

1991

An Inventory of Non-Point Pollution Sources on the Central South Branch of the Pawtuxet River

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AN INVENTORY OF NON-POINT
POLLUTION SOURCES ON THE
CENTRAL SOUTH BRANCH OF THE
PAWTUXET RIVER

BY

LATIMER WILLIAM SPINNEY IV

A RESEARCH PROJECT SUBMITTED IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE AND MASTER OF
COMMUNITY PLANNING

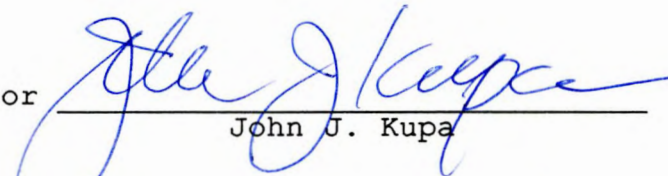
THE UNIVERSITY OF RHODE ISLAND

1991

MASTER OF COMMUNITY PLANNING
RESEARCH PROJECT
OF
LATIMER WILLIAM SPINNEY IV

Approved:

Major Professor



John J. Kupa

Acknowledged:

Director:



Howard H. Foster, Jr.

ABSTRACT

Water quality protection and preservation have, within the last decade, become imperative functions of local, state and federal governments. This focus has brought to light, newly revealed forms of water pollution. Nonpoint source pollution has become one of the major sources of pollutants. Nonpoint source pollution is a generic term for pollutants that come from individual sewage disposal systems, erosion and sediment, stormwater runoff, road deicing practices and fertilizer and pesticide use, to name a few.

The study area of this report consists of the portion of the south branch of the Pawtuxet River from South Main Street to Laurel Avenue and the surrounding sub-drainage basins. This is the section of the south branch of the River where the water quality classification changes from Class B to Class C.

A great number of reports have been written about water quality throughout the state, nonpoint source pollution and the Pawtuxet River, but none of them focus on this section of the river.

This study focuses on a specific portion of the river where a worsening water quality problem exists. The report discusses facts and reasons for the water quality problem as it relates to the types of nonpoint source pollution and offers solutions and recommendations for possibly alleviating the problem. The recommendations call for the development of best management practices or BMP's to alleviate the nonpoint source pollution problem. Some of these BMP's include:

- o Establishing wastewater management districts throughout the Town of Coventry.
- o Establishing vegetative buffer strips along the banks of the River.
- o Creating retention, detention or infiltration basins to filter pollutants from storm runoff.
- o Establishing sewer lines throughout the eastern portion of the Town to alleviate the environmental strain caused by ISDS failure.
- o Establishing programs that inform and educate the public about the River and its problems.

If implemented, these strategies would effectively reduce the amount of nonpoint source pollutants that enter the River, thereby improving its water quality. The process of achieving improved water quality on the Pawtuxet River involves not only the efforts of federal, state and local agencies but also the cooperation of private interest groups and the general public.

ACKNOWLEDGEMENTS

I would like to first thank my parents for talking me into going to graduate school. Additionally, I would like to thank Jack McGillivray from the Pawtuxet River Authority for being extremely patient and for loaning me a number of documents that were very useful for the completion of this study. I would also like to thank John Kupa and Farhad Atash for assisting me along the way, without their help I wouldn't have finished the program sane.

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CHAPTER ONE

INTRODUCTION

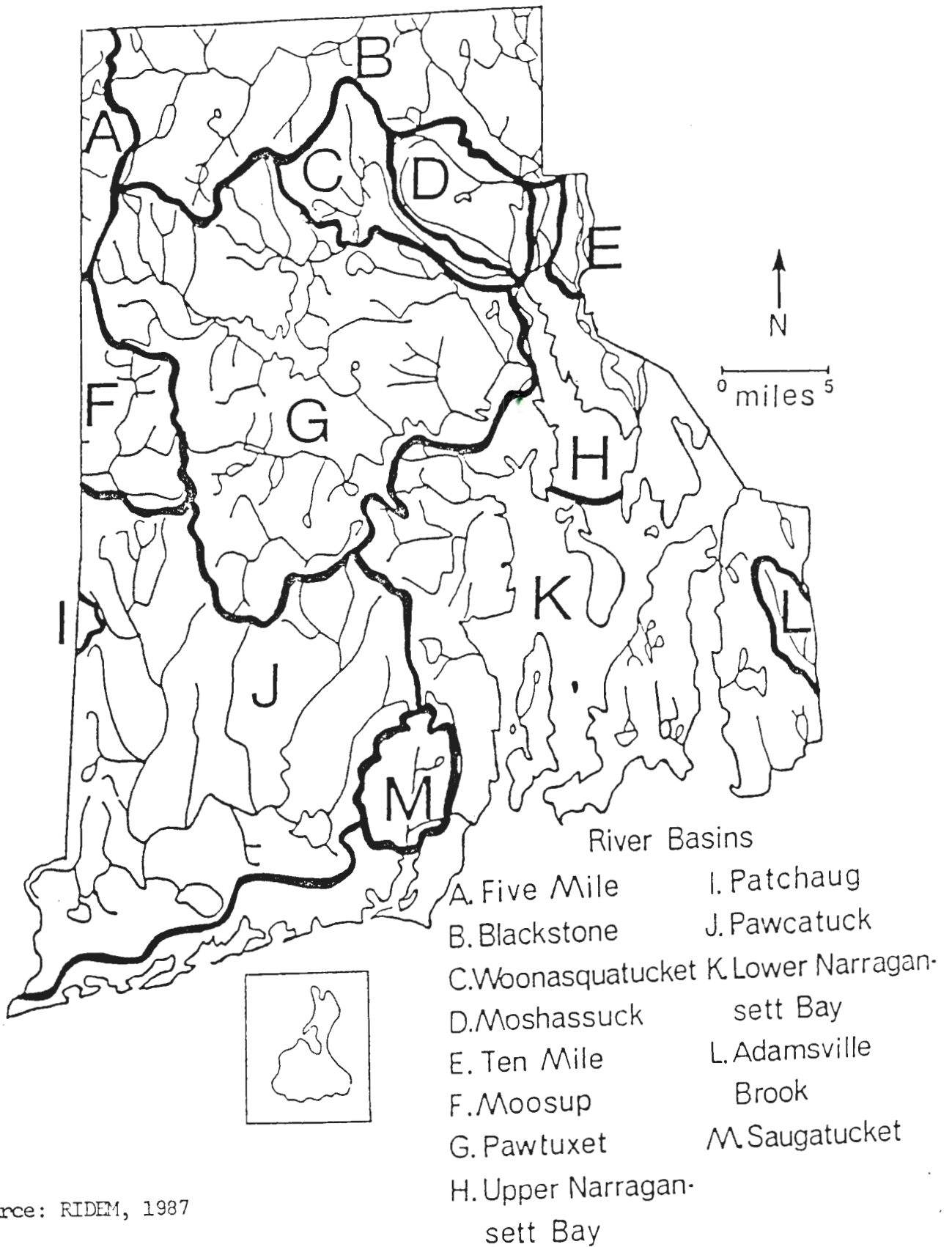
"The Pawtuxet River is the second largest source of fresh water flowing into Narragansett Bay. It provides as much as 25% of the Bay's fresh water. The Pawtuxet River Basin is the largest river basin located solely within the State Of Rhode Island (Figure 1.1). The Pawtuxet River begins as two branches (north and south) which meet at Riverpoint in West Warwick. From Riverpoint, the main stem of the Pawtuxet flows 12 miles downstream to Pawtuxet Cove in upper Narragansett Bay. The Pawtuxet River basin is located entirely in Rhode Island."(Cromwell, 1990)

The north branch of the Pawtuxet River is a 6.2 mile segment that has its origin at the Scituate Reservoir and ends at the confluence. The south branch consists of an 8.2 mile segment that begins at Johnson's Pond or the Flat River Reservoir and winds through Coventry to the confluence in West Warwick.

The study area of this report consists of the portion of the south branch that extends from the South Main Street bridge to the dam located at Laurel Avenue (Figure 1.2). The study area also includes two of the 56 sub-drainage basins or reaches of the Pawtuxet River Basin as determined by the Department of Environmental Management.

The study area is located in Reach 40 and a portion of

Rhode Island



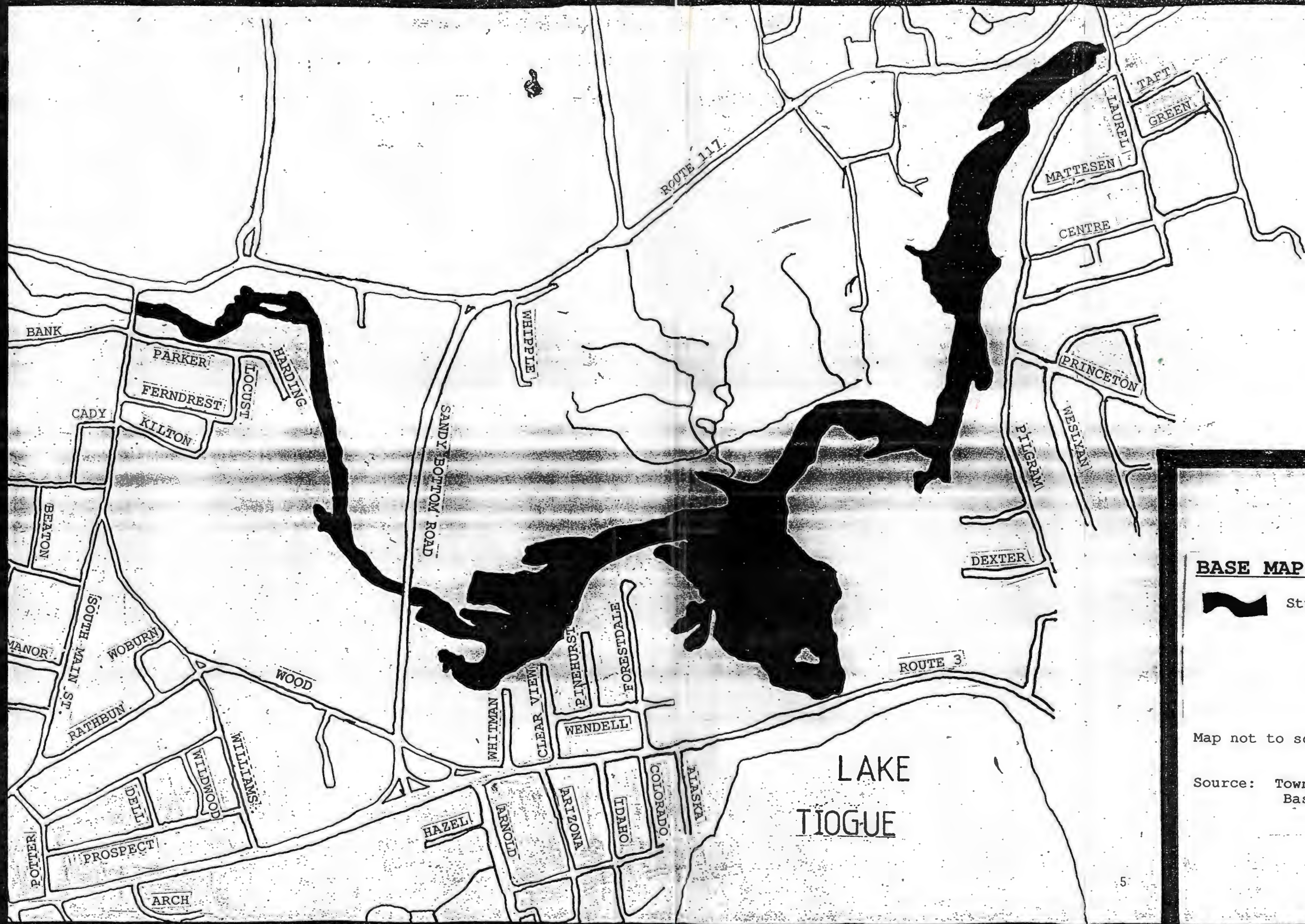
Source: RIDEM, 1987

Reach 39. Reach 40 extends from South Main Street to Lake Tiogue. The portion of Reach 39 that the study area is in extends from Lake Tiogue to Laurel Avenue. (Refer to Figure 1.4)


HISTORY

"The Pawtuxet basin's (Figure 1.1) recorded history began in colonial America in 1642, when Warwick was founded by Samuel Gorton. The town was named after Robert, Earl of Warwick in England. The Pawtuxet Indians who lived on the shore gave the river its name. In the Native American language, Pawtuxet means "place of little falls." During colonial times, many small communities dotted the river's edge near water-powered grist and sawmills. As demand increased for domestic goods, the basin's population grew.

The Pawtuxet River originally attracted industry because of its water power. Dams captured this energy and converted it to mechanical power for industry. In the combined length of the north and south branches (13.5 miles) 28 dams were built for industrial power. The first textile mill on the Pawtuxet was located in Centerville (West Warwick). Converted by resident Job Green from a gristmill, the textile mill produced cotton fiber. Between 1806 and 1809, 10 more textile



BASE MAP

 Study Area

Map not to scale.

Source: Town Of Coventry
Base Map

mills were built. The Lippit Mill, built between 1809 and 1810, still stands. Through 1920, the textile industry prospered. The popular "Fruit of the Loom" trademark was first coined by Pawtuxet River basin mill owners.

The Pawtuxet had another valuable function for industry: waste disposal. Dyes containing mercury, chromium and other toxic metals were rinsed out of cloth at the mills. The mill villages also used the river for household waste disposal. At the same time, Providence was using the Pawtuxet as its drinking water source. By fall 1891, the Pawtuxet was so polluted that Providence hired a special investigator to trace sources of pollution to the Pawtuxet. In May 1892, the General assembly appointed a special commission to study the Pawtuxet's pollution. Just 19 years later, unable to solve the Pawtuxet's problems, Providence decided to build the Scituate Reservoir by damming the upper portion of the Pawtuxet's north branch.

After the sharp decline in the textile industry in the 1920's, other industries came to fill the economic gap. Bradford Soap Works and other manufacturing firms helped revive the economy of the Pawtuxet River basin. As the population grew, human waste increasingly threatened the Pawtuxet's health. Finally, by the 1970's, the Pawtuxet became known as Rhode Island's dirtiest river."(Cromwell, 1990)

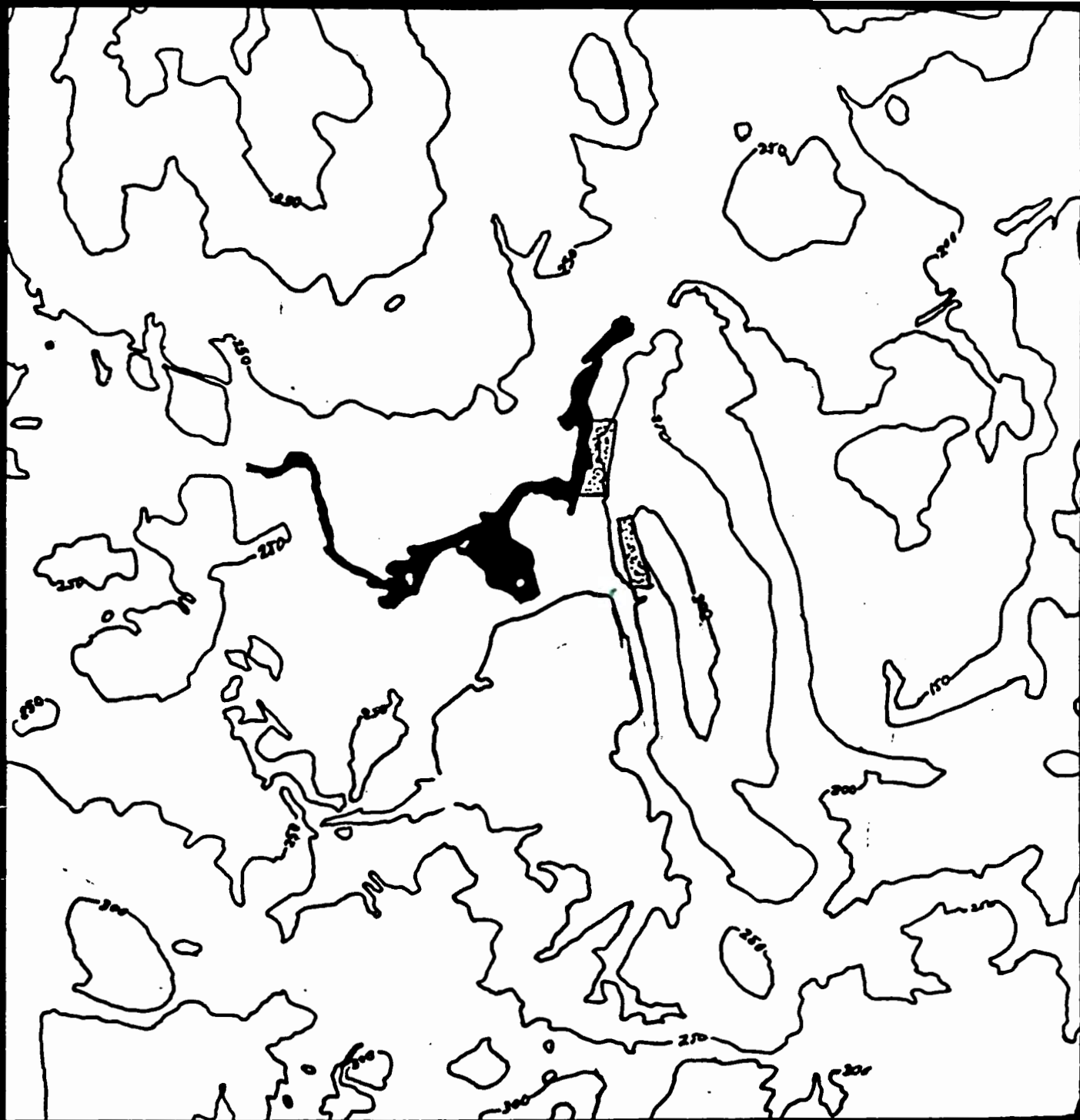
TOPOGRAPHY

The topography of the study area generally is very characteristic of river basin topography. The river portion of the study area is extremely flat at about 180 feet above sea level. This portion measures approximately 9000 feet in length and drops from 190 to 170 feet above sea level. Thus the gradient for this portion of the river is 0.22%. The gradient indicates that this portion of the river has a slow flow and a low flushing rate and allows pollutants that enter the river to be retained.

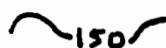


There are only two areas in the study area that have slopes greater than 15%. These areas are located in the Saw Mill Hill area just to the south of the Village of Anthony, as shown in Figure 1.3.

SURFACE WATER RESOURCES

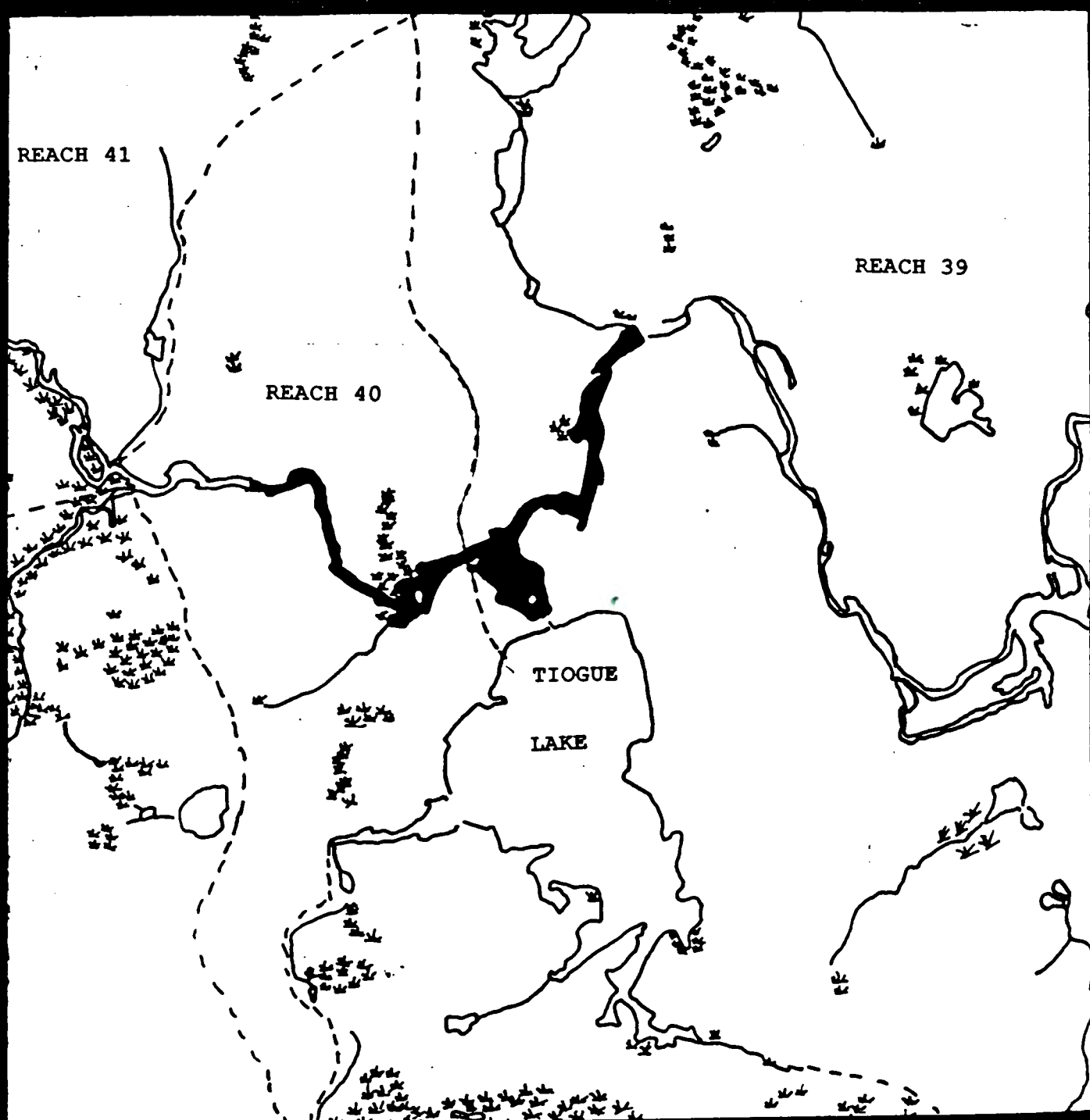
There are several surface water resources throughout the study area. Figure 1.4 depicts the study area, as well as the three reaches that are discussed in the study. Numerous wetlands, marshes, swamps and streams are located in each reach. Lake Tiogue is the largest body of water in the study area. It is connected to the Pawtuxet through a culvert that passes under Tiogue Avenue (Route 3). Mishnock river and Mishnock Swamp are located to the south east of the study area.



TOPOGRAPHY

-  150 Topographic Lines At 50' Intervals
-  Study Area
-  Slopes Greater Than 15%

Source: USGS Crompton, RI Quadrangle, 1975
Figure 1.3



SURFACE WATER RESOURCES

✱✱✱ Wetlands

~~~~~ River or Stream

○ Lake or Pond

----- Sub-Drainage Basin Borders

Study Area

Source: USGS Crompton, RI Quadrangle, 1975

Figure 1.4

## GROUNDWATER RESOURCES

Groundwater deposits surround the study area as shown in Figure 1.5. The cross-hatched areas are those that are underlain by glaciofluvial deposits or glacial outwash. The outwash soils are porous and allow water to readily flow through them. While in the till soil, the water recovers at a slower rate.

## VEGETATION

As can be seen on the following vegetation map (Figure 1.6), the greatest area of land surrounding the study area has been classified as Urban and contains little natural vegetation. However, there are also numerous small vegetated areas usually associated with river flood plain areas.

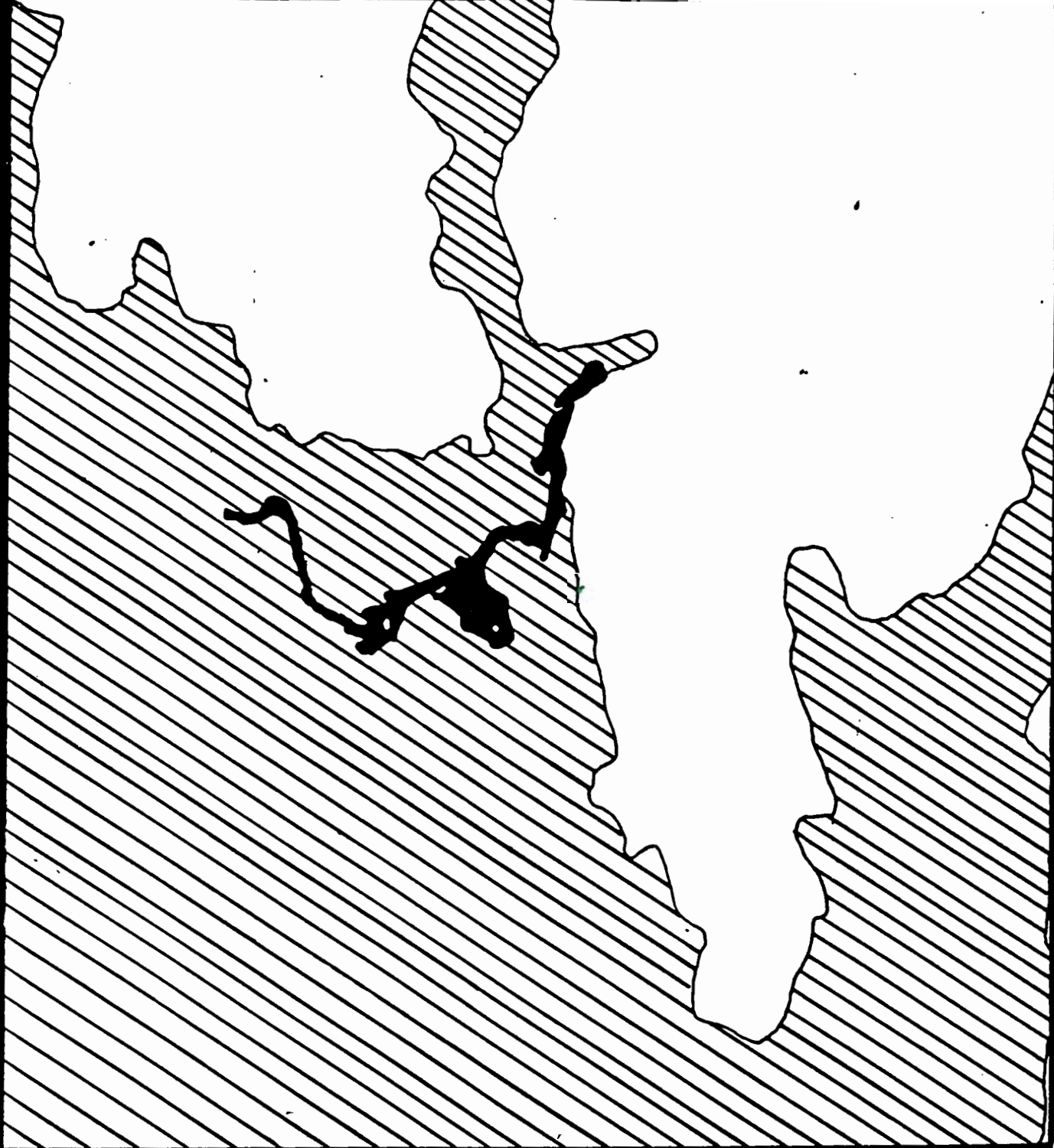
## SYMBOLS FOR VEGETATION TYPES

### FOREST TYPES

H = Hardwood Trees  
S = Softwood Trees  
SH = More than 50% Softwood  
HS = More than 50% Hardwood

### OPEN & WETLAND TYPES

AF = Abandoned Field  
AL = Agricultural Field  
O = Orchard  
AO = Abandoned Orchard  
U = Urban  
FM = Fresh Marsh  
SM = Salt Marsh  
Sh = Shrub Type



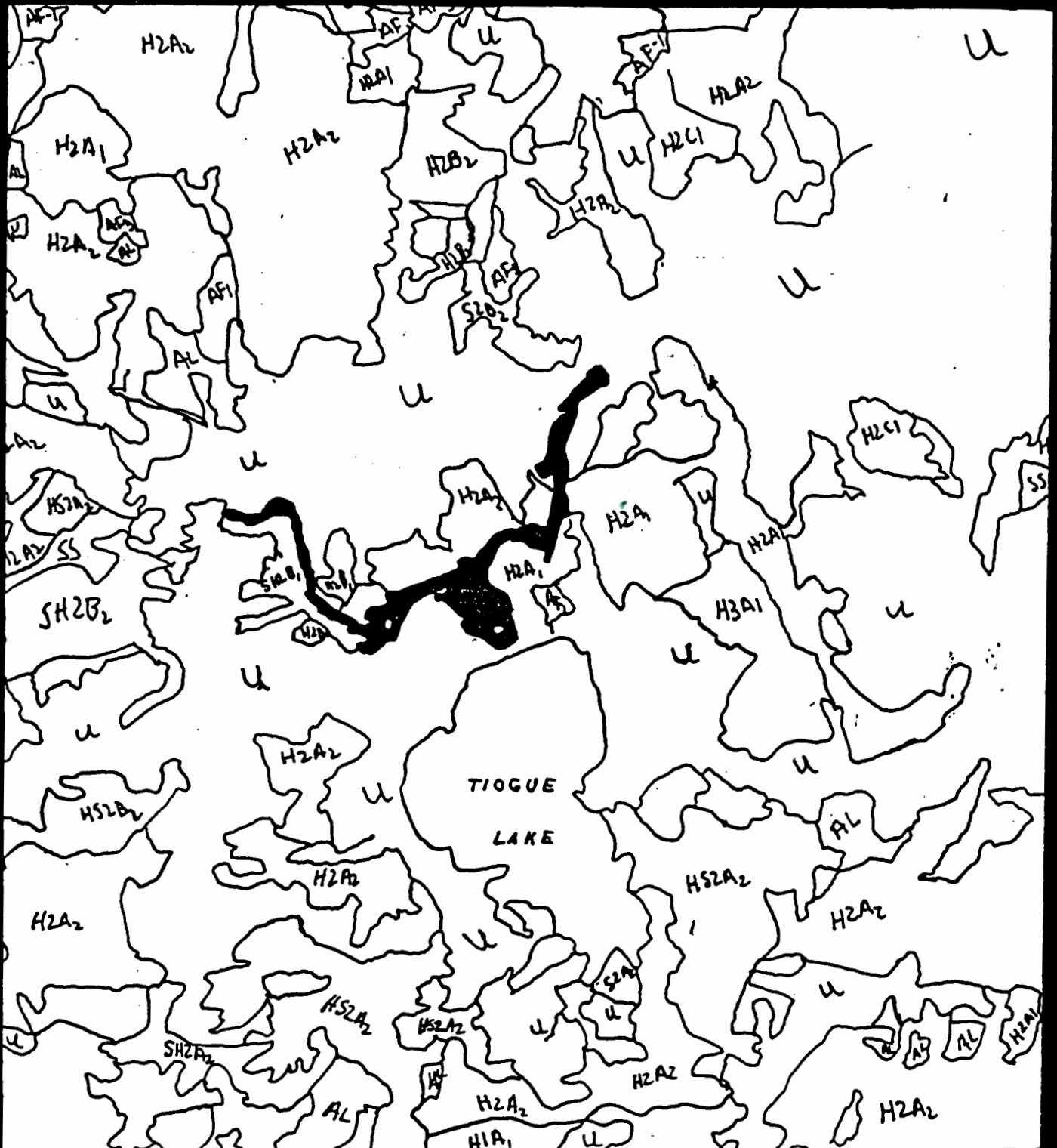
## GROUNDWATER RESOURCES

 Groundwater Deposits

 Study Area

Source: USGS Hydrologic Bulletin 6, 1955

Figure 1.5



## VEGETATION TYPES

Corresponding List Of Vegetation Types is Included on Preceding Page.

Source: Department of Forestry, 1972

## HEIGHT AND DENSITY SYMBOLS

### TREE HEIGHT

- 1 = 0 - 20 feet
- 2 = 21 - 40 feet
- 3 = 41 - 60 feet
- 4 = 61 feet and over
- 5 = Two height classes

### SHRUB HEIGHT

- I = 1 - 10 feet
- II = 10 feet and over

### TREE DENSITY

- A = 81 - 100% dense
- B = 51 - 80% dense
- C = less than 50% dense

### SHRUB DENSITY (subscript)

- 1 = 61 - 100% dense
- 2 = 31 - 60% dense
- 3 = 0 - 30% dense

## SOILS

Soils play a key role in the pattern of urban development as it relates to nonpoint source pollution. The infiltration rate of soils determines the speed that water leaches and also the placement of individual sewage disposal systems (ISDS).

| <u>Soils</u>              | <u>Hydrologic Group</u> | <u>Septic Tank Absorption Fields</u> |
|---------------------------|-------------------------|--------------------------------------|
| Aa - Adrian               | A/D                     | severe                               |
| CB - Canton-Urban         | B                       | slight                               |
| ChC - Canton and Charlton | B                       | severe                               |
| Co - Charlisle            | A/D                     | severe                               |
| HkC - Hinckley            | A                       | moderate                             |

|                       |   |        |
|-----------------------|---|--------|
| MmA - Merrimac        | A | slight |
| MmB - Merrimac        | A | slight |
| MU - Merrimac-Urban   | A | slight |
| NaB - Narragansett    | B | slight |
| Nt - Ninigret         | B | severe |
| Ru - Rumney           | C | severe |
| Sb - Scarboro         | D | severe |
| Ss - Sudbury          | B | severe |
| UD - Udorthents-Urban | C | severe |
| Ur - Urban            | C | severe |
| Wa - Walpole          | C | severe |
| WgA - Windsor         | A | slight |
| WgB - Windsor         | A | slight |

Source: Soil Survey of Rhode Island, USDA, 1977.

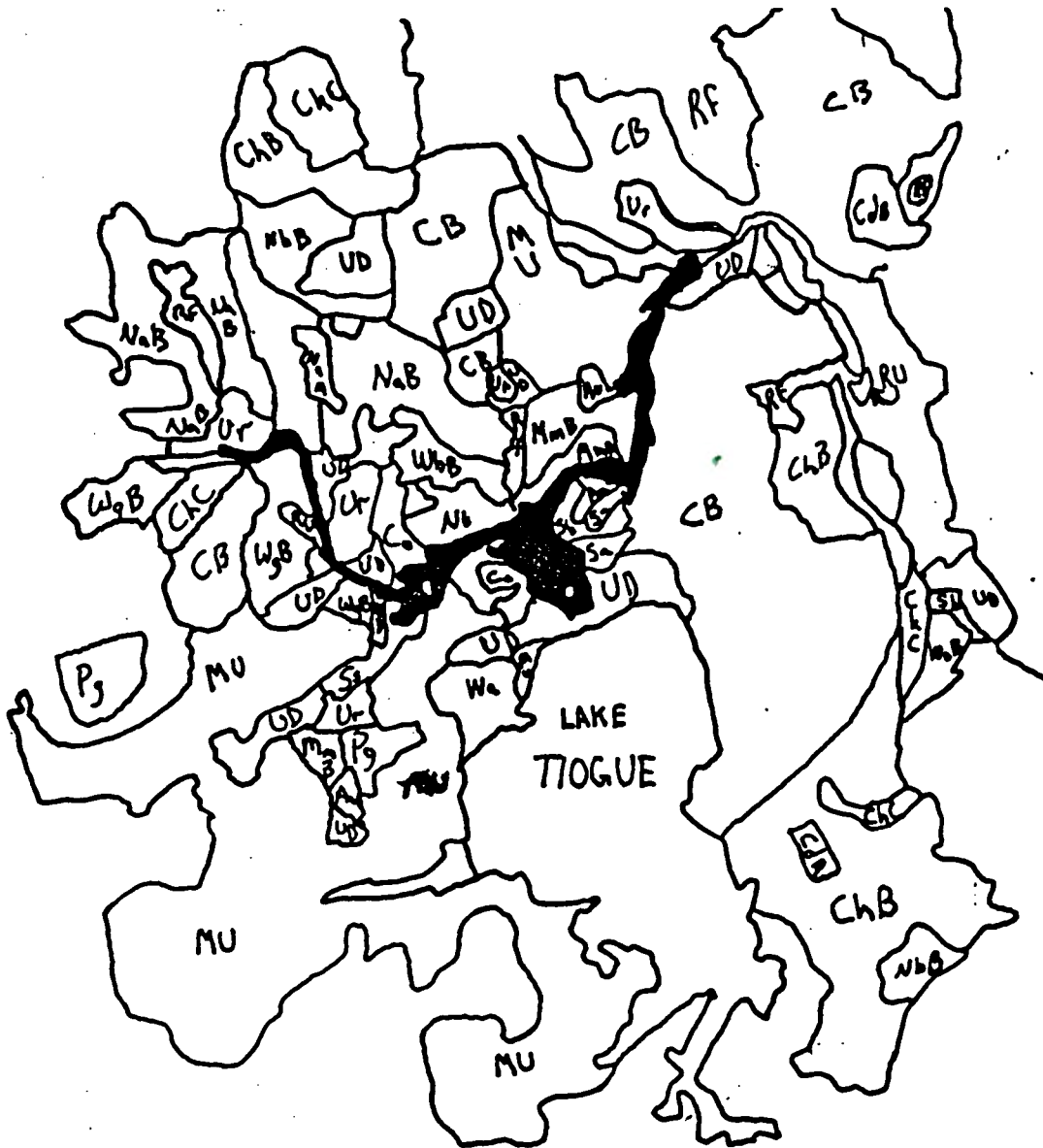
"Hydrologic Soil Group refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have

a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or natural material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained." (USDA, 1977)

As can be seen on the following soils map (Figure 1.7) there are six types of soils that fall into the hydrologic soil type A. Five types of soil are classified as group B soils. Four as hydrologic group C. One as hydrologic group D. And two have been assigned to an A/D mixture of hydrologic groups.

Of the 18 different types of soils located in the study area, 10 have severe constraints to ISDS. Figure 1.8 shows the soils with severe constraints for ISDS in the study area. The majority of these areas directly contact the river. These areas are shown in the Town of Coventry's Land Use Plan Development Constraints Map as being areas most suitable for development. The entire study area is considered to be in the most suitable category as shown in Figure 1.9. It is apparent, that since no municipal sewer system exists in the town, that soils with severe constraint limitations were not considered to be a factor in determining the development constraints.



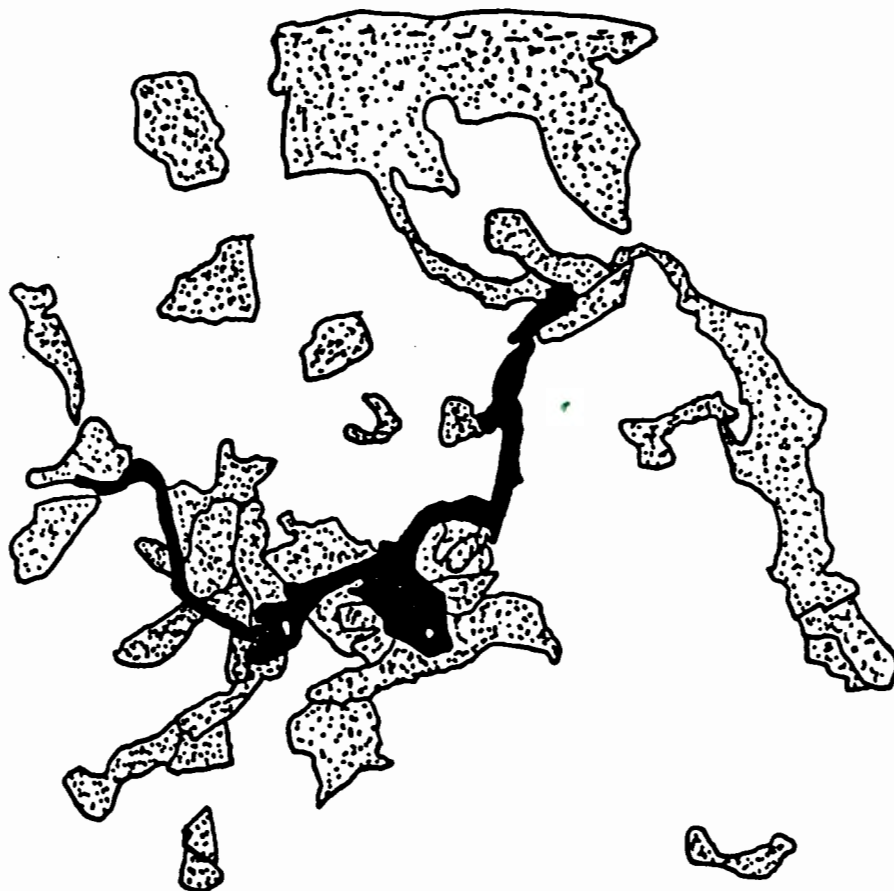


## SOILS



Corresponding List Of Soil Types  
is Included On Preceding Page.

Study Area

Source: USDA, Soil Survey Of Rhode Island, 1977

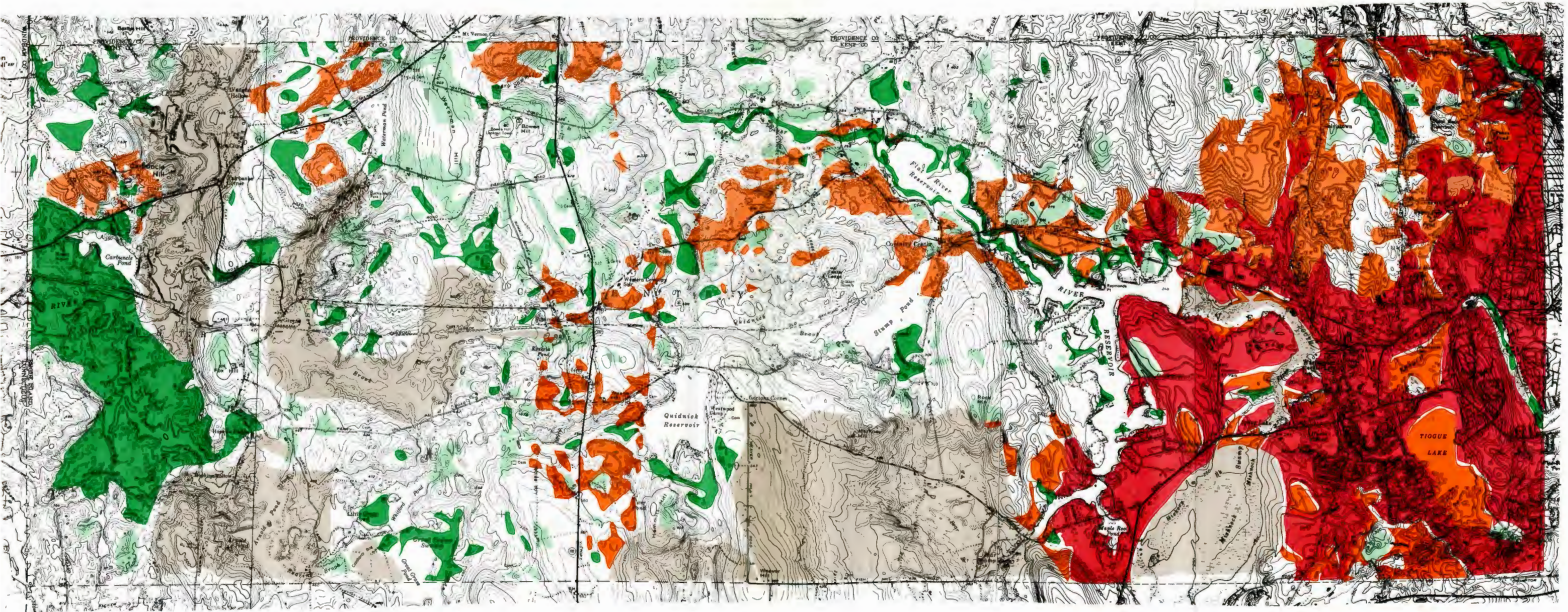


**SOILS WITH SEVERE ISDS CONSTRAINTS  
LIMITATIONS**

-  Areas of Severe Limitations
-  Study Area

Source: USDA, Soil Survey Of Rhode Island, 1977

Figure 1.8



**COVENTRY, RHODE ISLAND**

**DEVELOPMENT CONSTRAINTS MAP**



**LAND USE PLAN**



1986

COVENTRY DEPARTMENT OF  
PLANNING AND DEVELOPMENT



## INDIVIDUAL SEWAGE DISPOSAL SYSTEM (ISDS)

"Septic Systems or individual sewage disposal systems (ISDS) are generally an inexpensive and acceptable means of sanitary and household waste water disposal. The biggest drawback to these systems is that they can fail to operate properly, creating a health concern and a possible water quality contamination source.

There are four factors that govern the proper operation and life expectancy of a septic system: 1) location; 2) design; 3) installation; and 4) maintenance. The first three are regulated by the Department of Environmental Management. Maintenance, since it is unregulated has been severely neglected by many homeowners." (Dept of Admin., Div. of Planning, 1987)

One problem that is plaguing cities and towns in the State of Rhode Island is that there is a lack of organization involving information and records pertaining to individual sewage disposal systems. The Town of Coventry is no exception. These records are gathered by the Department of Environmental Management and supplied to the local governments throughout the state. Town Building Inspectors are responsible for keeping the ISDS records for each town. The way that these records are kept makes using them extremely difficult and time consuming for the Building Inspector and any one else who may need to use them. The sparse septic system records do not include any records prior to 1968. The

reason for this, as reflected by one official from the Town of Coventry, is because ISDS was not an important issue before that time. But, in reality, this is because the Department of Environmental Management wasn't created until this time.

Out of the 89 lots in the study area that directly contact the river, there were only ISDS records for 15 of these lots. It is extremely important that the individual town governments have better access to these records.

Out of the 15 lots that there were records for, only 5 of the systems have been updated in the last decade. These lots are:

|                 |                                                |
|-----------------|------------------------------------------------|
| Plat 13 Lot 223 | located between the river and Sandy Bottom Rd. |
| Plat 13 Lot 415 | located between the river and Sandy Bottom Rd. |
| Plat 13 Lot 416 | located between the river and Sandy Bottom Rd. |
| Plat 14 Lot 53  | located between the river and Washington St.   |
| Plat 23 Lot 166 | located between the river and Rte. 117.        |
| Plat 23 Lot 191 | Located between the river and Rte. 117.        |

Of these lots, Plat 13 Lots 415 and 416 share a common septic system, as well as, Plat 23 Lots 166 and 191. The present land use for all four of these lots is commercial businesses.

From 1968 to 1976, 304 maintenance, repairs and alterations to ISDS were approved. This, according to the 208

Water Quality Plan for the State of Rhode Island, was the fourth highest for a Rhode Island community during this period.

"It has been well documented that ISDS requires maintenance to operate properly. Maintenance means the cleaning or pumping out of an ISDS on a regular basis, approximately every three years."(Dept. of Admin., Div of Planning, 1987)

For practical purposes, figure 1.10 has been included to show the diagram and layout of a typical domestic septic tank system. This diagram, taken from the Department of Administration Division of Planning's report entitled "Waste Water Management Districts... A Starting Point, Report # 62" shows the path that domestic wastes travel through the process of the ISDS. "A septic system is comprised of the septic tank, distribution box, and leach field. Waste water enters the septic tank where solids settle to the bottom and excess liquid or effluent flows from the tank into a distribution box which evenly distributes the effluent into the leachfield. The waste water then percolates downward through the soil. Since most soil can be a good purifying medium, it can efficiently remove bacteria and viruses from household waste water if travel time through unsaturated soil is sufficient."(Dept. of Admin., Div. of Planning, 1987)

The document in full is included in the Appendix A.

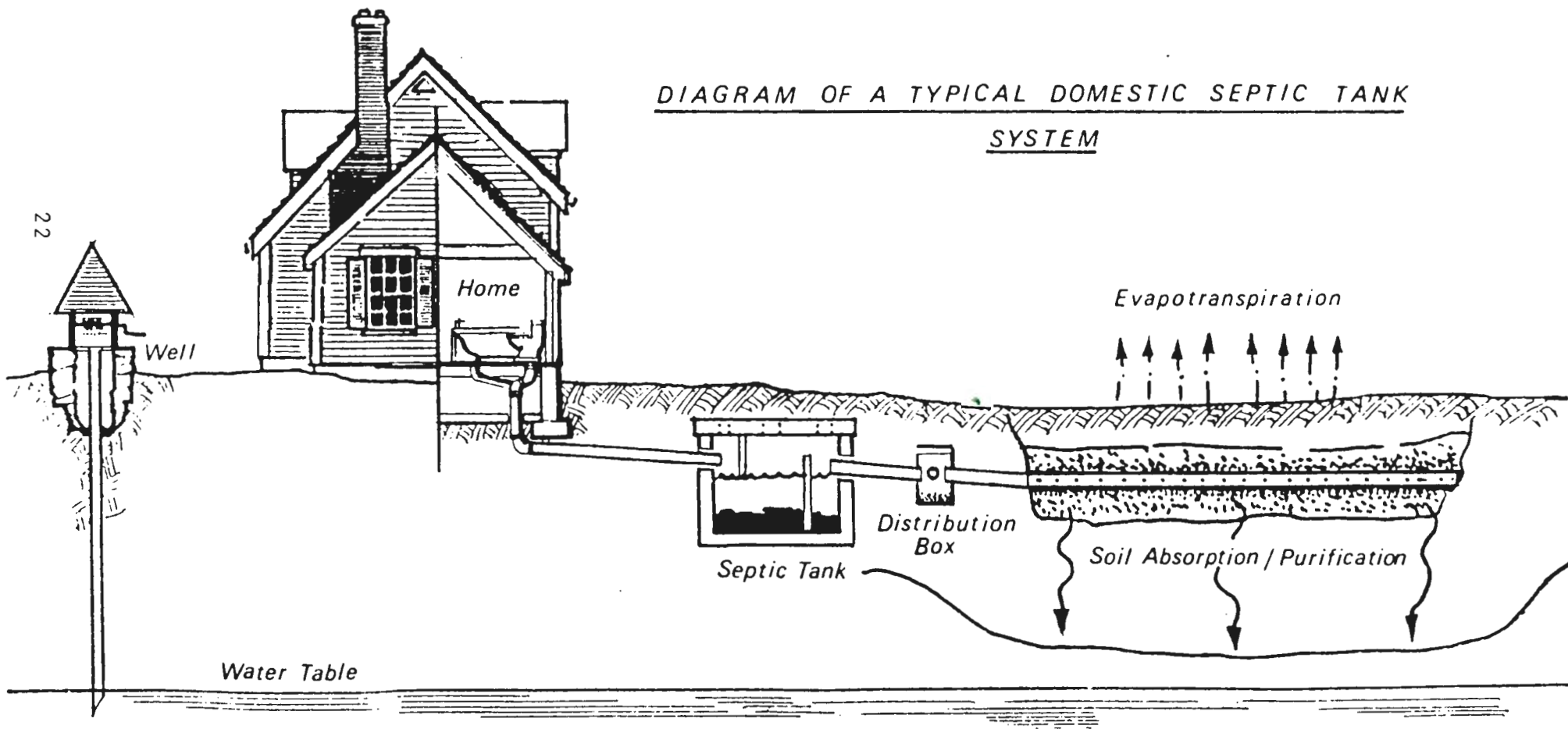


DIAGRAM OF A TYPICAL DOMESTIC SEPTIC TANK  
SYSTEM

Source: The Rhode Island Department of Administration, Division of Planning, 1997  
Figure 1.10

## PROBLEM AREAS

The Facilities Plan Supplement compiled by the Coventry Water Quality Task Force in 1982 outlined 18 areas with septic system disposal problems. Of the 18 areas, 13 are in locations that have the potential possibility of affecting the portion of the river in the study area. "These areas have not been addressed in terms of correcting waste disposal since the preparation of The Facilities Plan Supplement in 1982." (BRW, 1990)

The 13 problem areas are listed below in no particular priority order:

- Laurel Foster Nursing Home: Laurel Avenue and Center Street.
- Washington Street: Anthony South Side.
- Village of Anthony: Edward, Knight, Hazard, Boston and Anthony Streets and surrounding areas.
- Contentment Street (elderly housing area).
- Mister V's on Tiogue Avenue.
- The area located between Route 3, Arnold Road and Lake Tiogue, including Arizona Street.
- The area on the west side of Arnold Road north of little Tiogue.
- The area near Wood Street, South Main Street and Rathburn Street.
- Garland Industries on South Main Street at Route 117.
- Hopkins Hill Road near Little Huron.
- East of Arnold Road south of causeway behind Tiogue Fire Station, adjacent to the Cardi property.



-- Arnold Road and Holmes Road area.

-- Mohawk Street along east side of Tiogue Lake.

Source: Facilities Plan Supplement, August 1982.

All of these problem areas are located in one of the two sub-drainage basins that make up the up the study area. Any pollutants that escape the ISDS in these areas have the potential to reach the Pawtuxet River.

## SEWER POSSIBILITIES


The Town of Coventry, at present, does not have a public sewer system. As can be seen by figure 1.11 from the 208 Water Quality Plan for the State of Rhode Island, there is a tremendous need for a public sewer system. The major reason that sewers have not been added to the Town's infrastructure is due to the great cost of the project.

## IMPERVIOUS SURFACES

There is a great deal of impervious surface area in the study area. In Reach 40, 236.25 of the 525 acres are estimated to be impervious surfaces. That is 45% of the total area of the reach. For the purpose of this study, it has been determined that a portion of the study area that is in Reach 39 occupies approximately 22.5% of the 3,914 total acres. The estimated size of the study area portion is 880.7 acres. Of

# MUNICIPAL SEWERAGE NEEDS

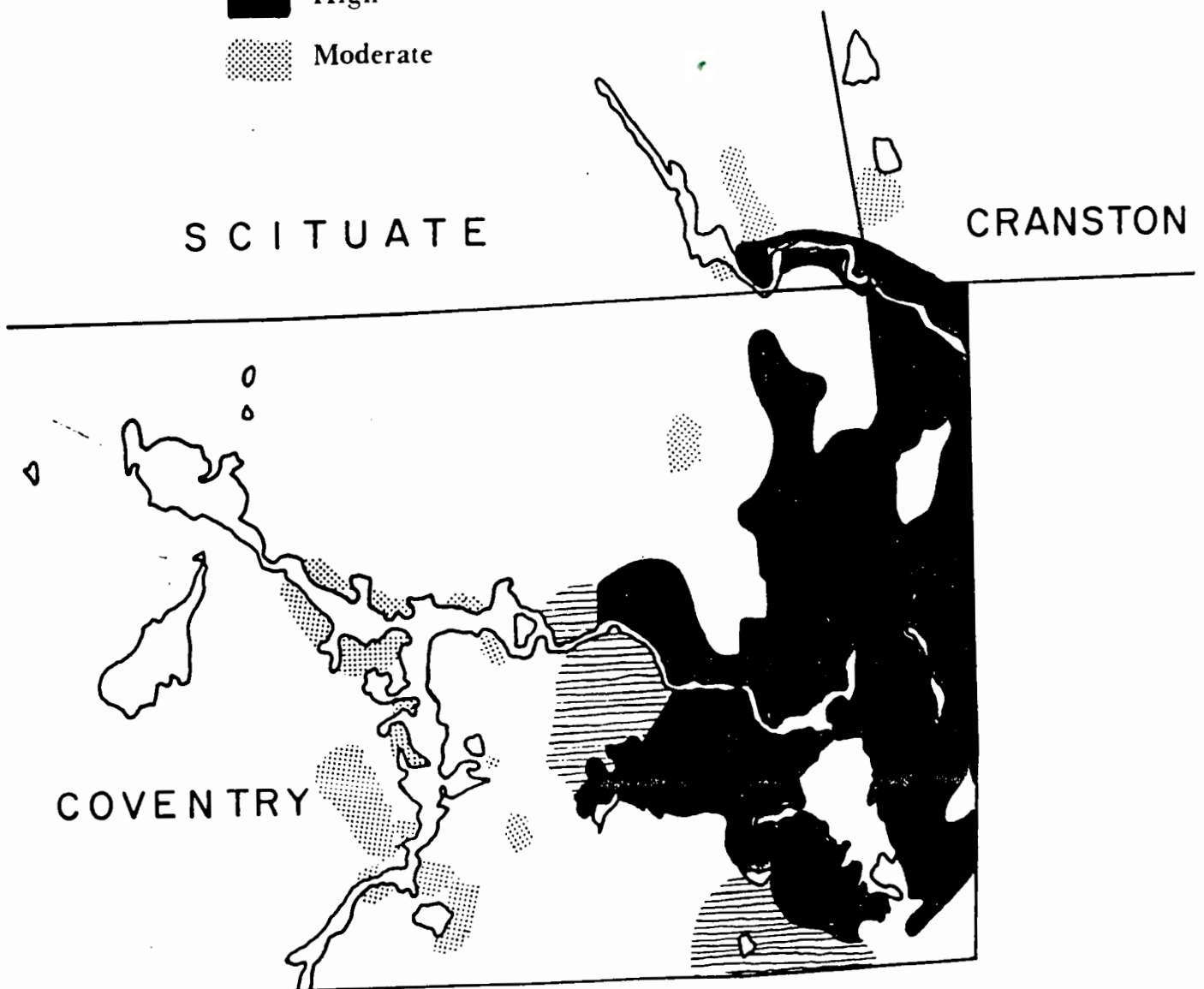
 Existing Sewer Service

 Industrial Zoned Sites

## PROBABILITY OF NEED FOR SEWERS

 High

 Moderate



Source: Rhode Island Department of Statewide Planning, 1979

Figure 1.11

this 880.7 acres, 317 acres or 36% are estimated to be impervious surfaces. This can be seen in Figure 1.12.

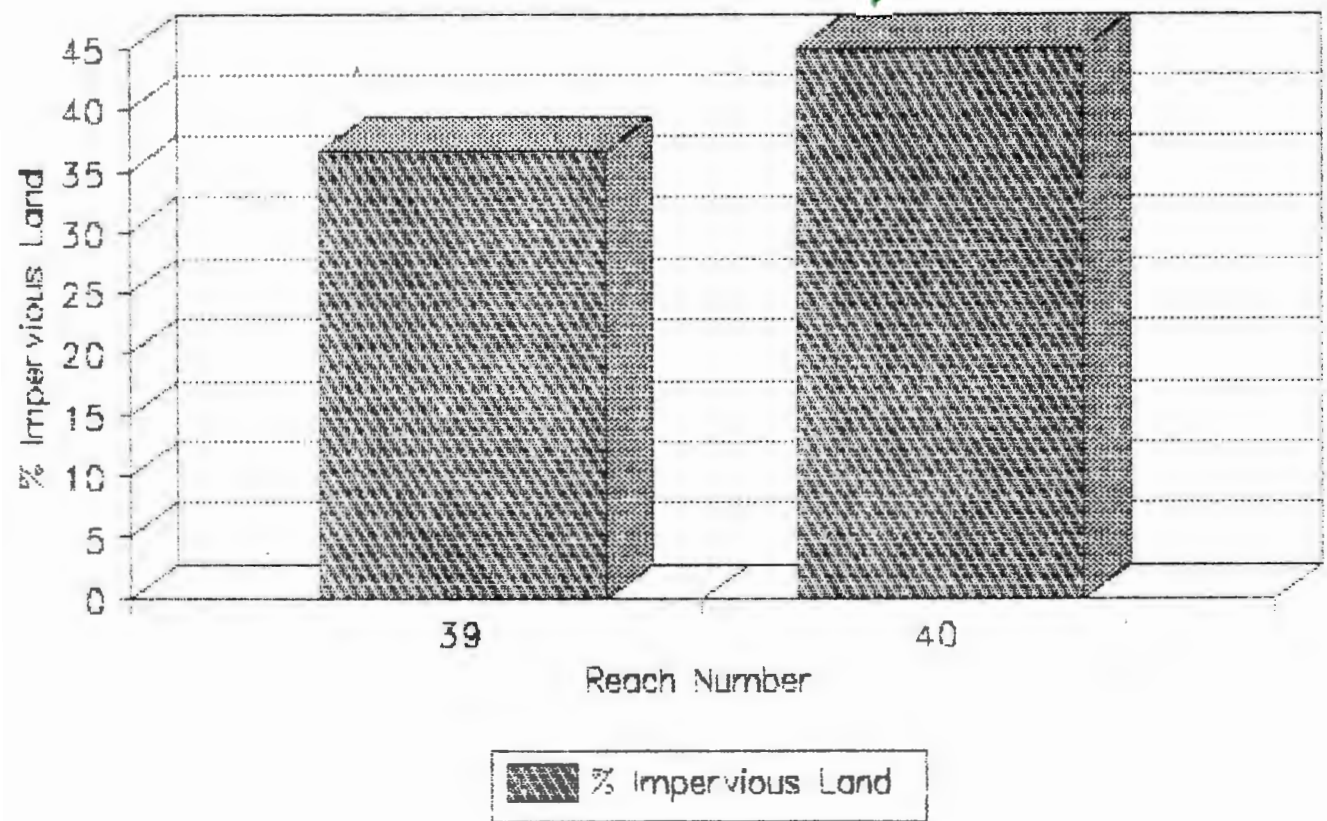
|          | <u>Total Area</u> | <u>Impervious Surface Area</u> | <u>Percent Impervious</u> |
|----------|-------------------|--------------------------------|---------------------------|
| Reach 39 | 880.7 acres       | 317 acres                      | 36%                       |
| Reach 40 | 525 acres         | 236.25 acres                   | 45%                       |

These impervious surface estimates are based on 1985 zoned land use for the Town Of Coventry. All of the land use classifications were taken into account in the impervious surface estimations. These estimations represent almost 50% of the area surrounding the study area is impervious. This amount of impervious surface is capable of generating a large amount of stormwater runoff.

## **STORMWATER RUNOFF**

Another major problem that has become an issue of concern in the study area is stormwater runoff. Figure 1.13 has been included to diagram the stormwater runoff cycle. Within the last couple of decades, there has been information that links stormwater runoff as a source of pollution that is depleting waterways of the essential oxygen demand as well as adding bacteria and other substances, some of which may be toxic. "Detectable levels of lead, zinc, iron, copper, chromium, cadmium, phosphorus, nitrates, coliform bacteria, sodium,

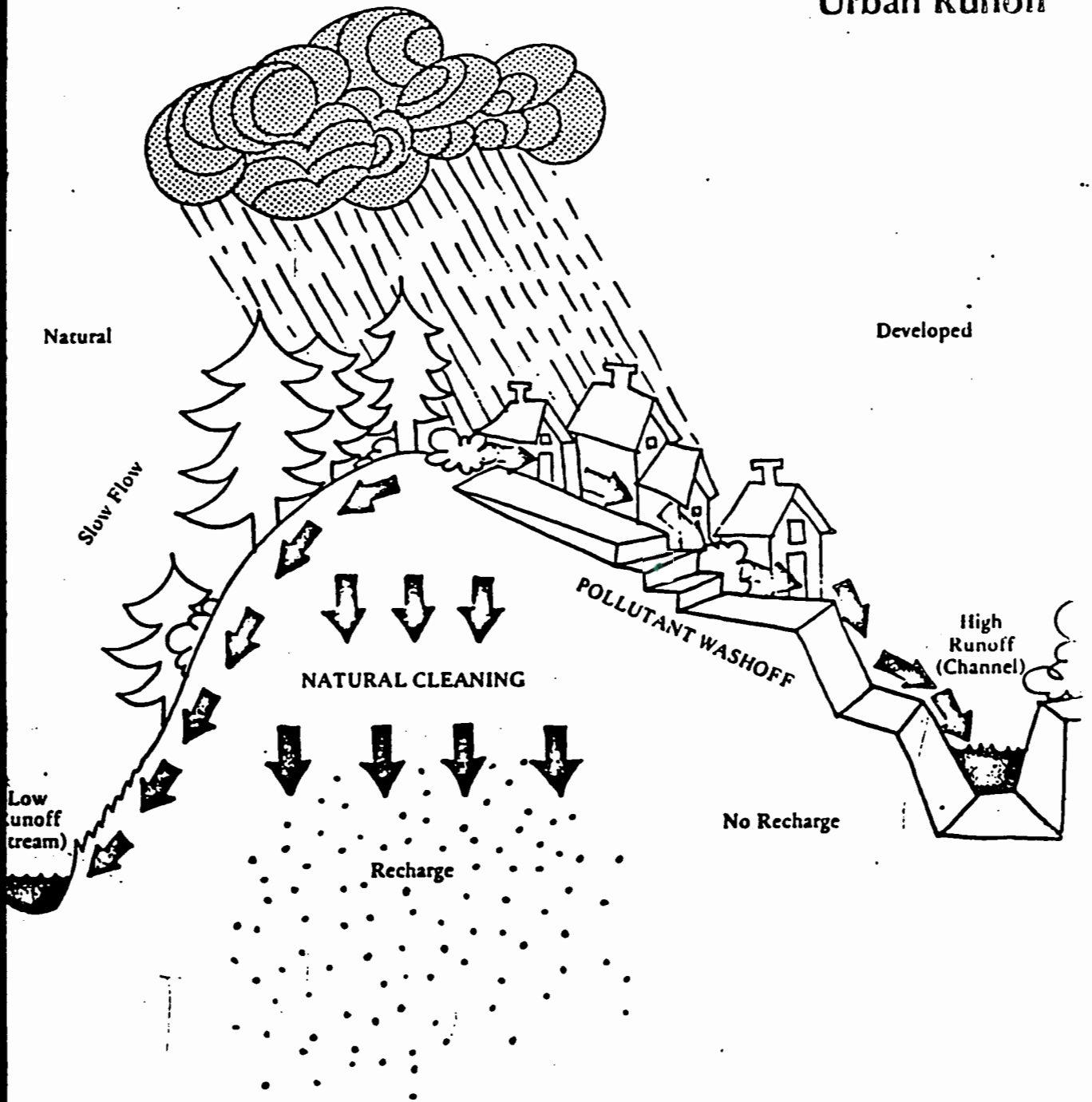
# ESTIMATED PERCENT IMPERVIOUS LAND IN THE STUDY AREA



Source: 1985 Land Use, Coventry, R.I.

Figure 1.12

# Urban Runoff



Source: Urban Land Institute, 1978

Figure 1.13

chloride, and hydrocarbons have been found in stormwater runoff from urban areas." (RIDEM, 1988) Stormwater runoff is produced from rainfall, that by itself is an important and integral component of the natural hydrologic cycle. It becomes a source of pollution in urban areas, where it picks up many of the liquids and solids present on impervious surfaces and transports them to rivers and streams. The overall outcome of this is the degradation in the quality of the water.

"The immensity and complexity of urban runoff as a source of water pollution is understandable considering everything we see lying on the streets, curbs, gutters, sidewalks, or parking lots. Candy wrappers, empty cigarette packs, and other non-biodegradable litter; grass leaves, and other vegetative debris;; pools of oil, iridescent slicks of gasoline, and other fluids from automobiles; wastes from pets; and salt and sand used to de-ice a winter road. All of these are carried by forces of travelling rain.

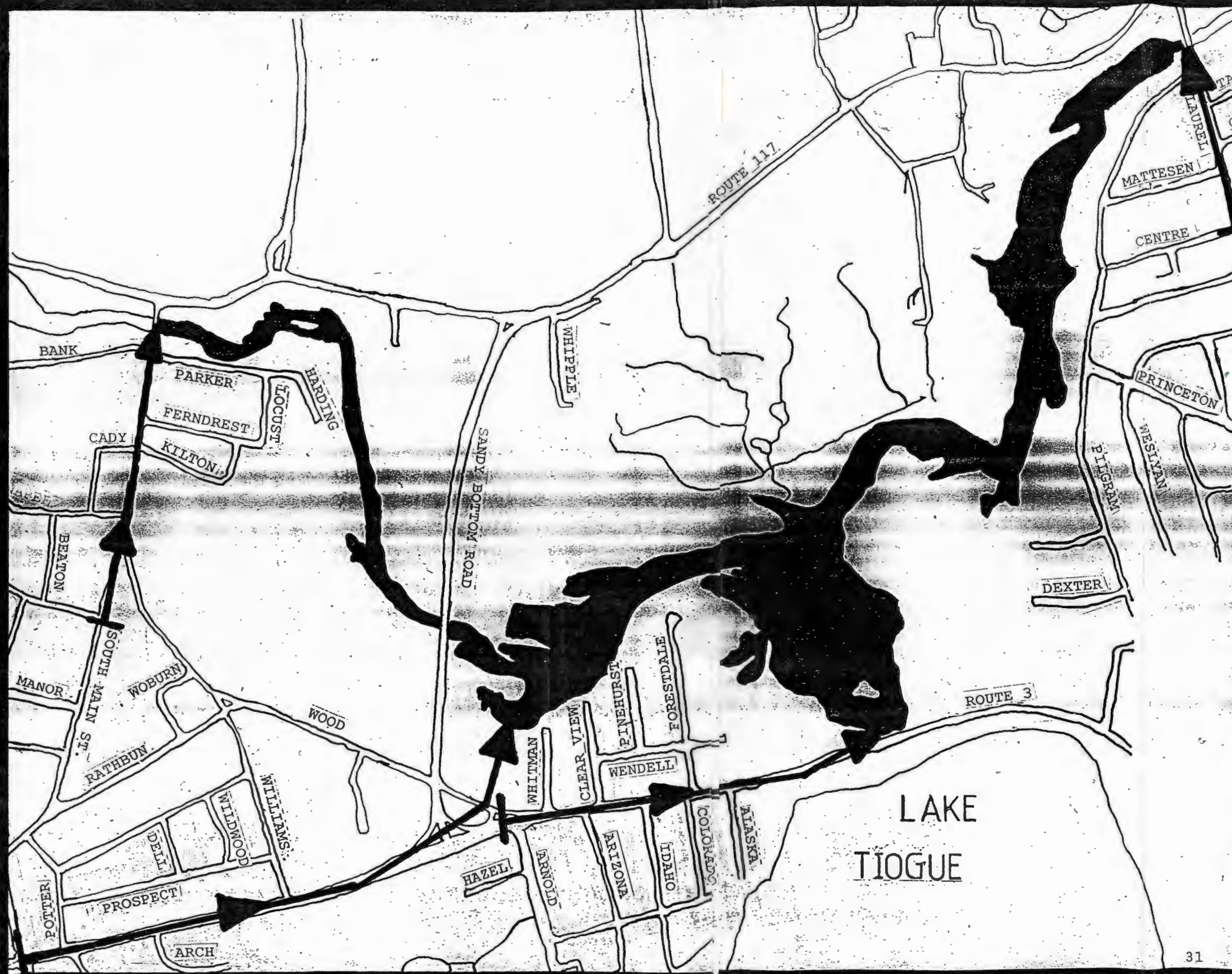
Things not quite as visible also go into urban runoff. Gaseous automobile emissions, the byproduct of the internal combustion engine, are cleansed from the air by falling rain. What polluted the air -- sulphur, nitrogen, and lead -- now also pollute the water. Lawn fertilizers, herbicides, and pesticides -- often ill-timed and excessively applied -- are washed away and can end up in a body of water that eventually may serve as a community's source of drinking water. Areas

under construction, where the soil has been exposed, can be eroded by the force of rain, carrying valuable topsoil and nutrients to riverbeds. Over time these rivers will fill, causing downstream flooding and shoreline erosion." (O'Mara, 1978)




There are storm sewers located along Tiogue Avenue (Rte. 3), Sandy Bottom Road (Rte. 33), South Main Street and Route 117 that transport stormwater runoff to its disposal in the Pawtuxet River. This, combined with the surface flow of runoff from the streets without storm sewers creates a significant waste load being brought to the river each time it rains. Figure 1.14 shows the approximate areas of the stormwater drainage systems. It also shows the direction of flow and the approximate points at which these systems drain into the river. There is neither a retention nor a detention system in place at the present time. There is nothing to filter the pollutants from the runoff before it enters the river.

Streets that affect the river through stormwater runoff:

- South Main St.
- Parker St.
- Harding St.
- Sandy Bottom Rd. (Rte. 33)
- Whitman St.
- Cedarview St.
- Pinehurst St.



**STORM SEWER SYSTEMS**

-  Study Area
-  Direction of flow
-  Storm Sewer System

Map not to scale.  
 Source: Town of Coventry,  
 Public Works Dept.



- Forestdale Ave.
- Tiogue Ave. (Rte. 3)
- Pilgrim Ave.
- Albro Ln.
- Donovan St.
- Dexter St.
- Mapledale St.
- Reddington St.
- Centre St.
- Laurel Ave.
- Princeton St.
- Wendll Ave.
- Clear View Dr.
- Whipple Ct.

## **ROAD SALT**

Road salt or sodium chloride is applied to road surfaces, parking lots, driveways and sidewalks as a deicing agent during the winter months. The salt is combined with sand to provide added traction on the slippery surface. The residue from the salt or combination of salt and sand stays on the paved surface and in turn gets picked up in the stormwater runoff process.

"Salt as a deicing agent, would pose less of an

environmental threat if it were applied properly. The excessive application of salt may cause environmental degradation. This can be due to a number of reasons: insufficient maintenance of equipment, antiquated equipment, insufficient operator training, inadequate supervision, poor record keeping or misinformation." (Dept of Admin., Div of Planning, 1990)

"The improper application and storage of road salt has been proven to contaminate surface and groundwater drinking supplies, damage roadside vegetation, impair fish and wildlife habitat, deteriorate highway structures, and corrode automobiles." (Dept. of Admin., Div. of Planning, 1990)

The policy of the Rhode Island Department of Transportation (RIDOT) is to apply 300 pounds per lane mile of roadway. RIDOT uses an approximate 3:1 ratio of sand:salt in their applications.

Although the Town of Coventry Public Works Department uses the same road salting standard mix ratio set by RIDOT, they don't apply the same amounts. They apply the salt/sand mixture as needed and where needed.

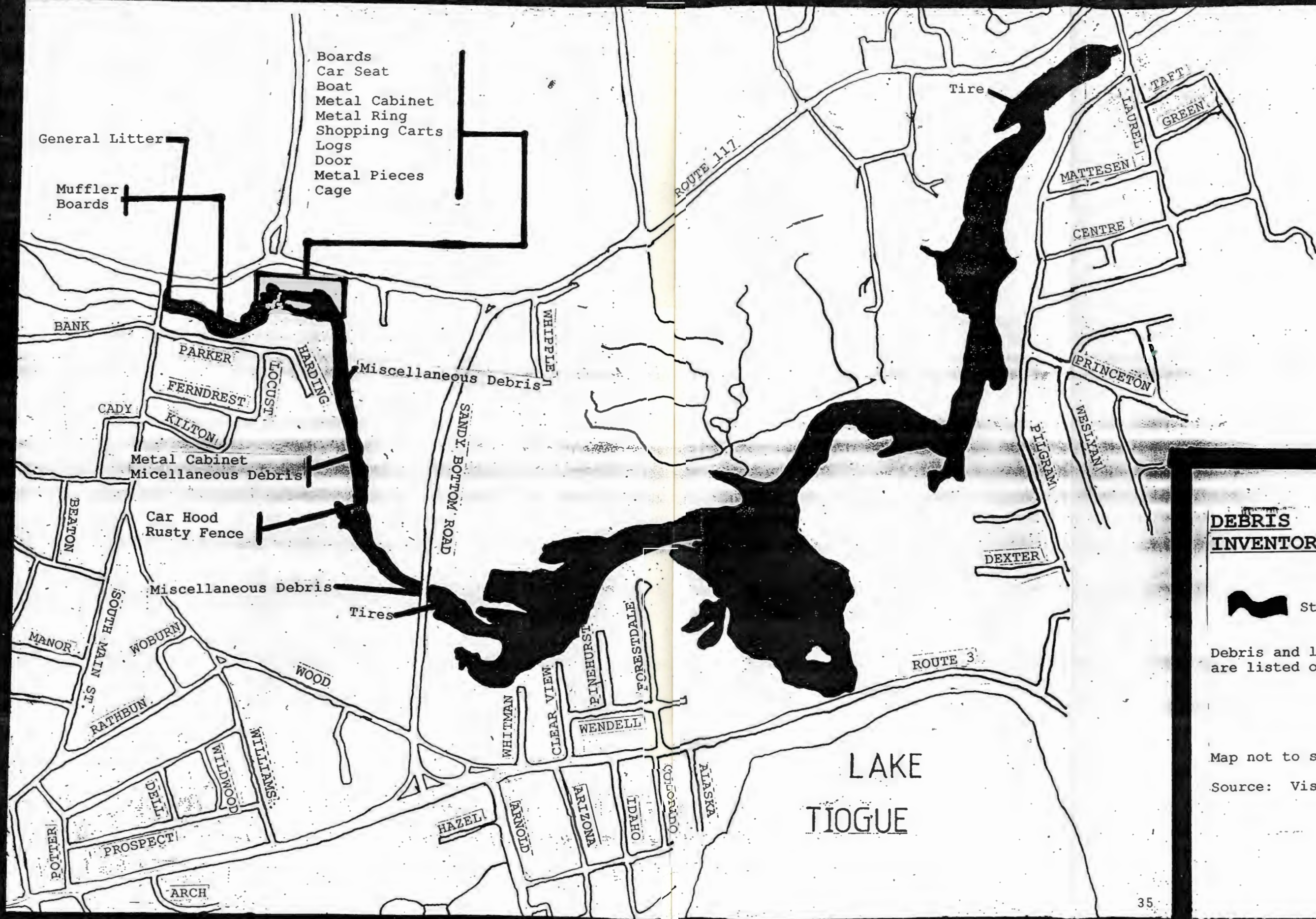
## SALT STORAGE

The Town of Coventry stores their road salt behind the Town Hall in central Coventry. This storage location is not in the study area. It is however located in reach 41 near the

beginning of the south branch of the Pawtuxet River and has the potential of leaching through the groundwater or over the surface to the river.

## **DEBRIS INVENTORY**

The portion of the river that makes up the study area has been littered with debris throughout its length. Debris such as tires, car parts, rusty metal pieces, boards, metal cabinets, shopping carts, doors, mufflers, and vending machines. These are just a small number of the articles that have been dumped into the river at various points. These articles dumped in and on the banks are continually adding toxins and other pollutants to the river. This debris also reduces the aesthetic character of the river and its surrounding area. Figure 1.15 shows the location of a majority of the visible debris, but there is also a lot of non-visible debris found in the river. Not long ago, a number of stolen vending machines were discovered in a deep portion of the river. (see Appendix B)



- Boards
- Car Seat
- Boat
- Metal Cabinet
- Metal Ring
- Shopping Carts
- Logs
- Door
- Metal Pieces
- Cage

General Litter

Muffler Boards

Miscellaneous Debris

Metal Cabinet  
Micellaneous Debris

Car Hood  
Rusty Fence

Miscellaneous Debris

Tires

Tire

### DEBRIS INVENTORY

Study Area

Debris and locations are listed on map.

Map not to scale.

Source: Visual Review.

## CHAPTER TWO

## CURRENT WATER QUALITY REVIEW

The water quality of the portion of the south branch of the Pawtuxet River between the South Main St. bridge and the Laurel Ave. bridge is class C due to the large number of industrial point sources combined with the increasing number of non-point sources in the area. Portions of this area are heavily developed and others are growing rapidly.

Section 6.2 of the Rhode Island Water Quality Standards classifies freshwater into 5 distinct classes.

"Class A - (drinking) water supply

Class B - public water supply with appropriate treatment

- agricultural uses

- bathing, other primary contact recreational activities

- fish and wildlife habitat

Class C - boating, other secondary contact recreational activities

\*Class D - migration of fish

- good aesthetic value

\*Class E - Nuisance conditions; uses limited to:

- certain industrial processes and cooling

- power

- navigation

\* Classes D and E shall be used to describe an existing condition only, and shall not be considered an acceptable goal for classification of any water." (RIDEM, 1988)

"The groundwater aquifer associated with portions of the Big River and Flat River Reservoir also underlies most of this watershed. Kent County Water Authority maintains four public wells near Mishnock Swamp and Tiogue Lake. This ground water source is high in manganese and the Authority is considering abandoning these wells when the Big River Reservoir is built.

In addition, one of the Tiogue wells has been contaminated with tetrachloroethylene and is not in use. Industrial wastes or individual sewage disposal systems (solvents are sometimes used to clean septic systems) are suspected sources." (Pawtuxet River Basin Non-Point Quality Standards Review and Management Plan, 1987)

Department of Environmental Management water quality sampling on Tiogue Pond has determined that the pond is maintaining Class B status as far as bacteria is concerned. There is a problem with eutrophication that is decreasing the appeal for swimming in the area. The pond is "shallow and nutrient rich, heavy residential development contributes runoff" (Ibid.) and the pond receives a very low level of clean inflow. "Full use of the pond is also limited by commercial development bordering the pond on Route 3. (Ibid.)

The 1986 RIDEM Stormwater Runoff Loadings And Impervious Area Calculations In The Pawtuxet River Basin Technical Report #1 divides the study area into reaches or sub-drainage areas as determined by RIDEM's Division of Water Resources. Two reaches cover the study area. Reach 40 extends from the

confluence of the Mishnock River and the south branch of the Pawtuxet to the junction between the south branch of the Pawtuxet and Tiogue Lake. Reach 39 extends from the Tiogue Lake junction to the confluence with the north branch. In order to determine the reach where the most non-point intrusion is estimated to occur, reach 41 was also added. Reach 41 extends from the Flat River Reservoir Dam to the confluence of the Mishnock River.

The pollutants that RIDEM included in their study are total suspended solids (TSS), biological oxygen demand (BOD), copper (Cu), lead (Pb), zinc (Zn), and total phosphorus (TP). The amounts that this report comes up with are runoff estimates that are calculated by "identifying the different land uses, selecting a runoff coefficient and pollutant loading factor for each and determining the annual amount of rainfall." (RIDEM, 1986)

These runoff estimates are useful in determining any variations in the amount and types of runoff from one sub-drainage area to another. They are also useful for making comparisons between sub-drainage basins and identifying potential problem areas throughout the sub-drainage basins.

These estimates "do not account for inputs from septic system failures, land fill leachate, or other concentrated non-point sources." (RIDEM, 1986)



|              | basin 39 | basin 40 | basin 41 |
|--------------|----------|----------|----------|
| TSS          |          |          |          |
| mg/l         | 97.32    | 100.21   | 110.61   |
| lb/year      | 916,398  | 142,546  | 298,732  |
| lb/acre/year | 241.98   | 280.63   | 195.12   |
| BOD          |          |          |          |
| mg/l         | 6.45     | 7.2      | 3.53     |
| lb/year      | 74,880   | 12,227   | 14,992   |
| lb/acre/year | 19.77    | 24.07    | 9.79     |
| TP           |          |          |          |
| mg/l         | .2       | .24      | .11      |
| lb/year      | 2,422    | 373      | 409      |
| lb/acre/year | .64      | .73      | .27      |
| Cu           |          |          |          |
| mg/l         | .02      | .02      | .02      |
| lb/year      | 325      | 44       | 85       |
| lb/acre/year | .08      | .08      | .05      |
| Pb           |          |          |          |
| mg/l         | .11      | .1       | .06      |
| lb/year      | 1,596    | 185      | 396      |
| lb/acre/year | .42      | .36      | .24      |
| Zn           |          |          |          |
| mg/l         | .2       | .16      | .2       |
| lb/year      | 3,417    | 304      | 1,259    |
| lb/acre/year | .90      | .60      | .82      |

Source: "Stormwater Runoff Loadings and Impervious Area Calculations In The Pawtuxet River Basin", Technical Report #1 RIDEM, 1986.

Maps depicting these runoff loading rates have been included in Appendix C.

From these estimates, it can be seen that the majority of these pollutants enter the river in sub-drainage basin 39. Basin 39, as mentioned previously, extends from the river's juncture with Tiogue Lake to the confluence with the north

branch. The boundary of this study includes only the small portion of this sub-drainage basin from the juncture with Tiogue lake to the Laurel Avenue dam.

There are also large amounts of these pollutants entering the river in sub-drainage basin 40, which encompasses the majority of the study area. This basin has the lowest total suspended solids, biological oxygen demand, copper, lead and zinc estimates of the three sub-drainage basins. But all of these estimates are in excess of the acceptable amount.

The pollutant loading data shows that basin 40 has the highest annual load per acre when compared to the other two sub-drainage basins.

Sub-drainage basin 40 has the highest estimates of total suspended solids, biological oxygen demand, copper and total phosphorus. The estimates are also very high for lead and zinc. This sub-drainage basin is the smallest of the three basins discussed. The reason that these figures are so high is because there is a small amount of land area depositing such a large amount of pollutants through stormwater runoff into a short segment of the river. Therefore, the concentration of the pollutants is increased. This explains why the State of Rhode Island has classified the portion of the south branch beginning at the South Main St. bridge Class C waters. The section just prior, from the Flat River Reservoir to South Main St. (basin 41), has a water quality classification of Class B.

For comparison purposes, the following figures are the Water Supply Source and Drinking Water Standards for both the State of Rhode Island and the U.S. Environmental Protection Agency.

|             | Rhode Island Standards | EPA Regulations |
|-------------|------------------------|-----------------|
| Lead (Pb)   | 0.05                   |                 |
| Zinc (Zn)   |                        | 5.0             |
| Copper (Cu) |                        | 1.0             |

From this, it can be seen that all three of the sub-drainage basins are exceeding the Rhode Island standard for lead. Basin 39 is estimated to have more than two times the accepted amount of lead. Basin 40 is estimated to contain twice the accepted amount of lead. While basin 41 is estimated to exceed the standard by just 0.01 mg/l.

All three of the sub-drainage basins are well below the Environmental Protection Agency's regulations for copper and zinc.

# CHAPTER THREE

## **MANAGEMENT STRATEGIES AND RECOMMENDATIONS**

The Rhode Island Department of Environmental Management's "Nonpoint Source Management Plan of 1988" uses Best Management Practices (BMP's) for nonpoint source pollution control. In this document, RIDEM developed a framework for nonpoint source pollution control. This framework breaks down their BMP's into ten different categories. These are:

1. Construction/Land Development
2. Urban Runoff
3. Highway Maintenance and Runoff
4. Individual Sewage Disposal Systems (ISDS)
5. Agricultural Activities
6. Resource Extraction - Sand and Gravel
7. Recreational Activities - Marinas
8. Materials Handling and Storage
9. Underground Storage Tanks
10. Automobile Junk and Salvage Yards

It is extremely important that all of these factors and best management practices are reviewed and taken into account in present and future decisions made by the planning department in the town. The recommendations in this study will address only the topics brought up earlier: stormwater runoff, individual sewage disposal systems, road salt, impervious surfaces and debris.

## STORMWATER MANAGEMENT

At present, the Town of Coventry is attempting to implement Wastewater Management Districts in the town. These districts will follow RIDEM's recommendations and guidelines in the Scituate Reservoir Watershed Management Plan. With the use of these management districts, the town will be able to "develop means to mitigate existing water quality contamination sources, and devise a management/regulatory structure necessary to oversee" (Div. of Planning, 1987) the flow of pollutants into the Pawtuxet River.

Best management practices or BMP's were developed in the late 1970's "for urbanizing areas that could remove urban pollutants and, in some cases protect downstream aquatic life. Most of these practices involve extra detention, retention or infiltration of urban stormwater to enhance pollutant removal and provide additional stormwater management. "(Schueler, 1987)

The "Vegetated Buffer Strip Designated Guidance Manual" recently developed for RIDEM and the Narragansett Bay Project by IEP, Inc. has set out "to provide guidelines for the determination of vegetative buffer strip widths for pollutant attenuation on a case-by-case (site-specific) basis. The purposed buffer designation (or sizing) method is aimed at mitigating stormwater quality impacts from urban and suburban developments." (Palstrom, 1991)

Other vegetative best management practices include:

grass swales, urban forestry, basin landscaping and shallow marsh creation. All of these methods are effective, simple ways to reduce particulate pollutant runoff in urban and suburban environments.

Figure 3.1 diagrams the process of the buffer designation model. This flow chart shows the steps that the reviewing person or committee would follow.

The special conditions evaluation (Figure 3.2) allows the reviewer to determine the suitable buffer strip width. The buffer designations range in sizes according to the surrounding land uses and physical features.

This plan to create buffer strips along rivers and wetlands to remove total suspended solids from stormwater runoff could be one effective method in the study area.

Another BMP would be to create extended detention ponds for the stormwater runoff. "Extending the detention time of dry or wet ponds is an effective, low cost means of removing particulate pollutants and controlling increases in downstream bank erosion." (Schueler, 1987)

Retention ponds or basins are another extremely effective BMP at a moderate cost to the developer. "If properly sized and maintained, wet ponds can achieve a high removal rate of sediment, BOD, organic nutrients and trace metals. Biological processes within the pond also remove soluble nutrients (nitrate and ortho-phosphorus) that contribute to nutrient enrichment (eutrophication). (Schueler, 1987)

FIGURE 1

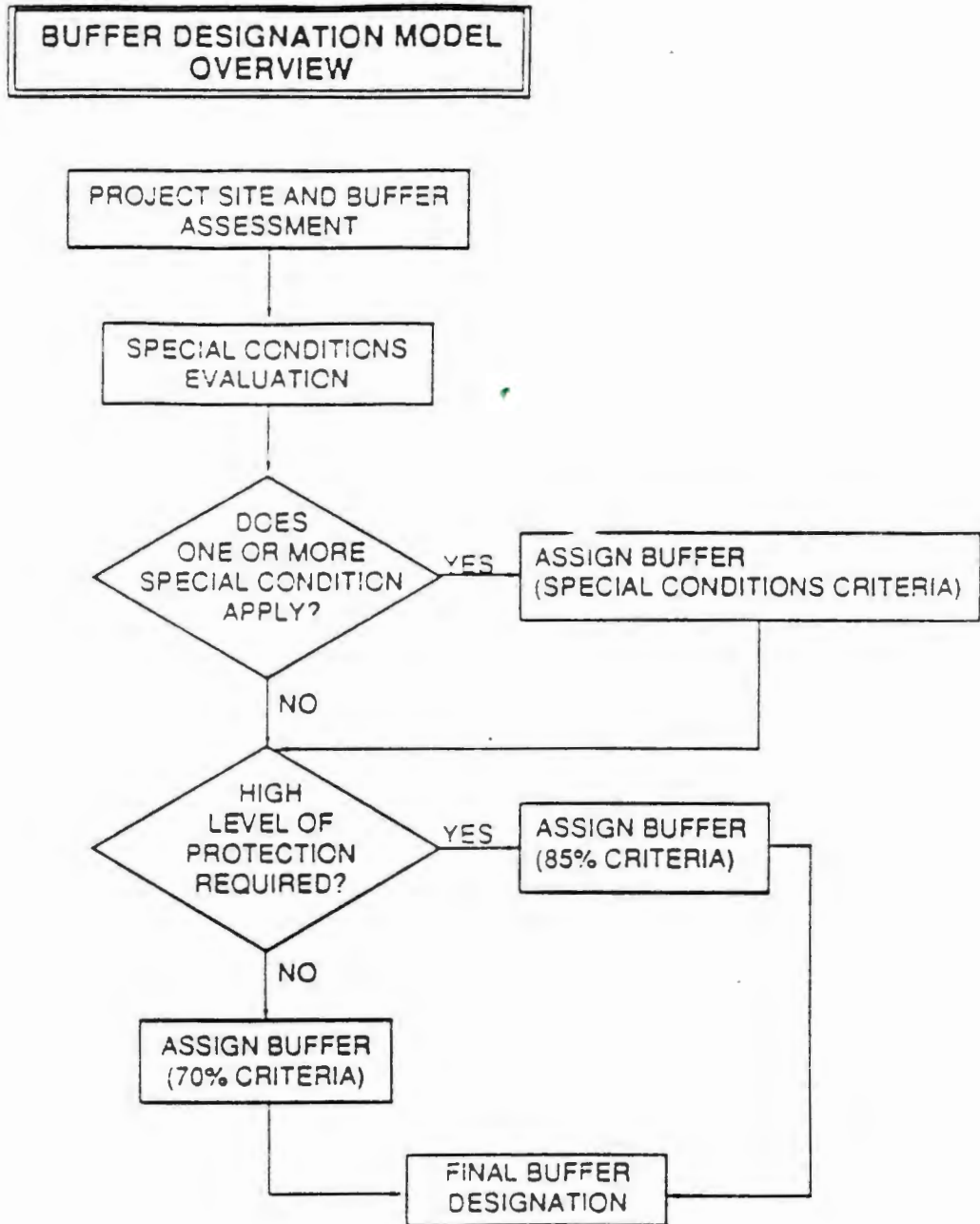




FIGURE 2

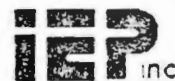
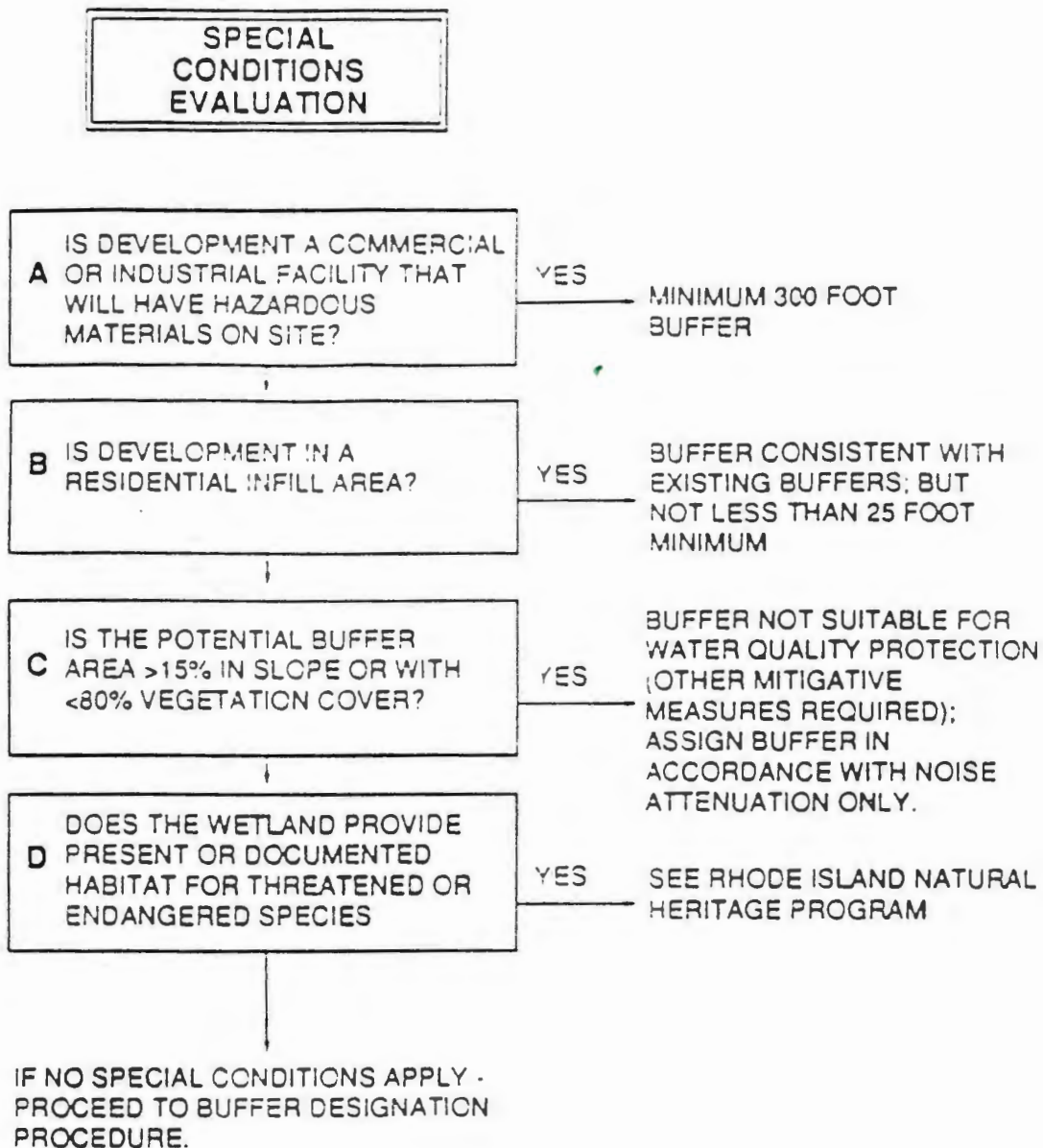


Figure 3.2

Infiltration trenches are another BMP that removes both soluble and particulate pollutants from stormwater. Trenches are best suited for on-site control. They may only be ideal for selected areas because they "are only feasible when soils are permeable and the water table and bedrock are situated well below the bottom of the trench.

Infiltration basins are also an effective method of removing soluble and particulate matter from stormwater runoff. This type of basin is easily adaptive to different sites and different storm conditions.

"Porous pavement has a high capability to remove both soluble and fine particulate pollutants in urban runoff, and also provides groundwater recharge, low flow augmentation and streambank erosion control." (Schueler, 1987) This might be an effective way for the town and state to control the level of pollutants entering the study area. There are a number of roads in the surrounding area that are slated for repairs and resurfacing. The town along with RIDEM could possibly set up porous pavement districts along the river.

Figures 3.3 through 3.6 have been included to show the restrictions, benefits, pollutant removal and community amenities of each of the previously mentioned best management practices.

| BMP                     | SLOPE | HIGH WATER TABLE | CLOSE TO BEDROCK | PROXIMITY TO FOUNDATIONS | SPACE CONSUMPTION | MAXIMUM DEPTH | RESTRICTED LAND USES | HIGH SEDIMENT INPUT | THERMAL IMPACTS |
|-------------------------|-------|------------------|------------------|--------------------------|-------------------|---------------|----------------------|---------------------|-----------------|
| EXTENDED DETENTION POND | ●     | ●                | ◐                | ●                        | ○                 | ●             | ●                    | ◐                   | ●               |
| WET POND                | ●     | ●                | ◐                | ●                        | ○                 | ○             | ●                    | ◐                   | ○               |
| INFILTRATION TRENCH     | ○     | ○                | ○                | ○                        | ●                 | ○             | ●                    | ○                   | ●               |
| INFILTRATION BASIN      | ◐     | ○                | ○                | ◐                        | ◐                 | ○             | ●                    | ○                   | ●               |
| POROUS PAVEMENT         | ○     | ○                | ○                | ○                        | ○                 | ○             | ○                    | ○                   | ●               |
| WATER QUALITY INLET     | ●     | ●                | ○                | ○                        | ●                 | ○             | ○                    | ○                   | ●               |
| GRASSED SWALE           | ○     | ○                | ◐                | ◐                        | ●                 | ●             | ○                    | ○                   | ●               |
| FILTER STRIP            | ◐     | ◐                | ◐                | ◐                        | ●                 | ●             | ◐                    | ○                   | ●               |

- MAY PRECLUDE THE USE OF A BMP
- ◐ CAN BE OVERCOME w/ CAREFUL SITE DESIGN
- GENERALLY NOT A RESTRICTION

Figure 3.3

Source: Schueler, Thomas; Controlling Urban Runoff: A Practical Manual For Planning And Designing Urban BMP's, 1987

| BMP                        | PEAK DISCHARGE CONTROL |               |                |                |                      |                             |
|----------------------------|------------------------|---------------|----------------|----------------|----------------------|-----------------------------|
|                            | 2 YEAR STORM           | 10 YEAR STORM | 100 YEAR STORM | VOLUME CONTROL | GROUNDWATER RECHARGE | STREAM/BANK EROSION CONTROL |
| <b>EXTENDED DETENTION</b>  |                        |               |                |                |                      |                             |
| DRY                        | ●                      | ●             | ●              | ○              | ○                    | ●                           |
| DRY w/ MARSH               | ●                      | ●             | ●              | ◐              | ○                    | ●                           |
| WET                        | ●                      | ●             | ●              | ○              | ○                    | ●                           |
| WET POND                   | ●                      | ●             | ●              | ◐              | ○                    | ○                           |
| <b>INFILTRATION TRENCH</b> |                        |               |                |                |                      |                             |
| FULL EXFILTRATION          | ●                      | ◐             | ○              | ●              | ●                    | ●                           |
| PARTIAL EXFILTRATION       | ●                      | ●             | ○              | ●              | ●                    | ●                           |
| WATER QUALITY TRENCH       | ○                      | ○             | ○              | ●              | ●                    | ●                           |
| <b>INFILTRATION BASIN</b>  |                        |               |                |                |                      |                             |
| FULL EXFILTRATION          | ●                      | ◐             | ○              | ●              | ●                    | ●                           |
| INFILTRATION/DETENTION     | ●                      | ●             | ●              | ●              | ●                    | ◐                           |
| OFF-LINE BASIN             | ○                      | ○             | ○              | ●              | ●                    | ◐                           |
| <b>POROUS PAVEMENT</b>     |                        |               |                |                |                      |                             |
| FULL EXFILTRATION          | ●                      | ◐             | ○              | ●              | ●                    | ●                           |
| PARTIAL EXFILTRATION       | ●                      | ●             | ◐              | ●              | ●                    | ◐                           |
| WATER QUALITY              | ○                      | ○             | ○              | ●              | ●                    | ◐                           |
| WATER QUALITY INLET        | ○                      | ○             | ○              | ○              | ○                    | ○                           |
| GRASSED SWALE              | ◐                      | ○             | ○              | ◐              | ◐                    | ○                           |
| FILTER STRIP               | ◐                      | ○             | ○              | ◐              | ◐                    | ○                           |

- SELDOM OR NEVER PROVIDED
- ◐ SOMETIMES PROVIDED w/ CAREFUL DESIGN
- USUALLY PROVIDED

Figure 3.4

Source: Schueler, Thomas; Controlling Urban Runoff: A Practical Manual For Planning And Designing Urban BMP's, 1987

| BMP/design                     | SUSPENDED SEDIMENT | TOTAL PHOSPHORUS | TOTAL NITROGEN | OXYGEN DEMAND | TRACE METALS | BACTERIA | OVERALL REMOVAL CAPABILITY |
|--------------------------------|--------------------|------------------|----------------|---------------|--------------|----------|----------------------------|
| <b>EXTENDED DETENTION POND</b> |                    |                  |                |               |              |          |                            |
| DESIGN 1                       | ☐                  | ☐                | ☐              | ☐             | ☐            | ⊗        | MODERATE                   |
| DESIGN 2                       | ◐                  | ◐                | ◐              | ◐             | ◐            | ⊗        | MODERATE                   |
| DESIGN 3                       | ◑                  | ◑                | ◑              | ◑             | ◑            | ⊗        | HIGH                       |
| <b>WET POND</b>                |                    |                  |                |               |              |          |                            |
| DESIGN 4                       | ◑                  | ◑                | ◑              | ◑             | ◑            | ⊗        | MODERATE                   |
| DESIGN 5                       | ◑                  | ◑                | ◑              | ◑             | ◑            | ⊗        | MODERATE                   |
| DESIGN 6                       | ◑                  | ◑                | ◑              | ◑             | ◑            | ⊗        | HIGH                       |
| <b>INFILTRATION TRENCH</b>     |                    |                  |                |               |              |          |                            |
| DESIGN 7                       | ◑                  | ◑                | ◑              | ◑             | ◑            | ◑        | MODERATE                   |
| DESIGN 8                       | ◑                  | ◑                | ◑              | ◑             | ◑            | ◑        | HIGH                       |
| DESIGN 9                       | ◑                  | ◑                | ◑              | ◑             | ◑            | ◑        | HIGH                       |
| <b>INFILTRATION BASIN</b>      |                    |                  |                |               |              |          |                            |
| DESIGN 7                       | ◑                  | ◑                | ◑              | ◑             | ◑            | ◑        | MODERATE                   |
| DESIGN 8                       | ◑                  | ◑                | ◑              | ◑             | ◑            | ◑        | HIGH                       |
| DESIGN 9                       | ◑                  | ◑                | ◑              | ◑             | ◑            | ◑        | HIGH                       |
| <b>POROUS PAVEMENT</b>         |                    |                  |                |               |              |          |                            |
| DESIGN 7                       | ◑                  | ◑                | ◑              | ◑             | ◑            | ◑        | MODERATE                   |
| DESIGN 8                       | ◑                  | ◑                | ◑              | ◑             | ◑            | ◑        | HIGH                       |
| DESIGN 9                       | ◑                  | ◑                | ◑              | ◑             | ◑            | ◑        | HIGH                       |
| <b>WATER QUALITY INLET</b>     |                    |                  |                |               |              |          |                            |
| DESIGN 10                      | ○                  | ⊗                | ⊗              | ⊗             | ⊗            | ⊗        | LOW                        |
| <b>FILTER STRIP</b>            |                    |                  |                |               |              |          |                            |
| DESIGN 11                      | ◐                  | ○                | ○              | ○             | ◐            | ⊗        | LOW                        |
| DESIGN 12                      | ◑                  | ◑                | ◑              | ◑             | ◑            | ⊗        | MODERATE                   |
| <b>GRASSED SWALE</b>           |                    |                  |                |               |              |          |                            |
| DESIGN 13                      | ○                  | ○                | ○              | ○             | ○            | ⊗        | LOW                        |
| DESIGN 14                      | ◐                  | ◐                | ◐              | ◐             | ◐            | ⊗        | LOW                        |

KEY:

- 0 TO 20% REMOVAL
- ◐ 20 TO 40% REMOVAL
- ◑ 40 TO 60% REMOVAL
- ◒ 60 TO 80% REMOVAL
- ◓ 80 TO 100% REMOVAL
- ⊗ INSUFFICIENT KNOWLEDGE

Figure 53.5

- Design 1: First-flush runoff volume detained for 6-12 hours.
- Design 2: Runoff volume produced by 1.0 inch, detained 24 hours.
- Design 3: As in Design 2, but with shallow marsh in bottom stage.
- Design 4: Permanent pool equal to 0.5 inch storage per impervious acre.
- Design 5: Permanent pool equal to 2.5 (Vr); where Vr=mean storm runoff.
- Design 6: Permanent pool equal to 4.0 (Vr); approx. 2 weeks retention.
- Design 7: Facility exfiltrates first-flush; 0.5 inch runoff, imper. acre.
- Design 8: Facility exfiltrates one inch runoff volume per imper. acre.
- Design 9: Facility exfiltrates all runoff, up to the 2 year design storm.
- Design 10: 400 cubic feet wet storage per impervious acre.
- Design 11: 20 foot wide turf strip.
- Design 12: 100 foot wide forested strip, with level spreader.
- Design 13: High slope swales, with no check dams.
- Design 14: Low gradient swales with check dams.

Source: Schueler, Thomas;

Controlling Urban Runoff:  
A Practical Manual For  
Planning And Designing

| BMP                             | LOW FLOW MAINTENANCE | STREAMBANK EROSION CONTROL | AQUATIC HABITAT CREATION | WILDLIFE HABITAT CREATION | NO THERMAL ENHANCEMENT | LANDSCAPE ENHANCEMENT | RECREATIONAL BENEFITS | HAZARD REDUCTION | AESTHETICS | COMMUNITY ACCEPTANCE |
|---------------------------------|----------------------|----------------------------|--------------------------|---------------------------|------------------------|-----------------------|-----------------------|------------------|------------|----------------------|
| DRY EXTENDED DETENTION          | ○                    | ●                          | ◐                        | ●                         | ●                      | ◐                     | ◐                     | ◐                | ◐          | ◐                    |
| WET EXTENDED DETENTION w/ MARSH | ○                    | ●                          | ●                        | ●                         | ○                      | ◐                     | ○                     | ◐                | ◐          | ◐                    |
| WET EXTENDED DETENTION          | ○                    | ●                          | ●                        | ●                         | ○                      | ●                     | ●                     | ◐                | ◐          | ●                    |
| WET POND                        | ○                    | ○                          | ●                        | ●                         | ○                      | ●                     | ●                     | ◐                | ◐          | ●                    |
| INFILTRATION TRENCH             | ●                    | ◐                          | ○                        | ○                         | ●                      | ○                     | ○                     | ●                | ○          | ●                    |
| INFILTRATION BASIN              | ●                    | ◐                          | ○                        | ●                         | ●                      | ◐                     | ◐                     | ●                | ○          | ◐                    |
| POROUS PAVEMENT                 | ●                    | ◐                          | ○                        | ○                         | ●                      | ○                     | ○                     | ●                | ○          | ●                    |
| WATER QUALITY INLET             | ○                    | ○                          | ○                        | ○                         | ●                      | ○                     | ○                     | ●                | ○          | ●                    |
| GRASSED SWALE                   | ◐                    | ○                          | ○                        | ◐                         | ●                      | ◐                     | ○                     | ●                | ◐          | ●                    |
| FILTER STRIP                    | ◐                    | ○                          | ○                        | ●                         | ●                      | ◐                     | ○                     | ●                | ◐          | ●                    |
| SHALLOW MARSH                   | ○                    | ○                          | ●                        | ●                         | ○                      | ○                     | ◐                     | ◐                | ◐          | ◐                    |

- SELDOM PROVIDED
- ◐ SOMETIMES PROVIDED (w/ Design Modifications)
- USUALLY PROVIDED

Figure 3.6

Source: Schueler, Thomas; Controlling Urban Runoff: A Practical Manual For Planning And Designing Urban BMP's, 1987

## INDIVIDUAL SEWAGE DISPOSAL SYSTEMS (ISDS)

First and foremost, it is extremely important that the Department of Environmental Management create ISDS data bases that can be easily accessible to the towns. These data bases would also have to be updated regularly in order for town officials as well as RIDEM officials to make accurate and consistent decisions pertaining to ISDS problems and concerns. This data could also possibly be included in the Rhode Island Geographical Information System (RIGIS). Maps could be created depicting the locations of ISDS. From these it could be easier for agencies, whether it be town planners or RIDEM officials to deal with ISDS applications. This ISDS information can also be overlaid with constraints maps to determine current and potential problem areas.

The Town should also review its new development constraints map taking into account poor soils for ISDS placement. At present, the map depicts a community that is partially or even fully sewerred.

Another recommendation is that the Town of Coventry adopt and enforce Waste Water Management Districts as proposed by the Department of Administration's Division of Planning. "This plan recommended that municipalities assume an active role in preventing septic system failures by establishing maintenance programs." (Dept. of Admin., Div. of Planning, 1987)

Developing the sewer system infrastructure for the

eastern portion of the town is imperative.

The Town of Coventry's Planning Department, headed by Charles Gricus, is working on utilizing RIDEM's Wastewater Management District Guidelines. They are also in the process of researching federal grants and that would allow the town to put sewers in place. Section 101 of the *Federal Water Pollution Control Act* states that "it is the national policy that Federal financial assistance be provided to construct publicly owned waste treatment works." (33 U.S.C. 1151)

If successful, the town might be able to hook up a portion of the system to West Warwick's system. If the majority of the town is to be sewerred, the town may have to build its own sewer treatment plant. This would bring about a tremendous financial burden as well as extreme negative affects to the Pawtuxet River if not planned and designed properly. One excellent document to refer to is "*Developing A Small Community Sewage Facility Through A Municipal Authority*", by The Pennsylvania State University, College of Agriculture. This document outlines strategic planning, design and cost estimates for the development of a facility. This document is included in Appendix D.

## ROAD SALT

In order to assist in the reduction of sodium chloride that enters the river, the Town could attempt to adopt the road salt policy that is in effect in the Scituate Reservoir



Watershed. It would only be necessary to implement this strategy along roads in which the runoff directly enters the river.

## IMPERVIOUS SURFACES

In order to cut down on impervious surfaces the town can, in the zoning regulations, request that new developments in a determined area around the river use either porous pavement or gravel in their parking areas and driveways.

## DEBRIS

The elimination of debris in and along the river can only be achieved if the general public is informed about the river. Education is the strongest advocate working for this cause. This step can begin in the school system for the children. Agencies such as the Pawtuxet River Authority and River Watchers can educate the adults in the community as to the impacts of debris within and surrounding the river.

C H A P T E R F O U R

## SUMMARY

It is imperative that a combination of local, state and federal agencies as well as concerned public interest groups become involved to reclaim the water quality of the south branch of the Pawtuxet River.

This study attempts to bring together a set of water quality degrading nonpoint sources of pollution for an area of the river that has not yet been specifically studied. The majority of the previous studies concentrated on either the river as a whole or the area around the Scituate Reservoir Watershed. The studies that looked at the south branch were predominantly concerned with the areas to the east that deal with the sewage treatment plants and the confluence with the main stem of the river.

All of the nonpoint pollution sources mentioned in this study are present in some capacity in the areas surrounding the river. Individual sewage disposal systems "can fail to operate properly, creating a health concern and a possible water quality contamination source." (Dept. of Admin., Div. of Planning, 1987) Stormwater runoff, road salt and debris are also known nonpoint contaminants. If all of these agencies work together to initiate some of the recommendations listed in the previous chapter, there will be a noticeable improvement in water quality over time in the upper southern branch. All facets of nonpoint pollution must be addressed in

order for this to take place.

The recommendations that address these problems are common solutions that are readily used in other communities throughout the country. There are many examples available to determine the solution that fits the specific situation.

All of the previously mentioned nonpoint source pollution problems that exist in the study area are important and need to be addressed, but there are two key areas that require more immediate attention. These are the areas of stormwater runoff and ISDS. The Town must work with the appropriate state and federal agencies to remedy these problems. If an adequate storm drainage system and a sewer system is installed throughout the study area, the untreated pollutant load into the river will be greatly reduced. It is up to the present generation to save the Pawtuxet for the future.

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A P P E N D I X

A P P E N D I X A

**WASTE WATER MANAGEMENT DISTRICTS...**

**A Starting Point**

**December, 1987**

**THE STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS**

**DEPARTMENT OF ADMINISTRATION**

**DIVISION OF PLANNING**

265 Melrose Street

Providence, Rhode Island 02907

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## **Appendices**

**Appendix A - An Act Relating To Septic System Maintenance**

**Appendix B - Model Ordinance - Waste Water Management District**

**Appendix C - Municipal Authority To Exceed DEM's ISDS Regulations**

**Appendix D - Sources Of Additional Information**

## PREFACE

This report was prepared as one of a series of documents to support the **Scituate Reservoir Watershed Management Plan**. The impetus for this effort is a task force appointed by Governor Edward DiPrete to determine what measures should be taken within the watershed to protect the water quality of the Scituate Reservoir from the degradational effects of escalating development.

The primary goals of the task force are threefold:

1. Determine appropriate land uses, densities, and development controls necessary to protect drinking water quality from the effects of new growth.
2. Develop means to mitigate existing water quality contamination sources, and
3. Devise a management/regulatory structure necessary to oversee the implementation of the watershed protection plan.

Additional reports will be published that will address key issues as determined by the Task Force. The findings of these documents will be used to formulate the final recommendations for a comprehensive **Scituate Reservoir Watershed Management Plan**.

## **ACKNOWLEDGEMENTS**

This report was prepared by Scott Millar, Principal Environmental Planner with assistance from David Lavalley, a student intern under the general supervision of Victor J. Parmentier, Supervising Planner. Additional Division of Planning staff involved with the preparation of this report include:

Daniel W. Varin, Associate Director

Mark J. Vincent, Environmental Planner; and

Linda S. Conti, Word Processing Typist - who patiently typed and retyped numerous drafts.

The draft report was also reviewed by the following town planners whose comments have been incorporated into the final report:

Marilyn Cohen, North Kingstown

Clark Collins, Narragansett

Jim Kanes, Charlestown

Jennifer Parker, Jamestown

Anna Prager, South Kingstown

In addition Lorraine Joubert, from the DEM, reviewed the draft for its consistency with the DEM's ISDS regulations.

## **PART 1: INTRODUCTION**

In April 1986, a Task Force was organized by the Rhode Island Department of Environmental Management (DEM) to review and recommend revisions to the DEM's Individual Sewage Disposal System (ISDS) or Septic System Regulations. The Task Force, which was comprised of soil scientists, geologists, public health officials, builders, planners, environmental groups, and DEM staff, evaluated ISDS Regulations for the following:

1. location, design and construction of new systems,
2. maintenance and repair of existing systems,
3. application of innovative technology, and
4. public education.

The Task Force completed its work in Decemer 1986, and issued a report which contained its findings and recommendations. A key Task Force finding was the inadequacy of the existing ISDS Regulations with respect to addressing the regular maintenance of septic systems. It was determined that the State did not have the resources to implement and enforce an ISDS maintenance program. Therefore, it was recommended that municipalities assume an active role in preventing septic system failures by establishing maintenance programs. The specific recommendations for maintenance were as follows:

1. Develop and seek passage of legislation authorizing municipalities to establish ISDS maintenance districts on a voluntary basis,
2. Prepare a model ISDS maintenance ordinance outlining specific standards and procedures for mandatory ISDS maintenance for adoption by communities establishing maintenance districts, and



3. Expand public information and education efforts to encourage proper homeowner care of ISDS.

To address the Task Force's ISDS maintenance recommendations, the Division of Planning, with assistance from the DEM, developed enabling legislation which allows municipal governments to establish maintenance programs. This legislation, which is contained in Appendix A, was approved in the 1987 General Assembly Session and signed into law by Governor DiPrete in June.

The purpose of this report is to explain how a community can initiate a municipal septic system maintenance program including options for its administration, staff support, financing and enforcement. A model ordinance to assist with the implementation of a maintenance program has also been developed and is included in Appendix B. The intent is to provide a starting point, options for consideration, and a recommended program that a community can modify to suit their own needs.

## **PART 2: SEPTIC SYSTEM MAINTENANCE**

### **Septic Systems**

Septic Systems or individual sewage disposal systems (ISDS) are generally an inexpensive and acceptable means of household waste water disposal. The biggest drawback to these systems is that they can fail to operate properly, creating a health concern and a possible water quality contamination source.

There are four factors that govern the proper operation and life expectancy of a septic system: 1) location; 2) design; 3) installation; and 4) maintenance. The first three are regulated by the Department of Environmental Management. <sup>(1)</sup> Maintenance, since it is unregulated, has been severely neglected by many homeowners.

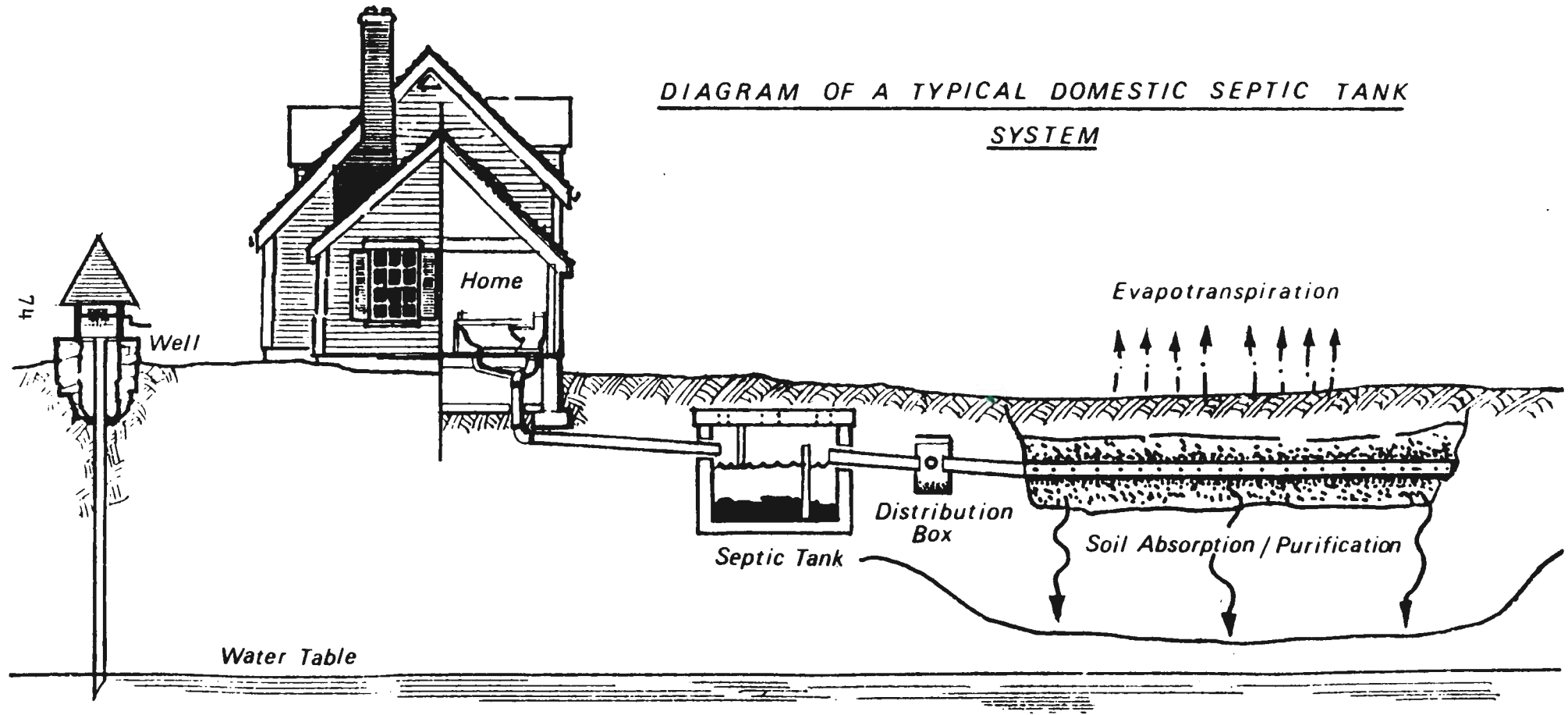
### **Maintenance**

It has been well documented that an ISDS requires maintenance to operate properly. Maintenance means the cleaning or pumping out of an ISDS on a regular basis, approximately every three years. As can be seen in Figure 1, a septic system is comprised of the septic tank, distribution box, and leach field. Waste water enters the septic tank where solids settle to the bottom and excess liquid or effluent flows from the tank into a distribution box which evenly distributes the effluent into the leachfield. The waste water then percolates downward through the soil. Since most soil can be a good purifying medium, it can efficiently remove bacteria and viruses from household waste water if travel time through unsaturated soil is sufficient.

- (1) It should be noted that the DEM ISDS regulations are minimum standards. Municipalities can establish more stringent criteria, if deemed necessary. Refer to Appendix C for further details.

FIGURE 1

DIAGRAM OF A TYPICAL DOMESTIC SEPTIC TANK SYSTEM



An ISDS fails when the solids from the septic tank accumulate to a level where they spill out into the leaching field and reduce the percolation capacity. This condition clogs the leachfield and causes untreated waste water to break out onto the ground surface or back up into the plumbing. To prevent this type of failure the solids in the septic tank must be pumped out regularly. When a leachfield becomes clogged expensive repairs are necessary to repair or replace the system.

### **Water Quality Problems**

Waste water that breaks out onto the surface not only poses a severe localized health threat but can run off to contaminate adjacent surface waters. A less obvious but equally as serious form of failure occurs where there is an insufficient separation between the groundwater and the bottom of the leachfield. In this case, effluent may not rise to the surface but seep through the soil with little or no treatment, resulting in the discharge of bacteria, viruses, and high levels of nutrients in the form of nitrates to the groundwater. Homeowners who are served by private wells and septic systems may face the danger of having their drinking water contaminated without their knowledge.

### **Solutions**

In the past, the standard solution to failing septic systems was to install public sewers. In large, densely populated communities, a municipal sewerage system may still be the most appropriate means for treating sewage. However, public sewers are extremely costly to install and are often beyond the means of most small or rural communities. In addition, the introduction of sewers to an area can stimulate unwanted development. For those communities that are unable to afford sewers and unwilling to ignore the problems associated with failed septic systems, the establishment of Waste Water Management Districts are a realistic alternative.

### **PART 3: WASTE WATER MANAGEMENT DISTRICTS**

Enabling legislation that was passed in the 1987 General Assembly Session allows Rhode Island municipalities to establish Waste Water Management Districts (WWMD). The purpose of these districts is to eliminate and prevent the contamination of state waters caused by malfunctioning ISDS through the implementation of inspection and maintenance programs. The adoption of an appropriate ordinance allows municipalities to:

- 1) Provide for the passage of district officials and septage haulers onto private property when necessary for the periodic inspection, maintenance, and correction of ISDS systems.
- 2) Raise funds for the administration, operation, contractual obligations and services of the Waste Water Management District by:
  - a) Assessing property owners for taxes or annual fees;
  - b) Borrowing, and for that purpose, by issuing bonds or notes of the city or town;
  - c) Setting rates for pumping.
- 3) Establish the necessary administrative, financial, technical, enforcement, maintenance, and legal structures to effectively implement and conduct Waste Water Management District programs, as well as hire the personnel necessary to support these structures.
- 4) Establish a public education program, which would precede the implementation of a WWMD, to make property owners aware of the proper maintenance and care of ISDS systems and the need for periodic pumping. After a WWMD has

been created, an education program could remain in place to educate new residents and update members of the district on new information or procedures.

- 5) Receive grants and establish a revolving fund to make grants and low interest loans available to individual property owners for the improvement, correction, or replacement of failed septic systems.
- 6) Authorize and contract with independent septage haulers.
- 7) Contract with other cities or towns for septage disposal through sewage treatment plants.
- 8) Designate proper collection and disposal sites for septage collected by authorized pumping and hauling agents.
- 9) Levy fines for noncompliance. Such fines shall be no greater than \$500 per violation. Each day of a continuing violation shall constitute a separate and distinct violation.

A WWMD can be established for all or portions of a community. In addition, two or more municipalities may wish to jointly adopt a regional WWMD. Any area that is not served by public sewers should be considered for a WWMD. However, some areas that should be given a high priority for a WWMD include:

- 1) Homes served by on-site wells and septic systems;
- 2) Watersheds or aquifers that provide or have the potential to provide public drinking water;

- 3) Areas with a history or strong potential for failed septic systems, such as areas with poorly drained soils; and
- 4) Sites adjacent to high quality surface waters.

A WWMD can be adopted in the same manner as other municipal ordinances. The town solicitor should be consulted to determine the proper procedures.

### Administration

There are a number of options for the administration of a WWMD. The following are some alternatives for designating the responsibility for implementation.

- 1) Existing Sewer Authorities - Since sewer authorities already govern public sewers within the town it might make sense to give them the power to oversee ISDS maintenance.
- 2) Public Works Department - An existing public works agency or town engineer could have the necessary technical expertise and administrative framework already in place.
- 3) New WWMD Commission - The town council could appoint a bi-partisan 5-7 member commission to implement the program. It would be helpful for commission members to have some knowledge in one or more of the following disciplines: engineering, soils, chemistry, biology, planning or education.

Since commissions are public bodies they are subject to the provisions of the R.I. open meetings law. Accordingly, meetings must be run with a few simple procedures:

Votes must be by quorum, accurate records should be kept, and the meetings must be open to the public.

### **Staff**

For a WWMD to be successful, full or part time staff are necessary to carry out the program. A district's operation has three components:

- 1) Septic System Inspection
- 2) Public Education
- 3) Office administration

There are several options on how to accomplish these three tasks. First, the district can hire either full or part-time staff to run the entire program. Second, the district can contract with a private contractor to assume all tasks. Finally, a combination of options one and two can be used. For example, the administrative and educational components could be performed by the town, with a private contractor hired to perform the inspections. Prior to making these decisions, the size of the WWMD should be considered, the frequency of inspections, the availability/experience of existing town personnel, and the availability and cost of private contractors. Caution should be exercised in assigning new duties to existing town staff that may already be overburdened.

### **Septic System Inspection**

The inspection of an ISDS is the key component of a WWMD program. Whoever conducts the inspections must be adequately trained. The inspector must be able to recognize subtle, as well as flagrant signs of system failure. At a minimum, septic system inspections should include:



- 1) **Septic Tank Sludge Levels** - the septic tank inspection port must be opened to examine the depth of sludge in the tank. When the sludge level accumulates to a depth of one third the distance to the leach field outlet or 16 inches in depth the tank should be pumped.
- 2) **Surface Break Out** - wastewater that "breaks out" onto the ground surface is an indication of failure.
- 3) **Lush Plant Growth** - Systems that have lush green grass growing over the tank or leachfield location are unlikely to be operating properly.
- 4) **Odor** - Strong sewage odors are an obvious indication of a septic system malfunction.
- 5) **Trees or Shrubs** - There should be no trees or shrubs growing over or within 10 feet of the leachfield.
- 6) **Impervious Area** - There should not be any patios, driveways, swimming pools or other impervious surfaces over the leachfield without the approval of the DEM.

If the inspection reveals a malfunctioning system, the owner should be given a written notice indicating the probable cause and recommended corrective actions. The owner should be given a reasonable time frame (30 days) to contact the DEM and apply for the necessary permit to repair the system, if necessary. An additional time limit should be established, on a case by case basis, to complete all necessary repairs.

If a system has not failed, but requires pumping, the owner should be required to show proof that the ISDS has been pumped within thirty days of the inspection. A receipt from the pumper can be used as adequate proof.

ISDS owners should be cautioned about having their systems pumped during the wet season, (December-March) particularly in areas with seasonally high water tables. A concrete septic tank is water tight and can become buoyant after the solids are pumped out. A high water table could either push an empty tank out of the ground or tilt it in the ground so that the waste water will not effectively flow into the leaching field.

Instead of an inspector measuring septic tank sludge levels, a district can automatically require that all tanks be pumped on a regular basis such as every three years. This requirement should be staggered through the district so that everyone does not need to have their system pumped in the same year. To encourage compliance, the district may wish to offer a rebate to subsidize some or all of the homeowner's pumping costs. An annual ISDS owner maintenance fee could be a source of funds for the rebate program.

Another option would be for the District to enter into a contractual agreement with a private firm to have all systems automatically pumped every three years, or as needed. For example if an ISDS costs \$75 to be pumped once every three years, a WWMD could assess an ISDS owner \$25 per year plus an administrative charge to fund District operations. This option may prove to be the most desirable for the following reasons:

1. Complete compliance with District pumping requirements would be assured.
2. An efficient and orderly pumping schedule can be established to avoid over loading septage receiving facilities.

3. It will be easier to keep maintenance records.
4. Septage can be more readily traced to insure proper disposal.
5. ISDS owners could be eligible for a reduced group rate from private pumpers.
6. The District can be sure that ISDS pumpers are properly trained and licensed.

(NOTE: All septage haulers are required to maintain records indicating the source and estimated volume of septage picked up, the date of shipment, and the name of the facility where the septage was discharged.)

The frequency of inspections should be determined by the nature of the WWMD. As a rule of thumb, an ISDS should be inspected on an annual basis. Inspections conducted at a rate less than this may not identify problems in a timely manner. Some systems, such as those located in areas prone to failures or vacation rental units will need more frequent inspections than once a year. This frequency can be established by the WWMD as needed.

Property owners should be notified of inspection schedules. This can be done by direct mailings, an advertisement in the local newspaper or a notice posted in the town hall and other municipal buildings. The mail is the best way to insure that homeowners have been notified but it is also the most costly. The newspaper could be a less expensive alternative, and a posted notice should only be used to supplement the first two options.

Regardless, of the maintenance requirements selected by a WWMD, it is imperative that accurate and up-to-date records be kept. A record card system could be established that would indicate the following:

- 1) Owner's name;
- 2) Street address or utility pole number;

- 3) Telephone number;
- 4) ISDS location, and age, if known; (The ISDS location should be mapped once it has been located.)
- 5) Date of last maintenance; and
- 6) Notes on the condition of the ISDS.

### Education

Public education is a critical part of any waste water management program. The first thing that any potential district is going to confront is the "what-I-do-on-my-property-is-my-business" attitude. People have to be convinced that the pollution caused by malfunctioning septic systems is not a problem that can be confined to a single property but, rather, is one that affects the entire community. It is much cheaper for a municipality to rely on septic systems than to install public sewers and assess homeowners for the expense. In addition, homeowners who are served by on-site wells and ISDS need to practice proper maintenance to safeguard their drinking water supplies.

Pamphlets, such as the one produced by Save the Bay, public information meetings, and newspaper articles are some of the means of reaching the community and explaining what a waste water management program is all about.

The district also needs to have an ongoing program to educate residents on the operation and maintenance of septic systems. For example, a simple fact about septic systems is that the less water going through a system the better it will operate. Devices that reduce water flow can be installed on faucets, showers, and toilets. The district should make residents aware of how these water restriction devices can improve the operation of their system. With an effective education program, the district can reduce the number of problems that residents encounter.

## **Financing**

As previously mentioned, the enabling legislation empowers municipalities to raise funds for the administration and operation of the district. There are a number of options that municipalities can consider to establish an operating budget. However, one simple and equitable means would be to assess each homeowner within the district an annual flat fee based on the number of dwelling units owned. Since commercial and industrial septic systems may need more time-consuming and frequent inspections, a higher fee could be assessed. In addition, any residential site requiring more than two inspections per year could also be assessed an extra fee for each subsequent visit.

There are several options for establishing the rate for the annual flat fee. It could either be based on what is necessary to support the district yearly operating costs or, to develop a reserve fund which could be used to assist needy homeowners with repairs or pumping fees.

## **Financial Assistance**

Some septic systems will be beyond the scope of maintenance and will need to be replaced. A situation that a WWMD is likely to encounter is when a homeowner with a failed ISDS cannot afford to repair it. In these situations, the district has the authority to issue bonds to obtain funds that can be allocated as either grants or low interest loans to assist qualified individuals.

It may be the case that an entire neighborhood needs ISDS repairs and the site is not suitable for conventional septic systems. In this case, it may be necessary to design an expensive community system to solve the problem. The WWMD may wish to offer financial aid to such a neighborhood to effectively mitigate the problem.

### Enforcement

The effectiveness of any ordinance is only as good as its enforcement. A WWMD has the authority to take some strong enforcement measures if necessary. The district may levy fines for noncompliance, which can go as high as \$500 per day.

### Septage Disposal

A key factor to consider prior to implementing a septic system maintenance program is the proper disposal of septage, or the solid/liquid contents that are pumped out of the septic tank. Septage is required to be taken to a waste water treatment facility for treatment. However, municipal treatment facilities are limited in the amount of septage that they can adequately accommodate. In addition a community with a treatment facility is only obligated to accept septage from within its own service area. For example the city of Cranston may but is not required to accept septage from the town of Scituate, which is not served by municipal sewers.

It is extremely important for a municipality, that does not have public sewers to establish an agreement with a municipal waste water treatment facility for septage disposal. Communities that have sewage treatment must exercise caution to prevent overloading the capacity of their treatment facilities. The failure to plan for septage disposal could encourage illegal septage dumping which could pose an even greater environmental threat than the problem of inadequate septic system maintenance.

Clearly the septage disposal problem is one that must be resolved before the adoption of large scale community maintenance programs. The Department of Environmental, with assistance from the Division of Planning, is currently working to assist municipalities with this issue.

## **Conclusion**

Waste Water Management Districts are a realistic and affordable solution to the problems of failing septic systems. Proper maintenance benefits homeowners and the community both environmentally and economically. Although a WWMD may require some hard work to establish, the payoff benefits everyone.

**APPENDIX A**  
**STATE OF RHODE ISLAND**  
**IN GENERAL ASSEMBLY**  
**JANUARY SESSION, A.D. 1987**

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**A N A C T**  
**RELATING TO THE SEPTIC SYSTEM MAINTENANCE**

It is enacted by the General Assembly as follows:

SECTION 1. TITLE 45 OF THE GENERAL LAWS ENTITLED "TOWNS AND CITIES"  
IS HEREBY AMENDED BY ADDING THERETO THE FOLLOWING CHAPTER:

**CHAPTER 24.5**

**WASTE WATER MANAGEMENT DISTRICTS**

45-24.5-1. Short Title. -- This chapter shall be known and may be cited as the "Rhode Island Septic System Maintenance Act of 1987."

45-24.5-2. Legislative findings. -- The general assembly hereby recognizes and declares that:

Septic systems or individual subsurface disposal systems (ISDS) are prone to failure without proper maintenance. ISDS failure poses a risk to public health through the contamination of the state's surface and underground waters. Improperly treated waste water from malfunctioning ISDS can impair or prevent the use of the state's waters for drinking and domestic purposes, as well as swimming, wildlife habitat, boating, fishing and other water-based recreation. In many suburban and rural areas of the state, the use of ISDS is the only practical or available means to treat waste water. Most community and individual water supplies and some of the state's prime recreational waters are located in areas that rely on ISDS. Recreational and drinking supply waters are the least tolerant of



waste water contamination and, therefore, require rigorous protection. ISDS will continue, for the near term, to be the primary means of waste water treatment in many areas of the state where public and private water supplies and recreational waters exist. Therefore, to help avoid both contamination of state waters and the associated risks to the public health and help preserve the natural ecosystems, waste water disposal systems must be properly maintained to prevent their malfunction and/or failure.

45-24.5-3. Declaration of purpose. — The purpose of this chapter is to authorize the cities and towns of the state to adopt ordinances creating Waste Water Management Districts (WWMD), the boundaries of which may include all or part of a city or town, as specified by such ordinance. Such ordinances shall be designated to eliminate and prevent the contamination of state waters, caused by malfunctioning individual subsurface disposal systems (ISDS), through the implementation of ISDS inspection and maintenance programs. The waste water management district ordinance programs shall be designed to operate as both an alternative to municipal sewer systems and as a method to protect surface and ground waters from contamination.

45-24.5-4. Powers of councils. — The city or town council of any city or town in the state, by itself or pursuant to chapter 45-43, and in accordance with the purposes of this chapter, are hereby authorized to adopt ordinances creating Waste Water Management Districts (WWMD), which may be empowered, pursuant to such ordinance, to:

(a) Provide for the passage of District officials onto private property when necessary for the periodic inspection of septic systems.

(b) Order the maintenance and/or pumping of ISDS systems in accordance with an appropriate schedule.

(c) Raise funds for the administration, operations, contractual obligations and services of the Waste Water Management District by:

1. Assessing property owners for taxes or annual fees;
2. Borrowing, and for that purpose, by issuing bonds or notes of the city or town;

3. Setting rates for pumping.

(d) Hire the personnel necessary to carry out the functions of the district.

(e) Establish a public education program, which would precede the implementation of a WWMD, to make property owners aware of the proper maintenance and care of ISDS systems and the need for periodic pumping. After a WWMD has been created, an education program could remain in place to educate new residents and update members of the district on new information or procedures.

(f) Receive grants and establish a revolving fund to make available grants and low interest loans to individual property owners for the improvement, correction or replacement of failed septic systems.

(g) Authorize and contract with independent septage haulers.

(h) Contract with other cities and towns for septage disposal through sewage treatment plants.

(i) Levy fines for non compliance. Such fines shall be no greater than \$500 per violation. Such fines shall go into a dedicated fund for the purpose of operating the Waste Water Management District. Each day of a continuing violation shall constitute a separate and distinct violation.

(j) Provide for an appeal process from the decision of the WWMD under the provisions of the Rhode Island Administrative Procedure Act. An aggrieved party shall have the right to appeal to the District Court.

45.24.5-5. Powers of the State agencies retained. -- The Departments of Environmental Management and Health shall retain all of their existing authority regarding individual sewage disposal systems.

SECTION 2. This act shall take effect upon passage.

**EXPLANATION**

**OF**

**AN ACT**

**RELATING TO SEPTIC MAINTENANCE**

**\*\*\***

This act enables municipal governments to establish septic system maintenance districts to oversee the maintenance of existing septic systems.

This act shall take effect upon passage.

## **APPENDIX B**

### **MODEL ORDINANCE**

#### **Waste Water Management District**

##### **Section 1.0 Purpose**

The city or town council hereby finds that, without proper operation and maintenance, Individual Sewage Disposal Systems (ISDS) or septic systems are prone to failure. ISDS failure poses a risk to public health and a potential contamination source to the surface and ground waters of the State. The purpose of this ordinance is to establish a Waste Water Management District (WWMD), in accordance with the provisions of Chapter 45-24.5 of the Rhode Island General Laws, to ensure that ISDS are properly operated, regularly inspected, and routinely maintained to prevent malfunctioning systems and to operate as an alternative to municipal sewer systems.

##### **Section 2.0 Definitions**

###### **2.1 Alteration**

An alteration is any change in size or type of system, or installation of a replacement system.

###### **2.2 Failed System**

Any sewage disposal system that does not adequately treat and dispose of sewage so as to create a nuisance or threat to public health and/or environmental quality, as evidenced by, but not limited to, the following conditions:

- a. Failure of a system to accept waste water discharge or backup of waste water into the building sewer.
- b. Discharge of waste water directly or indirectly to a subsurface drain, surface drain, or surface water.
- c. Effluent rising to the surface of the ground over or near any part of the septic system or downgrade from the absorption area at any change in grade, bank, or road cut.
- d. Discharge of improperly treated effluent to groundwater including but not limited to inadequate separation from the bottom of the leaching system to groundwater or impervious layer and resulting in contamination of ground or surface water.
- e. Condition of deterioration, damage, or improper design, to any ISDS that would preclude adequate treatment and disposal of waste water.
- f. Pumping records that indicate very frequent maintenance. A system shall be considered in need of repair or alteration if the system has been pumped, or in need of pumping, four or more times in a period of one year.

### **2.3 Individual Sewage Disposal System (ISDS)**

An individual sewage disposal system shall be a system installed to provide sanitary sewage disposal by means other than discharge into a public sewer system.

### **2.4 Leachfield**

A subsurface area from which septic tank effluent or waste containing little or no solids is leached into the soil.

## **2.5 Maintenance**

The inspection on a regular basis of the ISDS and as necessary the cleaning out or pumping of accumulated scum and sludge from any septic tank, building sewer, or any other component of an ISDS that can be cleaned or pumped.

## **2.6 Owner**

Owner is any person who alone, or jointly, or severally with others (a) has a legal title to any premises, or (b) has control of any premises, such as agreement of purchase, agent, executor, executrix, administrator, administratrix, trustee, lessee or guardian of the estate of a holder of a legal title. Each such person is bound to comply with the provision of this ordinance.

## **2.7 Person**

The term person shall include any individual, group of individuals, firm, corporation, association, partnership or private entity, including a district, city, town or other government unit or agent thereof, and in the case of a corporation, any individual having active and general supervision of the properties of such corporation.

## **2.8 Repair**

To mend, remedy, renovate, or restore to a sound state after injury, deterioration, partial destruction or, to replace a septic tank, distribution box, leachfields or pipes connecting any of these, with no change in type of material, location, or area of an ISDS.

## **2.9 Sanitary Sewage**

Any human or animal excremental liquid or substance, any putrescible animal or vegetable matter, garbage and filth, including the discharge of water closets, laundry tubs, washing machines, sinks, dishwashers and the contents of septic tanks, cesspools or privies.

## **2.10 Septage**

Septage is the solid or liquid materials which are pumped from an ISDS.

## **2.11 Septic System**

For the purpose of this ordinance a septic system is analogous to an individual sewage disposal system. Refer to section 2.3

## **2.12 Septic Tank**

A septic tank is a water tight receptacle which receives the discharge of sanitary sewage and is designed and constructed to permit the deposition of settled solids, the digestion of the matter deposited, and the discharge of the liquid portion into a leaching system.

## **2.13 Waste Water**

Waste water is analogous to sanitary sewage. Refer to section 2.9.

## **2.14 Waste Water Management District**

A Waste Water Management District (WWMD) is all or a portion of one or more cities or towns where the proper operation and maintenance of an ISDS will be required in accordance with the provisions of an adopted ordinance, which defines the district.

### **Section 3.0 Applicability**

This ordinance shall be applicable to every owner of premises that has an Individual Sewage Disposal System located within the designated boundaries of the Waste Water Management District.

### **Section 4.0 Waste Water Management District Boundaries**

The Waste Water Management District will regulate the operation and maintenance of all ISDS within - (specify the entire municipality, portion thereof, or a regional district including all or portions of two or more municipalities.)

### **Section 5.0 Regulations for ISDS Operation and Maintenance**

#### **5.1 Pumping of Individual Sewage Disposal Systems**

The contents of all ISDS within the WWMD shall be inspected and as necessary pumped out (within 2 years of the effective date of these regulations and every three years thereafter or as required.) Such pumping shall be performed by municipal employees or private operators duly authorized by the WWMD.



Additional pumpings may be required as deemed necessary by the WWMD for the proper operation of an ISDS.

## **5.2 Septage Disposal**

Septage or contents pumped from an ISDS shall be discharged at a waste water treatment facility approved by the Department of Environmental Management for this purpose. (NOTE: A WWMD shall make arrangements for the proper disposal of septage at an approved waste water treatment facility.)

## **5.3 Improper Discharges to ISDS**

The discharge of rain spouts, basement sumps, or any other drains to an ISDS, with the exception of washing machines, is prohibited.

## **5.4 Acid and Organic Chemical Septic Tank Additives**

The use or disposal of acids or any organic chemical solvents in an ISDS is prohibited, unless these can be sufficiently demonstrated to have a beneficial effect on ISDS operation and no adverse impacts to the environment.

## **5.5 Impervious Surfaces**

The location of swimming pools, patios, driveways or other impervious surfaces over leaching areas is prohibited without the approval of the Department of Environmental Management. (NOTE: The WWMD may wish to consider variances for unusual circumstances.)

## **5.6 Garbage Disposals**

Garbage disposal discharges to an ISDS shall be discouraged, since they add unnecessary solids to an ISDS, and installed in accordance with DEM ISDS regulations.

## **5.7 Trees and Shrubs**

The owner shall keep trees and shrubs at a minimum of 10 feet from the leaching area to keep roots from clogging or disrupting the ISDS.

## **5.8 Accessibility**

The owner shall maintain ISDS so that it is accessible for inspection and maintenance.

## **Section 6.0 ISDS Inspections**

This ordinance authorizes the passage of City, Town or WWMD officials or their designees and septage haulers onto private property when necessary for the periodic inspection, maintenance and repair of ISDS.

### **6.1 Inspection Frequency**

All ISDS shall be subject to an on-site inspection by the WWMD or its designee on an annual basis. More frequent inspections may be conducted if deemed necessary by the WWMD. All ISDS owners shall be sent a written notice of inspection schedules.

## **6.2 Inspection Records**

The WWMD shall maintain a record of each ISDS inspected including:

- Owner's name
- Street address or utility pole number
- Telephone number
- ISDS location (NOTE: A rough sketch map will assist in locating the system in subsequent years)
- Date(s) of previous maintenance
- Notes on ISDS condition

## **6.3 Inspection Reports**

A written report detailing the results of the inspection shall be kept on file with the WWMD. If the inspection reveals a malfunctioning ISDS, the owner shall be given a written notice indicating the probable cause and recommended corrective actions. A copy of said report shall also be sent to the DEM Division of Land Resources. The owner shall be given (30 days) to contact the DEM and apply for a permit to repair or replace the system, if necessary. A time limit to complete any needed repairs shall be established on a case by case basis.

If a system has not failed but requires pumping, the owner shall be required to show proof that the ISDS has been pumped within (30) days of the inspection. A receipt from the pumper shall constitute adequate proof.

## **Section 7.0 Administration**

Upon the adoption of this ordinance the (city/town council) shall establish an administrative framework necessary to implement the provisions of Chapter 45-24.5 and this ordinance. Refer to Waste Water Management Districts... A Starting Point for administrative options.

## **Section 8.0 Education**

It shall be the responsibility of the WWMD to establish a public education program to make ISDS owners aware of the proper operation and maintenance of these systems.

## **Section 9.0 Financing**

### **9.1 Fee Structure**

The WWMD shall have the authority to raise funds for the administration, operation, contractual obligations and services of the WWMD. (An annual service fee of \_\_\_\_ dollars will be assessed to each owner of an ISDS based on the number of these systems owned in the WWMD.)

### **9.2 Grant or Loan Program**

The WWMD shall have the authority to issue bonds or notes of the (city or town) and receive grants for the purpose of establishing a revolving fund to make low interest loans or grants available to qualified property owners for the improvement, correction, or replacement of failed ISDS. The WWMD shall establish

specific criteria that shall be subject to comments from a public hearing prior to implementing a loan or grant program. (NOTE: The criteria for the DEM sewer and water failure fund program could serve as a guide.)

## **Section 10.0 Enforcement**

### **10.1 Enforcement Responsibility**

The WWMD shall be responsible for enforcing the provisions of this ordinance.

### **10.2 Notice of Violations**

Any owner of an ISDS determined to be in violation of these regulations will be issued a written notice explaining the nature of the violation, required actions, a reasonable time frame for compliance, and the possible consequences for non-compliance.

### **10.3 Hearing**

Any owner receiving a written notice of violation shall be given an opportunity, within a reasonable time frame, for a hearing before the WWMD to state their case. If the evidence indicates that a violation has not occurred, the WWMD shall revoke the notice of violation.

#### **10.4 Penalties**

Any person neglecting or refusing to comply with a written notice of violation issued under the provisions of this ordinance shall be fined not more than \$500 per violation. Each day of a continuing violation shall constitute a separate and distinct violation.

(NOTE: A WWMD could correct a serious violation of this ordinance and place a lien on the violators property to recover the costs for any necessary pumping, repairs, and/or the replacement of an ISDS determined to be in violation following the procedures of Section 10.2 and 10.3.)

#### **Section 11.0 Severability**

If any provision of this ordinance or any rule or determination made hereunder, or application hereof to any person, agency, or circumstances is held invalid by a court of competent jurisdiction, the remainder of this ordinance and its application to any person, agency, or circumstance shall not be affected thereby. The invalidity of any section or sections of this ordinance shall not affect the validity of the remainder of the ordinance.

## **APPENDIX C**

### **MUNICIPAL AUTHORITY TO EXCEED DEM's ISDS REGULATIONS**

The Department of Environmental Management's Individual Subsurface Disposal System (ISDS) regulations have been established as minimum criteria for the location, design, and construction, of ISDS. The Rhode Island Supreme Court ruled that "clearly the intent of chapter 131 was to grant municipalities the option of providing additional restrictions concerning the construction of individual waste-water facilities." This decision was rendered in the case of Gara Realty, Inc. versus the Town of South Kingstown's Zoning Board of Review in April, 1987.

The complete text of this Supreme Court decision follows:

**GARA REALTY, INC.**

**V.**

**THE ZONING BOARD OF REVIEW OF THE TOWN OF SOUTH KINGSTOWN ET AL.**

#### **O P I N I O N**

MURRAY, J. This case is before the court on a writ of certiorari issued to review a Superior Court judgement affirming a decision of the Zoning Board of Review of the Town of South Kingstown. The review board denied the petitioner's application for a variance

1. Chapter 131 Section 6 of the Rhode Island Public Laws gives the DEM the authority to promulgate ISDS regulations.

to install a sewage-disposal system closer to an intertidal waterway than is allowed under article 3, section 308 of the Zoning Ordinances of the Town of South Kingstown.

The property involved is located at Peninsula Road, Matunuck, Rhode Island, and recorded as lot No. 124, map No. 68, block 121. It is zoned R-20 under South Kingstown's zoning ordinances which permits, among other uses, construction of single-family dwellings.

The petitioner, Gara Realty, Inc., purchased the lot in 1980. Thereafter, petitioner applied to the building inspector for a building permit to construct a single-family dwelling on the lot. Because the lot size precluded the possibility of constructing a sewage-disposal system 150 feet from Potter Pond as required by article 3, section 308, of the Zoning Ordinances of the Town of South Kingstown, the building inspector denied petitioner's application.

In a letter dated February 17, 1982, the building inspector advised petitioner to obtain a variance from the zoning board of review. The review board denied petitioner's request for a variance, and petitioner appealed to the Superior Court. In a bench decision rendered on November 28, 1984, the Superior Court judge affirmed the review board's decision. This petition for certiorari followed.

The petitioner presents several issues for review by this court: first, whether G.L. 1956 (1977 Reenactment) section 42-17.1-2, as amended by P.L. 1978, ch. 131, section 6, supersedes article 3, 308, of the South Kingstown zoning ordinances; second, whether the review board applied an erroneous standard for review of petitioner's request for a variance; third, whether the decision of the review board is substantially out weighed by the evidence presented; and fourth, whether the review board violated petitioner's rights under the United States and Rhode Island Constitutions.



In reviewing an action of a zoning review board, the Superior Court "must examine the entire record to determine whether 'substantial' evidence exists to support the board's findings." DeStefano v. Zoning Board of Review of Warwick, 122 R.I. 241, 245, 405 A.2d 1167, 1170 (1979). On certiorari, we determine whether competent legal evidence supports the decision of the Superior Court. Id.

The petitioner argues that section 42-17.1-2, as amended by P.L. 1978, ch. 131, section 6, supersedes article 3, section 308, of the South Kingstown zoning ordinances as a matter of law. Section 308(B) of the zoning ordinances provides that:

"No disposal trench, disposal bed, cesspool, seepage pit or other facility designed to leach liquid wastes into the soil shall be located within 150 feet of an intertidal salt marsh or within 150 feet of the line of mean high water of any tidal water body as defined in regulations adopted by the Coastal Resources Management Council of the State of Rhode Island and subsequent amendments thereto."

Public Laws 1978, ch. 131, section 6 provides in part that it is the prerogative of the director of environmental management, "to establish minimum standards, subject to the approval of the environmental standards board, relating to the location, design, construction and maintenance of all sewage disposal systems." The Department of Environmental Management Rules and Regulations Establishing Minimum Standards Relating to Location, Design, Construction, and Maintenance of Individual Sewage Disposal Systems, SD 2.16 (1980), provides for separate approval of "individual sewage disposal systems that are located within fifty (50) feet of a marsh, swamp, bog or pond."

The petitioner contends that the state provisions conflict with section 308, rendering it inoperative. The petitioner relies on Wood v. Peckham, 80 R.I. 479, 98 A.2d 669 (1953), for the proposition that where the State Legislature has sought to regulate a particular area, a municipality cannot regulate the same conduct.

The petitioner's reliance on Wood is misplaced. Regulation SD 2.16 merely sets forth "minimum" requirements for the construction of septic systems which are to be located on property adjacent to an intertidal waterway. Clearly the intent of chapter 131 was to grant municipalities the option of providing additional restrictions concerning the construction of individual waste-water facilities. It was, therefore, the prerogative of the town of South Kingstown to create more restrictive requirements, such as the 150-foot setback regulation set forth in section 308. Consequently, we affirm the decision of the trial court upholding the validity of section 308.

The petitioner next argues that the trial court erred in holding that it had the burden of proving "unnecessary hardship" in order to obtain the variance. We agree.

In order to determine whether petitioner sustained its burden of proof before the zoning review board, it is necessary to determine what is the appropriate standard of proof. The burden is dependent upon the nature of the relief sought. We have previously distinguished between three types of relief which are commonly available in certain circumstances. They are a variance, a deviation, and an exception.

When a landowner seeks to use the land for a purpose not ordinarily permitted, a variance must first be obtained. To obtain a variance, one must satisfy the "unnecessary hardship" standard of G.L. 1956 (1980 Reenactment) 45-24-19(c), which requires "a showing of deprivation of all beneficial use of property \* \* \*." Rozes v. Smith, 120 R.I. 515, 519, 388 A.2d 816,819 (1978). "(T)his standard is to be applied only to 'true variances' or those situations in which the proposed use of the property varies from any of the uses permitted under the ordinance." Id.

A deviation defines the type of relief available from restrictions governing a permitted use, such as area or setback restrictions. DeStefano, 122 R.I. at 246, 405 A.2d at 1170. To obtain relief, one "need only demonstrate an adverse impact amounting to more than a mere inconvenience." Id. This standard was first enunciated in Viti v. Zoning Board of Review of Providence, 92 R.I. 59, 166 A.2d 211 (1960), and is known as the Viti doctrine.

An exception is similar to a deviation in that it pertains to requested relaxation of area and setback requirements for a permitted use. In order to obtain an exception, one "need show only that 'neither the proposed use nor its location on the site would have a detrimental effect upon public health, safety, welfare and morals.'" Toohy v. Kelday, 415 A.2d 732, 736 (R.I. 1980) (quoting Hester v. Timothy, 108 R.I. 376, 385-86, 275 A.2d 637, 641-42 (1971)).

The type of relief sought in the case at bar is more akin to a deviation than to a true variance. This is because petitioner seeks relief from a setback requirement of a permitted use. The property is zoned for single-family dwellings. The petitioner seeks to build a single-family dwelling on the lot. Certainly the zoning board envisioned wastewater facilities as an accompanying permitted use on property zoned residential. Therefore, petitioner was not required to demonstrate total deprivation of all beneficial use of the land in order to obtain relief. Reynolds v. Zoning Board of Review of Lincoln, 96 R.I. 340, 191 A.2d 350 (1963). Rather, petitioner needed only to demonstrate "that the effect of such enforcement (would) amount to something more than a mere inconvenience." Rozes v. Smith, 120 R.I. at 519, 388 A.2d at 819.

Clearly petitioner has met its burden of proof. The construction of any single-family dwelling requires an accompanying means of sewage disposal. Because section 308

totally bars placement of such facilities on the premises at issue, enforcement of the ordinance effectively operates to preclude petitioner from building a house. We believe that this deprivation amounts to more than a mere inconvenience as a matter of law. We therefore believe that the trial court erred in denying petitioner relief.<sup>1</sup>

For these reasons we need not address the other issues raised in the petitioner's brief.

The petition for certiorari is granted, the decision of the Superior Court is quashed, and the case is remanded with instructions to grant the petitioner's request for a variance. Supreme Court No. 85-45-M.P. April 3, 1987.

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<sup>1</sup> Nothing herein should be construed to preclude the necessity on the part of the applicant to meet state sanitary standards.

#### **EXPLANATION**

Although the Town of South Kingstown was determined to have the authority to exceed the DEM's minimum ISDS standards, in this case the court ruled that Gara Realty Inc. must be granted an exemption from the 150-foot setback since they were eligible for a "deviation" of the zoning setback requirement. As stated in the Supreme Court decision, a deviation can be granted to a property owner who is seeking "relief from zoning restrictions governing a permitted use, such as setback requirements." Since the town established the construction of a home and an ISDS as a permitted use, the plaintiff was eligible for a deviation when a "mere inconvenience" (the preclusion of building a home) was demonstrated.

The key words in this decision are "permitted use." If, for example, the town had established the construction of an ISDS within a 150 foot setback from a waterbody as a prohibited use that would only be allowed as a special exception, the court more than likely would have reached a different opinion.

A special exception is similar to a deviation in that it pertains to the relaxation of area and setback requirements. The major difference being that the granting of an exception requires one to prove that neither the proposed use nor its location on the site would have a detrimental effect upon public health, safety, welfare, and morals. If Gara Realty Inc. were required to seek relief from the 150 foot setback requirement by means of an exception rather than a deviation, substantial documentation would have had to be provided to prove that the proposed ISDS would not be a public health or safety problem. The burden of providing such evidence is clearly more difficult than demonstrating a "mere inconvenience" as is the only requirement to obtain a deviation.

The Town of Narragansett, recently adopted a new zoning ordinance which establishes more stringent criteria for the location and construction of an ISDS. This was accomplished by establishing different overlay districts that prohibit the use of an ISDS within 200 feet of certain coastal waters and in areas with a high watertable. An ISDS would only be permitted in these areas through a special exception.

A "High Watertable Limitations Overlay District" composed of areas in which the watertable is within three feet below the surface<sup>1</sup> of the ground for significant periods of the year was established and identified by soil types that were mapped as part of a town

<sup>1</sup> The DEM has this same requirement but will grant approval, via an applicant appeals procedure, if the watertable is within two feet below the ground surface.

environmental inventory. Within this overlay district ISDS are listed as prohibited uses that would be allowed only as a special exception pending a site plan review, an approved DEM ISDS permit and the conformance with designated town development standards.

A "Coastal Resources Overlay District" which encompasses an area within 200 feet of a coastal feature prohibits all uses and only allows certain uses as special exceptions providing compliance with town development standards. An ISDS is not permitted even as a special exception, within 200 feet of certain coastal waters. For more specific information regarding these overlay districts refer to the Town of Narragansett's Zoning Ordinance.

In conclusion, it is apparent that municipalities can require more stringent requirements than the DEM ISDS Regulations. However, specific procedures must be closely followed in doing so.

## **APPENDIX D**

### **Additional Information Sources**

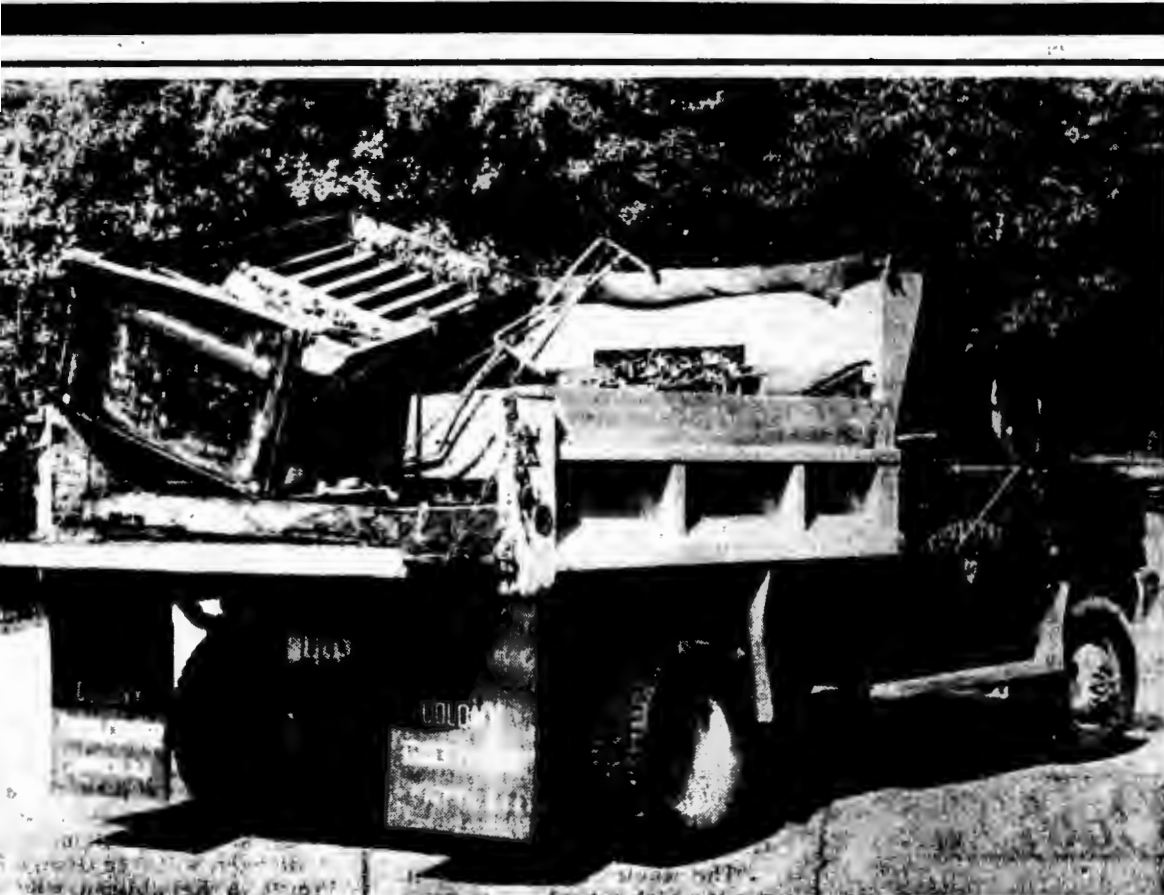
- 1) **Septic System Regulations - contact the Department of Environmental Management, 75 Davis Street, Providence, RI 02908, 277-2306**
  
- 2) **Septic System Brochures - contact Save The Bay, 434 Smith Street, Providence, RI, 272-3540**
  
- 3) **Questions Regarding WWMD - contact Scott Millar, Division of Planning, 265 Melrose Street, Providence, RI 02907, 277-2656**

A P P E N D I X B



# The Kent County Daily Times

Volume 4 - Number 69, Wednesday, July 18, 1990 West Warwick, R.I. USPS #423-860



## **Overhauling the Pawtuxet**

Members of the Coventry Highway Department spent yesterday morning hauling soda and cigarette machines, tires and a refrigerator from the murky bottom of the Pawtuxet River. A portion of the river near the Hill Street Bridge and the Arkwright Mill had ebbed enough to enable volunteers from the Pawtuxet River Watchers to spot the debris and load onto a pickup truck (above).

Daily Times photo by Ann Fontaine

A P P E N D I X C

FIGURE 1: PAWTUXET RIVER DRAINAGE BASIN WITH SUBDRAINAGE BASINS SHADED ACCORDING TO THE AVERAGE CALCULATED RUNOFF-BORNE LOADING RATE OF TOTAL SUSPENDED SOLIDS (LB/ACRE/YR)

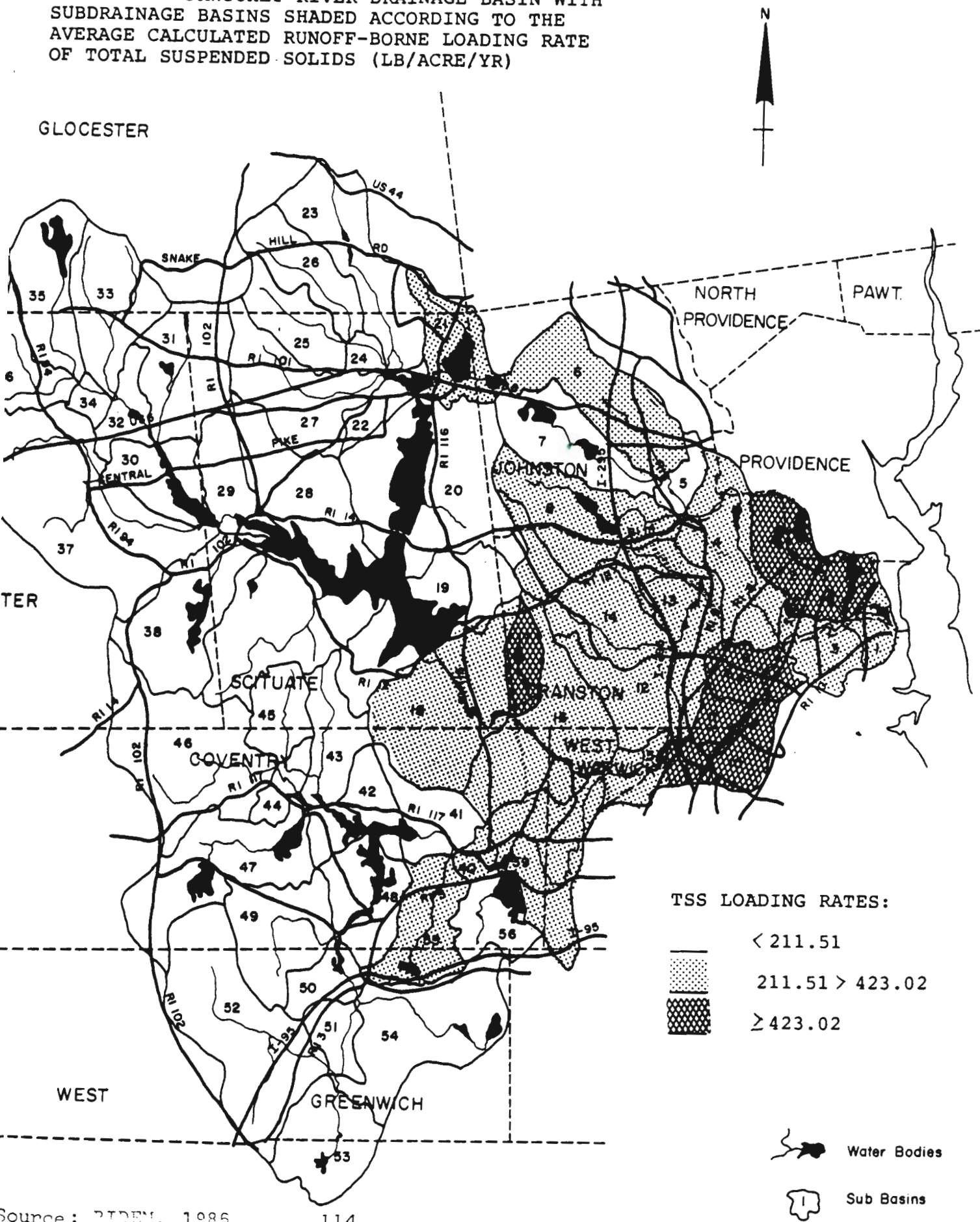


FIGURE 2: PAWTUXET RIVER DRAINAGE BASIN WITH SUBDRAINAGE AREAS SHADED ACCORDING TO THE AVERAGE CALCULATED RUNOFF-BORNE LOADING RATE OF BIOLOGICAL OXYGEN DEMAND (LB/ACRE/YR)

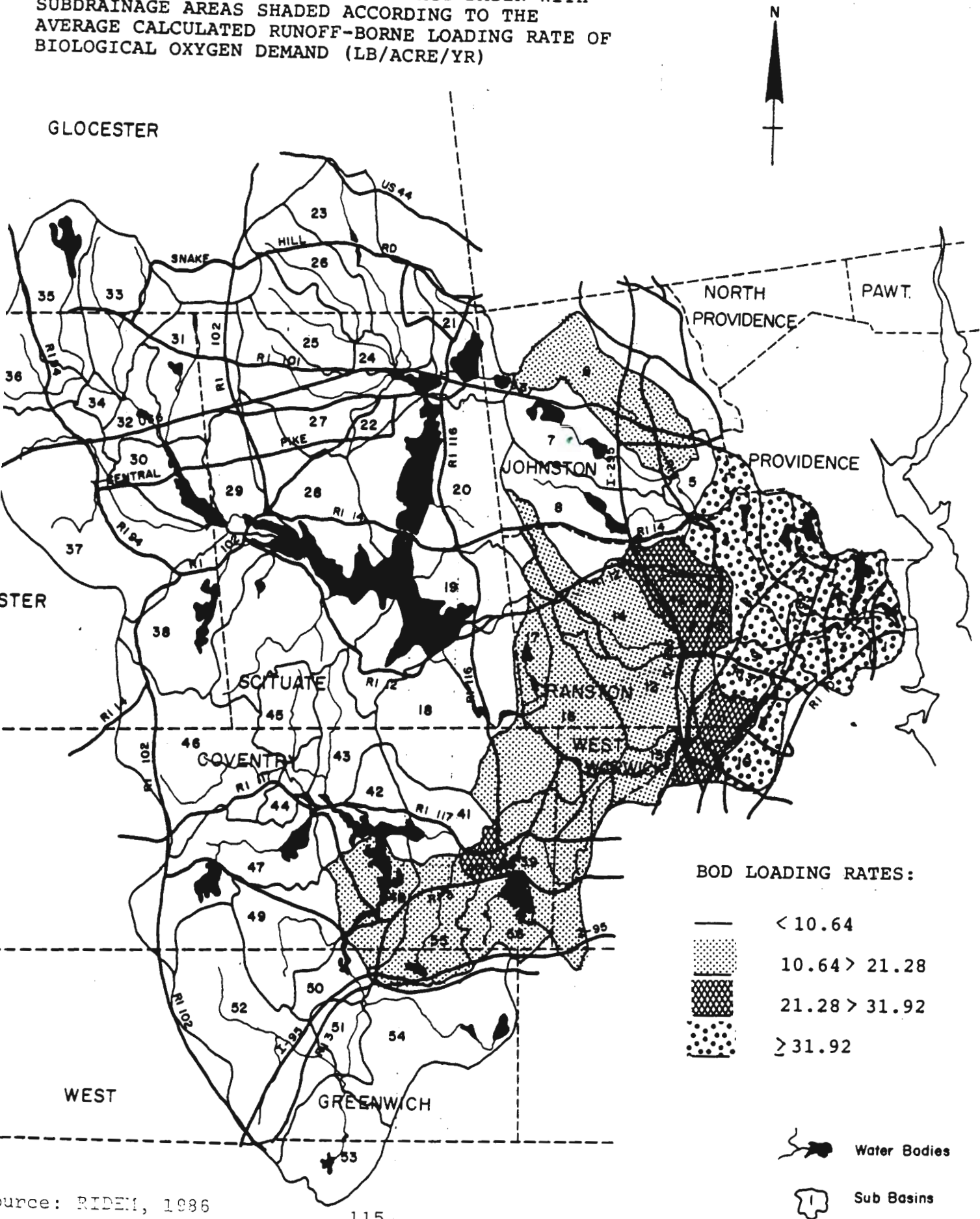


FIGURE 3: PAWTUXET RIVER DRAINAGE BASIN WITH SUBDRAINAGE AREAS SHADED ACCORDING TO THE AVERAGE CALCULATED RUNOFF-BORNE LOADING RATE OF TOTAL PHOSPHATE (LB/ACRE/YR)

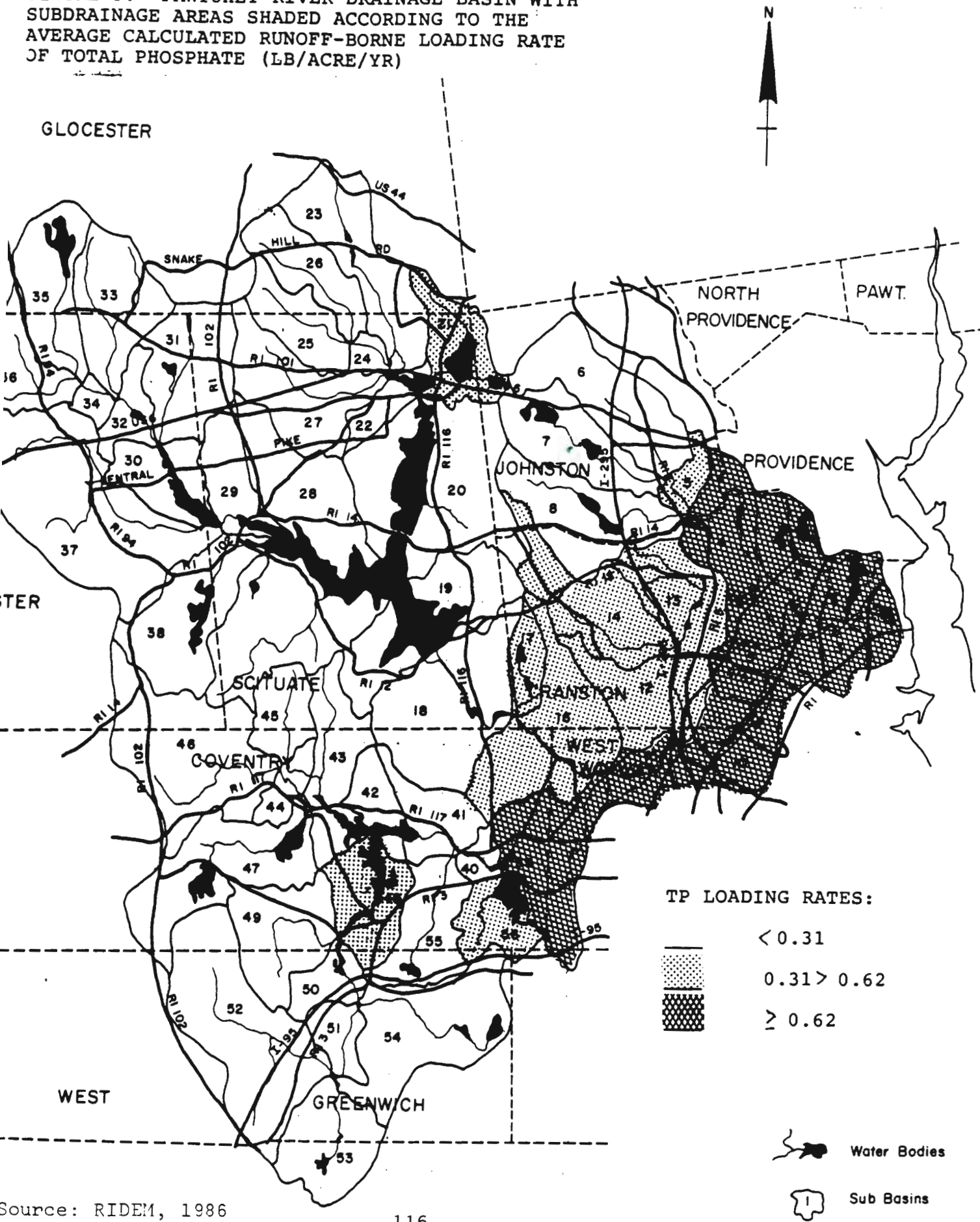
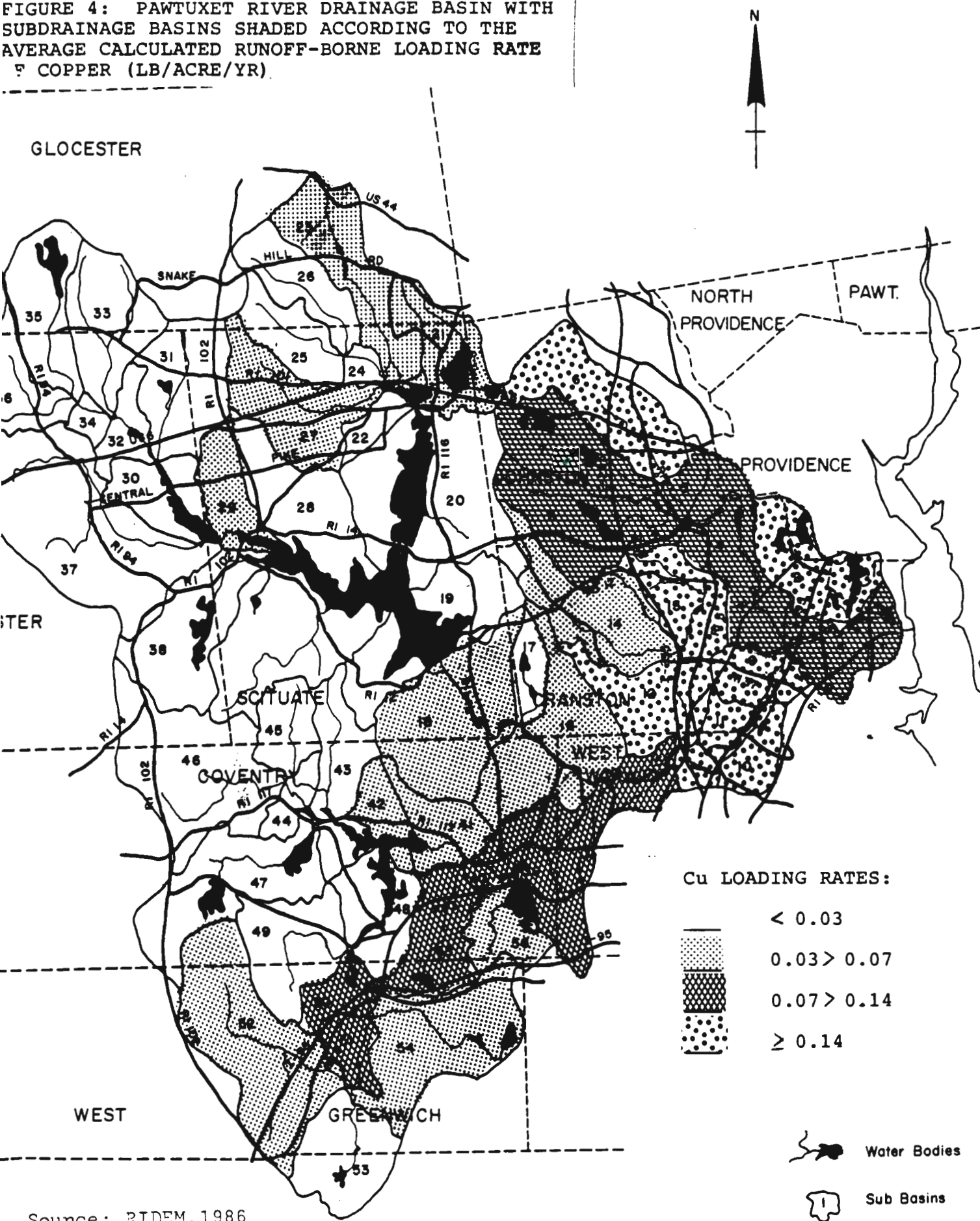


FIGURE 4: PAWTUXET RIVER DRAINAGE BASIN WITH SUBDRAINAGE BASINS SHADED ACCORDING TO THE AVERAGE CALCULATED RUNOFF-BORNE LOADING RATE OF COPPER (LB/ACRE/YR)



Source: RIDEM, 1986

FIGURE 5c PAWTUXET RIVER DRAINAGE BASIN WITH SUBDRAINAGE AREAS SHADED ACCORDING TO THE AVERAGE CALCULATED RUNOFF-BORNE LOADING RATE OF LEAD (LB/ACRE/YR)

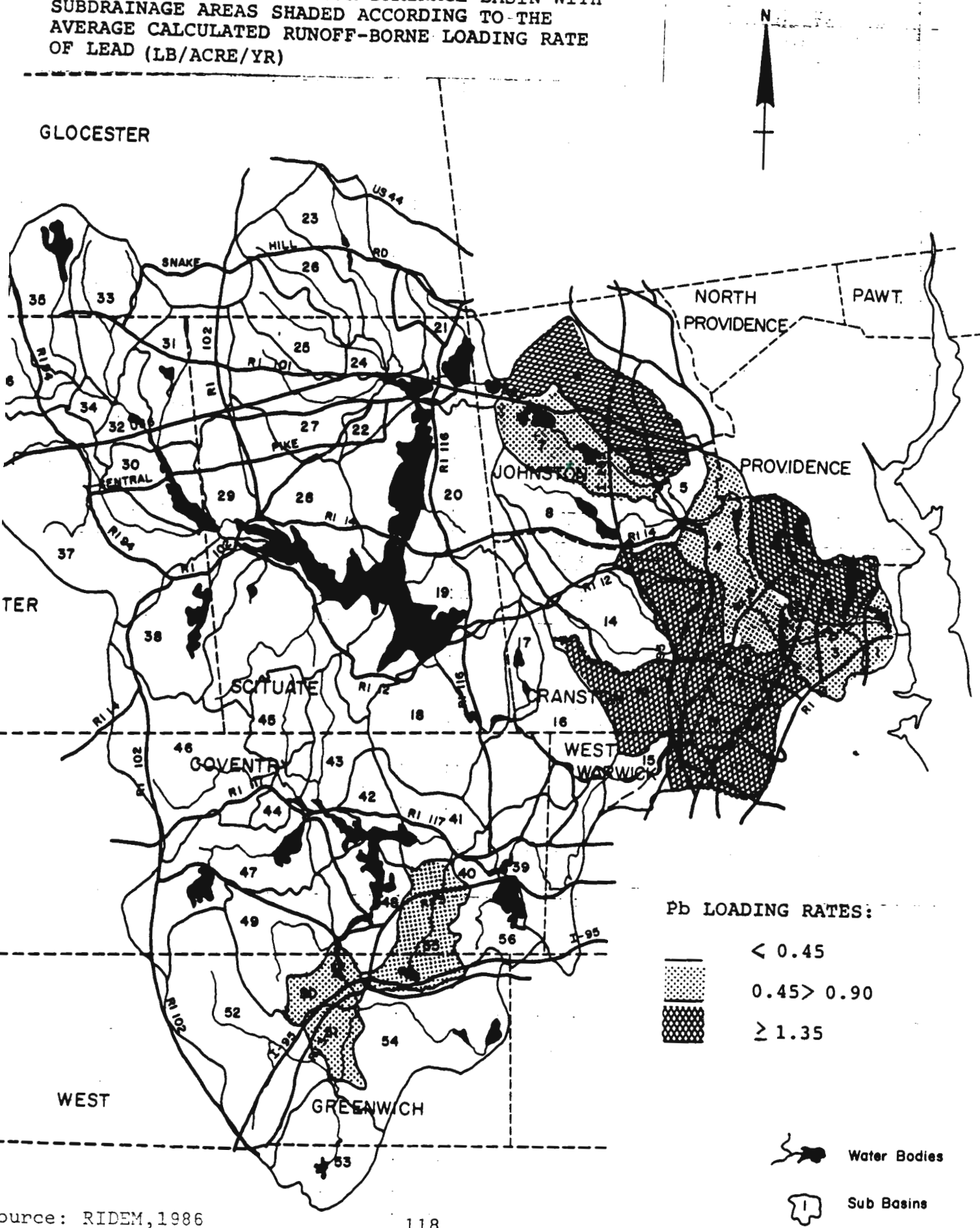
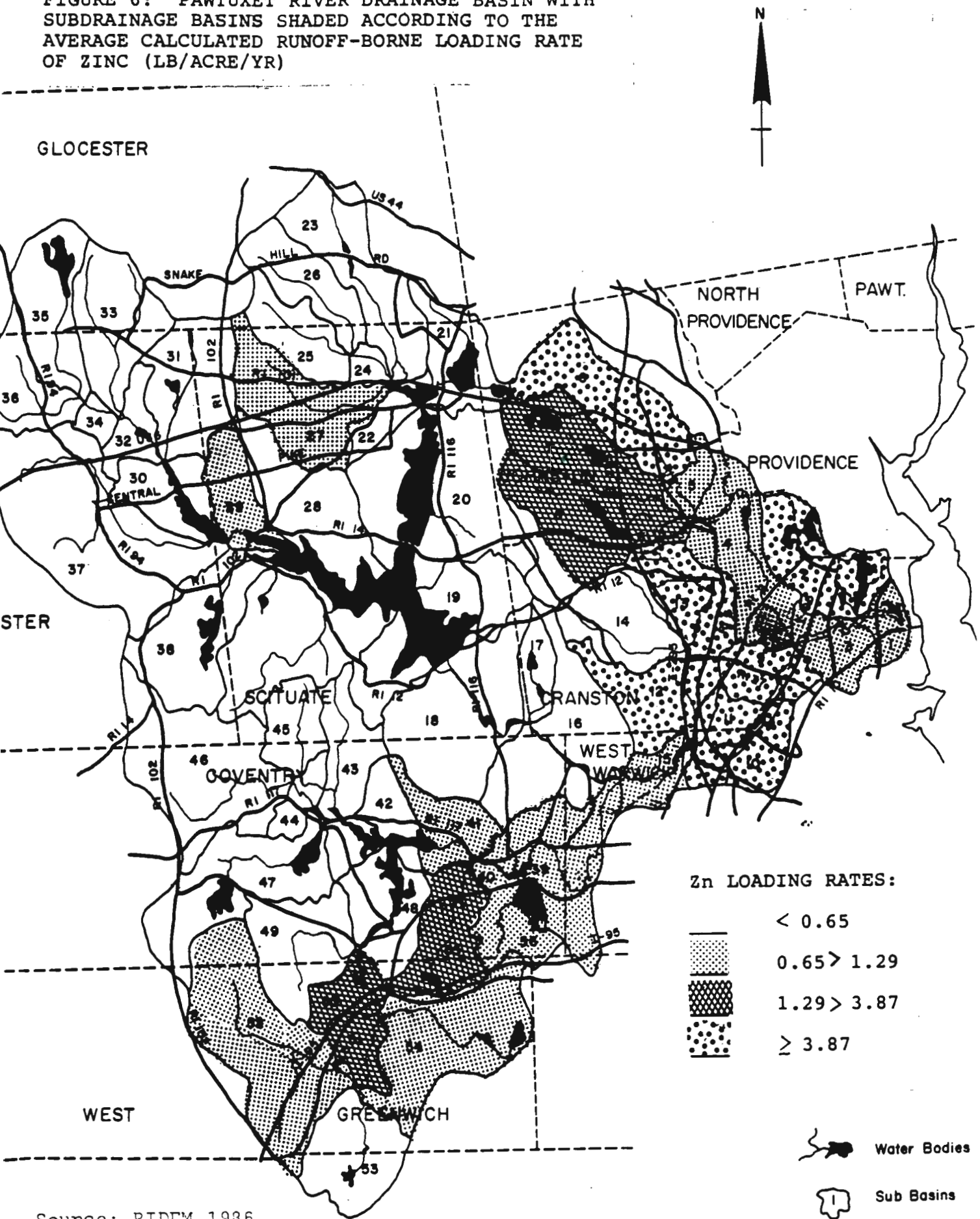


FIGURE 6: PAWTUXET RIVER DRAINAGE BASIN WITH SUBDRAINAGE BASINS SHADED ACCORDING TO THE AVERAGE CALCULATED RUNOFF-BORNE LOADING RATE OF ZINC (LB/ACRE/YR)



Source: RIDEM, 1986



A P P E N D I X D

**Special Circular 269**

**Developing  
a small community  
sewage facility through  
a municipal authority**

**The Pennsylvania State University  
College of Agriculture, Extension Service  
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## PREFACE

Our society has always prided itself on being concerned with cleanliness and order. This tradition has given increased attention to the quality of the environment during the past 50 years, with the momentum increasing considerably during the past 20 years.

State and national legislation enacted during this period has stated the commitment to curtailing the pollution of the land, air, and water. In addition, State Departments of Environmental Resources, such as the Pennsylvania Department of Environmental Resources, and the Federal Environmental Protection Agency have been established. Through legislation and these organizations, state and federal governments have increased their capability to provide organization, guidance, and technical and financial assistance to local governments in the effort to improve the quality of the environment.

Local governments face a number of problems, sewage treatment being a major one, in their attempts to curtail pollution at the local level. The benefit to society is enhanced by the accumulative corrective steps taken by the local people. A major need of small populated communities is to identify and develop technically and financially feasible sewage treatment systems.

Both the public and private sectors have been searching for ways to meet this need.

This publication focuses on some alternative sewage treatment systems and discusses costs of different systems based on size of populations served. The intent is to provide ideas, approaches, and information that may be useful to local governments and their citizens in their efforts to establish appropriate sewage treatment systems. A glossary of terms precedes the text for the convenience of the reader.

## GLOSSARY

**ALTERNATIVE SEWAGE COLLECTION AND TREATMENT SYSTEMS.** These systems are "alternative to" standard collection and treatment systems which work through gravity flow sewers throughout the entire systems, with occasional lift-pump stations where gravity flow is not possible, and treatment systems involving highly mechanized equipment which are generally labor and energy intensive.

**BOND DEBT SERVICE.** Bond debt service is that part of the annual indebtedness of a municipality or municipal Authority which is the result of having to pay off a bond issue.

**BOND ISSUE.** A bond issue is one means of borrowing a large sum of money to pay for costs incurred in producing a facility and *paying off* that money over a long or extended period of time. There are two forms of bond issue which are of interest in this publication. (1) Since the 1930s municipal bond issues have first been *rated* by two New York based firms, and then have been sold on the open market by New York based bonding houses. There are two major results of this nationwide mode of distribution. One result is that the denominations of the bonds have to be at least \$1,000 and the other is that in order to make the bond issues competitive with other forms of large capital investments, bonds have to pay a rate of interest competitive with those other forms of large capital investment. (See publications cited in the reference section of this paper.) (2) The second form of bond issue is a "local" bond issue, issued by the municipality or by the municipal Authority in small denominations, and offers interest rates competitive with what is available at smaller levels of investment. This means that individuals, local banks, and savings and loan organizations can buy these types of bond issues. Both types of bond issues share in common the fact that the municipality or the municipal Authority, in either case, becomes legally responsible for levying rates of user charges which at the very minimum cover the annual bond debt service.

**BOND ISSUE COUNSEL.** A bond issue counsel is a person who arranges for the bond issue. This person makes contact with bond rating firms and firms which float bonds on the open market. It is important to note that the bond counsel fee is generally step-wise. As of 1980 the range is a \$3,000 charge for any bond issue up to \$25,000, and a charge of \$15,000 to \$17,000 for bond issues from \$25,000 up to \$7 million.

**CLEAN WATER ACT OF 1977 (PL 95-217).** The Clean Water Act is that piece of Federal legislation which, among many other things, through financial incentives encourages the development of alternative and innovative technologies to improve the efficiency and lessen the costs of sewage collection and treatment facilities.

**COMBINED TECHNOLOGY (CT).** Combined technology is the term coined in this paper for a strategy being considered by the Department of Environmental Resources for putting together different sewage facility technologies or adding a new sewage facility technology in order to meet the sewage treatment needs of an area.

**COMMUNITY DEVELOPMENT WORK.** Community development work in this context means involving citizens from the start in the process of planning and producing a sewage facility that will meet their needs. Among other outcomes, good community development work reduces the number of legal battles with the Authority or municipality and hence may ultimately reduce the cost of the facility.

**CONSTRUCTION COSTS.** Construction costs include the cost of labor and material involved in producing, in this case, a collection and/or treatment system, or more generally, a sewage facility technology for a given area.

**DEPARTMENT OF ENVIRONMENTAL RESOURCES (DER).** The Pennsylvania Department of Environmental Resources is a cabinet-level agency with a broad legislative mandate to deal with many of Pennsylvania's environmental problems. Among the tasks of this Department is carrying out national clean water goals within Pennsylvania. All sewage facility monies released through DER and EPA are for eliminating public health problems and improving the quality of water in Pennsylvania, not for housing development purposes.

**DESIGN COSTS.** This refers to the cost entailed in designing a facility to meet a community's needs, in particular, tailoring a technology to the soil, slope, housing, and configurational constraints, among many other considerations.

**ENVIRONMENTAL PROTECTION AGENCY (EPA).** The United States Environmental Protection Agency is the federal organization which has been empowered by Congress through the Executive Branch to regulate factors which have an impact on the human environment in the United States.

**FACTORS AND COSTS.** One way of analyzing any organization is to look at it in terms of the factors involved in producing some facility or service, and these factors have costs associated with them.

**FARMER'S HOME ADMINISTRATION (FmHA).** FmHA is part of the U.S. Department of Agriculture. Of interest here is the fact that FmHA has monies available on the state level to loan to municipalities interested in developing sewage facilities.

**FEASIBILITY STUDY.** A feasibility study is a means of gaining a ballpark estimate of what a sewage facility might cost a municipality.

**GRINDER PUMPS.** A grinder pump is designed to grind up all of the solids suspended in liquid from a household, and under pressure, pump this fluid into a collecting line.

**LOW-COST TREATMENT SYSTEM.** A low-cost treatment system would be low-cost from three points of view: from the point of view of construction, from the point of view of energy used in running the system, and from the point of view of fewer man-hours required to run the system.

**MUNICIPAL AUTHORITY.** A municipal Authority is an organization whose powers and responsibilities are clearly stated below. It is important to note that a municipal Authority's powers do not exceed those of the municipality which empowers it, but that once created the municipal Authority, while being responsive locally, is like all other forms of local government — a creature of the state subject to regulation by the state.

**ON-LOT MANAGEMENT SYSTEM (OLMS).** This is a type of technology which has as its general goals creating sound on-lot sewage systems and ensuring that a newly created on-lot sewage system or existing systems are properly maintained. It of necessity involves a means of enforcing standards of building and maintenance.

**OPERATION AND MAINTENANCE COSTS.** Generally referred to as O and M costs, these are the costs incurred by the municipality or municipal Authority relating to running the facility and keeping it running. These costs include the costs of a facility operation, costs of service charges, and contingency costs covering the breakdown of machinery, and so forth.

**PLANNING COSTS.** Planning costs in a narrow sense include the costs of securing the financial package needed to finance a projected facility, as well as what are termed pre-application costs.

**PRE-APPLICATION.** Most existing federal and state agencies require the municipality or Authority to file papers termed pre-application papers. Pre-application is a way of notifying an agency that a municipality is interested in securing funding from that agency and that the municipality, in effect, is aware of the paperwork involved in securing that funding.

**PRESSURE PUMPS.** A pressure pump is a way of taking liquid runoff from a septic tank or what is termed a primary settling tank and pumping that fluid or liquid, under pressure, into a collector pipe.

**PRIMARY SETTLING TANKS.** A primary settling tank (or a solid retainer tank or a solid settling tank) is a way of separating solid materials from liquid materials coming out of a residence. Generally, this type of tank has to be pumped periodically to remove the settled solids.

**RIGHTS-OF-WAY.** This is a legal term which refers, in this case, to the municipality securing a pathway for laying the pipes it needs to create a collection system for sewage. These rights-of-way generally involve an easement (right of specific use) on the parcel of land from any householder or property owner who is in the pathway of the pipes.

**SETS TECHNOLOGY.** A Sewage Effluent Technology System (SETS) technology is a general way of referring to those technologies which treat sewage effluent somewhere at or near the point of departure of the effluent from the residence, as opposed to having processing or treatment occur only at some remote location. The three examples of SETS technologies considered here are the on-lot management system, the sewage effluent collection and treatment system, and the combined technology system. The on-lot management system treats the effluent near the residence. The Sewage Effluent Collection and Treatment System, or SECTS technology, has an initial processing and/or separation at the source. And the Confined Technology is merely taking one or the other in conjunction and creating a combined technology.

**SEWAGE EFFLUENT COLLECTION AND TREATMENT SYSTEM OR SECTS TECHNOLOGY.** This technology is a form of SETS Technology in that it involves either separating the solids from the waste water at the source, or grinding the effluent into a liquid form at the source. The effluent can then be pumped through smaller diameter pipes or run on a gravity flow basis through smaller diameter pipes to treatment systems, which can be labor and energy intensive because they are dealing just with the fluid.

**STEP I.** Step I refers to Step I monies in the EPA planning process. These monies are planning monies which EPA makes available through DER, reimbursing the municipality for 75 percent of the planning costs.

**STEP II.** Step II monies are monies made available again by EPA through DER to help cover the costs of designing a system and will be either 75 percent, if a standard treatment system is designated, or can go as high as 85 percent, if alternative or innovative sewage facility technologies are designed.

**STEP III.** Step III refers to monies made available for building a sewage facility. EPA will make available, through DER, 75 percent for a standard collection and treatment facility or 85 percent for any part or the whole of a system which is either alternative or innovative.

**USER CHARGES.** A user charge is the cost to the user of a service. A user charge could be paid on a daily, weekly, monthly, or annual basis; but is charged on the basis of use. With sewage facilities, user charges are generally figured on a monthly or a bi-monthly basis, based

upon the monies needed by the Authority to meet its total expenses.

**WASTEWATER.** Wastewater is the liquid part of the effluent from a residence.

## INTRODUCTION

Does your community have a residential sewage disposal problem? (Are on-lot systems failing? Is there any raw sewage in road gutters? Has the Department of Environmental Resources (DER) cited the community for polluting the soils and waters?)

Do you consider the soil characteristics of your community unsuitable for on-lot systems?

Do you consider your community too small to have some form of conventional collection and treatment system for domestic sewage?

Are you looking for a less expensive way to expand sewage disposal service to meet existing needs in your community?

If you answered yes to any of these questions, then your community is among hundreds of small Pennsylvania communities that have inadequate sewage treatment systems. Because standard gravity flow sewers with lift pump stations and conventional treatment plants are beyond the price range of most communities of 3,500 or under, many such communities have not seriously organized an effort to solve their sewage problems. In addition, some of these communities may not be familiar with the municipal authority, which is one organizational means for planning, financing, designing, building, and operating different sorts of public facilities, including sewage facilities.

One of the 1977 Clean Water Act's (P.L. 95-217) major goals is providing flexibility in both technology and funding to help deal with such problems. In Pennsylvania this goal includes the development of a Rural Wastewater Strategy, with the promise of affordable sewage facility technologies for small communities. The critical element in providing alternatives and other technologies to rural communities is *financial* feasibility: specifically, the ability of a community to finance a new sewage disposal system

through monthly charges to the user of the service.

These user charges are derived from four factors:

- planning costs
- design costs
- construction costs
- operation and maintenance costs

The first three are generally written into a bond issue which is paid off by a part of the user charges; the remainder of the user charges paying for operation and maintenance of the facility over time.

The complexities of the four factors have influenced the historical evolution of the municipal Authority. A municipal Authority is created by the governing body of a municipality or municipalities. It provides an organizational means of helping the municipality or municipalities handle the day-by-day, year-by-year practical details of planning, producing, financing, running, and maintaining sewage facilities. The cost associated with providing a facility would be the same whether a municipality (township or borough) or a municipal Authority does the job. The Authority, however, has the advantages of (1) improving chances of outside funding, (2) insulating the project from electoral politics, and (3) protecting the municipality from legal suits.

To better understand the entire process of developing a sewage treatment system, and to be able to estimate roughly the final costs that would be reflected in user charges of some specific alternative sewage facility technologies, we present in this publication the following information:

- Descriptions of three types of sewage facility technologies and their estimated costs, which as of 1980 may be legally and financially feasible for the small community.
- Present factors and costs related to establishing the municipal sewage Authority for each of the three types of technology.
- Provide factors/costs balance sheet for the municipality that might wish to

consider the alternatives we are presenting.

## THE PENNSYLVANIA RURAL SEWAGE FACILITY STRATEGY

The Pennsylvania Rural Sewage Facility Strategy is an approach to developing and maintaining improvements in current and alternative sewage treatment systems for the lesser populated rural communities of Pennsylvania.

Residential sewage represents the major sewage disposal problem in rural areas. The alternative technologies in this publication all center around what is called the Sewage Effluent Treatment System or SETS technologies. A SETS technology separates the treatment of residential sewage into two components: first, into the treatment of the sludge which generally accumulates in septic tanks (called septage), and second, the treatment of the wastewater or effluent which is the liquid run-off from the septic tank. The greatest environmental danger comes not from the sludge, but from the effluent. There are three basic types of SETS technology. The first is simply a means of upgrading and maintaining on-lot sewage systems. We call this the On-Lot Management System (OLMS) technology. The second technology is a Sewage Effluent Collection and Treatment System or SECTS technology, and the third technology is a combination of the two of them, or combined technology (CT).

The OLMS technology involves making sure that the drainage fields are properly designed or redesigned, built, and maintained. The OLMS technology has the potential to be so inexpensive a way for a small community to deal with its domestic sewage problems that debt may be quickly paid off, making it possible for the municipality to handle the problem without founding an Authority. The critical issue in any case is the management of the OLMS technology and the quality of

its technology and technical assistance.

The SECTS technology is a collection system of small diameter pipes which transmit the effluent from the residential septic tanks to one or more low-cost treatment systems such as the following:

- community conventional subsurface drainage field,
- a recirculating sand filter,
- a contracted connection with another municipality's sewage treatment system,
- a lagoon (with spray irrigation, stream discharge),
- community elevated sand mounds,
- intermittent sand filter.

The effluent can be conveyed to these systems by gravity flow, a grinder pump, or through a low pressure pump system, known as a STEP system for Septic Tank Effluent Pump.

The principle advantages of the SECT system, whether gravity flow or grinder/pressure pump, are that construction costs may be cut dramatically because the collection pipes may be placed in shallow excavations. Low pressure sewers can follow the contour of the land just below the frost line, and can be constructed of small diameter plastic pipes. The effluent treatment systems are designed to be low cost, low energy use, and low labor intensive. The municipality that uses the SECT technologies, particularly if it uses pressure pumps or grinder pumps, has to make sure that these pumps are functioning properly. In short, operation and maintenance of these systems involves adequate management and technical information.

It is important to note that both the OLMS and the SECT technologies have to be carefully constructed, operated, and maintained. Both types of systems have to have the septic tanks pumped out on a regular basis. In addition, the use of the CT (combination of OLMS and SECT technologies) may be the better system for the lesser populated areas with their combination of sparse and cluster developments.

#### **a. Cost Factors and Ranges for the On-Lot Management System (OLMS Technology)**

The OLMS technology is part of a management system to insure that on-lot systems are properly installed, evaluated, permitted, and maintained. Such a technology could also include the capacity to help home owners purchase/finance both individual and community on-lot systems. An OLMS technology managed by

a municipal Authority whose powers were conferred by the proper local ordinances could purchase and lease back on-lot systems to a home owner.\* This approach has particular importance in low income rural areas. On-lot sewage systems are the most common method of disposing and treating residential sewage in rural areas. Financing these is frequently a problem for low income families.

Such a technology would have minimal construction costs. Its major costs could be in the form of:

- salaries for management and field staff,
- securing technical information about soil types and appropriate sewage systems for replacing or improving existing systems that were not functioning properly,
- the initial planning and design of the specific technical system.

It is interesting to note that EPA's current rules and regulations allow monies under its Step III program to be used for the design/construction of on-lot systems. For illustration purposes, the OLMS technology in this publication is figured on the basis of 100 residences sharing management costs, with one quarter of these residences requiring new septic tanks and drainage fields. With current experience suggesting an average cost of septic tank and field at \$3,000, capital costs at \$75,000 (25 residences x \$3,000), and other equipment costs at \$25,000, the total cost of \$100,000 is put into a bond issue

#### **b. Cost Factors and Ranges for the Sewage Effluent Collection and Treatment System (SECTS Technologies)**

With any SECT technology, since property will be owned with some level of indebtedness, and easements will be needed for routing pipes, a municipal Authority may be the first choice of organizational means for local government to deal with these important details (especially eminent domain and easements).

SECT systems use alternative collection and treatment systems. The collection system takes the wastewater from primary settling tanks (generally septic tanks) on residential lots (see Figure 1).

\*The legal issues involved in the relationship between the municipal Authority and the ownership of the on-lot system are currently being studied and recommendations are being considered.

That wastewater travels through small diameter plastic pipes to plastic collector pipes, either by gravity flow, or under pressure from a grinder or pressure pump. The grinder pump simply takes household sewage and grinds it to a liquid and pressures it through pipes. Wastewater or ground liquid sewage can flow through these pipes to any of a variety of different wastewater treatment systems (see Figure 2).

One treatment system is the use of a sub-surface drainage field which could be located in suitable soils or other suitable material near a community. A set of perforated pipes allows the wastewater to be treated by ground filtration and bacterial action, turning the soils into a useful treatment system (see Figure 3). Another treatment system that could be used is the recirculating sand filter. Wastewater is purified by being filtered up to eight times through sand, allowing for natural bacterial action to clean the wastewater sufficiently to be discharged into a stream (see Figure 4). An additional alternative treatment system, marsh/pond/meadow treatment system (Figure 5), may be the combination that would be adaptable to the conditions and needs of some communities. These are effective and extremely inexpensive wastewater treatment systems requiring minimal labor and electric energy. Other systems may include lagooning and land application through spraying, or other systems of land application.

The sludge in the septic tanks will be pumped according to a maintenance schedule as it would in any on-lot system. The SECT technology costs are estimated on the basis of 75 to 200, 250 to 450, and 500 to 1,000 residences. The collection systems could flow into an alternative treatment system per 75 to 200 residences, meaning an estimated average 1, 3, and 6 treatment systems, roughly, per community costing around \$200,000, \$500,000, and \$1,000,000, respectively.

#### **c. Cost Factors and Ranges for Combined Technology**

A third alternative is simply an Authority which combines both an OLMS and a SECT technology. Such a combined Technology (CT) could be used by an Authority to solve the residential effluent problem. For example, some areas of a township might be best served by a small diameter gravity flow system which is treated by means of, say, a recirculating sand filter, while others would be best served by the proper upgrading of an on-

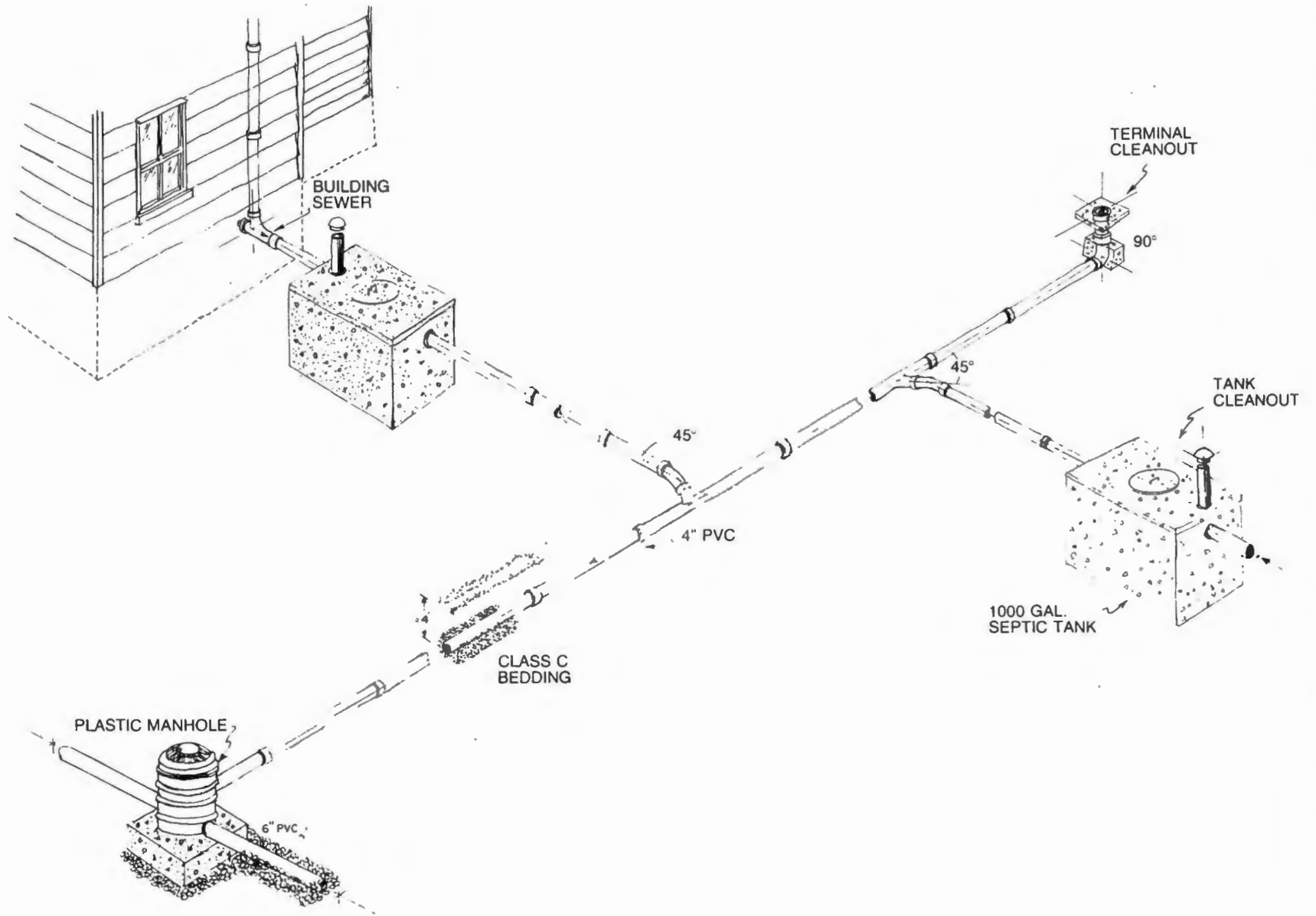


Figure 1. Rural wastewater collection system



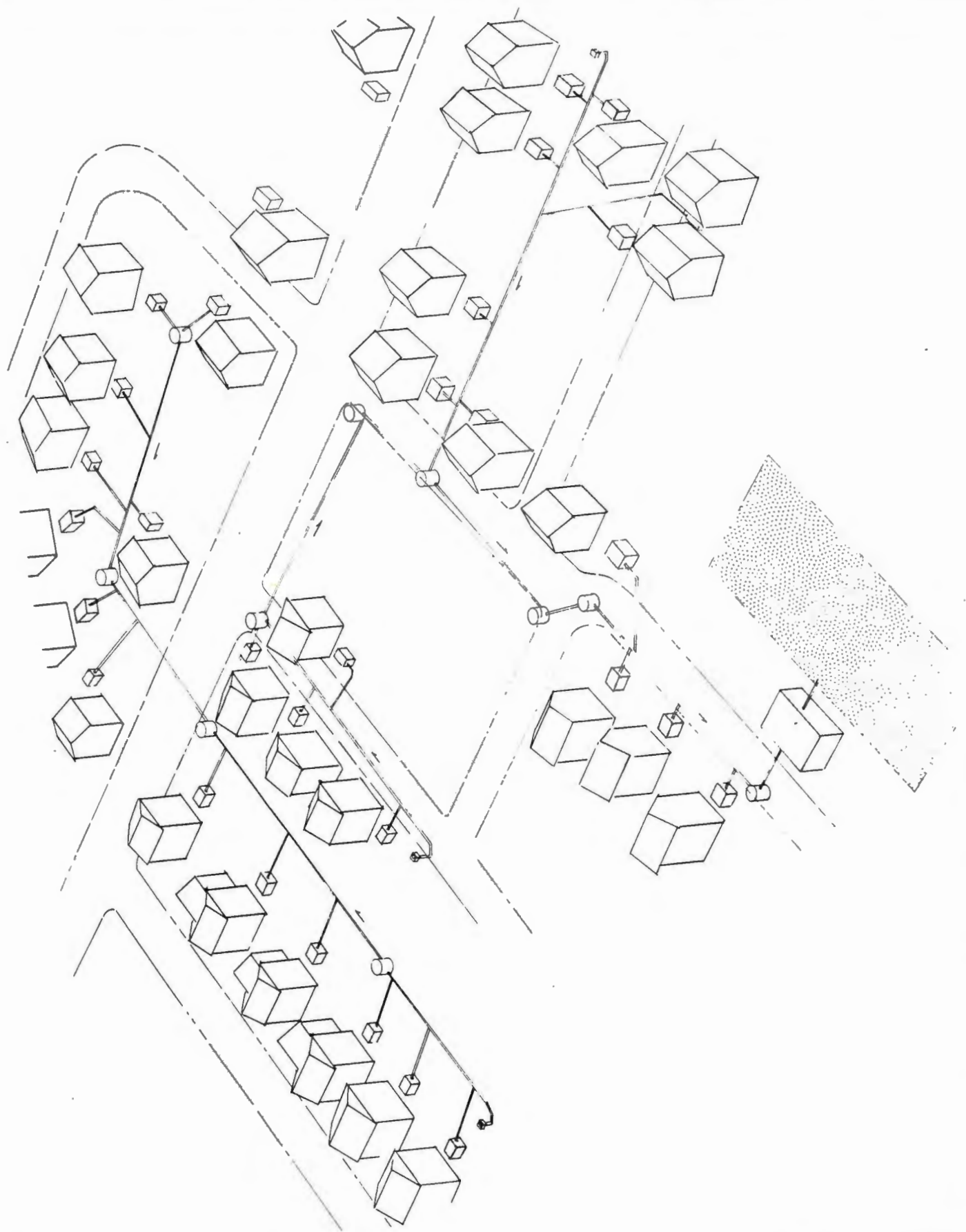


Figure 2. Gravity flow wastewater collection system — Partial view

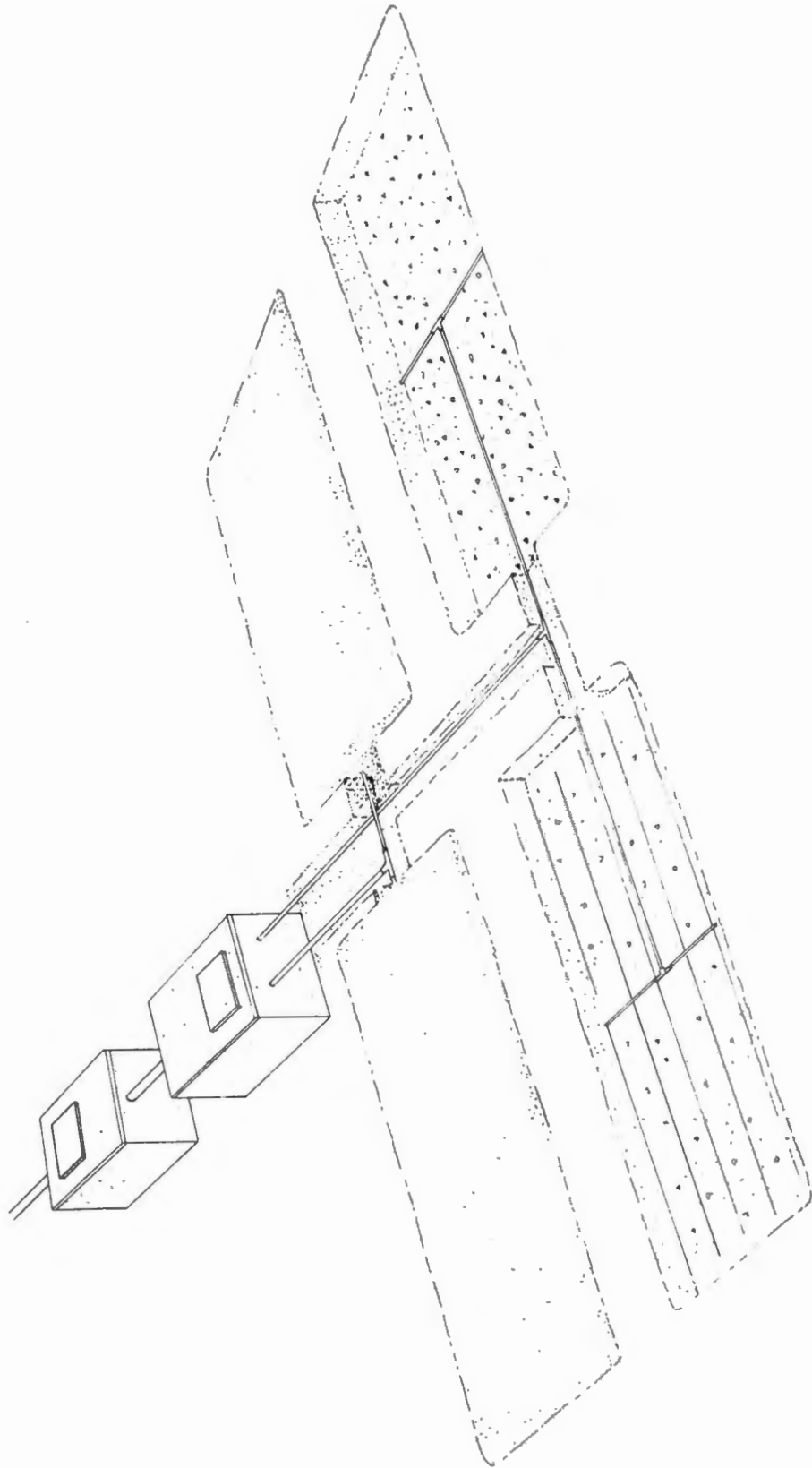


Figure 3. Subsurface disposal system

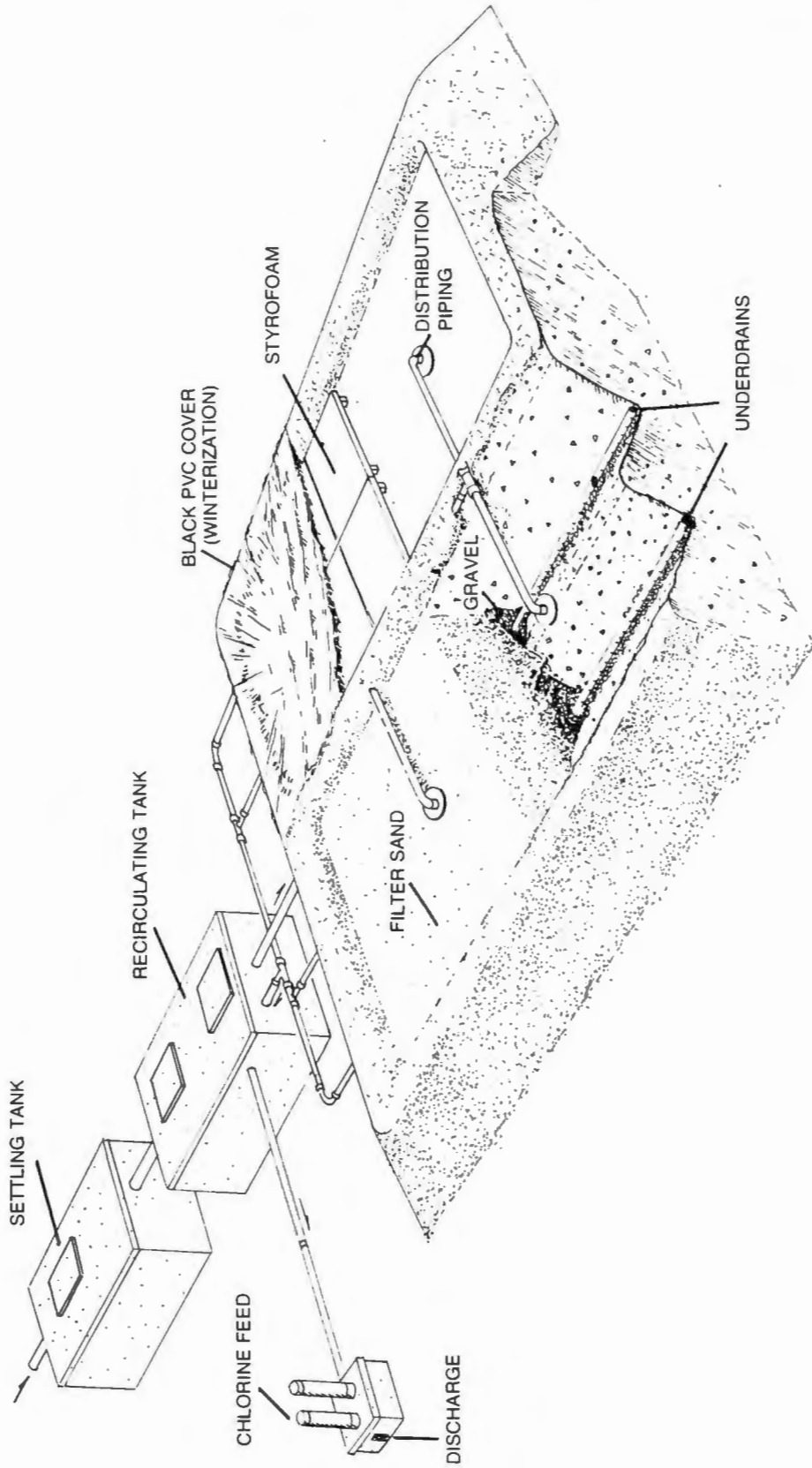


Figure 4. Recirculating sand filter system

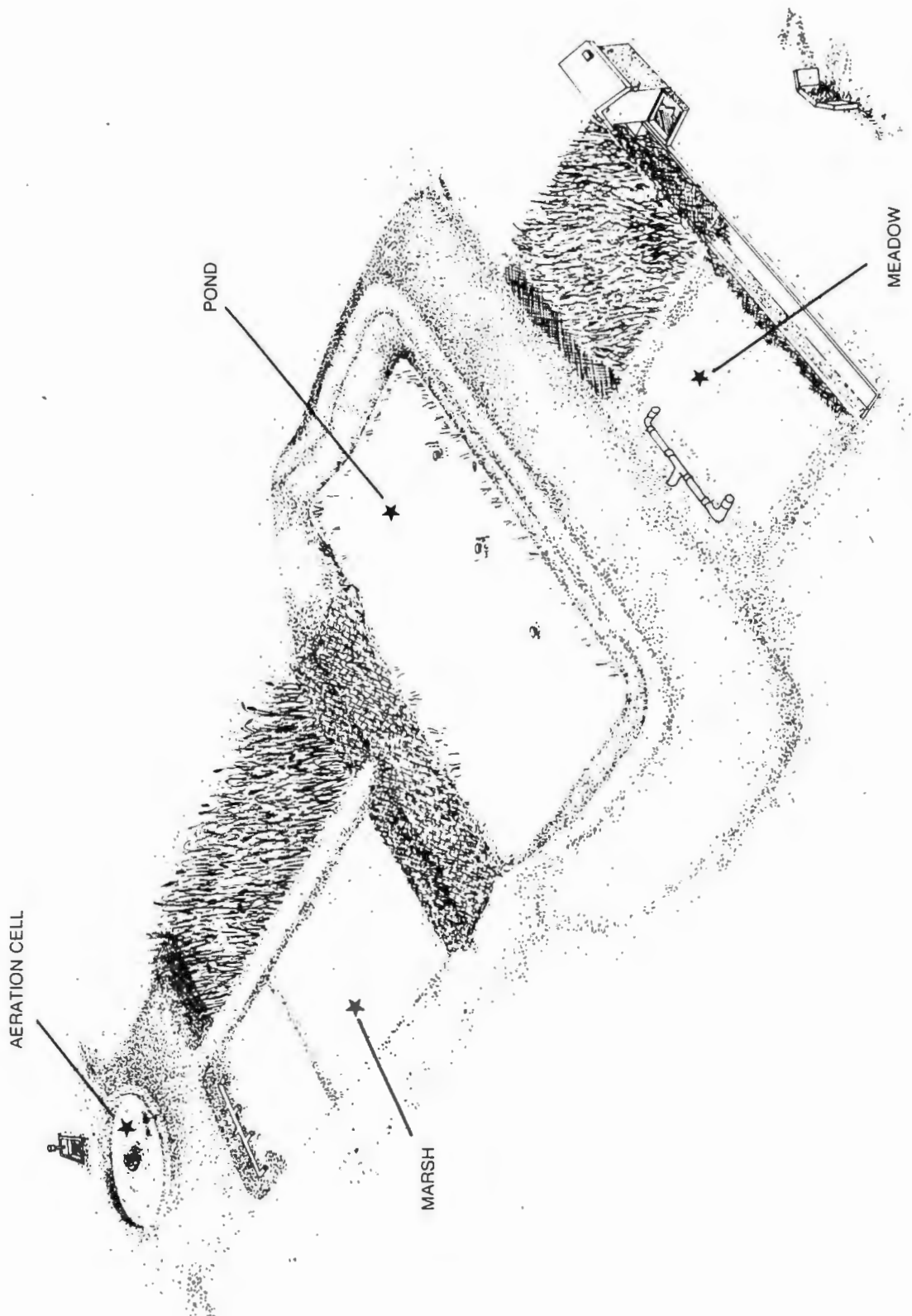


Figure 5. Marsh pond/meadow treatment system

lot system. Principally, this Combined Technology could avoid miles and miles of interceptor and collector sewers which would normally be constructed to join dispersed residential clusters. It is the cost of the collection system and not the treatment system that puts the price tag so high on sewage facilities. Combined Technology is almost infinite in its possibilities. We will later use as an example 900 residences on a SECT system and 100 residences dispersed enough to require an OLMS technology, or \$1,000,000 in facility costs.

## COST ESTIMATES FOR A MUNICIPAL AUTHORITY USING AN OLMS TECHNOLOGY, A SECT TECHNOLOGY, OR COMBINED TECHNOLOGY

### a. The Municipal Authority

Any township or borough or combination of townships and boroughs may by mutual agreement by law of the Commonwealth of Pennsylvania establish a municipal Authority or a joint municipal Authority. Such an organization (referred to as the Authority) may own property and incur debt, and must do both to the end of being a "benefit to the people of the Commonwealth."

Once created according to law by the municipal governing body, the Authority is an autonomous organization in its abilities to use eminent domain and to fix user charges, but it is still a creature of the municipalities and the Commonwealth. For example, the municipal Authority can do only that which the local municipal creating ordinances allow it to do in terms of the type and kind of sewage disposal facility. The state Supreme Court has ruled that a municipal Authority is an agent and instrumentality of the Commonwealth of Pennsylvania, as are all sub-state units of local government.

The following is a listing of the powers and responsibilities of the municipal Authority in Pennsylvania:\*

- (a) To have an existence for a term of 50 years or as qualified by law; generally the period of time required to pay off the bonded indebtedness should the mandatory limit of 40 years on the bond issue be exceeded.
- (b) To sue and to be sued.

(c) To adopt, use, and alter at will, a corporate seal.

(d) To acquire, purchase, hold, lease as lessee, and use any franchise, property, real, personal or mixed, tangible or intangible, or any interest therein, which is to say to be able to hold a variety of property.

(e) Acquire by purchase, lease, or otherwise to contract, empower, maintain, repair, and operate a project.

(f) To make by-laws for the management and regulation of its operation.

(g) To appoint officers, agencies, employees, and servants; to prescribe their duties and to fix their compensation.

(h) To fix, alter, or change, charge and collect rates and other charges in the areas served by its facility in order to pay for the operation of the facility.

(i) To borrow money, make and issue negotiable notes and bonds.

(j) To make contracts.

(k) To make intergovernmental arrangements for obtaining monies and other services.

(l) To have the power of eminent domain.

(m) To pledge the revenues or receipts of the Authority.

(n) To carry out activities which will promote the business and general welfare of the Authority to carry out the powers granted to it by acts of the General Assembly of the Commonwealth.

(o) Contract with any municipality or any public Authority on the terms deemed proper by the Authority for the construction and operation of any project which is partly in this Commonwealth and partly in an adjoining place or state.

(p) To make contracts to furnish project services with non-member municipalities.

(q) To make contracts of insurance.

(r) To charge the property benefiting from being improved by a sewage facility for the cost of construction of any sewer main.

(s) To charge for the cost of any sewer or construction according to the front foot rule.

(t) To charge a tapping on fee whenever the owner of any property connects such property with a sewage system or *water main* constructed by the Authority.

(u) Public Utility Commission approval is required before the Authority may institute proper proceedings to construct a facility.

(v) To appoint police officers who shall have the same rights as any other police officers in the Commonwealth with respect to the property of the Authority.

Such an Authority used as a means of implementing a sewage facility would

have the following life cycle:

1. Founding of Authority as a result of conducting feasibility study — first year
2. Planning and obtaining funding — first through fourth year
3. Design — second through fourth year
4. Construction — third through seventh year
5. Operation and maintenance of facility under Authority — fifth through fortieth year
6. Payment of debt — fifth through fortieth year
7. Return to municipality(ies) (after the cancellation of bonded indebtedness) — fifth through fortieth year
8. A legal 50-year life cycle is provided in case the Authority cannot retire its debt in 40 years

Some Authorities have gone to the planning and design stage and have spent upwards of \$30,000 to \$50,000, only to find that they have a design that is too expensive to build, or have had to redesign to obtain outside funding. Others have gone to construction (stage four) only to have delays and inflation at least double their estimated costs, making user charges totally unacceptable to the clients.

Clearly, the critical point is the first stage. A good feasibility study will give at least a ball park estimate of the costs of certain types of potentially affordable sewage facility technologies for the small community.

How much does it cost to found an Authority? How much will the potentially affordable and workable sewage facility technologies cost? The answer to the first question indicates what sort of risks the municipality will have to take until they finally obtain a feasible design. The second will provide some information as to what the total cost range might be.

An Authority might be formed before the design is done. Founding of an Authority or establishing another appropriate organizational arrangement indicates a certain degree of seriousness on the part of the municipality or municipalities. This action should be helpful in obtaining Federal (EPA), State, and FmHA funding for planning and design. Also, once the decision has been reached to solve sewage facility problems, there are an extraordinary number of day-to-day type details that should be assigned to a specific person. This person should be an individual from the area, a public-spirited individual who would be willing to work for small compensation with the idea that once the Authority is in full swing, and

\*The Pennsylvania Municipality Authorities Act and Related Laws, 1979

the facility is created, this person's position could improve in both responsibility and income. He or she will be learning on the job, and this is a way of *cutting costs*. The cost of founding an Authority, regardless of the system used, would be about the same for the three technologies. The cost of the technologies themselves (hence design, would vary according to the number of users, the terrain, the regional or local labor costs and a variety of other factors. But we present cost ranges according to a pre-set number of users. Therefore, we first discuss the cost of founding an Authority. Then we will present examples of an OLMS technology, a SECT technology, and a Combined Technology by roughly estimated costs. We then present cost balance sheets which could serve as models (guides indicating estimated costs incurred) for the municipality interested in founding an Authority and using one or more of these technologies, thus helping to determine at least the financial feasibility of the project.\*

\*Given that an Authority has been formed, the information that has evolved from a discussion following the approach that we have outlined could be used as part of the pre-application process for Federal and State monies. The three technologies presented above are *probably* the least cost alternatives for small communities and should be considered in any kind of pre-application for Federal and State monies.

### b. Some Important Factors and Costs in Founding a Municipal Authority

There are two basic requirements of any municipal Authority: (1) a public interest must be served; and (2) the facility must pay for itself. The latter means that the revenues from running the facility must be enough to cover all expenses, such as any renovations, maintenance, and the principal and interest on the debt incurred.\*\*

We noted above in the life cycle of the Authority that the first stage includes founding the Authority and the feasibility study. The second stage includes planning and obtaining outside funding. It is generally within the first and second stage, and at the end of the second stage in particular, that the bond issue is under consideration. The third stage, the design stage, gives information as to what the ultimate costs of the facility would be. The cut off points between stages are not clear, there is some overlapping of each stage by successive stages in the process of organizing, planning, financing, and developing the facility. The cost of the first three stages as well as the actual construction of the system are major factors which are built into the cost of the bonded indebtedness. So, under the general notion of costs in founding a municipal Authority for a sewage facility, we have the following factors:

- the cost of incorporating the authority,

\*\**The Pennsylvania Municipality Authorities Act and Related Laws, 1979, pp. 2-4.*

- the cost of the feasibility study and pre-application,
- cost of design,
- costs for rights-of-way,
- the cost of the bond issue counsel.

These key factors in founding an Authority can be cross-referenced with key resources needed to carry out each one of those mentioned below:

- costs of engineering,
- costs of legal counsel,
- costs of accounting,
- costs of management.

Table 1 graphically displays the cross-referencing of the key tasks and the key resources by costs incurred in the first four years of the life of an Authority. It is important to realize that most of the costs, if not all the costs reflected in Table 1, are written into the bond issue. This means that the sum total of expenses which precede the actual construction and use of the facility are an important part of the total costs of producing the facility. Any saving in the first three years can possibly mean lower user fees, for until the Authority can generate revenue, it operates on money *borrowed* at interest, and that sum plus the interest is written into the principal of the bond issue.

An efficient way to discuss the cost factors from incorporation of the Authority to the design and bond issue\* is to

\*The cost factor estimates are derived from case studies we conducted of the five sewage Authorities incorporated in Pennsylvania during the period 1972 to 1979.

Table 1: Cross referencing of key stages and key resources in founding a sewage Authority.

| STAGES                     | RESOURCES   |               |            |            |   | Management costs exclusive of engineering and bond counsel but including legal, accounting, and management costs |
|----------------------------|-------------|---------------|------------|------------|---|------------------------------------------------------------------------------------------------------------------|
|                            | Engineering | Legal counsel | Accounting | Management |   |                                                                                                                  |
| Incorporation of Authority |             |               |            |            |   |                                                                                                                  |
| Feasibility study          |             |               |            |            |   |                                                                                                                  |
| Pre-application            |             |               |            |            |   |                                                                                                                  |
| Design                     |             |               |            |            |   |                                                                                                                  |
| Design                     |             |               |            |            |   |                                                                                                                  |
| Rights-of-way acquisition  |             |               |            |            |   |                                                                                                                  |
| Bond issue                 |             |               |            |            |   |                                                                                                                  |
| Construction               |             |               |            |            |   |                                                                                                                  |
|                            | 1st Year    |               |            |            |   |                                                                                                                  |
|                            | 2nd Year    |               |            |            |   |                                                                                                                  |
|                            | 3rd Year    |               |            |            |   |                                                                                                                  |
|                            | 4th Year    |               |            |            |   |                                                                                                                  |
|                            | A B C D     | E F           | E' F'      | G          | G |                                                                                                                  |

at this matrix in Table 1 from the  
of view of:

- Costs of engineering (labelled A, B, C, D)
- Costs of legal counsel (labelled E, F)
- Costs of accounting (labelled E<sup>1</sup>, F<sup>1</sup>)
- Costs of management (labelled G)

### Costs of Engineering

Engineering per se does not enter as a factor in incorporating the Authority. But engineering is clearly a factor in the feasibility study, pre-application, and design and in the initial stages of running the Authority organization.

Local Authorities have a board of directors and some have a professional engineer (PE) to take care of running the Authority for up to a three year period until the actual facility is built. Other Authorities bring in a manager at the beginning on a part-time basis and the manager works with the PE, learning on the job.

Some engineers will do a feasibility study and pre-application proposal and will be reimbursed at a later point in time. In other situations, the engineer's costs are to be paid immediately for these situations, in which case the Authority will have to take out a loan to reimburse the engineer. In most cases, the engineer does the feasibility and/or pre-application work as well as the design work. Engineering charges for design apparently vary from 3 percent of the total costs of a complete facility. For example, the engineering charges, including a feasibility study on a \$1.3 million facility were \$60,000, representing a less than 7 percent charge. In another case a \$15.5 million facility had a greater than 7 percent engineering charge for design and all the pre-application requirements and feasibility study. Some of the basic lessons here are that the less expensive the technology, generally speaking, the lower should be the engineering costs. A rule of thumb is a figure of 7 percent of total facility costs for design, and 10 percent for design and pre-application work. Another suggestion is that the Authority have at least a part-time manager employed interacting with a professional engineer, which seems to lower the 7 percent figure. These considerations are summarized in Table 2: Engineering Factors and Costs.

incorporation or ordinance writing.

The basic costs of incorporating an Authority in terms of a lawyer doing the paperwork are around \$200. If the potential board happens to include a lawyer, she/he might do it free of charge. In the cases we examined, costs varied from no charge to as high as \$750.

It is possible that there could be a lawsuit filed immediately by a citizen challenging the formation of a sewer Authority. These suits have been known to run as high as \$6,000. Also, an Authority can be formed under pressure from the state and the municipal Authority might consider this unjust and choose to sue the state. These suits have been known to run as high as \$35,000 to \$40,000 in legal costs. Though suits are not a common practice with the establishment of every Authority, nevertheless they do occur on occasion.

Legal costs generally do not figure into the feasibility study, pre-application, or the design costs. However, when the design has been created and rights-of-way have been declared, it is possible that suits may be brought by citizens against the Authority with regard to the right-of-way. These, by law, can cost a maximum of \$500 per suit. A citizen could also claim an equity suit against the Authority, for the citizen might claim that she/he is

### Costs of Legal Counsel

It is important to realize that municipal attorneys are usually held on a retainer to be available for legal needs, and that this retainer does not generally include costs for performing legal services such as in-

Table 2: Engineering factors and costs:  
Projects of \$100,000, \$250,000, \$500,000, and \$1,000,000.

|                            |          | Engineering                                                                                                                                                                                                |           |           |             |
|----------------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|-------------|
| Incorporation of Authority |          |                                                                                                                                                                                                            |           |           |             |
| Feasibility study          | 1st Year | -----                                                                                                                                                                                                      |           |           |             |
| Pre-application Design     | 2nd Year | Engineering costs are estimated on the basis of the following percentages of the cost of the sewage facility: 7% for design, 10% for design and pre-application (10% figure is the number indicated by *). |           |           |             |
| Design                     |          | -----                                                                                                                                                                                                      |           |           |             |
| Rights-of-way acquisition  | 3rd Year |                                                                                                                                                                                                            |           |           |             |
| Bond issue                 |          |                                                                                                                                                                                                            |           |           |             |
| Construction               | 4th Year |                                                                                                                                                                                                            |           |           |             |
|                            |          | COST SUMMARY                                                                                                                                                                                               |           |           |             |
|                            |          | \$100,000                                                                                                                                                                                                  | \$250,000 | \$500,000 | \$1,000,000 |
|                            |          | 7,000                                                                                                                                                                                                      | 17,500    | 35,000    | 70,000      |
|                            |          | 10,000*                                                                                                                                                                                                    | 25,000*   | 50,000*   | 100,000*    |
|                            |          | 3,000                                                                                                                                                                                                      | 7,500     | 15,000    | 30,000      |
|                            |          | A                                                                                                                                                                                                          | B         | C         | D           |

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It is possible that there could be a lawsuit filed immediately by a citizen challenging the formation of a sewer Authority. These suits have been known to run as high as \$6,000. Also, an Authority can be formed under pressure from the state and the municipal Authority might consider this unjust and choose to sue the state. These suits have been known to run as high as \$35,000 to \$40,000 in legal costs. Though suits are not a common practice with the establishment of every Authority, nevertheless they do occur on occasion.

Legal costs generally do not figure into the feasibility study, pre-application, or the design costs. However, when the design has been created and rights-of-way have been declared, it is possible that suits may be brought by citizens against the Authority with regard to the right-of-way. These, by law, can cost a maximum of \$500 per suit. A citizen could also claim an equity suit against the Authority, for the citizen might claim that she/he is

not getting enough money for the disturbance of their land. These suits have run around \$5,000 in legal costs.

In addition, if a new ordinance has to be written to empower the Authority to employ a certain type of technology, the ordinance can run around \$375.

These considerations are reflected in Table 3: Costs of Legal Counsel.

Legal counsel is generally retained by the Authority or through one of the member municipalities. The basic lesson we learned is that good communications (sometimes thought of as good community development work) with the potential users of the facility during the discussion, planning, and development stages are necessary to avoid legal suits, thus keeping the costs of these, too, from being written into the bond issue. It is also cost saving if a lawyer volunteers his or her services.

### 3. Costs of Accounting

The accountant figures in the incorporation of the Authority in setting up the basic financial structure for the Authority. These charges have run from \$150 to \$300.

An Authority has a required audit. These audit charges have ranged from \$300 to \$1,200 a year. When the Author-

**Table 3: Costs of legal counsel**

|                                  |          | Legal counsel                                                 |                   |
|----------------------------------|----------|---------------------------------------------------------------|-------------------|
| Incorporation of Authority       |          | Incorporation \$200 to \$750                                  |                   |
| Feasibility study                | 1st Year | Suit against founding Authority \$5,000 to \$7,000            |                   |
|                                  |          | -----                                                         |                   |
| Pre-application                  |          | Suit filed by municipality against state \$35,000 to \$40,000 |                   |
| Design                           |          | \$700 retainer fee                                            |                   |
|                                  | 2nd Year |                                                               |                   |
| Design Rights-of-way acquisition |          | \$700 retainer fee                                            |                   |
|                                  | 3rd Year | -----                                                         |                   |
|                                  |          | Right-of-way suit \$500 maximum per                           |                   |
| Bond issue                       |          | -----                                                         |                   |
| Construction                     |          | Equity suit if contested, \$5,000                             |                   |
|                                  | 4th Year | \$700 retainer fee                                            |                   |
|                                  |          | Few legal issues                                              | Many legal issues |
|                                  |          | \$2,300                                                       | \$14,150          |
|                                  |          | E                                                             | F                 |
|                                  |          | -----                                                         |                   |
|                                  |          | \$11,850 difference                                           |                   |

**Table 4: Costs of accounting**

|                            |          | Professional accountant                               |                |
|----------------------------|----------|-------------------------------------------------------|----------------|
| Incorporation of Authority |          | Incorporation \$150 to \$300                          |                |
| Feasibility study          | 1st Year | Annual audit \$300 to \$1,200 with \$750 a "standard" |                |
|                            |          | -----                                                 |                |
| Pre-application            |          |                                                       |                |
| Design                     |          | Annual audit \$300 to \$1,200 with \$750 a "standard" |                |
|                            | 2nd Year |                                                       |                |
| Design                     |          | Annual audit \$300 to \$1,200 with \$750 a "standard" |                |
|                            | 3rd Year |                                                       |                |
| Rights-of-way acquisition  |          |                                                       |                |
| Bond issue                 |          |                                                       |                |
| Construction               |          | Annual audit \$300 to \$1,200 with \$750 a "standard" |                |
|                            | 4th Year |                                                       |                |
|                            |          | Minimum                                               | Maximum        |
|                            |          | \$1,350                                               | \$5,300        |
|                            |          | E <sup>1</sup>                                        | F <sup>1</sup> |
|                            |          | -----                                                 |                |
|                            |          | \$3,000 "standard" audit costs                        |                |

ity has any sort of trust indenture, which is to say when they owe money to a bank, an audit is required. The audit charges for an ongoing Authority as of 1980 have been recorded at about \$750 a year.

As with engineering and legal counsel fees, the fees of the professional accountant in the Authorities we surveyed have varied for the same services. And as far as we have been able to determine, there are no fixed rates for given services. These rates are determined in negotiation between the Authority and the professional accountant. These considerations are presented in Table 4: Costs of accounting.

**4. Costs of Management**

There seems to be a critical dividing point in the life of an Authority. That is, the time from the period when the Authority is first formed until the facility is constructed, and from its first being used to generate income to pay off the debt. The first phase has the Authority in a position where it cannot generate revenues from the facility because the facility doesn't exist. Therefore, the Authority is operating on borrowed money. At this point, there are two basic options. Running the Authority can essentially be turned over to a professional engineer until the facility is constructed (and income generated) or the Authority board can hire a manager either part- or full-time to oversee all phases of the development of the facility.

Most Authorities have opted for a part-time manager until the facility is constructed and there is an office budget reflecting management costs. A sample pre-facility budget is given in Table 13 in Appendix A. The essential difference between the budget reflecting the first phase (pre-facility) and the budget reflecting the second phase (after facility is constructed) is that the second phase reflects all of the factors which are involved in running an Authority, which includes the costs of charging the user. Such a budget is reflected in Table 14 in Appendix A as a sample budget of a conventional sewage facility serving 340 residences (note the annual electric bill and the borough subsidy!).

It is important to point out that the bond counsel fee is generally step-wise. That is, we found a \$3,000 charge for any bond issue up to \$25,000 and a charge of \$15,000 to \$17,000 for bond issues of \$25,000 up to \$7 million.

Management considerations are summarized in Table 5: Costs of Management. Figure 6 displays management



**Table 5: Costs of management**

|                                                                 |             | Management<br>(personnel and<br>office supply)<br>costs | Management, including<br>personnel, office<br>supplies, legal,<br>and accounting but<br>excluding engineering<br>and bond counsel<br>costs |                                         |
|-----------------------------------------------------------------|-------------|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| Incorporation of<br>Authority<br>Feasibility<br>Pre-application | 1st<br>Year | No facility<br>\$ 6,000                                 | Minimum<br>\$ 7,100                                                                                                                        | Maximum<br>\$12,500                     |
|                                                                 | 2nd<br>Year | No facility<br>\$10,000                                 | Minimum<br>\$11,000                                                                                                                        | Maximum<br>\$11,900                     |
| Design<br>Rights-of-way<br>acquisition                          | 3rd<br>Year | No facility<br>\$10,000                                 | Minimum<br>\$11,900                                                                                                                        | Maximum<br>\$11,900<br>2,500<br>+ 5,000 |
|                                                                 |             |                                                         | Minimum<br>\$11,900                                                                                                                        | Maximum<br>\$19,400                     |
| Bond issue<br>Construction                                      | 4th<br>Year | Facility<br>\$14,200                                    | Minimum<br>\$15,900                                                                                                                        | Maximum<br>\$23,400                     |
|                                                                 |             | \$40,200                                                | Minimum<br>\$45,900                                                                                                                        | Maximum<br>\$67,200                     |

which will ultimately be reflected in lower user charges by means of:

- Lowering the overall amount of money that has to be borrowed, hence the overall amount of money on which interest has to be paid, by lowering design and construction costs.
- Lowering the overall operating and maintenance costs of the facility.
- Seeking maximum outside Federal and/or State funding.

costs (the factors being legal, accounting, authority office, and bond counsel) in terms of these costs being paid as part of the bond issue.

### 5. User Charges

The user charges are made up of three components: (1) The bond issue payment must be made by the Authority on an annual basis and is therefore divided up under user charges in that year. These are calculated here on the basis of facility design and construction costs and first 4 years of Authority start-up costs. (2) The costs of the operation and maintenance of the facility. (3) The costs of the operation of the Authority offices.

Tables 6, 7, 8, and 9 present the bond issue aspect of user charges in terms of the first phase Authority cost (legal work, accounting, and management), bond counsel, and engineering costs written into the bond issue. We present these in the context of facilities costing \$100,000, \$250,000, \$500,000, and \$1,000,000. Table 6 would encompass the OLMS system serving users, Tables 7 and 8 a SECT technology, and Table 10 a Combined Technology.

The costs of operation and maintenance of the facilities discussed in Tables

6, 7, 8, and 9 can only be roughly estimated on the basis of their low labor and energy uses. Once an OLMS technology is in place, it would require annual inspection and appropriate equipment maintenance. The SECT technology requires inspection of pumps and periodic cleanout of the septic tanks and pipes, as well as some inspection and maintenance work on the waste water treatment system(s) used.

Given the relatively small number of residences involved in all but the 1,000 residence Combined Technology, we recommend that the municipality consider that *one* person be hired to run the office and carry out the inspection work. It is possible to form a cooperative arrangement with the local municipal Sewage Enforcement Officer. Repairs can be done by that person and/or on contract. A sample budget is provided in Table 10 for the system presented in Tables 6, 7, and 8 and one for Table 9 in Table 11.

Table 12 presents estimated user charges based on factors (1), (2), and (3).

The strategy we employ in this publication to minimize user charges, while at the same time providing appropriate sewage treatment and environmental protection, is to hold down the overall costs

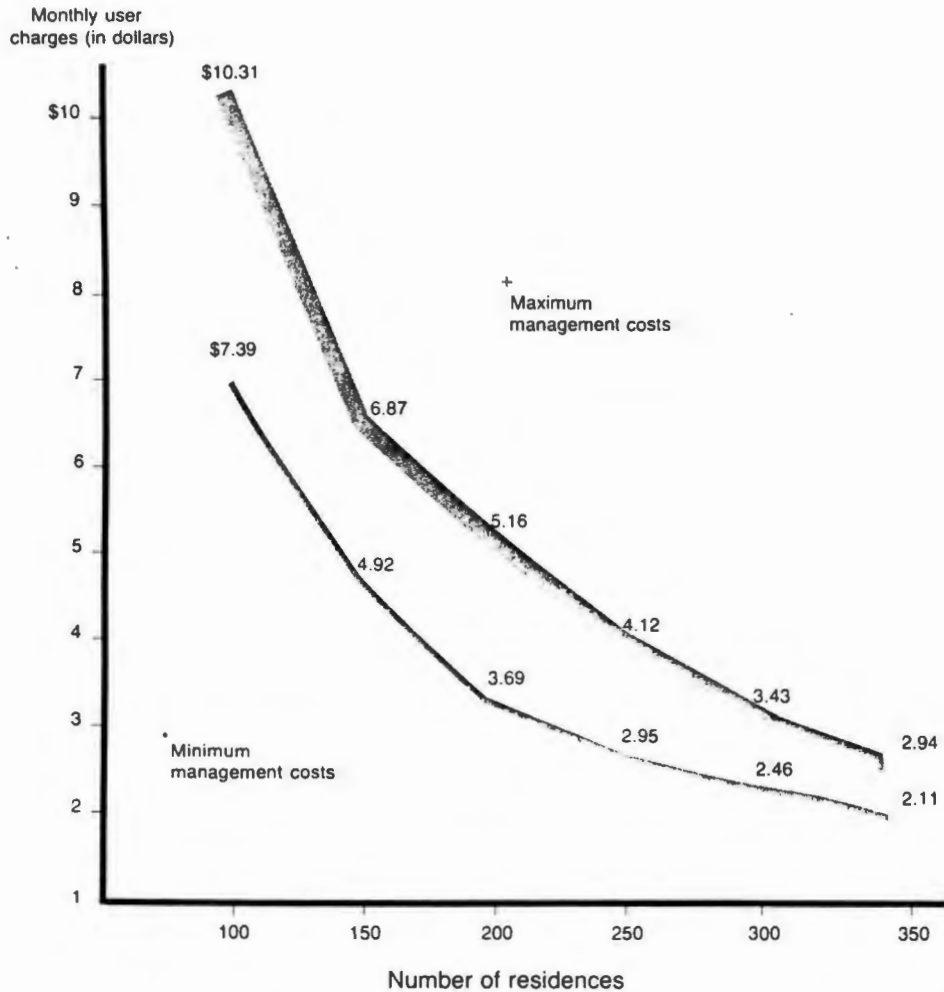


Figure 6: Management cost figures as user charges on a per month basis for initial 4 years of the Authority and written into the bond issue at 8% per year for 20 years (legal, accounting, Authority office, and bond counsel).

\* Minimum costs written in - \$68,279 (Table 6) becomes \$177,395 paid over 20 years.

+ Maximum costs written in - \$95,257 (Table 8) becomes \$247,668 paid over 20 years.

Table 6: Estimated costs of an Authority with an OLMS technology costing \$100,000 serving 75 to 100 residences.

|                                                                                                                  |   |                            |                    |
|------------------------------------------------------------------------------------------------------------------|---|----------------------------|--------------------|
| 1. Assume maximum management costs, first 3 years (\$30,000) the money borrowed at 15% (7,100 + 11,000 + 11,900) | - | 10,797 + 14,597 + 13,685 = | \$ 39,079          |
| with 4th year expense written into bond issue (or bank loan)                                                     | - |                            | \$ 14,200          |
| 2. Total of 3 year borrowed money and 4th year money written into bond issue at 3rd year                         | - |                            | \$ 53,279          |
| 3. Bond counsel fee written into bond issue                                                                      | - |                            | \$ 15,000          |
| Total of management costs written into bond issue                                                                | - |                            | \$ 68,279          |
| 4. Facility costs (local costs) receiving 75% Step I, 85% Step II, and 85% Step III grant                        | = |                            | \$ 750             |
| Step I \$3,000 - \$2,250                                                                                         | = |                            | \$ 1,050           |
| Step II \$7,000 - \$5,950                                                                                        | = |                            | \$ 15,000          |
| Step III \$100,000 - \$85,000                                                                                    | = |                            |                    |
| Total facility costs (local)                                                                                     | = |                            | \$ 16,800          |
| 5. First 4 year management and facility costs written into bond issue                                            | - |                            | \$85,079           |
| 6. 20 year bonds paying 8% per year result in annual user charges (100 users)                                    | - |                            | \$ 110.53 per year |
| monthly user charges (excluding operation and maintenance)                                                       | - |                            | \$ 9.21 per month  |

Table 7: Estimated costs of an Authority with a SECT technology costing \$250,000 serving 150 residences.

|                                                                                           |   |                            |            |
|-------------------------------------------------------------------------------------------|---|----------------------------|------------|
| 1. Assume maximum management costs, first 3 years (\$30,000) the money borrowed           | - |                            |            |
| at 15% (7,100 + 11,900 + 11,900)                                                          | - | 10,797 + 14,597 + 13,685 = | \$ 39,079  |
| with 4th year expense written into bond issue (or bank loan)                              | - |                            | 14,200     |
| 2. Total of 3 year borrowed money and 4th year money written into bond issue at 3rd year  | - |                            | \$ 53,279  |
| 3. Bond counsel fee written into bond issue                                               | - |                            | \$ 15,000  |
| Total of management costs written into bond issue                                         | - |                            | \$ 68,279  |
| 4. Facility costs (local costs) receiving 75% Step I, 85% Step II, and 85% Step III grant |   |                            |            |
| Step I \$7,500 - \$5,625                                                                  | = |                            | \$ 1,875   |
| Step II \$25,000 - \$21,250                                                               | = |                            | \$ 3,750   |
| Step III \$250,000 - \$212,500                                                            | = |                            | \$ 38,500  |
| Total facility costs (local)                                                              | = |                            | \$ 44,125  |
| 5. First 4 year management and facility costs written into bond issue                     | - |                            | \$ 112,394 |
| 6. 20 year bonds paying 8% per year result in annual user charges                         | - |                            | \$ 96.50   |
|                                                                                           |   |                            | per year   |
| monthly user charges (excluding operation and maintenance)                                | - |                            | \$ 8.04    |
|                                                                                           |   |                            | per month  |

Table 8: Estimated costs of an Authority with a SECT technology costing \$500,000 serving 350 residences.

|                                                                                           |   |                            |           |
|-------------------------------------------------------------------------------------------|---|----------------------------|-----------|
| 1. Assume maximum management costs, first 3 years (\$43,800) the money borrowed           | - |                            |           |
| at 15% (12,500 + 11,900 + 19,400)                                                         | - | 19,010 + 15,537 + 22,310 = | \$ 56,857 |
| with 4th year expense written into bond issue (or bank loan)                              | - |                            | 23,400    |
| 2. Total of 3 year borrowed money and 4th year money written into bond issue at 3rd year  | - |                            | \$ 80,257 |
| 3. Bond counsel fee written into bond issue                                               | - |                            | \$ 15,000 |
| Total of management costs written into bond issue                                         | - |                            | \$ 95,257 |
| 4. Facility costs (local costs) receiving 75% Step I, 85% Step II, and 85% Step III grant |   |                            |           |
| Step I \$15,000 - \$11,250                                                                | = |                            | \$ 3,750  |
| Step II \$50,000 - \$42,500                                                               | = |                            | \$ 7,500  |
| Step III \$500,000 - \$425,000                                                            | = |                            | \$ 75,000 |
| Total facility costs (local)                                                              | = |                            | \$ 86,250 |
| 5. Management and facility costs written into bond issue                                  | - |                            | \$181,507 |
| 6. 20 year bonds paying 8% per year result in annual user charges                         | - |                            | \$ 62.41  |
|                                                                                           |   |                            | per year  |
| monthly user charges (excluding operation and maintenance)                                | - |                            | \$ 5.61   |
|                                                                                           |   |                            | per month |

Table 9: Estimated costs of an Authority with a combined technology using a SECT system serving 900 residences and an OLMS technology serving 100 residences, costing around \$1,000,000, thus serving 1,000 residences.

|                                                                                           |   |                                      |
|-------------------------------------------------------------------------------------------|---|--------------------------------------|
| 1. Assume maximum management costs, first 3 years (\$43,800) the money borrowed           | - |                                      |
| at 15% (12,500 + 11,900 + 19,400)                                                         | - | 19,010 + 15,537 + 22,310 = \$ 56,857 |
| with 4th year expense written into bond issue (or bank loan)                              | - | 23,400                               |
| 2. Total of 3 year borrowed money and 4th year money written into bond issue at 3rd year  | - | \$ 80,257                            |
| 3. Bond counsel fee written into bond issue                                               | - | \$ 15,000                            |
| Total of management costs written into bond issue                                         | - | <u>\$ 95,257</u>                     |
| 4. Facility costs (local costs) receiving 75% Step I, 85% Step II, and 85% Step III grant |   |                                      |
| Step I \$30,000 - \$22,500                                                                | = | \$ 7,500                             |
| Step II \$100,000 - \$85,000                                                              | = | \$ 15,000                            |
| Step III \$1,000,000 - \$850,000                                                          | = | <u>\$ 150,000</u>                    |
| Total facility costs (local)                                                              | = | \$ 172,500                           |
| 5. Management and facility costs written into bond issue                                  | - | \$ 267,757                           |
| 6. 20 year bonds paying 8% per year result in annual user charges                         | - | \$ 34.00                             |
|                                                                                           |   | per year                             |
| monthly user charges (excluding operation and maintenance)                                | - | \$ 2.90                              |
|                                                                                           |   | per month                            |

Table 10: Estimated sample budget for small population OLMS and SECT facilities.

Operating expenses:

|                                              |                    |
|----------------------------------------------|--------------------|
| 1. Plant:                                    |                    |
| Salaries and wages — facility operator ..... | \$ 5,000.00        |
| Materials and supplies .....                 | 1,000.00           |
| Utilities.....                               | 1,000.00           |
| Repairs .....                                | 225.00             |
| General expense.....                         | 80.00              |
| Subtotal.....                                | <u>7,305.00</u>    |
| 2. Administrative:                           |                    |
| Salaries and wages-office.....               | \$ 7,900.00        |
| Office expense .....                         | 800.00             |
| Advertising.....                             | 50.00              |
| Professional fees.....                       | 1,500.00           |
| Telephone .....                              | 280.00             |
| Repairs .....                                | 50.00              |
| Payroll taxes.....                           | 1,000.00           |
| Insurance.....                               | 1,500.00           |
| General expense.....                         | 220.00             |
| Subtotal.....                                | <u>13,300.00</u>   |
| Total.....                                   | <u>\$20,605.00</u> |

Table 11: Estimated Sample Budget for a Combined Technology Facility Serving 1,000 Residences.

|                                      |                         |                 |             |
|--------------------------------------|-------------------------|-----------------|-------------|
| <b>REVENUE &amp; INCOME</b>          |                         |                 |             |
| Annual user charge                   |                         | 1,000 x \$63.90 | \$63,900.00 |
| <b>EXPENDITURES</b>                  |                         |                 |             |
| <b>OPERATION &amp; MAINTENANCE</b>   |                         |                 |             |
| Salaries & wages — Facility operator |                         |                 | \$ 9,500.00 |
| Materials & supplies:                | Tools                   | \$ 50.00        |             |
|                                      | Lab supplies            | 180.00          |             |
|                                      | Chart paper             | 40.00           | \$ 270.00   |
| Chlorine                             |                         |                 | 500.00      |
| General expense                      |                         |                 | 50.00       |
| Communication expense                |                         |                 | 175.00      |
| Electrical expense                   |                         |                 | 2,000.00    |
| Miscellaneous                        |                         |                 | 200.00      |
|                                      |                         |                 | \$12,695.00 |
| <b>ADMINISTRATION</b>                |                         |                 |             |
| Salaries & wages — Business manager  |                         |                 | \$11,000.00 |
| Materials & supplies:                | Postage                 | \$450.00        |             |
|                                      | P.O. Box rent, billings | 30.00           |             |
|                                      | Letterheads, etc.       | 590.00          |             |
|                                      | Copier supplies         | 190.00          |             |
|                                      | Ledger sheets, etc.     | 30.00           | \$ 1,290.00 |
| General expense                      |                         |                 | 50.00       |
| Advertising & printing               |                         |                 | 55.00       |
| Legal fees                           |                         |                 | 700.00      |
| Auditor fees                         |                         |                 | 750.00      |
| Communication expense                |                         |                 | 250.00      |
| Miscellaneous                        |                         |                 | 50.00       |
|                                      |                         |                 | \$14,145.00 |
| <i>Employee benefits &amp; taxes</i> |                         |                 |             |
| Social security taxes                |                         | \$ 1,000.000    |             |
| Unemployment compensation            |                         | 250.00          | \$ 1,250.00 |
| <i>Insurance</i>                     |                         |                 |             |
| Fire                                 |                         | \$ 300.00       |             |
| Compensation                         |                         | 750.00          |             |
| Casualty & liability                 |                         | 750.00          | \$ 1,800.00 |
| <b>ADMINISTRATION EXPENSES</b>       |                         |                 |             |
|                                      |                         |                 | \$17,195.00 |
| <b>TOTAL EXPENDITURES</b>            |                         |                 |             |
|                                      |                         |                 | \$29,890.00 |
| <b>DEBT SERVICE</b>                  |                         |                 |             |
|                                      |                         |                 | \$34,000.00 |
| <b>TOTAL</b>                         |                         |                 |             |
|                                      |                         |                 | \$63,890.00 |

Table 12: User Charges for OLMS (found in Table 7), SECT (Tables 8 and 9) and CT (Table 10) Reflecting (1) Bond Issue (2) Operation and Maintenance and (3) Costs of Running Authority Office.

|                                                | OLMS                 | SECTS                |                      | CT                      |
|------------------------------------------------|----------------------|----------------------|----------------------|-------------------------|
|                                                | Table 7<br>100 Users | Table 8<br>150 Users | Table 9<br>350 Users | Table 10<br>1,000 Users |
|                                                | ----- Cost -----     |                      |                      |                         |
| <b>(1) Bond issue</b>                          |                      |                      |                      |                         |
| Annual bond debt service (total for all users) | \$11,053.00          | \$14,475.00          | \$23,593.00          | \$34,000.00             |
| Annual/individual user                         | 110.53               | 96.50                | 67.41                | 34.00                   |
| Monthly/individual user                        | 9.21                 | 8.04                 | 5.62                 | 2.83                    |
| <b>(2) Operation and maintenance</b>           |                      |                      |                      |                         |
| Annual total for all users                     | \$ 7,305.00          | \$ 7,305.00          | \$12,695.00          | \$12,695.00             |
| Annual/individual user                         | 73.00                | 42.03                | 36.27                | 12.70                   |
| Monthly/individual user                        | 6.08                 | 3.50                 | 3.02                 | 1.06                    |
| <b>(3) Running authority office</b>            |                      |                      |                      |                         |
| Annual total for all users                     | \$13,300.00          | \$13,300.00          | \$17,195.00          | \$17,195.00             |
| Annual/individual user                         | 133.00               | 88.67                | 49.13                | 17.20                   |
| Monthly/individual user                        | 11.00                | 7.39                 | 4.09                 | 1.43                    |
| <b>Total individual user charge</b>            |                      |                      |                      |                         |
| Annual                                         | \$ 316.53            | \$ 227.20            | \$ 152.81            | \$ 63.90                |
| Monthly                                        | 26.37                | 18.93                | 12.73                | 5.32                    |

## SUMMARY AND RECOMMENDATIONS

Many townships and boroughs throughout Pennsylvania need to improve the collection and/or treatment of sewage. The challenge in meeting this need is to develop a system that will provide appropriate pollution protection for the air, land, and water at lowest cost to the users. Municipalities facing this problem are encouraged to:

1. Identify the geographic area and the townships and/or boroughs in which the problem exists.
2. Identify the number and types (domestic, commercial, etc.) of users to be served.
3. Consider alternative management systems, i.e.:
  - a. On-lot management systems (OLMS).
  - b. Sewage effluent collection and treatment system (SECTS).
  - c. A combination of the technologies used in the two systems (CT).
4. Determine and establish the organizational arrangement that will meet the need; i.e.:
  - a. A department within the local government.
  - b. A municipal Authority.
  - c. A joint municipal Authority that includes the participating municipalities.
  - d. Use the material in this publication as a guide in establishing the system and organizational arrangement to provide the service.
5. Determine the appropriate means of financing the facility, e.g.:
  - a. Local bond issue, small denomination (or in combination with medium and large denominations) with a local or regional sale of bonds.
  - b. Local issue, large denomination, with sales through national bonding markets.

## REFERENCES

### 1. Bond Issue

Issuing Municipal Bonds: A Primer for Local Officials.

1979, Andrea Lubov, U.S. Department of Agriculture, Economics, Statistics, and Cooperatives Service, in cooperation with the Department of Agricultural and Applied Economics, University of Minnesota.

*This manual gives an overview of how bonds of small local governments are issued, underwritten, marketed, and serviced. The manual distinguishes the different types of bonds, discusses the appropriateness of each type for different purposes, and illustrates the effect of different repayment structures on interest costs. The types of documents that a community must prepare in connection with a bond offering are also discussed.*

Municipal Bond Ratings.

1979, D.G. Schlosser, Information Services Center, Department of Community Affairs, Commonwealth of Pennsylvania.

*In response to numerous inquiries from local governments concerning municipal bond rating criteria and standards, this brochure gives local municipalities more information on bond ratings and how they are determined. Copies available from Department of Community Affairs.*

2. *Factor/Cost Approach to Public Facilities* (pioneered by Gerald A. Doeksen).

Economics of Water Delivery Systems in Rural Oklahoma.

1979, H. L. Goodwin, Gerald A. Doeksen, and James R. Nelson, Agricultural Experiment Station, Oklahoma State University, Bulletin B-745.

*An example of pioneer work in the factor/cost approach to public facilities which inspired this publication.*

### 3. The municipal Authority.

Municipal Authorities Board Members, Characteristics and Qualifications.

1974, Walter H. Niehoff, The Pennsylvania Municipal Authorities Association, Institute of Regional Affairs, Wilkes College, Wilkes-Barre, PA 18708. Available from the publisher.

Organizing a Municipal Authority in Pennsylvania.

1972, Pennsylvania Municipal Authorities Association, Harrisburg, PA 17110.

*This booklet gives a brief summary about organizing a municipal Authority. It could also serve as a "refresher course" for veteran Authority members or as a guide for others who desire essential information about municipal Authorities. Available from the publisher.*

#### Pennsylvania Municipal Authorities.

Current, William H. Markus and Peter H. B. Norton, The Pennsylvania State University, College of Agriculture, Cooperative Extension Service, University Park, PA 16802.

*Provides a history and comprehensive understanding of the municipal Authority in Pennsylvania. Copy available through County Cooperative Extension Office.*

#### The Pennsylvania Municipality Authorities Act and Related Laws.

1979, compiled by the Pennsylvania Municipal Authorities Association, Harrisburg, PA 17110.

*It is the purpose of this publication to enable persons interested in the law relating to municipal Authorities in the Commonwealth of Pennsylvania to locate readily all statutory material. The Pennsylvania Municipality Authorities Act of 1945, P.L. 382 has been printed with all amendments to the legislative session of 1978. The original Municipality Authorities Act was the Act of 1935, P.L. 463. There were numerous amendments to this Act and it was subsequently reenacted and is now the Act of 1945, P.L. 382, P.S. 301, et seq. Amendments were introduced at sessions of the Legislature subsequent to 1945. These are all embodied in the Act printed herewith. Available from the publisher.*

#### 4. Small Community Sewage Facilities

Alternative Methods of Effluent Disposal for On-Lot Home Sewage Systems, Special Circular 214.

Current, N. Henry Wooding, Cooperative Extension Service, College of Agriculture, The Pennsylvania State University, University Park, PA 16802.

*Provides basic information about on-lot systems, including perc tests, aerobic and anaerobic sewage-treatment tanks, and various types of drainage fields. Copy available through County Cooperative Extension Office.*

#### Home Sewage Disposal, Special Circular 212.

Current, N. Henry Wooding, Cooperative Extension Service, College of Agriculture, The Pennsylvania State University, University Park, PA 16802.

*Covers elevated sand mound, sand-lined beds and trenches, aerobic treatment standards, oversized absorption areas, effluent distribution systems, shallow placement absorption systems, a matrix for alternative systems, and soil groups. Copy available through County Cooperative Extension Office.*

#### Innovative and Alternative Technology Assessment Manual.

1979, United States Environmental Protection Agency, Municipal Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH 45268.

*Being circulated for review and comment, this manual contains information about over 100 alternative and innovative sewage facility technologies to be useful in the planning stage where performance and costs are of interest.*

*Specifically it provides (1) description, (2) technology status, (3) applications, (4) limitations, (5) typical equipment, (6) performance, (7) design criteria, (8) unit process reliability, (9) environmental impact, (10) a flow diagram, (11) energy notes, and (12) costs. Copies are available by writing to the cited address. In the near future, a revised manual based on the reactions to the above will be available.*

#### Small Wastewater Systems, Alternative Systems for Small Communities and Rural Areas.

1980, United States Environmental Protection Agency, Office of Water, Program Operations, Washington, D.C. 20460.

*A useful summary in diagram form of alternative systems, available at the above address.*

#### Technical Manual for Sewage Enforcement Officers.

1977, Local Government Research Corporation, The Pennsylvania Department of Environmental Resources, Harrisburg, PA. 17120

*Provides easily understood and useful technical information basic to understanding the slope and soil conditions and their relationship to a sewage system. County DER Office has copies.*

Table 13: Sample Budget of Authority *Before* "Standard" Facility is built. \_\_\_\_\_

**1st Year — No Facility**

I. Disbursements:

|                                      |             |
|--------------------------------------|-------------|
| 1. Executive director .....          | \$ 2,000.00 |
| 2. Board of directors expenses ..... | 1,200.00    |
| 3. Phone .....                       | 300.00      |
| 4. Copier .....                      | 132.00      |
| 5. Audit .....                       | 500.00      |
| 6. Office rent .....                 | 250.00      |
| 7. Postage .....                     | 60.00       |
| 8. Office supplies .....             | 100.00      |
| 9. Professional fees .....           | 1,100.00    |
| Total .....                          | \$ 5,642.00 |

**2nd to 4th Year**

II. Operating Expenses:

|                                 |             |
|---------------------------------|-------------|
| 1. Salaries and wages .....     | \$ 3,186.00 |
| 2. Plant supplies .....         | 144.00      |
| 3. Insurance .....              | 300.00      |
| 4. Dues and subscriptions ..... | 50.00       |
| 5. Office expense .....         | 412.00      |
| 6. Professional fees .....      | 300.00      |
| 7. Telephone .....              | 276.00      |
| 8. Taxes:                       |             |
| Social security .....           | 193.00      |
| Unemployment .....              | 37.00       |
| 9. Miscellaneous .....          | 45.00       |
| Total .....                     | \$ 4,943.00 |



Table 14: Sample budget of Authority *after* "standard" collection and treatment facility is built (serving 340 residences).

|                                         |                         |             |                     |
|-----------------------------------------|-------------------------|-------------|---------------------|
| <b>REVENUE</b>                          |                         |             |                     |
| Sewer user charges                      |                         |             | \$ 49,937 00        |
| Tap-on fees                             |                         |             | 3,300 00            |
| State subsidy                           |                         |             | 5,100 00            |
| Borough subsidy                         |                         |             | 12,000 00           |
| <b>TOTAL REVENUE</b>                    |                         |             | <b>\$ 70,337 00</b> |
| <b>EXPENDITURES:</b>                    |                         |             |                     |
| <b>OPERATION &amp; MAINTENANCE</b>      |                         |             |                     |
| Salaries & wages — Plant operator       |                         | \$ 9,000 00 |                     |
| Salaries & wages — Asst. plant operator |                         | 1,000 00    |                     |
| Materials & supplies:                   | Tools                   | \$ 50 00    |                     |
|                                         | Oil & grease            | 200 00      |                     |
|                                         | Lab supplies            | 180 00      |                     |
|                                         | Chart paper             | 35 00       | \$ 465 00           |
| Chlorine                                |                         |             | 500 00              |
| General expense                         |                         |             | 50 00               |
| Communication expense                   |                         |             | 175 00              |
| Electrical expense                      |                         |             | 12,000 00           |
| Maintenance & repair                    |                         |             | 500 00              |
| Sludge removal & disposal               |                         |             | 600 00              |
| Fuel-heat-water                         |                         |             | 100 00              |
| Miscellaneous                           |                         |             | 200 00              |
|                                         |                         |             | \$24,560 00         |
| <b>ADMINISTRATION</b>                   |                         |             |                     |
| Salaries & wages — Business manager     |                         | \$7,280 00  |                     |
| Materials & supplies:                   | Postage                 | \$230 00    |                     |
|                                         | P.O. Box rent, billings | 30 00       |                     |
|                                         | Letterheads, etc.       | 190 00      |                     |
|                                         | Copier supplies         | 90 00       |                     |
|                                         | Ledger sheets, etc.     | 30 00       | 570 00              |
| General expense                         |                         |             | 50 00               |
| Advertising & printing                  |                         |             | 55 00               |
| Legal fees                              |                         |             | 700 00              |
| Engineering fees                        |                         |             | 1,200 00            |
| Auditor fees                            |                         |             | 750 00              |
| Communication expense                   |                         |             | 250 00              |
| Miscellaneous                           |                         |             | 50 00               |
|                                         |                         |             | \$10,905 00         |
| <b>EMPLOYEE BENEFITS &amp; TAXES</b>    |                         |             |                     |
| Social security taxes                   |                         | \$ 998 00   |                     |
| Unemployment compensation               |                         | 236 00      | \$ 1,234 00         |
| <b>INSURANCE</b>                        |                         |             |                     |
| Fire                                    |                         | \$ 300 00   |                     |
| Compensation                            |                         | 750 00      |                     |
| Casualty & liability                    |                         | 750 00      |                     |
| Bonding                                 |                         | 95 00       | \$ 1,895 00         |
| <b>TOTAL EXPENDITURES</b>               |                         |             | <b>\$38,624 00</b>  |
| <b>DEBT SERVICE</b>                     |                         |             | <b>\$31,713 00</b>  |
| <b>TOTAL</b>                            |                         |             | <b>\$70,337 00</b>  |