The Preserve

Essex, Old Saybrook, and Westbrook, Connecticut

EASTERN CONNECTICUT ENVIRONMENTAL REVIEW TEAM REPORT

Eastern Connecticut Resource Conservation and Development Area, Inc.

The Preserve

Essex, Old Saybrook, and Westbrook, Connecticut

Environmental Review Team Report

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

for the
Selectmen
of
Essex, Old Saybrook,
and Westbrook, Connecticut

July 1999

CT Environmental Review Teams
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Acknowledgments

This report is an outgrowth of a request from the Selectmen of the towns of Essex, Old Saybrook and Westbrook through the Connecticut River Estuary Regional Planning Agency (CRERPA). CRERPA referred this request to the Eastern Connecticut Resource Conservation and Development Area (RC&D) Executive Council for their consideration and approval. The request was approved by the Council and the Middlesex County Soil and Water Conservation District (SWCD). The measure was then reviewed by the Eastern Connecticut Environmental Review Team (ERT).

The Eastern Connecticut Environmental Review Team Coordinator, Elaine Sych, and Acting Coordinator, Alison C. Guinness, 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 Monday, March 29, 1999.

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We would also like to thank Linda Krause, Connecticut River Estuary Regional Planning Agency, for coordinating the request and the process for the three towns; Peter Webster, First Selectman, Essex, Susan Townsley, First Selectman, Old Saybrook, Frank Lusk, First Selectman, Westbrook and many other town officials for their cooperation and assistance during this environmental review. In addition, we would like to thank Tim Taylor, The Preserve developer, his staff and many associates working on this project for their assistance in the creation of this document.

Prior to the review day, each Team member received a summary of the proposed project with location and soils maps and maps provided by the developer of the proposed development, including proposed master plan, open space, and clubhouse master plan. During the field review, Team members were given additional plans and information. Following the review, Team members were provided with additional information and maps as they became available. 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 towns and landowner. This report identifies the existing resource base and evaluates its significance to the proposed development, and also suggests considerations that should be of concern to the towns and applicant. The results of this Team action are oriented toward the development of better environmental quality and the long term economics of land use.

The Eastern Connecticut RC&D Executive Council hopes you will find this report of value and assistance in reviewing this proposed residential and golf course development.

If you require additional information please contact:

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Introduction

The Selectmen of the towns of Essex, Old Saybrook, and Westbrook have requested assistance from the Eastern Connecticut Environmental Review Team in reviewing a large residential golf course community proposed for property located in the three towns.

The Preserve is a 1,000 acre parcel located in northern Old Saybrook and encompassing land within the neighboring towns of Essex and Westbrook. The landscape features three main ridges and the Pequot Swamp Pond. The land previously was used for limited logging activities.

The proposed development consists of 308 single family homes on lots ranging in size from 1.0 to 3.0 acres. 282 lots will be in Old Saybrook, and 26 lots will be in Essex.

An 18 golf course is proposed with an 18,000 square foot clubhouse, 4 guest cottages, 5 tennis courts, a swimming pool and parking for 200 cars. 506.2 acres will be open space, including 240 acres for the golf course, 102.5 acres as open space for the public in the form of a greenway trail and nature preserve, and 100 acres will be turfgrass. The golf course will occupy the lower elevations of the property and will incorporate existing trees as feasible. The golf course will be designed to minimize the need for fertilizer and pesticide applications through the use of Integrated Pest Management (IPM).

The main access will be from Route 153 in Westbrook (over 90% of all traffic) with access to the Essex homes from Ingham Hill Road in Essex and access to eleven of the Old Saybrook homes from Ingham Road in Old Saybrook. There will be no through connections except for municipal vehicles, such as fire, police and school buses.

The ERT Process

Through the efforts of the Connecticut River Estuary Regional Planning Agency (CRERPA), this environmental review and report was prepared for the towns of Essex, Old Saybrook, and Westbrook.

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

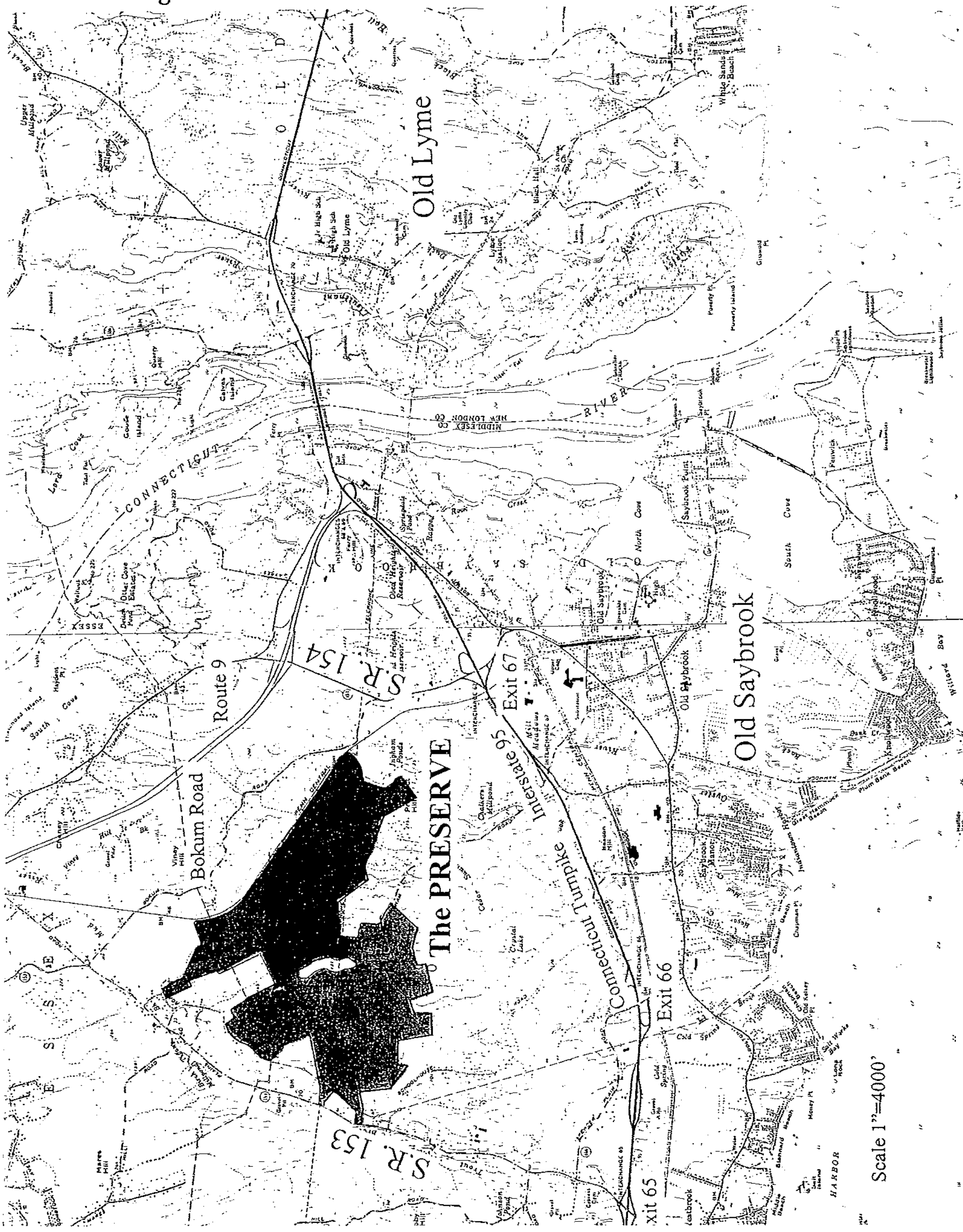
The review process consisted of four phases:

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 Monday, March 29, 1999 and some Team members made additional site visits. 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


Old Lyme
Old Saybrook
The PRESERVE
Route 9
S.R. 154
S.R. 153
Bokum Road
Exit 67
Interstate 95
Connecticut Turnpike
Exit 66
Scale 1"=4000'

Geology

Topography

The Preserve, is a proposed residential and recreational development situated in southeastern Connecticut approximately 2.7 miles northwest of downtown Old Saybrook. The site consists of approximately 1,000 acres of land located in the towns of Old Saybrook (933 acres), Essex (65 acres), and Westbrook (2 acres).

Four arcuate, or curving, ridges dominate the topography on the site. The crests of the ridges trend northwest southeast in the northern half of the property but swing into a more northeast southwest orientation toward the south (Figure 2). The highest elevation on the site (211 ft above mean sea level) is located on the eastern most ridge. The eastern ridge is separated from the central ridge by a valley containing an intermittent streambed. Pequot Swamp, an 11-acre freshwater marsh, is located in the center of the site sandwiched between two prominent ridges. The eastern of these, Ingham Hill, is capped by a distinct broad flat crestline. Numerous bedrock exposures are present thoughout the site including nearly vertical faces around Pequot Swamp. The bedrock geology is the primary control on the pattern and topographic expression of the various ridges. The eastern most ridge is underlain by the Hebron gneiss (h); Ingham Hill by a resistant, intensely horizontally jointed quartz-feldspar gneiss (brq); the ridge west of the Pequot Swamp by an amphibolite (a); and the western most ridge by the Monson Gneiss (m). The valleys between the ridges are underlain by the easily weathered Brimfield Schist (br).

Bedrock Geology

In the late 1950s and early 1960s, the area was mapped by Lawrence Lundgren, Jr. In 1964, the State Geological and Natural History Survey of Connecticut published Lundgren's work as *The Bedrock Geology of the Essex Quadrangle* (Lundgren, 1964) (Figure 3). Lundgren described the rocks on the site as belonging to the Brimfield, Monson and Hebron Formations.

Monson Gneiss (m on Lundgren's map, *Om* on the State Geologic Map)

Light-gray plagioclase-guartz-biotite gneiss interbedded with amphibolite and granite,

Hebron Gneiss (h on Lundgren's map, SOh on the State Geologic Map)

Greenish-gray layered calc-silicate gneiss interbedded with brownish-gray biotite schist and

Brimfield Schist (Obr/Obrg on the State Geologic Map)

Lundgren's map subdivides the Brimfield in more detail than is shown on the State Geologic map. His descriptions of the various Brimfield members are as follows:

Biotitic Schist (bm): rust-stained, micaceous schist that is rarely seen in outcrop due to its friability and subsequent lack of resistance to weathering. This member is further described as a coarse-grained, migmatitic schist in which layers rich in biotite and sillimanite are interleaved with more resistant layers rich in quartz, feldspar, and garnet. All samples contain abundant quartz and between 20 and 40% biotite with minor feldspar, sillimanite, garnet, graphite and pyrite.

Bedded Quartz-Garnet Rock (bg): A frequently rust-stained thin-bedded, fine grained, equigranular, pink to pale-reddish purple, garnet-quartz

rock composed of quartz and small dodecahedra of manganiferous garnet. Accessory minerals include plagioclase, graphite, and pyrite. Lundgren noted that similar rocks located in Massachusetts have been described as "coticule".

Quartz-Feldspar Gneiss (bqf): *A* white, weathering, foliated, medium grained, inequigranular quartz-plagioclase-orthoclase-biotite-garnet gneiss which generally contains between 15 and 25% biotite and garnet. The member is also described as containing layers of amphibolite, quartzite, and sillimanitic schist.

Amphibolite and Calc-Silicate Gneiss (a): *A* well-bedded, coarse-grained, dark-greenish black, hornblende-plagioclase rock containing variable amounts of diopside, garnet and sphene. Dark-greenish-black graphitic calc-silicate gneiss and diopsidic calcite marble are occasionally found with the amphibolite.

Anthophyllitic Gneiss (bqfa): An anthophyllitic and cordieritic quartz-plagioclase gneis interbedded with amphibolite. The gneiss is described as light gray, quartz-plagioclase rock with prisms of olive gray anthophyllite scattered through an equigranular matrix.

Quartzite (bq): A quartzite interbedded with sillimanitic-biotitic schist. The member is described as a medium-grained, vitreous, light-gray rock consisting of more than 80 percent quartz. Plagioclase, orthoclase, garnet, biotite, magnetite, and sillimanite constitute the remainder of most samples.

The coarse-grained *Pegmatite* (p) intrudes and crosscuts the foliation of all the rocks described above. Mineralogically, the pegmatite consists of

quartz, potassium feldspar and sodic plagioclase. Accessory minerals include biotite, garnet, and sillimanite.

Lundgren hypothesized that rocks of the Brimfield, Hebron and Monson formations folded during metamorphism into a syncline whose axial plane strikes northwest. This syncline, known as the *Chester Syncline* can be traced to the north-northwest across the entire Essex Quadrangle. To the south, the Chester Syncline shows the effects of a later deformation, which folded the rocks around steep plunging axes and east-west trending axial planes.

An intense near horizontal joint set cuts most of the rock units but is most obvious in exposures of the Pegmatites (p) and the white Quartz-feldspar Gneiss (brg) both of which lack a well developed vertical foliation. Outcrops of these units break into large flat slabs. Indeed the flat crest of the brg ridge east of the Pequot Swamp at the proposed clubhouse site is probably the result of glacial erosion taking full advantage of the prominent horizontal jointing of this unit.

Surficial Geology

Bedrock is very close to the surface over much of the site. Only a thin veneer of glacial till and slope transported debris covers the underlying bedrock. Outcrops are very common. The few streams that are present do not seem to have been deeply incised and there is no evidence of any stratified drift filling any of the low points within The Preserve boundaries (See Flint 1975).

Geologic Environmental Concerns

Potential adverse environmental impacts related to the geology of the site were considered as part of this review. The only potential impact noted was

the rusty weathering of the biotite schist (bm) and quartz-feldspar gneiss (bqf). This type of weathering indicates that sulfuric acid is being generated by the oxidation of sulfides present in these units (Figure 4). Site work (i.e. grading & blasting) will result in increased exposure and weathering of these lithologies. The increased weathering may result in a short-term (1-5 years after development) flux of sulfuric acid to site groundwater and wetlands. The observed intense horizontal jointing noted in the bedrock throughout the site suggests that groundwater movement will be strongly affected by the inhomogeneous distribution of vertical fractures and will basically follow the expected paths based on the surface topopraphy. As the developers do not propose to exploit the local groundwater for domestic use or irrigation, the only potential impact would be related to the community sewage treatment system. Given the proposed site and its design and the fractured nature of the local bedrock, off site groundwater concerns would seem to be minimal.

References

Lundgren, L., 1964. The Bedrock Geology of the Essex Quadrangle with Map. State Geological and Natural History Survey of Connecticut, QR-I5. 37 pp.

Flint, Richard F., 1975. The Bedrock Geology of the Essex and Old Lyme Quadrangles with Map. State Geological and Natural History Survey of Connecticut, QR-31. 41 pp.

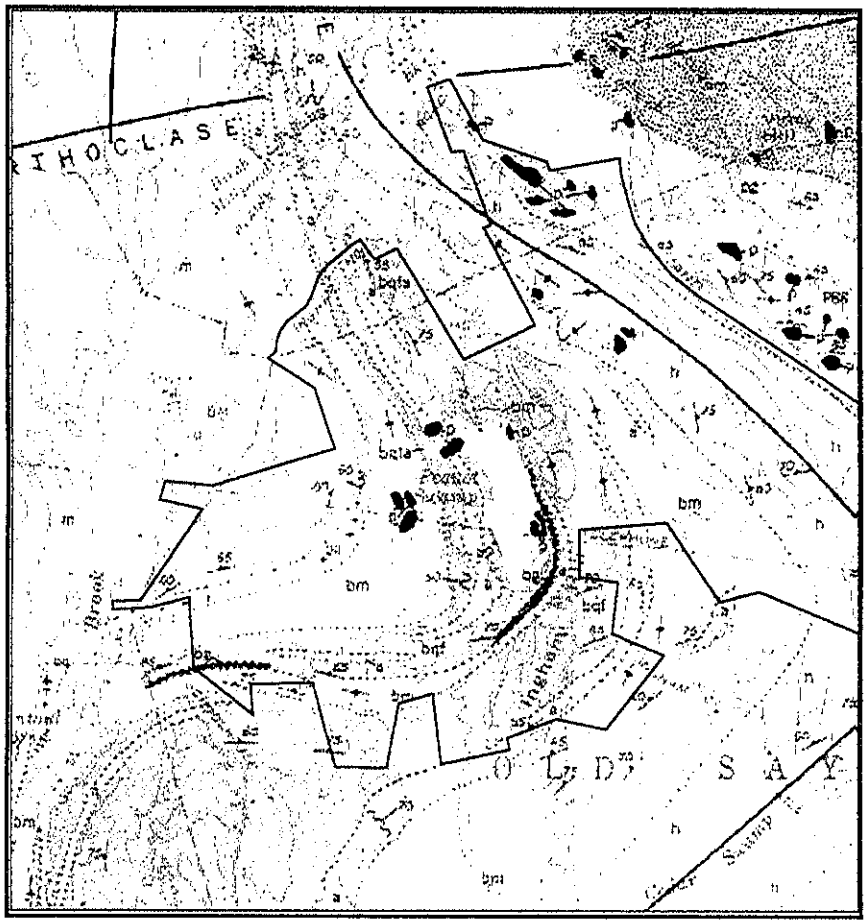
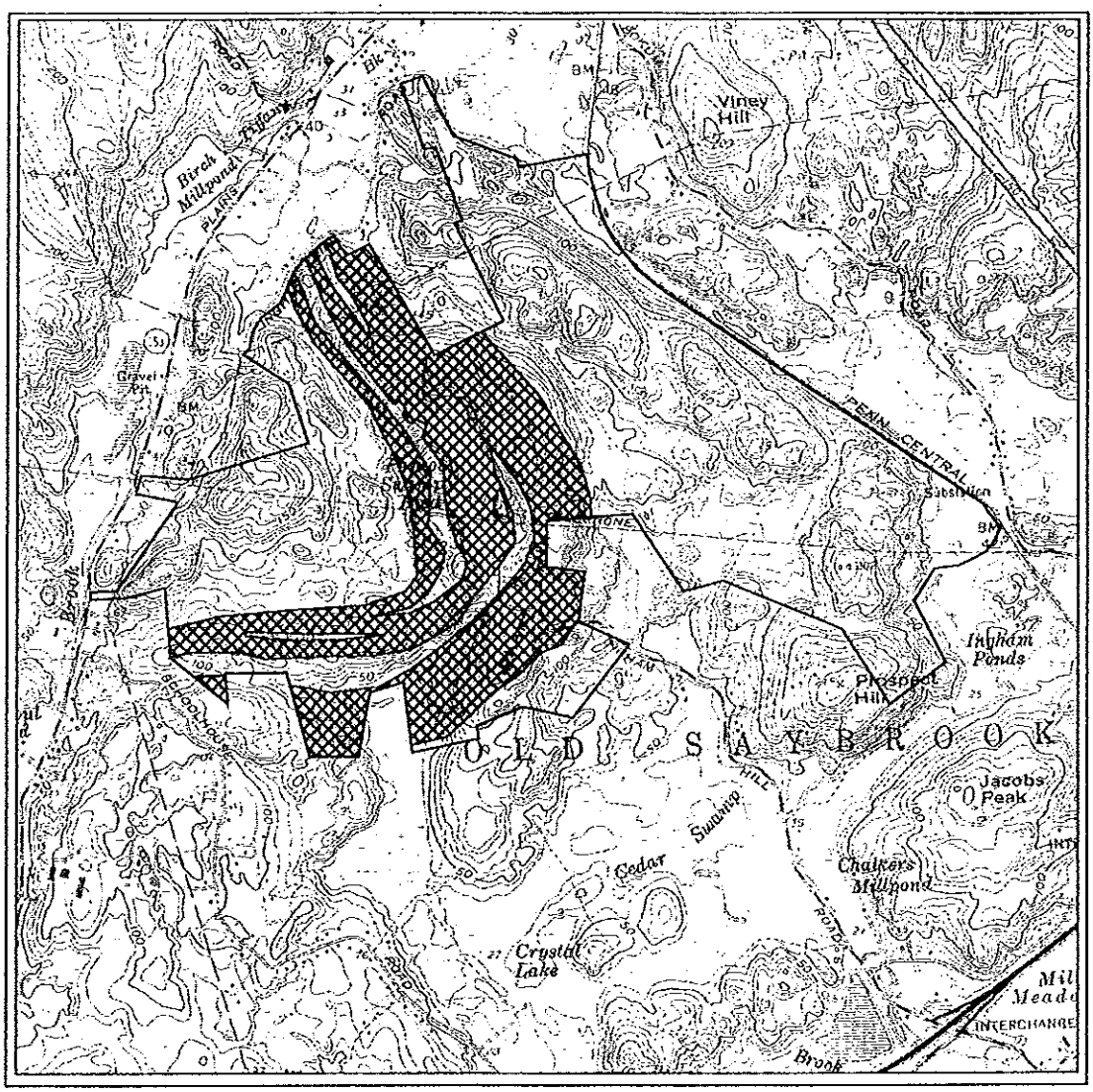


Figure 3

Bedrock Geology of "The Preserve"



Area of sulfide bearing bedrock within the boundary of "The Preserve" potentially capable of producing short-term acid drainage during construction

Hydrology and Soils

Below are comments concerning the proposed Preserve development consisting of 308 single family homes and an 18-hole golf course and impacts of the project on site hydrology located in the towns of Old Saybrook, Westbrook and Essex. Comments are based on a preliminary review of 1"=400' scale site plan and the Project Impact Assessment prepared by Sasaki Associates, Inc. These recommendations are advisory in nature and are intended to assist the Environmental Review Team in their charge.

General Flow Patterns

The project site encompasses a topographic divide between three watershed systems: Trout Brook to the west, a tributary of the Patchogue River; Oyster River to the south; and Mud River to the north. The applicant proposes to maintain the flow patterns in the three major watersheds upon development.

RECOMMENDATION

Maintaining and utilizing existing natural drainage is a good approach to new development. No specific recommendation at this time.

Stormwater Runoff Rates

The applicant proposes that under developed conditions, stormwater runoff rates from the project will be less than or equal to the existing stormwater runoff conditions. The applicant proposes to meet the existing stormwater conditions through a series of mitigation efforts - primarily through the use of detention basins.

It is now well understood that new development can have significant impact on regional hydrology - increasing water velocity and volume of runoff - often with an extraordinary effect on peak discharge, as well as, downstream channel degradation, habitat loss, changes in water temperature, contamination of water resources from polluted runoff and increased erosion and sedimentation. Although the applicant proposes to mitigate these effects with the use of detention basins and stormwater filtering systems, current studies show that detention alone is inadequate and a combination of detention and retention (or infiltration) is necessary.

RECOMMENDATION

Project design should be re-evaluated to determine where minimization of impervious surface could occur. For example, use of pervious material for parking areas, driveways and other paved surfaces; dispersion of rooftop runoff to lawns; and minimization and shortening of driveways, roadways and all other paved surfaces. This will allow for more on-site infiltration thereby decreasing stormwater volume and aquifer recharge.

Stormwater Management

In order to minimize the discharge of polluted runoff from the developed project, the applicant proposes to treat all stormwater runoff by utilizing a combination of detention ponds, water quality ponds and water quality inlets (ex: Storm Ceptor or Vortechnics).

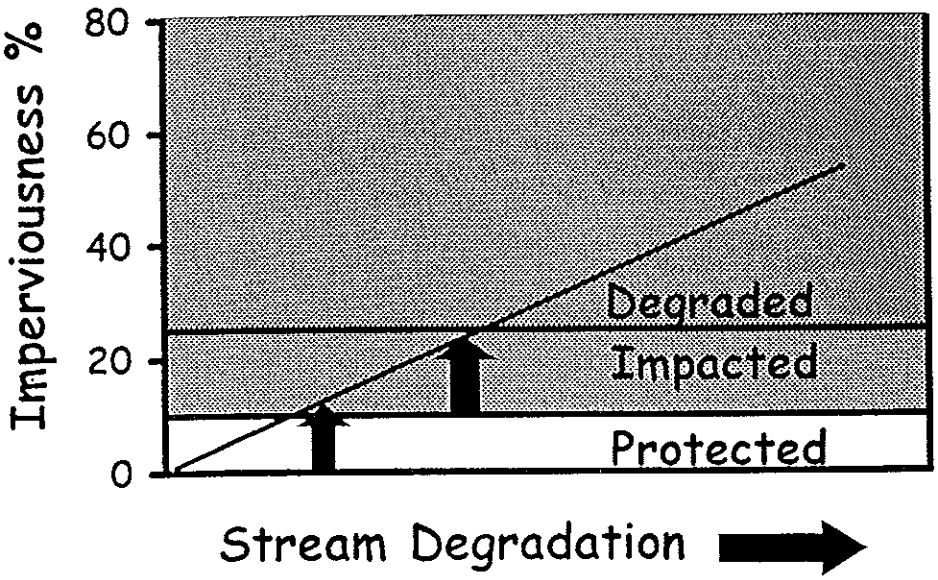


Figure 5. Percent of Imperviousness to Stream Degradation

A conservative estimate of approximately 38% impervious surface upon development is given for the proposed project. Since there is 0% impervious surface currently at the site, this represents a net increase of 38% imperviousness. Impervious surface is the principal cause of polluted runoff. The best strategy is to minimize the cumulative amount of new impervious surface. Minimizing the creation of impervious surface and thereby minimizing the generation of pollutants will have a far greater benefit than any combination of structural controls for water quality. **Moreover, minimizing impervious surface is more cost effective than treating stormwater runoff.** It has been shown that even 10% imperviousness in a watershed will have an impact on water quality (Figure 5).

3. CrC, **Charleton-Hollis very stony fine sandy loams, 3 to 15 percent slopes.** The stoniness and moderate slopes of this soil often presents a moderate to severe erosion hazard. These soils are considered fair potential for development. Extraordinary measures must be taken during construction to minimize soil erosion and sedimentation.

This review is general in nature given the scale and specificity of plans available at this time. The Conservation District will be available for future reviews, as fully developed plans become available. If you have any questions or need further assistance regarding this matter, please contact the district at (860) 345-3219.

Water Resources

Surface Water Hydrology

The site is almost entirely within the Oyster River drainage basin. This is a subregional basin draining about 5.8 square miles, and discharges into Long Island Sound. Surface waters on the site consist of Pequot Swamp Pond, a 25 acre shallow pond located in a small central valley within the site, and several small stream/wetland systems. Roaring Brook originates from Pequot Pond and drains the center of the site, and a small system of unnamed streams drain the more eastern portion of the site. These streams are all first order streams, originating from head water wetlands and from groundwater discharges from the adjacent hillsides. These two stream systems drain almost all of the site, about 1.5 square miles, and flow south combining with two other small tributaries to form the Oyster River. A small area of the northern site drains north to Tiffany Brook and to the Falls River. A small eastern section of the site drains easterly to Trout Brook and the Pachogue River. The site hydrology and drainage basins are shown on the Drainage Basins Map (Figure 6).

The State Water Quality Classifications classify all surface and ground waters in the state by existing water quality conditions and its designated existing and potential use. Classifications at and adjacent to the site are shown on the Water Quality Classifications Map (Figure 7). All the site's streams and water bodies are classified "A" surface water quality. Class "A" waters overall have excellent water quality and are designated for use as fishable/swimmable (suitable for recreational use, fish and wildlife habitat), as well as agricultural and industrial water supply, and potential drinking water supply. Review of the state Leachate and Wastewater Discharge Sources inventory that supports the water quality classifications, indicates that there are no known areas on

site which would impair the Class "A" water quality. The site review did not find any additional existing areas of potential pollution threats to surface water quality on site. The protection criteria for Class "A" waters prohibits waste water discharges.

Groundwater/Aquifer Resources

Statewide aquifer information is summarized on the map "Groundwater Availability in Connecticut," D. Meade, 1978. There are basically two types of aquifers: bedrock/till aquifers, and stratified drift (sand & gavel) aquifers. Generally, bedrock/till aquifers are low yielding (1 to 10 gallons per minute) and suitable for small domestic supplies. Stratified drift aquifers are the most productive aquifers and are especially high yielding where deposits are thick, transmissive and hydraulically connected to large streams. The site's specific bedrock and surficial geology determines aquifer resources on site (see the geology section for more detailed geology information). The site consists primarily of bedrock/till and is generally capable of yielding relatively small amounts of water to wells. This yield would be sufficient for small individual domestic water supply wells and small public uses. However public water is proposed for the site; consequently, no on-site wells will be developed. Three areas of stratified drift exist adjacent to the property on the east, south, and west. The south area is shallow, may contain fine materials, and may be susceptible to salt water intrusion, making it generally unsuitable for community water supply development. The eastern area is currently tapped by the Connecticut Water Company (Saybrook Wellfield) (Figure 8). This well supplies part of the Connecticut Water Company (CWC) shoreline system, has a safe yield of about 23 MGD, and probably represents the full water development potential of this aquifer. The well falls under the State Aquifer Protection Area Program, and the well recharge area has been preliminarily mapped as shown on the Community Water Supply Sources Map (Figure 8).

This area represents the land directly supplying the well and would be the most critical area to protect. As the map shows, the area is either off site or within the proposed open space area. The western aquifer, in the Trout Brook area, appears to have fairly good yield potential. This area has been assessed by CWC for a future wellfield (Holbrook Wellfield) (Figure 8) and has a projected safe yield of about .5 MGD. The potential recharge area to this wellfield has been preliminarily mapped and is shown on the Water Supply Sources Map (Figure 8). Some of the area is within the western residential edge of the site.

The State Water Quality Classifications, indicating ground water quality conditions at the site, are shown on the Water Quality Map (Figure 7). Groundwaters on the site are classified "GA." Class "GA" groundwaters have designated uses as existing private and potential public or private drinking water supplies, and as baseflow to adjacent surface water bodies. Water quality is generally good and at a minimum should be suitable for drinking or other domestic use without treatment. Review of the state waste sources inventory and the on-site review did not find any known potential pollution threats. Wastewater discharges to the ground in "GA" areas are limited to approved treated domestic sewage.

Potential Water Quality Issues

Proposed Land Use

Generally the proposed land uses and density, while able to be supported on site, need significant mitigation and infrastructure support to minimize impacts on existing surface and ground water resources. This is primarily because of the overall development constraints that exist throughout the site due to slope, shallow water table, or shallow bedrock. The proposed mitigation measures are necessary components. Generally residential lot sizes

of 1-2 acres or greater are a reasonable density given that general land conditions are good or buildable areas exist within the lot layout. Although the proposed lots are within or greater than this range, locating buildable areas within some lots will be difficult. The on-site construction of centralized sewage treatment and disposal systems is feasible but will require significant construction and operation. Golf courses, while providing certain open space functions, require intense greens maintenance and a high demand for pesticide and fertilizer use. Given this, the following comments are also provided.

Sewage Disposal

The construction of an on-site community septic system will require a pre-treatment plant and a large fill area (approx. 12 acres) to create a suitable site for the system drainage field. A discharge of this type could be allowed to the ground, but would require a wastewater discharge permit from the State Department of Environmental Protection (DEP). See the sewage treatment and disposal section for more information concerning permit requirements, water quality monitoring, and system operation. The community system is an alternative to individual septic systems and does allow flexibility for the layout of lots and buildings. Constraints existing throughout the site due to slope, shallow water table, or shallow bedrock, and installation of a collection system itself could require significant blasting and special construction considerations.

Stormwater Management

Stormwater from urbanization can be a significant "non-point" source of pollution. Management of both the quantity and quality of runoff should be considered to protect receiving waters. Certain stormwater discharges which may have potentially significant impacts are regulated by the State DEP Water

Management Bureau through a state general permit. This includes construction activities that disturb 5 acres or more, which would include this site. The state permit for construction centers on temporary sedimentation and erosion control during construction and post construction pollution prevention and treatment measures.

Construction Sediment & Erosion Control

For this project, temporary sediment and erosion controls are critical because of the site limitations in terms of steep slopes, the spread out nature of construction, significant fill areas, and blasting of rock. Strict construction phasing and temporary sediment basins will be necessary in addition to typical sediment barriers. Regular enforcement and maintenance will be necessary.

Site Layout and Protection of Sensitive Water Resources

Site layout and design is important to minimizing impacts and maintaining natural protection of receiving surface and ground waters. The subdivision of the land, road layout, and individual site plan layout should maintain the natural streambelt system and buffers, and direct development to the "buildable land" areas. This helps maintain the natural drainage patterns and recharge of runoff, and takes advantage of the passive treatment and flood control capacities while minimizing the use and maintenance of structures. Specific stream/wetland buffer issues are discussed further in the wetlands and fisheries sections. The site layout has minimized the activity within the public water supply wellhead areas to a small portion of the western residential subdivision.

Source Controls

Pollution prevention measures should be a major practice for the golf course and related commercial operations. The following practices should be part of a stormwater pollution prevention plan:

- Insure that all wastewater discharges are properly connected and disposed of.
- Prevent stormwater contact with all waste and material storage areas, and divert clean storm water from these areas. Hazardous materials should be stored inside a structure with secondary containment.
- Minimize the use of impervious surfaces where possible. Where reduction is difficult, large parking areas and cul-de-sacs can incorporate landscaped areas in between to help maintain natural recharge. Road widths should be minimized where possible. Because this is a fairly large lot conventional subdivision, the road network is extensive, and any way to reduce road lengths would be desirable.
- Minimize the application of sodium chloride chemicals as a deicing agent for snow and ice control, and maximize the use of abrasives. Especially in the wellhead area.
- Only apply chemical fertilizers after soil tests indicate the need. Minimize the use of chemical pesticides; use a licensed applicator in highly landscaped areas; and use non-chemical alternatives where available. The most common problems caused by chemical fertilizers and pesticides are improper handling and application. See the pesticide section for additional discussion of the proposed Integrated Pest Management (IPM) Plan.

Typical residential use will have minimal and more dispersed pollution sources, such as household waste and lawn maintenance, which are best handled through education.

Runoff Treatment & Control

Regardless of the extent of source controls, stormwater may pickup and transport pollutants from incidental sources such as litter, vehicle use, lawns, and atmospheric deposition. Contaminants from paved surfaces include suspended solids, hydrocarbons, metals, nutrients, bacteria, road salt, and thermal pollution. Roughly 90% of these contaminants are contained in the first 0.5 to 1 inch of runoff. This "first flush" may need treatment depending on the type and intensity of land uses and discharge point. It has been shown that basic separation treatment to remove gross particles and floatables followed by a land surface type of treatment such as vegetated swales, filter strips, or detention basins are effective and protect both surface and ground water quality. Direct infiltration structures such as dry wells or leaching fields can be effective, but care must be taken to avoid them in groundwater drinking supply areas (not recommended in private or public drinking water supply well areas). Design criteria should generally be for detention times or treatment methods which will remove 80% of the suspended material. The project stormwater management plan proposes to provide first flush treatment.

Peak Flow Control

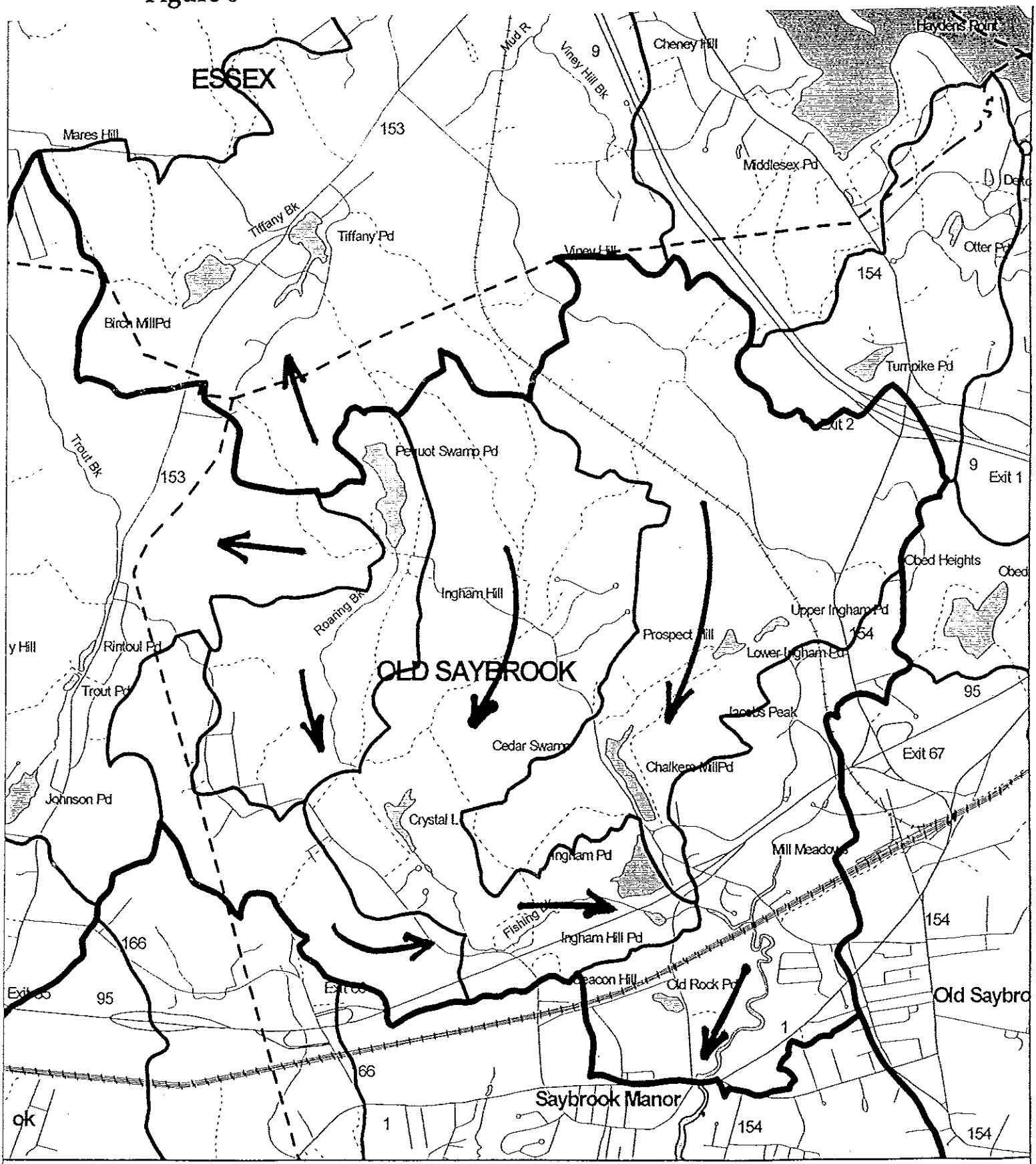
Runoff flow controls may be necessary to prevent downstream flooding or streambank erosion. The overall watershed, the site's location within the watershed, and selected downstream design points (stream culverts, structures, or water bodies) should all be considered when determining the potential affect of individual site runoff on peak flows of the receiving waters. When considering the use of detention measures, the following general guidelines can be used:

- In the lower one third of the watershed: little or no detention
- In the middle one third: limited detention
- In the upper one third: longer detention

The site is primarily at the upper watershed and the project has essentially been designed to detain runoff to create a 0% increase in runoff up to a 100 year storm. There are some concerns however about the construction and location of the detention basins:

1. A number of the basins will be constructed in some difficult areas requiring extensive grading and even rock blasting, leaving vertical rock faces. Basins located in the wellhead area or directly upgradient of private wells should have a vertical separation to bedrock of 5 feet.
2. It appears that most of the basins are located on private property and included in the total residential lot area, as opposed to public or open space area. This is unusual and raises concerns about maintenance, safety, and compatibility.

Figure 6



ArcView Quick Map
DRAINAGE BASINS

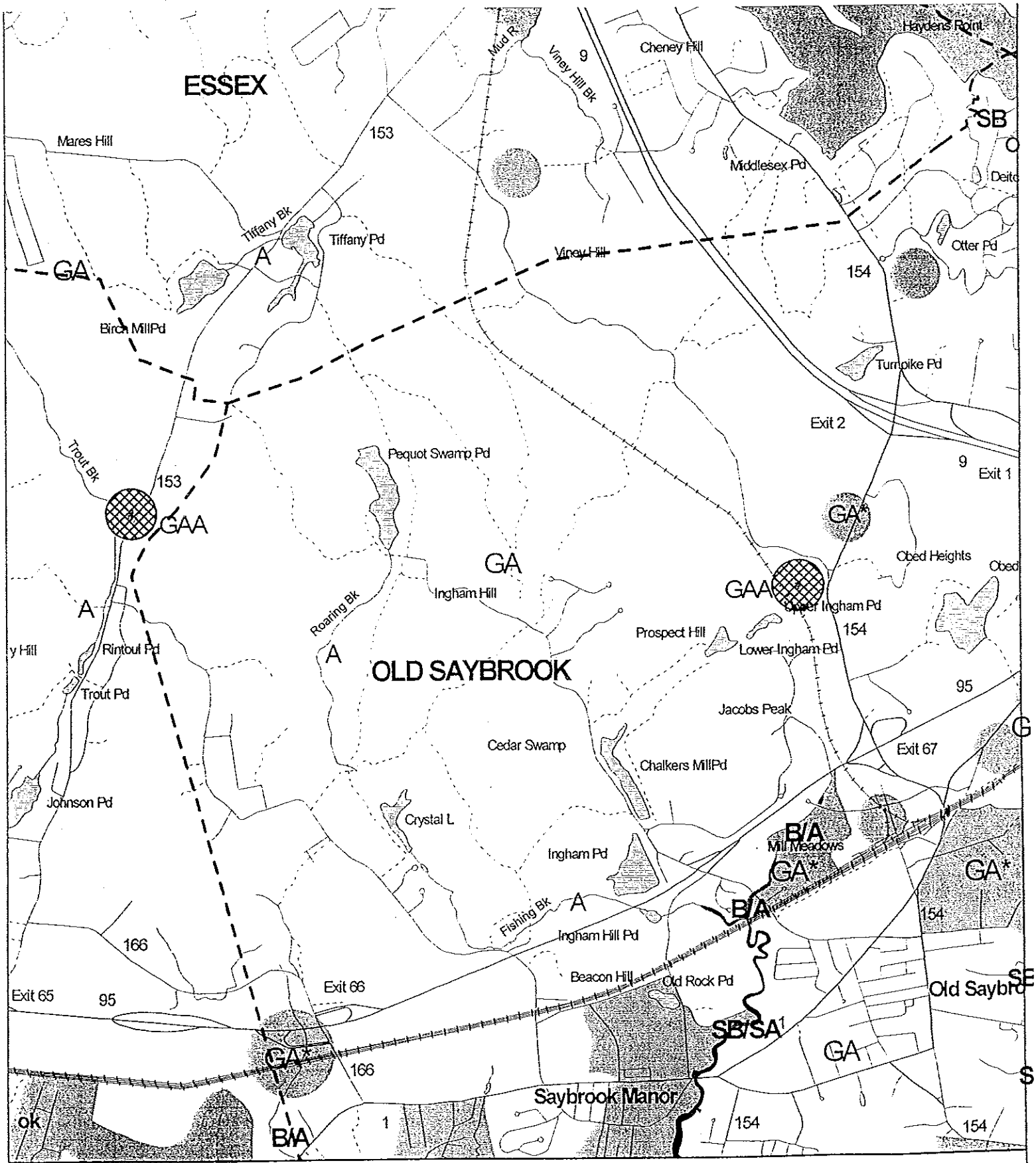
1250 0 1250 2500 Feet

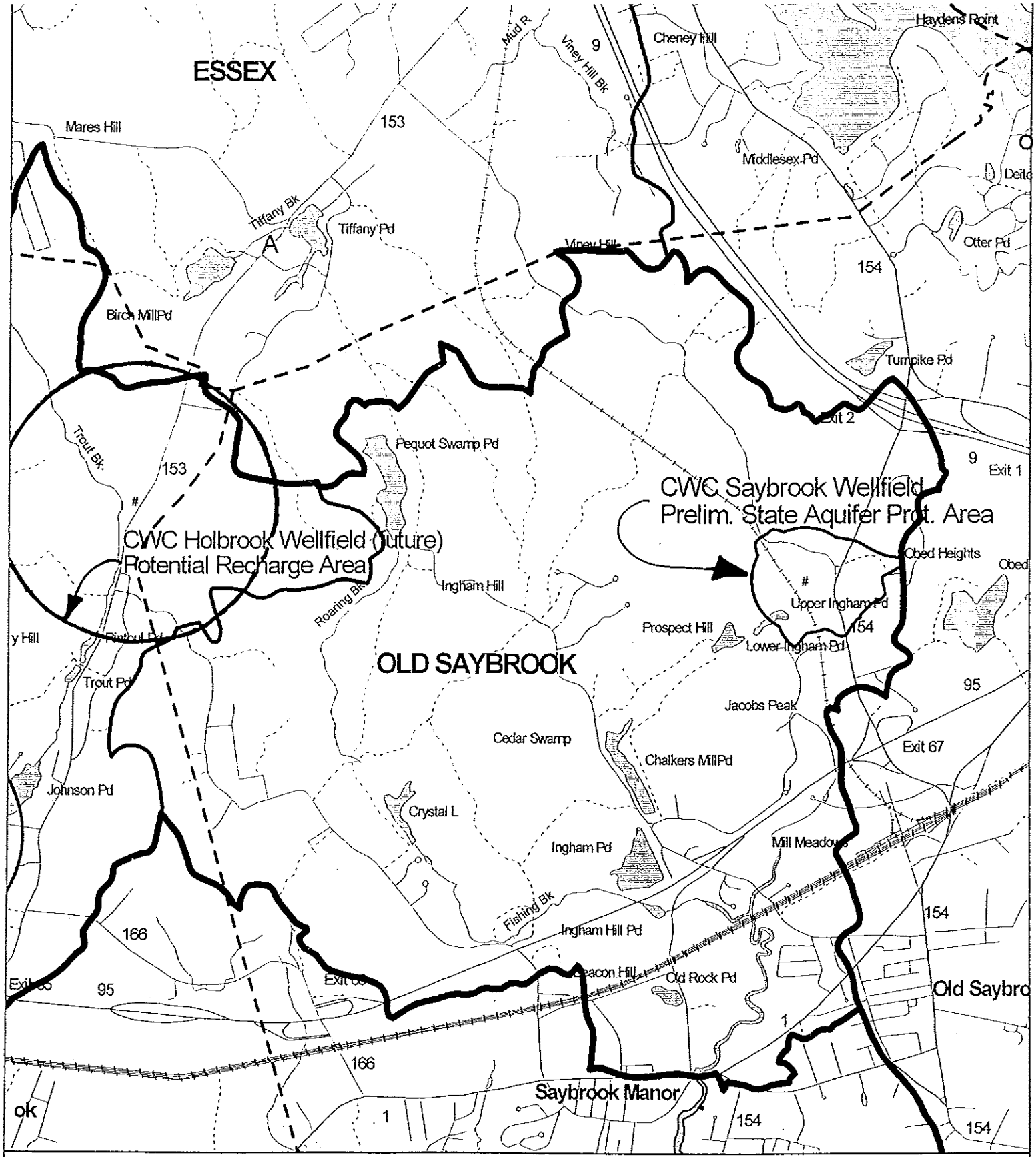
1:30000

N

State of Connecticut, Department of Environmental Protection

Map printed 6/29/1999


ESSEX
OLD SAYBROOK
Saybrook Manor
Old Saybro
Mares Hill
Tiffany Bk
Tiffany Pd
Birch MillPd
Viney Hill
Viney Hill Bk
Mud R
Cheney Hill
Haydens Point
Middlesex Pd
Otter Pd
Turnpike Pd
Exit 2
Exit 1
Pequot Swamp Pd
Trout Bk
Trout Pd
Rintoul Pd
Roaring Bk
Ingham Hill
Prospect Hill
Upper Ingham Pd
Lower Ingham Pd
Obed Heights
Jacobs Peak
Exit 67
Cedar Swamp
Chalkers MillPd
Crystal L
Ingham Pd
Mill Meadows
Fishing Bk
Ingham Hill Pd
Beacon Hill
Old Rock Pd
Exit 65
Exit 66
Johnson Pd
153
154
166
95
1
9
GA
GAA
GA*
A
B/A
SB
SB/SA
1250 0 1250 2500 Feet
1:30000
N
ArcView Quick Map
WATER QUALITY CLASSIFICATIONS
State of Connecticut, Department of Environmental Protection
Map printed 6/16/1999



ArcView Quick Map

COMMUNITY WATER SUPPLY SOURCES

1250 0 1250 2500 Feet

1:30000

N

State of Connecticut, Department of Environmental Protection

Map printed 6/29/1999

Wetland Resources

Primary supporting documents reviewed for this report include:

"Preliminary Master Plan", dated 3/24/99, by Timothy Taylor.
"Subdivision Plans: Old Saybrook", dated 4/26/99, last revised 5/17/99 by VHB.
"The Preserve: Project Impact Assessment", dated 4/99, by Sasaki Associates.
"Herpetological Survey Report for the Preserve Site", dated 5/25/99, by Evans Associates.

No detailed plans of the golf course were sent to the wetland reviewer. Therefore, the golf course review will be commensurate with the level of detail present in the 1"=300' scale master plan. Additionally, it should be noted that the Subdivision Plans referenced above included Phase I residential development only. Comments on Phase II and III are also made based on the master plan drawing which contains only road and lot line layout at a 1"=300' scale. The Project Impact Assessment covers all three phases.

This 1000 acre development, including 308 single family homes and a fully augmented 18-hole golf course is an exceptionally large proposal. The size of a project in and of itself should not necessarily be a determining factor for environmental impact. However, taken in context with the steep contours, notable wetland and watercourse resources, watershed relationships, wildlife and vegetation issues, the project size can become a predominant issue. In addition to this, the limited road access issue most likely intensifies the issue of scale in that it requires a more extensive, overreaching road configuration.

Correspondingly, the information submitted by the applicant reflects a very professional, comprehensive effort to address the impacts created by such a large scale project. For the sake of brevity, the wetland and watercourse inventory, environmental impact and impact mitigation information included in those reports will not be repeated verbatim. Only the primary concerns, in no particular order of importance, will be listed as they relate to this material, including recommendations when appropriate.

An irrigation water storage pond was mentioned in the narrative. However, it could not be located on the master plan.

The inclusion of the golf course in open space area calculations is debatable. The Connecticut Department of Environmental Protection (DEP) specifically excludes golf courses as part of its recently expanded open space program. While protection of the Pequot Swamp Pond and other wetland areas as permanent open space is laudable, it is believed that the dedicated open space of this parcel could be expanded further to include additional high value wetlands such as the many vernal pools that exist on this property and done so in a way that creates intact wildlife travel corridors.

While the site plan included textual "open space" references, the boundaries of this open space were not included. These boundaries should be described by meets and bounds and included on individual property deed descriptions. Additionally, it is recommended that the specific conservation restrictions applied to this land be listed as well.

The Impact Assessment (IA) mentioned that an attempt was made to maintain a 25 foot buffer to streams and pond, which according to the report occurred approximately 70% of the time. While this type of setback may be appropriate for urban situations, the DEP Fisheries Division recommends

that a 100 foot prohibitive buffer be maintained in order to adequately preserve the functions and values of perennial watercourses.

This project is proposed to occur in three phases. It is assumed that one phase is to be completed prior to the initiation of the next. Specific criteria should be developed as to when one phase is to be considered "complete," particularly as it applies to the stabilization of disturbed soils.

The proposed water quality monitoring program should be intensified. It is recommended that it be extended beyond the three-year period mentioned and be increased in its coverage. Refer to the Pesticides section and Appendix H of this ERT report for further details on this.

It was stated in the IA that it is likely that changes to the proposed configuration of the golf course fairways could be made in the field during the layout process. It is assumed that this would be after the permitting process has been completed. It should be noted that if these alterations would result in substantial, additional impacts to wetlands or watercourses, wetland permit modifications may be necessary.

The IA states that there will be no direct impacts to wetlands or watercourses. This goal is to be commended. However, there is to be 9.3 acres of wetland alterations for fairway crossings and 13,200 sq. ft. (0.3 acres) for the bridged roadway crossings. There is also a substantial amount of alteration in the upland buffers to the wetlands. While a figure was calculated for activities within the upland buffers to streams and water bodies, no estimates of activities within upland buffers to wetlands in general were seen. This information would be helpful.

It is recommended that the Army Corp of Engineers be contacted to discuss their possible jurisdiction where bridging the wetlands are concerned. Other projects with similar impacts have been of interest to them.

It is recommended that the proportion of wetland alteration to total wetland acres (91 acres not including Pequot Swamp Pond) be established, as well as that of activity in the upland buffer to total buffer areas.

The IA states that "...90 percent of the site's wooded wetland habitat will be included within the proposed open space system" (pg. 47). It is assumed that this includes the golf course as open space. It is recommended that this figure be re-calculated after omitting the golf course as open space as discussed above.

The "Summary of Functions by Site Wetland Areas" found on page 57 of the IA is an inadequate attempt to quantify the function and values of the wetlands. It is understood that the extent of wetlands on this property may make a detailed review too time consuming. However, more detail is recommended for the purposes of the local permit review. The table merely identifies which wetlands provide what functions. Minimally, the wetland and watercourse parcels should be individually rated on a high/medium/low system with limited narrative to substantiate the ratings based on the professional judgement of the reviewer.

As a result of the initial site visit, it was realized that the subject of vernal pools would be a critical natural resource issue for this proposal. Please refer to Appendix A for a general discussion on what vernal pools are, why they are a special habitat and how they are to be protected. **It is commonly agreed that the most important factor in vernal pool protection is not only avoiding direct impacts, but also avoiding disturbances within the surrounding upland areas due to the well documented, upland requirements of the amphibian**

species that breed in these pools. These disturbances include removal of vegetation, construction of houses and roads, and the introduction of collected stormwater.

The applicant is commended for acquiring expert professional assistance on this matter. The Evans herpetological survey concludes that, "[B]ased on the field evaluation many of the wetlands on the Preserve site are diverse, high quality systems that provide breeding habitat to a number of species of amphibians" (page 9). The report identified 14 wetland systems that contained vernal pools. It also stated that there were many other wooded wetland areas that may not be discreet, isolated wetlands but still contained the obligatory amphibian species. Unfortunately, there was no map indicating the location of specific vernal pools, nor a record of species composition or abundance. It is understood that the Town of Old Saybrook has also contracted with an environmental consultant to look into the abundance of vernal pools on this parcel. His preliminary findings indicate that there may be more vernal pool habitat than identified by the Evans Report.

The amphibian life that use these pools as breeding grounds soon migrate into the surrounding uplands to live out their adult phase and return to the pools only to breed. Migration distances vary significantly between species. One literature search turned up figures ranging from a minimum of 200 feet and a maximum of 750 feet with an average migration of about 525 feet. The wood frog has a significantly larger dispersal range, known to be as far as one half mile from their host pool.

Another phenomenon peculiar to vernal pools is that they often exist, as in this case, in groups, which have been shown to cooperate as a functional whole, with some pools in the group serving as a genetic "source" producing amphibian stock, and others as a genetic "sink" receiving this genetic stock. While research on this phenomenon is on-going, it is suspected that the

interplay between each pool in the group is crucial to their long-term survival.

It should be mentioned here that none of the observed amphibian species discussed within the Evans report is found on state or federal endangered species lists; yet scientists have been documenting a general downward trend in many amphibian species with one of the probable causes being upland habitat fragmentation. The wood frog is particularly susceptible to this fragmentation phenomenon. It has been shown in a Rhode Island study, that wood frogs require an unbroken territory of at least 100 acres and preferably over 1000 acres in order to proliferate.

Based on 1) what appears to be a very dynamic, multi-pool community of amphibians, 2) the developing evidence of declining amphibian populations, and 3) the studies that have documented the upland habitat requirements of these wetland dependent species present on this site, it is suggested that the applicant consider reconfiguring the proposed development surrounding these vernal pools to allow for less development and less impact on this critical habitat.

It is recommended that once all the results are available on vernal pool location, that efforts be made to rate these systems according to relative value and assign a more appropriate protection strategy based on different factors. These factors could include species diversity, proximity to other vernal pools, predicted migration routes, etc.

One of the major themes of the applicant's mitigation objectives is that the alterations of wetland habitat and the subsequent conversion of forested wetlands to scrub/shrub wetlands would create an increase in the wildlife diversity due to the creation of ecotones otherwise known as the "edge effect". That is, where two types of habitats abut, it creates a very active wildlife

habitat. While this is a common argument used in favor of these cases, an equally valid argument can be made against "habitat fragmentation" with its subsequent negative impacts to those species requiring large tracts of unbroken forested habitat to propagate. This negative impact is due to the loss of that habitat, as well as the invasion of more ubiquitous and possibly parasitic species. It is recommended that this phenomenon should also be addressed by the applicant. Refer to the Wildlife section of this ERT for a more detailed discussion on this topic.

The mitigation strategy also includes beneficial habitat enhancement projects. To the extent possible, these enhancements should be represented within the site plan, optimally after conferring with the DEP Wildlife Division for assistance and review.

It is recommended that the applicant add to the proposed conservation restrictions, upland buffer enhancements and upland buffer retention into the mitigation strategy.

The applicant's erosion and sedimentation narrative and plan is very well conceived and represented. As a potential indirect impact to wetlands, this will be a critical aspect of their impact avoidance strategy (as they have noted). The Hydrologic portion of the ERT addresses this topic more specifically. However, a few general comments/suggestions are included here:

> Both residential and golf course clearing limits should be represented on the plan.
>
> Provisions for ongoing maintenance of the permanent control measures, such as the water quality detention basins should be included within the plan.

Several detention basins are proposed without discrete, concentrated inflows. It is unclear what the purpose of these basins is. Are they for future development or are they to capture sheet flow to augment the "no net-increase" principle?

The plans will be submitted to the DEP Dam Safety Section to determine if the impoundments called for as part of the basins would fall under their jurisdiction. Questions about this program can be directed to Wes Marsh at (860) 424-3887.

The lack of detail for the proposed golf course makes it difficult to adequately assess the extent of wetland buffer activity, however some basic principles can be offered. Please refer to Appendices B, C, D and H for information on avoiding wetland and watercourse impacts due to golf course construction. One of the critical principles is to allow for a sufficient wetland buffer along greens, tees and fairways in order to remove any excess nutrients and/or pesticides that may be contained in the stormwater runoff flowing through them on its way to the wetland. For this purpose, it has been shown that an average buffer of approximately 60 feet is adequate.

Another unknown due to the detail of the golf course plans is how the water from the impervious surfaces of the club house facilities (parking lots, access roads, roofs, etc.) will be treated.

Performance standards for the stormwater treatment devices (Storm Ceptor, Vortechnics, etc.) should be scrutinized. Independent testing by the University of Connecticut (in cooperation with the Connecticut Department of Environmental Protection) is on-going. Contact Jack Clausen of the School of Natural Resources and Engineering for further information. It is recommended that these devices not be used as the sole source of stormwater

treatment but rather as a portion of a "treatment train" or sequence of water quality measures such as grassed swales, detention basins, etc.

"Geoblock porous pavement" was included in the details section of the plans, but no mention of it was made within the site layout material. This item would be particularly useful to construct the emergency access ways and overflow parking at the proposed clubhouse, thus reducing impervious surfaces.

There is a watercourse delineated on Lot 8 that is draining toward the proposed house. Should this be handled somehow?

Drainage easements should be sought for point discharges of detention basins that drain onto abutting properties.

What is the purpose of the diversion swale on LP 38 leading into a detention basin?

Details for the arch culverts, bridges and road spans are recommended.

Finally, when available, detailed plans for Phase III of this project should be reviewed in relation to the 3/4/98 memo from Ken Metzler, DEP Natural Diversity Data Base, found in Appendix E regarding the presence of endangered, threatened and special concern species that have been found on or near this site.

Fish Resources

Fish Populations

The proposed golf course and residential development will be constructed adjacent to several aquatic resources, some of which support viable fish populations.

Pequot Swamp Pond

Pequot Swamp Pond has gradually developed into a very shallow emergent freshwater marsh system due to the fact that the stone dam located on the western side of the pond is no longer maintained to impound water. The marsh contains very small pockets of open water habitat which would somewhat limit fish species diversity and population density. The type of freshwater fish that can be expected to inhabit this marsh include: chain pickerel, redfin pickerel, yellow perch and shiner species such as the golden shiner. All of these species can survive in shallow, warmwater conditions and require aquatic vegetation to successfully spawn.

Pequot Swamp Pond Outlet Watercourse

This watercourse is an unnamed tributary to Trout Brook. The stream on the proposed development property does not support any permanent fisheries resources. One of the primary functions of these streams and their associated wetlands is to provide clean and unpolluted waters to downstream areas of the watershed. It's possible that warmwater fish that reside in Pequot Swamp Pond may pass through this area as seasonal "blowdowns" during high flow periods. Blowdowns is a fisheries term that refers to fish that are blown or flushed out of pond habitats during freshets. More viable fisheries resources are available in downstream areas where the stream confluences with Trout Brook.

Cedar Swamp Brook Headwaters

No fisheries survey information is available within this watercourse; however, based on a field review of physical instream and riparian resources of the lower sections of this stream below the telephone right-of-way, the stream is expected to support a warmwater fish community comprised of: redfin pickerel, chain pickerel, sunfish species and golden shiner. American eel, a species which exhibits catadromous migratory behavior, may also be present.

Impacts

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

Site soil erosion and sedimentation of watercourses due to extensive vegetation clearing and cut/fill activities

Without proper safeguards, the placement of fill in concert with land disturbances associated with golf course and residential house construction may introduce suspended sediments to watercourses. This parcel with its steep, hilly topography presents a challenge to properly control soil runoff. If not properly controlled, suspended sediments may cause stream degradation in downstream areas. Sedimentation is of special concern in a meandering, low gradient stream system where deposited sediments take much longer to be washed and transported downstream by spring freshets. Excessive sediment deposition could damage the aquatic ecosystem in the following ways:

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

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

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

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

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

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

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

Alteration of Riparian Resources

A significant amount of development disturbances will occur within riparian habitats of perennial watercourses. Riparian vegetation serves several vital functions in the maintenance of biologically diverse stream and riparian ecosystems. Vegetated riparian ecosystems:

1) naturally filter sediments - nutrients, fertilizers, and other non-point source pollutants from overland runoff,
2) maintain stream water temperatures suitable for spawning, egg and fry incubation, and rearing of resident finfish,
3) stabilize streambanks and stream channels thereby reducing instream erosion and aquatic habitat degradation,
4) supply large woody debris to streams providing critical instream habitat features for aquatic organisms,
5) provide a substantial food source for aquatic insects which represent a significant proportion of food for resident finfish, and
6) serve as a reservoir, storing surplus runoff for gradual release into streams during summer and early fall base flow periods.

Recommendations

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

Increase the water level in Pequot Swamp Pond.

It is recommended to raise the water level in the pond approximately 2 to 3 feet. This management strategy will greatly enhance the amount of useable habitat for the existing fish community by creating additional areas of deeper open water.

Develop an aggressive and effective erosion and sediment control plan.
Proper installation and maintenance of erosion/sediment controls is critical to environmental well being. This includes such mitigative measures as filter fabric barrier fences, staked hay bales, and sediment basins. Land disturbance and clearing should be kept to a minimum and all disturbed areas should be restabilized as soon as possible. Exposed, unvegetated areas should be protected from storm events. The applicant and the local wetland enforcement officer should be responsible for checking this development on a periodic basis to ensure that all soil erosion and sediment controls are being maintained. In addition, the applicant should post a performance bond with the town to protect against future soil erosion violations. Past stream siltation disturbances in Connecticut have occurred when individual contractors either improperly deployed mitigation devices or failed to maintain these devices on a regular basis.

All instream work and land grading/filling near watercourses should take place during low flow periods.
This will help minimize the impact to the aquatic resources. Reduced streamflows and rainfall during the summer and early fall provide the least hazardous conditions in which to work near sensitive aquatic environments.

Maintain at the minimum, a 100 foot open space buffer zone along the edge of all perennial watercourses.
No construction or alteration of natural vegetative habitat should be allowed in this zone. Research has shown that 100 foot buffer zones help prevent damage to aquatic ecosystems that support diverse fish and aquatic insect life. These buffers help absorb surface runoff and other pollutants before they can enter wetlands and aquatic habitats. See Appendix F for DEP Fisheries Division policy on riparian corridor protection for specifics.

Natural Diversity Data Base

According to Natural Diversity Data Base files, we have records for a number of State-Listed plant species on the far eastern portion of this property and within the adjacent wetland draining into Ingham Pond. These include *Platanthera ciliaris* (Yellow-fringed orchid, State Threatened) and *Polygala cruciata* (Marsh milkwort, State Special Concern) on the referred property, and *Carex exilis* (Coast sedge, State Endangered) within the downstream wetland. Since all of these plants are adapted to a moist, nutrient-poor substrate, any input from storm water discharge may have a negative impact on both the plants and their habitat. In this regard, any discharges into this wetland should be avoided.

We also have a 1996 record for *Liparis lilifolia* (Lily-leaved twayblade, State Endangered) from the northwest perimeter of the property. This plant should be searched for in adjacent habitat prior to establishing a final site plan design.

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 Environmental & Geographic Information 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 the Data Base if there are any questions regarding this information (860-424-3585). 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.

Wildlife Resources

The following report is based on a site visit conducted on March 29, 1999 and a review of aerial photographs, site plans/maps, the Project Impact Assessment and related appendices (VIII, IX and X), and the Herpetological Survey Report. The forestry section of this ERT report and the consultants' reports provide a thorough, and generally accurate description of the property's vegetation and physical characteristics and wildlife that can be expected to inhabit the property. Therefore, this report will be limited to providing a brief description of the primary values of the property to wildlife and an assessment of the impacts of the project. Finally, general recommendations will be provided to help maintain as much wildlife value as possible during site development.

Wildlife Habitat Values

As suburban sprawl continues to fragment Connecticut's forests, significantly large properties (500-1000+ acres) like The Preserve, which are vital to preserving diverse and abundant wildlife populations, are becoming scarce. A diverse assemblage of wildlife can be expected to occupy the property, including many species of neotropical migrant birds that require large tracts of continuous forest for successful breeding (e.g., hermit thrush and yellow-throated vireo) and mammalian predators that have large home ranges (e.g., fisher and bobcat). As best indicated by the information provided in the Herpetological Survey Report, the property contains a diverse, high quality system of wetlands and watercourses. Some of the amphibians identified during the survey, such as the spotted salamander, marbled salamander and wood frog, are obligate vernal pool breeders and generally only persist in unfragmented habitats. Some of the large, rocky outcrops present may

provide den sites for a variety of animals, such as snakes, raccoons, coyotes, fishers and bobcats. Fisher and bobcat currently have limited distributions in the state (primarily northern Connecticut). However, they are expected to continue expanding their range southward into large forested areas over the next decade.

Impacts On Wildlife

As the existing forest becomes replaced by roads, houselots, and the golf course, wildlife habitat will be lost and the potential for wetland and water quality degradation will increase. Those wildlife species that rely on continuous forest will be drastically reduced in abundance and diversity or eliminated from the property altogether due to habitat loss and forest fragmentation. For example, it has been documented that isolated patches of forest smaller than 100 acres are characterized by a low density and diversity of forest interior breeding birds. High rates of cowbird parasitism and nest predation by housecats and other suburban predators have been reported where small forest patches are surrounded by open habitats and residential development. Although some species, such as the white-breasted nuthatch and hairy woodpecker are found in small, remnant patches of forest, the extensive amount of clearing proposed will eliminate the habitat required for successful breeding by many other species such as worm-eating warbler and barred owl.

As noted in the Impact Assessment, the removal of the forest canopy will stimulate the growth of shrubs and herbaceous plants; this likely will benefit species that use shrublands and young forests but do not require large habitat patches. Although wildlife diversity may increase, this increase will primarily include more common "generalist" species that are adapted to living in a variety of habitats (e.g., raccoon, woodchuck, Virginia opossum, striped

skunk, grey squirrel, white-tailed deer, house wren, northern flicker, European starling, song sparrow, brown-headed cowbird, northern oriole, house finch, American robin and American crow). Frequently maintained and generally insect-free fairways and roughs, where there is a consistent flow of human traffic, cannot provide the same habitat benefits as natural grasslands. Although the amount of open grass habitat on the property will greatly increase, most grassland nesting species will not colonize the golf course because they have very specific habitat requirements and are negatively affected by insuffcient habitat size, frequent mowing and human disturbance.

One group of species that are greatly affected by wetland alterations, water quality degradation and habitat fragmentation are the amphibians. Because amphibians have small home ranges, relatively limited dispersal capabilities and high site fidelity, they are highly sensitive to local environmental changes. The uplands surrounding vernal pools and other ephemeral wetlands are an integral part of the wetland systems that amphibians require for survival (M.W. Klemens, Research Scientist, Land Use Planner, Author. Wildl. Conserv. Soc., pers. commun., 1998.) For example, studies have shown that salamanders may move up to a half mile or more from their breeding pools into adjoining upland habitats to access feeding and wintering habitat. Road systems can serve as barriers to this movement and can significantly impact amphibian populations through direct mortality (i.e., road kills) where roads intersect major migration and dispersal routes. Other barriers, such as curbing, berms and drainage ditches, can trap amphibians or cause them to divert from their normal migration routes. Reptiles and small mammals are similarly affected by these barriers.

Forest canopy removal also may have a detrimental effect on vernal pool ecology by altering soil and water temperature, evaporation rates and the import of organic material (e.g., leaves and branches) into the pools.

Presently, a research project is being conducted in Rhode Island to investigate the effects of turf grass on amphibian movements to/from breeding ponds. Preliminary findings indicated that, although frogs readily moved across a 220 foot wide turf field, suggesting that most fairways will not represent a barrier to movement, travel corridors that connect ponds to upland wintering areas would be more effective if designed to include wooded habitat. Other recent research indicates that while some amphibians will readily use edge habitat, others will avoid such habitats. Their presence or absence appears to depend on the type of edge present (e.g., field/forest vs. road/forest).

A small stand of common reed grass *(Phragmites australis)* is present in the southeast portion of Pequot Swamp Pond. As a result of the proposed site alterations, there is a high potential for this species to invade other wetlands on the property, thus lowering their value to wildlife.

General Recommendations For Mitigating Impacts

Golf Course

Growing attention has been given to the concept of golf course "naturalization" in an attempt to reduce the negatives typically associated with the creation and maintenance of golf courses (i.e., forest fragmentation and water quality problems due to increased water, fertilizer and pesticide use). Naturalizing non-play areas can increase the wildlife habitat values of the course, help to protect water quality and reduce routine maintenance costs. Some management recommendations that should be considered include:

1) Avoid creating small isolated islands of habitat. Preserve travelways for wildlife by maintaining wide corridors of natural vegetation (100+') between

islands of habitat, particularly those that link wetlands to undeveloped uplands.

2) Maintain certain forest wildlife requirements whenever possible during land clearing:

a) Avoid cutting during the peak bird nesting period from mid-April through mid-July;

b) Retain the larger mast-producing trees (i.e., oaks, hickories, beech; a minimum of five mast-producing trees per acre, 14 inches dbh (diameter at breast height) or larger) as a food source;

c) Leave a minimum of 3 to 5 snags per acre (preferably 12 inches dbh or larger) to provide nesting and feeding sites for various birds and mammals;

d) Retain exceptionally tall trees which are used by raptors for perching and nesting sites;

e) Retain structural diversity in the understory by maintaining various "levels" of vegetation (i.e., from ground cover to shrubs, sapling and pole-sized trees). Leaf litter and woody debris (e.g., logs, stumps and downed limbs) also should be left undisturbed; they contribute to a healthy forest ecosystem by returning nutrients to the soil and providing cover for small mammals, birds, reptiles and amphibians.

3) Use natural landscaping techniques which avoid or minimize the creation of manicured grass and chemical applications wherever it will not disrupt daily course activities:

a) Designate "low maintenance" areas where grasses and wildflowers will be allowed to grow tall, such as along forest and pond edges. This will provide habitat for beneficial insect populations, reduce maintenance costs and help protect water quality. If keeping shrubs from invading these areas is desired, it will be necessary to mow once every one to two years, preferably outside of the nesting period.

b) Implement "backyard" habitat management practices around buildings and other developed public use areas to enhance wildlife habitat, aesthetics and wildlife viewing opportunities for golf course visitors. Landscaping these areas with a diversity of wildflowers and berry-producing trees, shrubs and vines will attract numerous species of songbirds, small mammals and butterflies. Nest boxes placed on posts in semi-open habitat with scattered trees and short ground cover may provide nest sites for species such as bluebirds and tree swallows. Wood duck nest boxes also could be placed along the marsh border and in undisturbed forested areas within and adjacent to the wetlands. If nest boxes are considered, a monitoring and maintenance program should be implemented, perhaps with a local birding club or interested course users. **Information on native wildlife plantings and nest box design, habitat selection and monitoring may be obtained by contacting the CTDEP Wildlife Division (Sessions Woods Wildlife Management Area, Burlington - (860) 675 -8130).**

4) Avoid extensive cutting in and adjacent to the wetlands to minimize impacts to reptiles and amphibians and to maintain travel corridors for wildlife. In addition to leaving all stumps intact, the logs, limbs and brush presently found in the wetlands, should remain intact to minimize wetland and wildlife disturbance. A minimum of 100 feet of undisturbed vegetation left between any stream/wetland and any development or disturbance is

recommended. Although this is a minimum standard recommendation, the buffer will preserve at least some measure of habitat value, help to filter sediments and excess nutrients and reduce disturbance within the wetlands. Silt fences/haybales used during construction should be staggered in shorter lengths so as not to impede amphibian migration to and from the wetlands and removed following site stabilization.

5) Take all prudent measures to limit the amount of chemicals used in the operation of the course. If water quality and insect populations are negatively affected, the entire species complex using the property, including birds, mammals, amphibians and reptiles, can be negatively impacted, both on and off site.

6) If ponds are to be constructed, they could be constructed with gently sloping sides and varying water depths (6" - 3') to provide a diversity of aquatic plants interspersed with open water. Preserve or plant a buffer of vegetation around the ponds to provide additional food and cover. Maintaining even a small buffer (25' in width) of taller grasses and forbs around the ponds would lessen the potential for attracting nuisance Canada geese to the course by creating a natural physical barrier to their movement on and off the ponds. Minimizing pond size (1/2 acre max.) and the amount of feeding habitat (i.e., short grass areas) adjacent to the ponds, also may decrease their attractiveness to geese.

7) The reaction of some golf course visitors to naturalizing portions of the course may be negative because park-like settings with well-manicured lawns and ponds are generally considered to be more visually appealing. However, most will likely develop an appreciation of this type of management if an effort is made to inform them (e.g., interpretive signs, written materials) of the wildlife values and other environmental benefits gained.

Note: Audubon International in cooperation with the United States Golf Association has developed a golf course certification program to promote environmental stewardship on golf courses. Information may be obtained by contacting the Audubon Cooperative Sanctuary System in Selkirk, NY at (518) 767-9051 (See Appendix I).

Subdivision

Most of the recommendations above also would apply to minimizing the impacts associated with the subdivision. Primary consideration should be given to minimizing the extent of clearing during house construction and encouraging landowners to use natural landscaping techniques. A community outreach program could be implemented to inform landowners about water quality protection, the effects of habitat fragmentation, and the importance of forest and wildlife stewardship. Written materials on these topics have been developed through the University of Connecticut Cooperative Extension System's *Nonpoint Education for Municipal Officials* (NEMO) Project and Forest Stewardship Program. Information may be obtained by contacting the Haddam Extension Office at (860) 345-4511.

To develop the most effective strategy for protecting amphibian populations on the property, further investigations would be necessary to determine their major migration and dispersal routes. This information would assist in determining:

1) Which wetlands and upland areas are in greatest need of protection (i.e., establishment of conservation easements and designation of open space), and

2) Where the use of wildlife passage structures (e.g., amphibian and reptile tunnels) would be necessary to facilitate the movement of animals across roadways. Scott Jackson or Curtice Griffin at the University of Massachusetts, Amherst could be contacted for information on various types of structures and their appropriate

application. Where curbing must be used, Cape Cod style curbs (i.e., curbs at 45 degree angle) are recommended.

Priority sites for establishing conservation easements would be those that would protect substantial (500+') upland buffers around the vernal pools containing the greatest diversity and abundance of amphibians, and especially those that would maintain contiguous woodlands that connect clusters of vernal pools to the larger wetland complex and large blocks of undisturbed habitat. The conservation easements should prohibit further development, the creation of manicured lawns and the use of chemical applications to reduce the amount of "lost habitat," promote the retention of wooded habitat and reduce the potential for wetland contamination. The easements should not prohibit accepted conservation practices, such as timber stand improvement and wildlife habitat enhancement, from being conducted. The restrictions and uses for the conservation easements and open space should be clearly defined and incorporated into the deed of record and the boundaries marked in the field.

Trail System

It was not clear what type of trail is being proposed. A narrow, passive-use recreation trail with a natural substrate, one that would require minimal vegetation removal, maintain forest canopy closure and prohibit the use of motorized vehicles, would have the least impact. Traversing wetlands and steep slopes should be avoided whenever possible to minimize erosion and sedimentation problems. Where wetlands must be crossed, a boardwalk system should be used. If a paved, multi-purpose trail is established and curbing is necessary, again, Cape Cod style curbing is recommended. Potential impacts of the greenway trail on private property owners should be identified. Where the trail bisects private property, the access should be of adequate width and the trail well-marked to help avoid potential conflicts (e.g., trespass by trail users).

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Forest Resources

Vegetation

The vegetation which is present on this 1000 acre tract was inventoried, mapped and described for The Preserve LLC by Sasaki Associates, Inc. This information has been incorporated into the document **"The Preserve Project Impact Assessment" (April 1999)** and begins on page 39. A list of inventoried plant species and a Vegetation Cover and Habitat Map may be found in that document.

Field review of the site along with aerial photo interpretation found the vegetation information including the vegetation cover map presented in the document described above to be accurate and complete.

A majority of this property has received harvests that removed merchantable hardwood trees 16 inches in diameter and greater over the last twenty years. The latest harvest was implemented in 1997. In general the trees that remain are reasonably healthy and are responding with increased vigor to the space created by these harvests. Hemlock infested with the Hemlock Woolly Adelgid that were large enough to salvage as sawtimber were also harvested. The smaller hemlock which were not harvested are declining due to adelgid infestation.

According to the information given in the above referenced document no more than 494 acres of existing vegetation will be replaced with roadways, residences and residential landscaping. This estimate may be high because not all of the acreage proposed for house lots will be cleared of natural vegetation and re-landscaped. In addition, 100 acres of existing vegetation will be replaced with turfgrass for the golf course. The golf course routing plan also

suggests that existing trees will be incorporated into the design where feasible. Regardless, development of this magnitude will undoubtably create a major impact on the natural vegetation of this tract.

Mitigating Development Impact

Tree and vegetation clearing and removal will take place on a significant portion of this tract should development of the proposed golf course and residential complex occur. If development of this property does occur, the sawtimber size trees and pole size trees that are going to be removed should be tallied and sold as sawlogs and fuelwood rather than chipped and removed at a cost to the developer.

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

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

Water Quality And Vegetation Clearing

Healthy woodlands provide a protective influence on water quality. They stabilize soils, reduce the impact of precipitation and runoff and moderate the effects of adverse weather conditions. By so doing, undisturbed woodlands help to reduce erosion, sedimentation, siltation and flooding. Research has shown that soil protected by the cover of leaf litter and humus associated with woodland areas contributes little or no sediment to streams.

Improper and careless clearing of vegetation for development or commercial purposes including timber harvesting, may, however, lower water quality in several ways:

1) Erosion, siltation and sedimentation caused by improperly located and improperly constructed access roads, skid trails, yarding areas and stream crossings;

2) Siltation and sedimentation caused by logging debris left in streams, interfering with natural flows; and

3) Thermal pollution resulting from complete or partial harvesting of streambank vegetation, eliminating shade.

Water Quality And Timber Harvesting

In 1979, a field study and analysis of timber harvesting operations in Connecticut revealed no significant contribution to the degradation of water quality. However, this study did identify sedimentation resulting from erosion as a principal potential problem.

Felling trees does not generally cause erosion. Approximately 90% of sedimentation from harvesting operations originates from exposed soil on logging roads, skid trails and yarding areas. Most erosion and sedimentation associated with woodland harvesting activities occurs during and immediately after harvesting. The basic principles of erosion control needed to reduce or avoid damage to the environment during harvesting include:

1. Disturb as little land as possible.
2. Use erosion control measures to protect disturbed areas.
3. Reduce the speed and volume of runoff.
4. Divert runoff from disturbed areas.
5. Install perimeter controls around disturbed areas.
6. Conduct conscientious maintenance of erosion controls.
7. Assign someone the direct responsibility of implementing and maintaining erosion control measures.

A carefully planned, executed and completed harvest will have little negative impact on the environment.

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

Guidelines For Low Impact Timber Harvesting

A carefully planned, executed and completed harvest will have little negative impact on the environment.

Planning The Harvest

A plan should be developed by a Certified Professional Forester before starting each harvesting operation. A good plan, when followed, will reduce soil erosion and sedimentation and increase the efficiency of operations and profitability of the harvest.

To minimize potential erosion problems, the harvesting plan must consider the watercourses, soils and topography of the area. Useful tools used in planning the harvest operation may include: topographic maps, aerial photos, USDA soil surveys and property maps. Use of these tools will not substitute for an actual site visit. Obtaining the proper permits will be necessary before executing the harvest.

Executing The Harvest

Logging roads, skid trails and yarding areas should be located where water can be easily diverted, not in swales or other low points. Grades on logging roads should generally not exceed a 10% slope, however, short sections may approach a 20% slope to avoid obstacles. If possible skid trails should be kept on the high side of wet or steep areas. Streambeds or swales should never be followed as skid trails. Where unavoidable, streams may be crossed, but only at right angles. Bridges or culverts may be needed where hard stream bottoms are not present. Streams, springs, seeps, wetlands, vernal pools, poor drainage areas, rock outcrops and other obstacles should be located so that they may be avoided. The potential for damage to logging roads, skid trails and yarding areas from water erosion is greatest during active harvest operations. The implementation of a harvest operation should be closely monitored by a Certified Professional Forester.

Completing The Harvest

Erosion control measures should be properly installed as soon as possible after the harvest is completed or when harvesting has been temporarily interrupted for more than a few weeks. These measures include:

1. Grading major skid trails to fill in ruts and smooth rough surfaces.
2. Installing water bars where necessary to divert water.
3. Cleaning out drainage dips and natural drain areas.
4. Mulching skid trails on steep slopes with hay, brush and or slash to slow water flow and retain sediment.
5. Removing temporary structures such as culverts or bridges.
6. Grading approaches to stream crossings to approximate original conditions.
7. Cleaning up and grading yarding areas.

8. Seeding and mulching yarding areas, approaches to stream crossings and steep skid trail sections.
9. Closing off access to logging roads, main skid trails and yarding areas to discourage unauthorized use.
10. Periodically inspecting and maintaining erosion control measures.

Remember: A small amount of extra effort at the end of the harvesting operation can go a long way in protecting soil and water resources and in maintaining good landowner and public relations.

For more in-depth information please see: "Timber Harvesting And Water Quality In Connecticut: A Practical Guide for Protecting Water Quality While Harvesting Forest Products," prepared by the Connecticut RC&D Forestry Committee, 1990.

This publication and additional technical advice and information on best management practices, the harvesting of forest products or other aspects of forest management may be obtained from:

State Forester's Office
79 Elm Street
Hartford, CT 06106
(860) 424-3630

DEP Eastern District HQ
Division of Forestry
209 Hebron Road
Marlborough, CT 06447
(860) 295-9523

Extension Forester
Cooperative Extension System
139 Wolf Den Road
Brooklyn, CT 06234
(860) 744-9600

DEP Western District HQ
Division of Forestry
230 Plymouth Road
Harwinton, CT 06791
(860) 485-0226

For additional information on wetlands and government regulations related to wetlands and water bodies please contact:

DEP Water Resources
79 Elm Street
Hartford, CT 06106
(860) 424-3706

Greenways

The Greenways Team member did not have the opportunity to walk the property in question. Consequently, comments will be confined to generalities. It appears that the developer is making an effort to protect a portion of the parcel in open space. It is hoped that this will connect directly to property that the Town of Old Saybrook has recently purchased, as well as to existing parks. Buffers are recommended along waterways wherever possible, but deference is made to the DEP Water Resources Division to provide guidance in that area. Recreational pathways should connect to public trails, and should be surfaced in a way that will allow for the greatest number of users. Finally, it is hoped that the majority of the designated open space will not be turf grass, but a more natural mix of vegetation. There was some difficulty determining the ratio of grass to other open space based on the map that was sent.

Please feel free to contact the Greenways Program at (860) 424-3578 if there are any questions.

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").

Due to the size and potential impacts on natural resources of this project, the Department has recommended to the developer that the pollution control plan be submitted more than thirty days prior to the start construction. If the Department finds that the Plan is inadequate, Connecticut General Statutes Section 22a-430b and general permit Section 7(c) allow the Commissioner to require an individual permit, a process that could delay approval of the project for several months. In order to prevent this and to ensure adequate review time, the Department has requested early submittal of the plan. While the generalizations made by the "Project Impact Assessment", the "Soil Erosion and Sediment Control Plan" and the "Stormwater Management Report" concerning the construction and post-construction stormwater treatment systems are reasonable and appear in most instances to meet permit requirement, a detailed review of the accompanying plans was not conducted, and the Technical Appendix was not submitted or reviewed, so the numbers presented have not been checked by this reviewer. A more thorough review of the plans will be conducted prior to issuance of a stormwater permit by the Department.

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.

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

Due to the amount of soil disturbance, one of the best ways to minimize erosion potential is to phase construction in order to minimize unstable areas. However, due to the balance of cuts and fills, phasing in some areas will be extremely difficult, although it is addressed as a management practice in the narrative. The Plan must be flexible to account for adjustment of controls as necessary to meet field conditions. At a minimum, the plan must include interior controls appropriate to different phases of construction.

This project has extreme slopes and numerous wetland areas to be protected, which will make ongoing inspections and adjustments of controls a critical 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. In particular, since phasing will be difficult and a large amount of disturbance will occur at once, 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. Due to the size of the project and the variability and complexity of controls both shown on the plans and potentially needed, a full time erosion and sediment control inspector, approved by the Department, will be required by the Department during construction.

Section 6(b)(6)(C)(ii) of the permit requires the plan to address dewatering wastewaters which this site may generate. The reports do not detail the "dewatering pit" or state that discolored waters may not be discharged.

The plan did not include sizing calculations for the sizing of the Stormceptor treatment units.

As stated in the submitted reports, minimization of disturbed areas and prompt stabilization will be key aspects to avoidance of pollution from this project. A few immediate comments with regard to the "Soil Erosion and Sediment Control Plan":

- The geotextile fabric proposed must be specified, as there are some materials that are not suitable for Connecticut winters.
- The "viability" of seeding should be better defined.
- The "catch basin filter baskets" are not detailed on the plans or specified.
- Contrary to the statement in the Plan, velocity dissipation devices must be installed at ALL pipe outlets.
- The plan should state that dust control will be used "as needed"; in other words, there should be no runoff from dust control waters.

Overall, if the site systems function as described, the reports would appear to meet the goals of the stormwater general permit for limitation of impacts. However, due to the scope of the project and the site constraints, the potential for problems, particularly during construction, is high. A far more detailed review than is appropriate for this report will be conducted prior to issuance of any DEP stormwater permit.

On-Site Sewage Treatment and Disposal

The Preserve is a residential and golf facility development that is being proposed on approximately 1,000 acres in Essex, Old Saybrook and Westbrook. The proposed development will include 308 single family residences (282 in Old Saybrook and 26in Essex), an 18,000 sq. ft. clubhouse, 4 - 2 bedroom guest cottages, pool and tennis courts.

Sewage from the development will be collected, pretreated for BOD_5, total suspended solids and nitrogen reduction, disinfected and discharged to a constructed lateral sand filter for further treatment and disposal. This system would be deemed a community sewerage system.

Preliminary site testing has been performed and a preliminary conceptual design report for the on-site sewage treatment and disposal system has been prepared.

Based upon site testing, the soil profile, soil permeabilities, depth to ledge and depth to groundwater mottling, the existing soils and hydrogeologic setting have insufficient capacity to treat and dispose of the projected sewage design flows. To address these limitations the consultant has proposed the forementioned pretreatment facility and constructed lateral sand filter.

Regulatory jurisdiction for on-site systems that exhibit design flows in excess of 5,000 gallons per day is with the Department of Environmental Protection (the Department). The Department also is responsible for alternative treatment technologies which discharge to a land treatment system. These requirements are contained in 22a-430 of the Connecticut General Statutes and Section 22a-430 of Regulation of State Agencies.

Although a complete technical review has not been completed several issues should be brought forward for discussion and consideration.

These include:

1) A community sewerage system (as defined by Section 7-245 of the Connecticut General Statues) is being proposed where more than two residential buildings will be served by a single treatment and disposal system. It has been the Department's practice to make the local water pollution control authority aware of this matter and be assured that the authority will insure the proper operation and maintenance of the system. Various arrangements have been made on similar projects and reviewed and approved by the Department.

2) Because of the topography and surficial geology, conventional and alternative collection technologies should be reviewed and evaluated.

3) The design of the pretreatment facility shall be flexible to account for flows and loads from development start-up to completion.

4) The Department has been involved with a number of successful constructed fill sections. Sand fill selection, availability and placement can be difficult, time consuming and costly. It will be imperative that all parties involved with the sewage treatment and disposal system for this project closely coordinate their efforts.

Pesticides Review

Introduction

This chapter of the Environmental Review Team (ERT) report presents an evaluation of the site hydrogeology and its vulnerability to potential impact from pesticide use by the proposed project, The Preserve, a 308 home residential and golf course community, to be located in the towns of Essex, Old Saybrook and Westbrook, Connecticut. The initial meeting of the ERT members to begin the review of the The Preserve convened on March 29, 1999. The meeting was followed by a field inspection conducted by team groups over much of The Preserve 1000 acre parcel. In addition to the summary materials provided by the ERT coordinator, a descriptive brochure for The Preserve was provided. The project impact assessment of The Preserve, prepared by Sasaki Associates, Inc., was received by Team members around mid-May, 1999. Appendices for the Sasaki report became available during June and July of 1999. Additional materials reviewed for this chapter are listed in the References at the end of this chapter. Most of this chapter was written before all The Preserve project materials became available. Due to the ERT report deadline, insufficient time was available to complete the review of all project documents. The Pesticides Team member is available for telephone or e-mail consultation for any municipal official from the three town region.

Approach and Methods

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** is the pesticide usage, the **pathways** are described by the hydrogeology and the **receptors** are the downgradient and downstream water resources. Here, the water resource receptors include surface water in the form of streams, ponds, and wetlands, and groundwater occurring naturally and that which is extracted from wells for consumption or irrigation.

Background

Golf Course Pesticide Usage and Water Quality (Source)

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 has resulted in more studies and detections of pesticide 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, three of the 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 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 a 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 impacts.

One important condition prevalent in Connecticut, shallow depth to groundwater, 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.[4]

A pesticide's particular physical and chemical characteristics will influence its affinity for water. These characteristics are its solubility, half-life persistence, and the partitioning coefficient for water and soil organic carbon (KOC). (See Appendix G for definitions of pesticide physical and chemical properties.) These properties will influence how a pesticide will react with the ground and surface water and the soil/sediment matrix. For instance, a pesticide may readily solubilize in water and thus function as a "leacher" by infiltrating through to the groundwater. The amount of organic material present in the surface soil layer may influence this downward migration of a pesticide. Some pesticides exhibit a tendency to sorb onto or stick to soil particles. This tendency, while lessening the downward percolation of the pesticide, will function as a "source" for possible migration off-site together with the soil particles and surface water runoff. Usually, a pesticide will fall into one or the other category (to leach or to sorb). Unfortunately, it is difficult to satisfy both these conditions in order to mitigate impact to both surface water and groundwater.

Two critical elements related to pesticide products are:

1) How and when a pesticide's active ingredient degrades into a metabolite and how toxic that metabolite may be. A metabolite may exhibit more toxicity, less toxicity or be the same as the parent material. The half-life property of a pesticide is related to the conversion of some of the pesticide's active ingredient into its respective metabolite.

2) Knowing what the "inert" or carrier products are that are combined with the active ingredient of a product. Inerts can be ingredients as simple as water or be oils, surfactants or solvents that in themselves represent potential contaminants to water quality. 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 identify the inerts is to have and refer to the Material Safety Data Sheets (MSDS) for the product.

Once pesticide residues occur in water, their clean-up measures can be difficult, costly, ineffective and often incomplete. As an example, glyphosate, a popular nonselective, broad-spectrum, post emergent herbicide, commonly known as "Roundup", is regulated by the Safe Drinking Water Act (SDWA) Amendments of 1986. Under SDWA, a water utility must monitor for and potentially treat for specific compounds. The literature describes the ineffectiveness of removal of low levels of glyphosate in water by activated carbon treatment and ultrafiltration membranes. Other conventional treatments, such as coagulation, sedimentation and sand filtration did not remove glyphosate appreciably (7% removal).[5]

Site Water Quality Classification

Connecticut water quality classifications for both surface water and ground water over the 1000 acre Preserve site are classified as "A". For groundwater, the GA classification means that the groundwater is within the area of influence of existing private water supply wells or an area with the potential to provide water to *public or private* water supply wells. The groundwater is presumed suitable for direct human consumption or other domestic uses without treatment and must be maintained in that GA condition. For surface water, the Class A is likewise high quality water subject to Connecticut's anti-degradation policy, requiring the maintenance and protection of high quality waters. Class A surface waters are known or presumed to meet water quality criteria which support environment-designated uses. Those uses include: potential drinking water supply, fish and wildlife habitat, recreational use, agricultural and industrial supply and other uses. Similarly, surface water of

A quality must likewise be maintained in that classification. Immediately downgradient and downstream of the site are GAA sites, Community and non-Community Water Systems (CWS) in addition to many private wells (Figure 9).[6]

Hydrological Setting (Pathways and Receptors)

The entire 1000 acre site of The Preserve, both the surface and subsurface, constitutes its hydrogeological setting. The actual boundaries of The Preserve, however, do not limit the extent of the hydrogeological regime. Rather, the configuration of this parcel, because it is virtually surrounded by lower elevation watercourse and wetland areas, contributes to downstream and downgradient receptors as pathways of surface and groundwater from the site. Because of the proposed golf course, pesticide and fertilizer usages are activities and potential impacts originating on site that may migrate off-site. Therefore, all hydrogeological features, both off-site and on-site, must be considered. The hydrogeology includes all the forms of surface water such as on-site streams and ponds, including the major feature on the site, the Pequot Swamp Pond, the wetlands and the groundwater ubiquitous to the entire site. Groundwater moves under vertical and horizontal gradients through the soil layer, the underlying surficial sediments and through fractures in the bedrock. Soils and sediments are absent where bedrock is exposed over much of the area. Weathered rock thicknesses were not observed on site but rather eroded ridges with their contours modified by the effects of deglaciation.

On-site, the hydrogeology is chiefly governed by fracture occurrence and interconnectedness in the dominantly bedrock folded and faulted setting. In addition to in-situ fracture permeability, contacts between the several types of rock often serve as a groundwater flow path. Significant glacial deposits occur in the Ingham Hill Road area in Essex. These are ice-contact stratified

deposits. Here they are inferred to be valley train deposits which are characterized by compositional features that exhibit the better sorting of outwash deposits. Some neighborhood wells in this area are shallow, approximately 30' depth, tapping into these permeable deposits. This area is not only downstream but also downgradient from the principal area of the proposed site. Downgradient receptors also exist in the Ingham Hill Road area of Old Saybrook, along Route 153 in Westbrook and in Community and non-Community Water Systems to the east, west and northwest of the project area. Additionally, Natural Diversity Database (NDDB) localities of endangered, threatened or special concern species are abundant around the area.

The Preserve project site is located on an upland folded ridge and narrow valley sequence. The more prominent ridges are of resistant gneisses flanked by the narrow valleys of more erodible schists. The area straddles the headwaters of three major drainage areas and parts of three towns: the Oyster River, 5101, draining to the southeast and Old Saybrook; the Falls River, 4019, draining to the northeast and Essex; the Patchogue River, 5102, draining to the southwest and Old Saybrook. The downstream and downgradient influences/impacts must be considered particularly with regard to the pesticides and fertilizers commonly used on golf courses, as well as lawns. Because public water supply will be provided, individual private wells on-site are not an issue. The public water supply available for The Preserve site, however, may be pumped from the Community Water Systems just downgradient from the site. It is obviously in the interest of The Preserve project to protect its own water supply. Additionally, on-site watercourses and off-site watercourses, wetlands, and the groundwater ubiquitous to the entire site and the groundwater downgradient and private and public wells downgradient must be considered with regard to potential impact by the constituents carried by the site's surface water runoff and groundwater movement.

Aquifer Protection Areas (APAs) are located downstream and downgradient from The Preserve site. To the west, along Route 153, is a large Aquifer Protection Area. It is located in outwash deposits along Trout Brook, a part of the Patchogue River valley train. From the Bowie gravel pit on the upstream part of the valley train, where the deposits are compositionally like ice contact sediments, the gradation of the valley train transitions to outwash deposits on the downstream part of the valley train. The hydrogeological significance of the two morphological and depositional forms is that the outwash will likely be more permeable and transmissable since the deposits are better sorted and consist primarily of coarse-grained sand and gravel. In contrast, the ice-contact drift deposits upstream are more well graded, that is, consisting of a wide range of grain sizes. This texture will be more closely packed resulting in a lower transmissivity. To the east of the site, near Ingham Ponds, is an active Community Water System (CWS) wellfield located in similar outwash and ice contact stratified drift deposits. Naturally, the groundwater in these two aquifer systems must be protected and remain in high quality condition. If the anticipated public water supply is is obtained from the Connecticut Water Company from either of these CWSs, it becomes clear **how critical it will be for The Preserve, its residents and activities to not impair its own water supply.** As mentioned before, groundwater quality classification in the CWS areas is GAA, the highest level water quality classification. This means that the water is presumed suitable for direct human consumption without the need for treatment. Again, water quality must be maintained in this condition.

Recommendations and Comments

- The best option would be to adopt a complete "organic" approach golf course in the rural, Connecticut-style setting versus the manicured, high maintenance type of golf course. "Organic golf" means that courses are

built with a substrate of compost, are planted with water efficient grasses and the use of fertilizers, 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.

- Normally, on proposals of this nature, water quality monitoring for both surface water and groundwater is recommended. Overall water quality monitoring with regard to the proposed golf course should also include monitoring wetland water quality and pore water within the unsaturated zone via lysimeters. Monitoring pore water, particularly below the greens of a golf course whose design structure is conducive to vertical infiltration and horizontal permeability, is an obvious choice for early detection monitoring before off-site migration of groundwater and pesticide constituents has occurred. This is highly recommended as is a much broader monitoring network than is described in some of The Preserve plan documents that shows only two groundwater monitoring points. Due to the parcel size and configuration, the water quality monitoring network should be more widespread, include lysimeters for pore water monitoring and consider all downstream and downgradient receptor locations previously discussed.

- Pursuing certification through the Audubon International Cooperative Sanctuary Program for Golf Courses is highly recommended. This program encourages and recognizes golf courses taking a leadership role in habitat enhancement, use of Integrated Pest Management (IPM) measures,

and protection of water resources. Explanatory materials on this program are located in Appendix H. Thirty-two golf courses in Connecticut are enrolled in the Sanctuary Program. Of the thirty-two courses, five are reportedly fully certified. Connecticut DEP yearly summary records of pesticide usage for two fully certified courses were examined, and total amounts of pesticides in both liquid and granular form were calculated. These amounts were compared with other randomly selected golf course summary records to determine if in fact fewer total pesticides were used. The two certified courses used respectively 92% and 79% less total pesticides than did non-certified courses.

- Some useful cultural practices that reflect a strong Integrated Pest Management (IPM) approach for a golf course include: selecting drought resistant grasses, such as, perennial ryegrasses and fine leaf fescues; watering deeply and infrequently; and mowing frequently, cutting no more than 1/3 of the grass blade.

- At an August, 1998, American Chemical Society meeting, several researchers sponsored by the U. S. Golf Association reported low level pesticide and metabolite leaching occurring at golf courses. The article goes on to discuss the accumulation of pesticides in the thatch layer below turf but does not elaborate on how pesticide residues in the thatch layer can function as a "source" through the half life of a pesticide or its metabolite (breakdown product) and thus be susceptible and available for leaching by any subsequent rainfall percolating through the soil horizon. Phosphorus fertilizers were also reported leaching at significant levels two years after application.[9] Here, as in other reports of this nature, the results are viewed from a regulatory point of view - the implications being that low levels of pesticides are acceptable as long as the detections are below the MCL (Maximum Contaminant Level) or HAL (Health Advisory Limit). The

problem here is that many pesticidal active ingredients and their inerts do not have MCLs or HALs established. It also raises the broader question of whether low levels of pesticides in water should be viewed as an acceptable condition.

- Pesticide storage, mixing, handling and loading are critical issues to address. According to EPA Regulation in 40 CFR (Code of Federal Regulation), pesticides must be stored in a secured facility to provide human safety, reduce vandalism and theft and to protect groundwater and the surface environment (surface water, ground cover and air space). Lockable storage and containment provisions and devices for spills or leaks are essential. An outline highlighting the provisions for the storage of pesticides and pesticide containers that includes a sketch plan for a pesticide storage building is found in Appendix I.

- In addition to pesticide storage considerations, secondary containment, worker safety to include personal protective equipment (PPE), available showers and eye washes, proper ventilation and waste disposal handling must be addressed. Secondary containment refers to structures built around pesticide storage facilities to contain products that have escaped due to leaks, spills, fire, impacts, vandalism or ruptured tanks or bags. Secondary containment is essentially a back-up system to prevent the movement of pesticides into the surrounding environment.

- The following document, "Designing Facilities for Pesticide and Fertilizer Containment", Document MWPS-37, 1st Edition, 1991, available from the MidWest Plan Service, Iowa State University, Ames, Iowa 50011-3080 is recommended. Although prepared for the agricultural industry, it is useful for any operation contemplating the use of pesticides.

- Written spill contingency plans are essential for this type of facility. Connecticut reporting requirements for pollution incidents and clean-up responsibilities are included in Appendix J.

- Minimize pesticide usage by employing Integrated Pest Management (IPM) techniques into golf course management plans and practices. The underlying principle behind IPM is to strive for the reduction of or elimination of pesticide usage. An essential element of IPM is to correctly identify the pest, be it a weed, insect or fungus. Does the presence of the correctly identified pest constitute an infestation? In other words, there are threshold levels within which a pest population can be tolerated and no treatment measures are necessary.

- Employ curative rather than preventative measures when pest treatment is necessary. Curative deals with an actual pest problem after the fact while pre-emergent or preventative treatments deal with the assumption that a pest problem may occur.

- When considering the selection of herbicides, insecticides and fungicides for potential use on a golf course, it is recommended that a computerized risk assessment be conducted to determine the leachability and runoff potential of each pesticide evaluated with regard to the particular soil types at the site. Three available systems are:

  1) NPURG, National Pesticide/Soils Database and User Decision Support System for Risk Assessment of Ground and Surface Water Contamination;

  2) The SCS/ARS/CES Pesticide Selected Properties Database and;

  3) NAPRA, the National Agricultural Pesticide Risk Analysis, an automated pesticide risk screening process.

Not all pesticide compounds are included in these systems, however.

- Pesticide selection for a golf course should consider the solubility levels of the pesticide, in addition to the KD or KOC and the half-life in soil and water (See Appendix G). Suggested criteria values would be:

  Solubility = less than 10 ppm;
  KOC = more than 300 (a larger number KOC refers to less mobile chemicals);
  half-life = less than 7 days;
  And not commonly found in groundwater

If use solubility and half-life or use KOC and half-life are available, the absent criterion becomes an unacceptable value.

Another protective criteria might be the use of the GUS or Groundwater Ubiquity Score of small or extremely small for leachability potential. The relevant pesticide characteristics should be evaluated in conjunction with the particular soil type on which it is applied. To reiterate, while the pesticide's characteristics may be favorable to impede infiltration to groundwater, those characteristics may result in a higher runoff potential to surface water.

- Many golf courses, both existing and proposed, are planning for or have in place a strategically designed monitoring well network to monitor for pesticide occurrence and movement in groundwater. Surface water including ponds and streams should also be monitored for pesticide occurrence. Refer to attached documents in Appendix H. When considering this option, it is important to ascertain the feasibility and practicality of conducting the laboratory analysis for the particular compounds of interest and their metabolites. Before pesticides are chosen for use, a determination should be made about whether laboratory

equipment, methodologies and expertise are available to test for these compounds.

- A **Pesticide Management Plan** for a golf course should contain the following provisions:[10]

  General Policy - Goal Statement
  Description of Pest Problems
  Pest Management Practices to be Used
  Methods of Pest Monitoring
  Pesticide Storage and Handling Procedures
  Irrigation Practices
  Unique Features designed to Minimize Pests
  Pesticide Application Buffer Zones

- Certain types of pesticides should be avoided entirely, such as, category I acute toxicants, reproductive toxicants, the most hazardous neurotoxic organophosphate and carbamate pesticides, probable and possible human carcinogens and endocrine disrupters.

- Incorporate Integrated Pest Management (IPM) practices in all circumstances of potential pesticide use. The IPM approach should describe in detail ways to eliminate or significantly reduce the use of pesticides. Reducing or eliminating pesticide use is the most direct way to lessen human exposure to pesticides via air or water.

- Finally, pesticide applications and applicators must conform to the statutes and requirements of the Connecticut Pesticide Control Act, C.G. S. Chapter 441, Part I and II, particularly in regard to the appropriate certification of the applicator, and the registration of the product contemplated for use. Extreme care must always be used when handling and applying pesticide

products. Special attention must be directed to label directions for use, proper mixing and loading procedures and any precautionary statements that appear on the label.

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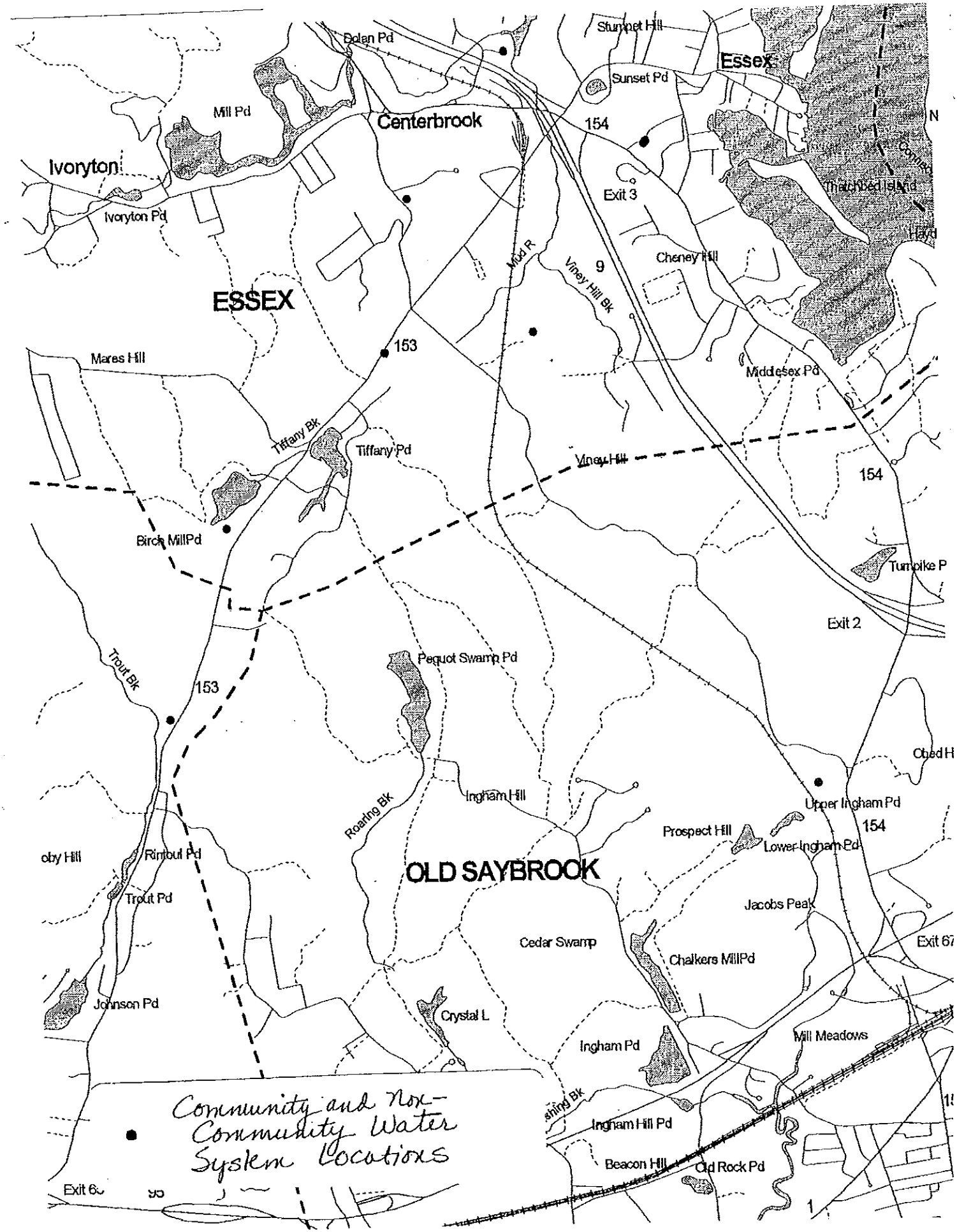

Dolan Pd
Sunset Hill
Essex
Sunset Pd
Mill Pd
Centerbrook
154
Ivoryton
Exit 3
Ivoryton Pd
Mud R
Viney Hill Bk
9
Cheney Hill
ESSEX
153
Mares Hill
Middlesex Pd
Tiffany Bk
Tiffany Pd
Viney Hill
154
Birch MillPd
Turnpike P
Exit 2
Pequot Swamp Pd
Trout Bk
153
Ingham Hill
Roaring Bk
Upper Ingham Pd
154
Prospect Hill
Lower Ingham Pd
Rimrock Pd
OLD SAYBROOK
Trout Pd
Jacobs Peak
Cedar Swamp
Chalkers MillPd
Johnson Pd
Crystal L
Ingham Pd
Mill Meadows
Community and Non-Community Water System Locations
Ingham Hill Pd
Beacon Hill
Old Rock Pd
Exit 6

Archaeology

The Preserve was reviewed by the Office of State Archaeology and the Connecticut Historical Commission for historical and archaeological sensitivity prior to the Environmental Review Team request. In that review process, the project area was deemed sensitive to archaeological resources. A Phase I historical resources and archaeological reconnaissance survey was conducted by Archaeological Consulting Services, Inc., in order to identify any significant historic structures and archaeological resources which might be adversely effected by the proposed development project. Our state agencies concurred that the archival and archaeological methodologies conducted by Archaeological Consulting Services, Inc., were consistent with state-of-the-art standards in archaeological survey.

This survey identified two historic Euroamerican features and four prehistoric Native American archaeological sites on the property. The development of The Preserve should have no adverse impact on existing historic structures and archaeological sites identified. These cultural resources are located in the proposed open space area. However, should changes to the proposed plans occur and the open space area where these archaeological sites are located is effected by development activities, then further archaeological fieldwork would be warranted to mitigate the cultural resource.

The Office of State Archaeology and the Connecticut Historical Commission are confident that the proposed plans for The Preserve should have no adverse effect on the state's archaeological heritage.

Planning Considerations

Summary

As an overall comment, The Preserve, a 308-lot subdivision, 18-hole Jack Nicklaus designed golf course and country club, is by far the largest project of any classification seen in the shoreline area in many years. In comparison, The Preserve represents almost twice the lots of a recently approved residential subdivision in nearby East Lyme, The Orchards, that town's largest single-family development in almost 25 years.

Of the approximately 1000 acres encompassing the entire site, 933 acres are located in Old Saybrook, 65 acres are located in Essex with 2 acres in Westbrook. Two hundred and eighty two of the 308 residential lots will be located in Old Saybrook, while the remaining 26 lots will be located in Essex. No lots are planned for Westbrook. The 18 hole, 72 par golf course and country club facility will be located in Old Saybrook and will be built in topographically lower areas of the center of the property around wetlands and Pequot Pond. Primary access will be from a point on Route 153 in Westbrook while a secondary access point located on Ingham Hill Road in Essex will serve the 26 Essex lots. Several other "municipal only" gated entries will be located at the eastern end of Barley Hill Road and near the northern end of Ingham Hill Road, both in Old Saybrook. Planned roadways within the development, totaling approximately 4.3 miles, will be built to town road standards. A community septic system and treatment plant located within the northern portion of the golf course, fed by a series of gravity and force-fed mains, will consist of a bio-oxidation and membrane filtration treatment facility with ultraviolet disinfection and a sand filter subsurface disposal field. Water for both domestic and irrigation purposes will be provided by the Connecticut Water Company from both the Guilford and Chester Systems.

The developer also plans to include a nature trail for use by the general public.

Review Comments/Concerns

The following constitutes the results of the general review conducted by the Connecticut River Estuary Regional Planning Agency for the ERT process. The review is based upon meetings held at the beginning of the ERT process and the Project Impact Assessment, dated April, 1999, as well on several discussions held with planning officials around the state. General planning issues raised as a part of this review process are as follows:

Traffic Circulation Issues

The designed traffic circulation for the subject property focuses on a primary access point off Route 153 in Westbrook. This primary access point is designed to serve the 282 residential lots and golf course located in Old Saybrook. A secondary access point serving the 26 lots located in Essex will connect to Ingham Hill Road in that town toward the northeast corner of the property. In an effort to allow for additional but restricted access, the developer is proposing the installation of several "municipal only" gates in Old Saybrook, one at the end of the Barley Hill cul-de-sac at the eastern end of the property (entrance to Phase 3), and two off Ingham Hill Road near the northern end of that road. The "municipal only" gates will be activated by security cards that will be issued to emergency personnel and bus drivers working for the Old Saybrook school system.

Dispersion of Traffic from Major Generator

A common practice in planning when designing a major traffic generator is to disperse traffic in several directions to the greatest degree possible, thereby reducing traffic impacts in any one or two locations. The proposed design,

with its one major entrance on Route 153, does not take advantage of such a dispersive traffic circulation pattern. In order to achieve better dispersion of traffic from The Preserve, an improved design may be to connect the proposed town roads within The Preserve to existing town roads in Old Saybrook, specifically Ingham Hill and Barley Hill Roads. This improved plan would necessitate removal of "municipal only" gates from the proposed plans and allow a continuous interconnection between existing and proposed roads. The result would be to alleviate, to a great degree, concerns of traffic volume impacts on Route 153 and disperse traffic from the development in a number of directions. This, of course, will raise other issues and potential impacts with respect to the likely need for Ingham Hill Road improvement.

"Municipal Only" Gates

Along with the traffic dispersion issues cited above, concern is raised over the restricted access created by the use of "municipal only" gates. An investigation of gates or similar devices throughout Connecticut used to restrict access suggests that such options are used primarily in private communities served by private streets (examples of such communities were cited by planning officials in the Greenwich and New Canaan areas of Fairfield County). Other than the private resident's access privileges, gates are usually operated through the use of keys by emergency personnel only with others allowed access only through residents. Although the infrequent, key-operated emergency access appears to work well in these communities, planners and engineers contacted were concerned with the logistics of allowing daily use of such gates by school buses, as proposed by the developer. Concern is also raised with respect to other daily activities including daily mail delivery and other service and delivery activities originating in Old Saybrook. In a report to this Agency dated May 12, 1999 from the Connecticut Conference of Municipalities (CCM), issues concerning the legality of restricting the access of town roads to residents of The Preserve were also raised. The town, through

Roadway Construction

A level of detail is necessary regarding the amount of blasting that will likely be necessary to build the road system. Submitted materials indicate that 136,000 cubic yards of materials will be blasted within Phase 1 of the project alone. Questions arise regarding what volume of bedrock will likely be removed throughout the development and how and where that material will be used or disposed of. Will bedrock removed for the construction of roads be crushed on site and used elsewhere for fill? What schedules will be developed for the days and hours of construction operations that could impact adjacent property owners including blasting, rock crushing, the transporting of materials by truck, routes of delivery or removal of construction materials, estimated number of truck trips, location of material stockpiles, location of staging areas with respect to sensitive resources, etc. The developer has developed a plan for pre- and post blasting inspection of adjacent structures. Although notice of blasting will be made for property owners within 500 feet of blasting, is it reasonable to think that damage to both structures and private wells (all or most of the surrounding properties are currently serviced by private wells) would not be likely outside of the proposed 250 foot inspection distance?

Community Septic System Construction Details

Submitted materials indicate that the septic system alone will require approximately 123,000 cubic yards of a specific grade of sand. In that large tractor trailer dumpers hold approximately 30 cubic yards of material and that the specific grade of sand will have to be imported, there will be in excess of 4000 tractor trailer-sized truck trips to the property for septic system construction alone. This raises questions of where the material source will be, where the trucks will be travelling from and which roads will be used to access the site? Will the access routes and substantial truck traffic adversely impact any residential areas or interfere with existing traffic patterns to any great degree? What will the schedule of delivery be for the delivery of

materials given the tremendous number of trips that will likely be involved? How will the developer mitigate potential adverse impacts of a large number of truck trips through the area to the greatest extent possible?

Although the community septic system would be under the authority of the Connecticut DEP, other pertinent septic system construction details necessary for local review include plans showing staging and stockpile areas, soil erosion and sediment control measures, the location of sensitive resource areas in and around the construction site and, potentially, plan and cross sectional views of the system itself and its relation to adjacent construction, i.e., the golf course.

Golf Course Construction

Similar to issues regarding construction of the septic system, questions arise with respect to how many additional truck trips to the site will occur? Will materials brought in to construct the golf course be delivered within the same time frame as the septic system materials or scheduled at a separate time? With respect to both septic system and golf course construction, where will material stockpiles and construction staging areas be located with respect to wetlands and other resources and where will access roads be constructed so as to avoid construction impacts to those stockpile and staging areas?

Construction of Irrigation Pond

Assessment materials indicate that the golf course will be serviced by an irrigation pond fed by public water from the Connecticut Water Company. Submitted plans do not show the location of or discuss in any detail the construction of such a pond. Details should include the location and size of the pond, its proximity to sensitive resources, where excavated materials will be stockpiled and used and how materials will be stabilized. Sedimentation and erosion control plans will be important to insure that the presumably large amount of excavated soil will be stabilized and surrounding wetlands

and other resources sufficiently protected. Depending upon the location of the pond, will blasting be necessary or will it be excavated out of existing soils?

Underdrains from Tees and Greens

The proposed drainage design includes underdrains to adequately drain storm water from the tees, greens and fairways on the golf course. In that many of the tees, greens and fairways are within close proximity to sensitive resources and that much of the pesticide/fertilizer application program will likely focus on these areas of the golf course, are 50 and 25 foot underdrain discharge point separating distances adequate to minimize potential adverse impacts to those resources?

Community Septic System Maintenance And Operation

Given the system is dependent on a network of gravity and force main collection systems as well as a bio-oxidation and membrane filtration treatment facility, a major concern that is not addressed in the materials submitted to the Connecticut River Estuary Regional Planning Agency is how the community septic system will be maintained/repaired and operated. Will an association of property owners be financially responsible for the maintenance, repair and operation of the treatment plant? Some have articulated the concern that if failure of any fashion or degree occurs and there is not an adequate maintenance agreement in place, the Towns, or more likely, the Town of Old Saybrook, will be responsible for overseeing the system repair. As one might guess, a residential subdivision cannot be "shut down" in the event of system failure like a shopping center could be.

In the event of septic system failure, responsibility for ground water protection would likely fall to the Old Saybrook Water Pollution Control Authority. As a result, additional questions to resolve would include whether or not a septic system in Old Saybrook servicing residences in Essex would

impact the type of agreement that will be needed to protect the two municipalities from responsibility for correction of such difficulties. With septic in one town and houses in another, who would be responsible for corrections and abatement orders?

Interestingly, this issue of local responsibility is a concern expressed by the Connecticut DEP when it comes to town-wide efforts to promote community septic systems as a solution to Old Saybrook's ongoing ground water contamination issues. If The Preserve can satisfactorily establish, operate and maintain the proposed community system including developing a binding and effective agreement, **the Town should look at this as a model that can be followed in its efforts to use the community system approach to town-wide septic disposal problem.**

The Preserve Nature Trail System

Early presentations by the developer suggested that The Preserve would include a substantial nature trail system that would encircle a large part of the approximately 1000 acre parcel. If an extensive nature trail system is a part of the proposal for The Preserve, submitted materials include little information to support the proposal. Although several trail outlines can be found on proposed residential lots to the west, northwest and north of the proposed golf course, the shorter than anticipated trail system appears somewhat discontinuous and does not include a clearly delineated or labeled parking area or beginning point/ending point. Rather than being a walkway through the woods of residential backyards on the extreme western side of the development, original presentations and descriptions by the developer led to the anticipation that the nature trail would extend throughout the natural areas and presumably be located on public lands donated to a local group such as the Old Saybrook Land Trust. Based upon the little information presented

in the Assessment, this apparently may not be the case. Being on private properties to a large extent, will the "trail" system be cleared in any way to improve how easily walkers or hikers will be able to pass or will hikers just be walking through the woods in someone's back yard? Will each property include an easement allowing the public to pass through each private property? Despite the "public" nature of the trail, what will happen if one or several property owners are unwilling to allow access across their land for the purposes of public access? Will the trail system be cleared? If not cleared, will the trail system at least be marked by signs with arrows every several hundred feet directing the hikers through the woods? Will there be other nature trail areas proposed for the property that aren't currently shown on the submitted plans? Who will bear the responsibility for maintaining the trail system? Who or what group will be liable for any accidents that may occur while hiking the nature trail system? The discontinuous appearance of the trail also suggests that portions of the trail will include the proposed roadway system. Are sidewalks or graveled walkways planned for these street areas that connect the trail?

In summary, submitted plans do not include a specific enough delineation and description of the nature trail system and associated amenities including parking areas and access points for review purposes.

Golf Course Design, Construction, Operation And Management

Review of submitted materials regarding the design, construction, operation and maintenance of the 18 hole Jack Nicklaus-designed golf course indicates that the developer intends to keep disruption of the natural landscape to a minimum to the greatest extent possible. This includes removal of a minimum of tree cover and ground vegetation to allow for access to the areas of the course as well as "shot making" (decisions regarding such vegetation removal occurs at the time of construction making it difficult for plan

reviewers to understand the extent to which such activities will occur). As with most golf course developments, however, a substantial amount of materials will be moved around the construction site (the golf course is included as a part of 629,000 cubic yards of earthwork in Phase I of the development), primarily in the form of cuts and fill. Additionally materials will be brought to the site to construct the golf course.

Lack Of Specific Construction Plans

Application materials discuss the placement of double silt fences in areas where disturbance will come in close proximity to sensitive resources. This approach places the responsibility of installing and maintaining such protective devices in the hands of construction personnel. Although the developer states that site personnel will be specifically hired to and be in charge of overseeing such activities, a lack of specific plans does not enable local enforcement personnel, including wetlands and zoning enforcement officers, to inspect a site for compliance with approved construction plans. Will specific golf course plans be submitted at a large enough scale to allow for review of potential impacts to sensitive resources?

Pesticide And Fertilizer Management Plan

Submitted materials indicate that the developer plans to incorporate a state-of-the art golf course management plan into the maintenance and operation of the pesticide and fertilizer application program. Management plans include chemical source reduction through Application Controls, Release Controls and Monitoring. This overall program relies heavily on a monitoring program that is only as good as the personnel hired to oversee and operate the program. That, however, is the nature of a management program such as this. The community (both The Preserve homeowners and the surrounding community-at-large) has to rely on the developer to oversee the management plan personnel to assure that established management procedures are being carried out so that excess chemicals do not contaminate area resources. If that

is the case, the proposed management plan appears to be the best available for golf course turf management.

Pesticide/Fertilizer Storage/Operation Facility - One concern is the lack of a plan or explanation indicating how pesticides and fertilizers will be stored on the site and how equipment used to apply such chemicals will be cleaned and stored so as to protect against resource contamination to the greatest extent possible. As with most golf course facilities, it is anticipated that the proposed golf course will likely include a groundskeeping/equipment storage structure with specified chemical storage areas. Plans reviewed by this office for other such proposals have included underground storage tanks for collection of rinse water resulting from periodic or daily cleaning of equipment contaminated with pesticide and fertilizer chemicals. A specific site plan showing these facilities and a specific management plan describing the reuse or disposal of such chemical rinsate and the general operation of such a facility should be included with the application as well.

Ground Water Monitoring Plan

The monitoring plan spells out how ground water and surface water resources will be tested during pre-construction, construction and post-construction phases of development. Submitted materials indicate that results of all monitoring activities will be entered into a computer spread sheet and retained on site. It may be advisable to have such reports submitted to local town health departments for review as well. In this way, an independent observer could oversee the management plan and maintain a file at the local level.

Storm Water Management

The developer has stated his intention to control the rate of runoff from the site so that the pre-development rate is not exceeded through the use of a system of detention storage basins. There is no information in the Project Impact Assessment with regard to specific designs or locations of such detention storage basins. Although storm water management will likely be reviewed by consulting engineers representing the towns, basins designs and locations and their descriptions should be included in application materials so that questions of location, design, landscaping, ownership/ maintenance and safety issues can be fully addressed.

Conclusion: Large Development Vs. Many Smaller Developments

Many residents of Essex, Old Saybrook and Westbrook have expressed a concern over the size of the proposed development known as The Preserve. As stated earlier, very few can remember as large a project as The Preserve anywhere on the shoreline. A project of this magnitude can have many potential impacts including the loss of what may be the largest piece of unprotected open space on the upper Connecticut coast.

From the standpoint of a planner, if development is inevitable, a large project such as this can be looked at in several ways. First, if the developer is successful in acquiring all necessary approvals and permits from local, state and federal agencies, the resulting development will be a very large, but integrated plan of interconnecting roads with large areas of open space (including the proposed golf course); generally, a well-planned development of a large parcel of land. This approach of developing a large parcel based upon a single plan has its benefits. Alternatively, another development

approach has the town looking at the 1000 acre parcel being "carved up" into a potentially large number of cul-de-sac accessed subdivisions as the property is sold off in pieces, pieces that would not likely be integrated in any meaningful way. Small parcels of open space associated with each of these subdivisions may or may not be interconnected nor provide an optimum benefit to humans *or* wildlife. Interconnecting roadways, an important infrastructural consideration, will continue to be lacking in that part of town.

Transportation

The Connecticut Department of Transportation has reviewed the possible traffic impacts related to The Preserve development and offers the following information:

The towns involved, Essex, Old Saybrook, and Westbrook, must first grant approval to the developers before they can go forward with the project, and a State Traffic Commission (STC) certificate application must be submitted and approved and other related permits satisfied before construction of the project can begin.

ConnDOT's Division of Traffic Engineering has conducted a preliminary review as it relates to the STC major traffic generator certificate application requirements. Based on their review, the following comments are offered:

- Generated volume/distribution appear reasonable
- Study area is acceptable
- Signal warrant analysis will be required for those locations where traffic signals are proposed.
- Detailed capacity analysis will be required for the signalized/unsignalized intersections significantly affected by the development.
- 40-scale plans for the site driveway intersection will be required.

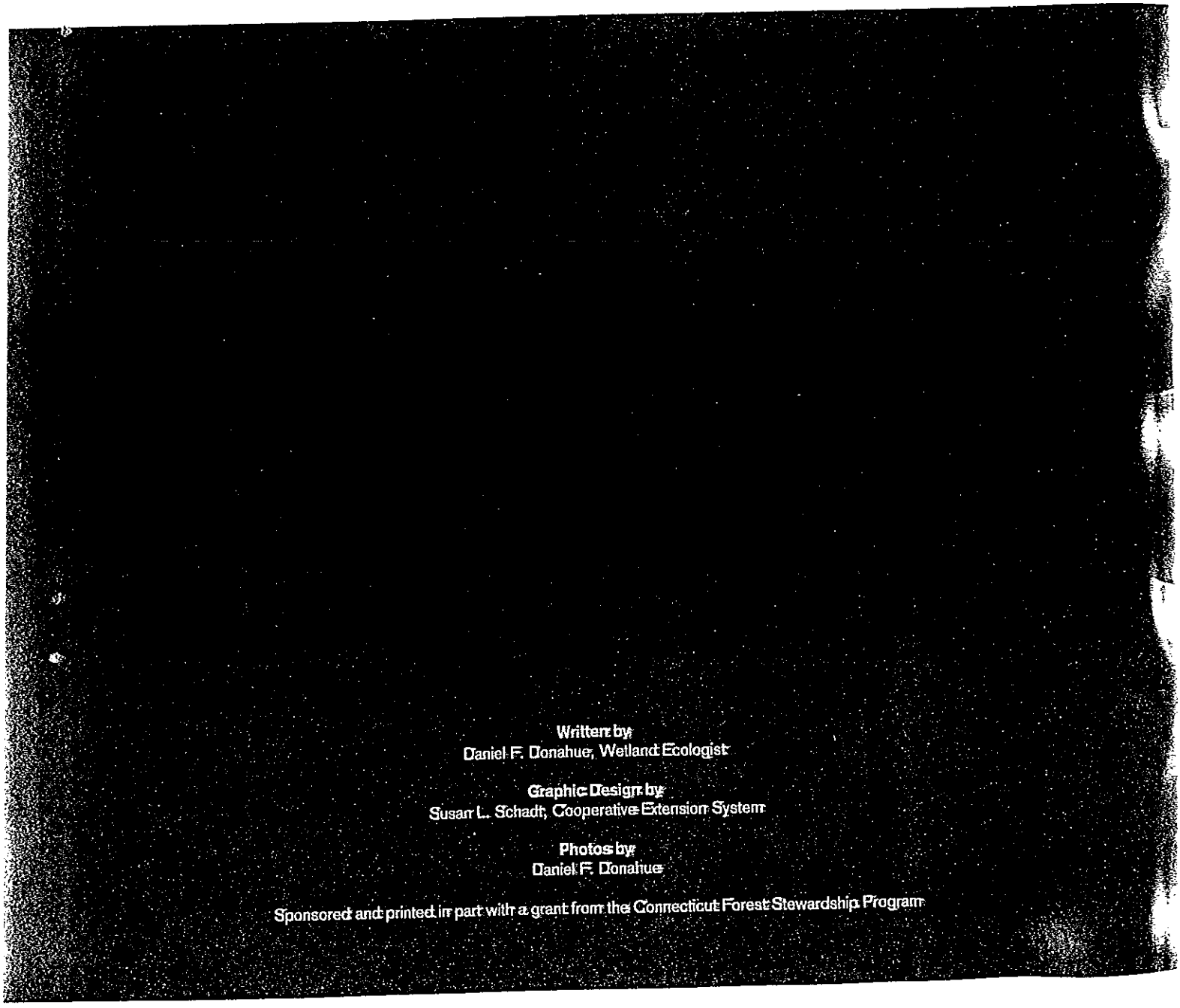
If there are any questions or a need for further assistance regarding this matter, please call (860) 594-2145.

Appendix A

A GUIDE TO THE

VERNAL POOL WETLANDS OF CONNECTICUT

IDENTIFICATION AND PROTECTION OF



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WHAT ARE VERNAL POOLS?

Vernal pools are small bodies of standing fresh water that are most obvious in the landscape during the spring of the year. They are usually temporary in nature. Vernal pools derive their name from *vernalis*, the Latin word for spring because they result from various combinations of snowmelt, precipitation, and high water tables associated with the spring season. For a vernal pool to exist, there must be a source of water and an enclosed basin which traps the water for some period of time. The depressions may be natural or of human origin, and they dry out most years and are fishless.

In order to meet the definition of a vernal pool, a wetland must have the following physical characteristics:

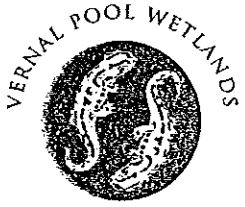
- It contains water for approximately two months during the growing season;
- It occurs within a confined depression or basin that lacks a permanent outlet stream;
- It lacks any fish population; and
- It dries out most years, usually by late summer.

WHERE ARE VERNAL POOLS FOUND?

Vernal pools can be found throughout the Connecticut landscape in a wide variety of vegetation types and landforms. They are commonly found in depressions in glacial till soils where bedrock and/or impervious soil layers restrict the downward percolation of surface water, and evaporation and transpiration account for the only loss of water. Glacial till uplands dominate the landscape in the eastern and western portions of the state.

Soils formed in glacial lake deposits also have a relatively impervious soil layer that effectively traps water in depressions. Areas of glacial lake deposits are scattered throughout the state, but are most common in the northern half of the Central Valley.

Vernal pools are also found where seasonal changes in groundwater levels intercept the ground's surface and cause ponds to form in kettle hole depressions, red maple swamps, river floodplain oxbow ponds, or in excavations such as gravel pits and quarries. The principal loss of water in these situations is from a combination of both evaporation and subsidence of the groundwater.



WHAT MAKES VERNAL POOLS SPECIAL?

The vernal pool is a unique microhabitat in which a number of wildlife species prosper. Some species are so well adapted to this environment that they are not able to successfully reproduce elsewhere.

The vernal pool involves a series of interactions between plants and animals from both terrestrial and aquatic habitats. Certain deciduous trees and shrubs adapted to seasonally flooded soils grow around the edges of the pool. Each fall they shed their leaves which collect on the bottom of the depression. This leaf litter is broken down by fungi and bacteria. When the pool fills in the spring it becomes a principal source of nutrients for macroinvertebrates including mollusks, crustaceans, and insects. These macroinvertebrates are consumed by salamander larvae, reptiles, frogs, toads, some birds, and each other. Species such as fairy shrimp and mosquito larvae are especially important food sources for amphibians that depend entirely on vernal pools for breeding and early development. These amphibians, in turn, are a source of biomass in the forest ecosystem.

In late March and early April, wood frogs and spotted salamanders migrate on the earliest warm, rainy nights and enter the pools where mating occurs and eggs are deposited on submerged twigs. The larvae will begin to grow

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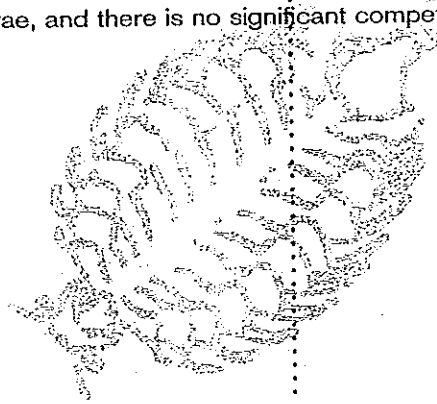
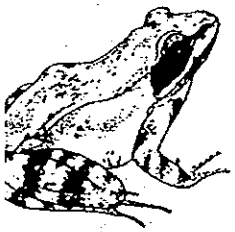
WHAT MAKES VERNAL POOLS SPECIAL?

(continued from page 6)

by using the nutrients contained in the eggs. When they emerge from the eggs they will feed on plant material and aquatic invertebrates in the water column. While the wood frog tadpoles pursue a vegetarian diet, the larval salamanders are carnivorous. Upon metamorphosis, juvenile amphibians leave the vernal pool for the surrounding upland habitat where they forage for food the remainder of the year. The following spring the cycle will be repeated.

One of the most important physical characteristics of vernal pools is that they dry out most years and are, therefore, inhospitable to fish. Under these conditions, amphibian breeding is more successful because there are no fish to feed on their eggs and larvae, and there is no significant competition for macroinvertebrate prey.





BLIGATE VERNAL OOL SPECIES

mphibians

Spotted salamander *(Ambystoma maculatum)*
Jefferson salamander *(Ambystoma jeffersonianum)*
Marbled salamander *(Ambystoma opacum)*
Wood frog *(Rana sylvatica)*
Eastern spadefoot toad *(Scaphiopus h. holbrookii)*

nvertebrates

Fairy shrimp

WHAT SPECIES OF WILDLIFE ARE FOUND IN AND AROUND VERNAL POOLS?

Vernal pools provide habitat for a wide variety of terrestrial and aquatic creatures. Upland species will use them as watering holes during periods of seasonal flooding. Many species of songbirds are attracted to them because of concentrations of insects and the prolific growth of seed and fruit-bearing shrubs.

There are certain amphibian and macroinvertebrate species that rely entirely on vernal pools for breeding and early development. These are referred to as obligate vernal pool species. Among the obligate amphibians are three salamanders, a frog, and a toad. Several mole salamanders, so-called because they spend much of their lives underground except for a short breeding period, are the spotted salamander *(Ambystoma maculatum)*, Jefferson salamander *(Ambystoma jeffersonianum)* – a Connecticut Special Concern species, and marbled salamander *(Ambystoma opacum)*. The spotted and marbled salamanders are more common and evenly distributed throughout the state,while the Jefferson salamander is more limited in distribution. The wood frog *(Rana sylvatica)* and the Connecticut Endangered eastern spadefoot toad *(Scaphiopus h. holbrookii)* are also thought to be entirely dependent on vernal pools for successful breeding.

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The principal obligate macroinvertebrates of interest in Connecticut are the fairy shrimp. Crustaceans about an inch long and orange in color, they glide gracefully along while lying on their backs. They hatch when the pond fills during early spring rains, grow, breed, and die. Fairy shrimp do not exist in permanent bodies of water.

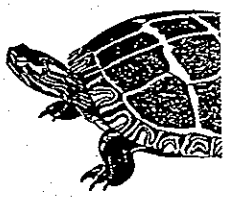
Amphibians and macroinvertebrates that occur in other types of wetlands as well as vernal pools are classified facultative, meaning that they will live and reproduce in vernal pools some of the time, but are not limited to them. These include certain amphibians, snails, fingernail clams, and the larvae of mosquitos and certain predatory caddisflies.

The blue-spotted salamander *(Ambystoma laterale)* – a Connecticut Special Concern species, green frog *(Rana clamitans melanota)*, pickerel frog *(Rana palustris)*, northern spring peeper *(Pseudacris c. crucifer)*, gray treefrog *(Hyla versicolor)*, and the eastern American toad *(Bufo a. americanus)* are all known to use vernal pools for breeding and early development.

Turtles that are known to use vernal pools include the snapping turtle *(Chelydra s. serpentina)*, painted turtle *(Chrysemys picta)*, and spotted turtle *(Clemmys guttata)*. Turtles may use the pools to breed but lay their eggs on land, and the pools may provide seasonal foraging habitats for these turtles.

The red-spotted newt *(Notophthalmus v. viridescens)*, and redback salamander *(Plethodon cinereus)* are often found in the vicinity of vernal pools but are not dependent upon them. The redback salamander is a common terrestrial species that does not breed in vernal pools.

Each group of organisms adapted to existence in vernal pools has some distinctive mechanism to survive the drought period. These organisms are unique and lend an exciting aspect to what might otherwise be considered just another wet place in the woods.



FACULTATIVE VERNAL POOL SPECIES

Amphibians

- Blue-spotted salamander *(Ambystoma laterale)*
- Green frog *(Rana clamitans melanot*
- Pickerel frog *(Rana pal*
- Northern spring peeper *(Pseudacris c. crucifer)*
- Gray treefrog *(Hyla versicolor)*
- Eastern American toad *(Bufo a. americanus)*

Reptiles

- Snapping turtle *(Chelydra s. serpentina)*
- Painted turtle *(Chrysemys picta)*
- Spotted turtle *(Clemmys guttata)*

Invertebrates

- Snails
- Fingernail clams
- Mosquito larvae
- Predatory caddisflies

ERNAL POOL HYSICAL HARACTERISTICS

It contains water for approximately two months during the growing season;

It occurs within a confined depression or basin that lacks a permanent outlet stream;

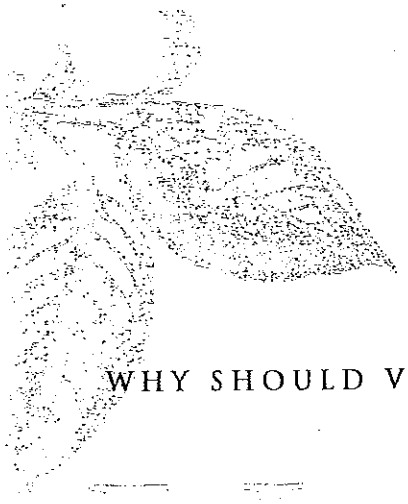
It lacks any fish population;

It dries out most years, usually by late summer.

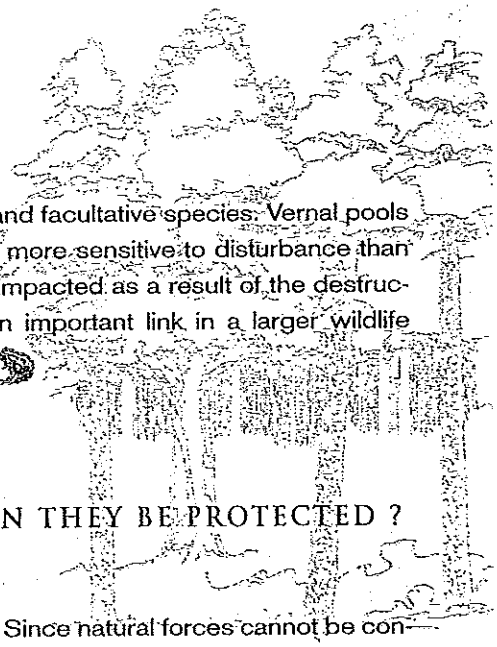
HOW ARE VERNAL POOLS CONCLUSIVELY IDENTIFIED?

A combination of physical characteristics and the occurrence of one or more obligate wildlife species are necessary to confirm the existence of a vernal pool. Physical characteristics include a confined basin with no permanent outlet stream, and standing water for approximately two months during the growing season. Obligate species include spotted, Jefferson, and marbled salamanders, wood frogs, eastern spadefoot toads, and fairy shrimp.

Vernal pools are more difficult to identify when they are dry. Look for a sparsely vegetated basin with leaf litter stained black or grey from being under water. From mid-September to late November you may need to brush away the most recent leaf litter to find the stained leaves. There may also be trees with water stains on their trunks as a result of seasonal flooding. One tree species that is especially well adapted to seasonal flooding is the pin oak *(Quercus palustris).* If one or more of these characteristics is present the site is worthy of further investigation.



WHY SHOULD VERNAL POOLS BE PROTECTED?



ernal pools should be protected for their habitat value for both obligate and facultative species. Vernal pools are small and often nondescript, and isolated from other wetlands. They are also more sensitive to disturbance than other types of wetlands. Breeding populations of some species may be severely impacted as a result of the destruction of just one pool. In addition, the destruction of a vernal pool can sever an important link in a larger wildlife migration corridor that can have negative consequences on many more animals.

WHAT ARE THE THREATS TO VERNAL POOLS AND HOW CAN THEY BE PROTECTED ?

Vernal pools can be impacted by a variety of natural and human influences. Since natural forces cannot be controlled, we must emphasize land use and management principles that modify human activities to the extent necessary to protect the vernal pool ecosystem while allowing legal and reasonable use of the land.

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WHAT ARE THE THREATS TO THE INTEGRITY OF VERNAL POOLS AND HOW CAN THEY BE PROTECTED?

(continued from page11)

Land Development

Land development poses the greatest risk to vernal pools since it results in permanent changes to vegetation, topography, and the timing and intensity of surface water drainage. These changes may destroy the pool or prevent wildlife from effectively re-colonizing an area following a construction disturbance. Development is also the principal cause of the habitat fragmentation which concerns many wildlife scientists.

There are a number of requirements a land developer must satisfy when seeking a wetlands permit. Wetland soils must be located and flagged by a soil scientist. Development plans must accurately indicate the location of wetlands in relation to development activities. Protective measures such as buffer zones and siltation fences must also be part of the plan. However, this regulatory process has not always been sufficient to protect vernal pools. This is because comprehensive assessment of the functional values of wetlands is rarely required. Furthermore, the relative size of a wetland has often been used incorrectly as an oversimplified way of estimating value, and vernal pools may not appear on municipal wetland maps.

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WHAT ARE THE THREATS TO THE INTEGRITY OF VERNAL POOLS AND HOW CAN THEY BE PROTECTED?

(continued from page 12)

In order to minimize the impacts to vernal pools caused by land development, inland wetland agencies should do the following:

(1) Examine site plans carefully to determine if small, isolated wetlands, especially those occurring in distinct topographic depressions, may in fact be vernal pools;

(2) Carefully view these areas during on-site inspections and compare the physical characteristics to those described above;

(3) If the physical characteristics and vegetation patterns of the basin suggest the occurrence of a vernal pool, then the agency may want to request a biological assessment to confirm the functional status of the wetland;

(4) If it proves to be a vernal pool, examine its relationship to other wetlands and surrounding upland habitats. (There may be important migration routes that also require protection); and

(5) Review the installation of silt fencing (both location and season of use) around vernal pools carefully. Improper placement can trap amphibians and reptiles during migration. Failure to remove the fencing can impact the breeding success of certain important species.

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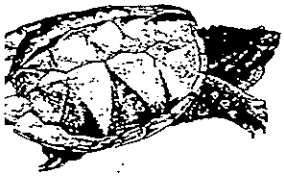

PROTECTING VERNAL POOLS DURING TIMBER HARVESTING

- *Flag the outer edge of the buffer and prohibit logging equipment from entering the vernal pool depression during any season of the year;*
- *Maintain an undisturbed vegetated buffer around the vernal pool, which should measure 50' from the edge of the pool, or a distance equal to the average height of dominant trees, whichever is greater;*
- *Whenever possible, avoid locating new haul roads or main skid trails within 100' of the pool; if existing roads and/or trails already occur within this zone, use good planning and common sense to avoid significant impact;*

WHAT ARE THE THREATS TO THE INTEGRITY OF VERNAL POOLS AND HOW CAN THEY BE PROTECTED?

(continued from page 13)

Forestry

Forestry is an important and appropriate land use in Connecticut and has a significantly lower impact on natural resource values than more intensive changes in land use, such as commercial and residential development. Forest practices, including timber harvesting, generally have less impact because they occur infrequently and are not a permanent alteration of the landscape. However, there are some precautions that should be taken during timber harvesting operations. The vernal pool itself should be protected as much as possible from any direct impact such as filling, draining, soil rutting, or deposition of tree tops.

It is also important to preserve a vegetated buffer surrounding the pool. Buffers preserve environmental conditions that are vital to the needs of the resident wildlife, especially amphibians. They serve to moderate the water temperature and relative humidity of the pool environment, and are the source of the annual leaf fall that provides the basis of the vernal pool food web. Buffers also protect migratory routes and upland foraging areas, because some adult amphibians may travel no more than a few dozen yards from the breeding pool.

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WHAT ARE THE THREATS TO THE INTEGRITY OF VERNAL POOLS AND HOW CAN THEY BE PROTECTED?

(continued from page 14)

Since forestry is considered farming under section 1-1(q) of the Connecticut General Statutes and is permitted as of right under the Inland Wetlands and Watercourses Act of 1972, the precise delineation of wetland boundaries is not necessary for implementation of forest practices if no activities which affect wetlands are being conducted. In fact, the cost of delineating wetlands can render the practice of forestry economically impractical, and possibly lead to development of the land to more intensive uses that pose a much greater threat to all wildlife.

There are effective ways that the professional forester can assure adequate protection of vernal pools during the conduct of forest practices. For example, the professional forester, when preparing an area for harvest, should look for physical characteristics that may indicate the presence of a vernal pool. If such areas are found, the forester can then explain to the forest owner the significance of the habitat and take the following steps:

(1) Flag the outer edge of the buffer and prohibit logging equipment from entering the vernal pool depression during any season of the year;

(2) Maintain an undisturbed vegetated buffer around the vernal pool, which should measure 50' from the edge of the pool, or a distance equal to the average height of dominant trees, whichever is greater;

PROTECTING VERNAL POOLS DURING TIMBER HARVESTING

- *Upon completion of the harvest, smooth out tire ruts within 200' the pool that are deeper than fou inches, (these can trap animals during migration);*
- *Do not cut trees that have any chance of falling directly into the vernal pool depression and do nc cut any trees that will obviously into the forested buffer area (if a tree inadvertently falls into the buffer area it is best to leave the top where it lies); and*
- *Rehabilitate roads and trails by using best management practice. (BMP's) such as mulching with straw and seeding, but only if t is a direct threat to the pool from soil erosion; (fertilizers should n be used).*

SOURCES OF ADDITIONAL INFORMATION

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- Smith, H. M. 1978. Amphibians of North America: A guide to field identification. Golden Press.

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Appendix B

II. PRECEPTS

The participating organizations are committed to the following basic precepts which provide a foundation for the environmental principles:

- To enhance local communities ecologically and economically.
- To develop environmentally responsible golf courses that are economically viable.
- To offer and protect habitat for wildlife and plant species.
- To recognize that every golf course must be developed and managed with consideration for the unique conditions of the ecosystem of which it is a part.
- To provide important greenspace benefits.
- To use natural resources efficiently.
- To respect adjacent land use when planning, constructing, maintaining and operating golf courses.
- To create desirable playing conditions through practices that preserve environmental quality.
- To support ongoing research to scientifically establish new and better ways to develop and manage golf courses in harmony with the environment.
- To document outstanding development and management practices to promote more widespread implementation of environmentally sound golf.
- To educate golfers and potential developers about the principles of environmental responsibility and to promote the understanding that environmentally sound golf courses are quality golf courses.

III. VOLUNTARY PRINCIPLES FOR PLANNING AND SITING, DESIGN, CONSTRUCTION, MANAGEMENT, FACILITY OPERATIONS AND WHAT GOLFERS CAN DO TO HELP.

A. Planning and Siting

1. Developers, designers and others involved in golf course development are encouraged to work closely with local community groups and regulatory/permitting bodies during planning and siting and throughout the development process. For every site, there will be local environmental issues and conditions that need to be addressed.

2. Site selection is a critical determinant of the environmental impact of golf courses. A thorough analysis of the site or sites under consideration should be completed to evaluate environmental suitability. It is very important to involve both the designer and a team of qualified golf and environmental professionals in this process.

3. Based on the site analysis and/or regulatory review process, it may be determined that some sites are of such environmental value or sensitivity that they should be avoided. Other less environmentally sensitive or valuable sites may be more suitable or even improved by the development of a golf course if careful design and construction are used to avoid or mitigate environmental impacts.

4. The presence and extent of some types of sensitive environments may render a site unsuitable or, in some cases, less suitable for golf course development. Examples include, but are not limited to:

   - Wetlands
   - Habitat for threatened or endangered plant or animal species
   - Sensitive aquatic habitats

5. There may be opportunities to restore or enhance environmentally sensitive areas through golf course development by establishing buffer zones or by setting unmaintained or low-maintenance areas aside within the site.

6. Golf course development can be an excellent means of restoring or rehabilitating previously degraded sites (e.g., landfills, quarries and mines). Golf courses are also excellent treatment systems for effluent water and use of effluent irrigation is encouraged when it is available, economically feasible, and agronomically and environmentally acceptable.

B. Design

1. When designing a golf course, it is important to identify existing ecosystems. Utilizing what nature has provided is both environmentally and economically wise. Emphasizing the existing characteristics of the site can help retain natural resources, allow for efficient maintenance of the course and will likely reduce permitting and site development costs.

2. A site analysis and feasibility study should be conducted by experienced professionals. The identification of environmentally sensitive areas and other natural resources is important so that a design can be achieved that carefully balances environmental factors, playability, and aesthetics.

3. Cooperative planning and informational sessions with community representatives, environmental groups and regulatory agencies should be part of the initial design phase. Early input from these groups is very important to the development and approval process. This dialogue and exchange of information should continue even after the course is completed.

4. Native and/or naturalized vegetation should be retained or replanted when appropriate in areas that are not in play. In playing areas, designers should select grasses that are best adapted to the local environmental conditions to provide the necessary characteristics of playability yet permit the use of environmentally sustainable maintenance techniques.

5. Emphasis should be placed upon the design of irrigation, drainage and retention systems that provide for efficient use of water and the protection of water quality. Drainage and stormwater retention systems should, when possible, be incorporated in the design as features of the course to help provide for both the short and long term irrigation needs of the maintained turf and the unmaintained areas of the course.

6. Water reuse strategies for irrigation should be utilized when economically feasible and environmentally and agronomically acceptable. It is important that recycled water meets applicable health and environmental standards and that special consideration be given to water quality issues and adequate buffer zones. Water reuse may not be feasible on some sites that drain into high quality wetlands or sensitive surface waters. Suitable soils, climatic conditions, groundwater hydrology, vegetative cover, adequate storage for treated effluent and other factors will all influence the feasibility of water reuse.

7. Buffer zones or other protective measures should be maintained and/or created, if appropriate, to protect high quality surface water resources or environmentally sensitive areas. The design and placement of buffer zones will vary based on the water quality classifications of the surface waters being incorporated into the course. Regulatory agencies and environmental groups can assist in the planning of buffer zones.

8. Design the course with sustainable maintenance in mind. The design should incorporate Integrated Plant Management and resource conservation strategies that are environmentally responsible, efficient, and cost effective. Integrated Plant Management includes integrated pest management and emphasizes plant nutrition and overall plant health.

9. The design of the course should enhance and protect special environmental resource areas and when present, improve or revive previously degraded areas within the site through the use of plants that are well adapted to the region. Seek opportunities to create and/or preserve habitat areas that enhance the area's ecosystem.

C. Construction

1. Use only qualified contractors who are experienced in the special requirements of golf course construction.

2. Develop and implement strategies to effectively control sediment, minimize the loss of topsoil, protect water resources, and reduce disruption to wildlife, plant species and designated environmental resource areas.

3. Schedule construction and turf establishment to allow for the most efficient progress of the work while optimizing environmental conservation and resource management.

4. Retain a qualified golf course superintendent/project manager early in the design and construction process(es) to integrate sustainable maintenance practices in the development, maintenance and operation of the course.

D. Maintenance

Plant Protection and Nutrition

1. Employ the principles of Integrated Plant Management (IPM), a system that relies on a combination of common sense practices of preventing and controlling pests (e.g., weeds, diseases, insects) in which monitoring is utilized to identify pests, damage thresholds are considered, all possible management options are evaluated and selected control(s) are implemented. IPM involves a series of steps in the decision-making process:

   a. Through regular monitoring and record keeping, identify the pest problem, analyze the conditions causing it, and determine the damage threshold level below which the pest can be tolerated.

   b. Devise ways to change conditions to prevent or discourage recurrence of the problem. Examples include: utilizing improved (e.g., drought resistant, pest

resistant) turfgrass varieties, modifying microclimate conditions, or changing cultural practice management programs.

c. If damage thresholds are met, select the combination of control strategies to suppress the pest populations with minimal environmental impact, to avoid surpassing threshold limits. Control measures include biological, cultural, physical, mechanical, and chemical methods. Biological control methods must be environmentally sound and should be properly screened and tested before implementation.

   Non-chemical control measures should focus on practices such as the introduction of natural pest enemies (e.g., parasites and predators), utilizing syringing techniques, improving air movement, soil aerification techniques, and mechanical traps. The selection of chemical control strategies should be utilized only when other strategies are inadequate.

When chemical and nutrient products need to be applied the following practices should be utilized:

2. Always read and follow label directions when using any plant protectant products. Strive to treat problems at the proper time and under the proper conditions to maximize effectiveness with minimal environmental impact. Spot treatments may provide early, effective control of problems before damage thresholds are reached.

3. Store and handle all pest control and nutrient products in a manner that minimizes worker exposure and/or the potential for point or non-point source pollution. Employ proper chemical storage practices and use suitable personal protective equipment and handling techniques.

4. Use nutrient products and practices that reduce the potential for contamination of ground and surface water. Strategies include: use of slow-release fertilizers, selected organic products, and/or fertigation.

5. Test and monitor soil conditions regularly and modify practices accordingly. Choose nutrient products and time applications to meet, not exceed, the needs of the turfgrass.

6. All plant protectant products should only be applied by or under the supervision of a trained, licensed applicator or as dictated by law.

7. Maintain excellence in the continuing education of applicators (including state licensing, professional association training and IPM certification). Training for non-English speaking applicators should be provided in the worker's native language.

8. Facilities should inform golfers and guests about golf course chemical applications. Common methods include permanent signs on the first and tenth tee boxes and/or notices posted in golf shops and locker rooms.

Water Usage

1. Use native, naturalized or specialized drought-tolerant plant materials wherever possible. For areas in play (greens, tees and fairways), using plant materials that are: well-adapted to local environmental conditions; can be efficiently managed; and provide the desired playing characteristics.

2. Plan irrigation patterns and/or program irrigation control systems to meet the needs of the plant materials in order to minimize overwatering. When feasible, use modern irrigation technologies that provide highly efficient water usage. Inspect systems regularly for leaks and monitor water usage.

3. Water at appropriate times to minimize evaporation and reduce the potential for disease.

4. Consider converting to effluent irrigation systems when available, economically feasible and agronomically and environmentally acceptable.

5. Manage water use effectively to prevent unnecessary depletion of local water resources.

Waste Management

1. Leave grass clippings and other organic materials in place whenever agronomically possible. If clippings are removed, compost and, if possible, recycle them.

2. Dispose of chemical rinsate in a manner that will not increase the potential for point or non-point source pollution. Methods include rinsate recycling or "spraying out" diluted compound in previously untreated areas.

3. Dispose of chemical packaging according to label directions (e.g., triple rinsing, recycling or returning to manufacturer).

4. Other waste products, such as used motor oil, electric batteries and unused solvents, should be recycled or disposed of according to the law and available community disposal techniques.

5. Seek to reduce waste by purchasing products that minimize unnecessary packaging.

Wildlife Management

1. Habitat for wildlife species that help control pests (e.g., bats, bluebirds, purple martins, etc.) should be protected. Additional habitat for these beneficial species should be created whenever feasible and environmentally desirable.
2. Manage habitat to maintain healthy populations of wildlife and aquatic species.
3. Species such as skunks, non-migratory Canada geese, and deer, when they become damaging, should be managed through non-harmful means whenever possible. Non-harmful control methods could include dogs, noisemakers, repellents, and trapping and removal. Managed hunting may be appropriate where legal and safe.

E. Facility Operations

1. Facilities should conduct an environmental assessment in order to develop and implement an overall environmental policy and/or long-range plan that reflects or expands upon these principles.
2. Maintain ongoing records to measure and document progress towards environmental improvement.
3. The environmentally responsible practices adopted for the maintenance of the golf course should extend to all areas of the overall facility grounds.
4. Facilities should adopt practices and technologies that conserve natural resources, including water and energy.
5. Facilities should develop and initiate comprehensive programs for recycling, reuse and waste reduction.
6. Facilities should properly store and dispose of solvents, cleaning materials, paints and other potentially hazardous substances.
7. Facilities are urged to join programs that help to foster effective environmental management and policies.
8. Facilities should take active steps to educate golfers, neighbors and the general public about their environmental policies and practices.

F. What Golfers Can Do To Help

The American golf community is dedicated to preserving the game's treasured links to nature. As a result, golf courses are now being developed, designed and managed more responsibly than ever before. However, we who play the game also have a responsibility to help ensure that golf remains compatible with nature and that our courses are well-managed and in harmony with the environment.

As golfers we should:

1. Recognize that golf courses are managed land areas that should complement the natural environment.
2. Respect designated environmentally sensitive areas within the course.
3. Accept the natural limitations and variations of turfgrass plants growing under conditions that protect environmental resources (e.g., brown patches, thinning, loss of color).
4. Support golf course management decisions that protect or enhance the environment and encourage the development of environmental conservation plans.
5. Support maintenance practices that protect wildlife and natural habitat.
6. Encourage maintenance practices that promote the long-range health of the turf and support environmental objectives. Such practices include aerification, reduced fertilization, limited play on sensitive turf areas, reduced watering, etc.
7. Commit to long-range conservation efforts (e.g., efficient water use, Integrated Plant Management, etc.) on the golf course and at home.
8. Educate others about the benefits of environmentally responsible golf course management.
9. Support research and education programs that expand our understanding of the relationship between golf and the environment.
10. Take pride in our environmentally responsible courses.

APPENDIX

The "Environmental Principles for Golf Courses in the United States" were developed through a collaborative research and dialogue process managed and facilitated by the Center for Resource Management. The following individuals participated in this process and can be contacted for further information.

1. **American Farmland Trust**
   Ed Thompson, Jr.
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   Washington, DC 20036
   202-659-5170

2. **American Society of Golf Course Architects**
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3. **Audubon International**
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4. **Center for Resource Management**
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   Meredith Miller
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   Denver, CO 80203
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5. **Friends of the Earth**
   Courtney Cuff
   1025 Vermont Ave., NW
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   202-783-7400, ext. 207

6. **Golf Course Superintendents Association of America**
   Joe O'Brien
   1421 Research Park Drive
   Lawrence, KS 66049
   913-841-2240

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   Lawrence, KS 66049
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7. **Golf Digest**
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   5520 Park Avenue
   Trumbull, CT 06611
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8. **National Coalition Against the Misuse of Pesticides**
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9. **National Golf Foundation**
   Rick Norton
   1150 So. U.S. Highway 1, #401
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10. **National Wildlife Federation**
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11. **North Carolina Coastal Federation**
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12. **Rain Bird - Golf Division**
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    818-812-3649

13. **Royal Canadian Golf Association**
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14. **SENES Oak Ridge, Inc. - Center for Risk Analysis**
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    Oak Ridge, TN 37830
    615-483-6111

15. **Sierra Club**
    Mark Massara
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16. **United States Environmental Protection Agency**
    Phil Oshida
    401 M Street, SW (4502F)
    Washington, DC 20460
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    Anne Leslie
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17. **United States Golf Association**
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    PO Box 708
    Far Hills, NJ 07931
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Appendix C

ROBINSON & COLE

WETLANDS WATCH

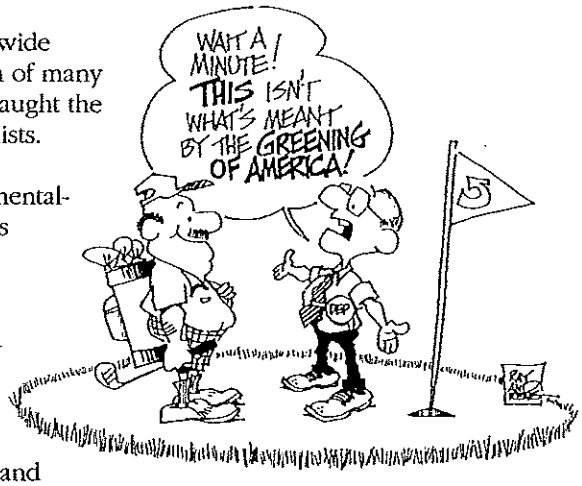
Volume 2, Number 2 *Summer 1993*

Dealing with Golf's Environmental Issues

The 1990s may well be called the decade of environment for golf in the United States. The cost of building and maintaining golf courses has risen dramatically and many proposed golf courses never get past the initial planning stage because of environmental concerns. While some people have sincere interest about potential effects of golf course activities on environmentally sensitive areas, others concerned about growth in their communities, oppose golf courses to obtain their ultimate objective: the rejection of a development. In response, organizations in golf, including the United States Golf Association (USGA), are spending millions investigating environmental impacts and educating golf course superintendents and others about the current issues.

Given the high profile status of the environment in golf today, it seems hard to believe that just a decade ago no one in golf thought much about Integrated Pest Management (IPM), underground storage tanks, surface and groundwater protection, and pesticide impacts on wildlife. What happened during that time to bring environmental issues to the forefront of golf? For one thing, environmental awareness became more prevalent throughout society in the United States and the world. Also, golf enjoyed a worldwide boom and the construction of many hundreds of golf courses caught the eye of wary environmentalists.

Just what are environmentalists and regulatory agencies concerned about when it comes to the construction and maintenance of golf courses? In a nutshell, they are concerned about the following:



- potential for pesticide and nutrient pollution of water resources;
- use of scarce water resources for irrigation of golf courses;
- loss of "natural" areas; and
- impact of pesticides on people, wildlife and other organisms.

The USGA is involved in a number of environmentally-oriented programs that address these issues. Let's take a closer look at each one.

■ Potential Pollution of Groundwater and Surface Waters

Given the importance of potable water resources to all facets of our lives, and the fact that fresh water is scarce and expensive in many parts of the United States, people are understandably interested in activities that have the potential for polluting our precious water resources. Agricultural use of pesticides and fertilizers has caused problems for water supplies in the past and people are naturally skeptical about claims that golf course activities don't

continued on page 4

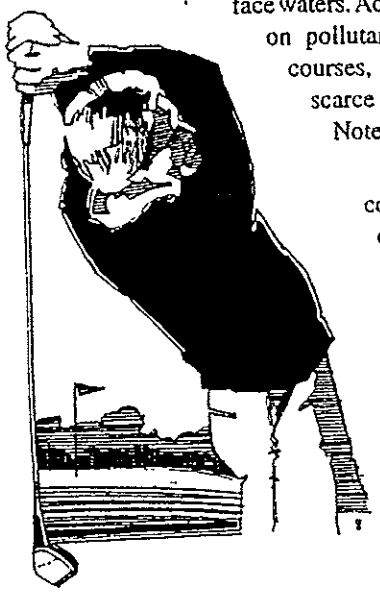
In this Issue

Appendix D

Technical Note 20

Minimizing the Impact of Golf Courses on Streams

Over 13,000 golf courses now exist in the U.S. and many more will be constructed to meet the growing popularity of the sport. The construction of a new golf course has the potential to create adverse impacts on the aquatic environment. To begin with, a typical 18 hole golf course can convert as much as 100 acres of rural land into a highly "terra-formed" environment of fairways, greens, tees, sand traps, and water hazards. As such, golf courses are often an attractive part of the urban landscape. Haphazardly designed golf courses, however, can disrupt and degrade the wetlands, floodplains, riparian zones, and forests that contribute to stream quality.



A second recurring concern about golf courses are the large inputs of fertilizer, pesticides, fungicides, and other chemicals that are required to maintain vigorous and attractive greens. In many cases, chemical application rates can rival and even exceed those used in intensive agriculture. Table 20.1 shows a side by side comparison of chemical application rates for a coastal plain golf course and cropfield in Maryland, as reported by Klein (1990).

The actual rate of fertilizer and pesticide application rates at a particular golf course can vary considerably, depending on the soil, climate, and management program. As an example, fungicides and nematicides are only lightly used in regions with cold winters, but constitute a major fraction of total pesticide applications in warmer climates. Given such intensive use of chemicals, golf courses clearly have the potential to deliver pollutants to ground and surface waters. Actual monitoring data on pollutant loads from golf courses, however, are quite scarce (but see Technical Note 27).

Golf course chemical application rates can rival and even exceed those used in intensive agriculture.

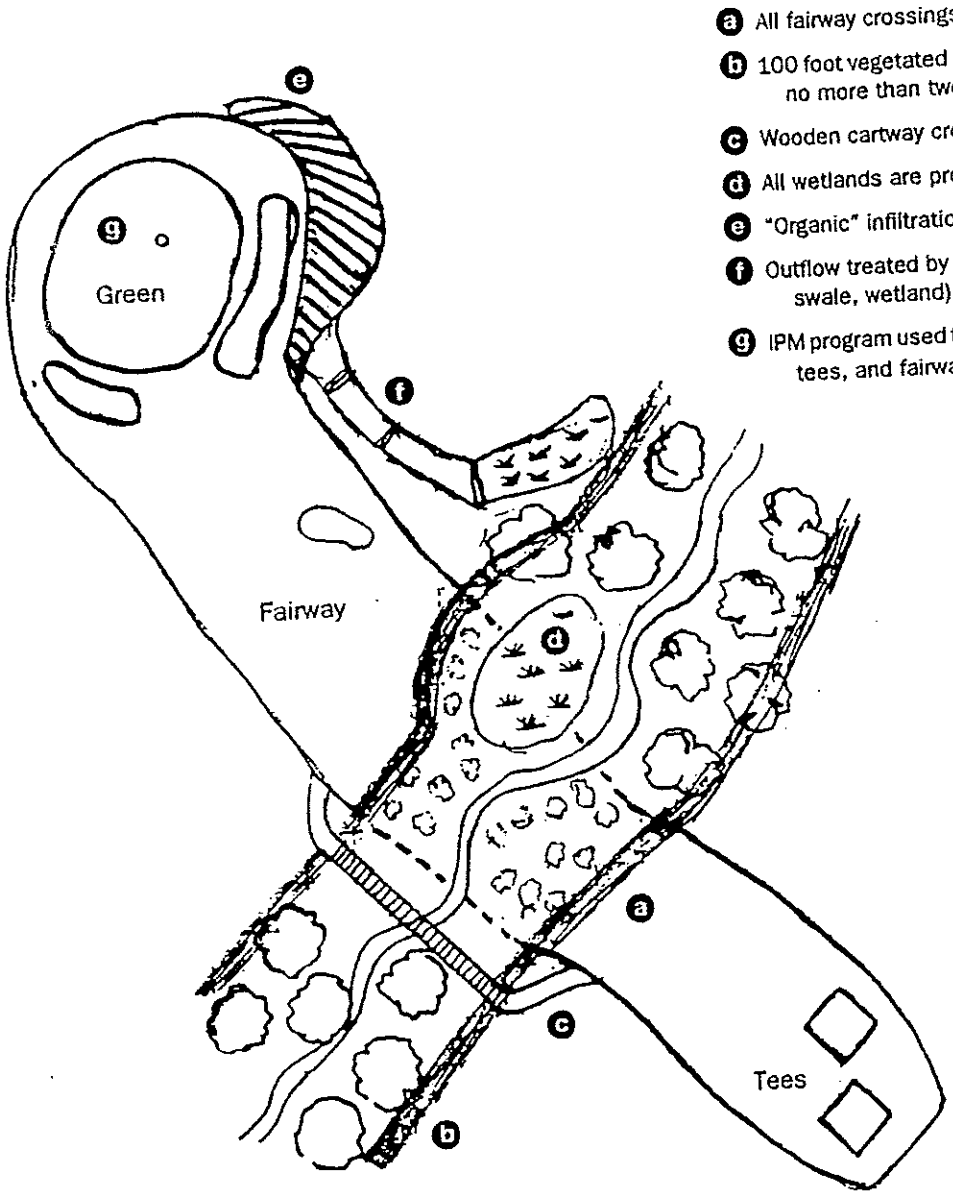
Golf courses are also intensive water consumers, particularly in drier regions of the country. This need for irrigable water can place strong demands on local groundwater and/or surface water supplies, which in turn, can cause baseflow depletion. In addition, the construction of the ubiquitous golf course water hazards can lead to downstream warming in sensitive trout streams.

In the late 1980's, Baltimore County, Maryland was confronted with a wave of golf course development proposals and strong concerns about the possible risk they might have on their Piedmont streams. The Department of Environmental Protection and Resource Management drafted and revised a series of environmental guidelines for new golf course construction. The guidelines stress the importance of integrating the layout of the course with the natural features of the site.

Table 20.1: Comparative chemical application rates for a Maryland golf course and corn/soybean rotation. Reported in pounds/acre/year *(adapted from Klein, 1990)*

Chemical	Cropland	Fairway	Greens	Tees
Nitrogen	184	150	213	153
Phosphorus	80	88	44	93
Herbicides	5.8	10.4	10.2	11.4
Insectcide	1.0	2.0	2.0	2.0
Fungicide	0.0	26.9	34.9	26.9
Total Pesticides	5.8	37.3	45.1	38.3

gure 20.1: Best management practices for a golf course and stream crossing ***(adapted from Powell and Jolley, 1992)***



- (a) All fairway crossings are perpendicular to the stream
- (b) 100 foot vegetated buffer maintained along the stream, with no more than two crossings per 1,000 feet
- (c) Wooden cartway crossing on wooden pilings
- (d) All wetlands are protected with extra buffer
- (e) "Organic" infiltration trench treats green leachate
- (f) Outflow treated by a combination of vegetative BMPs (filter, swale, wetland)
- (g) IPM program used to reduce chemical applications to greens, tees, and fairways

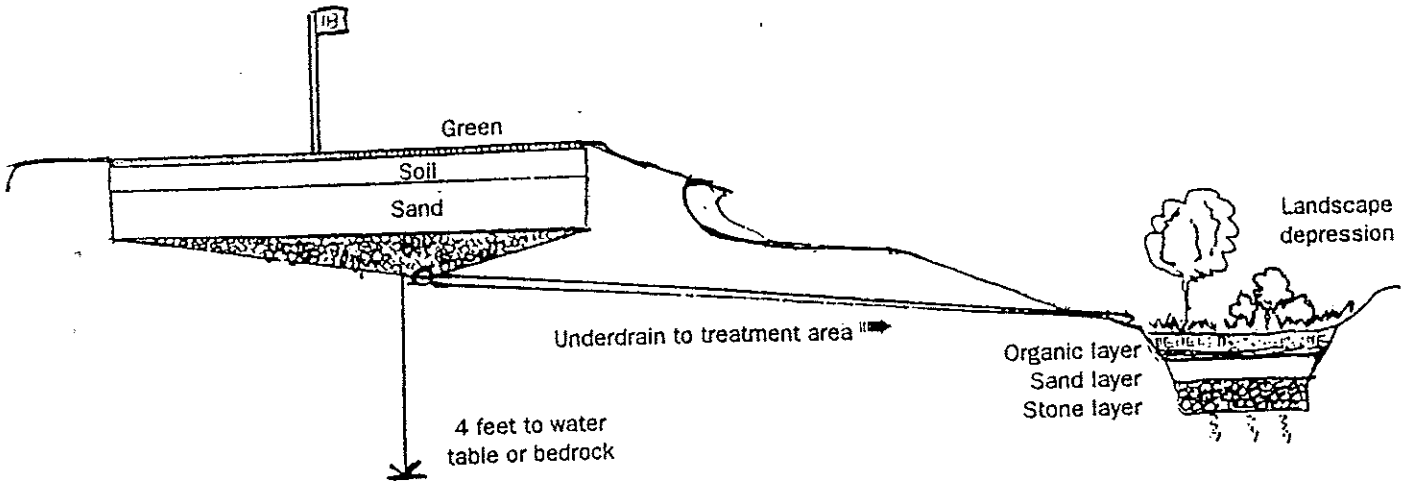
For example, the guidelines require a detailed evaluation of wetlands, perennial and intermittent streams, floodplains, slopes, forest stands and habitat features at the proposed course. The course must be configured to avoid or minimize disturbance to these resource areas. In this respect, long broad fairways are a prime culprit, as they frequently cross or encroach into streams and other buffer areas.

Long broad fairways are a prime culprit, as they frequently cross or encroach into streams and other buffer areas.

Consequently, the guidelines devote a great deal of attention to the issue of fairway crossings (see Figure 20.1). For example, no more than two fairway crossings are allowed for each 1,000 feet of stream length. These crossing must be perpendicular to the stream. If forests or wetlands are present at the crossing, this zone must be managed as unplayable rough and remain undisturbed as early successional forest or wetland. Cartways and footpaths that cross the stream corridor must be narrow and constructed of timber on wooden pilings. The County guidelines also limit the extent of forest that can be cleared during construction. No more than 25% of the pre-existing forest cover may be removed during course construction.

Constructed ponds are not permitted in trout streams unless they are "zero discharge" facilities constructed in upland areas (see Technical Note 19). Best management practices emphasize treatment of greens and tees

Figure 2: Schematic of a water quality treatment system to remove pollutants from a golf course green



where nutrient and pesticide applications are greatest. The use of a series of vegetative filtering mechanisms such as swales, forest buffers, sand filters, and infiltration trenches are recommended.

A common practice for greens is illustrated in Figure 20.2. To start with, a four foot thick mantle of soil is required below the green's underdrain system to prevent leachate from entering groundwater. The leachate is collected in perforated pipes and routed into small depression. This depression is usually filled with layers of organic matter, sand and stone, and then landscaped. The depression acts as both a biofilter and an infiltration facility.

Excess runoff from fairways is also treated by a series of best redundant best management practices (e.g., a grass swale leading to a pocket wetland or irrigation pond that in turn overflows into a forest buffer strip).

Since golf courses are largely pervious in nature, it is not always appropriate to size BMP systems for water quality treatment based on conventional water quality sizing rules (i.e., based on the amount of impervious area created at the site). Rather, it is more important to ensure proper control of each green, tee, and faiway, and to maximize the use of swales, forest buffers, and wetlands to achieve high rates of treatment.

The Baltimore County guidelines require the installation of permanent sampling wells in addition to periodic monitoring of storm runoff, groundwater, and the biological community present in golf course streams. The guidelines also recognize the importance of integrated pest management (IPM).

The golf course operator must submit an IPM plan that emphasizes the selection of drought and disease resistant turf that requires less maintenance, utilizes biological controls rather than chemicals, and carefully regulates the selection and application of pesticides. The use of slow release fertilizers is also encouraged to minimize the leaching of nitrates into groundwater.

To date, the guidelines have been applied to seven new golf course development proposals in Baltimore County with the active cooperation from the golf design community. Preliminary storm and groundwater monitoring data from several golf courses designed under the new guidelines indicate that they appear to have little impact on water quality, with the possible exception of nitrate leaching. Additional storm monitoring data is expected at both public and private courses over the next two years to attempt to confirm this observation.

—TRS

References:

Powell, R.O. and J.B. Jollie. 1993. Environmental guidelines for the design and maintenance of golf courses. Baltimore County Dept. of Environmental Protection and Resource Management. 22 pp. (410)887-4804.

Klein, Richard D. 1990. Protecting the aquatic environment from the effects of golf courses. Community & Environmental Defense Assoc. Maryland Line, MD. 54 pp.(410) 329-8194.

Appendix E

MEMORANDUM

TO: Steve Reviczky
DEP-Land Acquisition and Management, 6th Floor

FROM: Ken Metzler
DEP-NRC Natural Diversity Data Base, Store Level

DATE: March 4, 1998

SUBJ: "The Preserve", Old Saybrook

There has been much discussion about the request to increase the right-of-way over DEP land for access to the property known as "The Preserve" in Old Saybrook. My concerns have been addressed in a previous memo.

As a clarification to those comments, I offer the following:

1) According to the "Ecological Assessment" prepared by Valley Environmental Services for the applicant, "no rare species listed by Connecticut DEP were observed on the site." They then list marsh milkwort (*Polygola cruciata*), Connecticut Special Concern, as a plant found in a moist, open sandy area adjacent to the powerline corridor on the extreme eastern edge of the property. This verifies our observation of this plant seen in 1996. This is also the site where a few individuals of yellow-fringed orchid (*Platanthera ciliaris*), Connecticut Threatened, were observed in 1996 as well. In 1997, the milkwort was observed again at this site, but the orchid was not seen. This is possibly due to drought or to the marked decline of this plant documented at this site due to changing site conditions. In 1987, 60+/- plants were observed and documented at this site. Yellow-fringed orchid also has been documented to the east of this location and marsh milkwort and a sedge (*Carex exilis*, State Endangered) have been documented to the south. Since the seeds of yellow-fringed orchid survive in the soil for long periods, there is high potential for habitat modification (*e.g.* fire) to restore this population to a viable state.

2) Connecticut State Statute Section 26-303 "declares it is a policy of the state to conserve, protect, restore and enhance any endangered or threatened species and essential habitat". Section 26-310 further states that each state

agency "shall ensure that any action authorized, funded, or performed by such agency does not threaten the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat designated as essential to such species".

3) It is my opinion that the granting of a wider right-of-way over state land to provide access to this property will have significant impact to this orchid and its suitable habitat. Furthermore, any road way through this area will have an irretrievable impact on surrounding resources and may possibly have a negative impact from nutrient imput and the introduction of invasive species to the large number of state-listed wetland species found downstream from this site.

4) In summary, although the Connecticut Endangered Species Act does not provide protection to listed species on private land and/or the activities of land owners, it clearly states the statutory mandate of state agencies. DEP should not be a party to the destruction of this valuable resource. I urge you and the committee to say no.

KJM/dmd

Appendix F

DEPARTMENT OF ENVIRONMENTAL PROTECTION
INLAND FISHERIES DIVISION

POLICY STATEMENT
RIPARIAN CORRIDOR PROTECTION

I. INTRODUCTION, GOALS, AND OBJECTIVE

Alteration and exploitation of riparian corridors in Connecticut is a common event that significantly degrades stream water quality and quantity. Inasmuch as riparian ecosystems play a critical role in maintaining aquatic resource productivity and diversity, the Inland Fisheries Division (Division) recognizes that rigorous efforts are required to preserve, protect, and restore these valuable resources. Consequently, a riparian corridor protection policy has been developed to achieve the following goals and objective:

Goals

Maintain Biologically Diverse Stream and Riparian Ecosystems, and

Maintain and Improve Stream Water Quality and Water Quantity.

Objective

Establish Uniform Riparian Corridor Buffer Zone Guidelines.

II. DEFINITIONS

For the purpose of implementing a statewide riparian corridor protection policy, the following definitions are established:

Riparian Corridor: A land area contiguous with and parallel to an intermittent or perennial stream.

Buffer Zone: An undisturbed, naturally vegetated area adjacent to or contained within a riparian corridor that serves to attenuate the effects of development.

Perennial Stream: A stream that maintains a constant perceptible flow of water within its channel throughout the year.

Intermittent Stream: A stream that flows only in direct response to precipitation or which is seasonally dry.

III. RIPARIAN FUNCTION

Naturally vegetated riparian ecosystems perform a variety of unique functions essential to a healthy instream aquatic environment. The delineation and importance of riparian functions are herein described. Vegetated riparian ecosystems:

* Naturally filter sediments, nutrients, fertilizers, and other nonpoint source pollutants from overland runoff.

Appendix G

Selected physical and chemical properties of pesticides and metabolites evaluated for this study.

[Pesticides likely to affect the quality of Connecticut's ground water were initially identified using information on their characteristics and use. Information about pesticide characteristics was obtained largely from the U.S. Environmental Protection Agency priority list of pesticides developed for the National Pesticide Survey. Characteristics that affect pesticide mobility and persistence used in developing the priority list are described by Cohen and others (1984).

Values in the table are directly from cited references that are shown by number in superscript and listed at bottom of appendix. Other symbols are: --, no data found; <, less than; >, greater than; ±, value lies between number given and the number obtained by adding or subtracting the value after the sign; E is symbol for scientific notation where value is multiplied by 10 raised to indicated power, ie. 3.2E-8 = 3.2 x 10^{-8} = 0.000000032]

Water solubility: Concentration in water under equilibrium conditions expressed in milligrams per liter (mg/L). Solubility greater than 30 mg/L is an indicator of potential for ground-water contamination (Cohen and others, 1984).

Kd: The soil/water distribution coefficient (dimensionless) describes the tendency of a chemical to either sorb to solid soil particles or to dissolve in the soil water. Value for Kd less than 5 is an indicator of potential for ground-water contamination (Cohen and others, 1984). The Kd value can be different for a given pesticide in soils that differ in chemical and physical properties.

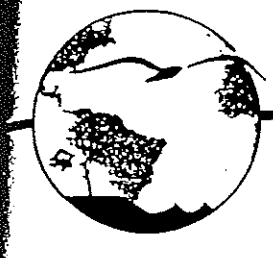
Koc: The partitioning coefficient between water and soil organic carbon (dimensionless) is equal to the Kd for a given compound and soil divided by the percent of soil organic matter. A Koc value less than 500 is an indicator of potential for ground-water contamination (Cohen and others, 1984).

Henry's Law Constant (H): This constant, expressed in atmospheres meter cubed per mole (atm-m^3/mol), is a measure of the escaping tendency or volatility of a chemical compound that is dissolved in water. A value equal to or less than 2.1 x 10^{-3} atm-m^3/mol is an indicator of potential for ground-water contamination (Cohen and others, 1984).

Hydrolosis half-life: The time it takes for half of the amount of pesticide that dissolves in water to react chemically with water to form other products. A half-life of greater than about 25 weeks is an indicator of potential for ground-water contamination (Cohen and others, 1984) and long hydrolosis half-life may indicate a pesticide can remain in ground water long after application.

Soil half-life: The time it takes for one half of the applied amount of pesticide to be degraded chemically or biologically. A half-life greater than 2 to 3 weeks is an indicator of potential for ground-water contamination (Cohen and others, 1984).

Appendix H



Audubon International

Center for Sustainable Resource Management

230 Second Street, Suite 311 • Henderson, Kentucky 42420 • (502) 869-9419

THE SIGNATURE PROGRAM

Late in the 1980s, Audubon International created the Audubon Cooperative Sanctuary System, a program for schools, backyards, corporate and business properties, and golf courses. As enthusiasm, support, and visibility increased for these programs, requests for environmental assistance surfaced from a different area -- landowners of properties that were in the planning and development stages. In response to that need, The Audubon Signature Program was created to provide a comprehensive, integrated approach to environmental planning for proposed developments.

Principles of Sustainability

The essence of the Audubon Signature Program is sustainability -- using natural resources, without depleting them, in ways that will support human activity. Audubon International believes that progress must be redefined and become synonymous with **sustainable**. To that end, Audubon International created a set of principles to guide land management toward better compatibility and harmony with the environment. This guidance document is called the *Audubon Principals for Sustainable Resource Management*. In addition, the *Landscape Restoration Handbook*, written under the direction of Audubon International, includes the "Principles for Ecological Restoration" and "Principles for Natural Landscaping." These three documents provide the foundation for Audubon's philosophy of sustainable development and sustainable resource management.

The Signature Program

The Audubon Signature Program gives Audubon International and the landowner a common frame of reference by which a project can be environmentally planned and evaluated. Only landowners who are committed to the principles of sustainability and who 1) complete and implement a Natural Resource Management Plan, or 2) for whom Audubon International prepares an Ecological Design are eligible to apply for Audubon Signature recognition.

Signature Program Designations

There are two possible designations that can be achieved though the Audubon Signature Program -- **Signature Status** and **Gold Signature Status**. Both designations require that the landowner: 1) apply and become accepted in the Signature Program, 2) sign an agreement pledging to follow the *Audubon Principles for Sustainable Resource Management*, 3) create a natural resource management plan for the design and maintenance of the site, 4) implement the plan, and 5) maintain, review, and enhance the plan throughout the life of the property. The primary differences between the two programs are based on the time at which the project becomes part of the program, whether only a portion of the property (a golf course, for example) or the entire property is included in the project, and the level of Audubon International involvement in the planning, design and oversight of the project.

The Audubon Cooperative Sanctuary System
Audubon International • 46 Rarick Road • Selkirk, New York 12158 • (518) 767-9051

Audubon Cooperative Sanctuary
Program for Golf Courses

■ Step 1: Registration

As a result of an initial inquiry, the golf course receives a brochure with registration material. To join, the golf course simply fills out and returns the registration form to Audubon.

■ Step 2: Resource Inventory Completion

30 minutes to 1 hour

A new member packet including a Resource Inventory is sent to the golf course once the registration fee is received. Golf course personnel fill out and return the Resource Inventory to tell Audubon more about their property, current management practices, special needs and goals. The new member packet includes:

- Resource Inventory- questionnaire regarding the golf course to be filled out and returned to Audubon
- Membership Art Print
- *Field Notes*: the Audubon Cooperative Sanctuary bi-monthly newsletter

■ Step 3: Planning and Organization

3 to 4 month average for most courses

Four to six weeks after Audubon receives the Resource Inventory the golf course is sent a Conservation Report. The Conservation Report provides an environmental assessment and project recommendations for the golf course. The course uses the Conservation Report to plan and organize Cooperative Sanctuary projects. With the customized report the golf course also receives the following:

- A Guide to Managing a Cooperative Sanctuary for Golf Courses
- Environmental Reports on a variety of habitat enhancement and natural resource management topics
- A native plant list specific to the course's region of the country
- List of plant nurseries in the state that provide native seed/plant stock
- Press release announcing the course's involvement in the ACSP for Golf Courses
- Environmental Planning Form and information about becoming a *Certified Audubon Cooperative Sanctuary*

■ Step 4: Project Implementation

Average of 1 to 3 years depending on the project

The course implements the conservation projects within the time frame established in their Environmental Plan. Audubon staff are available for telephone and written consultation to assist with project implementation. Site visits can be arranged on a fee-for-service basis.

■ Step 5: Certification

Average of 1 to 3 years

As the course implements their plan, they can apply for certification by documenting what they have done in each of six certification categories: *Environmental Planning, Wildlife Habitat Management, Integrated Pest Management, Water Conservation, Water Quality Management, Outreach and Education.*

As you begin planning effective water management strategies, try to answer the following questions: What is the drainage pattern on your course? What is the lowest point or points where water settles? How does water enter your course (rain/snow melt, stream, wetland, springs)? Where does water go when it leaves the property? Your answers will help you put your management plan in the context of your local watershed.

Protecting Surface Waters

Protecting surface waters should include a three-fold approach:

1) preventive measures;
2) control measures; and
3) detection.

Preventive measures include design considerations and Integrated Pest Management practices. Control measures are Best Management Practices that protect water quality through removal, filtration, detention, or rerouting of potential contaminants before they enter surface waters. Detection involves an environmental monitoring program that provides feedback to the superintendent as to conditions and movement of materials.

Best Management Practices

Preventive and structural controls constitute the building blocks of a watershed protection program for surface water quality and quantity at a golf course. The more you can prevent problems from occurring, the easier, less costly, and more effective your water quality protection program will be. Preventive controls include land use planning and source reduction to eliminate or minimize contamination in a watershed. For example, proper siting and care of equipment and chemicals at the maintenance facility can help you eliminate pollution problems.

Structural controls are more costly since they involve capital improvements designed to remove, filter, detain, or reroute contaminants carried in surface water. Many courses use a combination of both prevention practices and structural controls to effectively manage surface water.

One way to think about your water management program is as a "Best Management Practices (BMPs) train" in which individual BMPs are considered the cars. In most cases, the more BMPs you incorporate into the system, the better the performance of your "treatment train." The first cars might include BMPs to minimize generation of runoff and pollutants; the final car might include filtration through a buffer or retention in a pond.

3) *Subjective* - spot-checking for broad or open-ended exploration of problems. An example of this type of monitoring is monitoring associated with an algal bloom. The course personnel constantly spot-checks locations that are known problem areas.

4) *Objective* - to provide data for use in developing or confirming the results of ongoing programs.

Setting Up Your Monitoring Program

Several basic steps are required when setting up a monitoring program. Each of these steps is essential to providing the most comprehensive and thus most useful monitoring program.

Step 1. Establish your goals- What do you hope to find out or achieve with the monitoring program?

Step 2. Identify the sample media- What are you going to sample? Surface water, ground water, pond water, pond sediment? Each of these media has advantages and disadvantages. The goals of the monitoring program will dictate which are sampled. Some basic questions to consider include:

- Do you sample streams, creeks, lakes or ponds?
- Where are the water bodies or streams with regard to the course?
- Do you sample the same locations each time water samples are obtained?

Step 3. Determine sample locations- Where are you going to sample? Off site, on site? How many sample locations for each media? This is site-dependent. Sampling the same location over time is important. When sampling the same location you can compare results over time and thus determine environmental conditions over time. Generally, three or four sample locations are the minimum number required to assess water quality. Also, the inflow and outflow points on a stream are important locations because they indicate the quality of water coming onto the course and leaving the course.

Step 4. Determine sample frequency- Determine how often you are going to sample each location and each media during a year's time frame. It is important to sample during different seasons because the environment responds differently during each season. How many years are you going to sample? Are you going to sample during storm events or baseflow periods? We encourage at least quarterly sampling for two years to establish a baseline of water quality. Thereafter, sampling twice a year is sufficient, unless problems are encountered. Examples of problems may include fish kills, algal blooms, or wildlife that acts in a manner inconsistent with normal behavior. Sample frequency is site-dependent.

For more information on water quality management:

Dodson, R.D. and MM Smart. 1995. "Pond Ecosystems: Centers of Wildlife Conservation." Golf Course Management. November: 49-51.

Eaker, W.M. 1994. Stormwater Management in North Carolina. A Guide for Local Officials. Land of Sky Regional Council, Asheville, NC.

Livingston, E.H. and E. McCarron. 1991. Stormwater Management: A Guide For Floridians. Stormwater/Nonpoint Source Management, FDER. Tallahassee.

Madhun, Y.A. and V.H. Freed. 1990. "Impact of pesticides on the environment." *In* Pesticide in the Soil Environment. pp. 429-466. (ed. H.H. Cheng). Soil Science Society of America, Inc., Madison, WI.

Peacock, C.H. and M.M. Smart. 1995. "IPM, Monitoring, and Management Plans - A Mandate for the Future". USGA Green Section Record 33:10-14.

Peacock, C.H., M.M. Smart, and William Warren-Hicks. 1996 (in press). "Best Management Practices and Integrated Pest Management Strategies for Protection of Natural Resources on Golf Course Watersheds." *In* Watershed '96, National Symposium on Watershed and Water Relations, Baltimore.

Smart, M.M., J.R. Jones and J.L. Sebaugh. 1985. "Stream-Watershed Relations in the Missouri Ozark Plateau Province." J. Environ. Qual. 14:77-82.

USEPA. 1993. Guidance Specifying Management Measures for Sources of Nonpoint Pollution In Coastal Waters. United States Environmental Protection Agency, 840-B-92-002, Washington.

Wetzel, R.G. 1983. Limnology. Second edition. Saunders and Co. 763 p.

❖ *The Audubon Cooperative Sanctuary Program has technical staff that can help you set up a water quality monitoring program. Please call us to* schedule *an appointment.*

One of the critical strategies to an IPM approach is to set thresholds for pest problems and to use control treaments only when they are exceeded. Thresholds for insect pest problems are in many instances determined by location, since only a few insect problems are found uniformly across the country. These are also largely determined by the value of the area and the recuperative capacity of the turf.

Insect Thresholds for Common Pests	
Insect	Threshold Number per Square Foot
White grubs	6 to 10
Sod webworms	5 to 10
Cutworms	
Fairways	0.5 to 1
Greens	1 per square yard
Skipper larvae	0.5 to 1
Chinchbugs	25 to 30
Asiatic garden beetle	>20
Black turfgrass Ataenius	>50

Wauchke et al. (1994)

Keep accurate records as each site is monitored. Scouting records can be used to make pest control decisions. Look for trends that suggest pest numbers are increasing to levels that warrant control measures being taken. Early detection can often minimize damage and severity.

IPM Control Strategies

A variety of control tactics are available to the turfgrass manager. IPM involves understanding how these control tactics interact to influence the overall health of a turfgrass system. The primary objective in any IPM program is maintaining strong, healthy, actively-growing turfgrass that can resist and recuperate successfully from environmental stresses, pest damage, and weed infestation. IPM control strategies include:

• **Species and Cultivar Selection**–Introducing a species outside its range of adaptation increases its susceptibility to pests and stresses. Turfgrass species and cultivars must be selected to match local environmental and playing conditions. Where possible, select adapted species and cultivars that minimize water and pesticide use.

• **Mowing Practices**–Mowing height and frequency are directly related to the turfgrass species and growth rate of the plant. To minimize stress on the plant, no more than one third of the leaf blade should be removed with any one mowing. On greens, cutting heights consistently 1/8" or less can place the turf under severe stress, especially during weather extremes. Use of lightweight mowers on greens and fairways tremendously reduces soil compaction effects on turf growth.

• **Irrigation Practices**–Properly watered turf is more resistant to insects and diseases. Excessive irrigation is one of the most common problems observed in the field. It is important to survey the irrigation system to ensure that all irrigation heads are working and set properly to obtain uniform coverage.

Irrigation frequency should be dictated by meeting the evapotranspiration (ET) requirements of the plant. Irrigating deeply and less frequently produces a turf with a deeper root system and improved overall turf health. Care must be used when irrigating shallow-rooted turfs. Monitor root depth, soil moisture, ET conditions, and use visual inspection to determine turf irrigation needs.

• **Fertility and pH Management**–Fertilization is a necessary component of turf management. No one fertilizer program or fertilizer can suit all situations. The type of program must be decided upon by the golf course superintendent based on the specific conditions of the golf course.

Fertilization should be scheduled to meet the nutritional and growth requirements of the plant. The frequency of fertilizer application will vary depending on the turfgrass species and the type of fertilizer. Slow release fertilizers such as IBDU, sulphur coated urea, or natural organic materials, should be used on golf courses when possible. Use low rates of inorganic fertilizers with any one application.

A soil test is the best diagnostic tool available for assessing soil pH and phosphorus and potassium needs of the turf plant, as well as other nutrients. Soil test results serve as a guide for proper application of nutrients, avoid the waste of excessive fertilizer applications, and insure that nutrients are applied in the proper proportions. Once the turf has become established, soil tests should be conducted every one to three years.

• **Thatch Control**–The potential for thatch problems varies with turfgrass species, intensity of culture and traffic. Thatch becomes a problem on fairways and greens when it accumulates to a depth that increases potential for puffiness, mower scalping, disease development, and localized dry spot formation.

Avoid excessive fertilization to prevent excessive thatch formation. For greens, light vertical mowing at intervals dependent on the

Appendix I

Storage of Pesticides and Pesticide Containers

I. Storage Sites
   A. Location
      1) avoid areas where flooding occurs
      2) place downwind and downhill from sensitive areas (houses, ponds, recreation areas)
      3) drainage from site should be contained

II. Storage Facilities
   A. Structure
      1) use well ventillated, dry separate room, building, or covered area at temperatures above freezing
      2) secure storage area with climb-proof fence
      3) doors and gates should be kept locked
      4) ID signs placed on rooms, buildings, and fences advising on contents and warning of hazards
      5) drainage system for runoff
   B. Supplies
      1) supply of soap, detergent or hand cleanser and water
      2) absorptive clay, activated charcoal, vermiculite, pet litter, or sawdust for soaking up spill and leaks
      3) hydrated lime and sodium hypochlorite should be on hand to neutralize pesticide
      4) shovel, broom and dust pan present
      5) fire extinguisher
      6) label items of movable equipment used for handling pesticides and do not remove from site

III. Operational procedures
   A. Classification and separation
      1) Pesticide containers should be stored with label visible.
      2) Store containers off the floor.
      3) Rigid containers should be set upright.
      4) Place containers in orderly rows with each pesticide formulation segregated.
      5) Inventory should be maintained indicating number and identity of containers in each storage unit—date all containers when received.
      6) Excess pesticides and containers should be segregated according to method of disposal.
      7) Herbicides should be stored in a special place apart from other pesticides.
   B. Container inspection and maintenance
      1) All pesticide containers should be checked often for corrosion, leaks, loose caps or bungs.

facility, the appropriate Regional Administrator, U. S. Coast Guard, and pesticide Safety Team Network of National Agricultural Chemicals Association.

F. Fire Hazard Abatement
   1) Plainly label the outside of each storage area with "Danger," "Poison," "Pesticide Storage" signs.
   2) Post a list on the outside of the storage area of the types of chemicals stored therein.

G. Fire Fighting Precautions
   1) Wear air-supplied breathing apparatus and rubber clothing.
   2) Avoid breathing or otherwise contacting toxic smoke or fumes.
   3) Wash completely as soon as possible after encountering smoke and fumes.
   4) Contain the water used in fire fighting within the storage site drainage system.
   5) Fireman should take cholinesterase tests after fighting a fire involving organophosphate or N-alkyl carbamate pesticides, if heavily exposed to the smoke.
   6) Evacuate persons near such fires who may come in contact with smoke or fumes or contaminated surfaces.

H. Monitoring System
   1) If large quantities of pesticides are stored, arrange to have samples taken from water, wildlife, and plants near storage area.
   2) Samples should be assessed to be sure no pesticides are getting into the environment.

References:

EPA - S 165.10 Recommended procedures and criteria for storge of pesticides and pesticide containers.

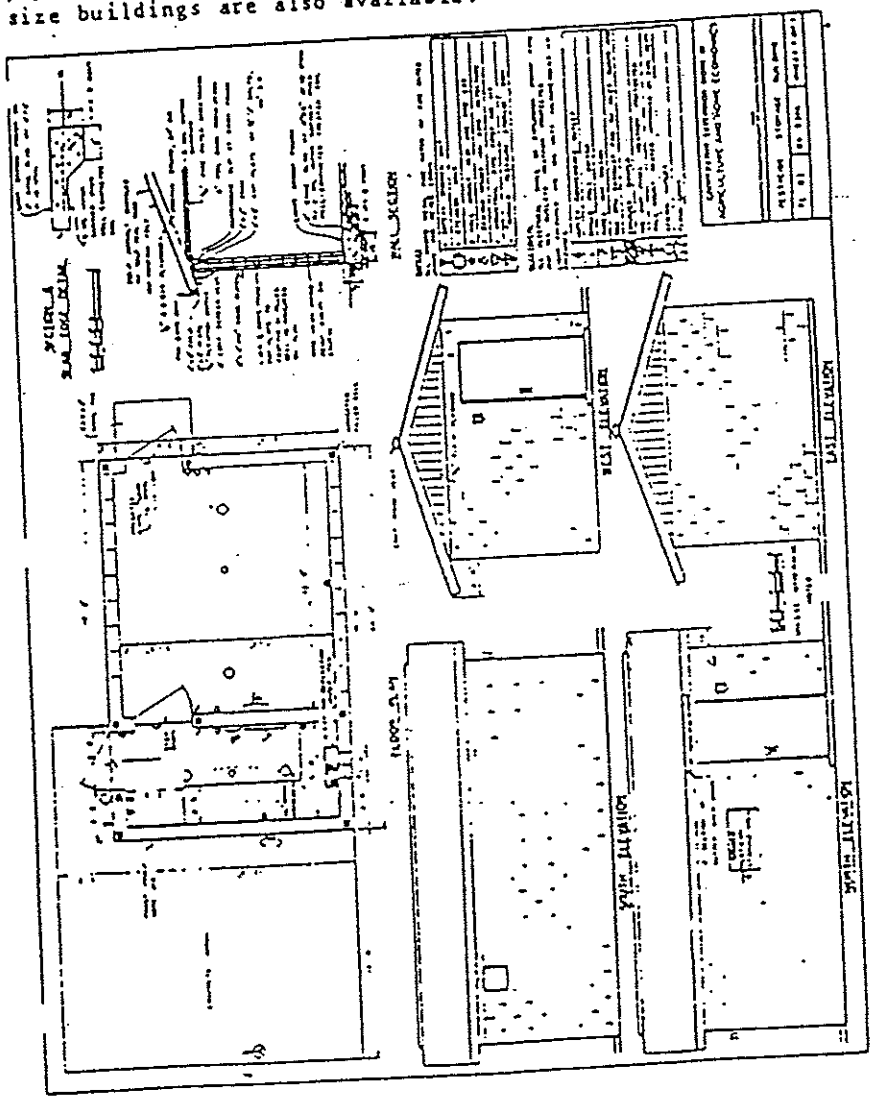
"Pesticide Applicator Training Manual - Core Manual"

Illinois Pesticide Applicator Study Guide

PLANS FOR PESTICIDE STORAGE BUILDING

John W. Bartok, Jr.
Extension Agricultural Engineer

A new plan for a 12' x 20' pesticide storage building has been recently received from the USDA Plan Exchange. This cement block building includes a heated storage room, ventilated mixing area and concrete apron. This building should meet the needs of medium and large growers to help comply with health and safety regulations. Working drawings are available from the Agricultural Engineering Department, Box U-15, UConn, Storrs, CT 06268. The cost is $1.00 payable to the University of Connecticut. Plans for other size buildings are also available.



Appendix J

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

REPORT OF POLLUTION INCIDENT BY PETROLEUM OR CHEMICAL PRODUCTS AS REQUIRED BY CHAPTER 446K SECTION 22a-450 OF THE CONNECTICUT GENERAL STATUTES

TO:The master of any ship, boat, barge or other vessel, or the person in charge of any terminal for the loading or unloading of any oil or petroleum or chemical liquids or solid, liquid or gaseous products, or hazadous wastes, or the person in charge of any establishment, or the operator of any vehicle,trailer or other machine which by accident, negligence or otherwise causes the discharge, spillage, uncontrolled loss, seepage or filtration of oil or petroleum or chemical liquids or solid, liquid or gaseous products, or hazadous wastes, shall immediately report such facts to:

The Department of Environmental Protection, Oil and Chemical Spill Response Division, (860) 424-3338, 24 hr/day. In the event of a telephone malfunction call (860) 424-3333.

Within 24 hours you are required to complete a written " Report of Petroleum or Chemical Product Discharge, Spillage or Release" and mail it to:

Connecticut Department of Environmental Protection
Bureau of Waste Management
Oil & Chemical Spill Response Division
79 Elm Street
Hartford, Connecticut 06106-5127

PENALTIES

Any person who fails to report incidents as required by Chapter 446K, Section 22a-450 may be fined not more than $1,000.00 and the employer of such person not more than $5,000.00.

FEDERAL REPORTING

Incident that are required to be reported under the EPCRA (SARA TITLE III), CERCLA,RCRA, Federal Code Of Regulations Title 40 (Environmental Protection) and/or Title 49 (Transportation) are reportable to the State Emergency Response Commission (Connecticut Department of Environmental Protection) – (860) 424-3338 and the National Response Center (800) 424-8802 and the local community emergency coordinator. A report to the local fire department is recommended (call 911 through CT).

ABOUT THE TEAM

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

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

PURPOSE OF THE TEAM

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

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

REQUESTING A REVIEW

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

For additional information and request forms regarding the Environmental Review Team please contact the ERT Coordinator: 860-345-3977, Eastern Connecticut RC&D Area, P.O. Box 70, Haddam, Connecticut 06438.