1984

WATERSHED SENSITIVITY DISTRICTS IN MIDDLETOWN, RHODE ISLAND

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WATERSHED SENSITIVITY DISTRICTS

IN

MIDDLETOWN, RHODE ISLAND

BY

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A Research Project Submitted in Partial Fulfillment
of the Requirements for the Degree of

Master in Community Planning

in

Community Planning and Area Development

University of Rhode Island
1984

MASTER OF COMMUNITY PLANNING

RESEARCH PROJECT

OF

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Acknowledgements

I would like to thank the following people who provided the expertise, support, and understanding without which this research project would not have been possible: Dr. John J. Kupa, my major professor, and the other project committee readers: Dr. Thomas D. Galloway, Director of the Graduate Curriculum in Community Planning, and Sue Kiernan, Director of Save The Bay's Aquidneck Island Project.

I would also like to thank Rick Keller, planner from the Rhode Island League of Cities and Towns for his comments and constructive criticism, and Maia L. Champlin from Save The Bay for her dedicated and excellent job in editing and typing this report.

Lastly, I would like to thank Milton and Carmem Araujo, my parents for their support and belief in my ability to do well which helped me get through the tougher parts of this learning experience.

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Watershed Sensitivity Districts in Middletown, RI

Abstract

The drinking water system serving over 50,000 residents of Aquidneck Island is comprised of nine reservoirs located in five separate Rhode Island Communities. Urban runoff, erosion and sedimentation caused by poor development practices has threatened both the quality as well as the quantity of this water supply. Despite a certain recognition of these problems, development within the drinking water watershed areas will continue to follow the same traditional patterns unless the local communities adopt stronger land use control measures.

Due to the geologic characteristics of the Island, existing groundwater resources on Aquidneck are limited. Thus, Newport, Middletown and Portsmouth rely on surface water reservoirs for their drinking water supply. However erosion and subsequent siltation has reduced the reservoirs' dependable yield 25 percent from their original capacity. In spite of their obvious importance to these communities the watershed areas of these reservoirs are not given any special protection.

The town of Middletown has recently recognized the importance of this issue in its new Comprehensive Community Plan adopted in May, 1984. The plan recommends that watershed sensitivity districts be established as a new zoning category. Through the adoption of innovative land use controls Middletown expects to avoid significant pollution of runoff, and to protect reservoirs and waterways against erosion and sedimentation.

The purpose of this research project is to carry out a watershed protection study to be used as a guide in the implemen-

tation of this recommendation. This report intends to provide the necessary information to town officials and local residents for better understanding of the importance of reservoir watershed protection regulations and their benefits to water quality. The report is organized into four chapters containing a summary of watershed data, a discussion of different alternatives for watershed protection and recommended tools for implementing watershed sensitivity districts in Middletown.

The content of this report is summarized as the following:

Chapter I: Natural Resources Inventory consists of a survey and analysis of fresh water resources, soils, vegetation and other natural features of the study watershed areas within the context of Middletown and Aquidneck Island.

Chapter II: Development Patterns and Growth Trends includes an inventory and analysis of present and projected land use within the study watershed areas. Growth trends islandwide and their potential impact to the study areas are discussed in light of the existing public utilities and development pressures.

Chapter III: Alternatives for Watershed Protection introduces a review of land use control criteria which relate to watershed protection. Their implementation and effectiveness are assessed according to previous experiences in other communities as well as to the state and local regulatory framework.

Chapter IV: Watershed Protection Plan and Recommendations presents a plan for watershed protection and discusses three alternative scenarios for the implementation of sensitivity districts in Middletown, RI.

Chapter I - Natural Resources Inventory

Narragansett Bay provides the immediate setting for Aquidneck Island's natural resources. Aquidneck, which is the Bay's largest island, covers about 39 square miles and is situated between the East Passage of the Bay and the Sakonnet River. The Island's topography, generally higher in the middle with gently rolling hills sloping down toward the bay, is unique in that it provides a majority of the island witha view of a coastal water body. (See Fig. I.1.)

Middletown is one of the three communities that occupy Aquidneck Island. As a mix of suburban residential development and farmland, Middletown represents an intermediate stage of development between the urban character of Newport to the south and the still predominantly rural town of Portsmouth to the north (see Fig. I.2). The island is a patchwork of scattered development, open space and active farm land.

On Aquidneck Island, there is considerable pressure for development. Middletown and Portsmouth have significant tracts of open, undeveloped land and are vulnerable to "suburban sprawl" development patterns. In order to avert sprawl and direct land development in an environmentally sound manner, these communities need to adopt and administer additional land use control measures. This study explores one of the various strategies available for better land use and growth management. Making sound decisions on the use of environmentally sensitive areas requires a complete consideration of natural resources data in the decision-making process.

FIGURE I-1
Narragansett Bay and Aquidneck Island

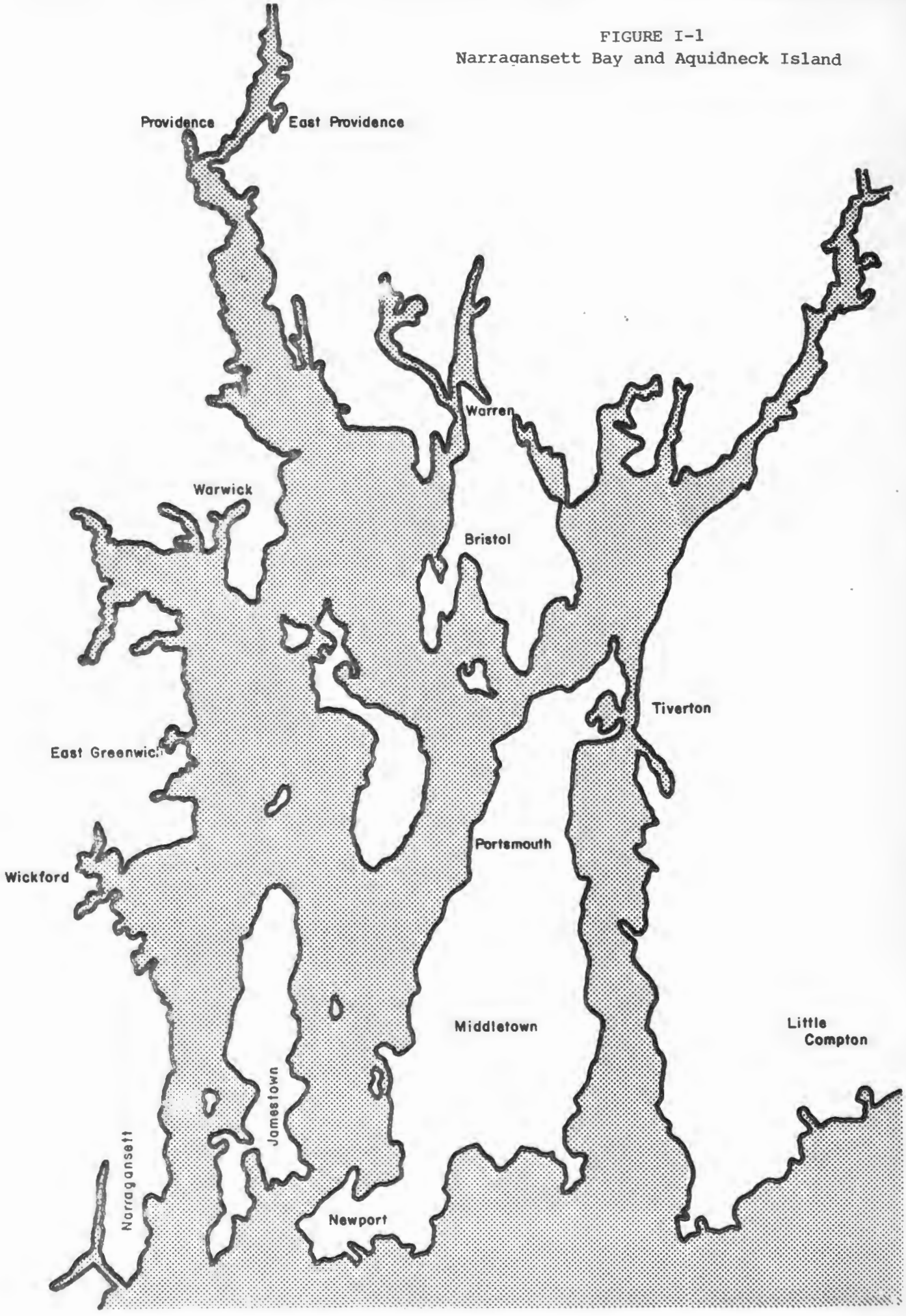
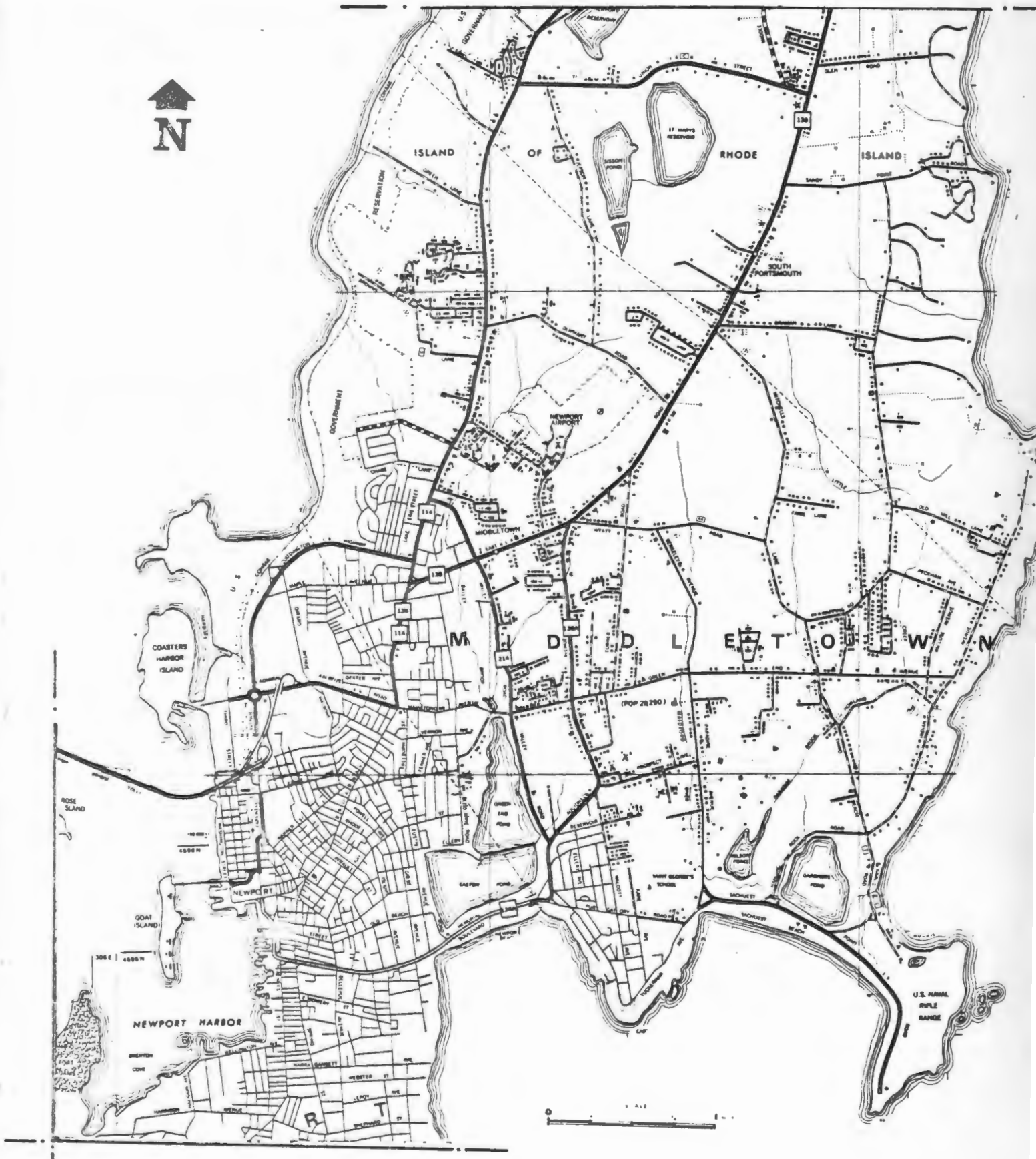


FIGURE I-2
Town of Middletown, Rhode Island



Source: Rhode Island Department of Transportation
Newport County Highway Map-1979

The first chapter of this report identifies and analyzes the land characteristics of the study watershed areas within the broader context of Middletown and the general natural environment of Aquidneck Island.

1. Freshwater Resources

The freshwater resources on Aquidneck Island, the source of which is precipitation (an average 42 inches of rainfall and snow per year), are limited. Most of the available fresh water is contained in a network of streams, ponds and shallow reservoirs. Because the island is small and its topography divided into many drainage basins, there is insufficient land area to catch enough precipitation and runoff to form large rivers or streams. Furthermore, geologic conditions, consisting of shallow soils with a hardpan layer covering a bedrock base, prohibit the accumulation of any significant amount of groundwater.

According to the U.S. Geological Survey, there are twenty-six streams on Aquidneck Island. Most of the streams are small and many are unnamed. Collectively, these streams form the natural drainage system for the island that ultimately discharges runoff into Narragansett Bay, the Sakonnet River or Mt. Hope Bay. The four major streams on the Island are: Maidford River, Paradise Brook, Bailey Brook and Little Creek. The former three are located in Middletown and they are part of the watershed system studied in this project (see Fig I.3).

The Maidford River, which flows 3.8 miles through Middletown, is the longest and largest stream on Aquidneck Island. It is a coastal stream originating north of Wyatt Road on Slate Hill where the land use is mostly agricultural. It then flows parallel to Paradise Avenue, through a residential area, flows through a wetland north of Second Beach, and empties into the Sakonnet River at Third Beach.

The watershed area drained by the Maidford River is 2260

FIGURE I-3
Aquidneck Island's Drinking Water Reservoir Watersheds

Source: Save The Bay Inc. Aquidneck Island Project-1982

acres (3.5 square miles) in size. Paradise Brook joins the Maidford River at the downstream end of the watershed and accounts for about 22% of the total watershed area with 490 acres of additional drainage surface.

There are two small man-made ponds in the lower portion of the watershed. Both serve as public water supplies for Newport and Middletown. Paradise Brook supplies Nelson Pond, and water is pumped from the Maidford River to fill Gardiner Pond. The whole Maidford River-Paradise Brook watershed receives an average of 42 inches of rainfall annually, and about two-thirds of this runs off the land.[1] (See Fig. I.4)

Bailey Brook, which is about 3 miles long, is shorter than the Maidford, but it drains a larger watershed area of 5 square miles in Middletown and Newport. It originates from two small streams north of Oliphant Road close to the Portsmouth town line and flows south parallel to West Main Road and across East Main Road before emptying into Easton's Pond in Newport. This watershed was found to be the most highly urbanized among reservoir watersheds on the Island. In 1982, sixty per cent of the land was in urban uses as opposed to the Maidford River watershed which has only 25% of its area urbanized.[2]

Bailey Brook is an especially important fresh water resource because it is related to the Island's drinking water supply in several ways. First, its discharge supplies the bulk of raw water for the Easton's Ponds, which supply the treatment plant that produces about 60 percent of Newport's drinking water. Second, the Brook's discharge is a pollution source that introduces nutrients and sediments into the ponds. Third, when

necessary, Bailey Brook acts as a channel for transmitting water bypassed from St. Mary's Pond in Portsmouth to Eastons Pond. This function is vital to the reliability of the drinking water system. (See Fig. I.4)

Seven of the ten major ponds and reservoirs on Aquidneck Island were constructed or expanded as manmade reservoirs to supply the Island's drinking water system. All of them are shallow and have limited volumes which total 1,797 million gallons for a 5.6 million gallons per day (MGD) wet weather yield of drinking water.[3] The Island's topography prohibits the possibility of any significant expansion of this volume. Furthermore, due to sedimentation and consequent siltation the capacity of certain ponds has been reduced up to 50%.[4] Dredging will be necessary to restore the original volumes of the ponds. (See Table 1-A.)

2. Wetlands

Aquidneck Island has both fresh water and salt water wetlands. In 1982, the total acreage of wetlands on the Island was 912 or 3.8% of the land area.[5] About two-thirds of these are fresh water wetlands, mostly located in the eastern and central parts of the Island. (See Fig. I.4.)

This study is particularly concerned with the fresh water wetlands within the surface water reservoir watershed areas. In Middletown, wetlands comprise 6% of the total land area. There are 242 acres of open water, 29 acres of salt water wetlands and 478 acres of fresh water wetlands.[6] These wetlands serve several functions including flood protection, erosion control and pollution abatement. As an integral part of the area's drainage

TABLE I-A

Drinking Water Reservoirs in Middletown

Watershed	Watershed Area (sq. mi.)	Reservoir	Construction Date	Acres	Usable Capacity* (mg)	Yield
Bailey Brook Watershed	3.75	Easton North	1876	110.4	336	2.5
		Easton South	1876	147.0	398	
Maidford River Watershed	.62	Nelson Pond	1883	29.7	99	1.7
Paradise Brook Watershed	2.25	Gardiner Pond	1900	72.9	360	

*mg - Million Gallons
Capacity reduced due to sedimentation. Exact amount unknown. Estimated to be up to 50% reduced.

Source: Newport Water Department

system, these wetlands are capable of controlling storm or flood waters by temporarily storing and then slowly releasing the waters. In these areas wetlands are especially valuable as protective buffer strips around reservoirs used in the drinking water system.

In addition, wetlands are extremely productive ecosystems and excellent sources of nutrients and food for many types of wildlife. They also provide nesting sites, breeding grounds and protective cover to a diverse number of terrestrial and aquatic animal species. Finally, wetlands have recreational, educational and high aesthetic value.

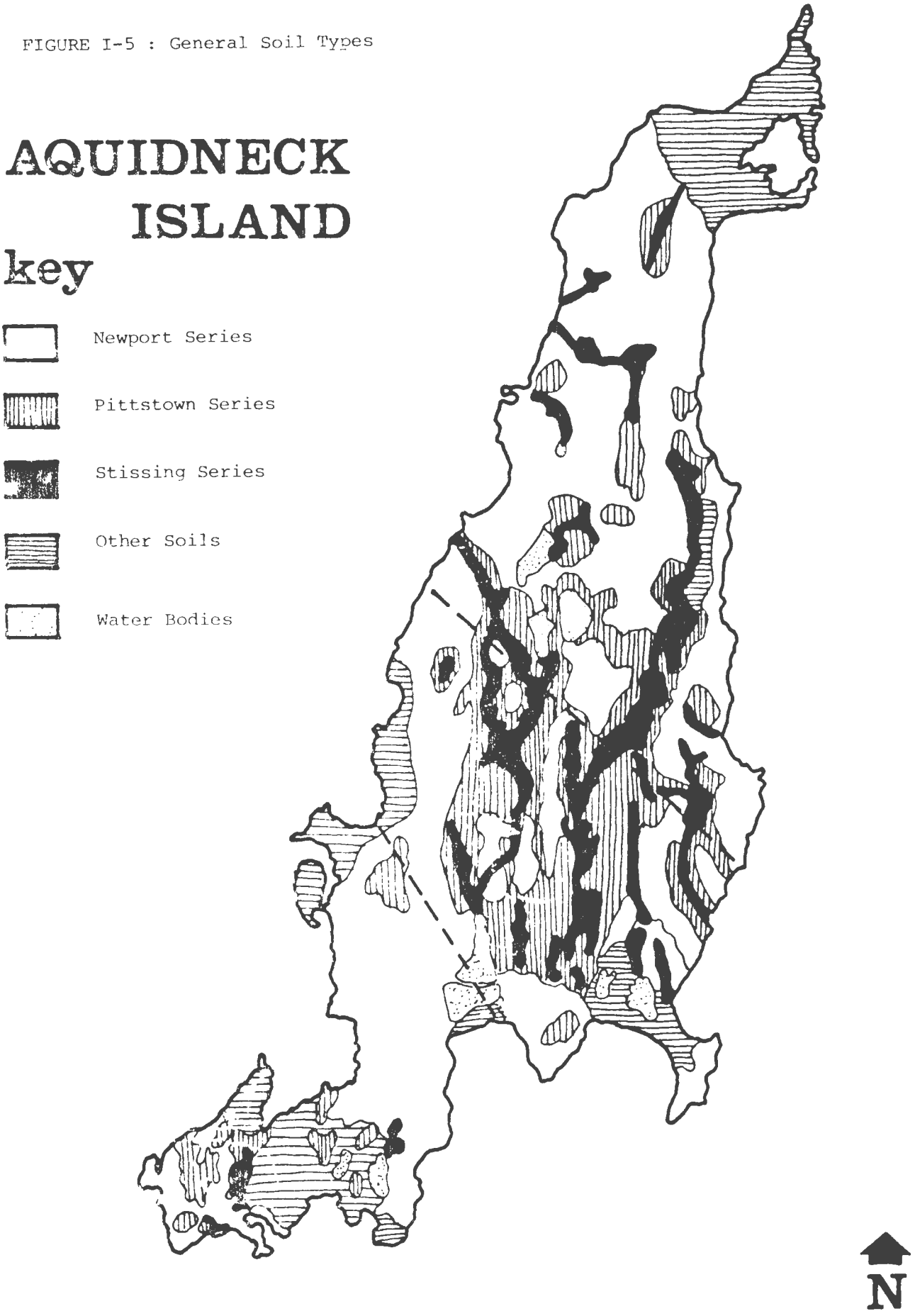
3. Geology and Soils

The soils of Aquidneck Island consist primarily of shale, with smaller amounts of sandstone and conglomerate rock. Similar to the rest of the Narragansett Basin, these soils are derived from unconsolidated glacial till with the exception of the northern tip of Portsmouth which contains soils formed from a well-sorted deposit of gravel and sand.

Most soils in Middletown, as on the rest of Aquidneck Island, are largely comprised of glacial till with a slowly permeable fragipan. Most local soils are subject to a high seasonal water table and present severe constraints for development. (See Fig I.5.)

The land on Aquidneck Island is generally rocky and covered by a relatively thin layer of soil. The fragipan, located 20-30 inches below the surface, affects the permeability of the soil and restricts downward movement of water. Soils in Middletown often have a moderate to high runoff potential due to their

FIGURE I-5 : General Soil Types



Source: Adapted from RI Soil Survey,1981

composition. The loamy, brittle subsurface soil horizon is low in porosity and organic content, and high in sand or silt content.

There are forty different soil groups on Aquidneck Island. Three of them are predominant in Middletown and in the study watershed areas: Newport, Pittstown and Stissing soils. Tables I-B and I-C describe the soil types and their extent in Middletown and the study watershed areas.

Table I-B

Acreage Composition by Series
Middletown, RI

Series Name	No. Acres
Pittstown	3,960
Newport	2,026
Pawcatuck*	82
Beaches*	79
Mansfield*	120
Rock Outcrop - Hollis Complex*	137
Hollis*	44
Stissing*	1,041
Cut and Fill	530
Paved Area	233
Other Minor units	88
	8,340

*Soils Prohibitive to community development = 1,503 acres (18%).

Source: Interim Soil Survey Report for Town of Middletown, RI - U.S.D.A., Soil Conservation Service, 1976, p. 15.

Table I-C

Percent Distribution of Main Soil Types by Watershed Area

Series Name	Middletown*	Bailey*	Maidford*	Paradise*
Newport	24.3	10.3	6.7	7.1
Pittstown	47.4	80.8	81.7	74.3
Stissing	12.5	5.2	10.8	2.7

*Percentage calculated with the following acreage totals: Middletown - 8,340; Bailey's Brook Watershed - 3,100; Maidford River Watershed - 1,360; Paradise Brook Watershed - 930 acres.

Source: Rhode Island Soil Survey

According to the Rhode Island Soil Survey, the Newport soil series is well-drained, coarse silt loam, with moderate to rapid permeability in the surface layers (top eight inches) and subsoil. In the substratum, which extends down at least sixty inches, permeability is slow to very slow, and as a result Newport soils are classified as having severe limitations for septic tank absorption.

Similarly, the Pittstown soils are moderately well drained and have moderate and slow permeability in the upper and lower layers respectively. These soils are found on the side slopes and crests of upland hills and from November to April have a perched water table 1.5 to 3 feet below the surface. Poor permeability in the lower soil layer presents a severe constraint to septic system operation.

The Stissing soils series contains silt loam soils that are poorly drained and have moderate to slow permeability. Stissing soils, found in nearly level areas and in depressions on hills, have a perched water table at or near the surface. This factor

combined with slow permeability in lower soil layers results in severe limitations for septic tank absorption fields.

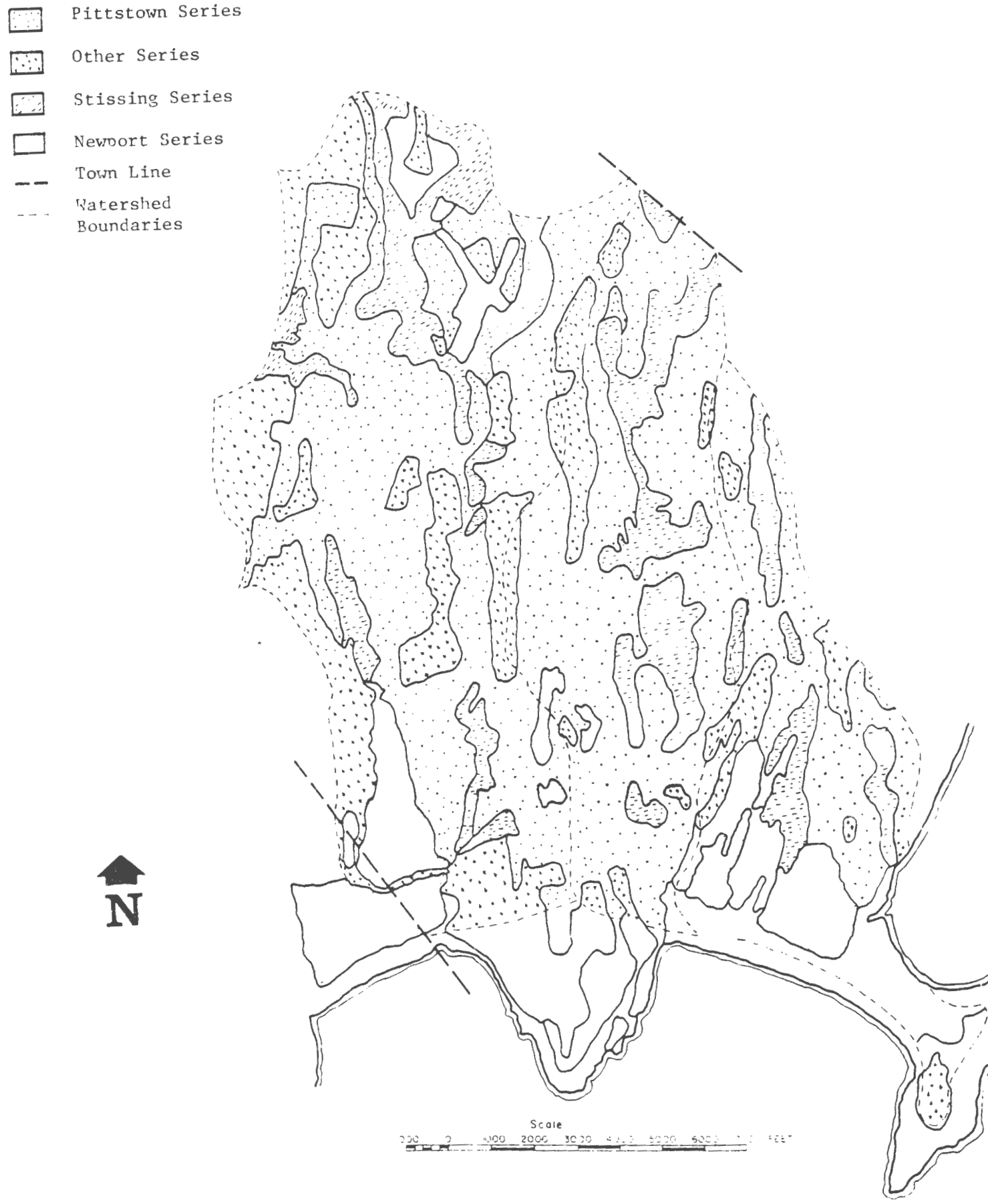
Because all three of the above soil types have severe constraints as to septic operation, soil information is absolutely essential for land use planning in non-sewered areas. This consideration especially applies to the study watershed areas where poor soil conditions are suspected of contributing to septic system failure and drinking water pollution. (See Fig I.6)

The Newport and Pittstown silt loams are also designated prime farm soils for their exceptional suitability to agricultural purposes. Seventy percent of Aquidneck Island is covered with prime farm land which justifies the fact that agriculture is still an important land use today on the Island. Middletown and Portsmouth are the two most intensively farmed towns in the state. They contain 15 percent of the state's total prime farmland acres while covering only 2.8 percent of the state's total area. Middletown has 5,381 acres of farmland which corresponds to 65% of the total town acreage. 70% of these soils are concentrated within the study watershed areas. (See Figs. I.7&8.)

Agriculture is also the predominant activity in the undeveloped watershed ares. Most of the 2,578 acres farmed in Middletown is concentrated within these areas. While on one hand prime soils are recognized as a valuable natural and economic resource to be preserved, this resource is unfortunately also subject to damage and loss as a result of human activities. The 208 Areawide Water Quality Management Study identified thirty-seven erosion problem sites in Middletown. Table 4 lists those sites found to be moderate to severe with regard to erosion

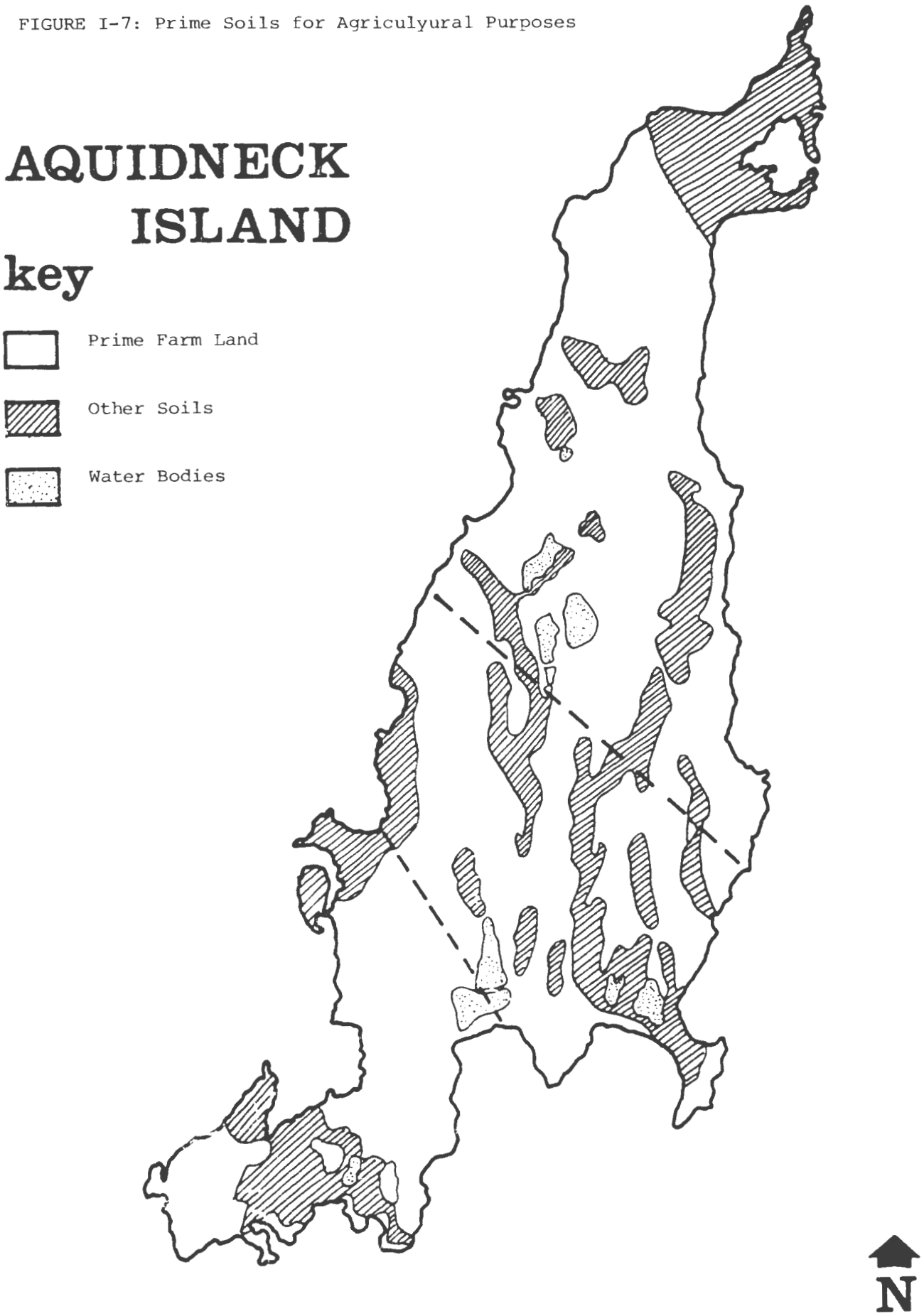
FIGURE I-6 General Soil Types

WATERSHED STUDY AREA



Source: Adapted from RI Soil Survey, 1981

FIGURE I-7: Prime Soils for Agriculyural Purposes



Source: Governor's Task Force on Agriculyural Preservation,1981

FIGURE I-8: Prime Farm Land

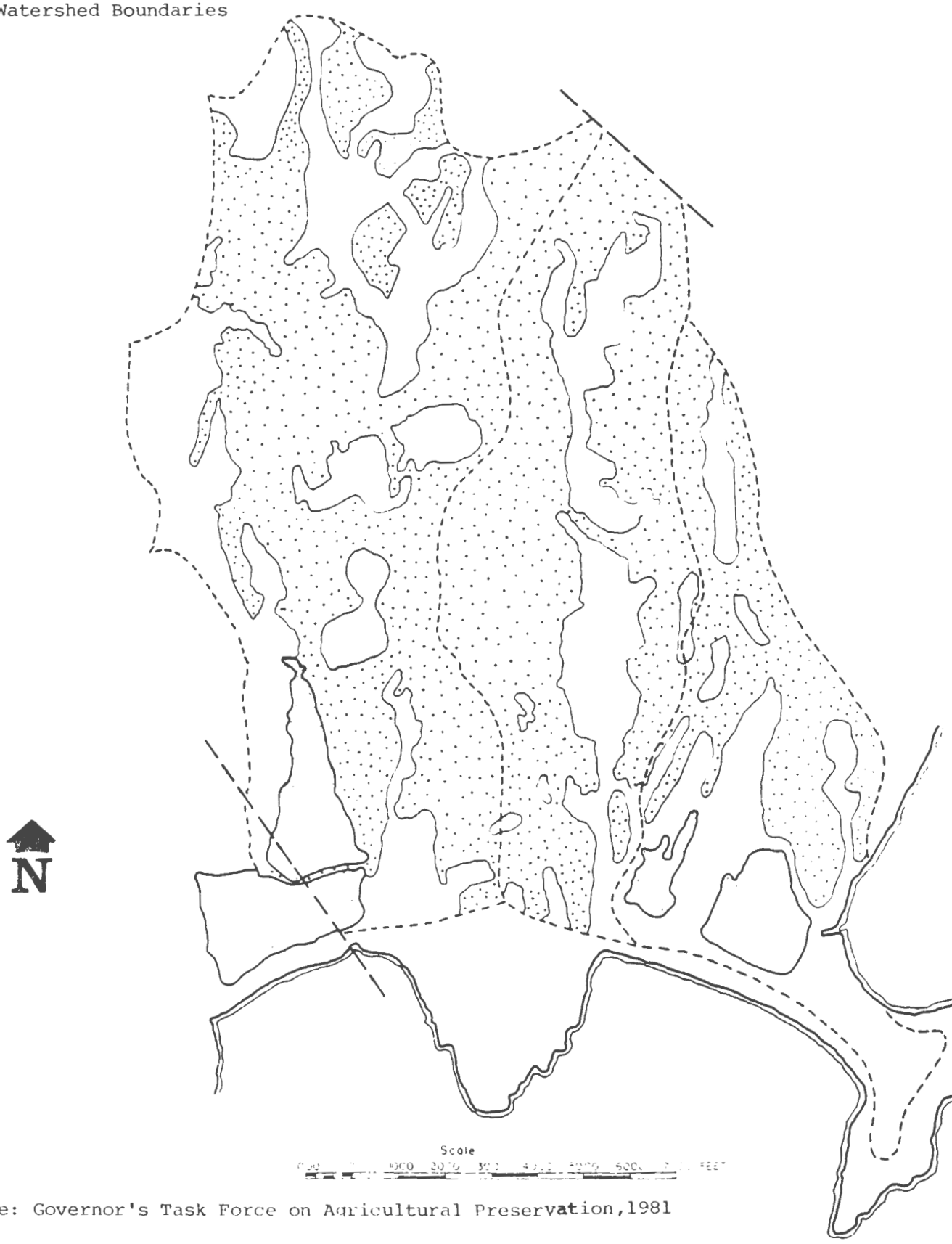
WATERSHED STUDY AREA

key

Prime Farm Land

Town Line

Watershed Boundaries



Source: Governor's Task Force on Agricultural Preservation, 1981

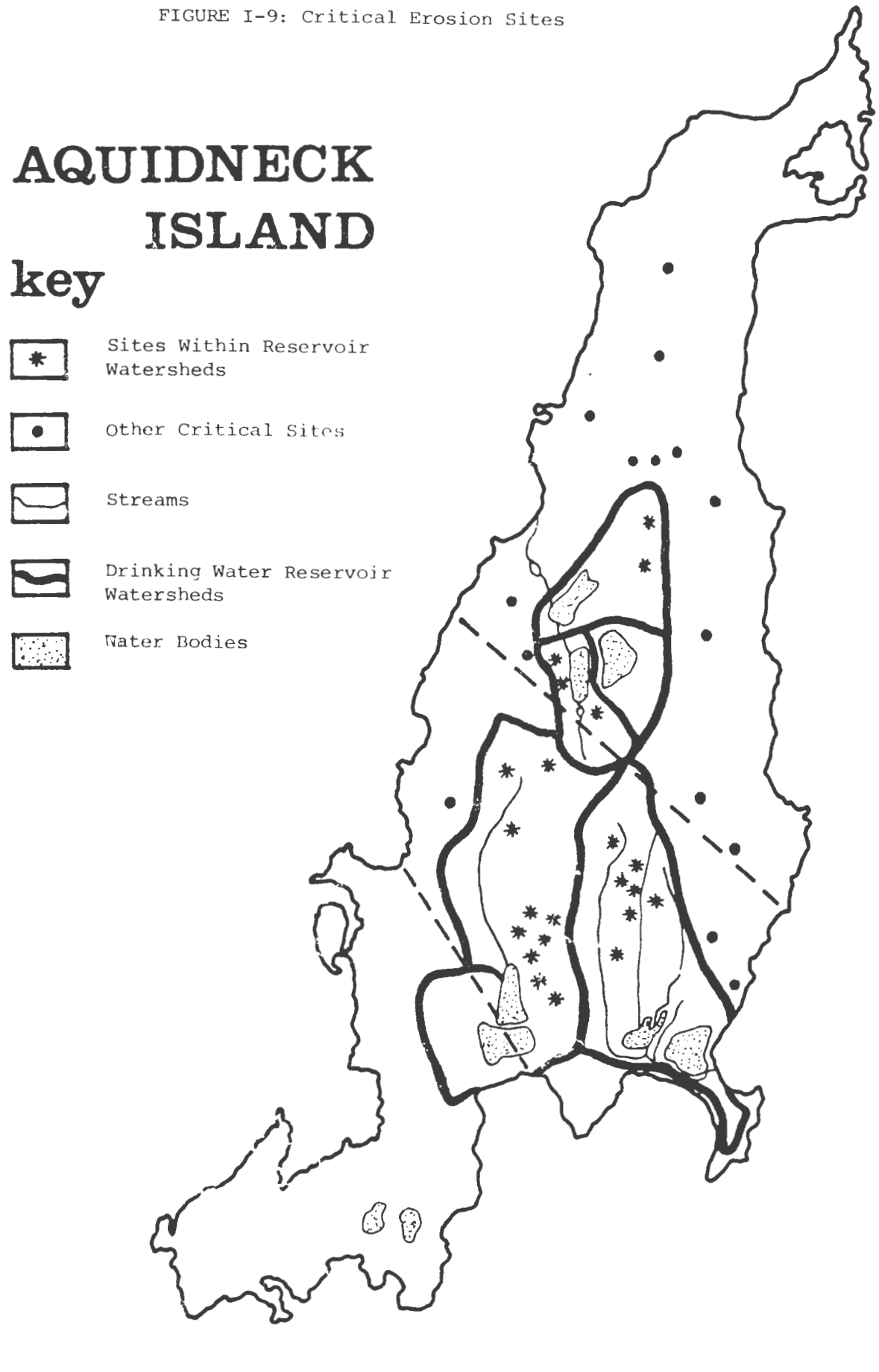
problems. Figure I.9 shows their approximate locations. As can be observed there is a significant incidence of erosion problems within watershed areas. Collectively, all the sites in Middletown resulted in an estimated soil loss of 4055 tons per year and accounted for 20 percent of the erosion sites identified statewide.[7]

Erosion is a problem not only because it causes the loss of a valuable resource that takes thousands of years to replace, but also because it results in sedimentation of receiving waterways. On Aquidneck Island, and especially in Middletown, the sedimentation of streams and reservoirs has affected their water quality and volume. However, while sediments are identified as carriers of nitrates, phosphates and pesticides from cultivated land, the actual amount of pollution associated with eroded sediments is still unknown.

Erosion problems Islandwide are adversely affecting the surface ponds that provide the Island's water supply. As a result, watersheds in Middletown and Portsmouth were targeted in the 208 plan as top priority for implementation of erosion and pollution control measures on a statewide priority list. (See Fig. I.9) The management practices recommended by the plan are reviewed in Chapter 3 of this study.

While prime soils are gradually lost through erosion, a larger scale loss occurs with the expansion of residential development. The same characteristics that make land suitable for agricultural use such as level topography, good top soils and adequate drainage, also make it attractive to developers. On Aquidneck Island between 1960 and 1982, agricultural acreage

FIGURE I-9: Critical Erosion Sites



Source: 208 Water Qality Statewide Plan

dropped from 45 to 24 percent of the total Island area. During the same time period, acres in residential use climbed from 14 to 32 percent of the total. As a result of these trends, preserving the remaining farmland and prime soils has become a state priority in which Aquidneck Island communities have an important responsibility to be realized.

4. Vegetation

On Aquidneck Island two main types of vegetation cover can be identified: Woodlands and open fields.

The woodlands or forests on the Island are similar in species composition to those found in the rest of Rhode Island. While almost two-thirds of the State is still forested, the woodlands on Aquidneck Island have been drastically reduced by human activities. Climax oak-hickory-maple forests that once covered the Island were virtually eliminated during the late 1700s as a result of expanding agriculture and the Revolutionary War.[8]

Farming remained an active land use on Aquidneck Island, so that reforestation has not been extensive. According to a 1982 land use survey, 1,594 acres of forest are left on the Island, which amounts to only 7% of the total Island acreage.[9] In Middletown, only 4% or approximately 330 acres of the total town area remain forested - 0.5% of which is located within the study watershed areas.[10] These portions, shown on figures I.10 & 11, are small and scattered acorss the patchwork landscape of the Island.

The types of trees on the Island are distributed in a pattern related to soils and drainage. Woodlands in the drier areas are dominated by oak, hickory and beech, while red maple

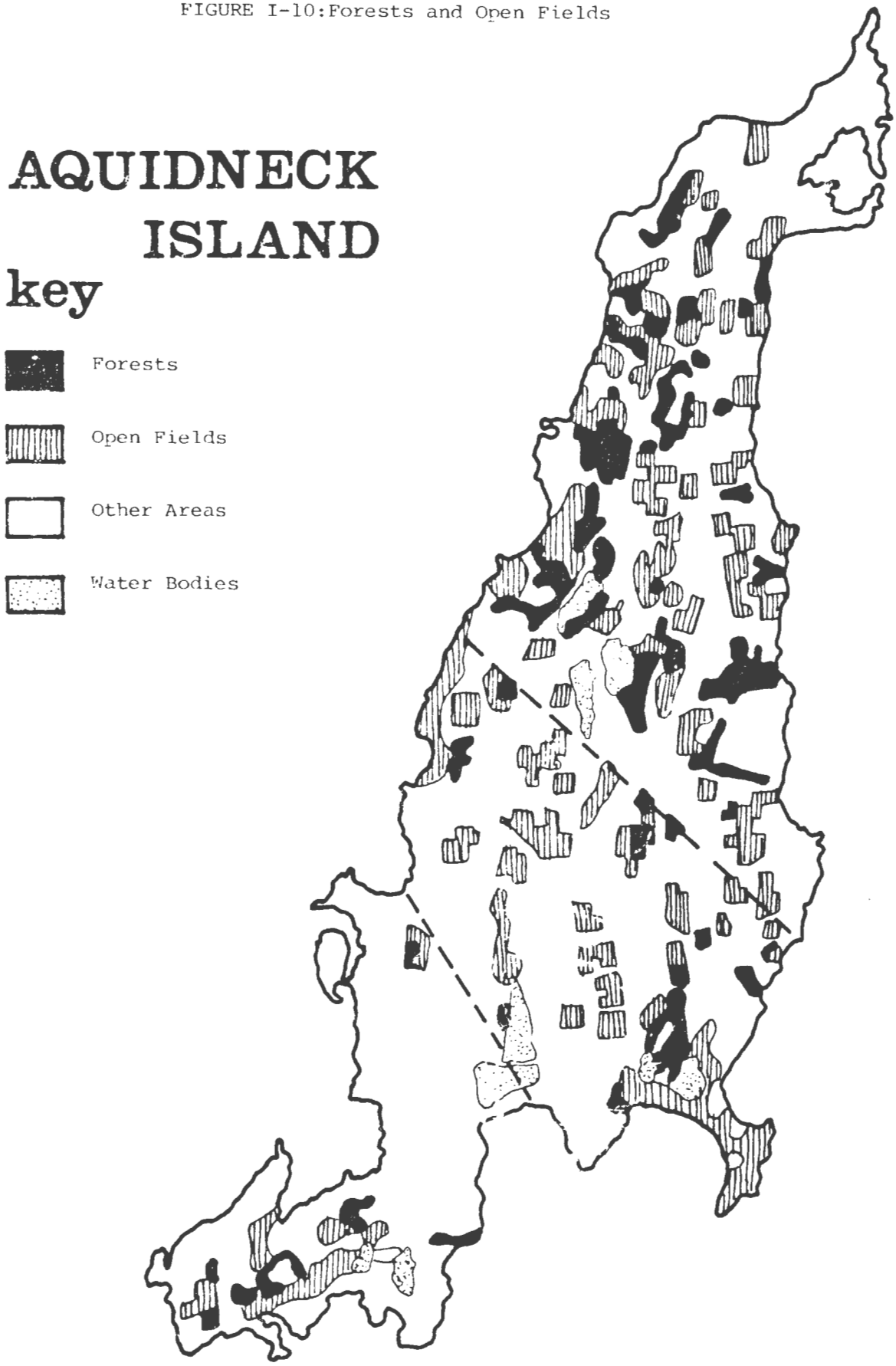
and tupelo are common in the moist areas.

Woodlands are an important wildlife habitat offering nesting, escape cover and food for many species of birds and mammals. The wildlife found in the study area is typical of a temperate deciduous forest and similar to that found on the rest of Aquidneck Island and throughout the State. Common mammals include squirrels, raccoons, striped skunks, cottontail rabbits and white-tailed deer. Those mammals inhabit fields as well as forests. The woodlands support a diversity of bird species including blue jays, cardinals, sparrows, mocking birds and other song birds, thrushes and woodpeckers. In addition, the red-tailed hawk, kestrel and screech owl inhabit or visit the area's woodlands.[11]

With the process of clearing the forests from the Island, the second important vegetation cover - open field - was created. Open or abandoned fields represent a transition stage that is part ofthe succession of vegetation that develops into a climax oak-hickory forest. In 1982, eleven percent (2,577 acres) of Aquidneck Island was classified as open field, 0.8% (180 acres) being located within the study watershed areas (see Figs. I.10 & 11.) Statewide, open fields accounted for only 4-5 percent of the total land acreage.[12] The land classified as open fields includes fields in various stages of succession. The most open of fields contain primarily herbaceous plants similar to those found elsewhere in Rhode Island. Such plants include ragweed, wild mustard, golden rod, sheep sorrel and chickweed.

If left undisturbed, shrubs and trees establish themselves

FIGURE I-10:Forests and Open Fields



Source: Save The Bay Land Use Survey,1982

FIGURE I-11: Vegetation

WATERSHED STUDY AREA

key

--	Town Line
---	Watershed Boundaries
H	Hard Wood
S	Soft Wood
Sh,Hs	Mixed
A	Agricultural Fields
AF	Abandomed Fields
U	Developed Land

Source: [illegible] Rhode Island

in open fields and eventually become the dominant plant community. On the study areas as Islandwide, the shrub community includes arrow wood viburnum, honeysuckle, bayberry, alder, gray birch and dogwood.[13]

The plant communities of open fields support a diversity of animals. The multitude of insects present attracts insect-eating birds such as tree swallows. Other common birds associated with fields include yellow warblers, sparrows, mockingbirds, mourning doves, larks and pheasants. The field is also home to small rodents such as the meadow mouse and short-tailed shrew. These rodents are often hunted by owls that may roost in nearby barns and red-tailed hawks that inhabit the Island. Finally, open fields are known to be habitat for cottontail rabbits, squirrels, skunks and the red fox.[14]

The woodlands and open fields found in the study watershed areas are important natural resources for several reasons. First, vegetative cover whether grass, weeds, shrubs or woodlands, is vital to the maintenance of fertile soils. The contribution of organic matter to the soils provided by vegetation is an important part of the recycling of nutrients and also help hold soils in place. Disturbing vegetative cover results in an increased volume and velocity of runoff, increased soil erosion and sedimentation of waterways, and decreased water quality. The important relationships between vegetative cover, soil erosion and non-point pollution illustrate the need for development controls, particularly in areas of steep slopes and adjacent to waterways as the ones studied by this project.

Woodlands and open fields also function as valuable wildlife habitat for a broad variety of animals such as the ones discussed previously. Unless this important function of vegetated areas is recognized and fully considered in land use decisions, development will continue to destroy the remaining habitat areas, and the additional benefits in terms of recreation opportunities, scientific study and ecological integrity provided to the Island will be lost.

End Notes - Chapter I

1. U.S. Department of Agriculture Soil Conservation Service, "Flood Plain Management Study," Middletown RI, February 1982, p. 6.

2. Ibid.

3. Save The Bay, Inc., "Natural Resources on Aquidneck Island," Technical Report No. 4, July 1983, p. 48.

4. Ibid.

5. Ibid. p. 38.

6. Lachowicz, Anthoni W., "Comprehensive Community Plan," Town of Middletown Rhode Island, August 1981, p. 14.

7. Rhode Island Statewide Planning Program, "208 Water Quality Management Plan for Rhode Island," Final Plan, August 1979, p. 421.

8. Rhode Island Statewide Planning Program, "Plan for Recreation, Conservation and Open Space," January 1981, p. 25.

9. Save The Bay, Inc., "Aquidneck Island Land Use Changes 1960-1982," June 1983, p. 16.

10. Ibid p. 45.

11. Save The Bay, Inc., "Natural Resources on Aquidneck Island," p. 32.

12. Cronan, J.M. and Brooks Albert, "The Mammals of Rhode Island," Rhode Island Department of Agriculture and Conservation, 1962.

13. Save The Bay, Inc., "Natural Resources on Aquidneck Island," p. 34.

14. Ibid.

Chapter II - Development Patterns and Growth Trends

The extent to which roads and public utilities are present in Middletown will have a fundamental impact on the development patterns and growth trends of the future. It is recognized that land development follows utilities - in particular, sewer and water service. In Middletown, there is a very close correlation between utilities and land development, due to natural restrictions imposed by the poorly drained soils, topographic features and drainage patterns. Although new development is also affected by existing land use and conditioned by conventional zoning and subdivision regulations, much of the future land use pattern of Middletown can be expected to be dictated by the availability of utilities. Well planned policies and conscientious decisions with regard to utility extension can be effective ways to better manage future growth.

The following section of this study will discuss Middletown's water and sewer services and their effect upon future growth patterns. An inventory of current land use patterns in Middletown and, in particular, of the study watershed areas is followed by an assessment of developmental pressures upon those areas based on population projections for the year 2000.

1. Water Supply

The Newport Water Department supplies water to 58,000 residents of Newport, Middletown and Portsmouth. Approximately 17,000 of its customers reside in Middletown. The areas not served by the public water lines rely on groundwater wells for domestic supply.

The raw water supply for the entire system comes from seven surface water reservoirs located on Aquidneck Island; four of them are located in Middletown - Easton North and South Ponds, Nelson Pond and Gardiner Pond. As was discussed in the previous chapter, the ponds are fed by the major streams in Middletown and are replenished by precipitation and drainage of the lands which comprises their watershed areas. The combined watershed areas which correspond to this study area comprise approximately 45% of Middletown's total land area.

During the past ten years, the water supply has been sufficient to meet the demand. The nine reservoirs are able to provide approximately 9.6 million gallons per day (MGD).[1] Middletown's reservoirs can contribute approximately 3.2 MGD.

Public water demand in Middletown reached its highest level at 8.48 MGD in 1961 when the Navy was present. In the following years, demand decreased, and by 1965, with the closing of the Newport Naval Base, demand dropped 22% to a low of 6.63 MGD. Since that time, there has been a slight but steady increase in demand as new development continues on the Island. The 1979 average daily demand was 7.56 MGD.[2]

Middletown's contribution to water demand has varied from the trend described for the entire system. In 1971, it accounted for 49% of the peak demand due in part to the high number of military personnel in the town. Thus, the Naval Base closing had a more immediate effect on Middletown's demand which dropped 27% to a low of 3.4 MGD in 1974. In the years following 1974, Middletown's demand has increased to the extent that its present

water demand of 4.45 MGD (1979) exceeds that of the 1971 peak when the Navy was present. Middletown's actual daily demand for 1980 was an average of 3.19 MGD.

With regard to future demand, the existing reservoirs should be capable of supplying water to meet the average daily demand of 9.43 MGD through the year 2005. However, as it exists today, the system will be unable to provide service to meet maximum daily demand much beyond the middle to late 1980s.[3]

A few alternatives for the development of new supply sources have been proposed. They range from pumping of water from the proposed Big River Reservoir across the northern Bay to desalination of ocean water. However all these possibilities have been proved unfeasible, at least in the short term.

To assure adequate water supplies before a supplemental supply source can be implemented, water conservation measures must be undertaken. These measures include modifying codes to require water saving devices, effective maintenance of water supply systems and wise management of aquifers, watershed areas and stream flows.

In addition, the quality of the water supply is being threatened by rural and urban runoff. Middletown has six rural runoff problem priority areas identified by the Statewide Planning Program;[4] four of them located within the study watershed areas. Development in these watershed areas has increased the amounts and types of pollutants and the speed at which they enter the water supply. The implementation of land use controls to minimize runoff is one of the recommendations of Middletown's Comprehensive Plan. These suggested measures are

discussed among other watershed management controls in Chapter 3 of this study.

2. Wastewater Systems in Middletown, RI

Public Water Disposal

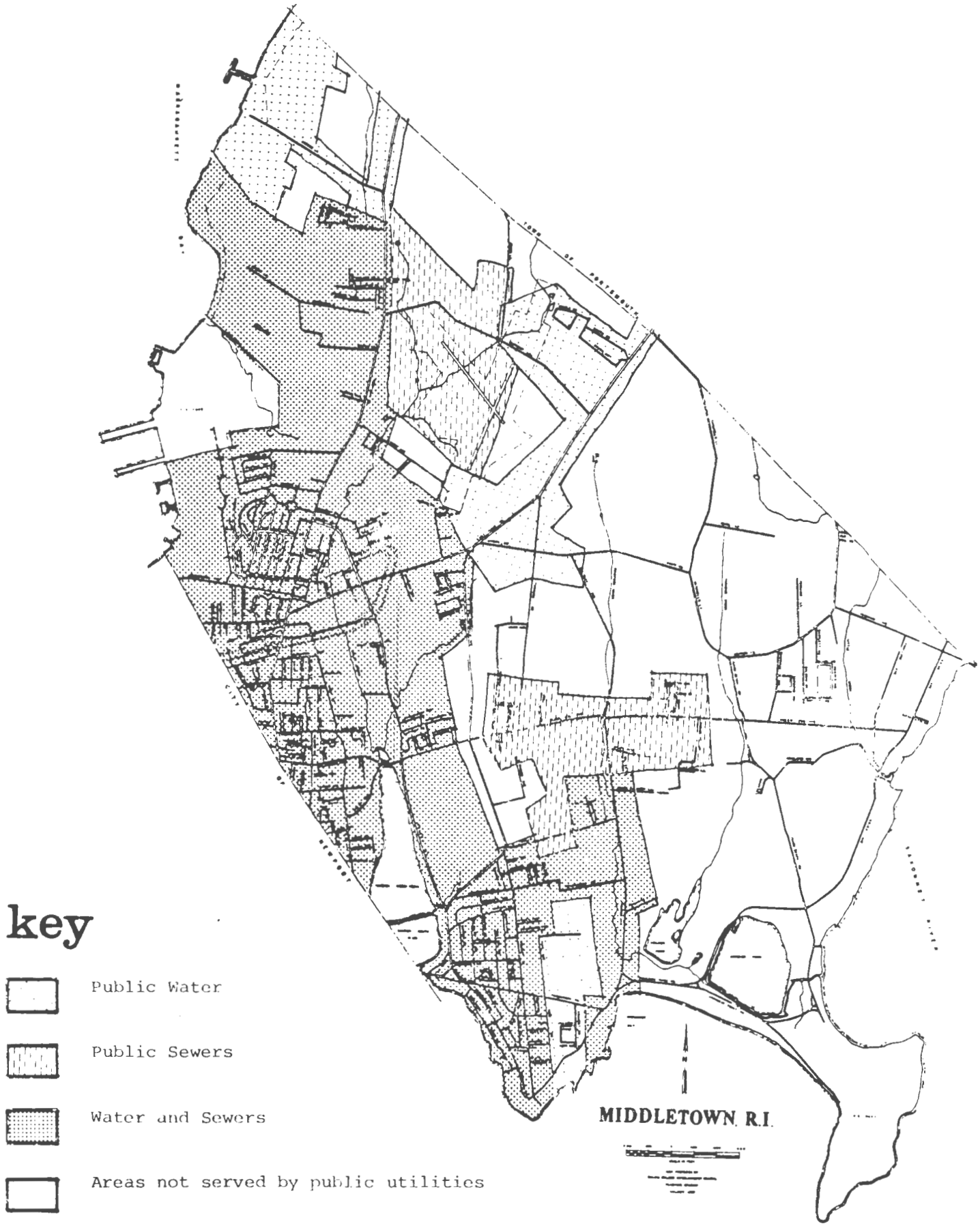
The City of Newport Water Pollution Control Department operates the only large, public wastewater treatment facility on Aquidneck Island. There are also several small-scale public and private plants treating wastewater on the Island.

Most of Middletown's population (about eighty percent) dispose of their wastewater into public sewers. Almost all Navy installations are also tied into the system. The sewers discharge into the Newport Sewage Treatment Plant which accepts wastes from about 40,000 people, as well as most commmercial businesses and industries located in Newport or Middletown.

While the most urbanized sections of Middletown are sewered, a large area remains unsewered as shown in figure II.1. The unsewered portion is basically concentrated on the eastern section of of town and corresponds to 60 percent of the study watershed area.

Middletown and the Navy maintain their own sewer lines and pump stations and have arranged for Newport to treat their wastewater. The Navy and parts of Middletown abutting Newport and lower West Main Road have had sewers since the 1940s. Middletown extended its collection system after 1968 when the town passed a $5 million bond issue. Statewide Planning had projected that sewers would continue to be extended so that in the year 2000 90% of the Middletown population will be served. At

FIGURE II-1: Public Utilities



Source: Middletown's Comprehensive Community Plan,1983

this time, however, almost all the money generated by the bond issue has been spent, and there are no definite plans for any extensions.

Newport Water Department supplies water directly to Middletown residents. The Newport sewage plant, built by the City off J.T. Connell Highway, went on line in 1956. The plant provides primary treatment of the wastewater before discharge into Narragansett Bay off Coddington Point. The plant was designed to treat 5.83 milion gallons per day (MGD) and has not been expanded since that time, and as a result is now overloaded with annual average flows of 8.5 MGD. According to DEM's monthly flow average records,[6] the plant receives flows up to 12.0 MGD at certain times of the year. Peak daily flows during wet weather conditions range up to 18 MGD. These flows, which can be more than 200% above design flow, together with the poor maintenance condition of the system adversely affect sewage plant performance and contribute to high levels of discharge pollution.

B. Individual Sewage Disposal Systems

The unsewered areas of Middletown, about 50% of its territory, rely on septic systems or cesspools for wastewater disposal. One-third of the town's population lives in these areas.

Individual on-site sewage disposal systems were identified in the 208 Water Quality Management Plan as cheaper than sewers. They are often an inexpensive and efficient method of treating wastewater when soil conditions are acceptable, and the system is properly designed and well maintained. This is not always true on Aquidneck Island where the majority of the soils pose severe constraints for septic system purposes and the systems are in

many cases old and poorly designed. Many of them were installed prior to 1968 when the state developed its permit procedures for septic tank systems. There were no mandatory standards for septic tank and leach field design before that.

The danger of contaminating wells on Aquidneck Island is small because most people are served by public water. In Middletown, where the most septic systems are being built, only a few are constructed on properties using drinking water wells. However, septic system failures may be affecting the public drinking water supply by polluting the Island's reservoirs. To date, the number or effect of failures on the raw water quality of the reservoirs has not been investigated, but the increasing residential development of watershed areas and its potential adverse impact to the drinking water quality is a special concern in this project.

3. Land Use Changes 1960-1980

A. Islandwide

Aquidneck Island as a whole is almost evenly divided between undeveloped and developed land uses. The undeveloped categories consist of agricultural, forest/shrub, and wetland uses. The developed category is comprised of the residential, commmercial, transportation, industrial and institutional classes (see Table A.1 in the Appendix.) The two composite categories account for 46 and 43 percent of the Island's acreage. The three largest single categories on the Island are residential (7,794 acres, or 32 percent of the total Island acreage), agricultural (5,811 acres, or 24 percent of the total),and forest/shrub (4,451 acres,

or 18 percent of the total). Other land use categories individually constitute 6 percent or less of the Island's total acreage.

Although Aquidneck Island is still largely undeveloped (46 percent), a major change in land use occurred between 1960 and 1982. Undeveloped acreage as a percentage of the total Island area declined from 59 to 46 percent while urban acreage increased from 31 to 43 percent.

As shown in Table II-A, which shows land use changes on the Island as a whole, agricultural and residential categories changed significantly between 1960 and 1982. In 1960, the dominant land use on the Island was agricultural - 10,846 acres, or 45 percent of the total. By 1982, agricultural uses had dropped to 5,811 acres, or 24 percent of the Island land area. Almost all (98 percent) of the farmland loss occured in Portsmouth and Middletown. The latter lost 1,840 acres going from 4,371 acres (54 percent) in 1960 to 2,531 (31 percent) in 1982.

During the same period residential land use became the largest single category with 7,794 acres, or 32 percent of the Island's area. Residential acreage on the Island more than doubled. The switch in dominance between agricultural and residential land use indicate that the Island has undergone a major land use change. Open space, especially farmland, is very attractive to developers in a place which has such high scenic values due to its unusual topography.

The third largest category of land use, forets/shrub, maintained its third place ranking between 1960 and 1982 and actually gained 1,500 acres. It increased from 12 to 18% of the Island's total acreage. Some of this gain is attributable to

Table II-A

Land Use Changes Islandwide (1960-1982)

Category	1960	Percent of Island Total	1970	Percent of Island Total	1982	Percent of Island Total	Acreage Change 1960-82	Percent Change 1960-82
Residential	3292	14	6388	26	7794	32	4502	137
Commercial	460	2	414	2	638	3	178	39
Industrial	147	0.6	215	1	269	1	122	83
Transportation	1471	6	752	3	367	2	-1104	-75
Recreational	800	3	1079	7	1219	5	419	52
Institutional	2095	9	1578	6	1086	5	-1009	-48
Agricultural	10846	45	8631	35	5811	24	-5035	-46
Mining and Waste	48	0.2	169	0.7	117	0.5	69	143
Wetland	392	2	1090	4	912	4	520	133
Forest/Shrub	2957	12	3331	13	4451	18	1494	51
Other	1499	6	1197	5	1441	6	-58	-4
	24,007 acres		24,803 acres		24,105 acres			

Source: Save the Bay Aquidneck Island Project Land Use Report, 1982.

reclassification of land in the surveys, some to reforestation of wetlands, and some to loss of agricultural land which has been taken out of production and allowed to convert to shrub or forest lands.

The institutional category lost 1,009 acres, partly due to the Navy cutbacks and partly due to changes in land use classifications. Wetlands gained 520 acres Islandwide, probably as a result of differing interpretations by the different surveyors.

Land devoted to industrial use increased by 122 acres between 1960 and 1982. While the increase in acres is not great when compared to other sectors, it does illustrate the ongoing transformation of the Island's high technology uses. This change is more important than the number of acres in industrial uses indicated.

B. Middletown

The top three categories of land use in Middletown are agricultural at 2,531 acres (31% of the total), residential at 2,302 acres (29% of the total) and forest/shrub at 1,342 acres (16% of the total). All other uses individually are 6 percent or less. Using a different method of classification, undeveloped uses still predominate (4,127 acres, or 50 perdent of the town's total acreage). The remaining 7 percent is devoted to uses that cannot be classified as either urban or undeveloped.

Although agricultural land is still the largest land use category in Middletown, it also had the greatest loss between 1960 and 1982. In 1960 agriculture was the dominant use with 54% of the total town acreage (4,371). Agricultural land since dropped to 31% or 2,531 acres. This loss is significant because Middletown has been identified as an important agricultural area

in the state. (See Table II-B.)

During the same 22 year period, residential uses have increased from 1,210 acres, or 15 percent, to 2,302 acres, or 28% of the community total area. Two factors that have encouraged development in Middletown are the extension of public services, in particular sewer and water lines into much of the rural area, and the town zoning regulations. Almost all the agricultural land in Middletown is zoned for residential development.

Most of the development that took place in Middletown between 1970 and 1982 occurred along East and West Main Roads. Residential development has occured in the agricultural areas of the eastern part of the town along Wapping Road, Green End Avenue, Mitchell Lane and Oliphant Lane, and along the Sakonnet River. The Aquidneck Industrial Park off of Valley Road and Aquidneck Avenue has accounted for most of the industrial development.

Finally, it should be noted that the loss of Middletown farmland did not result in an equal gain in residential or other urban categories. Rather, the forest/shrub category increased significantly from 473 to 1342 acres (184 percent) due to a combination of three factors. One is that the cost of farming is so high that a farmer cannot make a profit and may actually be losing money, the land has been taken out of production and is being held for speculative purposes, or the land is being held within estates or by family members and will remain open unless forced by taxes or transfer through death.[7]

Table II-B

Land Use Changes in Middletown (1960-1982)

Category	1960*	Percent of Total Land Use	1970*	Percent of Total Land Use	1982***	Percent of Total Land Use	Acreage Change 1960-82	Percent Change 1960-82
Residential	1210	(15)	1898	(24)	2302	(28)	1092	90
Commercial	100	(1)	166	(2)	270	(3)	170	170
Industrial	15	(0.1)	4	(0.04)	80	(1)	65	433
Transportation	467	(6)	173	(2)	181	(2)	-286	-61
Recreational	252	(3)	281	(3)	322	(4)	70	28
Institutional	733	(9)	505	(6)	417	(5)	-316	-43
Agricultural	4371**	(54)	3811++	(47	2531	(31)	-1840	-42
Mining and Waste	3	(0.03)	26	(0.3)	25	(0.3)	22	733
Wetland	135**	(2)	507	(6)	254	(3)	119	88
Forest/Shrub	473**	(6)	551	(7)	1342	(16)	869	184
Other	362	(4)	133	(2)	526	(6)	164	45
	8121 acres[1]		8055. acres[1]		8250 acres[1]			

* Figures from Statewide Planning Office
++ Figures from Eastern RI Conservation District
** Kupa Whitman Survey
*** Save the Bay Survey
1 The difference between the totals are due to differing survey methods. These totals disagree with each other by only 1-2 percent - well within acceptable map error limits.

Source: Save the Bay Aquidneck Island Project Land Use Report, 1982.

C. Middletown's Reservoir Watersheds

1. Bailey-Brook Watershed

The Bailey Brook watershed is the largest and most important watershed on Aquidneck Island. With a drainage area of 3,100 acres the two Easton Ponds provide most of the drinking water for the City of Newport and parts of Middletown, or almost half of the Island's population.

The watershed is the most highly urbanized reservoir watershed on the Island, with 60 percent of the land area now classified as urban. (See Fig. II.2 and Table II-C.) Residential uses make up 42 percent of the watershed, agricultural uses 20%, forest/shrub 11 percent and commercial 7% of the drainage area.

The Bailey Brook watershed showed the largest shifts in land use among the three watersheds studied. Between 1970 and 1982, urban uses increased from 1,466 acres or 46% to 1,818 acres or 60% while rural uses declined from 1,350 acres (43%) to 983 acres (33%).

Agricultural land had the largest decline, going from 1,139 acres or 36 percent of the watershed to 590 acres or 20%. Residential land increased from 1,123 acres or 36% to 1,255 acres or 42 percent.

The shift in land use from agricultural to urban over the past twelve years reflects population growth in Middletown despite the Navy cutbacks, and the town's policy of encouraging urban development in the watershed through zoning and the location of public services such as sewer lines. This watershed also contains most of the industrial and commercial development in Middletown.

FIGURE II-2 : Land Use Map

BAILEY'S BROOK WATERSHED

key: Land Use Categories

U. Urban Residential

C. Commercial

R. Recreational

A. Agricultural

P. Pasture

AF. Abandomed Fields

O. Open

OP. Open and Public Facilities

UO. Urban Open

F. Forest

OW. Open Water

Source: Save The Bay's Land Use Survey,1981

Table II-C

Land Use Changes in Bailey Brook Watershed (1970-1982)

Category	1970	Percent of Total Land Use	1982	Percent of Total Land Use	Acreage Change	Percent Change
Residential	1123	(36)	1255.2	(42)	132.2	12
Commercial	109.2	(3)	222.7	(7)	113.5	104
Industrial	12.9	(0.4)	82.9	(3)	70	543
Transportation	1203	(4)	127.5	(4)	7.2	6
Recreation	52.4	(2)	68.2	(2)	15.8	30
Institutional	100.1	(3)	129.2	(4)	29.1	29
Agricultural	1138.7	(36)	590.1	(20)	-548.6	-48
Mining and Waste Disposal	13.8	(13.8)	4.6	(0.1)	-9.2	-67
Wetland	115.7	(4)	65.5	(2)	-50.2	-43
Forest/Shrub	96.4	(3)	327.5	(11)	231.1	240
Other	276.4	(9)	124	(4)	-152.4	-55
	3158.9 acres		2997.4 acres			

Source: Save the Bay Aquidneck Island Project Land Use Report, 1982.

2. Maidford River Watershed

The Maidford River is the second largest reservoir watershed on the Island, with an area of 2.1 square miles or 1,360 acres. It is still largely agricultural with farmlands making up 63% of the watershed. Residential uses make up 20% while forest/shrub covers 14% of the total area. (See Fig. II.3 and Table II-D.)

From 1970 to 1982, the land in agricultural use fell from 74 to 63 percent of the watershed. Residential lands rose by over 74 acres from 14 to 20 percent, and forest/shrub lands showed the largest change increasing from 4 to 14 percent of the watershed area. This was partially attributable to farmland being abandoned. The residential total will probably increase rapidly in the future due to the recent extension of sewers into the watershed, once again raising concerns about the urban runoff and water quality.

Runoff is perhaps of more concern, however, in connection with the flooding problem that already exists in the Maidford River area. Development in the floodplain, uncontrolled runoff from sites with impervious surfaces such as streets and rooftops, and diverted stormwater, all contribute to the current flooding problem.

3. Paradise Brook Watershed

The Paradise Brook watershed has a total drainage area of about 1.5 square miles. The dominant land use is forest/shrub at 33% of the watershed. The Norman Bird Sanctuary, located in the area, has been allowed to revert to various stages of forest, shrub, and abandoned field to provide wildlife habitat and accounts for most of this acreage. Agriculture is the second

FIGURE II- 3: Land Use Map

MAIDFORD RIVER WATERSHED

key : Land Use Categories

U. Urban Residential

C. Commercial

R. Recreational

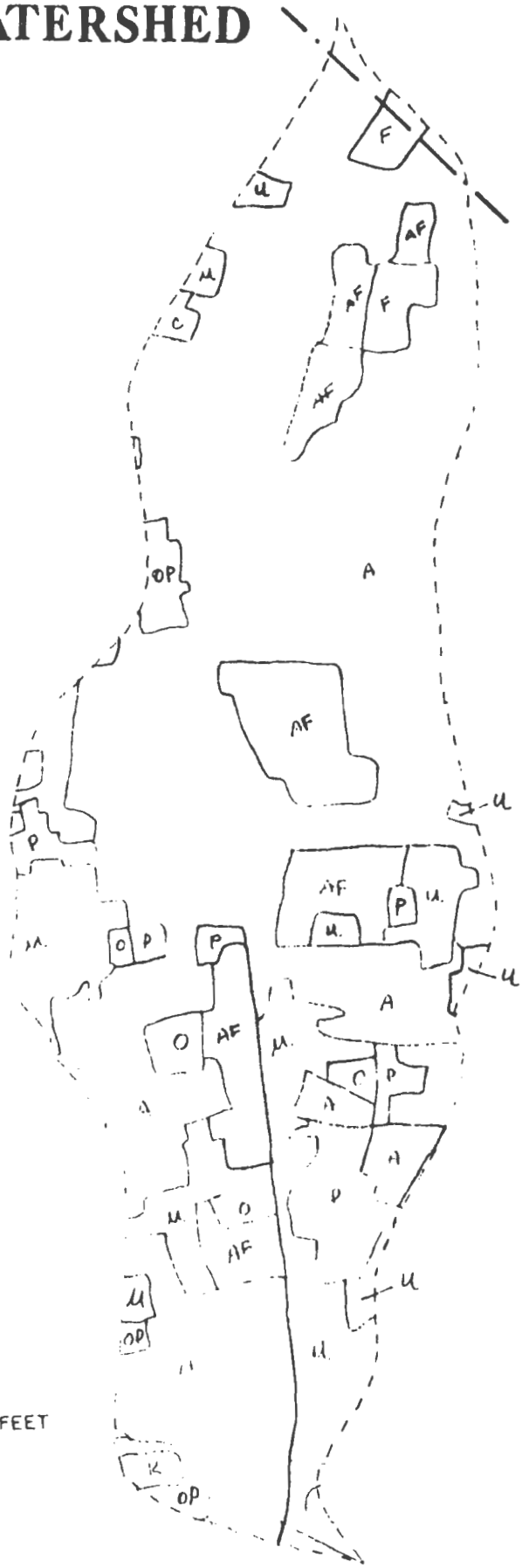
A. Agricultural

P. Pasture

AF. Abandomed Fields

O. Open

OP. Open and Public Facilities



N

Scale 1:24,000

1000 0 1000 2000 3000 4000 FEET

Source: Save The Bay Land Use Survey,1981

Table II-D

Land Use Changes in Maidford River Watershed (1970-1982)

Category	1970	Percent of Total Land Use	1982	Percent of Total Land Use	Acreage Change	Percent Change
Residential	193.8	(14)	268.2	(20)	74.4	38
Commercial	0		4.6	(0.3)	4.6	NA
Industrial	0		0			
Transportation	1.8	(0.1)	0		-1.8	NA
Recreation	15.6	(1)	7.9	(0.5)	-7.7	-49
Institutional	13.8	(1)	25.7	(2)	11.9	86
Agricultural	1008.3	(74)	855.3	(63)	-153	-15
Mining and Waste Disposal	0		1.5	(0.1)	1.5	NA
Wetland	57.8	(4)	7.2	(0.5)	-50.6	-87
Forest/Shrub	58.8	(4)	195.8	(14)	137	233
Other	3.7	(0.2)	0		-3.7	NA
	1353.6 acres		1366.2 acres			

Source: Save the Bay Aquidneck Island Project Land Use Report, 1982.

largest use at 25%, and residential use is third, comprising 17% of the watershed. (See Fig. II.4 and Table II-E.)

Land uses in the Paradise Brook area have remained fairly stable over the past twelve years, with only a minor gain in residential use and a small loss of agricultural land. With the large amount of rural and open land, reservoir water quality should remain good, as long as any large increases in the amount of urban development takes place within the watershed area.

As can be concluded based on these land use considerations, development in areas surrounding Middletown's drinking water reservoirs poses a threat to their continued use as sources of clean drinking water. Urban development results in sediments and pollutants being carried into the reservoirs as part of area runoff. This has caused several serious problems. First, it is estimated that sedimentation may have reduced storage capacity in Eastons Pond by as much as 50%.[8] Second, the nutrients such as phosphates and nitrates entering the reservoirs encourage algae blooms. Excessive algae is troublesome in the drinking water treatment process and can result in taste, odor, and color problems. Third, urban pollutants in the water become an additional treatment burden. Heavy metals and petroleum hydrocarbons are difficult and costly to remove from the water supply and at high levels can cause human health problems.

Citizens and local officials must realize that the cost of allowing further degradation of the water supply are very high. As the quality of the water deteriorates, treatment costs increase. Considering that the pressures for increasing development in those areas are inevitable, watershed protection through

FIGURE II-4: Land Use Map

PARADISE BROOK WATERSHED

key: Land Use Categories

U. Urban Residential

C. Commercial

R. Recreational

A. Agricultural

P. Pasture

AF. Abandomed Fields

O. Open

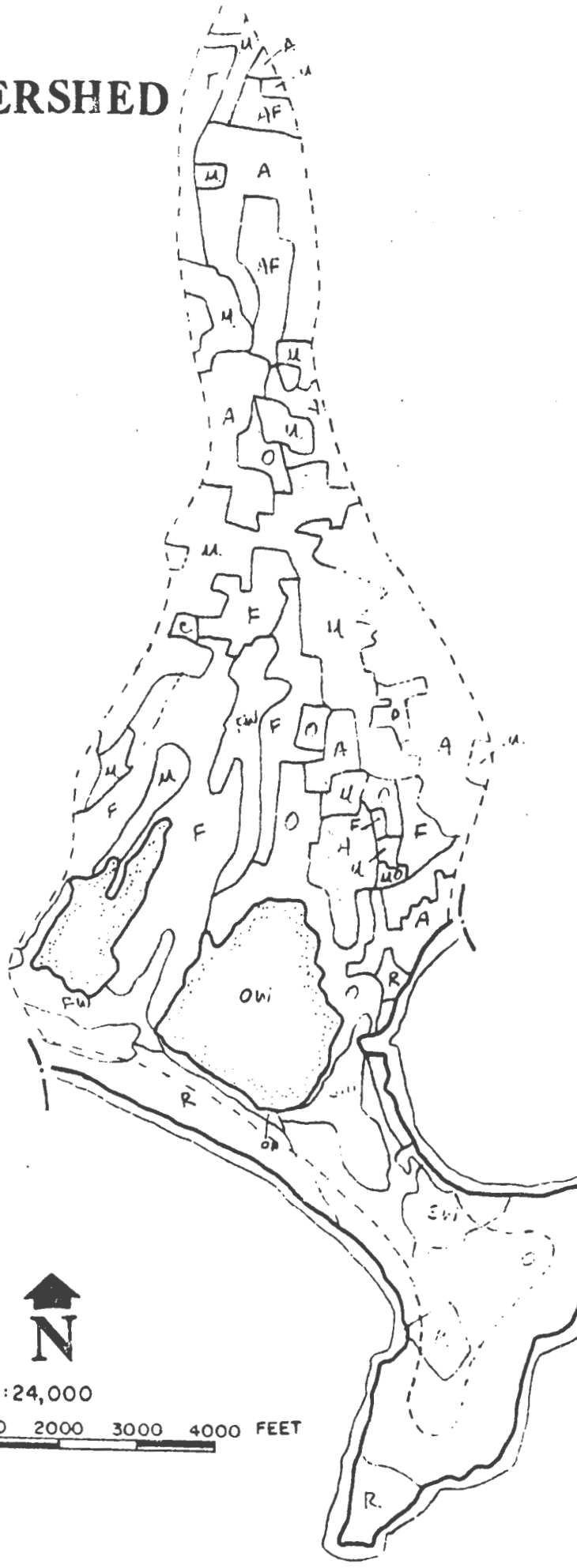
OP. Open and Public Facilities

UO. Urban Open

F. Forest

OW. Open Water

T. Transportation



Source: Save The Bay's Land Use Survey, 1981

Table II-E

Land Use Changes in Paradise Brook Watershed (1970-1982)

Category	1970	Percent of Total Land Use	1982	Percent of Total Land Use	Acreage Change	Percent Change
Residential	100.1	(11)	162.9	(17)	62.8	63
Commercial	0		0			
Industrial	0		0			
Transportation	0.9		0		-0.9	NA
Recreation	2.8	(0.3)	5.7	(0.6)	2.9	104
Institutional	11	(1)	5.6	(0.5)	-5.4	-49
Agricultural	265.4	(28)	236.7	(25)	-28.7	-11
Mining and Waste Disposal	19.3	(2)	11.8	(1)	-7.5	-39
Wetland	131.3	(14)	83.8	(9)	-47.5	-36
Forest/Shrub	263.5	(28)	309.5	(33)	46	17
Other	124.0	(13)	124.9	(13)	0.9	0.7
	918.3 acres		940.9 acres			

Source: Save the Bay Aquidneck Island Project Land Use Report, 1982.

careful land use management is the only feasible alternative to maintain the drinking water quality and quantity at acceptable standards.

4. Population Growth and Land Use Demand

A. Population Changes 1960-1980

According to the U.S. Census, Aquidneck Island's population in 1980 stood at 60,732 inhabitants. Newport represented 48 percent of this total with 29,259 persons; Middletown had 28 percent or 17,216, while Portsmouth's population of 14,257 accounted for 23.5 percent of the Island's total residents (See Table II-E.)

Population changes islandwide between 1970 and 1980 represented a loss of 20 percent. The major contribution to this population decrease was the Navy's withdrawal from the Island in the period from 1970 to 1975. If the 11,000 military personnel transferred out of Newport are subtracted from the 1970 population figure the decline is reduced to only 7 percent. This compares to a statewide decline of just over 1 percent for the same ten year period. Much of this additional drop reflects the loss of military dependents' and civilian jobs on the Navy base.

Regarding the previous period from 1960 to 1970, the most striking population shifts are shown by Newport and Middletown. The first experienced a 26 percent decline while the latter grew by 130 percent in this ten year period. This change can be largely explained by a change in census classification concerning military personnel living on ships berthed in Newport and Middletown. An estimated population of 10,000 reclassified residents exaggerated the actual population trends for the two communities.

Table II-F

Population Changes 1960-1980*
Aquidneck Island Communities

	1960	1970	1980
Newport	47,049	34,562	29,259
Middletown	12,675	29,290	17,216
Portsmouth	8,251	12,521	14,257
	67,975	76,373	60,732

*Source: U.S. Census Bureau

B. Population Growth Forecast

According to population projections made with the use of the Cohort Survival Methodology, the total population of Aquidneck Island is expected to grow by 20% between 1980 and 2000 (see Table II-G). On a community basis, Newport will grow by 13 percent, Middletown by 16 percent, and Portsmouth by 37 percent.

Without the implementation of proper growth management strategies, the population increase from 60,732 persons in 1980 to 72,733 persons in 2000 will place acute strains on the Island's water supply and wastewater disposal systems. Associated housing and urban development may eliminate the existing farmland and open space areas resulting in degradation of the Island's fresh and coastal waters.

Table II-G

Population Growth Forecasts*
Aquidneck Island Communities

Newport	1980	1990	2000
Newport	29,259	32,080	33,200
Middletown	17,216	18,500	20,000
Portsmouth	14,257	18,147	19,580
Aquidneck Island	60,732	68,727	72,780

C. Projected Land Use Demand

By the year 2000, it is expected that Middletown will have a population of 20,000 residents - an increase of 16.2% from the 17,216 residents in 1980. Based on this assumption it is important not only to project space requirements over the next 20 years, but also to determine where this future growth is more likely to take place.

Based on current growth projections and using 2.65 as the average number of persons per dwelling unit, some 1,599 new units will be needed between 1980 and 2000 to accommodate the expected growth.[9] This estimate has been adjusted to reflect losses in the existing housing stock, plus allow for a normal vacancy rate of 6%.

Middletown's Comprehensive Community Plan estimates the residential zoning capacity available in Middletown to be 5,160 dwelling units which represents a surplus of 37% with regard to the projected demand for the year 2000. Although the demand for housing is not likely to realize the zoning capacity of the Town, proper direction must be maintained to accommodate growth with the least adverse impact to the environment.

Concerning commercial land uses, the future areas expected to serve as Middletown's commercial districts are already well established.[10] It is expected that, for the most part, new commercial growth will take place as in-fill development on vacant lots along the established highway business corridors. West Main Road, in particular, can accommodate significant growth without expanding business zoning.

Middletown has also significant land areas which are currently being used for industrial activities, as well as areas suited for future industrial expansion. Middletown's Comprehensive Plan recommends that all new industrial expansion should occur on the former U.S. Naval Base property presently being used for shipbuilding and on the west side of West Main Road at Gate 17 Access Road.[11]

It is important to recognize however that conventinal zoning by itself cannot guide development. Although the existing zoning districts can accommodate the projected growth, adverse environmental impacts due to improper land characteristics and poor design can be extremely detrimental for the future of the community.

Commercial establishments with large paved areas for parking cause major increases in runoff that contribute to the degradation of the drinking water supply. There are 138 acres of land currently zoned for commercial development within the study watershed areas. (See Fig. II.5)

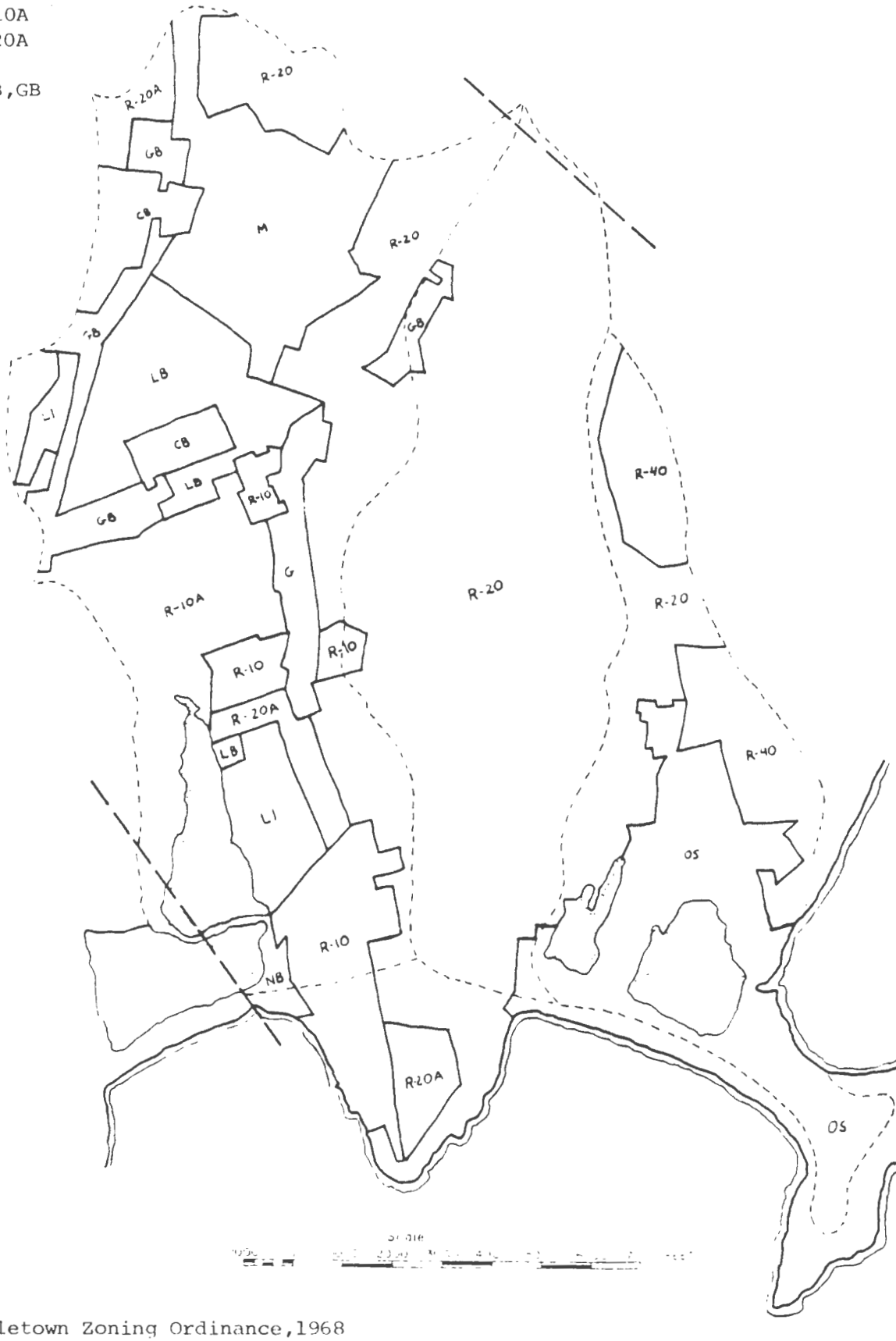
Aquidneck Island Industrial Park on Valley Road, now completely developed, was placed adjacent to Green End Pond, one of the major drinking water supplies. Also, the existing

FIGURE II-5: Current Zoning Districts

WATERSHED STUDY AREA

key

Residential: R-10,R-10A
R-20,R-20A
R-40
Commercial : NB,LB,CB,GB
Industrial : M,LI
Open Space : OP



Source: Town of Middletown Zoning Ordinance,1968

industrial area in the vicinity of the Newport State Airport is questionable for future industrial use due to the presence of wetlands, high water table and proximity to drinking water watersheds and residential area.

Under local land use regulations currently in place, existing and projected pressures for development will lead Middletown and the other Aquidneck Island communities to a series of irreversible environmental problems such as degradation of drinking water supply, loss of farmland, septic system failure and flooding. Table II-H briefly illustrates how the land will be impacted by future development islandwide, assuming that present policies will remain in place for the next 6 years.

Table II-H
Islandwide Growth for the Year 1990

Land Allocation (in acres)		Land Impacted (in acres)	
Residential	1129	Wetlands	314
Commercial	53	Steep Slopes (>15%)	283
Industrial	68	Active Farmland	353
Island Total	1250	Reservoir Watersheds	177
		Poorly Drained Soils	355

*Source: Save the Bay - Aquidneck Island Project 1983 - Acreage demand based on Save the Bay's land use projections. Land allocated according to existing growth trends, roads, public utilities and local land use regulations.

End Notes - Chapter II

1. Metcalf & Eddy, "Report to the City of Newport, Rhode Island on Short Term Modifications to Water Pollution Control Plant," Boston MA, April 1981.

2. Ibid.

3. Ibid.

4. New England Division, Corps of Engineers, Aquidneck Island RI, "Water Supply Study," August 1976.

5. RI Statewide Planning Program, Rural Runoff Task Force Report: "Erosion and Sedimentation," 1970.

6. Deparmtent of Environmental Management Reports, 1979-1982.

7. Save The Bay, Inc, "Land Use Changes on Aquidneck Island, 1960-1982," Technical Report No. 3, p. 39.

8. Metcalf & Eddy, "Report to the City of Newport, Rhode Island on Short Term Modifications to Water Pollution Control Plant," Boston MA, April 1981.

9. Lachowicz, Anthoni W., "Comprehensive Community Plan," Town of Middletown Rhode Island, May 1984, p. 64.

10. Ibid. p. 70.

11. Ibid. p. 70.

Chapter III - Alternatives for Watershed Protection

The main purpose of this chapter is to explore the various alternative land use controls available for watershed protection. Their applicability to the study watershed areas of Middletown is subjected, however, to the town's administrative capability as well as to the state and local regulatory framework. Considering that, the proposed analysis is introduced by a brief review of state and local land use regulations as they relate to water quality and supply. Section 2 also discusses the present land use decision-making process in Middletown concerning proposals for new development.

The implementation and effectiveness of the land use techniques reviewed in section 3 are evaluated in light of their performance in other communities in Rhode Island and throughout the United States.

The implementation and effectiveness of the land use techniques reviewed in section 3 are evaluated in light of their performance in other communities of Rhode Island and throughout the United States.

1. State Statutes Pertaining to Water Supply

A. State Authority to Regulate Public Water Supply Systems is governed by state statute,

46-13-1. et seq. "Public Water Supply".

This chapter places under Health Department jurisdiction all water sources, treatment works, and distribution apparatus associated with any public drinking water system. Health Department authority over public drinking water systems includes the setting of quality standards for drinking water and the monitoring of

systems to ensure compliance with these standards.

46-14-1. et seq. "Contamination of Drinking Water"

This chapter authorizes the Health Department to prohibit the introduction of "sewage, drainage, or refuse or polluting matter" into the watershed of any public water supply. The chapter does not contemplate preventive land use or pollutant discharge standards. Rather, it authorizes the Health Department to order the abatement of pollution post hoc, whenever the Department determines that it endangers a public drinking water supply.

3.46-15-1., et seq. "Water Resources Board"

In addition to setting forth the powers and responsibilities of the Water Resources Board, Chapter 46-15 outlines a general water resources development policy for the state. Essentially, this policy centers on water supply as the first-priority use of the state's water resources. The implementation of the policy outlined in this chapter has focused to date on the development of large scale surface water supplies and ground water sources in anticipation of future needs.[1]

Less specific provisions of Chapter 46-15 empower the Water Resources Board to act as steward of all of the state's water resources and to develop policies controlling allocation, inter-basin transfers, and conservation of water resources. There are no substantive performance standards, however, and to date these provisions have played a minor role in the Board's activities.

B. Other Applicable Statutes

The following statutes pertain to the protection and management of lands and waters in general. They have special relevance

when applied to watershed areas of public drinking water supplies, though not all of them make special provision for watershed areas.

2-1-18 et seq "Freshwater Wetlands"

The Freshwater Wetlands Act delegates to the Department of Environmental Management (DEM) regulatory authority over alterations to freshwater swamps, marshes, bogs, floodplains, streams, and ponds. The significance of the Freshwater Wetlands Act to water supply lies in the high percentage of the state's freshwater wetlands which are part of watersheds for public drinking water sources. This is especially true of surface water impoundments, many of which are surrounded by marshes and bogs and are drained and fed by streams and floodways. The intended purpose of the Freshwater Wetlands Act, that of preserving the natural water-purifying function of wetlands, is of especial significance to this study for its applicability to alterations of wetlands adjoining reservoirs.

46-12-1 et seq. "Water Pollution"

The Water Pollution Act authorizes DEM to classify surface waters and to promulgate rules and regulations for the protection of surface waters. To date, DEM regulations under the Act address solid waste landfills and septic tanks, two important sources of drinking water contamination.

During the past two legislative sessions, DEM has sought unsuccessfully to amend the Water Pollution Act so as to include groundwater within its jurisdiction. Passage of this amendment, as well as jurisdiction over non-point pollution sources, could provide the basis for more comprehensive state regulations, and address the protection of both reservoirs and wells.

45-24.1, et seq. "R.I. Enabling Legislation"

The General Laws of Rhode Island (as amended in 1956) empower cities and towns to control the use and development of local land by passing and administering zoning and subdivision regulations, and by adopting a comprehensive plan. Such zoning districts and regulations are adopted as necessary land use controls to protect the public health and safety and, among other objectives, to facilitate the adequate provision of public services and utilities. The Zoning Enabling Act (Section 45-24-4.3), however, has no explicit provisions that allow for specific use of the police power for protection of watershed lands.

Some Rhode Island communities have attempted to deal with current development and water quality problems through imaginative land use plans and innovative zoning techniques. These efforts, discussed in the next section of this chapter, have probably carried the local legislature well beyond the authorizations envisioned by the enabling legislation.

Rhode Island's zoning enabling legislation, adopted in 1921, has little to do with today's concept of land as a finite natural resource. It does not recognize the widely varying characteristics of land, which relate to its capacity to provide sites for development. It also preceded recognition of air, water, and noise pollution, and their effects to the environment as they are understood today.

Finally, the existing enabling legislation has not resulted in local land use plans or zoning ordinances that provide a valid basis for public facilities and services. Some amendments have

been made to the zoning enabling legislation in an effort to respond to obvious needs. In the mid-1950s, for example, every city and town was authorized to "prohibit or limit uses of land" in areas subjected to flooding. But these efforts have been sporadic and piecemeal, and have not yet resulted in converting the 1921 statute into land management legislation that meets contemporary needs.

2. Local Land Use Regulations

The existing land use regulations now in place in Middletown consist of zoning and subdivision regulations respectively adopted in December 1968 and March 1980. Both documents were amended on later dates, but no substantial changes were made to their provisions since their adoption.

The inadequacy of the existing zoning ordinance, especially with regard to watershed protection, is mainly due to the fact that it was written and adopted without any overall land use policy stated by a comprehensive land use plan. As a result, the definition of zoning districts is somewhat arbitrary and does not hold a logical relationship with the carrying capacity of the land.

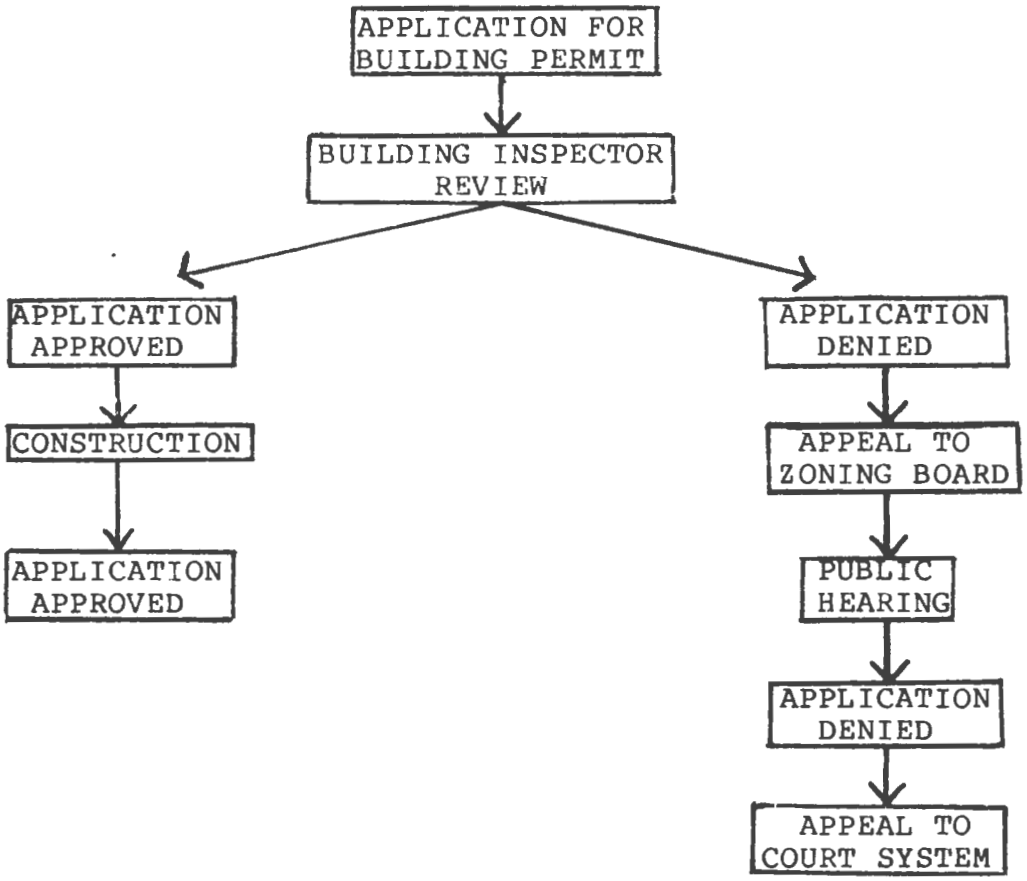
Middletown's zoning ordinance is administered by the town's building inspector and a zoning board of review. Due to the lack of technical expertise as well as more fully detailed criteria for reviewing proposals for new development, the enforcement of building codes and zoning ordinances can be inconsistent in Middletown. One of the major issues resulting from that is the lack of overall criteria according to which variances and special exceptions are granted. Zoning administration could be improved by the addition of a full-time professional planner/engineer to

assure both long-range comprehensive planning as well as more consistency in dealing with everyday development issues. This new staff position would also be key in coordinating the performance of the various boards and commissions.

The current building and zoning permit procedure can be represented by the following flow chart:

Chart III.1

Building and Zoning Permit Procedure



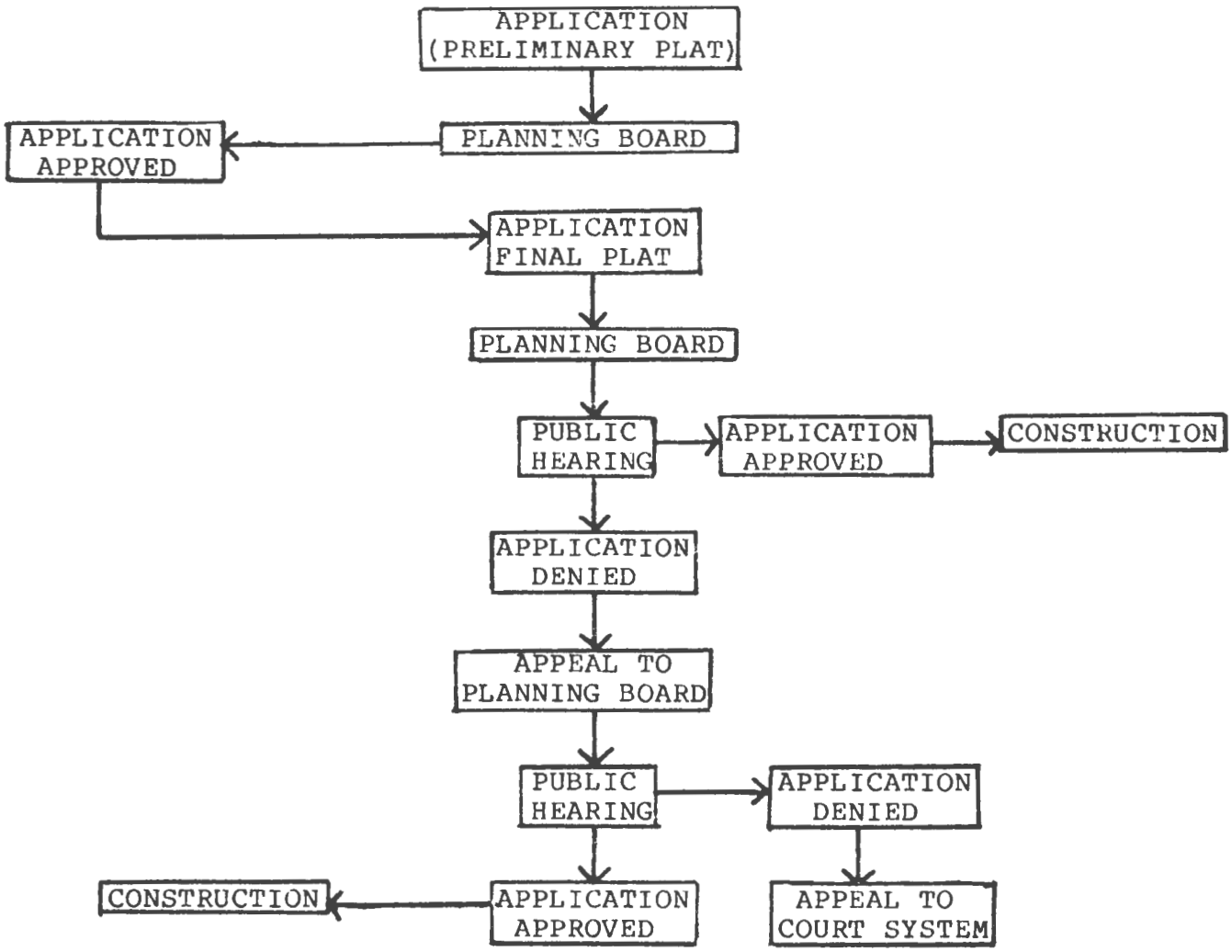
Middletown's subdivision regulations are administered by the town's planning board with a board of review for appeals. This document includes provision for minimum design standards with

requirements as to the extent and manner in which streets are to be graded and layed out. This section also includes requirements with regard to drainage patterns, soil erosion and sediment control.[2] Article 9 on required improvements establishes the specifications for water, sewer and other utilities to be provided. Performance bonds are the mechanism established by regulation to insure that the performance standards are met.

Middletown's subdivision regulations are good as a policy document, but they lack more detailed criteria for reviewing proposals for new development. Also here, the reviewing process is inconsistent and inadequate in addressing environmental concerns. Proposed amendments to the existing law should provide for technical assistance to the local planning boards. There is also need for clearer definitions, and procedures that include innovative and more flexible zoning techniques such as cluster zoning and planned unit development. In addition, stricter requirements should be adopted to control development of critical areas such as flood hazard zones and reservoir watersheds. The following flowchart illustrates the reviewing and permit procedure for subdivision of land in Middletown:

Chart III.2

Subdivision Review Procedure



Middletown's present land use regulations have no specific provisions concerning development within surface water reservoir watershed areas. Two recent amendments to the zoning and subdivision ordinances are important, however, for their relationship to watershed protection and water quality.

The first is an amendment to the zoning ordinance adopted in February 1984. Section 26-38, entitled "Areas Subjected to Flooding", requires a building permit granted by special exception for any new development proposed for flood hazard zones. This permit is issued by the local building inspector.

This ordinance, adopted to fulfill a requirement of the National Flood Insurance Program at the local level, should have been substantially strengthened, however, to reduce new construction on these areas. All proposals for new development, if allowed at all, should have been required to go through the zoning board first. This way, any applicant would be required to show that the permit is appropriate in light of the probability of flood damage. In addition, there should have been specific reference in the ordinance requiring the zoning board to find as fact that all requiremnts have been met as a precondition to granting a special exception.

Without these modifications and a more detailed reviewing procedure, followed by permanent enforcement, the effectiveness of this ordinance will be limited.

The second important amendment to the general provisions of the zoning ordinance was adopted in June 1984. Section 8.2 requires drainage calculations and provisions for a zero increase

in runoff for all developments exceeding 3,000 square feet of impervious surface.

According to this ordinance the applicant shall submit all computations in determining rates of stormwater runoff based upon an analysis of peak discharges from both a two-year and a ten-year frequency, 24 hour duration and shall be prepared by an engineer registered in the state.

Given these calculations, a drainage plan shall be prepared for the site, proposing the necessary measures to meet the criteria required for zero increase in runoff.

As these latest amendments show, there has been increasing local awareness of how development should relate to the natural characteristics ofthe land, as well as to the level of public services available and the common goals of the community. With the adoption of its Comprehensive Community Plan in May 1984, Middletown has the unique opportunity to improve present land use and development patterns by amending the existing regulations or adopting new ones that conform to the goals and recommendations of the comprehensive plan.

3. Alternative Controls for Watershed Protection

A. Large Lot Zoning

Large lot zoning is a technique requiring a large minimum lot size for residential development. Usually a lot size from 1 acre (43,560 sq. ft.) to 5 acres (217,800 sq. ft.) or more is required. Low density residential development, the intended result of large lot zoning, is an appropriate way to make development conform to the physical constraints of the land such as poor soils, steep slopes, natural sensitive areas, and

preservation of farm land.

In many communities, however, large lot zoning has been charged as a discriminatory measure against low income groups. Such cases have been brought before the courts, with different results. In some cases the decisions favored the zoning ordinance and in others the communities were ordered to provide low and moderate income housing on a "fair share" basis with regard to the other existing zoning districts.

Another limitation of large lot zoning is that even though it permits preservation of open space, it does not effectively maintain open space suitable for public recreation and conservation.

In addition, many categories that typify large lot zoning, such as high income residential and agricultural uses can be significant sources of non-point pollution. The traditional zoning does not regulate use performance or provide for site design criteria. Thus, nutrients used as fertilizers in lawns and agricultural fields end up in waterways and aquifers that feed surface reservoirs and wells, serving as major degraders of the water quality.

Another variation of large lot zoning is the establishment of conservation districts which are designed to preserve an area's unique amenities, e.g. historic sites, plant or animal habitats, ground water recharge areas, wetlands, etc. The effect of a conservation district is to rezone land for limited use as agriculture, recreation, forestry, conservation and/or other activities, or to set up special permit systems for development in the area.

Sanborton, New Hampshire and Montgomery County have adopted good examples of low density zoning ordinances in which different use categories are assigned to specific areas according to the natural features characterizing each one. General provisions for agricultural, recreational, residential and conservation uses are included in these model ordinances.[4]

Finally, a municipality may also zone large tracts of land for agricultural purposes only. California, Washington and Oregon are examples of states that already employ exclusive agricultural zones.

A disadvantage of exclusive agricultural zoning is the relative ease with which it may be suspended. Landowners may seek a zoning change from solely agricultural usage because of substantial profits which may be gained by selling farmland for residential or commercial use. This also means that the technique may encounter considerable political resistance before it is even tried.

Thus, it is clear that exclusive agricultural zoning by itself does not constitute a very strong mechanism to preserve land in agricultural use. Its effectiveness depends on the availability of other support instruments to reduce development pressures and speculation over that land.

The Rhode Island Farm Forest and Open Space Taxation Law adopted in 1968 was designed to reduce pressures for development of these areas by taxing land based on its present use rather than on the open market or its potential use value. If the land taxed under this system is later converted to other uses, additional taxes are due, equal to the difference between the

market and use-value assessment. Although well-intended, there are many problems with the law: "Disinterest on the part of local assessors, (their) complete authority over what lands qualify and what uses are placed on qualifying land, inadequacy of the two-year rollback, and lack of a definite legal system of rollback collections...."[5] Until there is more binding legislation and enforcement, the Open Space Tax Law will do little to achieve the goals originally intended for it.

Use-value assessment may also mean the loss of tax revenues to a municipality. California responded to this dilemma by granting state tax subsidies to local communities employing farm-value assessment. Since the entire state benefits from agricultural land preservation, it is considered reasonable that the state share the costs.

On the other hand, considering the potential negative impact of agricultural runoff to water quality, additional regulations to control non-point-source pollution might be necessary. The town of Sterling, Wisconsin enacted an ordinance that specifies the type of farming practices allowed on agricultural lands. Also in Wisconsin, Walworth County's zoning ordinance has specific provisions for agricultural practices regarding slopes, erosion and the use of fertilizers.[6]

Since there is no one clear solution to the problem of preserving farmland and open space, the best results seem to emerge when several techniques are used together. Sunderland, a small farming community in Massachusetts, has been successful in using a strategy to preserve farmland that combines zoning,

fiscal incentives, and by-laws to control agricultural practices on these areas.

B. Overlay Districts

Overlay districts establish additional requirements for the primary zoning district, based on specific hazards and problems posed by the land capability to hold development.

The location of the proposed development and its relationship with the area to be protected determine the additional requirements necessary for building permits.

In North Kingstown, RI, any structure proposed within the limits of the overlay districts has to comply with all requirements set forth in the primary district, with the ennumerated additions, exceptions and conditions related to the problem addressed by the overlay.

The planning board requests local departments and state agencies make available expert assistance in reviewing applications for development. Site plans must be approved by the planning director and town engineer before a building permit can be issues.

C. Floodplain zoning

Floodplain zoning provides a rational approach to channeling development away from areas susceptible to flooding. Municipalities can limit the use of land within a floodplain through the Zoning Enabling Act and the Fresh Water Wetlands Act of 1971. Under this legislation, property use on floodplains can be limited to those uses presenting minimum or no hazard to life and property as a result of high waters, such as agriculture, recreation and conservation.

In 1968, the National Flood Insurance Program was enacted to make flood insurance available to communities and individuals who meet federal construction safety standards. In 1973, the Flood Disaster Protection Act amended the 1968 Act to require communities with formally identified flood hazard areas to enter the Program as of July 1, 1975, and to comply with floodplain management measures as outlined by the Federal Insurance Administration.

Floodplain zoning is currently used by most Rhode Island communities. A major impetus for it is the National Flood Insurance Program, which sets land use control requirements for eligibility of insurance benefits. To meet these criteria, for example, South Kingstown, Charlestown, and Westerly have enacted ordinances regarding the elevation and anchoring of structures along barrier beaches. Inland towns have set up comparable guidelines for their flood prone areas.

Most of these communities have chosen to enact structural measures rather than land use controls in meeting federal requirements. In Rhode Island the structural requirements have been incorporated in the State Building Code. Consequently, all municipalities comply with this criterion for participation in the program. The land use requirements, however, are adopted as parts of local zoning ordinances or subdivision regulations. These are generally weak and frequently not enforced.

D. Cluster Zoning

Cluster zoning is a planning tool intended to reduce the spread of the built environment and gain greater amenity, while

maintaining the overall density allowed within a zoning district.

By clustering the structures in areas where the land characteristics are most suitable for development, open space can be preserved for common use.

Another advantage of cluster zoning is that it allows for a more flexible and innovative arrangement of structures on the site. By reducing the amount of paved areas, construction costs are also reduced, and surface runoff is minimized.

Clustering has become a popular development alternative to the conventional subdivision in Rhode Island. North Kingstown, South Kingstown, Smithfield and Coventry are examples of Rhode Island communities which currently employ cluster zoning ordinances.

The cluster zoning ordinance adopted by the town of East Brunswick, New Jersey requires a minimum of five acres of open space for any development seeking less stringent density requirements through the clustering of dwelling units. The open space provided is required to remain in private common use unless the Planning Board determines that public ownership is desirable. In the event that the Township decides to obtain title of that area, it should be maintained as open space for public use.

E. Planned Unit Development

This technique is slightly different from cluster, although the basic planning principles are the same. Both seek a more flexible approach to the development of large parcels of land as a whole. Clustering, however, is usually limited to residential development whereas PUDs usually include mixed uses - commercial, industrial, and even institutional categories besides residential at different densities.

The main advantage of PUDs is that they allow for different uses to be conveniently and appropriately mixed according to the natural constraints posed by the characteristics of the site. A further advantage comes from a design freedom which is not possible under single lot-single building consideration.

The design criteria for reviewing a Planned Unit Development proposal are general in nature, and they are frequently not applied until actual plans are proposed. This implies increased administrative discretion of the local planning staff while setting aside present land use regulations and rigid plat approval processes. This alternative also relies on the existence of an effective bargaining process between the developer and the municipality.

PUDs usually involve phased development over a relatively long period of time during which building arrangements and uses may have to be replanned to meet the changes in functional demands, technology, financing and other variables.

Enacting new legislation is not the only way to provide for this development alternative. Zoning amendments and conditional use techniques enable the characteristics of a PUD to be implemented and enjoyed. Some municipalities have explored the possibilities proposed by the "floating zone" technique, rather than using the concept of a pre-defined PUD district. In general, floating zones are special land use districts that remain unspecified on the zoning map. The specific location of the floating zone is not appointed until an application consistent with the Comprehensive Plan of a municipality is

received and approved. At that time the zoning district is affixed to a specific parcel or area.

Regulations for Planned Unit Development in Livingston County, NJ state that proposed project areas within previously assigned PUD districts must encompass a continuous minimum land area of fifty acres in the town. At least twenty percent of the total area to be developed must be kept open. All such land area proposed for common open space is offered for dedication to the Town Board, which has discretion and jurisdiction over its use. Specific requirements concerning the mix of uses, densities, architectural controls and site design criteria are also part of this model ordinance.

Due to the flexibility provided by the PUD option, a higher degree of planning expertise and a more detailed project review and permit procedure for the town are required as pre-conditions of success.

F. Timing and the Sequence of Growth

This technique permits a community to accommodate new development gradually and to ensure that local amenities are preserved. To time the sequence of growth effectively, the community creates a master plan incorporating its present public works capacity (water, sewers, roads, etc.). The Plan provides for phased growth first in areas presently served, and gradually extending outward following the expansion of services.

By timing the sequence of growth the community can efficiently plan the implementation of public services; low density sprawl can be avoided by planning impact development and planning for open space management. The community can thus better manage land use.

According to this mechanism all future residential subdivision development is designated "special use" and requires a permit. A developer is permitted to build only if the land is serviced adequately, judged on a point system.

This new concept of timing has been judged constitutional in the New York courts, provided the town has a definite schedule for constructing new utilities and other services, normally not exceeding 18 years. This is a particularly good approach for small towns suddenly faced with tremendous growth pressure.

G. Transfer of Development Rights

The concept this mechanism responds to is that if a community does not want development in a particular area it should make it possible for the landowner to sell his/her development rights to someone who owns land in an area where the community is prepared to encourage growth.

The community allots development rights in accordance with a master plan. The number of obtainable development rights is determined by the desire for development in each area. The number of development rights granted increases as the necessity for conservation is seen to decrease. A property owner whose land falls within a conservation district receives a limited number of development rights, while the number of rights required to develop that same property is high.

TDR ordinances create a market situation for development control, where development rights are considered a transferable commodity with a value fixed by the fluctuation of market demand.

The TDR approach is, however, difficult to implement, and is

not easily understood by various landowners. It requires a great deal of detailed planning and only works if there is a willingness to sell development rights in the conservation district, and a demand for those rights in the development district.

Due to its sophisticated and innovative character, the mechanism of TDRs has not been widely used in land use management. As a result, only a few TDR ordinances throughout the country have been enacted to this date. TDRs have been implemented in New York City for density control and in Chicago with the intent to preserve historic buildings. In Sunderland, Massachusetts and St. George, Vermont, where there is a pressing need to preserve agricultural land the ordinances have also been adopted.[7]

Towns seeking to implement TDRs should recognize that it has not been fully tested in most states, and new state enabling legislation is probably required as is the case in Rhode Island.

H. Land Acquisition

Full purchase of the title of the land is the least complicated and usually most expensive way of controlling the contractual rights of land. Fee simple acquisition may be hard for some communities or organizations to afford. Buying of land over a period of time in agreement with the land owner is a more practical technique. This spreads out the capital gain tax for the owner, while freezing the cost of the land for the town. The town might also lease back parts of land for use in accordance with the overall plan, or achieve the same end by buying selected parcels of land.

There are also many different alternatives available for a municipality to buy one specific piece of land when this is what is needed to achieve a specific goal. Rights of way and easements are examples of this procedure.

Land can be acquired by a community through a variety of methods that range from voluntary donations to land trusts and land banking. They all have political and administrative pre-conditions which vary according to the characteristics of each community.

I. Taxation

One factor behind the shift of open space and agricultural land to more intensive uses is the high property taxes that landowners face. Development pressures increase demand for land and municipal services. This eventually leads to higher tax rates which become necessary to generate the revenue for services to the new development.

Taxes for all lands are determined by fair market valuation of the property, meaning the property is assessed at its highest and best use rather than the actual use for which the land is utilized. Such a taxation system places a large tax burden on owners of open space who find it too costly to continue using their land for low intensity uses such as farming, forestry or maintaining open space.

Realizing that, many states enacted laws to deal with this problem. Maryland, in 1956, implemented the first tax law to encourage preservation of open space by allowing it to be taxed at use value rather than at fair market value.

Currently 41 states have use value assessment laws in place. In 1968, Rhode Island implemented the Forest and Open Space Act under which farm, forest and open space land can be assessed at use value.

J. Runoff and Erosion Controls

Runoff and erosion controls as well as other site design criteria may exist separately or may be incorporated as part of existing ordinances. These types of single-purpose environmental ordinances or by-laws can address a specific, actual or potential environmental problem and control it at the local level through regulation.

Stormwater runoff from developing urban areas can transport large amounts of sediment and associated pollutants (nutrients, metals) to the surface waters. Soil loss from construction sites in Rhode Island is estimated at 35.7 tons per year,nearly three times greater than from seriously eroding cropland.* Other pollutants such as petroleum products, paints, pesticides, cleaning solvents, cement wash, and asphalt from construction sites, are also carried by stormwater runoff and contriubte to water quality problems.

A number of local governments recognize that the cost of preventing damage from erosion is often less than the cost of correcting it. Also many believe that the cost of preventing erosion damage should be borne by those benefitting from the development, rather than by taxpayers paying to remove sediment from ditches, culverts, streets, harbors, lakes and streams.

Thus, local governments are developing or amending zoning and subdivision regulations and other local ordinances to include

runoff and erosion control requirements for developing land areas. Regulations seem to work best if they are tied into existing local regulations. The addition of these control requirements to these regulations merely requires the developer to asume a few additional responsibilities.

These ordinances typically require a developer to submit a detailed plan specifying how he will minimize erosion and runoff during and after development. An appropriate reviewer (for example, the town engineer or the local soil conservation district employee) reviews the erosion control plan. If the initial or preliminary plat is approved, and the erosion control plan is considered adequate, the developer may begin construction. Typically, before a final plat is filled, the person who reviewed tha plan inspects the site and certifies that the measures have been installed in accordance with the plan.

The city of Middletown, Wisconsin was one of the first cities in that state to adopt an ordinance to control runoff and erosion from land developments. Middletown's ordinance, adopted in 1979, includes erosion and runoff control provisions for most land-disturbing activities, including:

- earthmoving activities for areas 5,000 square feet or more
- excavating or dilling that exceeds 500 cubic yards
- constructing or repairing public roads

Any land division that requires a subdivision plat or a certified survey map is also covered by the ordinance. Additional on-site detention and runoff controls are required for developments of three acres or more when the city engineer

determines they are needed to prevent stormwater runoff problems.

In Rhode Island, at the present time, there is no general enabling legislation authorizing cities and towns to adopt erosion and sedimentation controls. The 208 Water Quality Management Plan for Rhode Island[9] recommends adoption of state legislation setting forth uniform standards for erosion and sedimentation controls, to be enforced by local communities.

End Notes - Chapter III

1. Rhode Island Statewide Planning Program, "Summary and Analysis of State Law Relating to Water Supply and Drinking Water Quality," Technical Paper No. 104, July 1982, p.1

2. Town of Middletown RI, "Rules and Regulations Regarding the Subdivision of Land," March 1980.

3. U.S. Department of Agriculture Soil Conservation Service, "Urban Hydrology for Small Watersheds," Technical Release No. 55, 1975.

4. Brooks, Richard Oliver, "Municipal Environmental Ordinances," University of Rhode Island, Kingston RI, Vol. II, pp. 417-439.

5. Lesher, William G., "Land Use Legislation in the Northeast: Rhode Island," Northeast Regional Research Project, November 1975, p. 29.

6. Arts, Jim and Anne Weirberg, "Local Government Options for Controlling Nonpoint Source Pollution," University of Wisconsin - Extension, May 1981.

7. Rhode Island Statewide Planning Program, "Methods of Avoiding Conflicts," Technical Paper #82, April 1979, p. A-11.

8. Rhode Island Statewide Planning Program, "208 Water Quality Management Plan for Rhode Island," Final Plan - August 1979, p. 408.

9. Ibid. p. 409.

Chapter IV - Watershed Protection Plan

1. The Plan Concept

The watershed sensitivity district concept for Middletown, Rhode Island suggests a series of actions to assure the preservation of the drinking water quality and supply, while providing an attractive environment for community growth. Initiation of action toward this end can be guided by the identification of effective tools for the implementation of each recommended strategy, as well as well-defined roles for local and state government, and the private sector.

Based on the analysis presented in the first three chapters of this study report, a plan for watershed protection was developed. The basis for the plan, as illustrated by Fig. IV.1, is the classification of the watershed areas into four categories according to their natural characteristics as well as the stage of development in which they are presently found. The study watershed areas were classified as critical areas, conservation areas, developed areas and areas of future growth.

Watershed critical areas are those adjacent to waterways and surface water reservoirs. These areas encompass stream and river valleys, erodible, shallow and wet soils, flood hazard zones, wetlands and wetland edges. Watershed critical areas are defined by a two hundred foot buffer zone around any of these features. Development in these areas should be restricted to open space uses, or developed on a special exception basis according to prescribed standards and a site plan review process.

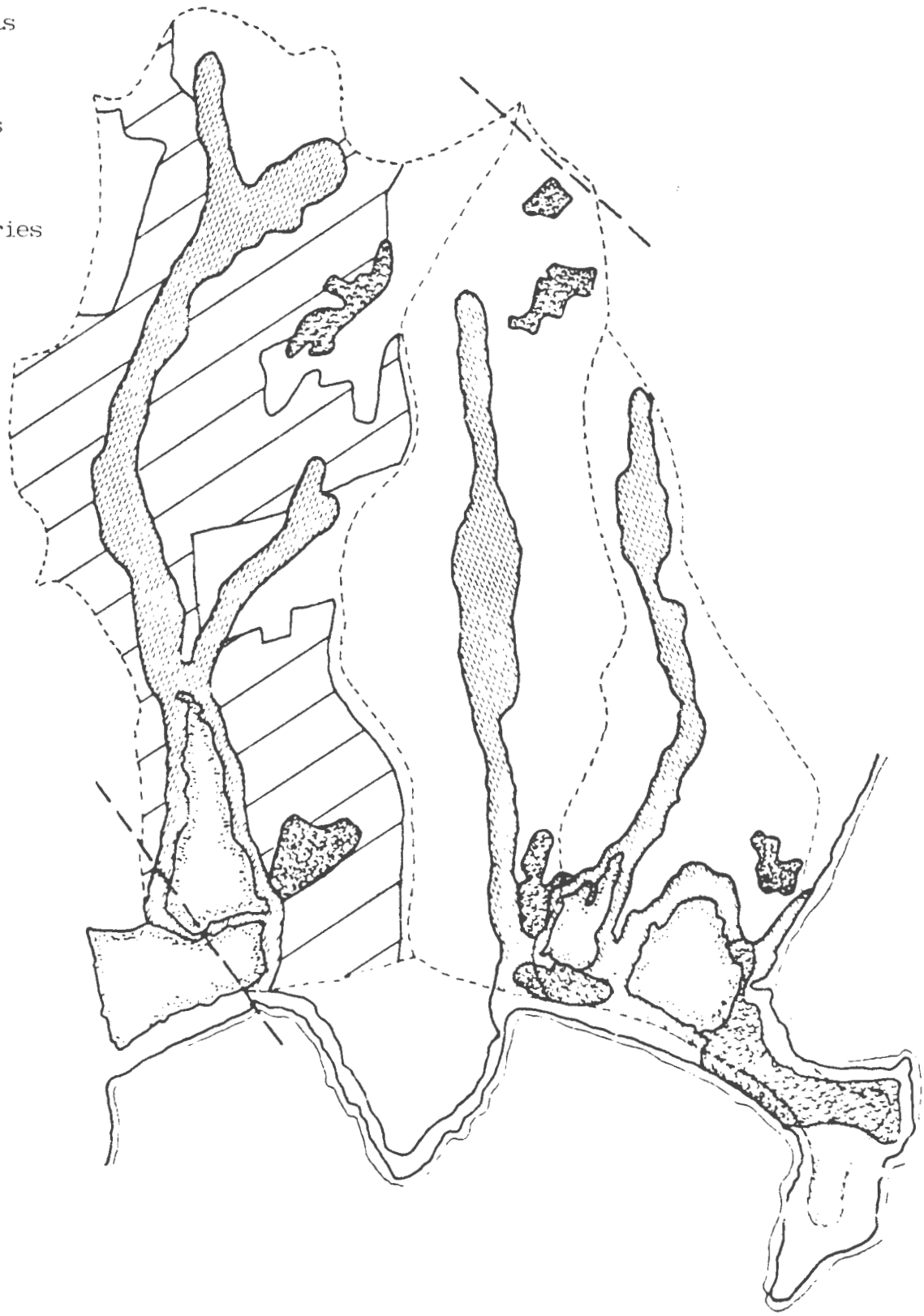
Conservation areas are those characterized by unique environmental features such as the remaining forested areas and

FIGURE IV-1 : Watershed Protection Plan

WATERSHED PROTECTION PLAN

key

- Watershed Critical Areas
- Conservation Areas
- Developed Areas
- Undeveloped Areas
- Town Line
- Watershed Boundaries



N

Scale

wildlife habitats. These areas should also be protected from development and encouraged to be used for open space, recreational, scientific and educational purposes. Considering that many of the areas falling under this category are located within critical watershed areas, the Plan provides for the development of a strong recreational and educational aspect associated wtih watershed protection.

Developed watershed areas, basically defined by Bailey's Brook Watershed, are characterized by an advanced stage of development and the presence of roads and utilities, which indicate the continuation of the urbanization process. Future development of the remaining vacant parcels should occur under strict land use controls.

Zoning densities should be upgraded to a minimum of 40,000 sq. feet lots for residential development. Cluster development should be encouraged as the best strategy for residential development of the larger remaining vacant areas. All industrial development should be channeled away from watershed areas, and new in-fill commercial development should only occur on selected areas assigned by the Comprehensive Community Plan. All proposals for new development on these areas should be submitted to site design review for the fulfillment of requirements for runoff, erosion and sediment controls.

As the last category, undeveloped areas are those basically concentrated within Paradise Brook and Maidford River's watershed. These areas are not served by sewers and have soils which pose severe constraints for development. They are also

characterized by the predominance of prime farm land as well as by the concentration fo land in agricultural use. The plan recommends 80,000 sq. feet as minimum lot size requirement for these areas and the use of cluster and planned unit development for any proposed new development on parcels over six acres. Strategies for conservation of farmland as well as the improvement of agricultural practices to reduce rural runoff are also fundamental recommendations to be implemented in these areas.

2. Plan Implementation

Three alternative scenarios were considered for the implementation of the watershed district plan developed by this study.

The first option or "worst scenario" consists of reliance on existing land management regulations and programs. It is based on the assumption that no new regulatory measures would be adopted and that local and state agencies would acquire watershed lands according to existing priorities and schedules for land acquisition.

Middletown's existing zoning and subdivision ordinances would continue to be amended on the current piece-meal basis to comply with federal and state land use regulations as well as with the community's goals and objectives provided by the Comprehensive Plan.

This strategy represents an attractive option since the burden on the local administrative body would not be increased, nor would governmental agencies be encumbered with large scale land acquisition costs and other efforts. Middletown's watershed areas, however, would continue to suffer the negative impact of

new development which would continue to occur under similar patterns to the ones identified by this report. Considering that Aquidneck Island is an attractive location for urban growth, the existing local regulations, even if upgraded, would not be able to cope with development pressures and adequately shape increasing urbanization for long. Although existing state programs safeguard valuable natural resources, they would not prevent the long term cumulative effects of development in all areas of the study watersheds.

Finally, if public land acquisition is not vigorously pursued, many parcels in watershed critical areas will be acquired and developed in environmentally incompatible patterns well in advance of future beneficial local or state actions.

Thus, a strategy relying entirely on existing regulations and current level of public land acquisition would not assure the effective protection of Middletown's watershed areas.

A second scenario was considered with reliance on a large scale public acquisition program and increased local and state land use regulation. This option is based on the assumption that public acquisition would be used to assure the preservation of all critical watershed areas - those of highest potential impact to the drinking-water quality supply. Public acquisition would be coupled with moratoriums on development, restrictive zoning and the substantial improvement of local ordinances to forestall development of lands scheduled for acquisition. Legislative support in the form of appropriations for land acquisition and modifications to the current enabling legislation to authorize

increased restrictions on land use development would be essential for the success of this strategy.

From the perspective of preservation of open space, this option can be viewed as the "ideal scenario". However, even though large scale public acquisition could assure the protection of critical watershed areas, it would be a prohibitively costly means of land use control. If coupled with a severely restrictive regulatory program, free choice and independent decisions for wise land management could be unreasonably not considered. In addition, the allienation of other governmental agencies from the process as well as the restricted role reserved to the private sector represents a tremendous increase of the administrative burden on the local government.

The third option explored consists of the combination of existing local and state acquisition, regulatory, educational and advisory programs with new tools and recommended new measures to implement the watershed protection plan in Middletown. This approach can be interpreted as the "realistic scenario" - a balance between options 1 and 2 - and it represents the proposed strategy for implementing the recommendations discussed in the following section.

3. Recommendations

A. Growth Management

Growth will continue to be detrimental to water quality and supply unless it is guided to occur on suitable locations, and minimized in areas which are inappropriate for development. Existing developed areas outside the drinking water reservoir watersheds should become the focal points for most future

development. Higher density residential, industrial and commercial development should be channeled to selected areas of least environmental constraints.

Zoning and subdivision regulations should be amended to permit neighborhood commercial and higher density residential development (2 to 4 units per acre) in selected areas where the carrying capacity of the land and the availability of public utilities is determined as appropriate (according to the Comprehensive Community Plan). This will provide an initial basis for stimulating growth outside the study watershed areas.

Amendments to existing zoning to reduce densities in watershed areas (40,000 sq foot lots in sewered areas and 80,000 sq foot lots in unsewered areas) should also be adopted according to the recommendations of the Comprehensive Community Plan. In conjunction with lower densities, both the development of larger parcels as well as in-fill development of watershed areas should only be allowed under new design criteria to reduce additional impacts on the water quality. Cluster provisions should be used in areas where large parcels of vacant land are still available as an attractive alternative to conventional subdivisions.

Through cluster and PUD provisions, Middletown could substantially reduce capital investments in roads, utilities and related services for future watershed development. The town would also be able to retain increased open space and secure improved site designs on the basis of these measures. Although there are no references to PUD and cluster provisions existing in Rhode Island enabling legislation, many communities have successfully used them, as discussed in Chapter 3.

Middletown's capital improvements programming could also be used to direct growth out of watershed critical areas. The allocation of public capital investments for roads, sewers, water, and related services for areas where growth is more appropriate, should be given higher priority. In a like manner, denial of improvements in those areas deemed inappropriate for development would impede growth, thereby assuring conservation of valuable open space while reinforcing growth and development within the more urbanized areas.

Finally, Middletown should carry on a comprehensive natural resources inventory as tha basis adopting official maps to guide land use and development decisions. This information would be used as an adjunct to new capital improvement policies for the revision of official town maps with specific delineation of growth and conservation areas. Chapter 45-23-1 of the RI General Laws enables communities to adopt official maps showing the location of streets existing and established by law as public streets. Based on these official maps the town can prevent the development of land not abutting a mapped street by denying building permits. Through this measure Middletown can direct development toward areas which are prepared for growth. Capital improvements programming and official mapping actions are both existing tools that can be acted upon, without delay, for the implementation of the watershed protection plan.

B. Preservation of Open Space

Preservation of open space within the study watershed arees, primarily in critical zones abutting streams and drinking-water

reservoirs is another key element to protect drinking water quality and supply. In addition, by preventing widespread growth the adverse impacts of development are minimized and the natural amenities of the watershed areas can be maintained.

Zoning and subdivision regulations hsould be amended for the adoption of conservation districts within these critical areas to assure that a 300 foot vegetated buffer can be established along the waterways. The same setback requirements should be adopted as a protective measure for the areas along the edges of surface water reservoirs. The already developed parcels within these area which do not meet these requirements would be considered as non-conforming use of the land until future action from the public sector or a private proposal for redevelopment can correct that status.

Local land use ordinances should also be amended to require any subdivisions involving more than six acres or more than three lot divisions be developed on a cluster design basis. This requirement specifically applies to the undeveloped watershed areas where cluster zoning could also be used as a strategy for preservation of farm land.

These measures represent the most restrictive steps Middletown could take within the context of traditional zoning. Although they will assure a more attractive form of low density development, they will not necessarily prevent sparwl or large scale subdivision if the adopted zoning changes are revised or otherwise made ineffective upon the emergence offuture development pressures.

Local government cannot prevent totally the development of land through traditional zoning without compensating affected landowners. Zoning in conjunction with transfer of development rights is a measure recently developed to alleviate this problem. As discussed in Chapter 3, TDR uses the open market to compensate individuals deprived of development rights on their land through local zoning.

A TDR program would involve the development of a zoning plan in which areas of least environmental constraints, outside the watershed sensitivity district, would be zoned for intensive development, while critical watershed areas would be zoned for limited or no development. Next, each acre of land within the zoning jurisdiction would be assigned an equal share of development rights. The distribution of rights would be designed to insure that areas zoned for limited development have a surplus of rights, while areas zoned for intensive growth are provided with insufficient rights to proceed with development. A market system would thus evolve, within which individuals seeking to develop intensive uses would have to acquire additional rights in advance of their projects. By selling their surplus development rights on the open market owners of restricted lands would be, thus compensated.

A TDR process could be used in Middletown as a comprehensive growth management program and an effective supporting strategy for the preservation of open space in watershed areas. Existing state enabling legislation and the complex administrative system required have, however, impeded widespread use of TDR programs. The legislation will have to be appropriately amended in advance

of any application of TDR in the state. The town would also have to amend existing ordinances and develop a process for allocating and recording the exchange of development rights. This process can be simplified with the utilization of TDR restricted to the surface reservoir watershed areas, through a special district zoning provision.

Land banking represents another possible approach to managing future development in the watershed areas. The mechanism consists of public acquisition of land imminently threatened by private development. Quasi-public acquisition (by public interest, non-profit organizations) can achieve the same ends. Subsequent to such acquisition, land can be resold or leased to prospective developers with deed restrictions or lease agreements prescribing its future use. A land banking program could be used to manage future growth within critical watershed areas.

Finally, public acquisition of full or partial interest in land is recommended as the most effective means of reserving open space for water quality protection and recreational purposes. Public acquisition would assure the long-term preservation and public use of valuable watershed resources. However, it requires large scale capital investments on a short-term basis and reduced local property tax revenues by removing land from the local tax rolls.

Land acquisition is also a time consuming process and will require the joint effort of several local, state, and private entities. A local organization should be designed to coordinate the acquisition program.

Considering the high cost of land, public acquisition of critical watershed areas could be supplemented with a program designed to stimulate voluntary dedications of restrictive covenants and easements on private property. By affixing restrictive covenants to the title on lands, existing property owners can prescribe conditions of the future use of the parcel. Covenants designed to prohibit development of scenic or natural areas would have the same effect as scenic or conservation easements.

This recommended strategy would insure the long term preservation of valuable watershed lands at no cost to the public. In addition, private property owners are afforded tax deductions on their federal income tax returns as an incentive to dedicate their land to public purposes. Since this measure relies entirely on the voluntary participation of landowners, a local organization should dedicate considerable effort toward stimulating landowner participation in the easement and covenant dedication program.

The creation of a watershed private land trust could also aid in the preservation of open space. Private land trusts are non-profit organizations established to preserve land for the public's benefit through acquisition or dedication of full or partial interests in land. Land trusts have proved effective in Connecticut, New Hampshire and Massachusetts. Their success as land preservation organizations is partially attributable to the tax advantages they can offer property owners.

In addition, preferential tax treatment under the Rhode Island Farm, Forest and Open Space Act (1968) can be used as an incentive to obtain voluntary dedication of private property for

open space conservation. However, this program needs to be strengthened in two areas to render it an effective open space preservation measure. First, local government needs a broader tax base to decrease its dependence on local property tax revenues. Second, the current two year tollback provision designed to penalize speculative conversion of open space land should be lengthened to ten years to make such conversions prohibitively expensive.

These modifications, in conjunction with an active program to stimulate private interest in participating in the program could make the tax deferral program an effective means of preserving open space.

C. Environmental Management

The protection of surface water features within the study watershed areas should receive special consideration within the context of the plan implementation strategy.

Adverse environmental impact from land use and development can be avoided by the adoption of special zoning districts. Through special watershed zoning districts development of critical watershed areas should be restricted to open space uses, or developed on a special exception basis according to prescribed standards and a site plan review process. Critical watershed areas that warrant this level of protection include floodplains, wetlands and wetland edges, areas of steep slopes, erodible, shallow and wet soils.

Improved management of environmental resources can be aided by the adoption of new by-laws for environmental protection as

well as by the utilization of local and state permit programs. Watershed protection could be increased if the concern reflected in existing permit programs were broadened to include the potential decrease in drinking water quality from sedimentation and overland urban runoff.

Middletown should develop and adopt regulations requiring the use of runoff, erosion and sedimentation controls to reduce degradation of the drinking water quality. The town should also modify zoning in rural areas to require property owners and developers to apply best management control practices with technical assistance from the Soil Conservation Service. Zoning should also be amended in rural areas to require natural buffer strips of 300 feet from the flowline of streams and edges of reservoirs and wetlands.

D. Other General Requirements

A plan to become a reality needs to be combined with a cohesive implementation strategy to be pursued within a sound organizational framework. To assure that the recommended actions are initiated and sustained, as well as carefully coordinated, a well organized implementation structure is made necessary.

The recommended organizational structure should be a joint state-local commission to guide the implementation of the plan. A professional planner should be hired by Middletown as a full time staff person also in charge of coordinating the work of the commission. The commission would be empowered to monitor local regulation of watershed development and to appeal local decisions if they were inconsistent with the adopted requirements of the watershed sensitivity district. The appeals process should be

based on existing appellate entities including, for example, the zoning boards of appeals at the town level and the state apellate structures associated with state permit programs. The commission would also be empowered to acquire and hold land for which it would be provided a permanent source of revenue to finance land acquisition.

Finally, it is important to recognize that the portection of the drinking water quality and supply on Aquidneck Island is an issue which cannot be confined within Middletown's municipal boundaries. Watershed areas, as any other natural resource, are many times comprised of areas under more than one political jurisdiction. This is the case on Aquidneck Island where the nine surface water reservoir watersheds that feed the Island's drinking water supply system, are located in five different communities. A permanent solution to the problem will only become a reality as a result of regional efforts that involve all participating communmities in a coordinated and comprehensive long-range planning process. Hopefully, Middletown will be the community, also best prepared to take the first step in this direction.

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Appendix I

TABLE A-I
LAND USE CATEGORIES

Composite Category	Component Category
Residential	U-Urban-Residential land
	NU-Navy residential
Commercial	C-Commercial
Industrial	I-Industrial
Transportation	T-Transportation-Highway, Buses, Freight Storage
Recreation	R-Recreation-Parks, Marinas, Beach, Golf, Athletic Fields, Drive-In
Institutional	OP-Open and Public-Public Facilities, Churches, Hospitals, Nursing Homes, Governmental Buildings, Cemetaries.
	NOP-Navy Institutions-Navy Base and other Government Buildings except residential uses
Agricultural	A-Tilled Crop Land and Farm Buildings, Nursery, Orchard, Green Houses.
	P-Pasture
Mining and Waste Disposal	M-Mining, Sand and Gravel
	D-Dumps-Sanitary Waste Disposal, Transfer Stations, Automobile Junkyards
Wetland	SM-Saltwater Marsh FM-Freshwater Marsh

Forest/Shrub	F - Forest Communities - Hardwood and Softwood (>12 ft tall)
	O - Open - Late Successional - Woody Vegetation dominant (up to 12 ft tall), Vegetated beach areas, scattered shrubs
	AF - Abandoned Fields - Early Successional - Herbaceous Vegetation Dominant
	NOP - Navy Open Land
Other	UO - Urban Open - Areas which have been cleared for development or which are lying adjacent to urban areas - Abandoned Properties
	OW - Open water - lakes, reservoirs
	OPN - State Owned Land