CA-Old Bridge

6/14/84

Exhibit G: Natural Resource Inventory, 1975

p 22

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EXHIBIT G

NATURAL RESOURCE INVENTORY

TOWNSHIP OF OLD BRIDGE
NEW JERSEY

EXHIBIT G

NATURAL RESOURCE INVENTORY

TOWNSHIP OF OLD BRIDGE ENVIRONMENTAL COMMISSION

CONSULTANT : DAMES & MOORE

DECEMBER, 1975

TOWNSHIP OF OLD BRIDGE

NEW JERSEY

TABLE OF CONTENTS

The preparation of this report was financed in part by an appropriation of the State Aid Account for the Continuing Planning Assistance Program.

TO THE RESIDENTS OF OLD BRIDGE: December 1975

It is the hope of the Old Bridge Township Environmental Commission that this Natural Resource Inventory will be a valuable tool for future usefulness, the Commission realized that the quality of the information contained in the inventory must be of a standard to meet the requirements of those who will use it. With this in mind, the Commission employed Dames & Moore, to gather and organize environmental information, with the Commission members acting as a catalyst in the interaction between these sources.

We would like to take this opportunity to acknowledge our thanks and appreciation to the people who have worked with the Commission in preparing this report. They are Mr. Arthur H. Stukey, Jr., B.S., M.S., our Geologist; Dr. Leonard J. Wolgast, Assistant Professor of Wildlife Ecology, Cook College, who supervised a group of graduate students in the preparation of the section on Vegetation and Wildlife; Mr. E. Fletcher Davis, Director of Planning, Old Bridge Township, and Mr. Harvey Goldie, P.E., Municipal Engineer of the Township, both of whom provided technical help and support which was invaluable; and Dames & Moore and their staff members who "put it all together." Finally, the Commission thanks the N.J. Department of Environmental Protection, the Old Bridge Township Council and Planning Board, without whose encouragement and financial support this report could not have been possible.

Ira Danzig
Chairman, Environmental
Commission of Old Bridge
Township

INTRODUCTION

This Natural Resources Inventory evolved out of the Old Bridge Township Environmental Commission's conviction that environmental data are an essential ingredient in the Township's planning and decision-making responsibilities. To serve this purpose, the Inventory must be comprehensive; it must be accurate; and it must withstand the scrutiny of the judicial process.

Recognizing the inter-agency value of the Natural Resources Inventory, the Environmental Commission requested comments from the Township Planning Board in terms of assuring that data and format would be useful to the Planning Board's needs. The Planning Board suggested several useful changes and supported the efforts of the Environmental Commission.

This report, then, represents the conclusion of a significant planning effort. It does not, however, represent the total planning effort. In addition to the text, the following graphic material has been prepared and is part of the Inventory, and is available at the Townships offices:

1. Two sets of eleven map overlays and base maps at a scale of 1' = 800' with dimensions of approximately 4' X 8'. One set is in color and suitable for presentation; the other set is black and white and suitable for reproduction.

2. One black and white set of eleven map overlays at a scale of 1" = 1600'.

3. A Suitability Rating map at a scale of 1' = 800'. This map shows the environmental suitability for development of each 10-acre square in the Township.

4. One set of 9" X 9" stereoscopic, aerial photographs at a scale of 1" = 1500'.

The Natural Resources Inventory and supporting information are tools to be used. The value of this Inventory has already been demonstrated at informal review meetings held prior to the publication of this document. The full value of this planning effort rests in the use of the information brought together in these environmental maps.

ORGANIZATION OF THE REPORT

This Natural Resources Inventory can be divided into two basic sections reflecting the two classes of maps being presented: (1) data maps, and (2) development suitability model.

The data maps consist of 12 maps, as follows:

SOURCE MAPS	INTERPRETIVE MAPS
Geology	Vegetation
Topography and	Flood Plains
Slope	Depth to Water Table
Soils	Septic Suitability
Surface Waters	Foundation Limitations
Aquifers	Erosion

The first six maps are "source" maps. They are based on available, mostly published, information. The latter five maps are "interpretive". They are derived from combinations of the source maps.

Where applicable, information on the data maps is classified as to development suitability according to slight, moderate and severe restrictions. All of the data maps are classified by development suitability except the geology, soils and surface water map.

Following the data maps is the Development Suitability Model. This model is a map which grids the township into 2,403, 10-acre squares. Each square or grid unit has a development value de-

rived from development suitability ratings of each data map, and the relative impertance or "weight" of each data map as determined by the Environmental Commission, resulting in a five-class breakdown of development suitability: (1) most suitable, (2) suitable, (3) adequate, (4) unsuitable, and (5) most unsuitable.

The Development Suitability Model map is not reproduced in this report due to the small scale of the grids.

REGIONAL LOCATION

Old Bridge is located on the southeastern boundary line of Middlesex County. It is bounded as follows:

-- on the north by Sayreville and Raritan Bay;

-- on the east by the Borough and Township of Matawan, Marlboro, and Manalapan;

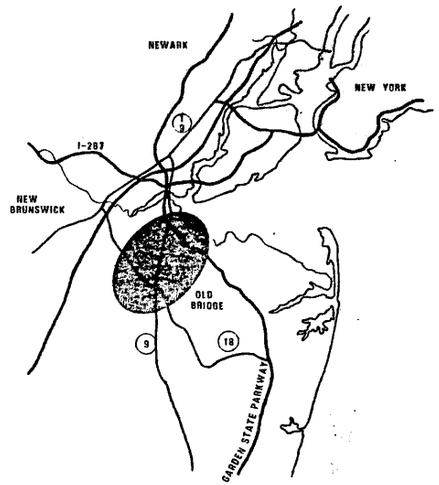
-- on the south by Manalapan and Monroe; and

-- on the west by Monroe, Spotswood, East Brunswick and Sayreville.

Although located in the outer ring of the New York metropolitan area, the Township over the past two decades has experienced remarkable growth. In 1950, its population was 7,366 persons. By 1960, this figure increased to 22,772 persons, or an increase of almost threefold. Between 1960 and 1970, the Township's rapid growth continued with its population increasing to 48,792 persons.

The Township's growth occurred as a result of a combination of several factors;

-- Large tracts of relatively level vacant land.



REGIONAL LOCATION

-- Access to a variety of major transportation facilities, primarily the highways, including the Garden State Parkway, and Routes 9, 18, 34, and 35.

-- A location about midway between the New York-Newark urban core and the shore recreation areas.

Because of its large size (40 square miles) and the scattered nature of its residential areas, Old Bridge Township is better recognized by some of its community names; Cliffwood Beach, Laurence Harbor, Cheesequake, and Browntown. In many respects, Old Bridge Township is more an agglomeration of small communities, each with its own special character, than a single large community.

The development which has occurred over the past two decades has, for the most part, taken place in a wide corridor running east to west through the Township, usually in proximity to the Old Bridge-Matawan Road. As noted in the Master Plan, some of the best land in the Township for development purposes is found in this corridor. Additionally, this corridor is crossed with a number of north-south highways which make all portions of the east-west corridor more accessible to northern employment centers.

The current Master Plan develops several conclusions relating to physical characteristics and the land use implications for planning. Although some numbers have changed since it was adopted in 1970, the basic conclusions remain. These are:

1. Over 8,000 acres of the Township are unsuitable for intense development due to poor drainage and soil conditions.

2. In spite of the large area not suited for intense development, about 7,000 acres of usable land remain available for development.

3. Residential growth is taking place at a rapid rate with the areal dispersion confined mostly to an east-west corridor centering on the Old Bridge-Matawan Road.

4. Near term, future residential growth will be largely confined to this same corridor.

5. No large areas of industrial growth are predominant, representing a weak link in the balanced growth of the Township.

GEOLOGY

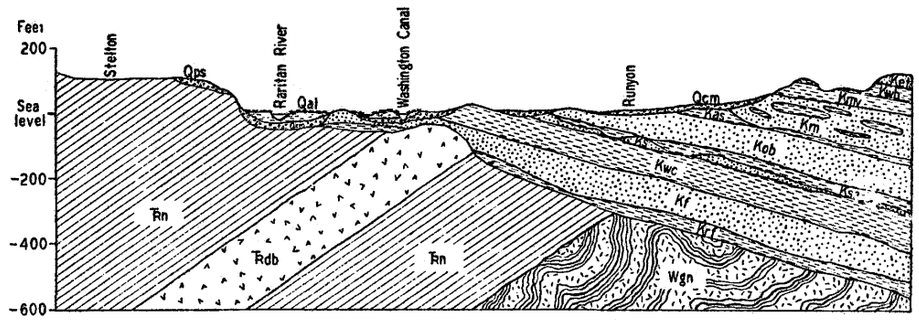
Old Bridge is located in the Atlantic Coastal Plain a few miles south of the dividing line between this province and the Piedmont Physiographic Province to the north and northwest.

Geologically the Township is underlain at depth by Precambrian Age metamorphic rocks. The surface of these rocks dip gently (about 60 feet per mile) toward the southeast. Generally the Precambrian rock surface is at depths of 300-400 feet below ground in Old Bridge.

Overlying the Precambrian basement rock are alternating units of unconsolidated sediments of Cretaceous Age. These formations consist mostly of sand, silt, and clay which tend to thicken to the southeast. In most cases these sediments were deposited in a marine environment relatively near the then existing coast.

The Cretaceous units present in Old Bridge include, from oldest to youngest, the Raritan Formation, Magothy Formation, Merchantville Clay, Woodbury Clay, and Englishtown Sand. In the Middlesex County area the Raritan Formation has been divided into a number of members which are somewhat distinctive. These include, beginning with the oldest, Raritan Fire Clay, Farrington Sand, Woodbridge Clay, Sayreville Sand, South Amboy Fire Clay, Old Bridge Sand, and Amboy Stoneware Clay. Some of these units are distinguishable in the subsurface of Old Bridge Township.

Overlying the Cretaceous Formations are Quaternary Age sediments which include the Pensauken and Cape May Formations and Recent alluvium and wind blown deposits.



QUATERNARY
- Qal Alluvium
- Qcm Cape May fm.
- Qps Pensauken fm

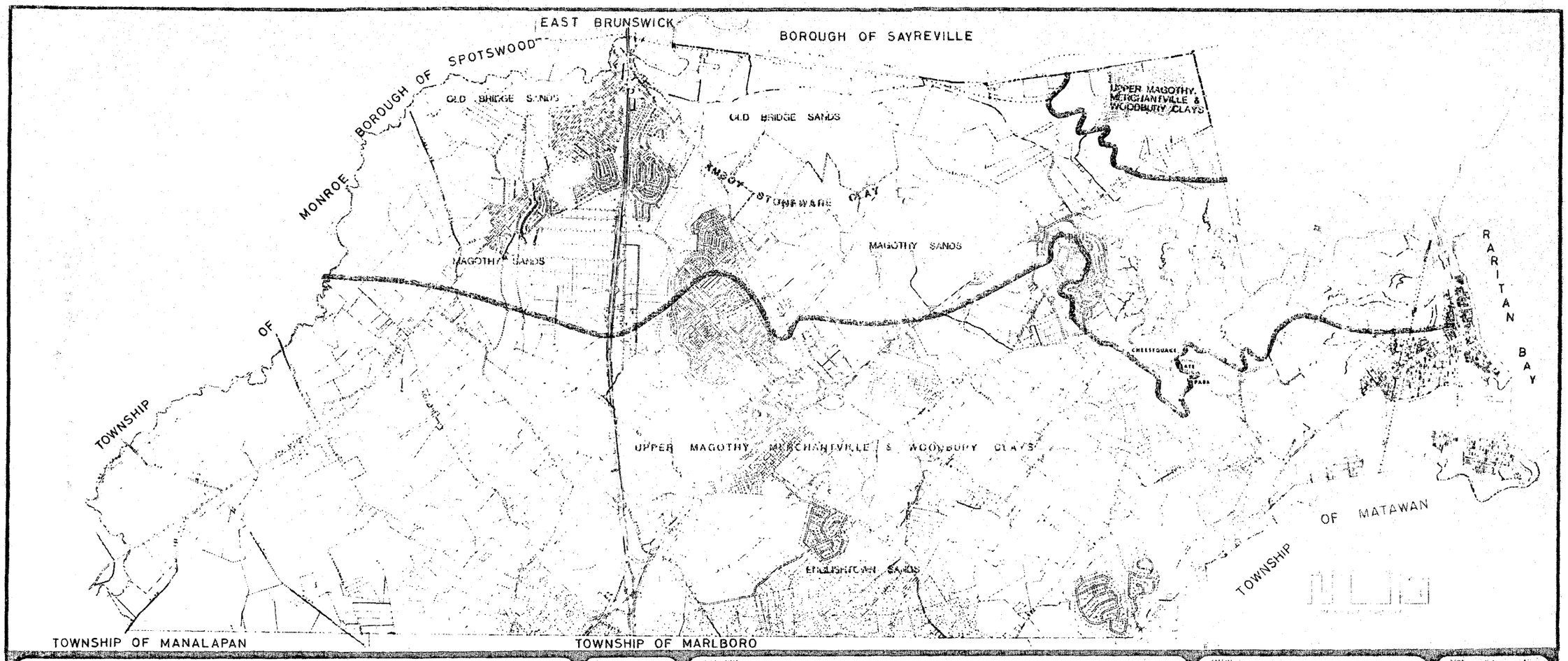
0 1 2 3 Miles

CRETACEOUS
SAND
CLAY

- Ket Englishtown sand
- Kwb Woodbury clay
- Kmv Merchantville clay
- Km Magothy fm.
- Kas Amboy stoneware clay
- Kob Old Bridge sand
- Ksa South Amboy fire clay
- Ks Sayreville sand
- Kwc Woodbridge clay
- Kf Farrington sand
- Krf Raritan fire clay

TRIASSIC
- Trdb Diabase sill
- Trn Newark group

PRE-CAMBRIAN ?
- Wgn Wissahickon fm.



TOWNSHIP OF OLD BRIDGE

DEPARTMENT OF PLANNING AND DEVELOPMENT

GEOLOGY

TOPOGRAPHY AND SLOPE

Slope is defined as the inclination of the ground with respect to a level plane. It is expressed in percent and is read as the difference in vertical height, in feet, for each 100 feet of horizontal distance. The Topography and Slope map shows slope, as derived from the soils map (and checked against the contour map) in four categories:

0 - 2%
3 - 5%
6 - 15%
16 % and greater

The four slope classes were selected to reflect slopes used in the Township and the County subdivision regulations.

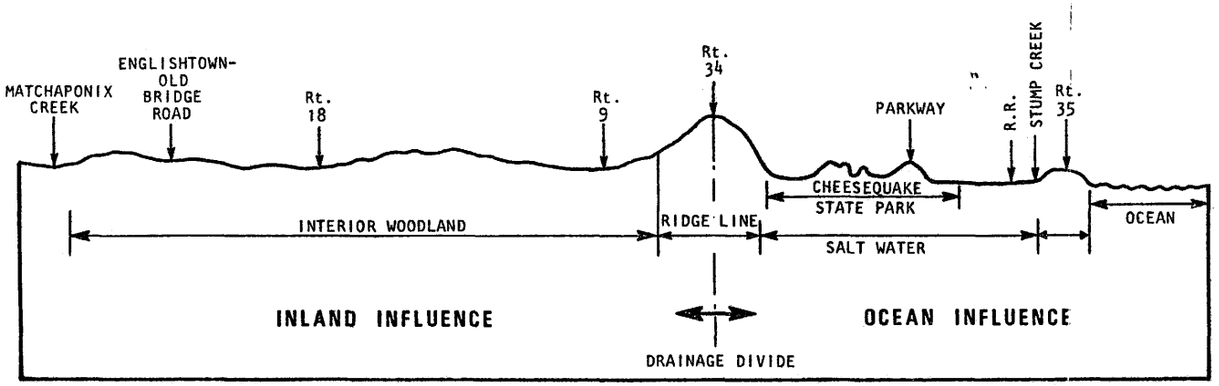
Old Bridge's terrain is generally flat to gently rolling. Localized areas of steep slopes are found mostly along the drainage divide separating the flat, low Cheesequake estuary and the Tennents Brook basin in the northeast section of the Township. Although the relatively steep slopes make up a small portion of the Township, they are important in terms of erosion and sedimentation.

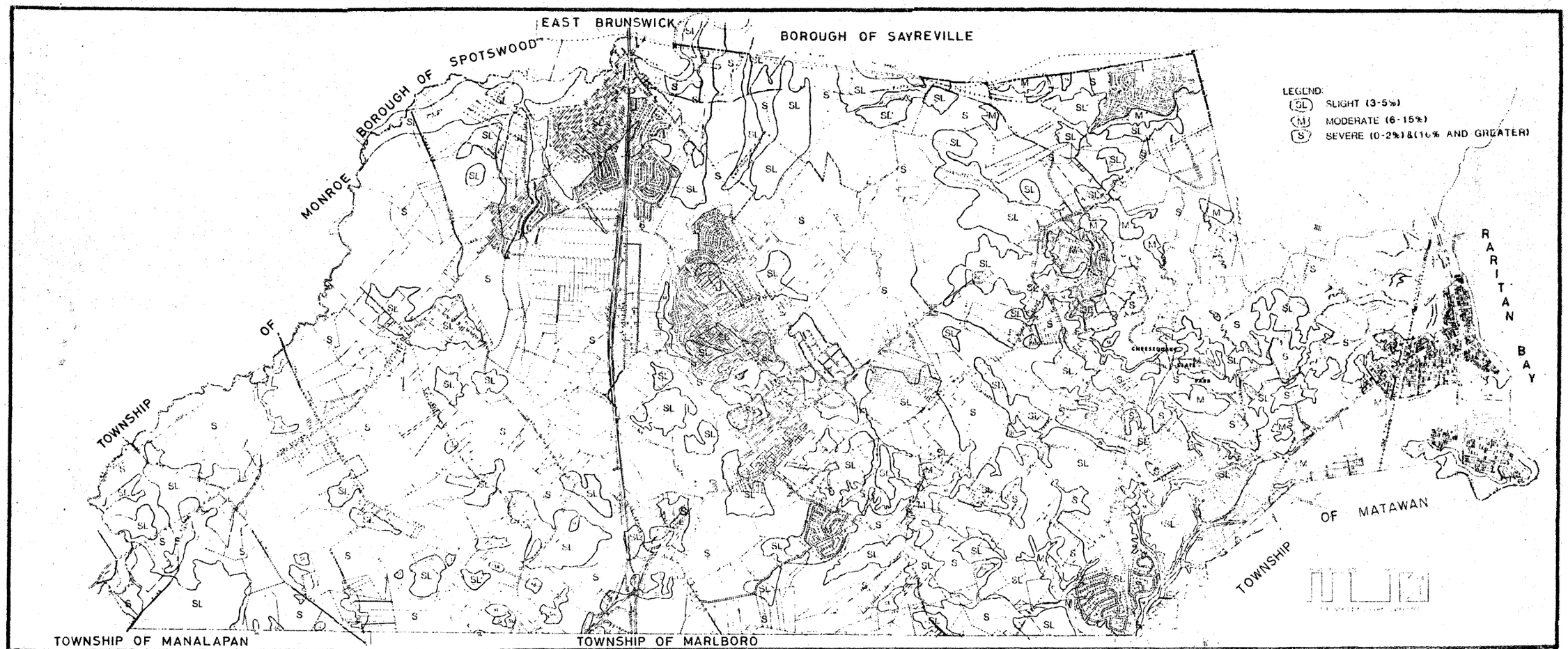
Slope is both a primary and secondary factor in considering the environmental developability of an area. Steep slopes create certain basic construction problems relating to soil instability; they are also a factor in drainage and erosion calculations.

The four slope classes reflect degrees of limitations to construction and development, as follows:

SLOPE CLASS	LIMITATIONS
0 - 2%	Severe
3 - 5%	Slight
6 - 15%	Moderate
16% and greater	Severe

The 0-2 percent category is considered severe because of inherent drainage problems resulting from the relatively flat land. Most of these flat land areas are found in the eastern coastal portion of the Township.





TOWNSHIP OF OLD BRIDGE

DEPARTMENT OF PLANNING AND DEVELOPMENT

SLOPE

SOILS

Old Bridge soils are both of the transported and the residual categories. Transported soils have been moved primarily by water and to a lesser extent by wind, and are found mostly in low-lying areas such as flood plains or stream terraces. Examples of transported soils are alluvial, tidal, marsh and the like.

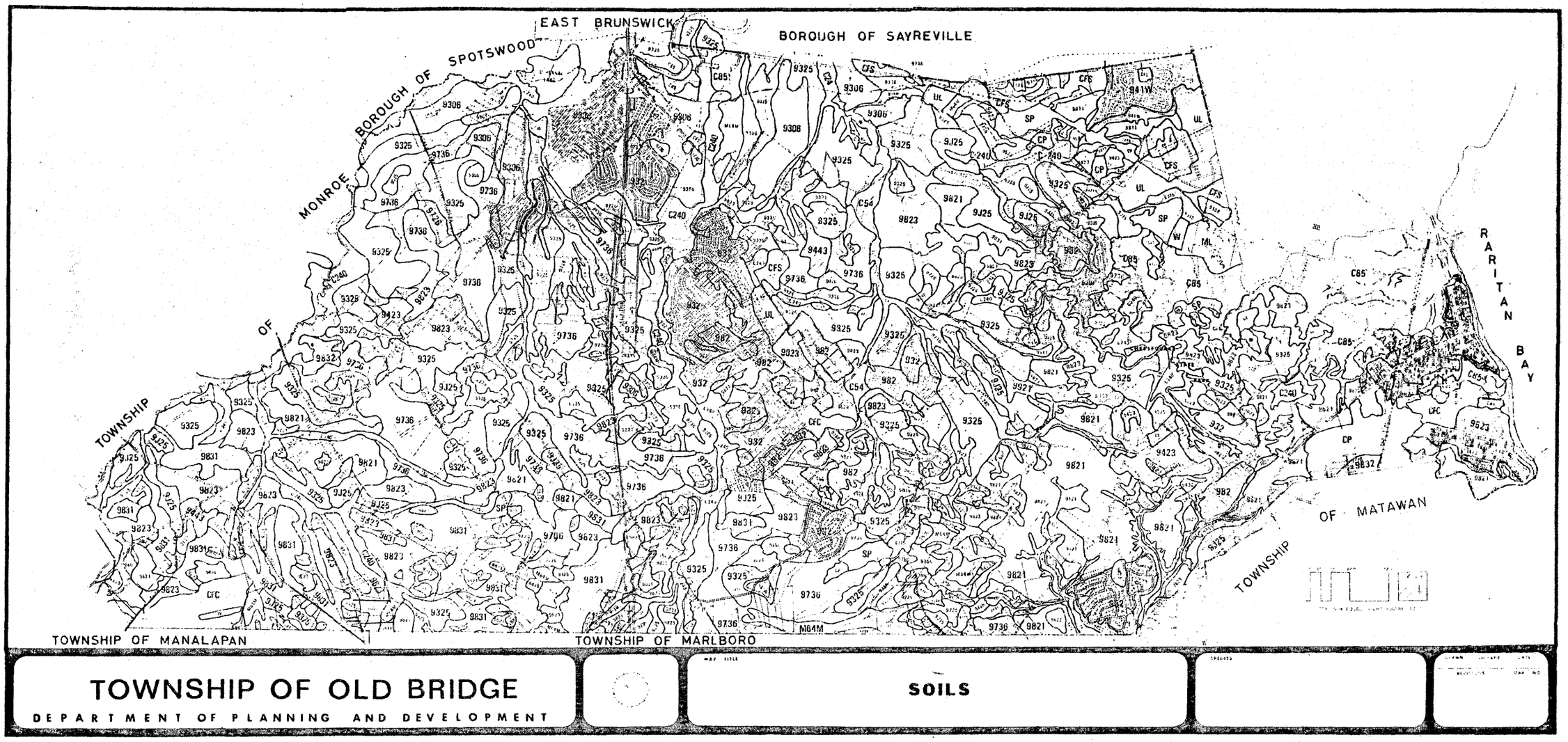
Residual soils have been formed in place from the geologic parent material outcropping at each location -- Quaternary deposits, Old Bridge Sand, Magothy Formation, and the Englishtown Formation. Examples of residual soils are the Lakewood, Hammonton, and Klej soil series.

Both of these soil categories have undergone some alteration of their normal soil profiles as a result of development. Because the residual soils are generally found out of the drainage areas of streams and tidal flats, these soils have undergone more extensive modification of their profiles. Development such as highways and residential subdivisions have resulted in some complex soil types. Examples of complex soils are fill land, Keyport-urban land, Sassafras-urban land and Urban land.

Soil characteristics in the Township are dependent primarily upon topographic position (valley, hill slope, or hill top), native vegetation parent material, and degree of development of the soil profile. Other factors affecting soil properties are the ground water table relative to the land surface and the extent of soil erosion.

The soils in the relatively flat valley bottoms generally tend to be heavier with a greater organic matter content than soils on more sloping land. Such lowland soils in many places in the Township are found under relatively high water table conditions and are represented by soils such as Atsion, Elkton, and Pocomoke. Soils that are well drained and are located on relatively higher land than the wet soils are represented by soils series such as Woodstown, Downer, and Sassafras. These well drained soils tend to have surface textures of loam or sandy loam and subsoils that are heavy or moderately heavy and are useful for production of most agricultural crops. Light textured upland soils are represented by the Lakewood and Evesboro soils series. These soils have good drainage characteristics as they are coarse textured and generally are encountered above the water table at a distance greater than five feet.

Soil characteristics are shown on Table A-1 in the Appendix.



TOWNSHIP OF OLD BRIDGE

DEPARTMENT OF PLANNING AND DEVELOPMENT

SOILS

SURFACE WATERS

The streams in Old Bridge exhibit a dendritic pattern, which is an irregular branching in many directions with the tributaries joining the main streams at a variety of angles. There are two main drainage areas in the Township: an interior and a coastal basin.

The interior drainage basins tend to cause water to flow away from Monmouth County and towards South River to the north. The major streams carrying this interior surface water are, from southeast to east, Matchaponix Brook (Barclay Brook), Iresick Brook, Deep Run, and Tennents Brook.

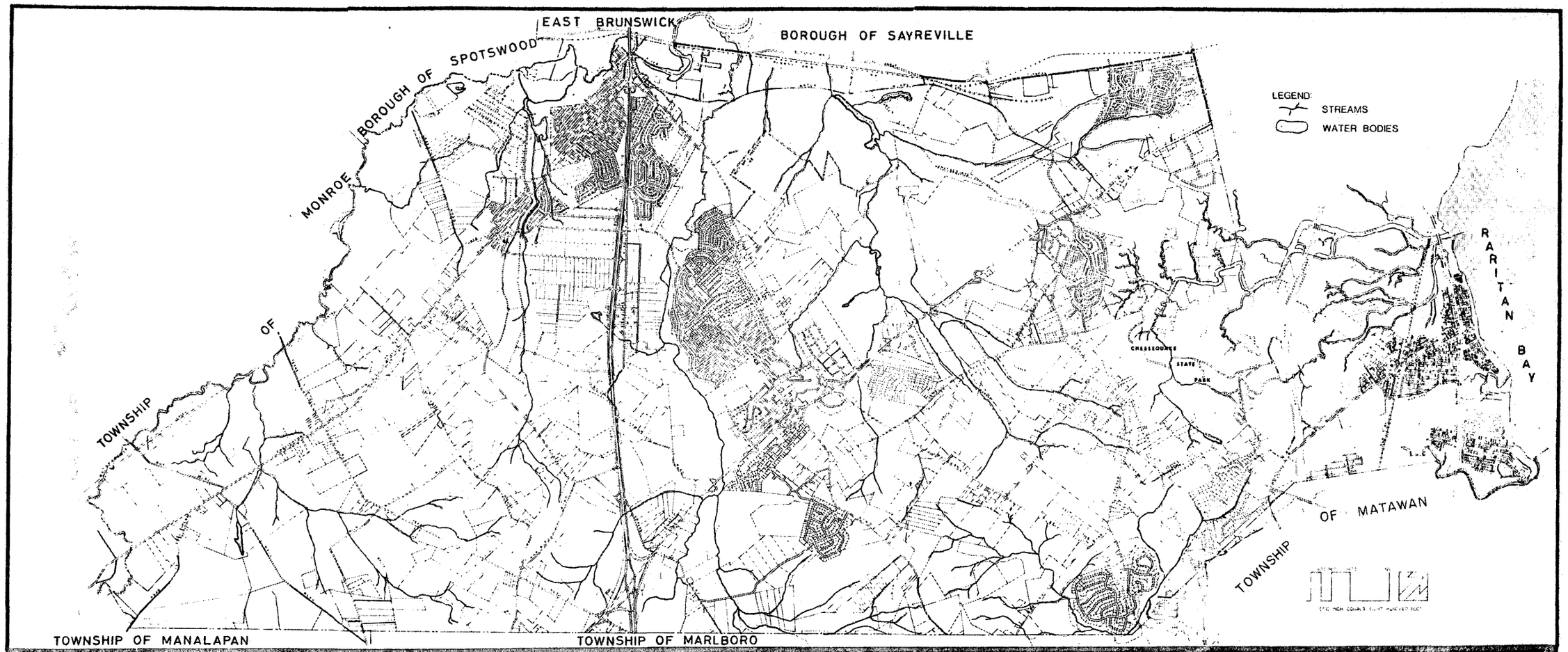
The coastal drainage basin, which is centered in Cheesequake State Park area, consists of tidal estuaries Cheesequake Creek and Hooks Creek draining directly into the Raritan Bay.

The United States Geological Survey maintains a continuous stage recorder (since 1935) at Duhernal Dam on the South River. It is of interest to note that the maximum flow for this station is 4.250 cubic feet/sec. (cfs) and the minimum is 0 cfs. Also the difference in maximum flows at Deep Run and Tennents Brook is significant, some 1063 cfs. These stations are only a few miles apart and the same storm caused this large difference in runoff.

DATA FOR SURFACE WATER IN MADISON TOWNSHIP

GAGING STATION LOCATIONS	DRAINAGE AREA	AVERAGE DISCHARGE	MAXIMUM DISCHARGE	MINIMUM DISCHARGE
	mi^2	cfs	cfs	cfs
Matchoponix Brook at Spotswood (1957-1966)	43.9	62.5	2,050 (1960)	2.5 (1957)
South River Old Bridge (1939 to present)	94.6	161.0	4,250 (1944)	0 (1967)
Tennents Brook at Browntown 1.5 miles upstream of Tennent Pond Dam (1932-1941)*	5.25	4.55	177 (1938)	0 (1932)
Deep Run at Brown town 0.7 mile downstream of Middlesex-Monmouth line (1932-1940)*	8.07	14.0	1,240 (1938)	0.1 (1939) (1936 also)
Barclay Brook	NA	NA	NA	NA

*Stations discontinued



TOWNSHIP OF OLD BRIDGE

DEPARTMENT OF PLANNING AND DEVELOPMENT

MAP TITLE

SURFACE WATER

CRITERIA

DRAWN CHECKED DATE

REVISIONS MAP NO.

AQUIFERS

The principal sources of ground water in Old Bridge Township are the Old Bridge Sand and Farrington Sand Members of the Raritan Formation. The Englishtown Formation which is present along the Old Bridge-Marlboro border in the area of Burnt Fly Bog is an important aquifer in New Jersey; however, at present only a few wells tap this unit in Old Bridge Township.

A minor aquifer in the Township consists of the permeable sand and gravel of the Quaternary system which occur over much of the surface of the Township. These deposits are generally not thick or widespread enough for high capacity wells, but they are tapped for small domestic supplies. In addition, the permeable nature of these sands and gravels aids in increasing the recharge of underlying aquifers by rainfall.

The Farrington Sand is found only in the subsurface in Old Bridge. This aquifer is generally a light gray or yellow, fine to medium grained sand with coarser sand and some pebbles near the base. There are some clay layers present in this aquifer. The Farrington Sand does not outcrop in Old Bridge. This unit's intake area is about 4 to 6 miles west of the Township.

The Old Bridge Sand is white to light yellow, fine to medium-grained, occasionally coarse grained sand, with thin, irregular clay beds locally. This aquifer outcrops partially in Old Bridge and dips southeast at about 40-45 feet per mile.

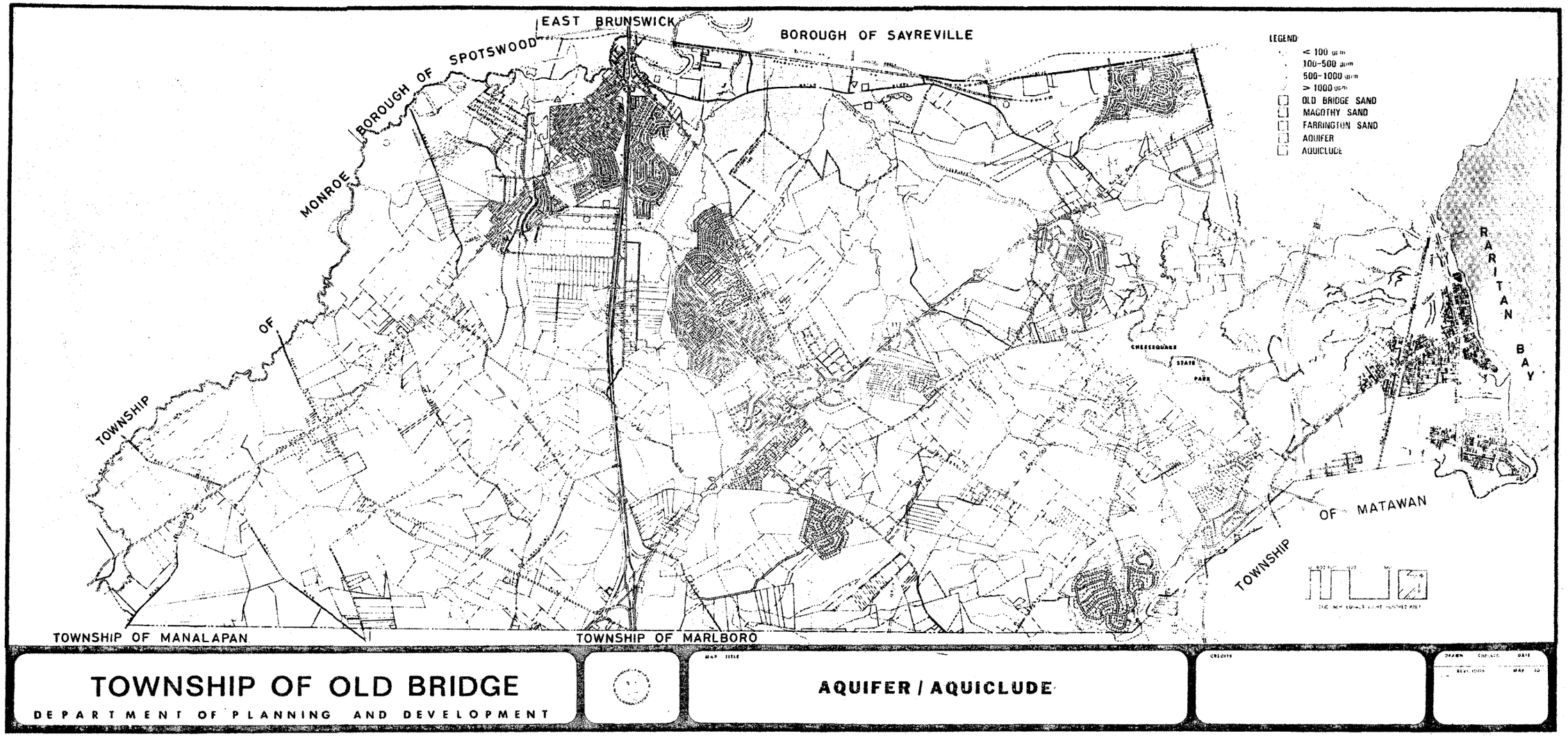
The Magothy Formation is a white fine grained sand with a number of clay lenses in the unit. This sand is not a major aquifer in Madison Township but does yield small quantities of water at some locations.

The Quaternary deposits which are present in some parts of the Township act as a minor aquifer where they are permeable enough. These deposits generally can yield sufficient water for domestic use.

The overall ground water quality in Old Bridge is good although locally, high iron concentrations are present. The major contaminant source which could affect the high yielding aquifers in this area is brackish water from the tidally influenced rivers nearby. Salty water has caused some contamination of water in the specific Farrington Sand northwest of the Township, towards the Borough of Sayreville. There are some indications that continued pumping of large volumes of water from this aquifer may induce movement of brackish water further inland towards the Township. There also exists the possibility of salt water intrusion into the Old Bridge Sand where it outcrops under the South River.

It is estimated that 1973 pumpage from the Old Bridge Sand was about 26 million gallons per day (mgd) in the Sayreville area which includes Old Bridge Township. Other estimates indicate this is approximately equal to the natural recharge rate to this aquifer. Assuming these estimates are correct, substantially increased pumping from the Old Bridge Sand, without an increase in induced or artificial recharge, could cause salt water intrusion near the South River. At present a number of successful artificial recharge projects are recharging the Old Bridge Sand with surface water.

The Farrington Sands in the South River area is presently being stressed much more than the Old Bridge Sand. The estimated safe yield of the Farrington Sands is about 16 mgd, while pumpage in 1973 totalled about 18.5 mgd. Some wells near the Raritan River have been abandoned due to salt water intrusion and there are some indications that salty water is continuing to move inland in the Farrington Sand.



TOWNSHIP OF OLD BRIDGE

DEPARTMENT OF PLANNING AND DEVELOPMENT

MAP TITLE

AQUIFER / AQUICLUDE

CREDITS

DRAWN CHECKED DATE

REVISIONS MAP NO.

VEGETATION

The vegetative types of Old Bridge are divided into four general categories:

- Water related habitats (salt marsh and estuarine, and freshwater systems)
- Forest habitats (pine, oak, mixed oak, mixed upland, mixed lowland)
- Field habitats (cultivated and old fields)
- Built-up areas

The water related habitats comprise an area of 1,336 acres. The vegetation in these areas differ but has been grouped due to the similarity of the ecological value.

1. The salt marsh and estuarine habitat is dominated by tall salt marsh cordgrass and meadow grass. This area is environmentally sensitive as a vital nursery ground for many valuable marine animals.

2. The freshwater habitats contain a variety of bogs and swamps. The bogs are characterized by the presence of southern white cedar. Such areas are especially important in that they possess potential habitats for several endangered animal species; the Pine Barrens Tree Frog, the Bog Turtle, the blue spotted salamander, and the Eastern tiger salamander. Four small bogs and one major bog, Burnt Fly Bog, of this type are shown on the vegetation map. The freshwater swamps contain a variety of flora such as cattails, bullrushes, wild rice, and swamp milkweed. Reptiles and amphibians are usually found only in the freshwater systems. Examples of mammals which occur in one or more areas of water related habitats are raccoon, muskrat, and opossum.

Water related habitats support a large and diverse population of birds including grebes, comorants, herons, swans, geese, sandpipers, terns and gulls. Birds potentially occurring in this habitat which are considered endangered are the bald eagle, the peregrine falcon, the osprey, and coopers hawk.

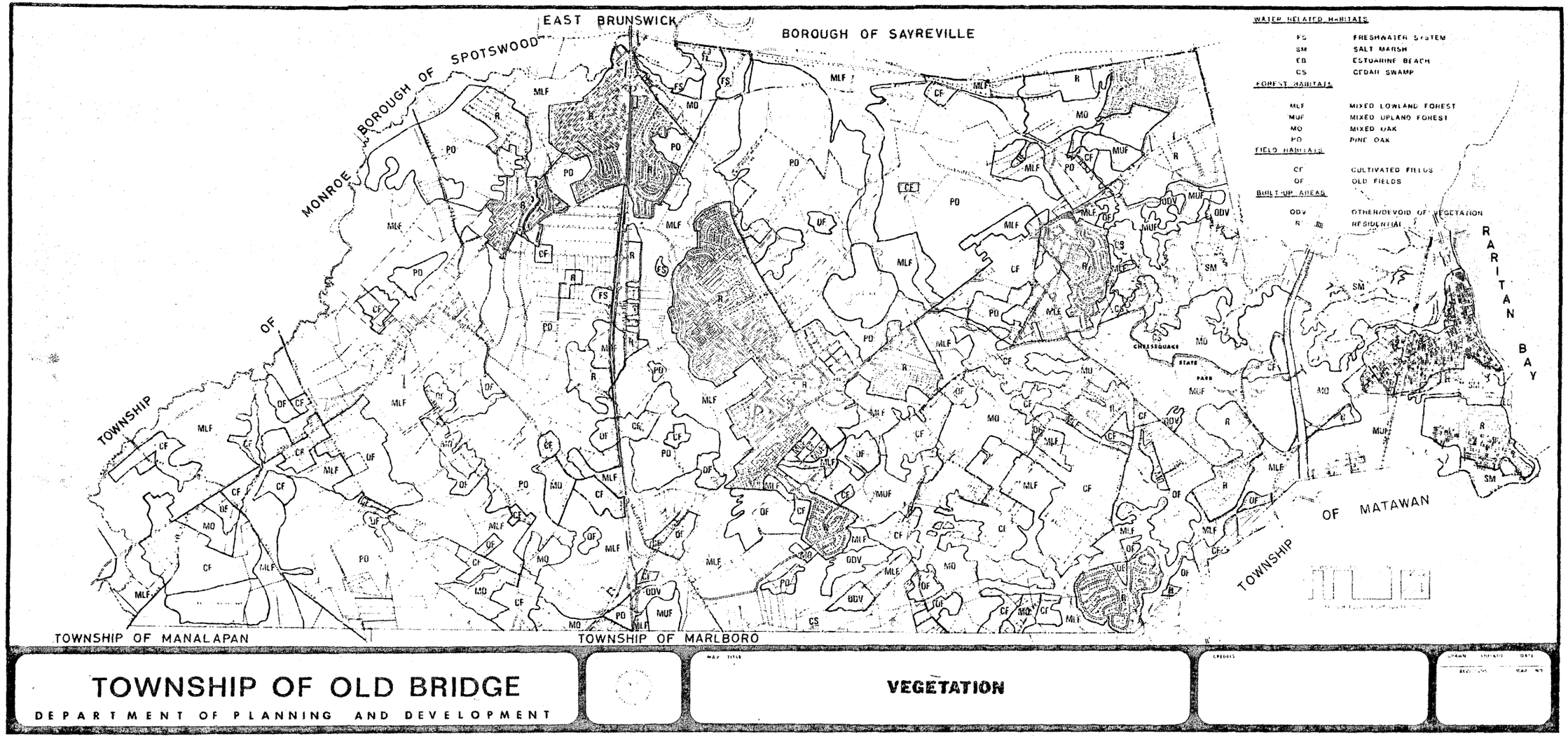
The forest habitat comprises an area of 12,832 acres. This is a broad category encompassing several habitats depending on topography and degree of plant succession. The climax vegetation of Old Bridge is the oak forest. Trees characteristic of this forest include oaks, pine, red maple, black cherry, river birch, elm, willow, hickories, beech and poplar. Typical mammals of forest habitats are the opossum, eastern cottontail, porcupine, and gray and red squirrels. This habitat also supports a large and diverse bird population, such as the ruffed grouse and woodpeckers which are confined to the forest. Endangered birds with the potential of occurring here are the osprey and coopers hawk.

The field habitats comprise 3,218 acres of Old Bridge. These fields are areas in which plant succession is in its earliest stages of development. The cultivated fields themselves lack a high ecological value to wildlife; however, they act as feeding areas and have transitional zones along their boundaries. The old fields are relatively short lived due to succession and vary from grass to pioneer trees. Mammals typical of these areas include opossum, rabbit, woodchuck and deer. Birds are relatively common using these habitats primarily as feeding areas and occasionally as nesting areas. Bobwhite and ring neck pheasant would be typical of the area. Two endangered birds, osprey and coopers hawk, have the potential to occur in the habitat.

The built-up areas are the fourth and final habitat. This is the only habitat that is increasing in acreage as man continues to develop and thus displace other subhabitats in the Township.

The vegetation ratings for limitation for development are based on both the environmental sensitivity and the relative commonness of the habitat, as follows:

Water-related habitat	--	severe
Forest habitat	--	moderate
Old fields	--	limited
Built-up areas	--	limited



TOWNSHIP OF OLD BRIDGE

DEPARTMENT OF PLANNING AND DEVELOPMENT

MAP TITLE

VEGETATION

CREDITS

DRAWN CHECKED DATE

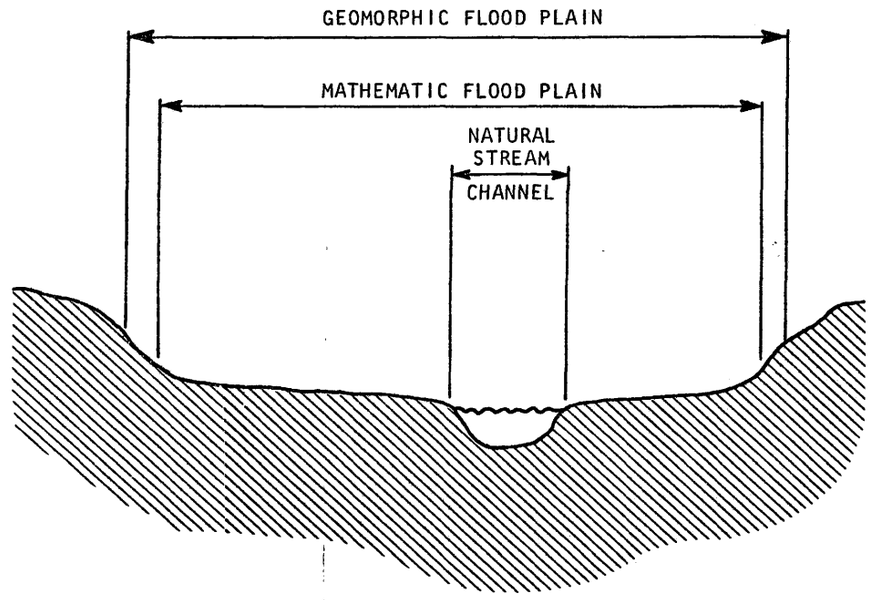
REVISIONS MAP NO.

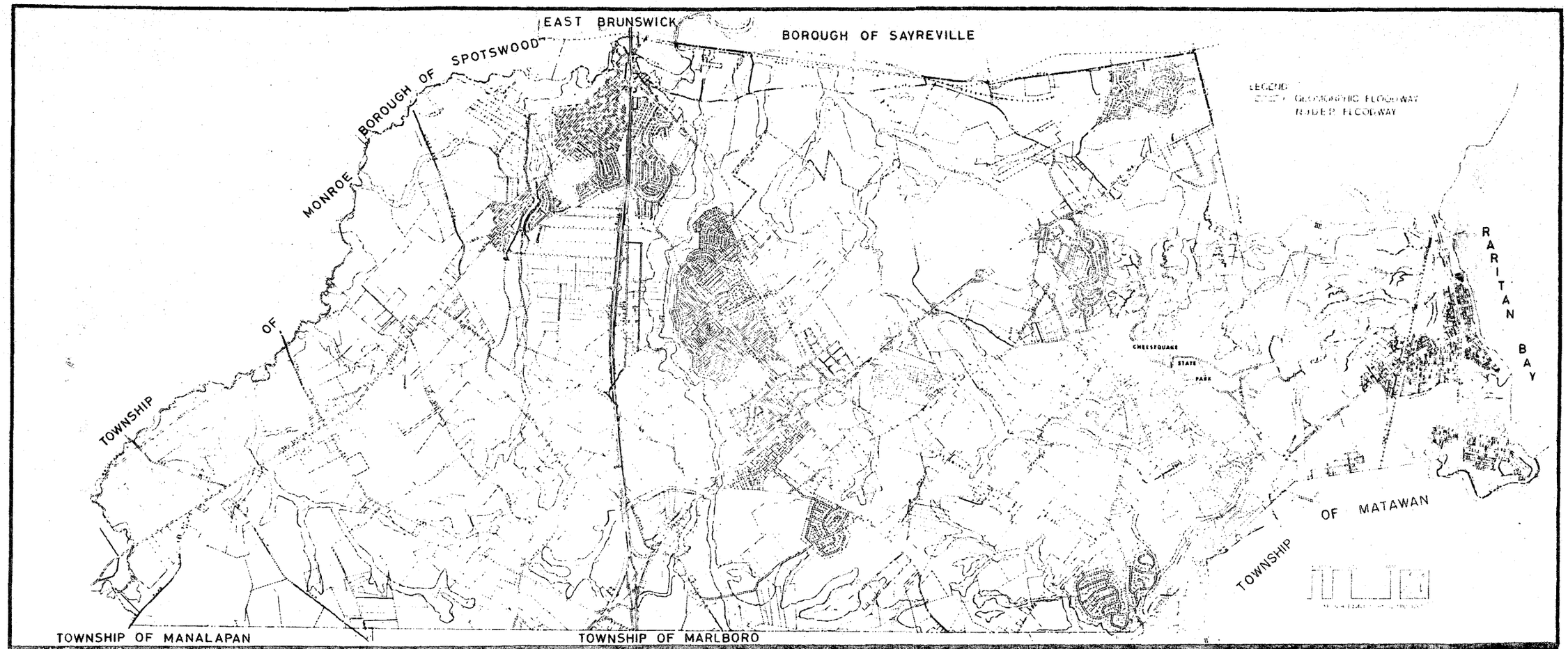
FLOOD PLAINS

In recent years Federal, State and Local governments have increasingly recognized that flood plains are a valuable natural resource, serving both to minimize the extent of flooding and to maximize the amount of ground water recharge, as well as to protect life and property. As with any natural resource, a prudent step in planning for its protection and utilization is to identify it, and the best identification format, as with any geomorphological phenomenon is a map.

Before an identification can be made the phenomenon must be defined. Currently, several definitions of "flood plain" are being used, some mathematical, others vegetative or geomorphological. Some of these definitions are arbitrary and have little resemblance to what a flood plain actually is. The definition used in this report was taken from the Dictionary of Geological Terms and is one accepted by geologist and geographer the world over, viz "that portion of a river valley, adjacent to the river channel, which is built of sediments (deposited) during the present regimen of the stream and which is covered with water when the river overflows its banks at flood stages". This definition is both natural and generic in that it describes a universal evolutionary process which results in the formation of a readily recognized natural phenomenon- a tabular, elongated depositional body of alluvium that is easily observable on the ground. The flood plains map shows both the geomorphic delineation utilized by Dames & Moore and the mathematical definition utilized by the State. Although these two methods utilize different definitions their agreement in areal extent is remarkably close.

FLOOD PLAIN SCHEMATIC





TOWNSHIP OF OLD BRIDGE

DEPARTMENT OF PLANNING AND DEVELOPMENT

MAP TITLE

FLOOD PLAINS

CREDIT

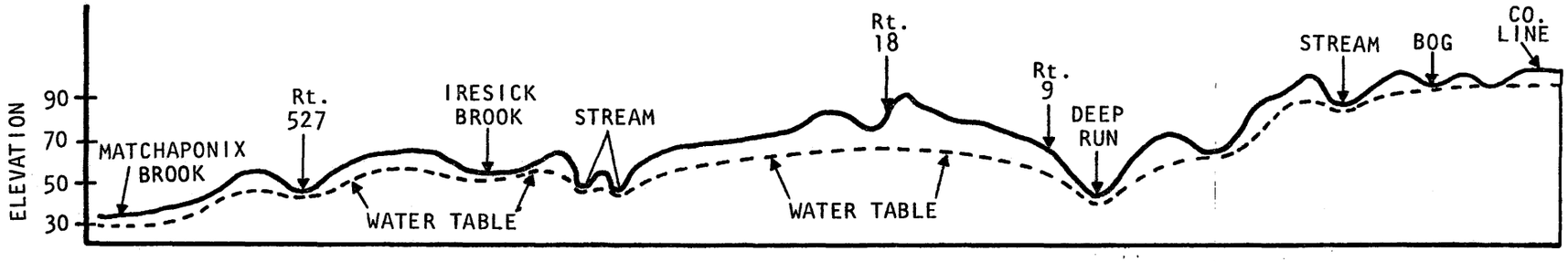
DRAWN

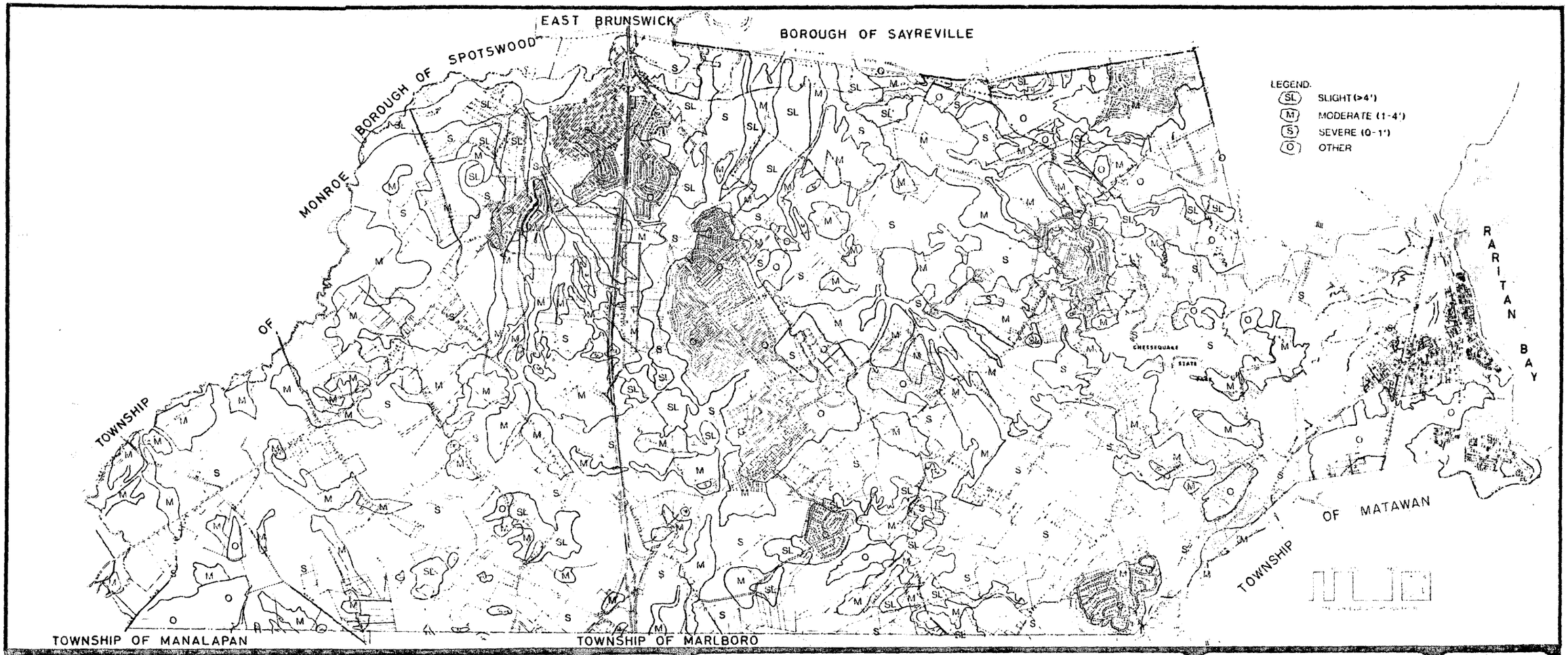
DEPTH TO WATER TABLE

The depth of the water table in Old Bridge Township is closely related to topography and soil types. In general the upland areas act as ground-water recharge areas and the streams, rivers, swamps, and ponds are ground-water discharge areas. In the topographically low areas near these discharge areas the water table is usually near or at the ground surface. In the upland recharge areas, especially where permeable soils are present the water table is generally more than 6 feet below ground and may be considerably deeper.

Sections of the Township where large volumes of the ground water are being pumped from the water table aquifer may have a much lower water table than there was originally. In general, pumpage from artesian aquifers which are overlain by confining formations will create zones of lowered hydrostatic pressure within these aquifers in the vicinity of the wells or well. Pumping from these aquifers, however, will generally not have a significant effect on the depth to water table in the surficial deposits.

The four categories and their respective depth to the water table are: severe 0-1'; moderate 1'-4'; and slight greater than 4'.





TOWNSHIP OF OLD BRIDGE

DEPARTMENT OF PLANNING AND DEVELOPMENT

MAP TITLE

AVERAGE DEPTH TO WATER TABLE

SHEETS

SEPTIC SUITABILITY

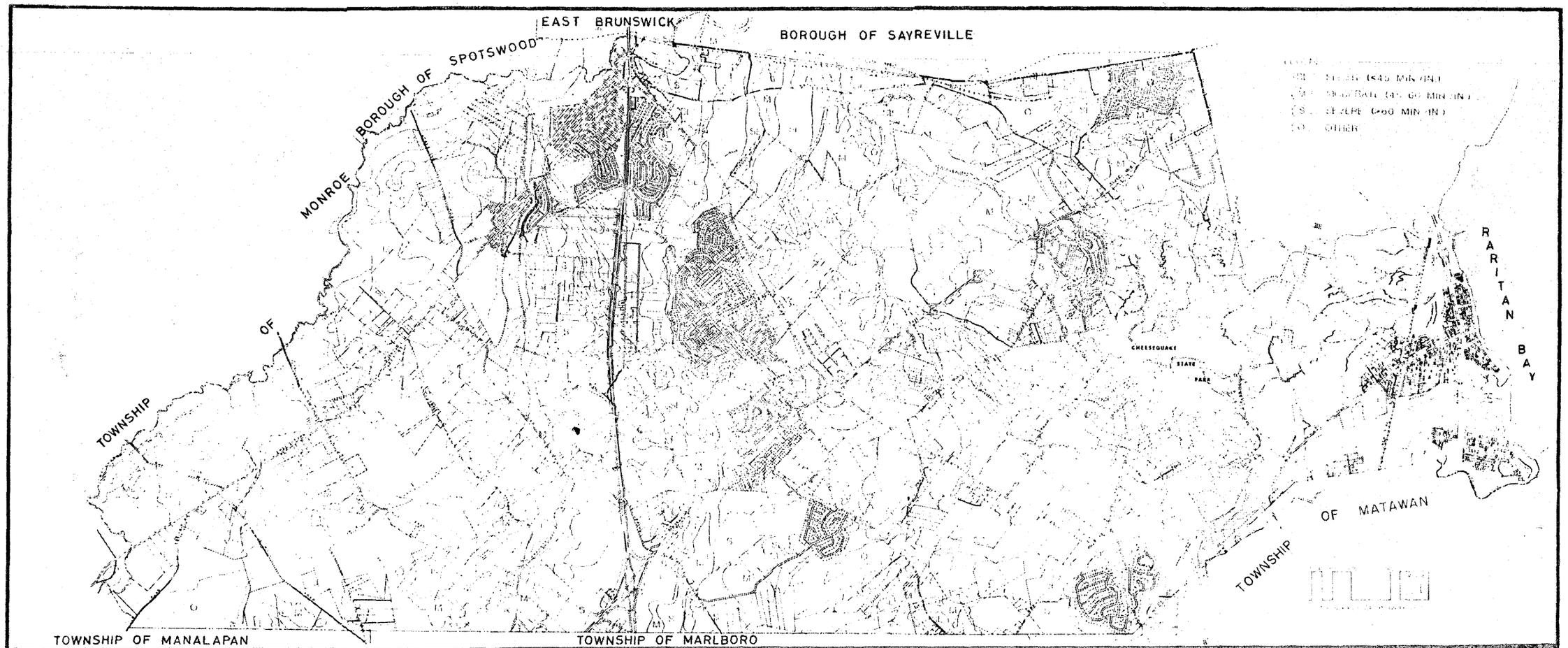
Most of Old Bridge Township is not presently served by a single central sewer system. However, the Middlesex County Sewerage Authority is presently undergoing a regionalization. This will result in the abandoning of several smaller facilities and treatment at a single facility. Areas without sewer service require individual septic tanks for waste disposal. Septic tanks require certain environmental characteristics to perform properly. The Soil Conservation Service has defined these characteristics and rated them slight, moderate and severe, depending on certain performance criteria. Slight is used for few or no significant limitation; moderate for one or more limitations that can normally be overcome at moderate costs by careful construction and design; severe is one or more limitations that cannot be overcome without considerable costs. A severe rating does not imply that the soil is unsuitable, but that development costs are high.

Important soil properties that are examined to determine septic suitability are percolation rate, depth to water table, slope, amount of stone, depth to bedrock and flood hazard.

It is not intended that the ratings substitute for on site percolation tests. The soil map and the ratings assigned to various community uses are for substantial areas and do not preclude differences between localized conditions and mapped conditions.

SEPTIC SUITABILITY

CHARACTERISTICS	SLIGHT	MODERATE	SEVERE
Permeability	>2.0"/hr	.6-2.0"/hr	<.2"/hr
Hydraulic conductivity	>1"/hr	1-0.6"/hr	<0.6"/hr
Percolation rate	>45 min/in	45-60 min/in	<60 min/in
Depth to water table	>72"	48-72"	<48"
Flooding	None	None	Occasional
Slope	0-8%	8-15%	>15%
Depth to bedrock	>72"	48-72"	<48"
Stoniness class	0-1	2	3, 4 & 5
Rockiness class	0	1	2, 3, 4 & 5
Soils	Hammonton Lakewood Keyport	Downer Evesboro Lakehurst Sassafras Woodstown Klej	Atison Elkton Pocomoke



TOWNSHIP OF OLD BRIDGE

DEPARTMENT OF PLANNING AND DEVELOPMENT

SEPTIC SUITABILITY

FOUNDATION LIMITATIONS

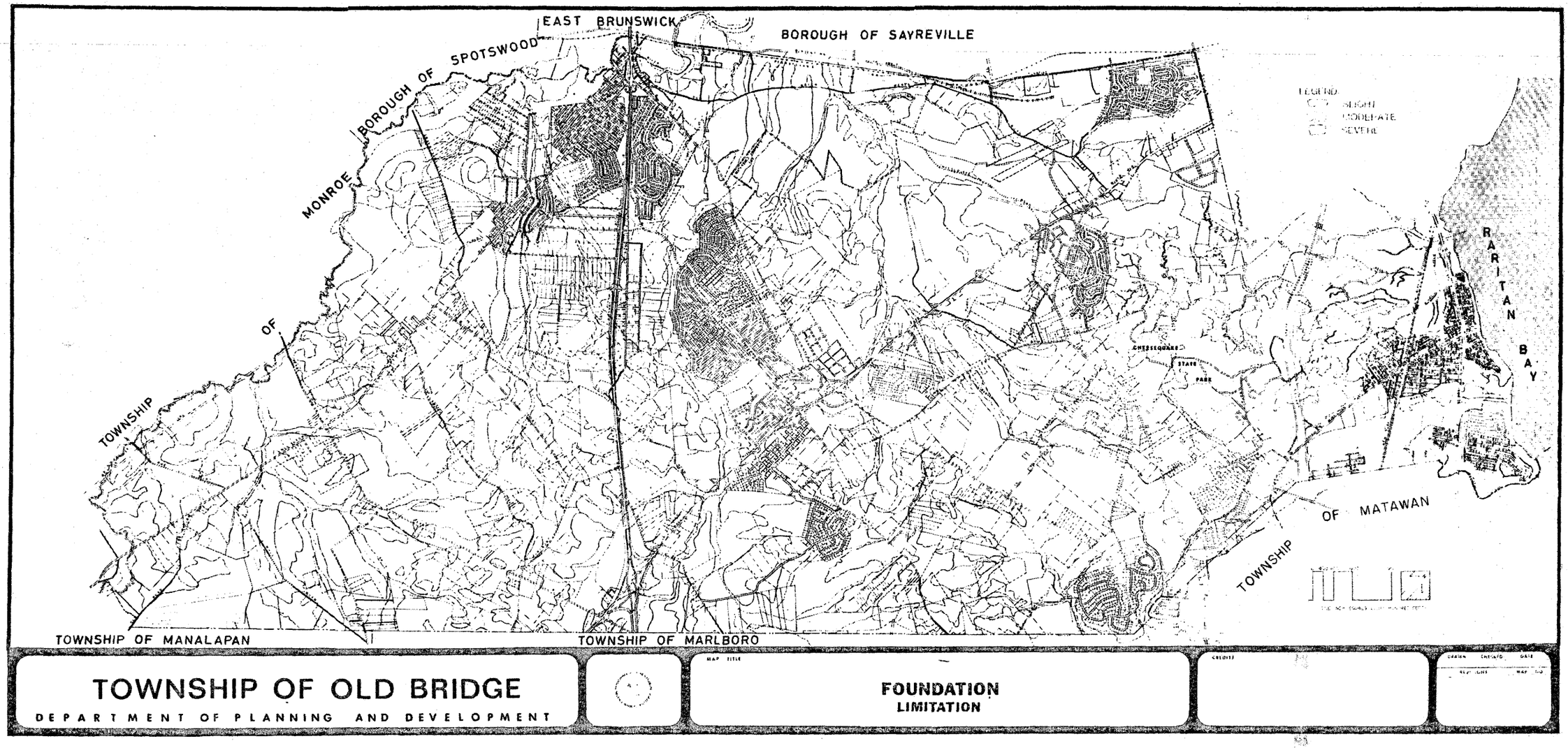
The Foundation Limitations Map is derived from the Soil Conservation Service Soil maps of Old Bridge Township. The three categories of slight, moderate and severe are based on soil, slope and hydrologic properties listed on the accompanying table. These properties affect bearing capacity, bearing strength, settlement, cost of excavation and cost of construction.

Route 18 generally divides the Township into two sections with differing qualities of foundation limitations. The area south of Route 18 has mostly severe and moderate foundation limitations. The area north of Route 18 has mostly moderate and slight foundation limitations.

This division results mainly from the area south of Route 18 being an area of low relief, dissected by numerous streams, susceptable to occasional floods, and with a relatively poor drainage class. In contrast the area to the north of Route 18 is higher in relief, less dissected by streams and generally of a better drainage class.

FOUNDATION LIMITATIONS

CHARACTERISTICS	SLIGHT	MODERATE	SEVERE
Drainage Class	Well drained	Moderately drained	Poorly drained
Seasonal water table	>60"	>30"	<30"
Flooding	None	None	Occasional
Slope	0-8%	9-15%	>15%
Shrink swell potential	Low	Moderate	High
Potential frost action	Low	Moderate	High
Depth to bedrock	>60"	40-60"	<40"
Soils	Downer Evesboro Lakehurst Sassafras	Hammonton Keyport Klej Lakehurst Woodstown	Alluvial Atison Elkton Muck Pocomoke Tidal Marsh



TOWNSHIP OF OLD BRIDGE

DEPARTMENT OF PLANNING AND DEVELOPMENT

MAP TITLE

FOUNDATION LIMITATION

CREDITS

DRAWN CHECKED DATE

SCALE MAP NO.

EROSION POTENTIAL

Erosion is the removal of soil and land from its present location by the agents of wind, water and man. The most important long term agent acting on soil removal is water. Normal soil erosion operates very slowly, yet inexorably. Over many thousands of years, normal soil erosion levels entire mountains to form plains, plateaus and river flats. When erosion exceeds this normal rate, it becomes destructive and is referred to as accelerated erosion. The effects of this type of erosion can be seen at a large construction site where there is no adequate erosion and sedimentation control plan being utilized, or on a large cleared and sloping field after a rainfall.

Water erosion acts in the form of rainfall and overland flow. Rain, even a gentle rain and more so a severe thunderstorm, exert three main influences. First it detaches the soil; then it destroys soil granulations and finally, under certain conditions, effects transportation of soil laterally. Overland flow then acts by carrying soil particles downslope to rills and eventually to small first order streams. Depending upon the amount of rainfall, the amount of runoff and the amount of vegetative cover on the ground, all act together to determine the quantity of erosion.

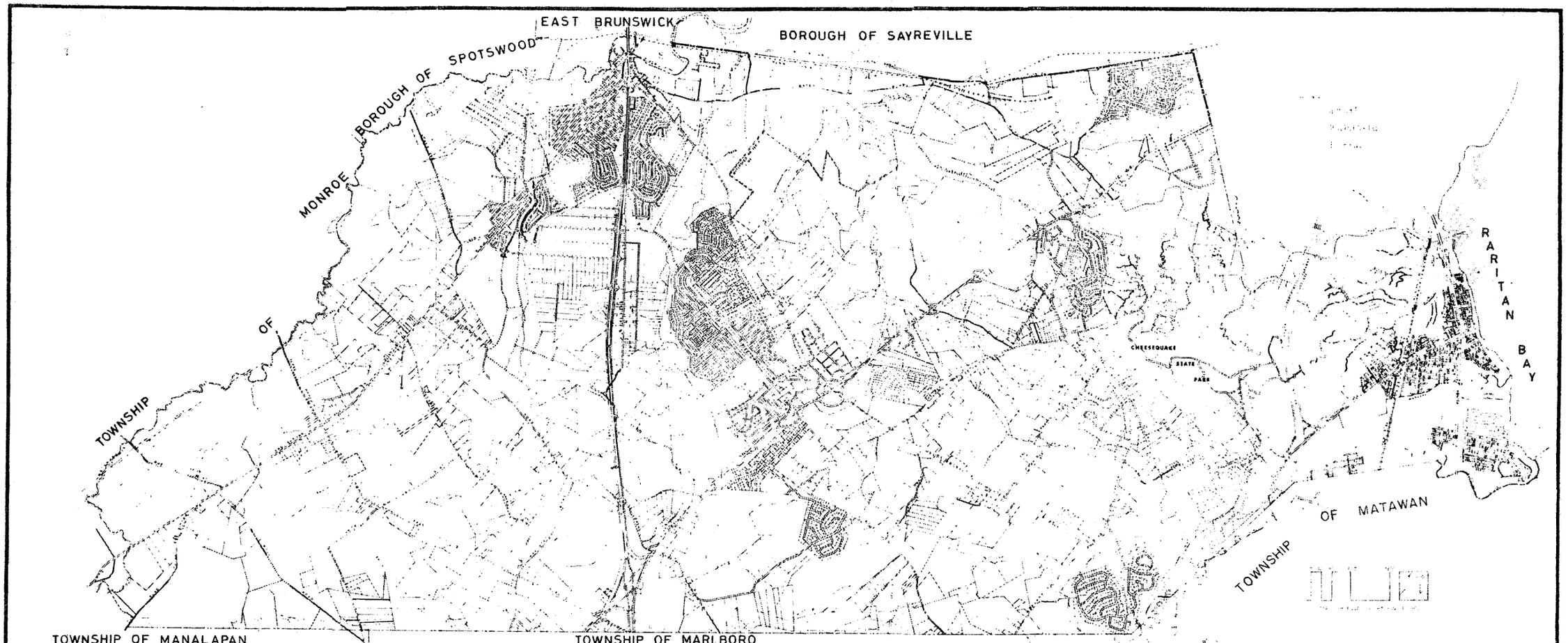
Erodibility (k) factors are relative erosion factors indicating the severity of sheet erosion that might be expected from bare (non-vegetated cover) soil. These ratings are discrete numbers; 0.17, 0.20, 0.24, 0.28, 0.32, 0.37, 0.43, and 0.49, with 0.17 being the lowest erosion hazard and 0.49 being the highest. The Erosion Potential map divides the rating into three groups:

LIMITATION	K FACTOR	SOILS
Slight	0.17-0.24	Atsion, Evesboro, Klej, Lakehurst, Lakewood
Moderate	0.28-0.37	Downer, Hammonton, Pocomoke, Sassafras, Woodstown
Severe	0.43-0.49	Elkton, Keyport

The erosion potential of each of the soils listed is modified by vegetation and slope.

The major area in the Township where there is a severe potential for erosion is a broad swath that follows the ridge line separating the Cheesequake Estuary from the Tennents Brook drainage basin. The alignments of Routes 34 and 9 (north of its intersection with 34) are generally located along this ridge line.

In addition to this broad area, there are numerous smaller sites with generally high erosion potential on locally steep land.



TOWNSHIP OF OLD BRIDGE

DEPARTMENT OF PLANNING AND DEVELOPMENT

EROSION POTENTIAL

DEVELOPMENT SUITABILITY MODEL

The preceding data maps set the basis for the design of an environmental development model for Old Bridge Township. The purpose of this model is to delineate those areas by 10 acre parcels which, in terms of environmental criteria, are most/least suitable for development.

In substance, the development of the model involved the following steps:

- divide the Township into uniform grid cells;
- select data maps for inclusion into the development suitability model;
- determine development limitations (slight, moderate, severe) for each characteristic of each data map;
- weigh each data map in terms of importance;
- apply weighted numerical ratings for each grid cell;
- group range of numerical ratings into classes ranging from least suitable to most suitable for development; and,
- map the classes of suitability for each grid cell.

1. GRID CELLS

Old Bridge was gridded by a lattice of horizontal and vertical lines defining a square cell, or grid cell. Each grid cell is 10 acres square. The Township covers 2,403 grid cells.

2. SELECTION OF DATA MAPS

The following data maps were selected as input to the Development Suitability Model:

Aquifers
Depth to Water Table
Erosion Capability
Flood Plains
Foundation Limitations
Septic Tank Limitations
Topography and Slope
Vegetation

3. DETERMINATION OF DEVELOPMENT LIMITATIONS RATINGS

Each of the above data maps graphically illustrates certain characteristics; the Topography and Slope map, for example, shows four classes of slope. For each data map, the classes of data are assigned a rating in terms of limitations to development -- slight (1), moderate (2), or severe (3). These ratings are professional judgments based on generally accepted standards. The ratings are included in the data map section above.

4. WEIGHTING OF DATA MAPS

Not all data maps are considered of equal importance; most people would consider flood plains as more significant to development suitability than slope. The determination of these weights is not necessarily a professional judgment, but rather one that is related to local values. For that reason, the assignment of an importance value for each data map was determined by a consensus of the Environmental Commission. The results of the consensus are as follows:

DATA MAP	WEIGHT	SLIGHT (1)	MODERATE (2)	SEVERE (3)	VALUE MAX.	VALUE MIN.
Aquifer	6				18	6
Flood Plain	5				15	5
Vegetation	4				12	4
Septic Tank Suitability	4				12	4
Erosion Capability	3				9	3
Foundations Limitations	2				6	2
Depth to Water Table	2				6	2
Slopes	1				3	1
					81	27

The minimum value of 27 can actually be less because several areas of the Township are noted on some data maps as "other" or blank.

5. APPLICATION OF VALUES TO DATA MAPS

A transparent grid was placed over the data maps and the value of each map is coded by grid cell. All of the values (eight, one for each data map) are summed by grid cell, so that each grid cell now has a value. The distribution of values by 10-acre cell is as follows:

SUMMATION AND DISTRIBUTION OF VALUES

VALUE	NUMBER OF CELLS	CUM.	% OF TOTAL
0-5	0	0	0
6-10	52	52	2.1
11-15	13	65	<1
16-20	83	148	3.4
21-25	22	170	<1
26-30	54	224	2.2
31-35	124	348	5.1
36-40	212	560	8.8
41-45	442	1,002	18.3
46-50	463	1,465	19.2
51-55	377	1,842	15.6
56-60	293	2,135	12.2
61-65	192	2,327	7.9
66-70	47	2,374	1.9
71-75	29	2,403	1.2
76-81	0		0
	2,403		97.9

6. DETERMINE SUITABILITY GROUPINGS

The distribution of cells by value is similar to a traditional bell curve with a concentration in the center. In order to determine suitability groupings, five classes of development suitability were selected: (1) most suitable, (2) suitable, (3) adequate, (4) unsuitable, and (5) least suitable. It was assumed that the number of cells in each suitability class would be equal, or 480 cells per class. The breakout is as follows:

VALUE (GRID CELL)	SUITABILITY
Less than 39	Most Suitable
39 to 44	Suitable
45 to 49	Adequate
50 to 56	Unsuitable
More than 56	Most Unsuitable

7. MAP THE VALUES

Each grid cell was color coded by suitability rating, thereby creating a Development Suitability Model overlay. This map is not reproduced herein because the reduction in scale would render the map meaningless.

USE OF DEVELOPMENT SUITABILITY MODEL

The Development Suitability Model is not a substitute for the Master Plan. It does not consider, for example, the social and economic forces which also impose development constraints and potentials on the Township.

The Development Suitability Model does, however, provide information relating to environmental impacts of public and private land planning decisions and activities. It is a basis for continuing land-use planning, and legislation to support such planning.

APPENDIX

CLIMATE

The climate of Old Bridge is classified as continental with limited influence from the Atlantic Ocean. Summertime temperatures seldom exceed 100 degrees but there are frequent readings in the 90's from May until September. Wintertime temperatures below 0 are infrequent and usually of a short duration. The normal average temperature for the year is 53 degrees.

The vegetative growing season, the number of days between the last freezing temperature in the spring and first freezing temperature in the fall, averages 185 days in length. This growing season starts around April 18 and ends around October 19 each year. However, readings less than 32 degrees have been recorded as late as May 25 and as early as September 28.

Rainfall in the area of Old Bridge Township averages 44 inches a year. The heaviest amounts normally occur during the late summer and early fall when tropical storms pass along the coast.

CLIMATOLOGICAL SUMMARY
RECORDED AT FREEHOLD (N.J.) WEATHER STATION
1941-1970*

	TEMPERATURE (°F)							PRECIPITATION TOTALS (inches)			MEAN NUMBER OF DAYS					
	Means			Extremes							Temperatures					
												Max.		Min.		
Month (a)	Daily Maximum	Daily Minimum	Monthly	Record Highest	Year	Record Lowest	Year	Mean	Greatest Daily	Year	Precip. .10 inch or more	90° and above	32° and below	32° and below	0° and below	Month
Jan.	39.7	23.0	31.4	73	1950	-14	1935	3.17	2.38	1936	5	0	8	27	1	Jan.
Feb.	41.5	23.8	32.7	76	1954	-20	1934	3.09	2.40	1966	6	0	5	23	*	Feb.
Mar.	50.0	30.3	40.2	87	1945	-2	1967	4.23	2.63	1953	7	0	1	19	*	Mar.
Apr.	62.3	39.7	51.0	92	1941	18	1944+	3.45	2.05	1961	7	*	0	6	0	Apr.
May	73.1	49.1	61.1	96	1941	29	1952+	3.93	4.54	1968	6	1	0	*	0	May
June	81.6	58.4	70.0	100	1934	35	1938	3.40	4.30	1938	6	5	0	0	0	June
July	85.6	63.5	74.6	106	1936	46	1945	4.69	5.15	1961	6	7	0	0	0	July
Aug.	83.6	61.9	72.8	102	1955	42	1940	4.39	4.04	1955	6	4	0	0	0	Aug.
Sept.	77.5	55.4	66.5	99	1953	32	1963+	3.47	5.68	1938	5	2	0	*	0	Sept.
Oct.	67.3	45.3	56.3	94	1941	20	1969	3.14	2.95	1955	5	0	0	2	0	Oct.
Nov.	55.1	36.1	45.6	83	1950	7	1938	4.11	3.55	1963	7	0	*	12	0	Nov.
Dec.	42.5	25.9	34.2	72	1966+	-5	1942	3.65	2.68	1946	7	0	5	24	*	Dec.
Year	63.3	42.7	53.0	106	July 1936	-20	Feb. 1934	44.72	5.68	Sept. 1938	73	19	19	113	1	Year

* Extremes for period 1931 - 1970
Means for period 1941 - 1970

BRIEF DESCRIPTION OF SOIL SERIES

(USDA, SOIL CONSERVATION SERVICE)

ATSION:

Atsion soils are very sandy throughout the profile and have a seasonally high water table. The surface horizon contains moderate to high amounts of organic matter and the subsoil contains enough organic matter to make the color dark. In places, the sand grains are cemented either weakly or strongly. The water table drops about 2 to 3 feet in summer.

DOWNER:

Downer soils are well drained with a sandy loam subsoil over stratified sand and loamy sand strats normally containing small amounts of gravel. Soils with substantial amounts of gravel are mapped separately where extensive. Where clayey or loamy substrats are extensive, these are mapped separately.

ELKTON:

Elkton soils are deep, poorly drained. They have a gray fine textured subsoil that is difficult to drain. The soils form in low positions in the landscape.

Slopes are nearly level. Natural fertility and available water capacity are moderate. Permeability is slow. Excess water is perched over the subsoil in winter and spring. Frost heaving is severe.

EVESBORO:

Evesboro soils are excessively drained, deep sandy soils. Most soils are underlain below 40 inches by sand, loamy sand, sandy loam, or sandy clay loam. The clayey substratum soil is underlain by sandy clay or clay.

Natural fertility and available water capacity are low. Permeability is rapid or moderately rapid except in the clayey substratum it is slow.

HAMMONTON:

Hammonton soils are deep, moderately well or somewhat poorly drained with a sandy loam subsoil over stratified loamy sand and sandy loam layers containing small amounts of rounded quartzose gravel. Where extensive, clayey substratum soils are mapped separately.

Natural fertility and available water capacity are moderately low. Permeability is moderate or moderately rapid, except for the clayey substratum soils which are slow in the substratum.

KEYPORT:

Keyport soils are deep, moderately well drained soils that have a moderately fine or fine textured subsoil. Water is perched over the subsoil in fall, winter, and spring when rainfall is normal and in summer when it is abnormally heavy. The soils form on intermediate positions in the landscape. Slopes range from nearly level to moderately steep.

Natural fertility and available water capacity are moderate. Permeability is slow.

KLEJ:

Klej soils are deep, moderately well and somewhat poorly drained sandy soils. Normally the water table reaches about 2 feet in late winter and early spring and drops below 5 feet in summer. Unless cover crops are planted, soils in fields are subject to blowing.

Natural fertility and available water capacity are low; permeability is rapid except in clayey substratum soils which have slow or moderately slow permeability.

LAKEHURST:

Lakehurst soils are moderately well or somewhat poorly drained sandy soils that have a bleached gray sand 7 or more inches thick as part of the surface soil. The subsoil and substratum are yellowish brown or paler and generally are mottled. In summer, the water table is normally below 5 feet.

Natural fertility is very low; permeability is rapid. Available water capacity is low.

LAKEWOOD:

Lakewood soils are deep, excessively drained, sandy soils that have a bleached gray sand 7 or more inches thick as part of the surface soil. The subsoil and substratum are yellowish brown sand. Bare soils are subject to blowing.

Natural fertility is very low. Available water capacity is low and permeability is rapid.

POCOMOKE:

Pocomoke soils are very poorly drained moderately sandy soils over stratified sand and sandy loam layers. The surface is very dark. The water table drops about 3 feet in summer. Where outlets are available, water levels can normally be dropped by drainage.

Natural fertility is moderate. Available moisture capacity is moderate but may be increased by capillarity from the water table. Permeability is moderate.

SASSAFRAS:

Sassafras soils are well drained, moderately sandy soils over stratified sand and loamy sand layers containing small amounts of hard quartzose gravel which is mostly fine in size. The subsoil is heavy sandy loam or sandy clay loam.

Natural fertility, available water capacity, and permeability are moderate for loam and sandy loam soils and moderately low for loamy soils.

WOODSTOWN:

Woodstown soils are moderately well drained, moderately sandy soils over stratified sand and loamy sandy layers containing small amounts of rounded quartzose gravel, extending 40 inches. In places, a clayey substratum is below 40 inches. The subsoil contains mottled colors indicating prolonged wetness.

Natural fertility, available water capacity and permeability are moderate. Normally the water table rises to 1 1/2 to 2 1/2 feet in late winter and spring and drops below 5 feet in summer.

MUCK:

This soil is composed of saturated finely divided organic matter ranging in depth from 16 inches to 4 feet. The water table is at the surface in winter and it does not drop much in summer except in extremely dry periods. Permeability is rapid, water holding capacity is high, and the material is extremely acid. Organic matter content is high. It shrinks severely upon drying so the material subsides if drained. The organic material is over sand or gravelly sand.

ALLUVIAL:

Alluvial land, loamy consists of loamy recent alluvial deposits in the floodplains of the major streams in the Coastal Plain. Stream overflows are frequent, normally several times each year and are of short duration. Slopes are nearly level. Most areas are in woodland or pasture. The seasonal high water table is near the surface in winter and it does not drop much in summer.

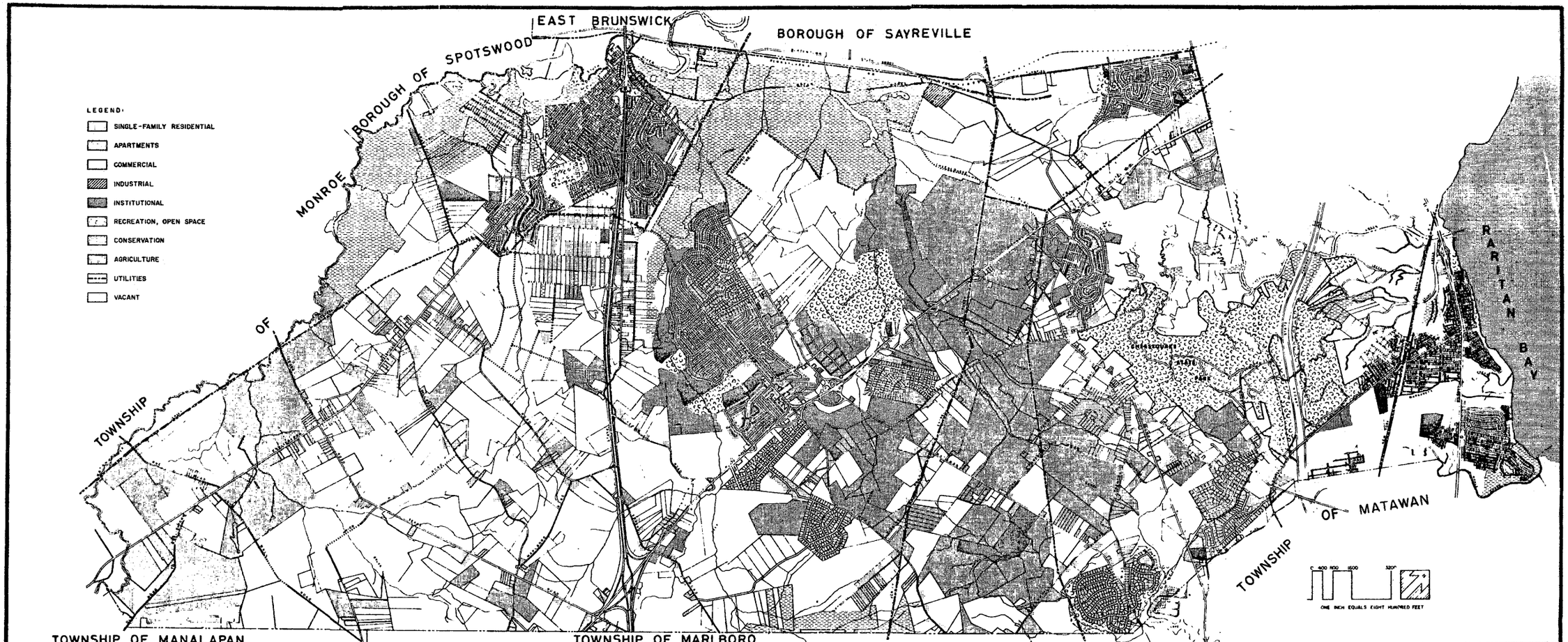
Alluvial land, sandy, mixed material along the floodplains of the major stream in the Coastal Plain. These areas normally have a sandy surface texture and a sandy to loamy sand subsurface layer. Slopes are nearly level and are frequently flooded. Permeability is rapid.

SOILS CHARACTERISTICS

NAME	NUMBER	STREAM OVERFLOW HAZARD	DEPTH TO BEDROCK	DEPTH TO SEASONALLY HIGH WATER TABLE	NATURAL FERTILITY	AVAILABLE WATER CAPACITY	SHRINK SWELL POTENTIAL	HYDROLOGIC GROUP
Atison	9736	Seldom	10 ft.+	0-1'	Low	Low	Low	D
Downer	9515	None	10 ft.+	5'+	Low	Low	Low	B
Elkton	9831	Slight	10 ft.+	0-1'	Moderate	Moderate	Low-moderate	D
Evesboro	9306	None	10 ft.+	5'+	Low	Low	Low	A
Hammonton	9525	None	10 ft.+	1.5'-4.0'	Low	Low	Low	B
Keyport	9821	None	10 ft.+	1.5'-2.5'	Moderate	Moderate	Low-moderate	D
Klej	9325	None	10 ft.+	1.5'-4.0'	Low	Low	Low	B
Lakehurst	9726	None	10 ft.	1.5'-4.0'	Very low	Low	Low	B
Lakewood	9706	None	10 ft.	5'+	Very low	Low	Low	A
Pocomoke	9443	Occasional	10 ft.	At surface	Moderate	Moderate	Low	D
Sandy Land	941	None	10 ft.+	5'+	Low	Low	Low	A
Sassafras	941	None	10 ft.+	3'-5'	Moderate	Moderate	Low	B
Woodstown	9423	None	10 ft.+	1.5'-4.0'	Moderate	Moderate	Low	B
Muck	-	Very frequent	10 ft.+	At surface	-	-	Low	D
Alluvial	-	Frequent	10 ft.+	0-1'	-	-	Low	D

Notes: 1. Above listing does not include complex soils such as fill, urban, or tidal marsh.

2. Hydrologic Group: A - best, D - worst



TOWNSHIP OF OLD BRIDGE

DEPARTMENT OF PLANNING AND DEVELOPMENT

MAP TITLE

EXISTING LAND USE

DRAWN | CHECKED | DATE

REVISIONS | MAP NO

Old Bridge Township Council

William Flynn, Mayor
George Bush
T. Gilbert Fallon
Sonja Fineberg
James B. Garland
Edward Murphy
George Stone

Old Bridge Township Planning Board

George Settlecowski, Chairman
James Fennessy, Vice Chairman
William Flynn, Mayor
Richard Dealy
James Garland
Thomas Hueston
Jean McNiff
John Morse
Richard Zipp
Thomas Norman, Attorney

Old Bridge Township Environmental Commission

Ira Danzig, Chairman
David Edwards
Jo Ann Gelman
Blanche Hoffman
Dr. Louis Klos
John Morse
Daniel F. Rodd

Old Bridge Township Manager

Lawrence A. Kenyon

Old Bridge Township Engineer

Harvey P. Goldie, P.E.

Old Bridge Township Planner

E. Fletcher Davis, PP, AIP