered or threatened species. Any activities requiring a state permit must conform to this state and federal law.

- ***Permits***

In addition to a Water Diversion Permit for irrigation purposes which is reportedly being sought by the applicant to divert water from the Housatonic River, it may be necessary to obtain a General Permit for the discharge of stormwater associated with construction activities which result in the disturbance of five or more total acres of land area. This General Permit may also require a stormwater management plan as part of the General Permit.

- ***Water Quality Classifications***

The water quality classification for groundwater in the area is "GA" which means groundwater is presumed to be suitable for direct human consumption and the goal is to maintain that quality. Surface water quality in the Housatonic River is classified "D/B". The "D" means that the river is currently not meeting water quality criteria for one or more designated uses. The "B", however, means that according to state policy the river must be upgraded to level "B" which indicates that the water quality supports certain designated uses. (11) This classification additionally conforms to Connecticut's non-degradation policy with regard to water quality in the state. Discharge to groundwater by way of surface infiltration or via the pond and thence to the Housatonic River by overland flow or through piping with runoff containing pesticide residues is not acceptable.

- ***Selected Pesticides Unacceptable***

The list of pesticides presented in the Delta Golf Course Environmental Management Plan on page 26, Table 1 was compared against recent literature data. (10, 12 & 13) All the listed pesticides have been found to migrate to and occur in groundwater. The important point to emphasize is that chemicals

heretofore considered to be non-leachers are now being discovered in the groundwater. Likewise, screening tools previously used to determine potential leachability or adsorbers are now less certain and therefore less applicable as predictive tools.

VII. Recommendations and Referrals

In conclusion, the best option would be to adopt a complete "organic" approach golf course in the countrified Connecticut-style setting versus the manicured high maintenance type of golf course. To reiterate, "organic golf" means that courses are built with a substrate of compost, are planted with water efficient grasses and the uses of fertilizer, insecticides, herbicides and fungicides are eliminated or greatly reduced. European golf courses frequently reflect more natural settings and less conditioned courses. When apprised of the possible consequences of pesticide usage on a golf course, most players are agreeable to a more natural setting of a minimized or pesticide-free golf course. From the outset, organic methods would likely be the simplest, most cost-effective approach to protect against the negative unintended consequences of pesticide usage.

Resource materials on the topics of organic and IPM pest control approaches are detailed in the following resources: Common Sense Pest Control by W. S. Olkowski et al, The Taunton Press, Newtown, CT; Bio-Integral Resource Center, P.O. Box 7414, Berkeley, CA; Cornell University IPM Program, New York State Agricultural Experiment State, Geneva, NY 14456.

Among the many "eco-friendly green" golf courses employing environmentally beneficial organic and IPM approaches are the following: the Presidio Golf Course in San Francisco, CA; Desert Willow in Palm Desert, CA; Widow's Walk

in Scituate, MA; Pinehurst Resort, Pinehurst, NC and several on Long Island, NY. (14)

VIII. References

(1) Barbash, J.E. and Resek, E.A., Pesticides in Ground Water, 1996.

(2) Mullaney, J. R. et al, Pesticides in Ground Water, Soil, and Unsaturated-Zone Sediments at Selected Sites in Connecticut, Connecticut Water Resources Bulletin #42, 1991.

(3) Northeast Regional Agriculture Engineering Service (NRAES) Cooperative Extension, Pesticides and Groundwater, Ithaca, New York, 1992.

(4) Kent Surficial Geology, Open File Report, Quadrangle Map #46

(5) Bingham, J. W. et al, Hydrogeologic Data for Southwest Connecticut. Connecticut Water Resources Bulletin No. 33A, 1987. Plate A.

(6) Heath, Ralph C., U.S. Geological Survey Water-Supply Paper 2220, 1984.

(7) Singer, J., "Pesticides" in Protecting Connecticut's Water Supply Watersheds: A Guide for Local Officials, CT DEP, in press, 2000.

(8) Speth, Thomas F., "Glyphosate Removal from Drinking Water", in Journal of Environmental Engineering, Vol, 119, No. 6, Nov.-Dec., 1993 pp. 1139-1157.

(9) Of fice of the New York State Attorney General Eliot Spitzer, The Secret Ingredients in Pesticides: Reducing the Risk: www.oag.state.ny.us

(10) Trent, Martin et al, Water Quality Montoring Program to Detect Pesticide Contamination in Groundwaters of Nassall an~ lff~lk ('.- llntie~ New York Tlme 1999

(11) Murphy, J., Water Quality Classifications Map of Connecticut, 1987.

(12) Barbash, Jack, NAWQA Pesticide National Synthesis Project, USGS- PNSP, "Pesticides Used on and Detected in Groundwater Beneath Golf Courses", 11-24-98. USGS Water Supply Paper #2220, p. 13, 1983.

(13) Office of the New York State Attorney General Eliot Spitzer, Toxic Fairways: Risking Groundwater Contamination from Pesticides on Long Island Golf Courses. Revision, December 1 995.

(14) Wexler, Mark, "Greener Golf", National Geographic Traveler, May-June 2000, pp. 120 -124.

Stormwater Management

Since the site construction involves the disturbance of over five acres, Connecticut's General Permit for the Discharge of Stormwater and Dewatering Wastewaters (the "Permit") will cover the project. The permit requires that the site register with the Department of Environmental Protection (CTDEP) at least 30 days before the start of construction. The registrant must also prepare, submit and keep on site during the construction project a Stormwater Pollution Control Plan (the "Plan"). The Plan must be followed and updated as needed during the course of construction. For example, if the single row of silt fence along the ponds and wetlands is inadequate then the erosion controls should be re-evaluated and updated to prevent pollutants from discharging off site.

Please note that while this review is based primarily on the State Permit, many of the erosion and sedimentation issues are included in the Connecticut Guidelines for Soil Erosion and Sediment Control (the "guidelines"), and are issues that must be dealt with on a local level before being included in the Plan. Silt fence installation must comply with the guidelines, and may be used only in drainage areas of one acre or less.

The Plan must include a site map as described in Section 6(b)(6)(A) of the General Permit and a copy of the erosion and sedimentation (E & S) control plan for the site. The E & S plan that has been approved by the Town in conjunction with the CT DEP Inland Water Resources Division (IWRD) and the local Soil and Water Conservation District may be included in the Plan. This plan and site map must include specifics on controls and limits of disturbance that will be used during each phase of construction. Specific site maps and controls must be described in the Plan, as well as construction details for each control used. Wherever possible, the site shall be phased to avoid the disturbance of over five acres at one time.

The permit requires that "the plan shall ensure and demonstrate compliance with" the guidelines.

This project has significant slopes and numerous wetland areas to be protected, which will make ongoing inspections and adjustments of controls an important aspect of this project. The permit (Section 6(b)(6)(D)) requires inspections of all areas at least once every seven calendar days and after every storm of 0.1 inches or greater (this is in contrast to some statements in the submitted reports.) The plan must also allow for the inspector to require additional control measures if the inspection finds them necessary, and should note the qualifications of personnel doing the inspections.

In addition, the plan must include monthly inspections of stabilized areas for at least three months following stabilization. There must be someone available to design and adjust E&S controls for changing site conditions, who has the authority and resources to ensure that such necessary changes are implemented. The permit (Section 6(C)(i)) requires when construction activities have permanently ceased or been temporarily suspended for more than seven days or when final grades are reached at any portion of the site, stabilization must occur within three days. The Stormwater Management Plan prepared by Delta Environmental Services report presently indicates that construction activities can be suspended up to 21 days before stabilization takes place. The Stormwater Management Plan must be modified to comply with the permit requirements. Structural practices including sedimentation basins are required for any discharge point that serves an area greater than 5 disturbed acres at one time. The basin must be designed in accordance with the guidelines and provide a minimum of 134 cubic yards of water storage per acre drained. Particular care must be taken along the Housatonic River and the pond at the 17th hole. Leave as large a vegetative buffer as possible in these areas. Maintenance of all structural controls shall be performed in accordance with guidelines and the Plan must identify these practices.

The permit (Section 6(b)(6)(C)(iii)) requires that the plan include a design for post-construction stormwater treatment of 80% of total suspended solids from the completed site. In order to comply with this requirement, the Department recommends incorporating swirl concentrator technology at the pond near the proposed location of the 17th hole since the majority of the stormwater runoff will be directed to this location. Special attention with respect to post-construction stormwater treatment because of the use of pesticides and fertilizers by the golf course will be needed. A turf management plan will be needed to ensure proper attention to pollutants caused by runoff from the golf course. For construction activities which result in the disturbance of ten or more acres of land area at one time, the Plan shall be submitted to the commissioner no later than thirty days before the initiation of construction activities.

Soils Resources

The soils resources information provided in the ERT field review packet were somewhat dated coming from an earlier ERT report on the Carlson Property in 1977, but the majority of these soils are accurate in their description. The information submitted in this report is based on the soil series descriptions and the mapping units descriptions which reflect the current soils mapping and the differences as presented in the 1979 USDA Soil Survey of Fairfield County and on field observations.

The site can be found on Figure 3 or sheet #1 of the *Fairfield County Soil Survey*.

Wetland Soils

- **Mapping Units**

1. The Limerick (02) map unit is a **Rippowam (Ro) fine sandy loam** which is a poorly drained soil as opposed to the somewhat poorly drained classification for the dated Limerick soil unit. It's an alluvial soil with a lithology of Schist, Gneiss, Granite and Quartzite. Rippowam soils are subject to flooding and typically flood annually, usually in the spring They are a wetland soil.

2. The Sudbury (455) designation is no longer used. It was replaced with the **Ninigret** (Nn) soil series. This soil map unit has a drainage class of a moderately well drained soil. This soil has a poor potential for community development. This soil has developed in a floodplain and in CT it is considered a wetland soil. Ninigret formed in glacial outwash. Typically, they have a fine sandy loam surface and subsoil layer, overlying sand and gravel to a depth of 60 inches or

more. Ninigret soils have low chroma mottles within a depth of 24 inches. The moderately well drained (Udifluvents) have a seasonal high watertable at a depth greater than 1.5 feet. Disturbance of these fine sandy loams without enhanced erosion and sediment (E&S) control measures would pose a threat to water quality and aquatic habitats.

- Enhanced E&S measures would provide timely and effective stabilization of these large areas of disturbed soils. The "collaring" of greens and fairways which utilizes sod to quickly stabilize soil and establish the rough around these types of areas should be included in any grading taking place in this close a proximity to this watercourse. These measures along with appropriate buffering along the river will reduce the threat to water quality and the ecosystem as a whole.

Non Wetland Soils

- **Mapping Units**

1. The Amenia (25XC) stony silt loams current designation is a **Georgia (GhC) very stony silt loam, 8 to 15 % slopes.** This is a moderately well drained soil that formed in glacial till which has a perched seasonal watertable at a depth 1.5 to 2.5 feet from late fall to early spring. This soil has a fair to poor potential for community development. The main limitations of this soil are the watertable, steepness of slope and its slow permeability which severely limits the performance of onsite septic systems. Foundation drains are necessary. During construction phase this soil requires temporary siltation basins and dewatering measures should be employed along with enhanced E&S controls. Minimizing disturbance or the phasing of land disturbance along with establishing vegetative cover is recommended. Proposed lots #5, 6 and 7 would be of concern in this area.

2. The Enfield (65A & 65C) silt loams current designation is an **Agawam (AfA & AfC) fine sandy loam.** The A slope ranging from O to 3 % and C slope ranging from 8 to 15 %. This well drained soil is on terraces on stream valleys. The permeability is moderately rapid in the surface layer and subsoil and rapid in the substratum. Runoff is medium. This soil has a fair potential for community development. The primary limitation is the steepness of slope and the rapid permeability which poses a contamination threat to ground water in areas used for septic systems. Careful design and installation of a system should be exercised in siting any parcel with this soil type. During the construction phase site disturbance should be held to a minimum and enhanced E&S measures are needed to stabilize this highly erodable soil. Proposed lots #11, 12 and 13 seem to be situated atop of this soil type.

3. Hinckley soils with slopes ranging from B to D are found throughout the parcel in significant amounts and in relatively sensitive areas (abutting wetlands, intermittent streams and major watercourses). The significant limitation is the rapid permeability of the soil in the substratum. The siting of septic systems in this soil poses a hazard to ground water. Concerns regarding the droughtiness of this soil and the demand for water for landscape plantings and lawns should be assessed to assure adequate well supplies. Conservation measures to reduce erosion threats are necessary for all of these soils, but the severe erosion hazard increases with the increase in the C & D slope areas. Lots raising these concerns are as follow: #s 16,18, 19-28, 35-39 and 45.

4. The **Hollis** (17MD) with 15 to 35 percent slopes is even steeper than indicated. Its HrE designation found in the soil survey indicates slopes attaining 45% and the topographic map of this area confirms this. This soil has poor potential for development. Runoff is rapid or very rapid. Limitations for this soil is its severe steepness and shallow depth to bedrock. Disturbance of this area should be avoided. Lots # 5, 6, 7 and 8 are proposed for this area.

Figure 3

⇑

Soils Map

Scale 1″ = 1320′

The Natural Diversity Data Base

The Natural Diversity Data Base maps and files regarding the project site have been reviewed. According to our information, there are a number of State-Listed plants that occur both on and/or immediately adjacent to the site in question, most of these species are associated either with open bedrock seeps along the Housatonic River, the mowed utility right-of-way, or the "forested peninsula" on the northern part of the property associated with the bend of the river. The plants are listed as follows:

Scientific Name	Common Name	State Status
Asplenium ruta-muraria	Wallrue spleenwort	Threatened
Carex crawei	Crawe's sedge	Threatened
Carex sterilis	Dioecious sedge	Special Concern
Carex tetanica	Rigid sedge	Special Concern
Carex viridula	Little green sedge	Endangered
Polygala senega	Senega snakeroot	Endangered
Sporobolus asper	Dropseed	Special Concern

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.

Please contact Ken Metzler if you have further questions regarding this information (424-3585). Also be advised that this is a preliminary review and not a final determination. A more detailed review may be conducted as part of any subsequent environmental permit applications submitted to DEP for the proposed site.

Aquatic Resources

I. Site Description

The ±343 acre parcel proposed for development of the River Oaks of Sherman golf course and residential development contains a 5 acre pond, several intermittent and perennial streams and is bounded easterly and north-easterly by the Housatonic River. The 1 1/2 mile segment of the Housatonic River is the site's most salient aquatic feature. The river is contained in a channel approximately 325 feet in bankrun width. Flow depths within this river segment can fluctuate on a daily basis due to the operation of the Bull's Bridge Hydroelectric Facility located in Kent roughly 1 mile north of the River Oaks of Sherman site. Average, normal flow depths are approximately 2.5 feet.

Surface flow within the moderate gradient Housatonic River channel is comprised nearly equally of deep moving pool and deep riffle. River substrate is composed of boulder, ledge, cobble, gravel, coarse sand, and sand-silt fines. Dense growths of hardwoods and woody shrubs predominate as riparian vegetation along the river. Physical in-stream habitat is provided by boulders, water depth and fallen or overhanging vegetation.

The unnamed 5 acre pond on the parcel is artificial in origin and is reported to have resulted from gravel excavation. Reportedly the pond has a maximum depth of 10 feet and average depths of 4 feet. Moderate growths of submergent aquatic vegetation are found throughout much the pond along with emergent aquatic vegetation species along the pond's irregular shoreline. Surface water from the pond discharges to the Housatonic River via an unnamed perennial stream.

The unnamed intermittent and perennial streams are contained in channels approximately 8 feet in top of bank width. Stream substrate is composed of cobble, gravel, coarse sand, and sand-silt fines. Dense growths of hardwoods and woody shrubs predominate as riparian vegetation and provide the streams with a nearly complete canopy.

The perennial stream has normal flow depths averaging 0.8 feet. The moderate gradient channel creates surface flow predominated by shallow riffle interspersed by moving pool.

The site of the proposed River Oaks of Sherman golf course and residential development has a long history of significant land use change. The site was modified for agriculture during the operation of the Carlson Farm, later excavated for sand and gravel and most recently being altered for a single family residential housing development. The riparian buffers along the streams and around the pond are the result of recent vegetation succession. Despite past land use practices, water quality of the pond and unnamed perennial watercourses have been maintained and are currently classified as *Class* A surface waters by the Department of Environmental Protection. Waters of this classification are potential drinking water supply, fish and wildlife habitat, recreational use, agricultural and industrial supply and other legitimate uses including navigation.

Historic land use practice had allowed the preservation of riparian vegetation along the Housatonic River through the River Oaks of Sherman site which provided a "filter" to renovate overland stormwater runoff. However, due to an off-site PCB contaminant source, the Department of Environmental Protection classifies the surface waters of the Housatonic River through the River Oaks of Sherman site as *Class D/Bc* surface waters. Surface waters of such a classification are presently not meeting water quality criteria or one or more designated uses due to severe pollution. Present conditions severely inhibit or preclude one or

more designated uses for extended time periods or totally preclude attainment of one or more designated uses. May be suitable for bathing or other recreational purposes, certain fish and wildlife habitat, industrial and other legitimate uses including navigation. May have good aesthetic value. State policy is to upgrade these waters to *Class A* or *B*.

II. Aquatic Resources

The Fisheries Division has conducted yearly fish surveys of the Housatonic River in the Cornwall area since the late 1970's. The primary purpose of the yearly survey is to evaluate the response of the river's trout population to catch and release fishing within the 7 mile river segment designated as a Trout Management Area in the Cornwall-Sharon area. Biennial fish surveys have been conducted in the Housatonic River segment near the River Oaks of Sherman site through this same time period as a comparative assessment of angling effect on the riverine fish population.

Division surveys of the Housatonic River near the River Oaks of Sherman site reveal a fish population comprised of brown trout *(Salmo trutta)*, smallmouth bass *(Micropterus dolomieu)*, redbreast sunfish (*Lepomis auritis*), common shiner *(Luxilus cornutus)*, cutlips minnow *(Exoglossum maxillingua)*, fallfish *(Semotilus corporalis)*, fathead minnow (*Pimephales promelas)*, longnose dace *(Rhinichthys cataractae)*, spottail shiner (*Notropis hudsonius)*, tessellated darter *(Etheostoma olmstedi)*, white sucker *(catostomus commersoni)*, and American eel (*Anquilla rostrata*). These fish species are common to large riverine systems in Connecticut.

Small numbers of the following species appear in the Division fish surveys: bluegill sunfish *(Lepomis macrochirus)*, largemouth bass *(Micropterus salmoides)* and pumpkinseed *(Lepomis gibbosus)*. These fish species are

common resident in Connecticut lakes and ponds and are transient in riverine habitat such as that found within this Housatonic River reach.

The Fisheries Division is currently in the process of implementing a new trout management plan for streams and rivers in Connecticut. In this plan, the Division has identified a number of watercourse segments with particularly good potential for improvement of the trout populations and fisheries. One of the watercourse segments in which the Division is considering more intensive trout management is the portion of the Housatonic River between the Bull's Bridge impoundment and Gaylordsville. The River Oaks of Sherman site lies midway within this river segment.

Proposed Division plans for this river segment include trout stocking and implementation of catch and release regulations. The river segment would be a Trout Management Area similar to the one currently established on the Housatonic River in Cornwall and Sharon. These regulations and management activities have been found to be effective for providing high-quality trout fishing.

With a shallow average water depth and moderate aquatic plant growth, the unnamed 5 acre pond can be classified as a warm-water resource. The Fisheries Division has never conducted surveys to evaluate the resident fish population. Based upon fish surveys of similar pond's in Connecticut, the unnamed pond on the River Oaks of Sherman site is likely to have a fish population of some or all of the following species: bluegill sunfish *(Lepomis macrochirus)*, pumpkinseed (*Lepomis gibbosus*), largemouth bass *(Micropterus salmoides)*, chain pickerel *(Esox niger)*, yellow perch *(Perca flavesens)*, golden shiner *(Notemigonuss crysoleucas)*, and brown bullhead (*Ameiurus nebulosus*).

Based upon channel grade, morphology and substrate composition, the unnamed perennial streams on the River Oaks of Sherman site can be classified

as coldwater resources. Although never subject to Division survey, brook trout *(Salvelinus fontinalis)* and blacknose dace *(Rhinichtys atratulus)* are anticipated to reside in the streams. These fish species are commonly associated with coldwater streams in Connecticut.

III. Resource Impacts

The alteration of riparian habitat associated with the intermittent and perennial surface waters is of paramount concern at the River Oaks of Sherman site. As previously mentioned, the site has a long history of significant land use change. The extent of which lead to encroachments on the site's surface waters. The vegetation succession which followed the land disturbance has provided an effective means of restoring aquatic habitats and renovating surface water quality. The proposed development of an 18 hole golf course and 65 single family residences can reverse the current trend of aquatic habitat and water quality restoration. Land clearing and grading for several of the golf course holes has begun to encroach upon the riparian area of the Housatonic River which had been afforded protection through the course of prior land alteration of the River Oaks of Sherman site.

Changes to riparian habitat from site development ultimately impacts the habitats and resources of surface waters. Riparian vegetation has the ability to prevent sediments, nutrients, fertilizers, and other non-point source pollutants from upland sources from entry into surface waters; such non-point source pollutants can degrade habitat and water quality. Additionally, the removal of riparian vegetation can impart the following effects:

- decrease stream bank stability thereby increasing surface water siltation and habitat degradation;

- eliminate or drastically reduce the supply of large woody debris provided to surface waters, such material provides critical physical habitat features for numerous species of aquatic organisms;

- reduce a substantial proportion of food for aquatic insects which in turn constitutes a reduction in a significant proportion of food available for resident fish;

- stimulate excessive aquatic plant growth;

- decrease the riparian corridor's ability to serve as a "reservoir" storing surplus runoff for gradual release back into the streams during summer and early fall low flow periods.

The following components of site design and future maintenance are also of concern for the impacts they are likely to cause:

1. The amount and source of golf course irrigation water. It is estimated that 250,000 gallons of water per day will be required to irrigate the 170 acre golf course. Developers of the golf course indicated an intent to divert surface water from the Housatonic River to the unnamed 5 acre pond. The pond would then serve as the water supply for the irrigation system. The removal of water from the Housatonic River for irrigation may result in a decrease of surface water elevations of the river which in turn could reduce or eliminate physical habitat. The magnitude of those impacts would be dependent upon the duration of pumping and the level of river flow.

The diversion of surface water from the Housatonic River to the unnamed pond may also result in impacts to the pond's habitats and resources. Riverine flow carries sediments and dissolved nutrients. The transport of these materials into

the pond will accelerate the eutrophication process which will be made evident by an overabundance of aquatic vegetation. Aquatic vegetation in amounts of up to 40% coverage is considered optimum for small ponds. However, an overabundance of aquatic plants, that is in excess of 40% coverage, can produce the following impacts:

- cause winter or summerkills of fish by the plants depleting large amounts of oxygen during the night, during prolonged periods of cloudiness or under the darkened cover of ice and snow;

- cause stunting (an overabundance of small fish with extremely slow growth rates) due to inability of large predator fish to find and consume small fish in heavy plant cover;

- detract from the pond's aesthetic value;

- interfere with access to water-based recreation.

The diversion of water from the Housatonic River may compromise the quality of water in the unnamed pond. The Housatonic River is currently classified as *Class D/Bc* surface waters due to PCB contamination of river sediments. It is feasible that the introduction of those sediments to the pond over time can subsequently cause PCB contamination of the pond food including fish.

2. Fertilizer, herbicide, and pesticide application. Should excess nutrients from fertilizer runoff reach surface waters, there will be a stimulation of aquatic plant growth potentially to levels decreasing habitat diversity. Herbicide or pesticide runoff may result in fish kills and water quality degradation.

3. Soil erosion and subsequent sediment transport through runoff from areas removed of vegetation during site development. Excessive erosion, sediment transport, and sediment deposition can degrade both water quality and physical habitat, in turn affecting the resident fish population. Specifically, excessive siltation has the potential to cause the following:

- deplete oxygen within the water column;
- disrupt fish respiration and gill function;
- reduce water depth resulting in a reduction of habitats used by fish for feeding, cover, and spawning;
- reduce fish egg survival;
- reduce aquatic insect production;
- promote excessive aquatic plant growth.

IV. Mitigative Recommendations

The following are recommended in an effort to protect the habitats and resources of the Housatonic River and the unnamed pond and streams on the River Oaks of Sherman site during and following development of the proposed golf course and residential housing development.

1. Maintain at a minimum a 100 foot vegetated riparian buffer zone along the Housatonic River, the unnamed pond, and the unnamed perennial stream. A 50 foot vegetated riparian buffer should be maintained along intermittent streams. Research has indicated that vegetated riparian buffer zones of these widths

prevents damage to aquatic ecosystems that are supportive of diverse species assemblages. Vegetated riparian buffers absorb surface runoff, and the pollutants they may carry, before they enter wetlands or surface waters. Please refer to the attached documentation presenting Division policy and position regarding vegetated riparian buffers for additional information (see Appendix B).

In association with the maintenance of vegetated riparian buffers, it is recommended that vegetation be reestablished to those areas along the Housatonic River and any other surface water which has been disturbed to date for development of the golf course or residential housing development. The width of vegetation re-establishment should follow the guidelines previously mentioned. The vegetation reestablished should be native to the immediate area, be non-invasive and be diverse in species composition.

It is further recommended that Hole #6 be relocated elsewhere on the site. This will allow continuity of a vegetated riparian buffer along the Housatonic River. The relocation of this hole may require a reduction in the number of residential dwellings.

2. Explore alternative irrigation water supply sources which do not rely on surface water withdrawals from the Housatonic River.

3. Limit liming, fertilizing, and the introduction of chemicals to developed land susceptible to runoff into the Housatonic River, the unnamed pond or the unnamed intermittent and perennial streams.

4. Establish comprehensive erosion and sediment control plans with mitigative measures (haybales, silt fence, etc.) to be installed prior to and maintained through all development phases. Land clearing and other disturbance should be kept to a minimum with all disturbed areas being protected from storm events and restabilized in a timely manner.

5. Limit regulated activities adjacent to riparian buffer zones to historic low precipitation periods of the year. Reduced precipitation periods of summer to early fall provide the least hazardous conditions when working near sensitive aquatic environments.

6. Stormwater runoff should not be allowed to discharge directly to the Housatonic River, unnamed pond or the unnamed intermittent and perennial streams. Prior to being discharged, stormwater should pass through structures or facilities designed for sediment and nutrient removal. Stormwater outlets should be adequately armored to prevent soil erosion.

Wildlife Resources

I. Introduction

A site visit was conducted to evaluate existing wildlife habitats on the 343 acre parcel with emphasis on the impacts of an 18 hole golf course with club house, maintenance facility, driving range, and residential community of 64 single family houses to be constructed. A variety of habitat types were identified: hardwood swamp, hemlock stand, mixed hardwood forest, open field, old field and riparian. The variety of habitat types provide wildlife with a diverse mix of food, water, and cover.

II. Habitats and Wildlife Use

Hardwood forests provide an abundance of food in the form of mast; berries, buds, insects, and catkins. Cover value for wildlife is greatly enhanced by the presence of snags (dead standing trees), cavity trees and large diameter den trees. Wildlife likely using the mature hardwood forest include scarlet tanager, ovenbird, white-breasted nuthatch, black-capped chickadee, black and white warbler, eastern wood-peewee, hairy and downy woodpecker, pileated woodpecker, American redstart, barred owl, broad winged hawk, red-backed salamander, and black rat snake. Mast produced by oaks provides excellent forage for a variety of animals such as white-tailed deer, gray squirrel, wild turkey, white-footed mouse and eastern chipmunk.

Conifer trees, such as hemlock, on the property provide winter cover and nesting sites for songbirds, hawks, owls and wild turkeys.

Open field habitats that contain a diversity of grasses and forbs provide cover for small mammals and attract numerous insects, a major food item for songbirds. Open fields serve as nesting areas for birds that specialize in grassland habitats if they are large enough. Wildlife likely using open field habitats and their associated edges include white-tailed deer, woodchuck, red fox, coyote, cottontail rabbit, skunk, meadow vole, eastern bluebird, American goldfinch, field sparrow, mockingbird, flycatchers, eastern towhee, American robin, American kestrel and red-tailed hawk.

Old field habitat provides a variety of food sources by way of grasses, forbs and berry producing shrubs/trees (red cedar). This habitat has diversity in the forms of cover it provides; sapling trees, shrubs and grasses. Wildlife likely to use this habitat are wild turkeys, coyotes, northern bobwhite, red fox, eastern bluebird, rose-breasted grosbeak, and cottontail rabbits.

Forested wetlands (hardwood swamp) typically contain high abundance of insects and dense undergrowth of herbaceous plants and berry producing shrubs. Many species of birds use forested wetlands at varying times of the year for breeding, feeding, and shelter. Examples include wood thrush, northern water thrush, common yellowthroat, and the eastern phoebe. Other wildlife likely using this habitat for food and cover are raccoons, short-tailed weasels, star-nosed moles, wood frogs, pickerel frogs, spring peepers, gray tree frogs and eastern garter snakes.

Riparian habitat provides habitat for many aquatic-based organisms such as fish, frogs, salamanders, toads, ducks, herons, muskrat, otter and mink. Vegetative diversity along the edges of the pond and Housatonic River provide valuable cover for wildlife as well as a diverse source berry producing shrubs and vegetation for foraging.

III. Wildlife Impacts

1. Large scale conversion of forested area into turf grass means less available wildlife habitat.

2. Loss of riparian (river) zone buffer; fairways are proposed to be developed 500 feet from the river's edge. The zone of vegetation along a river referred to as the riparian zone is very important for wildlife habitat, pollutant/runoff filtration and erosion control. At the time of inspection the riparian habitat along the Housatonic River had already been altered. Vegetation in some places along the river was cleared right down to the river with the exception of mature trees (green 7). While this practice of clearing scenic vistas is aesthetically pleasing, it eliminates the understory (shrub) layer of vegetation which provides nesting, feeding and breeding habitat for many species. Vertical diversity of vegetation (layers) is probably of greatest importance to most forest birds (DeGraff et al 1992). The Housatonic River, being one of the larger rivers in the state, is a major migratory corridor for neotropical migrants. These migrants rely on the river as a navigational landmark and the riparian zone vegetation along the river provides a source of food and place a to rest before continuing their migration.

- Bald eagles use the Housatonic river for winter foraging near Bulls Bridge hydroelectric plant. The bald eagle is a federally endangered species and one reason for its decline is the loss of waterside habitat due to human occupation or activity. Winter is the most critical time for these birds. They arrive in Connecticut to areas of open water to feed on fish, which is their preferred food. Therefore, access to their feeding area is essential to their survival. Wildlife Biologist Julie Victoria, of the Non-harvested Wildlife Program of the DEP, recommends that no on-site work take place between December 1 and March 1, as this is the major period of eagle use. All old growth trees at or exceeding 12 inches dbh (diameter at breast height) should be left standing,

especially near the waterside. The U.S. Fish and Wildlife Service's Northern States Bald Eagle Recovery Plan indicates that 1320 feet is the suggested minimum buffer zone from a feeding area.

- A reduced forest buffer provides less filtration for runoff before it enters the Housatonic river. As planned, fairways would be placed within the 100-year floodplain which means loss of floodwater filtration.

3 . Loss of wetland buffer along fairways. Wetlands should have a 100-foot buffer (DEP Fisheries) to maximize their value. Many amphibian and reptile species use wetland buffers for food, cover, and breeding/nesting purposes. Many species using wetlands rely on adjacent uplands.

IV. Discussion of Wildlife Species Changes

Changing a large area of the landscape from a primarily forested habitat into an area of golf course fairways and lawns, interspersed with patches of forest, houses, driveways and roads will result in a dramatic shift in the available wildlife habitat and thus the wildlife that uses the area. Many wildlife species that will likely be drawn to the area are the more common species like robins, crows, raccoons, Canada Geese and red foxes. Some of these species can be considered a nuisance when they damage property or conflict with human land use. The Canada goose can become a nuisance in a golf course setting by congregating in large numbers to feed on turf grasses, nest on open water ponds and leave a large amount of feces in and around the greens and waterbodies.

The brown-headed cowbird is a generalist species that takes advantage of open mowed areas. With increased forest fragmentation there may be an increase in brown headed cowbird parasitism. The English house sparrow is an invasive exotic species that aggressively competes for nesting cavities with native species

such as the Eastern bluebird and tree swallow. A breeding bird study of the property should be conducted for the abundance and types of breeding birds. There have been 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 that require larger unbroken parcels) wildlife (Bond 1957, Levenson 1981, Hohne 1981, Askins et al 1987). As forest 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 1985).

V. Recommendations to Reduce Impacts

1. As more habitat is converted to house lots and golf course fairways/greens, the amount of habitat for many species of wildlife will be directly reduced. Therefore, significantly reducing impacts would be difficult to accomplish without markedly reducing the amount of planned construction.

2. If houses are to be put in at all they should be built in a cluster formation to maximize the amount of undisturbed land. For example, clustering a number of homes on one lot versus chopping up an area into many houselots helps reduce forest and overall habitat fragmentation.

3. Reducing the golf course from 18 holes to 9 holes will leave more usable unfragmented wildlife habitat intact.

4. Minimizing the sizes of greens and fairways would reduce the total turf grass area.

5. Remove or reconfigure greens and fairways out of the 100-year floodplain (numbers 6,9, and 11). They should be placed in uplands to preserve the ecological integrity of the floodplain.

6. Increase (versus what is in the plans) the forested buffer along wetland boundaries (including the river).

7. Naturalize the golf course:

- *Use native species of vegetation to landscape;* (see Appendix C for Connecticut Native Tree and Shrub Availability List) Replanting areas with native trees, shrubs and wildflowers will help reduce the negative impacts to wildlife. Native vegetation is more valuable for food and cover.

- *Create wildlife corridors;* healthy and diverse wildlife populations do not thrive in small pockets of land. Contiguous corridors of undisturbed land are needed for wildlife to migrate from one large area of habitat to another. An undisturbed corridor of riparian buffer along the Housatonic river to Naromi Land Trust' s property to the north would serve as a byway for wildlife.

- *Leave dead trees (snags) standing where practical;* a sometimes overlooked but very important source of cover and food for woodpeckers and other cavity nesters and dwellers (in a forested area leave 3-5 per acre).

- *Plant native shrubs for wildlife;* the berries from shrubs like Dogwoods and Viburnums provide food year round.

- *Leave woodland understory;* shrubby thickets and saplings are important nesting and escape cover for many species of wildlife (migratory songbirds and mammals).

- *Designate "No Mow" areas;* this practice eliminates some maintenance and creates habitat and nesting areas for small mammals and reptiles. The taller grass should be mowed once a year or every other year (during late winter is better; mowing at this time keeps seeds and cover available during most of the winter)

- *Plant wildflowers;* meadow flowers are not only beautiful to look at but attract butterflies and songbirds. Using native seed mixtures is best.

- *Set up a nesting box project;* bluebirds are cavity nesters that have experienced a population decline in the recent past. Lack of suitable nesting cavities coupled with competition from European starlings and English house sparrows, the loss of open field habitats, and pesticide use has lead to this decline. Open habitat such as a golf course would be a good place to set up and monitor bluebird boxes. Bat boxes and kestrel/owl boxes are also an option.

- *Leave a vegetative buffer around the pond;* mowing right to the edge of a water body reduces the food and cover for amphibians and reptiles.

VI. Conclusion

Building a golf course and adjacent housing development requires significant alteration of the existing vegetation and topography. With these habitat changes there will be changes in the wildlife species and their use of the property. It is difficult to significantly minimize the negative wildlife resource impacts without asking for the elimination or at least significant reductions of the course and/or housing development design.

VII. Literature Cited

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Archaeological Resources

A review of the State of Connecticut archaeological site files and maps shows no known archaeological site within the project area; however, our files do indicate 12 archaeological sites in extremely close proximity. These archaeological sites are associated with the Housatonic River as well as the uplands of both Sherman and New Milford literally surrounding the property to the northwest, south and east.

Our suggestion is that this property has not been well explored archaeologically in the past and as a result we do not have very good information on it in our files. However, the area does possess an extremely high sensitivity for archaeological resources. There has been some disturbance in the project area, but for the most part the ground appears to be intact and this should allow for any sites that may be discovered to yield important information about the past.

The sites we do know about in the area consist of everything from very early Native American camps dating to almost 7,000 years ago as well as more recent Native American villages along the Housatonic River dating within the last 500 to 1,000 years. There is also a series of colonial and mill ruins located nearby suggesting a high probability of colonial and industrial resources.

The Office of State Archaeology would strongly recommend that an archaeological survey be conducted for the property. An archaeological survey will locate any cultural resources on the property and this information can be used for land use decision making in terms of either avoidance or mitigation prior to any landscaping or construction activities.

All archaeological survey work should be conducted in accordance with the Connecticut Historical Commission's *Environmental Primer for Connecticut's Archaeological Resources*. The Office of State Archaeology is prepared to offer any technical assistance to the Town of Sherman, as well as to the applicant, in conducting this archaeological survey. We look forward to working with them on the preservation of the town's historic heritage.

Appendix A

Carlson Farm Property Acquisition ERT Report (1977)

For Appendix Information A-B Please call the ERT Office at (860)345-3977.

ABOUT THE TEAM

The King's Mark Environmental Review Team (ERT) is a group of environmental professionals drawn together from a variety of federal, state and regional agencies. Specialists on the Team include geologists, biologists, soil scientists, foresters, climatologists and landscape architects, recreational specialists, engineers and planners. The ERT operates with state funding under the aegis of the King's Mark Resource Conservation and Development (RC&D) Area - an 83 town area serving western Connecticut.

As a public service activity, the Team is available to serve towns within the King's Mark RC&D Area - ***free of charge***.

Purpose of the Environmental Review Team

The Environmental Review Team is available to assist towns in the review of sites proposed for major land use activities or natural resource inventories for critical areas. For example, the ERT has been involved in the review of a wide range of significant land use activities including subdivisions, sanitary landfills, commercial and industrial developments and recreation/open space projects.

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 site and highlighting opportunities and limitations for the proposed land use.

Requesting an Environmental Review

Environmental reviews may be requested by the chief elected official of a municipality or the chairman of an administrative agency such as planning and zoning, conservation or inland wetlands. Environmental Review Request Forms are available at your local Soil and Water Conservation District and through the King's Mark ERT Coordinator. This request form must include a summary of the proposed project, a location map of the project site, written permission from the landowner/developer allowing the Team to enter the property for the purposes of a review and a statement identifying the specific areas of concern the Team members should investigate. When this request is reviewed by the local Soil and Water Conservation District and approved by the King's Mark RC&D Executive Council, the Team will undertake the review. At present, the ERT can undertake approximately two reviews per month depending on scheduling and Team member availability.

For additional information regarding the Environmental Review Team, please contact the King's Mark ERT Coordinator, Connecticut Environmental Review Team, P.O. Box 70, Haddam, CT 06438. The telephone number is 860-345-3977.