REPORT

TO THE

MIDDLETOWN COMMISSION

ON THE

CITY PLAN AND ZONING

SAWMILL BROOK RACE COURSE

MIDSTATE REGIONAL PLANNING AGENCY

MARCH 13, 1974

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CPA-CT-01-26-1039

THE PREPARATION OF THIS REPORT, INCLUDING ALL MAPS AND CHARTS, WAS FINANCED IN PART THROUGH A COMPREHENSIVE PLANNING GRANT FROM THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, A STATE REGIONAL PLANNING ASSISTANCE GRANT ADMINISTERED BY THE PLANNING AND BUDGETING DIVISION, DEPARTMENT OF FINANCE AND CONTROL, STATE OF CONNECTICUT AND BY CONTRIBUTIONS FROM MEMBER MUNICIPALITIES.

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PREFACE

This report is an outgrowth of a zone change referral to the Midstate Regional Planning Agency in accordance with the provisions of Chapter 124, Section 8-3(b) of the Connecticut General Statutes. Assistance in evaluating the proposal was requested by the Agency from the Eastern Connecticut Resource Conservation and Development Project's Environmental Review Team. The Agency attempted in a relatively short period of time with limited personnel to bring together as much relevant information as was possible. The report is based upon a series of separate reports prepared by different persons, thus the topical emphasis and degree of detail varies. The report does not presume to have identified and thoroughly analyzed all of the important aspects. It is, however, an attempt to highlight some of the important aspects which should be considered in the decision-making process. The team which assisted in the review of the proposed Sawmill Brook Race Course consisted of the following personnel:

SOIL CONSERVATION SERVICE

Barry Cavanna - District Conservationist
Dennis Hutchison - Soil Scientist
Dwight Southwick - Civil Engineer

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Peter Houle - Parks and Recreation Specialist
Dan Meade - Hydrologist-Geologist
Sid Quarrier - Geologist
Tom Peters - Air Pollution Control Engineer
Art Rocque - Environmental Analyst
Stanley House - Forester

DEPARTMENT OF HEALTH

Theodore C. Willerford - Principal Sanitary Engineer

CONNECTICUT INLAND-WETLANDS PROJECT

David Lavine - Project Director
Liz Petry - Project Coordinator
Chuck Dauchy - Environmental Planner
Sally Richards - Marine Biologist
Dorothy McCluskey - Special Projects Manager

UNIVERSITY OF CONNECTICUT - COOPERATIVE EXTENSION SERVICE

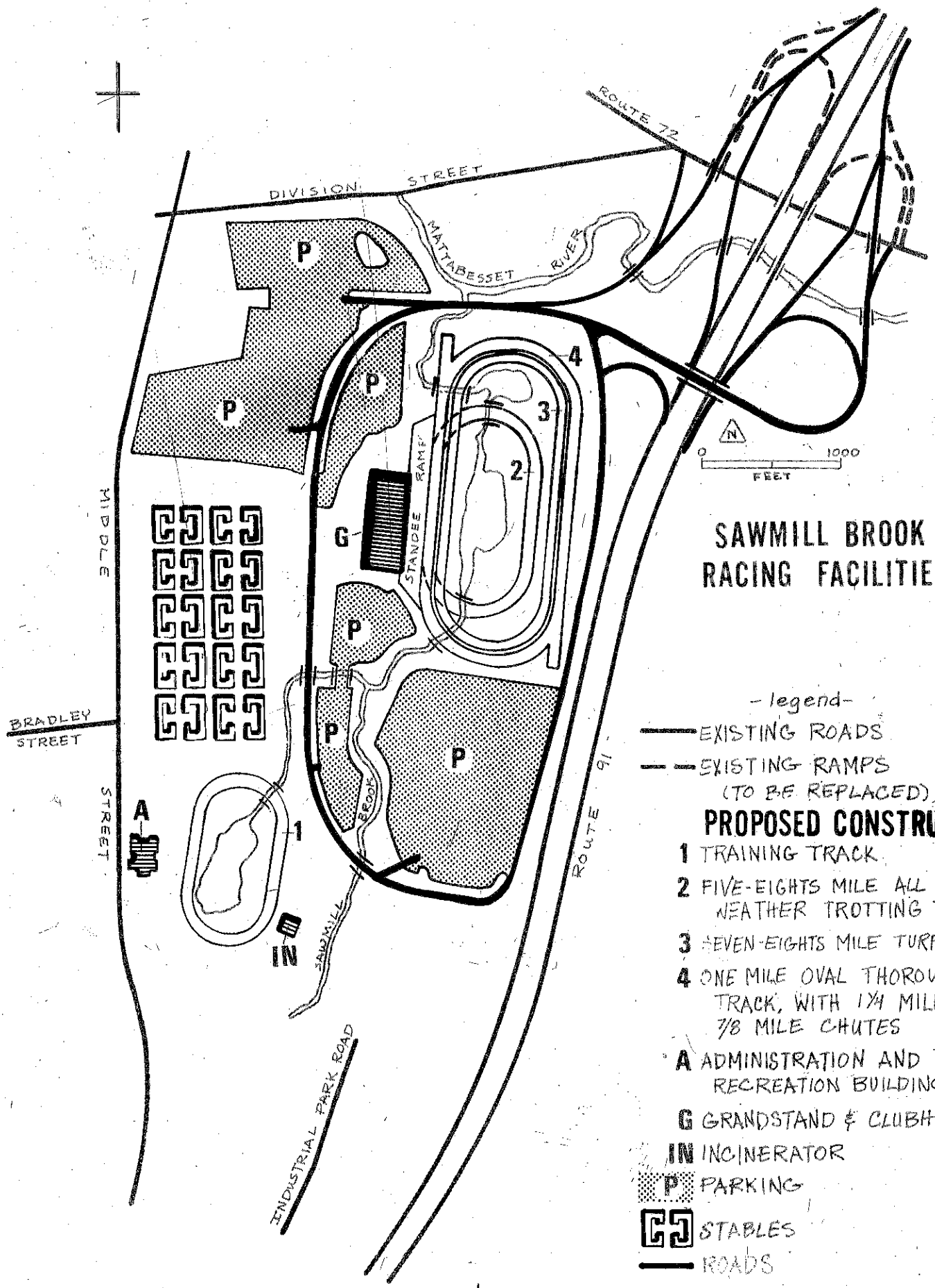
Robert C. Church - Associate Professor, Animal Sciences
David Miller - Climatologist

MIDSTATE REGIONAL PLANNING AGENCY

Stephen J. Holmes - Regional Planner
Geoffrey L. Colegrove - Planning Director

OTHERS

Barbara Hermann - RC & D Environmental Review Team Coordinator
John P. Sullivan - Acting Deputy Commissioner Bureau of Planning & Research - DOT
Stephen Stolicny - Transportation Planner, DOT
Preston Jump - Law Student University of Connecticut



SAWMILL BROOK RACING FACILITIES

-legend-

EXISTING ROADS

EXISTING RAMPS (TO BE REPLACED)

PROPOSED CONSTRUCTION

1 TRAINING TRACK

2 FIVE-EIGHTS MILE ALL WEATHER TROTTING TRACK

3 SEVEN-EIGHTS MILE TURF COURSE

4 ONE MILE OVAL THOROUGHBRED TRACK, WITH 1¼ MILE AND 7/8 MILE CHUTES

A ADMINISTRATION AND RECREATION BUILDING

G GRANDSTAND & CLUBHOUSE

IN INCINERATOR

P PARKING

STABLES

ROADS

I EXISTING CONDITIONS

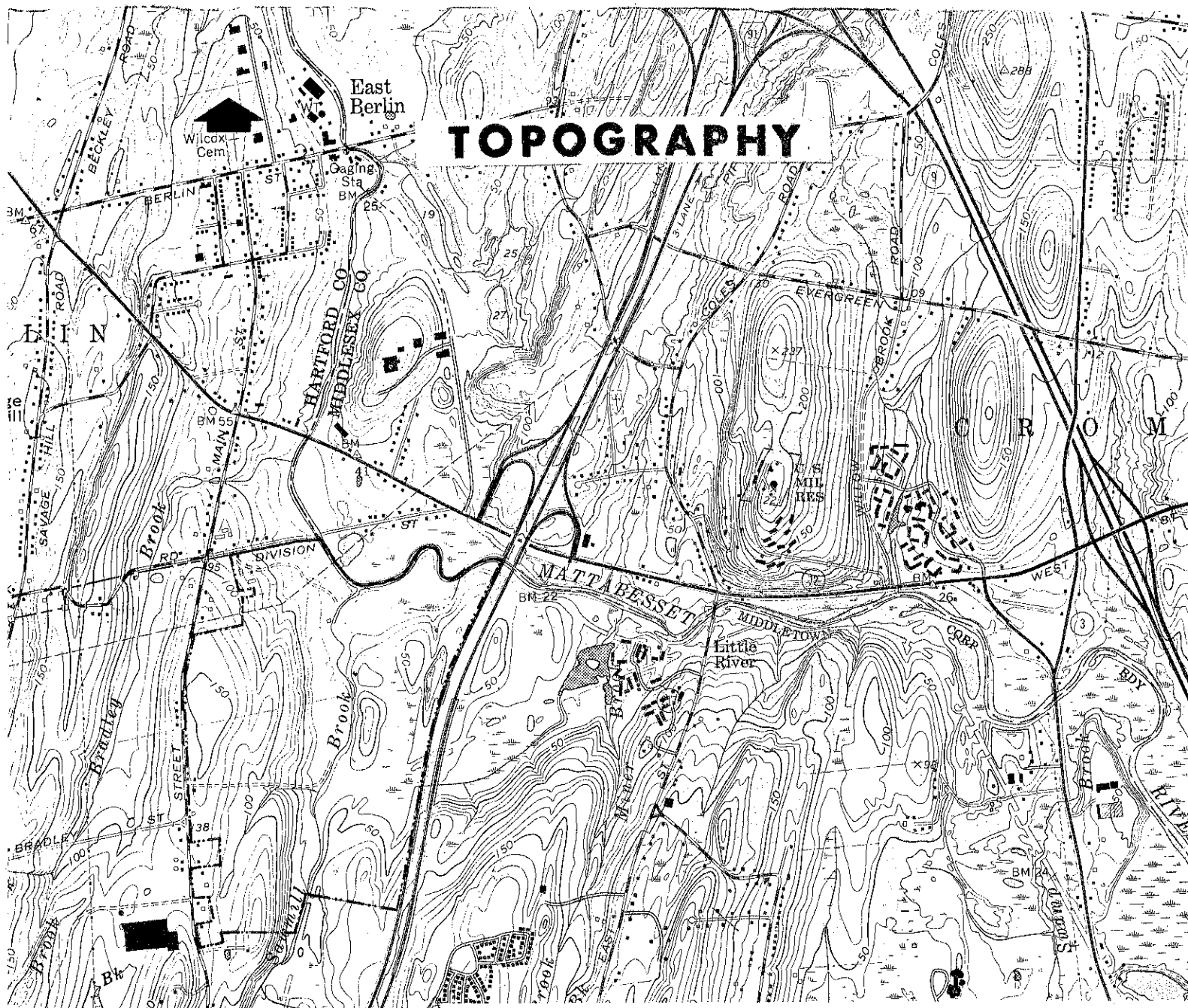
- TOPOGRAPHY
- GEOLOGY
- SOILS
- HYDROLOGY
- INLAND WETLANDS AND WATER QUALITY
- VEGETATION AND WILDLIFE

TOPOGRAPHY

The site includes hilltop areas with elevations of approximately 150 feet, sloping valley sides, stream bottom/floodplain areas, scattered small hills, and low areas. Some of the low areas have restricted drainage and are quite swampy. Local topographic relief is in excess of 130 feet (see topographic map). The slope map following the topographic map has been interpreted from the detailed soil survey. The slope is distributed as follows:

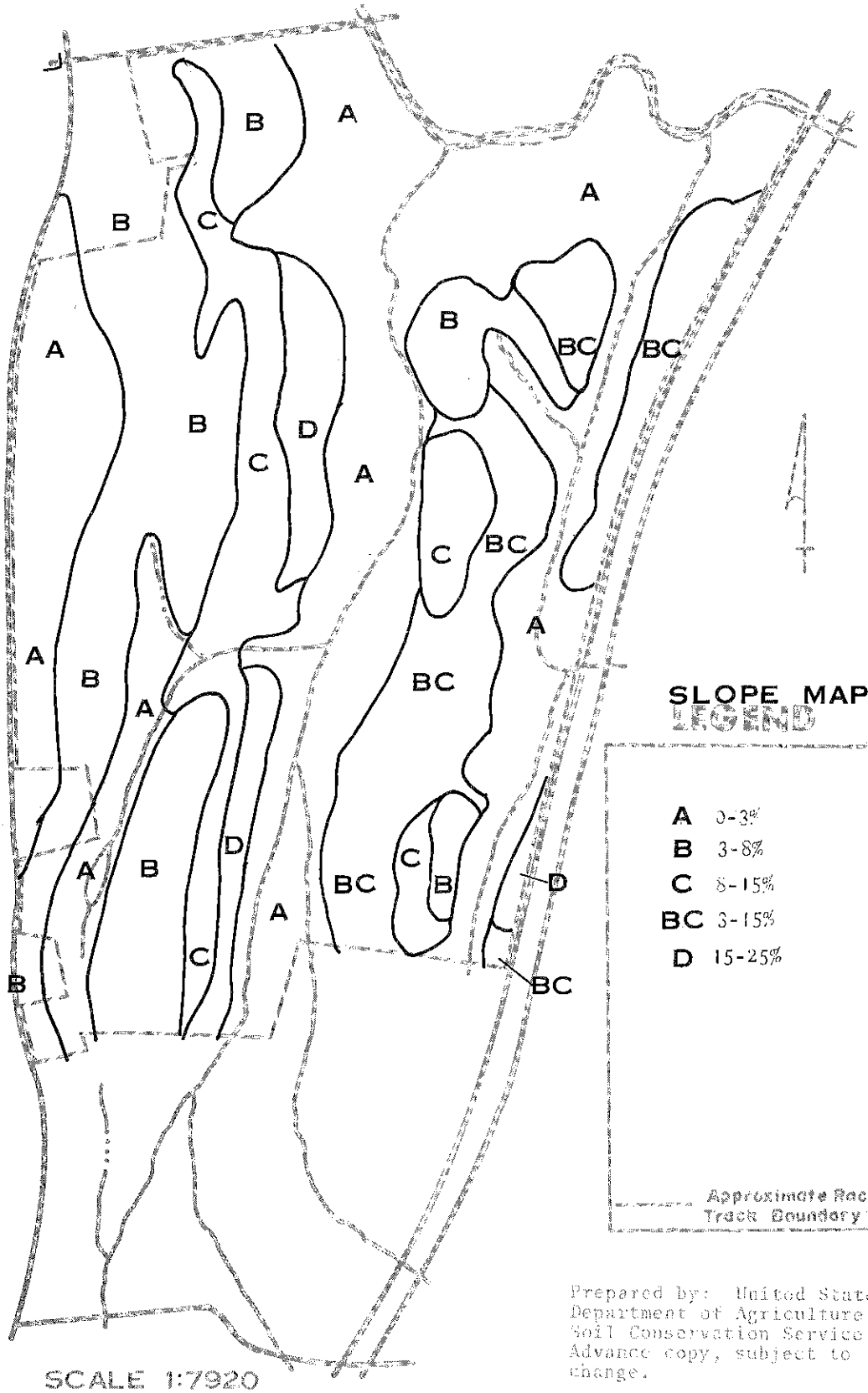
SLOPE	% OF SITE
A - 0 to 3%	47.5%
B - 3 to 8%	24.0%
C - 8 to 15%	10.0%
BC - 3 to 15%	14.0%
D - 15 to 25%	4.5%

The relatively large topographic relief and moderate-to locally-steep slopes will greatly increase the potential for erosion, especially during the construction phase of the project.



Middletown, Connecticut, Quadrangle
7.5 Minute Series (Topographic)
United States Department of the
Interior, Geological Survey.
1965, photo revised 1972
Scale 1" = 2000'

SAWMILL BROOK RACING FACILITY
MIDDLETOWN, CONNECTICUT



Prepared by: United States Department of Agriculture, Soil Conservation Service. Advance copy, subject to change.

GEOLOGY

Bedrock Geology

The rocks underlying the site are sedimentary and igneous rocks of Triassic age which strike in a northerly direction and dip to the east between 10 and 15 degrees. The extreme eastern part of the site is underlain by basalt (traprock) which is exposed at the surface just to the west of Interstate I-91. Excavation of this rock may be required for the construction of the proposed service road on the site. The remainder is underlain by shales and sandstones which are exposed at the surface at several places on the western part of the site. Bedrock may be encountered on the western portion of the site and in the hill lying in the center of the proposed racetrack itself. Test borings will determine the amount of bedrock excavation needed so that excavation costs and construction schedules can be accurately estimated.

Surficial Geology

The upland areas of the site are underlain by till of variable thickness. The till is relatively impermeable and contains a high percentage of fine-grained materials (silt and clay). High surface water run-off rates and considerable erosion potential can be anticipated in the till areas, especially during the construction phase of the project. The low areas are covered with alluvial deposits and are underlain by stratified material ranging in character from sand to clay. Clay underlies the floodplain at the north end of the site, and the extent and thickness of these clay deposits should be determined, as special foundation engineering may be required.

SOILS

The Natural Soil Groups map in this section was developed from detailed soil maps. The following descriptions and interpretations of the natural soil groups are based on the characteristics common to the member soils. Detailed information about the individual soils is contained in the interim soil survey report: "Soil Interpretations for Urban Uses, Midstate Region." The information in this report is based on examination and interpretation of soils to a maximum depth of about five feet. The soil survey does not replace needed on-site investigations for critical considerations. Additional information about natural soil groups and the detailed soil survey can be obtained from the Soil Conservation Service and cooperating agencies.

The table on the following page indicates by per cent the distribution of soils based on the detailed soil survey, with subtotals for the Natural Soil Group System (see maps on following pages entitled "Natural Soils Group" and "Soil Map").

The first order of grouping is:

A - Terrace soils - over sands and gravels
B - Upland soils - over friable to firm glacial till
C - Upland soils - over compact glacial till (hardpan)
D - Upland soils - rocky and shallow to bedrock
E - Floodplain soils
F - Marsh and swamp soils
G - Lake terrace soils - over strata high in silt and clay

Within these main divisions the soils are separated according to differences such as natural drainage, steepness of slope and degree of stoniness.

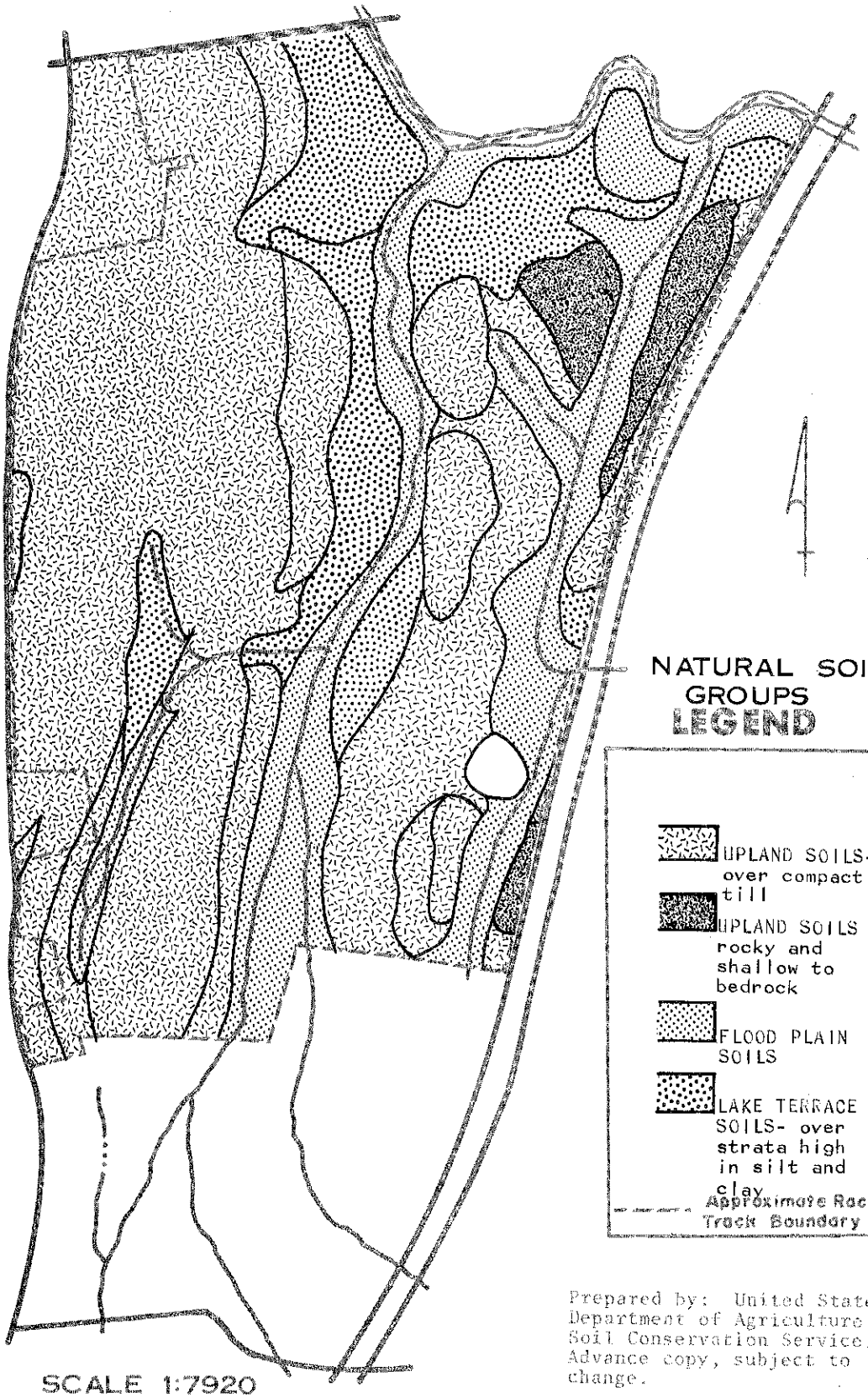
Unlike interpretive groupings, classification according to use (suitability or limitation) does not control the Natural Soil Groups.

For further analysis see Appendix I, which contains detailed descriptions for the soil mapping units on the site indicated on the following table and maps.

SAWMILL BROOK RACE COURSE

NATURAL SOIL GROUP	SOIL SYMBOL	MAPPING UNIT DESCRIPTION	PER CENT DISTRIBUTION ON SITE	SUBTOTAL BY NATURAL SOIL GROUPS
C - UPLAND SOILS - over compact till				
C-1a	38A	Wethersfield loam, 0-3% slopes	7 %	
	38B	Wethersfield loam, 3-8% slopes	22 %	
	38XB	Wethersfield stony loam, 3-8% slopes	2 %	
C-1b	38C	Wethersfield loam, 8-15% slopes	7.5%	
	38XC	Wethersfield stony loam, 8-15% slopes	2.5%	
C-1d	38D	Wethersfield loam, 15-25% slopes	3 %	
	38XD	Wethersfield stony loam, 15-25% slopes	1.5%	
C-2a	56A	Ludlow silt loam, 0-3% slopes	3 %	
C-2b	56XB	Ludlow stony silt loam, 3-8% slopes	1 % (less than)	
	564M BC	Ludlow very stony silt loam, 3-15% slopes	10 %	
				58.5%
D - UPLAND SOILS - rocky and shallow to bedrock				
D-1	94L BC	Holyoke-Chesire rocky complex, 3-15% slopes	4 %	
D-2	94MD	Holyoke extremely rocky silt loam, 15-35% slopes	1 % (less than)	
				4 %
E - FLOODPLAIN SOILS				
E-2	71V	Rowland silt loam	1 %	
E-3a	58	Alluvial land	19 %	
				20 %
G - LAKE TERRACE SOILS - over strata high in silt and clay				
G-2	443A	Berlin silt loam, 0-3% slopes	12 %	
G-3a	643	Scantic silt loam, reddish variant, 0-3% slopes	5.5%	
				17.5%
GRAND TOTALS (does not include items of less than 1%)			100 %	100 %

SAWMILL BROOK RACING FACILITY
MIDDLETOWN, CONNECTICUT



NATURAL SOILS GROUPS
LEGEND

- UPLAND SOILS- over compact till — C
- UPLAND SOILS rocky and shallow to bedrock — D
- FLOOD PLAIN SOILS — E
- LAKE TERRACE SOILS- over strata high in silt and clay — G
- Approximate Race Track Boundary

SCALE 1:7920

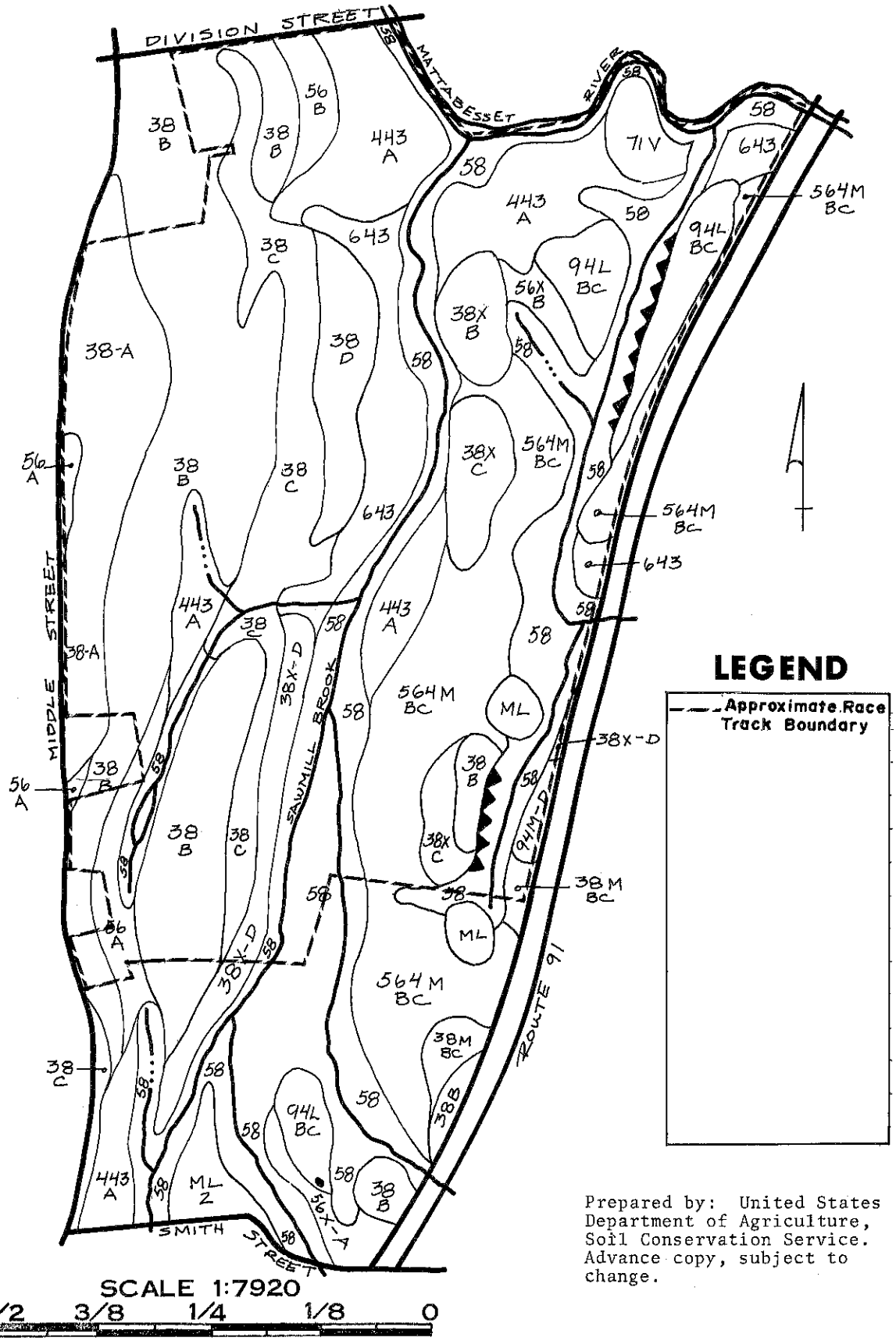
1/2 3/8 1/4 1/8 0

Prepared by: United States Department of Agriculture, Soil Conservation Service. Advance copy, subject to change.

SOIL MAP

SAWMILL BROOK RACING FACILITY

MIDDLETOWN, CONNECTICUT



LEGEND

Approximate Race Track Boundary

Prepared by: United States Department of Agriculture, Soil Conservation Service. Advance copy, subject to change.

HYDROLOGY

The site of the proposed Sawmill Brook Race Course lies within the drainage area of the Sawmill Brook which flows north into the Mattabesset River and eventually into the Connecticut River to the east. A floodplain for Sawmill Brook runs adjacent to this brook through the center of the site. The north end of the site, below 25 feet in elevation, should be considered a part of the floodplain of the Mattabesset and Connecticut Rivers. Surface and groundwater on the western three-fourths of the site drain into Sawmill Brook. Drainage on the eastern one-fourth of the site flows toward the Mattabesset River. The swamp in the east-central portion of the site apparently drains both northward into the Mattabesset River and southward across a break in the old trolley line road bed which forms a dike, crossing under Interstate I-91 where it drains into the Mattabesset River. The trolley line seems to have raised the water level in this swamp.

Drainage areas of the three water courses are as follows: Sawmill Brook, 6.90 square miles, Mattabesset River 108 square miles, and Connecticut River just below the junction of the Connecticut and Mattabesset Rivers, 10,863 square miles. Thus the Sawmill constitutes about 6.5% of the Mattabesset system and only about 0.06% of the Connecticut River drainage at Middletown. Of the total Sawmill Brook drainage basin area, five square miles are located within the Middletown city limits. The proposed race course, which consists of .56 square miles, represents 8.1% of the total drainage basin or 11.2% of the basin within Middletown.

Since there will be a negligible loss of water from the Sawmill system because water supply and sewage disposal will be provided through municipal systems the effects of flooding and sedimentation will have the greatest impact on the hydrology. The contours for the proposed site should be delineated in more detail. Because the present map is unclear, the potential effect of flooding cannot be determined; the Commission should, however, determine and evaluate the effect of flooding based upon proposed contours. The present water quality of the Mattabesset River is extremely poor, a result of land use and abuse throughout the drainage area. A significant number of contaminants is being generated in the Webster Brook area where discharges from such operations as land-fill dumps and sewerage treatment plants have in effect rendered downstream waters in both Webster Brook and the Mattabesset River void of life.

The water quality of the Connecticut River at this time also reflects a multitude of discharges into the river and its tributary streams; the quality however does support a significant quantity of aquatic life.

Flooding may be a result of local climatic extremes or it may be due to such factors as melt-offs, intense precipitation and other factors in the upper reaches of the Connecticut River. Historic data shows the flood of record arrested at a stage of 30.6 feet above mean sea level in the Middletown area. This flood occurred in 1936, and although the recurrence interval is extreme, it does show that Connecticut River flood stages have a more pronounced effect on land use in the lower Sawmill Brook and Mattabesset River than do local floods.

At the northern portion of the site, approximately 65 acres are within the area identified in Volume VIII of the "Comprehensive Water and Related Land Resources Investigation - Connecticut River Basin," Department of the Army, New England Division, Corps of Engineers, Plate No. M-8 as being within the Intermediate Regional Flood (I.R.F.)[1] This area presently stores approximately 542 acre-feet of flood water during the I.R.F.

In evaluating the proposed race course, the following should be considered:

1. Effect, if any, of flooding (Connecticut River flood stages to be main object of consideration) on the track and facilities;

2. Effect, if any, of additional run-off from paved areas on the flood stage in the Mattabesset River;

3. Effect of back-up of flood waters from the Connecticut and Mattabesset Rivers;

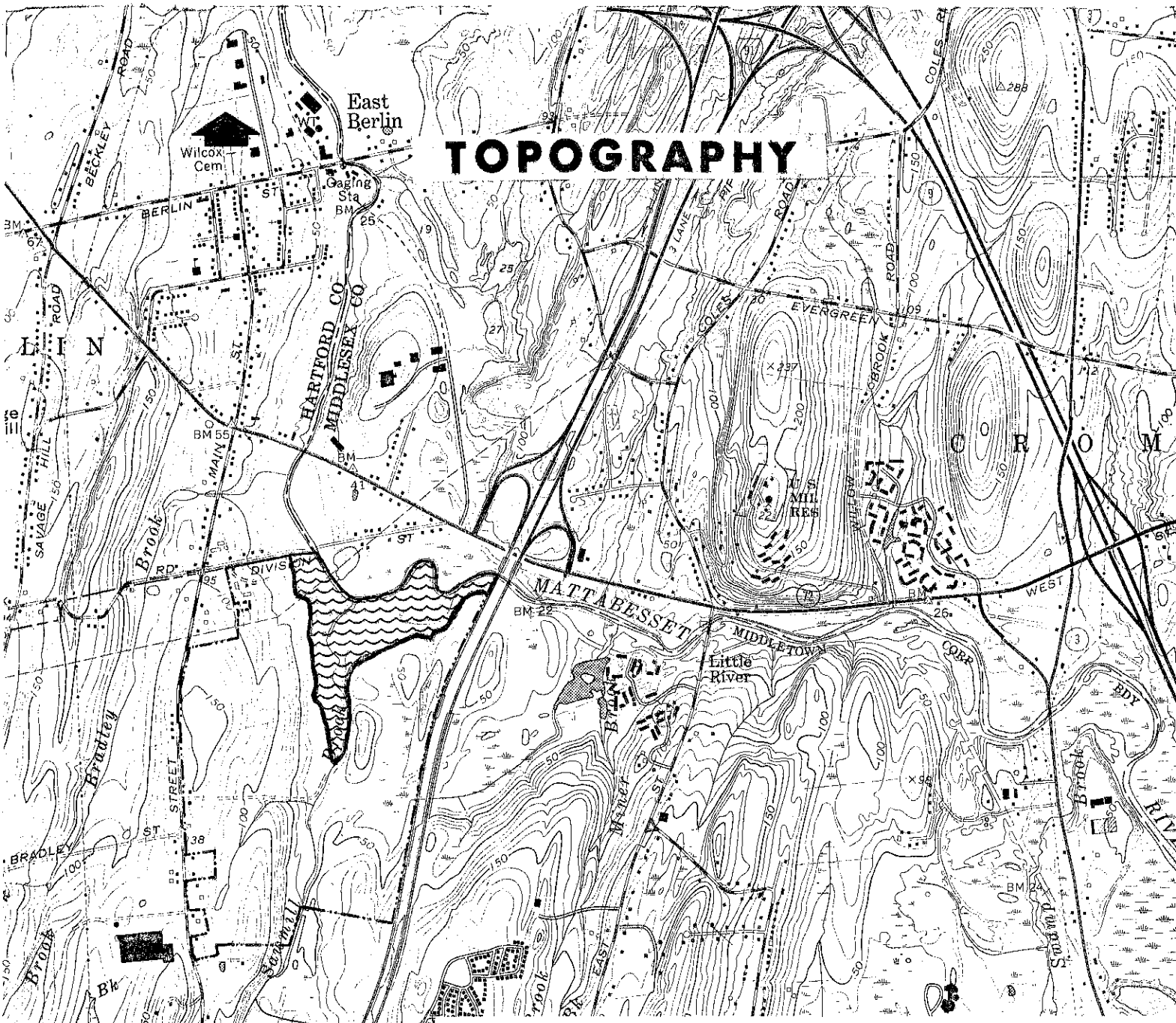
4. Effect of factors such as hydrocarbons, salts and drainage from paved areas on water quality;

5. Effect of silt in Sawmill Brook - Mattabesset River - Connecticut River system;

6. If environmental impact of this proposed use is considered minimal, will the impact of associated small businesses also be minimal.

As mentioned above, discharge significant to the Sawmill-Mattabesset system will be from run-off over paved areas or from erosion and sedimentation during construction, although the Mattabesset River might benefit from detritus scouring the organic matter in its system.

1. Intermediate Regional Flood is a flood having a one per cent chance of occurrence in any one year.



FLOOD PRONE AREA

Middletown, Connecticut, Quadrangle
7.5 Minute Series (Topographic)
United States Department of the
Interior, Geological Survey.
1965, photo revised 1972
Scale 1" = 2000'

INLAND-WETLANDS AND WATER QUALITY STANDARDS

Approximately 25.5% of the site consists of soils which are included in the definition of inland wetlands as defined by Public Act 73-571. The soils are distributed as follows:

INLAND-WETLAND SOILS

SOILS MAPPING UNIT	PER CENT OF SITE
58 Alluvial land	19 %
71V Rowland silt loam	1 %
643 Scantic silt loam, reddish variant	5.5%
	25.5%

The predominate wetland soil is alluvial land (58). This land type consists of areas so variable in texture and/or drainage that it is difficult to classify the material into series. These areas range in texture from a loamy sand to silt and in drainage from well drained to very poorly drained.

The next largest wetland land type is the Scantic silt loam. These soils are somewhat poorly to poorly drained and have developed in reddish colored silts and clays. The permeability of the subsoil is very slow. The water table is at or near the surface from late fall to late spring.

The following map indicates the inland wetlands and water courses on the site.

As a wildlife habitat the alluvial soils are poorly suited for the production of an open land wildlife habitat; however, with moderate treatment, habitat requirements of woodland wildlife can be established. The fluctuating water table and flood hazard limits these areas for wetland wildlife habitat. Likewise, Scantic silt loam soils are poorly suited for the production of open land wildlife habitat. Woodland and wetland wildlife habitat requirements can be developed in this soil type.

In accordance with the General Statutes of Connecticut, water quality standards have been established for all inland waters. Sawmill Brook has been placed within Class A and the Mattabesset River within Class B. The standards for each of these classes are found in Appendix II. The effects of the proposed construction will have to comply with these standards and the developer should provide sufficient plans and data to indicate his ability to comply with these standards. A permit for any proposed change in the standards would have to be obtained.

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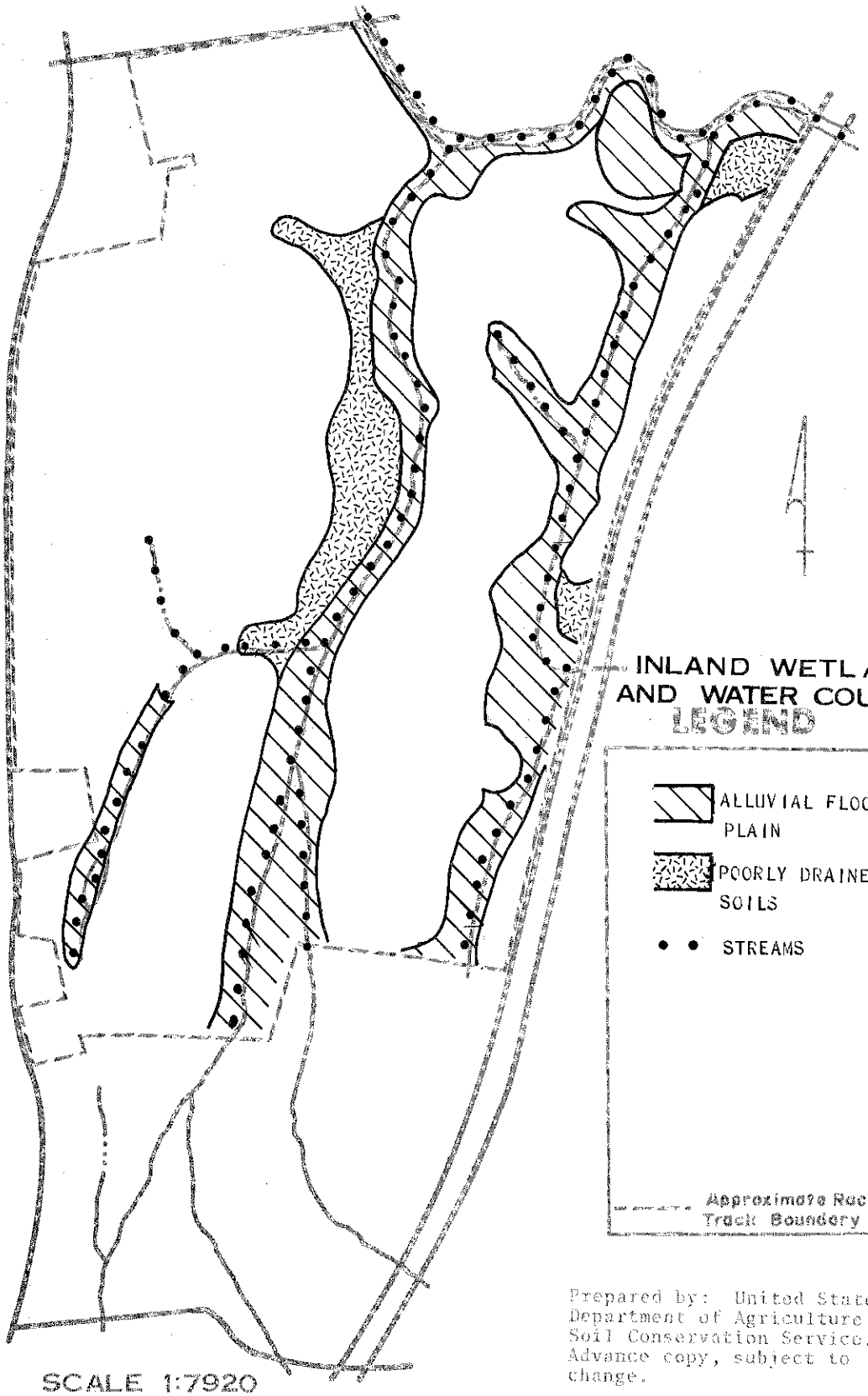
MIDDLETOWN, CONNECTICUT



Prepared by: United States Department of Agriculture, Soil Conservation Service. Advance copy, subject to change.

VEGETATION AND WILDLIFE

A great portion of the proposed site is being used for agriculture either in cultivation or pasture. Forested areas on the property consist only of a wood lot on the northern part which covers a knoll above Sawmill Brook, the swamp, and the hedgerows between the fields. The trees consist mainly of mixed hardwoods and red cedar, none of which can be considered unique. Though relatively small in number, the trees within the wood lot are large enough to cut for saw logs and the red cedar on the site can be used for posts and poles. Much of the forest would be cut for construction of the race course and should go into useful products, even though the monetary value will be insignificant in comparison to the overall project cost.

The combination of open fields, wooded upland and wetlands on the site contribute to a good wildlife habitat. However, the wildlife does not appear to be uncommon or unique to this area or other areas in Middletown.

II SITE ALTERATION

-EROSION AND
SEDIMENTATION

-SITE ALTERATION

EROSION AND SEDIMENTATION

During the construction phase of any development, there is an extremely great potential for erosion and sedimentation because of the exposed land surface. Other factors, such as slope, soil texture, construction practices, and heavy storms, can affect the amount of erosion that actually occurs.

The following table is a generalization[1] of potential soil losses during construction for disturbed and unvegetated areas. The data was developed from the United States Department of Agriculture soil-loss equation and reflects only sheet erosion; it does not take into account rill and gully erosion which could be substantial.

EROSION HAZARD

SOIL SYMBOL	CUBIC YARDS PER ACRE PER YEAR	ERODIBILITY
38 A	9	Slight
38 B	26	Moderate
38 C	70	Moderate to severe
38 D	163	Severe
38 XB	26	Moderate
38 XC	70	Moderate to severe
38 XD	163	Severe
56 A	9	Slight
56 XB	26	Moderate
58	9	Slight
71 V	11	Slight
94 L BC	66	Moderate to severe
94 MD	345	Severe
443 A	10	Slight
564 M BC	46	Moderate to severe
643	10	Slight

EROSION HAZARD ON SITE

CUBIC YARDS PER ACRE PER YEAR	% OF SITE
less than 26	47%
26-70	48%
71+	5%

The following map graphically depicts the erosion hazard of the soils on the proposed site.

1. Soil losses were based upon a slope length of 100 feet and averaged on soil solum and substratum. The slope per cent was based on the average of soil slope class.

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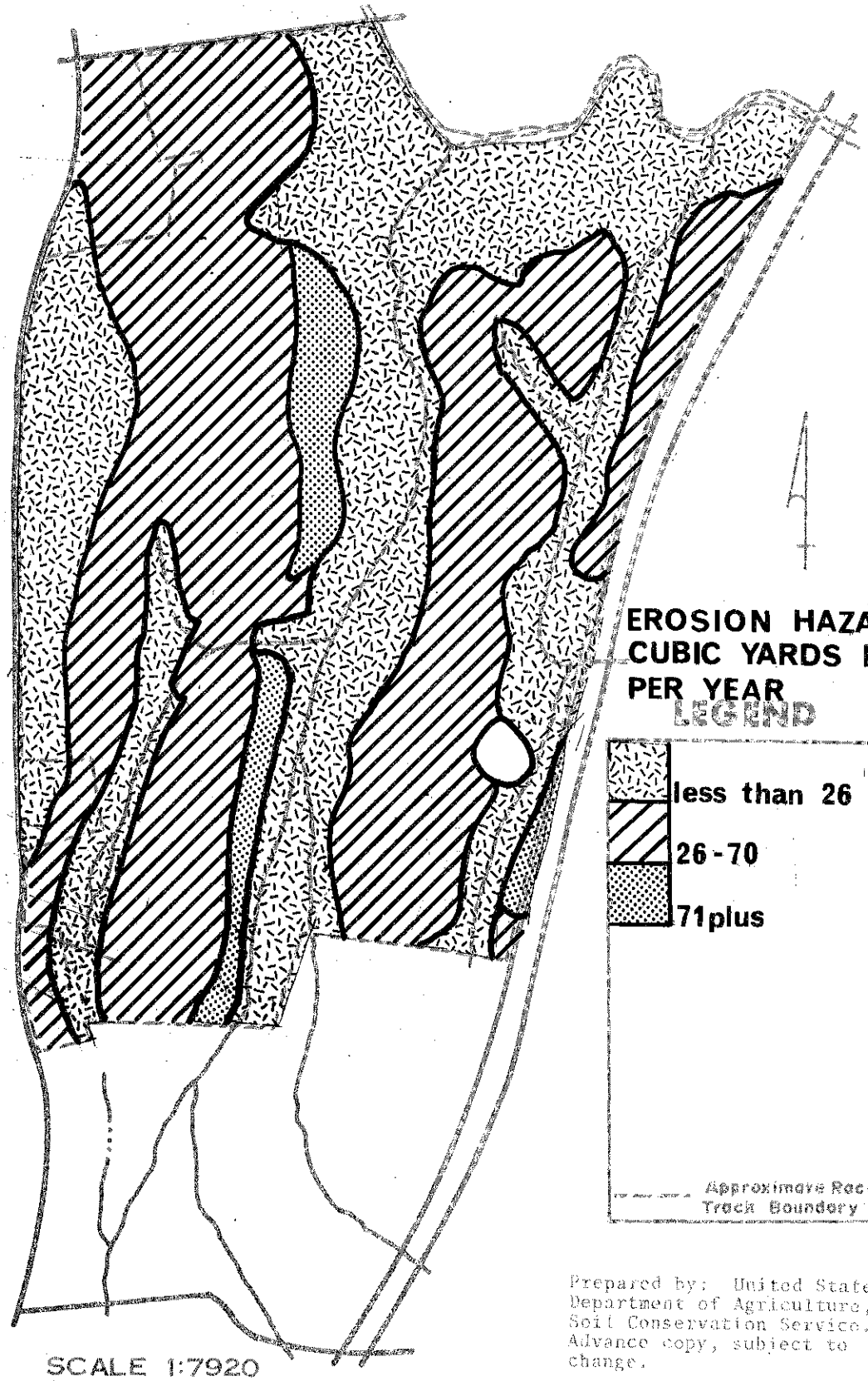
MIDDLETOWN, CONNECTICUT



EROSION HAZARD – CUBIC YARDS PER ACRE PER YEAR

LEGEND

- less than 26
- 26 - 70
- 71plus
- Approximate Race Track Boundary

SCALE 1:7920

1/2 3/8 1/4 1/8 0

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SITE ALTERATION

On page six of the developer's report the following statement is made. "Utilization of a comprehensive systems approach to project design and use will insure optimum utilization of land and maximum preservation of desirable natural site features...". What stands out is: "...insure maximum preservation of natural site features...". The proposed land alteration indicates that virtually all of the site's natural features and natural systems will be drastically altered. New systems and new features will be created replacing those destroyed or altered.

The following maps were compiled to give a visual impression of the amount of material which will be excavated or deposited on the existing land surface. The maps were developed by comparing the present topography with the topography of the finished site. The data was interpreted from "Grading and Drainage Plan" sheet c-1 of the drawing submitted in the application to the Commission on the City Plan and Zoning. The original interpretations were made at the scale of 1" = 200' and in the following categories:

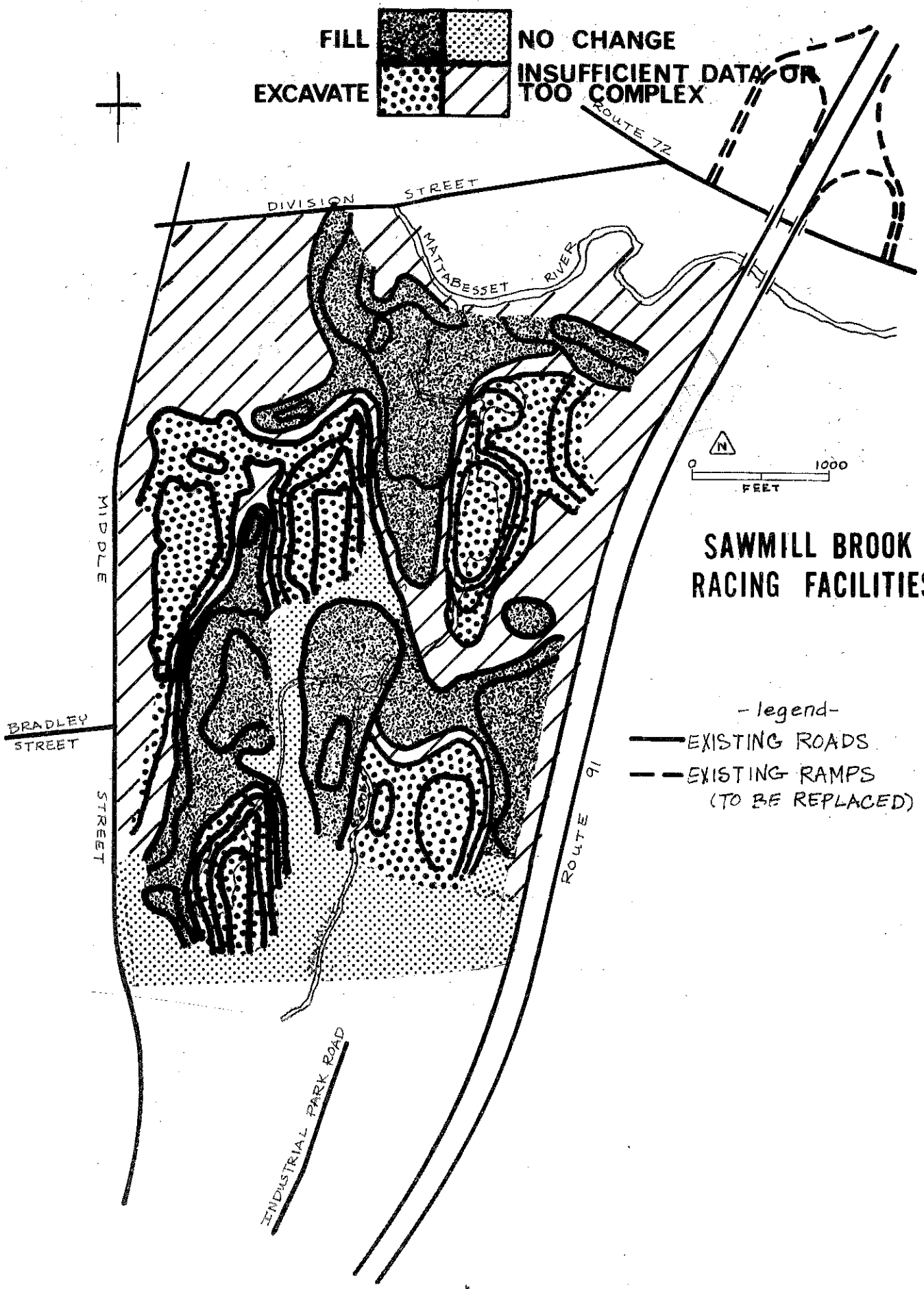
FILL AREAS:	EXCAVATION AREAS:
3 to 8 feet	3 to 8 feet
8 to 17 feet	8 to 17 feet
17 to 27 feet	17 to 27 feet
27 to 40 feet	27 to 40 feet

For publication purposes this data was summarized into broader categories. It is important to understand that these maps are general and were developed only to give a visual impression of the extent of change in the land surface. The maps are not necessarily accurate at any given location.

The extensive amount of proposed excavation, considerable topographic relief, character of the ground materials and the proximity of a through-flowing stream all indicate the potential of a major erosion and sedimentation problem during construction with potential significant effects on the Mattabesset River and the marshes at this river's mouth. The amount of proposed excavation is large. Virtually all areas of the site will be regraded, excavated or filled.

Local topographic relief is as much as 130 feet with moderate to steep slopes over much of the western two-thirds of the site. Much of the site is underlain by till, and samples of this material from the Cromwell/Rocky Hill areas indicate that from 30% to 80% of this till contains particle sizes less than 0.02 mm in diameter. Particles this small will not settle out in sediment ponds where current velocities exceed 0.1 cm/second. The through-flowing brook will tend to carry much of any eroded material off the site and into the Mattabesset River for

FILL AND EXCAVATION AREAS



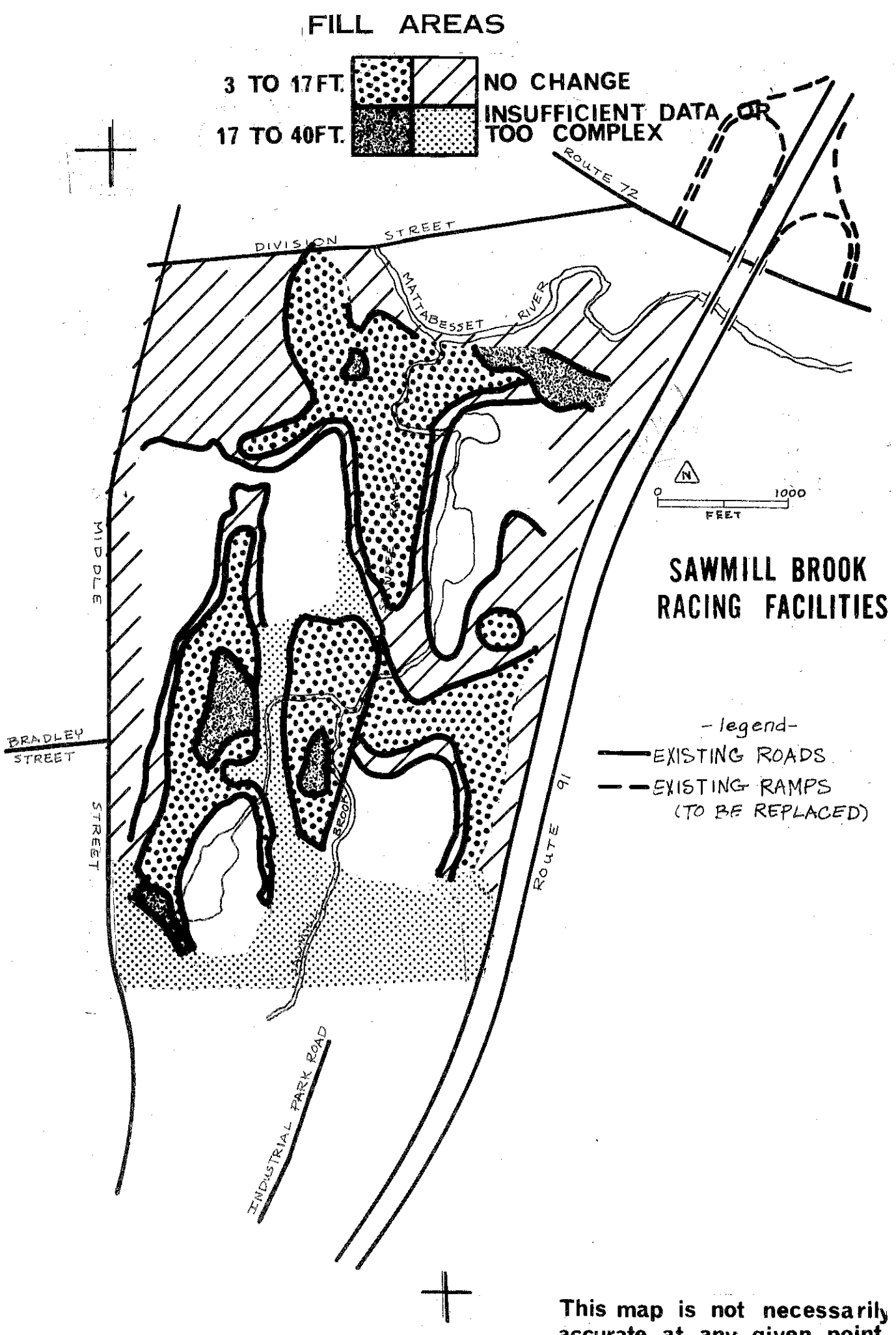
SAWMILL BROOK RACING FACILITIES

- legend -

——— EXISTING ROADS

— — EXISTING RAMPS (TO BE REPLACED)

This map is not necessarily accurate at any given point.


FILL AREAS
3 TO 17FT.
17 TO 40FT.
NO CHANGE
INSUFFICIENT DATA OR TOO COMPLEX
ROUTE 72
DIVISION STREET
MATTABESSET RIVER
MIDDLE STREET
BRADLEY STREET
SAWMILL BROOK
ROUTE 91
INDUSTRIAL PARK ROAD
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FEET
SAWMILL BROOK RACING FACILITIES
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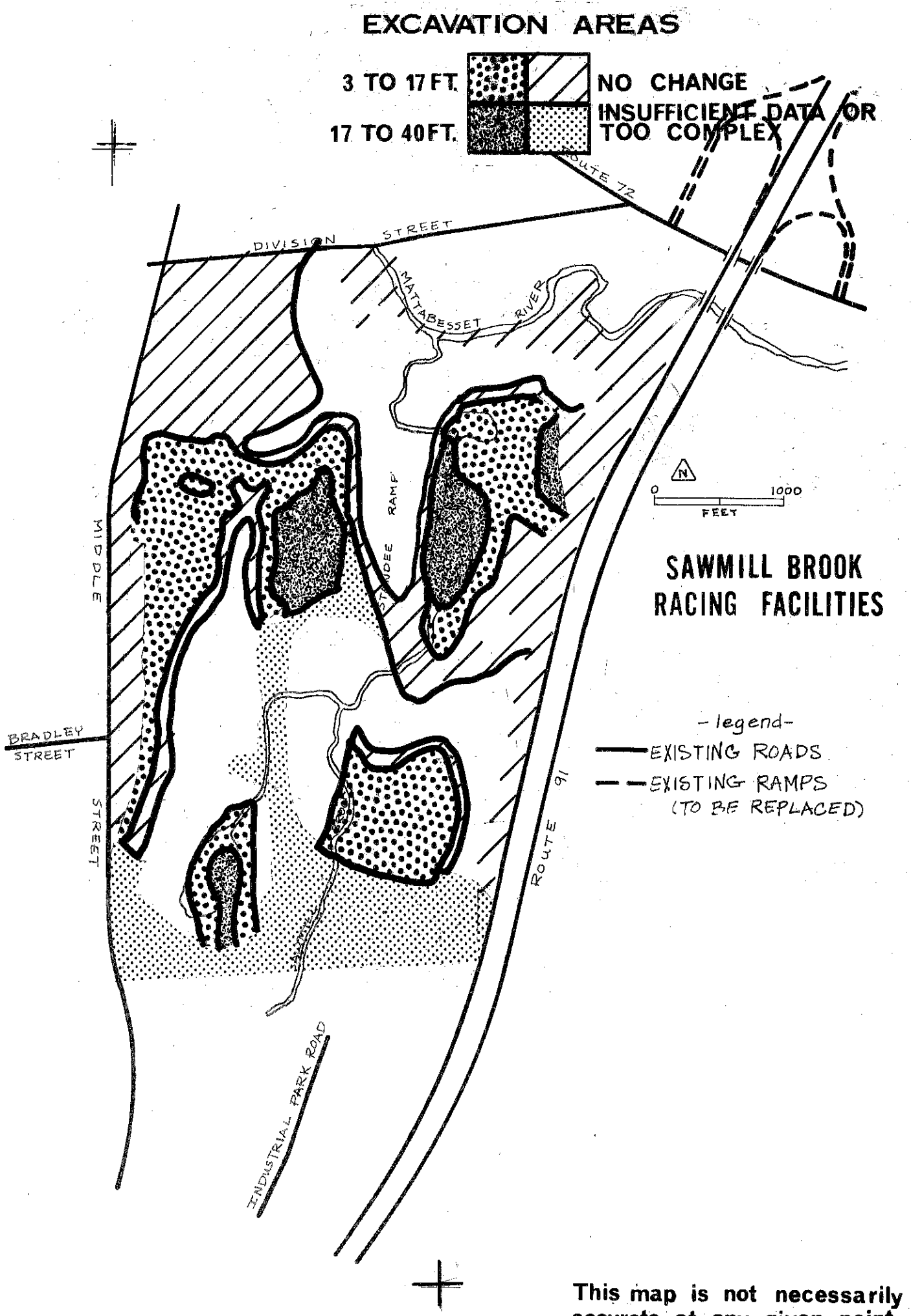
EXISTING ROADS
EXISTING RAMPS (TO BE REPLACED)
This map is not necessarily accurate at any given point.



This map is not necessarily accurate at any given point.

deposition of this material in the Mattabesset/Connecticut River and marsh system. The rapid surface water runoff from the slopes will erode the till material and carry large amounts of sediment into the river systems. Much of the sediment in suspension will not settle out in sediment basins which have appreciable through-flowing current velocities.

Measures for erosion and sediment control should be designed to prevent erosion before it starts and to isolate totally sediment-laden runoff from Sawmill Brook. The potential for erosion and sediment problems on this site is so great that a specific and detailed plan for control should be developed before construction is approved or begun. The control program should greatly exceed normal consideration for this problem and should be designed to handle even infrequent but occasional heavy summer rain storms, insuring that no significant amounts of sediment are carried off the site by surface water. Adequate control will probably have to be achieved by carefully regulating and phasing construction activity to prevent erosion, and by totally isolating all surface runoff away from Sawmill Brook, directing this runoff to "dead end" sediment ponds which disperse water through evapotranspiration and infiltration.

All control measures should be completed prior to the start of construction.

In developing the site it is suggested that the area east of Sawmill Brook be graded first and the new channels and pond for the diversion of Sawmill Brook be completed. Then, before start of construction west of Sawmill Brook, the brook should be diverted permanently into its new channel. This procedure would minimize the amount of activity in the immediate vicinity of Sawmill Brook and allow for greater protection from sedimentation.

In preparing erosion and sedimentation control plans, the standards and specifications in the Erosion and Sediment Control Handbook for Connecticut, published by and available from the Soil Conservation Service, should be followed as a minimum. Plans should also include methods for stabilization of the area upon completion of construction. When these plans are developed, a review by the Middlesex County Soil Conservation Service is suggested.

III OPERATIONAL IMPACTS

- -RUNOFF AND FLOOD PLAIN USE
- -WATER SUPPLY AND SEWAGE DISPOSAL
- -SOLID WASTE DISPOSAL
- -AIR QUALITY
- -EMPLOYMENT
- -TRANSPORTATION
- -LAND USE IMPACTS
- -ENERGY CONSERVATION AND CLIMATOLOGY

RUNOFF
AND
FLOOD PLAIN USE

The subject of erosion and sedimentation during construction has been discussed previously. Though of a much smaller impact, there is still a potential for erosion and sedimentation on the site after construction is completed. All storm drainage on the site should be separated from the sanitary sewerage and be directed to suitably designed sediment traps and sediment ponds to remove the fine-grained sediments. Within the stable areas measures should be taken to avoid introducing manure and other wastes into the storm drainage system. "Dead end" design, where the runoff is discharged into the ground, should be considered for the sediment traps and ponds. These traps and ponds will not remove chemicals dissolved in or floating on runoff waters (i.e., road salt, and petroleum products). The extent or significance of these pollutants has not been determined.

The use of permeable pavement materials should be considered for the parking lots and other paved areas. These materials can greatly reduce the amount of surface runoff, but their effectiveness is partly dependent on the permeability characteristics of the underlying ground materials.

If it is intended that the pond inside of the main racetrack is to serve as a sediment pond, it is recommended that Sawmill Brook not run through the same pond. The current from the brook will significantly reduce the pond's ability to function as a sediment trap. Alternatively, storm drainage can be diverted directly to the Mattabesset River.

This proposed pond will be excavated in a topographic high which shows 60+ feet in elevation. The pond's normal water surface is to be elevation 25. The volume of the pond is to be 15,000,000 gallons or about 46 acre feet. This means that with a surface area of about 4-5 acres the pond would have to be 15+ feet deep. Therefore, the total depth of excavation would be roughly 50 feet. Bedrock is exposed on both sides of the valley and it seems likely that an excavation of this magnitude (50 feet) would encounter bedrock. Certainly before excavation was started in any of the areas drilling would be recommended to identify the material to be encountered.

The water budget for the upper pond (inside of the training track) should be calculated carefully to determine if the pond will dry out or become excessively stagnant during dry conditions. A certain amount of organic

and other waste material from the stable area's storm drains will flow into this pond, and if there is insufficient year-round water flow, the drop in the water level of the pond could become a problem.

Since surface drainage can be influenced by Sawmill Brook, Mattabesset and Connecticut Rivers, stream channels and culvert sizes should be calculated for the following situations: a coincident event of a 100-year flood on the Connecticut River, fifty-year floods on both the Mattabesset River and the Sawmill Brook calculating the latter two on the basis of a 1990 (year) degree of urbanization for these smaller basins.

The proposed site development will encroach substantially on the floodplains on the Sawmill Brook, Mattabesset and Connecticut Rivers. The net effect of the loss of floodplain caused by the proposal is an estimated 542 acre-feet, which may not be significant. The Commission should, however, evaluate the impact of development on all undeveloped floodplains on the water courses. The Army Corps of Engineers in their comprehensive water and related land resources study for the Connecticut River basin strongly encourage the adoption of floodplain control measures as being essential to the protection of the valley. Much of the floodplain on the proposed site is currently being used for agriculture. In general, urbanization of floodplain areas presents a natural resource conflict. Agricultural use of a floodplain area does not necessarily present the same kind of natural resource/land use conflict.

WATER SUPPLY
AND
SEWAGE DISPOSAL

Municipal water and sewers are available, and unlike many such developments in outlying areas, these trunk lines have adequate capacity. The Mattabesset Sewer District has the capacity to accept the additional sewage from the site. However, the quantity and quality of sewage from the site should be estimated and evaluated to determine the ultimate impact of the additional flow on the district's reserve capacity and its treatment operation. Design of the stable pre-treatment facility should insure the exclusion of all solids including manure.

SOLID WASTE DISPOSAL

Solid waste production for the proposed race course was estimated to total 70 tons per day, with 63 tons being produced within the stable area. The 63 tons per day for 1,800 horses is a realistic figure that would closely approximate the absolute maximum production. To substantiate this estimate, the table on the following page shows the results of a study conducted at the University of Connecticut with three horses over a 48-hour period.

The approximately 70 tons per day of waste generated from the proposed facility would overburden the existing Middletown waste disposal facilities. Recognizing this, the developers' preliminary plans include the construction of an incinerator to reduce, by combustion, wastes generated on the site as well as municipal refuse from Middletown. A new incinerator would require a permit from the DEP Air Compliance Section under §19-508-3 and §19-508-18 of the DEP Air Regulations as a stationary source. Compliance with the strict federal emission standards generally requires the installation of abatement equipment. Depending on the equipment selection made (wet vs. dry), additional review by the DEP Water Compliance Section may be required as well to insure that there is no resultant water pollution. In addition, approval of the storage areas and overall plant operation will have to be obtained from the DEP Solid Waste Section to insure compliance with their operational guidelines.

EXISTING AIR QUALITY AND STANDARDS

	Primary Annual Standard	Secondary Annual Standard	Middletown 1973 Annual Averages
Particulates:	75 ug/m^3	60 ug/m^3	61.2[a] 63.0[b] ug/m^3
SO_X:	80 ug/m^3	60 ug/m^3	52.7[c]

Notes:

a. Moody School
b. City Hall
c. Sumner Street

Middletown currently does not meet the secondary standards for particulates, although there has been a constant trend of improvement during the last several years. Assuming this trend continues there is the possibility that Middletown will be well enough within the secondary standard to permit the construction of an incinerator by 1975 or 1976.

Information required for a stationary source permit (incinerator) includes a breakdown of the composition of the wastes to be incinerated, detailed plant design plans, hours and duration of operation and detailed specifications for emission control equipment and waste pretreatment facilities.

It should be noted that DEP, in conjunction with the Connecticut Resources Recovery Authority, is not encouraging the construction of new municipal incinerators. The emphasis for future solid waste disposal is being placed on resource and energy recovery. Although it would be possible for the city to take advantage of the presence of an incinerator at the track facility, it will still be necessary to develop resource recovery measures related to newsprint, glass, aluminum and ferrous metals. The city would have to make available an approved area for the disposal of the residue from the incinerator since there is no site designated in the proposal. The Department of Environmental Protection has indicated that it would review the specific incinerator design for heat recovery measures.

If storage of animal wastes is anticipated prior to incineration, systems are available to handle adequately the possible odor or fly problem. The proposal did not indicate storage, but continuous disposal of wastes. It would be advisable to consider emergency storage of solid wastes for situations such as a breakdown of the incinerator. A method of storage being proposed for a hunting club in a heavily populated section of Connecticut would use portable compactors with a "hospital seal", providing for volume reduction as well as elimination of odor and fly problems.

48-HOUR HORSE METABOLISM STUDY

ANIMAL	WEIGHT (KG.)	FED HAY (KG.)	FED GRAIN (KG.)	FECES WET (KG.)	FECES AS % OF DRY MATERIAL	FECES DRY MATERIAL (K.G.)	YEARLY FECES WET (KG.)	YEARLY FECES DRY (KG.)	URINE (LITERS)	YEARLY URINE (LITERS)
EASTER	590	22.2	2.9	68.5	24.20	16.6	12,500	3,030	9.4	1,716
REX	475	9.5	5.4	35.8	24.21	8.7	6,534	1,588	11.3	2,062
EXPLORER	500	16.1	3.4	43.5	25.93	11.3	7,939	2,062	6.0	1,095
AVERAGE PER DAY OR YEAR	—	8.0 KG. / DAY	2.0 KG. / DAY	24.6 KG. / DAY	24.78 %	6.1 KG. / DAY	8991 KG. / YEAR	2226 KG. / YEAR	4.45 L. / DAY	1,624 L. / YEAR
AVERAGE IN POUNDS	—	17.6 LBS. / DAY	4.5 LBS. / DAY	54.2 LBS. / DAY	—	13.4 LBS. / DAY	19,825 LBS. / YEAR	4,908 LBS. / YEAR	—	—

SOURCE: UNIVERSITY OF CONNECTICUT, COOPERATIVE EXTENSION SERVICE

EMPLOYMENT

The proposed racetrack represents no exception to the general business rule that employment increases during profitable periods and declines during unprofitable periods. Average daily patronage is most often used to measure the relative success of a track: the more people attending, the more employees needed to handle both patrons and horses. The developer of Sawmill Brook has projected average attendance of 12,000 persons daily with a peak attendance of 33,000 persons at no more than five special events yearly. He projects stable space for between 1,800 and 2,000 horses and that 3,000 employees would be hired to serve 12,000 fans per average racing day. The developer has not provided a detailed analysis of the available jobs; however, the following skilled and unskilled groups are traditionally involved in racetrack employment: Management - overall operation and supervision; Concessions - restaurants, lounges, parking and vendors; Racing Officials and Staff; Clerical - administrative and betting; Ground Crew; Maintenance Crew; Service - maid and janitorial; Security; and the "backstretch people" - stable and exercise hands, trainers, smiths, veterinarians. A great number of these jobs are unionized.

Approximately one backstretch person is needed for every three horses, in the absence of such labor-saving devices as mechanical hot-walkers for horse exercise and cooling down. Approximately 650 people will be required to care for 2,000 animals. Most will reside at the facility to provide 24-hour animal care. The average wage will be between $75 - $150 per week, room included and board subsidized by the management.

The next largest group will be approximately 500 concessionaires, based on figures from other operations, but depending largely upon the particular concessions developed at Sawmill Brook. Approximately 1,850 persons must be part of all the other groups combined to meet the developer's projected employment figures. Such a number seems excessive to staff grounds crew, security, management, officials, clerical, service, and maintenance positions. Although a ratio may be used to approximate the number of "backstretch people", use of such a method for overall employment based on attendance is limited by the differences between racing facilities. The figure of approximately 900 employees appears to be more reasonable. The total track employment would then be approximately 2,000 instead of 3,000 persons.

Those employed at the track will come largely from the Midstate Planning Region. Those who reside at the track, approximately 30% of the total, will possibly come from the greatest distance, since commuting is not a factor. Certain experts in track management and security, some concession personnel and racing officials will move to within a commuting radius of the track from out of state, but for the most part probably 50% or 60% of all employees will be persons presently living within a reasonable commuting area around the track. A group

such as the grounds crew may be largely drawn from a special area such as the Midstate Region, an area of excellent nurserymen. The part-time clerical positions at betting windows which pay approximately $26 base per 5 1/2 hour shift at other tracks, are generally filled with housewives and/or retired persons from nearby areas.

Alternate use of the Sawmill Brook site for light industry might, however, by the developer's own estimate, yield 4,500 jobs, whereas the estimate of probable racetrack employment based on projected attendance is less than half of that number of jobs. If the track does not in fact draw the projected average of 12,000 persons daily, total employment will be lower. For example, Penn National Race Course, 13 miles northeast of Harrisburg, Pennsylvania, opened almost two years ago with almost 1,000 employees in order to handle a projected average daily attendance of 9,000 persons. Actual attendance however has amounted to only 4,500 per day at this time and as a consequence the employment figure has dropped to less than 600.

TRANSPORTATION

I. Transportation Issues

A. The feasibility of locating a race track on the proposed Sawmill Brook site is contingent on the approval of a redesigned interchange system in the I-91 - Route 72 area. The most significant changes in the existing system are:

1) The complete elimination of the existing interchange

2) A fly-over directly onto the race course site for vehicles approaching from the south on I-91

3) A new right-turn exit ramp with a fly-over to the site for vehicles approaching from the north on I-91

4) A new exit ramp from the site with a fly-over for direct access to I-91 northbound

5) Several at-grade ramp connections and intersections

B. The Connecticut Department of Transportation (CONN DOT) was contacted in order to determine what procedures were necessary for approval of the design changes 1) through 5). The appropriate procedures are summarized as follows:

1) CONN DOT must review, comment on and approve the layout of the proposed revised interchange before submitting it to the Federal Highway Administration (FHWA). There would have to be assurances that such an interchange would not significantly affect the operations of I-91. At present CONN DOT has not reviewed any detailed plans for the proposed interchange.

2) a. FHWA must then review the proposal and approve, deny or approve with modifications. Steps 1) and 2) could take up to 18 months.

b. CONN DOT contacted the Division Office of FHWA regarding the question of providing direct access between an Interstate highway and a private development (i.e. the direct fly-overs across I-91 and Route 72 from I-91 northbound and southbound to the race track site). While FHWA did not rule out this possibility, it indicated that such an arrangement would have to be justified,

and the developer would have to show that there were no other feasible alternatives for providing such a service.

3) If FHWA approves the proposal the construction would take approximately two construction seasons.

C. A corollary issue related to the CONN DOT approval of the proposed interchange pertains to the taking of land within the Town of Cromwell.

From preliminary analysis, it appears that the interchange proposals in Cromwell require the acquisition of additional land in that town. This raises the question of whether or not the power of condemnation can be used, since the direct fly-over ramp from I-91 southbound would be built to serve a private facility.

If CONN DOT were to approve the proposed interchange, there is some indication from CONN DOT, that the state could bear some of the costs of the new interchange. However, even if the state does not share in the costs, CONN DOT's approval of the proposed interchange provides the basis for the use of condemnation of private lands within the Town of Cromwell.

II. Traffic Analysis

A. General comments

1) The traffic assignment data for local road systems, as shown in the report by Purcell Associates, does not conflict with the analysis conducted by CONN DOT's Planning Division. For purposes of analysis, the traffic assignments developed by CONN DOT and Purcell Associates were made assuming a limited interchange at Route 9 and I-91. (see figure 1).

A potential conflict with these assignments centers around the completion date for the Route 9 - I-91 interchange. CONN DOT has projected a completion date of fall of 1979 for the extension of Route 9 to the west to Route 15. Assuming that the race-track meets with the various approvals necessary, and could be finished by the fall of 1976, there would be a significant change in the traffic assignment as presented in the Purcell report.

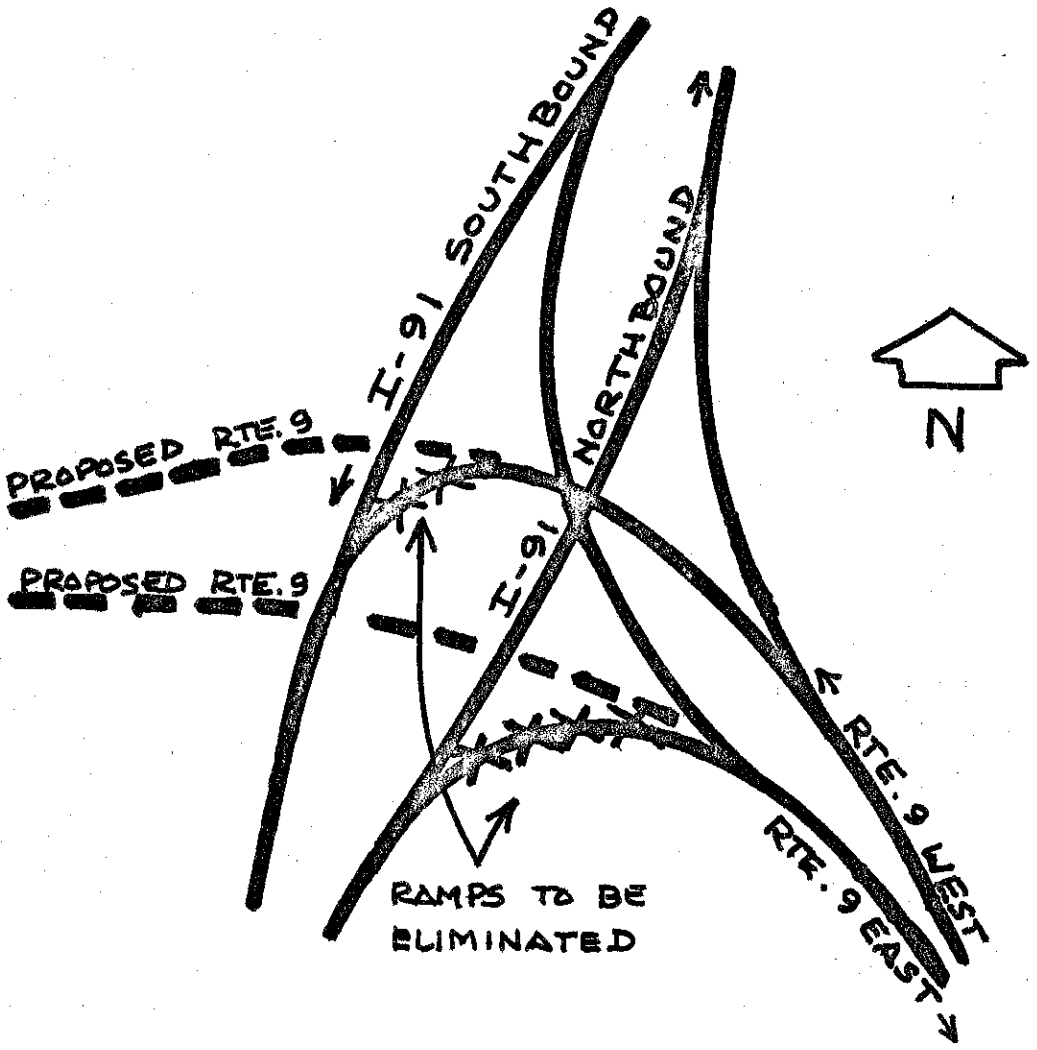


FIGURE 1

2) The completion of the Route 9 extension to Berlin is a critical factor in the assignment of traffic throughout the road network surrounding the racetrack. For the proposed traffic plan to work, it is essential that background traffic be removed, as much as possible, from Route 72. This problem becomes especially acute during the summer months when recreational traffic reaches peak levels on Routes 9 and 72.

3) CONN DOT found the consultants' (Purcell Associates) traffic generation and distribution estimates reasonable for the proposed racing facility. Therefore, CONN DOT used these estimates for capacity analysis. I-91 itself, would be able to accommodate the 6:30 p.m. to 7:30 p.m. exiting peak volume if the racetrack time schedule, as presented in the Purcell Associates' report, were followed. If the schedule were revised so that a significant portion

of this traffic exited between 4:00 p.m. and 6:00 p.m., the normal peak commuter period on a week day, serious traffic operational problems on I-91 would be created.

B. Specific Problem Areas

1.a. A severe weaving problem could occur in the area where northbound and southbound racetrack traffic merge upon entering the northern part of the track site. The weaving section is approximately 1,000 feet in length and begins at the site entrance fork and ends at the exit fork to the general parking area in the northwest part of the site.

The weaving movement occurs when passenger cars and buses approach the site from the north and desire to cross the roadway from the right to the left-hand lane in order to park in the preferred parking area to the south of the track or to park in the charter bus parking area.

b. The Purcell report contends that a traffic circulation system has been designed which will, "...channel each motorist to the 'best' parking area based upon the direction of his approach." Does this statement mean that vehicles approaching from the north will be directed to the north parking areas despite the possibility that they may want to use the preferred parking areas? Neither the report nor the traffic plans indicate how this channelization is to be effected.

c. Furthermore, this weaving movement is near capacity for level of service "D", which approaches unstable flow of vehicles. If a breakdown were to occur in this weave section, severe traffic operational problems would be encountered.

2.a. A potential problem exists at the entrance ramp to I-91 southbound as racetrack vehicles leave the site during peak hours. Under present design the ramp capacity will be exceeded at peak weekend exit time.

Sheet T-5, "Outbound Trip Assignment - Peak Departure Hour (6:30 - 7:30 p.m.)", indicates that 1930 vehicles will be using that ramp during that hour. When this figure is added to the lane 1 freeway volume and the background traffic volume coming from the ramp upstream, the demand volume exceeds the ramp capacity at the merge point. This will create a bottle-neck condition with queuing occurring for a long duration on the ramp and possibly resulting in speed reduction on through freeway lanes.

3.a. A similar problem, although not as severe, would exist on the entrance ramp for northbound I-91 traffic during the peak racetrack exit hour. The 1,680 racetrack vehicles plus 150 background traffic pushes the peak volume on this ramp over capacity. Also, a rather steep grade makes this ramp susceptive to further congestion with the addition of bus traffic exiting the racetrack.

b. The same sort of bottle-neck condition described above would occur at this ramp during peak hours. This condition could increase the chance of rear-end collision and speed reduction on the freeway itself, and traffic could back up onto local streets.

4.a. Given the two bottle-neck conditions which would exist during peak exit hours, an increased demand is placed on Route 72 and the local street system. In addition to the normal background traffic and the racetrack traffic that would be reasonably expected to use Route 72 to exit the track, the possibility exists that a significant portion of traffic destined for I-91 north and south would try to use either: a) Route 72 to get to Route 9 and then travel north to I-91, b) Route 72 to East Street and south to the Country Club Road interchange, or c) Route 72 to Middle Street and south to the Country Club Road interchange. The Purcell report has not addressed the latter two areas.

b. Additional study is needed to determine what traffic controls are necessary to insure steady flow between the Route 9 - Route 72 intersection and the Berlin Town line.

5. There is a significant discrepancy between the figure for total design vehicles (weekend event) on page 33 of the Purcell report, and the figure arrived at by computing total vehicles from the "Inbound Trip Assignment - Peak Arrival Hour (12:30 - 1:30 p.m.)" (Sheet - T-4 of Purcell report). The following examples illustrate this discrepancy:

Method 1 - Purcell report page 33

Weekend Design Load	12,000 x 1.33	=	16,000
Passenger Car Load Factor	= 2.5		
Public Transit Use	= 16,000 x 20%	=	3,200
Passenger Vehicles	= $\frac{16,000 - 3,200}{2.5}$	=	5,120
Transit Buses	= $\frac{3,200}{50}$	=	64
64 Transit Buses	= 64 x 4	=	256 passenger car equivalents

TOTAL DESIGN VEHICLES (Weekend Event)
=5,120 + 256 = 5,376 passenger cars

Method 2 - Purcell report sheet T-4

1. Inbound race course traffic - weekend (12:30 - 1:30 p.m.):
   From north 1,740
   From south 1,490

   3,230 vehicles

2. Page 24 (Purcell report) states that, "Approximately 50% of all incoming traffic will arrive between 90 and 30 minutes prior to the first race."

3. 3,230 vehicles = 50% of all incoming traffic.

4. 3,230
   x 2

   6,460 = 100% of racetrack vehicles

Method 2 - 6,460 vehicles
Method 1 - 5,376 vehicles
Difference 1,084 vehicles

6. From Sheet T-5, "Outbound Trip Assignment - Peak Departure Hour (6:30 - 7:30 p.m.)", it can be seen that 4,210 vehicles (1,930 - southbound + 2,280 northbound) will be leaving the site in that peak weekend hour. Page 25 of the Purcell report states that this hour, "...is the time period during which approximately 65% of the race course patrons will be exiting the site." Using the method employed in Number 5, the total number of vehicles exiting the site can be determined.

$$X = \text{total vehicles}$$
$$.65X = 4,210$$
$$X = \frac{4,210}{.65}$$
$$X = 6,477 \text{ total vehicles exiting racetrack}$$

This figure closely correlates with the 6,460 figure based on Sheet T-4, but not with the 5,376 passenger cars calculated on page 33 of the Purcell report.

7. Sheet T-3 of the Purcell report indicates that 10% of the outbound traffic will still be on the racetrack site at 7:30 p.m., approximately one hour after the last race. Depending on whether one uses the 5,376 total passenger cars for a weekend event from page 33 or the figures derived from the Inbound and Outbound Trip Assignment sheets T-4 and T-5, 6,460 and 6,477 respectively, there will be approximately 538 to 648 vehicles remaining on the site at 7:30 p.m.

8. The Purcell report states that the average weekend attendance is projected to be 16,000 persons. (page 33) This average weekend attendance has been used as the basis for designing the traffic network. (page 25) In light of the traffic conditions which would exist at peak hours for an attendance of 16,000, it should be shown what would happen if peak weekend attendance were encountered. The consultants' report does not indicate what the maximum weekend attendance could reach, only the average. In addition, if a normal bell curve distribution is utilized, it would seem reasonable

that 50% of the weekend race days would achieve attendance in excess of 16,000. This type of occurrence would lead to several weekend race days in which the designed traffic system is clearly over designed capacity.

9. Traffic estimates by the consultant were made on the basis of Average Daily Traffic (ADT). Inasmuch as the racing schedule is anticipated to coincide with a part of the heavier recreational traffic during the warmer months, a more appropriate method for evaluating traffic impact during peak racetrack hours would be to use traffic counts reflecting the peak recreational travel months.

As of June 1, 1974, the Connecticut Department of Environmental Protection will be regulating indirect sources of air pollution. In this case, the automobile traffic associated with the track would constitute the main source of indirect air pollution. The track owners would be required to obtain a construction permit from the Commissioner of the Department of Environmental Protection. The permit would only be issued if the facility were able to operate without interfering with the attainment or maintenance of applicable federal ambient air quality standards. Of the six major air pollutants for which standards have been established, the quantity of carbon monoxide (CO), caused primarily by automobile emissions, will probably determine whether a construction permit can be issued.

In modeling the proposed facility the key areas which will probably be considered are the queuing areas for both inbound and outbound traffic, the internal roadways to the exit ramps and the parking lots themselves. Based on EPA report "AP-42, Compilation of Air Pollutant Emission Factors" a 1972 motor vehicle will produce 68 grams of CO per mile at 20 miles per hour. At higher speeds it drops drastically and at lower speeds it increases to 115.6 grams per mile at 10 miles per hour and at 5 miles per hour between 136 and 170 grams per mile. The more expeditiously traffic is handled at the site and on the ramps leading from the site the less negative impact there will be on air quality.

At present there is a lack of air quality information for this area. There appears to be no data available that would automatically authorize the issuance or denial of a construction permit. It should be noted that the requirements for indirect source evaluation are being developed and are presented here as a rough guideline. Additional information and more extensive monitoring of current conditions as well as modeling of future impact may well be required as part of an application. The following general categories of information will however be required:

a) ambient pollutant concentrations as determined by on-site monitoring. Pollutants monitored will include SO_X and suspended particulates (incinerator) and CO (automotive). Additional monitoring data for HC and NO_X (automotive) and Ozone may be required.

b) local meteorology as determined by on or near site monitoring. Data to include wind direction, wind speed, and stability class.

c) automotive flow data both pre-and post-construction. Detail design showing entrances and exits for parking facilities and location and type of traffic control devices as well as estimates on expected speeds and peak-hour congestion will be required. The worst case must also be analyzed (i.e., maximum number of vehicles that the facility could attract for any single event). In addition, predictions of the impact of the facility in terms of vehicular congestion on existing local and state roads in the vicinity must be presented.

The proposed racing facility would use acreage that could accommodate approximately 4,500 industrially related jobs. Based on the uses now in or approved for this I-2 Zone, it is estimated that the track parking area would be approximately three times that required under the zoning code to accommodate employee and customer parking. These extensive areas make the control of surface water runoff more difficult to accommodate adequately. Industry in the I-2 Zone would require far less extensive site preparation and thus provide more of an opportunity to work with the natural features of the site.

There will undoubtedly be commercial uses developed which will be a spin-off of the presence of a track. The amount and the type of uses are difficult to assess as they vary among track facilities; nevertheless, whatever is developed in association with the track would be affected by the zoning in the immediate area. Cromwell has an extensive commercial zone along Route 72 from the Route 9 interchange with West Street to the Berlin town line. This area would be highly accessible from the track with the new interchange design. The only other nearby commercial area is located on Route 217 (East Street) in the Westlake Planned Residential Community. These commercial areas would generate traffic and will have an impact on the traffic pattern related to the track. The present I-2 Zone in Middletown does not permit commercial uses that would be associated with a racetrack, thus there should be no commercially-oriented traffic generated by the track in this area.

ENERGY CONSERVATION AND CLIMATOLOGY

ENERGY CONSERVATION

The following items were suggested for investigation to conserve energy should the track receive approval:

a) Orientation of the buildings to minimize the differential between heat and cooling requirements.

b) Investigation of all alternative sources of energy (coal, gas, oil and electric) in terms of environmental impact and efficient energy use including the possibility of on-site generation. Possible use of solar energy and waste heat from incinerator.

c) Use of double glazing, shading devices, building materials with reduced energy transfer and maximum insulation for exterior surfaces.

d) Investigation of methods of controlling lighting levels and recovering heat from exhaust systems.

CLIMATOLOGY

The winds in the central valley are from the north during the winter months and south during the summer, sometimes reaching quite high velocities. The removal of all the tall vegetation from the site and the removal of the hill on the east and northeast side of the property (where the proposed pond is to go) will expose the site to much higher climate extremes.

To eliminate this problem as much as possible construction of a vegetation covered (tall trees) berm along the north edge of the property would decrease the cold north winds during the winter. The "grandstand" area should be well protected from the north (with evergreens and berms) and left open from the south to allow cooling breezes in the summer.

The very large paved parking lot will cause a major change in the Radiant Energy Balance of the area resulting in a "Heat Island" effect. The sensible heat produced will be more than twice what is normally produced from grass areas. This effect can be lessened considerably by breaking the parking area up by leaving or planting east west rows of trees.

APPENDIX I

Description of Soil Mapping Units

pp. 13

UPLAND SOILS - OVER COMPACT TILL

Well drained soils

C-1a Non-stony or stony soils with slopes less than 8 percent
38A Wethersfield loam, 0-3% slopes - 38B Wethersfield loam, 3-8% slopes
38XB Wethersfield stony loam, 3-8% slopes

C-1b Non-stony or stony soils with slopes between 8 and 15 percent
38C Wethersfield loam, 8-15% slopes
38XC Wethersfield stony loam, 8-15% slopes

These soils occur mostly on the tops and upper slopes of drumlins--hills that were smoothed and elongated north to south by the movement of glaciers. The soils are underlain by compact glacial till and have a hardpan 16 to 36 inches below the soil surface. During wet seasons, excess water in the soil moves downslope above the pan. The till commonly contains stones and boulders which add difficulty when excavating or earth moving operations are needed. These soils have good moisture holding capacity for plant growth. Exceptional panoramic views are afforded from the higher areas.

Urban. The design and construction of on-site sewage disposal systems that function satisfactorily is very difficult because of the hardpan which drastically reduces percolation rates. Slopes above 8 percent add further difficulty and problems in design and site selection of absorption fields.

Conditions are favorable for excavation of basements for homes on soils with slopes less than 8 percent. Slopes above 8 percent are a moderate limitation, however, the steeper slopes present opportunities for a wider choice of architectural design.

Stability of footings is not a problem, but measures such as footing drains are needed to prevent seepage into basements. Soil conditions are favorable for the establishment and maintenance of lawns, trees, and shrubs. The stony soils and slopes above 8 percent add difficulty in landscaping.

Difficulty in constructing streets and parking lots ranges from slight on level areas, to moderate on 3 to 8 percent slopes, to severe on slopes above 8 percent. The hazard of frost heaving because of water accumulation above the hardpan requires special consideration. Also, soil slippage on road cuts is a hazard during wet seasons.

Recreation. These soils are favorable for picnic areas and camp sites. The level soils are favorable for play areas, but limitations for this use increases on soils with slopes above 3 percent.

Wildlife. These soils are well suited for the dependable growth of a wide variety of desirable wildlife food and cover plants. Habitat for woodland wildlife species is easily established, improved, or maintained. On the stony soils it is more difficult to establish grain, grasses, and legumes for openland wildlife. It is impractical to develop wetland wildlife habitat.

Woodland. These soils have good productivity for wood crops. Both hardwoods and conifers are well suited. Competition from hardwoods is a serious problem when managing for pine, spruce, or larch. Hardwoods to favor on these soils are red oak, white ash, and sugar maple.

Cropland. The soils cleared of stones are suitable for the production of most agricultural crops grown in the area. Erosion is a hazard and on the steeper slopes more intensive surface water control measures are needed.

UPLAND SOILS - OVER COMPACT TILL

Well drained soils

C-1d Non-stony or stony soils with slopes above 15 percent
38D Wethersfield loam, 15-25% slopes
38XD Wethersfield stony loam, 15-25% slopes

C-1e Very stony soils with slopes above 15 percent

These soils occur on the steeper side slopes of drumlins--hills that were smoothed and elongated north to south by the movement of glaciers. They are underlain by compact till and have a hardpan 16 to 36 inches below the soil surface. Permeability above the hardpan is moderate but the pan drastically reduces percolation. The steep slopes and predominance of very stony soils limit the use of this land. Most of these soils are wooded adding to the beauty of the landscape. They have excess water above the pan for short periods during wet seasons.

Urban. Costly measures are required to overcome the severe limitations imposed by steep slopes, stoniness, and hardpan in developing these areas for urban uses.

Recreation. These soils have severe limitations for picnic areas, camp sites, and play areas.

Wildlife. It is extremely difficult to establish or improve openland wildlife habitat on the stony and very stony soils and slope makes it difficult to establish grains, grasses, and legumes on the other soils in these groups. There are few or no soil limitations that affect the development or maintenance of woodland wildlife habitat. It is impractical to develop wetland wildlife habitat on these soils.

Woodland. These soils have good productivity for wood crops. Both hardwoods and conifers are well suited. Competition from hardwoods is a serious problem when managing for pine, spruce, or larch. Hardwoods to favor on these soils are red oak, white ash, and sugar maple. Equipment operation is difficult because of steep slopes and stoniness. Attention to erosion control measures is important on skid trails and roads.

Cropland. The soils cleared of stones in group C-1d are suited for the production of cultivated crops in long rotations with grasses and legumes. Because of the high erosion hazard, very intensive surface water control measures are required.

The very stony soils in group C-1e are not suited for the production of agricultural crops.

UPLAND SOILS - OVER COMPACT TILL

Moderately drained soils

C-2a Non-stony or stony soils with a moderately high seasonal water table

56A Ludlow silt loam, 0-3% slopes

[redacted]

C-2b Very stony soils with a moderately high seasonal water table

56XB Ludlow stony silt loam, 3-8% slopes

564M BC Ludlow very stony silt loam, 3-15% slopes

These soils occur on the slopes of drumlins--hills smoothed and elongated north to south by the movement of glaciers. They are underlain by compact glacial till and have a hardpan 16 to 36 inches below the soil surface. Permeability above the hardpan is moderate but the pan drastically reduces percolation. These soils have a high water table during wet seasons. During the period of highest saturation, usually in the early spring, the water table remains within 15 to 20 inches of the soil surface. This condition seldom persists beyond late spring. Slopes do not exceed 15 percent and those less than 8 percent predominate.

Urban. The design and installation of on-site sewage disposal systems that function satisfactorily is very difficult because of the hardpan and seasonal water table. The very stony soils add difficulty to installation.

During wet periods, the water table is a problem in construction of homes with basements. Measures such as land fill or drainage are needed to prevent seepage into basements. The very stony soils add difficulty in excavation.

Soil conditions are favorable for the establishment and maintenance of lawns, trees, and shrubs. The very stony soils and slopes above 8 percent add difficulty in landscaping.

The very stony soils and slopes above 8 percent present severe problems in the design and construction of streets and parking lots. The hazard of frost heaving because of water table and hardpan must be given special consideration in design and construction. Soil slippage on road cuts is a hazard during wet seasons.

Recreation. During the main season of use, the non-stony soils with less than 8 percent slope are favorable for picnic areas, camp sites, and play areas. Drainage is needed to overcome the seasonal water table on playing fields for intensive use and to extend the period of picnicking and camping. Limitations for recreational use increase on soils with more slope and stoniness.

Wildlife. Habitat requirements of openland wildlife species can be established, improved, or maintained but stoniness adds difficulty in management. There are few or no soil limitations that affect the development or maintenance of woodland wildlife habitat. It is extremely difficult and expensive to develop wetland wildlife habitat on these soils.

Woodland. These soils have good productivity for wood crops. Both hardwoods and conifers are well suited. Competition from hardwoods is a serious problem when managing for pine, spruce, or larch. Hardwoods to favor on these soils are red oak, white ash, and sugar maple. Equipment operation is difficult on the stony soils.

Cropland. The soils cleared of stones in group C-2a are suited to the production of adapted legumes and grass, late vegetables, and small fruits. With drainage these soils are also suitable for the production of alfalfa, corn, orchards, and early vegetables. Erosion is a hazard on these soils and on the steeper slopes intensive surface water control measures are needed.

When cleared of stones the very stony soils in group C-2b can be cropped as described above.

UPLAND SOILS - ROCKY AND SHALLOW TO BEDROCK

D-1 Rocky and very rocky soils with slopes less than 15 percent
94L BC Holyoke-Cheshire rocky complex, 3-15% slopes

D-2 Rocky and very rocky soils with slopes more than 15 percent and extremely rocky soils
94MD Holyoke extremely rocky silt loam, 15-35% slopes

The soils of groups D-1 and D-2 occur mostly on the rougher areas of the uplands. They may occupy narrow ridge tops but most often are on steep side slopes. The soils are underlain by hard bedrock and the areas contain barren rock outcrops. In many places, hard rock is less than 20 inches below the soil surface. These areas provide contrast in the landscape and scenic outlooks.

Urban. Rock outcrops and soils shallow to bedrock cause severe problems and high construction costs when developing this land for urban uses. Occasional pockets of deeper soils can be utilized for individual home sites.

Recreation. Picnic areas and camp sites are very difficult to develop and access is usually a severe limitation. However, the terrain provides an attractive setting for these uses.

Wildlife. These soils are poorly suited for the production of openland wildlife habitat. The habitat for woodland wildlife species can be established, improved, or maintained but moderate treatment is required. It is impractical to develop wetland wildlife habitat on these soils.

Woodland. The productivity of most of this land is poor for wood crops. Pockets of deeper soil within these areas have fair productivity. Equipment operation is very difficult because of rock outcrops. Seedling survival and windthrow of trees are problems on the shallower areas.

Cropland. These soils are not suited for the production of cultivated crops because of rock outcrops and shallowness. Scattered areas with deeper soils and less numerous rock outcrops can be used for improved hay, pasture, and orchards.

E-1 Well drained soils

E-2 Moderately drained soils having moderately high seasonal water table
71V Rowland silt loam

The soils of groups E-1 and E-2 occur on higher and intermediate levels for stream floodplains. They have a good moisture holding capacity for plant growth. The soils of group E-2 have a water table that remains within 12 to 20 inches of the surface during wet periods. The soils in these groups are best suited for open space uses.

Urban. The hazard of flooding severely limits these soils for residential, commercial, industrial, and intensive recreational development. The floodplains and lands adjacent to streams have many ecological values and their retention for well planned natural resource development is in the public interest.

Recreation. During the season of use these soils have slight limitations for many kinds of recreational uses including picnicking, camping, and play areas.

Wildlife. Habitat for openland and woodland wildlife species is easily established, improved, or maintained on these soils. They are well suited to a wide variety of desirable food and cover plants. It is impractical to develop habitat for wetland wildlife.

Woodland. Wood crop productivity is fair on the sandy loam soils and good on the silt loam soils. Competition from hardwoods is a problem when managing for pine, larch, or spruce. Flooding is a hazard to Christmas tree production on these soils especially if accompanied by ice damage. The moderately well drained soils are suitable for the more valuable hardwoods such as black walnut, yellow poplar, and red oak.

Cropland. Except for the hazard of flooding, the soils in group E-1 are well suited for the production of all cultivated and forage crops grown in the area.

The soils in group E-2 are suited for the production of grasses and legumes, silage corn, and late vegetables. They are poorly suited to alfalfa, tobacco, and potatoes because of the seasonal water table and the hazard of flooding.

FLOODPLAIN SOILS

Poorly and very poorly drained soils

E-3a Soils with a high seasonal water table
58 Alluvial land

E-3b Soils with a high water table during most of the year

The poorly drained soils in group E-3a have a water table that remains within 6 inches of the soil surface during the wettest part of the year. This high water table often persists into late spring and may recur during periods of high stream flow.

The very poorly drained soils in group E-3b have water ponded on the surface for significant periods in winter and spring. The water table usually remains within 3 feet of the soil surface throughout the year.

Urban. Because of flood hazard, the wetness these soils have very severe limitations for urban uses. They have many natural values for environmental enhancement.

Recreation. These areas have severe limitations for use as picnic areas, camp sites, and play areas.

Wildlife. These soils are poorly suited for the production of openland wildlife habitat.

On the poorly drained soils in group E-3a, the habitat requirements of woodland wildlife can be established, improved, or maintained, but moderate treatment is required. In the spring these areas provide natural habitat for wetland wildlife. The fluctuating water table limits the period of use and flood hazard restricts the construction and management of water developments.

The very poorly drained soils in group E-3b are poorly suited for the production and management of woodland wildlife habitat. The habitat requirements of wetland wildlife habitat can be developed, improved, or maintained but moderate treatment is required.

Woodland. Productivity of wood crops ranges from fair to very poor depending on the degree of wetness. Wetness causes severe problems in the use of equipment, the survival of tree seedlings, tree windthrow, and competition from other plants.

Cropland. When partly drained, the soils in group E-3a can be used for hay and silage corn. Frequent flooding and the lack of suitable outlets make drainage for other cultivated crops impractical. The soils in group E-3b are unsuited to the production of agricultural crops because of wetness and frequent flooding.

LAKE TERRACE SOILS - OVER STRATA HIGH IN SILT AND CLAY

Moderately well drained soils

G-2 Soils with a moderately high seasonal water table
443 Berlin silt loam, 0-3% slopes

The soils of this group occur in areas where glacial lake sediments accumulated. These sediments have a higher content of clay and fine silt than is common for soil material in this area. The permeability rate through the lake sediments is slow. Soil in this group has a water table during wet seasons. During periods of highest saturation, usually in early spring, the water table remains within 15 to 20 inches below the soil surface. About 8 to 20 inches of friable silty soil material overlie the firm more clayey lake bed deposits.

Urban. The design and installation of on-site sewage disposal systems that function satisfactorily are very difficult because the soils are slowly permeable and have a seasonal water table. On slopes above 8 percent, the design and site selection for absorption fields require special attention.

During wet periods, the water table is a problem in construction of building foundations. Special measures are needed to prevent seepage into basements. On slopes above 8 percent, difficulty is added to site preparation, the steeper slopes may present opportunities for a wider choice of architectural design.

Soil conditions are favorable for the establishment and maintenance of lawns, trees, and shrubs. Slopes above 8 percent add difficulty for landscaping.

The seasonal water table presents problems in the design, construction, and maintenance of streets and parking lots. Problems and costs are increased on soils with more slope.

Recreation. During the main season of use, these soils are favorable for picnic areas and camp sites. The level areas have moderate limitations for use as play areas, and limitations increase on the soils with more slope. Drainage is needed to overcome the seasonal water table on playing fields for intensive use and to extend the period of picnicking and camping.

Wildlife. Habitat for openland and woodland wildlife species is easily established, improved, or maintained on these soils. They are well suited for the dependable growth of a wide variety of desirable food and cover plants. Habitat for wetland wildlife species can be developed, improved, or maintained with moderate treatment on the more level soils, but such development on the sloping soils is more difficult and expensive.

Woodland. Productivity for wood crops is fair on these soils. Competition from hardwoods is a problem when managing for pine, spruce, and larch. Equipment operation is difficult during wet seasons.

Cropland. These soils are suited to the production of adapted grasses and legumes, silage corn, and late vegetables. They are poorly suited to alfalfa, tobacco, potatoes, and tree fruits. Erosion is a hazard even on gentle slopes and on the steeper slopes intensive surface water control measures are needed.

LAKE TERRACE SOILS - OVER STRATA HIGH IN SILT AND CLAY

Poorly and very poorly drained soils

G-3a Soils with high seasonal water table
643 Scantic silt loam, reddish variant

G-3b Soils with high water table during most of the year

These nearly level soils occur in areas where glacial lake sediments accumulated. In most places the finer textured lake sediments are covered by coarser loamy or sandy material from several inches to 3 feet thick. The permeability rate of the lake sediment is slow. The poorly drained soils in group G-3a have a high water table that is 0 to 6 inches below the soil surface during the wettest part of the year. The high water table may persist into late spring or recur after prolonged or heavy summer rains. The very poorly drained soils in group G-3b have water ponded on the surface for significant periods during the winter and early spring. The water table usually remains within 3 feet of the soil surface throughout the year.

Urban. These soils have severe limitations for most urban uses. Intensive drainage and land fill measures are necessary to overcome the high water table.

Recreation. These soils have severe limitations for picnicking, camp sites, and play areas. However, they have potential for development of ponds and conservation uses for environmental enhancement.

Wildlife. These soils are poorly suited for the production of openland wildlife habitat. On the poorly drained soils in group G-3a, habitat requirements of woodland and wetland wildlife species can be developed, improved, or maintained but moderate treatment is required.

The very poorly drained soils in group G-3b are poorly suited for the production and management of woodland wildlife habitat but are well suited for the development, improvement, and maintenance of wetland wildlife habitat.

Woodland. Productivity is poor on these soils. Wetness causes severe problems of equipment use, survival of tree seedlings, windthrow of trees, and competition from other plants. Red maple, elm, and willow are adapted to these soils.

Cropland. Because they are difficult to drain, the soils in group G-3a having clayey layers within 18 inches of the surface are not suitable for the production of cultivated crops. With drainage the other soils in this group are suitable for the production of most crops generally grown in the area.

If adequate subsurface drainage is installed the soils in group G-3a are suitable for the production of most crops generally grown in the area.

The soils in group G-3b are not suited to the production of agricultural crops.

1/18/71

APPENDIX II

Water Quality Standards

Department of Environmental Protection

Adopted December 1973

pp. 4

INLAND WATERS

CLASS A

May be suitable for drinking water supply and/or bathing; suitable for all other water uses; character uniformly excellent; may be subject to absolute restrictions on the discharge of pollutants; authorization of new discharges of other than minor cooling and clean water would require revision of the class to Class B (see General Policy 5) which would be considered concurrently with the issuance of a permit at public hearing.

1. Dissolved oxygen	75% saturation, 16 hours/day; 5 mg/l at any time
2. Sludge deposits - solid refuse - floating solids, oils and grease - scum	None other than of natural origin.
3. Silt or sand deposits	None other than of natural origin except as may result from normal agricultural, road maintenance, or construction activity provided all reasonable controls are used. (See Note 6)
4. Color and turbidity	None other than of natural origin except as may result from normal agricultural, road maintenance, or construction activity provided all reasonable controls are used. (See Note 6)
5. Coliform bacteria per 100 ml	Not to exceed a median of 100 nor more than 500 in more than 10% of samples collected. (See Note 12)
6. Taste and odor	None other than of natural origin.
7. pH	As naturally occurs.
8. Allowable temperature increase	None other than of natural origin except when it can be demonstrated that cold water fish spawning and growth will not be impaired. (See Note 17)
9. Chemical constituents	(See Note 4)
(a) Phosphorus	None other than of natural origin.

INLAND WATERS

CLASS B

Suitable for bathing, other recreational purposes, agricultural uses, certain industrial processes and cooling; excellent fish and wildlife habitat; good aesthetic value.

1. Dissolved oxygen	75% saturation, 16 hours/day; 5 mg/l at any time.
2. Sludge deposits - solid refuse - floating solids, oils and grease - scum	None except for small amounts that may result from the discharge from a waste treatment facility providing appropriate treatment.
3. Silt or sand deposits	None other than of natural origin except as may result from normal agricultural, road maintenance, or construction activity provided all reasonable controls are used. (See Note 6)
4. Color and turbidity	Turbidity shall not exceed 25 JTU, B_C 10 JTU. (See Note 15) A secchi disc shall be visible at a minimum depth of 1 meter, B_B-criteria may be exceeded. (See Note 14)
5. Coliform bacteria per 100 ml	Not to exceed a median of 1000 nor more than 2400 in more than 20% of samples collected. (See Note 12)
6. Taste and odor	None in such concentrations that would impair any usages specifically assigned to this class nor cause taste and odor in edible fish.
7. pH	6.5 - 8.0
8. Allowable temperature increase	None except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 85°F, or in any case raise the normal temperature of the receiving water more than 4°F. B_S - same as A. (See Note 16)
9. Chemical constituents	(See Note 4)
(a) Phosphorus	(See Note 18)

NOTES

These notes include additional criteria, and supplementary information to insure proper interpretation and use of the criteria.

4. The waters shall be free from chemical constituents in concentrations or combinations which would be harmful to human, animal or aquatic life for the most sensitive and governing water use class. In areas where fisheries are the governing considerations and approved limits have not been established, bioassays shall be performed as required by the appropriate agencies. When bioassays are necessary to establish limits on toxic substances, the recommendations for bioassay procedures, and application factors contained in the National Technical Advisory Committee's report to the Secretary of the Interior on Water Quality Criteria, April 1, 1968 or contained in the publication on criteria for water quality required by Section 304 (a)(1) of the Federal Water Pollution Control Act shall be considered. For public drinking water supplies the raw water sources must be of such a quality that United States Public Health Service Limits, or state limits if more stringent, for finished water can be met after conventional treatment.

6. Reasonable controls may be defined by the Commissioner on a case by case basis or the Commissioner may require that it be affirmatively demonstrated by any person or municipality engaged in such activities that all reasonable controls will be or are being used.

12. Coliform bacteria criteria are intended to provide a standard for coliform data evaluation and are related to the probability of contamination by undisinfected sewage. High results may be due to soil bacteria or bacteria from the feces of warm blooded animals which are not of sanitary significance. High results should therefore be investigated by sanitary survey or other appropriate means to confirm the cause. Fecal coliform analysis, which means primarily coliform organisms from the feces of warm blooded animals, may be useful as a secondary indicator. Although the reliability of fecal coliform analysis is not yet adequate to use as a standard, it is desirable that correlation data be generated. The Region I Office of the U. S. Environmental Protection Agency has suggested criteria for fecal coliform data evaluation. Such criteria should be considered only as a guideline and can be found in Appendix A.

14. The use of subscript b in Class Bb is intended to identify those areas where natural conditions or conditions which cannot be expected to be appreciably altered by the control of discharges may preclude bathing. It may also be used in Classes Bb and SBb to designate areas in the immediate vicinity of treated sewage outfalls where bathing is not advisable.

15. The use of subscript c in Classes Bc, Cc, SBc and SCc is to identify areas suitable for cold water fisheries especially fish passage.

16. The use of subscript s in Classes Bs and Cs is to identify areas suitable for cold water fisheries including fish spawning and growth.

17. Physcial obstructions such as dams which prevent cold water fish from reaching an area suitable for spawning and growth shall not be considered a valid reason for not meeting the criteria.

18. There shall be no point source discharge into any natural lake or pond or tributary surface waters which will raise the phosphorus concentration of the receiving surface waters to an amount in excess of 0.03 mg/l. For the purpose of this note the impoundments listed in Appendix B shall be considered natural lakes or ponds.