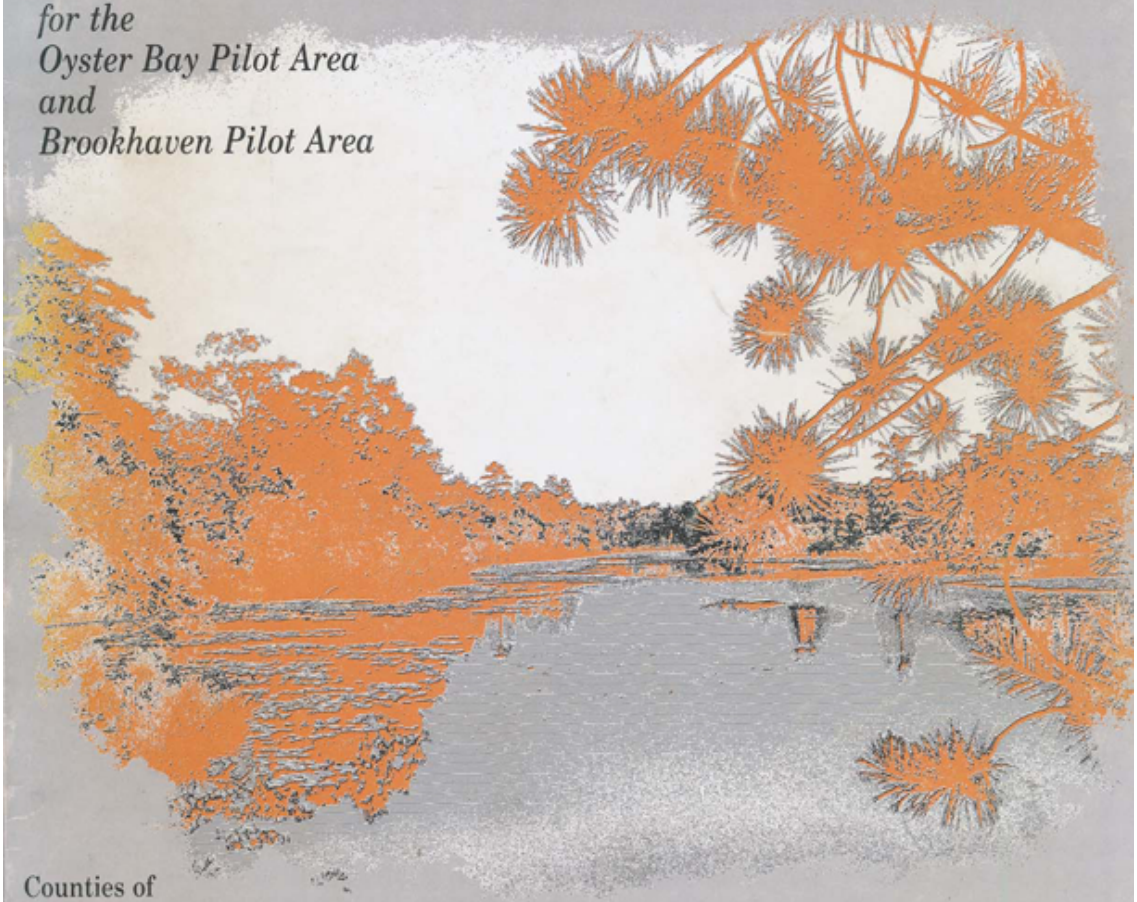
SPECIAL GROUND-WATER PROTECTION AREA PROJECT

for the
Oyster Bay Pilot Area
and
Brookhaven Pilot Area



Counties of
Nassau and Suffolk
New York

Prepared by:
Long Island Regional Planning Board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SPECIAL GROUND-WATER PROTECTION AREA PROJECT

for the
Oyster Bay and
Brookhaven Pilot Areas

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Foreword

The purpose of this document is to develop the concept of a Special Ground-Water Protection Area, introduced in the Nonpoint Source Management Handbook (LIRPB 1984) and the Draft New York State Ground-Water Management Program (NYSDEC). Through the creation of a specific ground-water management program for two pilot areas, the Board has attempted to provide the best available guidance for use by public officials, developers and residents concerned with the protection of ground and surface waters. The major objectives that underlie the recommendations are to maximize high quality recharge to the aquifers and to minimize pollutant loadings from all land uses.

The management programs emphasize the maintenance of water quality and quantity through local land use controls, including site plan review, the transfer of development rights, and other measures directed primarily at the reduction or exclusion of point and nonpoint sources of contamination.

It is our hope that people in other areas will find the Special Ground-Water Protection Area concept and related management approaches of value in their aquifer protection efforts.

Lee E. Koppelman
Executive Director

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Executive Summary

In Nassau and Suffolk Counties some 2.6 million people are totally dependent on ground water. Protection of the quality and quantity of the freshwater stored in the Long Island aquifers is of primary importance to the bi-county area.

The *Long Island Comprehensive Waste Treatment Management Plan* (Koppelman, 1978) introduced the concept of hydrogeologic zones based upon differences in ground-water flow patterns and water quality; identified those areas or zones contributing recharge to the deep aquifers and those contributing to the shallow aquifer; and provided both island wide and hydrogeologic zone recommendations. The water recharging the deep aquifers (Zones I, II, III and V) can be expected to remain in the system for hundreds of years or even longer; therefore, the quality of that recharge is a critical concern.

Much of the deep recharge area in Nassau and western Suffolk Counties is already developed, and more often than not, ground-water quality shows the effects of past and present human activities. However, two relatively undeveloped areas in Nassau County and seven in Suffolk County offer a last chance to prevent ground-water contamination through timely action. Both the New York State Groundwater Management Plan (NYSDEC, 1983) and the Nonpoint Source Management Handbook (LIRPB, 1984) delineated these areas and categorized them as *Special Groundwater Protection Areas* (SPGAs) warranting urgent management attention in order to maintain them as sources of high quality, uncontaminated recharge to the deep flow aquifer system.

This volume represents the next step in the development of the SGPA concept -- the verification or amendment of preliminary boundaries, and the more detailed investigation and development of individual management programs for two pilot areas.

In order to provide a broad range of recommendations that might prove useful in other SGPAs, in other parts of the deep aquifer recharge areas and wherever the protection of ground water is a concern, two distinctly different pilot areas were selected: the Oyster Bay SGPA and the Brookhaven SGPA.

The Oyster Bay SGPA, which recharges the last major reservoir of high quality ground water in Nassau County, is primarily a low density residential area that includes numerous estates, country clubs, preserves and a few farms. Politically more complex than the Brookhaven pilot area, it comprises part or all of the City of Glen Cove, the unincorporated portion of the Town of Oyster Bay and eleven villages. Despite mounting development pressures, there is still an opportunity to protect the ground water and to preserve the ecology and visual quality of a unique part of the bi-county region.

For the most part, required legal authority and institutional arrangements are already in place, although not always fully utilized. Additional legal and institutional arrangements are recommended in this report. The proposed programs generally rely upon the coordinated, focused application of a variety of regulatory and non-regulatory approaches. Although some of the recommendations are addressed to New York State, Nassau County, or Suffolk County the major responsibility for achieving the primary objectives of the pilot programs rests with the municipalities.

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The Oyster Bay management package consists of a series of general recommendations that are applicable throughout the area and elsewhere as well, together with a number of more detailed site specific proposals calling for the acquisition of a fee or easement or suggesting a design concept for the development of a single property or group of properties in a manner consistent with ground-water protection. The maintenance of existing large lot zoning, the maximum preservation of natural vegetation, the effective use of site plan review procedures and the retention of public and quasi-public open space are emphasized.

The Brookhaven (Western Pine Barrens) SGPA is located within Zone III and the quality of the underlying aquifer is generally very good. Extensive areas are available for development. Approximately 60% of the area is undeveloped, including over 6,000 acres of publicly owned lands that remain in a natural state and approximately 1,000 acres of land in agricultural use. More than 11,000 acres are covered with typical pine barrens vegetation, lowland woods and freshwater wetlands. The area also includes a portion of two Scenic and Recreational River Corridors, part of the Carmans River and the headwaters of the Peconic River.

Located entirely within the rapidly developing Town of Brookhaven, the SGPA contains a greater variety of land uses, among them somewhat higher residential densities in those parts of the area that have been developed, strip commercial uses along Route 25, sand mines, two cemeteries, two golf courses and thirteen small sewage treatment plants discharging to ground water.

There is an urgent need to remove existing sources of contamination resulting from unsatisfactory sewage treatment plants and improper disposal of synthetic organic chemicals from residential, commercial and industrial establishments. In addition, contamination from future development must be prevented. These measures are required in order to assure a high quality aquifer for future uses within the study area. It is also possible that some ground water may be exported to nearby areas to augment water supply needs.

The Brookhaven management package consists of a series of general recommendations that are applicable throughout the area and elsewhere as well, together with a number of more detailed site specific proposals. Recommendations for the Pilot Area include the amendment of the municipal zoning ordinance to increase minimum lot sizes, to contain strip commercial development, to limit industrial development, encourage the transfer of development rights to less sensitive parcels and to increase the effectiveness of site plan review. They also include New York State, Suffolk County or Town acquisition of the fee or development rights to specific parcels; the protection of the river corridors and the creation of greenbelts; and the reduction of contaminant loads from existing point and nonpoint sources.

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Acknowledgements

This Management Plan is the culmination of a collective endeavor. It is the product of an interdisciplinary effort involving a wide array of talents and expertise.This document could not have been properly completed without the participation and support of many people whose contributions are too numerous to list here. The names of the major contributors are listed in the credits. The Long Island Regional Planning Board wishes to take this opportunity to express its sincere thanks to them and to the other unnamed individuals who have helped to make this plan a reality.

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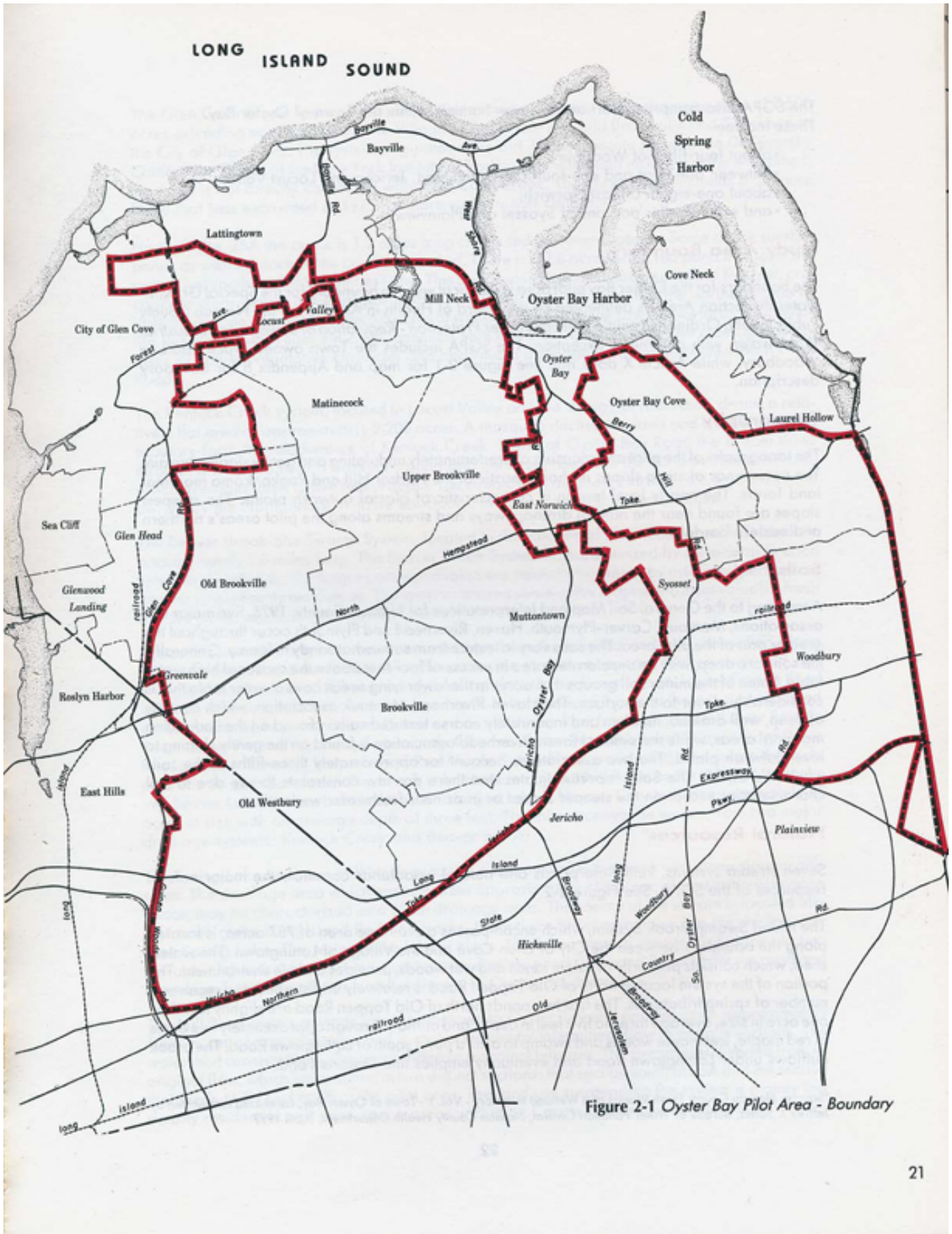

Figure 2-1 *Oyster Bay Pilot Area - Boundary*

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The SGPA also comprises portions of seven hamlets within the Town of Oyster Bay. These include:

- about four-fifths of Woodbury
- between one-third and one-fourth of Glen Head, Jericho and Locust Valley
- about one-eighth of East Norwich;
- and even smaller portions of Syosset and Plainview

Study Area Boundary

The boundary for the Oyster Bay pilot area is identical with the boundary for the Special Groundwater Protection Area as delineated by the Board of Health in Article X of the Nassau County Public Health Ordinance entitled *Groundwater Protection - Regulation of Sewage and Industrial Wastewater*, with one minor exception. The SGPA includes the Town owned Bruce Estate in Woodbury, while Article X does not. See Figure 2-1 for map and Appendix B for boundary description.

Topography

The topography of the pilot area consists of predominately undulating and gently sloping terrain. The occurrence of steep slopes is characteristic of the Harbor Hill and Ronkonkoma morainal land forms. The nearly level terrain is characteristic of glacial outwash plains. The steepest slopes are found near the natural drainageways and streams along the pilot areas's northern and eastern borders.

Soils

According to the General Soil Map and Interpretations for Nassau County, 1976, five major soil associations, Montauk, Carver-Plymouth, Haven, Riverhead and Plymouth occur throughout the greater part of the pilot area. The soils vary in texture from somewhat sandy to loamy. Generally, the soils are deep, with an unsaturated area in excess of four feet above the seasonal high water table. Some of the minor soil groups that occur in the lower lying areas have a water table that is considerably closer to the surface. The Haven-Riverhead-Montauk association, which consists of deep, well drained, medium and moderately coarse textured soils is found on the undulating morainal areas, while the similar Haven-Riverhead association is found on the gently sloping to level outwash plains. The two associations account for approximately three-fifths of the soils within the SGPA. The Soils report indicates that there are few constraints to use due to soil characteristics except on the steeper slopes or in or near freshwater wetlands.

Natural Resources*

Seven stream systems, kettlehole ponds and natural woodlands constitute the major natural resources of the SGPA. See Figure 2-2.

The Island Swamp Brook System, which encompasses a drainage area of 757 acres, is located along the boundary between the City of Glen Cove and the Village of Lattingtown. The watershed, which consists primarily of estate lands and wet woods, provides a *clean* environment. The portion of the system located north of Old Tappen Road is relatively undisturbed and receives a number of spring tributaries. The first two ponds north of Old Tappen Road are slightly less than one acre in size, average three to five feet in depth, and outflow through approximately five acres of red maple, wet maple woods and swamp to a third pond south of Lattingtown Road. The brook outflows under Lattingtown Road and eventually empties into Dosoris Pond.

*Source: Nassau County Fresh Waters and Wetland Inventory - Vol. 1 - Town of Oyster Bay, conducted and written by Jeffrey J. Sama, Bureau of Water Pollution Control, Nassau County Health Department, April 1977.

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The Glen Cove Creek System, also called Cedar Swamp Creek, has a drainage area of 7,500 acres extending northward from the Village of Brookville into Old Brookville and Glenhead to the City of Glen Cove. The system originates at an old 3/4 acre estate pond at the DeSeversky Conference Center of the New York Institute of Technology. Although included in the watershed, the pond is not directly connected with Glen Cove Creek. The system also includes a 5.5 acre basin that was excavated in 1975 for stormwater runoff control.

North of Rte. 25A the creek is 1.2 miles long and is fed by several ponds. Some of the smaller ponds as well as much of the creek, are turbid. There is a 2.8 acre spring fed pond that joins the system just southwest of Valentines Lane. This pond, which has an average depth of five feet, and contains clear water, is the largest in the Glen Cove Creek System. On the northeast side of Valentines Lane, the creek enters 6.5 acres of wetlands known as the Lewis Crawford Clark Wildlife Refuge. Downstream the creek connects with more backyard ponds. The creek gradually loses its natural vegetative character and becomes a drainage creek as it reaches Glen Cove Road.

The Kentuck Creek system, located in Locust Valley and the Village of Mill Neck, drains a relatively flat area of approximately 2,200 acres. A mosquito ditched lowland and a natural spring tributary form the headwaters of Kentuck Creek. North of Oyster Bay Road the stream flows through a valley to feed a backyard pond and then continues into the 2.2 acre Kentuck Pond, which averages three to five feet in depth. The stream then meanders through a 6.4 acre wetland owned by the North Shore Wildlife Sanctuary, and discharges into Beaver Lake.

The Beaver Brook-Shu Swamp System, located in the villages of Matinecock and Mill Neck, is approximately 1.8 miles long. The Beaver Brook System is characterized by considerable open space and wetlands. The larger ponds and lakes are partially bordered by estate properties and smaller single family residences. The system contains some of the largest and most valuable fresh surface water resources in Nassau County.

The surface waters originate as spring seepage from the hillsides and are channelled along Wolver Hollow Road and eventually dissipate. The stream reappears farther north and discharges into an unnamed 3.7 acre pond, that flows into Upper Francis Pond. Upper Francis Pond is 7.5 acres in size, with a six foot average depth. In the center of the pond there is a small island covered with white pines. Beaver Brook and its tributaries flow from the pond to Lower Francis Pond. Lower Francis Pond is approximately 4.0 acres in size. From this pond, Beaver Brook flows through approximately forty acres of Red Maple-Tulip climax woods and then enters the thirty acre Shu Swamp Sanctuary. The brook culminates in a pond that flows under the L.I.R.R. tracks into Beaver Lake. Beaver Lake is the second largest lake in Nassau County. It is approximately 63 acres in size with an average depth of three feet. The lake receives the waters from two major drainage systems: Kentuck Creek and Beaver Brook.

The Spring Lake system in Mill Neck occupies a narrow valley between very steep sloping hillsides. The drainage area which encompasses approximately 418 acres, almost entirely in open space, may be characterized as a *clean* drainage area. The source of the stream is located fifty feet north of the Long Island Railroad tracks. From there the stream flows into the shallow one acre Spring Lake. The water in the lake is clear. The lake connects through tributaries to two eutrophic lakes that feed a three-quarter acre shallow pond. The pond flows under the road and discharges into a small salt marsh adjacent to Oyster Bay Harbor.

The Mill River system extends from Muttontown to Oyster Bay and encompasses approximately 1,880 acres of drainage area and is characterized by intermittent flow in various sections. The watershed consists of a valley surrounded by morainal hillsides. The stream was diverted from its original flow, which has resulted in two distinct sections: that section south of 25A and the section that feeds Mill Pond north of the pilot area. The land use surrounding the system is mainly low density residential and open space areas, including County and federal preserves.

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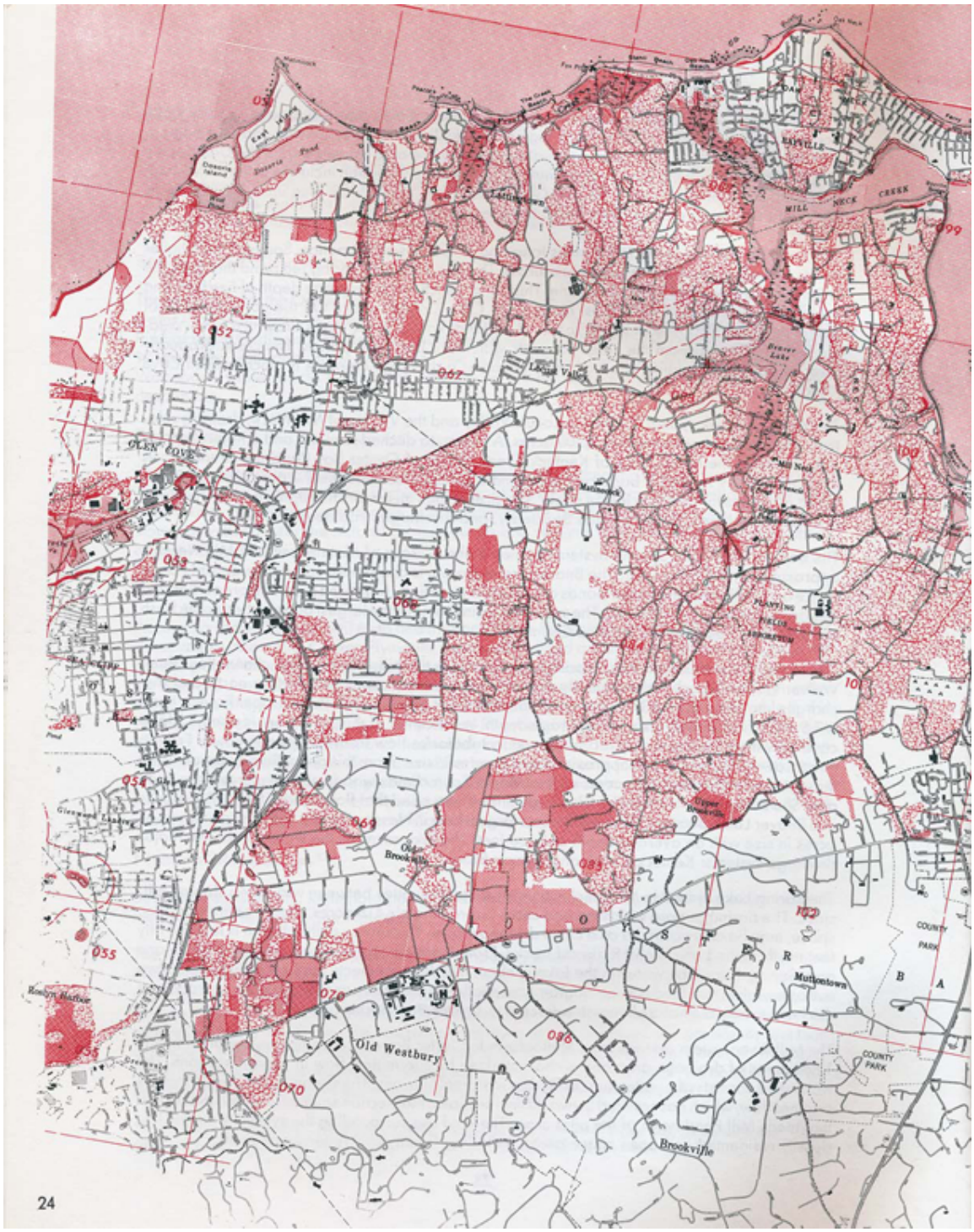
Old Westbury
Brookville
Muttontown
COUNTY PARK
COUNTY PARK
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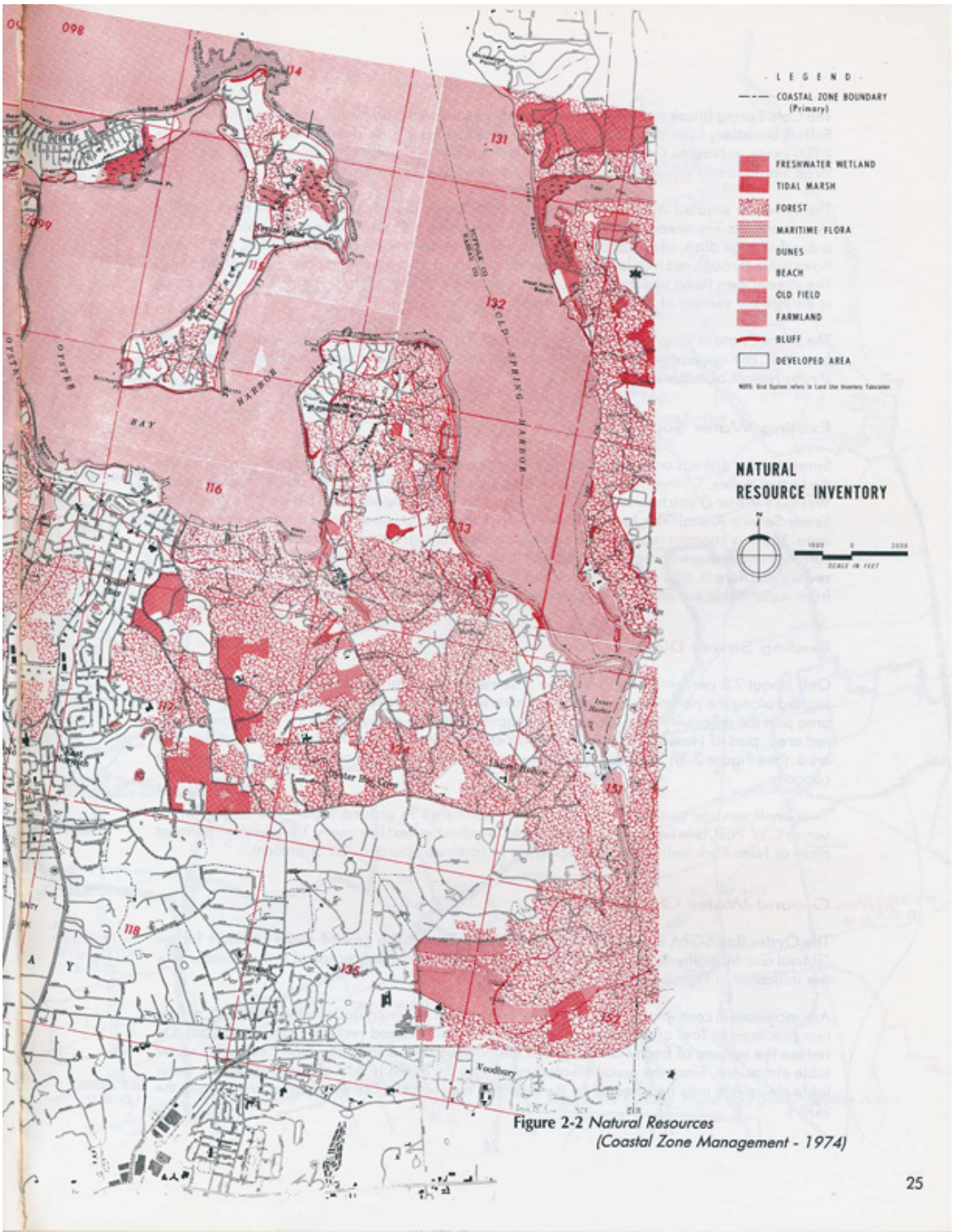

Figure 2-2 *Natural Resources (Coastal Zone Management - 1974)*

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The Cold Spring Brook system is approximately one mile long and is located along the Nassau-Suffolk boundary from Woodbury to the Village of Laurel Hollow. The drainage area comprises 2,800 acres in Nassau County alone. It is relatively undeveloped, containing estates and scattered single family residences, and can be considered a *clean* drainage area.

The system is situated within a very steep, narrow valley that receives drainage from the hilly morainal area. The stream has two source tributaries: one at Picardy Lane and the other, actually a dry drainage ditch, along Route 108. The tributaries meet north of Stillwell Lane. The stream flows north through red maple-wet woods and through a 6 acre wetland area, originally a pond. The stream then flows into the 8 acre, 6-12 foot deep Franklin's Pond. The outflow of the pond spills into the section of brook also known as Hatchery Creek.

The Bruce Estate in Woodbury is the site of an 1.5 acre kettlehole pond with an average depth of four feet. The approximately 38 acre drainage area comprises lawns, ornamental trees and shrubs typical of estates.

Existing Water Supply Districts

Several water districts and one private purveyor serve most of the Oyster Bay pilot area. They are the Locust Valley, Oyster Bay, Glen Cove City, Jericho, Village of Old Westbury, Plainview and Westbury Water Districts, and the Sea Cliff Water Service Company. (See Figure 2-3 - Water and Sewer Service Areas). The Jericho Water District, the largest, serves the central half of the pilot area. There is concern regarding the potential need for significantly increased pumpage if the currently undeveloped properties within the District are allowed to develop at densities requiring sewering. There is also concern regarding the proposal to pump significant amounts of water from wells within the SGPA to areas outside the SGPA's recharge area.

Existing Sewer Districts

Only about 7.3 percent of the pilot area is sewered. There are eight separate sewered areas located along the perimeter of the SGPA. Three sewer districts serve a small portion of the pilot area plus the adjacent, more intensive development outside of the boundary. The largest sewered area, part of Nassau County Sewer District No. 3, is in the southeastern sector of the pilot area. (See Figure 2-3). The existing sewage treatment plants and overall systems are at or near capacity.

Two small sewage treatment plants currently discharge to ground water. The larger, which serves C.W. Post, is to be hooked up to S.D. No. 3 within the next few years. The sewage treatment plant at New York Institute of Technology is to continue operation as at present.

Ground-Water Characteristics

The Oyster Bay SGPA is located in Hydrogeologic Zone I. The ground-water contours for the Glacial and Magothy aquifers, the ground-water divide and the direction of ground-water flow are indicated in Figure 2-4.

Any increases in consumptive use -- whether the result of sewering and marine discharge, irrigation practices or loss of industrial process water -- that exceed recharge can be expected to reduce the volume of freshwater stored in the aquifers and cause long term declines in water table elevations. Since the ground water underlying the SGPA is part of a larger system, water table elevations may be affected by the extent of consumptive use both within and outside the SGPA.

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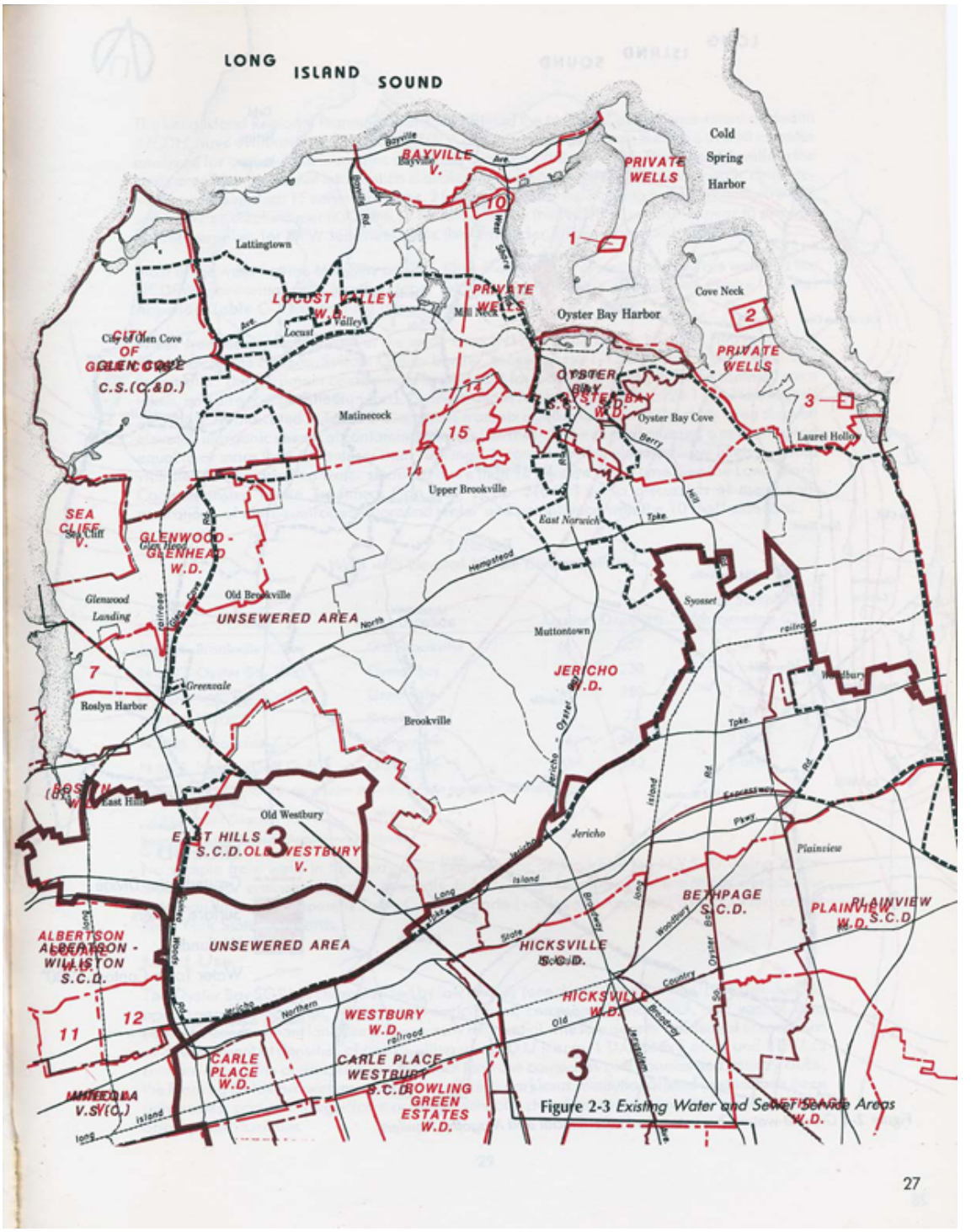

Figure 2-3 *Existing Water and Sewer Service Areas*

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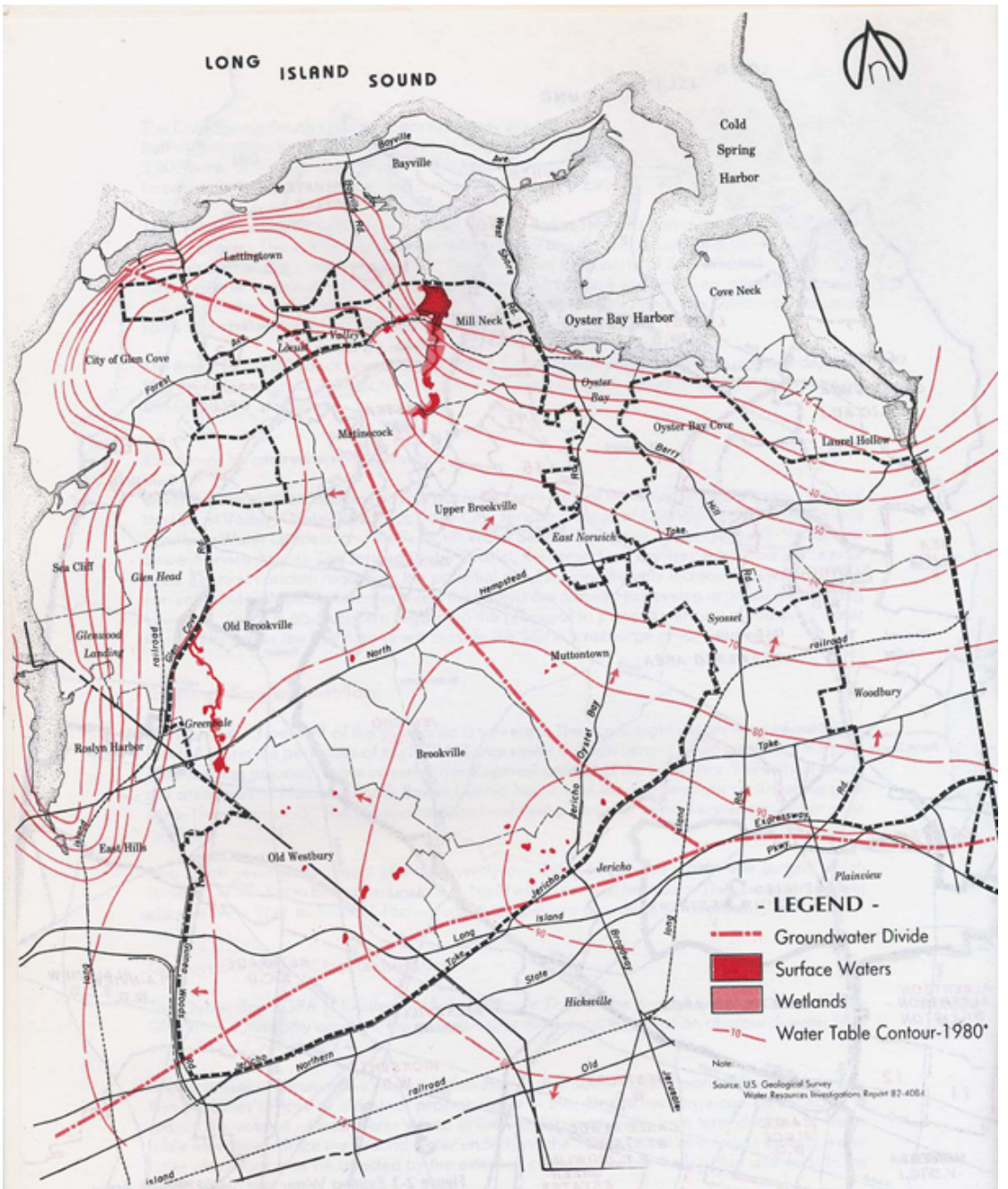

Figure 2-4 *Ground-water Characteristics in the Glacial and Magothy Aquifers*

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The Long Island Regional Planning Board (LIRPB) and the Nassau County Department of Health (NCDH) have evaluated the Oyster Bay SGPA ground-water quality on the basis of well samples analyzed for organic and inorganic chemicals between 1980 and 1984. There are 64 wells in the study area for which some information is available. Twenty-two of these provide public or institutional water supplies, 15 serve golf clubs, 2 furnish water for the Planting Fields Arboretum and 7 serve private establishments. Of the 17 wells owned by the NCDPW, several appear to provide potable supplies for DPW facilities, while the remainder function as monitoring wells.

Most of the wells tap the Magothy aquifer. Only five golf course wells, one private well and the NCDPW monitoring wells tap the Upper Glacial or water table aquifer. See Figure 2-5 and Appendix Table C-1 for detailed information relating to SGPA wells.

Water from one Magothy well in the study area (N1246) used by the NCDPW and located in Plainview on the Nassau/Suffolk County border, exceeded the NYS Drinking Water Standards for nitrates. The maximum contaminant level (MCL) for nitrates is 10 mg/l. Three samples were taken, and all exceeded the standard. Concentrations ranged from a low of 24.1 mg/l to a high of 29.5 mg/l. As indicated in Table 2-2, samples from six additional wells in the study area showed elevated inorganic chemical contaminant levels (nitrates). In the case of nitrates, a concentration equal to or more than 6.0 but less than 10.0 mg/l is considered an elevated level likely to cause violations of the drinking water standard more than 10 percent of the time. See the Long Island Comprehensive Waste Treatment Plan, Vol. 2, pp. 210-211 for a discussion of mean concentrations of nitrate-nitrogen in ground water and compliance with the 10 mg/l standard.

Table 2-2
Wells with Elevated Nitrate Concentrations

Well	Owner	Location	Aquifer	Depth(Ft)	# of Samples With Elevated C.L.*
N 6444	Brookville C.C.	Old Brookville	M	257	1 of 2
N 8183	Oyster Bay W.D.	Oyster Bay	M	230	5 of 8
N 8432	C.W. Post College	Greenvale	M	250	1 of 2
N 9117	NCDPW	Brookville	UG	73	1 of 1
N 9806	Woodcrest C.C.	Muttontown	M	NA	2 of 2
N 5071	Nassau Golf Club	Glen Cove	M	242	1 of 5

*C.L.- Concentration Levels greater than 6 mg/ but less than 10 mg/l).
M - Magothy
UG - Upper Glacial

Source: Nassau County Department of Health

No sample from wells in the study area exceeded or approached the N.Y.S. Drinking Water Standards for synthetic organic chemicals. In fact, in most samples concentrations were below detection limits. See Appendix Table C-1 for reported values and Appendix Table C-4 for current New York State Standards.

Land Use

The Oyster Bay SGPA is characterized by low density (one dwelling unit or less/acre) residential, open space-recreational, institutional, agricultural, commercial, industrial, and vacant land uses. The predominant land use is low density residential. The low density residential uses consist of development at densities of one dwelling unit (1 D.U.)/acre, 1 D.U./2 to 5 acres and 1 D.U./5 or more acres. The open space-recreational land use comprises golf courses and country clubs, the Planting Fields Arboretum, and Nassau County parkland. Institutional land uses include three universities, occupying significant acreage, schools, churches, cemeteries; and other public or quasi-public facilities.

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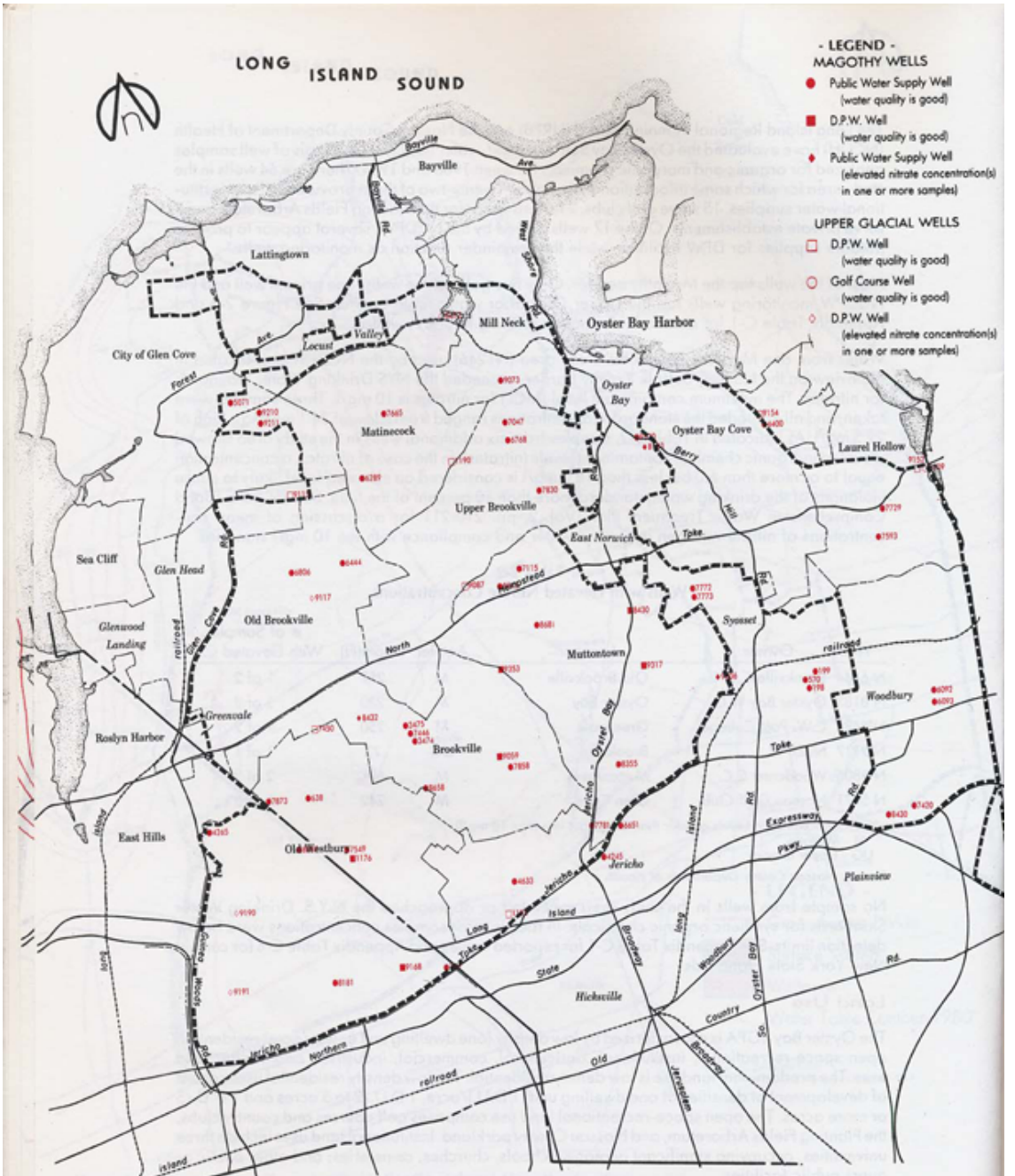

Figure 2-5 *SGPA Water Sampling Sites Used for Water Quality Sampling*

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Although many parcels have been cleared for farms, estates and subdivisions, a large part of the SGPA is still wooded. Today, only a few farms or nurseries remain, and many of the larger estates have been or are about to be subdivided. Most of the recent developments within the villages have involved the subdivision of vacant land or large estates for low density residential use, and the conversion of agricultural lands for residential development. Several condominiums and office buildings have been constructed at the southern boundary of the SGPA in the Jericho area.

The existence of numerous large parcels and a strong demand for luxury housing suggests the likelihood of further residential development.

A number of former estates are now public parks, nature preserves or various types of institutions. The 409 acre Planting Fields Arboretum and Conference Center; four large Nassau County holdings: the Christie Estate North (273 acres) and the Christie Estate South (172 acres) which constitute the Muttontown Preserve, Stillwell Woods (292 acres) and Manetto Hills (Washington Ave. Park) (142 acres); and the Town owned Bruce Estate (92 acres) -- all contribute to the aesthetic qualities of the landscape and the potential for relatively uncontaminated recharge of the groundwater resource.

Public and quasi-public conservation areas such as the 445 acre Muttontown Preserve, the 95 acre Shu Swamp-Beaver Brook Preserve and the scattered holdings of the Nature Conservancy and the North Shore Bird and Game Sanctuary add to the opportunities for high quality replenishment of the aquifers, as do those portions of the institutional properties that remain open or relatively undeveloped.

Major educational institutions such as the State University of New York at Old Westbury, C.W. Post College, the New York Institute of Technology, the New York Chiropractic College, the Mill Neck School for the Deaf, Miss Stoddart's School, the Friends Academy and the Greenvale School, as well as several public schools, occupy large parcels, a good portion of which remain in open space.

The thirteen private country clubs, which together occupy 2,251 acres or 7.8 percent of the entire SGPA, provide extensive recharge areas, although the quality of the recharge is likely to be somewhat impaired in the immediate vicinity of heavily fertilized greens and fairways.

Gradual increases in density can be expected to occur throughout much of the area as already platted parcels are occupied; as portions of existing estates and institutional properties are subdivided and developed in accordance with existing zoning; and as farms, nurseries, institutions and country clubs are converted to residential, or occasionally, commercial use.

To the extent that it is possible to retain existing open uses -- the private estates, golf clubs, farms and institutions -- it is possible to cap the expected growth at less than saturation. Similarily, to the extent that local land use regulations, especially subdivision ordinances and site plan review requirements, provide the incentives and the flexibility needed to insure environmentally sensitive development plans, the ground-water impacts of the additional growth can be minimized.

Zoning

Fortunately, the existing zoning of vacant land or of parcels currently developed at exceedingly low densities (one D.U./more than five acres) is generally compatible with the protection of ground-water quality and quantity. In most instances, the areas zoned for development at 1 or more D.U.s/acre are either located in sewered areas or are limited in extent and already fully developed.

Almost all of the Oyster Bay SGPA is zoned for single family residential development, except for small commercially zoned areas along Jericho Turnpike, the southern boundary of the study area, and several small, medium to high density residential areas with lot sizes ranging from 10,000 square feet to one acre.

P.31x

Lot size regulations alone cannot guarantee acceptably low ground-water nitrate-nitrogen concentrations. Limitations on the use of fertilizer through clearance allowances or maximum permissible turfed area regulation may well have to become a part of any truly effective ground-water protection measure. As for organic contamination, there is no direct relationship to lot size. Although larger lot sizes may reduce the level of activity and therefore the probability of contamination, it is the type of land use activity that is the primary factor.

Population

According to the Census, a total of 23,633 persons resided in the SGPA in 1980. Some 20,342 lived in 6,246 households; 3,291, in group quarters. By 1985 the estimated number of residents had increased by 7.1% and the number of households by 16.2%. Household size declined from 3.25 to 2.99 persons per dwelling unit. See Appendix Table E-1 for population change by jurisdiction within or partially within the SGPA. Gross density increased from 0.80 persons per acre or 515 persons per square mile in 1980 to 0.86 persons per acre or 551 persons per square mile in 1985.

GROUND-WATER MANAGEMENT PROBLEMS AND CONCERNS

Ground-water quality is generally excellent; however, existing institutional and commercial uses in unsewered areas may pose a site specific or areally limited threat to ground-water quality. Since there appears to be little ground-water monitoring downgradient of on-site disposal systems this judgment is necessarily based upon generally accepted contaminant load factors for residential development or density equivalency factors for commercial establishments rather than ground-water analyses.

Fertilizer use by golf courses, farms and nurseries may also be contributing locally significant amounts of nitrates to ground water. Elevated nitrate concentrations measured in wells located at the two golf courses for which data is available (see Table 2-2) and the documented relationship between agricultural activities and ground-water contamination (Long Island Waste Treatment Management Plan, Vol. 1 p. 71) suggest that this is the case. Intensification of development, through subdivision and conversion of portions or all of these sites, may further exacerbate water quality problems.

There is also a potential for environmental damage associated with any large scale pumping and export of water from the SGPA. The work undertaken as part of the *Flow Augmentation Needs Studies* (1980-1982), which dealt with the effects of sewering and marine discharge of effluent on stream flow to the south shore bays, and the recent United States Geological Survey Regional Model simulation of of proposed Nassau County ground-water development to supplement future supplies -- both suggest that significant increases in withdrawals for consumptive use pose a threat to the environment. As consumptive use of ground water reduces water table elevations, further losses of streamflow can be expected to impair the environmental integrity of the SGPA ponds and stream corridors, especially the greenbelt and protected natural area along the county line from Woodbury to Cold Spring Harbor.

OPPORTUNITIES

There are numerous opportunities for the State, the County, the localities, and private citizens to protect the ground water and to preserve the ecology and the visual quality of a unique part of the bi-county area.

In general, strict adherence to and proper administration of existing State, County and local laws and regulations, including municipal zoning ordinances, can be expected to go a long way toward maintaining the high quality ground-water recharge that the SGPA now provides. However, increased attention to land uses and activities will be required to provide the desired level of ground-water protection.

P.32x

If it can be assumed that acreage in parks, preserves, cemeteries and state owned parkway rights of way are permanently protected, then more than 1,900 acres or close to 7% of the pilot area can be expected to remain as open space. If other parcels now temporarily protected from development because of their current use as golf courses institutions, farms, nurseries, and private estates remain in these uses, then an additional 9,950 acres will bring the total open area to 11,850 acres or approximately 41% of the SGPA. While it is unlikely that all of the golf courses or most of the institutions, farms, nurseries and estates can be retained in their present use, a considerable portion of the open area can be placed under permanent protection and the remainder developed in an environmentally acceptable manner. See Figure 2-6 for the developmental status of lands within the SGPA.

Past efforts to preserve the environment and to provide educational and recreational opportunities have helped to protect the ground water. However, immediate action is needed to protect two important pieces of the existing greenbelt in the Old Brookville-Jericho area: the remaining portion of the Meadowbrook Club and the Underhill properties.

Despite the generally open character of the area, not all of the ponds and freshwater wetlands are adequately protected from the impacts of encroaching development. Public or quasi-public acquisition of such parcels through donation or purchase of the fee or development rights is just one of the ecological and ground-water protection options available to the municipalities.

The donation or purchase of development rights, together with a reduction in assessed valuation; negotiated purchase and lease-back; or even municipal ownership and operation may prove useful in preserving some of the golf courses.

Increased attention to site design with particular emphasis on the retention of natural features, the limited modification of lot sizes in return for the dedication of significant ecological or ground-water protection areas and the limitation of turfed areas, accompanied by a careful and comprehensive site plan review procedure is a key option for enhancing the environmental acceptability of whatever development does occur.

RECOMMENDATIONS FOR THE OYSTER BAY PILOT AREA

Introduction

In the pilot areas, as well as in the other deep aquifer recharge areas, the protection of ground water requires the active participation of state, county and local government as well as the cooperation of residents and commercial establishments. For the most part, the required legal authority and institutional arrangements are already in place, although not always fully utilized. See the 208 Nonpoint Source Handbook for a detailed discussion of the existing institutional authority. At the village level, some assistance in the selection and implementation of management techniques may be required. The proposed ground-water protection programs rely primarily on the coordinated, focused application of a variety of existing regulatory and non-regulatory approaches.

Recommended measures range from extremely general proposals calling for greater educational efforts to increase awareness of the importance of, and techniques for, the protection of ground water and for the preservation of open space, which are applicable throughout the bi-county area, to site specific proposals calling for the acquisition of the fee or an easement, or suggesting a design concept for the development of a single property or group of properties. All of the measures are expected to achieve or contribute to the achievement of one or both of the SGPA objectives: the prevention or, where that is not feasible, the minimization of additional contaminant loadings and the maximization of recharge.

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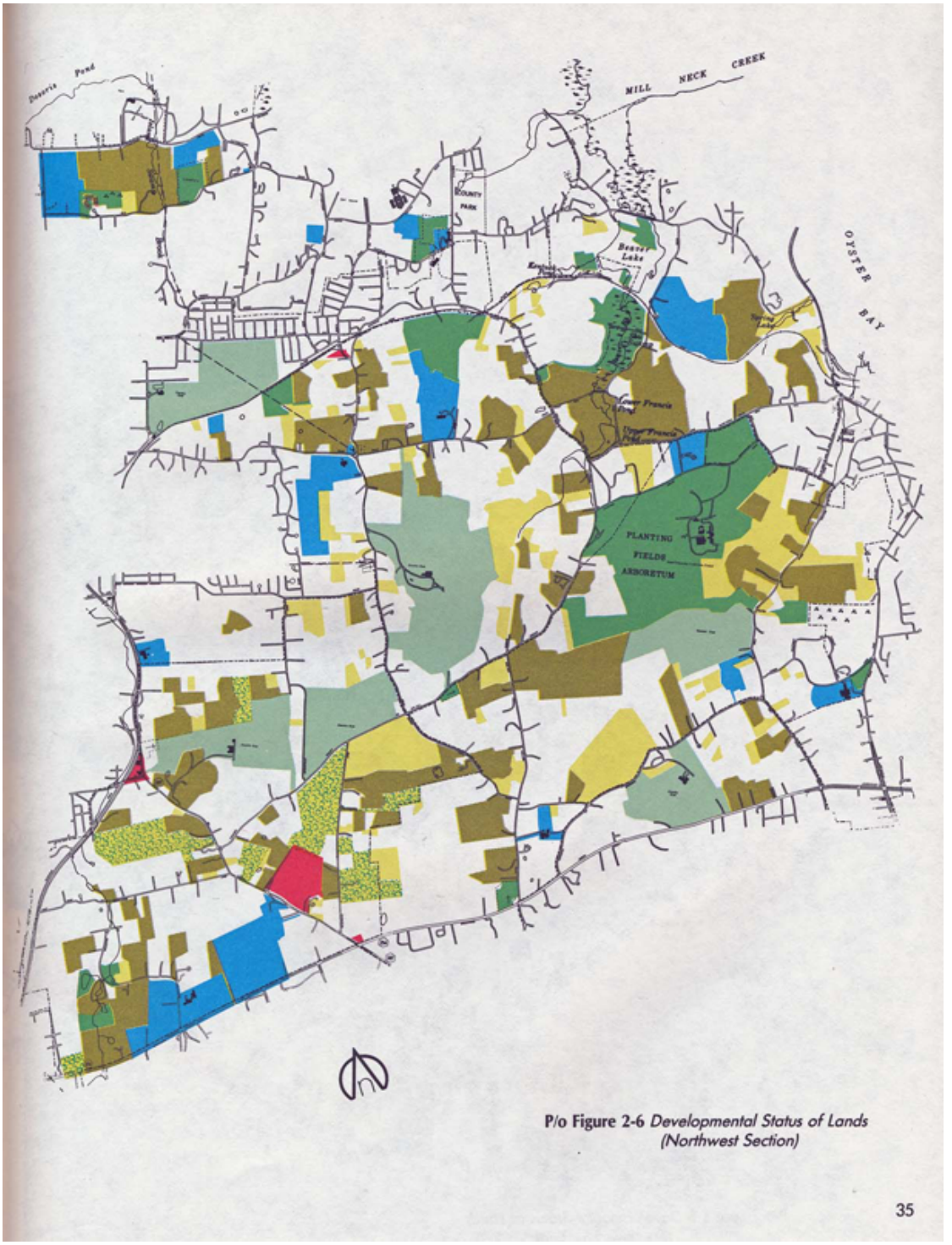
Figure 2-6
DEVELOPMENTAL STATUS OF LANDS

P.34x



P/o Figure 2-6 *Developmental Status of Lands (Northwest Section)*

35

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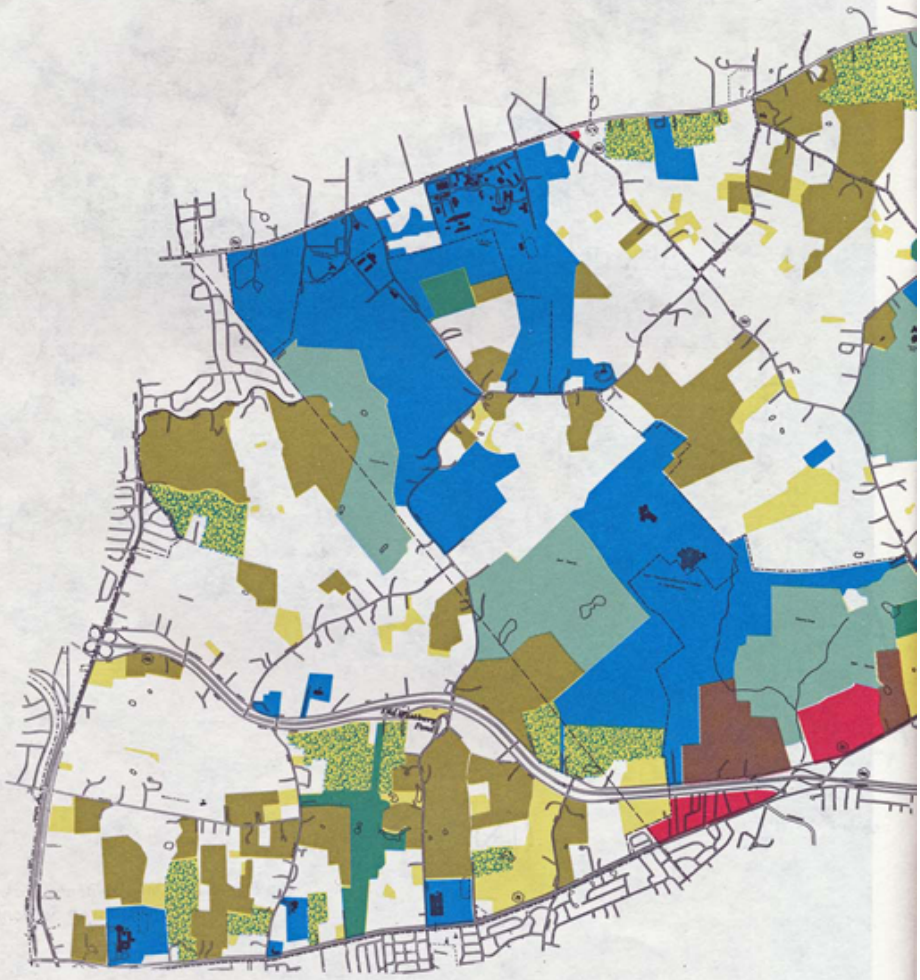

P/o Figure 2-6 *Developmental Status of Lands (Southwest Section)*

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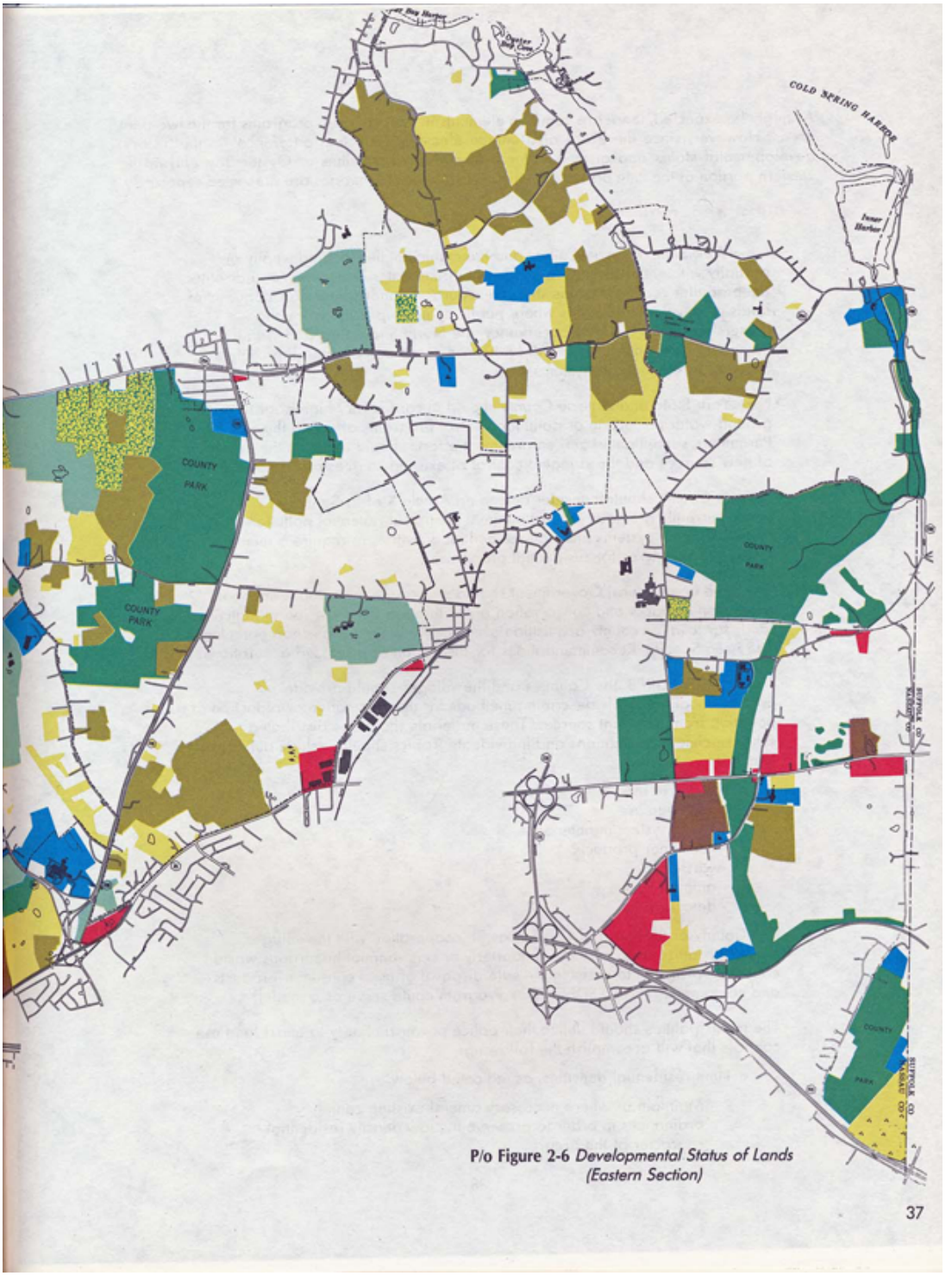

P/o Figure 2-6 *Developmental Status of Lands (Eastern Section)*

37

P.37x

As might be expected, there are common elements in the proposed programs for the two pilot areas. However, since there are also unique elements reflecting differences in the history, developmental status and ground-water protection opportunities in Oyster Bay and in the western portion of the Pine Barrens, the two *management packages* are presented separately.

General Recommendations

- New York State, Nassau County and the municipalities located wholly or partially within, the Oyster Bay Special Groundwater Protection Area or other deep aquifer recharge areas should encourage donations and/or bequests of lands or development rights where public ownership or quasi-public ownership by the Nature Conservancy, the North Shore Bird and Game Sanctuary or a similar entity will further the protection of natural recharge areas or threatened ecosystems.

- New York State and Nassau County should accord a very high priority to ground-water protection or pollution control programs affecting the SGPA. Permitting, surveillance, and enforcement efforts should focus on the exclusion of new sources and the stringent control of existing sources of contamination.

- Nassau County should consider amending Article X of its Sanitary Code, which currently provides at least minimal control of potential pollution from on-site sanitary systems and non-residential activities, to require a minimum lot size of two acres for residential properties.

- The State and Federal Government should encourage the establishment or expansion of parks and conservation areas through the provision of matching funds for town or county acquisition of major watershed protection parcels. See Area Specific Recommendations for discussion of proposed acquisitions.

- The State, the LIRPB, the Counties and the villages should provide informational materials describing methods for the elimination or reduction of pollution from nonpoint sources. These materials should be distributed to schools, civic organizations and individuals. Topics should include but not be limited to

  - fertilizer use
  - pesticide use
  - septic system maintenance
  - consumer products
  - waste oil
  - animal wastes
  - deicing salts

- The County or the Town of Oyster Bay, in cooperation with the villages, should organize and carry out a quarterly or semi-annual hazardous waste collection program to assist in the safe disposal of used consumer products and containers. (The NYSDEC **STOP Program** could serve as a model).

- The municipalities should utilize their police power authority to enact land use controls that will accomplish the following:

  - Limit residential densities, as indicated below.

    - Maintain or where necessary amend existing zoning ordinances in order to preserve the low density residential character of the area.

P.38x

- The local zoning ordinance should establish a minimum lot size of two or more acres for single family residences except in those limited areas where higher density development has already occurred.

  The Nassau County Department of Health Sanitary Code Article X requires a lot size of one acre per residence for on-site systems in unsewered areas. This offers a level of ground-water protection, which, although acceptable in the already more intensively developed areas where infill is occurring, cannot be considered adequate for the protection of the extensive recharge areas and relatively high quality ground water underlying much of northern Oyster Bay.

- Restrict multi-family or condominium development to those sites where a sewage collection and treatment system with excess capacity is available and where the sewage treatment system is capable of meeting treatment requirements. The extension of sewering to permit more intensive development is not recommended.
- Prohibit new industrial uses and non-essential commercial uses in order to minimize future contamination.
- Amend zoning ordinances as necessary to place institutional uses and country clubs in the lowest density residential category in each jurisdiction. Should the lowest category call for less than 2 acres/D.U., zone institutions and clubs for 2 acres/D.U.

- The muncipalities should acquire or otherwise protect future well sites where appropriate. Early consultation with the water purveyors can facilitate the reservation and protection of wells sites close to the ground-water divide or in other locations where there is little likelihood of contamination from upgradient sources.

- Discourage the conversion of partially or totally cleared sites; such as, golf courses, farms and nurseries, to more intensive uses that could increase nitrate and other contaminant loadings to ground water. Seek the donations of development rights to golf courses and other country club holdings in return for a reduction in property taxes. In the case of the IBM Club in Sands Point, the Club donated the development rights to Nassau County and the land and facilities were then reassessed to reflect actual value based upon current use rather than potential value for development. Wherever conversions are unavoidable, minimize ground-water quality impacts by limiting the number of dwelling units through large lot zoning and the extent of turfed area through the imposition of clearance regulations. Where past or current nitrate loadings have resulted in ground-water concentrations well below the 208 guideline of 6 mg/l, anticipated nitrate loadings should not be permitted to exceed pre-conversion levels. Where existing concentrations are greater than 6 mg/l, nitrate loadings should be reduced below pre-conversion levels and preferably below 6 mg/l. Minimize ground-water quantity impacts by retaining all stormwater runoff on the site. See the Nonpoint Source Handbook for stormwater runoff control and fertilizer use practices.

- Preclude or minimize additional contaminant loads attributable to the intensification of use or the conversion of part or all of any institutional property. Discourage the piece-meal sale of small parcels or individual building lots carved out of institutional properties through appropriate zoning and stringent subdivision controls. Where the institution that is selling off part of its land has an approved sewage collection and treatment system, require the seller to provide for the hook up of any new development located on the original site.

P.39x

- Limit nitrate loads associated with fertilizer use by amending zoning ordinances to limit the clearance of woodlands or other undisturbed natural areas. Relate permissible clearance to lot size and existing conditions. See Table 2-3 for suggested clearance standards.

- Amend subdivision regulations where necessary to extend coverage to all subdivisions; i.e., any division of land into two or more parcels.

- Enact a stormwater runoff and erosion control ordinance. See the Nonpoint Source Management Handbook for a model ordinance.

- Provide for detailed site plan review in accordance with the recommendations contained in the Handbook.

- Investigate the need, if any, for the imposition of animal waste disposal requirements for kennels, riding stables, or small concentrations of animals on residential properties.

- Investigate the need for the establishment of a septic system maintenance district to prevent groundwater contamination from the improper use of chemical additives. Such a district would provide for the routine pumping of on-site systems and the proper disposal of scavenger wastes.

Table 2-3
Proposed Site Clearance Standards for Residentially Zoned Lots*

		Site Clearance for Single Family Development Should Not Exceed	
Lot Size(Sq.Ft.)	Acreage	Square Footage	% of Site
20,000	1/2	10,200	51
26,400	2/3	12,300	41
30,000	3/4	13,250	46
40,000	1	14,200	36
60,000	1 1/2	17,000	28
80,000	2	19,800	25
120,000	3	23,000	19
160,000	4	26,400	17
200,000	5	29,700	15
>200,000	5	varies	15

*Adapted from the Site Clearance Recommendations for Residentially Zoned Lots, prepared for the Pine Barrens Commission, March 18, 1985.

Properties that are less than one acre and are proposed for residential development will require sewering.

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The Counties, in cooperation with the water purveyors, should provide homeowners and golf course owners and managers with information regarding the importance of water conservation and should urge the use of water saving devices and the adoption of conservation practices. Initially, conservation education programs should be addressed to residents of those areas where a sewage collection and treatment system with effluent discharge to marine waters and to owners or managers of clubs, institutions and farms where extremely heavy use water for irrigation or turf maintenance reduces the amount of *used* water returned to the aquifer. See Appendix A for suggested conservation measures.

Area Specific Recommendations

The following should not be regarded as all inclusive, since local officials and other SGPA residents may be aware of additional situations in which one or more of the recommendations presented below would also be appropriate. Inasmuch as the small portion of the Village of East Hills, the even smaller portion of the Village of Roslyn Harbor and the sections of Glen Head and Syosset included within the SGPA are already developed, no specific recommendations are offered for these areas.

City of Glen Cove

- Preserve the open space character and recharge potential of the estate area that constitutes the Glen Cove portion of the SGPA. Encourage the re-use of existing mansions and other estate structures for condominiums or the clustering of new units in accordance with current R-L (one acre) zoning.

- Seek the permanent preservation of the Island Swamp Corridor (see Figure 2-7). Encourage landowner donations of the fee or development rights to the ponds, wetlands and adjacent areas to the municipality or to a recognized conservation organization. Purchase the fee or development rights, if necessary.

- Require water conservation measures to mitigate ground-water losses due to sewering.

The Town of Oyster Bay

East Norwich (uninc.)

- Acquire the fee or development rights to the 114 acre Pine Hollow Country Club property, the largest remaining open space and recreational facility within the unincorporated area north of Route 25A, if or when the club is offered for sale. In the interim, the Town might investigate the feasibility of various alternatives; such as, immediate purchase of the fee and lease back to the seller for a period of years, procurement of an option to purchase at a specific figure or at a price established in accordance with a prearranged formula or, whenever there is an end to the current use, purchase or condemnation and operation as a self-supporting public facility. Alternatively, the Town and the Club could negotiate for the phased donation of development rights in return for a comparable reduction in assessed valuation.

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Figure 2-7 *Potential Acquisitions - Island Swamp Corridor*

P.42x

Jericho (uninc.)

- Maintain the ground-water recharge potential in this newly sewered area by
  - opposing any future sale or lease of portions of the State University property that would result in an intensification of use
  - prohibiting the northward extension of the existing high density condominium and commercial uses along Jericho Turnpike and the service road of the Expressway
  - ensuring the continuation of the open space use at the Meadowbrook Club and the Underhill property
- The State University should set aside a minimum of between 275 and 300 acres of its 580 acre campus as a preserve. See Figure 2-8.
- The Town should acquire the Underhill property using local funds supplemented insofar as possible by New York State Bond Act monies or Federal and State Sole Source Aquifer funds. Town action to acquire and preserve the entire Underhill property would protect the eastern portion of the existing greenbelt and aquifer recharge area and would partially offset the impacts of recent office and condominium development in the vicinity. The Town should also acquire the development rights to the 267 acre parcel presently occupied by the Meadowbrook Club. The Town should seek the donation of the development rights; however, if that does not prove feasible, it should be prepared to purchase the rights prior to the expiration of the current lease. Town ownership of these rights would preclude the expansion of intensive uses into the proposed greenbelt area (see Figure 2-9) and assure the continued existence of an important segment of the ground-water recharge area.

Locust Valley (uninc.)

- Protect Kentuck Pond and its headwaters. Seek donations of the fee or development rights or purchase the vacant parcels or portions of the parcels to either side of the stream and ponds north of Kentuck Lane. In the case of vacant parcels, ownership and management of these conservation areas should be entrusted to the Nature Conservancy, North Shore Bird and Game Sanctuary or similar entity. (See Figure 2-10).

Plainview (uninc.)

- Cooperate with Nassau County in the development of the Town owned, large excavated area directly west of Round Swamp Road. Nassau has identified the adjacent Manetto Hills County Park as an important water supply development or well field site and as a possible location for the construction of affordable housing. The Park is currently serving as both a recreation facility and recharge area. Preservation of the existing park and the siting of housing on a portion of the excavated area would permit the reservation of protected well fields, the siting of much needed housing and the maximization of the recreational and recharge areas.

Woodbury (uninc.)

- Oppose any sale of the northern portion of the Bethpage State Parkway right of way. This is a prime recharge area and an essential component of the 271 acre north-south greenbelt extending from Cold Spring Harbor, through the ponds and woodlands along the Nassau-Suffolk border, to Stillwell Woods and finally to Plainview. See Figure 2-11.

P.43x

Figure 2-8 *Potential Acqusitions - Jericho*

P.44x

Figure 2-9 *Proposed Greenbelt from Old Brookville, Old Westbury, Brookville and Jericho to Cedar Swamp Road*

P.45x

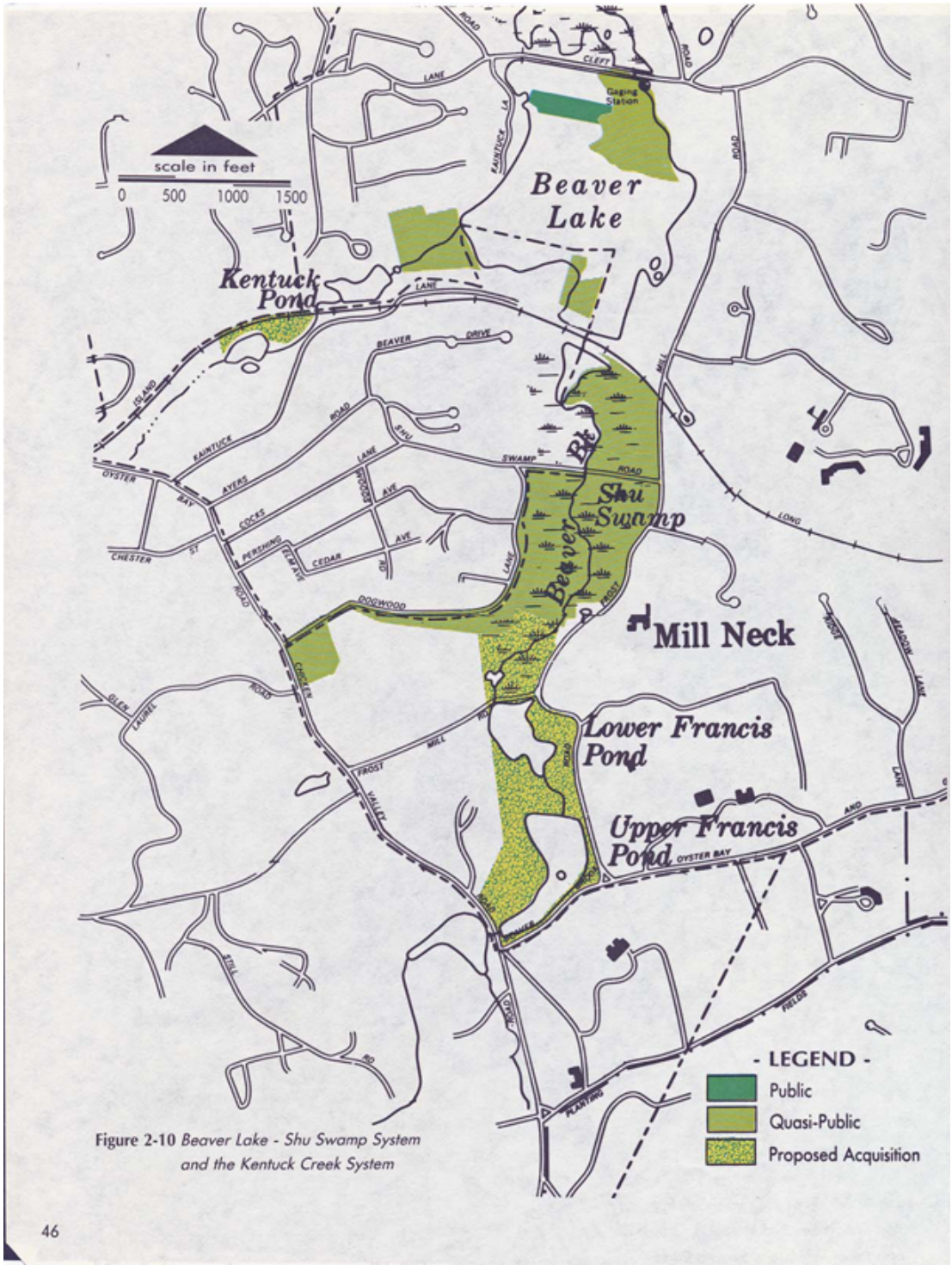

Figure 2-10 *Beaver Lake - Shu Swamp System and the Kentuck Creek System*

P.46x

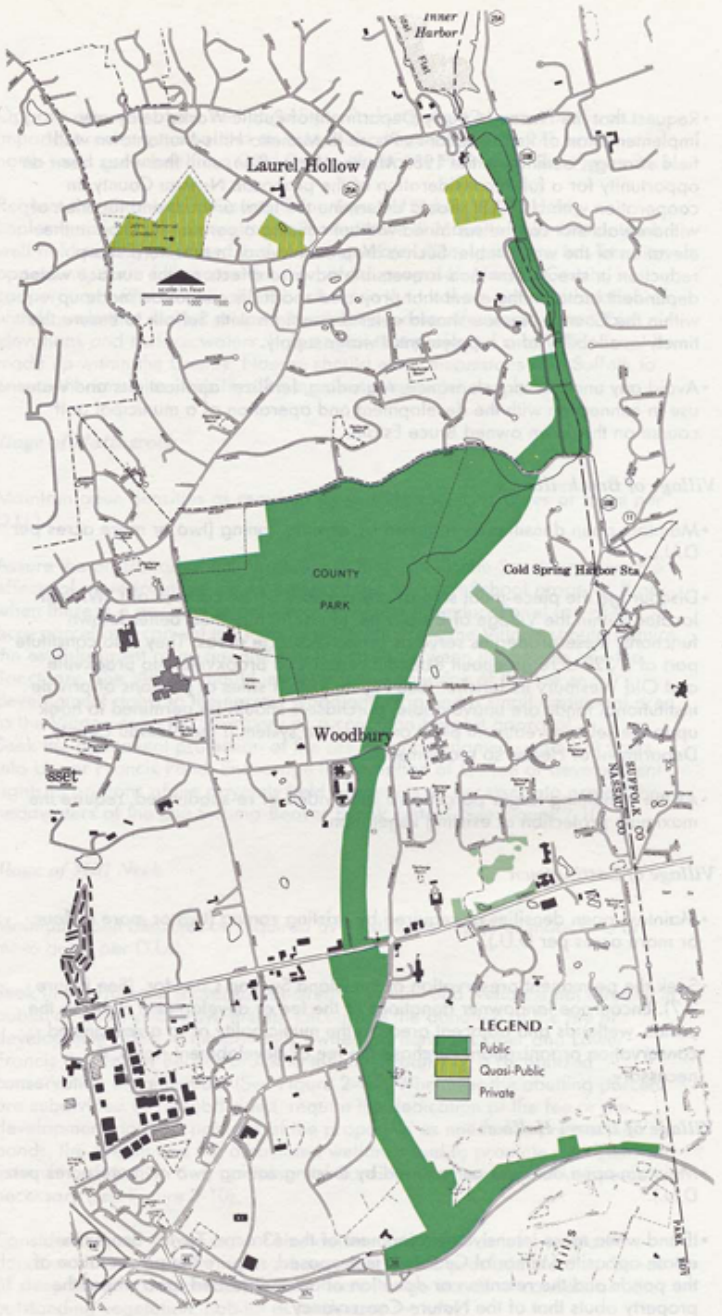

Figure 2-11 *Proposed Greenbelt in Woodbury and Laurel Hollow*

P.47x

- Request that the Nassau County Department of Public Works delay any implementation of its Consultant's Phase III Manetto Hills-Muttontown well field strategy, outlined in the 1980 *Master Water Plan*, until there has been an opportunity for a full reconsideration of the proposal. Nassau County, in cooperation with U.S.G.S. should determine the total amount and location of withdrawals that can be sustained without causing a permanent drop in the elevation of the water table. Such a drop could lead, in turn, to a sharp reduction in stream flow and irreversible adverse effects on the surface water dependent biota. In the event that projected shortfalls cannot be made up within the County, Nassau should enter discussions with Suffolk to ensure the timely availability of a supplemental water supply.

- Avoid any unnecessary clearance, regrading, fertilizer applications and water use in connection with the development and operation of a municipal golf course on the Town owned Bruce Estate.

Village of Brookville

- Maintain open densities as required by existing zoning (two or more acres per D.U.).

- Discourage the piece-meal sale of any portions of the campus of C.W. Post located within the Village of Brookville. In addition to their better known functions, these properties serve as prime recharge areas. They also constitute part of a 329 acre greenbelt extending from Old Brookville into Brookville and Old Westbury to Jericho. (See Figure 2-9). If sales of portions of private institutional lands are unavoidable, purchasers should be permitted to hook up to the seller's treatment plant or collection system if the Nassau County Department of Health so recommends.

- As the remaining larger parcels are subdivided or re-subdivided, require the maximum protection of existing vegetation.

Village of Lattingtown

- Maintain open densities as required by existing zoning (two or more or four or more acres per D.U.).

- Seek the permanent preservation of the Island Swamp Corridor. (See Figure 2-7). Encourage landowner donations of the fee or development rights to the ponds, wetlands and adjacent areas to the municipality or to a recognized conservation organization. Purchase the fee or development rights, if necessary.

Village of Laurel Hollow

- Maintain open densities as required by existing zoning (two or more acres per D.U.).

- If and when more intensive development of the 63 acre, Taylor-Benjamin estate opposite Memorial Cemetery is proposed, require the preservation of the ponds and the retention or donation of an undisturbed area where the property abuts that of the Nature Conservancy.

P.48x

- Oppose any sale of the Bethpage State Parkway right of way. This is an important recharge area and an essential component of the 271 acre north-south greenbelt from Cold Spring Harbor to Plainview. See Figure 2-11.

- Request that the Nassau County Department of Public Works delay implementation of its Consultant's Phase Phase III Manetto Hills-Muttontown well field strategy, outlined in the *Master Water Plan*, until there has been an opportunity for a full reconsideration of the proposal. Nassau County, in cooperation with U.S.G.S. should determine the total amount and location of withdrawals that can be sustained without adverse effects on water table elevations and surface waters. In the event that projected shortfalls cannot be made up within the County, Nassau should enter discussions with Suffolk to ensure the timely availability of a supplemental water supply.

Village of Matinecock

- Maintain open densities as required by existing zoning (5 acres or more per D.U.).

- Assure the protection of the North Shore Bird and Game Sanctuary from the effects of more intensive development of the Stoddart School property. If or when there is a decision to reduce or eliminate the educational use of the 59 acre parcel and convert the land to residential use, the Village should require the establishment of an adequate buffer area between the houses and the Sanctuary. The Village should insist upon the donation of the fee or development rights to the narrow woodland strip and a small additional area to the Village or to the Sanctuary as a condition for plat approval.
Seek the permanent protection of the stream and unnamed pond that flows into Upper Francis Pond. Encourage the donation of the fee or development rights to portions of the privately held properties as necessary to protect the headwaters of the Shu Swamp-Beaver Brook system (See Figure 2-10).

Village of Mill Neck

- Maintain open densities as required by existing zoning (3 or more or 5 or more acres per D.U.).

- Seek the permanent protection of streams, ponds and wetlands not already in public or quasi-public ownership. Encourage the donation of the fee or development rights to the privately owned portions of Upper and Lower Francis Ponds and Beaver Brook to the municipality or a recognized conservation organization. (See Figure 2-10). Whenever the abutting parcels are subdivided or re-subdivided, require the dedication of the fee or the development rights to portions of the properties as needed to protect the ponds, the stream and the associated wetlands and to promote the southward extension of the Shu Swamp Preserve. Consider the purchase of key parcels, if necessary (see Figure 2-10).

- Consider the use of minimal lot size adjustments (15% or less) and/or donation of development rights where necessary to preclude the disturbance of steep terrain or to permit the retention of large stands of conifers or other outstanding vegetation, habitat or landscape features.

P.49x

Village of Muttontown

- Maintain open densities as required by existing zoning (2 or more acres per D.U. except for a small sector along Jericho Turnpike).

- Sewer the limited area immediately north of Jericho Turnpike that is currently developed at less than one acre per dwelling unit. Proximity to the ground-water divide makes the proposed extension of the sewered area advisable, while the existence of a collection system on the periphery of the SGPA makes it feasible.

- Encourage additional donations of contiguous land to the important recharge area provided by the large undeveloped Nassau County Parkland. If or when there is a proposal to subdivide the 48 acre estate on the western side of the Muttontown Preserve at North Hempstead Turnpike, the Village should consider the use of minimal lot size adjustments (15% or less) in return for a significant addition to the Preserve. If this cannot be arranged, the Village should require the subdivider to donate the development rights to an adequate buffer strip between the public holdings and the new development to the County, Village or a recognized conservation organization.

- Utilize New York State Bond Act, State and Federal Sole Source Aquifer monies or other funds, if available, to purchase the fee or development rights to up to 50 acres of the 81 acre parcel on the north side of Muttontown Road next to the southwestern portion of the Preserve. (See Figure 2-12). In the event that funds are not available to permit the purchase of the proposed woodland acreage and its addition to the existing Preserve, and if the land is to be subdivided; the Village should use its land use control powers, as suggested above, in order to maximize the ground-water protection and recharge area.

Village of Old Brookville

- Maintain open densities as required by existing zoning (two acres or more per D.U.).

- Use land use controls to assure the maximum protection of Cedar Swamp Creek. (See Figure 2-13). Portions of the stream corridor have already been developed; other areas are likely to be subdivided. The Village should require the preservation of the stream, ponds and wetlands together with a buffer area whenever vacant parcels are divided into two or more lots. Dedication to the Nature Conservancy would be appropriate since this organization already owns several parcels in the area.

- Utilize New York State Bond Act, State and Federal Sole Source Aquifer monies or other funds, if available, to purchase the 39 acre vacant parcel located on the northerly side of North Hempstead Turnpike. Public acquisition of this parcel and management by the Nature Conservancy would contribute to the protection of both the ground water and the upper portion of the Cedar Creek stream corridor. In the event that necessary funds are unavailable, the Village should consider the use of lot size adjustments (15% or less) in return for the donation of the ponds, stream and appropriate buffer areas to the Nature Conservancy.

- Prohibit any rezonings that would permit the further intrusion of commercial uses with their associated traffic and potential ground-water impacts.

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Figure 2-12 *Potential Acquisitions in the Vill. of Muttontown*

P.51x

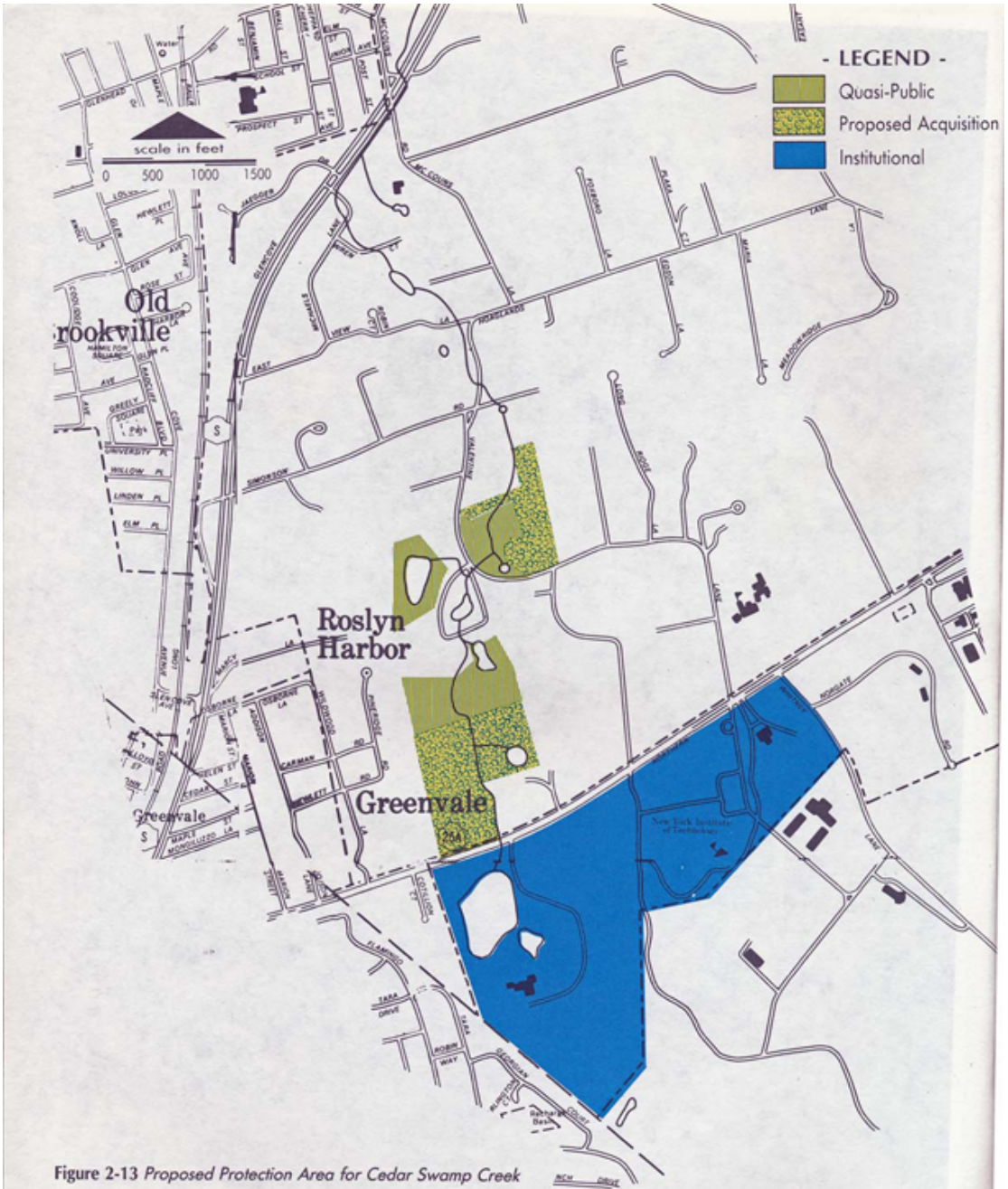

Figure 2-13 *Proposed Protection Area for Cedar Swamp Creek*

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Village of Oyster Bay Cove

- Maintain open densities as required by existing zoning (two acres or more per D.U.).
- Consider the preservation of two greenbelts, comprising approximately 50 acres, along parts of scenic North Hempstead Turnpike (Rte 25A). There is an opportunity to create a greenbelt on the south side of the road from the Nature Conservancy property to White Oak Tree Road, and on the north side from just west of Yellow Cote Road to Oyster Bay Cove Road. These greenbelts would enhance the visual quality of a designated scenic highway and would help to control traffic entering and leaving Rte. 25A. The Village should encourage landowners to donate the fee or development rights to the wooded area adjacent to the road, except for those portions required for access, to the municipality or the Nature Conservancy. If or when more intensive development is proposed, the Village should require the preservation of greenbelt land as a condition of plat approval.
- Consider the use of minimal lot size adjustments (15% or less) where necessary to preclude the disturbance of steep terrain or to protect outstanding vegetation, habitats or landscape features.

Village of Upper Brookville

- Maintain open densities as required by existing zoning (two or more or five or more acres per D.U.).
- Preserve the integrity of the 409 acre Planting Fields. Oppose any future sale or lease of portions of the property or any significant intensification of use. This property, together with the adjacent parcel owned by the Nature Conservancy, constitutes an important protected recharge area. Minimize the clearance of woodlands and meadows, especially in the vicinity of Planting Fields.
- Utilize New York State Bond Act, State and Federal Sole Source Aquifer monies or other funds, if available, to purchase the three undeveloped parcels along the eastern boundary of Planting Fields and to obtain the development rights to a part of the 12 acre wooded estate that also abuts the easterly edge of Planting Fields. The undeveloped properties should be added to Planting Fields and managed as a natural buffer and watershed protection area. (See Figure 2-14).
- As the remaining larger parcels are subdivided, require the maximum protection of existing vegetation.

Village of Old Westbury

- Maintain open densities as required by existing zoning (one or more or two or more acres per D.U.).
- Discourage the piece-meal sale of any portions of the campus or of other properties used or owned by the State University at Old Westbury, the New York Institute of Technology and C.W. Post College located within the Village. In addition to their better known functions, these properties serve as prime recharge areas. They also constitute part of a 329 acre greenbelt, extending from Old Brookville into Old Westbury, Brookville and Jericho. (See Figure 2-9). If sales of portions of private institutional lands are unavoidable, purchasers should be permitted to hook up to the seller's treatment plant or collection system if the Nassau County Department of Health so recommends.

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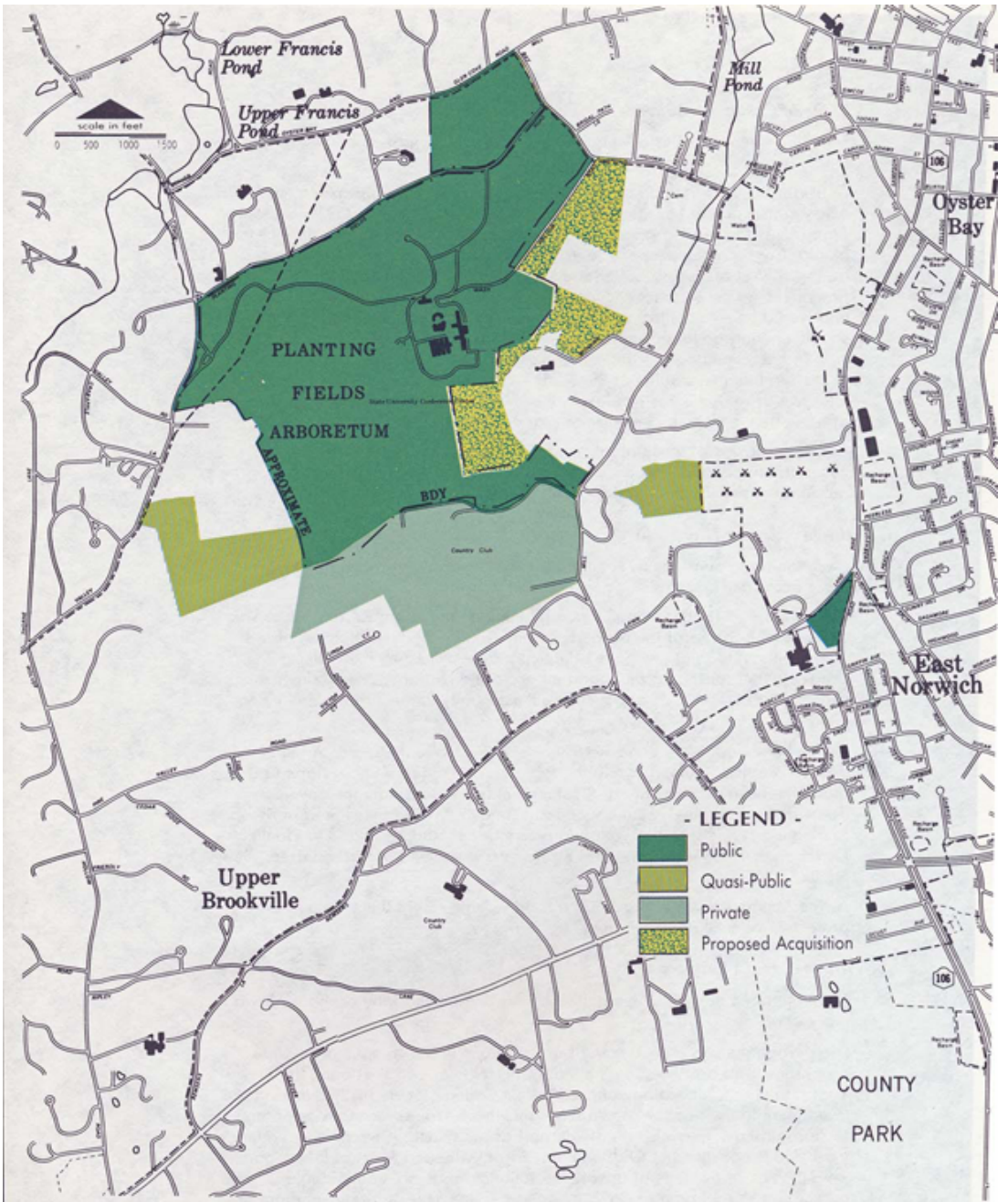

Figure 2-14 *Potential Acquisitions in the Vill. of Upper Brookville*

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Any State owned lands at SUNY-Old Westbury that are not used for educational purposes should be included in a separate State Conservation preserve.

- Require the installation of ground-water monitoring wells down gradient of institutional sewage treatment facilities to permit State or County evaluation of ground-water impacts. Consider interim or long-term discharge mitigation techniques, such as flow reduction, septic system modification or hook-up to an existing collection system as necessary to protect groundwater quality.

- To the extent feasible, encourage the retention of the remaining large parcels now used as estates and horse farms. Several of these parcels, together with the two country clubs form an important part of the recharge area and greenbelt described above.(See Figure 2-15)

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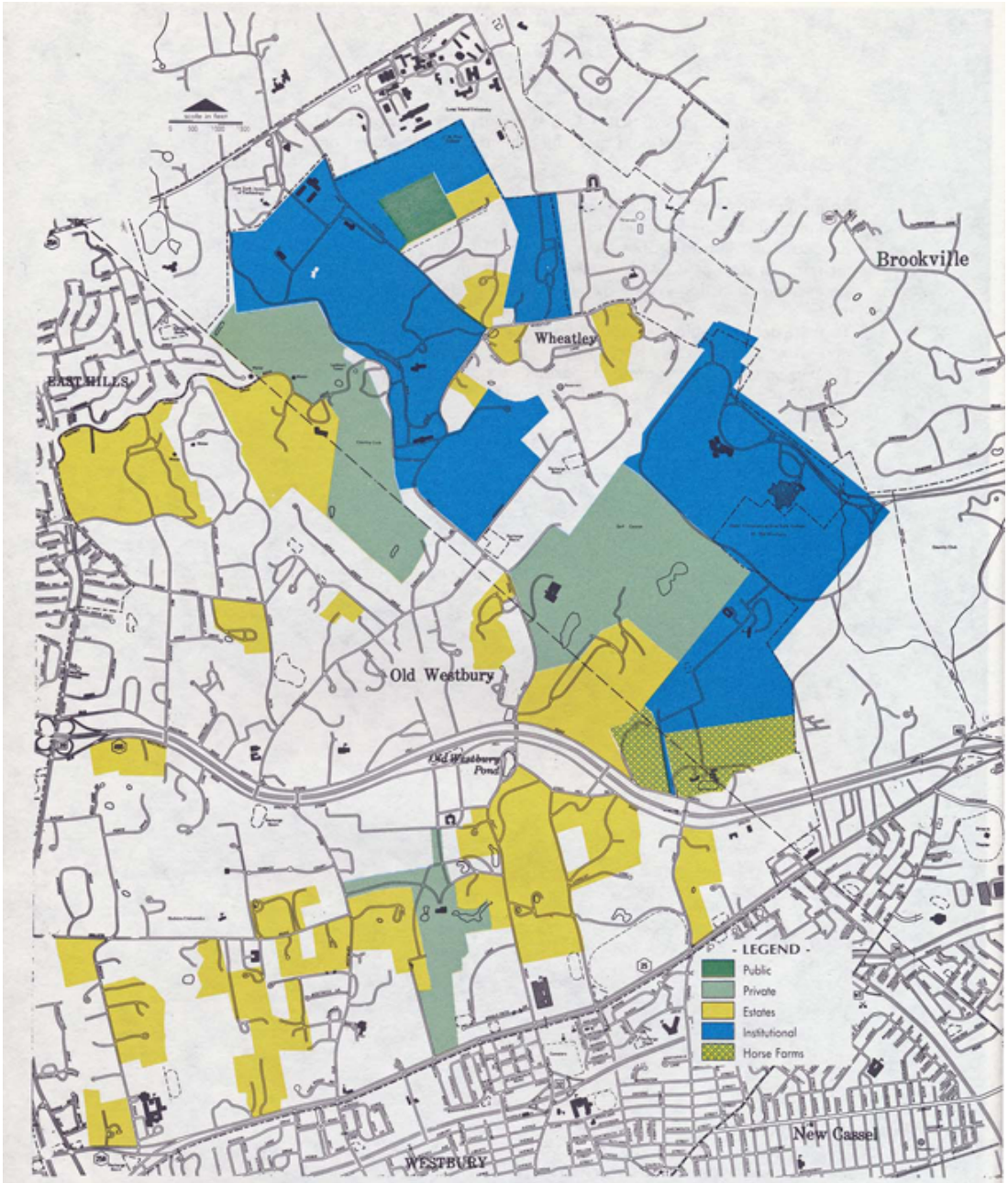

Figure 2-15 *Management Opportunities in the Vill. of Old Westbury*

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Chapter 3...

Brookhaven Pilot Area

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GENERAL BACKGROUND

Location

The entire pilot area is located within a single municipality, the Town of Brookhaven, Suffolk County, N.Y. See Figure 3-1 for study area boundary and Appendix B for a description of the road boundary. The study area, which comprises approximately 44 square miles, contains large tracts of privately owned, forested lands. Approximately 60% of the area is undeveloped, including over 6,000 acres of publicly owned land that remain in a natural state and approximately 1,000 acres of land in agricultural use. There are also old fields that testify to the abandonment of past agricultural activities. Most of the privately owned undeveloped lands, or more than 11,000 acres, are covered with typical pine barrens vegetation (oak-pine and pine-oak woods), lowland woods or are freshwater wetlands.

Topography and Soils

Four major soil associations occur within the pilot area:

Haven-Riverhead
Plymouth-Carver (level)
Plymouth-Carver (hilly)
Riverhead-Plymouth-Carver

Each association has characteristic slopes as described by the Soil Conservation Service in the *Soil Survey of Suffolk County, 1975.*

The Haven-Riverhead association is the most widely occurring soil group, extending throughout the northern and eastern portions of the pilot area. The association is characterized by nearly level terrain with short gentle slopes along shallow drainage ways. Some areas are pitted by steep-sided kettleholes. Slopes range from 0 to 15 percent but generally are 0 to 3 percent.

The Plymouth-Carver, nearly level and the Plymouth-Carver, hilly and rolling occur in the west central part of the area and in the southern portion, respectively.

The Riverhead-Plymouth-Carver association forms a narrow band across the southern border of the pilot area. Slopes generally range from 0 to 3 percent. Drainage channels may have slopes ranging from 8 to 15 percent. This association occurs on the southern glacial outwash plain.

Soils vary in texture from sandy to loamy throughout the study area. Because of the sandy nature of the soils, the application of fertilizers is likely to result in ground-water contamination. The seasonal high water table is greater than four feet in most associations. There are some minor soil groups in lower lying areas with higher water tables.

Natural Resources

This study area contains a number of ponds, streams, a portion of the Carmans River and the headwaters of the Peconic River (See Figure 3-2). The surface water elevation of these water bodies generally reflects ground-water levels. Most of the lands adjacent to the isolated ponds have been developed or are being considered for development.

Although subject to increasing development pressures, the land area within the designated Scenic and Recreational River Corridors (See Figure 3-2) extending for one half mile from the high water mark of the Carmans and Peconic Rivers remain primarily undeveloped and some of the wildlife habitats remain intact. However, many areas within these corridors and throughout the study area have been lost to development. Several species of fauna and flora in the general pine barrens area are endangered or threatened.

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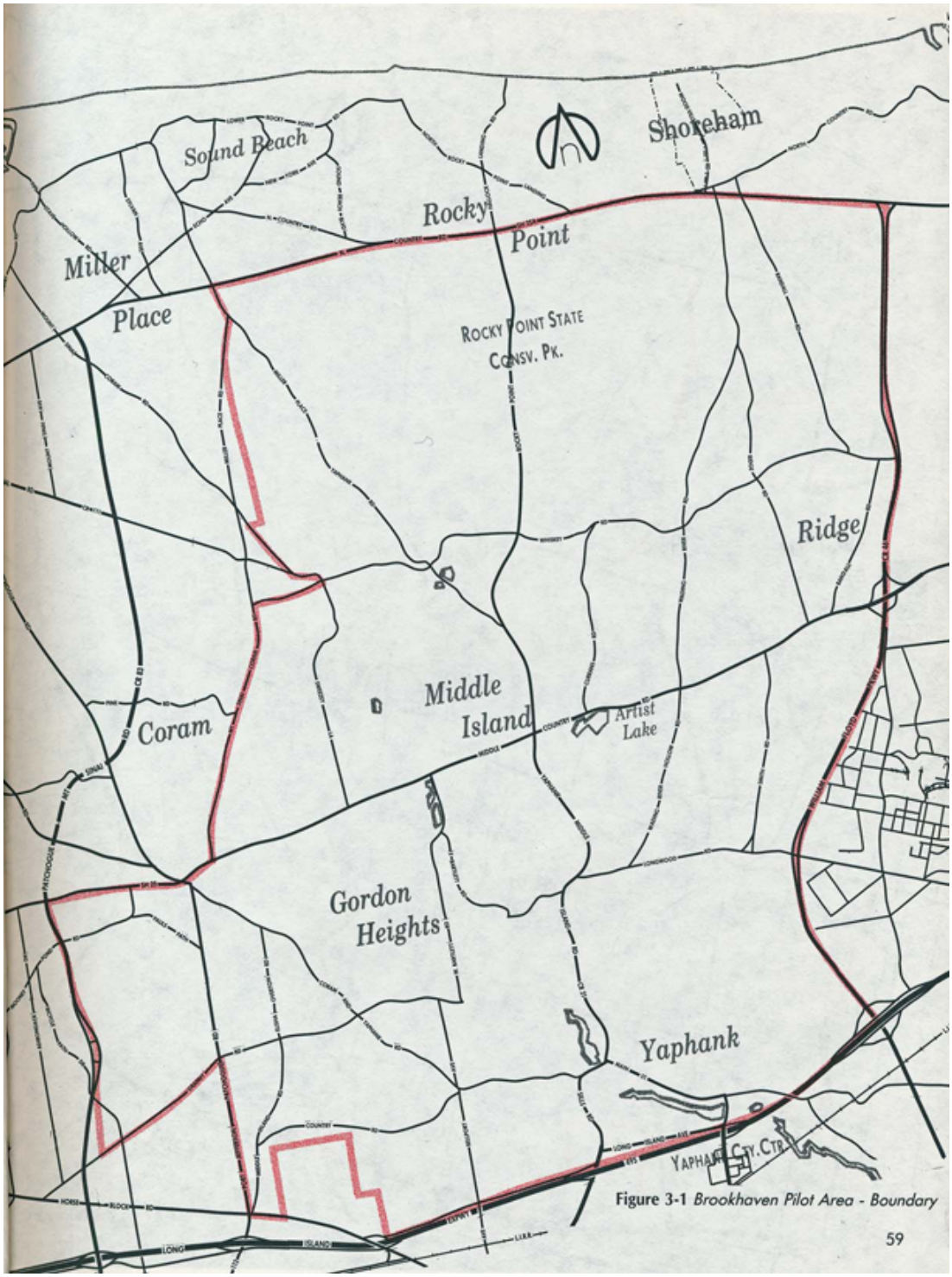

Figure 3-1 *Brookhaven Pilot Area - Boundary*

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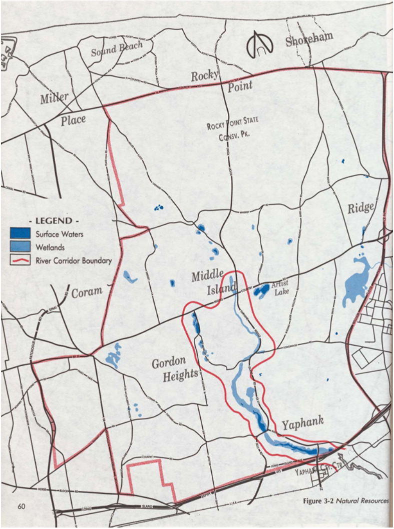

Figure 3-2 *Natural Resources*

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The NYSDEC has proposed minimum lot size requirements of two to four acres per D.U. in order to preclude higher density development within the river corridors. The County of Suffolk has followed a policy since 1960 of trying to place the majority of lands bordering these Rivers in the public domain. Wherever feasible the most stringent regulations should be applied to protect these watershed areas.

Hydrogeology

The pilot area lies within Zone III, a deep recharge zone. The recharge water entering the saturated zone, recharges the three major aquifers. The ground-water divide is generally parallel and to the north of Route 25, which traverses the pilot area. The area contains natural lakes and ponds: some are kettleholes that intersect the water table and some are perched. In general the water elevations of the ponds, streams and wetlands represent the upper surface of the water table in the Glacial aquifer. (See Figure 3-3).

Ground-water Quality Analysis

The Long Island Regional Planning Board (LIRPB) and the Suffolk County Department of Health Services (SCDHS) have evaluated ground-water quality in the Brookhaven Pilot area. Conclusions are based on SCDHS 1959-1984 well sample data for organic and inorganic chemicals. The majority of the public water supply wells, private wells, and monitoring wells are located in the Glacial aquifer. The well data includes the N.Y.S. well identification number, sampling date and chemical concentration. For nitrates and chlorides, additional information includes the total number of samples, monitoring start and end dates, the median concentration, both the lowest and highest, and the percentage exceeding the water quality limit. (See Appendix Table C-2 and C-3; Public water is provided in areas indicated in Figure 3-3).

Samples from three wells in the project area exceeded N.Y.S. Drinking Water Standards for nitrate as indicated in Table 3-1. The maximum contaminant level (MCL) for nitrates is 10 mg/l.

Table 3-1
Wells With Samples Exceeding the NYS Nitrate Standard for Potable Water

Well	Well Type	Location	Aquifer Screened	Depth (Ft.)	# of Samples Exceeding the MCL
S 45838	STP Monitoring	Coram	Glacial	128.67	3 of 8
S 45724	STP Monitoring	Ridge	Glacial	52.25	1 of 8
S 47225	Monitoring	Middle Island	Glacial	33.58	1 of 23

Source: Suffolk County Department of Health Services

Samples from four wells indicated elevated nitrate concentrations above 6 mg/l. In the study area, such concentrations are generally associated with urban development including commercial, industrial and residential at densities greater than two units per acre. (See Table 3-2).

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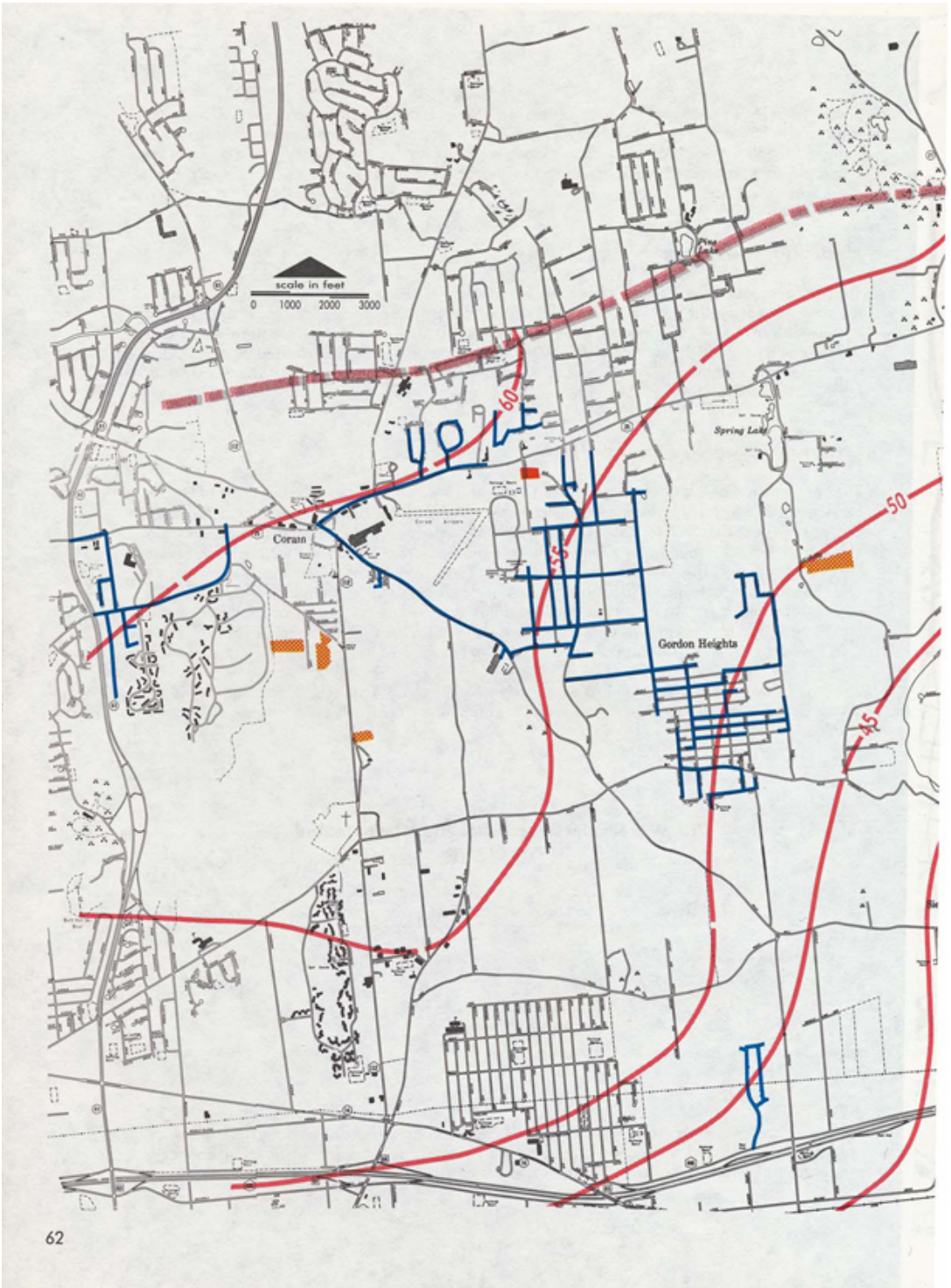
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60
55
50
45
Spring Lake
Corann
Gordon Heights
62

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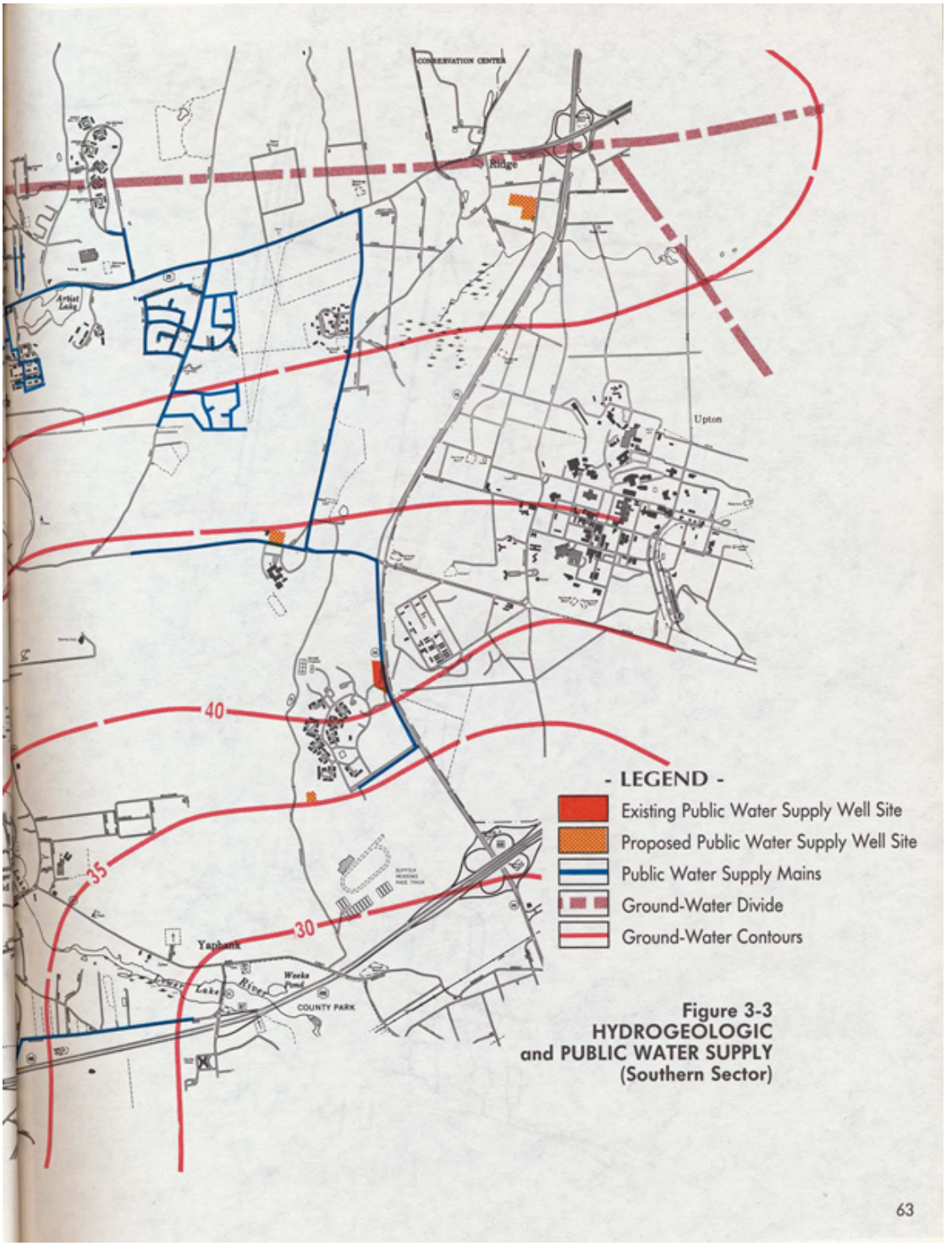

Figure 3-3
HYDROGEOLOGIC and PUBLIC WATER SUPPLY (Southern Sector)

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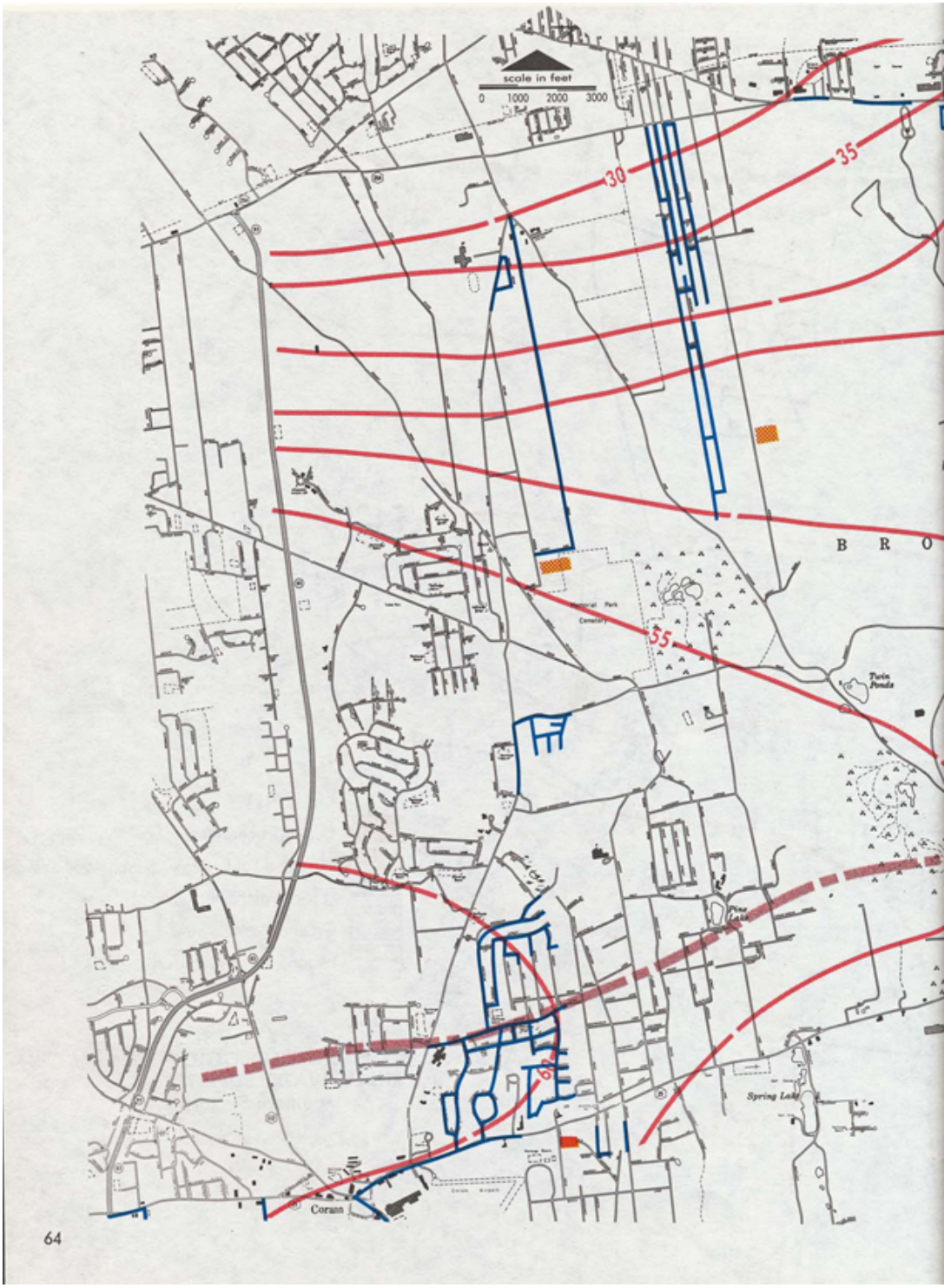
scale in feet
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35
55
B R O
Twin Ponds
Spring Lake
Corann
64

P.64x

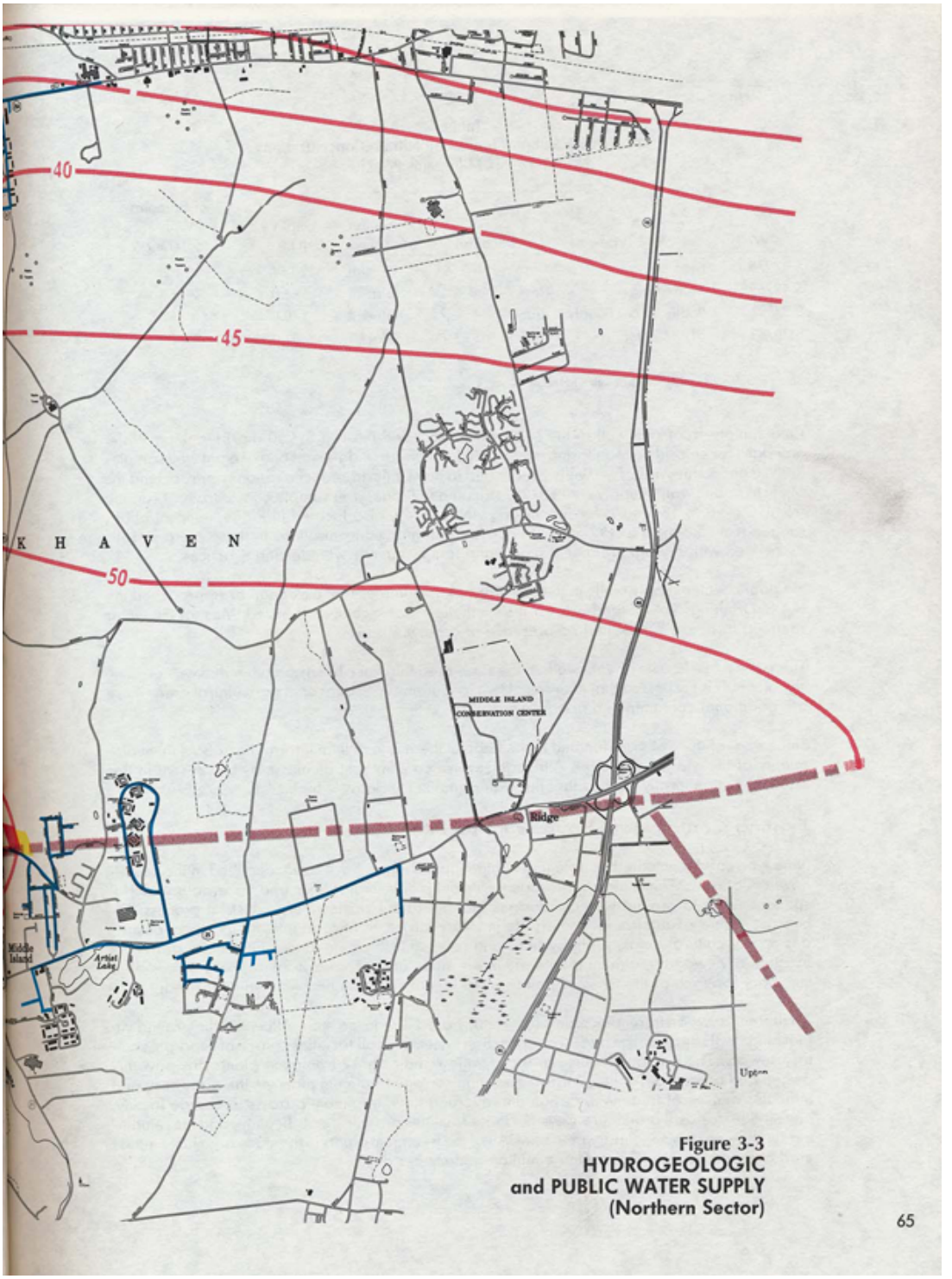

Figure 3-3
HYDROGEOLOGIC
and PUBLIC WATER SUPPLY
(Northern Sector)

65

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Table 3-2
Wells with Samples Indicating Nitrate Concentrations
Above Six Milligrams Per Liter

Well	Well Type	Location	Aquifer Screened	Depth (Ft.)	# of Samples With 6 to 10 mg/l
S 47975	Monitoring	Coram Hill	Glacial	128.67	1 of 26
S 49269	Monitoring	Rocky Point	Glacial	66.0	2 of 2
S 37991	Public Water Supply	Ridge	Glacial	140.0	4 of 8
S 70753	STP Monitoring	Middle Is.	Glacial	51.0	1 of 3

Source: Suffolk County Department of Health Services

One sample from one well in the study area exceeded the N.Y.S. 250 mg/l Drinking Water Standard for chlorides. Monitoring well S45724, located in Ridge, had one of eight well samples that exceeded the MCL. Two wells were found to have chloride concentrations approaching the MCL. In public water supply well S37991, located in Ridge, well sample concentrations ranged from 10 mg/l to 189 mg/l; for monitoring well S47749, also located in Ridge, concentrations ranged from 5.3 mg/l to 192 mg/l. The occasional high concentrations in these are generally associated with sewage treatment plants and less frequently with deicing practices.

No public water supply wells in the study area had samples that exceeded or approached the N.Y.S. Drinking Water Standards for the synthetic organic chemicals tested. Most of the water sampled from wells indicated no presence of organics.

There are a few known private wells in the study area that have been contaminated with organic chemicals. It is suspected that in areas of two to four units per acre or in agricultural areas there are additional contaminated private wells.

Since most of the wells are located in the Glacial there is very little information about the water quality of the Magothy aquifer. Although several contaminant plumes may be present in this aquifer, it is generally agreed that the water quality is relatively high.

Existing Contaminant Sources in the Pilot Area

Nine types of documented or potential contaminant sources have been identified in the Brookhaven Pilot Area. These include sewage treatment plants, major toxic and hazardous material spills or leaks to ground-water, industries that hold/haul wastewater, industrial process discharges, coin-op laundromat and dry cleaner discharges, fertilizer applications, use of pesticides on agricultural lands, septic systems and road salt storage and use. Figure 3-4 shows the location of sewage treatment plants within the study area. Tables 3-3 through 3-7 provide a summary for each of the types of point source identified in the Brookhaven Pilot Area.

All thirteen sewage treatment plants in the study area discharge their effluent to the ground via leaching pools or recharge beds. The collection systems for all facilities consist of separate sanitary sewers. There is one municipal facility, the remaining 12 treatment plants are privately owned and operated. Table 3-3 lists the existing sewage treatment plants in the study area and indicates degree of treatment, design and average flow, treatment process, recharge facility, and sludge disposal procedure. Seven of these facilities provide denitrification; and the remaining six provide only secondary treatment. All of the treatment plants in the study area have measured average flows well below one million gallons per day.

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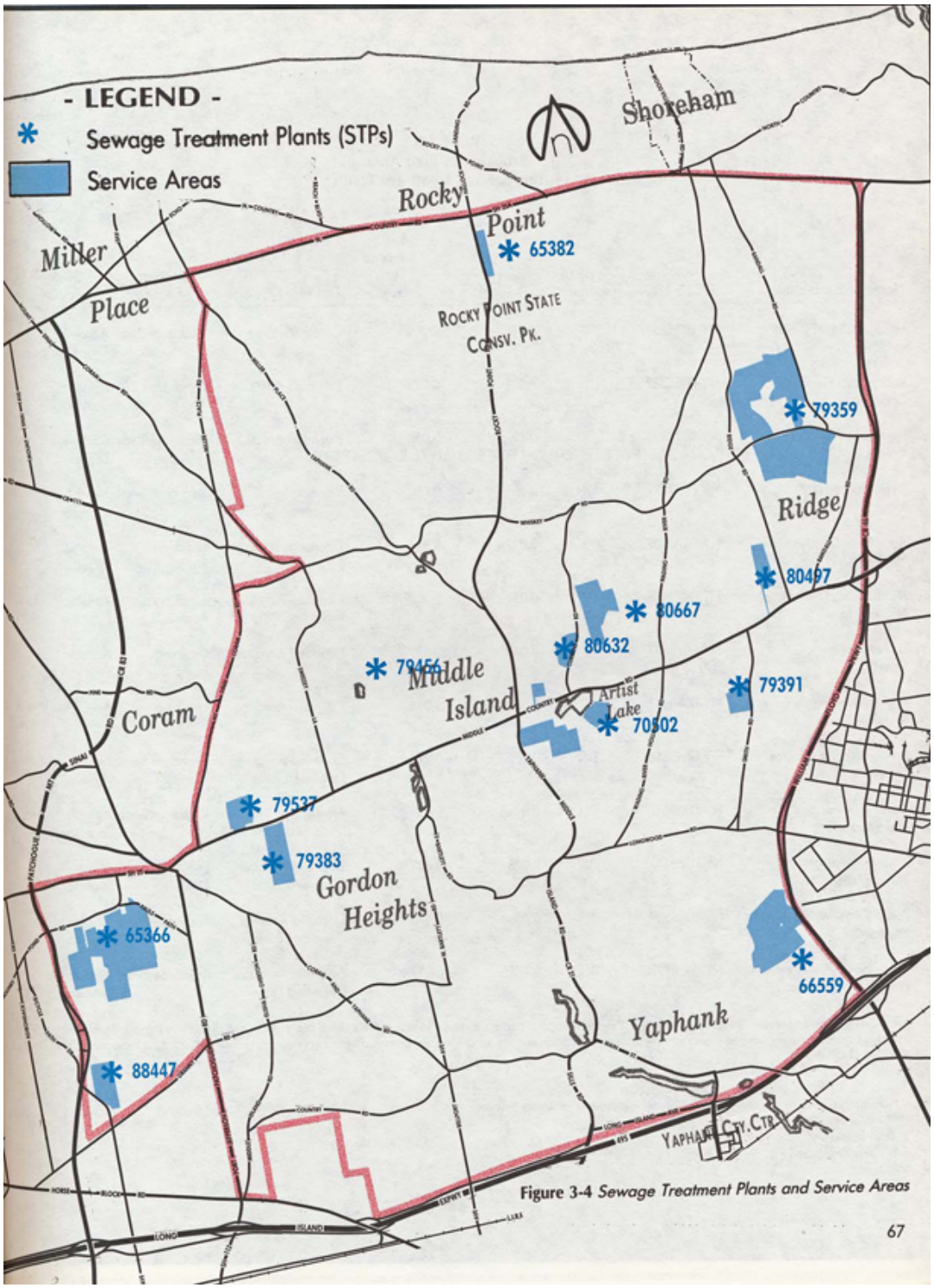

Figure 3-4 *Sewage Treatment Plants and Service Areas*

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Table 3-3
Brookhaven Pilot Area
Existing Sewage Treatment Plants*

Name of Establishment	SPDES No.	Type of Treatment***	Design Flow (mgd)	1985 Average Flow (mgd)	Treatment Process	Recharge Facilities	Sludge Facility
Leisure Village, Ridge	NY-0079359	S DN by 7/86	0.165	0.200	Contact Stabilization	Recharge Beds	Aerobic Digestor
Rocky Point Gardens Rocky Point	NY-0065382	S	0.03	0.029	Extended Aeration	Leaching Pools	Aerobic Digestor
Homestead Village Apts. Coram	NY-0079383	S	0.12	0.055	Extended Aeration	Recharge Beds	Aerobic Digestor
	OUT OF SERVICE (EXTENSION FOR 8/15//83 FOR OPERATION)						
Strathmore (#8)** Ridge	NY-0079391	DN	0.05	0.050	Bio-disc	Recharge Beds	Aerobic Digestor
Artist Lake Condos Middle Island	NY-0070502	S	0.097	0.021	Extended Aeration	Leaching Pools	Aerobic Digestor
Middle Island Nursing Home Middle Island	NY-0079456	DN	0.052	0.029	Extended Aeration, Deep Bed Filter	Leaching Pools	Aerobic Digestor
La Bonne Vie Coram	NY-0079537	S	0.06	0.029	Extended Aeration	Leaching Pools	Aerobic Digestor
Englishtown Gardens Middle Island	NY-0080632	S	0.03	0.016	Extended Aeration	Leaching Pools	Aerobic Digestor
Bretton Woods Condos Coram	NY-0065366	DN	0.275	0.212	Extended Aeration, Deep Bed Filter	Recharge Beds	Aerobic Digestor
Coventry Manor Middle Island	NY-0080667	DN	0.06	0.039	Bio-Disc, Deep Bed Filter	Recharge Beds	Aerobic Digestor
Allstate Building Farmingville	NY-0088447	DN	0.026	0.022	Extended Aeration, Deep Bed Filter	Leaching Pools	Aerobic Digestor
Parr Village (Whispering Pines) Yaphank	NY-0066559	DN	0.45	0.028	Extended Aeration, Deep Bed Filter	Recharge Beds	Aerobic Digestor
Ridge Haven Estates Ridge	NY-0080497	DN	0.171	0.032	Extended Aeration, Deep Bed Filter	Recharge Beds	Aerobic Digestor

Brookhaven scavenger is no longer in operation. Private cesspool carters have been instructed to take cesspool waste directly to Bergen Point. The cost of this transportation has been passed along to the customers. In addition, the long distance involved with this provides greater temptation for operators to illegally dispose of sewage.

*Source: Suffolk County Department of Health
**Strathmore (#8) is a municipal facility, all others are privately owned.
***P - Primary
S - Secondary
DN - Denitrification

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Table 3-4
Brookhaven Pilot Area
Documented Major Toxic and Hazardous Materials
Spills or Leaks to Ground Water

No.*	SCDHS File No.	Date Reported or discovered	Responsible Entity	Spill or Leak Location	Chemical Involved	Approx. Volume (Gallons)
38	1978-19	5/12/78	Oakcrest Fuel Co.	Oakcrest Ave., Middle Island	No. 2 Fuel Oil	100
112	1979-83	9/19/79	Power Test Gas Station	Route 112 & Horseblock Road Medford	Gasoline	600-1,000
146	1980-51	4/22/80	Chevron Gas Station	Route 25A & Hallock Landing Rd. Rocky Point (Gas in Groundwater)	Gasoline	Unknown
	1981-121	8/20/81	Unknown	Route 25A & Rocky Point Road Rocky Point	Fuel Oil	Unknown
	1981-130	7/28/81	HUD-FHA	Abandoned Home, 220 Fire Ave., c/o Connecticut Ave., Medford	Fuel Oil	Unknown
	1983-165	7/7/83	L.I.L.C.O.	Whiskey Road & Ridge Road Ridge	PCB Oil	10-15

*Corresponds to the numbers on the SCDHS Master List

Table 3-5
Brookhaven Pilot Area
Industries which Hold/Haul Wastewater

No.	SPDES No.	Industry	Address	Type
1	NY-0085499	Bix Furniture Stripping	11 Homestead Drive, Coram	Stripping Sludge
6	None	Wayne's Radiator Shop	153A Middle Country Road Coram	Acids, Flush-out, Rinses Antifreeze

Note: No Process water discharges allowed.

Table 3-6
Brookhaven Pilot Area
Industrial Process Water Discharges

No.	SPDES No.	Industry	Address	Types	Process Water Flow (gpd)	Days/Week Discharge	Surface Water or Ground Discharge	Principal (P) or Non-Principal (0)
4	None	Newtron Pharmaceutical	Mill Rd., Coram	Pharmaceuticals	Not Reported	5	GW	Unknown
9	NY-0085481	Wallmate Vinyls, Inc.	466 Mill Road	Mfg. Wallpaper	<100	5	GW	O

GW = Ground water

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Table 3-7
Brookhaven Pilot Area
Coin-OP Laundromats

No.	Name	Location	Approximate Flow (gpd)
2	Wash Bucket	2640 Middle Country Rd., Coram	8,700
4	Plain Fancy	Point Plaza Shopping Center Route 25A & Rocky Point Road Rocky Point	5,000-10,000

Note:
These locations have controls for runoff - either a housed facility or a runoff collection pad and tanks for holding and hauling runoff to approved sites. The SPDES permits prohibit discharge of runoff into the ground.

SPDES effluent permit requirements are being revised. Two major modifications are as follows:

- Fecal coliform and chlorine limits will be eliminated for facilities that discharge effluent into subsurface leaching pools; and
- Since August 31, 1982, all plants that discharge to ground-water without denitrification are required to upgrade to meet a total nitrogen limit of 10 mg/l.

Surveillance activities indicate that only six of the 13 facilities are attaining effluent quality requirements called for in their permits. Three treatment plants, Leisure Village, Strathmore Ridge and Artist Lake Condominiums, meet the current effluent limitation for total nitrogen (10 mg/l), based upon the average of the 1982 grab samples taken by SCDHS. A survey conducted by the SCDHS found that, in general, the major causes of the failures to meet effluent limits were inadequate operation and maintenance procedures rather than improper design or construction. Fortunately, these are the easiest types of problems to resolve. Greater surveillance by public inspectors and stiffer fines for violators should discourage sloppy and or negligent management.

There have been several documented major toxic or hazardous material spills or leaks to ground water (See Table 3-4). These spills have occurred as a result of oil or gasoline storage, transportation or handling practices and other toxic materials handling or transportation. Industries which hold or haul wastewater are indicated in Table 3-5, industrial process water discharges are shown in Table 3-6 and coin-operated laundromats are indicated in Table 3-7.

Land Use Characteristics

General land use patterns are depicted in Figure 3-5, the Land Use Characteristics Map. Each tax parcel was assigned to one of the following ten land use categories:

Existing Parkland/Open Space
Rural
Primarily Developed, Medium Density Residential
Partially Developed, Medium Density Residential
Developed High Density Residential
Commercial
Industrial
Transportation/Utilities
Institutional
Mixed Land Uses

Mixed Land Uses refers to areas where several uses occur without a distinctive pattern of land use. The designated NYS Scenic and Recreational River Corridor boundary is indicated on Figure 3-2 and Figure 3-5.

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Approximately sixty percent of the pilot area falls into two categories accounting for most of the undeveloped parcels--Rural (approximately 10,000 acres) and Parkland/Open Space (approximately 6,729 publicly owned acres). Several classes of land use are included in the Rural category. They are primarily vacant land, agricultural, golf courses, cemeteries, sand mines and low density residential development (0-1 D.U./acre). (See Table 3-8). Although many parcels have already been subdivided in accordance with existing zoning, the majority of parcels within the Rural category are subject to further subdivision. Under the existing zoning, at saturation, approximately 12,524 units could potentially be developed within the Rural category (See Table 3-9).

Table 3-8
Open Space Within the 205-J Brookhaven SGPA

PUBLICLY OWNED		QUASI PUBLIC		PRIVATE	
State	5,207 acres	Cemeteries	406 acres	Golf Courses	372 acres
County	888 acres				
Town	634 acres				
Total	**6,729 acres**				
				Grand Total	**7,507 acres**

Table 3-9
Brookhaven Pilot Area
Land Currently Available for Residential Development

Maximum Potential Housing Units and Population

Existing Zoning

Zoning	District	Acres	Housing Units: Units/ Acre[1]	Housing Units: (Units)	Population: Person/ Unit[2]	Population: (Persons)
A-1	1 Ac/Du	809	0.80	647	3.26	2,330
A	30,000 sq. ft.	3,711	1.00	3,711	3.26	13,360
B-1	22,500 sq. ft.	3,650	1.45	5,292	3.26	19,053
B	15,000 sq. ft.	833	2.00	1,666	3.26	5,998
MF (-1,-2)	7-11 Du/Ac	98	9.00	882	2.60	2,293
PRC		65	5.00	325	1.60	520
Total Residential[3]		9,166		12,523		43,554
		Proposed Zoning				
LF-5*	5 Ac/Du	781	0.16	125	3.26	408
LD-2*	2 Ac/Du	5,946	0.40	2,378	3.26	7,754
A-1	1 Ac/Du	1,744	0.80	1,395	3.26	4,548
A	30,00 sq. ft.	235	1.00	235	3.26	766
B-1	22,500 sq. ft.	484	1.45	702	3.26	2,288
B	15,000 sq. ft.	259	2.00	518	3.26	1,689
MF*	4-5 Du/Ac	89	4.50	401	2.60	1,043
Total Residential[3]		9,538		5,754		18,496

*Proposed zoning district
[1]Taken from Table 2. *Estimated Number of Dwelling Units Based on Existing Zoning,* 208 Areawide Waste Treatment Management Study, 1976.
[2]Taken from Table 1. *Estimated Average Household Size by Municipality,* Population Survey, 1985.
[3]Total Acreage differs due to proposed changes of lands zoned commercial and industrial to residential.

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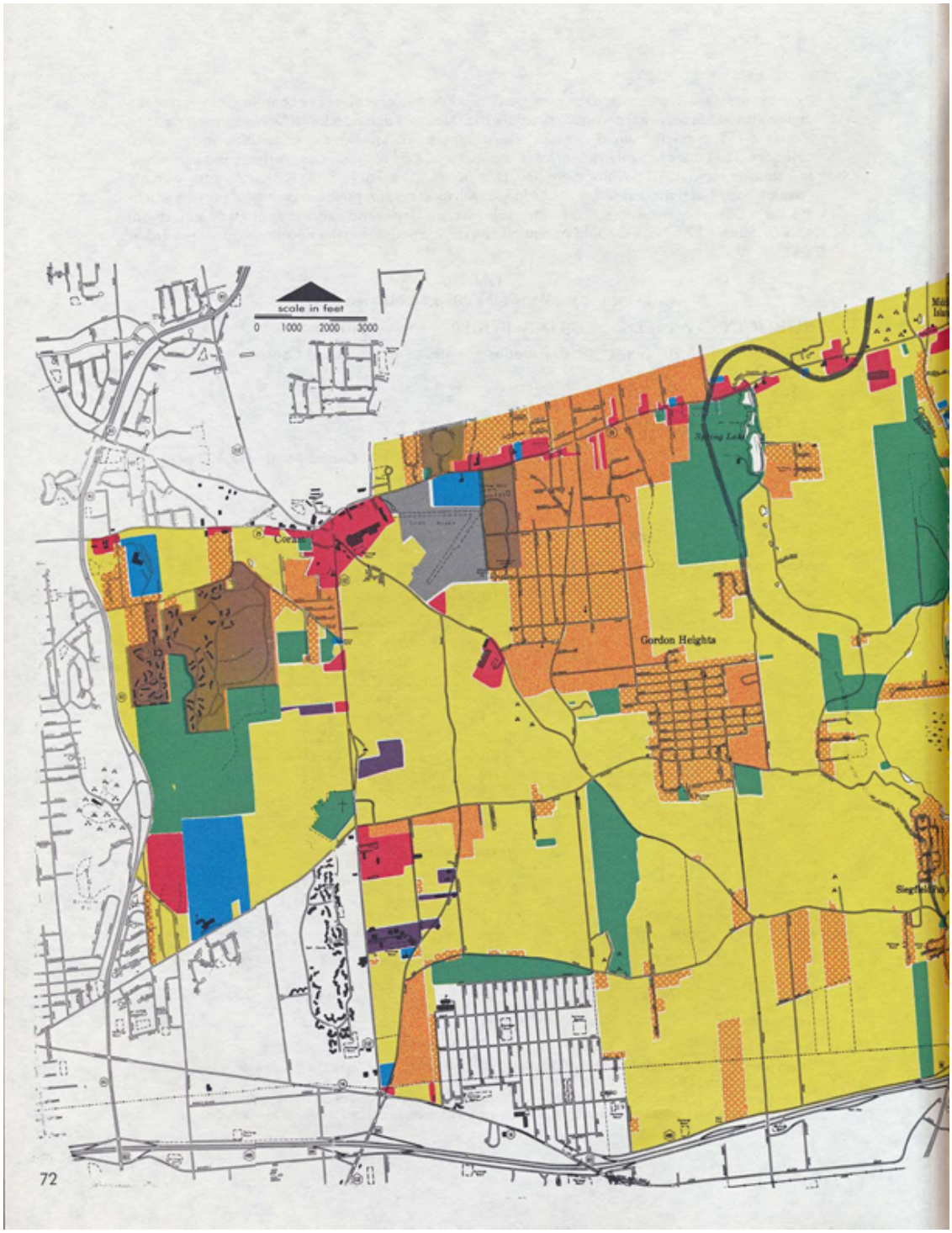

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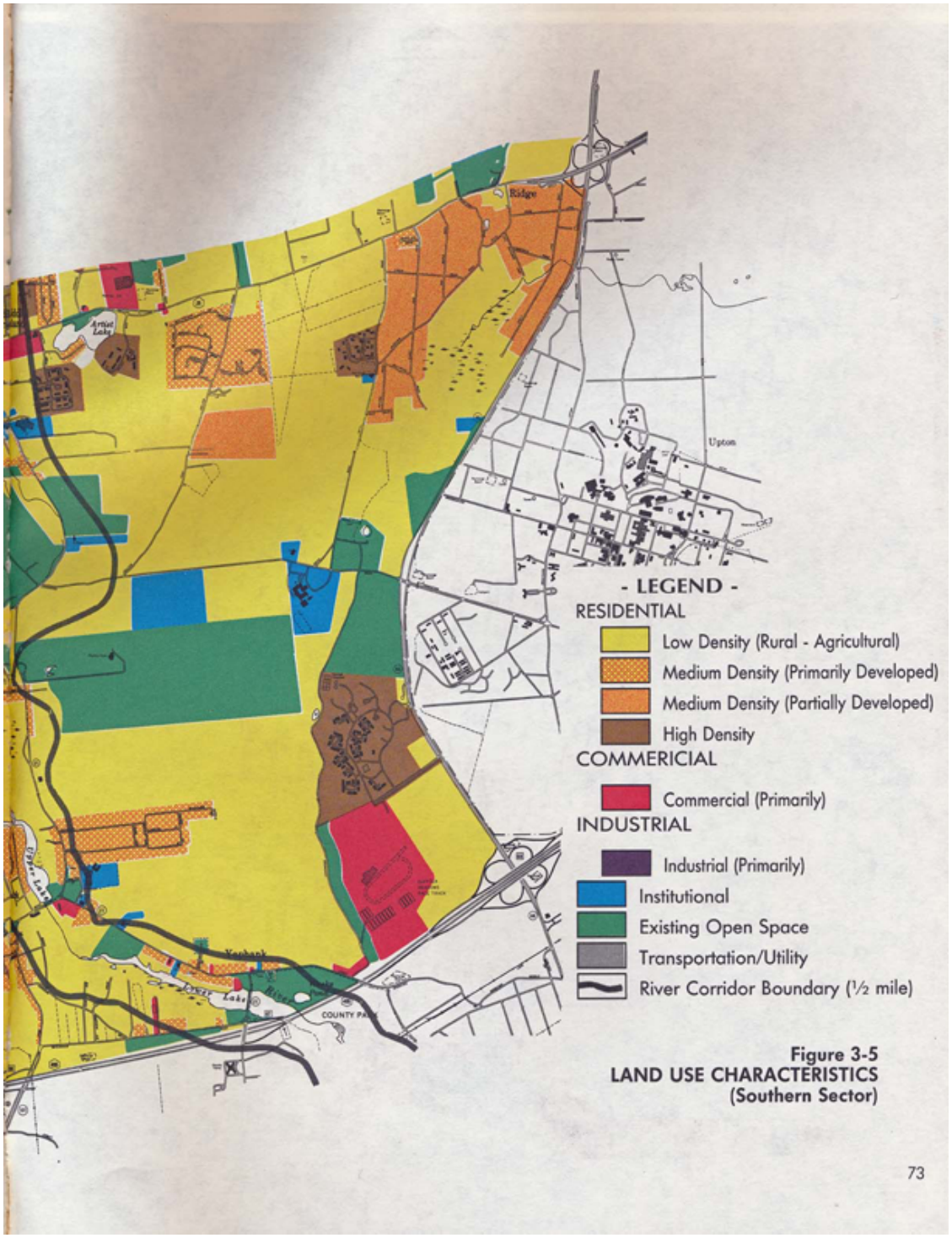

Figure 3-5
LAND USE CHARACTERISTICS
(Southern Sector)

73

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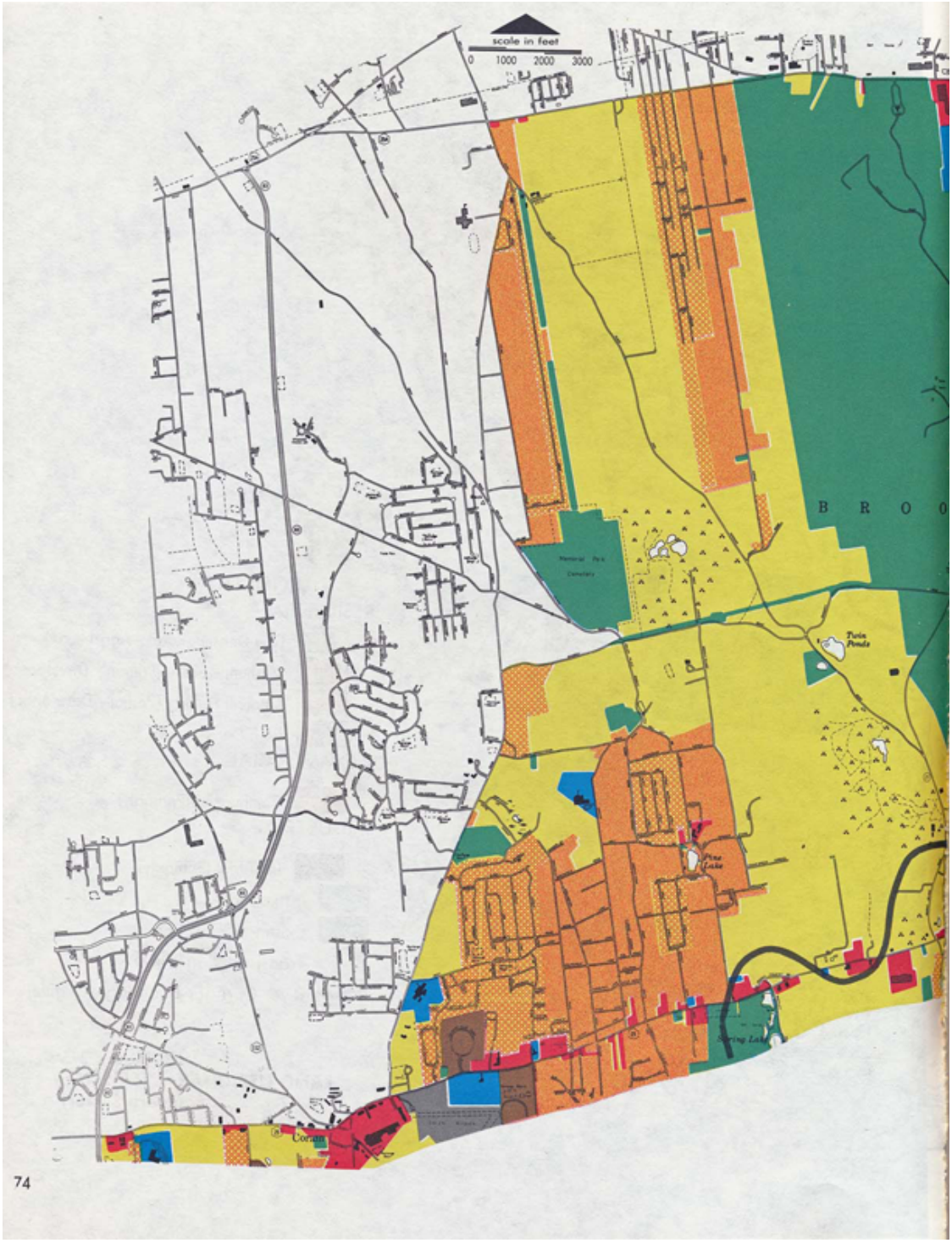
scale in feet
0 1000 2000 3000
B R O O
Twin Ponds
Pine Lake
Spring Lake
Corum

74

P.74x

Figure 3-5
LAND USE CHARACTERISTICS
(Northern Sector)

75

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The second category representing undeveloped land is the Existing Parkland/Open Space category. These lands are owned by the State, County and Town. Publicly owned lands include the New York State owned former RCA property, the Middle Island Conservation area, the County owned Cathedral Pines Park, a portion of Southaven Park, several County tax lien parcels that have been dedicated to the Nature Preserve and several Town owned parcels (See Figure 3-6). There are also other parcels that are being proposed for dedication to the Nature Preserve (See the Recommendations Section). Many of these parcels could act as linkages in an open space system. A number of the existing and proposed Nature Preserve parcels consist of whole or portions of *old filed* maps that predate zoning. As a rule, the lots were extremely small and are generally considered substandard. There are other areas with old filed maps where none of the lots within the map are owned by the County. If these lots were ever developed as platted, they would definitely pose a threat to groundwater quality.There are also two privately owned golf courses, the Spring Lake Country Club and Middle Island Country Club, and two large cemeteries, the Washington Memorial Park and Holy Sepulchre. The location of both the private and publicly owned open space throughout the pilot area provides several opportunities for the creation of an open space system. See Table 3-8 for the acreage by type of ownership.

There are four categories of residential uses that occur throughout the Pilot Area:

- Low Density
  (one D.U. or less/acre)
- Primarily Developed Medium Density Residential
  (an average of 2-4 D.U./acre, with approximately 75 percent of the parcels being developed)
- Partially Developed, Medium Density Residential category
  (typically 2 to 4 D.U./acre, with less than 75 percent of the parcels developed)
- High Density Residential
  (5 or more D.U./acre, apartment and condominium complexes).

Existing commercial activity is the next category on the Characteristics Map. The majority of the commercial activity within the Pilot Area occurs between Coram and Ridge, along Route 25 (Middle Country Road). The existing activities along Route 25 constitute a mixed land use pattern. The variety of land uses located along the developed commercial strip were evaluated according to their probable contribution to groundwater contamination. Ten groups were identified:

- Retail Store
- Restaurant/Bar/Deli
- Professional Office/Bank Building
- Medical Office
- Auto Sales/Service/Collision
- Gasoline station
- Single Family Residential
- Multi-Family Residential
- Cemetery
- Vacant/Abandoned

See Figure 3-7 for the land use adjacent to Route 25. The portion of this strip from Route 83 to Mount Sinai-Coram Road has the most intensive commercial development in the study area. Fast food establishments, clusters of small retail stores, car dealerships, gas stations, a major movie theatre complex and a shopping center are among the commercial uses.

From Mount Sinai-Coram Road east to Artist Lake, the commercial development is less intensive and is interspersed with vacant parcels and residential land uses. The commercial uses along this portion of Route 25 include small groups of stores, medical offices, auto repair shops, and gas stations. Sparse residential development also occurs. This area has the potential for further infill of commercial strip development, given the existing zoning and amount of vacant land.

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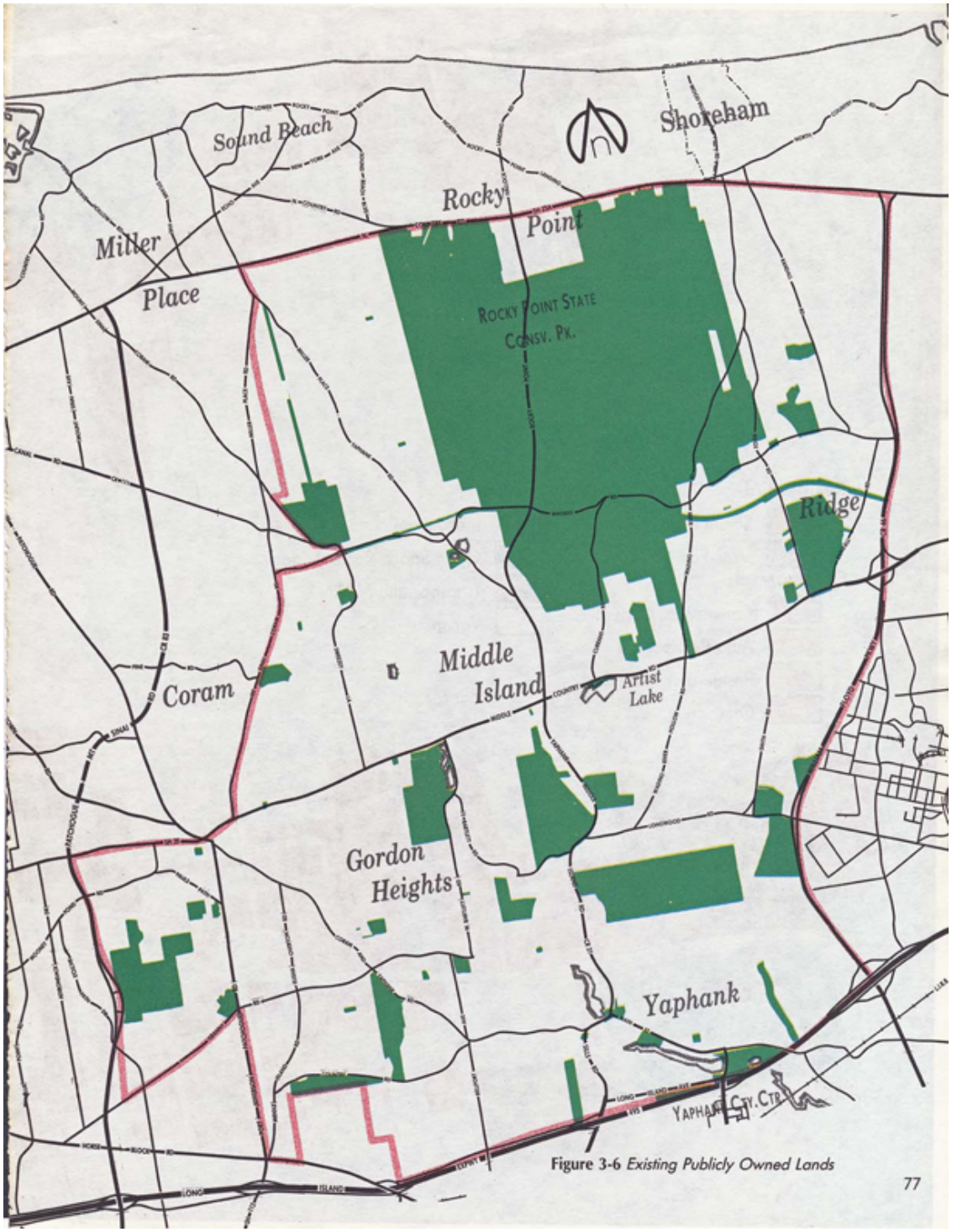

Figure 3-6 *Existing Publicly Owned Lands*

77

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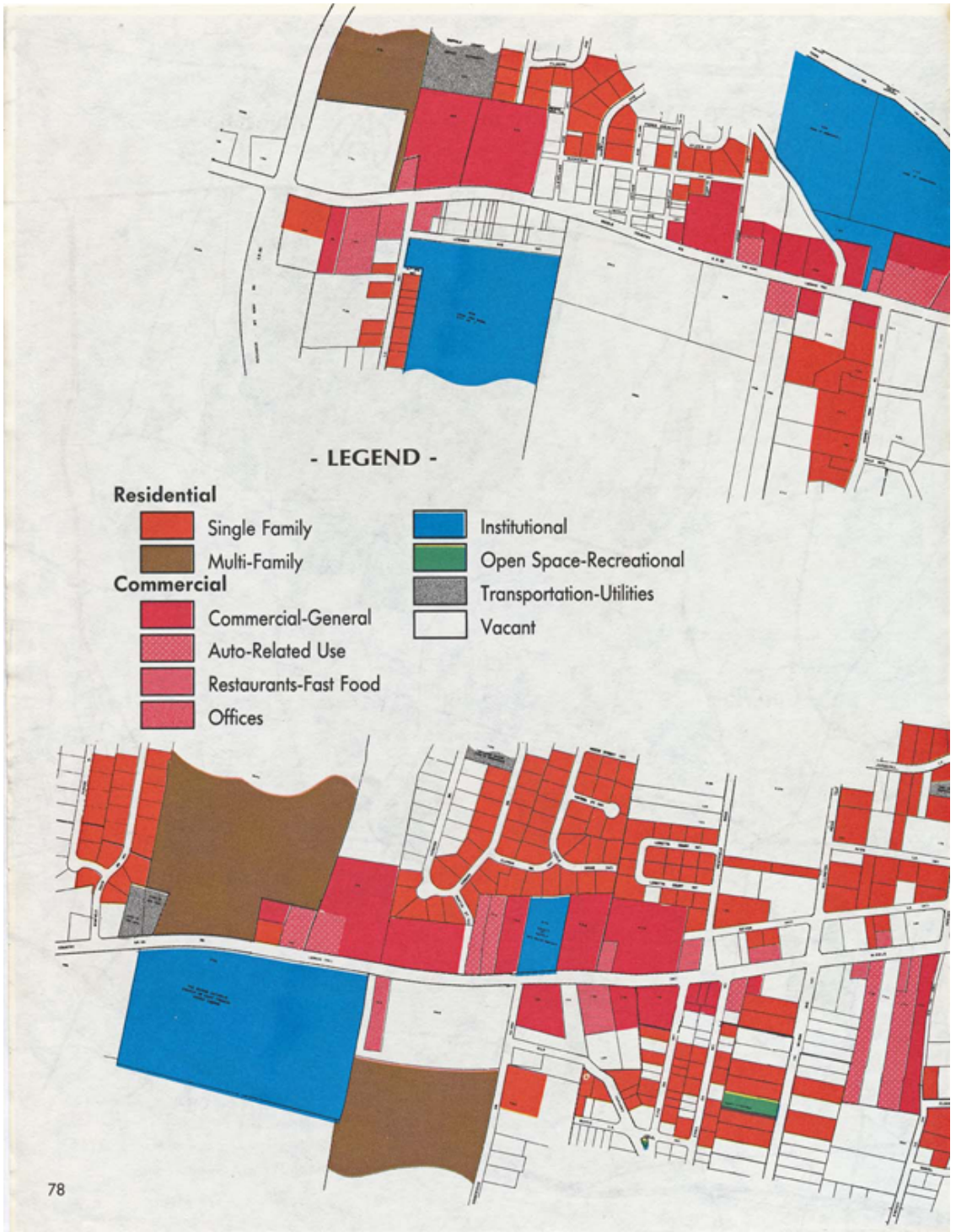
- LEGEND -
Residential
Single Family
Multi-Family
Commercial
Commercial-General
Auto-Related Use
Restaurants-Fast Food
Offices
Institutional
Open Space-Recreational
Transportation-Utilities
Vacant
78

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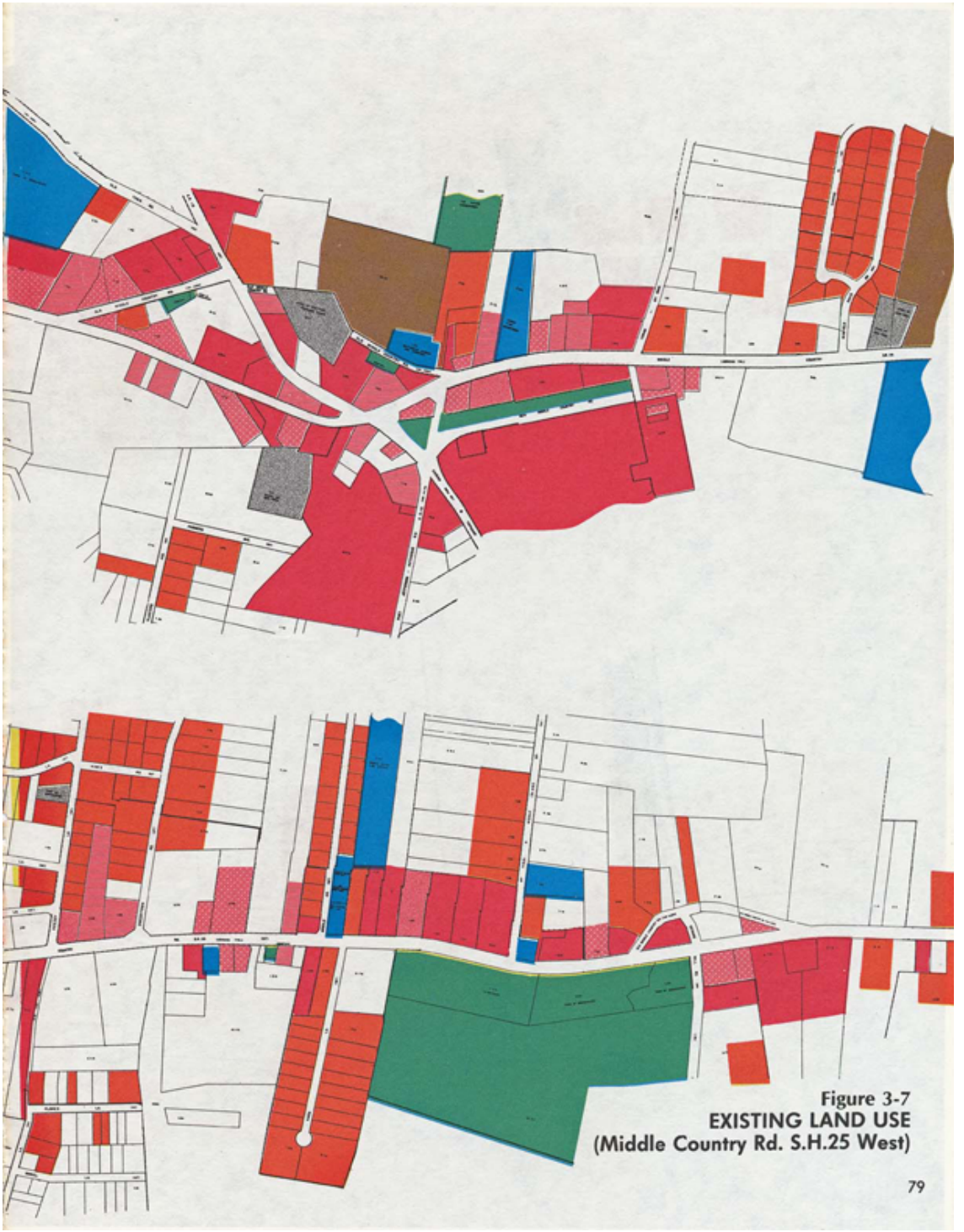

Figure 3-7
EXISTING LAND USE
(Middle Country Rd. S.H.25 West)

79

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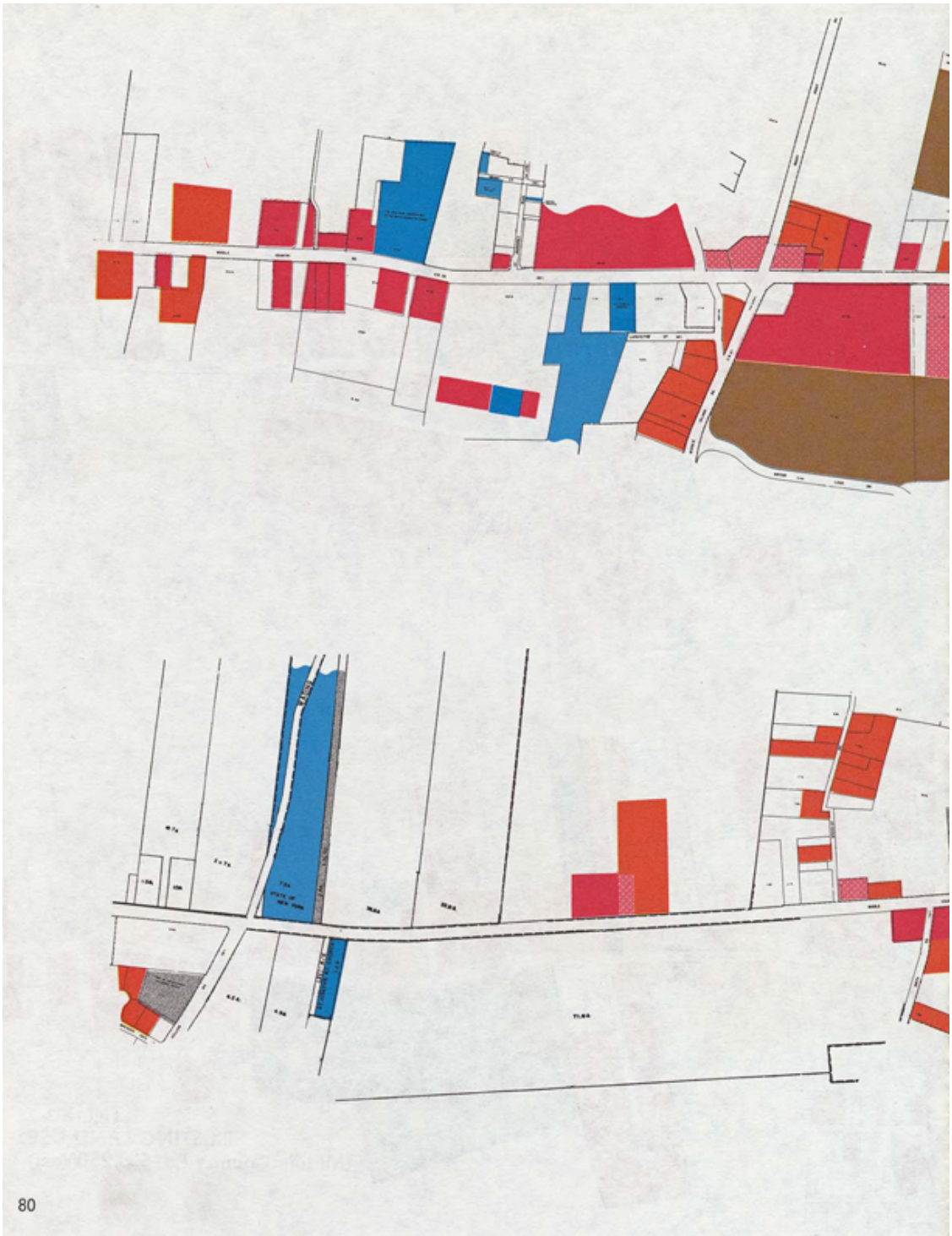

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Figure 3-7
EXISTING LAND USE
(Middle Country Rd. S.H.25 East)

P.81x

From Artist Lake east to Ridge, the majority of the parcels are vacant with little commercial development. The few commercial uses in this area include a bank, several retail establishments, and gas stations. There is a large vacant tract of land that is zoned for a shopping center; the remainder of the area is zoned for strip commercial uses and could be developed more intensively.

Two distinct commercial patterns are evident: Partially Developed Strip Commercial, and Developed Strip Commercial. The opportunity exists to limit the expansion of commercial development through changes in zoning.

There are limited industrial uses in the western portion of the study area. With the exception of those used for sand mining operations, most of the developed sites are relatively small parcels located away from the major highways.

The Transportation category includes the Coram Airport located on an 80 acre parcel. This parcel is zoned residential and is partially developed.

The Institutional category is made up of schools, churches, police stations and fire houses. These parcels are almost fully developed and little change is expected.

Zoning

The zoning districts in the study area include:

- residential single family (1 acre, 2/3 acre, 1/2 acre and 1/3 acre)
- multifamily (7 D.U./acre and 11 D.U./acre)
- commercial and industrial categories

There is also provision for planned retirement communities and nursing homes. If the zoning remains unchanged, then nearly all of this study area will require sewering. The major zoning categories in the pilot area are 1/3 acre, 1/2 acre and 2/3 acre residential (See Figure 3-8).

The commercial categories include:

- neighborhood business
- general business
- commercial center
- office building
- gas station
- duck ranch

The commercial zoning categories are located mainly along Route 25A, Route 25, Route 112 and the William Floyd Parkway. The predominant commercial zoning category along Route 25 is:

- commercial center (C-3)

The industrial categories include:

- light industry (L-1)
- heavy industry (L-2)
- industrial (L-3)
- electrical utility (L-4)

The industrial zones are located along Yaphank-Coram Road, Route 21, William Floyd Parkway and the Long Island Expressway; 422 acres of sand mines are included in this category. Most of the industrially zoned sites are zoned for light industry; however, three sites are zoned for heavy industry.

P.82x

Population

According to the 1980 Census, 27,539 people resided in the area. By 1985, the estimated population had increased by 3,000 persons. The number of households had risen by nearly 2,100 and the average household size had decreased from 2.86 persons in 1980 to 2.60 persons during the same five year period. If the current zoning remains the same, approximately 71,000 people could ultimately reside within this Special Ground Water Protection Area. This increase in residential population increases the pressure for commercial and industrial development, which in turn affect ground water quality and the retention of open space.

PROBLEMS, CONCERNS AND OPPORTUNITIES IN THE PILOT AREA

General Ground-Water Concerns

Past and present agricultural uses, heavily fertilized golf courses and lawns, existing residential development, schools and other uses are all potential sources of nitrate loads to ground-water.[1] Samples from wells underlying the recharge areas for these categories indicate some contamination. Illegal dumps, salt storage piles, underground and above ground storage tanks, and certain commercial and industrial discharges are both existing and potential sources of numerous contaminants to ground-water.

Sewage Treatment Plants

Within the project area, residential development at densities in excess of 1 D.U./acre will require sewage treatment. On the basis of existing zoning this could include most of the project area. However, opportunities exist to rezone lands to lower residential densities to protect ground water. In some areas the impacts of high densities can be mitigated by extending sewage service areas and by upgrading existing treatment plants. Almost one half of the sewage treatment plants provide only secondary treatment. Six treatment plants do not meet effluent requirements. Other causes of failure include inadequate operation and maintenance procedures which can be corrected with increased inspections and penalties.

Surface Water

The surface waters and wetlands are indicated on the Natural Resources Map, Figure 3-2. Development pressures are increasing in the Scenic and Recreational River Corridors, and in areas adjacent to freshwater wetlands and ponds. At present, no plan has been implemented for the management of the Scenic and Recreational River systems.

The are several large freshwater wetlands located next to major highways that are subject to increasing development. If the upland portions of these properties were to be developed, it could result in irreversible damage to the wetlands. These parcels can be protected now with revision of zoning and the use of site plan review and the imposition of conservation easements and/or the transfer of development rights.

Vegetation

The existing natural vegetation within the pilot area is associated with important ecosystems, including *fire climax* ecosystems, prime wildlife areas, and relatively high quality ground water. As the vegetation is replaced with fertilized lawns or other sources of contaminant loads, it can be anticipated that the reduction in the general quality of the aquifer will be accompanied by related losses among the many species in the pine barrens.

[1]208 Water Quality Management Plan, LIRPB, 1978

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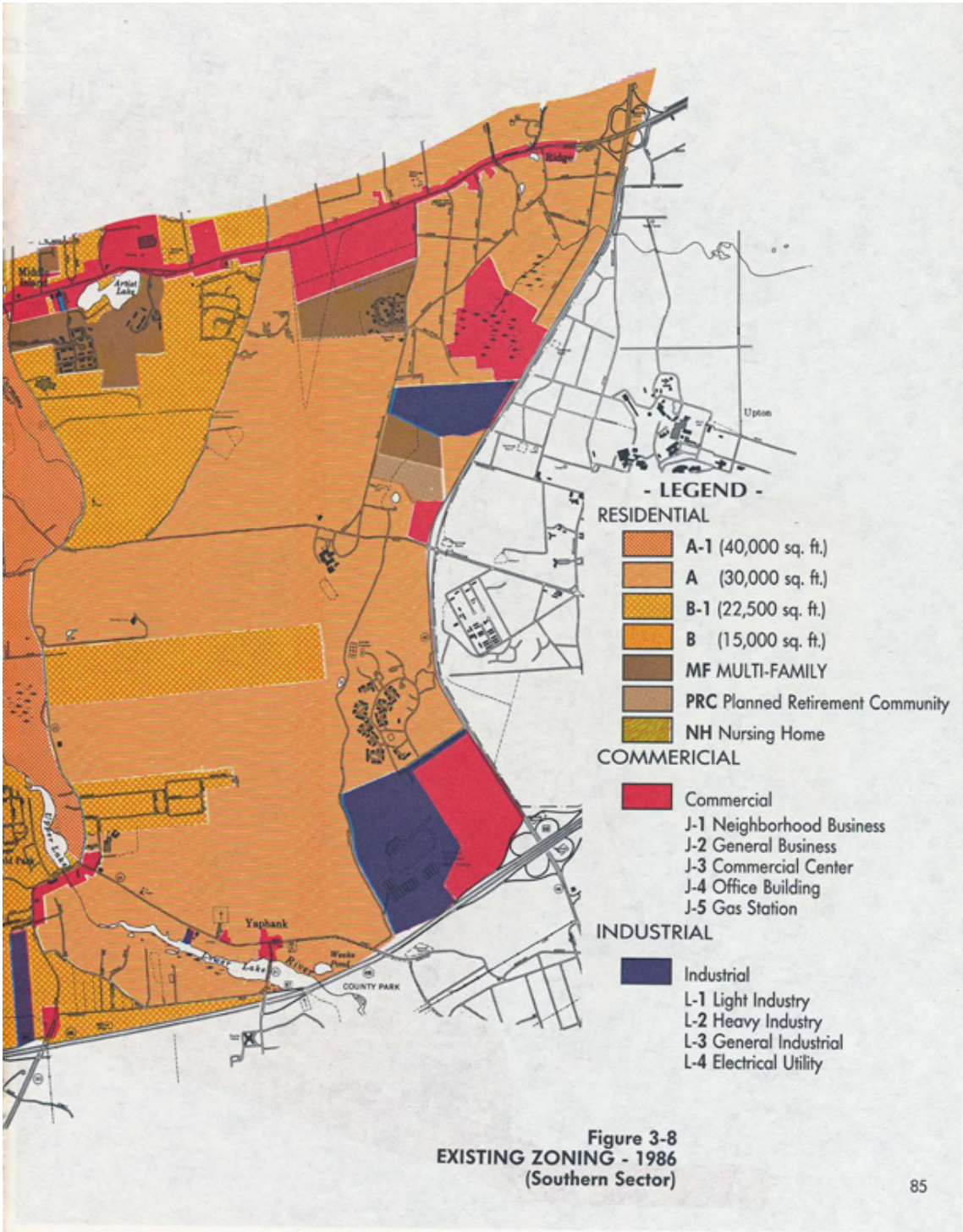

Figure 3-8
EXISTING ZONING - 1986
(Southern Sector)

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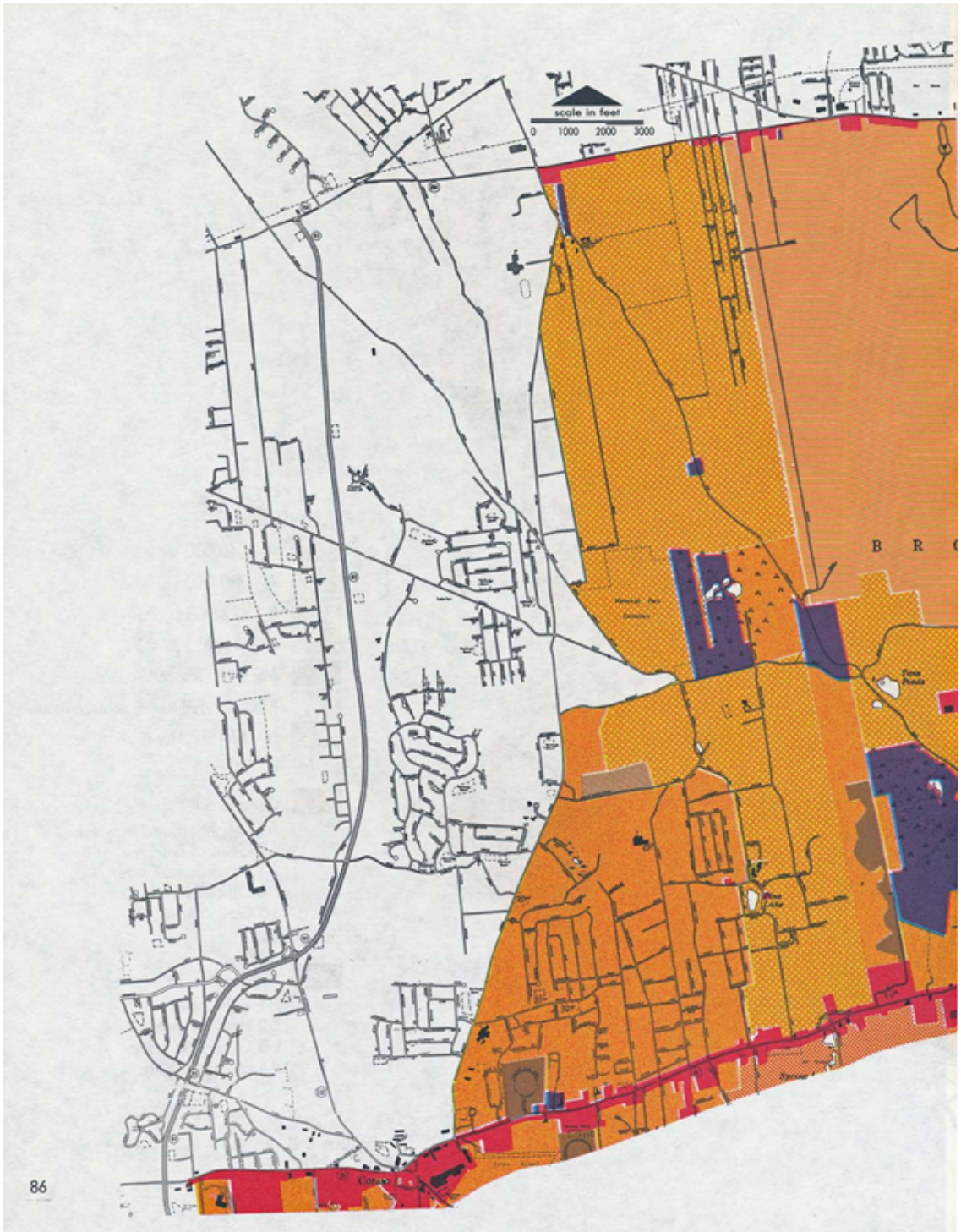

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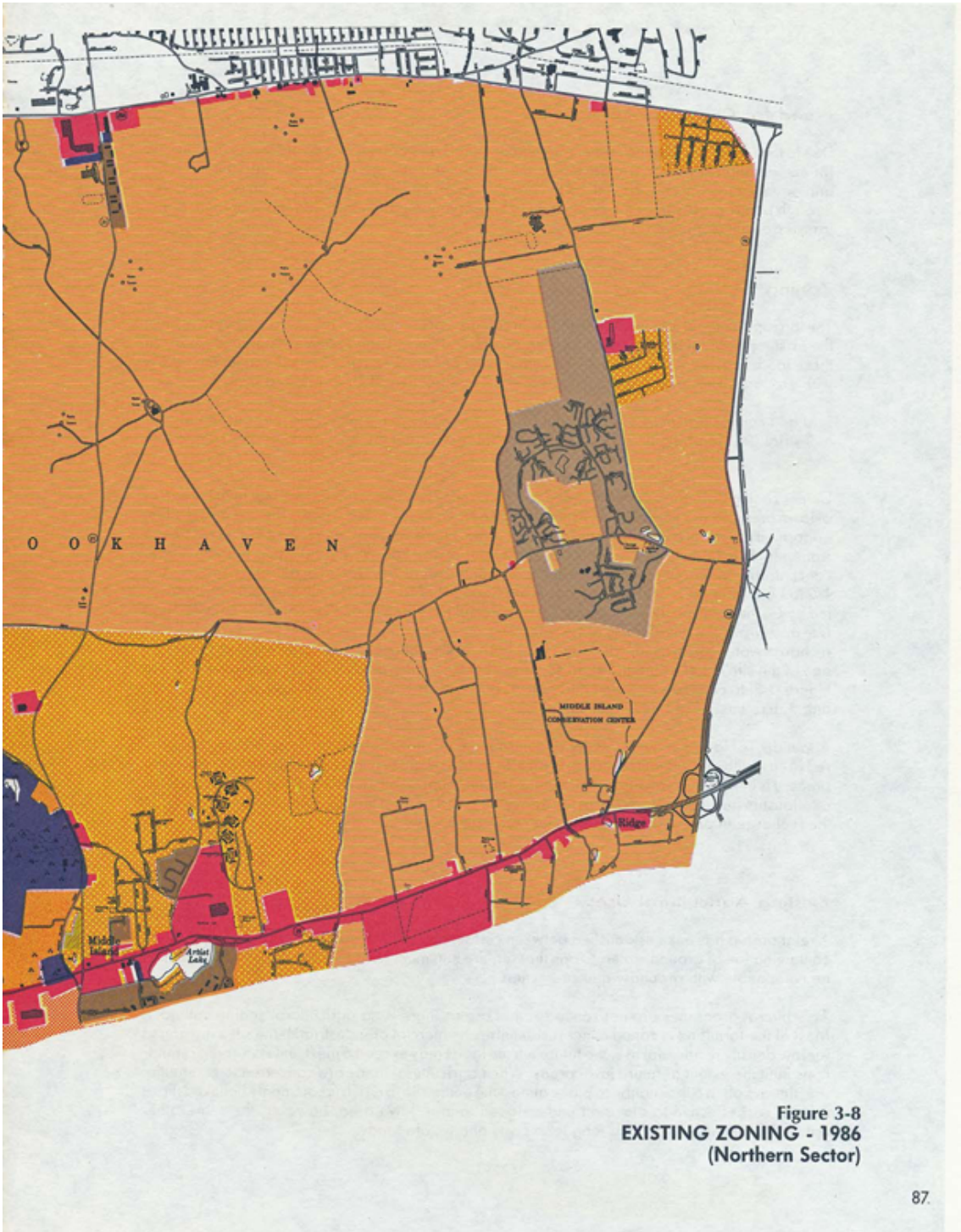

Figure 3-8
EXISTING ZONING - 1986
(Northern Sector)

87.

P.87x

Need for Open Space System

Due to the rapid rate of development, significant lands and open space corridors recommended for preservation may be lost to development. There is still an opportunity to protect the terrestial and aquatic environments as well as the ground water if these properties can be set aside now through public purchase or the dedication of conservation easements, donations of land, or the transfer of development rights.

Zoning

The large percentage of the lands in the rural category present a short term opportunity to protect the existing water quality of the underlying aquifers. Under existing zoning regulations many of these lands may be subdivided at two to four units per acre, which is considered incompatible with ground water protection (See Figure 3-9, Classification of Undeveloped Lands).

Past and current practices of piecemeal or spot zoning have permitted the introduction of new industrial uses in partially developed residential areas, and the juxtaposition of incompatible uses.

Unless zoning ordinances are amended to include site clearance regulations that limit the extent of lawn areas, future nitrate loads in the recharge water may exceed 6 mg/l. There is an excellent opportunity to reduce nitrate loads to 2, 3, or 4 mg/l in residential areas. (See the discussion in Appendix D Nitrates). Well samples collected during the 208 WTMP indicated that the nitrate concentrations in ground water underlying residential areas developed at densities greater than 1/2 to 1 unit per acre, could exceed the nitrate standard of 10 mg/l. The nitrate modeling conducted by Cornell University's Center for Environmental Research for the recent study entitled *Land Use and Ground-water Quality in the Pine Barrens of Southampton* indicates that nitrate loads in recharge water can exceed 5 or 6 mg/l for 1 D.U. on sites of one to five acres where the percentage of the site in turf exceeded 40 to 46 percent of the total area. See (Appendix Table D-2 and Figure D-2) to compare modeled nitrogen in recharge for varying percentages of turf for 2 acre and 5 acre unsewered development.

Appendix Table D-3 provides water and nitrogen comparisons between sewered and unsewered areas, with and without recharge basins. In order to reduce nitrate loadings in the unsewered areas, it is important to recharge stormwater on site. Appendix Figure D-1 graphically depicts the relationship between the amount of land devoted to turf and the modeled nitrate concentration in the recharge in an unsewered area with recharge basins.

Existing Agricultural Uses

A relationship has been established between certain agricultural uses and nitrate and pesticide contamination of ground water. Crops that require minimum fertilization and pesticide use may be compatible with ground-water protection.

Agricultural properties are not zoned for that use as there is no agricultural zoning category. Most of the farmland is zoned either residential, commercial or industrial. If the sites are zoned for low density residential use, the future nitrate loads may exceed 6 mg/l, unless zoning regulations limit the extent of future lawn areas. When agricultural lands are converted to residential use, there is often a temptation to place almost the entire site in turf. It is commonly believed that it is most cost effective to place all undeveloped land in lawn area; however, there are other options to minimize short and long term costs and nitrate loads.

P.88x

Existing Sand Mines

In many cases sand mines are industrially zoned regardless of the surrounding zoning or land use. Sand mines are a potential source of pollutants due to the illegal dumping that occurs in these locations. They are frequently used as construction and demolition debris disposal sites where illegal constituents may also be disposed of along with permitted items. With adequate supervision, these sites may be prepared for residential or other types of development using approved, clean fill. Such filling will serve to raise the existing grade and provide improved drainage and more interesting land forms. Compost materials can be be applied to improve top soil and facilitate revegetation.

Areas With High Water Table Levels

The existing water table levels are close to the surface in a number of places within the pilot area, especially at the headwaters of the Peconic and Carmans Rivers, at Artist Lake, along Route 25, and in areas with ponds, rivers, streams and wetlands. Normally the unsaturated zone acts to permit the retention or attenuation of some of the contaminants within this zone. However, due to the high water table, this action is minimal.

Protection of Water Dependent Ecosystems

If there is a significant drop in water table elevations as a result of excessive pumpage and export of ground water to other areas, then many of the ponds, streams, wetlands in the SGPA will be lost. The location of future public water supply wells can have a significant impact and should be carefully evaluated.

Protection of Ground-Water Quality

All of the study area is located within Zone III and the water quality of the underlying aquifer is generally very good. There is an urgent need to remove existing sources of contamination resulting from secondary treatment plants or from malfunctioning sewage treatment plants, improper disposal of synthetic organic chemicals from agricultural, residential, commercial and industrial establishments, and to provide proper sewage treatment where the effluent from commercial septic systems exceeds water discharge standards. In addition, ground-water contamination from future development must be prevented. These measures are required in order to assure a high quality aquifer for future uses within the study area. It is also possible that some ground water may be exported to nearby areas to augment water supply needs.

RECOMMENDATIONS FOR THE BROOKHAVEN PILOT AREA

Introduction

The goal of the recommendations is to

- maximize the recharge of high quality ground water to the aquifers
- minimize the pollutant loads from existing and future land use activities within the project area
- protect the natural environment, and the scenic, recreational, historic and archaeological resources associated with the river corridors.

In order to reduce contaminant loads, the density of future development must be reduced below that currently permitted through changes in zoning, more effective site plan review and the acquisition or preservation of critical parcels. Existing point or nonpoint sources should be minimized or eliminated and the establishment of new activities already associated with ground-water problems should be prevented.

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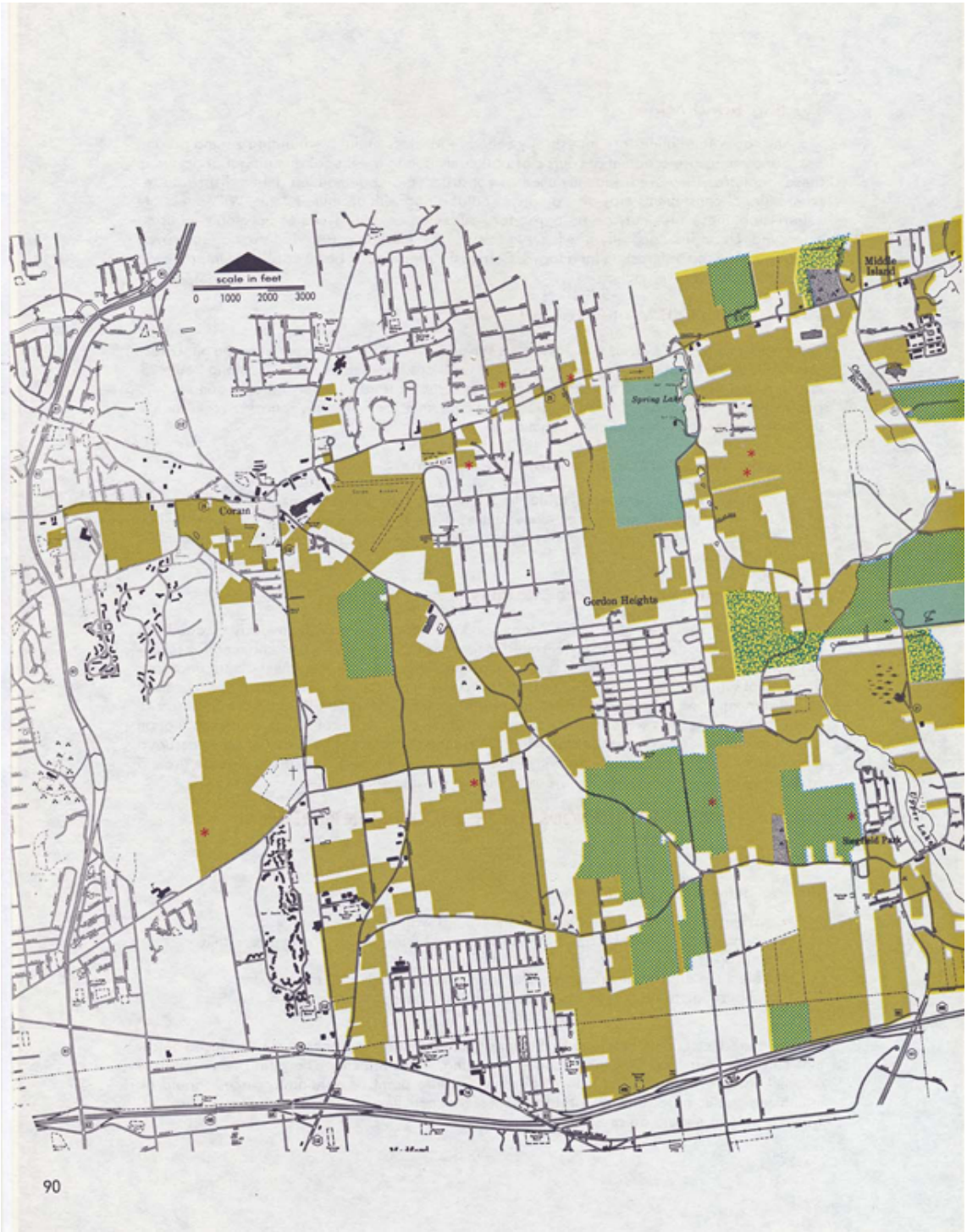
scale in feet
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Middle Island
Spring Lake
Coram
Gordon Heights
Sagtikos Pkwy
90

P.90x

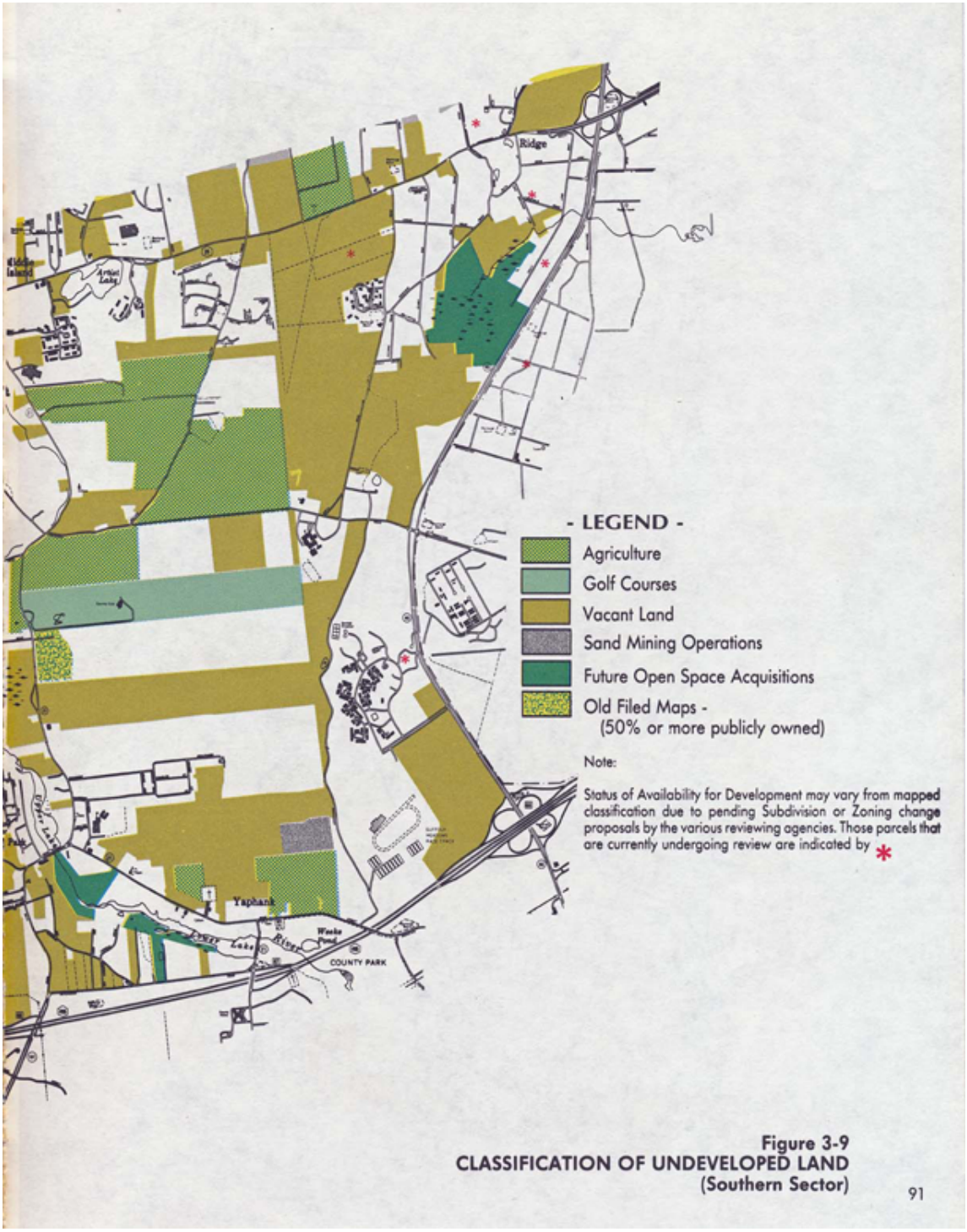

Figure 3-9
CLASSIFICATION OF UNDEVELOPED LAND
(Southern Sector)

P.91x


scale in feet
0 1000 2000 3000
B
Memorial Park Cemetery
Spring Lake
Coram

92

P.92x

Figure 3-9
CLASSIFICATION OF UNDEVELOPED LAND
(Northern Sector)

P.93x

Land Use

Some of the known land use activity impacts upon ground water can provide the justification for more stringent land use controls, in the form of zoning, site plan review and subdivision regulations. The Proposed Zoning Plan (Figure 3-10), Open Space Plan (Figure 3-11) and Potential TDR Sites (Figure 3-12), graphically represent recommended land-use patterns that reflect the goals of ground water and natural resource (terrestrial and aquatic habitat) protection as well as other planning concerns (i.e. traffic, land use compatibility, and the provision of tax ratables).

The Town should incorporate the following general land use objectives into the comprehensive plan and into the zoning ordinance in order to increase ground-water protection. See the following sections for area specific zoning, site plan, subdivision review, open space, and contaminant load reduction recommendations.

OBJECTIVES	IMPLEMENTATION TOOL A	SR	SPR	Z	PC	TDR
• Protect the existing open space and ground-water quality.	X	X	X	X	X	X
• Retain predominantly undeveloped land within one half mile of the river corridors or adjacent to wetlands as open space; or limit development to rural density residential use.	X	X	X	X	X	X
• Protect and encourage rural and low density residential development on the large undeveloped parcels.		X	X	X	X	X
• Prohibit any development of wetlands and adjacent areas. The illegal filling of wetlands for development should be punishable by substantial fines related to the extent and ecological value of the wetland acreage lost. In addition, the developer should be required to restore the wetland.		X	X	X	X	X
• Locate new high density or multi-family residential development in areas where that use already exists, where sewage collection and treatment service districts are already in place and may possibly be expanded and where the SCDHS investigations indicate adequate capacity for service area expansion.		X	X	X		X
• Limit additional strip commercial development along Route 25. Promote the infilling or clustering of new commercial uses where commercial centers already exist and where the road system can handle the additional traffic.				X		
• Limit new commercial and industrial development to those activities that do not store, manufacture, utilize or transport toxic or hazardous materials or wastes and to those areas where industrial or commercial development already exists.				X		
• Maximize high quality recharge to ground water and surface waters by minimizing site clearance and leaving as much land as possible in a natural condition. Encourage clustering, and modified lot development, where appropriate.		X	X	X		

A = Acquisition
SR = Subdivision Review
SPR = Site Plan Review
Z = Zoning Ordinances
PC = Protective Covenants
TDR = Transfer of Development Rights

P.94x

Zoning

The Town of Brookhaven should implement the following zoning recommendations:

- Eliminate spot zoning in order to prevent the juxtaposition of noncompatible land uses, such as high intensity uses within historic districts, the Scenic and Recreational River Corridors (i.e. Carmans, Peconic), or next to public open space lands, and certain commercial or industrial uses adjacent to residential areas.
- Adopt restrictive categories for commercial and industrial uses. (See commercial and industrial zoning recommendations).
- Provide for more intensive uses, such as multi-family housing and commercial development in the vicinity of Yaphank Coram Road.

Revise the zoning of vacant lands that have not yet been subdivided as indicated below.

Residential

- Upzone vacant subdividable parcels in developed areas that are presently zoned at 15,000, 22,500 or 30,000 sq. ft., to a minimum of 40,000 sq. ft. or 80,000 sq. ft., respectively. This is necessary to limit future contaminant loads to ground-water and to maximize high quality recharge.
- Upzone large unsubdivided residential parcels in environmentally sensitive areas to two to five acres per dwelling unit (See Figure 3-10).
- In areas where endangered species, freshwater wetlands and other significant resources occur, rezone the area to assure compatibility with resource protection (See Figure 3-10).
- Promote the public acquisition of land, or transfer of development rights in accordance with the Open Space and TDR recommendations (See Figures 3-11 & 3-12).

Commercial

- Rezone vacant commercially-zoned parcels that are not located in areas where commercial development exists or is now occurring. The revised zoning should be in accord with that of the surrounding area.
- Concentrate new commercial development along Route 25, east of Mt. Sinai-Coram Rd. to Artist Lake in areas adjacent to where it has already occurred.
- Rezone the area along Route 25 east of Artist Lake to low and medium density residential categories or to a combination of low and medium density residential and the commercial development categories (See Figure 3-10). Parcels submitted for site plan review should meet site clearance standards. Conservation easements should be required for the side and rear yards of commercially zoned properties along Route 25.

Industrial

- Rezone vacant industrially zoned parcels located adjacent to developing residential areas to a residential category appropriate for the area and compatible with groundwater protection.
- Amend the zoning ordinance as necessary to encourage the transfer of the development rights from industrially zoned parcels located within sensitive environmental areas to environmentally acceptable areas within the same school district. This is one option for providing tax ratables while allowing for environmental protection.

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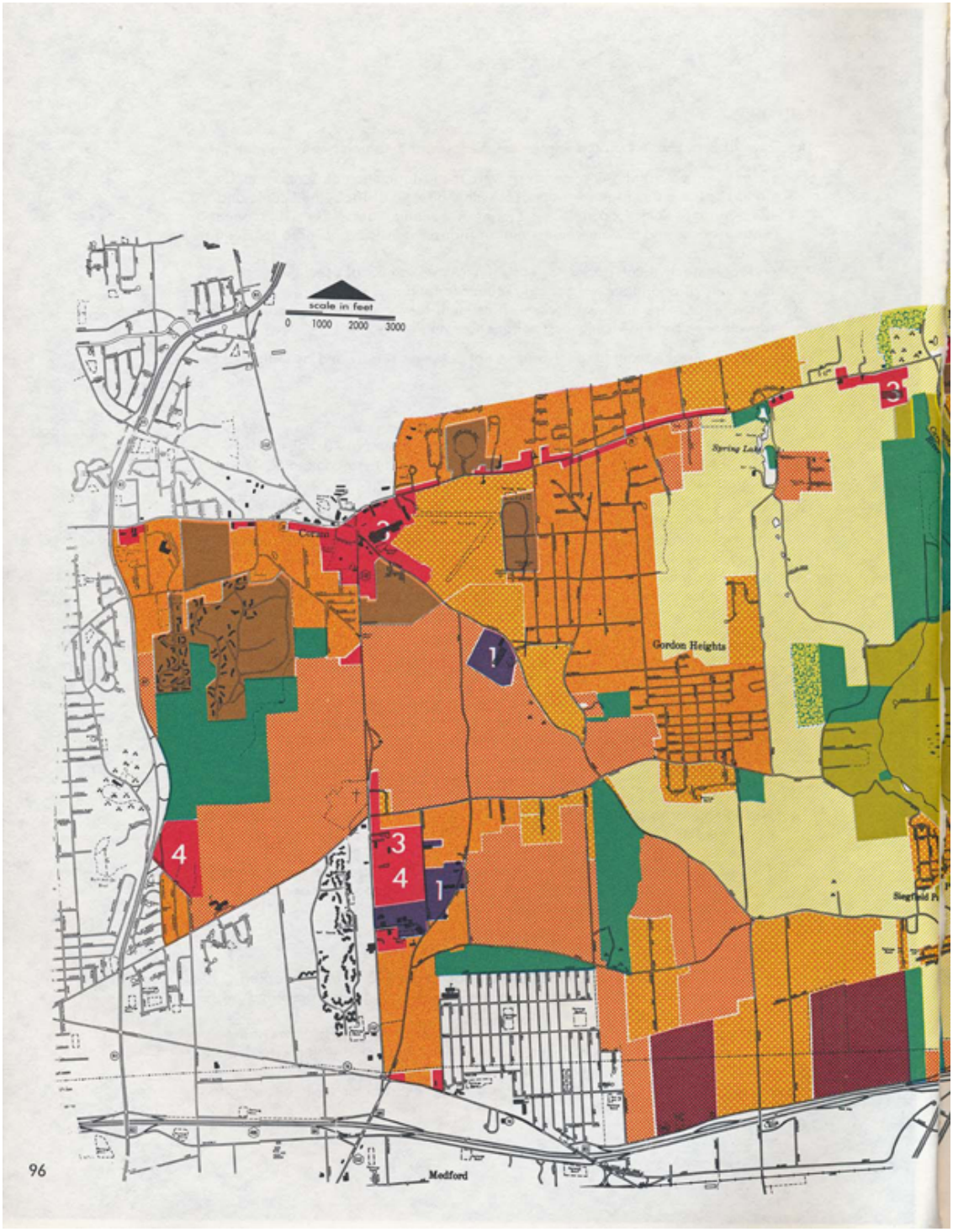

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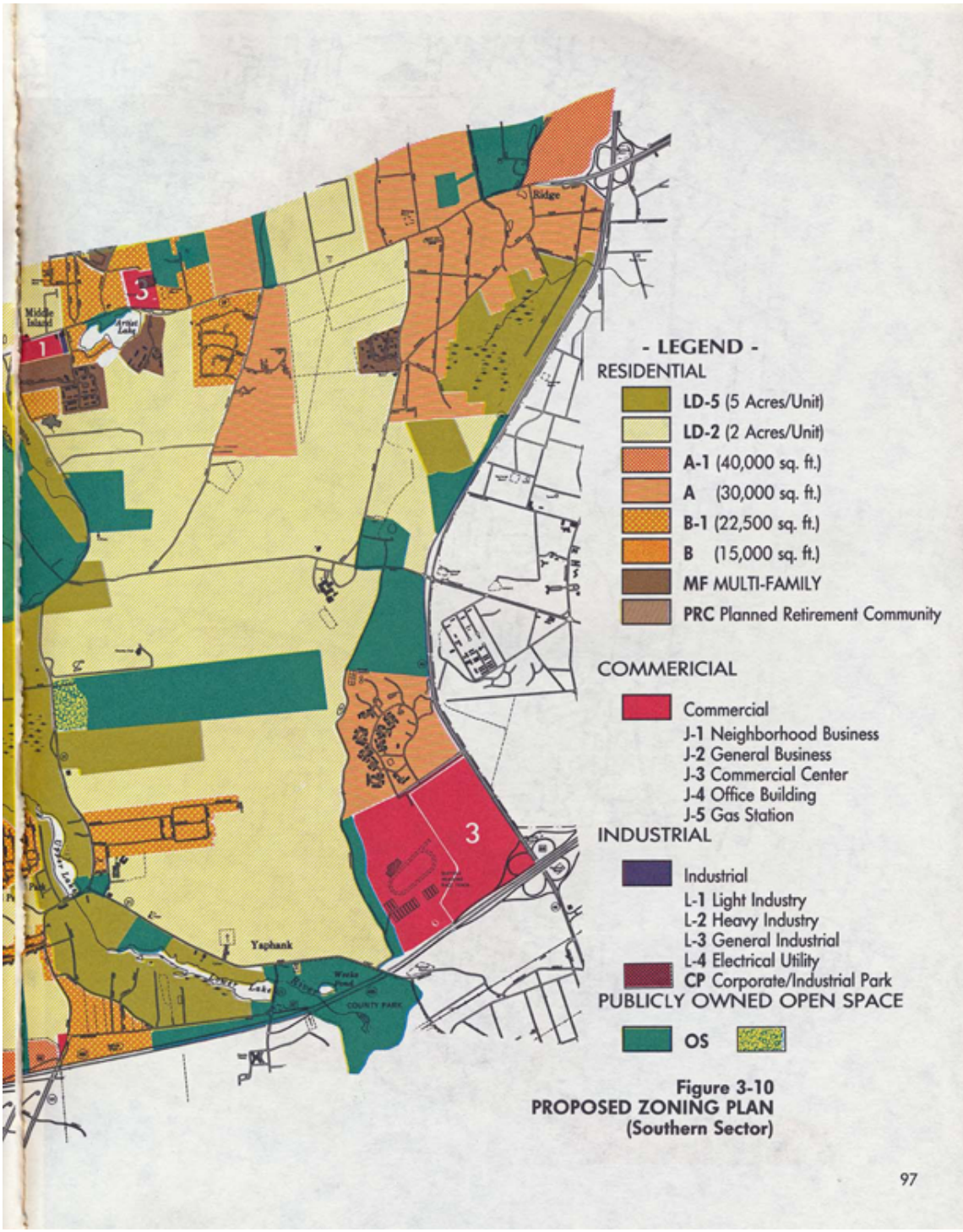

Figure 3-10
PROPOSED ZONING PLAN
(Southern Sector)

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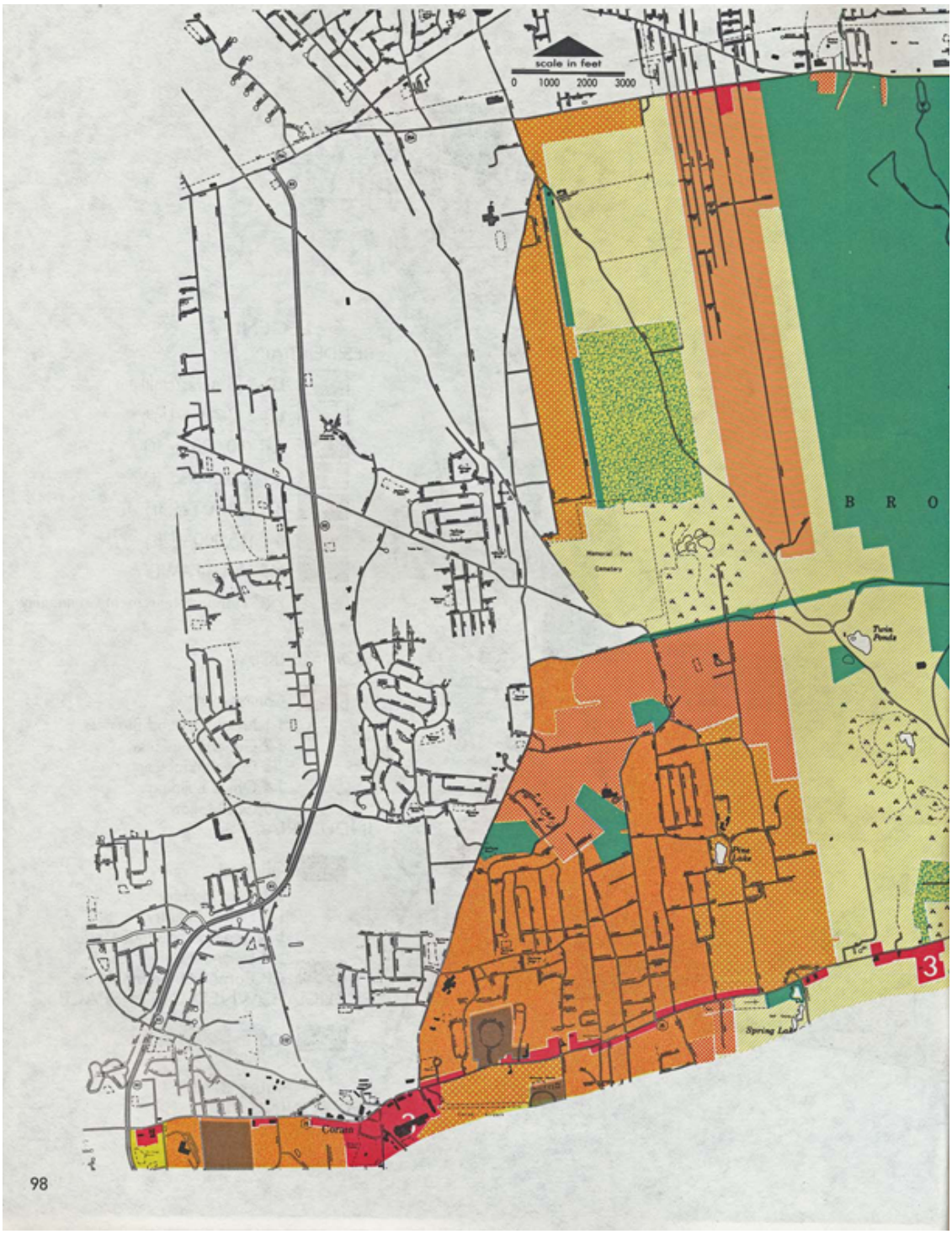

scale in feet
0 1000 2000 3000
B R O
Twin Ponds
Fire Lake
Spring Lake
3
98

P.98x

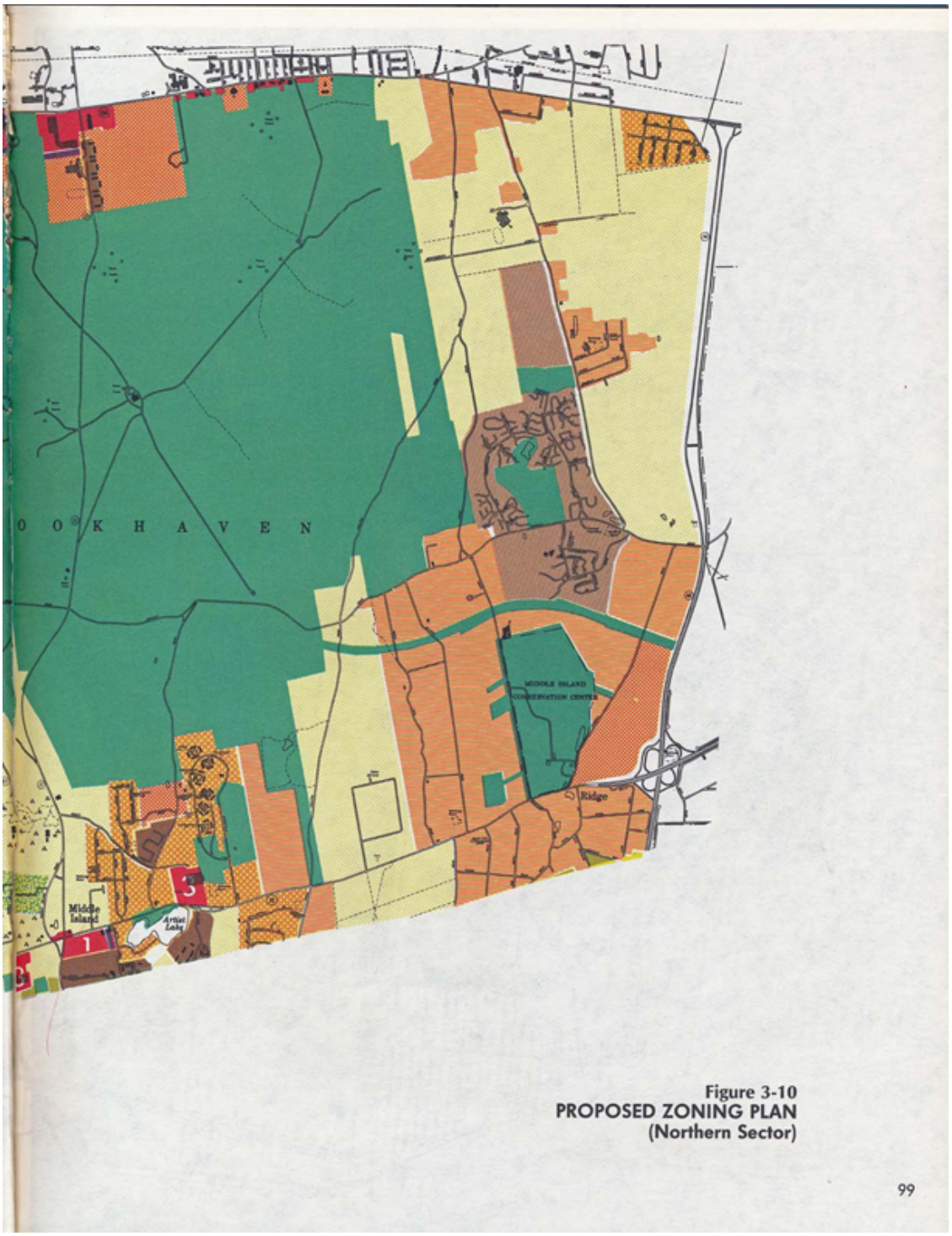


Figure 3-10
PROPOSED ZONING PLAN
(Northern Sector)

P.99x

P.100x

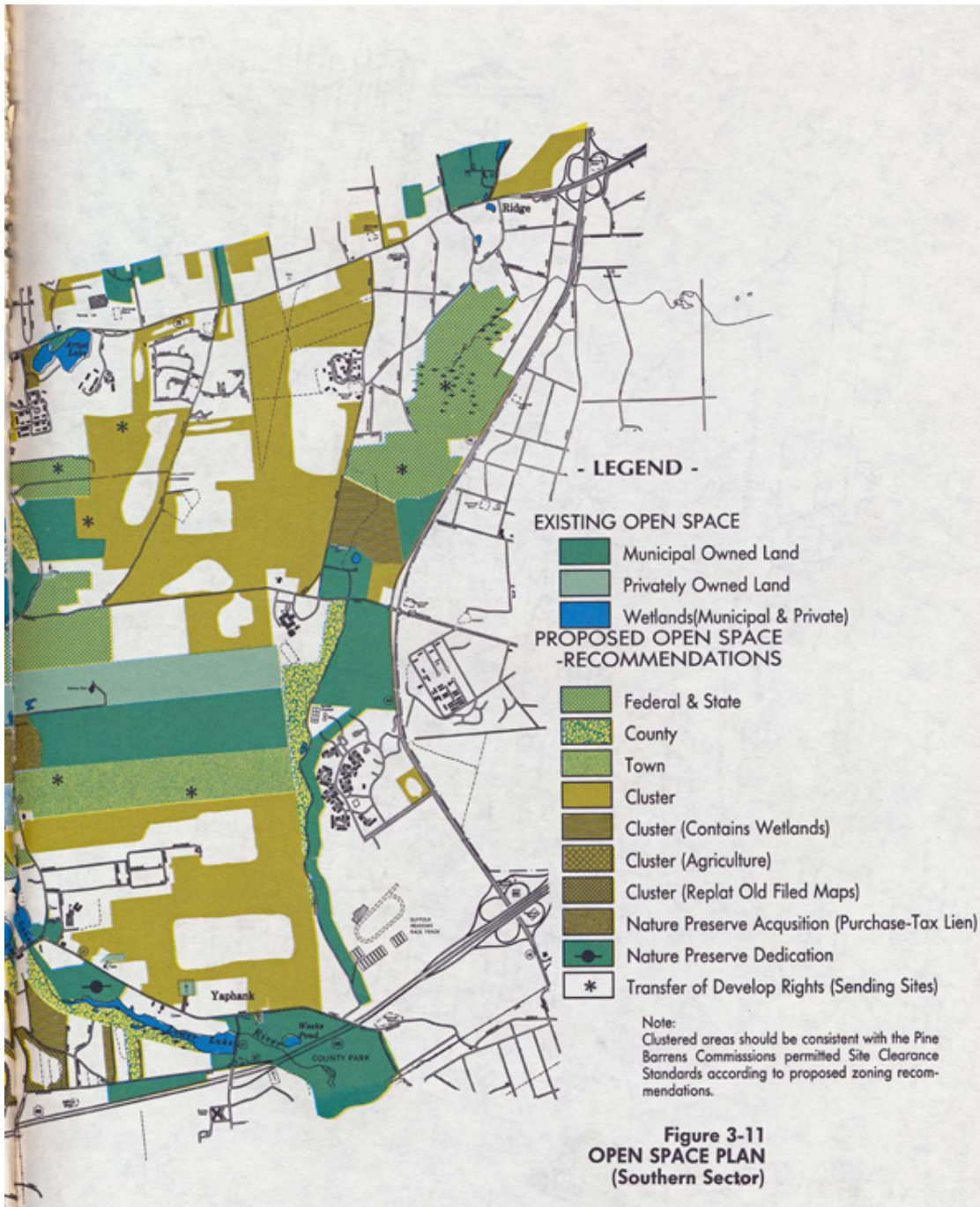
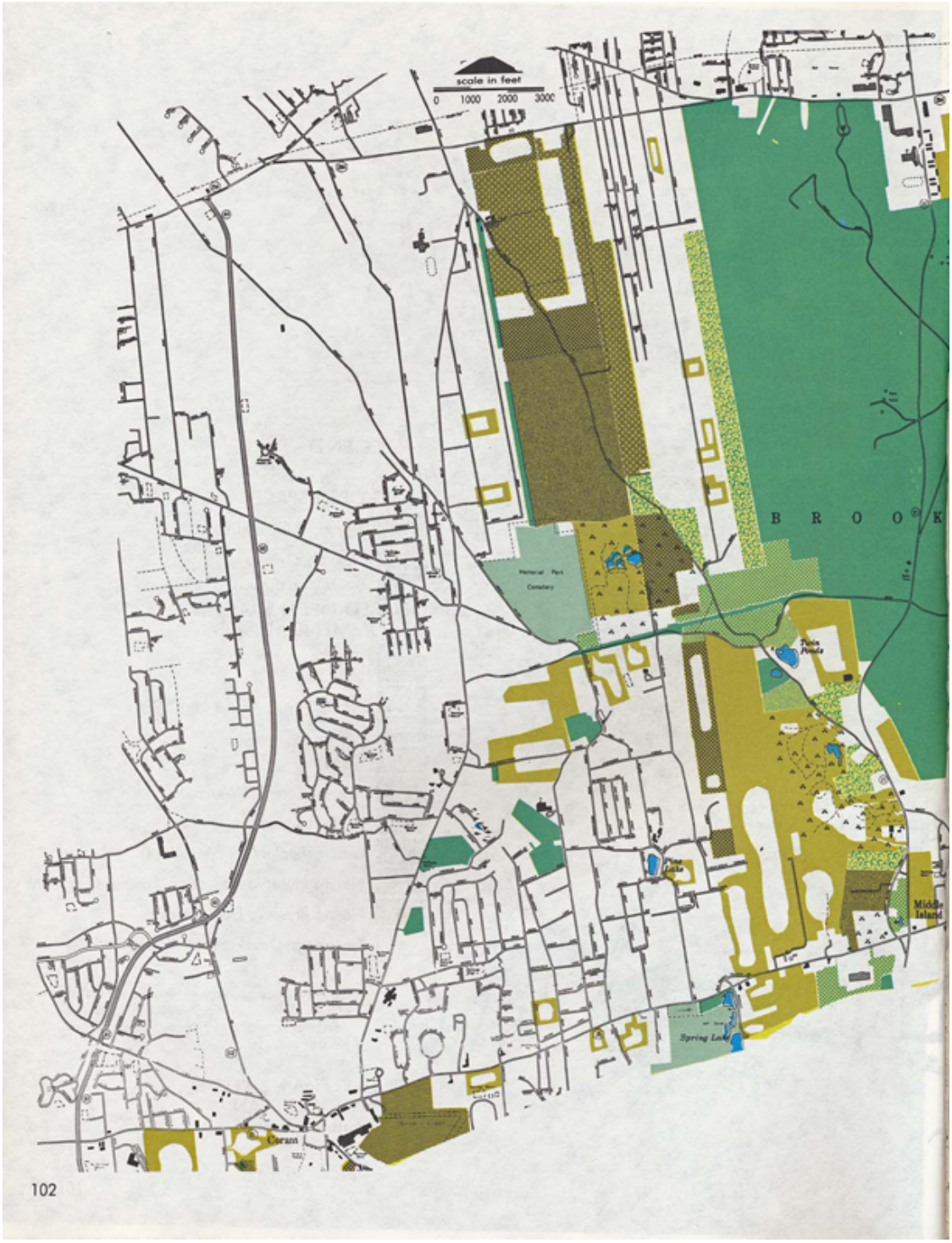


Figure 3-11
OPEN SPACE PLAN
(Southern Sector)

P.101x


scale in feet
0 1000 2000 3000
B R O O K
Memorial Park Cemetery
Three Ponds
Middle Island
Spring Lake
Ocean

102

P.102x

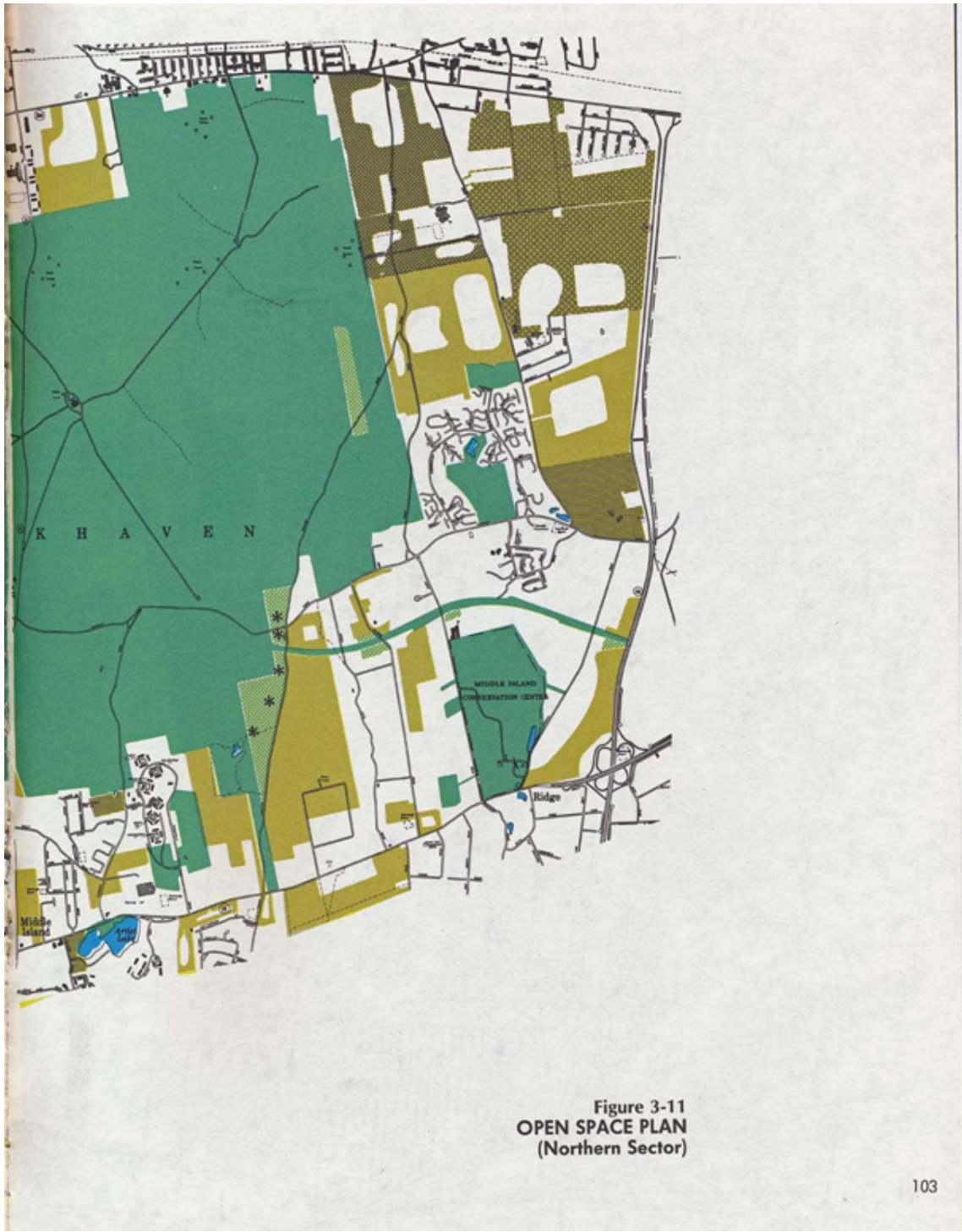
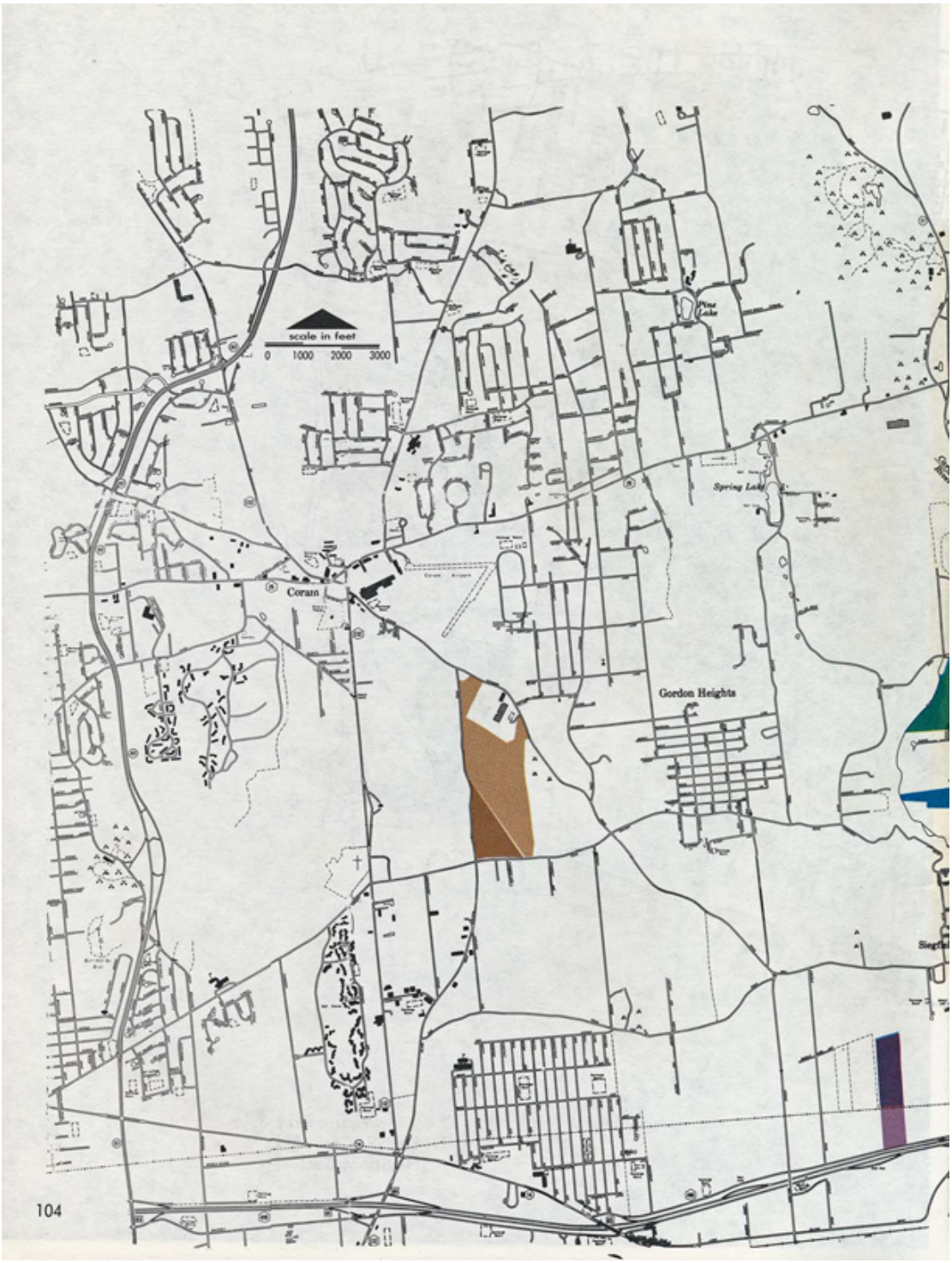


Figure 3-11
OPEN SPACE PLAN
(Northern Sector)

P.103x



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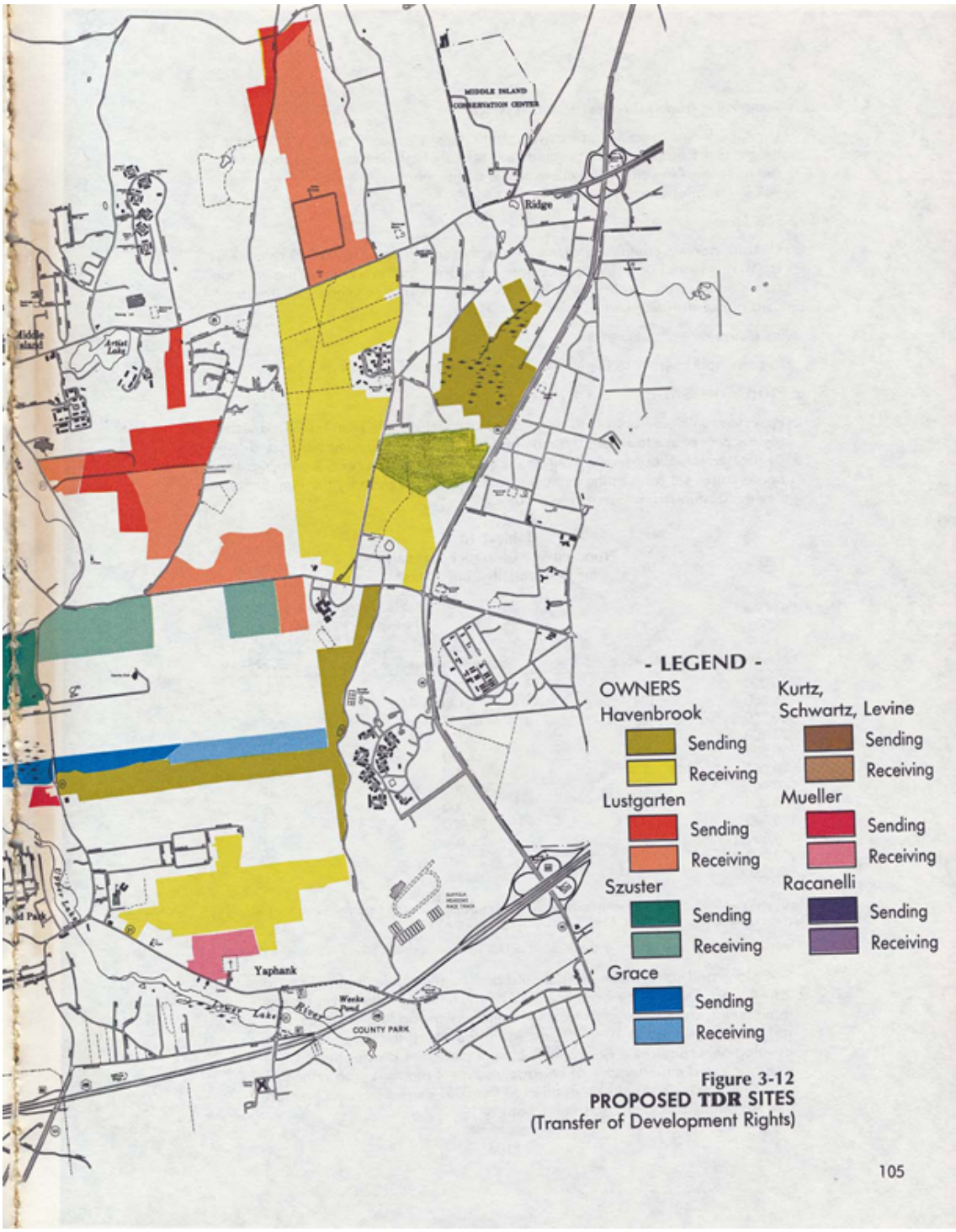

Figure 3-12
PROPOSED TDR SITES
(Transfer of Development Rights)

P.105x

Commercial and Industrially Zoned Areas

- Limit the future expansion of existing high density areas. The 40 and 50 foot height restrictions may not preclude excessively high densities and should be reevaluated. No further increases in the height standard should be allowed within the pilot area.

Sand Mines

- Upzone parcels containing active or inactive sand mines, to 40,000 or 80,000 sq. ft. residential or other appropriate categories that are compatible with the surrounding area. Existing development of the sand mines should be treated as a nonconforming use.

Golf Courses

- Rezone golf courses to the lowest density residential category.

Site Plan and Subdivision Review

- Provide municipal controls to be incorporated into a site plan and subdivision review procedure to insure the maximum protection of ground water and surface water. Clearance of vegetated sites should not exceed the applicable percentages set forth in the principles and standards used by the Pine Barrens Review Commission. (See Table 3-10).

Table 3-10
Proposed Site Clearance Standards for Residentially Zoned Lots*

Lot Size(Sq.Ft.)	Acreage	Site Clearance for Single Family Development Should Not Exceed	
		Square Footage	% of Site
10,000	1/4	8,000	80
15,000	1/3	9,100	60
20,000	1/2	10,200	51
26,400	2/3	12,300	41
30,000	3/4	13,250	46
40,000	1	14,200	36
60,000	1 1/2	17,000	28
80,000	2	19,800	25
120,000	3	23,000	19
160,000	4	26,400	17
200,000	5	29,700	15
>200,000	>5	varies	≤15

*Adapted from the Site Clearance Recommendations for Residentially Zoned Lots, prepared for the Pine Barrens Commission, March 18, 1985.

Properties that are less than one acre and are proposed for residential development will require sewering.

Site plans and subdivision plats should be designed to limit nitrogen loads to 2 to 4 mg/l. This can be accomplished by maximizing natural vegetation, maintaining stormwater on site, and limiting lawns and other areas of fertilized vegetation to 10 to 15 percent of the site. If the magnitude of the development requires a package treatment plant, the proper design, operation and maintenance of sewage treatment plants is also critical. Muncipal controls should be applied to the 205J extension area boundary. See Appendix B-3.(See Load Reduction)

P.106x

- Limit nitrogen loads for the developed portion of the site so that the maximum nitrogen concentration in the recharge water will not exceed 6 mg/l for any portion of the site and 2 to 4 mg/l throughout most of the site. For instance, if clustering is proposed, limit the total number of units so that estimated nitrogen loads in the recharge water for the portion of the site to be developed will be less than 6 mg/l. If the remainder of the property is kept in natural vegetation or non-fertilized meadow grass, the nitrogen loads for the remainder of the property should be neglible.
- Require planting plans for subdivision and site plan review applications for parcels greater than three acres. The amount of area devoted to vegetation requiring fertilization, including the lawn area, should be limited to 15 percent of the site. The Town should urge developers and homeowners to rely on species with minimal fertilizer and water requirements
- Require the inclusion of provisions for on-site recharge of all stormwater runoff from a 25 year storm in the plans for any new development. On-site disposal of stormwater runoff will maximize high quality recharge.

Open Space Recommendations

The pilot area contains several lakes and ponds, a large portion of the Carmans River Corridor, and the headwaters of the Peconic River. Most of the concepts contained in the Open Space Plan prepared by the Town for this SGPA should be adopted. Implementation will not only protect the ground-water resource but will also serve to protect unique surface waters, wetlands and woodland areas. The following actions should be accorded the highest priority:

- Protect lands now in public or quasi public ownership by rezoning them either to an open space - preservation or recreation category, that also permits residential use at one D.U./five or more acres.
- Acquire selected privately owned parcels to protect the natural resources of the area and to provide greenbelts or open space systems. These parcels may be acquired with Town funds or monies provided by State or Federal agencies. (See Figure 3-11).
- Insure the preservation of environmentally sensitive areas by placing them in the Nature Preserve category. (See Figure 3-11). The New York State DEC owned RCA property should be placed into the State Nature Preserve and Historic Trust.
- Encourage the use of the transfer of development rights (TDR) to protect environmentally sensitive recharge and wetland areas. See Transfer of Development Rights.
- Encourage clustering or modified lot development for large undeveloped parcels. Land that is reserved should be dedicated to the Town or County as a conservation easement.
- Prepare and adopt conservation easement and scenic easement ordinances. Such ordinances should provide for the development of easement preservation for single family, modified lot, and clustered residential development as well as for industrial and commercial site plan and subdivision applications.
- Require that any land covered by a conservation easement remain in natural vegetation or be permitted to revert to natural vegetation if the property has previously been disturbed. Easements should cover steep slopes; land adjacent to surface waters; wetlands, in areas where there is a very high water table; unique wildlife habitats, areas of archaeological importance or other designated sensitive areas.
- All areas subject to conservation easements should be delineated on the final map and reflected in the individual deeds of the affected parcels.

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The following recommendations apply to N.Y. State Scenic and Recreational River Corridors:

- Prohibit any site clearance within one hundred feet of surface waters or wetlands.
- Prohibit any direct discharge of stormwater runoff from new development to wetlands or surface waters. Stormwater should be directed into sedimentation basins.

Old Filed Maps

- Acquire substandard lots to prevent their development. Wherever feasible, the Town should acquire existing old filed maps that contain substandard lots and replat them to create larger lots that are compatible with ground-water protection and the environmental characteristics of the site. The Town should then sell the lots with the requirement that conservation easements be included in the deed.
- Where the County currently owns fifty percent or more of an existing old filed map, the County should continue to retain the remainder of the map through tax lien procedures, negotiated purchase or condemnation.

Transfer of Development Rights

There are several opportunities for *Transfer of Development Rights* (TDR) within the Brookhaven Pilot Area. Much of this area remains undeveloped and therefore presents a significant opportunity for preparation of a comprehensive plan in which TDR is an integral part. The TDR sites were identified in order to protect environmentally sensitive ground-water recharge areas and areas adjacent to wetlands. Figure 3-12 indicates the potential TDR sending and receiving sites that have been identified. These sites were selected on the basis of common ownerships and location within the same school district (Middle Island, SD #12). This presents one of the most efficient methods to achieve a TDR. Other more complicated methods where the sending and receiving sites are not in the same ownership or are in different school districts may also be utilized in this area.

- Establish a Town Transfer of Development Rights Program and to select a coordinator to manage the program.
- Wherever feasible, transfer the development rights from environmentally sensitive areas to other less sensitive areas.
- Coordinate the Transfer of Development Rights Program with this plan's proposed zoning and open space recommendations in order to provide the appropriate residential densities.
- Require the dedication of conservation easements covering lands that are preserved as a result of the use of TDR.

Recommendations for General Contaminant Load Reduction

Storage, Use and Disposal of Toxic or Hazardous Materials

- The SCDHS should establish a central point for dissemination of information for the storage, use and disposal of toxic and hazardous material and wastes for Suffolk County. A hot line number should be published in the newspapers and listed in several locations in the telephone book. The SCDHS should assume the responsibility for the dissemination of information and should hire the necessary staff to assure the hotline remains in operation on a continuing basis (9am-5pm).
- The Town should establish a permanent educational program to facilitate broader use of the **Stop Program**, which provides a site where the homeowner can drop off toxic and hazardous materials and wastes.

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Sewage Treatment Plants

The NYSDEC and the County should undertake the following actions to insure improved ground-water protection.

- Provide increased personnel and funding to implement the following recommendations.
  - The NYSDEC and the County should evaluate the design, operation and maintenance of all treatment plant systems in this Pilot Area.
  - Provide monitoring wells for any plants that are not currently monitored.
  - Require the upgrading of existing secondary treatment plants to tertiary treatment.
  - Insure the proper operation and maintenance of the plants by using increased site inspections and imposing stiffer penalities for violations.
  - Utilize the SPDES authority to require regularly scheduled ground-water monitoring and the upgrading of treatment plants as a condition for permit renewals.
  - Investigate the existing treatment plant operations to determine if additional capacity is available for the extension of service to adjacent developing areas.
  - Provide additional treatment plants where needed.

Salt Storage Piles

- Cover all salt storage piles with permanent structures. Establish and enforce site controls for these storage areas to prevent the discharge of leachate to groundwater. (See 208 Nonpoint Source Management Handbook, LIRPB, 1984 for guidelines).
- Consider various alternatives to minimize road salt application while protecting public safety.

Agricultural Uses

- Minimize the impacts of agricultural activities upon ground water. Encourage the selection of crops and agricultural practices that will reduce fertilizer and pesticide usage. Information on proper pesticide use and disposal can be obtained from the Cooperative Extension in Riverhead.

Developed Commercial Strip Area

- Investigate the level of compliance with the NYSDEC SPDES permit system and the Suffolk County Health Code Article 12 permit system throughout the portion of Route 25 within the pilot area. If it is determined that the establishments are not in compliance, then NYSDEC or SCDHS should initiate appropriate enforcement actions.

Existing Golf Courses

- Apply fertilizers according to need, as indicated by soil tests, in order to limit the overall future nitrate loads in the recharge water of the site due to fertilizer application. The amount of nitrates that reach groundwater increases almost exponentially as the amount of fertilizer (lbs/1000 sq. ft/year) is increased.

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Sand Mines

- Require any landowner or developer wishing to convert to a new use to meet the following conditions:
  - If clustering is proposed, limit anticipated nitrogen loads for the portion of the site to be developed to less than 6 mg/l. Individual site plan review is required in order to minimize excessive fertilized vegetation areas and future plumes. Provide a planting plan for site development that limits the amount of area requiring fertilization (including lawns) to 15 percent of the site.
  - Rehabilitate former sand mine *soils* by using leaves, wood chips and grass clippings for soil improvement following site grading. The landfilling of putrescible material should be prohibited.
- Provide for the limited supervised disposal of clean fill as needed for the rehabilitation of the mined out portions.
- Require any landowner or developer wishing to convert a sand pit to a new use to remove any abandoned cars, putrescible organic material and other specified wastes from existing sand mines prior to development.

Well Siting

- Preserve and protect sites that may be required for any high capacity public water supply wells.
  - Wherever feasible, supply wells should be located in the Magothy aquifer near the groundwater divide.
  - Provide alternative locations for the previously selected potential well sites located within the Scenic and Recreational River Corridors or adjacent to streams, ponds or wetlands, or down gradient of known plumes.

Well Permits

- The NYSDEC should develop standards for the use and discharge of nonpotable water.
- NYSDEC should consider the use of nonpotable water whenever a permit applicant does not require potable water for all of the site activities. The aquifer conditions and water quality should be evaluated in order to determine if the withdrawal of nonpotable water is a feasible alternative for commercial and industrial uses and for other nonresidential site applications. Well applicants for irrigation water for golf courses should be permitted to use water that is not considered potable due to excessive nitrate concentrations, provided that the proper safeguards for public health can be developed.
- Well permits for any well should not be granted if the proposed pumpage would result in a significant reduction of stream flow, loss of wetland acreage or lowering of the water table in ponds.
- NYSDEC should consider requiring a DEIS that has been scoped down to address ground-water quality, wetlands, stream flow and ground-water level impacts prior to the issuance of a permit for a well with a capacity greater or equal to 45 gpm and located within one half mile of a public water supply well.

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Public Education for Residents and Owners of Businesses and Industries:

- NYSDEC; the County, including the Cooperative Extension Service, and the Town should increase public education efforts to encourage voluntary compliance with proposed groundwater protection measures such as limiting site clearance, fertilizer usage and improper disposal of consumer products. For those areas served by public water, information regarding techniques to protect and conserve ground water should be provided by the water purveyor. See Water Conservation Appendix A.
- Commercial and industrial education measures should be implemented to encourage proper use and disposal of toxic and hazardous materials and wastes.

Appendix Outline

Appendix A	-	Water Conservation
Appendix B	-	Boundaries
Appendix C	-	Water Quality
Appendix D	-	Land Use and Nitrate Standards
Appendix E	-	Population

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